

DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

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CHARLES D. WALCOTT, DIRECTOR

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REPORT

OF Pg 55-

PROGRESS OF STREAM MEASUREMENTS

FOR

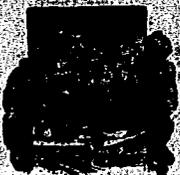
THE CALENDAR YEAR 1905

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

PART XII. The Great Basin Drainage

BY

M. C. HINDERLIDER, G. I. SWENDESEN, and HENRY THURTELL



Water-Supply and Irrigation Paper No. 176

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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.
- No. 176. The Great Basin drainage.
- No. 177. The Great Basin and Pacific Ocean drainages in California.
- No. 178. Columbia River and Puget Sound drainages.

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

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

#### *Drainage basins in the United States.*

##### NORTHERN ATLANTIC DRAINAGE BASINS.

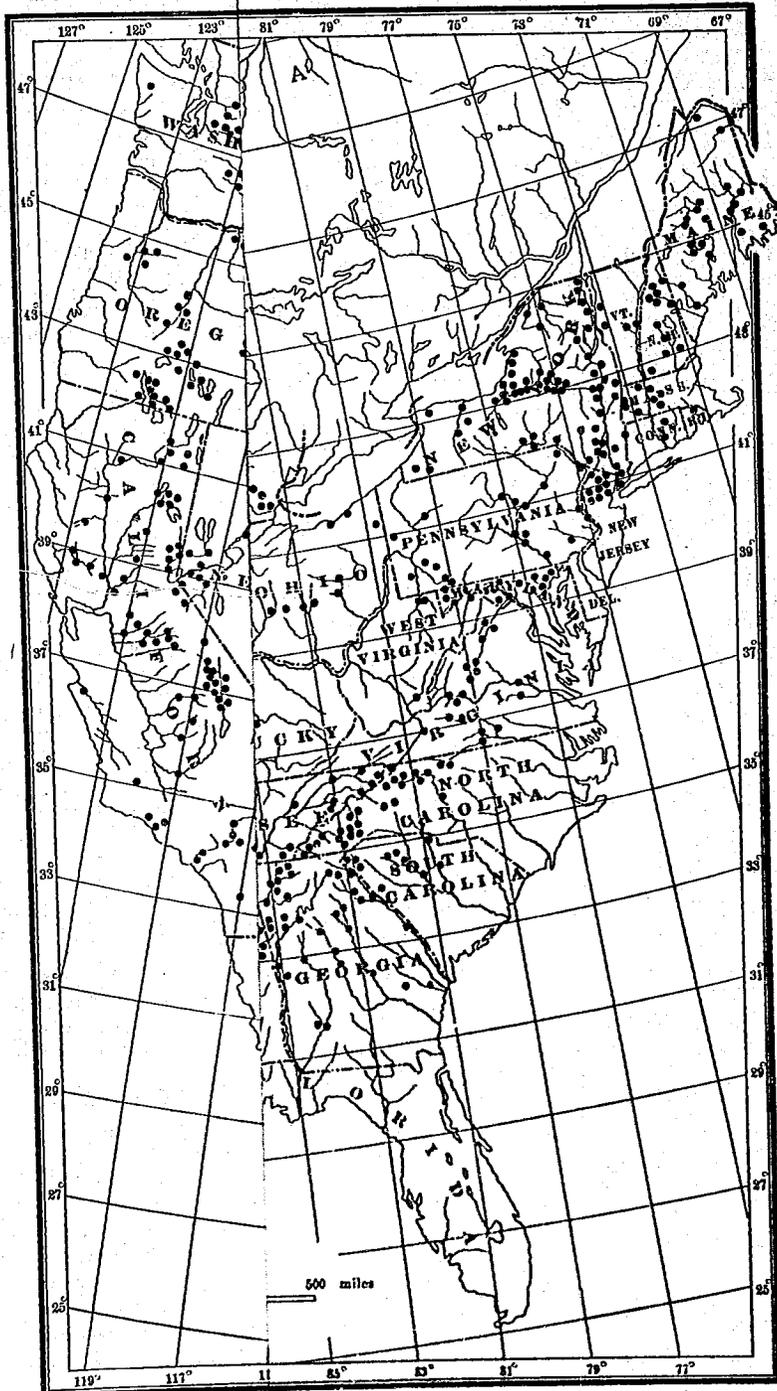
St. John.  
St. Croix.  
Penobscot.  
Kennebec.  
Androscoggin.  
Presumpscot.  
Saco.  
Merrimac.  
Connecticut.  
Blackstone.

Thames.  
Housatonic.  
Hudson.  
Passaic.  
Raritan.  
Delaware.  
Susquehanna.  
Potomac.  
Minor Chesapeake Bay.  
Minor northern Atlantic.

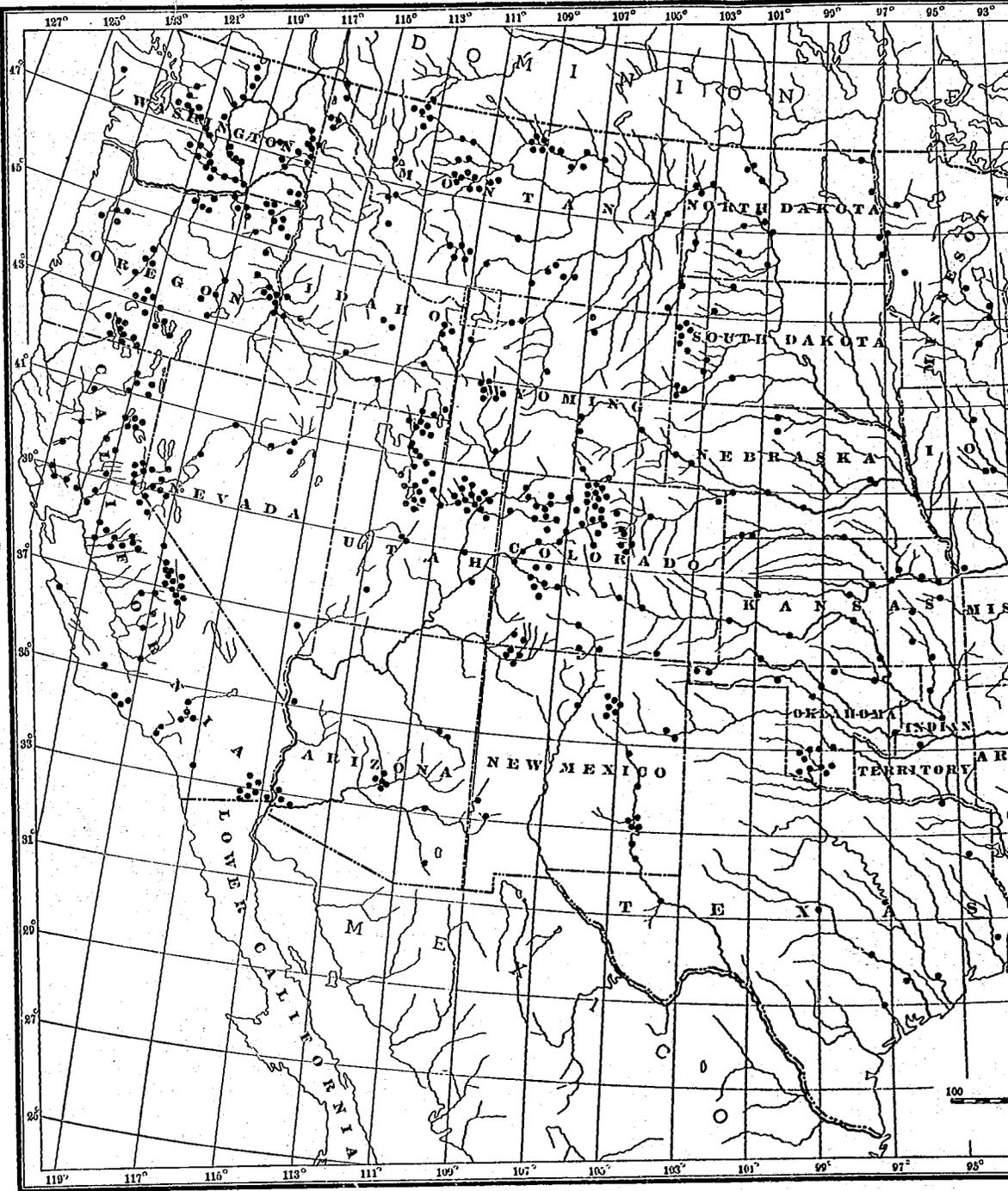
##### SOUTHERN ATLANTIC DRAINAGE BASINS.

James.  
Chowan.  
Roanoke.  
Tar.  
Neuse.  
Cape Fear.

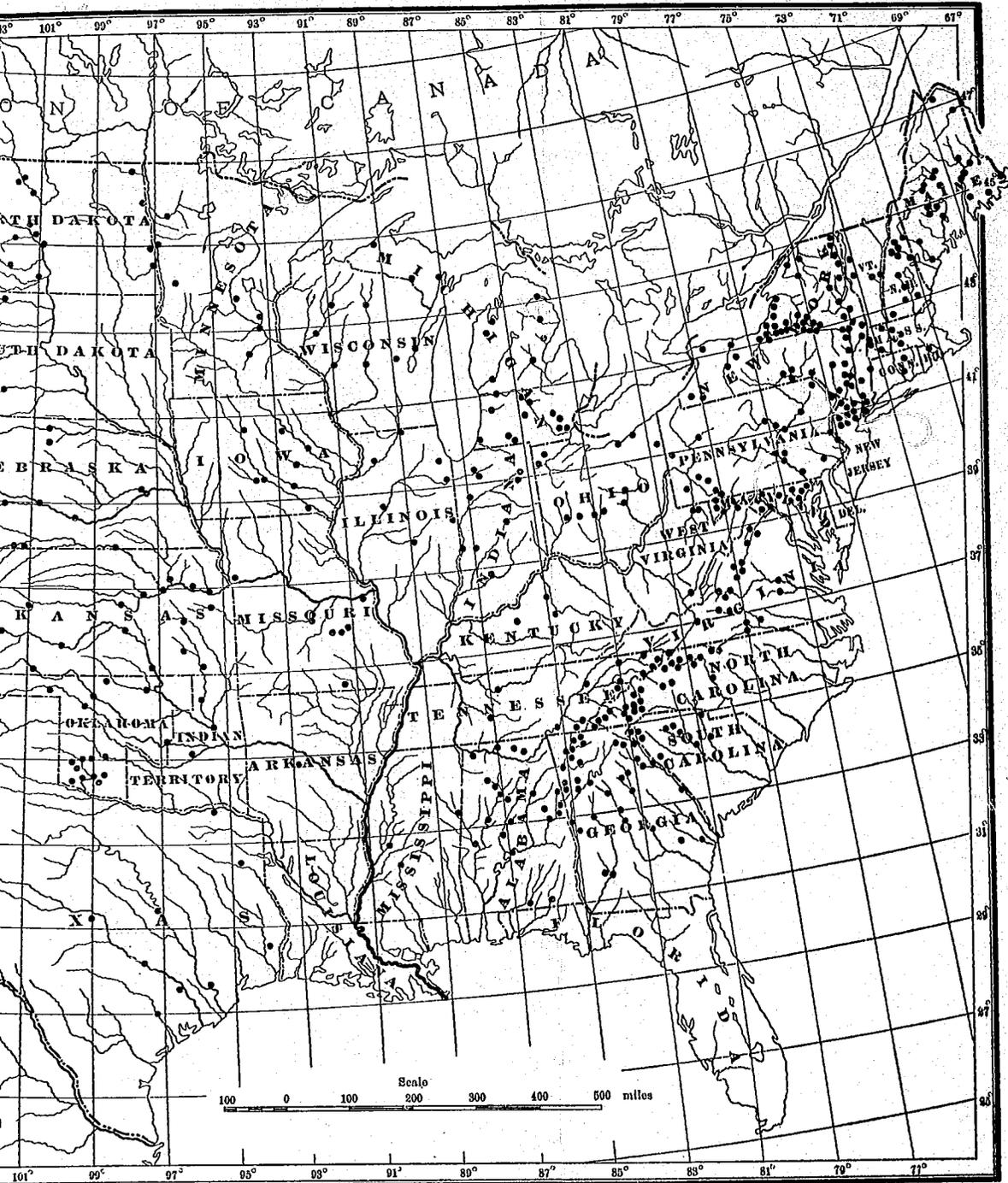
Great Pedee (Yadkin).  
Santee.  
Savannah.  
Ogeechee.  
Altamaha.  
Minor Southern Atlantic.



DURING 1905.



MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL CITIES



LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1905.

## EASTERN GULF OF MEXICO DRAINAGE BASINS.

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

## EASTERN MISSISSIPPI RIVER DRAINAGE BASINS.

Lower eastern Mississippi.	Upper eastern Mississippi.
Ohio.	

## ST. LAWRENCE RIVER DRAINAGE BASINS.

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

## WESTERN MISSISSIPPI RIVER DRAINAGE BASINS.

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

## WESTERN GULF OF MEXICO DRAINAGE BASINS.

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

## COLORADO RIVER DRAINAGE BASIN.

## THE GREAT BASIN.

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

## PACIFIC COAST DRAINAGE BASINS.

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

## 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 the rate of flow, as second-feet, gallons per minute, miner's inch, and run-off in second-feet per square mile; and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

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

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

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

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

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

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

#### EXPLANATION OF TABLES.

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

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off, based on all the facts obtained to date.

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

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

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

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

In the table of estimated monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest; this is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than that 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 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-foot.
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-foot. Between 100 and 10,000 second-foot 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 446,272 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 0.00014 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 equals 4 acre-feet.
- 100 Colorado miner's inches equal 2.60 second-feet.
- 100 Colorado miner's inches equal 19.5 United States gallons per second.
- 100 Colorado miner's inches equal 130 California miner's inches.
- 100 Colorado miner's inches for one day equal 5.2 acre-feet.
- 100 United States gallons per minute equal .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 147,108,000,000 cubic feet.
- 1 cubic mile equals 4,667 second-feet for one year.
- 1 gallon equals 3.7854 liters.
- 1 gallon equals 8.33 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. 0.5150842.
- 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 = 1.01375 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. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief description is given.

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (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,  $v = c\sqrt{r s}$ . This has been utilized by Kutter, both in developing his formula for  $c$  and in determining the values of the coefficient  $n$ , which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for  $n$  to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope, as shown by marks along the bank, and a knowledge of the general conditions.

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

The physical requirements are as follows: (a) Sufficient height of dam, so that back-water 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  $Q=c b h^3$ , 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.

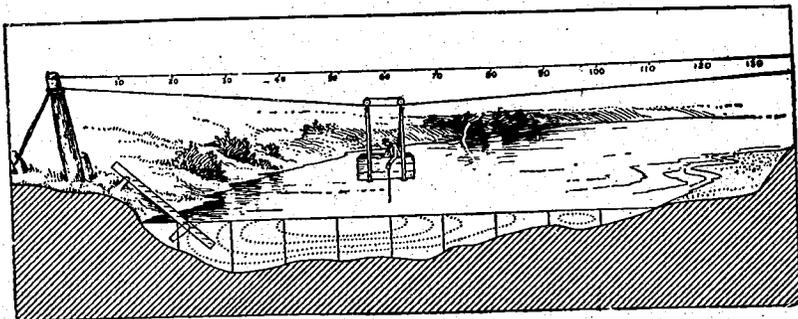


FIG. 1.—Cable station showing section of river, ear, gage, etc.

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, back-water, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and dams or other artificial obstructions that the gage height shall be an index of the discharge.

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

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

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

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

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

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

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

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

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

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

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

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

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the 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 a majority of the measurements. A large number of vertical velocity-curve measurements taken on many streams and under varying conditions show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

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

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

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as

shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the vertical velocity-curve method and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, varying thickness of ice. Such data as are available in regard to this subject are published in Water-Supply Paper No. 146, pages 141-148.

#### OFFICE METHODS OF COMPUTING RUN-OFF.

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

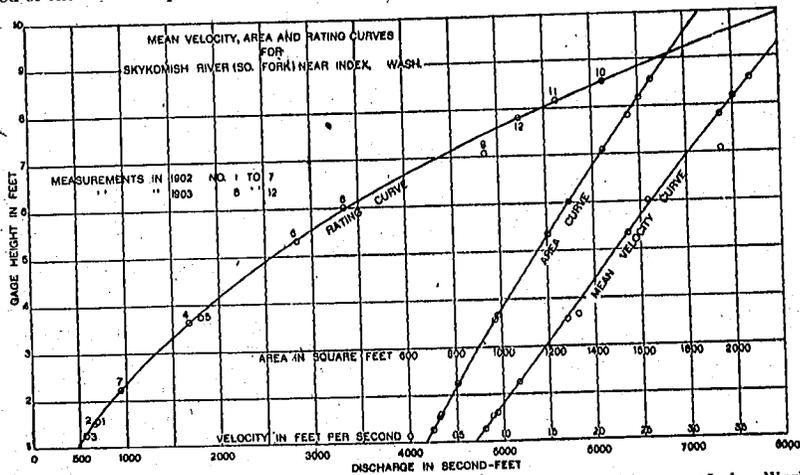


FIG. 2—Rating, area, and mean-velocity curves for South Fork of Skykomish River near Index, Wash.

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

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and 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 plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

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

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

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative 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 the 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 the case of velocity-area stations frequent discharges must be made if the estimates are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes, and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in estimating flow at stations where the bed shifts but slowly.

#### COOPERATION AND ACKNOWLEDGMENTS.

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

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

*California.*—The hydrographic work in Susan and Owens rivers drainages in eastern California was under the direction of J. B. Lippincott, supervising engineer; W. B. Clapp, district hydrographer; assisted by R. J. Taylor, J. S. Evans, F. R. S. Buttner, and J. Branham. The results of the data collected in Owens River Valley are contained in Water-Supply Paper No. 177, which contains the results of all the hydrographic data collected in the State of California during 1905.

The work in the Truckee, Carson, and Walker rivers drainages was under the direction of Henry Thurtell, State engineer of Nevada, assisted by W. A. Wolf.

*Idaho.*—The work in that portion of Idaho which lies in the Great Basin was under the direction of George L. Swendsen, district engineer, assisted by W. G. Swendsen, hydrographer.

*Nevada.*—The hydrographic work in this section has been carried on in cooperation with the State by Henry Thurtell, State engineer, assisted by W. A. Wolf. Acknowledgment is due to the Southern Pacific Company and also to the San Pedro, Los Angeles and Salt Lake Railroad Company for transportation furnished.

*Oregon.*—District engineer, John T. Whistler, assisted by Wilbur C. Sawyer, Edwards N. Smith, and Ivan Landes. Acknowledgment and thanks are due the Oregon Railroad and Navigation Company, the Oregon Short Line Railroad, the Sumpter Valley Railway, and the Columbia Southern Railway Company for transportation furnished.

*Utah.*—District engineer, George L. Swendsen, assisted by W. G. Swendsen, hydrographer. Acknowledgments are also due to the Oregon Short Line Railroad, the Denver and Rio Grande Railroad, and the San Pedro, Los Angeles and Salt Lake Railroad Company, for transportation furnished; to the Telluride Power Company; Logan River canal companies; Jordan River canal companies, Salt Lake engineer; J. Fawson Smith, jr., water commissioner for Jordan Valley; William Knight, superintendent of pumping plant at Utah Lake; and others who have given assistance from time to time. All daily papers of the State have supported the work strongly and have done much to emphasize the importance of hydrographic information to a proper development of irrigation interests.

#### GENERAL DESCRIPTION OF THE GREAT BASIN.

In the interior of the North American continent, west of the Rocky Mountains, is an immense area known as the Great Basin, the streams of which do not discharge to the ocean. The area is not one single drainage basin, but consists rather of a number of basins, some of which are connected and others closed; the outer rim of all, however, is at such an elevation that the region as a whole has no surface outlet.

