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

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1905

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

PART XI.—Colorado River Drainage above Yuma

BY

M. C. HINDERLIDER and G. L. SWENDSEN

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INTRODUCTION.

ORGANIZATION AND SCOPE OF WORK.

The hydrographic work of the United States Geological Survey includes the collecton 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 gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semiarid sections." (28 Stat. L., p. 398.)

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

Annual appropriations 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 systemized 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 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 to 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 above Yuma.
No. 176. The Great Basin drainage.
No. 177. The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Gila River.
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.

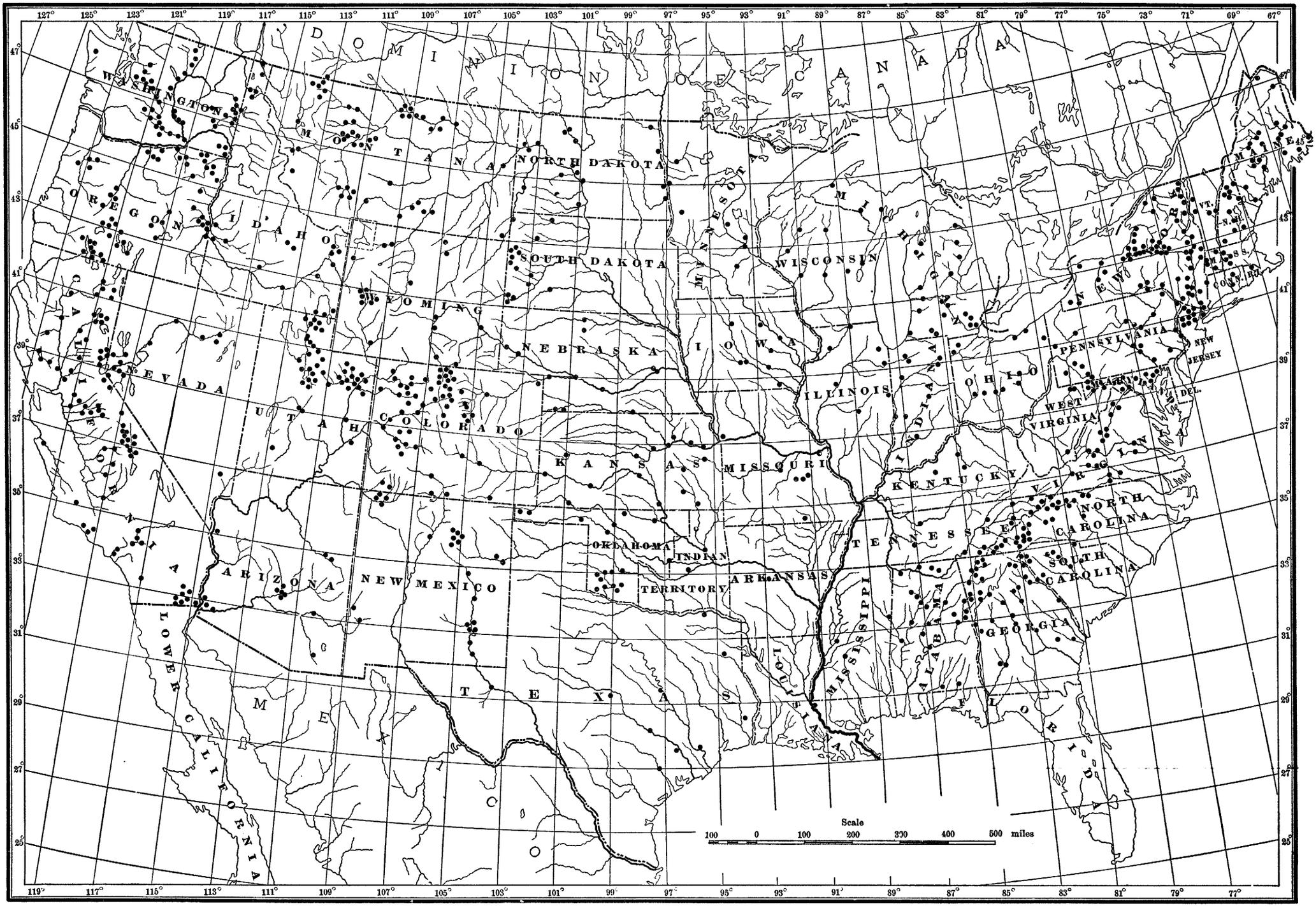
List of drainage basins in the United States.

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.
Applachicola.
Mobile.
Pearl.
Minor eastern Gulf of Mexico.

EASTERN MISSISSIPPI RIVER DRAINAGE BASINS.

Lower eastern Mississippi.
Ohio.
Upper eastern Mississippi.

ST. LAWRENCE 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 Mississipppi.
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.

THE 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 that passes 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 applied to 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 rain fall, 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 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 area of cross section, the mean velocity, the gage height, 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, and it is the flow as given in the rating table for that mean gage height As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest The column headed "Mean" is the average flow for each second during the month. On this are based the computations for the three remaining columns, which are defined above.

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 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; 0.125; 0.012; 0.0012. 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, nearly.
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.
1½ 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 $0.4025\, l\sqrt{h^3}$; 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 : 125000, 1 mile=0.50688 inch.
Scale 1 : 90000, 1 mile=0.70400 inch.
Scale 1 : 62500, 1 mile=1.01376 inches.
Scale 1 : 45000, 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. Geological 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 description is given:

Streams may be devided 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; (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; (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 the 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 flash boards 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, a 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.

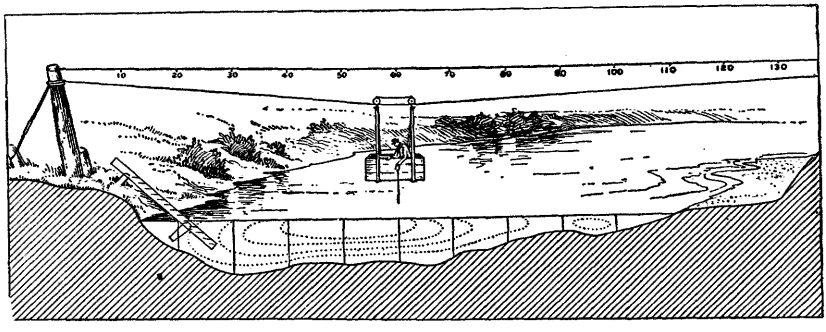


FIG. 1.—Cable station, showing section of river, car, gage, etc.

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 appurtenant 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 conditions 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. Assuming 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 surface, 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 the majority of measurements. A large number of vertical velocity-curve measurements taken on many streams under and 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 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 especially 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 in 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 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.

For stations on streams with permanent beds the first step in computing the run-off is the construction of the rating table, which shows the discharge corresponding to any stage

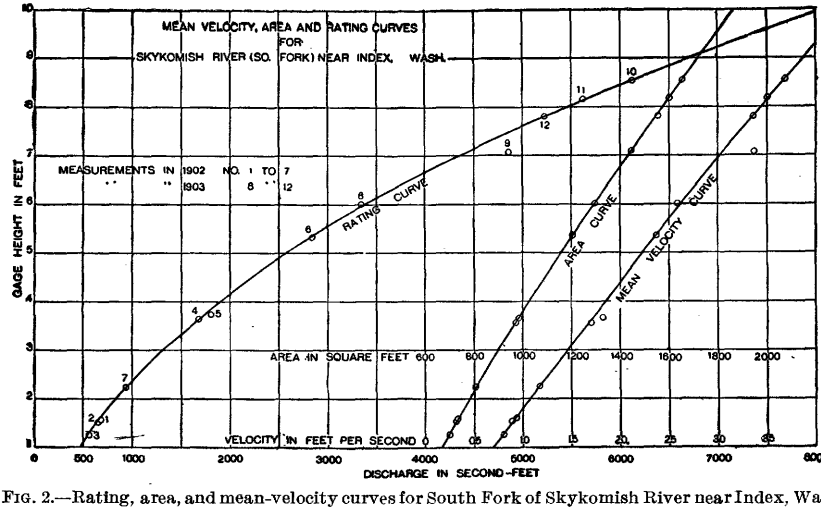


FIG. 2.—Rating, area, and mean-velocity curves for South Fork of Skykomish River near Index, Wash.

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 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 the conditions at or near the gaging station remains 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 platting 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 change 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 heights 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 list, arranged alphabetically by States, gives the names of the district hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Arizona.—District hydrographer, W.A. Farish,[a] assisted by H. S. Reed, W. Richins, O. Richins, R.H Ross, H. R. Fry, F. Asplind, Prof. G. E. P. Smith, R. L. Newman, and E. O. Blades.

California.—The hydrographic work of the United States Geological Survey in the Colorado River drainage in California has been carried on in cooperation with the State under the direction of Supervising Engineer J. B. Lippincott,[b] assisted by Engineer W. B. Clapp.

Colorado.—District and resident engineer, M. C. Hinderlider,[c] assisted by R. I. Meeker, William A. Lamb, H. G. Graham, A A. Weiland, O H. Timmerman, Melvin Beeson, Thomas E. Brick, and F. L. Meeker. Acknowledgments are due the Denver and Rio Grande, Colorado and Southern, Burlington and Missouri River, and Union Pacific railroads for transportation furnished to the district hydrographer and assistants. Acknowledgments are also due the Denver Union Water Company for the use of their reservoir as a rating station for current meters.

Nevada.—The hydrographic work in this section has been carried on in cooperation with the State by Henry Thurtell,[d] State engineer, assisted by W. A. Wolf, J. T. Shaw. R. A. Craig, O. F. Heizer, H. H. Church, and L. A. Woolley. Acknowledgment is due to the Southern Pacific Company for transportation furnished to the district hydrographer and assistants, and also to the San Pedro Los Angeles, and Salt Lake Railroad for transportation furnished to the State engineer.

New Mexico.—The hydrographic work in the northern portion of this Territory was carried on under the direction of the district hydrographer, M. C. Hinderlider, assisted by R. I. Meeker and O. H. Timmerman. Acknowledgments are due the Denver and Rio Grande Railroad for transportation for R. I. Meeker.

Utah.—Engineer George L. Swendsen,[e] assisted by W. G. Swendsen, acting hydrographer, and A. B. Larson. Acknowledgments are due to the Oregon Short Line, Denver and Rio Grande, and San Pedro, Los Angeles and Salt Lake railroads for transportation; to the Telluride Power Company, the Spanish Fork and Payson canal companies, the Sevier River water users, and State Engineer C. Tanner; also to Doctor Hyatt, of the United States Weather Bureau, for material assistance in field observations. The Salt Lake daily papers have continued their interest by following conditions very closely. The hydrographic work in the Uinta Indian Reserve and on upper Green River in Utah has been carried on under the direction of the district hydrographer, M. C. Hinderlider, by the resident hydrographer, Howard S. Reed, with headquarters at Fort Duchesne.

Wyoming.—The hydrographic work in this State has been carried on under the direction of the district hydroprapher, M. C. Hinderlider, and by the resident hydrographer, A. J. Parshall. Acknowledgments are due the Union Pacific Railroad for annual passes over its lines in Wyoming for the resident hydrographer.

GENERAL DESCRIPTION OF COLORADO RIVER DRAINAGE BASIN.

Colorado River is formed in the southeastern part of Utah by the junction of Grand and Green rivers. Green River is larger than the Grand and is the upward continuation of the Colorado. Including the Green the entire length of the Colorado is about 2,000 miles. The region drained is about 800 miles long, varies in width from 300 to 500 miles, and contains about 300,000 square miles. It comprises the southwestern part of Wyoming, the western part of Colorado, the eastern half of Utah, practically all of Arizona, and small portions of California, Nevada, New Mexico, and old Mexico. Most of this area is arid, the mean annual rainfall being about 8½ inches. The streams receive their supply from the melting snows on the high mountains of Wyoming, Utah, and Colorado.

There are two distinct portions of the basin of the Colorado. The lower third is but little above the level of the sea, though here and there ranges of mountains rise to elevations of 2,000 to 6,000 feet. This part of the valley is bounded on the north by a line of cliffs which present a bold, often vertical, step hundreds or thousands of feet, to the table-land above. The upper two-thirds of the basin stands from 4,000 to 8,000 feet above sea level, and is bordered on the east, west, and north by ranges of snow-clad mountains which attain altitudes varying from 8,000 to 14,000 feet above sea level. Through this plateau the Colorado and its tributaries have cut narrow gorges or canyons in which they

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[b] Office, 1108 Union Trust Building, Los Angeles, Cal.
[c] Office of district engineer for Colorado, Kansas, eastern Utah, northern New Mexico, and southern Wyoming, Chamber of Commerce Building, Denver, Colo.
[d] Office, Carson, Nev.
[e] Office, Salt Lake City, Utah.

flow at almost inaccessible depths. At points where lateral streams enter, the canyons are broken by narrow, transverse valleys, diversified by bordering willows, clumps of box elder, and small groves of cottonwood. The whole upper basin of the Colorado is traversed by a labyrinth of these canyons, most of which are dry during the greater portion of the year, and carry water only during the melting of the snow and the brief period of the autumnal and spring rains.

Low mesas, dry and treeless, stretch back from the brink of the canyons, and beyond are long lines of brilliantly colored cliffs, scores or hundreds of miles in length and hundreds or thousands of feet in altitude, presenting steep or even vertical faces of rock. These cliffs form a series of terraces, and each marks the boundary "of some geological series of strata the edges of which are exposed, like courses of masonry, in the scarp walls of the palisades." [a] The lateral extension of such a line of cliffs is very irregular, sharp salients being projected on the plains below and deep recesses cut into the terraces above.

The region is further diversified by short ranges of eruptive mountains. A vast system of fissures extends across the country, and huge cinder cones, red, brown, and black, stand along the fissures and form conspicuous landmarks, set, as they are, in contrast to the bright varigated rocks of sedimentary origin.[b]

As a matter of convenience the drainage area has been divided into three basins: (1) Green River basin, (2) Grand River basin, and (3) Colorado River below the junction of Grand and Green rivers, and each of these basins is subdivided to allow the separate description of branches of the main river.

GREEN RIVER DRAINAGE BASIN.

AREA AND EXTENT.

Green River and its tributaries drain an area rudely triangular in outline, bounded on the north and east by the Wind River Mountains and the ranges forming the Continental Divide, on the south and east by the White River Plateau and the Roan or Book Cliffs, and on the north and west by the Gros Ventre and Wyoming mountains and the great Wasatch Range. The greatest length of the basin, north and south, is about 370 miles. In an east-west direction it measures at its widest point about 240 miles. The total drainage area is approximately 41,000 square miles.

The area includes a large part of western Wyoming, northwestern Colorado, and eastern Utah. The Uinta and Uncompahgre Indian reservations are located in this basin in northeastern Utah.

In the following account of the work of the United States Geological Survey in this region during 1905 the basin has been subdivided, as a matter of convenience, the main river being described first and the tributary streams, beginning at the headwaters, afterwards.

GREEN RIVER.

DESCRIPTION OF BASIN.

Green River heads on the west slope of the Wind River Mountains in western Wyoming, its ultimate source being a number of small lakes fed by the glaciers and immense snow deposits always to be found on Fremont and neighboring peaks. For perhaps 25 miles the river flows northwestward through the mountains. It then turns abruptly and runs in a general southerly direction across western Wyoming into Utah. A few miles below the Wyoming-Utah boundary another sharp turn carries the river eastward along the Uinta Mountains, through which it breaks near the east end of the range. It then flows southward in Colorado for about 25 miles, turns back into Utah, and continues to flow in a southwesterly and southerly direction until it unites with the Grand to form the Colorado. Its length, measured roughly along the course, is approximately 425 miles.

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[a] Dutton, C. E., Physical geology of the Grand Canyon district: Second Ann. Rept. U. S. Geol. Survey, 1882, p. 51.

[b] Powell, J. W., Exploration of the Colorado River of the West, Washington, 1875, p. 6.

The topography of the headwater region is rugged in the extreme. The Wind River Range on the east and the Gros Ventre and Wyoming ranges on the northwest and west gradually close in as they extend southward, forming a basin comprising approximately 7,450 square miles in extent above the gaging station at Green River, Wyo. The upper part of this basin is very narrow, but southward the valley opens out and near Fontanelle, Wyo., is several miles wide, with benches and rolling table-lands extending westward to the foothills of the Wyoming Range and eastward to the bluffs which hug the east bank of the river. At Green River the valley is again narrow—only a few hundred yards in width—and for some distance southward the river runs between bluffs standing so close together that no flood plain is seen. Throughout much of its course in Utah the Green flows through a succession of long, deep, narrow canyons, with walls ranging in height from a few hundred to as many thousand feet, separated by short valleys containing small tracts of arable lands.

In its upper course the Green receives as tributaries numerous streams heading in the Wind River, Gros Ventre, and Wyoming ranges of mountains, some of them extending so far back into the abrupt, ragged canyons that they dovetail with streams flowing in opposite directions. The most important of these tributaries are Newfork River, Big Sandy Creek, La Barge Creek, Fontanelle Creek, Black Fork, and Henry Fork. South of the Uinta Mountains the first large stream flowing into the Green is the Yampa, which comes in from the east at the point where the Green turns westward to reenter Utah after its southward journey in Colorado. Farther south Ashley Creek and Uinta and White rivers discharge their waters to the Green, Ashley Creek and the Uinta from the west and the White from the east. Below this point the only tributaries of importance are Minnie Maud Creek and San Rafael River, which enter from the west, the latter at a point about 32 miles above the junction of the Green and the Grand.

In the foothills and in close proximity to the main ranges of the upper portion of the basin the soil is sand mixed with disintegrated granite, changing into a light, sandy loam on the rolling uplands, and a rich alluvial deposit in the valleys adjacent to the waterways. Very little land is under cultivation, and except in a few favored localities the only product is hay, which is consumed by the stock grazed on the surrounding hills. Directly south of the Uinta Mountains, in the region drained by Ashley Creek and Uinta, Whiterocks, and Duchesne rivers, large tracts of excellent agricultural land are found, much of it being comprised in the Uinta Indian Reservation.

The geology of this basin is described in the Eleventh Annual Report of the United States Geological and Geographical Survey of the Territories for 1877, F. V. Hayden in charge, pages 509–646. Information in regard to the hydrography is contained in the first to fourth annual reports of the Reclamation Service and in other United States Geological Survey reports.

GREEN RIVER AT GREENRIVER, WYO.

This station was established May 2, 1895, near the pump house at a point about 40 feet below the bridge of the Union Pacific Railroad, at Greenriver, Wyo. Since that date it has been maintained continuously, except for a few months during the winter and during the year 1900.

The channel is straight for about 500 feet above and 300 feet below the measuring section, and the banks are sufficiently high to prevent overflow. The bed of the stream is composed of sand. During low-water periods the entire right half of the channel is a bed of clean sand, shifting more or less each year, and the stream runs in a single channel on the left; but as the water rises it extends across the two channels and under the approaches of the bridge. At the gage there are at ordinary stages two channels and at times of flood four channels, interrupted, to some extent, by open cribs four feet wide, made by spiking heavy planks to piles driven into the bed of the stream, which here is sandy but stable.

Discharge measurements are made from the iron highway bridge about one-half mile below the railway bridge, as the section under the latter is unsatisfactory for the purpose. The initial point for soundings is a deep notch cut in the railing near the end of the bridge on the left bank.

The gage, which was observed during 1905 by William Slater, is a staff securely fastened to heavy submerged cribbing on the east bank of the river. The bench mark is a cross on the third step from the bottom of the south end of the east abutment of the railroad bridge; elevation 12.48 feet above the zero of the gage. It has not changed perceptibly since so placed.

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 272–273; Bull 140, p 200; WS 16, p 135; 28, p 131; 37, pp 286–287; 50, pp 366–367; 66, p 82; 85, p 75; 100, p 124; 133, p 53.

Discharge: Ann 18, iv, p 274; Bull 140, p 200; WS 16, p 135; 28, p 142; 37, p 287; 66, p 82; 85, p. 75; 133, p 54.

Discharge, monthly: Ann 18, iv, p 275; 19, iv, p 395; 20, iv, pp 378–380; 21, iv, p 302; Bull 140, p 201; WS 75, p 164; 85, p 77; 133, p 56.

Discharge, yearly: Ann 20, iv, p 58.

Gage heights: Bull 140, p 201; WS 11, p 70; 16, p 135; 28, p 134; 37, p 287; 50, p 367; 66, p 83; 85, p 76; 100, p 125; 133, p 54.

Hydrographs: Ann 18, iv, p 275; 19, iv, p 396; 20, iv, p 381; 21, iv, p 303.

Rainfall and run-off relation: Ann 20, iv, p 379.

Rating tables: Ann 18, iv, p 274; 19, iv, p 395; Bull 140, p 201; 28, p 144; 39, p 451; 66, p 173; 85, p 76; 133, p 55.

Discharge measurements of Green River at Greenriver, Wyo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 26	A. J. Parshall	164	470	1.53	0.88	718
April 6	do	163	470	1.22	.85	573
April 16	do	164	535	1.67	1.15	894
April 28	do	170	644	2.13	1.70	1,374
May 18	do	166	540	1.58	1.15	854
May 28	do	234	907	2.81	2.35	2,546
June 12	do	289	1,702	4.46	4.00	7,590
June 25	do	284	1,258	3.71	3.05	4,666
June 29	do	284	1,353	3.78	3.25	5,116
July 25	do	240	919	2.60	2.30	2,392
August 6	do	170	683	2.03	1.70	1,389
August 16	do	166	621	1.77	1.40	1,103
September 8	do	164	562	1.35	1.00	759
September 23	do	159	495	.90	.55	445
October 20	do	160	509	.93	.65	476

Daily gage height, in feet, of Green River at Greenriver, Wyo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.8	1.42	2.65	3.4	1.95	1.2	0.7
2	.85	1.45	2.68	3.3	1.9	1.2	.75
3	.8	1.55	2.85	3.32	1.82	1.2	.8
4	.82	1.72	3.12	3.22	1.8	1.2	.78
5	.85	1.8	3.48	3.08	1.75	1.25	.75
6	.88	1.78	3.7	3.02	1.7	1.28	.72
7	.95	1.7	3.95	2.95	1.65	1.22	.7
8	.92	1.68	3.78	2.88	1.65	1.2	.7
9	.95	1.58	3.7	2.82	1.6	1.15	.65
10	1.05	1.55	3.95	2.8	1.58	1.1	.65
11	1.22	1.5	4.08	2.72	1.55	1.02	.65
12	1.25	1.45	3.95	2.65	1.5	.92	.6
13	1.2	1.35	3.72	2.62	1.45	.82	.6
14	1.15	1.3	3.48	2.7	1.45	.75	.6
15	1.15	1.22	3.65	2.72	1.45	.72	.6
16	1.15	1.18	3.9	2.75	1.38	.7	.6
17	1.2	1.1	4.0	2.75	1.32	.65	.6
18	1.2	1.15	4.0	2.78	1.28	.65	.6
19	1.2	1.3	4.28	2.72	1.2	.65	.58
20	1.25	1.5	3.95	2.68	1.15	.6	.55
21	1.28	1.68	3.6	2.6	1.2	.6	.55
22	1.3	1.72	3.25	2.55	1.2	.55	.55
23	1.28	1.88	3.05	2.45	1.2	.55	.55
24	1.28	1.98	3.0	2.42	1.2	.55	.55
25	1.35	2.2	3.02	2.32	1.25	.5	.55
26	1.42	2.3	3.1	2.22	1.2	.5	.52
27	1.52	2.3	3.15	2.2	1.2	.5	.5
28	1.58	2.42	3.22	2.15	1.15	.55	.5
29	1.6	2.58	3.32	2.12	1.2	.58	.5
30	1.55	2.72	3.4	2.08	1.2	.62	.55
31	.....	2.75	.....	2.0	1.2	.....	.55

Station rating table for Green River at Greenriver, Wyo., from April 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.*
0.50	420	1.50	1,160	2.50	2,910	3.50	5,920
.60	475	1.60	1,265	2.60	3,180	3.60	6,250
.70	535	1.70	1,380	2.70	3,460	3.70	6,585
.80	600	1.80	1,510	2.80	3,745	3.80	6,920
.90	670	1.90	1,655	2.90	4,035	3.90	7,255
1.00	745	2.00	1,815	3.00	4,330	4.00	7,590
1.10	820	2.10	1,995	3.10	4,635	4.10	7,930
1.20	900	2.20	2,195	3.20	4,945	4.20	8,270
1.30	980	2.30	2,415	3.30	5,265	4.30	8,610
1.40	1,065	2.40	2,655	3.40	5,590		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1905 and is well defined.

Estimated monthly discharge of Green River at Greenriver, Wyo., for 1905.

[Drainage area, 7,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	1,265	600	883	52,540	0.119	0.133
May	3,602	820	1,582	97,270	.212	.244
June	8,542	3,320	5,947	353,900	.798	.890
July	5,590	1,815	3,459	212,700	.464	.535
August	1,735	860	1,122	68,990	.151	.174
September	964	420	639	38,020	.086	.096
October	600	420	486	29,880	.065	.075
The period				853,300		

GREEN RIVER AT JENSEN, UTAH.

This station was established November 7, 1903. It is located at Jensen post-office, about 300 feet below what is known as Billings Ferry, 15 miles from Vernal. The nearest railroad station, Dragon, Utah, is about 40 miles distant. Brush Creek enters the river 1½ miles above the station and Ashley Creek 3 miles below.

The channel is straight for about 1,000 feet above and below the station. The right bank is high, is composed of gravel, and will not overflow; the left bank is low and sandy and covered with underbrush. The bed of the stream is sandy and shifting. There is but one channel at all stages.

The first discharge measurements were made from the ferryboat, but the station was equipped with a cable and car during 1904. The initial point for soundings is the first white mark on the cable on the right bank.

The gage is a vertical timber 10 feet long, braced to a cottonwood tree about 10 feet from the edge of the river. The gage is referred to bench marks as follows: (1) A 40-penny spike driven into the cottonwood tree to which the gage is attached; elevation, 10.66 feet above the zero of the gage. (2) A 40-penny spike driven into the southwest corner of Mr. Billings's grain house about 3 feet above the ground; elevation, 25.64 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 123–124; 133, p 56.
Discharge: 100, p 124; 133, p 57.
Discharge, monthly: 133, p 58.
Gage heights: 100, p 124; 133, p 57.
Rating table: 133, p 58.

Daily gage height, in feet, of Green River at Jensen, Utah, for 1905.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	8.9	6.96	3.86	12	11.1	5.28	.....	22	8.28	4.7	.....
2	9.18	6.79	3.82	13	10.88	5.2	.....	23	7.52	4.52	.....
3	9.59	6.73	3.68	14	10.36	5.09	.....	24	7.71	4.48	.....
4	9.81	6.64	3.6	15	9.98	4.97	.....	25	7.66	4.4	.....
5	10.15	6.68	3.48	16	9.75	4.92	.....	26	7.59	4.25	.....
6	10.4	6.49	.....	17	9.52	4.87	.....	27	7.4	4.1	.....
7	11.09	6.11	.....	18	9.49	4.82	.....	28	7.23	3.99	.....
8	11.16	5.88	.....	19	9.46	4.86	.....	29	7.09	3.93	.....
9	10.92	5.69	.....	20	9.34	4.86	.....	30	6.96	4.0	.....
10	10.82	5.47	.....	21	8.86	4.82	.....	31	.....	3.76	.....
11	10.05	5.39	.....								

GREEN RIVER AT OURAY, UTAH.

This station was established March 23, 1904. It is located about 500 feet below the ferry maintained by the Government at Ouray, Utah. The nearest town is Vernal, Utah, 35 miles distant, and the nearest railroad station is Dragon, about 35 miles distant.

The channel is slightly curved for about 2,000 feet above and is straight for 1,200 feet below the station. Both banks are fairly high and timbered. The right bank overflows for a short distance at high stages. The bed is composed of clean sand and is shifting. The stream is usually confined to one channel, which changes as sand bars are formed during high water. The velocity is fairly good.

Discharge measurements are made from the Government ferry cable, which is suspended across the river about 500 feet above the gage. The initial point for soundings is the first white mark on the cable on the right bank of the river.

The gage is a staff securely driven into the river bottom and spiked to a large cottonwood tree that overhangs the right bank. The gage is referred to bench marks as follows: (1) A large nail driven into the inside face of the tree that supports the gage rod; elevation, 13.80 feet above the zero of the gage. (2) A large nail driven into a blaze on a root of one of a group of large cottonwood trees 150 feet northeast of the gage; elevation, 13.51 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 59–60.

Daily gage height, in feet, of Green River at Ouray, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.5	0.8	1.45	1.15	4.32	8.45	5.75
2	.5	.8	1.55	1.1	4.75	8.75	5.55
3	.5	.82	1.72	1.1	5.0	9.25	5.48
4	.5	.88	1.92	1.0	5.6	9.72	5.32
5	.5	.95	2.0	1.0	5.95	10.1	5.22
6	.5	1.0	1.9	1.02	5.4	10.28	5.05
7	.5	1.0	1.75	1.1	4.82	10.72	4.85
8	.5	1.0	1.5	1.02	4.45	11.12	4.42
9	.5	1.0	1.25	.92	4.25	11.28	.....
10	.5	1.0	1.1	1.0	4.1	10.95	.....
11	.55	1.0	1.0	1.5	4.22	10.4	.....
12	.65	1.0	1.0	1.82	4.4	10.55	.....
13	.7	1.0	1.0	2.1	4.7	10.75	.....
14	.7	1.02	.95	2.3	4.6	10.22	.....
15	.7	1.08	.9	2.3	4.28	9.72	.....
16	.7	1.1	1.0	2.3	4.0	9.35	.....
17	.7	1.12	1.05	2.3	3.95	8.92	.....
18	.7	1.18	1.2	3.05	4.05	8.88	.....
19	.7	1.2	1.32	3.05	4.45	8.7	.....
20	.7	1.22	1.38	3.3	5.65	8.38	.....
21	.7	1.25	1.4	2.65	6.55	8.25	.....
22	.7	1.25	1.42	2.7	7.22	8.0	.....
23	.7	1.25	1.48	2.9	7.72	7.7	.....
24	.7	1.28	1.5	2.75	8.3	7.32	.....
25	.7	1.3	1.5	2.65	8.78	6.9	.....
26	.7	1.3	1.48	2.75	8.95	6.58	.....
27	.7	1.3	1.38	3.05	9.1	6.5	.....
28	.7	1.3	1.28	3.2	8.9	6.28	.....
29	.7	.....	1.18	3.3	8.9	6.1	.....
30	.72	.....	1.1	3.5	8.72	5.9	.....
31	.78	.....	1.2	.....	8.52	.....	.....

GREEN RIVER AT GREENRIVER, UTAH.

This station was established October 21, 1894, discontinued in November, 1896, and reestablished February 16, 1905. It is located at the Rio Grande Western Railway bridge at Greenriver (formerly Blake), Utah, in latitude 39° north, longitude 110° 9′ west, in the San Rafael quadrangle.

The channel is straight for about 2,000 feet above and 1,000 feet below the station. Both banks are barren and are sufficiently high to prevent overflow. At the ferry cable the bed is of clay and shale and is apparently permanent except for a thin layer of silt or sand, which is deposited near the center at low stages and sluices out at high stages. The bed at the railroad bridge is in the main solid rock and is probably permanent, but is rather rough in profile. Conditions for high-water measurements are unfavorable owing to the large masonry piers of the bridge and the high velocity of the current. The velocity at the low-water section is low. Information in regard to winter conditions is incomplete.

At low and ordinary stages discharge measurements are made from a ferryboat at a point 400 to 500 feet above the bridge. The cable to which the ferryboat is attached is graduated at 20-foot intervals with white paint. The initial point for soundings is the south face of a blazed tree, to which the cable is attached, on the west side of the stream. High-water measurements are made from the lower chord on the upstream side of the steel-truss railroad bridge. The initial point for soundings is a white zero mark across the rail on the east end of the bridge.

The gage, which was read during 1905 by Frank Jacobs, is of the chain type, and is attached to the upper guard rail of the bridge at a point near the second pier from the west end. The length of the chain is 28.45 feet. The distance from the outside edge of the pulley to the 3-foot mark on the gage rod is 1.85 feet. The old bench mark established in 1894 was on a pier, but a new bridge has since been constructed and the pier changed. It was therefore impossible to get a definite tie to the original datum. A rough tie was, however, obtained from the old inclined gage on the shore near the pump house, and this showed the present datum to be 1.68 feet below the original. In view of the fact that the cross section at the gage has been changed to some extent by the relocation of the bridge piers, it is probably impossible to establish a satisfactory relation between the original records and those now being taken. The present bench mark is the top of a 1¼-inch iron drift bolt set in the west abutment of the railroad bridge on the north side. The bolt projects about 8 inches above the surface of the stone and is on one of the footing courses of the abutment about 3 feet from the top; elevation of bench mark above the zero of the gage, 25.64 feet.

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 275–276; Bull 131, p 48; 140, pp 202–203; WS 16, p 136; 28, p 131; 37, pp 292–293.
Discharge: Ann 18, iv, p 276; 19, iv, p 396; Bull 131, pp 48, 92; 140, p 202; WS 16, p 136; 37, p 293.
Discharge, monthly: Ann 18, iv, p 278; 19, iv, p 398; 20, iv, p 378, 387; 21, iv, p 304.
Discharge, yearly: Ann 20, iv, p 58.
Gage heights: Bull 140, p 203; WS 11, p 70; 16, p 136; 28, p 134; 37, p 293.
Hydrographs: Ann 18, iv, p 279; 19, iv, p 398; 20, iv, p 388; 21, iv, p 305.
Rainfall and run-off relation: Ann 20, iv, p 379.
Rating tables: Ann 18, iv, p 277; 19, iv, p 397; WS 28, p 144; 39, p 451.

Discharge measurements of Green River at Greenriver, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 16[a]	W. G Swendsen	450	1,605	1.95	4.70	3,129
April 25[a]	do	452	2,292	2.33	5.65	5,338
April 25[a]	do	452	2,292	2.34	5.65	5,380
May 12[b]	do	448	2,800	3.46	6.40	9,686
June 2[b]	do	474	3,864	5.76	8.80	22,270
June 20[b]	do	482	3,983	6.35	9.05	25,310
August 23[a]	A. B. Larson	438	1,659	1.31	4.14	2,175
August 23[a]	do	438	1,659	1.30	4.14	2,160

[a] Measurement made from ferryboat. [b] Measurement made from railroad bridge.

Daily gage height, in feet, of Green River at Greenriver, Utah, for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.8	4.6	5.95	8.95	7.5	5.05	3.9	5.9	4.0	3.9
2	.....	3.9	4.75	6.1	8.8	7.4	5.0	3.9	5.2	4.05	3.8
3	.....	3.9	4.8	6.6	9.0	7.3	5.0	3.9	4.9	3.95	3.6
4	.....	4.05	4.6	6.85	9.25	7.25	5.0	3.9	4.85	3.85	3.4
5	.....	4.1	4.5	7.15	9.6	7.2	5.0	4.05	4.65	4.05	3.4
6	.....	4.1	4.5	7.3	9.8	7.1	5.0	4.05	4.6	4.15	3.3
7	.....	4.25	4.5	7.25	9.85	7.0	4.9	4.7	4.45	4.1	3.3
8	.....	4.5	4.5	7.0	10.05	6.9	4.8	4.45	4.4	4.1	3.2
9	.....	4.6	4.6	6.7	10.3	6.8	4.7	4.35	4.25	4.2	3.2
10	.....	4.9	4.5	6.6	10.55	6.7	4.7	4.45	4.3	4.1	3.2
11	.....	5.05	4.5	6.4	10.5	6.6	4.6	4.55	4.4	4.0	3.3
12	.....	5.0	4.55	6.4	10.05	6.45	4.55	4.55	4.3	3.95	3.35
13	.....	4.85	4.75	6.6	10.2	6.3	4.5	4.35	4.2	3.9	3.4
14	.....	4.75	5.0	6.95	10.2	6.25	4.5	4.25	4.25	3.85	3.4
15	.....	4.7	5.15	6.75	9.95	6.05	4.5	4.05	4.1	4.0	3.4
16	3.8	4.7	5.4	6.55	9.85	6.0	4.5	4.0	4.1	4.0	3.3
17	3.6	4.7	5.3	6.4	9.35	5.95	4.45	3.9	4.1	4.0	3.4
18	3.45	4.7	5.3	6.4	9.25	5.85	4.35	4.0	4.1	4.0	3.4
19	3.45	4.7	5.65	6.4	9.15	5.8	4.2	4.1	4.0	3.9	3.4
20	3.5	4.8	5.65	6.6	9.05	5.75	4.2	4.0	3.9	3.9	3.4
21	3.5	4.75	5.45	7.0	8.85	5.7	4.2	4.15	3.9	4.0	3.4
22	3.5	4.95	5.4	7.55	8.65	5.7	4.2	4.2	4.0	4.4	3.4
23	3.6	5.0	5.5	7.95	8.55	5.6	4.2	4.3	4.05	4.25	3.5
24	3.6	4.9	5.55	8.3	8.4	5.6	4.0	4.2	4.0	4.2	3.6
25	3.6	4.8	5.65	8.6	8.35	5.5	4.0	4.4	4.0	4.1	3.6
26	3.7	4.8	5.65	8.85	8.15	5.45	4.15	4.45	4.0	4.0	3.6
27	3.7	4.8	5.5	9.05	8.05	5.4	4.15	4.6	4.0	4.05	3.6
28	3.8	4.8	5.55	9.2	7.85	5.3	4.0	4.65	4.0	4.15	3.6
29	.....	4.8	5.75	9.05	7.75	5.25	4.0	5.15	4.0	4.1	3.6
30	.....	4.7	5.95	9.05	7.6	5.2	3.95	5.85	4.0	4.0	3.6
31	.....	4.7	.....	9.0	.....	5.2	3.9	.....	4.0	.....	3.6

NOTE.—Ice conditions December 23-31.

Station rating table for Green River at Greenriver, Utah, from February 16, 1905, 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	1,220	4.60	2,900	6.00	7,110	7.80	16,110
3.30	1,290	4.70	3,100	6.10	7,510	8.00	17,360
3.40	1,370	4.80	3,320	6.20	7,920	8.20	18,670
3.50	1,460	4.90	3,560	6.30	8,340	8.40	20,020
3.60	1,550	5.00	3,820	6.40	8,770	8.60	21,410
3.70	1,650	5.10	4,090	6.50	9,210	8.80	22,870
3.80	1,760	5.20	4,370	6.60	9,660	9.00	24,400
3.90	1,870	5.30	4,660	6.70	10,120	9.20	25,970
4.00	1,990	5.40	4,960	6.80	10,600	9.40	27,590
4.10	2,120	5.50	5,280	6.90	11,090	9.60	29,260
4.20	2,260	5.60	5,620	7.00	11,590	9.80	30,970
4.30	2,410	5.70	5,970	7.20	12,640	10.00	32,720
4.40	2,560	5.80	6,340	7.40	13,750	10.50	37,230
4.50	2,720	5.90	6,720	7.60	14,900		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905. It is fairly well defined between gage heights 4.1 feet and 9.1 feet.

Estimated monthly discharge of Green River at Greenriver, Utah, for 1905.

[Drainage area, 38,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
February 16–28	1,760	1,415	1,556	40,120	0.041	0.020
March	3,955	1,760	3,020	185,700	.079	.091
April	6,915	2,720	4,256	253,200	.111	.124
May	25,970	6,915	13,910	855,300	.364	.420
June	37,700	14,900	26,380	1,570,000	.691	.771
July	14,320	4,370	8,202	504,300	.215	.248
August	3,955	1,870	2,751	169,200	.072	.083
September	6,530	1,870	2,530	150,600	.066	.074
October	6,720	1,870	2,506	154,100	.066	.076
November	2,560	1,815	2,052	122,100	.054	.060
December 1–22	1,870	1,220	1,382	60,300	.036	.029
The period				4,065,000		

NEWFORK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Newfork River and its tributaries drain a portion of the western slopes of the Wind River Range, extending from Fremont Peak southeastward to Mount Bonneville, Mount Geikie, and Twin Buttes. The main stream flows in a general southerly course to a point near Cora, Wyo., where it turns sharply to the southwest, joining Green River about 40 miles below.

The entire length of the Newfork does not exceed 50 miles. The basin as a whole is triangular in shape and comprises approximately 1,100 square miles. Forests, in some places dense, cover about 300 square miles. Pines predominate, but aspens and firs are also found.

Pine, Pole, and Boulder creeks and Eastfork River are the chief tributaries of the Newfork. These are all small streams, heading far back among the high peaks of the range and fed by the numerous springs and small mountain lakes with which the region is dotted. Fremont, Boulder, Fayette, Half Moon, Burnt, and Meadow lakes are the largest and most important of these. Fremont Lake, through which Pine Creek flows, has an area of approximately 2,500 acres. The outlet is narrow and a dam at this point might be made to raise the water surface about 30 feet. Such a dam would probably store all the surplus waters of the creek. Boulder Creek flows through Boulder Lake. The outlet of this lake also is narrow, and a dam to raise the surface of the lake about 5 feet is in process of construction. In the drainage area of Pole Creek there are said to be no less than 40 small settling basins.

The upper portion of all these streams is forested and the valleys and rolling bench lands are covered with sagebrush and a sparse growth of nutritious grasses. The soil of the foothill region is sandy and gravelly in character, gradually becoming a rich loam at the lower levels. Several ditches are taken out of Pine and Pole creeks and Eastfork River, and small areas of land are irrigated in a primitive way. The valley of Boulder Creek contains from 15,000 to 20,000 acres of the best agricultural land in the northern Green River basin. This could easily be watered from the creek, and diversion projects which contemplate the reclamation of the greater part of it are well under way.

NEWFORK RIVER NEAR CORA, WYO.

A temporary gaging station was established May 23, 1905, for the purpose of obtaining data in regard to the relative run-off of the stream and its tributaries. It is located at the "Pinedale Crossing," about 3 miles below Cora, in sec. 19, T. 34 N., R. 104 W.

The channel, though generally very winding, is straight for 150 feet above and 100 feet below the gage. The banks are not subject to overflow. The bed of the stream is composed of cobblestones and is permanent.

Discharge measurements are made by wading at a point 100 feet above or from a foot bridge 50 feet above the gage.

The gage was read at 5 p. m. six days each week (the Sunday reading being estimated) by J. J. Hansen, the mail carrier between Cora and Pinedale. The gage consists of a board nailed to a hewn timber, firmly braced by long poles to the left bank of the stream. The bench mark is the top of a stake driven into the ground 10 feet northeast of the gage, opposite the 3.50-foot mark on the gage

The station was discontinued August 31.

Discharge measurements of Newfork River near Cora, Wyo., in 1905.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 23	A. J. Parshall	25	19	1.32	2.10	25
May 25	do	25	19	.95	2.05	18
June 18	do	35	48	3.37	2.50	162
June 22	do	30	26	1.80	2.15	49
September 20	do	12	3.2	.62	1.90	2

Daily gage height, in feet, of Newfork River near Cora, Wyo., for 1905.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	2.5	2.3	2.1	12	2.25	2.15	2.1	23	2.1	2.1	2.0
2	2.5	2.28	2.1	13	2.2	2.15	2.1	24	2.1	2.1	2.0
3	2.5	2.25	2.1	14	2.25	2.2	2.1	25	2.1	2.1	2.0
4	2.3	2.2	2.1	15	2.3	2.2	2.1	26	2.1	2.15	2.0
5	2.1	2.2	2.2	16	2.3	2.18	2.05	27	2.15	2.15	2.0
6	2.1	2.2	2.1	17	2.7	2.15	2.05	28	2.2	2.1	2.0
7	2.1	2.2	2.1	18	2.5	2.1	2.05	29	2.2	2.1	2.0
8	2.15	2.2	2.1	19	2.3	2.1	2.05	30	2.25	2.1	2.0
9	2.25	2.2	2.1	20	2.2	2.1	2.0	31		2.1	2.0
10	2.3	2.2	2.1	21	2.2	2.1	2.0				
11	2.28	2.2	2.1	22	2.15	2.1	2.0				

NOTE.—Sunday gage heights estimated.

PINE CREEK NEAR PINEDALE, WYO.

Pine Creek, designated on the eariler maps as Fremont Creek, rises on the southern face of Fremont Peak, near the top, and flows southwestward to its point of junction with Newfork River. Its length is about 25 miles. From its source to a point about 2 miles beyond Fremont Lake, through which it flows, it is a winding stream having a series of falls and rapids, almost impassable even at low water. Its drainage area comprises 130 square miles, about 60 square miles being covered with forest, more or less dense. Two diversion ditches are taken from the stream, and together these irrigate about 2,000 acres of grass land. Another canal of larger dimensions is contemplated to provide water for an additional 6,000 acres.

A gaging station was established on the stream April 25, 1904. It was located about one-fourth mile west of Pinedale, but this location not proving entirely satisfactory, it was abandoned at the close of the season, and April 2, 1905, it was reestablished near the Hansen ranch, 1 mile above Pinedale, in sec. 28, T. 34 N., R. 109 W.

The channel is comparatively straight for several hundred feet above and below the gage. The stream runs high in its banks, but does not overflow. The bed is rocky and permanent. There is but one channel, and this is unobstructed except during the winter months, when ice forms. The range of gage heights seldom exceeds 2 feet.

High-water measurements are made by means of a boat, a strong wire being stretched from bank to bank for use as an anchor. During low-water periods measurements are made by wading at a point 300 yards below the gage, where the bed of the channel is generally smoother.

The gage, which during 1905 was read daily by J. J. Hansen, is a vertical 10-inch round timber, set 1 foot deep into the rocky bottom of the channel and braced firmly to a large pine tree on the right bank. The bench mark is a spike driven into the tree opposite the 5-foot mark on the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, of the United States Geological Survey, pages 60–62.

Discharge measurements of Pine Creek near Pinedale, Wyo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 29	A. J. Parshall	26	25	1.04	1.00	26
April 2	do	25	25	1.04	1.00	26
April 21	do	35	28	1.29	1.10	36
April 24	do	28	32	1.09	1.10	35
May 23	do	77	80	1.50	1.40	120
May 23[a]	do	35	52	2.04	1.40	106
May 25	do	77	87	1.58	1.45	137
May 30	G. N. Stadin	78	118	2.07	1.65	244
June 18[b]	A. J. Parshall	80	204	6.19	2.85	1,262
June 22[b]	do	80	180	4.88	2.50	878
August 11	do	80	116	2.31	1.70	268
September 16	do	30	34	2.26	1.30	77
September 20	do	30	31	2.16	1.25	67

[a] Measured at a point 300 yards below station, below a diversion ditch.
[b] Measurements made from boat.

Daily gage height, in feet, of Pine Creek near Pinedale, Wyo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.0	1.15	1.7	2.8	2.0	1.45	1.2
2	1.0	1.15	1.8	2.8	1.9	1.45	1.2
3	1.0	1.2	1 9	2.8	1.9	1.45	1.2
4	1.0	1.2	2.0	2.8	1.85	1.45	1.25
5	1.0	1.2	2.2	2.75	1.8	1.4	1.2
6	1.0	1.2	2.35	2.75	1.8	1.4	1.2
7	1.0	1.2	2.4	2.7	1.8	1.4	1.2
8	1.0	1.2	2.5	2.7	1.8	1.4	1.2
9	1.0	1.2	2.6	2.7	1.75	1.4	1.2
10	1.0	1.2	2.7	2.7	1.75	1.4	1.2
11	1.0	1.2	2.7	2.7	1.7	1.4	1.2
12	1.0	1.2	2.6	2.7	1.7	1.4	1.2
13	1.0	1.25	2.7	2.65	1.65	1.4	1.15
14	1.0	1.25	2.8	2.6	1.6	1.35	1.15
15	1.0	1.2	2.8	2.6	1.6	1.35	1.15
16	1.0	1.2	2.8	2.6	1.6	1.35	1.15
17	1.0	1.2	2.9	2.6	1.6	1.35	1.15
18	1.1	1.25	2.9	2.6	1.6	1.3	1.15
19	1.05	1.25	2.8	2.6	1.55	1.3	1.15
20	1.05	1.3	2.7	2.4	1.55	1.3	1.15
21	1.1	1.3	2.6	2.35	1.55	1.25	1.15
22	1.1	1.3	2.5	2.35	1.5	1.25	1.1
23	1.1	1.4	2.5	2.3	1.5	1.25	1.1
24	1.1	1.4	2.5	2.3	1.5	1.25	1.1
25	1.1	1.5	2.5	2.2	1.5	1.25	1.1
26	1.1	1.5	2.5	2.15	1.5	1.25	1.1
27	1.1	1.55	2.6	2.15	1.5	1.25	1.1
28	1.1	1.6	2.7	2.1	1.5	1.25	1.1
29	1.1	1.6	2.7	2.1	1.5	1.2	1.1
30	1.1	1.7	2.8	2.1	1.5	1.2	1.1
31	.....	1.7	.....	2.0	1.5	.....	1.1

Station rating table for Pine Creek near Pinedale, Wyo., from March 29 to September 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.*
1.00	26	1.60	206	2.20	607	2.80	1,200
1.10	35	1.70	258	2.30	694	2.90	1,313
1.20	54	1.80	316	2.40	786	3.00	1,430
1.30	83	1.90	380	2.50	885		
1.40	118	2.00	451	2.60	986		
1.50	159	2.10	526	2.70	1,091		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made from March 29 to September 20, 1905, and is well defined.

Estimated monthly discharge of Pine Creek near Pinedale, Wyo.

[Drainage area, 130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	35	26	29.6	1,761	0.228	0.254
May	258	43	95.8	5,890	.737	.850
June	1,313	258	932	55,460	7.17	8.00
July	1,200	451	904	55,580	6.95	8.01
August	451	159	236	14,510	1.82	2.10
September	138	54	96.9	5,766	.745	.831
October	67	35	45.1	2,773	.347	.400
The period				141,700		

POLE CREEK AT FAYETTE, WYO.

Pole Creek rises on the southern and western slopes of Newfork Peak, flows southwestward, and unites with Newfork River about midway between the points where Pine Creek and Eastfork River join that stream. Like the other tributaries of the Newfork, it is a mountain stream, its source of supply being the direct drainage at its head and numerous small lakes and ponds, of which Fayette and Halfmoon lakes are the largest. The creek is about 25 miles in length. For the last 10 miles of its course it flows through a level or slightly undulating valley, varying from 1 mile to 3 miles in width, with a rich alluvial soil. Two diversion ditches, which provide water for the irrigation of about 3,700 acres of land, are taken from the creek.

The gaging station was established April 22, 1904. It is located at a point opposite and about 300 yards distant from Fayette post-office, in sec. 9, T. 33 N., R. 108 W.

The channel is straight for about 50 feet above and 100 feet below the station. The right bank is low, is covered with brush, and is liable to overflow. The left bank is high and clean and does not overflow. The bed is composed of cobblestones and sand and is stable. There is but one channel at low water; at high water there is one main channel and a small slough on each side. The slope of the channel is toward the left bank, and the current is swift. Gage heights have a range of nearly 3 feet. The creek seldom freezes entirely over owing to the velocity of the current and the numerous adjacent springs. There are no natural obstructions except such as are formed by the accumulations of ice among the willows that fringe the banks and extend back for a considerable distance.

At ordinary stages discharge measurements are made by wading at a point about 200 yards below the gage. High-water measurements are made by means of a boat swinging from a wire stretched taut directly across the channel from bank to bank.

The gage, which was read during 1905 by G. N. Stadin, is a vertical timber set 1 foot deep into the cobblestone bed of the stream and firmly braced to the left bank. For use during high-water stages a wire gage has been attached to the vertical gage in such a way as to extend about 3 feet out over the stream. The gage is referred to bench marks as follows: (1) The top of a 3-inch stake driven firmly into the ground about 10 feet from the gage and marked with a copper number "0;" elevation above the zero of the gage, 4.47 feet. (2) The top of a similar stake about 10 feet from the gage, marked with a copper number "7;" elevation, 5.02 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 62–65.

Discharge measurements of Pole Creek at Fayette, Wyo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 30	A. J. Parshall	31	24	0.79	1.00	19
April 21	do	35	29	.97	1.10	28
April 25	do	37	33	1.03	1.15	34
May 19	G. N. Studin	42	47	2.00	1.55	94
May 21	A. J. Parshall	65	50	2.05	1.65	101
May 23	do	70	71	2.72	2.00	193
May 24	do	70	85	2.93	2.15	249
May 25	do	70	94	3.01	2.25	283
May 30	G. N. Studin	70	101	3.43	2.50	346
June 15[a]	A. J Parshall	70	155	5.13	3.00	795
June 16[a]	do	70	156	5.29	3.05	826
June 17[a]	do	70	163	5.58	3.15	910
June 20[a]	do	70	131	4.50	2.80	590
June 21[a]	do	70	122	4.18	2.70	510
June 22[a]	do	70	114	3.98	2.65	454
August 9	do	44	49	1.88	1.60	92
August 13	do	43	47	1.79	1.55	84
September 17	do	35	29	.96	1.12	28
September 19	do	35	28	.93	1.10	26

[a] Discharge measurement made from boat.

Daily gage height, in feet, of Pole Creek at Fayette, Wyo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.0	1.25	2.45	2.85	1.85	1.3	1.0
2	1.0	1.30	2.55	2.85	1.85	1.3	1.0
3	1.0	1.4	2.55	2.7	1.85	1.3	1.0
4	1.0	1.4	2.7	2.7	1.85	1.3	1.0
5	1.0	1.4	2.9	2.6	1.85	1.3	1.0
6	1.0	1.4	2.1	2.6	1.8	1.3	.95
7	1.0	1.4	3.1	2.55	1.75	1.25	.95
8	1.0	1.4	3.2	2.55	1.7	1.25	1.0
9	1.0	1.4	3.15	2.45	1.7	1.25	1.0
10	1.0	1.45	3.2	2.4	1.65	1.25	1.0
11	1.0	1.45	3.3	2.4	1.6	1.25	1.0
12	1.0	1.45	3.2	2.4	1.6	1.2	1.0
13	1.0	1.45	3.0	2.4	1.6	1.2	1.0

Daily gage height, in feet, of Pole Creek at Fayette, Wyo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
14	1.05	1.45	2.85	2.4	1.6	1.2	1.0
15	1.05	1.45	3.0	2.4	1.6	1.15	1.0
16	1.05	1.45	3.0	2.4	1.5	1.15	.95
17	1.05	1.45	3.05	2.35	1.5	1.15	.95
18	1.1	1.45	3.1	2.3	1.5	1.1	.95
19	1.1	1.5	3.0	2.25	1.5	1.05	.95
20	1.1	1.55	2.85	2.25	1.5	1.05	.95
21	1.1	1.5	2.7	2.15	1.5	1.05	.95
22	1.05	1.8	2.65	2.1	1.4	1.05	.95
23	.95	2.0	2.65	2.05	1.4	1.05	.95
24	1.15	2.15	2.65	2.0	1.4	1.05	.95
25	1.15	2.25	2.65	2.0	1.4	1.05	.95
26	1.15	2.25	2.75	2.0	1.35	1.05	.95
27	1.15	2.35	2.85	1.95	1.35	1.0	.95
28	1.15	2.35	2.9	1.9	1.35	1.0	.95
29	1.15	2.35	2.85	1.9	1.35	1.0	.95
30	1.20	2.4	2.9	1.85	1.35	1.0	.95
31	.....	2.45	.....	1.8	1.35	.....	.95

Station rating table for Pole Creek at Fayette, Wyo., from April 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.*
1.00	19	1.60	94	2.20	255	2.80	590
1.10	27	1.70	114	2.30	293	2.90	680
1.20	36	1.80	137	2.40	335	3.00	775
1.30	47	1.90	162	2.50	383	3.10	875
1.40	60	2.00	190	2.60	440	3.20	980
1.50	76	2.10	221	2.70	510	3.30	1,085

NOTE.—The above table is applicable only for open-channel conditions. It is based on 19 discharge measurements made during 1905. It is well defined between gage heights 1 foot and 3.2 feet.

Estimated monthly discharge of Pole Creek at Fayette, Wyo., for 1905.

[Drainage area, 126 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	36	16	23.8	1,416	0.189	0.211
May	359	42	132	8,116	1.05	1.21
June	1,085	221	669	39,810	5.31	5.92
July	635	137	319	19,620	2.53	2.92
August	150	54	91.5	5,626	.726	.837
September	47	19	32.8	1,952	.260	.290
October	19	16	17.3	1,064	.137	.158
The period	.....	.....	.....	77,600	.....	.....

FALL CREEK NEAR FAYETTE, WYO.

Fall Creek, a small tributary of Pole Creek, joins the latter less than 2 miles from the point where it emerges from the foothills. It is fed by numerous springs and small mountain lakes and flows through Burnt Lake, which covers an area of 700 or 800 acres. The creek is about 15 miles long and drains an area of 60 square miles, of which almost one-third is forested. The entire basin is very rough. One small ditch is taken from it, conveying water upon the Pole Creek flats.

A gaging station was established April 22, 1904. It is located about 1 mile southeast of Fayette post-office, at the crossing of the Upper Boulder road, in sec. 10, T. 33 N., R. 108 W.

The channel is straight for about 40 feet above and 50 feet below the station. The banks are high and are not liable to overflow. The bed of the stream is composed of cobblestones and gravel and is smooth. The current is swift except at very low water, when it becomes sluggish. There is but one channel at all stages. Early in 1905 some large cobblestones, which at low water protruded from the riffles below the gage, were removed, and the rating curve for 1905 is therefore slightly different from that for 1904. Gage heights have a range of almost 2 feet. The stream is frozen solid during the winter months.

Discharge measurements are made at low and ordinary stages by wading, and at high water by means of a boat, the initial point for soundings being the left bank at the gage. At extreme low water a section 200 yards below the gage is chosen.

The gage, which was read during 1905 by G. N. Stadin, is a vertical timber set in the bed of the stream and firmly braced to the left bank. The bench mark is a cross on the highest point of a stone about 1 foot in diameter planted firmly in the ground 10 feet from the gage and surrounded by smaller stones. Elevation above the zero of the gage, 4.63 feet.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 65–67.

Discharge measurements of Fall Creek near Fayette, Wyo., in 1905.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft*
April 21	A. J. Parshall	31	19	0.74	1.35	14
April 25	do	30	22	.64	1.35	14
May 21	do	34	27	1.30	1.55	35
May 23	do	35	38	1.90	1.73	72
May 24	do	35	39	2.05	1.80	80
May 30	G. N. Stadin	37	47	2.83	2.00	133
June 16	A. J. Parshall	37	72	4.53	2.70	326
June 19	do	37	62	3.61	2.35	224
Do	do	55	60	3.50	2.35	210
June 20	do	37	55	3.27	2.15	180
August 9	do	33	26	1.04	1.48	27
August 13	do	33	24	.87	1.42	21
September 17	do	12	4.2	.86	1.18	3.6
September 19	do	12	4.8	.69	1.15	3.3

Daily gage height, in feet, of Fall Creek near Fayette, Wyo., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.4	2.1	2.85	1.6	1.3	1.15	17	1.4	2.7	1.95	1.4	1.2	1.15
2	1.4	2.2	2.85	1.6	1.3	1.15	18	1.45	2.65	1.9	1.4	1.15	1.15
3	1.4	2.4	2.7	1.6	1.3	1.15	19	1.45	2.3	1.9	1.4	1.15	1.15
4	1.4	2.6	2.4	1.6	1.3	1.15	20	1.5	2.2	1.9	1.4	1.15	1.15
5	1.4	2.7	2.25	1.6	1.3	1.15	21	1.5	2.25	1.85	1.35	1.15	1.15
6	1.4	2.8	2.15	1.6	1.25	1.15	22	1.65	2.15	1.8	1.35	1.15	1.15
7	1.4	2.75	2.1	1.55	1.25	1.15	23	1.75	2.2	1.7	1.35	1.15	1.15
8	1.4	2.7	2.0	1.55	1.25	1.1	24	1.8	2.2	1.7	1.35	1.15	1.15
9	1.4	2.85	1.9	1.5	1.25	1.1	25	1.8	2.2	1.7	1.3	1.15	1.15
10	1.4	2.9	1.95	1.5	1.25	1.1	26	1.9	2.4	1.6	1.3	1.1	1.15
11	1.4	2.5	1.95	1.45	1.25	1.1	27	2.0	2.45	1.6	1.3	1.1	1.15
12	1.4	2.5	1.95	1.45	1.25	1.1	28	2.0	2.3	1.6	1.3	1.1	1.15
13	1.4	2.4	1.95	1.4	1.25	1.1	29	2.1	2.3	1.65	1.3	1.1	1.15
14	1.4	2.4	1.95	1.4	1.2	1.1	30	2.1	2.3	1.65	1.3	1.1	1.15
15	1.4	2.5	1.95	1.4	1.2	1.15	31	2.1	.....	1.65	1.3	.....	1.15
16	1.4	2.65	1.95	1.4	1.2	1.15							

Station rating table for Fall Creek near Fayette, Wyo., from May 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.*
1.10	2	1.60	46	2.10	157	2.60	293
1.20	5	1.70	65	2.20	183	2.70	321
1.30	10	1.80	86	2.30	209	2.80	350
1.40	18	1.90	108	2.40	237	2.90	380
1.50	31	2.00	132	2.50	265	3.00	410

NOTE.—The above table is applicable only for open-channel conditions. It is based on 14 discharge measurements made from April 21 to September 19, 1905.

Estimated monthly discharge of Fall Creek near Fayette, Wyo., for 1905.

[Drainage area, 60 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
May	157	18	50.4	3,099	0.840	0.968
June	380	157	252	15,000	4.20	4.69
July	365	46	130	7,993	2.17	2.50
August	46	10	23.5	1,445	.392	.452
September	10	2	5.33	317	.089	.099
October	3	2	2.77	170	.046	.053
The period	.....	.....	.....	28,020	.....	.....

BOULDER CREEK NEAR BOULDER, WYO.

Boulder Creek rises in the vicinity of Mounts Bonneville and Geikie, in the Wind River Mountains, flows westward through Boulder Lake, then turns to the southwest and unites with Newfork River 3 miles above the point where the latter stream is joined by the East-fork. Numerous small mountain lakes, scattered over an area 5 or 6 miles square, contribute their drainage to the creek near its head. Boulder Lake, the largest of these, lies at an elevation of 7,200 feet and its water surface is estimated to cover 1,500 acres. The total area of the basin is 160 square miles and approximately one-third of this is timbered. The upper two-thirds of the basin is very rough; but the lower third is a gently sloping flat, which contains 15,000 to 20,000 acres of excellent agricultural land.

The gaging station was established April 23, 1904. It is located at the Coolidge ranch, about 1½ miles northeast of Boulder post-office, in sec. 4, T. 32 N., R. 108 W., and is below all diversion ditches. In the 1904 Progress Report this station was given as Boulder Creek near Newfork, Wyo.

The channel is nearly straight for about 300 feet above and below the station. The right bank is low and is covered with brush and small trees, but is liable to overflow for a short distance only; the left bank is high and can not overflow. The bed of the stream is composed of cobblestones and sand and is stable. There is but one channel at all stages, and this slopes toward the left bank. The current is swift at high water, but becomes sluggish at low stages. Gage heights have a range of about 4 feet. The stream freezes solid during the winter months. Early in 1905 the larger rocks and some sunken driftwood opposite the gage were removed, slightly changing the cross section and the value of the gage heights on the discharge curve.

Discharge measurements are made by wading at the station until the water rises to about the 2-foot mark on the gage, when the wooden highway bridge, 2 miles below, is used. The initial point for soundings is at the gage.

The gage, which was read during 1905 by T. J. Coolidge, is a timber firmly set in the bed of the stream and braced to a tree and stump on the left bank. The bench mark is a spike driven in a stump opposite the 4-foot mark on the gage and 3 feet distant.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, of the United States Geological Survey, pages 67–69.

Discharge measurements of Boulder Creek near Boulder, Wyo.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 22[a]	A. J. Parshall	25	25	1.56	0.50	39
May 22	do	64	122	1.76	1.10	215
May 24	do	67	155	2.51	1.60	389
May 24[b]	do	57	161	2.45	1.60	394
May 28[b]	G. N. Stadin	60	191	2.79	1.90	533
June 16[b]	A. J. Parshall	81	331	5.33	3.90	1,763
June 19[b]	do	81	300	3.37	2.80	1,011
June 21[b]	do	80	268	2.99	2.40	800
June 24[b]	G. N. Stadin	81	301	3.89	3.00	1,172
August 10	A. J. Parshall	60	94	.98	.75	92
August 12	do	60	86	.86	.70	74
September 18	do	55	46	.39	.30	18

[a] Measured at point 100 yards above station. [b] Measured at bridge 2 miles below station.

Daily gage height, in feet, of Boulder Creek near Boulder, Wyo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.5	2.15	3.0	0.92	0.45	0.2
2	.....	.5	2.6	3.0	.9	.45	.2
3	.....	.6	2.98	2.78	.88	.45	.2
4	.....	.6	3.42	2.4	.82	.45	.2
5	.....	.6	3.92	2.4	.8	.45	.2
6	.....	.6	3.72	2.4	.8	.45	.2
7	.....	.6	3.55	2.38	.8	.42	.2
8	.....	.6	3.85	2.3	.78	.42	.2
9	.....	.6	4.15	2.3	.72	.4	.2
10	.....	.6	3.95	2.18	.7	.4	.2
11	.....	.6	3.35	2.12	.7	.4	.2
12	.....	.6	3.08	2.05	.7	.4	.2
13	.....	.6	3.25	2.02	.7	.4	.2
14	.....	.6	3.72	1.95	.65	.4	.2
15	0.5	.6	3.95	1.95	.6	.4	.2
16	.5	.6	3.88	1.95	.6	.4	.2
17	.5	.65	3.65	1.98	.6	.38	.2
18	.5	.72	3.25	1.85	.58	.3	.2
19	.5	.82	2.85	1.65	.55	.3	.2
20	.5	.92	2.45	1.5	.5	.3	.2
21	.5	1.0	2.40	1.5	.5	.28	.2
22	.5	1.1	2.55	1.45	.48	.25	.2
23	.5	1.3	2.8	1.38	.45	.25	.2
24	.5	1.6	3.08	1.3	.45	.25	.2
25	.5	1.68	3.2	1.25	.45	.25	.2
26	.5	1.75	3.22	1.2	.45	.25	.2
27	.5	1.8	3.35	1.2	.45	.25	.2
28	.5	1.9	3.42	1.18	.45	.22	.2
29	.5	1.9	3.4	1.12	.5	.2	.2
30	.5	1.9	3.15	1.02	.5	.2	.2
31	.....	1.85	.....	1.0	.5	.....	.2

Station rating table for Boulder Creek near Boulder, Wyo., from April 15, 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.*
0.20	9	1.10	189	2.00	594	2.90	1,097
.30	18	1.20	224	2.10	644	3.00	1,160
.40	29	1.30	263	2.20	695	3.20	1,289
.50	42	1.40	304	2.30	747	3.40	1,421
.60	58	1.50	349	2.40	800	3.60	1,557
.70	77	1.60	396	2.50	855	3.80	1,695
.80	100	1.70	444	2.60	913	4.00	1,835
.90	127	1.80	494	2.70	973	4.20	1,975
1.00	157	1.90	544	2.80	1,035		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1905. It is well defined between gage heights 0.5 foot and 3 feet.

Estimated monthly discharge of Boulder Creek near Boulder, Wyo., for 1905.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 15–31	42	42	42	1,333	0.271	0.161
May	544	42	188	11,560	1.21	1.40
June	1,940	913	1,350	80,330	8.71	9.72
July	1,160	157	543	33,390	3.50	4.04
August	133	35	64.5	3,966	.416	.480
September	35	9	23.6	1,404	.152	.170
October	9	9	9.0	553	.058	.067
The period				132,500		

EASTFORK RIVER AT NEWFORK, WYO.

Eastfork River, the southernmost as well as the largest of the tributaries of the Newfork, is formed by the three small creeks which drain its upper basin. Two of these, Silver and Willow creeks, head among the small mountain lakes about Twin Butte and on the southern slopes of Mount Geikie, at an elevation of about 9,000 feet; the third, Muddy Creek, is a spring stream and heads at a somewhat lower elevation farther to the south. The total area of the Eastfork basin is about 320 square miles, and perhaps 2 per cent of this is forested. The upper portion of the basin is the broken, rugged country of the mountains; farther down the valley opens out into broad, level stretches, with a gradual slope to the west. The soil is a sandy loam, well covered in its natural condition with a heavy growth of sagebrush and a smaller quantity of nutritious grasses. Irrigation is practiced in a primitive way, a few small diversion ditches taking water out upon lowland meadows.

A gaging station was established April 1, 1905. It is located at a point about one-third mile southeast of Newfork post-office, in sec. 34, T. 32 N., R. 108 W., and about one-fourth mile above the county highway bridge across Eastfork, near the Noble ranch house.

There is but one channel and the banks are not liable to overflow. The bed of the stream is sandy and shifting, and the section is less satisfactory than was supposed when the gage was installed. Gage heights have a range of about 4 feet. The bed at the highway bridge is less changeable and furnishes a better section than that first selected, though it is divided into three channels by the piling. The river freezes solid during the later months of the winter.

During the lower stages discharge measurements are made by wading at the station, the initial point for soundings being the bench mark. At high water, when the gage reads above 2.5 feet, measurements are made from the highway bridge, which is a three-span wooden structure, resting upon piling protected by rock at the bottom.

The gage, which during 1905 was read daily by Mrs. Cora Noble, is a vertical timber, firmly braced to the right bank. The bench mark is a copper "0" on the top of a post set in the ground 10 feet west of the gage; elevation, 5.68 feet above the zero of the gage.

Discharge measurements of Eastfork River at Newfork, Wyo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft*
April 22	A. J. Parshall	81	64	0.69	0.30	44
May 22	do	95	228	2.18	1.92	498
Do	do	95	246	2.35	2.13	577
May 24[a]	do	75	238	2.84	2.40	675
May 28[a]	G. N. Stadin	75	274	3.31	2.65	907
June 16[a]	A. J. Parshall	75	324	4.26	3.35	1,381
June 19[a]	do	75	259	2.97	2.50	769
June 21[a]	do	75	215	2.40	2.00	516
June 24[a]	G. N. Stadin	75	272	2.84	2.45	772
August 10	A. J. Parshall	85	80	.67	.40	54
August 12	do	83	71	.68	.35	48
September 18[b]	do	64	54	.63	.20	34

[a] Discharge measurement made at bridge below station.
[b] Discharge measurement made 100 yards below station.

Daily gage height, in feet, of Eastfork River at Newfork, Wyo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept	Oct.
1	1.6	0.5	3.1	1.65	0.4	0.3	0.2
2	1.6	.5	3.8	1.6	.4	.3	.2
3	1.6	.5	4.0	1.3	.4	.3	.2
4	1.6	.5	4.55	1.2	.4	.3	.2
5	1.8	.4	4.9	1.1	.4	.3	.2
6	1.2	.4	3.7	1.1	.4	.3	.2
7	.9	.4	3.5	1.0	.4	.3	.2
8	.9	.4	4.2	1.0	.4	.3	.2
9	.9	.5	4.4	1.0	.4	.2	.2
10	.8	.5	3.7	.9	.4	.2	.2
11	.5	.5	2.85	.9	.3	.2	.2
12	.4	.5	2.95	.8	.3	.2	.2
13	.4	.5	3.25	.8	.3	.2	.2
14	.4	.4	3.75	.8	.3	.2	.2
15	.4	.4	3.5	.8	.3	.2	.2
16	.4	.5	3.35	1.0	.3	.2	.2
17	.4	.6	3.3	1.0	.3	.2	.2
18	.3	1.0	2.95	.8	.3	.2	.2
19	.3	1.0	2.35	.6	.3	.2	.2
20	.3	1.4	2.1	.5	.3	.2	.2
21	.3	1.7	2.05	.5	.3	.2	.2
22	.3	2.0	2.4	.5	.3	.2	.2
23	.3	2.3	2.55	.6	.3	.2	.2
24	.3	2.3	2.55	.6	.3	.2	.2
25	.3	2.2	2.45	.5	.3	.2	.2
26	.4	2.2	2.6	.5	.3	.2	.2
27	.4	2.55	2.35	.5	.3	.2	.2
28	.4	2.55	2.3	.5	.3	.2	.2
29	.4	2.3	2.0	.4	.3	.2	.6
30	.4	2.05	1.6	.4	.3	.2	.8
31	.....	2.2	.....	.5	.3	.....	.3

Station rating table for Eastfork River at Newfork, Wyo., from May 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.*
0.20	30	1.00	181	1.80	445	2.60	851
.30	43	1.10	208	1.90	485	2.70	914
.40	58	1.20	236	2.00	527	2.80	979
.50	75	1.30	267	2.10	572	2.90	1,046
.60	93	1.40	300	2.20	621	3.00	1,115
.70	112	1.50	334	2.30	674	3.10	1,262
.80	133	1.60	370	2.40	731		
.90	156	1.70	407	2.50	790		

NOTE.—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 between gage heights 0.2 foot and 2.6 feet. The table has been extended beyond these limits. Above gage height 3.20 feet the rating curve is a tangent, the difference being 76 per tenth.

Estimated monthly discharge of Eastfork River at Newfork, Wyo., for 1905.

[Drainage area, 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.
April	445	43	127	7,557	0.397	0.443
May	820	58	286	17,580	.894	1.03
June	2,554	370	1,234	73,430	3.86	4.31
July	388	58	147	9,039	.459	.529
August	58	43	47.8	2,939	.149	.172
September	43	30	33.5	1,993	.105	.117
October	133	30	35.8	2,201	.112	.129
The period				114,700		

YAMPA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Yampa River rises in Egeria Park, in the southeastern part of Routt County, Colo., runs in a general northerly direction to Steamboat Springs, and thence westward to its point of junction with Green River, just east of the Colorado-Utah State boundary. Throughout almost its entire course it flows in a succession of open valleys alternating with deep, narrow canyons, the longest and deepest of the canyons being that through which it enters the Green.

The drainage basin of the river lies for the most part within the boundaries of Routt County, which is a little larger than the State of Massachusetts and comprises about 6,000 square miles. Its eastern limit is formed by the Park Mountains, and the melting of the snows on their high peaks is the source of numerous small streams whose waters augment the volume of the river and form its chief perennial supply. Westward from the mountains the basin is largely the eroded and dissected Yampa Plateau, whose wide terraces, abrupt cliffs, and deep-cut gulches and arroyos are the striking features of the region. The general level is over 6,000 feet above sea.

The rocks of the basin are largely of sedimentary origin and embrace chiefly formations of Tertiary and Cretaceous periods. The soils derived from these rocks are friable and soft, with considerable alkali, and large tracts are covered with sagebrush. The forests in the mountainous portion of the basin are composed of coniferous trees, and scattered clumps of piñon and cedars are found in the plateau country. Weather Bureau records show the mean annual precipitation at the town of Lay to be 12.35 inches.

Elk River, Fortification Creek, Elk Head Creek, William River, and Little Snake River are the most important tributaries of the Yampa. The upper basins of these streams are within the forested region, but along their lower courses are many cultivated areas.

Irrigation in the Yampa basin is confined to low bottom lands and scattered first-bench lands, but a number of systems are now under consideration.

YAMPA RIVER AT STEAMBOAT SPRINGS, COLO.

This station was established May 3, 1904, at the highway bridge at the east end of Steamboat Springs. May 8, 1905, it was reestablished at the new steel highway bridge, about one-fourth mile below the old bridge, in sec. 17, T. 6 N., R. 84 W.

The channel is straight for about 400 feet above and below the station. The left bank is low, but a roadway about 8 feet high leading to the bridge prevents any overflow. The left bank is high and practically clean. The stream does not overflow even at extremely high stages. The bed is composed of rock and gravel, with some sand, and is clean and permanent. There is but one channel at all stages, obstructed to some extent by several large bowlders. The current is swift at high and medium at low stages. Gage heights have a range of about 4.5 feet. Ice conditions during the winter months render gage readings impracticable.

Discharge measurements are made from the upstream side of the single-span bridge, to which the gage is attached. A stay line is used to keep the meter in position during measurements of high stages. The initial point for soundings is the upstream side of the left abutment, marked zero.

A standard chain gage, which was read twice each day during 1905 by Elmer Brightman, is attached to the downstream side of the bridge, 35 feet from the left abutment. The length of the chain is 13.43 feet. The gage is referred to bench marks as follows: (1) The top of the west side of the left abutment of the bridge; elevation 11.50 feet above the zero of the gage. (2) A standard United States Geological Survey iron post, located 100 feet south of the left end of the old wooden bridge, one-fourth mile up the river; elevation, 15.65 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 70–72.

Discharge measurements of Yampa River at Steamboat Springs, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 8	H. G. Graham	98	334	2.05	4.50	684
May 9	do	92	220	3.71	5.60	816
June 10	Hinderlider and Graham	97	447	7.36	8.15	3,290
Do	do	97	421	7.65	7.90	3,220
July 26	H. G. Graham	81	88	1.45	4.25	128
August 26	do	81	63	.75	4.00	47

Daily gage height, in feet, of Yampa River, at Steamboat Springs, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.65	4.95	7.5	5.15	4.38	4.0	4.18
2	3.65	5.0	7.7	5.65	4.3	4.0	4.18
3	3.65	4.9	7.85	5.4	4.3	4.0	4.1
4	3.7	4.65	8.4	5.15	4.25	4.0	4.1
5	3.75	4.55	8.7	5.05	4.18	4.02	4.1
6	3.75	4.15	8.25	4.9	4.2	4.15	4.1
7	3.75	4.45	8.6	4.8	4.22	4.18	4.08
8	3.75	4.55	8.68	4.72	4.18	4.18	4.08
9	3.8	4.75	8.68	4.68	4.15	4.12	4.08
10	4.05	5.65	8.15	4.65	4.2	4.1	4.08
11	4.05	5.62	8.65	4.52	4.25	4.1	4.08
12	4.0	5.6	7.75	4.52	4.38	4.02	4.08
13	4.05	5.48	7.75	4.42	4.32	4.1	4.08
14	4.05	5.38	7.5	4.42	4.25	4.1	4.08
15	4.0	5.32	7.65	4.42	4.18	4.08	4.08
16	4.15	5.55	7.3	4.32	4.15	4.02	4.08
17	4.15	5.75	7.08	4.32	4.12	4.02	4.08
18	4.25	6.05	7.02	4.3	4.02	4.02	4.08
19	4.25	6.22	6.85	4.3	4.0	4.02	4.08
20	4.25	6.45	6.8	4.32	4.0	4.08	4.12
21	4.15	6.75	6.72	4.3	4.0	4.08	4.18
22	4.15	6.85	6.72	4.28	4.0	4.08	4.18
23	4.15	7.1	6.35	4.25	4.0	4.02	4.18
24	4.15	7.25	6.2	4.18	4.0	4.02	4.18
25	4.15	6.95	6.0	4.15	4.0	4.08	4.18
26	4.15	7.02	5.88	4.12	4.0	4.08	4.18
27	4.25	6.95	5 65	4.18	4.0	4.08	4.18
28	4.3	6.95	5.5	4.32	4.0	4.08	4.18
29	4.35	6.8	5.4	4.35	4.0	4.1	4.18
30	4.75	6.82	5.2	4.35	3.98	4.18	4.18
31	.....	6.95	.....	4.38	4.0	.....	4.18

Station rating table for Yampa River at Steamboat Springs, Colo., from April 1 to May 18, 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	130	4.10	440	5.00	935	5.90	1,640
3.30	146	4.20	485	5.10	,000	6.00	1,740
3.40	170	4.30	530	5.20	1,070	6.20	1,940
3.50	200	4.40	580	5.30	1,145	6.40	2,150
3.60	232	4.50	630	5.40	1,220	6.60	2,370
3.70	268	4.60	685	5.50	1,300	6.80	2,610
3.80	307	4.70	745	5.60	1,380	7.00	2,850
3.90	350	4.80	805	5.70	1,465	7.20	3,110
4.00	395	4.90	870	5.80	1,550	7.40	3,400

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

Station rating table for Yampa River at Steamboat Springs, Colo., from May 19 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.*
3.90	35	4.90	395	5.90	1,025	6.90	1,920
4.00	55	5.00	445	6.00	1,105	7.00	2,030
4.10	80	5.10	495	6.10	1,185	7.20	2,260
4.20	110	5.20	550	6.20	1,270	7.40	2,500
4.30	145	5.30	610	6.30	1,355	7.60	2,750
4.40	180	5.40	675	6.40	1,445	7.80	3,010
4.50	220	5.50	740	6.50	1,535	8.00	3,270
4.60	260	5.60	805	6.60	1,625	8.20	3,540
4.70	305	5.70	875	6.70	1,720	8.40	3,820
4.80	350	5.80	950	6.80	1,820	8.60	4,100

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

Estimated monthly discharge of Yampa River at Steamboat Springs, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	775	250	418	24,870
May	2,320	462	1,405	86,390
June	4,240	550	2,435	144,900
July	840	86	254	15,620
August	173	51	92.5	5,688
September	104	55	73.1	4,350
October	104	75	88.2	5,423
The period				287,200

YAMPA RIVER NEAR CRAIG, COLO.

This station was established April 30, 1904. It is located on the wagon bridge 1 mile south of Craig, on the road to Meeker, Colo., in sec. 6, T. 6 N., R. 90 W., just below the mouth of Fortification Creek and about 7 miles above the mouth of Williams River.

The channel is straight for 250 feet above and 300 feet below the station. Both banks are low and overflow at extremely high stages. The bed of the stream is composed of sand, gravel, and cobblestones, and is permanent. There is but one channel at all ordinary stages, broken by the piers of the bridge; at high stages the stream flows through the culverts at each end of the bridge, and the current is materially broken by the driftwood which invariably collects at the upper side of the piers. The current is swift at high, but very sluggish at low water. Gage heights have a range of about 6 feet during an ordinary season. Ice in the channel renders gage readings impracticable during the winter months.

Discharge measurements are made from the downstream side of the three-span tubular steel pier bridge. The initial point for soundings is the vertical wall of the old log abutment on the left bank, to which the gage is attached.

The gage, which was read twice each day during 1905 by Lawson Thompson, is a vertical timber 12 feet long, fastened to a pile on the old log abutment at the left end of the bridge. The gage is referred to bench marks as follows: (1) The top of a bolt marked with a cross on the top of the tubular steel and concrete pier on the downstream side of the left abutment

of the bridge; elevation, 14.34 feet above the zero of the gage. (2) The top of a bolt marked with a cross on the top of the corresponding pier on the upstream side of the bridge; elevation, 14.37 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, of the United States Geological Survey, pages 72–74.

Discharge measurements of Yampa River near Craig, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 5	H. G. Graham	181	913	2.83	4.75	2,588
June 8	Hinderlider, Graham, and Hoyt	204	1,474	4.91	7.72	7,234
July 24	H. G. Graham	123	545	.82	2.70	445
August 25	do	122	447	.33	1.95	146
August 27	do	122	441	.32	1.95	139

Daily gage height, in feet, of Yampa River near Craig, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.8	5.6	6.75	4.55	2.6	1.8	2.0
2	3.05	5.85	7.15	4.45	2.65	1.8	2.0
3	2.9	5.55	7.15	4.7	2.6	1.8	2.0
4	2.85	5.05	7.45	4.55	2.65	1.8	2.0
5	2.75	4.65	8.05	4.35	2.6	1.8	2.0
6	2.85	4.5	8.0	4.1	2.85	1.8	2.0
7	3.35	4.35	7.45	3.8	2.85	1.8	2.0
8	3.7	4.5	7.6	3.8	2.85	1.95	2.0
9	4.15	5.15	7.8	3.7	2.85	2.2	2.0
10	4.35	5.25	8.1	3.65	2.85	2.2	2.0
11	4.05	4.8	7.55	3.6	2.65	2.2	2.0
12	3.8	4.65	7.35	3.55	2.55	1.9	1.9
13	3.8	4.6	7.0	3.5	2.5	1.9	1.9
14	4.25	4.7	7.2	3.4	2.4	1.9	1.9
15	3.8	4.55	6.9	3.4	2.35	1.8	2.0
16	3.8	4.8	6.95	3.25	2.4	1.8	2.0
17	3.95	4.75	6.7	3.15	2.4	1.8	2.0
18	4.15	5.7	6.4	2.95	2.4	1.8	2.1
19	4.4	6.3	6.25	2.9	2.45	1.8	2.0
20	4.4	6.65	6.0	2.95	2.4	1.8	2.0
21	4.25	6.8	5.8	2.9	2.25	1.85	2.0
22	4.15	7.15	5.75	2.9	2.25	1.9	2.0
23	4.2	7.4	5.9	2.75	2.3	1.9	2.0
24	4.4	7.7	5.75	2.7	2.15	1.8	2.1
25	4.35	7.45	5.55	2.55	1.95	1.9	2.1
26	4.35	7.0	5.45	2.6	1.9	1.9	2.0
27	4.65	6.95	5.3	2.6	1.9	1.9	2.1
28	5.1	6.9	5.0	2.55	1.9	1.9	2.1
29	5.25	6.75	4.9	2.5	1.9	1.9	2.1
30	5.4	6.35	4.75	2.5	1.9	1.9	2.15
31	.....	6.25	.....	2.5	1.8	.....	2.2

Station rating table for Yampa River near Craig, Colo., from April 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.*
1.80	100	3.00	670	4.20	1,750	5.80	4,040
1.90	125	3.10	740	4.30	1,860	6.00	4,390
2.00	155	3.20	810	4.40	1,980	6.20	4,750
2.10	190	3.30	890	4.50	2,100	6.40	5,130
2.20	230	3.40	970	4.60	2,230	6.60	5,520
2.30	270	3.50	1,060	4.70	2,360	6.80	5,930
2.40	320	3.60	1,150	4.80	2,490	7.00	6,360
2.50	370	3.70	1,240	4.90	2,630	7.50	7,520
2.60	420	3.80	1,330	5.00	2,770	8.00	8,750
2.70	480	3.90	1,430	5.20	3,070		
2.80	540	4.00	1,530	5.40	3,380		
2.90	600	4.10	1,640	5.60	3,700		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905. It is well defined between gage heights 1.9 feet and 4.8 feet.

Estimated monthly discharge of Yampa River near Craig, Colo., for 1905.

[Drainage area, 1,730 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	3,380	510	1,579	93,960	0.913	1.02
May	8,000	1,920	4,177	256,800	2.41	2.78
June	9,000	2,425	5,713	339,900	3.30	3.68
July	2,360	370	1,002	61,610	.579	.668
August	570	100	333	20,480	.192	.221
September	230	100	124	7,379	.072	.080
October	230	125	163	10,020	0.94	.108
The period				790,100		

YAMPA RIVER NEAR MAYBELL, COLO.

This station was established April 17, 1904. It is located at the Thornburg bridge, 10 miles west of Maybell and 75 miles from Meeker, Colo., in sec. 19, T. 7 N., R. 96 W.

The channel is straight for about 300 feet above and 600 feet below the station. The left bank is low and clean and overflows to a considerable extent during high water. The right bank is high and clean and is not subject to overflow. The bed of the stream is composed of gravel and sand and is shifting. Ice conditions render gage readings impracticable during the winter months. The ordinary range of gage heights is about 6 feet.

Discharge measurements are made from the downstream side of the two-span bridge to which the gage is fastened. The initial point for soundings is the edge of the left abutment.

The gage, which was read twice each day during 1905 by Peter Farrell, is a staff fastened to the left downstream edge of the middle pier of the bridge. The bench mark is a United States Geological Survey standard bronze tablet set in the top stone of the right abutment on the downstream side; elevation above the zero of the gage, 10.79 feet.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, of the United States Geological Survey, pages 75–77.

Discharge measurements of Yampa River near Maybell, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
May 24	H. G. Graham	210	1,623	5.64	6.20	9,154
May 25	do	210	1,645	5.53	6.25	9,097
May 27	do	210	1,496	5.23	5.60	7,824
June 25	do	207	1,165	4.03	4.20	4,689
June 26	do	206	1,099	3.72	3.90	4,086
Aug. 18	do	172	409	.56	.45	229

Daily gage height, in feet, of Yampa River near Maybell, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.3	3.9	5.8	2.4	1 55	0.1	0.3
2	1.35	4.2	6.0	2.25	1.2	.15	.25
3	1.5	4.3	5.85	2.65	1.2	.15	.3
4	1.45	4.1	5.9	2.4	1.25	.2	.35
5	1.25	4.1	6.0	2.4	1.15	.18	.3
6	1.35	3.5	6.1	2.4	.95	.4	.25
7	1.5	4.05	6.2	2.3	.95	.3	.2
8	1.65	4.1	6.75	2.2	.8	.35	.25
9	2.05	3.9	5.85	1.95	.7	.3	.2
10	2.65	3.75	5.5	1.75	.5	.45	.2
11	2.5	3.4	5.95	1.7	.55	.35	.3
12	2.4	3.4	6.5	1.5	.4	.4	.3
13	2.75	3.3	6.6	1.5	.45	.25	.2
14	2.75	3.55	6.65	1.4	.4	.28	.25
15	2.65	3.3	6.4	1.35	.2	.35	.3
16	2.55	3.4	5.55	1.45	.3	.3	.4
17	2.65	3.6	4.75	1.3	.25	.22	.3
18	2.6	4.1	4.55	1.25	.35	.2	.3
19	2.75	4.95	4.45	1.25	.4	.22	.2
20	2.8	5.55	4.35	1.15	.35	.2	.3
21	2.55	5.8	4.4	1.1	.35	.2	.55
22	2.6	5.85	4.2	1.35	.3	.25	.4
23	2.75	6.25	4.25	1.1	.15	.35	.3
24	2.8	6.25	4.45	1.05	.3	.28	.3
25	2.65	6.25	4.05	.9	.25	.25	.15
26	3.05	5.75	3.9	1.2	.15	.3	.2
27	3.1	5.65	3.75	1.15	.2	.4	.25
28	3.4	5.7	3.4	1.05	.25	.35	.35
29	3.35	5.9	3.3	1.15	.2	.25	.4
30	3.75	5.9	3.15	1.3	.2	.25	.3
31	.....	5.7	.....	1.5	.2	.....	.25

Station rating table for Yampa River near Maybell, Colo., from April 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.*
0.00	100	1.30	690	2.60	1,950	3.90	3,920
.10	130	1.40	760	2.70	2,080	4.00	4,100
.20	160	1.50	840	2.80	2,210	4.20	4,470
.30	190	1.60	920	2.90	2,340	4.40	4,860
.40	230	1.70	1,000	3.00	2,480	4.60	5,270
.50	270	1.80	1,090	3.10	2,620	4.80	5,710
.60	310	1.90	1,180	3.20	2,770	5.00	6,170
.70	350	2.00	1,280	3.30	2,920	5.20	6,640
.80	400	2.10	1,380	3.40	3,080	5.40	7,120
.90	450	2.20	1,490	3.50	3,240	5.60	7,610
1.00	500	2.30	1,600	3.60	3,400	5.80	8,110
1.10	560	2.40	1,710	3.70	3,570	6.00	8,630
1.20	620	2.50	1,830	3.80	3,740	6.50	10,070

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

Estimated monthly discharge of Yampa River near Maybell, Colo., for 1905.

[Drainage area, 3,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	3,655	655	1,825	108,600	0.497	0.554
May	9,325	2,920	5,581	343,200	1.52	.75
June	10,850	2,695	6,768	402,700	1.84	05
July	2,015	450	968	59,520	.264	304
August	880	145	303	18,630	.083	096
September	250	130	185	11,010	.050	056
October	290	145	188	11,560	.051	.059
The period				955,200		

ELK RIVER NEAR TRULL, COLO.

Elk River rises in the northeastern part of Routt County, Colo., flows southward, and joins Yampa River 6 miles below Steamboat Springs. The drainage basin comprises the western slope of the Park Range and the greater part of it is mountainous, but there is some open prairie land along the river and its larger tributaries. Much of this prairie land is under cultivation, being irrigated by numerous ditches from the streams. Hay is the principal crop, but in the lower portion of the valley cereals are raised to some extent. The higher portions of the basin are covered by heavy forests of pine and spruce. Precipitation consists principally of snow during the winter months.

The gaging station was established May 2, 1904. It is located about 2 miles southeast of Trull post-office, on the stage road between Steamboat Springs and Hayden, Colo., in sec. 32, T. 7 N., R. 85 W., and is below all tributaries.

The channel is straight for 100 feet above and for 300 feet below the station. Both banks are low but are not liable to overflow except at very high stages. The bed of the stream is composed of rock and is permanent. There is but one channel at all stages. The

current is swift at all times and exceedingly so at high water. Ice conditions render gage readings impracticable during the winter months. Gage heights have an ordinary range of about 4 feet.

Discharge measurements are made from the downstream side of the single-span bridge to which the gage is attached. The initial point for soundings is the vertical wall of the masonry abutment at the left end of the bridge on the downstream side. There is also a stay-wire about 50 feet above the bridge for holding the meter at high stages.

The gage was read twice each day during 1905 by H. W. Hitchins. The original gage was timber, placed vertically near the right end of the bridge. This was replaced June 22, 1904, by a standard chain gage, referred to the same datum. The chain hangs from a point 25 feet from the initial point for soundings on the downstream side of the bridge. The length of the chain is 16.20 feet. The bench mark is a United States Geological Survey standard aluminum bench-mark tablet, set on the downstream end of the masonry abutment at the right end of the bridge; elevation, 15.995 feet above datum of gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 78-80.

Discharge measurements of Elk River near Trull, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 7	H. G. Graham	115	315	2.95	7.28	931
June 11	Hinderlider and Graham	115	449	6.01	8.78	2,698
July 25	H. G. Graham	95	125	2.31	6.00	289
August 26	do	86	47	2.30	5.20	108

Daily gage height, in feet, of Elk River near Trull, Colo., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	S
1	.....	8.9	7.72	6.0	5.1	17	8.15	8.65	6.52	5.3	.....
2	.....	8.95	7.8	5.85	5.1	18	8.5	8.55	6.38	5.3	.....
3	.....	9.08	8.52	5.78	5.1	19	8.75	8.3	6.38	5.28	.....
4	.....	9.5	7.85	5.72	5.1	20	8.8	8.28	6.42	5.25	.....
5	.....	9.55	7.25	5.7	5.2	21	8.9	8.4	6.3	5.2	.....
6	.....	9.1	7.15	5.65	5.25	22	9.02	8.35	6.28	5.18	.....
7	7.25	9.05	7.2	5.65	5.32	23	9.22	8.45	6.32	5.15	.....
8	7.4	9.25	7.25	5.62	5.32	24	9.15	8.52	6.15	5.15	.....
9	7.9	9.42	6.95	5.6	5.22	25	8.85	8.45	6.0	5.2	.....
10	7.8	9.0	6.9	5.6	.....	26	8.78	8.2	5.95	5.2	.....
11	7.5	8.78	6.85	5.65	.....	27	8.8	8.05	5.9	5.2	.....
12	7.4	8.88	6.85	5.65	.....	28	8.72	8.15	5.9	5.18	.....
13	7.45	8.85	6.82	5.55	.....	29	8.45	8.0	5.82	5.15	.....
14	7.45	8.88	6.7	5.52	.....	30	8.3	8.1	5.88	5.18	.....
15	7.4	8.9	6.78	5.42	.....	31	8.55	.....	5.88	5.15	.....
16	7.85	8.85	6.65	5.38	.....						

Station rating table for Elk River near Trull, Colo., from May 2, 1904, to September 9, 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	60	6.00	312	7.00	785	8.00	1,520
5.10	73	6.10	350	7.10	845	8.20	1,710
5.20	88	6.20	390	7.20	905	8.40	1,910
5.30	107	6.30	430	7.30	975	8.60	2,120
5.40	130	6.40	470	7.40	1,045	8.80	2,365
5.50	156	6.50	520	7.50	1,115	9.00	2,630
5.60	184	6.60	570	7.60	1,190	9.20	2,910
5.70	213	6.70	620	7.70	1,270	9.40	3,190
5.80	244	6.80	670	7.80	1,350	9.60	3,485
5.90	277	6.90	725	7.90	1,430		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1905. It is fairly well defined between gage heights 5.5 feet and 9 feet.

Estimated monthly discharge of Elk River near Trull, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 7–31	2,938	940	1,841	91,290
June	3,410	1,520	2,303	137,000
July	2,032	250	667	41,010
August	312	80	146	8,977
September 1–9	111	73	87.9	1,569
The period				279,800

FORTIFICATION CREEK AT CRAIG, COLO.

Fortification Creek rises near Mount Walba, in northeastern Routt County, Colo., flows westward, southeastward, and southwestward, and joins Yampa River at Craig.

The gaging station was established June 12, 1905. It is located at the highway bridge about one-fourth mile east of Craig, Colo., in sec. 6, T. 6 N., R. 90 W.

The channel is straight for about 50 feet above and 20 feet below the station. The right bank is low and overflows at very high water; the left bank is high. The bed of the stream is composed of sand and silt and is shifting. There is at all stages but one channel, which is dry late in the summer.

Discharge measurements are made from the downstream side of the single-span bridge to which the gage is fastened. The initial point for soundings is the lower side of the bridge, flush with the west abutment.

The gage, which was read twice each day by H. W. Rose, a civil engineer who lives at the station, is a vertical staff, fastened to the east abutment on the lower side of the bridge.

A measurement made June 12, 1905, by H. G. Graham, gave the following results: Width, 51 feet area, 84 square feet; mean velocity, 2.52 feet per second; gage height, 4.40 feet; discharge, 212 second-feet.

Daily gage height, in feet, of Fortification Creek at Craig, Colo., for 1905.

Day.	June.	Day.	June	Day.	June.	Day.	June.
1	5.55	7	5.1	13	4.15	19	3.2
2	5.92	8	5.05	14	3.95	20	2.95
3	5.88	9	5.05	15	3.75	21	2.85
4	6.2	10	5.45	16	3.7	22	2.75
5	6.4	11	4.7	17	3.5	23	2.7
6	6.1	12	4.6	18	3.35	24	2.7

NOTE.—Creek dry after June 24.

WILLIAMS RIVER AT HAMILTON, COLO.

Williams River rises in the White River Plateau, the highest portion of which reaches an elevation of 11,000 feet. It flows northwestward and unites with Yampa River about 7 miles below Craig. It is joined by numerous small tributaries which drain portions of the Williams River Mountains on the east and the Danforth Hills on the south. The largest of these tributaries is Marapos Creek, which rises near the Milk Creek divide, flows eastward, and joins Williams River at Hamilton. The entire drainage area is hilly or mountainous, and throughout the upper portion of it there are extensive forests, mainly of white pine and spruce. Farther down the forests give way to a growth of willows and cottonwood along the river bottom and oak brush and shrubbery on the hillsides. Agriculture is confined to the narrow valley extending along the river and some of its largest tributaries. Wild hay is the principal crop, and cattle raising is carried on extensively. The precipitation consists chiefly of snow during the winter months. The maximum discharge occurs during the latter part of May.

The gaging station was established April 29, 1904. It is located at the highway bridge at Hamilton, on the stage road from Meeker to Craig, Colo., about 17 miles from Craig, in sec. 20, T. 5 N., R. 91 W.

The channel is straight for about 150 feet above and 100 feet below the station. The right bank is high, rocky, and clean; the left bank is low and wooded, but does not overflow except at extreme high stages. The bed of the stream is composed of cobblestones and gravel, but is shifting. There is but one channel at all stages. Gage heights have an ordinary range of about 3 feet. During the winter season ice obstructs the channel to such an extent that gage readings are impracticable.

Discharge measurements are made from the lower side of the single-span bridge to which the gage is attached. The initial point for soundings is the downstream end of the vertical log abutment at the left end of the bridge.

The gage, which during the early part of 1905 was read twice each day by Mrs. Thomas Hamilton, was a 14-foot timber, driven vertically into the bottom of the river, with the upper end fastened to the lower side of the bridge. May 21, 1905, a standard chain gage was installed, the datum being the same as that of the original gage. The length of the chain is 14.94 feet. The gage is referred to bench marks as follows: (1) A nail driven into the top log at the northeast corner of the left abutment of the bridge; elevation, 12.22 feet. (2) The head of a nail driven into a root on the west side of a small cottonwood tree about 25 feet from the left end of the bridge and just east of the road; elevation, 10.08 feet. (3) A nail driven into the southeast corner of the foundation of the blacksmith shop about 25 feet from the left end of the bridge; elevation, 10.08 feet. (4) A United States Geological Survey standard iron post at the southeast corner of the wagon bridge; elevation, 10.77 feet. Elevations are above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 80–82.

Discharge measurements of Williams River at Hamilton, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 3	H. G. Graham	46	149	2.87	4.10	428
May 21	do	60	262	4.91	6.05	1,286
June 7	Hinderlider, Hoyt, and Graham	55	199	4.22	5.48	840
June 13	H. G. Graham	55	203	4.98	5.55	1,011
July 23	do	39	76	1.17	3.25	89
Do	do	39	80	1.10	3.30	88
August 28	do	38	64	.55	2.90	35

Daily gage height, in feet, of Williams River at Hamilton, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.78	4.25	5.95	3.8	3.48	2.78	3.02
2	2.8	4.55	6.02	3.85	3.25	2.8	2.95
3	2.8	4.15	6.05	3.82	3.2	2.82	2.95
4	2.78	3.78	6.5	3.75	3.12	2.85	2.92
5	2.75	3.7	6.4	3.62	3.0	2.88	2.9
6	2.78	3.6	5.82	3.65	3.08	3.05	2.9
7	2.78	3.52	5.75	3.6	3.0	3.08	2.88
8	2.88	3.8	5.82	3.55	3.0	3.0	3.35
9	2.95	4.4	6.15	3.5	2.98	2.98	2.9
10	2.95	4.32	5.72	3.4	2.92	2.88	2.95
11	2.92	4.1	5.32	3.6	3.0	2.88	2.85
12	2.95	4.0	5.3	3.3	3.1	2.85	2.9
13	2.9	4.08	5.4	3.35	3.15	2.82	2.98
14	2.92	3.95	5.35	3.3	3.05	2.9	2.92
15	2.92	3.95	5.40	3.25	2.98	2.85	2.95
16	2.95	4.3	5.40	3.12	2.92	2.82	2.95
17	3.0	4.9	4.85	3.18	2.8	2.78	2.98
18	3.0	5.32	4.95	3.2	2.82	2.85	2.92
19	3.1	5.6	4.78	3.2	2.88	2.88	2.85
20	3.15	5.95	4.60	3.45	2.9	2.85	2.85
21	3.1	5.92	4.65	3.58	2.88	2.92	2.88
22	3.02	6.28	4.65	3.38	2.82	2.92	2.9
23	3.05	6.65	4.78	3.28	2.82	2.85	3.0
24	3.1	6.62	4.65	3.18	2.85	2.88	3.05
25	3.18	5.9	4.4	3.05	2.9	2.88	3.0
26	3.18	5.82	4.3	3.05	2.95	3.0	2.98
27	3.28	6.0	4.18	3.05	2.9	2.98	3.0
28	3.6	5.6	4.08	3.5	2.85	2.92	2.98
29	3.65	5.22	4.05	3.2	2.85	2.98	2.98
30	3.82	5.28	3.92	3.12	2.8	3.05	3.0
31	.....	5.65	.....	3.15	2.78	.....	3.0

Station rating table for Williams River at Hamilton, Colo., from April 1 to May 23, 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.*
2.70	60	3.80	330	4.90	720	6.00	1,240
2.80	80	3.90	360	5.00	760	6.10	1,300
2.90	100	4.00	390	5.10	800	6.20	1,360
3.00	125	4.10	420	5.20	845	6.30	1,430
3.10	150	4.20	455	5.30	890	6.40	1,500
3.20	175	4.30	490	5.40	935	6.50	1,570
3.30	200	4.40	525	5.50	980	6.60	1,640
3.40	225	4.50	560	5.60	1,030	6.70	1,710
3.50	250	4.60	600	5.70	1,080		
3.60	275	4.70	640	5.80	1,130		
3.70	300	4.80	680	5.90	1,180		

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

Station rating table for Williams River at Hamilton, Colo., from May 24 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.*
2.70	15	3.80	200	4.90	565	6.00	1,160
2.80	25	3.90	225	5.00	605	6.10	1,230
2.90	35	4.00	255	5.10	650	6.20	1,310
3.00	50	4.10	285	5.20	700	6.30	1,390
3.10	65	4.20	315	5.30	750	6.40	1,470
3.20	80	4.30	345	5.40	800	6.50	1,550
3.30	95	4.40	375	5.50	850	6.60	1,630
3.40	110	4.50	410	5.60	910	6.70	1,710
3.50	130	4.60	445	5.70	970		
3.60	150	4.70	485	5.80	1,030		
3.70	175	4.80	525	5.90	1,090		

NOTE.—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 2.9 feet and 3.3 feet.

Estimated monthly discharge of Williams River at Hamilton, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	336	70	135	8,033
May	1,675	255	737	45,320
June	1,550	231	745	44,330
July	212	58	115	7,071
August	126	23	46.6	2,865
September	62	23	36.6	2,178
October	102	30	43.6	2,681
The period				112,500

MILK CREEK NEAR AXIAL, COLO.

Milk Creek rises in the northeastern part of Rio Blanco County, Colo., flows northwestward, and enters Yampa River about 20 miles below Craig.

The gaging station was established April 20, 1904. It is located at the highway bridge about 4 miles below Axial, Colo., in sec. 19, T. 4 N., R. 92 W.

The channel is straight for 75 feet above and 50 feet below the station. Both banks are high and clean and do not overflow. The bed of the stream is composed of sand, and shifts to such an extent that it is difficult to obtain a good rating curve. There is but one channel at all stages, the current being swift at high and medium at low water. Gage heights have a range of about 3.5 feet during an ordinary season. Ice conditions render gage readings impracticable during the winter months.

Discharge measurements are made from the lower side of the single-span bridge to which the gage is attached. The initial point for soundings is at the left end of the bridge, at the water's edge, on the downstream side.

The original gage, which was read once each day during 1905 by Mrs. O. M. Hoback, who lives three-fourths of a mile east of the station, is a vertical staff, 10 feet long, driven 2 feet into the sandy bed of the stream, the top being nailed to the bridge timbers. The gage is referred to bench marks as follows: (1) A nail driven about 4 inches above the ground into the east side of a telephone pole 25 feet south of the bridge; elevation, 10.96 feet. (2) A nail driven into the north side of a 12-inch pile at the northeast corner of the bridge; elevation 10.08 feet. (3) A United States Geological Survey standard iron bench-mark post, set July 21, 1904, about 50 feet southeast of the gage rod; elevation 12.33 feet. Elevations are above the zero of the gage.

This station has been discontinued.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, of the United States Geological Survey, pages 83–85.

Discharge measurements of Milk Creek near Axial, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 2	H. G. Graham	25	77	2.23	5.80	172
May 20	do	30	128	1.90	6.80	242
June 13	do	22	39	1.75	4.85	68
July 22	do	15	8.7	.31	3.45	2.7
Aug. 28	do	16	10	.37	3.50	3.7

Daily gage height, in feet, of Milk Creek near Axial, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	3.6	5.5	6.45	3.45	3.7	17	3.8	6.1	4.35	3.4	.....
2	3.55	5.8	6.4	3.5	3.6	18	3.8	6.5	4.25	3.4	.....
3	3.55	5.5	6.3	3.5	3.6	19	4.0	6.9	4.1	3.5	.....
4	3.5	5.3	6.35	3.5	3.6	20	4.0	6.8	4.1	3.6	.....
5	3.5	4.85	6.2	3.5	3.6	21	3.9	7.1	4.0	3.5	.....
6	3.5	4.9	5.8	3.45	3.6	22	3.8	6.95	3.85	3.45	.....
7	3.55	4.8	5.6	3.5	3.5	23	3.85	7.1	3.8	3.5	.....
8	3.6	4.95	5.5	3.45	3.5	24	3.9	7.15	3.7	3.45	.....
9	3.65	5.7	5.4	3.45	3.5	25	4.0	6.85	3.65	3.4	.....
10	3.75	5.8	5.15	3.5	3.5	26	4.1	6.8	3.5	3.4	.....
11	3.75	5.4	4.7	3.6	3.6	27	4.2	6.8	3.5	3.4	.....
12	3.8	5.35	4.9	3.4	3.6	28	4.8	6.55	3.5	3.5	.....
13	3.9	5.25	4.8	3.5	3.5	29	4.95	6.3	3.5	3.45	.....
14	3.8	5.3	4.6	3.5	3.5	30	5.15	6.2	3.5	3.5	.....
15	3.8	5.3	4.4	3.5	3.5	31	.....	6.4	.....	3.4	.....
16	3.8	5.65	4.4	3.4	3.5						

Station rating table for Milk Creek near Axial, Colo., from April 20, 1904, to May 17, 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	2	4.10	48	5.00	111	5.80	175
3.30	4	4.20	55	5.10	119	5.90	183
3.40	8	4.30	62	5.20	127	6.00	191
3.50	12	4.40	69	5.30	135	6.10	200
3.60	17	4.50	76	5.40	143	6.20	209
3.70	23	4.60	83	5.50	151	6.30	218
3.80	29	4.70	90	5.60	159	6.40	227
3.90	35	4.80	97	5.70	167	6.50	236
4.00	41	4.90	104				

NOTE.—The above table is applicable only for open channel conditions. It is based on five discharge measurements made during 1904, and it is fairly well defined.

Station rating table for Milk Creek near Axial, Colo., from May 18 to August 16, 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.*
3.40	2	4.40	41	5.40	111	6.40	201
3.50	4	4.50	46	5.50	119	6.50	211
3.60	7	4.60	52	5.60	128	6.60	221
3.70	10	4.70	58	5.70	137	6.70	231
3.80	13	4.80	65	5.80	146	6.80	241
3.90	17	4.90	72	5.90	155	6.90	251
4.00	21	5.00	79	6.00	164	7.00	261
4.10	26	5.10	87	6.10	173	7.10	271
4.20	31	5.20	95	6.20	182	7.20	281
4.30	36	5.30	103	6.30	191		

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

Estimated monthly discharge of Milk Creek near Axial, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	123	12	35.9	2,136
May	276	97	184	11,310
June	206	4	70.4	4,189
July	7	2	3.5	215
August 1–16	10	4	5.7	181
The period				18,030

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Yampa River basin in 1905:

Miscellaneous discharge measurements made in Yampa River drainage basin in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 26	Little Snake	Maybell, Colo	105	918	5.50	.....	5,050
June 24	do	do	99	430	3.45	3.50	1,483

WHITE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

White River rises in Trappers Lake, which lies at an elevation of 9,500 feet above sea level in a small mountain basin of the White River Plateau in eastern Garfield County, Colo.; thence it flows westward to its point of junction with Green River in west-central Uinta County, Utah. Throughout its course it occupies a narrow, mountainous valley, with alternating parks and canyons, entering the longest and deepest of the canyons, in which it continues to its mouth, about 8 miles east of the Colorado-Utah State line.

The basin comprises an arid, broken, and much eroded plateau region, which topographically is a continuation of the Grand River Mesa south of Grand River. The headwater portion covers the greater area and is called the White River Plateau; below this and to the south is the Roan or Book Cliffs Plateau. Fragmentary plateaus also occur along the northern side of the river.

Numerous small streams, among which are Marvine Creek and South Fork, join the White in the upper, mountainous portion of the basin. Douglas, Piceance, and Evacuation Creeks, draining the Book Cliffs Plateau, enter White River from the south. In the spring these creeks carry considerable water, derived mainly from melting snow, but in the summer they are very nearly dry.

The rocks of the basin are largely of sedimentary origin, and west of the Great Hog Back the relief features produced by erosion are characteristic and remarkably uniform. The shales and marls, wherever sufficiently compact, have been made into steep, inaccessible bluffs, and sandstones have become vertical cliffs. The stream channels are deeply cut, and the flood waters carry a large amount of silt. The soils derived from these rocks vary from sandy to adobe texture, have practically no organic ingredients, and are very friable, and wind and water are constantly breaking them up and transporting them lower down in the basin each year.

Short grasses cover the tops of many of the ridges, while juniper and piñon overgrow their sides. Greasewood and sage brush occur extensively over dry valleys and along plateau-like ridges. In the moist valleys willows and cottonwoods grow in dense masses. In the White River Forest Reserve, which extends over the greater portion of the headwaters, and in general at elevations above 7,500 feet, quaking aspens and spruce predominate, while along the plateaus piñon and cedars are more in evidence.

The mean annual precipitation recorded at Meeker is 15.9 inches; farther west and at lower elevations it is undoubtedly much less.

Numerous ditches along the main stream and some of its tributaries divert water for irrigation, which has been practiced in a desultory way for many years. Native hay and kindred products are the chief agricultural staples in the upper part of the area, while grains, grasses, alfalfa, and some fruits are grown in the lower valleys.

NORTH FORK OF WHITE RIVER NEAR BUFORD, COLO.

This station was established July 28, 1903. It is located at the county bridge at Rawson's ranch, below the mouth of Marvine Creek, 7 miles from Buford, the nearest post-office, and 32 miles from Meeker, Colo.

The channel is straight for 200 feet above and 300 feet below the station. Both banks are high and are not liable to overflow. The bed of the stream is rocky and is free from vegetation. There is but one channel at all stages, broken by the two narrow bridge piers. The current is swift.

Discharge measurements are made from the three-span highway bridge to which the gage is attached. The bridge has a total span of 85 feet. The initial point for soundings is the edge of the abutment at the south end of the bridge.

The gage, which is read twice each day by H. N. Rawson, is a timber spiked to the lower side of the first pier from the south end of the bridge. It reads from 1 foot to 9 feet. The gage is referred to bench marks as follows: (1) The top of a bolt on the bridge nearest the gage; elevation, 11.51 feet. (2) A spike in the trunk of a large cottonwood tree at the southeast corner of the bridge; elevation, 7.46 feet. (3) A spike in one of the abutment logs at the end of the upper sill at the southwest corner of the bridge; elevation, 7.88 feet. Elevations are 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; 99–100, 133, pp 91–92.
Discharge: 100, p 100; 133, p 92.
Discharge, monthly: 100, p 101; 133, p 93.
Gage heights: 100, p 100; 133, p 92.
Rating table: 100, p 100; 133, p 93.

Discharge measurements of North Fork of White River near Buford, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 15	H. G. Graham	86	111	3.03	2.20	336
June 17	do	86	205	5.82	3.30	1,194
July 6	do	88	129	3.16	2.35	408
July 18	do	87	107	2.93	2.15	314
August 12	do	87	102	2.95	2.15	301
September 16	do	86	80	1.90	1.85	152

Daily gage height, in feet, of North Fork of White River near Buford, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.82	2.55	3.4	2.65	2.2	1.9	1.85
2	1.85	2.5	3.4	2.6	2.15	1.9	1.85
3	1.82	2.3	3.6	2.52	2.1	1.9	1.85
4	1.82	2.18	3.8	2.42	2.1	1.9	1.85
5	1.82	2.12	3.8	2.42	2.05	2.0	1.85
6	1.82	2.15	3.7	2.4	2.05	1.98	1.85
7	1.9	2.22	3.85	2.38	2.0	1.95	1.85
8	1.88	2.48	4.0	2.35	2.0	1.9	1.85
9	1.92	2.48	3.9	2.32	2.0	1.9	1.85
10	1.92	2.32	3.6	2.3	1.98	1.9	1.85
11	1.92	2.28	3.5	2.28	2.05	1.9	1.85
12	1.92	2.22	3.55	2.28	2.1	1.9	1.85
13	1.92	2.22	3.62	2.28	2.02	1.9	1.85

Daily gage height, in feet, of North Fork of White River near Buford, Colo., in 1905—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
14	1.92	2.2	3.68	2.22	2.0	1.9	1.85
15	1.92	2.22	3.7	2.22	2.0	1.9	1.85
16	1.92	2.58	3.55	2.18	1.95	1.85	1.85
17	1.92	2.75	3.45	2.18	1.95	1.85	1.85
18	1.92	2.95	3.4	2.2	1.95	1.9	1.85
19	1.92	3.02	3.32	2.2	1.95	1.85	1.85
20	1.92	3.38	3.3	2.3	1.95	1.85	1.85
21	1.92	3.55	3.25	2.22	1.9	1.85	1.85
22	1.92	3.65	3.2	2.2	1.9	1.85	1.85
23	1.98	3.7	3.2	2.15	1.9	1.85	1.85
24	1.98	3.35	3.2	2.15	1.9	1.85	1.85
25	1.98	3.25	3.15	2.15	1.9	1.92	1.85
26	2.02	3.25	3.2	2.15	1.9	1.92	1.85
27	2.05	3.28	3.0	2.15	1.9	1.85	1.85
28	2.1	3.05	2.85	2.15	1.92	1.85	1.85
29	2.2	2.95	2.78	2.15	1.92	1.85	1.85
30	2.32	3.05	2.72	2.1	1.9	1.9	1.85
31	.....	3.25	.....	2.15	1.92	.....	1.85

Station rating table for North Fork of White River near Buford, Colo., from April 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.*
1.80	135	2.40	450	3.00	910	3.60	1,505
1.90	180	2.50	515	3.10	1,000	3.70	1,610
2.00	225	2.60	585	3.20	1,095	3.80	1,720
2.10	275	2.70	660	3.30	1,195	3.90	1,835
2.20	330	2.80	740	3.40	1,295	4.00	1,950
2.30	390	2.90	825	3.50	1,400		

NOTE.—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 2.4 feet.

Estimated monthly discharge of North Fork of White River near Buford, Colo., for 1905.

[Drainage area, 181 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	402	144	200	11,900	1.10	1.23
May	1,610	286	756	46,480	4.18	4.82
June	1,950	676	1,332	79,260	7.36	8.21
July	622	275	375	23,060	2.07	2.39
August	330	180	219	13,470	1.21	1.40
September	225	157	176	10,470	.972	1.08
October	157	157	157	9,654	.867	1.00
The period	.....	.....	.....	194,300	.....	.....

SOUTH FORK OF WHITE RIVER NEAR BUFORD, COLO.

This station was established July 25, 1903. It is located at the county bridge at the lower end of a section of the river known as "Stillwater," about 7 miles from Buford, the nearest post-office, and about 30 miles from Meeker, Colo., in T. 1 S., R. 91 W.

The channel is straight for 50 feet above the station and for 300 feet below. Both banks are high and are covered with grass and sagebrush. The bed of the stream below the "Stillwater" and at the station is covered with bowlders, some of which are 2 or 3 feet in diameter. There is but one channel at all stages, broken by the middle pier of the bridge, and the current is swift. During the winter months ice obstructs the channel to such an extent that gage readings are impracticable.

High-water measurements are made from the bridge, which makes an angle of 20° with the normal to the stream. This is taken into account in making the measurements. The initial point for soundings is the edge of the abutment at the west end of the bridge. At low water, measurements are made by wading.

The gage, which was read twice each day during 1905 by Claud Dobbs, is a 10-foot vertical timber spiked to the upper side of the middle pier. The gage is referred to bench marks as follows: (1) The first bolt on the bridge east of the gage; elevation, 11.95 feet. (2) A spike in one of the logs of the abutment at the southwest corner of the bridge; elevation, 8.57 feet. (3) The corner of a large rock 30 feet west of the bridge and north of the road; elevation, 13.14 feet. (4) The top of a pyramid-shaped rock on the east side of the river below the bridge 41 feet distant from the northeast bolt on the bridge tie and projecting 8 inches above the ground; elevation, 7.02 feet. Elevations are above the zero of the gage. The elevation of the station above sea level, as determined by aneroid barometer, is 7,400 feet.

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

Description: 100, pp 97–98; 133, p 94.
Discharge: 100, p 98; 133, p 94.
Discharge, monthly: 100, p 99; 133, p 96.
Gage heights: 100, p 98; 133, p 95.
Rating table: 100, p 99; 133, p 96.

Discharge measurements of South Fork of White River near Buford, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 16	H. G. Graham	55	91	2.93	2.80	267
June 19	do	55	251	6.39	5.70	1,603
July 7	do	55	110	3.61	3.15	397
Juy 19	do	55	97	2.96	2.90	287
August 13	do	55	86	3.04	2.70	262
September 19	do	55	72	2.3	2.45	166

Daily gage height, in feet, of South Fork of White River near Buford, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct
1	2.4	2.95	4.88	3.5	2.72	2.45	2.45
2	2.4	3.05	5.18	3.45	2.7	2.45	2.45
3	2.4	2.95	5.48	3.4	2.7	2.45	2.45
4	2.35	2.82	6.22	3.32	2.7	2.5	2.45
5	2.38	2.8	6.9	3.25	2.68	2.58	2.45
6	2.4	2.75	6.52	3.2	2.65	2.55	2.45
7	2.4	2.75	6.55	3.15	2.62	2.55	2.45

Daily gage height, in feet, of South Fork of White River near Buford, Colo., for 1905—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
8	2.42	2.75	6.68	3.12	2.6	2.55	2.45
9	2.45	2.85	7.4	3.05	2.6	2.5	2.45
10	2.48	2.85	6.85	3.05	2.6	2.5	2.42
11	2.48	2.85	6.28	3.02	2.7	2.48	2.45
12	2.5	2.78	6.25	2.98	2.7	2.45	2.45
13	2.5	2.8	6.5	2.95	2.68	2.45	2.45
14	2.5	2.78	6.12	2.92	2.6	2.45	2.45
15	2.5	2.75	6.42	2.9	2.6	2.45	2.45
16	2.5	2.85	6.75	2.88	2.6	2.45	2.45
17	2.5	3.0	5.75	2.85	2.55	2.45	2.45
18	2.5	3.18	5.6	2.85	2.55	2.45	2.45
19	2.55	3.4	5.2	2.88	2.55	2.45	2.4
20	2.55	3.55	5.0	2.92	2.52	2.45	2.32
21	2.5	3.65	4.7	2.88	2.5	2.45	2.38
22	2.5	3.92	4.8	2.82	2.5	2.45	2.42
23	2.5	4.35	4.95	2.8	2.5	2.45	2.45
24	2.5	4.45	5.05	2.78	2.5	2.45	2.45
25	2.55	4.22	4.5	2.75	2.5	2.45	2.45
26	2.55	4.38	4.45	2.75	2.5	2.45	2.45
27	2.6	4.45	4.15	2.75	2.5	2.45	2.45
28	2.65	4.45	3.92	2.72	2.48	2.45	2.45
29	2.7	4.22	3.7	2.7	2.5	2.45	2.45
30	2.8	4.22	3.6	2.7	2.48	2.52	2.45
31	.....	4.55	.....	2.7	2.48	.....	2.45

Station rating table for South Fork of White River near Buford, Colo., from April 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.*
2.30	115	3.50	510	4.70	1,050	5.90	1,725
2.40	145	3.60	550	4.80	1,100	6.00	1,790
2.50	175	3.70	590	4.90	1,150	6.20	1,920
2.60	205	3.80	630	5.00	1,200	6.40	2,060
2.70	235	3.90	675	5.10	1,255	6.60	2,200
2.80	265	4.00	720	5.20	1,310	6.80	2,350
2.90	300	4.10	765	5.30	1,365	7.00	2,500
3.00	335	4.20	810	5.40	1,420	7.20	2,660
3.10	370	4.30	855	5.50	1,480	7.40	2,820
3.20	405	4.40	900	5.60	1,540		
3.30	440	4.50	950	5.70	1,600		
3.40	470	4.60	1,000	5.80	1,660		

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 between gage heights 2.4 feet and 5.7 feet.

Estimated monthly discharge of South Fork of White River near Buford, Colo., for 1905.

[Drainage area, 148 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	265	130	175	10,410	1.18	1.32
May	975	250	497	30,560	3.36	3.87
June	2,820	550	1,569	93,360	10.60	11.83
July	510	235	324	19,920	2.19	2.52
August	241	169	200	12,300	1.35	1.56
September	199	160	167	9,937	1.13	1.26
October	160	121	157	9,654	1.06	1.22
The period				186,100		

WHITE RIVER AT MEEKER, COLO.

This station was established May 24, 1901. It is located about one-half mile above the town of Meeker, at a point where a wagon bridge crosses the stream, on the ranch of L. F. Van Cleave, in sec. 25, T. 1 N., R. 94 W.

The channel is straight for 500 feet above and below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of gravel and cobble-stones and seems to be permanent. There is but one channel at all stages. The current is always swift and is extremely so at high water. Gage heights have an ordinary range of about 2.5 feet. During the winter months ice obstructs the channel to such an extent that gage readings are impracticable.

Discharge measurements are made from either the upstream or downstream side of the bridge, the initial point being at the left end.

The gage, which was read twice each day during 1905 by L. F. Van Cleave, consists of a vertical timber nailed to the left abutment of the bridge on the downstream side. The gage is referred to bench marks as follows: (1) The top of a bolt in the truss immediately above the gage rod; elevation, 10.83 feet above the zero of the gage. (2) A standard United States Geological Survey iron post, located 30 feet north of the north end of the bridge; elevation, 8.807 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; WS=Water-Supply Paper):

Description: WS 66, pp 91–92; 85, p 50; 100, pp 95–96; 133, p 97.
Discharge: WS 50, p 375; 66, p 92; 85, p 51; 100, p 96; 133, p 97.
Discharge, low-water: Ann 22, iv, p 396.
Discharge, monthly: WS 85, p 52; 100, p 97; 133, p 99.
Gage heights: WS 28, p 143; 66, p 92; 85, p 51; 100, p 96; 133, p 98.
Rating tables: WS 85, p 51; 100, p 97; 133, p 98.

Discharge measurements of White River at Meeker, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 25	Stiles and Hinderlider	79	166	1.80	3.60	299
April 3	A. J. Stiles	79	166	2.40	3.60	398
April 29	H. G. Graham	79	233	3.77	4.20	879
May 1	do	79	271	3.89	4.72	1,052
May 18	do	79	316	5.04	5.20	1,593
May 19	do	79	332	5.42	5.40	1,801
June 5	do	79	403	8.77	6.40	3,536
June 28	do	78	332	6.40	5.60	2,126
June 30	do	78	281	4.06	4.90	1,141
July 14	do	78	207	2.99	4.00	620
July 15	do	78	203	2.48	3.95	505
August 5	do	78	184	2.28	3.72	419
August 7	do	78	191	2.25	3.80	429

Daily gage height, in feet, of White River at Meeker, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.6	4.65	5.95	4.72	3.9	3.6	3.7
2	3.62	4.85	5.98	4.65	3.85	3.6	3.7
3	3.6	4.58	6.0	4.6	3.85	3.6	3.65
4	3.6	4.4	6.15	4.48	3.75	3.62	3.65
5	3.6	4.3	6.32	4.38	3.7	3.75	3.65
6	3.6	4.25	6.25	4.35	3.7	3.75	3.6
7	3.65	4.2	6.18	4.3	3.68	3.78	3.6
8	3.7	4.35	6.18	4.25	3.65	3.7	3.6
9	3.72	4.75	6.3	4.2	3.65	3.65	3.6
10	3.75	4.55	6.25	4.12	3.65	3.65	3.6
11	3.78	4.48	6.05	4.1	3.9	3.62	3.6
12	3.78	4.4	6.0	4.02	3.98	3.6	3.6
13	3.8	4.42	6.05	4.0	3.88	3.6	3.6
14	3.8	4.38	5.95	3.98	3.82	3.6	3.6
15	3.72	4.35	6.0	3.95	3.75	3.55	3.6
16	3.72	4.58	6.1	3.9	3.75	3.55	3.6
17	3.72	4.95	5.9	3.88	3.7	3.55	3.62
18	3.72	5.15	5.8	3.85	3.65	3.65	3.65
19	3.85	5.4	5.65	3.85	3.65	3.65	3.6
20	3.85	5.55	5.52	4.0	3.65	3.65	3.55
21	3.82	5.58	5.48	3.98	3.65	3.6	3.62
22	3.8	5.82	5.52	3.9	3.65	3.58	3.62
23	3.8	5.98	5.52	3.85	3.58	3.55	3.7
24	3.82	6.02	5.52	3.82	3.55	3.58	3.65
25	3.88	5.85	5.45	3.8	3.6	3.68	3.62
26	3.88	5.82	5.35	3.8	3.58	3.68	3.62
27	4.02	5.9	5.25	3.78	3.55	3.6	3.62
28	4.12	5.85	5.1	3.72	3.62	3.6	3.62
29	4.18	5.65	4.95	3.75	3.65	3.68	3.62
30	4.32	5.62	4.8	3.75	3.62	3.8	3.6
31	.....	5.68	.....	3.82	3.6	.....	3.6

Station rating table for White River at Meeker, Colo., from April 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.*
3.50	345	4.30	700	5.10	1,420	5.90	2,580
3.60	370	4.40	760	5.20	1,540	6.00	2,760
3.70	400	4.50	835	5.30	1,670	6.10	2,950
3.80	435	4.60	910	5.40	1,800	6.20	3,140
3.90	480	4.70	1,000	5.50	1,940	6.30	3,330
4.00	530	4.80	1,090	5.60	2,080	6.40	3,530
4.10	580	4.90	1,190	5.70	2,240		
4.20	640	5.00	1,300	5.80	2,410		

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

Estimated monthly discharge of White River at Meeker, Colo., for 1905.

[Drainage area, 634 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	712	370	443	26,360	0.699	0.780
May	2,798	640	1,490	91,620	2.35	2.71
June	3,370	1,090	2,444	145,400	3.85	4.30
July	1,018	407	572	35,170	.902	1.04
August	520	357	405	24,900	.639	.737
September	435	357	382	22,730	.603	.673
October	400	357	376	23,120	.593	.684
The period				369,300		

WHITE RIVER NEAR RANGELY, COLO.

This station was established April 14, 1904. It is located at the wagon bridge 1 mile west of Rangely, Colo., in sec. 3, T. 2 N., R. 102 W.

The channel is curved at the station and the bridge makes an angle of 15° with the radius of the curve. The right bank is high and clean and does not overflow; the left bank is low and clean, and overflows at high stages. The bed of the stream is composed of sand and gravel and is shifting. There is but one channel at all stages. There is an island about 200 feet above the bridge which breaks the current and causes it to run diagonally across the channel in various directions. The current is swift at all times and at high stages surges rapidly. Conditions at this station are unfavorable for accurate measurements, but there is no other available point on this section of the stream.

Discharge measurements are made from the downstream side of the single-span bridge, to which the gage is attached. The initial point for soundings is the vertical wall of the right abutment.

The gage, which was read twice each day during 1905 by Miss Zinnie Coltharp, is a 12-foot timber fastened to the downstream side of the right abutment of the bridge. The bench mark is a United States Geological Survey standard aluminum tablet, set on the top stone of the right abutment on the downstream side of the bridge; elevation, 16.86 feet above the zero of the gage.

This station was abandoned December 31, 1905.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 99-101.