In outline the Great Basin is rudely triangular. It is bordered on the west by the Sierra Nevada, on the north by the Columbia plateaus, on the east by the Rocky Mountains and the Colorado plateaus, and the southern extremity extends almost to the Gulf of California. This inclosed area is approximately 800 miles long from north to south, 500 miles broad at its widest part, and has been estimated to include 208,000 square miles. It comprises the western part of Utah, almost all of Nevada, and contiguous parts of Idaho, Oregon, and California.

Topographically this interior drainage area is characterized by isolated, narrow mountain ranges, trending north and south, which are separated by broad valleys varying considerably in altitude. In the southern part the valleys are low, Death Valley being below sea level, while in the north the valleys have a general elevation of from 4,000 to 5,000 feet. The intervening highlands often rise several thousand feet above their bases, and some of the peaks of the bordering ranges attain elevations of 13,000 feet above sea level.

Upper branches of the intermontane valleys extend into the interior ranges as narrow drainage ways that are dry during most of the year; but the drainage from the high mountains on the east and west borders of the basin passes through deep canyons into the broad valleys, where the perennial streams maintain lakes. Among these are Great Salt, Utah, and Sevier lakes in the eastern part, and Pyramid, Winnemucca, Honey, Walker, Mono, and Owens lakes in the western part of the Great Basin. With the exception of Utah Lake, which discharges by Jordan River into Great Salt Lake, these lakes are saline in character, as a consequence of the concentration of salts due to evaporation. Bear Lake, in the mountains of the eastern border, and Lake Tahoe, in the Sierras, are large bodies of fresh water that drain, respectively, to Great Salt and Pyramid lakes. Shallow, temporary bodies of water accumulate in some of the broad intermontane val-

leys during the wet season, but completely evaporate during the summer, leaving muddy plains called playas.

Geologically the Great Basin is well known as the type region of the "Basin Range structure." Many of the isolated, narrow mountain ranges that trend north and south are steep on one side, exposing cross sections of the rocks, and sloping on the other, conforming with the dip of the strata. These ranges have been uplifted by movements of the earth's crust which have broken it into tilted blocks. The greatest displacements of the Great Basin are associated with the eastern and western borders, the Wasatch Mountains and the Sierra Nevada having been uplifted many thousand feet. The mountains of the Great Basin are commonly composed of Paleozoic strata, often modified by vulcanism, and the products of weathering and disintegration of these rocks have accumulated in the broad intervening valleys, which are strewn to great depths with unconsolidated débris.

The climate of the Great Basin is extremely arid, and except a few favored spots where irrigation is practiced, the region in general is a desert. Over the larger part of the area the annual precipitation is less than 10 inches, but it is greater on the bordering high lands, especially on the Sierra Nevada, where it is over 40 inches. Temperature varies widely, owing to the large extent of the area and to differences in elevation. Over most of the region the heat of the summer days is intense, but the diurnal variation is considerable. Evaporation is enormous. From the surface of water in the vicinity of Salt Lake City it amounts to about 60 inches in a year, and over the major part of the Great Basin it is much greater, amounting in places possibly to 150 inches.

An arid climate, however, has not always prevailed in this region. In late geologic time (early Quaternary) the bordering high mountains supported glaciers, and enormous lakes, the old shore lines of which are now plainly marked on the sides of many valleys, accumulated in the Great Basin. The two largest of these lakes have been named after early explorers: Lake Bonneville occupied a considerable part of western Utah, its shrunken remnants being represented by Sevier, Utah, and Great Salt lakes; and Lake Lahontan covered an immense area in western Nevada.

The chief rivers of the Great Basin rise in the mountains which form its eastern and western borders and receive their principal supply from melting snow. The nature of the stream discharge is characteristic; the maximum commonly occurs in late spring or early summer, after which the flow decreases, reaching a minimum during the winter months. After leaving the mountains the streams receive little or no increment; in the broad, waste-filled valleys evaporation and seepage cause diminution in size, and often they entirely cease to flow.

For convenience of treatment, the drainage of the Great Basin has been divided into four areas, viz, Wasatch Mountains, Humboldt Sink, Sierra Nevada, and minor Great Basin drainages. The data collected in these areas during 1905 are given in the following pages:

#### WASATCH MOUNTAINS DRAINAGE.

##### PRINCIPAL STREAMS.

The Wasatch Mountains drainage area includes the western half of Utah and small portions of Idaho and Wyoming. The headwaters of the various streams lie either in the Wasatch Mountains or in the plateaus to the south, and they drain either into Great Salt Lake or Sevier Lake. The following are the principal rivers of the area:

Bear and Weber rivers, discharging into Great Salt Lake.

City, Parleys, Emigration, Mill, and Big and Little Cottonwood creeks, tributary to Jordan River and thus to Great Salt Lake. These creeks have small watersheds, but in the mountain courses maintain perennial flows. On reaching the main valley they are extensively used for irrigation and the first three furnish the chief water supply for Salt Lake City.

American Fork and Hobblo creeks, Spanish Fork, and Provo River, discharging into Utah Lake.

Sevier River, with its tributary, San Pitch River, draining into Sevier Lake.

## BEAR RIVER BASIN.

## DESCRIPTION OF BASIN.

Bear River rises on the northern slope of the Uinta Mountains, in the northeastern part of Utah, and after a circuitous course—in which it leaves Utah and enters Wyoming, reenters Utah, appears again in Wyoming, and makes a long detour in Idaho—it returns again to Utah and finally discharges its waters into Great Salt Lake. The maximum elevation of the upper rim of the basin is 13,000 feet.

In the upper part of its course, above the Dingle gaging station, the country is rough and broken, the rocks of the extreme headwater regions being principally sandstone and quartzite, covered with a thin layer of soil which supports scattered groves of fir and aspen. Farther down the prevailing formation is a compact limestone covered with a clayey soil, generally dry and with a rank growth of sagebrush. The tributary streams are numerous and well distributed, but they are generally short and confined to steep, narrow canyons. There are no marshes, extensive meadows, or forests, but a few small lakes lie near the head of the river. Numerous small springs and the melting snow which comprises the greater part of the precipitation are the chief sources of supply. The annual high-water period occurs during May and June, and the stream is not subject to quick floods or freshets.

Just below Dingle the main stream passes through the north end of Bear Lake Valley in a well-defined channel with no overflow, and from this point to Preston it is confined largely to a steep, narrow canyon, with occasional small, narrow valleys containing irrigated farms. The tributaries in this portion of the basin are few, the principal ones being Mink and Cottonwood creeks. About 10 miles below Dingle the outlet to Bear Lake joins the river. This is a small, crooked, sluggish stream, that discharges but little water at any time, though it is the only visible outlet to Bear Lake, which has an area of about 144 square miles.

The total unappropriated flow between Dingle and Preston is used for irrigation. There is no storage on the main stream, but on Mink Creek a number of small storage reservoirs are contemplated or in process of construction, the water to be diverted for the irrigation of lands in the northwest end of Cache Valley.

Between Preston and Collinston the Bear is a sluggish stream, traversing the west side of Cache Valley in a well-defined channel, which during extreme floods overflows slightly and covers a very narrow strip immediately along the river. The principal tributary streams in this portion of the course are Cub Creek and Logan River. The former has its source in the Bear River Range, and drains a rough country composed of limestone with but little overlying soil. The creek is confined to a steep, narrow canyon until it reaches Cache Valley, where it flows sluggishly for about 15 miles through a winding, but well-defined, channel into Bear River. It discharges considerable water into the main stream during flood and winter seasons, but its entire summer flow is used for irrigation in the north end of Cache Valley. A gaging station was maintained during a part of 1900 and 1901 on Cub Creek about 4 miles northeast of Franklin, at the mouth of the canyon, but, owing to unfavorable conditions, it was discontinued.

Logan River enters the Bear about 7 miles above the gaging station at Collinston, a short distance above the point where it leaves Cache Valley and enters the canyon.

Practically the only inflow to the Bear in Cache Valley is from seepage and springs. The lower portions of the valley form an artesian basin containing numerous small, flowing wells. The water table lies very near the surface, and during the early spring the lower lands are largely swamp.

The Bear River Canal Company diverts the entire summer flow of the stream above Collinston onto agricultural lands lying on both sides of the river below Bear River Canyon. This system has a capacity of about 1,000 second-feet, and during the winter and flood seasons a part of the water is used to develop electric power at a point about one-fourth mile above the Collinston station, being returned to the river at Collinston. From 10 to 30 second-feet reach the stream through leaks and as seepage from the diversion canals.

Owing to the complete control of the stream by irrigation works, the discharge is liable to extreme variation at any period.

BEAR LAKE AT FISHHAVEN, IDAHO.

This station was established October 5, 1903. It is located at Fishhaven, Idaho, on the west shore of Bear Lake, about 4 miles north of the Idaho-Utah State line. It is on land used as a summer resort, owned by G. C. Gray, of Montpelier, Idaho, and is immediately south of the summer resort known as Nelsons Camp.

A plain staff gage, read when the surface of the lake is calm by John L. Nelson, is driven vertically into the bed of the lake 10 feet east of a crib where water from a spring rises to the surface. The gage is protected by 2 by 4 inch stakes driven on either side. The spring melts the ice before the regular breaking-up season, the consequence being that the shore at this point is comparatively free from ice, while only a few hundred feet away it is piled up in great, grinding masses. The gage is referred to bench marks as follows: (1) A wooden hub driven flush with the ground, 1 foot south of a 15-inch cottonwood tree, 1 foot east of a fence on the east side of the county road, 142 feet north of the gage, and about 18° to the west; elevation above zero of gage, 12.19 feet. (2) A shoulder cut on an above-ground root of a 20-inch cottonwood tree, 2 feet southeast of the southeast corner of the porch of a house on the summer-resort grounds; it bears 81° W., 93 feet south of the gage rod; elevation above zero of gage, 7.13 feet. By readings on the lake surface here and at the north end of the lake, October 5, 1903, the elevation of the zero of gage was found to be 12.26 feet by the datum used on canal surveys, etc., during 1903. This elevation is probably correct to within 0.05 foot. The elevation above sea level is approximately 6,000 feet.

An extreme high-water mark pointed out by the observer, who has lived here thirty-three years, indicates that twenty or thirty years ago the surface of the lake stood at approximately gage height 6.5 feet. A more definite mark shows a gage height of 6 feet as occurring twenty years ago

Daily gage height, in feet, of Bear Lake at Fishhaven, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2.									2.7			
5.	2.5							3.0				
6.		2.55										
8.				2.0			3.05			2.4		
10.			2.7			3.15						1.85
11.											2.05	
12.								2.9				
14.					3.15				2.6			
15.		2.55										
16.	2.5										2.3	
17.			2.7	2.95								
18.												1.8
19.								2.8				
20.						3.15	3.03				2.0	
22.		2.6										
23.					3.2							
24.	2.5											
25.			2.75	2.1								
26.									2.5	2.2		
27.												1.8
28.		2.65										
29.							3.03					
30.				3.05		3.1						
31.	2.5		2.8		3.25						1.9	

NOTE.—Lake frozen over from February 22 to March 17.

## BEAR RIVER AT DINGLE, IDAHO.

This station was established May 9, 1903. It is located in a cut made by the Oregon Short Line Railroad Company one-fourth mile east of the Dingle railroad station and about 250 feet south of the track.

The channel is straight for about 400 feet above and below the station. Both banks are high, are not liable to overflow, and are barren except for small brush. The bed of the stream is of well-compacted small gravel and soil and seems to be permanent. The velocity is moderate at ordinary stages, and is well distributed. The stream freezes over late in November or early in December, and ordinarily the ice does not begin to break up until late in February. There is no anchor or needle ice at any stage. Winter records at this station are of special importance, as the object of the station is the collection of facts concerning the amount of water available for storage in Bear Lake.

Discharge measurements are made by means of a cable and car of the regular form, the length of the span being 151 feet. The cable is marked at 10-foot intervals with white paint. The initial point for soundings is the first mark from the north and is 8 feet from the north cable support.

The gage, which is read daily by M. K. Hopkins, was originally of the vertical type, but in December, 1905, it was replaced by a new inclined gage, consisting of a 6 by 6 inch fir, fastened to three vertical double posts well embedded in the bank. It is located 3 feet below the old gage and about 25 feet above the cable. The datum of the new gage was made to agree with that of the old one. The gage is referred to bench marks as follows: (1) A United States Geological Survey standard metallic post bearing N. 33° 15' E., 37 feet from as north end of cable; elevation above zero of gage, 15.59 feet; elevation above mean sea level, determined from Oregon Short Line Railroad elevations, 6,000 feet. (2) Top of south cable post; elevation, 18.04 feet above zero of gage. (3) Top of 4-foot stick of timber planted 2.7 feet in the ground; elevation above zero of gage, 18.42 feet. During the winter of 1904-5 gage readings were taken once or twice each week, the surface of the water being read after the ice had been cut around the gage and the thickness of the ice in each case noted.

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

Description: 100, p 135; 133, p 238.

Discharge: 100, p 135; 133, p 238.

Discharge, monthly: 100, p 137; 133, p 240.

Gage heights: 100, p 136; 133, p 239.

Rating table: 100, p 136; 133, p 240.

## Discharge measurements of Bear River at Dingle, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		Feet.	Square Feet.	Feet per second.	Feet.	Second-feet.
February 13 a.	C. Tanner.....	92	130	1.43	b 4.45	194
March 24.....	W. G. Swendsen.....	107	210	1.80	4.22	379
September 19.....	do.....	97	130	.98	3.48	133

a Stream frozen; ice 1 foot thick near the center and increasing gradually to 1.5 feet at either side. No anchor or slush ice.

b Surface of water in hole cut in ice.

BEAR RIVER BASIN.

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.8			4.2	4.2	3.7	3.85	3.35	3.3	3.5	3.55	3.5
2.....	4.7		4.8	4.1	4.15	3.95	3.8	3.4	3.3	3.5	3.55	3.5
3.....	4.6	4.8		4.1	4.2	4.0	3.75	3.35	3.3	3.5	3.55	3.5
4.....	4.6	4.8	4.7	4.1	4.2	3.95	3.75	3.4	3.3	3.5	3.0	3.55
5.....	4.4	4.8		4.1	4.2	4.05	3.8	3.4	3.3	3.5	3.55	3.5
6.....	4.4		4.45	4.05	4.15	4.2	3.8	3.35	3.4	3.5	3.55	3.5
7.....	4.5		4.45	4.0	4.1	4.25	3.65	3.3	3.4	3.5	3.55	4.4
8.....	4.5			4.0	4.1	4.5	3.5	3.3	3.4	3.5	3.5	4.4
9.....	4.5		4.4	4.1	4.1	4.05	3.4	3.3	3.4	3.5	3.55	4.5
10.....	4.5			4.1	4.1	4.0	3.45	3.3	3.4	3.5	3.55	4.25
11.....	4.6	4.6	4.4	4.1	4.05	4.0	3.5	3.3	3.4	3.5	3.55	
12.....	4.6		4.4	4.1	4.05	4.7	3.5	3.3	3.35		3.55	
13.....		4.45	4.7	4.1	4.0	4.9	3.05	3.3	3.35	3.5	3.5	
14.....	4.0	4.45	4.4	4.1	4.0	5.0	3.7	3.3	3.35	3.5	3.55	4.35
15.....			4.4	4.15	4.0	4.8	3.7	3.3	3.35	3.5	3.55	
16.....			4.45	4.2	3.9	4.7	3.7	3.3	3.35	3.5	3.55	
17.....	4.7		4.45	4.2	3.9	4.75	3.65	3.3	3.35	3.5	3.5	4.0
18.....		4.45	4.4	4.2	4.0	4.0	3.0	3.3	3.35	3.5		
19.....			4.4	4.2	3.9	5.05	3.0	3.3	3.45	3.5	3.55	
20.....			4.4	4.2	3.9	4.95	3.0	3.2	3.5	3.5	3.55	
21.....	4.7		4.4	4.2	3.9	4.8	3.0	3.2	3.5	3.5	3.5	4.0
22.....		4.7	4.3	4.2	3.9	4.65	3.55	3.2	3.5	3.5	3.55	
23.....			4.3		3.95	4.35	3.5	3.2	3.5	3.5	3.55	
24.....	4.8		4.2	4.2	3.95	4.2	3.5	3.2	3.5	3.5	3.55	
25.....		4.7		4.2	3.95	4.1	3.5	3.2	3.5	3.55	3.55	3.8
26.....			4.2	4.2	3.9	4.0	3.4	3.2	3.45	3.55	3.55	
27.....		4.8	4.2	4.2	3.9	3.95	3.4	3.2	3.5	3.55		
28.....	4.7		4.2	4.2	3.8	4.0	3.35	3.3	3.45	3.55	3.5	3.8
29.....			4.2	4.2	3.8	3.95	3.3	3.3	3.5	3.0	3.3	
30.....	4.8		4.2	4.1	3.8	3.9	3.4	3.3	3.5	3.55	3.2	
31.....			4.2		3.75		3.35	3.3		3.55		4.0

NOTE.—River frozen January 1 to about March 14 and December 7 to 31. During this period the readings were to the water surface in a hole cut in the ice.

The following thicknesses of ice were recorded:

	Thickness in feet.		Thickness in feet.
January 4.....	0.75	February 11.....	1.1
January 8.....	1.0	February 18.....	1.2
January 21.....	1.2	February 22.....	1.2
January 24.....	1.2	February 25.....	1.3
January 28.....	1.2	February 27.....	1.3
February 4.....	1.1	March 2.....	1.2
February 5.....	1.1	March 6.....	.7

March 11, ice nearly gone. March 18, no ice at gage.

Station rating table for Bear River at Dingle, Idaho, from March 11 to December 6, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.10	60	3.00	260	4.70	590	5.50	1,020
3.20	75	4.00	295	4.80	635	5.60	1,085
3.30	90	4.10	330	4.90	685	5.70	1,155
3.40	110	4.20	370	5.00*	740	5.80	1,230
3.50	135	4.30	410	5.10	790	5.90	1,300
3.60	160	4.40	455	5.20	840	6.00	1,375
3.70	190	4.50	495	5.30	895	6.10	1,460
3.80	225	4.60	540	5.40	955		

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1903-1905. It is well defined between gage heights 3.5 feet and 7.4 feet. Above gage height 6.1 feet the rating curve is a tangent, the difference being 60 per tenth.

The above table is the same as that used for 1904.

Estimated monthly discharge of Bear River at Dingle, Idaho, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	310	180	259	15,920
February.....	310	195	259	14,380
March.....	590	180	365	22,440
April.....	370	295	348	20,710
May.....	370	208	294	18,080
June.....	765	190	467	27,790
July.....	242	90	157	9,654
August.....	110	75	89	5,472
September.....	135	90	113	6,724
October.....	160	135	138	8,485
November.....	160	75	141	8,390
December 1-6.....	147	135	137	1,630
The period.....				159,700

NOTE.—Discharge interpolated for days when the gage was not read. Estimates for January, February, and March corrected for effect of ice. They are merely approximate.

#### BEAR RIVER NEAR PRESTON, IDAHO.

This station was established October 11, 1889. It is located about 6 miles from Preston, Idaho, 10 miles north of the Idaho-Utah boundary line and about 300 feet below the county road crossing at the old bridge of the Oregon Short Line Railroad. The data collected at this station are of extreme importance as showing the amount of water that passes from Idaho into Utah and will be of great value in the final adjudication of water rights on the stream.

The channel is straight for about 250 feet above and below the station. Both banks are barren and are sufficiently high to prevent overflow. The bed of the stream is of gravel and clay and is permanent. A light growth of moss near the north side of the gaging section interferes slightly with summer records; otherwise the conditions are good. The stream is ice covered from about the end of December to the middle of February. There is no needle ice and but little fluctuation.

Discharge measurements are made by means of a cable and car, rebuilt in 1904. The cable has a span of about 250 feet and is marked at 10-foot intervals with red paint. The initial point for soundings is the north post supporting the cable.

The gage, which is read daily by Mrs. Hannah Nelson, was originally of the vertical type and consisted of a board nailed to a pile of the highway bridge. This was replaced August 4, 1890, by a wire gage, which proved unsatisfactory, and October 31, 1903, a new temporary gage was again attached to the bridge pile. In December, 1904, a new inclined gage was established at a point about 50 feet below the bridge. It consists of a piece of 8 by 8 inch fir, supported by three vertical double posts. The bench mark is a United States Geological Survey standard metallic post, set flush with the surface of the ground at a point about 8 feet upstream from the south post supporting the cable; elevation above zero of gage, 7,428 feet. All readings have been reduced as nearly as possible to the same datum.

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

- Description: Ann 14, II, pp 118-119; 18, IV, p 313; Bull 131, p 53; 140, pp 225; WS 16, p 157; 28, p 146; 38, pp 332-333; 51, p 400; 66, p 117; 85, p 82; 100, pp 133-134; 133, p 241.
- Discharge: Ann 18, IV, p 314; Bull 131, pp 53, 62; 140, p 226; WS 16, p 157; 28, p 153; 35, pp 18-19; 38, p 333; 51, p 400; 66, p 117; 85, p 83; 100, p 134; 133, p 241.
- Discharge, monthly: Ann 11, II, p 102; 12, II, pp 352, 360; 13, III, p 98; 14, I, p 119; 18, IV, p 315; 19, IV, p 432; 20, IV, p 459; 21, IV, p 394; 22, IV, p 407; Bull 140, p 227; WS 75, p 191; 85, p 84; 133, p 243.
- Discharge, yearly: Ann 11, II, p 99; 13, p 99; 20, IV, p 60.
- Gage heights: Bull 131, pp 54-55; 140, p 226; WS 11, p 76; 16, p 157; 28, p 149; 38, p 334; 51, p 410; 66, p 117; 85, p 83; 100, p 134; 133, p 242.
- Hydrographs: Ann 12, II, p 330; 14, II, p 118; 18, IV, p 310; 19, IV, p 433; 20, IV, p 460; 22, IV, p 407; 75 p 101.
- Rating tables: Ann 18, IV, p 314; 19, IV, p 432; Bull 131, p 54; 140, p 226; WS 28, p 154; 39, p 452; 52, p 521; 66, p 176; 85, p 84; 133, p 242.

*Discharge measurements of Bear River near Preston, Idaho, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 25.....	W. G. Swendsen.....	188	348	1.78	1.60	617
February 17 <sup>a</sup> ..	C. Tauner.....	197	524	1.46	2.80	766
March 23.....	W. G. Swendsen.....	192	470	2.26	2.15	1,059
March 23.....	do.....	192	470	2.27	2.15	1,067
May 3.....	do.....	196	513	2.64	2.45	1,354
June 7.....	do.....	187	358	1.60	1.45	574
July 11.....	do.....	152	203	.89	.60	182
August 23.....	W. D. Beers.....	145	216	.82	.60	177
September 16..	W. G. Swendsen.....	171	239	1.22	.80	291
October 30.....	do.....	186	340	1.56	1.43	528

<sup>a</sup> Back water caused by a large quantity of floating ice piled up near the gaging station. This rendered the velocity zero for 60 feet in the middle of the stream. There was a small amount of ice on the edges of the stream at the gaging station, but none near the gage.

## STREAM MEASUREMENTS IN 1905, PART XII.

Daily gage height, in feet, of Bear River near Preston, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.6	1.5	1.5	1.88	2.15	1.7	.....	0.5	0.7	1.0	1.04	1.3
2.....	2.6	1.5	1.52	1.8	2.33	1.7	.....	.5	.7	1.0	1.04	1.25
3.....	2.6	1.6	1.55	1.8	2.42	1.62	.....	.5	.7	1.07	1.04	1.25
4.....	2.6	1.6	1.6	1.8	2.38	1.6	.....	.5	.7	1.18	1.04	1.25
5.....	2.5	.....	1.6	1.8	2.3	1.63	0.6	.62	.7	1.32	1.04	1.25
6.....	2.5	1.6	1.68	1.8	2.23	1.53	.62	.5	.7	1.3	1.04	1.2
7.....	2.45	1.6	1.68	1.8	2.1	1.43	.7	.5	.72	1.3	1.04	1.37
8.....	2.4	1.6	1.72	1.8	2.1	1.47	.68	.5	.7	1.3	1.04	1.3
9.....	2.4	1.6	1.78	1.8	2.1	1.4	.63	.5	.7	1.3	1.04	1.4
10.....	2.4	1.8	1.78	1.8	2.1	1.43	.6	.5	.7	1.3	1.04	1.4
11.....	2.4	1.9	1.85	1.8	2.05	1.53	.6	.5	.7	1.3	1.04	1.5
12.....	2.4	.....	1.92	1.8	2.05	1.65	.6	.5	.72	1.3	1.04	1.7
13.....	2.4	.....	2.0	1.8	2.0	1.67	.6	.5	.8	1.35	1.04	2.0
14.....	2.4	.....	2.07	1.87	1.95	1.85	.6	.5	.8	1.32	1.04	2.6
15.....	.....	2.8	2.15	1.9	1.95	1.68	.6	.5	.8	1.22	1.04	.....
16.....	3.5	2.72	2.2	1.9	2.0	1.6	.6	.5	.8	1.05	1.04	.....
17.....	3.5	2.7	2.15	1.97	2.05	1.72	.6	.5	.8	1.05	1.35	.....
18.....	3.5	2.55	2.25	2.02	2.15	1.87	.6	.5	.77	1.04	1.3	2.65
19.....	1.5	2.57	2.3	2.08	2.15	1.9	.6	.5	.7	1.04	1.3	.....
20.....	1.5	2.48	2.27	2.0	2.15	1.9	.6	.5	.8	1.04	1.35	.....
21.....	1.5	1.5	2.23	1.95	2.1	1.65	.8	.5	.8	1.04	1.32	.....
22.....	1.5	1.5	2.2	1.97	2.07	1.5	.8	.6	.8	1.04	1.3	.....
23.....	1.6	1.5	2.12	2.0	2.0	1.42	.8	.75	.8	1.04	1.3	2.45
24.....	1.6	1.5	2.1	2.0	1.95	1.32	.8	.63	.8	1.04	1.27	.....
25.....	.....	1.58	2.05	2.07	1.9	1.25	.75	.7	1.0	1.04	1.25	.....
26.....	1.55	1.6	2.07	2.1	1.9	1.2	.7	.67	.95	1.45	1.25	.....
27.....	1.5	1.55	2.1	2.05	1.9	1.0	.65	.65	.9	1.45	1.25	.....
28.....	1.5	1.52	2.0	2.05	1.9	.....	.6	.7	1.0	1.45	1.25	.....
29.....	1.5	.....	2.0	2.05	1.87	.....	.6	.7	1.0	1.45	1.27	.....
30.....	1.5	.....	2.0	2.05	1.8	.....	.55	.7	1.0	1.41	1.3	.....
31.....	1.5	.....	1.95	.....	1.72	.....	.52	.7	.....	1.41	.....	.....

NOTE.—River frozen January 1-18 and February 10-20. Ice conditions December 7-31.

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

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.50	158	1.10	371	1.60	642	2.10	1,020
.60	186	1.20	418	1.70	708	2.20	1,110
.70	217	1.30	468	1.80	779	2.30	1,205
.80	251	1.40	522	1.90	855	2.40	1,300
.90	283	1.50	580	2.00	935	2.50	1,400
1.00	328	.....	.....	.....	.....	.....	.....

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

*Estimated monthly discharge of Bear River near Preston, Idaho, for 1905.*

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January 19-31.....	642	580	595	15,340	0.132	0.064
February 1-9; 21-28.....	642	580	615	20,740	.137	.087
March.....	1,205	580	907	55,770	.202	.233
April.....	1,020	779	871	51,830	.194	.216
May.....	1,320	722	991	60,930	.220	.254
June.....	855	328	599	35,640	.133	.148
July.....	251	164	201	12,360	.045	.052
August.....	234	158	176	10,820	.039	.045
September.....	328	217	250	14,880	.056	.062
October.....	551	328	429	26,380	.095	.110
November.....	495	346	401	23,860	.089	.099
December 1-6.....	468	418	443	5,272	.098	.022
The period.....				333,800		

NOTE.—Discharge interpolated on days when gage was not read.

#### BEAR RIVER NEAR COLLINSTON, UTAH.

This station was established July 1, 1889. It is located 6 miles from Collinston station on the Oregon Short Line Railroad, about one-fourth mile below the electric-power plant in Bear River Canyon. It is at the lower end of the canyon separating Cache and Great Salt Lake valleys, at a point below all diversion from the stream. It shows the amount of unappropriated water that is discharged as waste into Great Salt Lake.

The stream at this point is wide and shallow. Both banks are sufficiently high to prevent overflow; the west bank slopes gradually, while the east is abrupt. The bed is composed of boulders and clay and is somewhat rough, but apparently permanent. A deposit of material which was washed into the stream by the water from a spillway at the power plant during 1903 changed the original condition considerably during 1903 and 1904. The cross section was rechecked, however, in March, 1905, and found to agree very closely with the original standard cross section, the new material having been washed out. The velocity ranges from 2 to 4 feet per second. There is a free flow except at a small hole near the east bank. The discharge ranges from 7,000 feet during flood season to nothing during the summer, when the entire flow is diverted for irrigation above the station. The stream probably never freezes entirely over, but ice forms along the edges to quite an extent during December and January.

Discharge measurements were originally made from a small boat attached by means of a chain and pulley to a cable stretched across the stream. During 1904 discharge measurements were made from a bridge recently built across the stream at the power house, but owing to poor conditions at this point a cable and car were established at the old section in January, 1905. The total length of the span is 301 feet. The cable is marked at 20-foot intervals with paint, beginning at the west post, which is the initial point for soundings.

The gage, which is read daily by D. A. Cannon, a watchman along the Bear River canals, consisted originally of a vertical iron bar driven into the river bed and supported at the top by a horizontal bar fastened to posts on the bank. It was replaced in February, 1905, by an inclined gage. This is a 6 by 6 inch fir, fastened by means of iron straps to three posts firmly embedded in the bank, and graduated to read vertically. It is located at the same point as the old vertical gage. The low-water gage is an iron peg driven into the bed of the stream about 50 feet from the west bank. It has the same datum as the regular gage.

The gage is referred to bench marks as follows: (1) A metallic post, 3 inches in diameter and 4 feet long, set in the ground at a point 30 feet S. 74° W. from the west post supporting the cable; elevation, 9.59 feet above zero of gage, and so stamped on the top; (2) a nail in an oak post 20 feet west of the gage and 20 feet north of the cable; elevation above gage datum, 7.35 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, p 319; Bull 131, pp 55-56; 140, p 227; WS 16, p 159; 28, p 146; 33, pp 335-336; 51, p 413; 66, p 120, 85, p 80; 100, p 131; 133, p 433.

Discharge: Ann 18, iv, p 319; Bull 131, pp 90, 92; 140, p 228; WS 16, p 159; 28, p 153; 35, pp 18-19; 38, p 336; 51, p 413; 66, p 120; 85, p 80; 100, p 131; 133, p 244.

Discharge, monthly: Ann 11, II, p 103; 12, II, pp 352, 360; 13, III, p 96; 14, II, pp 120-121; 18, IV, p 320; 19, IV, p 435; 20, IV, pp 458-460; 21, IV, p 395; 22, IV, p 410; Bull 140, p 229; WS 75, p 193; 85, p 82; 100, p 133; 133, p 245.

Discharge, yearly: Ann 11, II, p 60; 13, III, p 99; 20, IV, p 60.

Gage heights: Bull 131, pp 56-57; 140, p 229; WS 11, p 77; 16, p 159; 28, p 150; 33, p 336; 51, p 414; 66, p 121; 85, p 81; 100, p 132; 133, p 244.

Hydrographs: Ann 12, II, p 332; 14, II, p 121; 18, IV, p 320; 19, IV, p 435; 20, IV, p 401; 21, IV, p 395; 22, IV, p 411.

Rainfall and run-off relation: Ann 20, IV, p 459.

Rating tables: Ann 18, IV, p 320; 19, IV, p 434; Bull 140, p 228; WS 28, p 154; 39, p 453; 52, p 521; 66, p 176; 85, p 81; 100, p 132; 133, p 245.

*Discharge measurements of Bear River near Collinston, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet</i>	<i>Second-feet.</i>
February 10....	C. Tanner.....	270	486	2.46	1.75	1,195
March 20.....	W. G. Swendsen.....	276	711	2.73	2.50	1,943
March 29.....	.....do.....	276	711	2.78	2.50	1,976
May 17.....	.....do.....	276	684	2.79	2.45	1,910
September 7 <sup>a</sup> ..	A. B. Larson.....	10	10	1.04	.37	31
October 31.....	W. G. Swendsen.....	268	400	2.32	1.60	1,039

a 350 feet below regular station.

BEAR RIVER BASIN.

Daily gage height, in feet, of Bear River near Collinston, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.7	1.9	1.95	2.35	2.6	2.25	-0.1	-0.5	-0.5	1.2	1.55	1.4
2.....	1.8	1.95	1.95	2.3	2.8	2.2	.1	.5	.5	1.2	1.55	1.45
3.....	1.75	2.0	2.0	2.2	3.1	2.1	.15	.5	.5	1.1	1.55	1.45
4.....	1.75	2.0	2.0	2.2	3.15	2.1	.....	.55	.5	1.1	1.55	1.45
5.....	1.8	2.0	2.0	2.1	3.0	2.05	.2	.55	.5	1.1	1.55	1.5
6.....	1.9	2.0	1.95	2.1	2.9	1.95	.2	.55	.5	1.1	1.55	1.45
7.....	1.8	1.9	1.9	2.1	2.75	1.8	.25	.55	.....	1.1	1.6	1.4
8.....	1.6	1.85	1.95	2.15	2.65	1.6	.25	.55	.4	1.15	1.6	1.3
9.....	1.75	1.8	1.95	2.2	2.6	1.4	.3	.55	.4	1.15	1.6	1.2
10.....	1.9	1.75	1.9	2.2	2.6	1.35	.3	.55	.4	1.2	1.6	1.1
11.....	1.7	1.7	1.9	2.3	2.6	1.3	.4	.55	.4	1.2	1.6	1.0
12.....	1.7	1.5	1.95	2.3	2.6	1.3	.4	.55	.35	1.2	1.6	1.0
13.....	1.8	1.3	2.0	2.25	2.6	1.35	.45	.5	.3	1.2	1.6	1.05
14.....	1.6	1.4	2.1	2.2	2.5	1.4	.45	.5	.3	1.25	1.55	1.05
15.....	1.6	1.6	2.1	2.3	2.4	1.4	.45	.5	+.3	1.3	1.55	1.1
16.....	1.65	1.7	2.1	2.3	2.4	1.35	.5	.5	.3	1.3	1.55	1.1
17.....	1.7	1.7	2.1	2.3	2.4	1.3	.5	.5	.3	1.3	1.55	1.15
18.....	1.75	1.7	2.15	2.3	2.5	1.4	.5	.55	.3	1.35	1.55	1.15
19.....	1.75	1.7	2.25	2.4	2.8	1.4	.5	.55	.4	1.4	1.5	1.2
20.....	1.75	1.65	2.5	2.6	2.95	1.45	.5	.55	.4	1.45	1.5	1.25
21.....	1.7	1.65	2.4	2.6	3.0	1.45	.5	.55	.4	1.45	1.5	1.25
22.....	1.75	1.7	2.35	2.55	3.0	1.4	.5	.55	.4	1.4	1.45	1.2
23.....	1.8	1.7	2.35	2.55	2.9	1.35	.45	.55	.4	1.45	1.45	1.2
24.....	1.8	1.8	2.4	2.5	2.85	1.1	.45	.5	.35	1.5	1.45	1.25
25.....	1.85	1.9	2.4	2.45	2.8	.6	.45	.5	.3	1.5	1.45	.....
26.....	1.85	1.9	2.4	2.5	.....	.6	.45	.45	.3	1.5	1.45	1.3
27.....	1.85	1.9	2.5	2.55	.....	.55	.45	.45	.35	1.5	1.45	1.35
28.....	1.85	1.95	2.5	2.6	2.5	.55	.5	.5	.7	1.5	1.45	1.4
29.....	1.9	.....	2.5	2.6	2.55	.55	.5	.5	.65	1.5	1.5	1.45
30.....	1.95	.....	2.4	2.6	2.55	.5	.5	.5	.7	1.5	1.5	1.4
31.....	2.0	.....	2.4	.....	2.4	.....	.5	.5	.....	1.6	.....	1.35

Station rating table for Bear River near Collinston, Utah, from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second feet.						
-0.55	10	0.40	266	1.40	868	2.40	1,850
-0.50	15	.50	310	1.50	950	2.50	1,960
-0.40	29	.60	336	1.60	1,035	2.60	2,075
-0.30	47	.70	406	1.70	1,125	2.70	2,190
-0.20	68	.80	460	1.80	1,220	2.80	2,310
-0.10	92	.90	518	1.90	1,320	2.90	2,435
.00	120	1.00	580	2.00	1,420	3.00	2,560
.10	152	1.10	646	2.10	1,525	3.10	2,690
.20	187	1.20	716	2.20	1,630	3.20	2,830
.30	225	1.30	790	2.30	1,740		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-05. It is well defined between gage heights 1.3 feet and 2.5 feet.

*Estimated monthly discharge of Bear River near Collinston, Utah, 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.....	1,420	1,035	1,199	73,720	0.200	0.231
February.....	1,420	790	1,199	66,590	.200	.208
March.....	1,660	1,320	1,605	98,690	.208	.300
April.....	2,075	1,525	1,800	107,100	.300	.335
May.....	2,760	1,850	2,201	135,300	.367	.423
June.....	1,685	310	895	53,260	.149	.166
July.....	120	15	36.4	2,238	.0061	.0070
August.....	22	10	13.0	779	.0022	.0025
September.....	406	15	158	9,402	.026	.029
October.....	1,035	646	806	49,500	.134	.154
November.....	1,035	909	970	58,080	.163	.182
December.....	950	580	767	47,160	.128	.148
The year.....	2,760	10	971	701,900	.160	2.17

NOTE.—Discharge interpolated on days when gage was not read. Discharge applied for open channel during winter months.

## LOGAN RIVER NEAR LOGAN, UTAH.

Logan River rises on the west slope of the Bear River Range, flows southwest, then northwest, and unites with Bear River near Benson, Utah. The entire basin is rough and rugged, the elevations ranging from 4,500 to 9,000 feet and the stream being confined largely to a steep and rough channel in a comparatively narrow canyon. The principal formation is a compact limestone, with little or no soil except near the summit of the range, where a thin layer supports quite extensive groves of fir and aspen. The lower reaches of the stream are practically barren of timber, except for a few scattered pine and mahogany trees and a rather thick growth of underbrush. A large amount of timber has been cut out and the area has been overgrazed by sheep and cattle. There are no flood basins or marshes in the region. Probably three-fourths of the precipitation in the basin is snow, the melting of which forms the chief source of supply for the spring and early summer flow; the late summer and winter flow is derived chiefly from springs, which are well distributed over the basin. In its upper course the stream has numerous small tributaries, all short and swift. Temple Fork and South Fork, which enter the river about 10 and 15 miles, respectively, above the gaging station, are perennial streams and furnish from one-third to one-fourth of the total flow. Blacksmith Fork comes in below the gaging station. There is no storage on the stream at present. The entire flow, after being utilized to furnish power at two electric plants near the mouth of the canyon, is used for irrigation.

A gaging station was established June 1, 1896, about 2 miles east of the city of Logan, near the mouth of the canyon. It was discontinued July 18, 1903, and reestablished April 13, 1904, at a point along the canyon road about 50 feet below the highway bridge, at the mouth of the canyon, 800 feet below the Hercules power house and about 1,000 feet above the old gaging station.

The channel is straight for about 150 feet above and 75 feet below the gaging section. The banks are of rock and soil, permanent, and are sufficiently high to prevent overflow. The bed of the stream was originally of boulders and gravel, well cemented together, very rough, and of such shape that the stream was not well distributed. When the station was reestablished the channel was improved by removing large boulders and sufficient of the finer material to distribute the flow and render the bed comparatively smooth. During the

spring flood of 1904 a deposit of boulders and gravel was made at the section, reducing it to about the original conditions, but leaving a loose and probably shifting bed. There is but one channel at all stages. Discharge ranges from about 150 to 1,000 second-feet, with a velocity of from 3 to 7 feet per second. The depth is 1.5 to 3.5 feet. There are no dams or riffles and the grade of the stream is about uniform. Winter flow is affected but little by ice, as the stream never freezes over.