Discharge measurements of White River near Rangely, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 30	A. J. Stiles	79	208	2.53	3.70	526
June 2	H. G. Graham	90	515	6.48	5.90	3,336
June 3	do	90	521	6.63	6.00	3,457
July 11	do	78	239	2.51	3.95	600
August 3	do	77	238	2.46	3.90	587
September 5	do	77	260	3.07	4.20	798

Daily gage height, in feet, of White River near Rangely, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.78	4.25	5.62	4.8	3.94	3.75	4.88
2	3.68	4.5	5.85	4.8	3.92	3.78	4.82
3	3.79	4.5	5.98	4.78	3.9	3.8	4.38
4	3.81	4.3	6.0	4.75	3.9	3.82	4.18
5	3.72	4.2	6.0	4.75	3.9	4.15	4.05
6	3.66	4.1	6.22	4.58	3.88	4.18	3.92
7	3.69	4.0	6.38	4.45	3.9	4.14	3.78
8	3.78	4.0	6.22	4.18	3.9	4.1	3.7
9	3.82	4.1	6.3	4.14	3.88	4.1	3.72
10	3.9	4.42	6.32	4.14	3.86	3.98	3.78
11	3.9	4.35	6.45	4.1	3.89	3.99	3.85
12	3.88	4.26	6.55	3.96	3.9	3.96	3.89
13	3.88	4.22	6.38	3.89	3.9	3.95	3.9
14	3.88	4.2	6.12	3.84	3.88	3.8	3.89
15	3.81	4.22	6.15	3.82	3.9	3.8	3.89
16	3.81	4.24	6.0	3.79	3.89	3.85	3.9
17	3.74	4.28	6.11	3.82	3.88	3.8	3.9
18	3.75	4.5	6.15	3.84	3.89	3.85	3.88
19	3.76	4.78	5.85	3.82	3.9	3.85	3.88
20	3.78	4.6	5.5	3.84	3.89	3.9	3.9
21	3.82	5.15	5.36	3.82	3.86	3.85	3.9
22	3.81	5.84	5.29	3.86	3.85	3.82	3.9
23	3.81	5.92	5.22	3.89	3.89	3.92	3.9
24	3.8	6.0	5.32	3.9	3.92	3.88	3.88
25	3.81	6.16	5.26	3.81	3.91	3.85	3.88
26	3.83	6.28	5.19	3.85	3.92	3.9	3.9
27	3.85	5.95	5.08	3.88	3.95	3.92	3.91
28	3.88	5.92	4.99	3.89	3.95	4.75	3.92
29	3.92	5.98	4.95	3.89	3.88	4.92	3.9
30	4.0	5.92	4.92	3.9	3.85	4.98	3.9
31	.....	5.5	.....	3.9	3.81	.....	3.9

Station rating table for White River near Rangely, Colo., from April 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.*
3.60	380	4.40	1,010	5.20	2,020	6.00	3,490
3.70	435	4.50	1,110	5.30	2,180	6.10	3,710
3.80	495	4.60	1,220	5.40	2,350	6.20	3,930
3.90	565	4.70	1,330	5.50	2,520	6.30	4,160
4.00	645	4.80	1,450	5.60	2,700	6.40	4,390
4.10	730	4.90	1,580	5.70	2,890	6.50	4,630
4.20	820	5.00	1,720	5.80	3,080	6.60	4,870
4.30	910	5.10	1,870	5.90	3,280		

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

Estimated monthly discharge of White River near Rangely, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	645	413	506	30,110
May	4,114	645	1,752	107,700
June	4,750	1,608	3,152	187,600
July	1,450	489	748	45,990
August	605	502	561	34,500
September	1,692	381	674	40,110
October	1,554	435	636	39,110
The period				485,100

MARVINE CREEK NEAR BUFORD, COLO.

Marvine Creek rises in Marvine Lake, in the southeastern part of Rio Blanco County, Colo., and flows northwestward to its point of junction with White River.

The gaging station was established July 27, 1903. It is located at a point where the stream is crossed by a large aspen log. The station is 10 miles from Buford, the nearest post-office, and is about 35 miles from Meeker.

The channel is 30 feet wide and is straight for 100 feet above and below the station. The right bank is sloping and will overflow for 10 or 15 feet at high water. The left bank is steep and is not liable to overflow. Both banks are covered with thick brush. The bed of the stream is covered with bowlders and is free from vegetation. The channel is divided into two parts by a large sunken log, which supports the middle of the footbridge. The current is swift.

Discharge measurements are made from the log which spans the stream at the gage. The initial point for soundings is at the gage rod.

The gage, which is read twice daily by James Fitzgerald, is a vertical 5-foot timber, fastened to the lower side of the foot log, which is used as a bridge. It is referred to bench marks as follows: (1) The top of a rock 22 feet west of the gage rod; elevation, 4.62 feet. (2) The top of a triangular-shaped rock between two spruce trees on the west bank; elevation, 6.01 feet. (3) The top of a large rock 30 feet northwest of the gage; elevation. 4.61 feet. Elevations are 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, p 101; 133, p 103.
Discharge: 100, p 102; 133, p 103.
Discharge, monthly: 100, p 102; 133, p 105.
Gage heights: 100, p 102; 133, p 104.
Rating table: 100, p 102; 133, p 104.

Discharge measurements of Marvine Creek near Buford, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 15	H. G. Graham	29	35	2.54	1.80	90
June 17	do	40	95	7.61	3.50	723
July 6	do	29	41	3.66	2.10	150
July 18	do	29	41	3.56	2.10	146
August 12	do	29	38	3.79	2.00	144
September 18	do	29	37	3.14	1.95	116

Daily gage height, in feet, of Marvine Creek near Buford, Colo., for 1905.

Day	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.85	2.28	2.32	2.08	1.88	1.95
2	.....	1.85	2.28	2.28	2.02	1.88	1.95
3	.....	1.85	2.3	2.25	2.02	1.88	1.92
4	.....	1.85	2.45	2.22	2.0	1.88	1.92
5	.....	1.85	2.52	2.2	2.0	1.95	1.9
6	.....	1.85	2.45	2.2	2.0	1.95	1.9
7	.....	1.85	2.5	2.15	1.98	1.95	1.9
8	.....	1.85	2.68	2.15	1.98	1.92	1.9
9	.....	1.85	2.78	2.15	1.98	1.92	1.9
10	1.7	1.85	2.7	2.15	2.0	1.92	1.9
11	1.7	1.85	2.6	2.1	2.05	1.92	1.9
12	1.7	1.85	2.6	2.08	2.0	1.9	1.9
13	1.7	1.85	2.7	2.08	1.98	1.9	1.9
14	1.7	1.85	2.7	2.08	1.95	1.9	1.95
15	1.7	1.85	2.8	2.08	1.98	1.9	1.9
16	1.7	1.9	2.7	2.05	1.98	1.9	1.9
17	1.7	1.92	2.65	2.05	1.98	1.9	1.9
18	1.7	1.98	2.6	2.1	1.98	1.9	1.9
19	1.7	2.02	2.55	2.12	1.98	1.9	1.9
20	1.7	2.08	2.52	2.15	1.95	1.9	1.9
21	1.7	2.12	2.5	2.1	1.92	1.9	1.9
22	1.7	2.12	2.55	2.05	1.92	1.9	.....
23	1.75	2.2	2.65	2.05	1.92	1.9	.....
24	1.75	2.15	2.55	2.05	1.92	1.92	.....
25	1.75	2.15	2.45	2.02	1.92	1.92	.....
26	1.75	2.15	2.45	2.02	1.95	1.95	.....
27	1.75	2.18	2.45	2.02	1.95	1.95	.....
28	1.75	2.22	2.38	2.0	1.92	1.95	.....
29	1.85	2.15	2.38	2.0	1.92	1.98	.....
30	1.85	2.15	2.35	2.0	1.92	1.95	.....
31	.....	2.2	.....	2.08	1.92	.....	.....

Station rating table for Marvine Creek near Buford, Colo., from April 10 to October 21, 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	74	2.00	126	2.30	205	2.60	304
1.80	89	2.10	150	2.40	235	2.70	339
1.90	106	2.20	177	2.50	269	2.80	377

NOTE.—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 2.1 feet.

Estimated monthly discharge of Marvine Creek near Buford, Colo., for 1905.

[Drainage area, 50 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 10-30	98	74	78.6	3,274	1.57	1.23
May	183	98	127	7,809	2.54	2.93
June	377	199	272	16,180	5.44	6.07
July	211	126	153	9,408	3.06	3.53
August	145	110	120	7,379	2.40	2.77
September	122	103	109	6,483	2.18	2.43
October 1-21	116	106	108	4,498	2.16	1.69
The period				55,030		

DUCHESNE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Duchesne River rises in the high peaks of the Uinta and Wasatch mountains, flows in a general southeasterly direction, and enters Green River 3 miles above the mouth of the White. It is a very crooked stream, swinging back and forth across its valley, its course marked by a thick line of cottonwoods.

The principal tributaries of the Duchesne are Strawberry, East, and Lake creeks and Uinta River. From the mouth of Strawberry Creek down to Lake Creek the valley of the Duchesne averages 2 miles in width and is bordered on both sides by sandstone bluffs approximately 200 feet high. The cliffs on the northern side of the river are capped by a heavy deposit of coarse river gravel and cobblestones.

Strawberry Creek, the main upper tributary of the Duchesne, drains an area of 1,166 square miles. The stream rises in the Uinta Mountains and the run-off is derived chiefly from melting snow except during the late summer, when the flow comes from small springs well distributed over the entire drainage basin. Numerous tributaries enter the stream, particularly from the north and west, Indian, Bryants Fork, Mud, Horse, Sugar Springs, and Co-op creeks being the principal ones. They are all short and fall rapidly until they reach the valley, through which they flow sluggishly in well-defined channels. The main stream traverses the valley from north to south and is very sluggish. Very little sediment is carried by the stream at any stage. The average elevation of Strawberry Valley is 7,500 feet, which is rather high for agricultural purposes but is splendidly adapted to grazing. Indian Creek, on which a gaging station was maintained during 1905, drains a small portion of the southern slopes of the Uinta Mountains. Its basin comprises smooth, rolling hills, fairly well timbered with pine and aspen. The normal flow is derived chiefly from springs.

The greater part of the precipitation is in the form of snow, which covers the ground for six or eight months each year.

Uinta River and its principal tributary, Whiterocks River, have their sources in a series of lakes in the Uinta Mountains, fed by the snow that exists the year round in the canyons and on the high slopes. The upper drainage area of these streams is very mountainous and difficult of access. After leaving their canyons, 7 or 8 miles above the Indian agency at Whiterocks, the rivers flow southeastward, uniting in various channels between the agency and Fort Duchesne, from which point they flow in one channel, entering Duchesne River 6 miles below, near the Ouray Indian school. Pole, Farm, and Dry Gulch creeks are small tributaries of the Uinta.

STRAWBERRY CREEK IN STRAWBERRY VALLEY, UTAH.

This station was established May 2, 1903. It is located in the canyon about one-fourth mile above the junction of Strawberry and Indian creeks, and is somewhat inaccessible, the nearest settlement being Heber, 40 miles away. The chief object of the station is the determination of the amount of water available for storage in Strawberry Valley.

The channel is straight for about 600 feet above and 400 feet below the station. The banks are wooded and are sufficiently high to prevent overflow. The bed of the stream is composed of gravel and during the summer months is overgrown with moss and weeds. The current is sluggish. The stream is frozen during the winter months.

Discharge measurements are made by means of a cable and car of regular form. The initial point for soundings is the first metal tag on the tagged wire at the left bank.

Gage readings and discharge measurements during 1905 were made by T. C. Callister. The original gage was of the vertical type and was used until September, 1904, when a new, inclined gage was established at the same locality, about 1,000 feet above the cable. The datum of the new gage is the same as that of the old. The bench mark is a large sandstone bowlder S. 82° E. 175 feet from the gage, 12 feet from the bank of the river, and projecting about 3 feet above the ground. It is marked "Rec. Ser. B. M. No. 7;" elevation, 19.15 feet above the zero of the gage, and 7,496 feet above sea level. July 2, 1905, a low-water station was established at a riffle about 200 feet below the regular gage, where the velocity is sufficiently high to prevent the growth of vegetation, which interferes seriously with the results at the regular station during the summer months. The gage at this point is a vertical staff driven into the stream bed and is referred to bench mark No. 7, above described, its zero having an elevation of 19.93 feet. The annual discharge at this station is therefore represented by two discharge curves.

Beginning April 15, 1905, evaporation and precipitation observations were made at a point near the station. The evaporation records are obtained by means of a 4 by 4 by 4 foot metallic tank set in the ground with its top about 3 inches from the surface. The equipment used in obtaining the precipitation records is of the standard form used by the United States Weather Bureau stations and was furnished by Doctor Hyatt, director of the Utah division of the United States Weather Bureau. The results of the expermients are shown in the following tables:

Evaporation in Strawberry Valley, Utah.

	Inches.
April	1.43
May	2.37
June	5.68
July	6.03
August	4.71
September	3.20
October	1.31

Precipitation in Strawberry Valley, Utah.

	Inches.
April	1.01
May	1.06
June	.17
July	1.08
August	1.28
September	3.04
October	.78
November	Missing.
December	2.00

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 100, p 112; 133, p. 121.
Discharge: Ann 21, iv, p 322; 22, iv, p 384; WS 50, p 374; 100, p 112, 133, pp 121, 363.
Discharge, monthly: WS 100, p 113; 133, p 122.
Gage heights: WS 100, p 113.
Rating table: WS 100, p 113.

Discharge measurements of Strawberry Creek in Strawberry Valley, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
January 8[a]	C. Tanner	28	20	1.01	.....	20
April 17	T. C. Callister	64	75	1.63	1.43	122
April 21	do	64	81	1.72	1.64	140
April 26	do	66	179	2.61	3.15	467
May 1	do	64	125	2.1	2.28	262
May 4	do	64	96	1.83	1.86	176
May 18	do	64	112	2.01	2.12	226
May 23	T. Thomas	68	156	2.36	2.78	368
June 17	T. C. Callister	63	63	1.39	1.20	87
June 25	do	62	53	1.08	.98	57
July 2[b]	do	37	36	1.23	1.50	44
July 12[b]	do	37	32	1.11	1.40	35
July 28[b]	do	37	29	.92	1.31	26
December 8[a]	A. B. Larson	34	41	.83	1.67	34
December 9[a]	do	34	45	.83	1.75	37
December 11[a]	do	34	50	.76	1.85	38
December 13[a]	do	32	46	.80	1.95	37
December 18[a]	do	26	46	.73	2.22	34

[a] Creek frozen.
[b] Measurement made at riffle 200 feet below gage. Gage heights refer to temporary gage at riffle.

Daily gage height, in feet, of Strawberry Creek in Strawberry Valley, Utah, for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.23	2.35	0.81	1.32	1.27	1.42	.....	1.56
2	.....	2.11	2.34	1.5	1.32	1.3	1.38	1.37	1.58
3	.....	2.06	2.28	1.5	1.32	.....	1.38	.....	1.56
4	.....	1.89	2.24	1.48	1.33	1.3	1.38	1.35	1.56
5	.....	1.74	2.11	1.47	1.32	1.33	1.38	.....	1.54
6	.....	1.66	2.0	1.45	1.3	.....	1.38	1.35	1.51
7	.....	1.64	1.96	1.44	1.29	1.35	1.35	.....	1.6
8	.....	1.68	1.94	1.43	1.27	1.36	.....	1.38	1.67
9	.....	1.76	1.89	1.42	1.27	1.37	1.34	.....	1.75
10	.....	1.76	1.76	1.41	.....	.....	1.33	1.38	1.75

Daily gage height, in feet, of Strawberry Creek in Strawberry Valley, Utah, for 1905—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	1.67	1.65	1.41	1.33	.....	1.35	.....	1.85
12	.....	1.74	1.56	1.4	1.32	1.31	.....	.....	1.91
13	1.05	1.72	1.48	1.39	1.3	1.31	1.36	1.41	1.95
14	1.23	1.64	1.4	1.39	1.3	.....	1.35	.....	1.99
15	1.3	1.6	1.3	1.48	1.28	.....	.....	.....	2.09
16	1.34	1.7	1.28	1.41	1.27	1.3	1.33	.....	2.12
17	1.42	1.94	1.24	1.38	.....	1.3	1.32	.....	2.15
18	1.42	2.08	1.25	1.36	.....	1.33	.....	.....	2.22
19	1.53	2.2	1.17	1.35	1.25	1.3	1.47	.....	2.23
20	1.47	2.35	1.13	1.37	1.25	1.31	1.45	.....	2.24
21	1.72	2.49	1.09	1.36	1.25	.....	.....	.....	2.27
22	1.84	2.61	1.06	1.38	1.25	1.32	1.43	.....	.....
23	1.88	2.74	1.02	1.37	1.25	1.31	.....	1.43	.....
24	2.24	2.59	1.0	1.35	.....	.....	.....	.....	.....
25	2.88	2.53	.98	1.35	.....	1.45	1.32	1.42	.....
26	2.9	2.6	.95	1.33	.....	1.4	1.32	1.41	.....
27	2.47	2.48	.93	1.3	.....	1.35	1.32	1.48	.....
28	2.38	2.46	.9	1.31	1.3	.....	.....	1.5	.....
29	2.14	2.3	.9	1.31	1.3	1.51	1.35	1.52	.....
30	2.26	2.2	.89	1.31	1.31	1.49	.....	1.58	.....
31	.....	2.26	.....	1.31	1.29	.....	1.38	.....	.....

NOTE.—Gage heights after July 2 refer to new gage at riffle, as the old gage heights were unreliable after that date on account of growing moss.

November 23–26 there was ice along the edges but the flow was unobstructed. November 27–28 back water caused by ice. November 29 to December 31 the creek was frozen completely over. Gage heights are to water surface.

Station rating table for Strawberry Creek in Strawberry Valley, Utah, from April 13 to July 1, 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.*
0.80	41	1.40	110	2.00	205	2.60	329
.90	51	1.50	124	2.10	224	2.70	352
1.00	62	1.60	139	2.20	243	2.80	376
1.10	73	1.70	154	2.30	263	2.90	400
1.20	85	1.80	170	2.40	284	3.00	425
1.30	97	1.90	187	2.50	306		

NOTE.—The above table is based on nine discharge measurements made during April to June, 1905. It is well defined between gage heights 0.9 foot and 3 feet.

Station rating table for Strawberry Creek in Strawberry Valley, Utah, from July 2 to November 25, 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.*
1.25	23	1.35	31	1.45	39	1.50	44
1.30	27	1.40	35				

NOTE.—The above table is based on three discharge measurements made during July, 1905. It is well defined.

Estimated monthly discharge of Strawberry Creek in Strawberry Valley, Utah, for 1905.

Month	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 13–30	400	68	192	6,855
May	362	139	225	13,840
June	274	50	129	7,676
July	44	27	34.6	2,128
August	29	23	26.1	1,605
September	45	25	30.7	1,827
October	42	29	32.5	1,998
November	38	31	35.0	2,083
December[a]	35	35	35.0	2,152
The period				40,160

[a] Daily discharge estimated at 35 second-feet, based on five discharge measurements.
NOTE.—Daily discharge interpolated for missing gage heights.

INDIAN CREEK IN STRAWBERRY VALLEY, UTAH.

This station was established April 5, 1905. It is located in the canyon about 250 feet above the junction of the creek with Strawberry Creek. It is about 1 mile below the point where Indian Creek leaves Indian Creek Valley and enters the canyon, and is 40 miles from Heber, the nearest post-office. The records will show the amount of water that can be diverted from Indian Creek into the Strawberry Valley storage reservoir.

The channel is straight for about 25 feet above and below the station. The right bank is vertical for about 1½ feet above the bed and then slopes gradually upward; the left bank slopes irregularly from the bed. Both banks are sufficiently high to prevent overflow. The bed of the stream is smooth and rocky and is not liable to shift. A slight growth of moss occurs in the summer, but does not interfere with the rating curve to any great extent. The velocity is medium and the discharge ranges from 20 to 100 second-feet. Definite information in regard to winter conditions is lacking.

Discharge measurements are made from two poles laid across the stream. The initial point for soundings is at the right bank.

The gage, which was read during 1905 by the men at the Reclamation Service camp in Strawberry Valley, under the direction of T. C. Callister, is a large stake driven into the bed about 180 feet above the measuring section. It is referred to a bench mark consisting of a cross on a large sandstone bowlder 50 feet south of the river; elevation, 16.28 feet above the zero of the gage and 7,480 feet above mean sea level.

Discharge measurements of Indian Creek in Strawberry Valley, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 15	T. C. Callister	16	16	0.87	1.00	13.5
April 18	do	17	14	.91	1.00	13
April 25	J. Thomas	18	18	1.56	1.20	28
April 26	T. C. Callister	18	20	1.95	1.38	40
May 15	do	16	14	1.39	1.10	18.7
June 17	do	16	13	1.72	1.10	22
October 14	do	16	8.3	1.10	.92	9.1
December 9[a]	A. B. Larson	14	16	.63	1.46	10.1
December 10[a]	do	14	12	.78	1.25	9.8
December 11[a]	do	12	18	.72	1.67	12.8
December 13[a]	do	14	25	.52	1.81	12.9
December 19[a]	do	13	23	.47	2.08	10.9

[a] Ice measurement.

Discharge measurements of Indian Creek at point of diversion in Strawberry Valley, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 21	T. C. Callister	16	6.8	1.12	0.71	7.6
May 3	Callister and Thomas	18	11	1.34	.92	15
May 5	T. C. Callister	18	16	1.62	1.11	25
May 17	do	18	16	1.62	1.11	25
May 19	do	18	19	1.77	1.3	33
May 21	do	19	21	1.78	1.41	37

Daily gage height, in feet, of Indian Creek in Strawberry Valley, Utah, for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.1	1.2	1.02	1.0	0.95			1.2
2		1.13	1.2	1.02	1.0	.95	0.96		1.2
3		1.12	1.21	1.02	1.0		.95		1.16
4		1.1	1.2	1.02	1.0	.95	.93	0.92	1.11
5		1.08	1.2	1.02	1.0	1.0	.93		1.1
6		1.06	1.19	1.02	.98		.93	.92	1.1
7		1.06	1 18	1.02	.98	1.0	.93		1.3
8		1.1	1.17	1.02	.97	.98		.91	1.44
9		1.11	1.16	1.01	.98	.96	.93		1.46
10		1.11	1.13	1.01			.92	.92	1.25
11		1.1	1.11	1.0	1.0		.93		1.67
12		1.1	1.12	1.0	.99	.95			1.75
13		1.11	1.12	1.0	1.0	.94	.92	.86	1.81
14	1.0	1.09	1.11	1.0	.99		.92		1.9
15	1.0	1.1	1.11	1.01	.98				1.94
16	1.01	1.12	1.11	1.0	.97	.94	.92		2.0
17	1.02	1.19	1.1	1.0			.92		2.01
18	1.0	1.22	1.11	1.0		.95			2.03
19	1.02	1.3	1.1	.99	.96	.94	.95		2.08
20	1.04	1.31	1.08	1.0	.96	.93	.93		2.09
21	1.14	1.34	1.08	1.0	.96				2.16
22	1.15	1.37	1.06	1.0	.97	.95	.92		
23	1.15	1.39	1.05	1.0	.95	.93		.88	
24	1.36	1.35	1.05	1.0					
25	1.56	1.32	1.05	1.0		.98	.92	.87	
26	1.25	1.31	1.04	1.0		.95	.92	.88	
27	1.14	1.3	1.04	.98		.94	.92	1.0	
28	1.15	1.29	1.03	1.0	.97			1.2	
29	1.07	1.28	1.04	1.0	.97	1.01	.94	1.58	
30	1.07	1.24	1.03	1.0	.98	.99		1.4	
31		1.24		1.0	.97		.96		

NOTE.—Creek frozen November 27 to December 31.

Station rating table for Indian Creek in Strawberry Valley, Utah, from April 14 to November 26, 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.*
0.90	8.2	1.10	20	1.30	35	1.50	51
1.00	13.2	1.20	27	1.40	43	1.60	59

NOTE.—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 0.9 foot and 1.4 feet.

Estimated monthly discharge of Indian Creek in Strawberry Valley, Utah, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet
	Maximum.	Minimum.	Mean.	
April 14–31	56	13	22.3	752
May	42	17	27.1	1,666
June	28	15	20.9	1,244
July	15	12	13.6	836
August	13	11	12.1	744
September	14	10	11.1	660
October	11	9	9.8	603
November	11	6.5	8.4	500
December [a]	11	11	11.0	676
The period				7,681

[a] Daily discharge estimated at 11 second-feet, based on five measurements.
NOTE.—Daily discharge interpolated for missing gage heights.

Table of evaporation at Fort Duchesne, Utah, for 1904.

Month.	Total evaporation in inches.
August 26–27	0.35
September	3.18
October	1.84
November 1–16	.43
Total for period	5.80
Average daily evaporation	0.0734

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Duchesne River basin in 1904:

Miscellaneous discharge measurements made in Duchesne River drainage basin 1904.

Date.	Stream.	Locality.	Gage height.	Discharge.
			Feet.	*Sec.-ft.*
April 21	Duchesne	Myton, Utah	6.20	901
April 22	do	do	6.08	766
May 19	do	do	8.13	3,289

PRICE RIVER DRAINAGE BASIN.

PRICE RIVER NEAR HELPER, UTAH.

Price River rises in the Wasatch Mountains, in the southeastern part of Utah County, flows in a general southeasterly direction, and unites with Green River at a point about 14 miles above Greenriver, Utah. The main source of supply is the snow in the upper reaches of the basin, where elevations range from 8,000 to 9,000 feet. The region is extremely rough and rugged. The principal rock is a loose and badly disintegrated sandstone. There is but little soil and practically no vegetation except for small groves of scrubby cedar and a few scattered pines. The original scanty underbrush and grass have been almost entirely tramped out by sheep and cattle. The river is subject to floods in the spring and early summer, during which time it carries immense quantities of sediment. Gordon and Pleasant creeks are the main tributaries. They are both short, steep streams and enter the river from the west almost at right angles.

The gaging station was established February 21, 1904. It is located on the upper side of the ford near the settlement of Spring Glen, about 3 miles south of Helper, Utah, and 350 feet west of the main line of the Denver and Rio Grande Railroad.

The channel is straight for about 125 feet above and 400 feet below the station, and the banks are sufficiently high to prevent any overflow. The bed of the stream is composed of fine gravel and sand and shifts slightly, especially during high water. Information in regard to winter conditions is incomplete.

Low-water measurements are made by wading. The initial point for soundings is a 2 by 4 inch post driven in the left bank S. 8° W., 2½ feet from the gage. The course of the section is N. 44° W. A 2 by 4 inch post marks the position of the gaging station on the right bank. Measurements during high water are impossible, as there is no provision for crossing except by wading.

The gage, which was read daily during 1905 by John Tryon, is a staff driven into the stream bed and supported at the top by a timber buried in the bank. The gage is referred to bench marks as follows: (1) A Standard United States Geological Survey cap cemented in a sandstone bowlder embedded in the bank at a point S. 65° E. 23 feet from the gage; elevation, 12.55 feet above the zero of the gage, and so marked. (2) A cross chiseled on a large bowlder embedded in the bank S. 6° E. 19.2 feet from the gage, marked "B. M.;" elevation, 11.19 feet above the zero of the gage.

A description of this station, with gage height and discharge data, is contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 128–130.

Discharge measurements of Price River near Helper, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
January 21	C. Tanner	38	25	0.87	3.35	22
February 17	W. G. Swendsen	48	37	1.02	3.40	38
March 17	do	52	50	1.36	3.65	68
April 25	do	55	63	1.88	3.95	119
May 13	do	53	78	1.96	4.00	154
June 2	do	79	153	3.76	4.92	575
August 24	A. B. Larson	47	24	.48	3.22	11.5

Daily gage height, in feet, of Price River near Helper, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.3	3.35	3.45	3.55	4.5	4.9	3.5	3.4	3.2	3.5	3.3	3.3
2	3.3	3.35	3.45	3.6	4.5	4.9	3.4	3.4	3.2	3.5	3.3	3.3
3	3.35	3.35	3.45	3.65	4.5	4.9	3.4	3.5	3.2	3.4	3.4	3.3
4	3.3	3.35	3.45	3.65	4.3	4.9	3.4	3.4	3.2	3.4	3.4	3.3
5	3.3	3.35	3.45	3.65	4.2	4.9	3.4	3.4	3.3	3.4	3.3	3.3
6	3.3	3.35	3.45	3.45	4.2	4.8	3.4	3.4	3.4	3.4	3.3	3.3
7	3.3	3.4	3.45	3.15	4.1	4.6	3.4	3.4	3.4	3.4	3.3	3.2
8	3.3	3.4	3.5	3.15	4.2	4.6	3.4	3.3	3.4	3.4	3.3	3.2
9	3.3	3.4	3.45	3.15	4.2	4.5	3.4	3.3	3.4	3.4	3.3	3.2
10	3.3	3.4	3.45	3.15	4.1	4.5	3.4	3.3	3.4	3.4	3.3	3.3
11	3.3	3.4	3.5	3.25	4.0	4.4	3.4	3.4	3.4	3.3	3.3	3.3
12	3.3	3.4	3.4	3.35	4.0	4.3	3.4	3.4	3.3	3.3	3.3	3.3
13	3.4	3.55	3.55	3.35	4.0	4.2	3.4	3.4	3.3	3.3	3.3	3.2
14	3.3	3.6	3.55	3.35	4.1	4.2	3.4	3.3	3.3	3.3	3.3	3.3
15	3.3	3.6	3.55	3.45	4.1	4.2	3.4	3.3	3.2	3.3	3.3	3.2
16	3.3	3.6	3.55	3.5	4.1	4.1	3.4	3.2	3.2	3.3	3.3	3.2
17	3.4	3.6	3.65	3.45	4.3	4.1	3.4	3.2	3.2	3.3	3.3	3.2
18	3.3	3.4	3.65	3.45	4.4	4.1	3.3	3.2	3.2	3.3	3.4	3.2
19	3.3	3.4	3.65	3.45	4.6	4.1	3.3	3.2	3.2	3.3	3.3	3.2
20	3.3	3.4	3.65	3.45	4.8	3.9	3.3	3.2	3.2	3.3	3.3	3.2
21	3.35	3.4	3.65	3.4	4.9	3.9	3.3	3.2	3.2	3.3	3.3	3.2
22	3.35	3.4	3.6	3.4	4.9	3.8	3.3	3.2	3.2	3.4	3.3	3.2
23	3.35	3.5	3.55	3.4	4.9	3.8	3.3	3.2	3.2	3.4	3.4	3.3
24	3.35	3.45	3.55	3.4	4.9	3.7	3.3	3.2	4.5	3.4	3.4	3.2
25	3.35	3.45	3.65	3.95	5.0	3.6	3.4	3.2	3.5	3.4	3.4	3.2
26	3.35	3.5	3.65	4.0	5.0	3.6	3.3	3.2	3.4	3.4	3.3	3.2
27	3.35	3.5	3.6	4.2	5.0	3.6	3.3	3.3	3.3	3.4	3.4	3.2
28	3.35	3.5	3.55	4.3	5.1	3.5	3.3	3.2	3.3	3.4	3.3	3.2
29	3.35	.....	3.55	4.3	5.1	3.5	3.3	3.3	6.8	3.4	3.2	3.2
30	3.35	.....	3.45	4.4	5.1	3.5	3.3	3.3	3.6	3.4	3.3	3.2
31	3.35	.....	3.45	.....	4.9	3.5	3.4	3.3	.....	3.3	.....	3.1

NOTE.—These gage heights are liable to some error. Observer made no report of ice conditions, but it is probable that the river was frozen for short periods.

Station rating table for Price River near Helper, Utah, 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.*
3.10	4	3.60	60	4.10	182	4.60	404
3.20	9	3.70	78	4.20	219	4.70	455
3.30	18	3.80	98	4.30	260	4.80	508
3.40	30	3.90	122	4.40	305	4.90	563
3.50	44	4.00	150	4.50	354	5.00	620

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904–1905. It is well defined between gage heights 3.2 feet and 4.9 feet.

Estimated monthly discharge of Price River near Helper, Utah, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January[a]	30	18	21.1	1,297
February	60	24	36.3	2,016
March	69	37	49.8	3,062
April	305	6	71.5	4,254
May	678	150	379	23,300
June	563	44	254	15,110
July	44	18	25.8	1,586
August	44	9	18.8	1,156
September	1,740	9	87.8	5,224
October	44	18	26.3	1,617
Novemner	30	9	20.5	1,220
December[a]	18	4	12.0	738
The year	1,740	4	83.6	60,580

[a] No ice record, discharge applied as for open channel.

GRAND RIVER DRAINAGE BASIN.

AREA AND EXTENT.

Grand River and its tributaries drain an area comprising approximately 26,180 square miles, of which 22,290 are in Colorado and the rest in eastern Utah. East and southeast the basin is limited by the high ranges of the Continental Divide, which separate it from the basins of the Platte and the Arkansas rivers. On the north are the White River and Book Cliffs plateaus, while westward it extends to the canyon district of the Colorado.

The tributaries include innumerable small creeks and five large streams, viz, Blue, Eagle, Roaring Fork, Gunnison, and Dolores rivers.

In the following account of the work of the United States Geological Survey in this region during 1905 the basin has been subdivided, the main river being described first and the tributaries afterwards in their order, from the head down.

GRAND RIVER.

DESCRIPTION OF BASIN.

Grand River rises on the western slopes of the Rocky Mountains among the high peaks of the Front Range, flows in a general southwesterly direction across Colorado into Utah, and unites with Green River to form the Colorado. From source to mouth the total distance traversed is about 350 miles.

In most respects the Grand is a typical mountain stream, flowing throughout its course in a succession of deep canyons, with precipitous and ofttimes perpendicular walls varying in height up to 3,000 feet above the water's edge, alternating with long, narrow, fertile valleys.

The headwater region, comprising approximately 50 per cent of the basin, consists of a long stretch of the western portion of the Continental Divide, extending from the north-central portion of Colorado southward nearly to the Colorado-New Mexico line, a distance of 260 miles, and separating the waters of the Grand from those of the Platte and Arkansas basins. The area is extremely rugged, elevations ranging from 7,000 to 14,000 feet. Gradients are steep, stream channels are numerous, and tributaries are rapid, the fall varying from 20 to 150 feet. The streams of this region derive their waters chiefly from the snow masses on the Continental Divide and furnish the perennial discharge of the Grand. The intermediate or middle portion of the basin, consisting largely of broken and scoured plateaus of sedimentary origin, contributes a relatively small amount of the run-off, the tributaries being

few and, with the exception of Gunnison River, insignificant. The lower portion of the basin, immediately adjacent to the Colorado-Utah State line, is an arid, much eroded region, furnishing an appreciable run-off, which carries a large amount of sediment.

The largest tributaries of the headwater region are Frazer, Williams Fork, Troublesome, Blue, and Muddy rivers, which add their waters to the Grand before it leaves Middle Park. Eagle River comes in near Eagle, just above the point where the river enters Grand River Canyon, and Roaring Fork unites with it just below the mouth of the canyon at Glenwood Springs. At Grand Junction, Colo., the river receives the waters of its largest tributary, Gunnison River, and thereafter no other stream of importance enters until the Dolores comes in, 15 miles west of the Utah boundary.

A peculiar feature of the drainage is what might be termed its one-sided nature, practically all its important tributaries entering the river from the east. That part of the basin lying north and west of the Grand is much less extensive in area, is lower, and is generally broken and barren, and a considerable portion of the waters of its streams is diverted for irrigation.

The geological formations of the basin range from the granite and masses of igneous origin on the crest of the Continental Divide to the younger and less resistant sedimentary rocks of the plateau region. The soils of the upper basin, though shallow, generally contain considerable organic matter; those of the intermediate basin are largely decomposed and disintegrated sedimentary rocks, in the lower basin the soils consist of adobe clays and sandy loams, which grade imperceptibly from one to the other. The scant vegetation of the lower basin renders soil erosion large.

The mountainous portion of the basin is still well covered with forests of spruce, quaking aspen, cedar, and pinon, and the forestation of the intermediate basin is fair. The controlling vegetation of the lower basin is sagebrush, chico, and cactus pads, with scattered pines, cedars, and pinons.

The precipitation ranges from 5 to 10 inches in the lower basin, 10 to 20 inches in the intermediate region, and 20 to 30 inches in the headwater region. By far the greater part of this is in the form of snow.

Natural storage within the basin is limited to a few small, high, mountain lakes. The stream channels of the upper basin are bordered to some extent by flat bottom lands, which are used as meadows and which are irrigated by a large number of small ditches. In the intermediate basin are a few small reservoirs storing snow and flood waters. A number of pumping plants also draw upon this district. Irrigation is extensively practiced in the Uncompahgre, Gunnison, and Grand valleys, and a large project now under construction by the Reclamation Service will require 1,200 second-feet of the discharge of Gunnison River. The immense power possibilities of the Grand are at present but little developed.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

This station was established July 29, 1904. It is located at the highway bridge between Grand Lake and Hot Sulphur Springs, Colo., about 3 miles southwest of Grand Lake postoffice, in T. 3 N., R. 76 W. The nearest railroad station is at Granby, on the Denver, Northwestern and Pacific, 15 miles distant.

The channel is straight for about 500 feet above and for 150 feet below the station. Both banks are about 2 feet high and are covered with heavy sod, willows, and scattered pine trees. The ground slopes upward from the top of the banks rather abruptly, so that even at very high stages the overflow is confined to a comparatively narrow channel. The bed of the stream at the station and for a considerable distance above and below is covered with large bowlders, which at high water cause a boiling and wave motion and at low stages eddies and in some places dead water. The channel is very rough and has a great fall. There is but one channel at all stages. The ordinary range of gage heights is about 3 feet. Gage readings are impracticable during the winter months owing to the formation of ice at the rod. The section is not entirely satisfactory, but it is the best available.

Discharge measurements are made at the higher stages from the downstream side of the single-span wooden bridge to which the gage is attached. The initial point for soundings is a 10-penny nail driven into the bridge floor over the north face of the right abutment and marked zero with black paint.

The gage, which was read twice each day during 1905 by G. W. Carr, is a staff attached vertically to the downstream edge of the right abutment of the bridge. The gage reads from 2 to 10.3 feet, the 2-foot mark resting on the bed of the stream. The bench mark is a 10-penny nail driven into a notch cut in the northeast root of a 12-inch pine tree which stands at the right end of the bridge on the downstream side; elevation, 8.36 feet above the zero of the gage. The elevation of the station above sea level is about 8,400 feet.

A description of this station with gage-heights and discharge data is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 130-132.

Discharge measurements of North Fork of Grand River near Grand Lake, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 5	W. A. Lamb	39	80	1.80	4.10	144
May 30	do	43	122	3.47	4.80	423
June 11	do	53	159	4.99	5.60	793
June 30	do	52	137	4.20	5.20	576
July 7	do	39	99	3.08	4.60	305
July 26	do	39	87	1.59	4.15	138
August 2	do	39	80	1.28	4.00	102
August 16	do	39	63	1.02	3.76	64
September 9	do	38	55	.75	3.60	41
September 18	do	38	49	.65	3.49	32

Daily gage height, in feet, of North Fork of Grand River near Grand Lake, Colo., for 1905.

Day.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.3	4.38	5.2	5.05	4.02	3.58	3.55	3.48	4.28
2	3.3	4.4	5.22	5.05	4.0	3.6	3.52	3.5	3.45
3	3.3	4.3	5.4	4.95	3.98	3.62	3.5	3.62	3.4
4	3.3	4.2	5.8	4.7	3.98	3.68	3.5	3.68	3.38
5	3.3	4.08	5.8	4.6	3.92	3.62	3.5	3.6	3.4
6	3.35	3.95	5.78	4.6	3.9	3.6	3.48	3.58	3.88
7	3.3	4.12	5.8	4.55	3.88	3.6	3.45	3.48	3.8
8	3.3	4.28	5.88	4.62	3.82	3.58	3.45	3.35	3.4
9	3.35	4.35	6.2	4.6	3.8	3.55	3.48	3.38	3.38
10	3.3	4.25	6.1	4.58	3.8	3.55	3.48	3.45	3.85
11	3.3	4.12	5.6	4.58	3.82	3.55	3.5	3.5	3.65
12	3.35	4.1	5.7	4.5	4.02	3.5	3.5	3.5	.....
13	3.4	4.15	5.85	4.55	3.98	3.5	3.5	3.45	.....
14	3.4	4.1	5.7	4.52	3.85	3.5	3.5	3.5	.....
15	3.4	4.1	5.75	4.62	3.8	3.48	3.5	3.45	.....
16	3.4	4.3	5.85	4.58	3.78	3.48	3.5	3.35	.....
17	3.42	4.6	5.68	4.52	3.72	3.45	3.5	3.38	.....
18	3.5	4.72	5.45	4.45	3.7	3.5	3.48	3.4	.....
19	3.48	4.75	5.35	4.3	3.7	3.52	3.42	3.55	.....
20	3.5	4.8	5.2	4.3	3.68	3.5	3.52	3.5	.....
21	3.52	4.88	5.3	4.32	3.65	3.5	3.65	3.45	.....
22	3.52	4.95	5.3	4.22	3.62	3.5	3.68	3.4	.....

Daily gage height, in feet, of North Fork of Grand River near Grand Lake, Colo., for 1905— Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	3.55	5.1	5.38	4.15	3.6	3.48	3.62	3.4	.....
24	3.58	5.02	5.65	4.15	3.6	3.45	3.6	3.5	.....
25	3.6	4.92	5.75	4.18	3.6	3.5	3.52	3.52	.....
26	3.62	4.88	5.7	4.12	3.6	3.5	3.5	3.55	.....
27	3.75	4.92	5.7	4.15	3.6	3.48	3.5	3.45	.....
28	3.92	4.95	5.55	4.15	3.6	3.45	3.5	3.4	.....
29	4.02	4.88	5.42	4.1	3.68	3.45	3.5	3.4	.....
30	4.15	4.85	5.35	4.1	3.62	3.52	3.48	3.5	.....
31	.....	5.05	.....	4.05	3.6	.....	3.45	.....	.....

NOTE.—Ice conditions during December.

Station rating table for North Fork of Grand River near Grand Lake, Colo., 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.*
3.30	17	4.10	130	4.90	434	5.70	861
3.40	24	4.20	160	5.00	479	5.80	927
3.50	33	4.30	194	5.10	526	5.90	996
3.60	43	4.40	230	5.20	575	6.00	1,067
3.70	55	4.50	267	5.30	627	6.10	1,141
3.80	69	4.60	306	5.40	681	6.20	1,220
3.90	85	4.70	347	5.50	738		
4.00	105	4.80	390	5.60	798		

NOTE.—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 3.5 feet and 5.6 feet.

Estimated monthly discharge of North Fork of Grand River near Grand Lake, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	145	17	35.8	2,130
May	526	95	291	17,890
June	1,220	575	816	48,560
July	502	118	254	15,620
August	110	43	67.5	4,150
September	53	28	35.7	2,124
October	53	26	34.2	2,103
November	53	20	31.1	1,851
The period	.....	.....	.....	94,430

GRAND LAKE OUTLET AT GRAND LAKE, COLO.

This station was established July 31, 1904. It is located at the footbridge at the west end of Grand Lake, about one-half mile south of Grand Lake post-office, Colo., in sec. 6, T. 3 N., R. 75 W. The nearest railroad station is 18 miles distant, at Granby, on the Denver, Northwestern and Pacific Railway.

The channel is straight for about 300 feet above and for 150 feet below the boat station. Both banks are about 3 feet high, and their level tops are covered with white pine trees. The stream does not overflow at this point, which is one-fourth mile below the gage and outlet. The current is swift at high water and medium at lower stages. The bed of the stream is composed of gravel and cobblestones and is firm and free from vegetation. At the gage both banks are low and are liable to overflow. There is but one channel at all stages. Gage heights have an ordinary range of 2.5 feet. Ice conditions render gage readings impracticable during the winter months.

High-water measurements are made from a boat at a ford about one-fourth mile below the gage. Points for soundings are marked at 5-foot intervals by tin tags fastened to a wire stretched across the stream 50 feet above the ford. The initial point for soundings is the tree to which the wire is fastened on the right bank. At ordinary and low stages measurements are made by wading at convenient points below the gage.

The gage, which was read twice each day during 1905 by J. W. Davies, is a staff attached vertically to the southeast corner of the second pier from the north end of the footbridge, the 2-foot mark resting on the bed of the stream. The gage is referred to bench marks as follows: (1) A cross on the top of a large granite bowlder 85 feet south of the left bank of the outlet and 40 feet west of the lake, marked with black paint "U. S. G. S. B. M." elevation, 12.05 feet above the zero of the gage. (2) A cross cut in the top of a granite bowlder 1,198 feet north from the initial point for soundings and marked "B. M.;" elevation, 14.93 feet above the zero of the gage. Elevation above sea level is about 8,500 feet.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 132–134.

Discharge measurements of Grand Lake Outlet at Grand Lake, Colo., in 1905.

Date.	Hydrographer.	Width	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 4	Wm. A. Lamb	48	49	1.53	2.00	75
May 31	do	56	105	3.28	2.90	345
June 11	do	170	347	2.39	3.88	830
July 1	do	156	275	2.13	3.42	585
July 8	do	151	222	1.39	2.77	308
July 27	do	120	137	1.34	2.42	184
August 3	do	126	124	1.07	2.21	133
August 17	do	49	47	1.40	1.95	66
September 11	do	36	34	.82	1.62	28
September 18	do	36	30	.57	1.50	17

NOTE.—Measurements made at different sections.

Daily gage height, in feet, of Grand Lake Outlet at Grand Lake, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.34	1.92	3.22	3.37	2.34	1.76	1.48
2	1.36	2.02	3.46	3.24	2.28	1.74	1.48
3	1.38	2.04	3.64	3.01	2.22	1.62	1.48
4	1.39	2.0	3.98	2.82	2.19	1.66	1.48
5	1.39	1.96	4.18	2.74	2.16	1.68	1.48
6	1.39	1.9	4.03	2.71	2.13	1.68	1.47
7	1.39	1.85	4.02	2.7	2.1	1.69	1.45
8	1.39	1.84	4.11	2.74	2.06	1.7	1.43
9	1.4	1.92	4.44	2.72	2.03	1.68	1.42
10	1.48	1.96	4.21	2.71	2.0	1.66	1.4
11	1.52	1.96	3.9	2.75	2.0	1.65	1.39

Daily gage height, in feet, of Grand Lake Outlet at Grand Lake, Colo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
12	1.54	1.92	3.9	2.78	2.06	1.62	1.38
13	1.54	1.9	4.0	2.75	2.08	1.59	1.37
14	1.54	1.9	3.9	2.74	2.06	1.58	1.38
15	1.56	1.87	3.98	2.76	2.04	1.54	1.39
16	1.56	1.86	4.12	2.76	2.0	1.54	1.4
17	1.57	1.96	3.72	2.68	1.94	1.52	1.42
18	1.57	2.12	3.69	2.62	1.9	1.5	1.44
19	1.58	2.24	3.46	2.56	1.86	1.49	1.45
20	1.62	2.36	3.32	2.56	1.84	1.49	1.46
21	1.62	2.48	3.4	2.54	1.82	1.49	1.44
22	1.63	2.66	3.38	2.52	1.8	1.48	1.44
23	1.64	2.94	3.46	2.47	1.78	1.47	1.42
24	1.64	3.06	3.66	2.42	1.78	1.46	1.42
25	1.64	2.96	3.76	2.4	1.78	1.44	1.42
26	1.64	2.88	3.87	2.42	1.8	1.44	1.43
27	1.66	2.9	3.84	2.43	1.79	1.44	1.43
28	1.72	2.97	3.74	2.41	1.8	1.44	1.43
29	1.76	2.89	3.66	2.41	1.8	1.45	1.44
30	1.82	2.8	3.56	2.42	1.8	1.48	1.47
31	.....	2.9	.....	2.38	1.8	.....	1.46

Station rating table for Grand Lake Outlet at Grand Lake, Colo., 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	10	2.20	122	3.10	433	4.00	900
1.40	13	2.30	148	3.20	479	4.10	956
1.50	18	2.40	176	3.30	527	4.20	1,013
1.60	25	2.50	207	3.40	578	4.30	1,071
1.70	34	2.60	240	3.50	630	4.40	1,130
1.80	46	2.70	275	3.60	682	4.50	1,190
1.90	60	2.80	312	3.70	735		
2.00	77	2.90	350	3.80	789		
2.10	98	3.00	390	3.90	844		

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

Estimated monthly discharge of Grand Lake Outlet at Grand Lake, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet
	Maximum.	Minimum.	Mean.	
April	49	11	22.7	1,351
May	416	52	168.	10,330
June	1,154	489	785	46,710
July	563	170	267	16,420
August	159	44	76.2	4,685
September	41	15	23.7	1,410
October	17	12	14.7	904
The period	.....	.....	.....	81,810

NORTH INLET TO GRAND LAKE AT GRAND LAKE, COLO.

This station was established August 3, 1905. It is located at the footbridge which crosses the stream about 100 yards north of the mouth and 300 yards east of Grand Lake post-office, in sec. 5, T. 3 N., R. 75 W.

The channel is straight for 300 feet above and for 200 feet below the station. The right bank is low, is covered with grasses and scattered willows and white pine trees, and at high stages overflows to a considerable extent. The left bank is high and is covered with a dense growth of white pines and underbrush. The bed of the stream is composed of large cobblestones and gravel and is permanent. There is but one channel at all ordinary stages, broken by the middle pier of the bridge. The current is swift at high and medium at low water.

High-water measurements are made from the upstream side of the two-span footbridge. The initial point for soundings is a 40-penny nail driven in the top of the west end of the north stringer of the bridge, 97 feet from bench mark No. 2. The point is marked with black paint. Low-water measurements are made by wading at convenient points above the bridge.

The gage, which was read twice each day during 1905 by J. Cairns, is a 4-foot timber fastened to the west face of the outer pier of the bridge. It is referred to bench marks as follows: (1) A 40-penny nail driven horizontally in the west face of a white pine tree 8 inches in diameter located on the left bank of the stream, 20 feet northeast of the east end of the bridge, marked "U. S. B. M.;" elevation, 5.32 feet above the zero of the gage. (2) A 40-penny nail driven horizontally in the east face of a white pine tree 1 foot in diameter located on the right bank of the stream 97 feet west of the initial point for soundings; elevation, 4.43 feet above the zero of the gage.

Discharge measurements of North Inlet to Grand Lake at Grand Lake, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 4	W. A. Lamb	48	43	1.37	2.30	.58
May 31	do	50	111	1.84	3.05	204
July 27	do	48	53	1.62	2.40	86
August 3	do	46	50	1.36	2.30	68
September 11	do	34	23	.61	1.90	14
September 18	do	30	15	.63	1.85	9.4

NOTE.—Measurements made at different sections.

Daily gage height, in feet, of North Inlet to Grand Lake at Grand Lake, Colo., for 1905.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.0	1.8	1.85	1.85	17	2.1	1.9	1.8	1.9	1.8
2	.....	2.0	1.8	1.85	1.8	18	2.1	1.9	1.8	1.9	1.8
3	2.3	1.9	1.8	1.85	1.8	19	2.0	1.9	1.8	1.9	1.8
4	2.3	1.9	1.8	1.85	1.8	20	2.0	1.9	1.85	1.9	1.8
5	2.3	1.9	1.8	1.9	1.8	21	2.0	1.9	1.95	1.9	1.8
6	2.3	1.9	1.8	1.9	1.8	22	2.0	1.9	1.9	1.9	1.8
7	2.3	2.0	1.8	1.9	1.8	23	2.0	1.9	1.9	1.9	1.8
8	2.2	1.9	1.8	1.9	1.8	24	2.0	1.8	1.9	1.9	1.8
9	2.2	1.9	1.8	1.9	1.8	25	2.0	1.8	1.85	1.9	1.8
10	2.2	1.9	1.8	1.9	1.8	26	2.0	1.8	1.85	1.9	1.8
11	2.2	1.9	1.8	1.9	1.8	27	2.0	1.8	1.8	1.9	1.8
12	2.2	1.9	1.8	1.9	1.8	28	2.0	1.8	1.8	1.9	1.8
13	2.2	1.9	1.8	1.9	1.9	29	2.0	1.8	1.85	1.9	1.8
14	2.2	1.9	1.8	1.9	1.9	30	2.0	1.8	1.9	1.9	1.8
15	2.15	1.9	1.8	1.9	1.9	31	2.0	.....	1.95	.....	1.8
16	2.1	1.9	1.8	1.9	1.9						

GRAND RIVER AT HOT SULPHUR SPRINGS, COLO.

This station was established July 27, 1904. It is located at the highway bridge one-eighth mile below Hot Sulphur Springs, Colo., in sec. 3, T. 1 N., R. 78 W., and is 5 miles above the mouth of Williams Fork River.

The channel is straight for about 200 feet below the station. Above the station it is curved at almost a right angle. Both banks are high and can not overflow. The bed of the stream is composed of bed rock, heavy gravel, and large bowlders on the right side, while on the left side it is a sloping gravel bar extending outward to the left abutment of the bridge. It is free from vegetation and, except for the gravel bar, is permanent. There is but one channel at all stages broken by the two piers of the bridge. The current is swift and at low water passes under the bridge squarely. At high water the current in the greater part of the section passes under the bridge at an angle. The accuracy of measurements is affected by the boiling of the water at the piers and by the large bowlders in the channel beneath the bridge. During the spring and early summer of 1905 the channel 100 feet below the station was somewhat obstructed by large bowlders which were blasted from a railroad cut on the right bank. This obstruction backs the water up on the gage to a considerable extent and at extreme low stages causes dead water in a portion of the cross sections.

Discharge measurements, except at very low stages, are made from the upstream side of the three-span bridge. The initial point for soundings is located over the inner face of the right abutment and is marked with a circle on the upstream hub rail. A stay line is located 30 feet above the bridge.

The gage, which was read once each day during 1905 by Mrs. Carrie Wills, consists of a vertical staff, bolted vertically to the downstream end of the first pier from the right bank. The gage reads from 2 to 10.8 feet, the 2-foot mark resting on bed rock. The gage is referred to bench marks as follows: (1) A cross painted on the north pier above the gage rod; elevation, 16.48 feet above the zero of the gage. (2) A cross cut in the top of a bench on the northwest face of a sandstone cliff on the east side of the road 50 feet south of the bridge; elevation, 25.49 feet above the zero of the gage. The elevation of the station above sea level is approximately 6,550 feet.

A description of this station and gage-height and discharge data are contained in Water-Supply Paper, No. 133, United States Geological Survey, pages 135–137.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 1	W. A. Lamb	80	401	3.16	5.22	1,269
May 6	do	66	333	2.14	4.40	722
May 29	do	97	517	5.10	6.55	2,638
June 3	do	106	665	6.27	7.85	4,167
June 9	do	102	782	7.33	9.15	5,733
July 5	do	74	446	3.46	5.52	1,542
July 25	do	70	359	2.10	4.58	731
August 16	do	63	269	1.28	3.95	343
August 29	do	58	279	.99	3.74	277
September 9	do	58	284	.99	3.60	281
September 15	do	54	250	.81	3.45	203
October 2	do	54	251	.73	3.43	183

Daily gage height, in feet, of Grand River at Hot Sulphur Springs, Colo., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.65	2.9	5.35	7.4	6.75	4.55	3.35	3.5	3.45
2	2.7	2.95	5.58	7.55	6.35	4.6	3.3	3.5	3.45
3	2.7	2.75	5.38	7.8	6.1	4.6	3.4	3.5	3.45
4	2.68	2.65	4.98	8.5	6.0	4.45	3.4	3.4	3.5
5	2.68	2.75	4.8	8.95	5.45	4.3	3.32	3.4	3.5
6	2.68	2.8	4.58	8.4	5.45	4.3	3.32	3.4	3.5
7	2.68	3.0	4.7	8.5	5.45	4.25	3.4	3.4	3.5
8	2.68	3.15	4.8	9.05	5.42	4.2	3.4	3.4	3.5
9	2.7	3.4	5.2	8.75	5.42	4.22	3.32	3.4	3.5
10	2.65	3.6	4.98	8.25	5.45	4.28	3.3	3.4	3.48
11	2.65	3.58	4.78	8.25	5.42	4.2	3.32	3.4	3.45
12	2.65	3.62	4.7	8.25	5.42	4.05	3.3	3.4	3.42
13	2.65	3.58	4.8	8.0	5.42	4.0	3.32	3.42	3.42
14	2.68	3.55	4.62	8.05	5.42	4.0	3.22	3.48	3.42
15	2.65	3.5	4.62	7.65	5.45	4.02	3.2	3.42	3.42
16	2.68	3.75	4.88	7.55	5.22	4.08	3.2	3.4	3.42
17	2.7	3.6	5.45	7.65	5.18	3.95	3.0	3.4	3.4
18	2.65	3.78	5.85	7.88	5.05	3.92	3.0	3.4	3.4
19	2.65	4.02	6.15	7.85	5.02	3.9	3.4	3.4	3.4
20	2.7	3.95	6.38	7.4	4.98	3.88	3.5	3.4	.....
21	2.65	3.8	6.48	7.4	4.9	3.85	3.4	3.4	.....
22	2.7	3.88	6.72	7.45	4.75	3.8	3.4	3.4	.....
23	2.7	3.95	7.05	7.1	4.58	3.78	3.4	3.4	.....
24	2.65	4.22	7.12	7.15	4.45	3.75	3.4	3.4	.....
25	2.7	4.05	6.75	7.5	4.42	3.58	3.4	3.4	.....
26	2.7	4.08	6.62	7.45	4.42	3.45	3.4	3.4	.....
27	2.65	4.48	6.75	7.5	4.46	3.4	3.4	3.45	.....
28	2.75	4.62	6.85	7.55	4.46	3.4	3.4	3.45	.....
29	2.75	4.65	6.6	7.4	4.46	3.42	3.4	3.45	.....
30	2.8	4.88	6.48	7.1	4.6	3.38	3.48	3.45	.....
31	2.85	.....	6.6	.....	4.6	3.4	.....	3.45	.....

Station rating table for Grand River at Hot Sulphur Springs, Colo., from July 27, 1904, to April 15, 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	185	2.90	276	3.20	402	3.50	554
2.70	215	3.00	313	3.30	450	3.60	609
2.80	245	3.10	355	3.40	501		

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

Station rating table for Grand River at Hot Sulphur Springs, Colo., from May 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.*
3.00	95	4.20	500	5.40	1,430	7.20	3,360
3.10	110	4.30	560	5.50	1,530	7.40	3,600
3.20	130	4.40	620	5.60	1,630	7.60	3,840
3.30	150	4.50	680	5.70	1,730	7.80	4,080
3.40	180	4.60	750	5.80	1,830	8.00	4,320
3.50	210	4.70	820	5.90	1,930	8.20	4,560
3.60	240	4.80	900	6.00	2,030	8.40	4,800
3.70	280	4.90	980	6.20	2,250	8.60	5,040
3.80	320	5.00	1,060	6.40	2,470	8.80	5,280
3.90	360	5.10	1,150	6.60	2,690	9.00	5,540
4.00	400	5.20	1,240	6.80	2,910	9.20	5,800
4.10	450	5.30	1,330	7.00	3,130		

NOTE.—The above table is applicable only for open-channel conditions. It is based on twelve discharge measurements made during 1905. It is well defined above gage height 3.4 feet. Owing to changing conditions from April 15 to April 30 the above table has been applied indirectly for that period.

Estimated monthly discharge of Grand River at Hot Sulphur Springs, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	260	200	212	13,040
April	1,036	200	550	32,730
May	3,264	736	1,785	109,800
June	5,605	3,240	4,137	246,200
July	2,855	632	1,265	77,780
August	750	174	410	25,210
September	210	95	164	9,759
October	210	180	186	11,440
November 1–19	210	180	195	7,349
The period				533,300

GRAND RIVER NEAR KREMMLING, COLO.

This station was established July 24, 1904. It is located at the mouth or upper end of Gore Canyon, about 3 miles southwest of Kremmling, Colo.

The channel is straight for about 100 feet above and for 150 feet below the station. The right bank is the grade of the Denver, Northwestern and Pacific Railway; the left bank is abrupt and is covered with bowlders and bushes; neither bank overflows. The bed of the stream is composed of sand, silt, and bowlders and is very shifting, the change in channel being as great as 10 feet in places. The channel scours out during high-water stages and gradually fills up again as the water subsides. There is but one channel at all stages. The current is very sluggish at low water and medium to swift at high water. Gage heights have a range of about 15 feet during an ordinary season. Gage readings in the winter months are somewhat affected by ice in the channel. The shifting of the bed makes the development of a good rating curve a difficult matter. The station is not entirely satisfactory, but it is the best location available below the mouth of Blue River.

Discharge measurements are made from a cable stretched across the river just below the gage and about 150 feet above the wagon bridge. The cable is approximately 280 feet

long and is tagged with tin tags marked every 5 feet from the top of the right bank, which is a high sandstone cliff, to the top of the left bank. The initial point for soundings is the face of the rock to which the cable is anchored on the right bank.

Gage readings at this station were made twice each day during 1905 by J. C. Harper. The original equipment consisted of a wire gage attached to the cantilever arm of the frame to which the gage rod was spiked in a horizontal position. This gage was destroyed by high water in June, 1905, and after the water had subsided the old gage was placed on a new cantilever arm similar to the old one but about 3 feet higher, the gage datum remaining the same and the wire was replaced by a standard chain. The length of the chain is 36.50 feet. Bench mark No. 1 is a cross cut in the east face of a large bowlder on the right bank about 20 feet south of the cable marked with black paint "U.S. B.M.;" elevation, 25.03 feet above the zero of the gage. The elevation above sea level is about 7,250 feet. Bench mark No. 2 is a cross cut and painted block on top of a cone-shaped granite bowlder on the left bank of the river about 50 feet downstream from the gage. Elevation of bench mark above gage datum is 9.57 feet. This bench mark is submerged at high water.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 137–139.

Discharge measurements of Grand River near Kremmling, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 28	W. A. Lamb	115	775	2.27	5.24	1,762
May 10	do	118	1,190	1.97	6.48	2,344
May 27	do	141	1,810	3.08	10.98	5,575
June 6	do	160	2,688	4.24	15.14	11,400
June 16	do	150	2,362	3.67	13.05	8,668
June 18	M. C. Hinderlider	142	2,183	3.32	11.81	7,248
June 27	W. A. Lamb	135	1,945	2.97	10.22	5,777
July 13	do	106	1,293	1.49	5.80	1,927
July 22	do	116	1,310	1.30	5.15	1,703
August 10	do	104	920	.93	3.10	852
August 25	do	102	409	1.68	2.38	689
September 5	do	104	380	1.72	2.29	655
September 14	do	100	271	1.85	1.83	500
September 27	do	101	202	2.09	1.60	423

Daily gage height, in feet, of Grand River near Kremmling, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.41	0.95	1.09	2.08	6.88	11.83	8.81	4.54	2.90	1.90	1.32	0.92
2	1.36	.97	1.06	2.21	7.50	12.42	8.33	4.27	2.48	1.75	1.23	1.15
3	1.18	.95	1.14	2.03	7.22	12.92	8.04	3.99	2.16	1.85	1.58	1.06
4	1.01	.95	1.09	1.53	6.50	14.03	7.40	3.88	2.22	1.70	1.88	1.13
5	.98	.93	1.06	1.65	5.98	15.42	6.76	3.70	2.32	1.68	1.92	1.18
6	.94	.97	1.16	2.08	5.40	15.25	6.61	3.72	2.40	1.65	1.97	1.06
7	.88	.85	1.19	2.68	5.22	14.46	6.34	3.76	2.52	1.54	1.82	.75
8	.76	.93	1.14	2.61	5.35	14.66	6.32	3.32	2.46	1.50	1.68	.82
9	.78	.83	1.16	2.93	6.40	15.28	6.21	3.38	2.34	1.50	1.56	1.26
10	.98	.75	1.09	3.31	6.38	15.43	5.48	3.18	2.26	1.46	1.44	1.60
11	.96	.84	1.14	3.38	6.45	14.45	5.46	3.15	2.14	1.24	1.20	1.90
12	.88	.80	1.16	3.25	6.54	13.46	5.90	3.56	2.02	1.36	1.21	1.64
13	.88	.95	1.22	3.33	5.65	13.54	5.87	3.76	1.90	1.42	1.32	1.90
14	.86	.95	1.24	3.35	5.68	13.45	5.76	3.44	1.84	1.56	1.60	1.72

Daily gage height, in feet, of Grand River near Kremmling, Colo., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	.84	.90	1.32	3.05	5.50	12.77	5.98	3.18	1.74	1.64	1.55	1.35
16	.98	1.05	1.39	2.98	5.87	13.06	5.88	3.00	1.68	1.60	1.48	1.22
17	.98	1.05	1.49	2.91	6.99	12.54	5.95	2.76	1.64	1.92	1.65	1.00
18	1.01	1.10	1.44	3.01	7.88	11.75	5.42	2.66	1.66	1.90	1.75	1.08
19	1.04	1.03	1.29	3.48	8.78	11.53	5.36	2.38	1.78	1.82	1.67	.82
20	.88	.93	1.34	3.48	9.61	11.37	5.24	2.48	1.79	1.70	1.20	.63
21	.84	1.03	1.49	3.11	9.78	10.29	5.35	2.41	1.79	1.50	1.28	.70
22	.86	1.05	1.52	3.05	10.52	10.29	5.14	2.32	1.72	1.65	1.48	.68
23	.96	1.07	1.46	3.31	11.31	10.51	4.64	2.29	1.65	1.75	1.45	.64
24	1.04	1.05	1.34	3.68	11.59	10.43	4.50	2.36	1.60	1.82	1.82	.56
25	.98	1.03	1.44	3.71	11.08	10.35	4.46	2.41	1.60	1.82	1.32	.50
26	.78	1.03	1.59	3.48	10.70	10.35	4.45	2.46	1.60	1.61	1.34	.44
27	.78	1.07	2.04	4.11	11.00	10.35	4.42	2.42	1.60	1.66	1.49	.45
28	.86	1.07	1.79	5.05	10.95	10.04	4.51	2.36	1.58	1.83	1.30	.32
29	.81	.....	1.46	5.32	10.44	9.46	4.61	2.48	1.58	1.85	1.08	.28
30	.94	.....	1.49	5.85	10.09	9.32	4.64	2.55	1.68	1.82	.68	.46
31	.96	.....	1.82	.....	10.65	.....	4.66	2.82	.....	1.68	.....	.34

NOTE.—No ice record.