Discharge measurements are made by means of a cable and car of the regular form. The cable is marked at 4-foot intervals with red paint. A guy line is stretched about 25 feet above the cable, for use during high water. The initial point for soundings is a 4 by 4 inch post, set in the west bank and projecting about 4 feet above the ground.

Observations are taken by the Telluride Power Company, under the direction of E. P. Bacon, manager. The gage is of the vertical type, consisting of a 2 by 2½ inch steel rod, with the upstream side drawn to an edge. It is driven into the bed of the stream and is supported at the top by a horizontal 4 by 4 inch fir buried in the bank and fastened to a vertical post near the water edge. The bench mark is a United States Geological Survey standard metallic plug, cemented in a limestone ledge 250 feet N. about 30° W. of the cable, on a prominent point near the north side of a road leading to the power house; elevation, 24.85 feet above zero of gage; elevation above mean sea level, as determined from Oregon Short Line Railroad elevations, 4,502 feet.

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

- Description: Ann 18, iv, pp 310-317; 19, iv, p 433; 20, iv, p 462; 21, iv, p 397; WS 16, p 158; 28, p 146; 38, p 334; 51, p 411; 60, p 118; 85, pp 80-87; 100, p 137; 133, p 246.  
 Discharge: Ann 18, iv, p 317; WS 16, p 158; 28, p 153; 38, p 335; 51, p 411; 66, p 118; 85, p 87; 100, p 137; 133, p 246.  
 Discharge, monthly: Ann 18, iv, p 318; 19, iv, p 434; 20, iv, p 462; 21, iv, p 397; 22, iv, p 408; WS 75, p 192; 133, p 248.  
 Discharge, yearly: Ann 20, iv, p 60.  
 Gage heights: WS 11, p 77; 16, p 158; 28, p 150; 38, p 335; 51, p 412; 66, p 119; 100, p 138; 133, pp 247, 248.  
 Hydrographs: Ann 19, iv, p 434; 20, iv, p 463; 22, iv, p 409.  
 Rating tables: Ann 18, iv, p 318; 19, iv, p 433; WS 28, p 154; 39, p 453; 52, p 521; 66, p 176; 133, p 247.

*Discharge measurements of Logan River near Logan, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	Feet per second.	Feet.	Second-feet.
January 22....	W. G. Swendsen.....	51	49	3.16	4.40	155
February 21....	do.....	50	49	3.26	4.45	160
March 21.....	do.....	51	52	2.57	4.40	134
April 17.....	do.....	51	58	3.02	4.50	175
June 5.....	do.....	57	109	5.86	5.61	637
August 21.....	W. D. Boers.....	52	56	2.79	4.55	155
August 24.....	do.....	30	50	2.53	4.48	149
September 14..	W. G. Swendsen.....	51	50	3.20	4.52	161
October 20.....	do.....	51	43	2.89	4.40	124
November 20..	do.....	51	42	3.02	4.37	126

<sup>a</sup> Measured 300 feet below station.

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.45	4.48	4.4	4.43	4.9	5.5	5.1	4.59	4.5	4.43	4.4	4.33
2.....	4.4	4.48	4.38	4.41	4.95	5.5	5.05	4.6	4.5	4.43	4.4	4.31
3.....	4.4	4.53	4.38	4.41	4.9	5.55	5.05	4.57	4.5	4.43	4.4	4.32
4.....	4.4	.....	4.4	4.41	4.85	5.55	5.05	4.57	4.5	4.4	4.4	4.31
5.....	4.4	4.5	4.4	4.41	4.75	5.57	5.0	4.57	4.52	4.4	4.4	4.25
6.....	4.4	4.4	4.4	4.4	4.7	5.58	4.95	4.57	4.52	4.4	4.4	4.25
7.....	4.4	4.4	4.4	4.45	4.75	5.45	4.9	4.57	4.53	4.4	4.4	4.25
8.....	4.4	4.4	4.4	4.45	4.8	5.5	4.85	4.57	4.5	4.42	4.4	4.25
9.....	4.4	4.4	4.42	4.48	4.85	5.5	4.8	4.57	4.48	4.45	4.4	4.25
10.....	4.4	4.4	4.42	4.40	4.75	5.5	4.75	4.56	4.48	4.45	4.4	4.27
11.....	4.4	4.4	4.42	4.5	4.8	5.5	4.7	4.56	4.48	4.45	4.4	4.33
12.....	4.35	4.25	.....	4.47	4.8	5.5	4.7	4.56	4.48	4.43	4.4	4.33
13.....	4.35	4.28	4.42	4.46	4.8	5.45	4.67	4.56	4.47	4.43	4.4	4.36
14.....	4.45	4.3	4.42	4.5	4.85	5.45	4.65	4.56	4.47	4.43	4.38	4.32
15.....	4.43	4.35	4.42	4.45	4.75	5.4	4.65	4.55	4.47	4.43	4.38	4.35
16.....	4.44	4.38	4.48	4.40	4.85	5.4	4.65	4.55	4.5	4.43	4.38	4.38
17.....	4.43	4.35	4.48	4.47	4.93	5.35	4.65	4.54	4.45	4.43	4.38	4.3
18.....	4.43	4.3	4.47	4.48	5.3	5.2	4.65	4.54	4.45	4.45	4.35	4.35
19.....	4.43	4.35	4.45	4.5	5.3	5.2	4.65	4.55	4.47	4.45	4.35	4.38
20.....	4.43	4.3	4.47	4.5	5.3	5.1	4.65	4.54	4.47	4.45	4.35	4.35
21.....	4.43	4.3	4.41	4.55	5.3	5.1	4.65	4.5	4.46	4.43	4.35	4.38
22.....	4.45	.....	4.45	4.55	5.25	5.07	4.65	4.54	4.45	4.43	4.33	4.38
23.....	4.45	4.38	4.4	4.65	5.25	5.1	4.65	4.5	4.45	4.42	4.35	4.33
24.....	4.47	4.4	4.45	4.65	5.2	5.1	4.65	4.48	4.45	4.42	4.35	4.35
25.....	4.45	4.38	4.43	4.65	5.25	5.1	4.6	4.5	4.48	4.42	4.35	4.35
26.....	4.45	4.3	.....	4.7	5.3	5.1	4.6	4.5	4.49	4.4	4.32	4.4
27.....	4.43	4.38	4.42	4.8	5.3	5.1	4.6	4.48	4.47	4.4	4.29	4.38
28.....	4.43	4.38	4.45	4.8	5.35	5.1	4.6	4.5	4.47	4.4	4.4	4.38
29.....	4.43	.....	4.45	4.75	5.3	5.1	4.6	4.5	4.47	4.4	4.38	4.38
30.....	4.43	.....	4.45	4.8	5.3	5.1	4.6	4.45	4.45	4.4	4.3	4.35
31.....	4.43	.....	4.45	.....	5.35	.....	4.6	4.5	.....	4.4	.....	4.38

NOTE.—Stream does not freeze at this point during winter months in sufficient amount to materially affect the rating.

Station rating table for Logan River near Logan, Utah, from April 25, 1904, to December 31, 1905.

Gage height	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
4.30	100	5.00	350	5.70	675	6.40	1,052
4.40	130	5.10	364	5.80	720	6.50	1,108
4.50	164	5.20	438	5.90	770	6.60	1,164
4.60	195	5.30	483	6.00	833	6.70	1,222
4.70	230	5.40	520	6.10	887	6.80	1,280
4.80	268	5.50	577	6.20	941	6.90	1,338
4.90	308	5.60	625	6.30	990		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 21 discharge measurements made during 1904-1905. It is fairly well defined between gage heights 4.4 feet and 6.25 feet.

*Estimated monthly discharge of Logan River near Logan, Utah, for 1905.*

[Drainage area, 218 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.....	155	122	142	8,731	0.651	0.750
February.....	173	00	131	7,275	.601	.626
March.....	167	131	144	8,854	.601	.762
April.....	208	130	177	10,500	.812	.900
May.....	506	230	368	22,030	1.00	1.05
June.....	615	382	496	29,510	2.28	2.54
July.....	304	195	248	15,270	1.14	1.31
August.....	105	150	176	10,820	.807	.930
September.....	173	150	158	9,402	.725	.860
October.....	150	130	143	8,793	.656	.756
November.....	130	100	120	7,076	.592	.660
December.....	130	00	118	7,250	.641	.624
The year.....	615	00	202	140,700	.630	12.62

NOTE.--Discharge interpolated on days when gage was not read.

#### BLACKSMITH FORK NEAR HYRUM, UTAH.

This stream rises on the western slope of the Bear River Range and flows southwest and then northwest into Logan River. The drainage basin of the tributary is in every way similar to that of the main stream. Only the flood and winter discharge, however, reaches the Logan, the entire spring and summer flow being used for irrigation on the tillable lands below the gaging station.

The gaging station was established July 10, 1900, near the tollgate in the mouth of the canyon near Hyrum, Utah, which is the nearest post-office. The station was discontinued December 31, 1902, and reestablished May 16, 1904, about 1,000 feet downstream from the tollgate and 800 feet above the Hyrum city electric-power plant. A station is also maintained at the power-plant race.

The channel is straight for 200 feet above and 50 feet below the station. The right bank for 20 feet back is a low, wooded flat, subject to overflow during extreme high water; beyond this point the bank is high and barren. The left bank is wooded and high and does not overflow. The bed of the stream is composed of bowlders and gravel and is somewhat rough, but apparently permanent, though a slight change seems to have occurred during December, 1904. During flood stages the velocity is high, ranging from 4 to 6 feet per second; under normal conditions it is 2 to 3 feet per second. The discharge varies from about 80 to 1,000 second-feet. Ice does not form in sufficient quantity to interfere with the results at any stage.

Discharge measurements are made by means of a cable and ear of regular form. The cable is marked at 4-foot intervals with red paint. A guy line for use during high water is stretched across the stream about 30 feet above the cable. The initial point for soundings is the south post supporting the cable.

The gage, which is observed daily by Uriah Benson, a farmer living at the tollgate, is of the vertical type, and consists of a 2 by 2½ inch iron bar with the upstream side drawn to an edge, driven into the bed of the stream and supported by a horizontal piece buried in the bank. The gage is referred to bench marks as follows: (1) A United States Geological Survey standard metallic plug, set in a solid limestone ledge about 40 feet east of the north post supporting the cable; elevation above zero of gage, 17,875 feet. (2) Top of the eyebolt of the north anchor of the cable; elevation above zero of gage, 9,578 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 51, p 412; 66, p 119; 85, p 84, 133; p 249.

Discharge: WS 51, p 412; 66, p 119; 85, p 85; 133, p 249.

Discharge, monthly: Ann 22, iv, p 409; WS 75, p 192; 85, p 86; 133, p 251.

Gage heights: WS 51, p 413; 66, p 120; 85, p 85; 133, p 250.

Hydrograph: Ann 22, iv, p 410.

Rating tables: WS 52, p 521; 66, p 176; 85, p 86; 133, p 250.

*Discharge measurements of Blacksmith Fork near Hyrum, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.			
		Feet.	Square	Feet per	Feet.	Second-
			feet.	second.		feet.
January 23.....	W. G. Swendsen.....	38	35	2.26	3.50	78
February 22.....	do.....	38	24	2.32	3.50	80
April 16.....	do.....	39	44	2.72	3.70	119
May 4.....	do.....	41	58	3.18	3.98	186
July 9.....	do.....	39	41	2.29	3.60	95
August 22.....	W. D. Beers.....	37	39	1.91	3.60	77
October 28.....	W. G. Swendsen.....	30	23	1.23	3.30	28
November 27.....	do.....	30	23	1.33	3.31	31

*Daily gage height, in feet, of Blacksmith Fork near Hyrum, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.5	3.5	3.5	3.6	4.0	4.1	3.6	3.6	4.8	3.6	3.3	3.3
2.....	3.5	3.5	3.5	3.6	4.0	4.1	3.6	3.6	4.8	3.6	3.3	3.3
3.....	3.5	3.5	3.5	3.6	4.0	4.1	3.6	3.6	4.8	3.6	3.3	3.3
4.....	3.5	3.5	3.5	3.6	4.0	4.1	3.6	3.6	4.8	3.6	3.3	3.3
5.....	3.5	3.5	3.5	3.6	4.0	4.1	3.6	3.6	4.8	3.6	3.3	3.3
6.....	3.4	3.5	3.5	3.6	3.9	3.9	3.6	3.6	4.8	3.6	3.3	3.3
7.....	3.4	3.5	3.5	3.6	3.9	3.9	3.6	3.6	4.8	3.6	3.3	3.3
8.....	3.5	3.5	3.5	3.7	3.9	3.9	3.6	3.6	4.8	3.6	3.3	3.3
9.....	3.5	3.4	3.5	3.7	3.9	3.9	3.6	3.6	4.8	3.6	3.3	3.3
10.....	3.5	3.4	3.5	3.6	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.3
11.....	3.5	3.4	3.5	3.6	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
12.....	3.5	3.4	3.5	3.6	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
13.....	3.5	3.4	3.5	3.7	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
14.....	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
15.....	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
16.....	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
17.....	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	4.8	3.6	3.3	3.2
18.....	3.5	3.5	3.5	3.7	4.0	3.8	3.6	3.6	4.8	3.6	3.3	3.2
19.....	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	4.8	3.6	3.3	3.2
20.....	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	4.8	3.6	3.3	3.2
21.....	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	4.8	3.6	3.3	3.2
22.....	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	4.8	3.6	3.3	3.2
23.....	3.5	3.4	3.6	3.9	4.1	3.8	3.6	3.6	4.8	3.6	3.3	3.3
24.....	3.5	3.4	3.6	3.9	4.1	3.8	3.6	3.6	4.8	3.6	3.3	3.3
25.....	3.5	3.4	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
26.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
27.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
28.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
29.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
30.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3
31.....	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	4.8	3.6	3.3	3.3

NOTE.—Stream does not freeze at this point during the winter months in sufficient quantity to materially affect the rating.

Station rating table for Blacksmith Fork near Hyrum, Utah, from January 1 to July 31, 1905.

Gage height.	Discharge.						
Feet	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.40	64	3.60	98	3.80	140	4.00	190
3.50	80	3.70	118	3.90	164	4.10	216

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

Station rating table for Blacksmith Fork near Hyrum, Utah, from August 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.20	18	3.70	94	4.10	189	4.50	304
3.30	29	3.80	115	4.20	216	4.60	336
3.40	42	3.90	138	4.30	244	4.70	369
3.50	57	4.00	163	4.40	273	4.80	402
3.60	75						

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during August to December, 1905, and the form of the 1904 curve. It is well defined between gage heights 3.2 feet and 4 feet.

Estimated monthly discharge of Blacksmith Fork near Hyrum, Utah, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	80	64	79.0	4,858
February.....	80	64	75.4	4,188
March.....	98	80	85.2	5,239
April.....	190	98	132.	7,855
May.....	216	164	187.	11,500
June.....	216	118	151.	8,085
July.....	98	98	98.0	6,026
August.....	402	75	85.5	5,257
September.....	402	75	228.	13,570
October.....	75	29	61.1	3,757
November.....	29	29	29.0	1,726
December.....	29	18	26.2	1,611
The year.....	402	18	103	74,570

NOTE.—Above estimates do not represent total flow of river. See Blacksmith Fork power plant race (pp. 34-35).

**BLACKSMITH FORK POWER PLANT RACE, NEAR HYRUM, UTAH.**

This station was established May 16, 1904, for the purpose of ascertaining the amount of water diverted around the regular gaging station at the tollgate and thus determining the total flow of the stream at that point. It is located about 600 feet down the canyon road from the tollgate at the mouth of the canyon, about 200 feet below the head of the canal or race, and about 500 feet south of the river station.

The channel is straight for 100 feet above and 200 feet below the station. Both banks are sufficiently high to prevent overflow. The bed of the stream is of gravel and is apparently permanent, except for probable slight changes near the edges. The depth varies from 2 to 3 feet and the velocity from 2 to 3 feet per second. Practically no ice forms in the channel at any time.

Discharge measurements are made from a foot plank placed across the stream and fastened at the ends to pieces of timber buried in the bank. The plank is marked at 1-foot intervals. The initial point for soundings is the north end of the plank, marked zero.

The gage, daily readings of which are made by Uriah Benson, is a 2 by 2½ inch iron bar driven vertically into the bed of the stream, supported at the top by the plank from which the measurements are made, and graduated by means of punch holes. The bench mark is a point on a projecting rock on the southeast corner of a rock house about 400 feet northwest from the station. It is marked with red paint. Elevation above zero of gage, 8.845 feet.

A description of this station, gage height, and discharge data and rating table are contained in Water-Supply Paper No. 133 of the United States Geological Survey, pp. 251-253.

*Discharge measurements of Blacksmith Fork power plant race, near Hyrum, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
January 23.....	W. G. Swendsen.....	12.0	23	2.55	4.50	58
October 28.....	do.....	13.5	28	3.02	4.90	83

*Daily gage height, in feet, of Blacksmith Fork power plant race near Hyrum, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.5	4.5	4.5	4.5	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
2.....	4.5	4.5	4.5	4.5	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
3.....	4.5	4.5	4.6	4.5	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
4.....	4.45	4.5	4.6	4.5	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
5.....	4.45	4.5	4.5	4.5	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
6.....	4.45	4.5	4.5	4.6	4.5	4.6	4.6	4.6	.....	4.4	4.9	4.9
7.....	4.45	4.5	4.5	4.6	4.4	4.6	4.6	4.6	.....	4.4	4.9	4.9
8.....	4.45	4.5	4.5	4.6	4.4	4.6	4.6	4.6	.....	4.4	4.9	4.9
9.....	4.45	4.4	4.5	4.6	4.4	4.6	4.6	4.6	.....	4.4	4.9	4.9
10.....	4.5	4.4	4.5	4.6	4.4	4.5	4.6	4.6	.....	4.4	4.9	4.9
11.....	4.5	4.4	4.5	4.6	4.4	4.5	4.6	4.6	.....	4.4	4.9	4.5
12.....	4.5	4.4	4.5	4.6	4.4	4.5	4.6	4.6	.....	4.4	4.9	4.5
13.....	4.5	4.4	4.5	4.6	4.4	4.5	4.6	4.6	.....	4.4	4.9	4.5
14.....	4.5	4.5	4.5	4.6	4.4	4.5	4.6	4.6	.....	4.4	4.9	4.5
15.....	4.5	4.5	4.5	4.7	4.4	4.5	4.6	4.6	4.5	4.4	4.9	4.6
16.....	4.5	4.5	4.5	4.7	4.4	4.4	4.6	4.6	4.5	4.4	4.9	4.7
17.....	4.5	4.45	4.5	4.7	4.4	4.4	4.6	4.6	4.5	4.4	4.9	4.6
18.....	4.5	4.45	4.5	4.7	4.5	4.4	4.6	4.6	4.4	4.4	4.9	4.6
19.....	4.5	4.45	4.5	4.8	4.5	4.4	4.6	4.5	4.4	4.4	4.9	4.5
20.....	4.5	4.45	4.5	4.8	4.5	4.4	4.6	4.5	4.4	4.4	4.9	4.5
21.....	4.5	4.45	4.5	4.8	4.5	4.4	4.6	4.5	4.4	4.4	4.9	4.5
22.....	4.5	4.45	4.5	4.8	4.5	4.4	4.6	4.5	4.4	4.7	4.9	4.6
23.....	4.5	4.45	4.6	4.5	4.5	4.4	4.6	4.4	4.4	4.9	4.9	4.6
24.....	4.5	4.45	4.6	4.5	4.6	4.4	4.6	4.4	4.4	4.9	4.9	4.7
25.....	4.5	4.45	4.6	4.5	4.6	4.6	4.6	4.4	4.4	4.9	4.9	4.7
26.....	4.5	4.45	4.6	4.5	4.6	4.6	4.6	4.3	4.4	4.9	4.9	4.7
27.....	4.5	4.45	4.6	4.5	4.6	4.6	4.6	4.3	4.4	4.9	4.9	4.8
28.....	4.5	4.5	4.5	4.5	4.6	4.6	4.6	4.3	4.4	4.9	4.9	4.8
29.....	4.5	.....	4.5	4.5	4.6	4.6	4.6	4.3	4.4	4.9	4.9	4.8
30.....	4.5	.....	4.5	4.5	4.6	4.6	4.6	4.3	4.4	4.9	4.9	4.8
31.....	4.5	.....	4.5	.....	4.6	.....	4.6	.....	.....	4.9	.....	4.8

NOTE.—Flow not materially affected by ice conditions.

Station rating table for Blacksmith Fork power plant race near Hyrum, Utah, from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
4.30	44	4.50	58	4.70	73	4.90	88
4.40	51	4.60	66	4.80	80		

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

Estimated monthly discharge of Blacksmith Fork power plant race near Hyrum, Utah, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	58	54	57.2	3,517
February.....	58	51	55.2	3,066
March.....	66	58	59.8	3,677
April.....	80	58	65.3	3,880
May.....	66	51	57.6	3,542
June.....	66	51	59.9	3,564
July.....	66	60	66.0	4,058
August 1-30.....	60	44	59.8	3,558
September 15-30.....	58	51	52.3	1,659
October.....	88	51	62.5	3,843
November.....	88	88	88.0	5,236
December.....	88	58	74.5	4,581
The year.....	88	51	63.2	44,100

WEBER RIVER BASIN.

DESCRIPTION OF BASIN.

Weber River rises on the northern slope of the Uinta Mountains and flows in a tortuous course northwestward into Great Salt Lake.

The upper portion of the basin is very rough. The highest peaks, reaching an elevation of about 13,000 feet, are masses of sandstone and quartzite, entirely barren of vegetation and covered with snow for almost the entire year. Farther down the prevailing formation is limestone, overlain with sandstone and conglomerate. A thin layer of soil covers the basin in patches and supports small groves of fir and aspen. There are no extensive forests, meadows, or marshes. The greater part of the precipitation is in the form of snow, the melting of which is the chief source of the spring flood and early summer flow. A large part of the normal flow is derived from springs, which are well distributed over the area. Numerous tributaries, all short and confined to steep, narrow canyons, enter all along the course.

Between Oakley and Croyden the river traverses a very narrow valley comprising irrigated farms. The principal formation over this area is of conglomerate and sandstone, with but little loose and porous overlying soil except near the stream bed, where the deposit of boulders and soil ranges from 10 to 20 feet in depth. The chief tributaries in this stretch of the river are Beaver Creek, which enters from the south about 6 miles below Oakley and drains a rough country about 71 square miles in extent; Chalk Creek, from the east, which drains a rough, dry country, about 248 square miles in area, and enters the Weber 15 miles above Croyden; and Lost Creek, which comes in from the east at a point about one-half

mile above the Devils Slide gaging station and has a watershed of 205 square miles. Gaging stations are maintained near the mouth of Chalk and Lost creeks.

Between Croyden and Plain City the stream flows in a well-defined channel through a comparatively narrow, steep canyon, with occasional stretches of narrow valley containing irrigated farming lands. The rock is a porous and badly fissured sandstone and conglomerate, with but little overlying soil. Near the mouth of the canyon the material is a very rough but compact limestone. East Creek, which enters near Morgan, discharges but little water into the river, as its flow is completely controlled by a storage reservoir about 5 miles above its mouth, the water being used for irrigation in the Morgan Valley, through which the Weber flows. After leaving the Wasatch Range the Weber enters the Great Salt Lake Valley, through which it flows in a well-defined channel with no overflow.

Ogden River joins the Weber about 8 miles above Plain City. It drains a rough and rugged limestone area, 363 square miles in extent, in the western slopes of the Wasatch Range. The main stream and its numerous short tributaries are confined to steep, narrow canyons. The entire normal flow of the stream is diverted for irrigation near the foot of the canyon about 3 miles above the mouth of the river, after being used for the development of power by the Utah Light and Railway Company. The flood and winter flow, therefore, is all that reaches the Weber, except for a small amount of seepage from the irrigated district. The city of Ogden also derives its water supply from Ogden River.

There are at present no storage reservoirs on the Weber, but a number of possibilities exist.

#### WEBER RIVER NEAR OAKLEY, UTAH.

This station was established October 22, 1904. It is located approximately 200 feet south of the main canyon road, about 3 miles above Oakley, Utah, and is above all diversions to the Kamas prairie region. The object of the station is to determine the amount of water available for diversion through the low Kamas Pass into Provo River, which is a part of the reclamation scheme in the development of the Weber River project.

Except for a slight depression, which probably carries a small amount of water during extreme floods, there is but one channel at all stages. The right bank for about 200 feet from the main channel is a low, wooded bottom, and is liable to overflow at extreme high water; the left bank is high and wooded. The bed of the stream, which is composed of large boulders, gravel, and soil, is very rough, but thus far has been found to be permanent. Ice forms during December and January to a sufficient extent to render open-channel curves useless. The flow, which ranges from about 75 to 1,000 second-feet, reaches a maximum during May and a minimum during the winter months. The velocity ranges from 4 to 7 feet per second.

Discharge measurements are made by means of a cable and car. The cable is marked at 4-foot intervals with paint, the anchor bolt which supports the cable on the left bank being the initial point. A guy line stretched across the stream about 40 feet above the gaging section is found useful at all stages.

The gage, which is read daily by John Franson, a farmer, is of the inclined type and consists of three sections of 2-foot by one-half inch iron, fastened to the solid limestone ledge by means of bolts set in cement. It is graduated with chisel marks and paint to read vertically. The bench mark is a United States Geological Survey standard metallic plug, set in the ledge 0.5 foot from the anchor bolt used as initial point for soundings; elevation above zero of gage, 14.79 feet.

A description of this station and gage height and discharge data are contained in Water-Supply Paper No. 133 of the United States Geological Survey, pp. 253-254.

*Discharge measurements of Weber River near Oakley, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
March 9.....	W. G. Swendsen.....	41	55	1.13	4.10	63
March 9.....	do.....	41	55	1.17	4.10	65
May 1.....	do.....	47	91	2.65	4.02	243
June 16.....	do.....	51	137	5.75	6.00	787
June 27.....	do.....	49	116	3.34	5.30	389
August 8.....	C. Tanner.....	42	57	1.26	4.20	72
August 18.....	W. D. Beers.....	42	62	1.10	4.18	68

*Daily gage height, in feet, of Weber River near Oakley, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		4.05	4.1	4.15	4.95	6.0	5.0	4.3	4.05	4.35	4.15	4.05
2.....				4.15	5.05	6.15	4.05	4.3	4.09	4.3	4.15	4.0
3.....				4.2	5.05	6.3	4.0	4.3	4.05	4.3	4.15	4.0
4.....	5.4			4.25	4.9	6.4		4.3	4.05	4.25	4.15	4.0
5.....				4.3	4.8	6.45	4.8	4.3	4.05	4.25	4.15	
6.....				4.35	4.7	6.5	4.75	4.3	4.05	4.2	4.15	4.1
7.....				4.35	4.75	6.6	4.75	4.3	4.1	4.2	4.15	4.2
8.....		4.05		4.4	4.8	7.0	4.7	4.2	4.1	4.2	4.1	
9.....			4.1	4.4	4.8	6.8	4.7	4.2	4.1	4.2	4.1	4.8
10.....			4.1	4.35	4.75	6.3	4.7	4.2	4.1	4.2	4.1	
11.....	4.7		4.1	4.3	4.7	6.25	4.65	4.2	4.1	4.2	4.1	
12.....			4.15	4.3	4.7	6.3	4.65	4.2	4.1	4.2	4.1	
13.....			4.15	4.3	4.7	6.3	4.0	4.2	4.1	4.2	4.1	5.15
14.....			4.15	4.3	4.7	6.3	4.0	4.2	4.1	4.2	4.1	
15.....		5.1	4.15	4.35	4.7	6.25	4.65	4.15	4.1	4.2	4.1	
16.....			4.15	4.35	4.8	6.0		4.15	4.1	4.2	4.1	4.6
17.....			4.15	4.35	5.0	5.9	4.55	4.15	4.1	4.2	4.1	
18.....	4.5		4.2	4.4	5.2	5.7	4.55	4.15	4.1	4.2	4.1	
19.....			4.2	4.45	5.3	5.7	4.55	4.15	4.1	4.2	4.1	
20.....			4.2	4.45	5.35	5.8	4.5	4.15	4.1	4.2	4.1	4.75
21.....			4.2	4.45	5.4	5.75	4.5	4.15	4.1	4.2	4.1	
22.....		4.3	4.2	4.45	5.05	5.75	4.5	4.1	4.1	4.2	4.1	
23.....			4.15	4.55	5.7	5.7	4.5	4.1	4.1	4.2	4.1	4.85
24.....			4.15	4.6	5.7	5.6	4.45	4.1	4.1	4.15	4.1	
25.....	4.05		4.15	4.65	5.7	5.55	4.4	4.1	4.1	4.15	4.1	
26.....			4.15	4.75	5.75	5.4	4.35	4.1	4.1	4.1	4.1	
27.....			4.15	4.8	5.75	5.35	4.35	4.1	4.1	4.1	4.1	5.25
28.....			4.15	4.85	5.75	5.35	4.3	4.1		4.1	4.1	
29.....			4.15	4.9	5.8	5.2	4.3	4.1	4.2	4.15	4.1	
30.....			4.15	4.9	5.85	5.1	4.3	4.1	4.35	4.15	4.1	5.1
31.....			4.15		5.85		4.3	4.1		4.15		

NOTE.—Ice conditions January, February, and December noted on observer's records as follows:  
 January 4, ice at banks; river open in the center.  
 January 11, ice 1 foot thick at banks; 0.5 foot thick in the center.  
 January 18, ice broken up.  
 January 25, river clear.  
 February 1, river clear.  
 February 8, ice at banks; river open in the center.  
 February 15, ice 0.5 foot thick at banks; 0.25 foot thick in the center.  
 February 22, ice broken up.

March 1, river clear.

December 2, ice 0.3 foot thick at banks.

The following thicknesses of ice were recorded during December:

	Feet.		Feet.
December 9.....	0.7	December 23.....	0.7
December 13.....	.5	December 27.....	.8
December 16.....	.6	December 30.....	1.15
December 20.....	.6		

Observer reports no anchor ice during December.

Gage readings during December are to the surface of the water in a hole cut in the ice.

Station rating table for Weber River near Oakley, Utah, from October 23, 1904, to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
4.00	46	4.80	209	5.60	542	6.40	1,066
4.10	58	4.90	241	5.70	597	6.50	1,145
4.20	73	5.00	275	5.80	655	6.60	1,227
4.30	90	5.10	312	5.90	716	6.70	1,312
4.40	109	5.20	352	6.00	780	6.80	1,400
4.50	130	5.30	395	6.10	847	6.90	1,490
4.60	154	5.40	441	6.20	917	7.00	1,580
4.70	180	5.50	490	6.30	990		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1904-5. It is well defined between gage heights 4 feet and 6 feet.

Estimated monthly discharge of Weber River near Oakley, Utah, for 1904 and 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1904.				
October 23-31.....	82	82	82.0	1,464
November 1-26.....	100	66	72.1	3,718
1905.				
March.....	73	58	64.3	3,954
April.....	241	66	124	7,379
May.....	686	180	372	22,870
June.....	1,580	312	808	48,080
July.....	275	90	156	9,592
August.....	90	58	70.4	4,329
September.....	100	52	58.9	3,505
October.....	100	58	73.0	4,488
November.....	66	58	59.9	3,564
The period (1905).....				107,800

NOTE.—Ice conditions November 27, 1904, to February 28, 1905, and December 2-31, 1905. Discharge interpolated on days when gage was not read.

#### WEBER RIVER NEAR CROYDEN, UTAH.

This station was established February 1, 1905. It is located about 1½ miles west of the town of Croyden, one-fourth mile below the junction of Lost Creek and Weber River, about three-fourths mile up the river from Croyden station on the Union Pacific Railroad, and 10 miles down the river from the town of Echo, just below the narrow canyon at the lower end of Henefer Valley.

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The station is important as showing the amount of water available for storage in the Henefer basin, about 2 miles above the station, the development of which is a part of the reclamation scheme on the Weber River project. The winter records will be of special value, since the entire winter-flow of the stream is at present discharged as waste into Great Salt Lake.

The channel is straight for about 1,000 feet above and 700 feet below the station. Both banks are sloping and sufficiently high to prevent overflow. The bed of the stream is of small, compact gravel and soil and is smooth and permanent. The velocity is moderate and uniform. The stream is shallow, especially during low water, the depth seldom exceeding 3 feet. There is a free flow, no obstruction to gage readings or discharge measurements existing. Information as to winter conditions is as yet rather indefinite.

Discharge measurements are made by means of a cable and car. The cable is marked at 5-foot intervals, the west face of a tree to which the east end of the cable is attached being the initial points for soundings.

The gage, which is read daily by Isaiah Stewart, a farmer who lives about 300 feet from the station, is an inclined piece of 4 by 4 inch fir, fastened to vertical posts near the water's edge and to a large cottonwood tree on the right bank about 75 feet above the cable. It is graduated to read vertically. The gage is referred to bench marks as follows: (1) A 3-inch metal post set 3½ feet in the ground on the bank 20 feet north from the gage; elevation above datum of gage, 8.41 feet; (2) a 30-penny nail driven in the tree which supports the upper end of the gage; elevation above gage datum, 7.87 feet.

Results of discharge measurements at this station are contained in Water-Supply Paper No. 133 of the United States Geological Survey, page 364.

*Discharge measurements of Weber River near Croydon, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 31 <sup>a</sup> ...	W. G. Swendsen.....	90	95	2.04	1.90	193
March 7.....	do.....	95	126	2.67	2.22	337
May 2.....	do.....	102	192	3.73	2.85	703
June 17.....	do.....	100	213	4.10	3.05	875
June 28.....	do.....	91	113	2.45	2.10	277
August 10.....	W. D. Beers.....	89	56	.92	1.40	51
November 16..	W. G. Swendsen.....	91	88	1.76	1.75	155

<sup>a</sup> Measurement made by wading.

Daily gage height, in feet, of Weber River near Croydon, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.05	1.05	1.05	2.05	2.85	1.9	1.4	1.4	1.65	1.8	1.8
2.....		1.05	1.05	2.0	2.8	3.0	1.0	1.4	1.4	1.65	1.8	1.8
3.....		1.95	2.0	2.0	2.75	3.1	1.85	1.4	1.45	1.65	1.8	1.85
4.....		1.05	2.1	1.05	2.0	3.55	1.8	1.4	1.45	1.6	1.8	1.8
5.....		1.9	2.2	1.95	2.6	3.6	1.75	1.4	1.5	1.6	1.8	1.7
6.....		1.9	2.1	1.05	2.55	3.35	1.7	1.4	1.5	1.6	1.8	1.6
7.....		1.9	2.2	1.05	2.5	3.3	1.65	1.4	1.5	1.6	1.8	1.65
8.....		1.9	2.1	1.95	2.45	3.9	1.6	1.4	1.5	1.6	1.8	1.7
9.....		1.85	2.1	1.05	2.5	3.0	1.55	1.4	1.5	1.6	1.8	1.7
10.....		1.8	2.1	2.2	2.5	3.9	1.5	1.4	1.5	1.6	1.8	1.7
11.....		1.8	2.1	2.3	2.4	3.4	1.5	1.5	1.5	1.6	1.8	1.65
12.....		1.05	2.1	2.25	2.4	3.4	1.5	1.5	1.5	1.6	1.75	1.6
13.....		1.05	2.05	2.2	2.4	3.4	1.5	1.5	1.5	1.6	1.75	1.6
14.....		1.05	2.05	2.15	2.35	3.45	1.5	1.4	1.5	1.6	1.75	1.6
15.....		1.65	2.0	2.15	2.3	3.5	1.5	1.4	1.5	1.6	1.75	1.6
16.....		1.65	2.0	2.2	2.3	3.5	1.5	1.4	1.5	1.6	1.75	1.65
17.....		1.8	1.95	2.25	2.3	3.0	1.65	1.4	1.5	1.6	1.8	1.6
18.....		1.8	2.0	2.3	2.4	2.9	1.75	1.4	1.5	1.6	1.8	1.6
19.....		1.8	2.1	2.3	2.6	2.8	1.9	1.4	1.5	1.6	1.8	1.6
20.....		1.8	2.05	2.4	2.7	2.7	1.9	1.4	1.5	1.6	1.8	1.6
21.....		1.8	2.0	2.6	2.8	2.7	1.9	1.4	1.5	1.6	1.8	1.6
22.....		1.8	1.95	2.4	2.95	2.65	1.9	1.4	1.5	1.7	1.85	1.6
23.....		1.9	1.9	2.2	2.95	2.6	1.8	1.4	1.5	1.75	1.8	1.6
24.....		1.9	1.95	2.3	2.95	2.6	1.8	1.4	1.5	1.75	1.8	1.6
25.....		1.95	2.0	2.3	2.9	2.4	1.8	1.4	1.5	1.75	1.8	1.6
26.....		1.95	2.0	2.4	2.85	2.3	1.6	1.4	1.5	1.75	1.75	1.7
27.....		1.95	2.0	2.6	2.85	2.2	1.5	1.4	1.5	1.75	1.8	1.6
28.....		1.95	2.0	2.7	2.8	2.0	1.45	1.4	1.5	1.75	1.8	1.6
29.....			2.0	2.6	2.8	2.0	1.4	1.4	1.55	1.75	1.8	1.6
30.....			2.0	2.6	2.75	1.95	1.4	1.4	1.7	1.8	1.75	1.6
31.....	1.9		1.95		2.75		1.4	1.4		1.8		1.6

NOTE.—Narrow strip of ice along edges during part of the winter months, but not enough to materially affect the flow.

Station rating table for Weber River near Croydon, Utah, from January 31 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.40	50	2.10	274	2.80	673	3.40	1,100
1.50	73	2.20	319	2.90	745	3.50	1,250
1.60	99	2.30	368	3.00	820	3.60	1,345
1.70	128	2.40	422	3.10	900	3.70	1,445
1.80	160	2.50	480	3.20	985	3.80	1,545
1.90	195	2.60	541	3.30	1,070	3.90	1,650
2.00	233	2.70	605				

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 1.4 feet and 3.1 feet.

*Estimated monthly discharge of Weber River near Croydon, Utah, for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February.....	214	114	175	9,719
March.....	319	135	246	15,130
April.....	605	214	346	20,590
May.....	782	368	574	35,200
June.....	1,050	214	876	52,130
July.....	195	50	119	7,317
August.....	73	50	52.2	3,210
September.....	128	50	73	4,344
October.....	160	99	115	7,071
November.....	178	144	157	9,342
December.....	178	73	112	6,887
The period.....				171,000

NOTE.—See note to gage-height table, p. 40.

**WEBER RIVER NEAR PLAIN CITY, UTAH.**

This station was established in 1903 by the State of Utah, under the direction of the State engineer, and was maintained under his direction until May 14, 1905, when it was taken up by the United States Geological Survey with the stipulation that the expense of daily gage readings should be defrayed by the State. It is located at the Plain City and West Weber highway bridge, about 10 miles west of Ogden, on the main road leading to Plain City and West Weber, below all points of diversion from and inflow to the stream.

The station is important as showing the amount of water discharged by the stream into Great Salt Lake, information necessary to the adjudication of water rights on the Ogden and Weber rivers.

Both banks are abrupt and sufficiently high to prevent overflow. The bed of the stream is composed of clay, sand, and gravel and is comparatively smooth, but it is liable to shift during flood seasons. At normal stages the stream is sluggish, but at high water the velocity ranges from 2 to 3.5 feet per second. The discharge at this point may vary from 5,500 second-feet during the spring flood to almost nothing during summer, when the entire flow is diverted above for irrigation, that passing the station being merely seepage from the irrigated lands tributary to the stream. Information as to ice conditions is as yet indefinite.