Station rating table for Grand River near Kremmling, Colo., from January 1 to December 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.20	220	1.60	440	3.00	830	5.80	1,950
.30	230	1.70	465	3.20	900	6.00	2,050
.40	240	1.80	490	3.40	970	6.20	2,170
.50	250	1.90	515	3.60	1,040	6.40	2,290
.60	260	2.00	540	3.80	1,110	6.60	2,410
.70	275	2.10	565	4.00	1,180	6.80	2,530
.80	290	2.20	590	4.20	1,250	7.00	2,670
.90	305	2.30	620	4.40	1,330	7.20	2,810
1.00	320	2.40	650	4.60	1,410	7.40	2,950
1.10	340	2.50	680	4.80	1,490	7.60	3,090
1.20	360	2.60	710	5.00	1,570	7.80	3,250
1.30	380	2.70	740	5.20	1,650	8.00	3,410
1.40	400	2.80	770	5.40	1,750		
1.50	420	2.90	800	5.60	1,850		

[a] From May 14 to July 10, inclusive, the table was applied indirectly, owing to shifting conditions.

NOTE.—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 1.6 feet and 6.5 feet.

Estimated monthly discharge of Grand River near Kremmling, Colo.. for 1905.

[Drainage area, 2,380 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	402	287	314	19,310	0.132	0.152
February	340	282	316	17,550	.133	.138
March	550	332	390	23,980	.164	.189
April	1,975	426	924	54,980	.388	.433
May	6,430	1,660	3,523	216,600	1.48	1.71
June	11,820	4,850	7,999	476,000	3.36	3.75
July	4,340	1,338	2,046	125,800	.860	.992
August	1,386	617	866	53,250	.364	.420
September	800	436	532	31,660	.224	.250
October	520	368	475	29,210	.200	.231
November	532	272	419	24,930	.176	.196
December	515	228	325	19,980	.137	.158
The year	11,820	228	1,511	1,093,000	.635	8.62

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

This station is located in the mountains, midway between the Continental Divide and the Colorado-Utah boundary line, and just above the third large tributary of the Grand, which is called Roaring Fork.

A comparison of the miscellaneous discharge measurements made at the mouth of Roaring Fork, at Glenwood Springs, during 1903 and 1904, with the discharge of the Grand, at Glenwood Springs, shows that the volume of water being discharged by the Roaring Fork augments the volume of water which passes the Glenwood station by 50 per cent. While there is a moderate amount of irrigation of the first bottom lands from the tributaries above this point, relatively little of the run-off of the basin is used.

The station was established May 12, 1899, at the request of the Denver and Rio Grande Railroad Company. It was at first located at the railroad bridge, a quarter of a mile west of the depot and just above the mouth of Roaring Fork; but at the beginning of 1900 it was removed to a point near the electric-light works. The measuring section is located at the State Street Bridge, which crosses the river at the main thoroughfare of Glenwood Springs, and is about 10 feet below the point at which all discharge measurements from 1900 to 1904, inclusive, were made.

The channel at the cable section is straight for a distance of several hundred feet each way. The left bank is the Denver and Rio Grande Railroad embankment and is well protected by a concrete and dry rubble retaining wall. The right bank is a low wall composed of bowlders, without any binding material, and protects the grounds of the Hotel Colorado. At extremely high water these grounds have been flooded, but this is a rare occurrence. The bed of the stream is composed of bowlders and cobblestones and is permanent. A small amount of silt is deposited at low water, but it scours out in the spring and does not change the cross section materially. There is but one channel at all stages. At high water the current is swift, often reaching a velocity as high as 20 feet per second; at low water the current has a moderate velocity. Gage heights range from 2.5 to 12 feet.

Discharge measurements since May 16, 1905, have been made by means of a cable, car, and stay line 60 feet upstream, the cable being anchored to the piers of the State Street Bridge. Measurements from 1900 to 1904, inclusive, were made from the footway which

crosses the stringers of the bridge below the roadway, about 10 feet above the present section. Plottings of old and new cross sections show no material difference.

Gage readings at this station are made by W. H. Richardson, the manager of the Glenwood Electric Light and Power Company, morning and evening each day during the entire year. The first gage was wire, but when the station was removed to the electric-light works a new gage rod was placed. This consisted of a light vertical staff, to the lower end of which was attached a wooden float, which rested on the surface of the water, standing in a well or box made of 6-inch boards. The bottom of this well connected with a small wooden flume extending out into the river, which allowed the water in the well to assume the level of the river surface. In July, 1902, this gage being in bad repair was replaced by an automatic water-register, the site being the same as that of the old float gage. The register never worked satisfactorily and was later replaced by another float gage, using the same well and intake flume. The present gage consists of a copper float and counterweight connected with a silk line passing over pulleys so arranged that a rise of 1 foot of the river registers but one-half foot on the rod. By this arrangement the large rise and fall of the river is readily accommodated by a length of gage that would be impossible with a direct-reading gage. The gage rod proper consists of a light pine rod, 1 by 1 inch by 5 feet, securely fastened in a vertical position inside a small house in which the apparatus is located and which sets on top of the vertical well. A pointer attached to a counterweight slides along the gage rod and registers the rise and fall of the river. This gage has given entire satisfaction. The original basis for the installation of this gage and the method of correction since that time is the relation of the depth of water in the well to the gage reading. When the gage reads correctly the difference between the depth of water in the well and the gage reading is 2.25 feet. The bench mark established June 27, 1904, is a cross cut in the top of the foundation capstone of the power house directly in front of the gage house, east of the power-house door, and is indicated by the letters "B.M." cut in the vertical face of the foundation stone on which the bench mark is located. Elevation of bench mark above the datum of the gage is 17.77 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: WS 37, pp 293-294; 50, pp 375-376; 66, p 92; 85, p 48; 100, pp 89-90; 133, pp 139-140.
Discharge: WS 37, p 294; 50, p 376; 85, p 49; 100, p 90; 133, p 140.
Discharge, monthly: Ann 22, iv, p 389; WS 75, p 174; 85, p 50; 100, p 92; 133, p 141.
Gage heights: WS 37, p 294; 50, p 376; 66, p 93; 85, p 49; 100, p 91; 133, p 140.
Hydrographs: Ann 22, iv, p 389; WS 75, p 174.
Rating tables: WS 52, p 520; 66, p 174; 85, p 50; 100, p 91; 133, p 141.

Discharge measurements of Grand River at Glenwood Springs, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 28	R. I. Meeker	190	508	2.01	3.77	1,019
May 16	do	200	871	4.01	5.50	3,496
June 2	do	210	1,630	10.07	9.12	16,410
June 5	do	215	1,983	13.91	10.70	27,580
July 9	do	208	906	4.35	5.82	3,941
July 10	do	208	904	4.28	5.78	3,871
August 13	do	194	643	2.98	4.68	1,919
September 26	do	185	486	2.35	3.95	1,142

Daily gage height, in feet, of Grand River at Glenwood Springs, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	3.34	3.29	3.36	3.68	5.95	8.55	7.32	5.05	4.35	3.88	3.95	3.25
2	3.4	3.29	3.46	3.82	6.4	9.1	6.75	4.95	4.45	3.9	3.85	3.32
3	3.34	3.26	3.48	3.88	6.42	9.2	6.58	4.85	4.32	3.98	3.88	3.25
4	3.4	3.24	3.56	3.78	6.12	9.9	6.45	4.82	4.35	3.95	3.85	3.35
5	3.44	3.24	3.61	3.72	5.85	10.7	6.15	4.72	4.32	3.92	3.98	3.38
6	3.47	3.24	3.61	3.72	5.6	10.7	6.02	4.68	4.3	3.92	4.0	3.3
7	3.47	3.24	3.64	3.78	5.45	10.4	5.95	4.65	4.35	3.92	3.98	3.18
8	3.44	3.19	3.51	3.92	5.48	10.3	5.88	4.65	4.4	3.9	3.98	3.18
9	3.42	3.19	3.44	4.1	5.8	10.72	5.85	4.58	4.32	3.85	3.92	3.15
10	3.37	3.19	3.46	4.28	6.05	10.58	5.78	4.5	4.22	3.85	3.92	3.1
11	3.32	3.19	3.48	4.48	5.88	10.48	5.7	4.5	4.22	3.85	3.88	2.9
12	3.32	3.12	3.51	4.5	5.68	10.38	5.7	4.52	4.15	3.82	3.82	3.0
13	3.22	2.96	3.56	4.48	5.58	10.02	5.7	4.7	4.12	3.85	3.8	3.1
14	3.22	2.99	3.61	4.45	5.65	9.68	5.65	4.78	4.1	3.85	3.78	3.02
15	3.32	3.04	3.66	4.5	5.62	9.68	5.65	4.62	4.05	3.85	3.85	2.95
16	3.4	3.09	3.66	4.45	5.68	9.25	5.68	4.52	4.02	3.88	3.9	3.35
17	3.37	3.14	3.71	4.32	6.0	8.85	5.58	4.42	4.0	3.9	3.88	3.4
18	3.4	3.29	3.64	4.3	6.62	8.58	5.5	4.35	4.0	3.95	3.88	3.4
19	3.47	3.24	3.66	4.45	7.1	8.25	5.5	4.32	4.02	3.95	3.88	3.38
20	3.44	3.29	3.66	4.52	7.48	7.9	5.42	4.25	4.05	3.92	3.82	3.4
21	3.4	3.29	3.64	4.58	7.68	7.8	5.28	4.22	4.1	3.82	3.78	3.4
22	3.42	3.29	3.66	4.4	7.92	7.75	5.3	4.15	4.05	3.82	3.82	3.3
23	3.42	3.26	3.66	4.4	8.4	7.78	5.28	4.12	4.02	3.95	3.78	3.25
24	3.4	3.26	3.64	4.48	8.58	7.8	5.2	4.12	4.0	3.98	3.75	3.22
25	3.4	3.32	3.61	4.6	8.45	7.78	5.12	4.15	3.98	3.95	3.65	3.2
26	3.37	3.32	3.68	4.62	8.2	7.65	5.12	4.18	3.95	3.95	3.68	3.28
27	3.37	3.34	3.68	4.62	8.2	7.65	5.02	4.15	3.92	3.95	3.68	3.32
28	3.27	3.39	3.81	4.92	8.22	7.58	5.02	4.15	3.92	3.95	3.85	3.4
29	3.24	.....	3.78	5.35	8.08	7.5	5.05	4.18	3.9	4.0	3.48	3.32
30	3.27	.....	3.68	5.52	7.85	7.42	5.02	4.18	3.95	4.02	3.12	3.22
31	3.32	.....	3.65	.....	8.0	.....	5.02	4.3	.....	3.95	.....	3.22

Station rating table for Grand River at Glenwood Springs, Colo., 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	530	4.40	1,640	5.90	4,000	7.80	9,380
3.00	570	4.50	1,760	6.00	4,210	8.00	10,210
3.10	610	4.60	1,880	6.10	4,420	8.20	11,110
3.20	660	4.70	2,010	6.20	4,640	8.40	12,090
3.30	710	4.80	2,150	6.30	4,860	8.60	13,160
3.40	770	4.90	2,290	6.40	5,090	8.80	14,350
3.50	830	5.00	2,440	6.50	5,330	9.00	15,660
3.60	900	5.10	2,590	6.60	5,580	9.20	17,030
3.70	970	5.20	2,740	6.70	5,840	9.40	18,410
3.80	1,050	5.30	2,890	6.80	6,110	9.60	19,800
3.90	1,130	5.40	3,050	6.90	6,390	9.80	21,200
4.00	1,220	5.50	3,220	7.00	6,670	10.00	22,600
4.10	1,320	5.60	3,400	7.20	7,260	10.20	24,020
4.20	1,420	5.70	3,590	7.40	7,910	10.40	25,440
4.30	1,530	5.80	3,790	7.60	8,620	10.60	26,860

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 between gage heights 3.5 feet and 10.7 feet.

Estimated monthly discharge of Grand River at Glenwood Springs, Colo., for 1905.

[Drainage area, 4,523 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	812	670	753	46,300	0.166	0.191
February	764	554	672	37,320	.149	.155
March	1,058	746	906	55,710	.200	.231
April	3,256	956	1,641	97,650	.363	.405
May	13,050	3,135	6,675	410,400	1.48	1.71
June	27,710	7,980	16,590	987,200	3.67	4.10
July	7,646	2,470	3,614	222,200	.799	.921
August	2,515	1,340	1,735	106,700	.384	.443
September	1,700	1,130	1,356	80,690	.300	.335
October	1,240	1,066	1,142	70,220	.252	.290
November	1,220	620	1,067	63,490	.236	.263
December	770	530	685	42,120	.151	.174
The year	27,710	530	3,070	2,220,000	.679	9.22

GRAND RIVER NEAR PALISADES, COLO.

This station was established April 9, 1902. It is located at the steel highway bridge at the point where the river enters Grand Valley, 2 miles above Palisades, in T. 11 S., R. 98 W., and is above all irrigating ditches supplying water to Grand Valley, with the exception of one pumping plant, which takes about 20 second-feet from the river one-fourth mile above the station.

The stream channel is straight for 600 feet both above and below the station. The right bank is high and rocky, is composed largely of bowlders, cobblestones, and gravel, and will not overflow. The left bank is somewhat lower and will overflow for a short distance, but only at extreme high water. It is composed primarily of bowlders covered with sand. Above the banks are narrow mesas merging into abrupt talus slopes capped by sandstone, which rise precipitously for several hundred feet. From station 70 to station 140 the bed of the stream is approximately level and is composed of solid sandstone. Below the surface of the water on each side of this clean portion of the channel are large fragments of sandstone and large lava bowlders. During low water a deposit of silt forms to a depth of about 1 foot in the deeper portion of the channel and also fills in the large interstices of the rough banks. At high water this deposit is scoured out. The depth of the water varies from 12 feet at low stages to 22 feet at extreme high stages. This unusual depth of water at the low stage is due to the retardation of flow caused by immense sandstone bowlders and detritus across the stream channel, about 1,500 feet below the station, at a point locally called the Narrows. As a result the low-water current is sluggish and there are considerable areas of dead or backwater along each side. At high water the current is moderate at the sides, increasing very rapidly toward the center of the stream, where velocities of 20 feet per second have been observed. There is but one channel at all stages. Surface ice forms across the channel during winter.

At the recently constructed suspension bridge at Palisades the channel is straight, wide, and of uniform depth, the bed is of cobblestones, and the stream current is even. Conditions at the suspension bridge are far superior to those at the highway bridge for high-water measurements, while the reverse is true for low-water measurements.

At low water discharge measurements are made from the downstream side of the single-span steel highway bridge, which is 212 feet between masonry abutments. The initial point for soundings is the edge of the capstone of the left masonry abutment. At high

stages discharge measurements are made from the 320-foot suspension bridge at Palisades, the initial point for soundings being at the face of the left abutment.

The gage, which was observed twice daily during 1905 by S. M. Purdy, was originally of wire and was located on the downstream side near the center of the highway bridge. On April 5, 1904, the wire gage was replaced by a new chain gage. The zero of the chain gage is identical with the zero of the wire gage. The scale on the inside of the chain-gage box reads from 11.6 to 22.5 feet. The length of the chain is 21.27 feet. The bench mark is a point on the capstone on the downstream end of the approach abutment on right bank of river. It is marked with a circle cut about the point and the letters "B. M.;" elevation above the zero of the gage, 29.49 feet.

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

Description: 85, pp 46–47; 100, p 87; 133, p 142.
Discharge: 85, p 47; 100, p 88; 133, p 142.
Discharge, monthly: 85, p 48; 100, p 89; 133, p 144.
Gage heights: 85, p 47; 100, p 88; 133, p 143.
Rating tables: 85, p 48; 100, p 89; 133, p 143.

Discharge measurements of Grand River near Palisades, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 29[a]	R. I. Meeker	140	1,083	1.39	12.40	1,504
June 3[a]	do	222	2,767	9.00	20.25	24,900
July 11[a]	do	191	1,683	3.68	14.92	6,210
August 12[b]	do	270	774	3.49	13.30	2,699
September 27[b]	do	255	677	2.38	12.50	1,608

[a] Measured at gage. [b] Measured from suspension bridge.

Daily gage height, in feet, of Grand River near Palisades, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	12.5	15.2	19.35	17.0	14.25	12.7	12.75
2	12.5	16.1	20.05	16.75	14.05	12.8	12.7
3	12.55	16.45	20.35	16.3	13.85	12.85	12.7
4	12.55	16.05	21.0	16.0	13.7	12.8	12.7
5	12.45	15.55	22.05	15.8	13.55	12.95	12.7
6	12.4	15.15	22.0	15.5	13.6	13.05	12.55
7	12.4	15.0	21.8	15.35	13.4	12.95	12.5
8	12.4	14.9	21.35	15.2	13.4	12.9	12.5
9	12.4	15.3	22.0	15.15	13.35	12.8	12.5
10	12.95	15.6	22.0	15.0	13.25	12.8	12.5
11	13.3	15.65	21.3	14.95	13.3	12.8	12.5
12	13.7	15.3	21.25	14.95	13.3	12.7	12.5
13	13.4	15.35	20.6	14.8	13.45	12.7	12.5
14	13.3	15.45	20.35	14.75	13.4	12.6	12.5
15	13.3	15.2	20.4	14.7	13.35	12.6	12.5
16	13.3	15.3	20.4	14.7	13.25	12.55	12.55
17	13.2	15.65	19.9	14.65	13.1	12.5	12.65
18	13.2	16.45	19.45	14.55	12.95	12.5	12.7
19	13.25	17.3	19.05	14.4	12.85	12.5	12.65
20	13.35	17.85	18.7	14.75	12.8	12.5	12.6
21	13.4	18.1	18.35	14.5	12.7	12.5	12.6
22	13.35	18.85	18.15	14.35	12.7	12.5	12.6

Daily gage height, in feet, of Grand River near Palisades, Colo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
23	13.3	19.45	18.2	14.3	12.6	12.5	12.75
24	13.35	19.95	18.2	14.15	12.6	12.5	12.7
25	13.5	19.8	17.95	14.0	12.7	12.7	12.7
26	13.6	19.55	18.0	13.9	12.75	12.6	12.7
27	13.75	19.5	17.95	13.85	12.7	12.5	12.7
28	13.95	19.4	17.7	13.75	12.65	12.5	12.7
29	14.35	19.0	17.4	13.7	12.65	13.0	12.7
30	14.85	18.7	17.3	13.85	12.7	12.9	12.7
31	.....	18.8	.....	13.95	12.75	.....	12.75

Station rating table for Grand River near Palisades, Colo., 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.*
12.00	1,120	13.70	3,440	15.30	7,120	17.80	15,430
12.10	1,210	13.80	3,640	15.40	7,380	18.00	16,250
12.20	1,300	13.90	3,850	15.50	7,650	18.20	17,080
12.30	1,400	14.00	4,060	15.60	7,920	18.40	17,920
12.40	1,500	14.10	4,270	15.70	8,200	18.60	18,780
12.50	1,610	14.20	4,490	15.80	8,480	18.80	19,650
12.60	1,720	14.30	4,710	15.90	8,770	19.00	20,530
12.70	1,830	14.40	4,940	16.00	9,070	19.20	21,430
12.80	1,950	14.50	5,170	16.20	9,680	19.40	22,340
12.90	2,070	14.60	5,400	16.40	10,320	19.60	23,260
13.00	2,200	14.70	5,640	16.60	10,980	19.80	24,200
13.10	2,350	14.80	5,880	16.80	11,660	20.00	25,160
13.20	2,510	14.90	6,120	17.00	12,370	20.50	27,640
13.30	2,680	15.00	6,360	17.20	13,100	21.00	30,210
13.40	2,860	15.10	6,610	17.40	13,850	21.50	32,860
13.50	3,050	15.20	6,860	17.60	14,630	22.00	35,590
13.60	3,240						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1905 and three high-water measurements of 1906. It is well defined.

Estimated monthly discharge of Grand River near Palisades, Colo., for 1905.

[Drainage area, 8,546 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	6,000	1,500	2,644	157,300	.309	.345
May	24,920	6,120	13,080	804,300	1.53	1.76
June	35,870	13,470	24,440	1,454,000	2.86	3.19
July	12,370	3,440	6,084	374,100	.712	.821
August	4,600	1,720	2,527	155,400	.296	.341
September	2,275	1,610	1,830	108,900	.214	.239
October	1,890	1,610	1,747	107,400	.204	.235
The period	.....	.....	.....	3,161,000	.....	.....

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the Grand River basin in 1905.

Miscellaneous discharge measurements made in Grand River drainage basin in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 9	Willow Creek	Near Hot Sulphur Springs, Colo.	42	115	5.77	[a] 3.90	664
June 28	do	do	28	30	1.67	[a] 6.20	38
July 27	East Inlet	Grand Lake, Colo.	33	47	1.64	[b] 7.30	77
August 17	do	do	21	25	.92	[b] 7.80	23
September 11	do	do	24	13	.77	[c] 8.15	10
March 28	Yampa Hot Spring.	Glenwood Springs	2.6	2.5	2.28	0.97	5.66
July 10	do	do	2.6	2.6	2.31	.99	6.00
August 13	do	do	2.6	2.9	2.21	1.10	6.40

[a] Distance to water surface from bolt in stringer of southwest corner of bridge.
[b] Distance to water surface from knot indicated in overhanging tree.
[c] U. S. B. M.

FRASER RIVER DRAINAGE BASIN.

FRASER RIVER AT GRANBY, COLO.

Fraser River rises among the peaks of the Front Range in southeastern Grand County, Colo., and flows in a general northwesterly direction to its point of junction with Grand River in the east-central part of Middle Park. The stream receives a number of small tributaries, among which are Elk, St. Louis, Crooked, and Pole creeks, all short mountain streams draining the eastern slopes of the Vasquez Mountains.

The gaging station was established July 28, 1904. It is located on the main road between Coulter and Grand Lake, at the wagon bridge three-fourths mile southwest of Granby and about 4 miles above the mouth of the river, in sec. 9, T. 1 N., R. 76 W. In the 1904 Progress Report this station was called Fraser River, near Coulter, Colo.

The channel is straight for about 100 feet above and curved for 100 feet below the station. The right bank is about 2 feet high, is covered with willows, and overflows at high stages. The left bank above the station is a high, abrupt mesa; below the station it is a 6-foot mesa for about 50 feet, then a low, brush-covered flat, which is overflowed at high stages. The bed of the stream is composed of smooth cobblestones, and the cross section is fairly uniform, clean, and permanent. There is but one channel at all stages, broken by two crib piers, which cause boiling effects and back water at high stages. The current is swift at high and medium at low water. Gage heights have a range of about 2.5 feet during an ordinary season. Ice conditions render winter gage readings impracticable.

About 40 feet below the bridge a small temporary diversion dam is placed in the stream every year for the greater part of the low-water season to divert water into an irrigation ditch on the left bank. This weir backs the water up on the gage to a considerable depth and necessitates the construction of a separate rating curve for this period.

Discharge measurements are made from the downstream side of the three-span bridge to which the gage is attached. The initial point for soundings is immediately over the inner face of the left abutment and is marked with a circle on the downstream hand rail.

The gage, which was read twice each day during 1905 by J. N. Ostrander, a civil engineer, who lives but a few hundred feet away, is a staff, spiked vertically to the downstream inner edge of the first pier from the left bank. The gage reads from 2 feet to 10.8 feet, the 2-foot mark resting on the bed of the stream. The gage is referred to bench marks as follows:

(1) A nail in the top of the white-pine stake driven into the left bank about 30 feet south of the left end of the bridge, projecting about 6 inches above the surface of the ground, and marked "U. S. G. S. B. M.;" elevation, 13.12 feet above the zero of the gage. (2) A cross cut on the top of the foundation stone at the southeast corner of the residence of the observer. The stone is marked "U. S. B. M." on the east face; elevation, 13.09 feet above the zero of the gage.

Discharge measurements of Fraser River near Granby, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 3	W. A. Lamb	53	122	2.16	5.10	263
May 30	do	58	168	4.03	5.70	677
June 11	do	68	192	5.70	6.20	1,092
June 30	do	54	145	3.41	5.50	495
July 8	do	56	149	2.03	5.50	302
July 26	do	52	118	1.40	5.01	165
August 2	do	50	118	1.38	5.05	163
August 16	do	44	94	1.06	4.75	100
September 9 [a]	do	42	61	1.26	4.60	77
October 2 [a]	do	39	60	1.17	4.60	70

[a] Made by wading above bridge.

Daily gage height, in feet, of Fraser River at Granby, Colo., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	6.1	5.45	5.1	4.7	4.6	17	5.22	6.15	5.2	4.75	4.6	4.35
2	.....	6.12	5.4	5.05	4.62	4.6	18	5.32	6.05	5.2	4.7	4.55	4.35
3	.....	6.22	5.35	5.0	4.6	4.55	19	5.42	5.9	5.15	4.65	4.55	4.3
4	.....	6.55	5.3	4.96	4.6	4.5	20	5.48	5.85	5.25	4.65	4.5	4.25
5	.....	6.65	5.25	4.9	4.7	4.5	21	5.55	5.85	5.25	4.62	4.5	4.32
6	.....	6.4	5.25	4.9	4.7	4.5	22	5.69	5.85	5.15	4.6	4.5	4.25
7	4.88	6.5	5.15	4.9	4.7	4.5	23	5.88	5.85	5.1	4.6	4.5	4.3
8	5.08	6.5	5.3	4.85	4.72	4.5	24	5.78	5.8	5.12	4.62	4.5	4.3
9	5.15	6.6	5.5	4.82	4.6	4.5	25	5.65	5.72	5.08	4.62	4.5	4.4
10	4.98	6.42	5.4	4.8	4.6	4.42	26	5.68	5.75	5.05	4.65	4.45	4.4
11	4.92	6.35	5.35	4.92	4.6	4.4	27	5.78	5.7	5.0	4.65	4.45	4.4
12	4.9	6.3	5.3	5.05	4.6	4.35	28	5.9	5.58	4.98	4.65	4.4	4.4
13	5.02	6.35	5.28	4.95	4.6	4.35	29	5.72	5.55	5.0	4.7	4.5	4.4
14	4.92	6.3	5.3	4.88	4.6	4.35	30	5.72	5.5	5.1	4.7	4.5	4.4
15	4.9	6.35	5.3	4.82	4.6	4.3	31	5.78	.....	5.1	4.65	.....	4.4
16	5.05	6.35	5.3	4.75	4.6	4.3							

Station rating table for Fraser River at Granby, Colo., from January 1 to July 8, 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.*
4.90	180	5.40	431	5.90	819	6.40	1,313
5.00	218	5.50	499	6.00	910	6.50	1,422
5.10	262	5.60	572	6.10	1,005	6.60	1,533
5.20	313	5.70	649	6.20	1,104		
5.30	369	5.80	732	6.30	1,207		

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

Station rating table for Fraser River at Granby, Colo., from July 9 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.*
4.20	26	4.60	74	5.00	154	5.40	267
4.30	35	4.70	91	5.10	179	5.50	302
4.40	46	4.80	110	5.20	206		
4.50	59	4.90	131	5.30	235		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is well defined between gage heights 4.6 feet and 5.5 feet. This second table is necessary on account of a dam which was put in a short distance below the gage.

Estimated monthly discharge of Fraser River at Granby, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 7–31	819	172	451	22,360
June	1,590	499	1,030	61,290
July	465	149	250	15,370
August	179	74	110	6,764
September	95	46	70.1	4,171
October	74	30	47	2,890
The period				112,800

WILLIAMS FORK DRAINAGE BASIN.

WILLIAMS FORK NEAR HOT SULPHUR SPRINGS, COLO.

Williams Fork rises in the Williams River Mountains in southeastern Grand County, flows in a general northwesterly direction, and unites with Grand River in the central part of Middle Park, Colorado.

The gaging station was established July 25, 1904. It is located at the wagon bridge on the ranch of F. A. Field, in T. 1 N., R. 79 W., about 9 miles west of Hot Sulphur Springs, 4 miles above the mouth of the stream, and below all the tributaries.

The channel is straight for about 100 feet above and below the station. The right bank is a low gravel bar, lined with willows, and at extreme high stages is overflowed for a distance of 75 feet from the second channel. The left bank is a level pasture land, about 4 feet high, and is not liable to overflow. The bed of the stream is composed of small and medium-sized bowlders and is permanent. At low water there is but one channel; at high water a second channel begins about 300 feet above the bridge, on the right side of the stream, passes about 100 feet from the right end of the bridge, and enters the main stream 200 feet below. This channel is very rough and irregular and is almost entirely covered with grass and shrubbery. The current is swift at high and medium at low stages. Gage heights have a range of about 1.8 feet in an ordinary season. During the winter months ice obstructs the channel to such an extent as to make gage readings impracticable. High-water measurements are affected by the back water and boiling caused by the middle pier of the bridge and by the roughness of bed of the second channel.

Discharge measurements are made from the downstream side of the 2-span wooden bridge to which the gage is attached. The initial point for soundings is a 60-penny nail driven into the top of the left end of the downstream guard rail of the bridge, immediately over the inside face of the abutment. The second channel formed at high water is measured by wading at convenient points.

The gage, which was read twice each day during 1905 by F. A. Field, is a staff, graduated from 2 to 8 feet, fastened vertically to the downstream end of the middle crib pier, the 2-foot mark resting on the bed of the stream. The bench mark is a 60-penny nail driven into the

south face of a white-pine tree standing on the left bank of the river 30 feet north of the west end of the bridge; elevation, 6.03 feet above the zero of the gage. Elevation above sea level is about 7,600 feet.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 146–148.

Discharge measurements of Williams Fork near Hot Sulphur Springs, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 2	W. A. Lamb	50	85	2.73	3.89	232
May 8	do	44	74	2.26	3.70	167
May 29	do	54	103	3.65	4.15	376
June 5	do	66	157	5.39	4.85	846
June 8	do	64	147	5.60	4.80	824
June 29	do	47	99	3.90	4.20	386
July 12	do	48	91	2.36	3.85	215
July 24	do	43	73	1.89	3.61	138
August 29	do	33	54	1.13	3.31	61
September 8	do	33	54	1.19	3.30	64
September 29	do	25	44	1.11	3.23	49

Daily gage height, in feet, of Williams Fork near Hot Sulphur Springs, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.19	3.84	4.39	4.18	3.58	3.33	3.32
2	3.14	3.88	4.48	4.11	3.52	3.29	3.32
3	3.12	3.80	4.55	4.09	3.51	3.32	3.30
4	3.13	3.70	4.72	4.02	3.52	3.30	3.26
5	3.18	3.62	4.82	3.98	3.50	3.31	3.22
6	3.20	3.57	4.72	3.94	3.51	3.34	3.22
7	3.24	3.63	4.82	3.90	3.50	3.34	3.22
8	3.25	3.71	4.78	3.90	3.50	3.30	3.22
9	3.32	3.74	4.89	3.89	3.48	3.29	3.22
10	3.36	3.65	4.80	3.84	3.49	3.28	3.10
11	3.34	3.62	4.68	3.84	3.50	3.28	3.18
12	3.36	3.60	4.68	3.82	3.52	3.26	3.19
13	3.40	3.71	4.74	3.80	3.50	3.26	3.24
14	3.34	3.63	4.68	3.81	3.48	3.25	3.18
15	3.28	3.60	4.70	3.80	3.46	3.22	3.18
16	3.30	3.69	4.68	3.76	3.40	3.21	3.28
17	3.30	3.84	4.65	3.71	3.40	3.26	3.24
18	3.38	3.92	4.55	3.70	3.38	3.29	3.21
19	3.44	3.98	4.52	3.76	3.39	3.36	3.16
20	3.38	4.05	4.45	3.76	3.35	3.30	3.14
21	3.32	4.05	4.46	3.72	3.34	3.30	3.14
22	3.39	4.15	4.42	3.71	3.36	3.28	3.22
23	3.39	4.22	4.40	3.64	3.38	3.28	3.27
24	3.42	4.22	4.43	3.62	3.36	3.24	3.30
25	3.42	4.18	4.34	3.61	3.31	3.24	3.24
26	3.45	4.18	4.36	3.61	3.30	3.26	3.24
27	3.56	4.25	4.28	3.62	3.28	3.26	3.24
28	3.62	4.24	4.25	3.60	3.28	3.22	3.30
29	3.66	4.12	4.21	3.58	3.37	3.22	3.22
30	3.78	4.18	4.17	3.58	3.35	3.38	3.27
31	.....	4.31	.....	3.58	3.36	.....	3.30

Station rating table for Williams Fork near Hot Sulphur Springs, Colo., 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.*
3.10	25	3.60	130	4.10	335	4.60	650
3.20	40	3.70	160	4.20	390	4.70	730
3.30	60	3.80	200	4.30	450	4.80	810
3.40	80	3.90	240	4.40	510	4.90	900
3.50	105	4.00	285	4.50	580		

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

Estimated monthly discharge of Williams Fork near Hot Sulphur Springs, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	192	28	74.1	4,409
May	456	122	253	15,560
June	891	374	628	37,370
July	379	125	201	12,360
August	125	56	87.6	5,386
September	76	42	56.5	3,362
October	64	25	46.6	2,865
The period				81,310

TROUBLESOME RIVER DRAINAGE BASIN.

TROUBLESOME RIVER AT TROUBLESOME, COLO.

Troublesome River rises among the peaks of the Continental Divide in the northern part of Grand County, Colo., and flows southward to its point of junction with Grand River in Middle Park.

The gaging station was established July 22, 1904. It is located about 100 yards below the highway bridge at Troublesome, Colo., in sec. 12, T. 1 N., R. 80 W.

The channel is straight for about 50 feet above and 100 feet below the station. The right bank is about 3 feet high and is lined with a heavy growth of willows; the left bank is precipitous, is about 4 feet high, and is bordered by a level meadow; neither bank overflows. The bed of the stream is composed of small cobblestones and gravel, and is clean, uniform, and permanent. There is but one channel, broken by the piers of the bridge, which form eddies and undercurrents in a portion of the cross section. The current is very swift at high and medium at low stages. Gage heights have a range of about 2.5 feet in an ordinary season. During the winter months the channel is so obstructed by ice as to make gage readings impracticable.

Discharge measurements are ordinarily made by wading at convenient points near the gage rod. At extremely high stages they are made from the 2-span bridge about 100 yards above the gage-rod. The initial point for soundings is the west face of the stake driven into the top of the left bank, to which the gage rod is fastened.

The gage, which was read twice each day during 1905 by Mrs. Eva M. Becker, is an inclined staff, graduated from 0.8 foot to 5.8 feet, securely fastened to stakes driven into the left bank and bed of the stream. One vertical foot equals 1.525 feet on the slope. The gage is referred to bench marks as follows: (1) A 10-penny nail driven into the top of the stake on the left bank to which the gage is fastened; elevation, 5.83 feet above the zero of the gage.

(2) The center of a black cross painted on the bottom log near the southeast corner of Mrs. E. M. Becker's house, marked "U. S.+B. M.;" elevation, 16.08 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pp. 148–150.

Discharge measurements of Troublesome River at Troublesome, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 29	W. A. Lamb	30	39	2.28	2.57	89
May 8	do	31	45	2.71	2.72	122
May 28	do	42	95	4.73	3.40	449
June 5	do	43	108	5.32	3.70	575
June 8	do	40	93	5.14	3.35	478
June 29	do	26	36	1.64	1.75	59
July 11	do	16	9.3	0.86	1.12	8
July 24	do	18	19	0.58	1.18	11
August 13	do	23	25	0.88	1.38	22
August 27	do	22	23	0.83	1.34	19
September 7	do	24	25	0.92	1.40	23
September 29	do	23	23	0.87	1.35	20

NOTE.—Measurements made at different sections.

Daily gage height, in feet, of Troublesome River at Troublesome, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.0	2.8	3.3	1.6	1.48	1.35	1.32
2	2.0	2.95	3.4	1.65	1.38	1.3	1.3
3	1.95	2.82	3.45	1.68	1.35	1.3	1.3
4	1.9	2.7	3.75	1.6	1.35	1.3	1.3
5	1.95	2.6	3.7	1.52	1.3	1.35	1.25
6	2.1	2.52	3.18	1.42	1.35	1.38	1.22
7	2.1	2.5	3.32	1.3	1.3	1.4	1.2
8	2.1	2.55	3.28	1.18	1.3	1.38	1.2
9	2.1	2.82	3.22	1.15	1.3	1.35	1.2
10	2.1	2.75	3.12	1.12	1.3	1.35	1.28
11	2.15	2.72	2.88	1.1	1.32	1.35	1.25
12	2.1	2.6	2.75	1.08	1.38	1.35	1.38
13	2.1	2.62	2.78	1.05	1.38	1.3	1.4
14	2.1	2.6	2.75	1.02	1.35	1.3	1.4
15	2.05	2.62	2.58	1.08	1.35	1.3	1.4
16	2.1	2.8	2.55	1.05	1.35	1.29	1.42
17	2.1	3.15	2.42	1.05	1.32	1.28	1.45
18	2.1	3.28	2.32	0.95	1.32	1.3	1.42
19	2.15	3.52	2.25	1.0	1.3	1.35	1.38
20	2.15	.....	2.22	1.15	1.3	1.35	1.35
21	2.1	.....	2.15	1.32	1.32	1.35	1.3
22	2.15	.....	2.18	1.25	1.35	1.35	1.35
23	2.2	.....	2.08	1.2	1.35	1.32	1.4
24	2.2	.....	1.98	1.28	1.35	1.3	1.4
25	2.3	.....	1.95	1.3	1.35	1.3	1.4
26	2.25	.....	1.9	1.42	1.35	1.35	1.4
27	2.3	.....	1.8	1.4	1.35	1.35	1.4
28	2.42	3.35	1.72	1.35	1.35	1.35	1.4
29	2.5	3.25	1.7	1.4	1.35	1.35	1.4
30	2.55	3.2	1.68	1.4	1.35	1.3	1.42
31	.....	3.08	.....	1.42	1.35	.....	1.48

Station rating table for Troublesome River at Troublesome, Colo., from January 1 to May 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.*
1.90	14	2.40	63	2.90	167	3.40	322
2.00	21	2.50	78	3.00	196	3.50	357
2.10	29	2.60	96	3.10	226	3.60	392
2.20	39	2.70	117	3.20	257		
2.30	50	2.80	141	3.30	289		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905. It is well defined between gage heights 1.9 feet and 2.7 feet.

Station rating table for Troublesome River at Troublesome, Colo., from May 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.*
1.00	5	1.80	68	2.60	229	3.40	475
1.10	7	1.90	84	2.70	255	3.50	510
1.20	10	2.00	102	2.80	282	3.60	546
1.30	15	2.10	121	2.90	311	3.70	584
1.40	22	2.20	141	3.00	342	3.80	623
1.50	31	2.30	162	3.10	374		
1.60	42	2.40	183	3.20	407		
1.70	54	2.50	205	3.30	441		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1905. It is well defined between gage heights 1.1 feet and 1.8 feet, and is fairly accurate to gage height 3.8 feet.

Estimated monthly discharge of Troublesome River at Troublesome, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	87	14	35.1	2,089
May, 23 days	458	78	192	8,759
June	604	52	259	15,410
July	52	4.5	17.5	1,076
August	29	15	18.0	1,107
September	22	14	17.3	1,029
October	39	10	19.1	1,174
The period				30,640

MUDDY RIVER DRAINAGE BASIN.

MUDDY RIVER AT KREMMLING, COLO.

Muddy River rises among the high peaks in the northwestern part of Grand County, Colo., and flows southeastward to the point where it unites with Grand River.

The gaging station was established July 24, 1904. It is located at the highway bridge about one-eighth mile northwest of Kremmling, in sec. 7, T. 1 N., R. 80 W., about 2 miles above the mouth of the river. The station is below all tributaries of importance.

The channel is curved for about 100 feet above and straight for 50 feet below the station. The right bank is about 8 feet high above and 10 feet high below the station, and is clean and almost perpendicular. The left bank below the bridge is 10 feet high, slopes at an angle of about 45 degrees, and is lined with willows; above the bridge it is irregular and about 8 feet high. The stream at this point does not overflow except at extremely high stages, and then only for a short distance back from the left bank. The bed of the stream is composed of mud, with some sand and a few loose rocks washed from the riprap near the south abutment of the bridge, and is clean but shifting. There is but one channel at all stages, broken by the middle pier of the bridge, which is irregularly shaped and causes back water and undercurrents in a portion of the cross section, affecting the discharge measurements at high stages. The current is medium at high and very sluggish at low water. The shifting of the bed makes it very difficult to obtain a good rating curve. Gage heights have a range of about 6 feet during an ordinary season. In the winter months ice obstructs the channel to such an extent that gage readings are impracticable.

At high-water stages discharge measurements are made from the downstream side of the two-span highway bridge to which the gage is attached. The initial point for soundings is a 10-penny nail driven into the downstream hand rail over the north face of the left abutment. The hand rail is marked from 0 to 58 feet with nails driven at 2-foot intervals. At ordinary and low-water stages measurements are made by wading at convenient points below the station.

The gage, which was read twice each day during 1905 by C. S. McGee, is a staff attached vertically to the lower left corner of the middle pier of the bridge. The gage reads from 2 to 14 feet, the 2-foot mark resting on the bed of the stream. The gage is referred to bench marks as follows: (1) A 60-penny spike driven horizontally into the west face of the left end of the downstream bridge stringer over the left abutment; elevation, 13.65 feet above the zero of the gage. (2) A 30-penny nail driven horizontally in the stringer at the east end of the north abutment of the bridge; elevation, 13.95 feet above the zero of the gage.

A description of this station with gage height and discharge data is contained in Water-Supply Paper No. 133, United States Geological Survey, pp. 150–151.

Discharge measurements of Muddy River at Kremmling, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
April 28	Wm. A. Lamb	42	99	1.75	6.32	173
May 8	do	41	140	1.81	6.90	254
May 27	do	49	338	1.98	9.95	669
June 7	do	48	354	1.90	10.10	671
June 15	do	49	264	1.32	8.38	349
June 26	do	52	66	1.18	6.35	78
July 11	do	14	11	1.45	4.61	16
July 24	do	11	6.6	.95	4.30	6.3
August 12	do	12	7.0	1.44	4.45	10
August 25	do	9	4.0	.72	4.10	2.9
September 7	do	10	5.2	1.21	4.25	6.3
September 29	do	10	5.6	1.02	4.25	5.7

NOTE.—Measurements made at different sections.

Daily gage height, in feet, of Muddy River at Kremmling, Colo., for 1905.

Day	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	7.35	6.9	8.9	5.55	4.7	4.1	4.4
2	7.3	7.32	9.35	5.15	4.6	4.0	4.4
3	6.82	7.5	9.5	5.15	4.6	4.05	4.4
4	6.68	7.2	10.15	5.1	4.6	4.1	4.4
5	6.35	7.05	10.0	5.0	4.6	4.1	4.4
6	6.38	6.4	9.45	5.0	4.5	4.2	4.4
7	6.3	6.45	9.55	4.7	4.5	4.2	4.4
8	6.35	6.65	9.55	4.6	4.5	4.2	4.4
9	6.25	7.3	10.1	4.6	4.5	4.2	4.4
10	6.1	7.35	10.15	4.5	4.5	4.0	4.4
11	5.9	6.9	9.45	4.5	4.55	4.0	4.3
12	5.6	6.6	8.9	4.5	4.3	4.0	4.3
13	5.25	6.7	8.65	4.5	4.25	4.0	4.3
14	5.1	6.75	8.75	4.4	4.3	4.0	4.3
15	5.0	6.65	8.4	4.3	4.3	4.0	4.3
16	5.15	7.0	8.15	4.4	4.3	4.0	4.3
17	5.18	8.1	7.95	4.4	4.2	4.0	4.3
18	5.2	8.3	7.45	4.4	4.2	4.0	4.3
19	5.25	9.15	7.3	4.35	4.2	4.0	4.4
20	5.05	9.6	7.05	4.3	4.1	4.0	4.4
21	5.02	9.5	6.9	4.3	4.1	4.0	4.4
22	4.95	9.75	6.75	4.3	4.1	4.0	4.4
23	5.1	10.1	6.65	4.3	4.1	4.0	4.4
24	5.25	10.65	6.5	4.3	4.1	3.7	4.4
25	5.18	9.85	6.35	4.3	4.1	3.7	4.4
26	5.3	9.45	6.25	4.3	4.1	4.0	4.5
27	5.38	9.35	6.1	4.3	4.1	4.0	4.5
28	5.9	9.45	6.05	4.3	4.1	4.0	4.5
29	6.25	8.9	5.95	4.85	4.1	4.2	4.5
30	6.48	8.55	5.7	4.7	4.1	4.3	4.4
31	.....	8.6	.....	4.7	4.1	.....	4.4

Station rating table for Muddy River at Kremmling, Colo., from July 25, 1904, to June 4, 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.*
4.20	5	5.50	85	6.70	223	7.90	380
4.30	8	5.60	95	6.80	236	8.00	394
4.40	11	5.70	105	6.90	249	8.20	422
4.50	15	5.80	116	7.00	262	8.40	450
4.60	19	5.90	127	7.10	275	8.60	478
4.70	24	6.00	138	7.20	288	8.80	506
4.80	29	6.10	150	7.30	301	9.00	534
4.90	35	6.20	162	7.40	314	9.20	562
5.00	42	6.30	174	7.50	327	9.40	590
5.10	50	6.40	186	7.60	340	9.60	618
5.20	58	6.50	198	7.70	353	9.80	646
5.30	67	6.60	210	7.80	366	10.00	674
5.40	76						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5 and is well defined. Above gage height 10 feet the rating curve is a tangent, the difference being 15 per tenth.

Station rating table for Muddy River at Kremmling, Colo., from June 5 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.*
4.00	2	5.20	31	6.40	90	8.20	309
4.10	3	5.30	34	6.50	98	8.40	341
4.20	5	5.40	38	6.60	106	8.60	374
4.30	7	5.50	42	6.70	115	8.80	409
4.40	9	5.60	46	6.80	125	9.00	445
4.50	11	5.70	50	6.90	136	9.20	483
4.60	13	5.80	54	7.00	147	9.40	523
4.70	16	5.90	59	7.20	171	9.60	564
4.80	19	6.00	64	7.40	195	9.80	606
4.90	22	6.10	70	7.60	221	10.00	649
5.00	25	6.20	76	7.80	249	10.15	682
5.10	28	6.30	83	8.00	278		

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

Estimated monthly discharge of Muddy River at Kremmling, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 25-31	8	5.6	6.9	96
August	29	5	11.4	701
September	36.4	5	14.8	881
October	19	8	13	799

Estimated monthly discharge of Muddy River at Kremmling, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	308	38	121	7,200
May	772	186	408	25,090
June	696	50	337	20,050
July	44	7	14	861
August	16	3	7.1	436
September	7	.5	2.7	161
October	11	7	8.7	535
The period				54,330

BLUE RIVER DRAINAGE BASIN.

BLUE RIVER NEAR KREMMLING, COLO.

Blue River rises among the peaks of the Continental Divide in the extreme southeastern part of Summit County, Colo., and flows in a general northwesterly direction until it joins Grand River above the point where the latter stream enters Gore Canyon.

The gaging station was established July 21, 1904. It is located at the State highway bridge on the road between Kremmling and Dillon, Colo., 17 miles from the former and 26 miles from the latter, in T. 2 S., R. 80 W., and is below all tributaries of any importance.

The channel is straight for about 400 feet above and 200 feet below the station. The banks are lined with willows and are not liable to overflow. The bed of the stream is very rough, but is clean and stable. There is but one channel at all stages, broken by the center pier of the bridge. Several large bowlders in the channel near the gaging section cause a wave and boiling motion of the water at high stages and eddies and dead water during low stages. Gage heights have a range in an ordinary season of about 2.5 feet. During the winter months ice forms in the channel to such an extent as to make gage readings impracticable.

Discharge measurements are made from the downstream side of the two-span iron bridge to which the gage is attached. The initial point for soundings is a 4-penny nail driven into the downstream guard rail at the left end of the bridge immediately over the east face of the left abutment. It is marked zero.

The gage at this station is read once each day by Mrs. Dolly Heatherly, who lives 1 mile south of the bridge. The original gage was a staff, graduated from 2 to 11 feet, fastened vertically to the west face of the middle masonry pier near the downstream end. On August 26, 1904, this gage was removed and was replaced by a regulation chain gage, the elevation of the datum of the two gages being the same. In September, 1905, the wooden gage was reset in its original position and datum and is to be used during season of high water; at all other times the chain gage is to be used. The gage is referred to bench marks as follows: (1) A cross cut in the top of the second step from the top of the downstream wing of the left abutment, painted black, and marked "U. S.+B. M."; elevation, 9.04 feet above the zero of the gage. (2) A 60-penny spike driven vertically into the west end of the block, to which the pulley of the gage is fastened; elevation, 11.69 feet above the zero of the gage.

A description of this station, with gage height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 151–153.

Discharge measurements of Blue River near Kremmling, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
April 27[a]	W. A. Lamb	108	151	2.29	2.50	346
May 9	do	131	210	2.80	2.90	589
May 26	do	147	371	5.01	3.50	1,860
June 7	do	166	541	6.06	4.60	3,276
June 28	do	151	382	4.53	3.45	1,732
July 23	do	139	236	2.97	3.12	702
August 12	do	125	212	2.70	2.82	572
August 26	do	118	182	2.30	2.58	420
September 6	do	115	182	2.43	2.59	422
September 13	do	110	151	1.88	2.45	284
September 28	do	99	125	1.69	2.30	211

[a] Channel partly filled with ice along sides and piers.

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.9	3.95	3.4	2.85	2.7	2.2	2.15	2.2
2		3.0	4.0	3.4	2.8	2.5	2.3	2.15	2.0
3		2.9	4.1	3.4	2.75	2.45	2.3	2.2	2.1
4		2.95	4.2	3.2	2.7	2.5	2.25	2.3	2.0
5	2.1	2.8	4.3	3.1	2.7	2.5	2.2	2.25	1.7
6	2.1	2.6	4.0	3.1	2.7	2.5	2.25	2.25	1.7

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7	2.2	2.65	4.1	3.0	2.7	2.5	2.25	2.25	2.0
8	2.2	2.8	4.15	3.0	2.7	2.5	2.25	2.2	2.2
9	2.25	2.9	4.45	3.0	2.6	2.45	2.2	2.15	2.3
10	2.3	3.0	4.0	2.9	2.6	2.3	2.2	2.1	.....
11	2.3	2.8	4.0	2.9	2.6	2.3	2.15	2.2	.....
12	2.3	2.75	3.95	2.9	2.6	2.3	2.1	2.2	.....
13	2.3	2.95	4.05	2.9	2.7	2.3	2.2	2.2	.....
14	2.35	2.8	3.95	2.8	2.6	2.3	2.2	2.2	.....
15	2.2	2.7	4.0	2.95	2.6	2.3	2.2	2.2	.....
16	2.3	2.7	3.95	2.9	2.6	2.25	2.2	2.15	.....
17	2.3	2.9	4.0	2.9	2.5	2.2	2.25	2.1	.....
18	2.35	3.05	3.75	2.8	2.5	2.25	2.25	2.15	.....
19	2.5	3.6	3.65	2.85	2.45	2.3	2.2	2.1	.....
20	2.4	3.65	3.65	2.8	2.45	2.3	2.2	2.15	.....
21	2.35	3.65	3.55	2.8	2.45	2.3	2.3	2.3	.....
22	2.4	3.55	3.5	2.85	2.4	2.3	2.25	2.2	.....
23	2.35	3.75	3.7	2.8	2.4	2.3	2.25	2.1	.....
24	2.4	3.65	3.75	2.8	2.4	2.25	2.25	2.1	.....
25	2.4	3.6	3.55	2.85	2.45	2.3	2.25	2.2	.....
26	2.4	3.5	3.65	2.9	2.5	2.3	2.3	2.1	.....
27	2.5	3.6	3.55	2.85	2.45	2.3	2.3	2.2	.....
28	2.6	3.55	3.55	2.8	2.45	2.25	2.3	2.15	.....
29	2.65	3.6	3.45	2.8	2.5	2.2	2.25	2.0	.....
30	2.8	3.65	3.4	2.8	2.5	2.2	2.2	2.0	.....
31	.....	3.7	.....	2.8	2.65	.....	2.2	.....	.....

EAGLE RIVER DRAINAGE BASIN.

EAGLE RIVER NEAR EAGLE, COLO.

Eagle River, an important headwater tributary of Grand River, rises among the high peaks of the Continental Divide, in Eagle County, Colo., immediately opposite the headwaters of Arkansas River, flows a little north of west for about 20 miles, and then in a general westerly direction to its junction with the Grand. It is a very rapid stream throughout its entire course, flowing alternately through canyons and narrow, terraced valleys.

The drainage area is almost wholly in Eagle County. The upper third of the basin is entirely mountainous, the general elevation at the crest of the divide being 12,000 feet above sea level, with peaks over 14,000 feet in altitude. In this part of its course the river descends in falls and cascades, the average slope above the mouth of Roche Moutonnée Creek being 150 feet per mile. The rocks are about equally divided between metamorphic granites and sedimentary formations. The forest cover is excellent, soil is shallow, and erosion is small. The annual precipitation, which is mostly in the form of snow, varies from 20 to 30 inches. This portion of the basin furnishes 90 per cent of the discharge of the stream.

The lower two-thirds of the basin is also mountainous but is less accentuated, the elevations varying from 7,000 to 11,000 feet. The rocks are largely sedimentary, erosion is greater, and the forest cover is meager. The precipitation is approximately 20 inches.

The principal tributaries of the Eagle are Gore, Roche Moutonnée, Gypsum, and Brush creeks.

Below Wolcott a few small ditches divert water for irrigation of the narrow first bench lands, and there is enough irrigation in Gypsum and Brush Creek valleys to divert the entire flow during the latter part of the season.

The gaging station was established March 12, 1905. It is located at Rule's private road bridge, in T. 5 S., R. 85 W., 2½ miles below Eagle, Colo. The chief object of the station is the collection of power data.

The channel is straight for 250 feet above and 150 feet below the station. The right bank is high, is composed of bowlders, cobblestones, and gravel, and does not overflow; the left bank, a long, narrow bottom bordered by abrupt mesa bluffs, overflows at high water to base of bluffs. Both banks are covered with scattered trees and brush. The bed of the stream is composed of cobblestones and bowlders and is permanent but very rough. There is but one channel at all stages. At low water there is an area of dead water at the left abutment, due to a depression in the bed of the stream under the bridge, and the current is sluggish; at high water this area of dead water disappears. The center of the current is very swift during high water. Above and below the bridge the velocity is much greater than at the bridge. The height of water ranges from 0.8 foot to 6 feet on the gage. Ice forms over the channel under the bridge during cold weather.

Discharge measurements are made from the downstream side of the 66-foot single-span wooden bridge, which stands at right angles to the stream current. The initial point for soundings is the face of the left abutment.

A vertical staff gage, which was read twice each day during 1905 by Kenneth Rule, is spiked to the face of the left abutment of the bridge. The gage is graduated from zero to 10 feet. The bench mark is a point encircled by paint and marked "B.M." on a large bowlder at the right of the bridge; elevation, 15.72 feet above the zero of the gage.

Discharge measurements of Eagle River near Eagle, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 18	R. I. Meeker	40	119	1.57	0.80	187
May 12	do	50	207	3.55	2.20	735
July 10	do	45	233	3.41	2.40	794
August 15[a]	do	45	202	2.01	1.55	406
September 25[a]	do	60	162	1.22	1.00	198

[a] Made from Eagle bridge.

Daily gage height, in feet, of Eagle River near Eagle, Colo., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.7	2.65	4.45	3.25	1.75	1.15	1.15	0.9	0.9
2		.8	3.0	4.7	3.05	1.7	1.05	1.15	.9	.95
3		.7	2.6	4.9	2.85	1.6	.95	1.15	1.0	.9
4		.65	2.35	5.8	2.65	1.65	1.25	1.05	.95	.8
5		.7	2.25	5.45	2.6	1.6	1.35	1.05	.95	.8
6		.7	2.0	5.35	2.6	1.6	1.35	1.05	.95	.8
7		.75	2.05	5.45	2.55	1.6	1.35	1.05	.9	.8
8		.9	2.25	5.45	2.6	1.6	1.45	1.05	.9	.9
9		1.0	2.5	5.65	2.4	1.65	1.4	1.0	.9	1.0
10		1.15	2.45	5.65	2.4	1.6	1.35	1.0	.9	1.2
11		1.15	2.25	5.15	2.35	1.7	1.3	1.0	.9	1.5
12		1.25	2.15	4.8	2.3	1.75	1.35	.95	.9	2.0
13		1.2	2.4	4.9	2.25	1.7	1.3	.95	.8	1.8
14		1.25	2.25	4.95	2.2	1.65	1.25	.9	.8	2.0
15		1.15	2.25	4.65	2.15	1.6	1.2	.9	.9	2.4
16		1.2	2.5	4.4	2.05	1.55	1.05	.95	.9	2.4
17		1.15	2.95	4.15	2.0	1.35	1.1	.95	.9	2.5

Daily gage height, in feet, of Eagle River near Eagle, Colo., for 1905—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	.....	1.2	3.25	4.2	1.85	1.3	1.1	0.95	0.9	2.4
19	0.8	1.4	3.55	3.9	1.85	1.15	1.1	.9	.9	2.4
20	.8	1.35	3.75	3.85	1.8	1.15	1.0	.95	.9	2.4
21	.7	1.25	3.85	3.95	1.75	1.1	1.0	.95	.9	2.4
22	.75	1.3	4.2	3.7	1.7	1.0	1.05	.9	.9	2.5
23	.7	1.3	4.5	3.8	1.7	1.0	1.0	.9	.9	2.5
24	.65	1.4	4.5	3.85	1.7	.95	1.0	.9	.9	2.6
25	.7	1.4	4.1	3.75	1.7	1.0	1.0	.9	.9	.....
26	.7	1.35	4.15	3.8	1.7	1.0	1.0	.9	.9	.....
27	.78	1.5	4.25	3.7	1.65	1.05	1.0	.95	.9	.....
28	.7	1.75	4.2	3.7	1.75	1.05	1.0	1.0	.9	.....
29	.65	2.2	3.9	3.45	1.8	1.15	1.15	1.0	.9	.....
30	.7	2.35	3.9	3.4	1.7	1.25	1.2	1.1	.9	.....
31	.7	.....	4.4	.....	1.7	1.3	.....	1.1	.....	.....

GUNNISON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Gunnison River is formed in Gunnison County, Colo., by the union of East and Taylor rivers, two streams that have their origin among the snow-covered peaks and on the slopes of the Continental Divide in the northeastern part of the county and which descend through narrow mountain valleys and unite about 12 miles above Gunnison. From the junction of these rivers the Gunnison flows west and southwest to the point where it enters Grand River at Grand Junction, in the central part of Mesa County, Colo.

The upper course of the river lies through a broad, mountainous valley, but near the mouth of Lake Fork the valley narrows and the river enters the Black Canyon of the Gunnison, through which it winds in a tortuous course for 56 miles between granite walls that rise precipitously 3,000 feet above the water's edge. A short distance below the mouth of North Fork, the largest tributary of the river, the canyon walls break abruptly, and the valley is broad and fertile. Below Delta the river enters another narrow canyon, with walls averaging 800 feet in height, and this continues irregularly to Grand Junction, a few tracts of narrow bottom land lying between the channel and the canyon walls.

As an aid to description the basin may be divided into an upper, mountainous area and a lower, plateau area, the two being divided roughly by a north-south line drawn through the town of Hotchkiss.

The mountainous portion of the basin is the greater in area and varies in altitude from 6,000 to 14,000 feet. The geologic formations include large areas of igneous as well as sedimentary rocks, the soil cover is shallow, and large tracts are entirely barren. In the more inaccessible parts of the region the primeval forest still exists, but at many places, especially in the neighborhood of the mining camps, the timber has all been cut off. The prevailing forests are spruce, aspen, cedar, and characteristic mountain undergrowth. All the arable land in the high mountain valleys is devoted to forage crops, and a number of small ditches divert water for their irrigation. Power development of considerable magnitude is feasible in this part of the basin.

The plateau region embraces the Uncompahgre Plateau along the southwestern border of the basin, the Vernal and Inclinado mesas in the central part, and the Grand Mesa in the northern part. These plateaus have an extreme elevation of 10,000 feet above sea level and break down in a series of broad steps to the valleys, with parallel drainage lines cutting deeply at right angles through these steps. The topography is the product of erosion acting on sedimentary formations. The soil of the lower valleys is chiefly adobe, and the higher

mesas have large content of gravel and sand. Groves of quaking aspen, interspersed with large, open grazing plots, cover broad areas of this plateau region. Forests of pine and aspen occur on the top of the Grand Mesa, with pinon pines and cedars along the foothills. In the valleys chico and sagebrush form the controlling vegetation, except along the streams, which are bordered to some extent by cottonwood, willow, and undergrowth.

The chief tributaries of the Gunnison are Ohio, Tomichi, Lake Fork, and Cimarron creeks and Smith, North Fork, and Uncompahgre rivers, the North Fork being the largest.

North Fork River rises in the Huntsman Hills, 20 miles south of Glenwood Springs, flows in a general south and southwesterly course, and unites with the Gunnison about 8 miles west of Hotchkiss. The drainage area is highly mountainous, except for a small portion which lies below Paonia, extreme points reaching an altitude of 13,000 feet. The mesa lands at the lower end of the valley stand 5,500 feet above sea level. The higher peaks are formed of granitic rocks, but lower down Cretaceous formations occupy at least 80 per cent of the area of the basin. The mountains are forested and the mesa lands are covered with sagebrush. All the tillable lands of the North Fork and its tributaries have been brought under cultivation, and irrigation is practiced to such an extent that the entire flow is needed for existing systems.

Uncompahgre River, the principal tributary of the Gunnison from the south, rises among the snowy peaks of the highly serrated Uncompahgre Mountains and flows a little west of north to its junction with the Gunnison at Delta. The basin embraces a mountainous, plateau, and valley area of 1,130 square miles, oblong in shape, the width increasing slightly at the lower end. The mountain area occupies but a small part of the basin, but contributes the perennial waters of the stream. The plateau area is greatest in extent and borders the valley on both sides, the larger Uncompahgre Plateau lying to the southwest. Escarpments are conspicuous features of this plateau. The relief features are terraced mesas flanked by shale buttes and ridges, trenched by deep, narrow canyons. Uncompahgre Valley proper begins at a point near Eldredge Siding, on the Denver and Rio Grande Railroad.

The other tributaries of the Gunnison need not here be described. Ohio, Tomichi, Lake Fork, and Cimarron creeks are perennial streams, but almost their entire volume is diverted for irrigation during the growing season, so that very little of their water reaches the Gunnison except at times of heavy storms or during spring floods.

Precipitation records for the Gunnison basin are meager. Those which exist show a range from 9 inches in the plateau region to about 25 inches in the mountains.

The natural flow of the Uncompahgre and North Fork rivers is diverted for irrigation along their respective valleys, and the Gunnison tunnel will divert water from the mountainous area and transmit it to the Uncompahgre Valley, which has been an irrigated district since the early eighties.

EAST RIVER AT ALMONT, COLO.

East River rises in the Elk Mountains in the northern part of Gunnison County, Colo., flows in a general southerly direction, and unites with Taylor River to form the Gunnison.

The gaging station was established April 17, 1905. It is located at the county highway bridge at Almont, 100 feet above Taylor River, in T. 51 N., R. 85 W. The object of the station is the determination of the amount of flood waters available for storage in connection with the Uncompahgre Valley project and the collection of power data.

The channel section measures 75 feet between the bridge abutments and is straight for 100 feet both above and below the station. The banks are low and are liable to overflow at extreme high water. The bed of the stream is composed of bowlders and cobblestones and is very rough but generally permanent. There are two channels at all stages, divided by the center pier of the bridge, and the current is swift. Gage heights range from 0.7 foot to 5 feet.

Discharge measurements are made from the downstream side of the two-span wooden bridge. The initial point for soundings is the face of the left abutment and is indicated by a brass-headed tack in the hand rail, marked with a circle.

The gage, which was read during 1905 by Vernon Davis, is a vertical staff graduated from zero to 7 feet, spiked to the right end of the pier on the downstream side of the bridge. The bench mark is a point on a large stump in Cottage Grove on the right bank of the river, about 25 feet from the bridge, encircled by black paint and marked "B. M.;" elevation, 6.51 feet above the zero of the gage.

Discharge measurements of East River at Almont, Colo., in 1904 and 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec-ft.*
June 14	R. I. Meeker	73	182	6.62	2.60	1,205
July 19	do	73	112	3.30	1.65	370
August 16	do	73	105	3.01	1.55	316
September 23	do	72	76	2.00	1.15	152
1905.						
April 15	do	58	75	2.53	0.80	190
May 26	A. A. Weiland	73	256	7.62	2.90	1,951
June 17	do	73	237	7.89	3.10	1,869
July 6	do	71	153	5.08	2.10	777
August 10	do	64	94	2.86	1.50	269
August 29	do	51	75	2.28	1.30	171

NOTE.—The 1904 measurements were made before the station was established. The gage heights were obtained from reference points.