Discharge measurements are made from the upstream side of the bridge, which is a two-span steel truss structure, with a center pier of two metallic cylindrical caissons 4 feet in diameter and filled with concrete. The floor railing of the bridge is marked at 5-foot intervals, beginning at a zero mark which is coincident with the north face of the south abutment, this being the initial point for soundings.

The upstream face of the center bridge pier is graduated to feet and tenths, marked with white paint, and forms the gage, which is read daily by David O. Wadman. No bench marks have yet been established.

*Discharge measurements of Weber River near Plain City, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
May 13.....	C. Tanner.....	127	564	2.45	8.30	1,382
May 18.....	W. G. Swendsen.....	132	789	2.40	9.30	1,804
September 8 <sup>a</sup> ..	A. B. Larson.....	10	5.1	.92	2.80	4.7
November 17..	W. G. Swendsen.....	105	110	1.04	4.00	115

<sup>a</sup> Measurement made 100 feet below station.

Daily gage height, in feet, of Weber River near Plain City, Utah, for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		6.5	3.2	2.8	2.8	3.2	4.1	4.5
2.....		6.7	3.1	2.8	2.8	3.3	4.2	4.5
3.....		6.7	3.0	2.8	2.8	3.3	4.2	4.5
4.....		6.6	3.0	2.8	2.8	3.4	4.2	4.5
5.....		6.8	3.0	2.8	2.8	3.3	4.2	4.5
6.....		6.6	3.0	2.8	2.8	3.2	4.2	4.5
7.....		6.4	2.9	2.8	2.8	3.1	4.2	4.5
8.....		6.1	2.9	2.8	2.8	3.2	4.2	4.5
9.....		6.8	2.9	2.8	2.8	3.2	4.2	4.6
10.....		7.4	2.9	2.8	2.8	3.3	4.2	4.6
11.....		6.8	2.9	2.8	2.8	3.3	4.2	4.6
12.....		6.6	3.0	2.8	2.8	3.2	4.2	4.7
13.....	8.3	6.4	3.0	2.8	2.8	3.1	4.2	4.7
14.....	8.3	6.2	2.9	2.8	2.8	3.1	4.1	4.7
15.....	8.2	6.0	2.8	2.8	2.8	3.1	4.1	4.7
16.....	8.3	5.9	2.8	2.8	2.8	3.2	4.1	4.7
17.....	8.6	6.0	2.8	2.8	2.9	3.2	4.1	4.8
18.....	9.1	6.1	2.8	2.8	2.9	3.2	4.1	4.8
19.....	9.8	5.9	2.8	2.8	3.2	3.3	4.1	4.9
20.....	9.8	5.6	2.8	2.8	3.2	3.3	4.1	4.9
21.....	10.1	5.0	2.8	2.8	3.2	3.4	4.1	4.9
22.....	9.8	5.0	2.8	2.8	3.1	3.4	4.2	4.9
23.....	9.4	5.1	2.8	2.8	3.1	3.5	4.2	5.0
24.....	9.0	4.0	2.8	2.8	3.1	3.5	4.3	5.0
25.....	8.4	4.5	2.8	2.8	3.2	3.6	4.4	5.0
26.....	8.0	4.3	2.8	2.8	3.2	3.7	4.5	5.0
27.....	8.0	4.0	2.8	2.8	3.2	3.7	4.5	5.0
28.....	7.9	3.4	2.8	2.8	3.2	3.8	4.5	5.1
29.....	7.9	3.0	2.8	2.8	3.2	3.9	4.5	5.1
30.....	7.4	3.6	2.8	2.8	3.2	4.0	4.5	5.1
31.....	7.0		2.8	2.8		4.1		5.1

NOTE.—Stream probably frozen after December 17.

Station rating table for Weber River near Plain City, Utah, from May 13 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.80	5	4.30	158	5.80	483	7.40	1,007
2.90	8	4.40	174	5.90	511	7.60	1,088
3.00	13	4.50	191	6.00	540	7.80	1,173
3.10	19	4.60	209	6.10	569	8.00	1,260
3.20	26	4.70	228	6.20	599	8.20	1,348
3.30	34	4.80	248	6.30	629	8.40	1,438
3.40	43	4.90	269	6.40	660	8.60	1,530
3.50	53	5.00	290	6.50	691	8.80	1,624
3.60	64	5.10	312	6.60	723	9.00	1,720
3.70	76	5.20	334	6.70	755	9.20	1,817
3.80	88	5.30	357	6.80	788	9.40	1,916
3.90	101	5.40	381	6.90	822	9.60	2,016
4.00	115	5.50	405	7.00	857	9.80	2,117
4.10	129	5.60	430	7.20	930	10.00	2,220
4.20	143	5.70	456				

The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1905 and the form of the 1003-4 curve. It is well defined.

*Estimated monthly discharge of Weber River near Plain City, Utah, for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 13-31.....	2,272	857	1,544	53,190
June.....	1,007	13	501	29,810
July.....	26	5	8.3	510
August.....	5	5	5.0	307
September.....	26	5	12.9	768
October.....	129	19	45.4	2,792
November.....	191	129	148	8,807
December 1-17.....	248	191	208	7,014
The period.....				108,100

#### LOST CREEK NEAR CROYDEN, UTAH.

Lost Creek, which enters Weber River near the town of Croyden, drains an area of 205 square miles. The basin is generally rough and barren, the rocks being conglomerate and sandstone, with a few outcropping ledges of loose, porous limestone and but a thin layer of soil. The stream flows for the most part in a narrow canyon, with occasional small flats devoted to irrigated farms. Near the head the creek receives numerous tributaries, all short and confined to steep, narrow canyons. The normal flow comes principally from springs, well distributed over the entire watershed, but the spring flood is caused by the melting of snow, which forms the greater part of the precipitation. There are no forests, swamps, or meadows along the stream. A few undeveloped storage sites exist in the upper portion of the basin.

The station was established February 3, 1905. It is located about 150 feet above the junction of Lost Creek with Weber River, about 10 miles down Weber River from Echo, and about 1½ miles west of the town of Croyden on the main road up Lost Creek. The data derived are of value in connection with the amount of water to be diverted into the Henefer reservoir.

The channel is slightly curved for about 100 feet above and 75 feet below the station. The right bank is steep and high; the left bank is sloping and near the channel is sufficiently high to prevent overflow, but about 50 feet back there is an old channel, originally occupied by the stream, which may contain some water during extreme floods. The bed of the creek is composed of gravel and sand and is liable to shift at flood stages. A slight raise in the bed about 20 feet below the gage causes a small riffle. The velocity is moderate and fairly uniform.

Discharge measurements are made by wading. The section is located about 20 feet above the gage and is marked by a 4 by 4 inch by 2-foot stake, the initial point for soundings, driven into the right bank about 6 feet from the edge.

The gage, which is read daily by Isaiah Stewart, a farmer, is an inclined 4 by 4 inch by 12-foot piece of Oregon fir, fastened to vertical posts embedded in the right bank. As the bank is composed of loose gravel and sand the permanency of the gage is uncertain. The bench mark is a 3-inch metallic post, set 3½ feet in the ground at a point 50 feet north east of the gage and 15 feet northwest of the initial stake; elevation above gage datum 8.71 feet.

## Discharge measurements of Lost Creek near Croyden, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
February 2.....	W. G. Swendsen.....	30	24	1.00	2.85	24
May 2 <sup>a</sup> .....	do.....	27	72	2.53	3.50	181
June 28.....	do.....	26	15	1.00	2.68	15
August 19.....	W. D. Beers.....	20	12	.82	2.00	10

<sup>a</sup> Gaging made at bridge.

## Daily gage height, in feet, of Lost Creek near Croyden, Utah, for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.85	2.85	3.4	2.75	2.7	2.6	2.6	2.55	2.55	2.6
2.....	2.85	2.85	2.85	3.5	2.75	2.7	2.6	2.6	2.55	2.55	2.65
3.....	2.85	2.85	2.85	3.45	2.75	2.7	2.6	2.6	2.55	2.55	2.65
4.....	2.85	2.85	2.85	3.35	2.75	2.7	2.6	2.6	2.55	2.55	2.55
5.....	2.8	2.85	2.85	3.3	2.75	2.7	2.6	2.6	2.55	2.55	2.65
6.....	2.8	2.85	2.85	3.3	2.75	2.7	2.6	2.6	2.55	2.55	2.65
7.....	2.8	2.85	2.85	3.25	2.75	2.7	2.6	2.6	2.55	2.55	2.65
8.....	2.8	2.85	2.85	3.2	2.8	2.7	2.6	2.6	2.55	2.55	2.65
9.....	2.8	2.85	2.9	3.25	2.8	2.65	2.6	2.6	2.55	2.55	2.65
10.....	2.8	2.85	3.0	3.25	2.8	2.6	2.6	2.6	2.55	2.55	2.65
11.....	2.8	2.85	2.95	3.2	2.8	2.6	2.6	2.6	2.55	2.55	2.65
12.....	2.7	2.85	2.95	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
13.....	2.7	2.85	2.9	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
14.....	2.75	2.85	2.9	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
15.....	2.75	2.85	2.9	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
16.....	2.75	2.85	2.9	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
17.....	2.8	2.85	3.0	3.2	2.75	2.6	2.6	2.6	2.55	2.55	2.6
18.....	2.8	2.85	3.0	3.25	2.75	2.6	2.6	2.6	2.55	2.55	2.6
19.....	2.8	2.85	3.0	3.3	2.75	2.6	2.6	2.6	2.55	2.55	2.6
20.....	2.8	2.85	3.0	3.3	2.75	2.6	2.6	2.6	2.55	2.55	2.6
21.....	2.8	2.85	3.1	3.3	2.7	2.6	2.6	2.6	2.55	2.55	2.6
22.....	2.8	2.85	3.05	3.35	2.7	2.6	2.6	2.6	2.55	2.6	2.6
23.....	2.85	2.85	3.0	3.35	2.7	2.6	2.6	2.6	2.55	2.6	2.6
24.....	2.85	2.85	3.1	3.35	2.7	2.6	2.6	2.6	2.55	2.6	2.6
25.....	2.85	2.85	3.1	3.3	2.7	2.6	2.6	2.55	2.55	2.6	2.6
26.....	2.85	2.85	3.15	3.2	2.7	2.6	2.6	2.55	2.55	2.6	2.6
27.....	2.85	2.85	3.2	3.2	2.7	2.6	2.6	2.55	2.55	2.6	2.6
28.....	2.85	2.85	3.3	2.8	2.7	2.6	2.6	2.55	2.55	2.6	2.6
29.....		2.85	3.3	2.8	2.7	2.6	2.6	2.55	2.55	2.6	2.6
30.....		2.85	3.3	2.8	2.7	2.6	2.6	2.55	2.55	2.6	2.6
31.....		2.85		2.75		2.6	2.6		2.55		2.6

NOTE.—Open-channel conditions throughout the year.

CHALK CREEK AT COALVILLE, UTAH.

Chalk Creek joins Weber River at Coalville. Its basin is rough and barren, the rocks being chiefly sandstone and conglomerate, with but little overlying soil. Small springs scattered over the entire area furnish the principal part of the normal flow, while the spring and flood run-off is derived from melting snow. The stream has few tributaries. There are no swamps, meadows, or forests in the area. Small tracts of irrigated lands lie near the mouth of the canyon. The water supply of the town of Coalville comes mostly from this stream.

The gaging station was established October 23, 1904. It is located at a foot bridge on the main road leading north, one-eighth mile from the county court-house at Coalville.

The channel is slightly curved and somewhat irregular for about 150 feet above the station. Below it is wider and is straight for about 100 feet. Both banks are sufficiently high to prevent overflow. The bed of the stream is composed of small cobbles and is somewhat rough, but apparently permanent. There is but one channel at all stages, broken during high water by the supporting piles of the bridge. The velocity is moderate and the stream shallow.

Discharge measurements are made from the foot bridge. The initial point for soundings is the zero mark near the left end of the bridge.

The gage, which is read daily by Miss Eva Rees, consists of a vertical staff attached to a pile near the right bank of the stream. The bench mark is a cut on the south corner of the stone abutment of the highway bridge; elevation, 0.00 feet above gage datum.

A description of this station and gage height and discharge data are contained in Water-Supply Paper No. 133 of the United States Geological Survey, pp. 254-255.

*Discharge measurements of Chalk Creek at Coalville, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
March 8.....	W. G. Swendsen.....	34	21	0.77	1.42	16
May 1.....	do.....	44	64	2.45	2.25	154
June 16.....	do.....	32	42	1.68	1.86	67
June 27.....	do.....	38	28	.80	1.50	22

Daily gage height, in feet, of Chalk Creek at Coalville, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.5	1.5	1.5	2.19	2.38	1.25	1.2	1.13	1.37	1.47	1.5
2.....		1.5	1.55	1.63	2.18	2.38	1.25	1.2	1.13	1.32	1.46	1.5
3.....	1.5		1.55	1.57	2.08	2.32	1.24	1.19	1.13	1.31	1.52	1.5
4.....		1.5	1.52	1.57	2.03	2.4	1.23	1.18		1.42	1.6	1.46
5.....			1.52	1.6	1.97	2.32	1.22	1.18	1.13	1.44	1.53	1.45
6.....		1.5		1.6	1.96	2.19	1.2	1.18	1.13	1.43	1.51	
7.....	1.4		1.52	1.62	1.98	2.2	1.2	1.19	1.15	1.45	1.53	
8.....			1.42		2.03	2.27	1.18	1.19	1.2		1.52	1.4
9.....			1.5	1.68	1.98	2.35	1.2	1.17	1.2	1.37	1.55	
10.....		1.5	1.5	1.8	1.93	2.25	1.23	1.2		1.37	1.43	
11.....	1.4	1.5	1.54	1.66	1.88	2.15	1.21	1.2	1.2	1.47	1.44	
12.....			1.54	1.65	1.86	2.02	1.17	1.19	1.2	1.47	1.39	1.35
13.....			1.54	1.69	1.87	2.03	1.3	1.17	1.18	1.45	1.43	
14.....	1.4	1.5	1.56	1.71	1.87	2.02	1.28	1.18	1.19		1.53	
15.....			1.54	1.67	1.91	1.99		1.2	1.2		1.43	1.37
16.....			1.56	1.73	2.02	1.95	1.21	1.17	1.2	1.45	1.37	1.4
17.....		1.5	1.55	1.76	2.17	1.92	1.33	1.17			1.55	
18.....	1.51		1.58	1.73	2.4	1.91	1.35	1.15	1.2	1.55	1.5	
19.....	1.52		1.62	1.82	2.4	1.81	1.4	1.15	1.2	1.57	1.35	1.38
20.....		1.5	1.6	1.83	2.6	1.8	1.57	1.15	1.2	1.55	1.5	
21.....	1.52		1.57	1.81	2.55	1.68	1.54	1.15	1.2	1.55	1.5	1.38
22.....			1.5	1.8	2.47	1.67	1.52	1.15	1.2	1.57	1.5	
23.....		1.5	1.62	1.8	2.47	1.67	1.53	1.15	1.2	1.56	1.43	
24.....		1.5	1.6	1.82	2.4	1.67		1.15	1.2	1.53	1.43	
25.....	1.5	1.5	1.52	1.9	2.3	1.62	1.5	1.15	1.2		1.36	
26.....		1.5	1.56	1.98	2.3	1.55		1.15	1.22	1.55	1.33	
27.....		1.5	1.55	2.05	2.3	1.55	1.2	1.15	1.2	1.55		
28.....	1.5		1.5	2.1	2.37	1.46	1.23	1.15		1.55		1.4
29.....			1.53	2.1	2.25	1.36	1.21	1.15	1.3	1.55		
30.....	1.5		1.6	2.11	2.2	1.28	1.17		1.4	1.56	1.3	1.45
31.....	1.5		1.6		2.3		1.19	1.13		1.58		

NOTE.—Ice conditions January 1 to February 22 and December 6-31.

Station rating table for Chalk Creek at Coalville, Utah, from October 23, 1904, to December 31 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.10	3	1.50	22	1.90	74	2.30	168
1.20	6	1.60	31	2.00	94	2.40	197
1.30	10	1.70	43	2.10	116	2.50	227
1.40	15	1.80	57	2.20	141	2.60	258

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1904-5. It is well defined between gage heights 1.4 feet and 2.25 feet.

*Estimated monthly discharge of Chalk Creek at Coalville, Utah, for 1904 and 1905.*

[Drainage area, 248 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1904.						
October 23-31.....	22	20	21.6	386	0.087	0.029
November.....	31	8	20.2	1,202	.081	.090
1905.						
February 23-28.....	22	22	22.0	262	.089	.020
March.....	33	10	26.0	1,599	.105	.121
April.....	118	22	55.4	3,296	.223	.240
May.....	274	68	139	8,547	.500	.640
June.....	107	9	95.2	5,065	.384	.428
July.....	28	4.8	11.0	676	.044	.051
August.....	6	3.6	4.8	295	.019	.022
September.....	15	3.0	5.9	351	.024	.027
October.....	29	10	20.0	1,285	.084	.097
November.....	31	10	18.7	1,113	.075	.084
December 1-5.....	22	18	20.6	204	.083	.015
The period (1905).....				23,290		

NOTE.—Ice conditions December, 1904; January 1 to February 22, and December 6-31, 1905. Discharge interpolated on days when gage was not read.

## AMERICAN FORK BASIN.

## AMERICAN FORK NEAR AMERICAN FORK, UTAH.

American Fork drains a rough, broken, limestone country, comprising a portion of the western slopes of the Wasatch Mountains. The stream is confined to a steep, narrow canyon, and receives few tributaries, its normal flow being derived almost entirely from springs. There are no storage reservoirs, swamps, or lakes in the area, and the timber growth is scanty. The entire summer flow is diverted for irrigation near the mouth of the canyon; the winter flow and a part of the spring flood is discharged into Utah Lake.

The station was established May 21, 1900. It is located about 6 miles northeast of the town of American Fork, Utah, 50 feet north of the county road, and 200 feet southwest of the electric power house.

Measurements are made over a sharp-crested rectangular weir. A nail driven into the weir structure just south of the south opening, and level with the crest of the weir, serves to determine gage heights, which are read daily by Peter Anderson. During floods considerable gravel is deposited in the weir approach, making measurements at such times erroneous; this condition is partly overcome by raising the crest and sluicing out the deposit.

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

Description: Ann 20, iv, p 469; WS 51, p 417-418; 66, p 124; 100, p 139; 133, p 250.

Discharge. WS 51, p 418; 66, p 124; 100, p 140.

Discharge, daily mean: WS 133, p 261.

Discharge, monthly: Ann 13, iii, p 96; 20, iv, p 469; WS 75, p 195; 133, pp 260-261.

Discharge, yearly: Ann 13, iii, p 99; 20, iv, p 61.

Gage heights. WS 51, p 419; 66, p 124; 100, p 140; 133, p 250.

Rating table: WS 66, p 176; 12, ii, p 361.