Daily gage height, in feet, of East River at Almont, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.75	3.25	2.35	1.9	1.3	1.0
2	.....	1.8	3.6	2.35	1.8	1.2	.9
3	.....	1.7	4.35	2.3	1.7	1.2	.9
4	.....	1.45	4.7	2.25	1.7	1.2	.9
5	.....	1.4	4.55	2.15	1.7	1.2	.9
6	.....	1.3	4.0	2.2	1.7	1.2	.9
7	.....	1.3	3.85	2.0	1.7	1.3	.9
8	.....	1.4	4.4	2.0	1.6	1.2	.9
9	.....	1.55	4.75	1.95	1.5	1.2	.....
10	.....	1.45	4.15	1.85	1.5	1.2	.....
11	.....	1.45	3.85	1.85	1.5	1.2	.....
12	.....	1.4	3.55	1.85	1.5	1.2	.....
13	.....	1.5	3.65	1.85	1.5	1.2	.....
14	.....	1.5	3.55	1.85	1.4	1.2	.....
15	.....	1.45	3.55	1.85	1.4	1.2	.....
16	0.8	1.7	3.35	1.85	1.4	1.1	.....
17	.75	1.9	2.95	1.85	1.4	1.1	.....
18	.8	2.05	2.9	1.85	1.4	1.1	.....
19	.9	2.45	2.7	1.8	1.4	1.1	.....
20	.85	2.6	2.4	1.7	1.4	1.0	.....
21	.8	2.75	2.55	1.8	1.4	1.0	.....
22	.9	2.85	2.4	1.7	1.4	1.0	.....
23	.85	3.3	2.5	1.7	1.4	1.0	.....
24	.85	3.15	2.6	1.7	1.5	1.0	.....
25	1.05	2.85	2.5	1.75	1.5	1.0	.....
26	1.0	3.1	2.45	1.7	1.4	1.0	.....
27	1.1	3.0	2.4	1.75	1.4	1.0	.....
28	1.2	2.75	2.4	1.7	1.4	1.0	.....
29	1.45	2.55	2.4	1.7	1.4	1.0	.....
30	1.65	2.5	2.35	1.8	1.4	1.0	.....
31	.....	2.85	.....	2.1	1.4	.....	.....

Station rating table for East River at Almont, Colo., from April 16 to June 1, 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.*
0.80	190	1.50	420	2.20	850	2.90	1,610
0.90	210	1.60	470	2.30	940	3.00	1,750
1.00	240	1.70	520	2.40	1,030	3.10	1,900
1.10	270	1.80	580	2.50	1,130	3.20	2,060
1.20	300	1.90	640	2.60	1,240	3.30	2,220
1.30	340	2.00	700	2.70	1,360		
1.40	380	2.10	770	2.80	1,480		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is not well defined. Estimates based on this table are rough approximations.

Station rating table for East River at Almont, Colo., from June 2 to October 8, 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	80	2.00	610	3.00	1,750	4.00	3,430
1.10	110	2.10	700	3.10	1,900	4.10	3,620
1.20	140	2.20	790	3.20	2,050	4.20	3,810
1.30	180	2.30	890	3.30	2,210	4.30	4,000
1.40	220	2.40	990	3.40	2,370	4.40	4,190
1.50	270	2.50	1,100	3.50	2,540	4.50	4,380
1.60	330	2.60	1,220	3.60	2,710	4.60	4,570
1.70	390	2.70	1,340	3.70	2,890	4.70	4,770
1.80	460	2.80	1,470	3.80	3,070	4.80	4,970
1.90	530	2.90	1,610	3.90	3,250		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905, and is well defined between gage heights 1.3 feet and 3.1 feet.

Estimated monthly discharge of East River at Almont, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30	495	180	249	7,408
May	2,220	340	910	55,950
June	4,870	940	2,329	138,600
July	940	390	537	33,020
August	530	220	280	17,220
September	180	80	117	6,962
October 1–8	80	60	62.5	992
The period				260,200

TAYLOR RIVER NEAR ALMONT, COLO.

Taylor River rises in northeastern Gunnison County, Colo., among the high peaks of the Continental Divide, flows in a general southwesterly direction, and unites with East River to form the Gunnison.

The gaging station was established April 17, 1905. It is located at George Clark's private road bridge, 14 miles above Almont, Colo., in T. 15 S., R. 83 W. The object of the station

is the determination of the amount of flood water available for storage in connection with the Uncompahgre Valley project, and the collection of power data.

The channel is straight for several hundred feet both above and below the station. The banks are both low, composed of bowlders and earth, are partly lined with willows, and are not liable to overflow. The stream bed is made up of large bowlders and cobblestones, and is very rough but permanent. The fall is large, the slope being equal to 0.016, or about 80 feet per mile. The crib piers of the bridge divide the channel into three parts. The velocity is rapid at all stages. Ice conditions interfere with measurements during the winter months. Accurate measurements are exceedingly hard to obtain on account of the roughness of the channel.

Discharge measurements are made from the downstream side of a pole bridge, which is 75 feet between abutments and is supported by two crib piers. The gage, which was read during 1905 by George Clark, is a vertical staff, graduated from zero to 7 feet, spiked to the left side of the left pier. The bench mark is a point, encircled with white paint and marked "B. M.," on top of a granite bowlder on the left bank just below the bridge; elevation above the zero of the gage, 4.34 feet.

Discharge measurements of Taylor River near Almont, Colo., in 1904 and 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 15	R. I. Meeker	58	142	5.61	2.22	796
July 18	do	58	101	3.27	1.47	330
August 17	do	58	104	3.88	1.77	404
September 21	do	58	69	2.33	1.12	161
1905.						
April 17	R. I. Meeker	44	64	1.78	1.00	114
May 26	A. A. Weiland	58	173	5.76	2.60	996
June 17	do	58	174	5.86	2.60	1,044
July 6	do	58	130	3.32	1.70	432
August 10	do	58	100	2.27	1.20	227
August 29	do	58	99	2.03	1.10	201

NOTE.—The 1904 measurements were made before the station was established. The gage heights were obtained from reference points.

Daily gage height, in feet, of Taylor River near Almont, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.1	3.4	1.9	1.45	1.1	1.1	1.0
2		1.8	3.55	1.85	1.35	1.1	1.1	1.0
3		1.35	3.75	1.75	1.4	1.1	1.1	1.0
4		1.3	4.15	1.75	1.4	1.1	1.1	1.0
5		1.25	4.25	1.7	1.35	1.1	1.1	1.0
6		1.25	3.85	1.75	1.35	1.1	1.1	1.0
7		1.15	3.8	1.65	1.3	1.1	1.1	1.0
8		1.75	4.2	1.65	1.25	1.1	1.1	1.0
9		1.55	4.4	1.6	1.2	1.1	1.1	1.0
10		1.4	3.7	1.6	1.2	1.1	1.0	1.0
11		1.4	3.4	1.55	1.25	1.1	1.0	1.0
12		1.4	3.4	1.55	1.3	1.1	1.0	1.0
13		1.45	3.6	1.55	1.25	1.1	1.0	1.0
14		1.5	3.4	1.55	1.2	1.1	1.0	1.0
15		1.6	3.4	1.55	1.2	1.1	1.0	1.0
16		1.8	3.1	1.55	1.2	1.1	1.0	1.0

Daily gage height, in feet, of Taylor River near Almont, Colo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
17	1.0	1.85	2.8	1.55	1.2	1.1	1.0	0.95
18	1.05	2.15	2.7	1.45	1.15	1.1	1.0	.85
19	1.1	2.3	2.5	1.45	1.1	1.1	1.0	.8
20	1.1	2.4	2.6	1.45	1.1	1.1	1.0	.7
21	1.1	2.6	2.45	1.45	1.1	1.1	1.0	.7
22	1.1	2.7	2.4	1.45	1.1	1.1	1.0	.65
23	1.1	2.95	2.45	1.35	1.1	1.1	1.0	.5
24	1.15	2.95	2.4	1.35	1.1	1.1	1.0	.4
25	1.2	2.9	2.4	1.35	1.1	1.1	1.0	.....
26	1.2	2.8	2.4	1.35	1.1	1.1	1.0	.....
27	1.4	2.55	2.25	1.35	1.1	1.1	1.0	.....
28	1.8	2.4	2.2	1.35	1.1	1.1	1.0	.....
29	1.95	2.3	2.15	1.35	1.1	1.1	1.0	.....
30	2.05	2.3	2.15	1.35	1.1	1.1	1.0	.....
31	.....	3.0	.....	1.45	1.1	.....	1.0	.....

Station rating table for Taylor River near Almont, Colo., from April 17 to May 26, 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	115	1.60	365	2.20	725	2.80	1,190
1.10	150	1.70	420	2.30	795	2.90	1,280
1.20	185	1.80	475	2.40	870	3.00	1,370
1.30	225	1.90	535	2.50	945		
1.40	270	2.00	595	2.60	1,025		
1.50	315	2.10	660	2.70	1,105		

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

Station rating table for Taylor River near Almont, Colo., from May 27 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.*
0.40	70	1.30	255	2.20	725	3.20	1,555
.50	85	1.40	290	2.30	795	3.40	1,750
.60	100	1.50	330	2.40	870	3.60	1,950
.70	115	1.60	375	2.50	945	3.80	2,160
.80	135	1.70	425	2.60	1,025	4.00	2,370
.90	155	1.80	480	2.70	1,105	4.20	2,580
1.00	175	1.90	535	2.80	1,190	4.40	2,790
1.10	200	2.00	595	2.90	1,280		
1.20	225	2.10	660	3.00	1,370		

NOTE.—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 foot and 2.6 feet.

Estimated monthly discharge of Taylor River near Almont, Colo., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 17 to 30	628	115	248	6,887
May	1,370	168	650	39,970
June	2,790	692	1,518	90,330
July	535	272	351	21,580
August	310	200	182	11,190
September	200	200	200	11,900
October	200	175	121	7,440
November 1 to 24	175	70	156	7,426
The period				196,700

GUNNISON RIVER NEAR CIMARRON, COLO.

This station was established September 18, 1903. It is located at the Denver and Rio Grande Railroad bridge, 1½ miles from Cimarron, Colo., 1,000 feet above the mouth of Cimarron River, in T. 19 S., R. 91 W. The purpose of the station was the collection of hydrographic data relative to the Uncompahgre Valley project, which comtemplates the diversion of 1,300 cubic feet of water per second from Gunnison River about 12 miles below. The station was discontinued December 16, 1905, having been replaced by the station established at the east portal of Gunnison tunnel in April, 1905.

The channel is straight for 1,000 feet above and 300 feet below the station. The left bank is a granite cliff which rises vertically from the water. The right bank is a mountain slope of about 45°. The bed of the stream, which is permanent, is composed of granite bowlders along the sides with an even deposit of small cobblestones in the center. There is but one channel at all stages. At the cable section the left bank is an offset in the stream channel filled with a deposit of mud. The velocity is swift at low stages and very rapid during high water. Gage heights range from 3 to 12 feet.

Discharge measurements are made by means of a cable, car, stay, and tag lines. The initial point for soundings is at the face of the left cliff, 20 feet from the eye bolt to which cable is fastened, and is marked zero on the tag line.

A standard chain gage, which was read twice daily during 1905 by G. C. Gates, is installed on the upstream side of the Denver and Rio Grande Railroad bridge near the west end, about 75 feet downstream from the cable. The gage scale reads from zero to 10 feet, with two markers, giving a range of 20 feet in gage heights. The length of chain from end of weight to center of first marker is 56.06 feet. The bench mark is the top of the southeast corner capstone of the east masonry abutment of the Denver and Rio Grande Railroad bridge, a line being cut across the corner of the capstone to indicate the bench mark; elevation, 56.52 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 80–81; 133, p 157.
Discharge: 100, p 81; 133, p 157.
Discharge, monthly: 100, p 82; 133, p 159.
Gage heights: 100, p 81; 133, p 158.
Rating table: 100, p 82; 133, p 158.

Discharge measurements of Gunnison River near Cimarron, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 1	R. I. Meeker	90	235	2.71	4.30	636
May 23	A. A. Weiland	115	1,420	6.84	14.50	9,719
June 6	do	110	1,612	7.37	16.50	11,880
June 18	do	110	1,249	6.01	13.20	7,506
July 1	do	100	768	4.86	9.40	3,736
July 19	do	95	436	3.47	6.50	1,513
August 11	do	85	362	3.35	5.90	1,214
October 4	R. I. Meeker	78	239	2.44	4.40	583
October 5	do	78	232	2.23	4.30	517

Daily gage height, in feet, of Gunnison River near Cimarron, Colo., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.35	10.05	14.85	9.4	8.25	4.75	4.9	4.45	3.45
2	.....	4.45	10.15	15.6	8.95	7.35	4.7	4.55	4.05	3.25
3	.....	4.5	9.65	16.05	8.45	7.15	4.45	4.55	4.1	3.5
4	.....	4.45	8.25	17.15	7.55	7.0	4.55	4.4	4.15	3.95
5	.....	4.1	7.75	17.9	7.95	6.7	4.7	4.3	4.35	3.6
6	.....	4.25	7.55	16.6	7.8	6.45	4.75	4.25	4.25	3.75
7	.....	4.5	8.35	16.2	7.6	6.5	4.75	4.2	4.15	3.85
8	.....	4.8	8.5	16.9	7.5	6.35	4.7	4.1	4.1	3.85
9	.....	4.85	9.2	17.3	7.35	5.85	4.65	4.05	4.2	3.7
10	4.85	5.8	8.75	16.5	7.15	5.75	4.6	4.1	3.95	3.8
11	4.75	5.8	8.15	15.35	7.05	5.9	4.5	4.15	4.0	3.9
12	4.65	5.8	7.85	15.2	6.65	5.85	4.4	4.15	4.0	3.75
13	4.8	5.65	8.0	14.85	6.5	5.8	4.35	4.15	3.75	4.05
14	4.75	5.5	8.2	14.8	6.65	5.65	4.2	4.15	3.7	4.1
15	4.85	5.65	8.7	14.8	6.6	5.5	4.15	4.05	4.0	3.95
16	5.2	5.45	9.25	14.35	6.75	5.4	4.25	4.15	3.95	4.1
17	5.15	5.5	10.92	14.3	6.65	5.2	4.2	4.35	4.0	3.8
18	5.2	5.55	11.45	13.2	6.6	5.0	4.1	4.25	4.05	.....
19	5.0	5.9	12.5	12.55	6.5	4.95	4.1	4.05	4.0	.....
20	5.05	5.9	13.0	12.25	6.5	4.75	4.15	3.95	3.9	.....
21	4.7	5.65	13.25	12.2	6.55	4.55	4.2	4.1	4.1	.....
22	4.85	5.55	13.9	12.0	6.55	4.75	4.2	4.05	4.05	.....
23	4.45	5.75	14.6	11.45	6.35	4.8	4.1	4.3	4.15	.....
24	4.3	5.75	14.7	11.35	6.35	4.8	4.15	4.5	3.85	.....
25	4.3	5.9	14.2	11.3	6.2	5.05	4.2	4.25	3.7	.....
26	4.45	6.1	14.4	11.15	6.15	5.05	4.25	4.25	3.55	.....
27	4.5	6.55	14.8	11.1	6.05	5.0	4.3	4.25	4.35	.....
28	4.55	6.7	14.55	10.8	6.15	4.7	4.2	4.35	3.85	.....
29	4.25	8.3	12.5	10.6	6.65	4.9	4.15	4.2	3.4	.....
30	4.35	9.5	12.15	10.15	7.15	5.0	4.45	4.25	3.35	.....
31	4.3	.....	13.15	.....	7.9	5.0	.....	4.3	.....	.....

Station rating table for Gunnison River near Cimarron, Colo., from March 10 to December 17, 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	300	5.00	775	6.80	1,660	10.20	4,535
3.30	320	5.10	815	6.90	1,725	10.40	4,750
3.40	340	5.20	855	7.00	1,790	10.60	4,970
3.50	360	5.30	895	7.20	1,925	10.80	5,190
3.60	380	5.40	940	7.40	2,065	11.00	5,410
3.70	400	5.50	985	7.60	2,215	11.50	5,960
3.80	425	5.60	1,030	7.80	2,365	12.00	6,535
3.90	450	5.70	1,075	8.00	2,520	12.50	7,110
4.00	475	5.80	1,120	8.20	2,680	13.00	7,685
4.10	500	5.90	1,165	8.40	2,840	13.50	8,260
4.20	526	6.00	1,215	8.60	3,000	14.00	8,860
4.30	553	6.10	1,265	8.80	3,180	14.50	9,460
4.40	580	6.20	1,315	9.00	3,360	15.00	10,060
4.50	610	6.30	1,370	9.20	3,540	15.50	10,660
4.60	640	6.40	1,425	9.40	3,725	16.00	11,260
4.70	670	6.50	1,480	9.60	3,915	16.50	11,860
4.80	705	6.60	1,540	9.80	4,115		
4.90	740	6.70	1,600	10.00	4,325		

NOTE.—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 4 feet and 9.4 feet. The table has been extended beyond these limits. Above gage height 16.5 feet the rating curve is a tangent, the difference being 125 per tenth.

Estimated monthly discharge of Gunnison River near Cimarron, Colo., for 1905.

[Drainage area, 3,844 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 10–31	855	540	676	29,500	0.176	0.144
April	3,820	500	1,118	66,520	.291	.325
May	9,820	2,178	5,511	338,900	1.43	1.65
June	13,610	4,482	8,867	527,600	2.31	2.58
July	3,725	1,240	1,863	114,600	.485	.559
August	2,720	625	1,101	67,700	.286	.330
September	688	500	576	34,270	.150	.167
October	740	462	540	33,200	.140	.161
November	595	330	472	28,090	.123	.137
December 1–17	500	310	424	14,300	.110	.070
The period				1,255,000		

GUNNISON RIVER AT EAST PORTAL OF GUNNISON TUNNEL, COLORADO.

This station was established April 1, 1905, and replaces the Cimarron station, 12 miles above. It is located about 100 yards above the portal of the tunnel and is in T. 49 N., R. 7 W., 21 miles by wagon road from Montrose. The object of the station is to determine the volume of flow of the river at this point, as 1,300 second-feet will be diverted by the Gunnison tunnel when it is completed.

The channel is straight for 500 feet above and 300 feet below the station. The banks are steep, rocky mountain sides, and do not overflow. The bed of the stream is composed primarily of solid ledges of schists with a shifting deposit of gravel and sand which reaches a depth of 3 to 4 feet at low water. There is but one channel at all stages. The current is sluggish at low water, but becomes swift during high water. Gage heights range from 5 to 14 feet.

Discharge measurements are made by means of a cable, car, and tag line. The initial point for soundings is the left bank at high-water mark and is indicated by zero on tag line.

The gage, which is read twice daily by H. L. Daniels, is a vertical staff, graduated from zero to 15 feet, bolted to a vertical cliff on the right bank of the river 50 feet upstream from the cable. The bench mark is a United States Geological Survey standard aluminum tablet set in a rock ledge 50 feet south of the mouth of Gunnison tunnel; elevation of bench mark above the zero of the gage, 29.11 feet.

Discharge measurements of Gunnison River at east portal of Gunnison tunnel, Colorado, in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. ft.	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 1	O. McDermith	1,301	3.48	9.05	4,529
May 27	do	1,793	4.76	11.80	8,540
June 3	do	2,105	5.32	12.80	11,200
June 17	do	1,758	4.04	11.25	7,100
June 20	do	1,649	4.06	10.60	6,690
June 29	do	1,410	3.04	9.25	4,184
July 6	do	1,166	2.17	7.60	2,525
July 13	do	1,054	1.61	6.85	1,695
August 3	do	1,091	1.87	7.12	2,044
August 11	do	917	1.12	6.00	1,025
August 19	do	860	.89	5.60	763
August 28	do	846	.81	5.50	689
September 13	do	806	.71	5.24	575

Daily gage height, in feet, of Gunnison River at east portal of Gunnison tunnel, Colorado, for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	8.95	11.95	8.75	7.85	5.5	5.55	5.3	5.2
2	.....	9.05	12.55	8.45	7.4	5.5	5.35	5.3	5.4
3	.....	8.65	12.85	8.15	7.15	5.4	5.3	5.3	5.6
4	.....	8.1	13.35	8.0	7.05	5.5	5.3	5.3	5.6
5	.....	7.8	13.95	7.85	6.85	5.5	5.25	5.3	5.6
6	.....	7.6	13.15	7.65	6.75	5.6	5.2	5.3	5.6
7	.....	7.6	12.9	7.6	6.65	5.6	5.2	5.25	5.7
8	.....	7.9	13.1	7.6	6.4	5.5	5.2	5.2	6.0
9	5.9	8.4	13.65	7.45	6.2	5.5	5.2	5.2	6.0
10	6.05	8.75	13.05	7.25	6.2	5.45	5.15	5.2	6.0
11	6.2	7.95	12.55	7.05	6.15	5.35	5.1	5.2	6.0
12	6.25	7.8	12.25	7.0	6.05	5.3	5.1	5.1	6.0
13	6.1	8.0	12.1	6.85	6.0	5.25	5.1	5.1	6.0
14	6.15	7.9	11.9	6.8	6.0	5.2	5.1	5.0	6.0
15	6.0	8.05	11.9	6.8	6.0	5.2	5.1	5.1	6.0
16	e6.1	8.48	11.75	6.8	5.85	5.2	5.1	5.05	6.0
17	6.18	9.5	11.2	6.8	5.8	5.15	5.2	5.1	6.1

Daily gage height, in feet, of Gunnison River at east portal of Gunnison tunnel, Colorado, in 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	6.28	9.9	10.95	6.8	5.7	5.1	5.2	5.2	6.5
19	6.42	10.5	10.65	6.7	5.6	5.1	5.2	5.15	6.5
20	6.38	10.85	10.6	6.6	5.6	5.2	5.2	5.0	6.5
21	6.2	11.15	10.5	6.6	5.5	5.2	5.2	5.1	6.6
22	6.15	11.45	10.15	6.6	5.5	5.1	5.2	5.15	6.6
23	6.2	11.95	9.95	6.6	5.5	5.1	5.2	5.2	6.5
24	6.3	11.9	9.85	6.6	5.5	5.1	5.25	5.1	6.3
25	6.4	11.7	9.8	6.5	5.65	5.1	5.2	5.1	6.3
26	6.55	11.75	9.75	6.5	5.65	5.2	5.3	5.1	6.3
27	6.82	11.75	9.65	6.65	5.5	5.1	5.3	5.2	6.3
28	7.28	11.5	9.6	6.5	5.5	5.2	5.3	5.2	6.3
29	7.8	10.75	9.35	6.5	5.7	5.2	5.3	5.2	6.3
30	8.35	10.8	9.05	6.9	5.65	5.4	5.3	5.2	6.3
31	.....	10.9	.....	7.8	5.6	.....	5.3	.....	6.3

GUNNISON RIVER NEAR CORY, COLO.

This station was established April 30, 1903, It is located at the wooden highway bridge on the road between Delta and Cory, Colo., about 6 miles east of Delta.

The channel is over 200 feet wide and is straight for 300 feet above and 500 feet below the station. The right bank is abrupt, high, and wooded, and does not overflow; the left bank is a gradual slope of cobblestones, gravel, and sand to the annual flood plain; is partly covered with trees and underbrush, and overflows at extreme high water. The bed of the stream is composed of bowlders and cobblestones and is permanent. There is but one channel at all stages. The current is swift at high water. Gage heights range from 5 to 13 feet.

Discharge measurements are made from the downstream side of the two-span bridge. The initial point for soundings is a brass tack in the hand rail at the center of the left pier, downstream side of bridge.

A standard chain gage, which was read twice daily during 1905 by John Shea, is located on the downstream side of the bridge 90 feet from the right bank. The gage scale reads from zero to 10 feet, with two markers, allowing for a range of 20 feet in gage heights, the second marker being used above 10 feet. The length of the chain from the end of the weight to the center of the second marker is 14.12 feet. The bench mark is the top edge of the iron rim of the northwest cylinder pier, downstream side of bridge, marked with white paint at the point of B. M.; elevation above the datum of the gage, 17.59 feet.

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

Description: 100, p 76; 133, p 159.
Discharge: 100, pp 76, 93; 133, p 160.
Discharge, monthly: 100, p 78; 133, p 161.
Gage heights: 100, p 77; 133, p 160.
Rating table: 100, p 77; 133, p 161.

Discharge measurements of Gunnison River near Cory, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 10	R. I. Meeker	188	760	2.70	6.85	2,052
May 6	Oro McDermith	213	1,090	4.03	8.20	4,388
May 19	A. A. Weiland	256	1,682	7.88	10.95	13,280
May 21	R. I. Meeker	260	1,785	8.11	11.35	14,480
May 21	A. A. Weiland	260	1,785	8.04	11.25	14,350
May 31	do	256	1,688	7.64	10.95	12,890
June 3	do	269	2,056	8.86	12.20	18,220
June 13	do	266	1,893	8.38	11.80	15,860
June 27	do	232	1,329	5.57	9.45	7,405
July 11	do	200	852	3.09	7.30	2,632
August 1	do	210	942	3.46	7.70	3,263
October 2	R I. Meeker	180	566	1.54	5.90	870

Daily gage height, in feet, of Gunnison River near Cory, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov	Dec
1	5.25	5.5	5.6	6.0	9.8	11.75	8.75	7.6	5.8	5.8	5.7	5.35
2	5.3	5.5	5.8	6.0	10.2	12.15	8.55	7.35	5.85	5.8	5.75	5.3
3	5.3	5.5	5.8	6.0	9.5	12.2	8.4	7.05	5.85	5.8	5.7	5.3
4	5.4	5.5	5.85	6.0	8.9	12.7	8.25	7.0	5.95	5.7	5.7	5.3
5	5.45	5.5	5.85	5.9	8.5	13.1	7.95	6.9	5.8	5.7	5.7	5.4
6	5.45	5.4	5.9	5.9	8.25	12.7	7.9	6.75	5.8	5.7	5.6	5.4
7	5.45	5.5	6.0	5.9	8.4	12.35	7.8	6.55	5.8	5.7	5.6	5.4
8	5.4	5.4	6.0	6.2	8.55	12.8	7.65	6.5	5.85	5.7	5.6	5.45
9	5.3	5.5	5.9	6.65	9.3	12.85	7.55	6.45	5.8	5.7	5.6	5.4
10	5.3	5.5	6.0	6.85	9.0	12.63	7.45	6.45	5.8	5.7	5.6	5.3
11	5.3	5.45	6.0	6.85	8.65	12.13	7.3	6.4	5.75	5.6	5.6	5.3
12	5.25	5.4	6.0	6.95	8.55	11.93	7.25	6.4	5.7	5.6	5.6	5.35
13	5.25	5.4	6.0	6.95	8.7	11.88	7.2	6.4	5.75	5.6	5.55	5.35
14	5.25	5.5	6.0	6.95	8.7	11.53	7.05	6.4	5.7	5.6	5.55	5.4
15	5.25	5.45	6.05	6.85	8.75	11.43	7.0	6.3	5.7	5.65	5.5	5.4
16	5.3	5.4	6.1	6.95	9.2	11.28	7.0	6.2	5.7	5.75	5.6	5.4
17	5.3	5.5	6.1	7.0	10.2	10.88	6.9	6.0	5.7	5.7	5.6	5.4
18	5.4	5.5	6.2	7.05	10.55	10.58	6.8	6.0	5.8	5.75	5.6	5.4
19	5.4	5.5	6.3	7.2	11.1	10.48	6.8	6.0	5.7	5.8	5.6	5.4
20	5.4	5.45	6.3	7.15	11.35	10.28	6.75	5.9	5.75	5.8	5.5	5.4
21	5.4	5.4	6.3	7.05	11.5	10.06	6.75	5.8	5.75	5.8	5.5	5.45
22	5.4	5.4	6.2	7.05	11.8	9.96	6.7	5.8	5.7	5.8	5.5	.....
23	5.3	5.4	6.2	6.95	12.2	9.81	6.7	5.8	5.7	5.8	5.5	.....
24	5.35	5.4	6.1	7.25	12.3	9.76	6.75	5.75	5.7	5.7	5.5	.....
25	5.35	5.4	6.0	7.45	11.9	9.56	6.7	5.7	5.7	5.7	5.5	.....
26	5.3	5.4	6.0	7.5	11.9	9.51	6.75	5.7	5.7	5.7	5.5	.....
27	5.3	5.5	6.0	7.75	11.95	9.41	6.8	5.7	5.7	5.7	5.55	.....
28	5.35	5.5	6.0	8.3	11.65	9.4	6.85	5.8	5.7	5.7	5.6	.....
29	5.3	.....	6.0	8.85	10.85	9.15	6.9	5.8	5.7	5.7	5.5	.....
30	5.4	.....	6.0	9.25	10.5	8.9	7.05	5.85	5.75	5.7	5.45	.....
31	5.5	.....	6.0	.....	10.95	.....	7.4	5.8	.....	5.75	.....	6.50

Station rating table for Gunnison River near Cory, Colo., from January 1 to December 21, 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.*
5.20	430	6.60	1,630	8.00	3,810	9.80	8,490
5.30	480	6.70	1,750	8.10	4,010	10.00	9,180
5.40	530	6.80	1,870	8.20	4,210	10.20	9,910
5.50	590	6.90	2,000	8.30	4,410	10.40	10,660
5.60	660	7.00	2,130	8.40	4,620	10.60	11,450
5.70	730	7.10	2,270	8.50	4,840	10.80	12,280
5.80	810	7.20	2,420	8.60	5,070	11.00	13,130
5.90	900	7.30	2,570	8.70	5,300	11.20	14,000
6.00	990	7.40	2,730	8.80	5,540	11.40	14,880
6.10	1,090	7.50	2,900	8.90	5,790	11.60	15,790
6.20	1,190	7.60	3,070	9.00	6,050	11.80	16,730
6.30	1,290	7.70	3,250	9.20	6,600	12.00	17,700
6.40	1,400	7.80	3,430	9.40	7,190		
6.50	1,510	7.90	3,620	9.60	7,820		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905. It is fairly well defined above gage height 5.9 feet. Above gage height 12 feet the rating curve is a tangent, the difference being 500 per tenth.

Estimated monthly discharge of Gunnison River near Cory, Colo., for 1905.

[Drainage area, 5,233 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	455	503	30,930	0.096	0.111
February	590	530	563	31,270	0.108	0.112
March	1,290	660	1,013	62,290	0.194	0.224
April	6,745	900	2,251	133,900	0.430	0.480
May	19,200	4,310	10,320	634,600	1.97	2.27
June	23,200	5,790	14,110	839,600	2.70	3.01
July	5,420	1,750	2,643	162,500	0.505	0.582
August	3,070	730	1,306	80,300	0.250	0.288
September	945	730	775	46,120	0.148	0.165
October	810	660	744	45,750	0.142	0.164
November	770	560	645	38,380	0.123	0.137
December 1–21	560	480	517	21,530	0.099	0.077
The period				2,127,000		

GUNNISON RIVER AT WHITEWATER, COLO.

This station was regularly established April 10, 1902, incomplete series of gage heights having been obtained during 1895, 1897, and 1901. It is located at the steel wagon bridge constructed by the State of Colorado at a point about one-half mile above the railroad station at Whitewater, on the Denver and Rio Grande Railroad. It was intended that this station should replace that formerly maintained on the Gunnison at Grand Junction, which was abandoned on account of conditions that rendered accurate gagings impossible.

The channel is straight for 1,000 feet above and 500 feet below the station. The cross section at the bridge is 282 feet wide, is uniform in area, and is clean. The right bank is of alluvial material, with abrupt slopes about 14 feet high; the left bank is of the same material,

but slopes more gently and overflows at extreme high water. The bed of the stream is composed of cobblestones, coarse gravel, and sand, and is fairly permanent. At the center of the cross section the current is broken by cylindrical piers and old sheet piling, and a small area adjacent to these fills in with silt at low water but scours out during high water. There is but one channel at all stages. The current is moderate at low water but swift at high. Gage heights range from 3.5 to 14 feet.

Discharge measurements are made from the downstream side of the two-span steel bridge. A stay line is used at high water. The initial point for soundings is the edge of the capstone of the left masonry abutment on the downstream side of the bridge.

The gage, which was read twice daily during 1905 by James Page, was originally of wire, and was located on the downstream side of the right span. On April 8, 1904, the old gage was replaced by a new chain gage with the same datum. The gage scale is graduated from zero to 10 feet, with two markers, giving a range of 20 feet in gage heights. The length of the chain from the end of the weight to the center of the first marker is 21.59 feet. The second marker is 11.59 feet from end of weight and is used when gage heights are above 10 feet. The bench mark, established July 3, 1904, is a standard United States Geological Survey iron bench-mark post located about 40 feet southeast of the east end of the bridge; it is stamped 4,653.6 feet above sea level; the elevation of the bench mark above the datum of gage is 6.83 feet.

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 140, p 189; WS 16, p 140; 66, p 94; 85, p 42; 100, pp 64–65; 133, p 162.
Discharge: WS 85, p 43; 100, p 65; 133, p 163.
Discharge, monthly: WS 85, p 44; 100, p 67; 133, p 164.
Gage heights: WS 16, p 140; 66, p 95; 85, p 43; 100, p 66; 133, p 163.
Rating table: WS 85, p 44; 100, p 66; 133, p 164.

Discharge measurements of Gunnison River at Whitewater, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 30	R. I. Meeker	246	487	2.17	4.25	1,059
May 21	do	275	2,744	6.76	11.95	18,560
May 22	do	275	2,797	7.22	12.15	20,210
June 4	do	275	3,092	8.08	13.25	25,000
July 12	do	262	978	2.68	5.62	2,622
August 11	do	253	691	1.95	4.45	1,345
September 28	do	205	513	1.66	3.90	824

Daily gage height, in feet, of Gunnison River at Whitewater, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	4.3	9.4	11.65	7.7	6.4	4.0	4.65
2	4.3	10.1	12.45	7.35	6.15	4.05	4.65
3	4.35	9.6	12.75	7.1	5.65	3.9	4.45
4	4.25	8.85	13.15	6.85	5.3	3.95	4.35
5	4.4	8.35	13.85	6.55	5.15	4.6	4.25
6	4.25	7.75	13.6	6.45	5.05	4.4	4.2
7	4.2	7.65	13.05	6.25	5.05	4.45	4.25
8	4.5	7.95	13.2	6.05	4.95	4.35	4.15
9	4.85	8.7	13.5	6.05	4.75	4.25	4.05
10	5.1	8.8	13.55	5.95	4.6	4.2	4.0
11	5.55	8.35	12.95	5.8	4.45	4.05	3.95

Daily gage height, in feet, of Gunnison River at Whitewater, Colo., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
12	5.8	7.95	12.5	5.65	4.55	4.05	3.9
13	5.7	7.8	12.25	5.5	4.55	4.0	3.9
14	5.55	7.85	12.05	5.5	4.5	3.9	3.9
15	5.4	7.8	11.85	5.4	4.45	3.8	4.0
16	5.3	8.35	11.7	5.45	4.4	3.8	3.95
17	5.55	9.4	11.1	5.35	4.25	3.8	4.0
18	5.75	10.3	10.45	5.35	4.1	3.75	4.05
19	5.75	10.9	10.15	5.15	4.0	3.7	4.2
20	5.9	11.6	9.9	5.15	3.95	3.7	4.15
21	5.75	11.95	9.6	5.1	3.9	3.75	4.15
22	5.5	12.15	9.35	5.1	3.8	3.75	4.0
23	5.65	12.6	9.15	5.1	3.7	3.75	4.3
24	5.75	12.75	9.05	5.05	3.85	3.7	4.3
25	6.05	12.55	8.8	4.85	3.8	3.8	4.25
26	6.4	12.45	8.75	4.65	3.85	3.95	4.3
27	6.7	12.35	8.5	4.7	3.95	3.95	4.25
28	7.35	12.05	8.4	4.7	3.85	3.9	4.3
29	8.1	11.3	8.2	4.65	3.8	4.35	4.25
30	8.65	10.65	8.0	5.0	3.95	4.55	4.25
31	.....	10.95	.....	5.8	4.05	.....	4.25

Station rating table for Gunnison River at Whitewater, Colo., from April 1 to May 1, 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.*
4.00	695	5.20	1,860	6.40	3,530	7.60	5,610
4.10	765	5.30	1,985	6.50	3,690	7.70	5,800
4.20	840	5.40	2,110	6.60	3,850	7.80	5,990
4.30	920	5.50	2,240	6.70	4,010	7.90	6,190
4.40	1,005	5.60	2,370	6.80	4,180	8.00	6,400
4.50	1,095	5.70	2,505	6.90	4,350	8.20	6,830
4.60	1,190	5.80	2,640	7.00	4,520	8.40	7,300
4.70	1,290	5.90	2,780	7.10	4,690	8.60	7,810
4.80	1,395	6.00	2,920	7.20	4,870	8.80	8,350
4.90	1,505	6.10	3,070	7.30	5,050	9.00	8,910
5.00	1,620	6.20	3,220	7.40	5,230	9.20	9,490
5.10	1,740	6.30	3,370	7.50	5,420	9.40	10,090

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-5 Below 7.8 feet the table is the same as for 1904.

Station rating table for Gunnison River at Whitewater, Colo., from May 2 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.*
3.70	720	5.20	2,085	6.70	4,280	9.40	10,180
3.80	795	5.30	2,205	6.80	4,450	9.60	10,750
3.90	870	5.40	2.330	6.90	4,625	9.80	11,340
4.00	950	5.50	2,460	7.00	4,800	10.00	11,960
4.10	1,030	5.60	2,590	7.20	5,160	10.20	12,600
4.20	1,115	5.70	2,725	7.40	5,540	10.40	13,250
4.30	1,200	5.80	2,865	7.60	5,930	10.60	13,920
4.40	1,290	5.90	3,010	7.80	6,340	10.80	14,610
4.50	1,380	6.00	3,160	8.00	6,760	11.00	15,320
4.60	1,470	6.10	3,310	8.20	7,200	11.50	17,180
4.70	1,565	6.20	3,465	8.40	7,650	12.00	19,240
4.80	1,660	6.30	3,620	8.60	8,120	12.50	21,520
4.90	1,760	6.40	3,780	8.80	8,600	13.00	23,920
5.00	1,860	6.50	3,945	9.00	9,100	13.50	26,370
5.10	1,970	6.60	4,110	9.20	9,630		

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

Estimated monthly discharge of Gunnison River at Whitewater, Colo., for 1905.

[Drainage area, 7,868 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	7,945	840	2,494	148,400	.317	.354
May	22,710	6,030	12,720	782,100	1.62	1.87
June	28,080	6,760	16,810	1,000,000	2.14	2.39
July	6,130	1,518	2,783	171,100	.354	.408
August	3,780	720	1,429	87,860	.182	.210
September	1,470	720	962	57,240	.122	.136
October	1,518	870	1,103	67,820	.140	.161
The period				2,315,000		

NORTH FORK OF GUNNISON RIVER NEAR HOTCHKISS, COLO.

This station was established April 13, 1904. It is located 4 miles below Hotchkiss, Colo., on the ranch of L. Gorsuch, and replaces the station maintained during 1903 at the highway bridge one-half mile east of Hotchkiss and abandoned because of unsatisfactory conditions.

The channel is 180 feet wide and is straight for 800 feet both above and below the station. The banks are composed of alluvial material and are not liable to overflow. The bed of the stream is composed of large and small cobblestones, with some gravel, and changes only during extreme high water. There are two channels at low water, divided by a bar; at high stages there is but one channel. The current is swift at all stages. Gage heights range from 1 foot to 6 feet.

Discharge measurements are made by means of a cable and car, the property of the observer. The initial point for soundings is near the left end of the cable and is marked "zero" on the tag line. A stay line 40 feet upstream is used during high water.

The gage, which was observed during 1905 by L. Gorsuch, is an inclined timber, graduated from zero to 7 feet, and is located on the right bank about 800 feet downstream from

the cable. The bench mark is a point on a large bowlder on the right bank of the stream about 50 feet to the right of the gage, designated by a circle of white paint and marked "B. M.;" elevation above the zero of the gage, 9.34 feet.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 167–170.

Discharge measurements of North Fork of Gunnison River near Hotchkiss, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 11	R. I. Meeker	160	204	3.78	3.10	771
May 7	Oro McDermith	164	365	4.94	3.95	1,802
May 20	A. A. Weiland	175	714	7.80	5.40	5,570
June 2	do	175	698	8.12	5.30	5.671
June 14	do	170	583	6.59	4.70	3,843
June 28	do	170	374	4.49	3.60	1,682
July 12	do	143	187	3.42	2.60	639
August 2	do	115	122	2.52	2.2	308
October 3	R. I. Meeker	65	48	2.35	1.78	113

Daily gage height, in feet, of North Fork of Gunnison River near Hotchkiss, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.3	2.6	2.52	5.0	5.45	3.25	2.45	1.28	1.88	1.8	1.75
2	2.3	2.32	2.75	2.6	5.32	5.55	3.2	2.3	1.18	1.8	1.8	1.7
3	2.3	2.35	2.8	2.58	4.65	5.45	3.02	2.18	1.15	1.78	1.75	1.7
4	2.3	2.4	2.7	2.55	4.2	5.8	2.95	2.1	1.20	1.7	1.75	1.7
5	2.35	2.4	2.6	2.55	4 05	5.95	2.95	2.05	1.25	1.7	1.7	1.75
6	2.35	2.4	2.6	2.65	3.85	5.45	2.9	2.0	1.32	1.7	1.7	1.75
7	2.38	2.35	2.6	2.85	3.92	5.45	2.82	2.0	1.42	1.7	1.7	1.75
8	2.4	2.3	2.58	3.02	4.35	5.45	2.85	1.92	1.48	1.68	1.7	1.8
9	2.4	2.25	2.5	3.15	4.75	5.7	2.75	1.88	1.4	1.65	1.7	1.8
10	2.4	2.25	2.5	3.28	4.35	5.45	2.72	1.78	1.35	1.65	1.7	1.82
11	2.4	2.25	2.5	3.3	4.1	5.25	2.62	1.78	1.32	1.65	1.7	1.82
12	2.38	2.25	2.5	3.35	4.15	5.1	2.58	1.82	1.25	1.65	1.65	1.88
13	2.35	2.2	2.5	3.35	4.25	5.05	2.52	1.88	1.25	1.65	1.65	1.88
14	2.35	2.2	2.5	3.35	4.15	4.95	2.5	1.82	1.25	1.7	1.65	1.88
15	2.32	2.2	2.58	3.25	4.25	4.9	2.48	1.78	1.25	1.7	1.72	1.92
16	2.3	2.2	2.65	3.32	4.6	4.7	2.42	1.72	1.25	1.7	1.75	1.92
17	2.3	2.2	2.68	3.32	5.08	4.5	2.4	1.62	1.25	1.75	1.8	1.95
18	2.35	2.25	2.7	3.35	5.38	4.35	2.32	1.52	1.3	1.78	1.8	1.95
19	2.35	2.28	2.6	3.52	5.6	4.15	2.3	1.42	1.32	1.68	1.75	1.95
20	2.3	2.3	2.62	3.35	5.7	4.02	2.3	1.42	1.3	1.65	1.7	1.95
21	2.2	2.3	2.62	3.28	5.7	3.95	2.22	1.4	1.3	1.6	1.65	2.05
22	2.2	2.32	2.58	3.32	5.9	3.78	2.2	1.35	1.3	1.65	1.68	2.05
23	2.2	2.25	2.52	3.32	6.0	3.72	2.18	1.3	1.3	1.72	1.82	2.05
24	2.2	2.25	2.5	3.55	6.0	3.72	2.1	1.22	1.32	1.8	1.78	2.15
25	2.25	2.28	2.5	3.68	5.7	3.7	2.08	1.2	1.42	1.75	1.68	2.15
26	2.25	2.28	2.5	3.62	5.7	3.6	2.05	1.22	1.48	1.7	1.78	2.15
27	2.3	2.25	2.6	3.82	5.65	3.5	2.0	1.4	1.5	1.7	1.95	2.22
28	2.35	2.3	2.58	4.2	5.55	3.55	1.98	1.42	1.5	1.7	2.0	2.2
29	2.35	.....	2.52	4.4	4.95	3.42	1.95	1.4	1.55	1.7	1.85	2.2
30	2.35	.....	2.5	4.65	4.65	3.35	2.1	1.35	1.82	1.72	1.8	2.2
31	2.35	.....	2.52	.....	5.25	.....	2.45	1.35	.....	1.8	.....	2.25

NOTE.—No ice record.

Station rating table for North Fork of Gunnison River near Hotchkiss, Colo., from January 1 to May 16, 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	120	3.10	790	4.00	2,200	4.90	4,290
2.30	150	3.20	920	4.10	2,400	5.00	4,570
2.40	190	3.30	1,050	4.20	2,610	5.10	4,850
2.50	240	3.40	1,190	4.30	2,820	5.20	5,140
2.60	300	3.50	1,340	4.40	3,040	5.30	5,440
2.70	370	3.60	1,500	4.50	3,270	5.40	5,740
2.80	460	3.70	1,660	4.60	3,510		
2.90	560	3.80	1,830	4.70	3,760		
3.00	670	3.90	2,010	4.80	4,020		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is well defined between gage heights 2.2 feet and 3.1 feet. Above gage height 3.5 the table is uncertain.

Station rating table for North Nork of Gunnison River near Hotchkiss, Colo., from May 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.*
1.00	0	2.10	260	3.20	1,280	4.60	3,680
1.10	2	2.20	320	3.30	1,410	4.80	4,150
1.20	8	2.30	390	3.40	1,540	5.00	4,640
1.30	18	2.40	460	3.50	1,680	5.20	5,140
1.40	32	2.50	540	3.60	1,830	5.40	5,660
1.50	50	2.60	630	3.70	1,980	5.60	6,190
1.60	75	2.70	720	3.80	2,140	5.80	6,740
1.70	105	2.80	820	3.90	2,310	6.00	7,300
1.80	135	2.90	930	4.00	2,480		
1.90	170	3.00	1,040	4.20	2,850		
2.00	210	3.10	1,160	4.40	3,250		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is well defined above gage height 1.7 feet.

Estimated monthly discharge of North Fork of Gunnison River near Hotchkiss, Colo., for 1905.

[Drainage area, 850 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	190	120	159	9,777	0.187	0.216
February	190	120	146	8,108	.172	.179
March	460	240	292	17,950	.344	.397
April	3,635	252	1,162	69,140	1.37	1.53
May	7,300	1,920	4,476	275,200	5.27	6.08
June	7,160	1,475	3,986	237,200	4.69	5.23
July	1,345	190	577	35,480	.679	.783
August	500	8	125	7,686	.147	.170
September	142	5	27.5	1,636	.032	.036
October	163	75	108	6,641	.127	.146
November	210	90	121	7,200	.142	.158
December	355	105	199	12,240	.234	.270
The year	7,300	5	948	688,300	1.12	15.20

CIMARRON CREEK AT CIMARRON, COLO.

Cimarron Creek rises in the extreme southwestern part of Gunnison County and flows northward to its point of junction with Gunnison River. The drainage area is entirely mountainous. During the summer and fall short, heavy rainstorms occur frequently, and the rapid run-off induced by the steep slopes of the basin causes sudden fluctuations in gage heights.

The gaging station was established April 28, 1903. It is located at Smith's private bridge, 1,000 feet south of the Denver and Rio Grande Railroad station at Cimarron, in T. 48 N., R. 6 W., and about 1 mile above the mouth of Cimarron Creek.

The channel is straight for 100 feet above and 250 feet below the bridge. Both banks are low, rocky, and partly wooded and have not been known to overflow during the past ten years. The bed of the stream is composed of bowlders and cobblestones and is very rough, but is stable. The gradient is steep, though somewhat uneven. At low water there is but one channel. At high water there are two channels divided by the central pier of the bridge. The current is always rapid. Gage heights range from 1.5 to 4 feet. Accurate measurements are difficult to secure on account of the roughness of the section and the swift and irregular velocities.

Discharge measurements are made from the downstream side of the footbridge, which is supported by two log abutments and one log crib pier in the center of the stream. The initial point for soundings is the left abutment on the downstream side and is marked zero on the bridge. The bridge was washed away in June, 1905, but was replaced shortly afterwards at a greater elevation.

The gage, which was read during 1905 by J. L. Linscott, is a vertical staff graduated from zero to 6 feet, spiked to the face of the left abutment of the bridge on the downstream side. The bench mark consists of two nails driven into the root of a cottonwood tree 50 feet west of gage; elevation above the zero of the gage, 8.24 feet. This station was discontinued December 31, 1905.

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

Description: 100, pp 82–83; 133, p 165.
Discharge: 66, p 55; 85, p 77; 100, pp 83, 94; 133, p 165.
Discharge, monthly: 100, p 84; 133, p 167.
Gage heights: 100, pp 83–84; 133, p 166.
Rating table: 100, p 84; 133, p 166.

Discharge measurements of Cimarron Creek at Cimarron, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 1	R. I. Meeker	32	20	2.20	1.70	44
May 11	Oro McDermith	39	45	3.33	2.30	153
May 23	A. A. Weiland	47	108	6.67	3.50	720
May 23	R. I. Meeker	48	103	6.65	3.48	685
June 6	A. A. Weiland	47	140	7.76	4.20	1,087
June 19	do	62	103	5.99	3.45	617
July 18	do	33	28	3.00	2.00	84
August 11	do	35	23	2.30	1.85	53
October 5	R. I. Meeker	24	18	1.72	1.65	31

Daily gage height, in feet, of Cimarron Creek at Cimarron, Colo., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.95	2.65	3.7	2.85	2.5	1.63	1.77	1.63	1.55
2	.....	1.68	2.82	3.85	2.77	2.3	1.6	1.87	1.65	.....
3	.....	1.68	2.5	3.92	2.75	2.25	1.63	1.65	1.65	.....
4	.....	1.75	2.38	4.1	2.5	2.17	1.6	1.9	1.63	.....
5	.....	1.68	2.35	4.25	2.6	2.1	1.63	1.65	1.65	.....
6	.....	1.68	2.28	4.1	2.55	2.07	1.73	1.65	1.65	.....
7	.....	1.65	2.2	4.1	2.55	2.0	1.63	1.63	1.57	.....
8	.....	1.78	2.2	4.08	2.55	2.05	1.57	1.6	1.55	.....
9	.....	1.82	2.62	4.12	2.4	1.8	1.6	1.65	1.57	.....
10	1.8	1.82	2.28	4.03	2.45	1.7	1.57	1.65	1.55	.....
11	1.6	1.82	2.3	4.0	2.4	1.85	1.6	1.6	1.53	.....
12	1.75	1.78	2.28	3.91	2.35	1.8	1.6	1.55	1.53	.....
13	1.72	1.72	2.38	3.82	2.3	1.8	1.6	1.57	1.57	.....
14	1.75	1.75	2.3	3.8	2.25	1.77	1.63	1.55	1.6	.....
15	1.78	1.65	2.42	3.87	2.3	1.73	1.5	1.6	1.57	.....
16	1.78	1.7	2.85	3.65	2.15	1.7	1.47	1.6	1.57	.....
17	1.75	1.82	2.95	3.52	2.1	1.67	1.5	1.63	1.6	.....
18	1.78	1.82	3.0	3.53	2.0	1.7	1.63	1.6	1.57	.....
19	1.8	1.85	3.1	3.37	2.13	1.57	1.63	1.63	1.53	.....
20	1.82	1.78	3.1	3.33	2.3	1.63	1.57	1.6	1.57	.....
21	1.72	1.68	3.28	3.3	2.15	1.6	1.55	1.6	1.53	.....
22	1.8	1.78	3.55	3.3	2.15	1.6	1.63	1.63	1.55	.....
23	1.7	1.82	3.65	3.13	2.03	1.63	1.63	1.87	1.55	.....
24	1.78	1.78	3.4	3.2	1.9	1.63	1.63	1.63	1.5	.....
25	1.8	1.8	3.3	3.23	2.1	1.63	1.77	1.53	1.55	.....
26	1.72	1.85	3.5	3.1	2.1	1.6	1.67	1.63	1.53	.....
27	1.8	1.92	3.55	3.07	2.2	1.6	1.63	1.65	1.63	.....
28	1.75	2.25	3.5	3.05	2.15	1.63	1.7	1.63	1.57	.....
29	1.75	2.3	3.22	2.97	2.95	1.65	1.77	1.65	1.55	.....
30	1.78	2.4	3.2	2.95	2.85	1.7	2.05	1.65	1.55	.....
31	1.8	.....	3.45	.....	2.73	1.73	.....	1.7	.....	.....

NOTE.—River frozen during December.

Station rating table for Cimarron Creek at Cimarron, Colo., from March 10 to December 1, 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	22	2.30	152	3.10	473	3.90	973
1.60	28	2.40	181	3.20	526	4.00	1,050
1.70	37	2.50	213	3.30	582	4.10	1,130
1.80	49	2.60	247	3.40	640	4.20	1,213
1.90	65	2.70	285	3.50	700	4.30	1,300
2.00	83	2.80	327	3.60	763		
2.10	105	2.90	373	3.70	830		
2.20	126	3.00	422	3.80	900		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905. It is well defined between gage heights 1.7 feet and 3.5 feet.

Estimated monthly discharge of Cimarron Creek at Cimarron, Colo., for 1905.

[Drainage area, 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.
March 10-31	52	28	44.5	1,942	.212	.173
April	181	32	57.5	3,422	.274	.306
May	796	126	389	23,920	1.85	2.13
June	1,256	397	796	47,360	3.79	4.23
July	397	65	185	11,380	.881	1.02
August	213	26	59.4	3,652	.283	.326
September	93	20	32.4	1,928	.154	.172
October	65	24	33.4	2,054	.159	.183
November	32	22	26.7	1,589	.127	.142
The period				97,250		

UNCOMPAHGRE RIVER NEAR COLONA, COLO.

This station was established April 9, 1904. It is located at the private road bridge of J. M. Duckett, in T. 47 N., R. 8 W., one-half mile above Eldredge siding on the Denver and Rio Grande Railroad and 3 miles above Colona, Colo. It is best reached by driving from Montrose. The station replaces one that was established August 10, 1903, at Kettle's bridge, 1 mile south of Colona, to take the place of the original station, which was located one-half mile northeast of Colona. Both of these stations were abandoned because of unsatisfactory conditions.

The channel is straight for about 300 feet above and below the station. The banks are about 4 feet high, are rocky and partly wooded, and neither is subject to overflow. The bed of the stream is composed of large and small cobblestones, and a loose deposit of silt shifts along each side. There is but one channel at all stages and the current is swift. Gage heights range from 0.5 foot to 4 feet. Accurate measurements are difficult to secure on account of the rough bed and steep gradient of the channel.

Discharge measurements are made from the downstream side of the 46.2-foot single-span bridge to which the gage is attached. The initial point for soundings is the downstream edge of the left abutment.

The gage, which was read during 1905 by Miss Clara Duckett, is an 8-foot board graduated from zero to 7 feet. It was spiked vertically to the upstream side of the left abutment. The high water of June, 1905, caused the pier to sink 0.18 foot during July, and on August 14, 1905, the gage was moved to the downstream side of the left pier and set at the original datum. The bench mark is the upper edge of a large screw set about 3 feet above the ground in an 8-inch willow tree 75 feet south and upstream from the right end of the bridge; elevation, 9.97 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 72–73; 133, pp 171–172.
Discharge: 100, p. 73; 133, p 172.
Discharge, monthly: 100, p 75; 133, p 174.
Gage heights: 100, p 74; 133, p 173.
Rating tables: 100, pp 74–75; 133, pp 173–174

Discharge measurements of Uncompahgre River near Colona, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft*
April 13	R. I. Meeker	46	49	2.84	1.10	139
May 3	Oro McDermith	47	91	4.27	1.90	389
May 18	A. A. Weiland	47	110	4.88	2.30	537
May 29	do	47	114	4.94	2.20	564
June 8	do	47	170	8.15	3.75	1,384
June 21	do	47	129	6.38	2.80	822
July 8	do	47	98	4.95	2.12	485
July 24	do	47	76	3.92	1.72	298
August 7	do	47	73	3.96	1.72	289
August 14	do	47	63	3.39	1.40	214
October 1	R. I. Meeker	43	57	3.25	1.56	185

Daily gage height, in feet, of Uncompahgre River near Colona, Colo., for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.2	1.05	2.2	2.95	2.62	1.87	1.2	1.47	1.06	0.96
2	.....	1.15	1.1	2.25	3.25	2.42	1.97	1.2	1.22	1.11	.96
3	.....	1.15	1.0	1.9	3.4	2.32	1.97	1.2	1.27	1.11	.....
4	.....	1.0	.95	1.85	4.2	2.27	1.82	1.3	1.22	1.11	.....
5	0.7	1.1	.95	1.75	4.1	2.22	1.82	1.35	1.27	0.96	.....
6	.75	1.05	1.0	1.7	4.0	2.07	1.82	1.3	1.27	1.01	.....
7	.75	1.0	1.05	1.65	4.0	1.82	1.72	1.3	1.27	.96	.....
8	.7	1.0	1.15	1.75	4.1	1.82	1.72	1.3	1.22	1.01	.....
9	.7	1.0	1.2	1.9	4.2	1.92	1.72	1.3	1.22	1.01	.....
10	.7	1.0	1.3	1.75	4.0	1.92	1.62	1.3	1.22	.96	.....
11	.7	1.0	1.3	1.7	4.0	1.87	1.52	1.15	1.12	1.01	.....
12	.....	1.0	1.3	1.75	4.0	1.82	1.47	1.15	1.12	1.01	.....
13	.....	1.0	1.15	1.8	4.1	1.82	1.47	1.2	1.17	.96	.....
14	.....	1.0	1.0	1.7	4.05	1.92	1.6	1.2	1.12	.96	.....
15	.....	.9	1.0	1.8	4.0	2.02	1.6	1.15	1.07	1.01	.....
16	.....	.9	1.0	2.15	3.8	1.82	1.6	1.25	1.22	.96	.....
17	.....	.9	1.2	2.6	3.4	1.82	1.4	1.1	1.22	.96	.....
18	.....	.95	1.2	2.65	3.5	1.82	1.4	1.15	1.22	1.01	.....
19	.8	1.0	1.4	2.55	3.0	1.87	1.35	1.15	1.22	1.01	.....
20	.8	1.0	1.35	2.55	3.4	2.02	1.2	1.2	1.22	.96	.....
21	.85	1.0	1.35	2.5	3.2	1.87	1.2	1.1	1.22	.96	.....
22	.85	.95	1.2	2.9	2.95	1.87	1.2	1.15	1.12	1.01	.....
23	.9	1.0	1.7	2.9	3.0	1.72	1.1	1.15	1.12	.96	.....
24	.9	1.15	1.2	2.9	3.0	1.82	1.1	1.0	1.22	1.06	.....
25	.9	1.0	1.3	2.9	3.0	1.72	1.1	1.05	1.17	1.06	.....
26	.8	1.0	1.45	2.75	3.0	1.72	1.1	1.0	0.97	1.06	.....
27	.8	1.0	1.75	2.8	3.0	1.87	1.1	1.0	1.02	.96	.....
28	.9	1.0	1.9	2.75	3.0	1.97	1.25	1.15	1.07	.96	.....
29	.....	1.0	2.1	2.3	2.95	2.47	1.15	1.3	1.12	1.01	.....
30	.....	.9	2.1	2.2	2.8	2.87	1.35	1.15	1.12	1.01	.....
31	.....	.9	.....	2.65	.....	2.47	1.45	.....	1.17	.....	.....

NOTE.—River frozen February 12-18.

Station rating table for Uncompahgre River near Colona, Colo., from February 5 to December 2, 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	75	1.60	275	2.50	645	3.40	1,165
.80	85	1.70	310	2.60	695	3.50	1,235
.90	100	1.80	345	2.70	750	3.60	1,305
1.00	120	1.90	380	2.80	805	3.70	1,380
1.10	140	2.00	420	2.90	860	3.80	1,460
1.20	165	2.10	460	3.00	920	3.90	1,540
1.30	190	2.20	505	3.10	980	4.00	1,625
1.40	215	2.30	550	3.20	1,040	4.10	1,710
1.50	245	2.40	595	3.30	1,100	4.20	1,800

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905. It is fairly well defined between gage heights 1.2 feet and 3.8 feet.

Estimated monthly discharge of Uncompahgre River near Colona, Colo., for 1905.

[Drainage area, 433 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
February, 17 days	100	75	85.8	2,893	0.198	0.125
March	165	100	122	7,501	.282	.325
April	460	110	197	11,720	.455	.508
May	860	293	543	33,390	1.25	1.44
June	1,800	805	1,279	76,110	2.95	3.29
July	844	317	436	26,810	1.01	1.16
August	408	140	246	15,130	.568	.655
September	202	120	161	9,580	.372	.415
October	236	114	161	9,900	.372	.429
November	143	112	121	7,200	.279	.311
The period				200,200		

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

This station was established April 22, 1903. It is located at the iron highway bridge west of Montrose and one-fourth mile west of the Denver and Rio Grande Railroad near Haskell Park.

The channel is straight for 100 feet above and 300 feet below the bridge. The right bank is of earth; the left bank is of earth below the bridge, but above the bridge is the steep slope of a shale bluff. Both banks are liable to overflow at extreme high water. The bed of the stream is composed of cobblestones and gravel and is quite rough. There is but one channel at all stages, broken during high water by the left pier of the bridge. The higher portion of the left side of the channel is covered with undergrowth which obstructs the flow during high stages. The current is rapid at all times. Gage heights range from 2 to 6 feet.

Discharge measurements are made from either side of the bridge. The initial point for soundings is at the inner edge of the lower cylinder bridge pier at the right bank.

The gage, which was read twice daily during 1905 by Herbert Reeves, is a vertical staff, graduated from zero to 8 feet, spiked to a wing dam 20 feet above the bridge. The zero of this gage, which was established April 15, 1904, is 1.45 feet higher than that of the original gage which it replaced. The bench mark consists of two nails driven into a blaze on the root of a cottonwood tree 50 feet to the right of the gage; elevation, 8.61 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; WS=Water-Supply Paper):

Description: WS 50, p 379–380; 100, p 70; 133, p 175.
Discharge: WS 50, p 380; 66, p 98; 100, p 70; 133, p 175.
Discharge, monthly: Ann 22, iv, p 392; WS 100, p 72; 133, p 177.
Gage heights: WS 11, p 69; 50, p 380; 100, p 71; 133, p 176.
Rating tables: WS 52, p 520; 100, pp 71–72; 133, p 176.

Discharge measurements of Uncompahgre River at Montrose, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 13	R. I. Meeker	35	40	2.72	2.40	109
May 9	Oro McDermith	37	66	4.21	3.22	278
May 25	A. A. Weiland	43	120	5.64	4.30	677
June 4	R. I. Meeker	91	218	6.78	5.38	1,479
June 24	A. A. Weiland	40	96	5.33	3.73	512
July 3	do	35	64	2.89	2.57	185
July 21	do	32	48	1.98	2.05	95
August 8	do	35	44	1.73	1.95	76
September 30	do	34	44	2.93	2.45	129

Daily gage height, in feet, of Uncompahgre River at Montrose, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.35	2.22	2.35	2.28	3.7	4.15	3.35	2.33	1.4	1.9	1.33	2.25
2	2.38	2.2	2.4	2.4	4.25	4.8	3.3	2.05	1.23	1.77	1.43	2.25
3	2.3	2.2	2.55	2.4	3.6	5.0	2.4	2.1	1.57	1.5	1.33	2.45
4	2.28	2.2	2.6	2.32	3.2	5.8	2.2	2.0	1.73	1.45	1.45	2.35
5	2.3	2.2	2.45	2.15	3.08	5.65	2.15	1.95	1.47	1.45	1.45	2.35
6	2.32	2.2	2.48	2.35	2.7	5.15	2.3	2.0	1.33	1.35	1.43	2.25
7	2.25	2.2	2.4	2.35	2.55	5.55	2.35	2.05	1.5	1.35	1.4	2.3
8	2.38	2.2	2.32	2.5	2.45	5.5	2.4	1.93	1.4	1.4	1.45	2.15
9	2.32	2.2	2.3	2.55	2.5	5.25	2.25	2.0	1.47	1.2	1.4	2.15
10	2.2	2.2	2.3	2.5	2.55	5.05	2.15	2.03	1.5	1.2	1.4	2.05
11	.....	2.2	2.3	2.45	2.75	5.25	2.15	1.93	1.4	1.2	1.4	2.25
12	.....	2.2	2.3	2.4	3.3	5.0	2.15	1.93	1.45	1.2	1.3	2.3
13	.....	2.2	2.3	2.4	3.35	4.85	2.25	2.25	1.57	1.2	1.2	2.35
14	.....	.....	2.3	2.4	3.62	4.7	2.1	2.0	1.5	1.23	1.35	2.3
15	.....	.....	2.3	2.25	3.62	4.53	2.15	1.95	1.5	1.23	1.5	2.25
16	.....	.....	2.2	2.02	3.65	4.6	2.25	1.93	1.5	1.2	1.35	2.1
17	.....	.....	2.2	2.02	3.5	4.45	2.15	1.9	1.47	1.2	1.45	2.2
18	.....	.....	2.25	2.02	3.6	4.3	2.0	1.73	1.35	1.17	1.35	2.3
19	2.25	.....	2.21	2.0	3.6	4.3	1.95	1.63	1.45	1.23	1.45	2.35
20	2.3	2.2	2.2	2.0	3.75	3.45	2.4	1.57	1.4	1.17	1.35	2.2
21	2.3	2.2	2.2	2.0	3.85	3.35	2.0	1.55	1.25	1.17	1.25	2.3
22	2.35	2.22	2.2	2.0	3.92	3.45	2.2	1.45	1.4	1.23	1.3	2.35
23	2.3	2.2	2.35	2.02	4.48	3.4	2.05	1.43	1.4	1.35	1.55	2.25
24	2.28	2.25	2.25	2.25	4.5	3.5	2.05	1.45	1.43	1.35	1.5	2.3
25	2.3	2.25	2.45	2.35	4.55	3.45	1.97	1.35	1.53	1.4	1.65	2.2
26	2.2	2.22	2.35	2.5	4.45	3.55	1.95	1.4	1.47	1.45	1.65	2.1
27	2.2	2.22	2.35	2.85	4.25	3.7	2.0	1.4	1.43	1.35	1.75	2.05
28	2.2	2.3	2.32	3.85	4.1	3.4	2.15	1.85	1.33	1.5	1.7	2.05
29	2.22	.....	2.25	3.88	4.0	3.25	2.75	1.53	1.55	1.5	1.75	2.05
30	2.22	.....	2.22	3.7	4.05	3.2	2.83	1.37	1.87	1.45	2.05	2.1
31	2.2	.....	2.3	.....	3.9	.....	2.8	1.37	.....	1.37	.....	2.15

NOTE.—River frozen January 11–17. February 14–19.

Station rating table for Uncompahgre River at Montrose, Colo., from January 1 to June 3, 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	57	2.80	184	3.60	412	4.40	717
2.10	69	2.90	207	3.70	446	4.50	765
2.20	82	3.00	231	3.80	481	4.60	817
2.30	96	3.10	257	3.90	516	4.70	874
2.40	111	3.20	285	4.00	552	4.80	936
2.50	127	3.30	315	4.10	590	4.90	1,004
2.60	144	3.40	346	4.20	630	5.00	1,080
2.70	163	3.50	379	4.30	672		

NOTE.—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 2 feet and 4.3 feet.

Station rating table for Uncompahgre River at Montrose, Colo., from June 4 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	6	2.00	86	3.00	288	4.00	595
1.10	10	2.10	100	3.10	315	4.20	671
1.20	14	2.20	116	3.20	343	4.40	755
1.30	19	2.30	133	3.30	371	4.60	850
1.40	25	2.40	151	3.40	400	4.80	970
1.50	32	2.50	170	3.50	430	5.00	1,125
1.60	40	2.60	191	3.60	461	5.20	1,300
1.70	50	2.70	213	3.70	493	5.40	1,500
1.80	61	2.80	237	3.80	526	5.60	1,725
1.90	73	2.90	262	3.90	560	5.80	1,970

NOTE.—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 2 feet and 4 feet. Below 1.9 the table is very uncertain. The table has been extended beyond these limits.

Estimated monthly discharge of Uncompahgre River at Montrose, Colo., for 1905.

[Drainage area, 565 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 (23 days)	108	82	93.1	4,247	.165	.141
February (22 days)	96	82	83.8	3,657	.148	.121
March	144	82	99.7	6,130	.176	.203
April	446	57	115	6,843	.204	.228
May	791	119	433	26,620	.766	.883
June	1,970	343	873	51,950	1.55	1.73
July	386	80	140	8,608	.248	.286
August	138	22	64.4	3,960	.114	.131
September	69	16	30.1	1,791	.053	.059
October	73	13	23.3	1,433	.041	.047
November	93	14	31.2	1,856	.055	.061
December	160	93	121	7,440	.214	.247
The period				124,500		

UNCOMPAHGRE RIVER AT DELTA, COLO.

This station was established April 29, 1903. It was originally located at a highway bridge one-fourth mile above the Denver and Rio Grande Railroad bridge, but on November 17, 1903, the station was removed to the Denver and Rio Grande Railroad bridge, one-fourth mile northwest of the Denver and Rio Grande Railroad station, in order that the measured discharge of the river might include the mill-ditch waste. Excluding the discharge of seasonal high water in May or June and an occasional rise from local storms, the water passing this station is entirely seepage water from irrigation above.

The channel at the gage rod and the bridge below is a long gentle curve. The right bank is of earth, is high and clean, and is not subject to overflow. The left bank is also of earth and is clean; but it is low and may overflow during extreme high water. The bed of the stream is composed of earth and fragments of rock and is fairly permanent. There is but one channel at all stages. The current is sluggish at low and swift at high water. Gage heights range from 0.6 foot to 4 feet.

Discharge measurements were originally made from the highway bridge, to which the first gage was attached, or by wading near the gage. From November 17, 1903, to May 2, 1904, measurements were made from the Denver and Rio Grande Railroad bridge. After the latter date measurements were made from the single-span road bridge 100 feet below the new gage. The initial point for soundings is the face of the left abutment at the downstream side of the road bridge and is marked by a brass-headed nail in the hand rail. At low-water measurements are made by wading near the bridge.

Gage readings at this station are made by Michael O'Rourke. The first gage at the railroad bridge was a vertical rod nailed to a 12-inch pile on the downstream side of the bridge. It read from 1 foot to 6 feet. Readings were taken from this gage until April 21, 1904, when a new gage was installed on the right bank 45 feet east of the center of the Denver and Rio Grande Railroad track at the south approach to the bridge. There is no definite and constant relation between the new and old rods as the cross sections are not identical. The new gage is an inclined rod, graduated up to 6 feet. The bottom of the rod rests on the river bottom and is held in place by six 2- by 4-inch timbers driven firmly into the bank. The bench mark for the vertical gage was a cross on the top of the lower chord of the bridge over the gage rod; its elevation was 8.75 feet above the zero of the gage. The bench mark for the inclined gage is a point marked with black paint and the letters "B. M.," on the surface of the northeast corner of the stone abutment where the south end of the steel bridge rests, on the downstream side; elevation, 7.36 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, p 67; 133, pp 177–178.
Discharge: 66, p 98; 100, p 68; 133, p 178.
Discharge, monthly: 100, p 69; 133, p 180.
Gage heights: 100, p 68; 133, p 179.
Rating tables: 100, p 69; 133, pp 179–180.

Discharge measurements of Uncompahgre River at Delta, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 12	R. I. Meeker	58	64	1.78	1.45	114
May 5	Oro McDermith	64	110	2.21	2.05	243
May 19	A. A. Weiland	64	179	4.95	3.30	887
May 31	do	64	145	3.23	2.42	469
June 12	do	64	240	5.88	3.90	1,411
June 26	do	64	122	2.93	2.22	358
July 11	do	49	38	.53	.80	20
July 31	do	47	40	.62	.90	25
October 2	R. I. Meeker	50	44	.82	1.00	36

Daily gage height, in feet, of Uncompahgre River at Delta, Colo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	1.57	2.0	1.47	2.62	2.92	1.48	1.14	0.76	0.99	0.8	1.49
2	1.8	1.58	2.22	1.52	3.08	3.28	1.32	.98	.72	.95	.81	1.5
3	1.74	1.64	2.07	1.61	2.94	3.44	1.06	.9	.71	.91	.82	1.47
4	1.8	1.69	2.08	1.45	2.39	3.66	.96	.84	.76	.88	.83	1.5
5	1.76	1.73	1.98	1.36	2.06	4.2	.92	.8	.87	.86	.84	1.53
6	1.8	1.66	1.84	1.23	1.78	4.2	.88	.82	.86	.78	.84	1.5
7	1.84	1.62	1.79	1.2	1.72	3.79	.78	.88	.87	.82	.86	1.49
8	.....	1.64	1.76	1.4	1.87	4.0	.81	.82	.8	.84	.86	1.6
9	.....	1.54	1.67	1.42	2.0	4.23	.81	.81	.81	.84	.84	1.63
10	.....	1.5	1.59	1.49	1.91	4.38	.8	.78	.84	.84	.83	1.57
11	.....	1.58	1.53	1.46	1.67	3.97	.8	.78	.84	.82	.82	1.54
12	.....	1.5	1.49	1.44	1.5	3.88	.77	.81	.79	.83	.84	1.48
13	.....	1.39	1.47	1.22	1.43	3.7	.78	.8	.78	.82	.86	1.53
14	.....	1.35	1.47	1.13	1.38	3.57	.76	.81	.76	.82	.85	1.63
15	.....	.....	1.49	1.13	1.32	3.54	.76	.79	.76	.82	.84	1.68
16	.....	.....	1.5	1.03	1.55	3.45	.74	.72	.76	.82	.85	1.62
17	.....	.....	1.53	1.04	2.52	3.15	.73	.69	.7	.8	.91	1.63
18	.....	.....	1.58	0.95	2.94	3.03	.71	.69	.77	.78	.9	1.69
19	.....	.....	1.5	.98	3.34	3.0	.7	.71	.78	.79	.89	1.69
20	.....	.....	1.5	1.06	3.54	2.8	.68	.72	.79	.83	.9	1.64
21	.....	.....	1.56	.96	3.5	2.68	.68	.72	.82	.82	.91	1.7
22	1.56	1.68	1.59	.87	3.54	2.43	.7	.73	.82	.81	.9	1.77
23	1.6	1.66	1.59	.88	3.68	2.2	.74	.73	.83	.82	.88	1.88
24	1.62	1.63	1.47	.87	3.76	2.22	.74	.73	.84	.83	.88	1.94
25	1.61	1.66	1.45	.82	3.58	2.14	.69	.72	.78	.8	.93	.....
26	1.62	1.69	1.46	.78	3.53	2.12	.66	.78	.92	.82	1.0	.....
27	1.6	1.75	1.54	.76	3.41	2.08	.67	.77	.83	.82	1.13	.....
28	1.56	1.85	1.58	1.65	3.26	2.04	.7	.74	.84	.84	1.25	.....
29	1.5	.....	1.48	2.23	2.96	1.83	.68	.77	.84	.79	1.29	.....
30	1.56	.....	1.47	2.42	2.59	1.7	.7	.77	.85	.78	1.26	.....
31	1.56	.....	1.43	.....	2.56	.....	1.21	.76	.....	.8	.....	.....

NOTE.—River frozen January 8-21 and February 15-21.

Station rating table for Uncompahgre River at Delta, Colo., 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	3	1.60	150	2.60	535	3.60	1,145
.70	8	1.70	180	2.70	585	3.70	1,220
.80	15	1.80	210	2.80	640	3.80	1,295
.90	24	1.90	240	2.90	695	3.90	1,375
1.00	35	2.00	275	3.00	750	4.00	1,455
1.10	50	2.10	315	3.10	810	4.10	1,535
1.20	65	2.20	355	3.20	870	4.20	1,620
1.30	85	2.30	395	3.30	935	4.30	1,710
1.40	105	2.40	440	3.40	1,005	4.40	1,800
1.50	125	2.50	485	3.50	1,075		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1905, and is not well defined.

Estimated monthly discharge of Uncompahgre River at Delta, Colo., for 1905.

[Drainage area, 1,130 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 1–7; 22–31	222	125	167	5,631	0.148	0.094
February 1–14; 22–28	225	95	157	6,539	.139	.109
March	363	111	161	9,900	.142	.164
April	449	6	88.1	5,242	.078	.087
May	1,265	89	597	36,710	.528	.609
June	1,782	180	894	53,200	.791	.882
July	121	6	21.0	1,291	.019	.022
August	56	8	15.3	941	.014	.016
September	26	8	15.8	940	.014	.016
October	34	14	18.1	1,113	.016	.018
November	83	15	27.9	1,660	.025	.028
December	254	119	156	7,426	.138	.123
The period				130,600		

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Gunnison River basin in 1905:

Miscellaneous discharge measurements made in Gunnison River drainage basin in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
August 10	Lotis Creek	Just above mouth	14	13	1.92	25
August 22	East River	1 mile below Brush Creek	40	34	1.88	64
August 22	Slate River	1 mile below Crested Butte, Colo.	60	34	1.12	38

COLORADO RIVER DRAINAGE BASIN BETWEEN JUNCTION OF GRAND AND GREEN RIVERS AND YUMA.

COLORADO RIVER.

DESCRIPTION OF RIVER.

From the junction of Grand and Green rivers the Colorado flows southwestward, passes across the northwestern corner of Arizona, then turns to the south and for the remainder of its course forms a part of the southeastern boundary of Nevada and California and the western boundary of Arizona. It empties into the Gulf of California about 60 miles below Yuma, Ariz. The canyons through which it flows are world famed and need not here be described.

The Colorado has been called the Nile of America, and like the Nile it is subject to an annual summer rise which comes at the time when it is most needed for irrigation. It is of interest to compare the Colorado with the Nile and Susquehanna rivers. The Nile being similar in type, the Susquehanna being contrasted and showing the difference in flow between arid and humid regions. In this comparison a normal year based upon records of the past ten years for the Colorado and Susquehanna rivers and such data as could be found in regard to the Nile has been used. The Colorado has been taken as the standard of comparison

The Nile has 5.7 times the drainage area and the Susquehanna about one-eighth the area. The rainfall in the Nile basin is 3.8 times greater; that in the Susquehanna basin is 4.5 times greater. The run-off per square mile from the Nile basin is 1.9 times greater; that from the Susquehanna basin is 37 times greater. The ratio of run-off to rainfall in the Nile basin is 2 times smaller; that of the Susquehanna basin is 8.2 times greater.

The discharge of the Nile is 10.8 times greater; that of the Susquehanna is 4.5 times greater.

The maximum flow of the Colorado is from 70,000 to 110,000 second-feet and occurs in May, June, or July; for the Nile it is about 358,000 second-feet and occurs about the first of September; for the Susquehanna it is from 200,000 to 400,000 second-feet and occurs during March, April, and May.

The minimum flow of the Colorado is from 2,500 to 3,000 second-feet and occurs during January and February; that of the Nile is about 14,500 second-feet and occurs about the end of May; for the Susquehanna it is from 2,500 to 5,000 second-feet and occurs in September and October.

The mean flow of the Colorado is about 10,700 second-feet; for the Nile it is about 115,800 second-feet; for the Susquehanna it is about 43,000 second-feet.

The water of the Colorado carries an immense amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. Prof. R. H. Forbes, in Bulletin No. 44, University of Arizona Agricultural Experiment Station, says:

> On the basis of the profile constructed from available data for the volume of flow of the Colorado, and of the year's silt determinations made in the laboratory, it is estimated conservatively that the river during 1900 brought down about 61,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

A comparatively small amount of land is irrigated by the waters of the Colorado, owing to the fact that the stream and its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable. There are two pumping plants that lift water for irrigation at Yuma and several at other points on the river above Yuma. The Imperial canal diverts water from the river at a point about 10 miles by river below Yuma.

The principal tributaries of the Colorado below the Grand and Green are the San Juan, Little Colorado, Bill Williams Fork, and Gila rivers, which enter from the east, and the Virgin River, which enters from the west. With the exception of the Virgin and Bill Williams Fork rivers, these streams and their various tributaries are described in other parts of this report.

COLORADO RIVER AT HARDYVILLE, ARIZ.

This station was established May 11, 1905. It is maintained in cooperation with the State of California, and is located one-fourth mile above the deserted town of Hardyville and 7 miles above Fort Mohave, Ariz.

The right bank is composed of cemented gravel, is high, and is not subject to overflow. The left bank is made up of alluvial material, easily eroded, is low and wooded, and is liable to overflow at flood stages. The bed is composed of cemented gravel and changes gradually as the river falls from flood stage to low water, a bar forming in that portion of the section nearest the right bank and altering the section materially. There is but one channel at all stages. The flow ranges from 3,000 to 100,000 second-feet, with velocities of from 2 to 8 feet per second and a variation of probably 12 feet in gage heights.

Discharge measurements are made from a car and cable located 250 feet above the pumping plant of the Rattan mill. The initial point for soundings is the end of the turn-buckle farthest from the river on the Nevada side.

The gage, which was read once each day during 1905 by Marion Herrick, is located 275 feet below the cable on the left bank. The gage is in two sections: The lower section is an inclined rod fastened to posts buried in the bank; the upper section is a timber set vertically

in the bank. The bench mark is the top of a 3-inch iron pipe buried in the gravel bank 100 feet from the river and 40 feet below the gage rod. Its elevation is 20.54 feet above the zero of the gage and 507.18 feet above sea level.

Discharge measurements of Colorado River at Hardyville, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 17	O. W. Peterson	6.65	33,140	August 13	C. W. Jenkins	4.20	12,270
May 20	do	6.95	33,910	August 27	do	4.00	11,650
May 27	C. W. Jenkins	11.20	69,010	September 2	do	3.20	5,934
June 4	do	10.50	64,750	September 17	do	3.40	7,523
June 10	do	14.50	107,700	October 1	do	3.00	4,657
June 18	do	12.80	81,030	October 15	do	3.90	6,579
June 25	do	10.15	52,860	October 29	do	3.60	6,574
July 9	do	6.70	30,650	November 4	Jenkins and Lee	3.48	5,949
July 16	do	5.70	22,406	November 12	C. W. Jenkins	3.85	6,504
July 23	do	5.10	17,620	November 19	do	3.70	5,979
July 30	do	4.60	14,590	November 25	do	3.60	5,757
August 6	do	5.00	17,040	December 3	do	6.00	17,850

Daily gage height, in feet, of Colorado River at Hardyville, Ariz., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	11.8	8.55	4.5	3.4	3.75	3.45	7.4
2	.....	11.5	8.4	4.5	3.4	4.05	3.45	7.1
3	.....	11.1	8.3	4.65	3.2	4.7	3.5	6.05
4	.....	10.7	8.0	4.8	3.2	4.35	3.45	5.35
5	.....	10.8	7.9	5.2	3.45	5.1	3.5	4.8
6	.....	11.85	7.55	5.0	3.55	4.8	3.5	4.5
7	.....	12.5	7.3	4.7	3.5	4.8	3.6	4.3
8	.....	13.1	7.0	4.7	3.6	4.7	4.0	4.2
9	.....	13.7	6.7	4.85	3.5	4.7	3.85	4.1
10	.....	14.4	6.7	4.6	3.6	4.45	3.85	3.9
11	6.85	14.3	6.5	4.5	4.0	4.25	3.75	3.75
12	6.9	14.0	6.15	4.3	3.7	4.1	3.85	3.75
13	6.95	14.3	6.0	4.25	3.5	4.0	3.8	3.8
14	7.15	14.45	5.85	4.15	3.5	3.95	3.65	3.8
15	7.15	14.5	5.2	4.0	3.45	3.85	3.85	3.7
16	6.95	13.8	5.85	4.0	3.45	3.8	3.75	3.7
17	6.7	13.3	5.5	3.9	3.4	3.7	3.7	3.7
18	6.8	12.8	5.3	3.8	3.3	3.7	3.7	3.7
19	6.95	12.5	5.25	3.8	3.2	3.7	3.7	3.6
20	7.0	12.2	5.2	3.8	3.2	3.6	3.7	3.6
21	7.35	11.85	5.1	3.75	3.05	3.55	3.6	3.65
22	8.1	11.35	5.1	3.75	3.05	3.5	3.6	3.7
23	8.8	10.8	5.1	3.6	3.0	3.5	3.6	3.8
24	9.5	10.5	4.95	3.6	3.05	3.5	3.7	3.8
25	9.9	10.15	4.85	3.6	2.95	3.45	3.6	3.8
26	10.6	10.0	4.7	4.75	2.95	3.5	5.4	3.95
27	11.1	9.5	4.7	3.7	2.95	3.45	5.4	3.9
28	11.5	9.1	4.7	3.4	2.95	3.5	5.1	3.9
29	12.7	9.2	4.7	3.3	3.95	3.55	5.0	3.9
30	12.4	9.6	4.65	3.4	3.95	3.5	5.1	3.8
31	12.1	.....	4.6	3.4	.....	3.5	.....	3.8

Daily discharge, in second-feet, of Colorado River at Hardyville, Ariz., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	73,460	45,260	14,080	7,160	9,290	5,650	29,500
2	.....	70,700	44,020	14,080	7,160	11,600	5,700	26,500
3	.....	67,090	43,200	15,090	5,970	15,900	6,000	18,200
4	.....	63,550	40,750	16,110	5,970	13,100	5,750	14,300
5	.....	64,430	39,940	18,950	7,460	18,200	5,800	11,500
6	.....	73,920	37,120	17,500	8,065	15,600	5,500	10,400
7	.....	80,000	35,120	15,430	7,760	15,300	6,000	10,200
8	.....	85,780	32,750	15,430	8,370	14,300	8,500	9,500
9	.....	91,700	30,410	16,460	7,760	14,000	7,200	8,800
10	.....	98,780	30,410	14,750	8,370	12,000	7,000	7,400
11	31,580	97,760	28,850	14,080	10,850	10,300	6,000	6,300
12	31,970	94,700	26,160	12,770	8,980	8,900	6,500	6,300
13	32,360	97,760	25,000	12,440	7,760	7,900	6,200	6,700
14	33,940	99,290	23,840	11,800	7,760	7,200	5,200	6,700
15	33,940	99,800	18,950	10,850	7,460	6,200	6,700	6,000
16	32,360	92,700	23,840	10,850	7,460	6,000	6,100	6,000
17	30,410	87,740	21,180	10,200	7,160	5,300	5,800	6,000
18	31,190	82,880	19,690	9,600	6,560	5,600	5,900	6,000
19	32,360	80,000	19,320	9,600	5,970	5,600	5,980	5,300
20	32,750	77,180	18,950	9,600	5,970	5,200	6,000	5,300
21	35,520	73,920	18,220	9,290	5,090	4,850	5,400	5,600
22	41,560	69,340	18,220	9,290	5,090	4,800	5,500	6,000
23	47,330	64,430	18,220	8,370	4,800	4,800	5,600	6,700
24	53,230	61,810	17,150	8,370	5,090	5,050	6,350	6,700
25	56,640	58,790	16,460	8,370	4,515	4,700	5,760	6,700
26	62,680	57,500	15,430	15,770	4,515	5,400	17,800	,800
27	67,090	53,230	15,430	8,980	4,515	5,050	17,300	7,400
28	70,700	49,840	15,430	7,160	4,515	5,700	14,500	7,400
29	81,920	50,680	15,430	6,560	10,540	6,050	13,200	7,400
30	79,060	54,080	15,090	7,160	10,540	5,900	13,300	6,700
31	76,240	.....	14,750	7,160	.....	5,900	.....	6,700

NOTE.—Rating table used May 11 to October 1. For the remainder of the period indirect method was used.

Estimated monthly discharge of Colorado River at Hardyville, Ariz., for 1905.

[Drainage area, 138,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
May 11 to 31	81,920	30,410	47,370	1,973,000	.342	.267
June	99,800	49,840	75,760	4,508,000	.547	.610
July	45,260	14,750	25,310	1,556,000	.183	.211
August	18,950	6,560	11,810	726,200	.085	.098
September	10,850	4,515	6,972	414,900	.050	.056
October	18,200	4,700	8,571	527,000	.062	.071
November	17,800	5,200	7,606	452,600	.055	.061
December	29,500	5,300	9,097	559,400	.066	.076
The period	.....	.....	.....	10,720,000	.....	.....

SAN JUAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

San Juan River rises among the snow masses that crown the high peaks of the San Juan Mountains in southwestern Colorado, flows southwestward into New Mexico, then swings to the west and northwest, passing from San Juan County, N. Mex., across the extreme southwestern corner of Colorado into San Juan County, Utah, in the southwestern part of which it unites with the Colorado.

For the first 75 miles of its course the San Juan is a typical mountain stream, but at Canyon Largo, N. Mex., where it turns westward, its character changes, and it occupies a broad-winding, sandy channel in an arid valley, bordered on each side by terraced mesas. Below the mouth of Mancos River the valley narrows and the river bottom is bounded by abrupt bluffs, broken and cut by dry water channels, and merging farther on into the walls of a deep, narrow, box canyon in which the river flows to its end.

The drainage area includes portions of four States and Territories. Its topography ranges in type from mountainous at the headwaters in Colorado to the types exemplified in the valleys, plateaus, and eroded mesas of Utah, New Mexico, and Arizona. Large areas of eruptive rocks occur in the highest portions of the basin, but the predominating formations are of sedimentary origin. The headwater streams are protected by fine forests of spruce and yellow pine and, at lower elevations, large areas of aspen. The lower basin is practically barren except for an extensive growth of sagebrush, scattered cedars, piñons, and range grasses.

The principal tributaries of the San Juan are Navajo, Piedra, Pine, Florida, Animas, and La Plata rivers, the Animas being the most important.

Animas River has its source in the region above Silverton, draining portions of the Needle and La Plata mountains, the former being the most rugged of the Rocky Mountain ranges. The river flows southward to the Colorado-New Mexico line and thence southwestward to the point where it joins the San Juan at Farmington, N. Mex. The upper portion of the basin, above Durango, is very mountainous and furnishes the greater part of the run-off. This region is generally well timbered with pine, spruce, and aspen, but large areas consist of naked granite peaks. Immediately above and below Durango the valley broadens and is bordered by mesas and bluffs cut by narrow canyons and covered with sagebrush and scattered pines and piñons; along the stream channels cottonwoods predominate. The rocks of this region are chiefly of sedimentary origin. The soils of the lower valleys consist of sandy loam and are very fertile.

La Plata River rises in the granite masses known as La Plata Mountains, about 25 miles northwest of Durango, Colo., and flows southward to its point of junction with the San Juan. Its drainage basin is a narrow strip parallel to and adjoining the Animas basin. The upper portion of the basin is a well-watered and forest-clad mountain region which merges southward into an arid mesa, plateau, and canyon country. La Plata Valley proper is a narrow, shallow depression from Hesperus down, bounded on both sides by high, broken table-lands and deeply eroded mountains. The lower mountain slopes are covered with piñon, scrub oak, and cedar; the lower valleys support heavy growths of sagebrush and chico; the upper mountain slopes were at one time heavily timbered with spruce and yellow and white pine, but these forests have been largely removed by lumbermen.

The other tributaries of the San Juan need not here be described. Those mentioned are perennial streams but much of their water is diverted for irrigation and never reaches the main river. In addition to the perennial streams are many intermittent creeks throughout New Mexico which contribute large volumes of water during heavy storms.

Much land is now under cultivation along the valleys of the San Juan, Animas, Pine, Florida, and La Plata rivers and the smaller tributaries in Colorado. Numerous small lakes high up in the mountains tend to equalize the flow of some of the tributaries, and many large and small storage-reservoir sites are available which will in time be developed.

One large power plant has been constructed in this basin and others are contemplated. The largest deposits of lignite and bituminous and coking coal to be found in the West are in this drainage area.

SAN JUAN RIVER NEAR FARMINGTON, N. MEX.

This station was established June 18, 1904. It is located near the Methodist Indian school about 3 miles south of Farmington, N. Mex., and about 2 miles below the mouth of Animas River.

The channel is straight for about 900 feet above and below the station. The right bank is a high sandstone cliff and can not overflow. The left bank at low water is a gravel bar extending out to 325 feet from the initial point for soundings, when it rises to a height of 6 feet; it probably never overflows beyond this point. The bed of the stream is composed of cobblestones, shale, and a few large, scattered bowlders. It is clean and permanent except on the left side where sand rests on the shale. There is but one channel at all stages. The current is swift at high and medium at low water. Gage heights range from 3 to 12 feet.

Discharge measurements were made from the suspension footbridge, which was carried away by the high water of 1905. Since then discharge measurements have been impracticable as there is no other bridge on the river.

The gage, which was read during 1905 by Elmer King, is a standard chain gage and is attached to a framework extending from the top of a sandstone cliff, about 15 feet above low water, on the right bank of the river, about 300 yards above the bridge. The gage scale is placed horizontally on the top of the cliff and is graduated from zero to 20 feet. The length of the wire from the end of the weight to the marker, which is a knot tied in the wire near the ring, is 20.79 feet. On May 23, 1905, a high-water gage, consisting of an inclined staff graduated to read from 8.6 to 16.4 feet, was set in the right bank about 150 feet below the wire gage. The bench mark is a cross, painted black and marked "U. S. G. S. B. M.," on the top of the sandstone cliff about 50 feet east of the gage; elevation above the datum of the wire gage, 12.79 feet. The top of the gage rod (above the brace) is 0.82 foot above the bench mark. The elevation of the bench mark above the datum of the new gage is 12.94 feet, and hence the datum of the new gage is 0.15 foot above the datum of the old gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pp. 180–183.

A measurement made by M. C. Hinderlider May 23, 1905, gave the following results: Width, 302 feet; area, 1,764 square miles; mean velocity, 9.73 feet per second; gage height, 10.55 feet; discharge, 17,170 second-feet.

Daily gage height, in feet, of San Juan River near Farmington, N. Mex., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.22	3.3	4.15	4.18	7.0	10.05	7.4	5.55	4.25	5.95	4.22	4.18
2	3.35	3.4	4.25	4.32	7.5	10.7	6.15	5.3	4.28	5.5	4.25	4.15
3	3.3	3.35	4.75	4.4	7.25	12.4	6.05	5.0	4.22	5.12	4.2	4.18
4	3.25	3.35	5.1	4.15	6.9	12.25	6.0	4.95	4.32	4.85	4.22	4.25
5	3.3	3.75	5.0	4.15	6.75	12.35	6.0	4.95	4.68	4.75	4.2	4.28
6	3.15	3.68	4.95	4.35	6.6	13.1	5.85	4.9	4.65	4.55	4.22	4.28
7	3.2	3.55	5.4	4.5	6.4	11.65	5.6	4.8	4.62	4.52	4.25	4.3
8	3.3	3.58	5.05	4.88	6.35	11.8	5.85	4.7	4.65	4.48	4.32	4.22
9	3.22	3.5	4.6	4.75	6.2	12.0	5.8	4.65	4.58	4.48	4.22	4.18
10	3.3	3.55	4.45	5.0	6.4	11.9	5.65	4.55	4.55	4.55	4.2	4.2
11	3.22	3.45	4.15	6.95	6.3	12.0	5.6	4.7	4.55	4.52	4.15	4.15
12	3.1	3.85	4.25	7.1	6.05	12.05	5.45	4.7	4.55	4.45	4.2	4.2
13	3.1	3.2	4.15	6.35	5.95	11.9	5.4	4.8	4.5	4.48	4.15	4.2

Daily gage height, in feet, of San Juan River near Farmington, N. Mex., for 1905—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14	3.12	3.35	4.15	6.15	6.05	11.6	5.25	4.7	4.5	4.48	4.18	4.18
15	2.75	3.35	4.55	6.22	6.1	11.4	5.15	4.55	4.45	4.45	4.2	4.15
16	3.25	3.25	4.55	6.35	6.7	11.4	5.2	4.45	4.45	4.42	4.2	4.2
17	3.3	3.3	4.6	6.0	7.65	11.75	5.15	4.4	4.42	4.4	4.22	4.2
18	3.35	3.35	4.8	5.9	8.0	10.6	5.1	4.35	4.38	4.38	4.2	4.12
19	3.35	3.4	4.7	5.95	8.35	10.7	5.15	4.25	4.32	4.38	4.2	4.15
20	3.1	3.4	4.7	5.95	8.75	10.75	5.1	4.12	4.32	4.3	4.2	4.2
21	3.15	3.4	4.65	5.8	8.8	9.9	5.05	4.08	4.35	4.28	4.15	4.2
22	3.38	3.8	4.48	5.95	8.1	10.05	5.2	4.05	4.3	4.3	4.6	4.1
23	3.2	5.02	4.0	6.75	11.2	10.0	5.1	3.95	4.28	4.28	4.4	3.95
24	3.2	4.95	3.9	7.0	11.05	9.85	5.05	4.65	4.3	4.28	4.2	4.0
25	3.25	4.85	4.12	6.55	11.1	9.75	5.05	4.52	4.58	4.3	4.15	3.98
26	3.2	4.25	4.18	6.15	10.85	9.55	4.85	4.1	4.6	4.22	4.18	4.0
27	3.2	3.95	4.42	6.1	11.0	9.6	4.82	4.15	4.62	4.28	4.9	4.12
28	3.2	4.0	4.2	6.55	10.15	9.55	4.9	4.28	4.6	4.28	5.08	4.2
29	3.22	.....	4.15	6.8	9.95	8.45	4.95	4.25	4.62	4.3	4.75	4.0
30	3.2	.....	4.2	6.7	9.55	8.4	6.25	4.4	6.05	4.25	4.15	4.05
31	3.2	.....	4.15	.....	9.55	.....	5.65	4.2	.....	4.28	.....	3.95

Station rating table for San Juan River near Farmington, N. Mex., 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.*
2.70	25	4.00	900	5.60	3,850	8.20	10,400
2.80	55	4.10	1,020	5.80	4,290	8.40	10,960
2.90	90	4.20	1,150	6.00	4,750	8.60	11,520
3.00	130	4.30	1,300	6.20	5,230	8.80	12,080
3.10	180	4.40	1,450	6.40	5,710	9.00	12,640
3.20	230	4.50	1,610	6.60	6,200	9.50	14,050
3.30	290	4.60	1,780	6.80	6,700	10.00	15,500
3.40	350	4.70	1,950	7.00	7,200	10.50	17,000
3.50	420	4.80	2,140	7.20	7,720	11.00	18,500
3.60	500	4.90	2,340	7.40	8,240	11.50	20,000
3.70	580	5.00	2,540	7.60	8,780	12.00	21,500
3.80	680	5.20	2,970	7.80	9,320	12.50	23,000
3.90	780	5.40	3,410	8.00	9,860	13.00	24,500

NOTE.—The above table is applicable only for open-channel conditions. It is based on 13 discharge measurements made during 1904, and one high-water measurement made during 1905. Low-water estimates based on this table are therefore uncertain. The table has been extended beyond these limits.

Estimated monthly discharge of San Juan River near Farmington, N. Mex., for 1905.

[Drainage area, 6,920 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	338	40	242	14,880	0.035	0.040
February	2,582	230	682	37,880	.099	.103
March	3,410	780	1,625	99,920	.235	.271
April	7,460	1,085	4,290	255,300	.620	.692
May	19,100	4,635	10,110	621,600	1.46	1.68
June	24,800	10,960	18,270	1,087,000	2.64	2.94
July	8,240	2,180	3,604	221,600	.521	.601
August	3,740	840	1,747	107,400	.252	.290
September	4,870	1,180	1,673	99,550	.242	.270
October	4,635	1,180	1,690	103,900	.244	.281
November	2,708	1,085	1,306	77,710	.189	.211
December	1,300	840	1,084	66,650	.157	.181
The year	24,800	40	3,860	2,793,000	.558	7.56

ANIMAS RIVER AT DURANGO, COLO.

This station was established June 20, 1895, and has been maintained during the greater part of each year since. It was originally located at the old wagon bridge, one-fourth mile west of the railroad bridge, at Durango and about 200 feet above the Rio Grande Southern Railroad bridge. On June 20, 1901, the station was removed to a new bridge, located just below the site of the old one.

The channel is straight for 300 feet above and 400 feet below the station. Both banks are high and rocky and not liable to overflow. The bed of the stream is rocky and fairly permanent. There is but one channel at all stages, broken by the center pier of the bridge. Gage heights range from 6 to 13 feet. During the high water of 1905 such radical changes occurred in the channel as to make two rating tables necessary.

Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is the downstream edge of the right abutment.

The gage at this station was read twice daily during 1905 by C. G. Graden. The original gage was spiked to the west side of the south end of the middle pier of the wagon bridge. The head of a bolt at the east abutment of the railroad bridge is 17.24 feet above this gage datum. During the early part of 1899 the old wagon bridge was removed and a new one was constructed a short distance below. On April 1, 1899, a gage was fastened to the central pier of this bridge. Owing to this change in the location and height of the rod there is no apparent relation between the rating tables before and after 1899. The present gage, established June 20, 1901, is a vertical 14-foot timber, fastened to the southwest corner of the center masonry pier on the downstream side of the new wagon bridge, one-eighth mile west of the railroad station at Durango. The timber is held in place by spikes driven into cracks in the masonry. The gage is referred to bench marks as follows: (1) A chiseled point at the southwest corner of the center pier of the highway bridge; elevation 16.75 feet above the zero of the gage. (2) A chiseled point on the lower side of the left abutment of the bridge; elevation, 16.84 feet above the zero of the gage. On April 1 and 2, 1903, sand and gravel were washed down by Lightner Creek, which enters about 100 feet below the bridge, and were deposited around the gage rod. On April 14, 1903, a new wire gage was established on the downstream side of the bridge in the span next the left bank. This gage was read until June 6, when it was stolen. In the meantime the sand and gravel had been washed from the foot of the old gage, from which readings were taken thereafter.

The wire gage read zero when the vertical gage read 5 feet. All 1903 readings were reduced to the datum of the vertical gage.

This station was discontinued December 31, 1905.

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 283–284; Bull 140, pp 198–199; WS 16. p 146; 28, p 132; 38, p 310; 50, p 383; 66, p 97; 85, pp 35–36; 100, pp 51–52; 133, pp 183–184.

Discharge: Ann 18, iv, p 284; Bull 140, p 199; WS 16, p 146; 28, p 142; 38, p 310; 50, p 383; 66, p 97; 85, p 36; 100, p 52; 133, p 185.

Discharge, monthly: Ann 18, iv, p 285; 19 iv, p 414; 20, iv, pp 379, 403; 21, iv, p 301; 22, iv, p 394; WS 85, p 37; 100 p 54; 133, p 186.

Discharge, yearly: Ann 20, iv, p 59.

Gage heights: Bull 140, p 200; WS 11, p 72; 16, p 146; 28, p 139; 38, p 311; 50, p 384; 66, p 97; 85, p 36; 100, p 53; 133, p 185.

Hydrographs: Ann 18, iv, p 285; 19, iv, p 415; 20, iv, p 403; 21, iv, p 301; 22, iv, p 394.

Rainfall and run-off relation: Ann 20, iv, p 379.

Rating tables: Ann 18, iv, p 284; 19, iv, p 414; Bull 140, p 199; WS 28, p 145; 39, p 452; 52, p 520; 66, p 174; 85, p 37; 100, p 53; 133, p 186.

Discharge measurements of Animas River at Durango, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 25	M. C. Hinderlider	89	195	6.14	8.70	1,198
May 16	do	189	513	6.49	10.00	3,330
May 20	do	189	756	6.85	11.00	5,179
July 3	O. H. Timmerman	183	648	4.32	8.75	2,703
July 13	do	158	435	3.04	7.90	1,321
July 14	do	158	446	3.05	7.93	1,360
July 14	do	158	448	3.16	8.00	1,417
July 31	do	163	509	3.80	8.30	1,935
August 7	do	156	407	2.50	7.75	1,017
August 18	do	143	296	1.99	7.00	590
August 30	do	143	273	1.92	6.90	525
September 9	do	143	281	1.84	7.05	516
September 15	do	143	239	1.64	6.90	391
September 20	do	143	223	1.59	6.86	355
September 28	do	143	244	1.62	6.90	396
September 29	do	143	318	2.17	7.38	690
October 1	do	163	440	3.66	8.04	1,514
October 1	do	163	434	3.33	7.96	1,447
October 2	do	163	390	2.71	7.80	1,057
October 2	do	163	382	2.74	7.78	1,048
October 3	do	160	370	2.54	7.64	939
October 3	do	158	362	2.56	7.61	928
October 5	do	158	324	2.32	7.42	757

Daily gage height, in feet, of Animas River at Durango, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.6	9.9	11.9	9.0	8.2	7.0	7.8	6.8	6.7
2	7.8	10.4	12.05	8.7	8.0	7.0	7.7	6.8	6.7
3	7.8	10.0	12.3	8.7	8.0	7.0	7.5	6.7	6.6
4	8.0	9.6	12.6	8.6	8.0	7.0	7.5	6.7	6.6
5	8.1	9.4	12.45	8.4	8.0	7.0	7.5	6.7	6.6
6	8.2	8.6	12.0	8.4	8.0	7.0	7.3	6.7	6.6
7	8.2	8.6	12.0	8.4	7.9	7.0	7.3	6.7	6.6
8	8.4	8.7	12.5	8.4	7.7	7.0	7.2	6.7	6.6
9	8.4	8.7	11.9	8.4	7.7	7.0	7.2	6.7	6.6
10	8.5	8.7	11.8	8.3	7.5	7.0	7.0	6.7	6.6
11	8.6	8.8	11.6	8.3	7.6	7.0	7.0	6.7	6.6
12	8.6	8.7	11.7	8.1	7.6	6.9	7.0	6.7	6.6
13	8.7	8.8	11.7	8.0	7.5	6.9	7.0	6.7	6.6
14	8.6	9.0	11.5	8.0	7.3	6.9	7.0	6.7	6.6
15	8.6	9.3	11.5	8.0	7.3	6.9	7.0	6.7	6.6
16	8.7	9.5	11.3	8.0	7.2	6.9	6.9	6.6	6.6
17	8.8	10.2	11.4	8.0	7.2	6.9	6.9	6.6	6.6
18	9.0	11.2	11.4	8.0	7.1	6.8	6.9	6.6	6.6
19	8.9	11.3	11.3	8.0	7.1	6.8	6.9	6.7	6.6
20	8.9	11.4	11.3	8.1	7.0	6.8	6.9	6.7	6.6
21	8.9	11.6	11.1	8.2	7.0	6.8	6.8	6.7	6.6
22	8.8	11.5	11.2	8.2	7.0	6.8	6.8	6.7	6.6
23	8.9	11.8	10.8	8.2	7.0	6.8	6.8	6.7	6.6
24	9.1	11.8	10.5	8.0	7.2	6.8	6.8	6.7	6.6
25	9.4	11.6	10.3	7.8	7.0	6.9	6.8	6.7	6.6
26	9.3	11.85	10.0	7.8	7.0	6.8	6.8	6.7	6.6
27	9.3	11.5	9.6	7.8	7.0	7.0	6.8	6.7	6.6
28	9.6	11.1	9.5	8.0	7.0	7.2	6.8	6.7	6.6
29	9.8	10.7	9.1	8.6	7.0	9.0	6.8	6.7	.....
30	9.8	11.25	9.0	9.0	7.0	7.8	6.9	6.7	.....
31	.....	11.6	.....	8.7	7.0	.....	6.9	.....	.....

Station rating table for Animas River at Durango, Colo., from April 1 to June 4, 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	550	8.70	1,340	9.80	2 980	10.90	4,970
7.70	600	8.80	1,450	9.90	3,150	11.00	5,160
7.80	650	8.90	1,570	10.00	3,320	11.20	5,550
7.90	700	9.00	1,700	10.10	3,490	11.40	5,950
8.00	760	9.10	1,840	10.20	3,670	11.60	6,350
8.10	820	9.20	1,990	10.30	3,850	11.80	6,750
8.20	890	9.30	2,150	10.40	4,050	12.00	7,150
8.30	960	9.40	2,310	10.50	4,210	12.20	7,590
8.40	1,040	9.50	2,470	10.60	4,400	12.40	8,030
8.50	1,130	9.60	2,640	10.70	4,590	12.60	8,470
8.60	1,230	9.70	2,810	10.80	4,780		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1905. It is very poorly defined Estimates based upon it are roughly approximate.

Station rating table for Animas River at Durango, Colo., from June 5 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.*
6.60	240	7.80	1,160	9.00	2,930	10.40	5,030
6.70	290	7.90	1,290	9.10	3,080	10.60	5,330
6.80	350	8.00	1,430	9.20	3,230	10.80	5,630
6.90	410	8.10	1,580	9.30	3,380	11.00	5,930
7.00	470	8.20	1,730	9.40	3,530	11.20	6,230
7.10	540	8.30	1,880	9.50	3,680	11.40	6,550
7.20	610	8.40	2,030	9.60	3,830	11.60	6,870
7.30	690	8.50	2,180	9.70	3,980	11.80	7,190
7.40	770	8.60	2,330	9.80	4,130	12.00	7,510
7.50	850	8.70	2,480	9.90	4,280	12.50	8,310
7.60	940	8.80	2,630	10.00	4,430		
7.70	1,040	8.90	2,780	10.20	4,730		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is fairly well defined between gage heights 6.9 feet and 8.8 feet. Above 9 feet the table is very uncertain.

Estimated monthly discharge of Animas River at Durango, Colo., for 1905.

[Drainage area, 812 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	2,980	550	1,465	87,170	1.80	2.01
May	6,850	1,230	3,894	239,400	4.80	5.53
June	8,470	2,930	6,297	374,700	7.75	8.65
July	2,930	1,160	1,825	112,200	2.25	2.59
August	1,730	470	816	50,170	1.00	1.15
September	2,930	350	534	31,780	.658	.734
October	1,160	350	522	32,100	.643	.741
November	350	240	290	17,260	.357	.398
December	290	240	243	14,940	.299	.345
The period				959,700		

ANIMAS RIVER NEAR FARMINGTON, N. MEX.

This station was established June 18, 1904. It is located at the highway bridge about 1 mile northeast of Farmington, N. Mex.

The channel is straight for about 900 feet above and below the station. The right bank is a gradually sloping gravel bar, covered with small cobblestones and scattered trees and shrubs; it has been known to overflow, but this is an extremely rare occurrence. The left bank is a flat, grassy, perpendicular bank, 5 or 6 feet above low water, is lined with willows, and is not liable to overflow. The bed of the stream is composed of gravel, cobblestones, and silt, is free from vegetation, and is permanent The current is moderately swift.

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 the west face of the left abutment and is marked zero with black paint on the bridge floor.

A standard chain gage, which is read twice each day by Mrs. Adellie Ricketts, is attached to the downstream side of the bridge, 40 feet from the left end. The gage scale is graduated from 2 to 7.8 feet. The length of the chain is 12.78 feet. The bench mark is a United States Geological Survey standard bench-mark tablet set into the southwest face of a 12-inch cottonwood tree about 50 feet north of the right end of the bridge; its elevation is 11.13 feet above the datum of the gage and 3.17 feet below the top of the horizontal bridge chord on which the gage box rests.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pp. 191–195.

Discharge measurements of Animas River near Farmington, N. Mex., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 24	M. C. Hinderlider	179	849	7.72	8.34	6,555
July 6	O. H. Timmerman	144	449	3.59	6.25	1,611
July 20	do	141	323	2.71	5.35	876
July 27	do	141	280	2.45	5.05	687
August 2	do	146	399	3.40	5.82	1,357
August 9	do	126	286	2.56	5.10	732
August 21	do	112	172	1.31	4.22	226
August 24	do	107	139	1.00	3.92	139
August 24	do	107	136	1.00	3.92	136
August 26	do	75	122	.93	3.90	114
August 26	do	75	120	.93	3.90	112
September 12	do	107	139	1.62	4.19	226
October 8	do	137	269	2.26	5.02	618

Daily gage height, in feet, of Animas River near Farmington, N. Mex., for 1905.

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	4.53	4.47	4.92	5.34	7.08	8.29	7.32	6.03	3.84	6.4
2	4.59	4.56	5.2	5.3	7.26	8.8	7.06	5.78	3.81	5.94
3	4.51	4.5	5.2	5.24	6.99	9.29	6.78	5.64	3.76	5.66
4	4.5	4.59	5.37	5.22	6.64	9.4	6.6	5.58	3.82	5.44
5	4 48	4.52	5.43	5.25	6.38	9.75	6.54	5.5	4.26	5.34
6	4.48	4.44	5.56	5.3	6.19	9.72	6.36	5.46	4.47	5.22
7	4.57	4.37	5.66	5.52	6.18	9.55	6.2	5.37	4.38	5.14
8	4.46	4.32	5.66	5.77	6.27	9.7	6.2	5.2	4.34	5.04
9	4.49	4.22	5.36	5.88	6.4	9.6	6.08	5.05	4.3	4.98
10	4.38	4.16	5.3	5.89	6.46	9.3	5.92	4.94	4.22	4.95
11	4.38	4.28	5.3	5.92	6.37	9.12	5.8	4.94	4.18	4.93
12	4.3	4.28	5.26	6.6	6.22	9.02	5.7	5.05	4.16	4.86
13	4.36	4.2	5.22	6.3	6.3	9.0	5.56	5.0	4.18	4.81
14	4.32	4.06	5.28	6.1	6.4	8.91	5.42	4.9	4.11	4.76
15	4.3	4.28	5.48	5.85	6.46	8.88	5.58	4.78	4.16	4.68
16	4.3	4.18	5.32	5.9	6.8	9.04	5.7	4.71	4.14	4.6
17	4.34	4.3	5.28	5.94	7.32	8.68	5.51	4.66	4.07	4.58
18	4.38	4.3	5.36	5.91	7.67	8.52	5.4	4.53	4.0	4.57
19	4.38	4.33	5.54	5.92	7.82	8.49	5.35	4.41	3.96	4.54
20	4.36	4.3	5.52	5.9	7.98	8.36	5.32	4.36	3.96	4.5
21	4.48	4.34	5.46	5.91	8.02	8.14	5.38	4.28	3.94	4.47
22	4.31	4.32	5.36	5.92	7.98	8.0	5.33	4.16	3.94	4.46
23	4.26	4.42	5.3	6.05	8.1	7.84	5.38	4.07	3.93	4.48

Daily gage height, in feet, of Animas River near Farmington, N. Mex., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
24	4.24	4.58	5.2	6.3	8.35	7.9	5.3	3.96	3.92	4.47
25	4.26	4.75	5.16	6.13	8.54	7.84	5.2	3.91	4.04	4.46
26	4.24	4.84	5.23	6.12	8.58	7.72	5.14	3.92	4.55	4.4
27	4.4	4.75	5.33	6.04	8.63	7.72	5.06	4.05	4.4	4.36
28	4.39	4.68	5.4	6.26	8.38	7.7	5.06	4.04	4.38	4.35
29	4.39	.....	5.29	6.49	8.02	7.59	5.09	3.96	4.47	4.34
30	4.36	.....	5.3	6.75	7.56	7.48	6.23	3.91	6.5	4.33
31	4.34	.....	5.3	.....	7.75	.....	6.4	3.88	.....	4.33

Station rating table for Animas River near Farmington, N. Mex., from October 20, 1904, to May 16, 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.*
4.20	125	5.00	450	5.80	1,145	6.60	2,400
4.30	150	5.10	510	5.90	1,265	6.70	2,580
4.40	177	5.20	580	6.00	1,385	6.80	2,760
4.50	208	5.30	655	6.10	1,530	6.90	2,940
4.60	243	5.40	735	6.20	1,700	7.00	3,120
4.70	287	5.50	825	6.30	1,870	7.10	3,300
4.80	337	5.60	925	6.40	2,040	7.20	3,485
4.90	390	5.70	1,030	6.50	2,220	7.30	3,670

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made after October 25, 1904, and is well defined.

Station rating table for Animas River near Farmington, N. Mex., from May 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.*
3.70	65	4.90	570	6.10	1,665	7.60	4,560
3.80	95	5.00	630	6.20	1,800	7.80	5,055
3.90	125	5.10	695	6.30	1,945	8.00	5,575
4.00	155	5.20	765	6.40	2,100	8.20	6,135
4.10	190	5.30	840	6.50	2,265	8.40	6,735
4.20	225	5.40	920	6.60	2,435	8.60	7,370
4.30	265	5.50	1,005	6.70	2,615	8.80	8,025
4.40	310	5.60	1,095	6.80	2,800	9.00	8,700
4.50	355	5.70	1,195	6.90	2,995	9.20	9,380
4.60	405	5.80	1,300	7.00	3,200	9.40	10,060
4.70	455	5.90	1,415	7.20	3,630	9.60	10,740
4.80	510	6.00	1,535	7.40	4,085		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1905. It is well defined between gage heights 3.9 feet and 5.8 feet.

Estimated monthly discharge of Animas River near Farmington, N. Mex., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	239	135	176	10,820
February	358	95	186	10,330
March	988	402	695	42,730
April	2,670	595	1,338	79,620
May	7,468	1,666	3,962	243,600
June	11,250	4,273	7,655	455,500
July	3,901	669	1,448	89,030
August	1,574	119	534	32,830
September	2,265	83	275	16,360
October	2,100	278	576	35,420
The period				1,016,000

LA PLATA RIVER AT HESPERUS, COLO.

This station was established June 14, 1904, in connection with investigations relating to the La Plata project in New Mexico. It is located at the highway bridge on the west side of Hesperus, Colo.

The channel is straight for about 50 feet above and below the station. Both banks are low and covered with brush and scattered trees, but neither is liable to overflow. The bed of the stream is composed of large and small cobblestones, but is not permanent. A small island above the bridge, dead water at low stages, and a tortuous channel below the bridge affect the accuracy of meter measurements at the bridge. The current is swift. The fall of the river, according to levels run by the La Plata Ditch Company for about 10 miles, is 135 feet per mile. Gage heights range from 0.8 foot to 3.5 feet.

Discharge measurements are made by wading at suitable points along the stream at low stages, as the conditions at the bridge are at some stages unfavorable to careful gagings. At high stages measurements are made from the wooden wagon bridge on the west side of Hesperus. The initial point for soundings is a nail driven into the downstream side of the wagon bridge over the south face of the north abutment.

The gage was read twice daily during 1905 by Fred Harrison. The original gage was a 4-foot board graduated from zero to 3.9 feet. This gage was spiked to the upstream end of the south face of the north abutment, with the zero mark resting on the bed of the river. The bench mark is a nail driven horizontally into the west face of a 12-inch cottonwood tree about 8 inches above the ground, about 75 feet northeast of the gage rod, on the right bank of the river; elevation, 9.15 feet above the zero of the gage. On account of the boiling action of the water at this gage, a new staff gage was installed on April 26, 1905. The new gage is graduated from zero to 5.2 feet and is spiked in a vertical position to the south face of the north abutment on the downstream side of the bridge. The datum of the new gage is not the same as that of the old, being 8.09 feet below the above bench mark.

On August 20, 1905, it was found necessary to transfer this gage to the north face of the south abutment downstream side of the bridge where it is now located. Elevation of gage datum same as that last described, viz, 8.09 feet below the bench mark.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pp. 195-196.

Discharge measurements of La Plata River at Hesperus, Colo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 26	M. C. Hinderlider	29	35	2.86	1.20	100
July 4	O. H. Timmerman	29	32	3.94	1.70	126
July 4	do	29	33	3.85	1.70	127
July 15	do	29	19	2.29	1.25	44
July 17	do	29	16	2.60	1.15	42
July 29	do	29	21	2.90	1.31	61
August 5	do	29	19	2.39	1.28	45
August 29	do	23	11	1.51	.95	16
September 4	do	16	28	.96	1.00	27
September 30	do	29	24	2.67	1.70	63
September 30	do	29	21	2.53	1.55	54

NOTE.—Gage heights refer to datum of April 26, 1905.

Daily gage height, in feet, of La Plata River at Hesperus, Colo., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	.....	1.92	2.7	1.9	1.25	0.92	1.32	0.92	1.18
2	.....	1.88	2.85	1.9	1.2	.92	1.22	.9	1.3
3	.....	1.62	2.85	1.75	1.2	.92	1.18	.9	1.1
4	.....	1.5	3.15	1.68	1.18	1.0	1.18	.9	1.0
5	.....	1.3	2.85	1.65	1.18	.92	1.18	.9	1.0
6	.....	1.25	2.8	1.55	1.18	.92	1.18	.9	.95
7	.....	1.22	2.9	1.48	1.15	.92	1.12	.95	.9
8	.....	1.5	3.1	1.45	1.1	.92	1.12	.88	.9
9	.....	1.48	2.9	1.35	1.02	.92	1.1	.85	.85
10	.....	1.32	2.9	1.35	1.02	.92	1.1	.85	.85
11	.....	1.38	2.8	1.3	1.02	.92	1.1	.85	.85
12	.....	1.4	2.85	1.22	1.02	.92	1.1	.9	.85
13	.....	1.4	2.8	1.22	1.0	.92	1.1	.9	.88
14	.....	1.45	2.95	1.22	1.0	.92	1.1	.85	.88
15	.....	1.68	3.3	1.2	1.0	.92	1.1	.85	.85
16	.....	1.9	3.0	1.18	.98	.9	1.1	.85	.85
17	.....	2.0	2.9	1.18	.98	.9	1.05	.85	.82
18	.....	2.18	2.75	1.12	.92	.9	1.0	.9	.8
19	.....	2.45	2.5	1.12	.92	.9	1.0	.8	.8
20	.....	2.15	2.55	1.15	.92	.9	1.0	.8	.8
21	.....	2.25	2.45	1.15	.92	.9	1.0	.85	.8
22	.....	2.6	2.45	1.15	.92	.9	1.0	.9	.75
23	.....	2.35	2.45	1.12	.92	.9	1.0	.92	.75
24	.....	2.45	2.35	1.15	.92	.9	1.0	1.05	.7
25	.....	2.65	2.35	1.1	.92	.9	1.0	1.1	.7
26	1.35	2.85	2.35	1.1	.92	.9	1.0	1.1	.95
27	1.38	2.4	2.25	1.12	.92	.9	.95	1.12	.78
28	1.6	2.3	2.15	1.1	.92	.9	.95	1.15	.5
29	1.65	2.3	2.05	1.32	.92	1.92	.95	1.1	.5
30	1.78	2.4	2.0	1.3	.92	1.55	.92	1.15	.5
31	.....	2.65	.....	1.3	.92	.....	.9	.....	.45

NOTE.—Gage heights refer to datum of April 26, 1905.

LA PLATA RIVER NEAR LA PLATA, N. MEX.

This station was established June 1, 1905, in connection with investigations relating to the La Plata project. It is located on the single-span wooden highway bridge 1 mile southeast of La Plata post-office, N. Mex., in sec. 3, T. 31, R. 13 W., below all points of diversion.

The channel is straight for 50 feet above the bridge, beyond which it bends to the right; below the bridge it is straight for 300 feet. The left bank is well defined but is liable to overflow at high stages. During high water the right bank overflows below the bridge but does not overflow above. Both banks are lined with sagebrush and willows. There is but one channel at all stages. Gage heights range from 1 foot to 4.5 feet. At gage height of 1 foot the river is dry.

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

The gage, which was read twice each day during 1905 by Frank Williams, is a vertical staff graduated from 3 to 10.1 feet, spiked to the northwest corner of the east abutment of the bridge. The 3-foot mark rests on the bed of the stream and the 9.4-foot mark is even with the surface of the bridge floor. The gage is referred to bench marks as follows: (1) The head of a 20-penny spike driven vertically into the top of the second log from the bottom at the northeast corner of Mr. Williams's house; elevation, 21.37 feet above the zero of the gage. (2) A nail driven into the spur root on the south side of a cottonwood tree southeast of house; elevation, 19.47 feet above the zero of the gage.

Discharge measurements of La Plata River near La Plata, N. Mex., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 25	M. C. Hinderlider	36	107	5.22	4.40	599
July 7	O. H. Timmerman				1.10	[a]3
July 10	do					[a].4
July 26	do					[a]2.0

[a] Estimated.

Daily gage height, in feet, of La Plata River near La Plata, N. Mex., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.49	2.32	(a)	(a)	4.11	(a)	1.3
2		3.78	1.84	(a)	(a)	3.86	(a)	1.3
3		3.92	1.46	(a)	(a)	3.62	(a)	1.3
4		4.01	1.09	(a)	(a)	3.08	(a)	1.3
5		4.26	1.14	(a)	(a)	1.74	1.52	1.3
6		3.42	1.09	(a)	(a)	1.14	(a)	1.3
7		4.32	1.09	(a)	(a)	(a)	(a)	1.2
8		4.51	1.14	(a)	(a)	(a)	(a)	1.2
9		3.72	1.14	(a)	(a)	(a)	(a)	1.2
10		3.48	1.09	(a)	(a)	(a)	(a)	1.2
11		3.77	1.09	(a)	(a)	(a)	(a)	1.2
12		3.67	1.09	(a)	(a)	(a)	(a)	1.2
13		4.36	1.09	(a)	(a)	(a)	(a)	1.2
14		3.47	(a)	(a)	(a)	(a)	(a)	1.2
15		3.57	(a)	(a)	(a)	(a)	(a)	1.2
16		3.47	(a)	(a)	(a)	(a)	(a)	1.2

[a] Standing in pools.

Daily gage height, in feet, of La Plata River near La Plata, N. Mex., for 1905—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17		3.37	(a)	(a)	(a)	(a)	(a)	1.2
18		3.27	(a)	(a)	(a)	(a)	(a)	1.2
19		3.22	1.44	(a)	(a)	(a)	(a)	1.2
20		3.07	(a)	(a)	(a)	(a)	(a)	1.2
21		2.98	(a)	(a)	(a)	(a)	(a)	1.2
22		2.83	(a)	(a)	(a)	(a)	(a)	1.2
23		2.79	(a)	(a)	(a)	(a)	(a)	1.2
24		2.6	(a)	(a)	(a)	(a)	(a)	1.2
25	4.33	2.46	(a)	(a)	(a)	(a)	1.20	1.2
26	4.28	2.49	1.84	(a)	(a)	(a)	(a)	1.2
27	3.76	2.42	1.39	(a)	(a)	(a)	1.48	1.2
28	3.77	2.42	1.19	(a)	(a)	(a)	1.32	1.2
29	3.37	2.22	1.09	(a)	4.4	(a)	1.3	1.2
30	3.2	2.22	1.09	(a)	4.36	(a)	1.3	1.2
31	3.28		(a)			(a)		1.2

[a] Standing in pools.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the San Juan basin in 1905:

Miscellaneous discharge measurements made in San Juan River drainage basin in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
July 17	Boyle ditch	Hesperus, Colo	4	3.4	3.59	12.2
September 2	do	do		1.5	1.00	1.5
October 4	do	do				.2
September 18	do	Kline, Colo				.00
July 17	Brown Bros. ditch	Hesperus, Colo				.3
September 18	do	do		1.5	1.00	1.5
August 10	Enterprise ditch	La Plata, Colo				(a)
September 18	Fort Lewis ditch No. 1.	Fort Lewis, Colo		2.0	1.00	[b] 2
Do	Fort Lewis ditch No. 2.	do		1.0	1.00	[b] 1
July 17	Fort Lewis ditch	Hesperus, Colo		.8	1.00	.8
July 18	Freed ditch	Kline, Colo				(a)
September 18	do	do				(a)
Do	Green canal	do				(a)
July 17	H. and H. ditch	Hesperus, Colo	4.7	4.2	1.02	4.3
September 18	do	do		2.0	1.00	[b] 2
July 17	Hay Gulch ditch	do	5	5.8	2.48	14.41
September 2	do	do	4	3.2	1.91	6.1
September 7	do	do	5.6	3.01	5.28	15.92
September 30	do	do	5.6	5.0	4.42	22.1
July 18	Helton ditch	Kline, Colo	4	2.0	1.10	2.2
September 18	do	do				(a)
July 17	Indian ditch	Hesperus, Colo		1.0	.75	.8
July 17	Kellar ditch	do				(a)
April 26	La Plata canal	do				8.8
July 4	do	do	10	9.2	.66	6.1
July 15	do	do	4	2.8	2.29	6.4

[a] Dry.

[b] Estimated.

Miscellaneous discharge measurements made in San Juan River drainage basin in 1905— Continued.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Sec.-ft.*
July 17	La Plata canal	Hesperus, Colo	4	1.6	1.75	2.8
July 29	do	do	4	2.4	2.42	5.8
August 5	do	do	4	1.6	1.06	1.7
September 2	do	do	4	2.4	1.21	2.9
September 4	do	do	4	2.0	1.35	27.1
July 15	La Plata and Cherry Creek ditch.	do	4.8	3.4	5.68	19.93
September 2	do	do		2.0	1.0	[a] 2.0
September 30	do	do				[b]
October 4	do	do				[b]
April 25	Lightner Creek	Durango, Colo				17.7
July 14	do	do				[a] 6.5
July 31	do	do				[a] 6
August 7	do	do				[a] 7
September 9	do	do				[a] 9
September 15	do	do				[a] 7
September 20	do	do				[a] 6
October 1	do	do				[a] 7
October 4	Placer ditch	Hesperus, Colo				[b]
July 15	Parrott ditch	do				[b]
September 16	do	do				[b]
October 4	do	do				[b]
September 30	Parrott City canal	Parrott City, Colo				[b]
September 2	Ramott canal	Hesperus, Colo				[b]
July 18	Revival ditch		2	1.0	1.00	1.00
July 17	Short Line ditch	Hesperus, Colo	4	1.2	.92	1.1
September 18	do	Kline, Colo				[b]
July 17	Slate ditch		8	4.8	2.17	10.4
July 18	Stinebaugh ditch					[b]
September 5	Steinmegger canal	Hesperus, Colo				[b]
July 17	Trainor ditch	Kline, Colo				[a] .5
September 18	do	do				[b]
Do	Ute Indian ditch	Fort Lewis, Colo				[b]
July 18	Warren ditch					[b]

[a] Estimated. [b] Dry.

LITTLE COLORADO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The country drained by the Little Colorado River consists of a high plateau with an elevation over 4,000 feet above sea level, extending from the Continental Divide in northwestern New Mexico westward to the San Francisco Mountains in Arizona, and from the Grand Canyon of the Colorado southward to the Mogollon Mesa. The greater part of this plateau is composed of rolling plains with a few feet of soil at the surface underlain by rock. Through this plateau the river winds northwestward to its junction with the great Colorado.

The run-off from approximately 6,000 square miles of the drainage area finds its way into the Little Colorado above the mouth of Rio Puerco, the largest tributary which joins the main stream 2 miles above the town of Holbrook, Ariz. Both the Little Colorado and the Rio Puerco are flashy streams, seldom clear even during low stages. They have shifting, sandy bottoms, and when not confined in canyons the stream beds are wide with abrupt earth banks. The discharge fluctuates greatly, being insignificant in dry seasons. The floods are short and violent and carry large quantities of silt in suspension.

LITTLE COLORADO RIVER AT WOODRUFF, ARIZ.

This station was established March 16, 1905. It is located about 100 yards below the crossing of the Holbrook-Winslow wagon road and one-fourth mile below the Woodruff dam.

The channel is straight for 300 feet above and 100 feet below the station. The banks are high, with some brush, and neither is liable to overflow. The bed of the stream is composed of sand. The current is swift at high and medium stages of water.

Discharge measurements are made by means of a cable, car, and tag wire. The initial point for soundings is the iron hook on the chain connecting the cable with anchorage on left or west bank of stream.

The gage is observed twice each day by R. L. Newman. The original gage was a combined vertical and inclined rod located on the right or east bank of the stream about 60 feet below the measuring section. This gage was destroyed on May 3, 1905, by high water, caused by the breaking of the St. John and Woodruff dams. It was replaced on May 6, 1905, with a temporary gage, which was used until July 30, 1905, when a permanent gage was installed at the original location. The bench mark is a nail driven into a 6-inch cottonwood tree 23 feet N. 10° W. from east end of gage. The original elevation of this bench mark was 19.40 feet above the zero of the gage. This tree was so bent over by the rush of water on May 3 that the bench mark is about 0.05 foot lower than it was originally. The zero of the gage established July 30, 1905, was set 13.03 feet below the elevation of the bench mark, or approximately 13.07 feet below the original elevation. On July 30, 1905, the water stood at 5.0 feet on the temporary gage set by the observer May 6, and registered 0.8 foot at the same time on the new permanent gage.