*Daily gage height, in feet, of American Fork near American Fork, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	0.30	0.38	0.40	0.38	0.90	1.36	0.90	0.48	0.36	0.43	0.37	0.33
2.....	.40	.39	.40	.38	.84	1.34	.85	.48	.36	.42	.37	.34
3.....	.39	.38	.41	.38	.76	1.45	.85	.47	.....	.41	.37	.....
4.....	.40	.37	.41	.38	.73	1.39	.79	.47	.38	.41	.37	.31
5.....	.41	.....	.41	.41	.69	1.39	.79	.47	.39	.40	.37	.31
6.....	.39	.37	.42	.43	.66	1.39	.77	.46	.40	.33	.37	.29
7.....	.39	.38	.44	.52	.66	1.41	.75	.46	.39	.39	.37	.29
8.....	.37	.37	.43	.52	.68	1.57	.78	.46	.38	.40	.37	.31
9.....	.38	.37	.43	.....	.69	1.45	.77	.45	.37	.39	.36	.31
10.....	.38	.38	.43	.58	.68	1.35	.74	.44	.36	.39	.36	.31
11.....	.37	.38	.43	.52	.60	1.35	.75	.44	.36	.39	.36	.31
12.....	.38	.23	.44	.50	.60	1.41	.73	.43	.35	.38	.36	.31
13.....	.38	.33	.44	.49	.62	1.50	.72	.41	.35	.38	.36	.31
14.....	.38	.37	.44	.50	.63	1.50	.71	.41	.35	.38	.36	.31
15.....	.38	.37	.44	.51	.64	1.47	.68	.40	.35	.38	.36	.31
16.....	.38	.37	.44	.53	.76	1.37	.65	.40	.35	.38	.35	.31
17.....	.38	.37	.43	.53	.97	1.34	.65	.40	.35	.37	.35	.31
18.....	.38	.37	.43	.53	1.01	1.14	.62	.40	.35	.36	.35	.31
19.....	.37	.37	.43	.56	1.11	1.08	.60	.39	.35	.36	.35	.31
20.....	.37	.37	.43	.55	1.16	1.14	.56	.38	.35	.36	.36	.31
21.....	.38	.37	.42	.55	1.19	1.17	.56	.38	.37	.38	.36	.30
22.....	.38	.37	.43	.54	1.16	1.27	.55	.38	.37	.38	.36	.30
23.....	.38	.37	.43	.56	1.16	1.24	.53	.38	.37	.38	.36	.30
24.....	.37	.37	.44	.59	1.16	1.12	.52	.41	.37	.38	.35	.31
25.....	.37	.38	.43	.62	1.28	1.10	.51	.39	.38	.38	.35	.30
26.....	.37	.39	.45	.71	1.26	1.05	.49	.37	.37	.38	.35	.32
27.....	.37	.39	.45	.72	1.27	1.01	.49	.38	.37	.38	.33	.30
28.....	.37	.40	.45	.74	1.16	.96	.49	.38	.47	.38	.30	.32
29.....	.37	.....	.45	.75	1.11	.94	.48	.41	.52	.38	.30	.32
30.....	.37	.....	.43	.86	1.10	.92	.48	.38	.45	.38	.32	.30
31.....	.37	.....	.43	.....	1.32	.....	.40	.38	.....	.38	.....	.32

NOTE.—January 1 to March 20 and September 28 to December 31, crest 30.5 feet long; March 30 and 31, crest 33 feet long; April 1 to September 27, crest 36.5 feet long. Ice conditions on the river affect the flow at the weir but little.

Daily discharge, in second-feet, of American Fork near American Fork, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	25	24	26	28	104	193	104	40	26	29	23	19
2.....	26	25	26	28	94	189	95	40	26	28	23	20
3.....	25	24	27	28	81	212	95	39	a 27	27	23	a 19
4.....	26	23	27	28	76	199	85	39	28	27	23	18
5.....	27	a 23	27	32	70	199	85	39	30	26	23	18
6.....	25	23	28	35	65	199	82	38	31	25	23	16
7.....	25	24	30	46	65	203	79	38	30	25	23	16
8.....	23	23	29	46	68	239	84	38	28	26	23	18
9.....	24	23	29	a 50	70	212	82	37	27	25	22	18
10.....	24	24	29	54	68	191	77	35	26	25	22	18
11.....	23	24	29	46	56	191	79	35	26	25	22	18
12.....	24	11	30	43	56	203	76	34	25	24	22	18
13.....	24	19	30	42	59	223	74	32	25	24	22	18
14.....	24	23	30	43	61	223	73	32	25	24	22	18
15.....	24	23	30	44	62	217	68	31	25	24	22	18
16.....	24	23	30	47	81	195	64	31	25	24	21	18
17.....	24	23	29	47	116	189	64	31	25	23	21	18
18.....	24	23	29	47	123	148	59	31	25	22	21	18
19.....	23	23	29	51	142	136	56	30	25	22	21	18
20.....	23	23	29	50	152	148	51	28	25	22	22	18
21.....	24	23	28	50	158	154	51	28	27	24	22	17
22.....	24	23	29	48	152	174	50	28	27	24	22	17
23.....	24	23	29	51	152	168	47	28	27	24	22	17
24.....	23	23	30	55	152	144	40	32	27	24	21	18
25.....	23	24	29	59	176	140	44	30	28	24	21	17
26.....	23	25	31	73	172	131	42	27	27	24	21	18
27.....	23	25	31	74	174	123	42	28	27	24	10	17
28.....	23	26	31	77	152	114	42	28	33	24	17	18
29.....	23	.....	31	79	142	111	40	32	38	24	17	18
30.....	23	.....	31	97	140	107	40	28	31	24	18	17
31.....	23	.....	31	.....	184	.....	42	28	.....	24	.....	18

a Discharge interpolated.

Estimated monthly discharge of American Fork near American Fork, Utah, for 1905.

[Drainage area, 66 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.....	27	23	24.0	1,470	0.30'	0.420
February.....	26	11	23.0	1,277	.348	.362
March.....	31	20	29.2	1,795	.442	.510
April.....	97	28	49.9	2,069	.760	.844
May.....	184	50	110	6,793	1.07	1.62
June.....	239	107	176	10,470	2.07	2.98
July.....	104	40	65.1	4,093	.980	1.34
August.....	40	27	32.7	2,011	.405	.571
September.....	28	25	27.4	1,630	.415	.463
October.....	20	22	24.5	1,500	.371	.428
November.....	23	17	21.5	1,270	.320	.364
December.....	21	16	17.8	1,094	.270	.311
The year.....	239	11	60.1	36,270	.760	10.31

## PROVO RIVER BASIN.

## DESCRIPTION OF BASIN.

Provo River has its source in the Uinta Mountains and flows westward in a steep, narrow canyon until it reaches Heber or Provo Valley, through which it winds in a well-defined channel. Leaving the valley, it flows southwestward, cutting through the Wasatch Range in another steep, narrow, and extremely rough canyon, and finally discharging its surplus waters into Utah Lake.

In the mountain regions the principal rock is a compact limestone. Except in Heber Valley there is but little soil in any portion of the basin. Small groves of fir and aspen are, however, scattered over almost the entire area, and there is a light growth of underbrush. There are no extensive forests, meadows, or marshes. In the canyons the stream receives numerous short and swift tributaries, deriving their principal supply from springs, but a part also from the melting of the snow, which covers portions of the high mountains during the entire year. The highest peaks reach elevations of about 13,000 feet.

Heber Valley, which comprises an area of about 20 square miles, is an irrigated farming district, composed of a deposit of loose boulders, gravel, and soil, very porous. Most of the water comes from the main stream, though a part is received from small creeks which enter the valley from the south. The most important of these is Daniels Creek, into which some water is diverted from Strawberry River, a tributary of Green River, by three small canals in low passes at the head of the creek.

There are a few lakes at the head of the river, but they are so small that they probably have little effect in regulating the flow. There is no storage on the stream at present, but a few possibilities exist which will doubtless be developed in the future, as the entire stream, after being used at the mouth of the canyon for the development of power, is now utilized on lands in the vicinity of Utah Lake, and the supply is altogether insufficient.

**PROVO RIVER ABOVE TELLURIDE POWER COMPANY'S DAM, NEAR PROVO, UTAH.**

This station was established March 1, 1905. It is located about three-fourths of a mile up the river from Upper Falls, a station on the Provo Canyon branch of the Rio Grande Western Railway, about 4 miles above the mouth of the canyon and 800 feet south of the canyon road, in J. W. Slick's pasture. It is about one-half mile above the Telluride Power Company's dam and above all diversions into Utah Lake Valley. The object of the station is the collection of data concerning the amount of water passing from the river into this valley.

The channel has a slight uniform curvature for about 200 feet above and 300 feet below the station, describing approximately the arc of a circle. Both banks are sufficiently high to prevent overflow; the left bank is formed by the Rio Grande Western Railway grade. The bed of the stream is composed of well-compacted rock and soil, is comparatively smooth, and is not liable to shift, but a slight growth of moss occurs from the time of the spring flood until freezing weather. The velocity is low near the right bank, but increases uniformly to a point near the left. The discharge may vary from 100 to 1,400 second-feet. Conditions of free flow exist except for a very short distance near the left bank.

Discharge measurements are made by means of a cable and car. The cable is marked at 4-foot intervals, beginning at the north support, which is the initial point for soundings.

Daily gage readings are made, without expense to the Geological Survey, by the Telluride Power Company, the observations being under the direction of E. A. Briscoe, an engineer at the power house about 4 miles below the station. The gage is of the inclined type and consists of a 4-by-4 inch by 16-foot fir, bolted to a vertical cedar post embedded in the bank at the water's edge and to a box-elder stump at the shore end, about 25 feet upstream from the cable on the left bank. It is graduated with saw cuts and paint to read vertically. The gage is referred to bench marks as follows: (1) A 4-inch iron pipe with a metallic cap, set 3½ feet in the ground at a point 12 feet from the north cable post, under a fence; this has an elevation of 7.31 feet above gage datum and is so stamped on the top. (2) A project-

ing point, marked with black paint, on a limestone ledge in a railroad cut about a foot above the track and 22 feet upstream from the line of the gage; elevation, 17.18 feet above datum of gage.

*Discharge measurements of Provo River above Telluride Power Company's dam, near Provo, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 28 <sup>a</sup> . . . . .	H. S. Kleinschmidt . . . . .	70	144	1.51	3.73	217
March 3 <sup>b</sup> . . . . .	W. G. Swendsen . . . . .	69	130	2.26	3.93	294
May 13 . . . . .	do . . . . .	71	132	2.35	4.05	309
June 14 . . . . .	Hoyt & Swendsen . . . . .	75	223	3.68	5.30	820
June 22 . . . . .	do . . . . .	71	166	2.82	4.43	460
August 28 <sup>c</sup> . . . . .	A. B. Jayson . . . . .	67	94	1.46	3.62	130
September 27 <sup>c</sup> . . . . .	W. G. Swendsen . . . . .	67	85	1.64	3.57	139

<sup>a</sup> Measurement by wading 35 feet above cable.  
<sup>b</sup> Measurement by wading approximately at present cable station.  
<sup>c</sup> Growing moss changed conditions.

*Daily gage height, in feet, of Provo River above Telluride Power Company's dam, near Provo, Utah, for 1905.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 . . . . .	3.85	3.0	3.85	4.4	5.15	4.0	3.9	3.7	3.65	3.75	3.0
2 . . . . .	4.1	4.0	3.85	4.4	5.4	3.95	3.85	3.6	3.65	3.75	3.0
3 . . . . .	3.9	4.0	3.85	4.5	5.5	3.95	3.9	3.6	3.65	3.75	3.0
4 . . . . .	3.9	4.1	3.85	4.4	5.6	3.95	3.8	3.6	3.65	3.75	3.0
5 . . . . .	3.9	4.05	3.8	4.2	5.77	3.95	3.8	3.6	3.65	3.75	3.85
6 . . . . .	3.85	4.05	3.85	4.1	5.5	3.95	3.8	3.6	3.65	3.75	3.05
7 . . . . .	3.85	4.0	3.85	4.1	5.4	3.95	3.8	3.6	3.65	3.75	3.0
8 . . . . .	3.85	3.95	3.85	4.1	5.8	3.95	3.8	3.6	3.55	3.8	3.55
9 . . . . .	3.8	3.9	3.85	4.25	6.1	3.95	3.8	3.6	3.65	3.8	3.55
10 . . . . .	3.8	3.9	3.95	4.2	5.9	3.95	3.8	3.6	3.6	4.0	3.0
11 . . . . .	3.8	3.9	4.1	4.2	5.4	3.95	3.85	3.6	3.6	4.0	3.0
12 . . . . .	5.8	3.9	4.0	4.1	5.15	3.95	3.85	3.6	3.6	3.8	3.0
13 . . . . .	5.1	3.9	4.0	4.1	5.15	3.95	3.8	3.6	3.6	3.85	3.0
14 . . . . .	5.1	3.0	4.0	4.1	5.2	3.95	3.75	3.6	3.6	3.85	3.0
15 . . . . .	4.7	3.9	4.0	4.1	5.1	4.0	3.75	3.6	3.6	3.85	3.8
16 . . . . .	4.1	3.9	4.1	4.0	5.05	3.95	3.8	3.6	3.6	3.85	3.8
17 . . . . .	3.8	3.85	4.1	4.1	4.9	3.95	3.8	3.6	3.6	3.85	3.8
18 . . . . .	3.8	3.85	4.1	4.25	4.8	3.95	3.7	3.6	3.6	3.9	3.8
19 . . . . .	3.8	3.85	4.1	4.4	4.6	3.9	3.8	3.6	3.6	3.9	3.8
20 . . . . .	3.8	3.9	4.1	4.45	4.45	3.9	3.7	3.6	3.6	3.9	3.8
21 . . . . .	3.8	3.9	4.15	4.6	4.4	3.9	3.7	3.6	3.6	3.9	3.7
22 . . . . .	3.8	4.0	4.1	4.7	4.45	3.9	3.7	3.55	3.6	3.9	3.7
23 . . . . .	3.8	3.95	4.1	4.8	4.4	3.9	3.7	3.55	3.65	3.9	3.7
24 . . . . .	3.8	3.9	4.1	4.85	4.35	3.9	3.7	3.55	3.65	3.85	3.8
25 . . . . .	3.8	3.9	4.1	4.8	4.35	3.9	3.7	3.6	3.65	3.85	3.8
26 . . . . .	3.8	3.85	4.3	4.8	4.4	3.85	3.7	3.6	3.65	3.85	3.8
27 . . . . .	3.85	4.0	4.3	4.9	4.1	3.85	3.65	3.6	3.65	3.85	3.8
28 . . . . .	3.9	3.9	4.3	5.0	4.05	3.85	3.7	3.55	3.65	3.9	3.8
29 . . . . .		3.9	4.3	5.1	4.0	3.85	3.65	3.7	3.7	3.9	3.8
30 . . . . .		3.95	4.5	4.9	4.0	3.85	3.7	3.7	3.7	3.9	3.8
31 . . . . .		3.9		4.85		3.9	3.7		3.75		3.8

NOTE.—Ice jam February 12, 13, and 14. Open-channel conditions during the remainder of the winter months.

Daily discharge, in second-feet, of Provo River above Telluride Power Company's dam, near Provo, Utah, for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	254	260	254	440	703	301	245	103	150	103	244
2.....	335	301	254	440	870	285	237	135	150	104	245
3.....	200	301	254	485	926	285	243	136	100	104	245
4.....	200	335	254	440	973	285	212	136	100	104	245
5.....	200	318	238	371	1,054	284	211	137	100	104	230
6.....	254	318	254	335	926	284	210	137	100	104	170
7.....	254	301	254	335	870	283	200	138	100	104	156
8.....	254	285	254	335	1,000	282	208	138	132	210	143
9.....	238	200	254	380	1,215	281	207	130	101	210	143
10.....	238	200	285	371	1,117	280	200	130	147	273	187
11.....	238	200	335	371	870	280	221	140	147	273	157
12.....	238	200	301	335	703	270	220	140	147	210	157
13.....	238	200	301	335	703	278	203	141	147	220	157
14.....	238	200	301	335	780	277	187	141	147	227	158
15.....	238	200	301	335	740	202	187	142	148	227	210
16.....	238	200	335	301	717	275	200	142	148	227	210
17.....	238	254	335	335	651	274	200	143	148	227	210
18.....	238	254	335	380	608	273	168	143	148	242	210
19.....	238	254	335	440	525	260	107	144	148	242	210
20.....	238	200	335	400	400	255	107	144	148	243	210
21.....	238	200	353	525	440	255	100	145	140	243	187
22.....	238	301	335	500	400	254	105	132	140	243	187
23.....	238	285	335	608	440	254	104	133	103	243	187
24.....	238	200	335	630	427	253	103	133	103	228	217
25.....	238	200	335	608	427	253	102	147	103	228	217
26.....	238	254	408	608	440	230	101	147	103	220	218
27.....	254	301	408	651	335	230	144	147	104	220	218
28.....	200	200	408	605	318	237	158	132	104	244	218
29.....	200	200	408	740	301	237	140	173	178	244	218
30.....	285	485	651	301	238	238	162	173	178	244	218
31.....	200	200	630	.....	.....	245	102	.....	103	.....	218

NOTE.—Discharge February 12-16 assumed as 238 second-feet, on account of ice conditions. A rating table was used to obtain daily discharge February 1 to July 4. The daily discharge July 5 to December 31 was obtained by indirect methods, as applied to shifting channels. The effect produced by the existence of moss at this station seems to be about the same as by a shifting of the bed, i. e., the moss seems to collect sediment and make a soft coating over the bed of the stream, but does not affect flow near surface.

Estimated monthly discharge of Provo River above Telluride Power Company's dam, near Provo, Utah, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February.....	335	238	240	13,830
March.....	335	254	270	17,100
April.....	485	238	310	18,080
May.....	740	301	408	28,760
June.....	1,215	301	687	40,880
July.....	301	230	267	10,420
August.....	245	144	160	11,080
September.....	173	132	143	8,550
October.....	103	132	157	6,651
November.....	273	103	220	13,450
December.....	245	143	200	12,300
The period.....	.....	.....	.....	101,500

## PROVO RIVER AT MOUTH OF CANYON, NEAR PROVO, UTAH.

This station was established July 27, 1889. It is located about 6 miles north of Provo, about 1,000 feet above Olmstead station, on the Provo Canyon branch of the Rio Grande Western Railway, and 1,200 feet above the power house of the Telluride Power Company. H

The station was originally established to determine the total flow of the Provo above all diversions to Utah Lake Valley; but since that time a small canal has been taken out about 3 miles above the station and the system of the Telluride Power Company has been extended by a new flume line of sufficient capacity to divert the entire normal flow of the stream. The power plant of the Telluride Power Company has been rebuilt at a point about 1,200 feet below the station, the tailrace discharging directly into the canals at the mouth of the canyon. Practically no water now passes the station except the flood discharge and a small portion of the side drainage between the power company's dam and the gaging station, the greater part of the side drainage being diverted into the flume at various points along the line. The station is thus of little importance, but it is maintained at an extremely low cost, since the gage readings are made by the Telluride Power Company and the discharge curve is so well defined that but few more measurements are necessary.

The channel is straight for about 200 feet above and 100 feet below the station. The right bank is steep and rocky and does not overflow; the left is somewhat low and sloping and is liable to overflow at extreme flood stages. The bed of the stream is composed of boulders and soil and is very rough, but permanent. The velocity is high, ranging from 4 to 6 feet per second. Ice forms near the banks and appears also as drift or floating ice. It is, however, limited in quantity and probably never piles up or gorges. There is no anchor or needle ice at any time.

Discharge measurements are made by means of a cable and car. The cable is marked at 3-foot intervals with white paint. The initial point for soundings is the first white mark on the cable south of the vertical post that supports the cable on the right bank. A guy line is stretched across the stream about 40 feet above the station and is found useful at all stages.

The original gage was of the inclined type and consisted of a piece of Oregon fir attached to vertical posts embedded in the left bank about 2 feet below the line of the cable. The present gage, daily readings of which are made under the direction of E. A. Brisco, an engineer at the power plant, is a vertical piece of aspen driven into the stream bed and supported at the top by a horizontal piece buried in the bank. It is located on the right bank about 30 feet above the line of the cable. Simultaneous readings on the two gages are found to be equal, but the zero of the new gage is 0.10 foot above that of the old one. The bench marks are as follows: (1) A cross chiseled in a limestone rock about 1 foot square, 100 feet S. 15° E. from the old gage; elevation above old gage datum, 6.98 feet. (2) A standard United States Geological Survey metallic plug, cemented in the top of the south abutment of the highway bridge about one-eighth mile below the station; elevation above zero of gage, 4.75 feet. (3) A cross chiseled on the top of a boulder projecting 1 foot above the ground, 126 feet N. 75° W. from the north post supporting the cable; elevation above zero of gage, 11.21 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 14, ii, p 123; 18, iv, pp 325-326; Bull 131, p 59; 140, p 234; WS 16, p 162; 28, p 146; 38, pp 338-339; 51, p 416; 66, p 123; 85, p 88; 100, pp 140-141, 142-143; 133, pp 261-262.