Discharge measurements of Little Colorado River at Woodruff, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 22	W. A. Farish	9.25	736	September 27	R. L. Newman	2.1	137
May 1	do	7.4	480	September 28	do	1.4	66
July 31	Newman and Farish.	3.05	459	September 29	do	1.7	178
August 3	R. L. Newman	.8	54	September 30	do	1.3	80
August 4	do	.5	28	October 1	do	1.0	63
August 6	do	.3	18.1	October 3	do	.8	32
August 7	do	.5	30	October 4	do	0.8	30
August 8	do	.8	49	October 6	do	0.7	35
August 9	do	.5	45	October 7	do	0.7	35
August 10	do	.5	53	October 8	do	0.7	22
August 11	do	1.3	201	October 10	do	0.6	15.4
August 13	do	.4	94	October 12	do	0.6	15.1
August 14	do	.5	58	October 13	do	6.6	13.8
August 15	do	.4	77	October 14	do	0.6	11.5
August 16	do	.3	44	October 16	do	0.5	16
August 17	do	.3	46	October 17	do	0.5	14.8
August 18	do	.3	12	October 19	do	0.5	14.8
August 19	do	.1	6.2	October 20	do	0.5	15.1
August 22	do	.0	9.3	October 21	do	0.5	14.7
August 24	do	1.3	132	October 23	do	0.4	12.8
August 25	do	1.1	99	October 24	do	0.4	12.7
August 27	do	3.7	342	October 25	do	0.4	13.4
August 29	do	.5	30	October 26	do	0.4	12.5
August 31	do	.5	17.4	October 27	do	0.4	13.6
September 1	do	.3	13.1	October 28	do	0.4	13.7
September 3	do	.3	17.7	October 30	do	0.4	11.6
September 4	do	.2	11.4	October 31	H. S. Reed	0.4	14.4
September 6	do	6	1,216	October 31	do	0.4	14
September 7	do	1.4	131	November 1	R. L. Newman	6.4	11
September 9	do	1.4	114	November 7	do	1.0	39
September 11	do	.5	33	November 8	do	1.0	38
September 12	do	.5	28	November 9	do	3.35	249
September 13	do	.3	17.8	November 10	do	1.4	52
September 14	do	.3	19	November 11	do	1.1	38
September 16	do	.2	13.7	November 20	do	.7	25
September 20	do	.1	8	November 21	do	1.5	67
September 21	do	.1	8.3	November 22	do	2.0	130
September 23	do	.1	8.7	November 23	do	2.7	172
September 24	do	4.75	880	November 24	do	1.2	46
September 25	do	3.7	657	November 25	do	1.0	33

Daily gage height, in feet, of Little Colorado River at Woodruff, Ariz., for 1905.

Day.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.9	7.5	3.65	2,0	2.4	0.3	1.1	0.4	1.7
2	.....	8.05	6.95	3.6	2.0	1.55	.6	.95	.4	1.55
3	.....	11.2	19.65	3.5	2.0	.8	.25	.8	.4	1.45
4	.....	11.1	11.5	3.45	1.95	.5	.75	.75	4.0	1.3
5	.....	12.4	9.75	3.4	1.9	.3	.75	.7	2.2	1.3
6	.....	12.8	8.75	3.35	1.9	.3	2.5	.7	1.15	1.2
7	.....	12.15	8.0	3.25	1.9	.5	1.7	.7	.9	1.05
8	.....	11.4	7.5	3.85	1.9	.65	1.4	65	1.65	.8
9	.....	10.15	7.0	3.95	2.8	.6	1.35	.6	2.65	.7
10	.....	10.0	6.5	3.75	2.7	.5	.95	.6	1.4	.7
11	.....	8.25	7.25	3.45	2.6	.9	.6	.6	1.1	.7
12	.....	12.3	7.55	3.2	2.5	.55	.5	.6	1.0	.55
13	.....	13.4	5.95	3.2	2.4	.45	.35	.6	1.0	.75
14	.....	9.2	5.4	3.2	2.3	.4	.3	.6	.9	.6
15	.....	8.65	5.35	3.15	2.25	.4	.3	.5	.85	.5
16	7.4	7.4	4.95	3.1	2.0	.3	.2	.5	.8	.5
17	10.3	6.7	4.75	3.05	1.95	.3	.2	.5	.8	.5
18	10.45	6.3	4.6	3.0	1.9	.25	.2	.5	.8	.5
19	9.75	5.9	4.5	3.0	2.1	.1	.1	.5	.75	.5
20	9.45	5.45	4.45	2.5	3.6	.0	.1	.5	.7	.6
21	12.4	5.65	4.4	2.0	2.0	.0	.1	.5	.7	.6
22	8.05	5.25	4.3	2.0	1.95	.0	.1	.5	1.35	.6
23	7.85	5.3	4.35	2.0	2.05	.0	.15	.4	2.3	.55
24	7.35	8.9	4.25	2.0	2.0	.65	3.95	.4	1.25	.5
25	7.35	11.95	4.2	2.0	1.9	1.15	4.55	.4	1.1	.4
26	6.95	18.55	4.1	2.0	2.15	.8	4.0	.4	1.0	.4
27	6,3	13.55	4.1	2.0	2.05	2.85	1.9	.4	21.9	.4
28	6.3	9.9	4.0	2.0	2.1	1.35	1.35	.4	7.75	.4
29	6.4	8.05	4.0	2.0	5.2	0.5	1.6	.4	5.5	.35
30	6.7	7.85	4.0	2.0	7.25	.5	1.4	.4	2.0	.3
31	5.7	.....	3.8	.....	4.75	.5	.....	.4	.....	.3

Daily discharge, in second-feet, of Little Colorado River at Woodruff, Ariz., for 1905.

Day.	Mar.	Apr.	May.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	320	492	317	13	80	12	72
2	.....	560	432	145	32	53	12	65
3	.....	1,028	2,296	54	15	32	12	62
4	.....	1,013	.....	28	47	26	323	56
5	.....	1,208	.....	18	47	22	126	56
6	.....	1,268	.....	18	948	35	42	52
7	.....	1,170	.....	29	190	35	36	47
8	.....	1,058	.....	38	122	18	80	39
9	.....	870	.....	53	80	15	167	36
10	.....	848	.....	53	65	15	52	36
11	.....	589	.....	122	40	15	38	36
12	.....	1,193	.....	93	28	15	36	32
13	.....	1,358	.....	100	20	14	36	37
14	.....	728	.....	49	19	12	32	33
15	.....	646	.....	47	19	15	31	30
16	481	481	.....	44	14	15	29	30
17	893	404	.....	46	14	15	29	30
18	916	362	.....	10	14	15	29	30
19	810	320	.....	6	8	15	26	30
20	766	274	.....	5	8	15	25	33
21	1,208	294	.....	5	8	15	25	33
22	562	254	.....	9	8	15	71	33
23	534	259	.....	9	10	13	135	32
24	475	683	.....	54	684	13	44	30
25	475	1,140	.....	106	868	13	36	28
26	432	2,030	.....	64	848	13	33	28
27	362	1,380	.....	166	234	13	10,000	28
28	362	830	.....	46	118	13	2,960	28
29	372	561	.....	30	155	13	1,735	27
30	404	534	.....	23	92	13	85	25
31	299	.....	.....	17	.....	13	.....	25

NOTE.—Owing to no measurements being made during May, June, and July, no estimates have been made. Discharge obtained by indirect method.

Estimated monthly discharge of Little Colorado River at Woodruff, Ariz., for 1905.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 16–31	1,208	299	584	18,530	0.097	0.058
April	2,030	254	789	46,950	.132	.147
August	317	5	58.2	3,579	.0097	.011
September	948	8	159	9,461	.026	.029
October	80	12	20.1	1,236	.0034	.0039
November	10,000	12	543	32,310	.090	.100
December	72	25	37.4	2,300	.0062	.0072
The period	.....	.....	.....	114,400	.....	.....

LITTLE COLORADO RIVER AT HOLBROOK, ARIZ.

This station was established March 17, 1905. It is located at the county bridge across Little Colorado River at Holbrook, Ariz.

The channel is straight for about 300 feet both above and below the station. A stone jetty along the side of the wagon road forms the right bank; the left bank is clean and does not overflow. The bed of the stream is sand to an average depth of 3 to 5 feet, and is very unstable. The entire flow of the river passes under the bridge; but as the section is wide the current does not always flow at right angles to the bridge.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the face of the bridge abutment on west bank of stream. Soundings are taken at each of the floor beams.

The gage, which was read twice each day during 1905 by Mrs. Anna Connor, is a staff fastened in an upright position to the downstream face of the first pier from the west bank. The gage is referred to bench marks as follows: (1) The corner of the top of the bridge pier to which the gage is fastened; elevation, 11.80 feet above the zero of the gage. (2) The bottom outside edge of the bridge chord; elevation, 12.73 feet above the zero of the gage.

Discharge measurements of Little Colorado River at Holbrook, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
March 20	W. A. Farish	5.9	942	September 18	R. L. Newman	2.9	11
March 21	do	6.6	1,380	September 19	do	2.9	11
March 21	do	6.35	1,139	September 22	do	2.9	12
April 30	do	4.6	923	September 25	do	3.95	500
May 2	do	4.7	568	September 27	do	3.6	174
May 24	E. C. Murphy	3.48	175	September 30	do	4.0	464
July 30	W. A. Farish	4.4	1,215	October 2	do	3.3	96
August 1	R. L. Newman	3.5	176	October 4	do	3.3	87
August 1	do	3.5	170	October 6	do	3.3	79
August 5	do	3.0	58	October 8	do	3.2	29
August 8	do	3.0	43	October 11	do	3.0	15
August 11	do	3.2	55	October 13	do	3.0	22
August 12	do	3.3	174	October 16	do	3.0	27
August 15	do	3.0	33	October 18	do	3.1	25
August 17	do	3.1	95	October 20	do	3.0	20
August 21	do	2.9	64	October 23	do	3.1	25
August 25	do	3.2	60	October 25	do	3.0	18
August 27	do	3.8	714	October 27	do	3.0	20
August 30	do	3.3	116	October 30	H. S. Reed	3.0	11
August 31	do	2.9	47	November 1	R. L. Newman	3.0	11
September 2	do	3.3	81	November 8	do	4.3	624
September 4	do	3.3	59	November 9	do	4.25	412
September 6	do	5.5	3,444	November 13	do	3.3	49
September 8	do	3.6	124	November 18	do	3.1	40
September 10	do	3.5	81	November 22	do	3.7	225
September 11	do	3.2	46	November 24	do	4.0	112
September 13	do	3.1	11	November 29	do	3.9	479
September 15	do	2.9	15				

Daily gage height, in feet, of Little Colorado River at Holbrook, Ariz., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.45	4.78	3.4	3.0	3.5	3.3	3.6	3.1	3.25
2	.....	5.9	4.72	3.35	3.0	3.5	3.45	3.45	3.1	3.5
3	.....	5.9	6.2	3.3	2.9	3.4	3.3	3.3	3.1	3.2
4	.....	6.25	.....	3.2	2.8	3.3	3.1	3.3	4.25	3.2
5	.....	6.8	.....	3.2	2.8	3.15	4.2	3.3	3.9	3.2
6	.....	6.9	.....	3.0	2.8	3.15	4.8	3.3	3.5	3.2
7	.....	6.45	.....	3.0	2.8	2.95	4.15	3.3	3.2	3.2
8	.....	5.85	.....	3.0	2.8	3.3	3.7	3.3	3.7	3.15
9	.....	5.9	.....	3.2	2.8	3.05	3.7	3.3	4.85	3.1
10	.....	5.4	5.8	3.4	2.8	3.2	3.7	3.2	3.6	3.1
11	.....	5.7	5.55	3.3	2.8	3.45	3.4	3.2	3.6	3.15
12	.....	6.45	4.9	3.2	2.8	3.55	3.3	3.2	3.45	3.2
13	.....	6.15	4.25	3.2	2.8	3.2	3.0	3.2	3.4	3.3
14	.....	5.35	4.0	3.2	2.8	3.2	3.0	3.1	3.4	3.4
15	.....	5.3	3.9	3.2	2.8	3.1	3.0	3.1	3.3	3.2
16	.....	4.75	3.85	3.2	3.5	3.25	3.0	3.1	3.3	3.1
17	6.1	4.55	3.8	3.2	3.05	3.15	3.0	3.1	3.2	3.1
18	6.25	4.6	3.8	3.2	3.0	3.0	3.0	3.1	3.2	3.1
19	5.95	4.6	3.7	3.2	3.0	2.9	3.0	3.1	3.1	3.1
20	6.05	4.65	3.7	3.2	4.05	2.9	3.0	3.1	3.1	3.1
21	6.4	4.6	3.95	3.2	3.25	2.9	3.0	3.1	3.1	3.1
22	5.5	4.7	3.9	3.2	2.9	3.0	3.0	3.1	4.55	3.15
23	5.3	4.6	3.65	3.15	3.0	2.9	3.0	3.1	4.25	3.2
24	5.55	6.45	3.4	3.1	3.0	2.9	4.9	3.1	4.0	3.2
25	5.45	6.8	3.4	3.1	3.0	2.9	4.45	3.1	3.7	3.2
26	5.45	7.35	3.4	3.1	3.0	3.75	4.8	3.1	3.5	3.2
27	5.42	5.55	3.4	3.0	3.0	4.1	4.1	3.1	8.55	3.4
28	5.42	5.8	3.4	3.0	2.8	3.5	3.5	3.1	5.75	3.4
29	5.3	4.65	3.4	3.0	3.25	3.5	3.7	3.0	4.05	3.45
30	5.22	4.7	3.4	3.0	4.5	3.5	4.0	3.0	3.80	3.4
31	5.22	.....	3.4	.....	4.05	3.0	.....	3.0	.....	3.4

Daily discharge, in second-feet, of Little Colorado River at Holbrook, Ariz., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	792	578	145	44	170	130	220	30	115
2	.....	940	558	132	44	170	160	140	30	325
3	.....	940	1,055	120	22	145	75	91	30	95
4	.....	1,081	.....	88	5	120	30	87	410	95
5	.....	1,570	.....	88	5	77	280	83	295	95
6	.....	1,665	.....	44	5	77	1,480	79	160	95
7	.....	1,238	.....	44	5	33	545	75	60	95
8	.....	923	.....	44	5	120	175	75	225	70
9	.....	940	.....	88	5	55	175	75	1,620	45
10	.....	776	905	145	5	88	175	39	195	45
11	.....	872	824	120	5	125	85	39	195	70
12	.....	1,238	616	88	5	310	50	39	145	95
13	.....	1,035	408	88	5	100	15	39	130	140
14	.....	760	328	88	5	85	15	29	130	205
15	.....	744	296	88	5	50	15	29	95	95
16	.....	568	280	88	170	115	15	29	95	45

Daily discharge, in second-feet, of Little Colorado River at Holbrook, Ariz., for 1905—Cont'd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	1,015	504	264	88	55	115	15	29	60	45
18	1,081	520	264	88	44	80	15	29	60	45
19	958	520	232	88	44	64	15	29	30	45
20	995	536	232	88	344	64	15	29	30	45
21	1,190	520	312	88	99	64	15	29	30	45
22	808	552	296	88	22	80	15	29	860	70
23	744	520	216	77	44	64	15	29	412	95
24	824	1,238	145	66	44	64	1,760	29	325	95
25	792	1,570	145	66	44	64	875	29	225	95
26	792	2,075	145	66	44	310	1,480	29	160	95
27	782	824	145	44	44	1,200	520	29	20,180	205
28	782	905	145	44	5	430	155	29	7,295	205
29	744	536	145	44	99	340	265	19	1,000	270
30	718	552	145	44	488	215	465	19	260	205
31	718	.....	145	.....	344	60	.....	19	.....	205

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of Little Colorado River at Holbrook, Ariz., for 1905.

[Drainage area, 17,630 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 17–31	1,190	718	863	25,680	0.049	0.027
April	2,075	504	915	54,450	.052	.058
May (25 days)	1,055	145	353	17,500	.020	.019
June	145	44	82.6	4,915	.0047	.0052
July	488	5	67.9	4,175	.0039	.0045
August	1,200	33	163	10,020	.0092	.011
September	1,760	15	302	17,970	.017	.019
October	220	19	50.7	3,117	.0029	.0033
November	20,180	30	1,159	68,960	.066	.074
December	325	45	113	6,948	.0064	.0074
The period	.....	.....	.....	213,700	.....	.....

Summary of observations of evaporation at Holbrook, Ariz., in 1905.

AUGUST.

Day.	Period (in hours) in which measured evaporation has occurred.	Amount of evaporation.	Temperature of water in pan.			Temperature of water outside pan.		
			A. M.	P. M.	Mean.	A. M.	P. M.	Mean.
2	12 hours	0.06	.....	72	.....	.....	72	.....
3	24 hours	.19	66	77	71.5	66	77	71.5
4	.....do	.24	68	77	72.5	69	78	73.5
5	.....do	.26	78	79	78.5	71	79	[a] 75.0
6	.....do	.27	71	80	75.5	71	80	75.5
7	.....do	.29	72	78	75.0	72	79	75.5
8	.....do	.23	74	78	76.0	73	78	75.5
9	.....do	.26	71	72	71.5	70	72	71.0
10	.....do	.29	70	75	72.5	70	75	72.5
11	.....do	.12	68	77	72.5	69	77	[b] 73.0
12	.....do	.24	69	78	73.5	70	78	74.0
13	.....do	.25	69	76	72.5	70	76	73.0
14	.....do	.29	69	77	73.0	69	77	73.0
15	.....do	.24	70	77	73.5	71	77	74.0
16	.....do	.23	70	78	74.0	70	77	73.5
17	.....do	.19	70	78	74.0	71	78	74.5
18	.....do	.26	70	78	74.0	71	77	74.0
19	.....do	.21	69	77	73.0	70	78	74.0
20	.....do	.24	70	76	73.0	70	77	73.5
21	.....do	.23	69	76	72.5	70	77	73.5
22	.....do	.31	70	74	72.0	71	75	[c] 73.0
23	.....do	.10	70	75	72.5	71	75	73.0
24	.....do	.20	70	75	72.5	71	75	[b] 73.0
25	.....do	.09	70	76	73.0	70	75	72.5
26	.....do	.21	71	78	74.5	71	78	74.5
27	.....do	.19	71	71	71.0	71	71	71.0
28	.....do	.22	70	78	74.0	71	77	74.0
29	.....do	.16	71	81	76.0	71	80	75.5
30	.....do	.23	72	76	74.0	72	76	74.0
31	.....do	.30	72	76	74.0	72	76	74.0

[a] Slight wind. [b] Rain. [c] High wind.

Summary of observations of evaporation at Holbrook, Ariz., in 1905—Continued.

SEPTEMBER.

Day.	Period (in hours) in which measured evaporation has occurred.	Amount of evaporation.	Temperature of water in pan.			Temperature of water outside pan.		
			A. M.	P. M.	Mean.	A. M.	P. M.	Mean.
1	24 hours	0.19	69	76	72.5	70	76	73.0
2	do	.24	79	78	78.5	70	78	74.0
3	do	.26	69	71	70.0	69	71	70.0
4	do	.06	69	70	69.5	68	70	69.0
5	do	.09	66	66	66.0	67	66	66.5
6	do	.11	64	70	67.0	65	70	67.5
7	do	.14	64	73	68.5	65	72	68.5
8	do	.18	65	71	68.0	65	71	68.0
9	do	.18	65	73	69.0	65	73	69.0
10	do	.17	64	72	68.0	65	70	67.5
11	do	.16	62	73	67.5	63	72	67.5
12	do	.22	65	71	68.0	65	71	68.0
13	do	.21	65	72	68.5	66	72	69.0
14	do	.21	66	72	69.0	66	72	69.0
15	do	.21	61	73	67.0	61	73	67.0
16	do	.27	65	72	68.5	65	72	[a] 68.5
17	do	.22	63	70	66.5	63	70	[a] 66.5
18	do	.20	65	68	66.5	65	68	66.5
19	do	.20	59	70	64.5	60	70	65.0
20	do	.18	60	69	64.5	61	70	65.5
21	do	.17	60	70	65.0	61	71	66.0
22	do	.16	61	71	66.0	62	71	66.5
23	do	.06	62	62	62.0	62	62	62.0
24	do	.0	61	65	63.0	61	65	63.0
25	do	.0	60	60	60.0	60	60	60.0
26	do	.10	61	61	61.0	62	61	61.5
27	do	.14	65	72	68.5	64	71	67.5
28	do	.09	63	61	62.0	63	61	62.0
29	do	.05	61	59	60.0	63	60	61.5
30	do	.10	55	61	58.0	56	62	59.0

[a] High wind.

Summary of observations of evaporation at Holbrook, Ariz., in 1905—Continued.

OCTOBER.

Day.	Period (in hours) in which measured evaporation has occurred.	Amount of evaporation.	Temperature of water in pan.			Temperature of water outside pan.		
			A. M.	P. M.	Mean.	A. M.	P. M.	Mean.
1	24 hours	0.08	55	67	61.0	56	66	61.0
2	do	.14	56	68	62.0	57	68	62.5
3	do	.12	59	67	63.0	59	67	63.0
4	do	.11	57	69	63.0	57	69	63.0
5	do	.12	59	70	64.5	60	69	64.5
6	do	.11	60	70	65.0	60	70	65.0
7	do	.15	59	73	66.0	61	73	67.0
8	do	.26	61	65	63.0	60	64	[a]62.0
9	do	.16	58	64	61.0	58	64	61.0
10	do	.16	58	65	61.5	58	64	61.0
11	do	.17	58	67	62.5	58	67	62.5
12	do	.08	55	62	58.5	55	60	57.5
13	do	.14	56	58	57.0	56	58	57.0
14	do	.14	55	60	57.5	54	60	57.0
15	do	.18	55	64	59.5	54	64	59.0
16	do	.20	52	57	54.5	51	56	53.5
17	do	.19	50	55	52.5	50	54	52.0
18	do	.18	49	53	51.0	49	54	51.5
19	do	.14	50	56	53.0	49	56	52.5
20	do	.10	42	49	45.5	42	48	45.0
21	do	.08	42	62	52.0	49	59	54.0
22	do	.13	57	64	60.5	56	63	59.5
23	do	.09	52	57	54.5	52	56	54.0
24	do	.11	52	58	55.0	51	57	54.0
25	do	.14	50	59	54.5	51	58	54.5
26	do	.08	51	54	52.5	51	55	53.0
27	do	.10	48	53	50.5	49	52	50.5
28	do	.11	48	52	50.0	50	52	51.0
29	do	.16	49	59	54.0	50	57	53.5
30	do	.17	42	60	51.0	43	59	51.0
31	do	.16	41	56	48.5	42	57	49.5

[a] High wind.

Summary of observations of evaporation at Holbrook, Ariz., in 1905—Continued.

NOVEMBER.

Day.	Period (in hours) in which measured evaporation has occurred.	Amount of evaporation.	Temperature of water in pan.			Temperature of water outside pan.		
			A. M.	P. M.	Mean.	A. M.	P. M.	Mean.
1	24 hours	0.07	42	52	47.0	43	51	47.0
2	do	.00	43	59	51.0	42	57	49.5
3	do	.06	50	54	52.0	50	54	52.0
4	do	.04	51	59	55.0	51	59	55.0
5	do	.0[illegible]	50	54	52.0	50	53	51.5
6	do	.03	52	50	51.0	52	50	51.0
7	do	.07	50	55	52.5	50	55	52.5
8	do		51	47	49.0	51	48	49.5
9	do	.08	47	52	49.5	47	52	49.5
10	do	.07	45	48	46.5	46	48	47.0
11	do	.08	45	50	47.5	45	50	47.5
12	do	.10	47	52	49.5	47	52	49.5
13	do	.04	43	54	48.5	44	54	49.0
14	do	.06	52	51	51.5	52	51	51.5
15	do	.08	43	52	47.5	44	52	48.0
16	do	.06	47	50	48.5	47	50	48.5
17	do	.07	45	51	48.0	46	51	48.5
18	do	.06	40	52	46.0	41	52	46.5
19	do	.06	43	52	47.5	45	50	47.5
20	do	.08	49	50	49.5	49.5	50	49.5
21	do	.05	44	50	47.0	45	50	47.5
22	do	.00	45	48	46.5	45	48	46.5
23	do	.02	45	48	46.5	45	48	46.5
24	do	.07	45	48	46.5	45	48	46.5
25	do	.05	45	49	47.0	45	49	47.0
26	do	.00	50	49	49.5	50	48	49.0
27	do	.00	45	48	46.5	45	48	46.5
28	do	.10	40	49	44.5	42	49	[a] 45.5
29	do	.00	41	49	45.0	41	49	45.0
30	do	.03	40	45	42.5	40	45	42.5

[a] High wind.

Summary of observations of evaporation at Holbrook, Ariz., in 1905—Continued.

DECEMBER.

Day.	Period (in hours) in which measured evaporation has occurred.	Amount of evaporation.	Temperature of water in pan.			Temperature of water outside pan.		
			A. M.	P. M.	Mean.	A. M.	P. M.	Mean.
1	24 hours	0.08	38	48	43.0	41	48	44.5
2	do	.00	38	42	40.0	40	42	41.0
3	do	.05	40	45	42.5	40	42	41.0
4	do	.00	40	45	42.5	40	45	42.5
5	do	.04	40	45	42.5	40	45	42.5
6	do	.00	40	45	42.5	40	45	42.5
7	do	.04	40	48	44.0	40	48	44.0
8	do	.00	40	43	41.5	40	43	41.5
9	do	.00	40	42	41.0	40	42	41.0
10	do	.00	40	41	40.5	40	41	40.5
11	do	.00	35	38	36.5	34	38	36.0
12	do	.00	40	42	41	40	42	41.0
13	do	.00	40	42	41.0	40	42	41.0
14	do	.00	38	41	39.5	34	40	37.0
15	do	.00	40	43	41.5	40	43	41.5
16	do	.00	39	41	40.0	40	41	40.5
17	do	.00	39	40	39.5	40	41	40.5
18	do	.00	37	39	38.0	39	40	39.5
19	do	.00	37	39	38.0	39	40	39.5
20	do	.01	35	40	37.5	37	40	38.5
21	do	.00	35	40	37.5	36	40	38.0
22	do	.00	33	38	35.5	34	39	36.5
23	do	.00	32	34	33.0	32	34	33.0

CHEVLON FORK NEAR WINSLOW, ARIZ.

This station was established December 18, 1905. It is located 4½ miles above the mouth of the river, in sec. 34, T. 18 N., R. 17 E., 19 miles east of Winslow, Ariz.

The channel is straight for 150 feet above and below the station. The current is very swift during high water. At extreme low water the current is rather sluggish, but it has a good velocity at ordinary stage. Both banks are practically vertical cliffs about 33 feet high. A dirt bank extending about 12 feet from the base of the cliff and 3 or 4 feet high has been deposited at the foot of the cliff on the left bank. The bed is of solid rock excepting a small bank of sand on the left bank which is alternately deposited and scoured out.

Discharge measurements are made by means of a cable, car, and tagged and stay wires The initial point for soundings is the face of the eyebolt to which the tagged wire is fastened on the left bank of the stream. A secondary cable has been stretched across the river 100 feet downstream from the tagged wire for use in making float measurements at very high stages.

An automatic water stage register is placed on an overhanging platform 26.5 feet above the bed of the creek. The station is visited and the register reset once each week by R. L. Newman. The distance to the center of the first band from the top of the baseboard upon which the register sets is 5.90 feet; to the center of the second band, from the same point, 9.57 feet. The base of the register baseboard is 27.30 feet above the datum of the gage.

Discharge measurements of Chevlon Fork near Winslow, Ariz., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
November 25	H. S. Reed	5.0	1.36	0.65	1.00	0.88
December 19	do	42.0	104	.32	2.10	33.3

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Little Colorado River drainage basin during 1905:

Miscellaneous discharge measurements made in Little Colorado River drainage basin in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 19	Chevlon Fork	Crossing of Holbrook-Winslow wagon road.	26.7	8.2	1.10	.....	9.1
August 19	do	do	26.7	7.9	1.39	0.5	11.1
August 30	do	do	25.5	13.7	.92	.7	12.6
September 10	do	do	23.6	9.9	.65	.4	6.4
September 19	do	do	26.0	7.0	.65	.5	4.5
September 29	do	do	24.0	12.7	1.34	.7	17.0
October 9	do	do	19.7	9.0	1.03	.5	9.3
October 18	do	do	20.1	9.1	1.16	.5	10.6

VIRGIN RIVER DRAINAGE BASIN.

MUDDY RIVER NEAR MOAPA, NEV.

Muddy River is a branch of the Virgin, one of the more important tributaries of the Colorado. The stream drains a long narrow strip of country in the eastern part of Lincoln County, Nev., flows southward, and joins the Virgin about 25 miles above the point where the latter stream enters the Colorado.

The gaging station was established January 1, 1904. It is located near the crossing of the San Pedro, Los Angeles and Salt Lake Railroad, about 6 miles downstream from Moapa, Nev. The station is above the Narrows and will show the amount of water available for storage at the proposed reservoir site in the Narrows.

The channel is straight for 35 feet above and below the station, and high, brush-covered banks slope up from the vertical sides of the channel. The immediate banks are low, but not liable to overflow. The bed of the stream is composed of sand and is shifting. It is covered with vegetation, which is kept grubbed out near the station. The current has a moderate velocity.

Discharge measurements are made from a footbridge 450 feet downstream from the gage. The initial point for soundings is a nail driven into the downstream side of the bridge at the right bank.

The gage, which was read twice each day during 1905 by J. V. Houghton, is a vertical staff nailed to a post driven into the right bank. The bench mark is the top of a 2-inch post driven into the ground in a willow clump 20 feet from the gage on the right bank; elevation, 9.90 feet above the zero of the gage.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 196–197.

Daily gage height, in feet, of Muddy River near Moapa, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	3.6	2.0	2.0	2.1	1.9	1.9	2.0	1.9	2.2	2.3	2.5
2	2.2	3.6	2.0	2.2	2.0	1.9	1.9	2.0	2.0	2.2	2.4	2.5
3	2.2	3.6	2.0	2.2	2.0	1.9	1.9	2.0	1.9	2.2	2.4	2.6
4	2.2	3.6	2.0	2.2	2.0	1.9	1.9	1.9	1.95	2.2	2.4	2.6
5	2.2	3.6	2.0	2.2	1.9	2.0	1.9	1.9	1.9	2.2	2.4	2.6
6	2.2	3.6	2.0	2.2	1.9	2.0	1.9	1.9	1.9	2.2	2.4	2.7
7	2.2	3.6	2.0	2.2	2.0	2.0	1.9	1.9	1.9	2.0	2.4	2.7
8	2.2	3.6	2.0	2.2	2.0	2.0	1.9	2.0	1.9	2.0	2.4	2.7
9	2.2	3.6	2.0	2.2	2.0	2.0	1.9	2.0	2.0	2.0	2.4	2.7
10	2.2	3.4	2.0	2.3	2.0	2.0	1.9	6.5	1.9	2.0	2.4	2.8
11	2.3	3.4	2.0	3.6	2.0	1.9	1.9	5.8	1.8	2.0	2.4	2.85
12	2.3	3.3	3.0	3.8	2.0	1.9	1.9	2.5	1.8	2.0	2.4	2.8
13	2.3	3.3	3.5	3.4	2.0	1.9	1.9	2.0	1.8	1.0	2.4	2.7
14	2.3	2.7	4.0	3.4	2.0	1.9	1.7	2.0	1.9	1.9	2.5	2.7
15	2.3	2.7	4.2	3.2	2.0	1.9	1.5	2.0	2.0	1.9	2.5	2.7
16	2.3	2.6	4.4	3.2	1.9	1.9	1.2	2.0	2.0	1.9	2.4	2.7
17	2.3	2.5	4.4	2.6	1.9	1.9	3.6	2.0	2.0	1.9	2.4	2.7
18	2.5	2.5	4.2	2.4	1.9	1.9	3.5	2.0	2.0	2.0	2.4	2.7
19	2.5	2.4	4.0	2.2	1.9	1.9	3.4	2.0	2.0	2.15	2.5	2.6
20	2.45	2.3	3.5	2.1	1.9	1.9	3.0	2.0	2.0	2.2	2.5	2.6
21	2.45	2.3	3.5	2.1	1.8	1.9	3.0	1.9	1.9	2.2	2.5	2.6
22	2.45	2.2	3.0	2.1	1.8	1.9	3.0	1.9	1.9	2.2	2.5	2.6
23	2.45	2.2	2.2	2.1	1.8	1.9	2.5	1.9	1.9	2.25	2.5	2.6
24	2.45	2.1	2.2	2.15	1.8	1.9	2.3	1.9	2.0	2.3	2.5	2.6
25	2.45	2.0	2.2	2.1	1.8	1.9	2.3	2.0	2.0	2.3	2.5	2.6
26	2.45	2.0	2.1	2.1	1.8	1.9	2.0	2.0	2.0	2.3	2.5	2.6
27	2.45	2.0	2.0	2.1	1.8	1.9	2.0	2.0	2.0	2.3	2.6	2.7
28	2.45	2.0	2.0	2.1	1.8	1.9	2.0	2.0	2.0	2.3	2.6	2.7
29	2.45	.....	2.0	2.1	1.8	1.9	1.9	1.90	2.6	2.3	2.6	2.7
30	2.45	.....	2.0	2.1	1.8	1.9	1.9	1.90	2.15	2.3	2.5	2.7
31	3.8	.....	2.0	.....	1.8	.....	1.9	1.90	.....	2.3	.....	2.7

GILA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Gila River rises in western and southwestern New Mexico, receiving its waters from mountains having an elevation of from 7,000 to 8,000 feet. At the point where it crosses into Arizona it still has an elevation of 6,000 feet. From this place it flows between mountain ranges, falling rapidly, until at Florence, 180 miles away, it is about 1,500 feet above sea level. At a point about 15 miles above Florence the river emerges upon the plains, through which it winds for about 75 miles before receiving the waters of its principal tributary, the Salt. From the junction of the Salt the Gila continues west and southwest and enters the Colorado at Yuma, Ariz., near the southwestern corner of the Territory.

The principal tributaries are the San Pedro and Santa Cruz rivers from the south, and the San Francisco, Salt, Aqua Fria, and Hassayampa rivers from the north.

San Francisco River rises in the southwestern part of Socorro County, N. Mex., and flows southwestward into Graham County, Ariz., where it unites with the Gila. The basin comprises approximately 1,800 square miles of high, mountainous country.

Salt River, though considered a tributary of the Gila, is in fact larger both in catchment area and in discharge. It receives the drainage from central Arizona, its principal tributary, the Verde, flowing southeasterly and south from the mountains and table-lands south of the Colorado River. The Verde Valley is situated in Yavapai County, Ariz., on the headwaters of the stream, and extends from a canyon above Camp Verde to a point about 10 miles below the fort. About a mile above the junction of the Verde and 30 miles above Phoenix the Salt enters upon the plains of the Gila Valley.

San Pedro River rises in the northern part of the Mexican State of Sonora, flows northward for more than 100 miles, and empties into the Gila a few miles below the town of Dudleyville, 45 miles above Florence, Ariz. Rising in a country of very light snowfall, the river depends for the greater part of its water supply on the frequent showers of the rainy seasons. It flows over a sandy bed between high, steep banks, and during the dry season it shrinks to an insignificant stream of clear water which rises and sinks in the sand with the varying depth of bed rock.

The floods of the upper Gila and its tributaries are usually short and violent, occurring during the months of January and February. The season of low water occurs in June and July.

GILA RIVER NEAR CLIFF, N. MEX.

This station was established September 9, 1904. It is located 9 miles below Cliff postoffice and one-half mile below the mouth of Mangos River. It is 40 miles from Silver City, N. Mex. The station is best reached by stage from Silver City to Gila Store, thence by private conveyance. If the river is in flood, the latter part of the journey must be made on horseback.

The channel is straight for 400 feet above and 300 feet below the station. The banks are about 6 feet high, are clean, and are subject to overflow during extreme high water. The bed of the stream is composed of sand and gravel, is free from vegetation, and is shifting. There is but one channel at all stages. At low water the channel, although straight, cuts across the section at a slight angle; during freshets the channel will be at right angles to the measuring section.

Discharge measurements are made by means of a cable and car. The initial point for soundings is the zero of the tagged wire.

The gage is read twice each day by Mrs. Winnie P. Clark. The original gage was a staff fastened to a large cottonwood tree on the east side of the river. This gage was carried out by heavy freshets in the early part of 1905, but observations of gage heights were continued on a temporary gage until February 17, 1905, when the station was temporarily abandoned. On May 22, 1905, the gage was reestablished and the station put in order, and observations of gage heights were again begun. The bench mark is a point marked "U.S.G.S. B.M." with black paint in a blaze on a sycamore tree N. 84° E. 293 feet from the gage; elevation, 8.55 feet above the zero of the gage.

A description of this station, with gage-height data, is contained in Water-Supply Paper No. 133, United States Geological Survey, page 198.

Discharge measurements of Gila River, near Cliff, N. Mex., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft*
June 14	F. Asplind	3.15	358	September 20	F. Asplind	2.70	70
June 14[a]	do	3.15	337	September 21	do	2.65	61
July 7	do	2.10	85	September 22	do	2.75	80
July 8	do	2.05	73	September 23	do	2.75	82
July 9[a]	do	2.05	82	September 24[a]	do	10.20	5,528
July 9[a]	do	2.05	73	September 25	do	3.85	276
July 24	do	2.50	153	September 25	do	3.65	222
July 25	do	2.38	126	September 26	do	3.65	220
July 26	do	2.25	110	September 27	do	3.55	201
July 26[a]	do	4.05	602	September 28	do	3.65	225
July 27	do	2.65	192	October 26	do	3.10	118
July 27	do	2.58	173	October 27	do	3.10	118
July 27	do	2.45	144	October 28	do	3.10	121
July 28	do	2.60	178	October 29	do	3.10	119
July 28	do	2.40	131	October 30	do	3.10	122
July 29	do	3.30	338	October 31	do	3.10	121
August 18	do	2.90	184	November 1	do	3.10	120
August 19	do	2.72	106	November 2	do	3.15	134
August 20	do	2.70	95	November 4	do	3.35	168
August 21	do	2.70	93	November 5	do	3.35	168
August 22	do	2.80	120	November 21	do	3.25	154
August 23	do	2.65	96	November 22	do	3.98	316
August 24	do	2.65	74	November 23[a]	do	5.85	1,091
August 25	do	2.65	74	November 23	do	6.00	1,210
August 26	do	2.80	121	November 24	do	5.15	714
August 27	do	2.75	111	November 25	do	4.60	485
September 19	do	2.70	71	November 26	do	4.45	427

[a] Float measurement.

Daily gage height, in feet, of Gila River, near Cliff, N. Mex., for 1905.

Day.	Jan.	Feb.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	.95	1.05		3.45	2.18	2.9	2.82	3.85	3.1	6.45
2	.9	1.05		3.42	2.18	2.85	4.4	3.7	3.12	5.98
3	.9	1.67		3.48	2.18	2.8	3.8	3.62	3.12	5.55
4	.9	3.97		3.5	2.18	2.9	3.6	3.52	3.22	5.38
5	.9	4.07		3.5	2.18	3.25	3.9	3.42	3.35	5.15
6	.9	4.02		3.35	2.12	2.9	3.75	3.4	3.35	5.0
7	.9	3.4		3.3	2.1	2.9	3.52	3.3	3.4	4.88
8	.9	2.9		3.37	2.08	3.55	3.5	3.28	4.17	4.75
9	.93	2.72		3.62	2.05	3.1	3.85	3.22	4.12	4.62
10		2.65		3.55	2.05	3.48	3.65	3.2	4.05	4.6
11		2.6		3.35	2.08	3.5	3.5	3.18	3.85	4.6
12		2.5		3.25	2.1	3.4	3.32	3.15	3.72	4.6
13		2.3		3.18	2.18	3.15	3.22	3.15	3.6	4.55
14		2.15		3.12	2.18	3.07	3.2	3.12	3.65	4.5
15		2.12		3.02	2.18	3.02	3.1	3.1	3.5	4.5
16		2.8		2.97	2.15	2.95	2.95	3.1	3.42	4.45
17		6.45		2.9	2.12	2.9	2.9	3.1	3.4	4.4
18				2.85	2.18	2.95	2.82	3.1	3.35	4.4
19				2.78	2.22	2.75	2.72	3.12	3.3	4.7

Daily gage height, in feet, of Gila River, near Cliff, N. Mex., for 1905—Continued.

Day.	Jan.	Feb.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	1.2	.....	.....	2.7	2.28	2.7	2.7	3.1	3.2	4.52
21	1.1	.....	.....	2.65	2.35	2.7	2.68	3.1	3.22	4.48
22	1.1	.....	4.2	2.52	2.3	2.8	2.72	3.1	3.95	4.42
23	1.09	.....	4.05	2.45	2.3	2.67	2.75	3.08	5.8	4.35
24	1.09	.....	4.0	2.38	2.32	2.67	4.88	3.08	5.1	4.22
25	1.1	.....	3.92	2.38	2.32	2.67	3.78	3.1	4.6	4.15
26	1.1	.....	3.85	2.28	3.37	2.85	3.58	3.1	4.42	4.15
27	1.1	.....	3.72	2.28	2.55	2.72	3.55	3.1	11.9	4.15
28	1.1	.....	3.68	2.25	2.6	2.65	3.6	3.1	9.9	4.18
29	1.1	.....	3.62	2.25	3.28	2.65	3.48	3.1	8.25	4.2
30	1.1	.....	3.52	2.22	3.55	2.62	3.9	3.1	7.1	4.2
31	1.1	.....	3.4	.....	2.95	2.7	.....	3.1	.....	4.2

Daily discharge, in second-feet, of Gila River, near Cliff, N. Mex., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	405	93	165	87	268	127	3,190
2	.....	396	93	150	411	235	130	2,387
3	.....	414	93	130	255	219	130	1,570
4	.....	420	93	165	215	219	147	1,247
5	.....	420	93	270	280	183	170	810
6	.....	375	83	165	245	179	170	655
7	.....	360	80	165	199	161	179	532
8	.....	381	77	436	195	158	348	550
9	.....	458	72	250	267	147	335	498
10	.....	436	72	418	225	144	317	490
11	.....	375	77	420	195	141	268	490
12	.....	346	80	385	165	136	239	490
13	.....	326	93	270	147	136	215	470
14	.....	310	93	235	144	130	225	450
15	.....	282	93	215	127	127	195	450
16	.....	268	88	185	105	127	183	430
17	.....	250	83	165	98	127	179	411
18	.....	237	93	185	87	127	170	411
19	.....	218	99	110	73	130	161	530
20	.....	198	110	95	70	127	144	458
21	.....	186	123	95	68	127	147	442
22	648	158	113	130	73	127	292	419
23	598	144	113	85	77	120	985	397
24	582	129	117	85	602	120	715	361
25	556	129	117	85	251	127	490	342
26	532	110	381	150	211	127	419	342
27	490	110	164	100	205	127	13,640	342
28	478	104	178	80	215	127	9,835	349
29	458	104	354	80	192	127	6,700	355
30	426	99	436	65	280	127	4,515	355
31	390	.....	263	95	.....	127	.....	355

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of Gila River, near Cliff, N. Mex., for 1905.

[Drainage area, 2,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
May 22-31	648	390	516	10,230	0.211	0.078
June	458	99	272	16,180	.111	.124
July	436	72	133	8,178	.054	.062
August	436	65	182	11,190	.074	.085
September	602	68	192	11,420	.078	.087
October	268	120	149	9,162	.061	.070
November	13,640	127	1,392	82,830	.568	.634
December	3,190	342	665	40,890	.271	.312
The period				190,100		

GILA RIVER AT SAN CARLOS, ARIZ.

This station was established July 11, 1899, in connection with the investigation of the water supply of the Gila Valley.[a] It is located one-half mile south of the Indian agency at San Carlos and below the mouth of San Carlos Creek.

The channel is straight for some distance above and below the station, and the water is comparatively swift. The right bank is high, but the left is low and liable to overflow. The bed of the stream is sandy and shifting.

Discharge measurements are made from a cable and car a short distance above the gage rod. The gage at this station is read by R. H. Ross. The original gage was an inclined rod securely fastened to posts driven into the left bank. During the heavy floods of January, February, and March, 1905, the cable and gage were washed away, and there are breaks in the gage records for those months. In April and May, 1905, the station was visited by Mr. Gerard H. Matthes, who constructed an approximate gage record covering the period between April 1 and May 14, based on the data available at that time. On May 14 a chain gage was established on the right bank of the river about 500 feet below the new cable. In August, 1905, new cables were placed in position and the station was rebuilt. Owing to the fact that the channel left the chain gage during low water, an inclined gage was placed on the right bank of the stream about 60 feet above the cable for use at low stages. The zero of this gage coincides in elevation with the zero of the chain gage. The bench marks are as follows: (1) Nail in cottonwood tree on edge of bank 50 yards upstream from gage; elevation, 23.38 feet. (2) Nail in cottonwood tree near ditch back of gage; elevation, 20.58 feet. (3) Three nails driven at the same level in three forks of old cottonwood tree on irrigating ditch one-third mile north of gage; elevation, 23.85 feet. Elevations are above the zero of the gage. This station was discontinued December 31, 1905.

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 38, pp 313-314; 50, p 385; 66, p 98; 85, pp 32-33; 100, p 48; 133, p 199.
Discharge: WS 38, p 314; 50, p 386; 66, p 99; 85, p 33; 100, p 50; 133, pp 200-202.
Discharge, mean daily: WS 133, p 203.
Discharge, monthly: Ann 21, iv, p 332; 22, iv, p 397; WS 75, p 179; 85, p 35; 100, p 51; 133, p 204.
Gage heights: WS 38, p 314; 50, p 386; 66, p 99; 85, p 34; 100, p 49; 133, p 202.
Hydrographs: Ann 21, iv, p 332; 22, iv, p 398; WS 75, p 180.
Rating tables: WS 39, p 452; 52, p 520; 85, pp 34-35.

[a] The results of this investigation are set forth in Water-Supply and Irrigation Paper No. 33, entitle "Storage of Water on Gila River, Arizona," by J. B. Lippincott.

Discharge measurements of Gila River at San Calos, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 6	R. H. Ross	1.45	127	October 15	F. Rabinnovitz	11.25	117
June 14	Matthes & Rabinnovitz.	11.12	422	October 17	do	11.20	65
June 25	F. Rabinnovitz	10.80	28	October 26	do	11.05	42
June 30	do	10.50	58	October 28	do	11.00	28
July 14	do	10.82	178	October 30	do	11.05	57
July 31	do	11.44	243	November 2	do	11.15	58
August 5	do	11.15	213	November 4	do	11.10	76
August 11	do	11.57	957	November 6	do	11.45	292
September 17	do	11.50	168	November 10	do	12.45	1,438
September 24	do	11.35	89	November 13	do	11.90	766
September 30	do	12.10	760	November 15	do	11.75	461
October 9	do	11.40	109	November 17	do	11.80	492
October 12	do	11.30	78	November 20	do	11.70	381
October 21	do	11.15	36	November 22	do	12.00	951
October 24	do	11.10	46	November 24	do	13.20	3,237

Daily gage height, in feet, of Gila River, at San Carlos, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.5	1.7	5.6	.....	13.35	11.05	10.5	11.38	11.38	12.05	11.15
2	1.5	1.7	5.3	12.8	13.3	11.05	10.5	11.3	11.22	11.88	11.15
3	1.5	1.7	5.5	13.65	13.3	11.01	10.5	11.16	11.3	11.9	11.12
4	1.5	5.55	5.4	14.4	13.2	11.99	10.5	11.2	11.8	11.82	11.1
5	1.45	4.9	5.35	14.35	13.0	11.01	10.5	11.15	11.8	11.72	11.18
6	1.45	4.9	4.9	13.45	12.85	11.02	10.5	11.12	12.6	11.62	11.48
7	1.45	4.4	4.5	12.8	12.6	11.99	10.5	11.1	12.35	11.52	11.42
8	1.45	3.8	4.8	13.0	12.35	11.07	10.5	11.22	12.17	11.48	11.7
9	1.45	3.42	6.7	12.7	12.3	11.11	10.5	11.78	11.8	11.4	12.78
10	7.0	3.2	5.55	12.75	12.2	11.36	10.5	11.52	11.92	11.35	12.48
11	.....	3.15	5.1	12.9	12.2	11.26	10.55	11.52	11.95	11.35	12.2
12	.....	3.05	4.6	14.7	12.2	11.25	10.38	11.42	11.8	11.32	12.05
13	.....	2.95	4.1	14.9	12.05	11.22	10.62	11.34	11.7	11.3	11.92
14	.....	2.78	5.1	14.65	11.95	11.14	10.88	11.38	11.65	11.28	11.8
15	.....	2.7	5.1	14.15	11.9	11.14	10.7	11.27	11.6	11.22	11.78
16	.....	2.85	4.5	14.1	11.86	11.08	10.68	11.1	11.5	11.2	11.72
17	.....	5.05	8.0	14.3	11.82	11.06	10.6	11.07	11.5	11.2	11.75
18	.....	7.9	.....	14.5	11.81	11.07	10.58	11.02	11.42	11.15	11.7
19	.....	9.0	.....	14.0	11.8	11.05	10.5	11.04	11.35	11.15	11.65
20	.....	4.45	.....	13.9	11.77	11.01	10.48	11.1	11.32	11.15	11.68
21	.....	3.7	.....	13.75	11.69	11.26	10.45	11.04	11.28	11.15	11.65
22	.....	3.35	.....	13.7	11.65	10.72	10.28	11.55	11.25	11.15	12.0
23	.....	3.2	.....	13.7	11.59	10.92	10.18	11.17	11.25	11.12	13.02
24	.....	3.65	.....	14.3	11.57	10.9	10.13	11.56	11.75	11.1	13.2
25	.....	4.95	.....	14.5	11.48	10.84	10.13	[a]11.45	12.08	11.1	13.1
26	.....	3.75	.....	14.85	11.43	10.79	10.1	11.45	12.62	11.05	12.8
27	.....	3.4	.....	14.6	11.35	10.72	10.11	11.35	12.35	11.0	14.88
28	.....	3.3	.....	14.0	11.28	10.66	10.87	11.22	12.15	11.0	.....
29	.....	.....	.....	13.7	11.21	10.62	11.5	11.65	12.0	11.0	.....
30	.....	.....	.....	13.45	11.16	10.55	11.58	11.1	12.08	11.02	.....
31	.....	.....	.....	.....	11.13	.....	11.4	11.1	.....	11.08	.....

[a] Gage washed out. River changed its course. New gage set same level.

GILA RIVER AT DOME (GILA CITY), ARIZ.

This station was established October 15, 1903. It is located 20 miles above the junction of the Gila with the Colorado. The point of gaging first established was one-fourth mile north of the depot at Dome. The river now flows in a channel fully 1 mile north of the original channel.

The Gila carries an enormous amount of mud and sand. At times the waves of sand traveling along the bed of the stream are so large, the current is so swift, and the stream to shallow, that the water is broken into a uniform succession of waves 2 feet high and over. During 1905 there have been ten floods reaching a maximum mean discharge for twenty-four hours, as follows: Two floods of 95,000 second-feet or over; 1 flood of 80,000 second-feet or over; 2 floods of 40,000 second-feet or over; 5 floods of 13,000 second-feet or over. At every flood the channel shifts. The valley at its narrowest is half a mile wide and the waters may occupy any part or all of it. There is no place on the lower part of the Gila where a permanent cable can be erected at a reasonable expense.

Up to about 8,000 second-feet discharge measurements are made by means of a boat and cable above that by means of floats. When the Colorado above the Gila is known to be constant the crest of the flood is measured after it joins the Colorado at Yuma, and an allowance of 5 per cent is made for flattening of the crest between Dome and Yuma.

The gage observer is B. Rinehart. Fourteen gages have been put in by the hydrographer since the establishment of the station, not including temporary rods placed by the observer.

The permanent bench mark is a standard United States Geological Survey iron post at the southwest corner of depot under platform, marked "189 Y"; elevation, 189.60 feet above sea level and 31.97 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: 133, p 204.
Discharge: 133, p 205.
Discharge, monthly: 133, p 206.
Gage heights: 100, p 27; 133, p 205.

Discharge measurements of Gila River at Dome (Gila City), Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 14	W. D. Smith	8.25	3,323	April 14	W. D. Smith	12.60	[b]88,000
January 15	do	9.20	4,287	May 30	do	7.00	[c]2,269
January 15	do	9.90	4,941	June 13	do	5.90	749
January 16	do	12.80	17,300	September 19	do	3.70	33
January 17	do	14.60	[a]23,000	October 5	do	6.00	755
January 24	do	6.10	2,305	October 9	do	4.70	374
February 8	do	16.95	[a]80,000	November 28	do	7.10	2,467
March 20	do	13.10	[a]95,000	November 29	do	14.70	[d]95,000
April 4	do	9.00	[b]6,552				

[a] Estimated from gaging at Yuma, Ariz.
[b] Float measurement.
[c] Measurement made 4 miles above Yuma, Ariz.
[d] Estimated from the discharge of the Colorado River at Yuma and from gage observations at Dome Picacho, and Laguna.

Daily gage height, in feet, of Gila River at Dome (Gila City), Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
1	.....	3.1	8.05	8.5	9.1	6.7	.....	.....	.....	.....	.....
2	.....	2.75	10.65	8.5	8.8	6.5	4.4	.....	.....	.....	.....
3	.....	2.45	11.55	8.3	8.9	6.0	.....	.....	6.6	.....	.....
4	.....	2.3	9.5	8.6	8.7	.....	4.2	.....	6.4	.....	.....
5	.....	3.55	8.0	8.9	8.3	.....	.....	.....	6.0	.....	8.2
6	.....	7.0	7.3	9.6	8.4	.....	4.0	.....	5.6	.....	8.0
7	.....	14.0	6.15	9.8	8.3	.....	.....	.....	5.0	.....	7.7
8	.....	16.95	5.4	9.0	8.0	.....	3.9	.....	.....	.....	7.6
9	.....	15.45	5.2	8.8	8.0	.....	.....	.....	4.7	.....	7.5
10	3.0	13.1	5.0	8.9	8.0	.....	3.8	.....	.....	.....	7.7
11	7.0	10.75	8.0	9.0	7.7	.....	.....	.....	4.3	.....	7.5
12	7.5	7.25	9.2	8.9	8.2	.....	3.7	.....	.....	.....	7.4
13	7.8	4.25	7.6	10.7	8.0	5.9	.....	4.8	4.0	.....	.....
14	7.95	6.75	7.5	12.6	7.8	5.9	3.7	4.6	.....	4.5	7.4
15	9.45	5.0	9.25	11.55	7.9	.....	.....	4.4	3.7	5.0	.....
16	13.7	4.0	11.8	10.8	8.0	6.0	3.6	.....	.....	5.0	7.5
17	14.6	4.55	10.5	10.0	8.0	.....	.....	3.8	3.6	.....	.....
18	12.0	4.8	11.15	9.35	7.9	5.9	3.6	.....	.....	4.5	7.6
19	10.1	10.95	12.55	8.85	7.6	.....	.....	3.7	3.5	.....	.....
20	8.7	11.95	13.1	8.35	7.8	5.7	3.5	.....	.....	4.2	7.6
21	8.05	12.05	11.0	8.05	7.6	.....	.....	3.6	.....	.....	.....
22	7.45	11.85	10.5	8.4	7.7	5.4	3.5	3.5	.....	4.1	7.6
23	6.65	5.7	10.3	8.85	7.8	.....	.....	3.5	.....	.....	7.7
24	6.1	5.0	10.1	8.75	7.6	5.1	.....	.....	.....	4.1	7.7
25	5.75	6.0	9.9	9.05	7.5	.....	.....	.....	.....	.....	.....
26	5.45	9.05	9.7	9.65	7.5	4.9	.....	.....	.....	4.1	7.8
27	5.25	8.05	9.5	9.55	7.5	.....	.....	.....	.....	.....	.....
28	4.95	8.1	9.3	9.7	7.4	4.7	.....	.....	.....	6.1	7.5
29	4.6	.....	9.1	9.65	7.2	.....	.....	.....	.....	14.7	.....
30	4.1	.....	8.9	9.4	7.0	4.5	.....	.....	.....	12.6	7.4
31	3.6	.....	8.7	.....	6.9	.....	.....	.....	.....	.....	7.4

NOTE.—No gage record June 4 to 12. No flow during August.

Daily discharge, in second-feet, of Gila River at Dome (Gila City), Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
1	.....	80	5,150	6,800	9,500	1,850	280	.....	.....	.....	30,700
2	.....	.....	21,500	6,800	8,100	1,550	270	.....	.....	.....	24,400
3	.....	.....	34,000	6,000	8,500	900	240	.....	940	.....	18,200
4	.....	.....	11,800	7,300	7,700	880	210	.....	870	.....	11,900
5	.....	280	5,000	8,500	6,000	860	180	.....	750	.....	5,700
6	.....	2,220	3,050	12,400	6,400	840	150	.....	630	.....	5,000
7	.....	20,800	1,050	13,800	6,000	830	140	.....	450	.....	4,100
8	.....	82,000	450	9,000	5,000	810	120	.....	400	.....	3,800
9	.....	35,800	370	8,100	5,000	790	100	.....	360	.....	3,600
10	40	14,900	300	8,500	5,000	770	90	.....	300	.....	4,100
11	2,220	6,900	5,000	9,000	4,100	750	80	.....	240	.....	3,600
12	2,600	2,920	10,000	8,500	5,600	730	60	.....	200	.....	3,300
13	2,840	60	3,800	22,000	5,000	720	60	390	150	.....	3,300
14	2,960	1,920	3,500	64,000	4,400	720	60	330	100	390	3,300
15	4,680	300	10,300	34,000	4,700	740	40	270	60	450	3,400
16	18,600	.....	39,000	23,000	5,000	750	30	180	40	450	3,600

Daily discharge, in second-feet, of Gila River at Dome (Gila City), Ariz., for 1905—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
17	26,000	140	20,000	15,300	5,000	740	30	90	30	380	3,700
18	10,200	230	27,800	10,900	4,700	720	30	80	20	300	3,800
19	5,650	24,800	62,000	8,300	3,800	690	20	60	.....	260	3,800
20	3,690	42,800	95,000	6,200	4,400	660	.....	40	.....	210	3,800
21	3,060	45,200	25,500	5,150	3,800	620	.....	30	.....	200	3,800
22	2,560	40,200	20,000	6,400	4,100	570	.....	20	.....	180	3,800
23	1,990	630	18,000	8,300	4,400	520	.....	.....	.....	180	4,100
24	1,660	300	16,100	7,900	3,800	480	.....	.....	.....	180	4,100
25	1,460	900	14,500	9,250	3,500	450	.....	.....	.....	180	4,200
26	1,290	9,250	13,100	12,750	3,500	420	.....	.....	.....	180	4,400
27	1,180	5,150	11,800	12,100	3,500	390	.....	.....	.....	480	4,000
28	1,020	5,300	10,600	13,100	3,300	360	.....	.....	.....	780	3,600
29	830	.....	9,500	12,750	2,800	330	.....	.....	.....	95,000	3,400
30	560	.....	8,500	11,200	2,350	300	.....	.....	.....	36,900	3,300
31	310	.....	7,700	.....	2,150	.....	.....	.....	.....	.....	3,300

NOTE.—Daily discharge obtained from several rating tables, each covering a short period of time. Discharge estimated for missing gage heights. No flow during August.

Estimated monthly discharge of Gila River at Dome (Gila City), Ariz., for 1905.

[Drainage area, 71,050 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	26,000	0	3,077	189,200	0.043	0.050
February	82,000	0	12,250	680,300	.172	.179
March	95,600	300	16,590	1,020,000	.233	.269
April	64,000	5,150	12,910	768,200	.182	.203
May	9,500	2,150	4,874	299,700	.069	.080
June	1,850	300	725	43,140	.010	.011
July	280	0	70.6	4,341	.00099	.0011
August	0	0	0	0	.0	.0
September	390	0	49.7	2,957	.00070	.00078
October	940	0	179	11,010	.0025	.0029
November	95,000	0	4,557	271,200	.064	.071
December	30,700	3,300	6,100	375,100	.086	.099
The year	95,000	0	5,115	3,665,000	.072	.967

SAN FRANCISCO RIVER AT ALMA, N. MEX.

This station was established October 18, 1904. It is located about one-half mile south of Alma, N. Mex., and 85 miles northwest of Silver City. It is best reached by stage from Silver City, which makes the trip daily except Sundays.

The channel is straight for about 500 feet above and below the station. The banks are about 4 feet high, are clean, and are subject to overflow during extreme high water. The bed of the stream is composed of gravel, is free from vegetation, and is firm and regular. The current is swift.

Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the zero of the tagged wire. The cable was carried away by

a heavy flood on March 16, 1905, but was recovered and restored at a point about 600 feet higher upstream on March 24. Measurements prior to March 16 were taken at the lower section; since then the upper section has been used.

The gage, which is read twice each day by Mrs. Ella D. Hollimon, consists of a staff fastened to the east or left bank of the stream. The gage was washed out by the flood of March 16, 1905, but was immediately replaced in its old position. The bench mark is a 20-penny nail driven into a blaze in a cottonwood tree 118.5 feet N. 73° E. from the gage; it is marked "U. S. G. S. B. M."; elevation above the zero of the gage, 9.06 feet.

A description of this station with gage height and discharge data is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 206–208.

Discharge measurements of San Francisco River at Alma, N. Mex., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
February 8	Frank Asplind	4.50	[a]362	May 30	Frank Asplind	2.25	63
February 10	do	3.70	[a]172	May 30	do	2.25	[a]60
February 14	do	3.90	[a]209	May 31	do	2.2	54
February 27	do	4.30	[a]294	June 3	do	2.15	43
March 4	do	5.20	[a]1,463	June 4	do	2.15	[a]45
March 11	do	3.80	[a]767	June 6	do	2.10	35
March 13	do	3.20	[a]385	June 7	do	2.10	[a]32
March 14	do	4.4	[a]1,098	June 16	do	2.05	24
March 15	do	4.6	[a]1,207	June 17	do	2.05	[a]22
March 16	do	4.0	[a]925	June 19	do	2.00	22
March 25	do	4.1	[a]1,068	June 20	do	2.00	[a]21
March 27	do	4.2	[a]1,065	June 21	do	1.95	16.8
April 3	do	5.70	[a]2,835	June 23	do	1.90	12.4
April 4	do	4.30	[a]1,634	June 24	do	1.85	9.1
April 6	do	5.40	[a]2,517	June 26	do	1.80	5.8
April 7	do	5.00	[a]2,115	June 29	do	1.75	4.0
April 11	do	4.20	[a]1,336	July 15	do	1.95	15.5
April 12	do	4.70	[a]1,719	July 15	do	2.00	21
April 14	do	4.50	[a]1,546	July 18	do	1.90	12.5
April 18	do	3.90	933	July 20	do	2.15	40
April 19	do	3.80	806	July 21	do	2.20	52
April 22	do	3.55	502	August 1	do	2.15	33
April 24	do	4.50	1,478	August 2	do	2.15	29
April 26	do	4.05	1,128	August 3	do	2.10	23
April 27	do	3.90	970	August 4	do	2.18	33
April 29	do	3.75	828	August 5	do	2.20	40
May 2	do	3.55	629	August 8	do	2.50	104
May 4	do	3.30	479	August 9	do	2.20	39
May 6	do	3.00	[a]359	August 10	do	2.20	40
May 9	do	3.00	333	August 11	do	2.22	46
May 12	do	2.90	289	August 11	do	2.45	79
May 12	do	2.90	[a]251	August 12	do	2.30	54
May 14	do	2.85	261	August 14	do	2.15	27
May 14	do	2.85	[a]238	August 15	do	2.10	19.2
May 16	do	2.80	234	August 16	do	2.05	16.7
May 16	do	2.80	[a]211	August 30	do	2.15	10.9
May 25	do	2.4	95	August 31	do	2.30	31
May 26	do	2.4	[a]95	September 2	do	2.20	16.1
May 27	do	2.35	83	September 3	do	3.55	[a]741
May 28	do	2.30	72	September 4	do	2.40	65
May 28	do	2.30	[a]70	September 4	do	4.30	[a]1,218

[a]Float measurement.

Discharge measurements of San Francisco River at Alma, N. Mex., in 1905—Continued.

Date	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
September 5	Frank Asplind	2.82	248	October 24	Frank Asplind	2.40	68
September 6	do	3.25	455	November 7	do	2.40	59
September 7	do	2.32	80	November 8	do	3.20	220
September 8	do	2.25	58	November 9	do	2.72	99
September 9	do	2.30	71	November 10	do	2.52	68
September 11	do	2.20	49	November 11	do	2.40	51
September 12	do	2.15	39	November 13	do	2.45	61
September 13	do	2.10	30	November 15	do	2.40	54
September 14	do	2.10	28	November 17	do	2.40	55
September 16	do	2.10	28	November 18	do	2.40	55
October 2	do	2.30	[a] 58	December 6	do	2.25	167
October 3	do	2.25	[a] 46	December 7	do	1.95	107
October 4	do	2.20	37	December 9	do	1.75	72
October 5	do	2.20	37	December 11	do	1.75	68
October 6	do	2.20	36	December 12	do	1.70	60
October 7	do	2.20	36	December 13	do	1.70	59
October 9	do	2.20	37	December 14	do	1.65	50
October 10	do	2.20	36	December 15	do	1.60	42
October 11	do	2.20	34	December 16	do	1.62	46
October 12	do	2.20	36	December 18	do	1.60	42
October 13	do	2.20	36	December 19	do	1.60	43
October 14	do	2.20	35	December 20	do	1.60	42
October 16	do	2.20	35	December 22	do	1.60	43
October 18	do	2.20	34	December 23	do	1.50	34
October 19	do	2.20	36	December 26	do	1.45	30
October 20	do	2.20	35	December 28	do	1.50	33
October 21	do	2.20	33	December 29	do	1.45	28
October 23	do	2.40	68	December 30	do	1.45	27

[a] Float measurement.

Daily gage height, in feet, of San Francisco River at Alma, N. Mex., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	2.2	5.85	3.6	3.52	2.2	1.8	2.35	2.3	2.5	2.3	.....
2	1.2	2.8	5.5	4.15	3.5	2.18	1.8	2.1	2.2	2.48	2.5	.....
3	1.2	2.45	5.55	5.0	3.4	2.1	1.8	2.05	2.2	2.35	2.5	2.42
4	1.2	5.0	5.55	4.4	3.4	2.1	1.78	2.05	2.5	2.3	2.6	2.42
5	1.2	5.0	5.6	4.9	3.3	2.0	1.75	2.1	2.5	2.3	2.9	2.32
6	1.2	5.15	4.7	4.85	3.15	2.0	1.78	2.15	2.4	2.2	3.8	2.25
7	1.2	4.8	5.0	4.75	3.1	2.0	1.8	2.05	2.3	2.2	3.6	2.1
8	1.2	4.5	5.42	4.6	3.1	2.2	1.8	3.25	2.3	2.2	3.8	1.85
9	1.75	4.25	4.35	4.25	3.1	2.18	1.8	2.35	2.3	2.2	3.0	1.8
10	5.85	3.7	3.75	4.25	3.0	2.1	1.8	2.2	2.25	2.15	2.52	1.72
11	3.4	3.2	3.6	4.2	3.0	2.1	1.8	2.5	2.22	2.15	2.5	1.7
12	2.65	3.5	3.4	4.45	2.95	2.1	1.8	2.35	2.22	2.2	2.42	1.68
13	2.4	3.7	3.2	4.95	2.9	2.0	1.8	2.3	2.15	2.2	2.4	1.68
14	2.35	3.9	4.35	4.42	2.82	2.0	1.8	2.2	2.12	2.2	2.4	1.68
15	2.3	3.65	4.3	4.2	2.8	2.0	1.9	2.2	2.1	2.2	2.4	1.62
16	2.3	3.85	4.0	3.95	2.8	2.0	1.9	2.18	1.98	2.2	2.4	1.62
17	2.3	6.3	5.9	3.85	2.77	2.0	2.0	2.12	2.0	2.2	2.4	1.58
18	2.3	6.4	5.1	3.85	2.75	1.92	1.9	2.1	2.0	2.2	2.4	1.52

Daily gage height, in feet, of San Francisco River at Alma, N. Mex., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	2.3	3.75	4.7	3.8	2.75	1.95	1.9	2.1	2.0	2.2	2.35	1.52
20	2.22	3.8	5.2	3.7	2.7	1.9	2.1	2.0	2.0	2.2	2.35	1.52
21	2.22	3.0	4.6	3.6	2.7	1.9	2.1	2.85	2.1	2.2	2.52	1.62
22	2.21	2.9	4.5	3.52	2.7	1.9	2.1	2.8	2.2	2.2	3.85	1.65
23	2.21	4.35	4.5	4.55	2.55	1.9	2.15	2.35	3.2	2.2	3.62	1.62
24	2.2	3.22	4.3	4.7	2.5	1.9	2.0	2.1	4.65	2.4	3.3	1.62
25	2.15	3.95	4.1	4.4	2.45	1.88	2.0	2.05	3.5	2.38	2.7	1.52
26	2.1	3.75	4.1	4.0	2.42	1.82	2.0	2.1	3.2	2.3	2.62	1.42
27	2.1	4.4	4.0	3.9	2.37	1.8	2.0	2.1	3.2	2.3	.....	1.42
28	2.1	6.05	3.85	4.0	2.3	1.8	2.0	2.15	3.12	2.3	.....	1.42
29	2.2	.....	3.75	3.7	2.27	1.8	2.75	2.3	2.8	2.3	.....	1.38
30	2.35	.....	3.5	3.5	2.25	1.8	2.25	3.05	2.6	2.3	.....	1.38
31	2.5	.....	3.55	.....	2.22	.....	2.35	2.85	.....	2.3	.....	1.38

Daily discharge, in second-feet, of San Francisco River at Alma, N. Mex., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10	190	3,410	681	618	52	6	72	27	115	45	.....
2	10	570	2,360	1,155	602	48	6	24	16	100	85	.....
3	10	287	2,510	2,048	548	32	6	18	75	65	85	215
4	10	910	2,510	1,380	548	32	5	21	90	55	115	215
5	10	910	2,660	1,932	494	20	4	26	120	55	210	185
6	10	1,310	460	1,874	413	20	5	32	85	36	755	162
7	10	560	910	1,758	386	20	6	20	74	36	575	120
8	10	370	2,120	1,590	386	52	6	425	74	36	550	74
9	80	295	325	1,245	386	48	6	72	74	36	190	67
10	3,162	170	180	1,245	332	32	6	40	63	25	75	56
11	1,080	110	155	1,200	332	32	6	110	36	25	70	53
12	357	140	130	1,430	306	32	6	63	56	36	60	51
13	260	170	110	1,990	280	20	6	50	42	36	55	51
14	240	210	325	1,400	240	20	6	33	36	36	55	51
15	220	163	310	1,200	230	20	12	30	32	36	55	44
16	220	200	230	975	230	20	12	30	18	36	55	44
17	220	4,760	3,092	885	215	20	20	23	17	36	55	40
18	220	5,060	2,164	885	205	14	12	19	17	36	55	35
19	220	180	1,700	840	205	16	12	16	17	36	45	35
20	196	190	2,280	760	180	12	32	9	17	36	45	35
21	196	90	1,590	681	180	12	32	75	25	36	85	44
22	193	80	1,480	618	180	12	32	55	40	36	750	48
23	193	325	1,480	1,535	135	12	42	42	415	36	585	44
24	190	112	1,290	1,700	120	12	20	12	1,575	68	405	44
25	175	220	1,110	1,380	107	11	20	8	565	60	125	35
26	160	180	1,110	1,020	99	8	20	11	405	45	110	27
27	160	340	1,020	930	88	6	20	9	405	45	.....	27
28	160	4,010	885	1,020	74	6	20	11	365	45	.....	27
29	190	.....	800	760	88	6	205	23	195	45	.....	25
30	240	.....	602	602	64	6	63	220	125	45	.....	25
31	315	.....	642	.....	58	.....	85	160	.....	45	.....	25

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of San Francisco River at Alma, N. Mex., for 1905.

[Drainage area, 1,800 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	3,162	10	282	17,340	0.157	0.181
February	5,060	80	790	43,870	.439	.457
March	3,410	110	1,289	79,260	.716	.826
April	2,048	602	1,224	72,830	.680	.759
May	618	58	269	16,540	.149	.172
June	52	6	21.8	1,297	.012	.013
July	205	4	23.8	1,463	.013	.015
August	425	8	56.7	3,486	.032	.037
September	1,575	16	170	10,120	.094	.105
October	115	25	45.6	2,804	.025	.029
November 1–26	755	45	204	10,520	.113	.109
December 3–31	215	25	65.7	3,779	.036	.039
The period				263,300		

SAN PEDRO RIVER AT CHARLESTON, ARIZ.

This station was established January 22, 1904. It is located about one-half mile west of Charleston station on the El Paso and Southwestern Railroad and 6 miles south of Fairbank, Ariz.

The channel is straight for about 800 feet above and 500 feet below the station. Both banks are nearly vertical for 20 feet, are clean, and are not subject to overflow. The bed of the stream is composed of sand and is shifting. At high water there is but one channel, but at low water the channel is divided by sand bars. The current is swift.

Discharge measurements are made at high water by a cable and car 10 feet below the gage. The initial point for soundings is 21 feet from the cable support on the east bank. Low-water measurements are made by wading.

The gage is read twice each day by H. R. Fry. The original gage was read until March 28, 1904, when a second gage was established 200 feet upstream from the first. The second gage, which was read from March 29 to July 30, 1904, is in two sections: The upper section is attached vertically to a cottonwood tree on the left bank; the upper end of the lower section, which is inclined, is fastened to the same tree and the lower end is set in the bed of the stream. In July and August, 1904, floods changed the channel to such an extent that a third gage became necessary. This was established August 15, 1904, on the east bank, directly opposite the old or second gage, and consists of a vertical rod fastened to a dead-man in the bank at the same datum as the old gage. Readings have since been made from the third gage. The bench marks are as follows: (1) A United States Geological Survey standard iron bench-mark post near a post on the east side of the El Paso and Southwestern Railroad station at Charleston; elevation, 57.265 feet above the zero of the gage and 3,957.265 feet above mean sea level. (2) A spike in the west side of the root of a tree on the west bank of the river, 100 feet above the gage; elevation, 35.860 feet above the zero of the gage and 3,935.860 feet above mean sea level.

A description of this station, with gage-height and discharge data, is contained in Water-Supply Paper No. 133, United States Geological Survey, pages 208–211.

Discharge measurements of San Pedro River at Charleston, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft*
January 4	H. R. Fry	26.05	24	June 28	H. R. Fry	26.30	17
January 11	do	26.90	124	July 5	do	26.15	12
January 18	do	26.80	35	July 12	do	27.30	122
January 25	do	26.70	31	July 19	do	26.25	14
February 1	do	26.40	23	July 29	do	26.50	61
February 9	do	27.25	120	August 7	do	.....	38
February 15	do	26.60	36	August 12	do	26.00	46
February 21	do	27.35	147	August 17	do	26.05	82
March 1	do	27.10	111	August 26	do	26.80	133
March 22	do	26.85	81	September 7	do	26.30	80
March 30	do	26.80	99	September 15	do	25.60	37
April 5	do	26.30	71	September 21	do	25.70	38
April 12	do	26.20	50	September 28	do	26.10	62
April 19	do	26.30	79	October 4	W. Rayling	25.60	28
April 26	do	26.00	37	October 11	do	25.50	34
May 3	do	26.15	51	October 18	do	25.60	31
May 10	do	25.95	31	October 25	do	25.50	27
May 17	do	25.85	25	November 1	do	25.50	23
May 24	do	25.85	22	November 8	do	25.40	24
May 24	do	25.85	20	November 15	do	25.70	42
May 31	do	25.82	18	November 22	do	25.80	54
June 7	do	25.80	18	December 6	do	.....	98
June 14	do	26.65	52	December 13	do	.....	102
June 21	do	26.35	20	December 20	do	25.50	61
June 28	do	26.30	20	December 27	do	25.40	54

NOTE.—Gage washed away by flood on November 28.

Daily gage height, in feet, of San Pedro River at Charleston, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	26.15	26.4	27.1	26.65	26.35	25.82	26.25	.....	25.65	25.8	25.5	.....
2	26.1	26.4	28.02	26.57	26.25	25.82	26.25	.....	26.85	25.8	25.5	.....
3	26.1	26.4	27.52	26.45	26.15	25.82	26.25	.....	27.6	25.7	25.5	.....
4	26.05	26.5	27.7	26.3	26.15	25.82	26.22	.....	27.75	25.6	25.5	.....
5	26.05	27.1	27.8	26.27	26.05	25.78	26.15	.....	28.25	25.5	25.5	.....
6	26.05	26.62	27.45	26.22	26.05	25.8	26.18	.....	26.5	25.5	25.5	.....
7	26.1	27.9	27.75	26.17	26.05	25.8	26.18	.....	26.35	25.35	25.35	.....
8	26.1	27.6	28.85	26.1	25.92	25.85	26.18	.....	26.45	25.5	27.2	.....
9	26.1	27.2	27.85	26.1	25.92	26.00	26.22	27.5	26.0	25.5	27.55	.....
10	26.65	26.87	28.5	26.1	25.95	27.65	26.22	26.9	25.95	25.5	26.75	.....
11	26.9	26.85	27.35	26.1	25.9	27.15	26.48	26.8	25.55	25.5	26.7	.....
12	26.9	26.8	27.87	26.2	25.9	26.85	27.28	26.0	25.55	27.0	25.9	.....
13	26.85	26.7	27.1	26.47	25.87	26.68	27.32	26.35	25.55	27.0	25.8	.....
14	26.9	26.65	27.06	27.3	25.85	26.6	26.62	27.0	25.55	26.45	25.7	.....
15	26.9	26.6	27.1	26.9	25.85	26.6	26.45	26.05	25.9	26.2	25.7	.....
16	26.95	26.6	26.9	26.5	25.82	26.52	26.35	26.85	26.3	26.0	25.7	.....
17	26.85	26.65	30.85	26.3	25.82	26.5	26.32	27.92	26.4	25.8	25.7	25.5
18	26.85	26.85	28.25	26.3	25.82	26.42	26.25	26.1	26.35	25.6	25.6	25.5
19	26.8	27.65	27.6	26.27	25.82	26.42	26.25	27.75	25.9	25.6	25.6	25.5
20	26.8	27.8	27.23	26.2	25.8	26.35	26.2	28.15	25.7	25.6	25.6	25.5
21	26.8	27.27	26.95	26.15	25.83	26.35	26.22	29.1	26.2	25.6	25.6	25.6

Daily gage height, in feet, of San Pedro River at Charleston, Ariz., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	26.8	27.12	26.85	26.2	25.83	26.3	26.22	27.85	26.25	25.5	26.0	25.5
23	26.8	26.9	26.9	26.17	25.83	26.3	26.18	27.15	25.8	25.5	25.8	25.4
24	26.75	26.82	26.9	26.15	25.83	26.28	26.18	26.45	25.9	25.5	26.1	25.4
25	26.65	26.6	26.85	26.0	25.83	26.28	28.1	27.15	27.8	25.5	25.8	25.4
26	26.55	26.75	26.6	26.97	25.83	26.25	28.45	26.8	27.25	25.5	25.8	25.4
27	26.5	26.6	26.42	25.95	25.83	26.25	28.32	26.6	26.4	25.5	29.15	25.4
28	26.45	26.65	26.32	25.95	25.82	26.3	26.95	26.1	26.15	25.5	29.3	25.4
29	26.45	.....	26.3	26.2	25.82	26.25	26.5	25.85	26.1	25.5	.....	25.4
30	26.45	.....	26.82	26.41	25.82	26.28	26.5	25.75	25.9	25.5	.....	25.4
31	26.4	.....	26.75	.....	25.82	.....	26.3	25.85	.....	25.5	.....	25.4

NOTE.—Gage washed out by flood November 28.

Daily discharge, in second-feet, of San Pedro River at Charleston, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	36	23	110	91	64	18	15	.....	44	41	23	.....
2	30	23	247	86	58	18	15	.....	49	41	23	.....
3	30	23	172	79	51	18	15	.....	177	34	23	.....
4	24	25	164	71	51	18	14	.....	186	28	23	.....
5	24	47	114	70	42	16	12	.....	219	24	23	.....
6	24	27	162	56	42	17	13	.....	95	25	23	.....
7	30	235	207	48	42	17	13	.....	83	17	21	.....
8	30	180	370	44	43	18	13	.....	90	29	149	.....
9	30	108	222	44	31	25	14	135	61	30	174	.....
10	94	70	319	44	32	135	14	93	58	31	118	.....
11	124	67	148	44	29	97	33	86	30	34	112	.....
12	124	61	76	50	28	74	118	46	30	134	56	.....
13	66	49	110	67	25	57	123	77	30	134	49	.....
14	41	43	104	122	25	48	49	129	30	96	42	.....
15	41	36	110	96	25	47	31	70	57	79	42	.....
16	44	36	81	69	22	39	20	62	82	62	42	.....
17	35	43	668	79	23	36	18	211	88	47	42	61
18	35	73	281	79	24	28	14	86	86	31	38	61
19	31	191	185	75	24	28	14	198	55	31	38	61
20	31	214	129	65	22	20	13	225	40	31	38	61
21	31	136	86	58	23	20	13	287	73	32	38	68
22	31	113	81	65	23	15	13	206	76	25	68	61
23	31	81	87	61	23	15	12	164	45	25	53	54
24	30	69	87	58	21	12	12	110	52	26	74	54
25	28	36	81	44	21	12	177	157	183	27	45	54
26	26	58	51	145	19	10	201	134	143	26	45	54
27	25	36	30	30	18	10	192	120	82	26	286	54
28	24	43	17	30	18	18	96	86	65	25	296	54
29	24	.....	15	50	18	16	61	69	55	24	.....	54
30	24	.....	100	75	18	16	61	62	48	23	.....	54
31	23	.....	89	.....	18	.....	55	69	.....	23	.....	54

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of San Pedro River at Charleston, Ariz., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	124	23	39.4	2,423
February	235	23	76.6	4,254
March	668	15	152	9,346
April	145	30	66.5	3,957
May	64	18	29.8	1,832
June	135	10	30.6	1,821
July	201	12	47.2	2,902
August (9-31)	287	46	125	5,702
September	219	30	80.4	4,784
October	134	17	40.7	2,502
November (1-28)	296	21	71.6	3,976
December (17-31)	68	54	57.3	1,705
The period				45,200

SALT RIVER AT ROOSEVELT, ARIZ.

This station was established February 7, 1901. It is located at the town of Roosevelt, which is the United States Reclamation Service construction camp for the Salt River dam and reservoir, and is about 12 miles west of Livingston, Ariz. The gage rod and cable are at the upper end of the gorge, about 2,000 feet below the mouth of Tonto Creek and 1,500 feet above the dam site.

Discharge measurements are made by means of a car suspended from a cable.

The gage is a vertical rod fastened to the rocks on the left bank of the river.

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

Description: 66, pp 99-100; 85, p 25; 100, p 42; 133, p 212.
Discharge: 66, p 100; 85, pp 26-27; 100, pp 42-43; 133, pp 212-213.
Discharge, mean daily: 133, p 214.
Discharge, monthly: 75, p 178; 85, p 29; 100, p 45; 133, p 214.
Gage heights: 66, p 100; 85, p 28; 100, p 44; 133, p 213.
Rating table: 85, p 28.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge	Date.	Hydrographer.	Gage height.	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 4	Osburn Richins	21.00	30,360	February 4	Osburn Richins	23.50	[a]43,350
January 4	do	20.50	26,680	February 7	do	11.50	[a]6,872
January 4	do	23.50	38,530	February 14	do	9.60	3,424
January 4	do	16.00	16,200	February 17	do	17.40	[a]22,640
January 7	do	11.50	6,107	February 18	do	17.10	25,610
January 10	do	11.50	[a]3,189	February 18	do	16.80	[a]23,000
January 11	do	15.80	[a]12,600	February 23	do	10.90	[a]5,384
January 13	do	10.00	4,528	February 27	do	10.10	[a]5,166
January 18	do	8.10	742	February 28	do	11.80	11,790
January 21	do	8.10	751	February 28	do	15.95	[a]19,920
January 27	do	7.70	554	February 28	do	18.00	[a]28,120
February 4	do	16.00	[a]18,220	February 28	do	19.50	[a]33,430
February 4	do	21.00	[a]34,160	February 28	do	20.00	[a]36,340
February 4	do	20.50	[a]30,020	March 2	do	11.40	[a]11,610

[a] Float measurement.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1905—Continued.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
March 10	Osburn Richins	11.55	[a]10,060	June 12	Osburn Richins	6.70	1,823
March 13	do	13.00	[a]13,540	June 13	do	6.50	1,762
March 14	do	20.50	[a]40,520	June 14	do	6.30	1,597
March 17	do	20.70	[a]41,380	June 16	do	6.10	1,378
March 18	do	19.70	[a]39,850	June 17	do	6.10	1,369
March 20	do	21.30	[a]51,130	June 19	do	5.85	1,256
March 24	do	10.50	11,000	June 20	do	5.70	1,079
March 29	do	9.50	6,748	June 21	do	5.60	938
April 4	do	13.70	14,600	June 22	do	5.55	905
April 6	do	12.00	7,154	June 23	do	5.45	877
April 10	do	12.40	7,908	June 24	do	5.40	864
April 12	Richins and Farish.	23.50	[a]43,560	June 26	do	5.30	808
				June 27	do	5.20	770
April 12	do	25.00	[a]47,620	June 28	do	5.15	733
April 13	do	20.00	40,230	June 29	do	5.10	715
April 14	do	12.90	19,030	June 30	do	5.05	687
April 15	do	11.80	13,370	July 1	do	5.05	687
April 16	do	11.40	11,500	July 7	do	4.60	455
April 18	Osburn Richins	10.00	8,875	July 8	do	4.50	415
April 20	do	10.15	9,262	July 10	do	4.40	374
April 22	do	9.60	8,335	July 12	do	4.30	344
April 24	do	10.95	11,050	July 13	do	4.40	358
April 25	do	11.85	13,920	July 14	do	4.30	383
April 26	do	11.75	13,840	July 15	do	4.30	337
April 27	do	11.10	11,470	July 17	do	4.60	427
April 28	do	10.90	9,814	July 18	do	4.50	400
May 1	do	10.50	9,524	July 19	do	4.50	392
May 3	do	10.60	9,534	July 20	do	4.35	363
May 4	do	10.20	8,390	July 22	do	4.40	402
May 5	do	9.80	6,522	July 24	do	4.50	406
May 6	do	9.30	5,811	August 1	do	5.20	656
May 10	do	9.30	5,471	August 2	do	5.00	603
May 11	do	9.00	5,606	August 4	do	4.60	554
May 12	do	8.80	4,956	August 5	do	4.40	522
May 13	do	8.60	4,269	August 7	do	4.50	523
May 15	Murphy and Richins.	8.42	4,080	August 8	do	4.30	490
				August 10	do	5.30	634
May 17	Osburn Richins	8.40	4,026	August 11	do	5.90	736
May 18	do	8.40	4,043	August 12	do	5.10	603
May 19	do	8.45	4,155	August 14	do	4.90	536
May 20	do	8.35	4,012	August 15	do	4.70	461
May 22	do	7.90	3,299	August 17	do	4.80	471
May 23	do	7.80	3,131	August 18	do	4.70	436
May 24	do	7.65	2,846	August 19	do	4.50	391
May 25	do	7.50	2,841	August 21	do	5.50	774
May 27	do	7.30	2,420	August 22	do	4.70	452
May 29	do	7.00	2,272	August 23	do	7.20	2,495
May 31	do	6.70	1,921	August 25	do	6.70	1,578
June 2	do	6.55	1,840	August 26	do	5.20	705
June 5	do	6.70	1,957	August 28	do	5.00	527
June 7	do	6.50	1,701	August 30	do	5.20	362
June 8	do	6.60	1,881	August 31	do	5.10	337
June 9	do	7.20	2,414	September 1	do	5.00	340
June 10	do	7.10	2,275	September 2	do	5.30	574

[a] Float measurement.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1905—Continued.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
September 4	Osburn Richins	5.20	741	November 8	E. O. Blades	6.60	2,045
September 6	do	6.65	2,031	November 9	do	5.40	1,292
September 8	do	5.40	913	November 10	do	5.00	791
September 9	do	4.70	762	November 11	do	4.80	715
September 11	do	4.60	653	November 13	do	4.50	638
September 12	do	4.40	612	November 14	do	4.40	587
September 14	do	4.20	448	November 15	do	4.30	510
September 16	do	4.00	316	November 16	do	4.20	539
September 18	do	3.80	315	November 17	do	4.20	524
September 20	do	3.80	292	November 18	do	4.15	491
September 22	do	3.60	227	November 20	do	4.10	471
September 25	do	6.15	1,252	November 21	do	4.15	484
September 26	do	6.30	1,321	November 22	do	6.75	3,168
September 30	do	6.90	1,414	November 23	do	6.55	2,230
October 2	do	5.60	710	November 24	do	6.75	2,660
October 3	do	5.30	574	November 25	do	6.50	1,827
October 4	do	5.10	500	December 5	do	7.65	2,497
October 5	do	4.90	385	December 6	do	7.55	2,347
October 7	do	4.70	261	December 7	do	7.45	1,993
October 9	do	4.40	283	December 8	do	7.35	1,762
October 11	do	4.20	231	December 9	do	7.30	1,561
October 19	do	4.00	316	December 11	do	7.10	1,341
October 20	do	3.90	297	December 12	do	7.10	1,276
October 21	do	3.90	302	December 13	do	7.00	1,149
October 23	Richins and Blades.	3.90	300	December 14	do	7.00	1,168
				December 15	do	6.90	1,091
October 24	do	3.80	308	December 16	do	6.90	981
October 25	do	3.80	307	December 18	do	6.80	888
October 26	E. O. Blades	3.80	335	December 19	do	6.80	869
October 27	do	3.80	320	December 20	do	6.80	865
October 28	do	3.80	331	December 21	do	7.00	1,041
October 30	do	3.80	314	December 22	do	7.00	1,213
October 31	do	3.80	304	December 23	do	6.95	945
November 1	do	3.80	305	December 26	do	6.60	697
November 2	do	3.80	299	December 27	do	6.70	829
November 3	do	3.80	306	December 28	do	6.80	887
November 6	do	4.25	628	December 29	do	6.80	945
November 7	do	4.20	610				

Daily gage height, in feet, of Salt River at Roosevelt, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	6.91	7.65	14.8	10.0	10.5	6.55	5.0	5.2	5.05	6.15	3.8	8.75
2	6.91	7.85	12.1	10.3	10.6	6.52	4.9	4.95	5.15	5.6	3.8	8.5
3	6.91	8.95	11.0	11.35	10.6	6.45	4.85	4.75	6.05	5.2	3.8	8.1
4	6.9	21.0	10.8	13.2	10.25	6.72	4.8	4.55	4.95	5.05	3.8	7.85
5	6.9	16.25	11.05	12.6	9.75	6.7	4.7	4.4	5.5	4.9	3.95	7.65
6	6.9	15.4	11.1	11.6	9.25	6.7	4.6	4.45	6.4	4.75	4.25	7.55
7	6.9	12.0	10.9	11.9	9.0	6.5	4.6	4.45	5.65	4.65	4.2	7.45
8	6.9	10.15	10.6	11.9	9.0	6.62	4.5	4.3	5.3	4.45	6.65	7.55
9	7.46	9.45	10.9	12.15	9.2	7.2	4.45	4.2	4.8	4.3	5.4	7.3
10	12.75	9.35	11.45	12.6	9.25	7.05	4.4	5.15	4.75	4.2	5.0	7.2
11	15.65	8.85	11.4	16.2	9.0	6.85	4.4	5.75	4.65	4.2	4.75	7.1
12	13.5	11.75	10.35	23.5	8.75	6.65	4.3	5.15	4.5	4.1	4.65	7.0

Daily gage height, in feet, of Salt River at Roosevelt, Ariz., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	9.9	10.1	15.5	22.5	8.6	6.5	4.35	4.95	4.5	4.0	4.5	7.0
14	9.0	9.5	19.95	13.35	8.5	6.25	4.3	4.9	4.2	4.0	4.4	7.0
15	8.65	9.3	14.1	11.9	8.42	6.2	4.3	4.7	4.0	4.0	4.3	6.9
16	8.55	9.92	12.5	10.9	8.4	6.1	4.6	4.8	4.0	4.0	4.2	6.9
17	8.45	17.35	20.25	9.9	8.4	6.1	4.6	4.75	3.9	4.0	4.2	6.8
18	8.35	16.70	19.35	9.9	8.4	5.9	4.45	4.7	3.8	4.0	4.15	6.8
19	8.25	11.45	14.65	9.9	8.42	5.82	4.5	4.6	3.8	4.0	4.1	6.8
20	8.13	10.35	19.65	10.15	8.3	5.7	4.5	4.5	3.8	3.9	4.1	6.8
21	8.1	9.7	14.0	9.75	8.07	5.6	4.5	5.15	3.7	3.9	4.15	7.0
22	8.04	9.5	10.9	9.55	7.87	5.55	4.45	4.6	3.6	3.9	6.75	7.0
23	7.97	10.25	10.25	9.85	7.75	5.42	4.4	6.8	3.6	3.9	6.55	6.95
24	7.88	11.75	10.35	11.4	7.62	5.4	4.5	5.15	5.45	3.8	6.75	6.85
25	7.84	10.47	9.85	11.65	7.5	5.35	4.5	6.35	5.55	3.8	6.4	6.72
26	7.77	10.18	9.8	11.6	7.4	5.3	4.5	5.4	5.9	3.8	7.5	6.6
27	7.71	10.1	9.7	11.0	7.27	5.15	4.5	5.25	5.1	3.8	26.7	6.7
28	7.68	17.95	9.5	10.9	7.15	5.12	6.1	5.0	5.0	3.8	17.3	6.8
29	7.65	.....	9.3	10.65	6.95	5.08	6.85	5.0	5.9	3.8	10.7	6.8
30	7.65	.....	9.45	10.5	6.8	5.05	5.7	5.15	6.8	3.8	9.4	6.8
31	7.65	.....	9.8	.....	6.7	.....	5.1	5.05	.....	3.8	.....	6.8

Daily discharge, in second-feet, of Salt River at Roosevelt, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov	Dec.
1	172	526	17,100	7,548	9,350	1,800	650	655	380	1,132	313	8,700
2	172	625	12,150	8,076	9,700	1,770	600	590	460	710	313	4,700
3	172	3,900	9,250	9,819	9,700	1,700	575	572	1,497	527	313	3,670
4	165	31,400	8,925	12,020	8,475	1,970	550	545	526	480	313	3,020
5	165	18,800	11,300	8,937	6,738	1,950	500	522	1,000	385	420	2,497
6	165	16,700	11,330	6,495	5,675	1,950	455	523	1,806	310	628	2,347
7	165	8,250	11,220	6,989	5,175	1,750	455	515	1,136	250	610	1,993
8	165	4,500	11,060	6,989	5,175	1,870	415	490	891	250	2,210	1,762
9	346	3,145	11,220	7,437	5,575	2,450	395	475	783	260	1,292	1,561
10	5,900	2,959	11,540	8,937	5,675	2,300	375	612	772	230	790	1,451
11	12,300	2,037	11,500	20,040	5,175	2,100	375	705	707	230	695	1,341
12	9,460	8,306	8,200	43,350	4,675	1,900	345	612	632	217	67	1,158
13	4,000	4,400	22,050	45,470	4,375	1,750	358	547	632	231	638	1,158
14	2,400	3,238	38,700	20,370	4,200	1,500	335	530	448	245	587	1,158
15	1,685	2,867	17,600	14,010	4,060	1,450	335	461	316	259	510	1,091
16	1,513	4,040	12,150	10,620	4,025	1,350	427	471	316	274	539	981
17	1,341	21,550	39,800	8,864	4,025	1,350	427	450	310	298	524	935
18	1,170	20,450	36,550	8,864	4,025	1,150	378	436	303	302	491	888
19	999	7,000	23,200	8,864	4,060	1,086	392	413	303	316	471	867
20	828	4,800	44,400	9,303	3,850	1,000	392	390	303	300	471	867
21	743	3,614	23,440	8,601	3,455	950	392	625	265	300	484	1,041
22	715	3,238	11,940	8,250	3,159	925	403	427	227	300	3,168	1,213
23	682	4,250	9,524	8,777	3,012	860	402	1,864	227	300	2,230	945
24	640	7,700	9,895	11,500	2,870	850	406	625	970	313	2,660	860
25	620	4,990	8,040	12,750	2,750	825	406	1,327	1,010	313	1,755	765
26	588	4,560	7,855	12,500	2,650	800	406	803	1,150	313	2,150	697
27	560	4,400	7,484	11,160	2,520	725	406	680	830	313	97,710	829
28	546	27,550	6,742	10,800	2,400	712	1,300	527	790	313	45,250	887
29	526	.....	6,000	9,906	2,200	690	2,000	527	1,150	313	14,050	945
30	526	.....	6,700	9,370	2,050	675	935	350	1,515	313	9,480	945
31	526	.....	7,300	.....	1,950	.....	617	325	.....	313	.....	945

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of Salt River at Roosevelt, Ariz., for 1905.

[Drainage area, 5,756 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	12,300	165	1,611	99,060	0.280	0.323
February	31,400	526	8,207	455,800	1.43	1.49
March	44,400	6,000	15,300	940,800	2.66	3.07
April	45,470	6,495	12,550	746,800	2.18	2.43
May	9,700	1,950	4,604	283,100	.800	.922
June	2,450	675	1,405	83,600	.244	.272
July	2,000	335	529	32,530	.092	.106
August	1,864	325	600	36,890	.104	.120
September	1,497	227	722	42,960	.125	.140
October	1,132	217	342	21,030	.059	.068
November	97,710	313	6,391	380,300	1.11	1.24
December	8,700	697	1,684	103,600	.293	.338
The year	97,710	217	4,495	3,226,000	.781	10.52

SALT RIVER AT M'DOWELL, ARIZ.

This station was established April 20, 1897. It is located one-third mile above the junction of Salt and Verde rivers, 30 miles northeast of Phoenix, 15 miles northeast of Mesa, and 1¾ miles above the Arizona canal diversion dam.

The channel is straight for about 500 feet above the station. The right bank is about 3½ feet high at the water's edge and rises with a gradual slope for 400 feet; it is clean and is subject to overflow. The left bank rises vertically for about 5 feet, at which point there is a small bench, from which the rocks rise to a considerable height; this bank is clean and does not overflow. The bed of the stream is composed of sand and is shifting, and it is necessary to make a large number of measurements in order to obtain an accurate estimate of the discharge. The current is swift.

Discharge measurements are made by means of a cable and car. The initial point for soundings is 120 feet south of the standard under the cable at the north bank. Low-water measurements are made by wading about 1,000 feet upstream from the cable, where a tag wire has been placed.

Gage heights and measurements are taken by W. Richins, who devotes his whole time to the work. There have been five gages in use at this station, as follows:

Gage No. 1, set April 20, 1897, was a 2- by 6-inch timber bolted to the rocks on the south bank of the river, about one-fourth mile above the cable. This gage, which has since been removed, was used until November 30, 1899, when the station was temporarily abandoned. The bench mark is a nail in a palo verde tree about 75 feet west of the cable anchorage on the north bank; elevation, 17.33 feet above the zero of the gage.

Gage No. 2 was established in 1901. It consists of a 2- by 6-inch timber fastened to a tree on the north bank of the river three-fourths mile above the cable. The zero of this gage is 1,323.54 feet above sea level. Its bench mark is a nail in a root of a willow tree, to which the gage is fastened; elevation, 1,328.69 feet above sea level, and 5.10 feet above the zero of the gage. On April 2, 1903, high water in Verde River backed up the water on gage No. 2 and changed the cross section by depositing sand.

Gage No. 3 was installed May 19, 1903. It consists of a 1- by 6-inch stadia rod spiked to a 2- by 4-inch timber and fastened to a tree on the south bank 1⅓ miles above the cable. The water surface at this gage is about 15 feet higher than at the mouth of the Verde River,

and the zero of the gage is 1,336.27 feet above sea level. Three bench marks have been established for this gage, as follows: (1) A nail in a mesquite stump 200 feet east of Peters's corral; elevation, 1,363.2 feet above sea level and 26.93 feet above the zero of the gage. (2) A nail in the root of a mesquite tree on top of the bank 50 feet northwest of the northwest corner of Peters's corral and about 75 feet from the gage; elevation, 1,356 feet above sea level and 19.73 feet above the zero of the gage. (3) A nail in the willow tree to which the gage is attached; elevation, 1,344.27 feet above sea level and 8.00 feet above the zero of the gage.

Gage No. 4 was a temporary gage on the north side of the river about 600 yards above the section and was read in conjunction with gage No. 3. This temporary gage, No. 4, was washed out by heavy floods early in 1905.

Gage No. 5 was established because of the difficulty and time involved in reaching gage No. 3 during high water and also because the river had changed its channel in such a way as to leave gage No. 3 dry. It was located on the right bank of the river about one-fourth mile below the location of No. 3. No. 5 was read from March 10, the date of its establishment, to March 20, 1905, on which date it was destroyed.

The river swept back to gage No. 3, which was used until April 14, when another change of channel rendered No. 3 useless. A temporary gage was then established at the old location of No. 4. This was observed until September 1, 1905, when a permanent gage was established. The zero of this gage is at an elevation of 1,326.62 feet above sea level and is referred to two bench marks: (1) On a mesquite tree 200 feet northwest of the gage; elevation, 1,346.12 feet above sea level. (2) A nail in tree at gage; elevation, 1,336.37 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; WS=Water-Supply Paper):

Description: Ann 19, iv, pp 418–419, 420–421; WS 16, p 148; 28, p 133; 38, p 321; 50, pp 386–387; 66, p 101; 85, pp 23–24; 100, pp 36–37; 133, pp 215–216.
Discharge: Ann 19, iv, p 419; WS 16, p 148; 28, p 143; 38, p 321; 66, p 102; 85, p 24; 100, pp 38–39; 133, pp 215–216.
Discharge, mean daily: WS 133, p 220.
Discharge, monthly: Ann 20, iv, p 406; 21, iv, p 386; WS 75, p 179; 85, p 25; 100, pp 40–41; 133, p 221.
Discharge, yearly: Ann 20, iv, p 59.
Gage heights: WS 16, p 149; 28, p 140; 38, p 322; 66, p 102; 85, p 25; 100, p 40; 133, p 219.
Hydrographs: Ann 19, iv, p 423; 20, iv, p 406; 21, iv, p 387.
Rating tables: Ann 19, iv, p 419; WS 28, p 145; 100 pp 40–41.

Discharge measurements of Salt River at McDowell, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 11	W. Richins	9.30	18,500	March 11	W. Richins	5.68	9,961
January 13	do	5.25	5,134	March 14	do	10.20	[a]29,040
January 16	do	3.25	1,235	March 17	do	11.20	[a]37,970
January 20	do	2.95	1,110	March 29	do	6.05	6,385
January 24	do	2.44	569	March 31	do	6.00	6,441
January 27	do	2.37	477	April 4	do	6.55	7,657
January 31	do	2.32	439	April 5	do	6.55	9,070
February 3	do	3.70	1,474	April 12	do	10.60	60,570
February 4	do	12.10	[a]43,280	April 13	do	10.20	54,190
February 7	do	7.95	13,890	April 14	do	.....	21,840
February 10	do	5.00	4,797	April 19	do	4.40	9,756
February 14	do	4.83	4,464	April 21	do	4.30	9,667
February 17	do	9.50	25,560	April 25	do	5.20	15,990
February 21	do	5.00	6,207	April 28	do	4.50	11,920
February 24	do	6.75	10,150	May 2	do	4.35	10,680
March 1	do	8.65	24,780	May 5	do	3.65	8,173
March 8	do	5.40	[b]8,406	May 10	do	3.42	7,427

[a]Flat measurement. [b]Gage height of new gage No. 4=5.9.

Discharge measurements of Salt River at McDowell, Ariz., in 1905—Continued.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 12	W. Richins	2.92	5,604	July 29	W. Richins	−0.35	874
May 16	do	2.50	4,329	August 1	do	− .26	752
May 19	do	2.40	4,243	August 3	do	− .05	546
May 23	do	1.85	3,327	August 5	do	− .04	493
May 24	do	1.75	3,149	August 8	do	− .06	463
May 26	do	1.57	2,889	August 10	do	− .08	557
May 30	do	1.30	2,228	August 16	do	− .20	445
May 31	do	1.25	2,066	August 22	do	− .05	507
June 2	do	1.20	1,848	August 24	do	.50	1,098
June 6	do	1.28	1,888	August 29	do	− .10	457
June 7	do	1.20	1,838	August 31	do	− .28	354
June 9	do	1.77	2,859	September 2	do	5.03	[a] 1,815
June 12	do	1.25	2,077	September 5	do	4.25	781
June 13	do	1.12	1,861	September 7	do	5.18	1,993
June 14	do	.92	1,600	September 9	do	4.30	842
June 15	do	.83	1,683	September 12	do	4.03	640
June 16	do	.80	1,532	September 15	do	3.80	458
June 17	do	.78	1,336	September 19	do	3.56	330
June 19	do	.65	1,210	September 21	do	3.50	302
June 20	do	.63	1,155	September 23	do	3.45	266
June 21	do	.60	1,081	September 26	do	4.90	1,614
June 22	do	.55	1,000	September 30	do	5.15	1,995
June 23	do	.49	968	October 4	do	4.14	718
June 24	do	.45	860	October 7	do	3.88	477
June 26	do	.42	819	October 10	do	3.70	374
June 27	do	.39	776	October 12	do	3.63	339
June 28	do	.37	791	October 14	do	3.60	350
June 29	do	.35	716	October 17	do	3.55	315
June 30	do	.31	676	October 19	do	3.52	311
July 1	do	.29	684	October 21	do	3.50	289
July 3	do	.18	575	October 26	do	3.52	297
July 4	do	.16	526	October 28	do	3.52	302
July 5	do	.12	521	October 31	do	3.50	284
July 6	do	.08	496	November 2	do	3.47	300
July 7	do	.02	460	November 4	do	3.50	308
July 8	do	−.04	459	November 7	do	3.90	515
July 11	do	−.17	368	November 9	do	5.25	1,843
July 13	do	−.26	345	November 11	do	4.12	665
July 15	do	−.02	481	November 14	do	4.02	534
July 18	do	−.12	428	November 16	do	3.90	495
July 20	do	−.24	370	November 18	do	3.84	460
July 22	do	−.25	355	November 22	do	4.50	1,045
July 25	do	−.13	445	November 24	do	5.25	2,219
July 27	do	−.17	415				

[a] Gage readings are from rod No. 4. Four feet on this rod is the same as zero on the other. All subsequent readings are from this rod.

Daily gage height, in feet, of Salt River at McDowell, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.82	2.32	9.5	5.9	4.2	1.2	0.28	0.25	3.68	[a] 4.9	3.47	[b] 6.8
2	1.82	2.32	6.65	6.35	4.35	1.2	.25	.15	5.05	[a] 4.62	3.47	6.57
3	1.82	3.8	6.05	6.0	4.3	1.2	.2	.03	[a] 4.0	4.22	3.47	6.3
4	1.82	10.25	5.25	6.85	4.05	1.25	.16	.09	4.47	4.12	3.5	6.1
5	1.82	10.9	5.2	6.55	3.65	1.32	.11	−.04	4.52	4.02	[a] 3.66	6.3
6	1.81	9.15	5.35	6.2	3.3	1.26	.06	−.05	4.33	3.94	3.76	6.15
7	1.8	8.05	5.23	6.2	3.35	1.2	.02	−.05	5.05	3.86	3.92	6.09
8	1.82	6.6	5.07	6.05	3.4	1.18	−.05	−.08	4.55	[a] 3.8	4.75	5.92
9	1.85	5.85	4.95	5.85	3.2	1.72	−.09	−.05	4.3	3.75	5.12	5.85
10	8.9	5.15	5.75	5.9	3.37	1.5	−.14	+.06	[a] 4.12	3.68	4.32	5.68
11	9.3	5.05	5.85	5.35	3.15	1.5	−.18	+.03	4.03	3.64	4.12	5.62
12	7.35	5.7	4.57	10.3	2.87	1.28	−.24	.24	4.01	3.62	[a] 4.1	5.56
13	5.2	5.5	6.18	10.6	2.75	1.12	−.14	.03	3.92	3.6	4.08	5.5
14	3.85	4.8	10.1	6.75	2.7	.96	−.23	−.03	3.85	3.6	4.01	5.4
15	3.2	4.25	7.62	5.6	2.5	.84	−.01	−.14	3.77	[a] 3.58	3.94	5.36
16	3.2	4.7	5.78	4.95	2.45	.81	−.03	−.21	3.74	3.56	3.89	5.32
17	3.1	9.2	10.85	4.85	2.42	.78	−.08	−.22	[a] 3.67	3.54	3.87	[a] 5.25
18	3.2	9.65	10.85	4.6	2.45	.67	−.14	−.26	3.6	3.53	3.84	5.22
19	3.15	7.6	9.3	4.35	2.38	.68	−.2	−.23	3.54	3.52	[a] 3.82	5.14
20	2.95	6.1	10.0	4.5	2.3	.62	−.26	−.22	3.52	3.51	3.81	5.1
21	2.9	4.9	9.25	4.25	2.25	.58	−.3	−.21	3.49	3.5	3.88	5.46
22	2.78	4.1	8.25	3.9	2.0	.54	−.25	−.03	3.46	[a] 3.53	4.95	5.68
23	2.6	4.35	7.4	3.85	1.82	.48	−.22	.58	3.45	3.53	5.5	5.52
24	2.44	6.45	6.82	4.7	1.72	.44	−.15	.50	[a] 5.9	3.53	5.2	[a] 5.35
25	2.41	5.8	6.51	5.1	1.65	.42	−.14	.35	5.0	3.52	5.4	5.1
26	2.38	5.45	6.4	5.1	1.58	.42	−.13	.4	5.02	3.51	[b] 6.0	5.1
27	2.37	4.45	6.35	4.6	1.45	.38	−.19	.18	4.32	3.5	[b] 21.2	5.0
28	2.37	8.65	6.33	4.5	1.43	.36	+.32	.05	4.03	3.52	[b] 15.0	5.02
29	2.35	.....	6.13	4.3	1.38	.33	.35	−.12	3.97	[a] 3.5	[b] 10.0	5.04
30	2.34	.....	5.75	4.2	1.28	.3	1.5	−.23	[a] 5.32	3.5	[b] 7.5	5.05
31	2.32	.....	5.95	.....	1.25	.....	.63	−.28	.....	3.49	.....	5.0

[a] Interpolated gage heights.
[b] Approximate flood heights during time gage was out.

NOTE.—Several gages used during the year. See station description.

Daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	184	527	29,060	5,678	10,140	2,020	660	735	380	1,635	275	6,000
2	184	527	14,700	8,026	10,760	2,020	630	635	1,838	1,262	275	5,160
3	184	1,576	11,680	6,200	10,560	2,020	580	530	595	764	275	4,170
4	184	26,860	7,651	10,636	9,579	2,200	552	575	1,061	685	290	3,430
5	184	32,320	7,399	9,070	8,192	2,237	517	493	1,127	610	370	4,170
6	177	17,870	8,154	7,244	6,976	2,128	486	475	879	550	426	3,600
7	170	14,280	7,530	7,244	7,155	2,020	462	475	1,838	492	535	3,350
8	184	9,544	6,745	6,460	7,323	1,984	420	450	1,168	450	1,438	2,750
9	205	7,095	6,140	5,417	6,629	2,977	396	515	840	420	1,936	2,500
10	17,050	3,882	11,720	5,678	7,219	2,570	376	685	685	380	970	1,815
11	18,870	3,632	12,100	4,366	6,457	2,570	362	650	617	360	665	1,625
12	11,990	6,606	7,121	55,080	5,484	2,164	351	895	602	350	670	1,540
13	5,008	5,953	13,390	60,600	5,093	1,876	376	640	535	340	655	1,480
14	1,663	3,006	28,650	22,720	4,945	1,616	352	570	485	340	534	1,380

Daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	1,132	2,626	19,000	17,850	4,430	1,430	483	485	432	330	490	1,340
16	1,132	3,755	11,830	14,420	4,335	1,385	475	440	414	320	490	1,300
17	1,063	24,650	34,850	13,760	4,278	1,340	445	425	365	310	490	1,228
18	1,132	26,630	34,850	12,100	4,335	1,178	410	400	340	305	445	1,195
19	1,097	17,620	25,540	10,760	4,202	1,192	390	415	310	300	455	1,120
20	959	11,040	28,260	11,530	4,050	1,108	365	415	300	295	450	1,075
21	926	5,768	35,800	10,350	3,958	1,050	350	415	285	290	505	1,440
22	843	2,250	17,940	9,058	3,495	990	355	565	270	305	975	1,820
23	720	3,354	13,510	8,884	3,162	904	377	1,180	265	305	3,176	1,495
24	609	9,471	10,480	12,760	2,977	852	425	1,100	4,220	305	2,060	1,330
25	589	8,008	8,861	15,420	2,847	826	440	860	1,770	300	2,903	1,075
26	568	7,220	8,287	15,420	2,718	826	440	920	1,797	295	4,545	1,075
27	561	3,792	8,027	12,100	2,477	776	395	660	866	290	138,000	975
28	561	24,780	7,922	11,530	2,441	752	830	550	610	300	83,530	990
29	547	.....	6,878	10,560	2,348	716	874	445	580	290	33,100	1,020
30	541	.....	5,066	10,140	2,164	680	2,780	375	2,430	290	17,710	1,030
31	527	.....	5,939	.....	2,110	.....	1,260	355	.....	285	.....	975

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly dischagre of Salt River at McDowell, Ariz., for 1905.

[Drainage area, 6,260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	18,870	170	2,250	138,300	0.359	0.414
February	32,320	527	10,170	564,800	1.62	1.69
March	35,800	5,066	14,680	902,600	2.35	2.71
April	60,600	4,366	13,700	815,200	2.19	2.44
May	10,760	2,110	5,253	323,000	.839	.967
June	2,977	680	1,547	92,050	.247	.276
July	2,780	350	568	34,920	.091	.105
August	1,180	355	591	36,340	.094	.108
September	4,220	265	930	55,340	.149	.166
October	1,635	285	444	27,300	.071	.082
November	138,000	275	9,954	592,300	1.59	1.77
December	6,000	975	2,047	125,900	.327	.377
The year	138,000	170	5,178	3,708,000	.827	11.10

VERDE RIVER AT M'DOWELL, ARIZ.

This station was established April 20, 1897. It is located 30 miles northeast of Phoenix, 15 miles northeast of Mesa, 2⅛ miles above the Arizona Canal diversion dam, and three-fourths mile above the mouth of the river.

The channel is straight for 300 feet above and below the station, with a width of 100 feet at low water and 450 feet at high water. The right bank is high, rocky, and clean, and is not subject to overflow; the left bank is low, clean, and is liable to overflow. The bed of the stream is composed of sand and is shifting. The current is swift.

Discharge measurements are made by means of a cable, car, and tagged wire. At low water the channel is oblique to the gaging section and measurements are made by wading at a point 400 feet above the cable.

Gage heights are observed by W. Richins. Three gages have been in use at this station, as follows:

Gage No. 1, established April 20, 1897, consisted of a vertical rod attached to a large cottonwood tree on the east bank about 60 feet below the cable. This was read until November 11, 1899, when the station was temporarily abandoned. The bench mark is a point on a cat's claw (acacia) tree about 100 feet southeast of the gage; elevation, 27.02 feet above the zero of the gage.

Gage No. 2 was established in January, 1901, and observations were resumed. It is an inclined 2- by 4-inch timber, fastened to the rocks on the west bank about 500 feet above the cable, the zero of the gage being 1,325.4 feet above sea level. Three bench marks were established for this gage, as follows: (1) A nail in a mesquite tree about 6 feet below the cable anchorage on the east bank; elevation, 1,345.5 feet above sea level, and 20.10 feet above the zero of the gage. (2) A nail in the cable standard at the east bank; elevation, 1,341.3 feet above sea level, and 15.90 feet above the zero of the gage. (3) A mark on rock at the gage; elevation, 1,330.4 feet above sea level, and 5.00 feet above the zero of the gage.

Gage No. 3 was established May 16, 1904, on account of water piling up at No. 2 during flood. It is a vertical rod fastened to a willow tree on the east bank about one-half mile above the cable. The zero of the gage is 1,339.26 feet above sea level. Two bench marks were established for this gage: (1) A nail in a large cottonwood tree on the top of the east bank near the gage; elevation, 1,354.11 feet above sea level, 14.85 feet above the zero of the gage. (2) A nail in the willow tree to which the gage is attached; elevation, 1,347.26 feet above sea level, and 8.00 feet above the zero of the gage.

Gage No. 3, with the tree to which it was attached, was washed out during the heavy flood February 25, 1905. As the water showed no tendency to pile up at Gage No. 2, readings were resumed on that gage, which was used to the end of the year.

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 19, iv, pp 420-421; Bull 131, p 49; WS 16, p 150, 28 p 133; 38, p 323; 50 p 387; 66, pp 102-103; 85, p 21; 100, pp 31-32; 133, pp 222-223.

Discharge: WS 16, p 150; 38, p 323, 66, p 103; 85, p 22; 100, pp 33-34; 133, pp 223-226.

Discharge, mean daily: WS 133, p 227.

Discharge, monthly: Ann 11, ii, p 100; 19, iv, p 423; 20, iv, p 407, 21, iv, p 387; WS 75, p 177; 100, p 36; 133, p 227.

Discharge, yearly: Ann 20, iv, p 59.

Gage heights: Bull 131, p 51; WS 16, p 150; 28, pp 141,143; 38 p 324; 66, p 103; 85, p 23; 100, p 35; 133, p 226.

Hydrographs: Ann 19, iv, p 423; 20, iv, p 407; 21, iv, p 388; WS 75, p 177.

Rating table: Ann 19, iv, p 422.

Discharge measurements of Verde River at McDowell, Ariz., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 11	W. Richins	7.00	9,159	February 14	W. Richins	3.90	[a] 1,648
January 13	do	3.70	2,183	February 17	do	7.60	[a] 8,174
January 16	do	2.65	876	February 21	do	5.90	4,195
January 20	do	2.62	739	February 24	do	9.70	11,670
January 24	do	2.30	612	March 1	do	14.5	23,280
January 27	do	2.25	580	March 6	do	8.75	5,433
January 31	do	2.18	462	March 11	do	6.95	2,617
February 4	do	13.20	32,990	March 14 [a]	do	16.0	28,850
February 7	do	7.75	7,921	March 17 [a]	do	17.0	31,090
February 10	do	4.60	2,706	March 29	do	7.75	2,973

[a] Float measurement.

Discharge measurements of Verde River at McDowell, Ariz., in 1905—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
March 31	W. Richins	7.00	1,954
April 4	do	6.70	1,341
April 5	Parish and Richins.	6.6	1,363
April 5	do	6.6	1,393
April 6	do	6.65	1,383
April 6	do	6.65	1,436
April 6	do	6.65	1,448
April 12	Richins and Earle	19.0	35,550
April 14	W. Richins	11.4	15,110
April 21	do	6 8	3,115
April 21	do	6.3	2,041
April 25	do	6.15	1,694
April 28	do	6.2	1,797
May 2	do	5.76	1,195
May 5	do	5.4	980
May 10	do	5.8	1,282
May 12	do	5.4	989
May 19	do	4.70	640
May 23	do	4.48	470
May 25	do	4.45	428
May 26	do	4.4	408
May 30	W. B. Richins	4.3	389
June 1	do	4.3	389
June 2	do	4.25	385
June 6	do	4.13	410
June 8	do	4.1	358
June 9	do	4.15	334
June 12	do	4.05	291
June 13	W. Richins	4.03	279
June 15	do	3.98	278
June 17	do	3.95	299
June 20	do	3.91	245
June 22	do	3.86	237
June 24	do	3.81	237
June 27	do	3.75	188
June 29	do	3.72	191
July 1	do	3.7	205
July 4	do	3.61	157
July 6	do	3.58	131
July 8	do	3.57	132
July 11	do	3.56	128
July 13	do	3.55	132
July 15	do	4.12	323
July 18	do	3.80	243
July 20	do	3.70	181
July 22	do	3.61	158
July 25	W. Richins	3.70	178
July 27	do	3.70	180
July 29	do	4.83	668
August 1	do	4.50	517
August 3	do	4.38	436
August 5	do	4.10	330
August 8	do	4.00	291
August 10	do	4.67	540
August 12	do	5.00	737
August 16	do	4.25	372
August 22	do	4.20	333
August 24	do	4.95	764
August 29	do	5.07	746
August 31	do	4.70	491
September 2	do	4.73	521
September 5	do	4.45	426
September 7	do	6.90	2,961
September 9	do	5.40	1,046
September 12	do	4.65	426
September 15	do	4.38	391
September 19	do	4.15	302
September 21	do	4.00	280
September 23	do	4.00	275
September 26	do	5.23	975
September 30	do	8.80	5,899
October 4	do	4.70	675
October 7	do	4.35	404
October 10	do	4.20	364
October 12	do	4.10	361
October 14	do	4.08	321
October 17	do	4.05	302
October 19	do	4.02	316
October 21	do	4.0	293
October 26	do	4.01	308
October 28	do	4.03	319
October 31	do	4.01	311
November 2	do	3.96	328
November 4	do	3.99	301
November 7	do	4.20	392
November 9	do	5.70	1,885
November 11	do	5.15	1,168
November 14	do	4.45	622
November 16	do	4.35	466
November 18	do	4.3	415
November 22	do	4.5	504
November 24	do	5.0	1,012

Daily gage height, in feet, of Verde River at McDowell, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.08	2.16	15.0	a6.9	5.85	4.25	3.7	4.45	4.98	b7.4	4.01	a6.6
2	1.09	2.18	11.35	6.82	5.65	4.22	b3.6	4.39	a4.75	b5.95	4.01	a5.9
3	1.08	2.74	10.45	6.75	5.55	4.2	3.63	4.31	b4.65	4.92	4.0	5.3
4	1.06	13.25	10.1	6.68	5.48	b4.15	3.6	4.19	4.55	4.68	a3.99	4.95
5	1.05	13.25	9.75	6.6	5.4	4.13	3.57	a4.1	4.4	4.52	b4.05	4.7
6	1.05	10.25	9.0	6.65	5.45	4.12	3.57	b4.08	5.53	4.42	4.12	4.45
7	a1.05	8.15	8.65	6.65	a5.45	4.1	3.57	4.02	6.65	4.32	4.5	4.32
8	b1.15	6.4	8.4	6.62	6.0	4.1	3.56	3.98	5.62	b4.25	5.12	4.22
9	1.25	5.3	7.8	6.6	6.15	4.13	b3.55	4.75	a5.4	4.22	5.62	a4.2
10	6.75	4.6	7.38	6.66	5.7	a3.98	3.56	4.75	b4.65	4.18	5.45	a4.0
11	7.4	a4.62	6.95	9.4	5.5	b4.0	3.55	5.08	4.75	4.12	a5.15	4.0
12	6.15	a5.4	6.9	17.75	5.32	4.05	3.54	5.2	4.62	4.09	b4.8	3.92
13	3.8	a4.8	9.85	15.0	6.1	4.02	3.56	4.63	4.52	4.09	4.6	3.86
14	3.1	3.85	15.1	11.4	a5.7	3.97	3.68	a4.5	4.42	a4.08	4.45	3.82
15	2.85	3.55	11.35	10.85	5.25	3.97	a4.1	4.35	4.36	b4.07	4.38	3.76
16	2.65	3.5	11.45	9.7	4.95	3.97	b3.95	4.28	a4.3	4.06	4.35	a3.75
17	2.55	6.1	16.25	8.5	4.85	3.95	3.88	4.25	b4.21	4.03	4.32	b3.7
18	2.85	8.6	14.55	7.7	4.75	3.9	3.79	4.3	4.12	4.01	a4.3	3.68
19	2.72	7.95	a12.0	7.0	4.68	b3.9	3.73	a4.15	4.12	4.02	b4.27	3.66
20	2.59	6.5	b11.4	6.45	4.65	3.9	3.68	4.08	4.08	4.0	4.25	3.66
21	a2.5	5.85	b10.8	6.25	a4.6	3.85	3.63	4.05	4.0	a4.0	4.35	3.73
22	b2.41	5.45	b10.2	a6.1	4.52	3.85	a3.61	4.18	4.0	b4.0	4.6	3.76
23	2.32	6.2	b9.6	b6.1	4.46	3.82	b3.62	5.0	a4.0	4.0	5.0	3.82
24	2.28	12.0	a9.0	6.2	4.42	3.8	3.64	4.9	4.3	4.0	4.98	b3.75
25	2.26	b9.1	8.75	6.5	b4.42	3.78	3.68	5.52	4.75	4.02	a4.95	a3.68
26	2.29	b8.2	a8.6	6.85	4.38	3.76	3.65	a6.1	5.02	4.0	b5.5	3.65
27	2.27	8.25	b8.2	6.35	4.35	3.74	3.68	b5.7	4.8	4.0	17.0	3.64
28	2.27	14.0	a7.8	6.2	a4.32	3.72	4.4	5.25	4.85	a4.03	b10.0	3.63
29	2.25	.....	7.6	a6.1	4.28	3.71	a4.85	5.02	5.4	b4.0	b8.0	3.61
30	b2.2	.....	7.15	b6.0	4.27	3.69	a5.5	4.85	8.45	3.99	a7.2	3.61
31	2.16	.....	6.95	.....	4.27	.....	4.85	4.65	.....	4.01	.....	b3.61

a One gage reading. b Estimated.

NOTE.—Gage changes from No. 3 to No. 2 February 24.

Daily discharge, in second-feet, of Verde River at McDowell, Ariz., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	248	499	25,130	1,819	1,342	370	205	490	720	4,080	325	3,280
2	250	507	10,580	1,710	1,145	370	185	452	535	2,200	340	2,400
3	248	968	8,800	1,615	1,082	380	173	403	490	920	321	1,850
4	243	32,970	8,107	1,520	1,037	380	155	365	455	665	301	1,535
5	241	32,970	7,414	1,411	987	385	137	330	410	515	325	1,310
6	241	19,310	5,928	1,478	1,018	400	132	325	1,200	440	355	1,087
7	241	9,743	5,276	1,478	1,018	380	132	297	2,550	390	575	981
8	263	5,400	4,884	1,439	1,507	358	130	285	1,270	370	1,200	905
9	285	3,750	3,946	1,411	1,696	335	128	630	1,046	360	1,775	890
10	8,674	2,700	3,289	1,493	1,177	277	130	585	475	355	1,550	750
11	10,060	2,730	2,617	6,433	1,050	283	128	785	535	355	1,168	750
12	7,394	3,900	2,539	32,140	949	291	125	860	410	355	865	694
13	2,379	3,000	7,612	24,640	1,655	280	130	525	400	340	700	656
14	1,400	1,637	25 500	15,160	1,205	270	164	455	385	321	622	632

Daily discharge, in second-feet, of Verde River at McDowell, Ariz., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	1,100	1,403	10,580	13,720	925	275	315	404	380	318	525	596
16	860	1,367	10,780	10,710	760	290	280	385	360	305	466	590
17	755	4,950	29.410	7,566	715	300	262	364	325	298	435	560
18	1,100	9,767	23,460	5,471	660	267	240	383	300	300	415	548
19	944	8,641	12,120	3,639	630	255	207	327	297	316	400	536
20	791	6,130	10,630	2,337	600	237	175	315	293	298	383	536
21	710	5,004	9,368	1,893	555	230	165	280	275	293	423	578
22	642	4,311	8,110	1,617	495	235	158	327	275	296	580	596
23	583	5,010	6,850	1,617	440	230	160	753	275	300	1,000	632
24	559	12,170	5,594	1,782	422	230	165	735	345	303	1,000	590
25	548	6 126	5.070	2,448	415	217	175	1,085	570	306	955	548
26	564	4,572	4,755	3,246	400	200	165	1,617	805	305	1,610	530
27	553	4,650	3,916	2,115	390	183	175	1,160	625	305	[a]61,460	524
28	553	21,050	3,077	1,782	380	187	435	870	650	319	13,115	518
29	542	.....	2,770	1,617	375	190	685	715	1,125	305	5,520	506
30	515	.....	2,158	1,507	375	192	1,080	590	5,350	305	4,240	506
31	499	.....	1,887	.....	375	.....	710	465	.....	311	.....	506

[a] Calculated from Kutter's formula.

NOTE.—Daily discharge obtained by indirect method.

Estimated monthly discharge of Verde River at McDowell, Ariz., for 1905.

[Drainage area, 6,000 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	10,060	241	1,419	87,250	0.236	0.272
February	32,970	499	7,709	428,100	1.28	1.33
March	29,410	1,887	8,780	539,900	1.46	1.68
April	32,140	1,411	5,227	311,000	.871	.972
May	1,696	375	832	51,160	.139	.160
June	400	183	283	16,840	.047	.052
July	1,080	125	245	15,060	.041	.047
August	1,617	280	567	34,860	.094	.108
September	5,350	275	771	45,880	.128	.143
October	4,080	293	544	33,450	.091	.105
November	61,460	301	3,432	204,200	.572	.638
December	3,280	506	875	53,800	.146	.168
The year	61,460	125	2,557	1,822,000	.426	5.68

SANTA CRUZ RIVER AT TUCSON, ARIZ.

This station was established October 15, 1905, by G. E. P. Smith. It is located at Congress Street Bridge, Tucson, Ariz.

The channel is straight for 500 feet above and 300 feet below the station. The current is swift. The left bank is low, wooded, and liable to overflow. The right bank is about 12 feet high and not liable to overflow. The bed of the stream is composed of bowlders, and shifts during floods.

Discharge measurements are made from the bridge, which consists of one steel span 100 feet long and four pile bents each 15 feet long. The initial point for soundings is the east edge of upstream cylindrical pier on the west bank.

The gage is painted on the pier, which is taken as the initial point. During 1905 the gage was read twice each day by George S. Calliahan.

Discharge measurements of Santa Cruz River at Tucson, Ariz., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
November 27...	G. E. P. Smith	68	46	5.40	1.58	251
November 28...	do	90	317	7.90	3.60	2,515
December 27...	do	44	17	2.40	0.65	40

Daily gage height, in feet, of Santa Cruz River at Tucson, Ariz., for 1905.

Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	1.0	25	1.3	.....
2	.....	1.0	26	1.1	.....
8	1.65	.....	27	1.38	.....
9	1.25	.....	28	3.85	.....
22	1.65	.....	29	2.4	.....
23	1.20	.....	30	1.45	.....
24	2.0	.....			

NOTE.—All water taken out by canals heading above station, leaving the river channel dry at station except on days for which gage heights are recorded.

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CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 175.]

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, Water-Supply Papers Nos. 165, 166, 167, 168, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers 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:

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