Discharge: Ann 18, iv, p 326; Bull 131, p 92; 140, p 234; WS 16, p 162; 28, p 153; 38, p 339; 51, p 416; 100, p 141; 66, p 123; 85, p 88; 100, p 143; 133, p 262.

Discharge, monthly: Ann 11, ii, p 104; 12, ii, pp 354, 361; 13, iii, p 97; 14, ii, pp 123-124; 18, iv, p 327; 19, iv, p 442; 20, iv, pp 458, 468; 21, iv, p 399; 22, iv, p 416; Bull 140, p 235; WS 75, p 195; 100, pp 142, 144; 133, p 264.

Discharge, yearly: Ann 13, iii, p 99; 20, iv, p 61.

Gage heights: Bull 131, p 60; 140, p 234; WS 11, p 79; 16, p 162; 28, p 339; 51, p 417; 66, p 124; 100, p 141, 143-144; 133, p 263.

Hydrographs: Ann 12, II, p 340; 14, II, p 125; 18, IV, p 328; 19, IV, p 442; 20, IV, p 408; 21, IV, p 399; 22, IV, p 417.

Rainfall and run-off relation: Ann 20, IV, p 459.

Rating tables: Ann 18, IV, p 326; 19, IV, p 441; Bull 131, p 59; 140, p 234; WS 28, p 154; 39, p 456; 52, p 521; 60, p 176; 100, pp 142, 144; 133, p 263.

Water powers: Ann 19, IV, p 441.

*Discharge measurements of Provo River at mouth of canyon, near Provo, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
March 4.....	Henry Kleinschmidt.....	73	116	2.58	4.50	309
May 24.....	W. G. Swendsen.....	75	138	3.52	4.95	485
August 29 <sup>a</sup> ....	A. B. Larson.....	32	41	.62	3.55	25

<sup>a</sup> Measurement made 100 feet above regular station.

*Daily gage height, in feet, of Provo River at mouth of canyon, near Provo, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.1	4.21	4.51	4.4	4.78	5.39	4.05	3.65	3.58	3.66	3.51	3.81
2.....	3.98	4.42	4.50	4.34	4.8	5.03	3.93	3.54	3.5	3.75	3.56	3.81
3.....	4.12	4.6	4.58	4.37	4.77	5.7	3.87	3.69	3.44	3.76	3.59	3.68
4.....	4.3	4.52	4.65	4.32	4.72	5.95	3.95	3.52	3.57	3.68	3.52	3.8
5.....	4.22	4.51	4.46	4.3	4.5	5.87	3.83	3.61	3.67	3.68	3.50	3.62
6.....	4.14	4.52	4.66	4.3	4.34	5.77	4.0	3.55	3.7	3.71	3.56	3.77
7.....	4.2	4.21	4.18	4.35	4.22	5.65	3.95	3.53	3.6	3.71	3.52	3.8
8.....	4.4	4.28	4.0	4.34	4.4	5.86	3.93	3.56	3.58	3.66	3.55	3.68
9.....	4.1	4.11	3.98	4.24	4.47	6.33	3.83	3.5	3.63	3.69	3.55	3.49
10.....	4.1	4.14	3.91	4.6	4.5	5.97	3.65	3.51	3.64	3.7	4.04	3.45
11.....	4.1	4.08	3.88	4.68	4.49	5.65	3.73	3.55	3.48	3.61	3.92	3.45
12.....	4.38	4.08	4.2	4.35	4.28	5.19	3.6	3.55	.....	3.63	4.05	3.48
13.....	4.1	4.01	4.14	4.25	4.3	5.75	3.6	3.53	.....	3.6	4.03	3.51
14.....	4.12	4.0	4.0	4.4	4.28	5.75	3.7	3.49	.....	3.62	3.96	3.47
15.....	4.05	4.05	4.3	4.44	4.29	5.53	3.67	3.52	.....	3.64	3.98	3.68
16.....	4.07	4.09	4.52	4.45	4.4	5.5	3.63	3.57	.....	3.63	4.0	3.6
17.....	3.79	4.2	4.5	4.52	4.45	5.23	3.6	3.5	.....	3.59	3.99	3.62
18.....	3.78	4.1	4.4	4.52	4.43	5.0	3.63	3.45	.....	3.64	3.89	3.62
19.....	4.02	4.12	4.5	4.51	4.76	4.87	3.65	3.63	.....	3.65	3.91	.....
20.....	4.1	4.15	4.57	4.51	4.77	4.78	3.62	3.61	.....	3.58	3.76	.....
21.....	3.56	4.14	4.18	4.56	4.89	4.71	3.5	3.53	.....	3.61	3.89	.....
22.....	4.04	4.11	4.45	4.5	5.06	4.77	3.5	3.46	.....	3.63	3.82	.....
23.....	4.14	4.15	4.43	.....	5.1	4.85	3.5	3.55	.....	3.57	3.88	.....
24.....	4.13	4.25	4.49	4.4	5.09	4.7	3.55	3.68	.....	3.57	3.8	.....
25.....	4.05	4.22	4.43	4.45	5.0	4.43	3.6	3.59	3.51	3.55	3.74	.....
26.....	4.08	4.21	4.43	4.75	5.02	4.17	3.6	3.59	3.52	3.6	3.93	.....
27.....	4.06	4.42	4.49	4.94	5.1	4.2	3.58	3.59	3.49	3.61	3.9	.....
28.....	4.03	4.5	4.48	4.84	5.2	4.15	3.57	3.57	3.55	3.59	3.95	.....
29.....	4.03	.....	4.43	4.72	5.22	4.05	3.6	.....	3.85	3.58	3.95	.....
30.....	4.08	.....	4.43	4.78	5.15	3.93	3.6	.....	3.78	3.65	3.91	.....
31.....	4.13	.....	4.34	.....	5.1	.....	.....	.....	.....	3.64	.....	.....

Station rating table for Provo River at mouth of canyon, near Provo, Utah, from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.40	12	4.20	177	5.00	532	5.80	1,050
3.50	20	4.30	212	5.10	589	5.90	1,120
3.60	31	4.40	250	5.20	649	6.00	1,192
3.70	46	4.50	290	5.30	711	6.10	1,265
3.80	64	4.60	332	5.40	775	6.20	1,340
3.90	87	4.70	377	5.50	841	6.30	1,415
4.00	114	4.80	425	5.60	910	6.40	1,490
4.10	144	4.90	477	5.70	980		

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 6.3 feet.

Daily discharge, in second-feet, of Telluride Power Company's flume near Provo, Utah, for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	24	52	40	40	45	79	163	130	136	173
2.....	29	40	62	35	62	88	141	130	124	184
3.....	23	41	78	40	70	85	117	130	125	170
4.....	29	38	77	29	68	82	126	145	124	178
5.....	36	36	49	24	75	74	148	150	127	183
6.....	41	36	57	59	61	106	131	130	130	175
7.....	43	34	66	41	62	80	139	127	130	163
8.....	33	45	68	24	59	75	142	130	127	155
9.....	37	55	63	70	75	80	137	135	129	167
10.....	44	50	49	39	96	69	137	127	162	169
11.....	46	26	59	32	95	52	133	130	170	170
12.....	27	78	65	39	99	87	136	130	160	150
13.....	38	60	66	53	101	80	.....	.....	160	171
14.....	25	51	62	48	90	88	.....	.....	155	168
15.....	43	55	54	50	98	85	.....	130	153	188
16.....	49	55	43	42	97	85	.....	131	160	185
17.....	41	48	59	58	100	79	.....	128	160	183
18.....	56	36	70	48	94	89	.....	126	160	187
19.....	62	83	45	42	92	105	.....	129	161	.....
20.....	41	66	55	48	85	124	.....	135	.....	.....
21.....	56	60	38	45	87	130	.....	126	.....	.....
22.....	62	65	40	41	87	131	.....	158	.....	.....
23.....	49	.....	50	42	87	117	.....	150	.....	.....
24.....	47	85	44	37	84	123	.....	158	.....	.....
25.....	38	75	48	68	81	114	133	161	.....	.....
26.....	40	.....	36	81	80	150	124	141	.....	.....
27.....	39	.....	65	45	80	146	122	135	.....	.....
28.....	32	50	48	47	80	121	119	142	.....	.....
29.....	44	37	32	40	77	.....	157	.....	.....	.....
30.....	53	33	44	64	78	.....	137	.....	.....	.....
31.....	54	.....	30	.....	.....	.....	.....	160	.....	.....

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*Estimated monthly discharge of Provo River at mouth of canyon, near Provo, Utah, for 1905.*

[Drainage area, 640 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.....	250	27	142	8,731	0.222	0.256
February.....	332	114	100	10,550	.297	.300
March.....	359	82	230	14,700	.373	.430
April.....	499	191	288	17,140	.450	.502
May.....	661	184	396	24,350	.619	.714
June.....	1,438	95	687	40,880	1.07	1.19
July.....	129	20	50.1	3,080	.078	.090
August.....	44	16	26.8	1,048	.042	.048
September (17 days).....	76	15	32.6	1,099	.051	.032
October.....	56	26	37.1	2,281	.058	.067
November.....	129	21	73.0	4,344	.114	.127
December 1-18.....	66	16	38.3	1,308	.060	.040
The period.....				130,200		

*Estimated monthly discharge of Telluride Power Company's flume near Provo, Utah, for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March.....	62	23	41.3	2,539
April (27 days).....	85	26	51.5	2,758
May.....	78	30	53.6	3,296
June.....	81	24	45.7	2,719
July 1-30.....	101	45	81.5	4,850
August 1-28.....	150	52	97.3	5,404
September 1-12, 25-30.....	163	117	136	4,856
October (27 days).....	161	126	137	7,337
November 1-19.....	170	124	140	5,276
December 1-18.....	188	150	173	6,176
The period.....				45,210

NOTE.—To obtain total flow of Provo River at head of diversion dams, the flume discharge should be added to that of the gaging station given above.

#### PROVO RIVER AT THE RIO GRANDE WESTERN RAILWAY BRIDGE, NEAR PROVO, UTAH.

This station was established January 25, 1905. It is located at the Rio Grande Western Railway bridge about 2 miles northwest of the town of Provo, below all points of diversion and inflowing streams. It replaces the old station maintained at the San Pedro Los Angeles, and Salt Lake Railroad bridge, about 300 feet below, the conditions at the latter point being so changed by the reconstruction of the bridge that the section could no longer be used.

The purpose of the station is to determine the amount of water discharged by the Provo into Utah Lake. As the entire normal spring and summer flow is diverted for irrigation above this point, the station is maintained only during flood and winter seasons.

The channel is straight for about 150 feet above and 200 feet below the station. The normal flow is confined to a comparatively narrow channel near the center, but the high-

water channel is much wider, including a small timbered flat on both sides. The railroad grade, however, prevents any overflow at the gaging section. The bed of the stream is composed of coarse gravel and is liable to change during floods. The velocity is uniform but high, ranging from 4 to 7 feet. Information in regard to ice conditions is incomplete.

Discharge measurements are made from a foot plank, fastened to 4 by 4 inch pieces of fir bolted to the lower chord on the upstream side of the bridge. The plank is graduated with paint, beginning at the north face of the masonry abutment on the south end of the bridge, which is the initial point for soundings. A guy line is stretched 24 feet upstream from the foot plank.

The gage, which is read daily by Lars Thompson, a farmer, is of the inclined type, consisting of a 4 by 4 inch by 16-foot timber of Oregon fir drift-bolted to the old piles and sills of the former bridge, about 10 feet east of the present bridge, the incline being such that 15.88 feet along the piece equal 10 feet vertical. It is graduated with saw cuts and paint to read vertically. The gage is referred to bench marks as follows: (1) A standard United States Geological Survey metallic plug, cemented in the masonry wall, 0.5 foot south of its face at the southeast corner of the bridge; this is 11.29 feet above the gage datum and is so stamped. (2) A cross cut in the top of the same wall at the southwest corner of the bridge; elevation above gage datum, 11.25 feet.

*Discharge measurements of Provo River at the Rio Grande Western Railway bridge, near Provo, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-foot.
January 25.....	H. S. Kleinschmidt.....	44	54	3.52	2.80	101
February 14 <sup>a</sup> .....	do.....	37	38	3.12	2.53	120
February 16.....	do.....	43	40	3.40	2.74	170
March 9.....	do.....	43	40	3.30	2.70	100
June 21.....	W. G. Swendsen.....	17	8.5	1.52	2.00	12.0

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<sup>a</sup> Ice divides stream into two channels.

*Daily gage height, in feet, of Provo River at the Rio Grande Western Railway Bridge, near Provo, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....		2.85	2.75	2.6	2.7	2.55	17.....		2.75	2.05	2.75	2.0	3.05
2.....		3.1	2.75	2.55	2.8	3.05	18.....		2.7	2.05	2.7	2.0	2.8
3.....		3.15	2.8	2.52	2.8	3.5	19.....		2.7	2.7	2.0	2.0	2.47
4.....		3.0	2.9	2.53	2.7	3.7	20.....		2.7	2.85	2.7	2.25	2.18
5.....		2.95	3.0	2.5	2.6	3.75	21.....		2.7	2.75	2.75	2.1	2.0
6.....		2.9	3.0	2.5	2.4	3.6	22.....		2.7	2.75	2.0	2.15	Dry.
7.....		2.85	2.9	2.47	2.25	3.54	23.....		2.7	2.7	2.0	2.0	.....
8.....		2.8	2.8	2.45	2.2	3.05	24.....		2.7	2.05	2.0	2.02	.....
9.....		2.85	2.7	2.6	2.2	4.27	25.....		2.7	2.05	2.85	2.58	.....
10.....		2.85	2.7	2.75	2.4	4.2	26.....		2.8	2.08	2.05	2.75	2.02
11.....		2.85	2.7	2.85	2.3	3.73	27.....		2.8	2.05	2.8	2.85	2.08
12.....		2.8	2.7	2.8	2.15	3.55	28.....		2.8	2.05	2.7	2.0	2.75
13.....		2.6	2.67	2.8	2.05	3.53	29.....		2.8	.....	2.05	2.75	2.8
14.....		2.55	2.7	2.75	2.1	3.45	30.....		2.8	.....	2.7	2.7	2.05
15.....		2.7	2.7	2.7	2.0	3.43	31.....		2.8	.....	2.05	.....	2.55
16.....		2.8	2.65	2.7	2.25	3.25							

NOTE.—Station discontinued June 22.

## HOBBLE CREEK BASIN.

## HOBBLE CREEK NEAR SPRINGVILLE, UTAH.

Hobble Creek rises on the western slope of the Wasatch Mountains and flows in a general southwesterly direction to Utah Lake. There is little overlying soil and but a scanty growth of timber or brush. The steep, narrow canyon in which the stream flows is broken here and there by narrow openings or flats, covered with a shallow deposit of boulders and soil and comprising irrigated farms. As these tracts lie along the banks of the creek, a large part of the water used on them is returned to the stream as seepage. There are no tributaries of importance, but short, intermittent streams, each of which is confined to a steep, narrow canyon, enter all along the course. There are no storage reservoirs, lakes, or marshes to control the flood discharge, which occurs in the spring as the result of melting snow. The entire normal summer flow is used for irrigation, but the diversion takes place for the most part at the mouth of the canyon below the gaging station.

The station was established March 23, 1904. It is located about 1 mile above the mouth of the canyon, 4 miles southeast of Springville, Utah, 600 feet northeast of the head of Mapleton Canal, and about 1,200 feet southwest of the Springville electric power plant.

The channel is straight for about 75 feet above and 50 feet below the station. Both banks are high and wooded. The bed of the stream is of loose, fine gravel, and shifts almost constantly. There is but one channel at all stages. The velocity ranges from 3 to 4.5 feet per second. As the normal winter flow comes largely from springs, the stream probably does not freeze at the station.

Discharge measurements are made by wading at a point near the gage. The initial point for soundings is a 2 by 4 inch post located on the south bank near the water's edge.

The gage, which is read daily by J. B. Stevenson, an electrician, is a vertical staff, driven into the bed of the stream and fastened at the top to an overhanging tree. The gage is referred to bench marks as follows: (1) A nail in the top of the 2 by 4 inch post used as the initial point for soundings; elevation above gage datum, 4.91 feet. (2) A nail in a post set 26 feet south of the initial point; elevation above gage datum, 12.38 feet. (3) A 30-penny nail in the east side of a pole of the electric transmission line, 97 feet northwest of the initial point; elevation, 21.80 feet above gage datum.

A description of this station, gage height and discharge data, and rating table are contained in Water-Supply Paper No. 133 of the United States Geological Survey, pages 268-270.

*Discharge measurements of Hobble Creek near Springville, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
February 16...	H. S. Kleinschmidt.....	14	12	1.62	1.25	20
April 5.....	W. G. Swendsen.....	18	11	2.57	1.42	28
May 5.....	W. P. Hardesty.....	18	18	3.22	1.80	58
May 23.....	W. G. Swendsen.....	19	29	3.92	2.30	112
June 6.....	A. B. Larson.....	18	17	3.84	1.75	64
June 11.....	.....do.....	18	21	3.72	1.80	76
June 26.....	.....do.....	18	16	2.82	1.55	44
July 11.....	G. M. P. Dougall.....	18	9.2	2.35	1.30	22
July 17.....	.....do.....	18	9.8	2.30	1.30	23
July 20.....	G. S. Schow.....	18	8.7	2.21	1.16	19
August 9.....	.....do.....	18	9.5	2.15	1.25	20
August 16.....	.....do.....	17	9.6	1.84	1.24	17.7
August 30.....	A. B. Larson.....	17	9.7	1.48	1.21	14.4
September 16..	G. S. Schow.....	17	8.7	1.65	1.20	14.5
September 28..	A. B. Larson.....	17	8.3	1.60	1.19	13.6
October 12.....	W. D. Beers.....	16	7.8	1.61	1.20	12.6

Daily gage height, in feet, of Hobble Creek near Springville, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.38	1.35	1.4	2.1	1.75	1.35	1.15	1.25	1.2	1.23	1.25
2		1.4	1.35		2.05	1.8	1.35	1.2	1.25	1.2	1.25	1.22
3		1.4	1.35	1.4	1.95		1.3	1.3	1.25	1.18	1.22	1.2
4		1.4	1.35		1.85	1.8	1.35	1.35	1.2	1.15	1.25	1.2
5	1.3	1.4	1.4		1.8	1.85	1.3		1.2	1.12	1.25	1.2
6		1.4	1.4	1.45	1.75	1.8	1.26	1.2	1.2	1.12	1.22	1.18
7		1.38	1.4		1.7	1.8	1.24	1.25	1.25	1.1	1.23	1.2
8		1.38	1.4	1.5	1.75	2.0	1.25	1.2	1.3	1.1	1.25	1.2
9		1.38	1.4	1.5	1.75	1.92	1.25		1.3	1.12	1.28	1.2
10		1.38		1.8	1.75	1.8	1.25	1.22	1.25	1.13	1.3	1.1
11			1.4	1.6	1.8	1.75	1.25	1.2	1.25	1.15	1.27	1.17
12			1.6	1.8	1.8	1.75	1.25	1.2	1.25	1.17		1.16
13	1.3		1.4	1.6	1.9	1.75	1.25	1.15	1.25	1.2	1.2	1.15
14			1.4		1.95	1.85	1.25	1.2	1.25	1.18	1.22	1.18
15		1.38	1.4	1.6	2.05	1.8	1.3	1.25	1.25	1.17	1.23	1.2
16		1.35	1.4	1.7	2.1	1.7	1.3	1.2	1.25	1.2	1.22	1.25
17	1.3		1.4	1.6	2.3	1.6	1.3	1.2	1.25	1.2	1.23	1.22
18		1.35	1.4		2.35	1.6	1.3	1.14	1.25	1.2	1.2	1.25
19	1.3		1.4	1.7	2.4	1.65	1.3	1.12	1.22	1.18	1.18	1.25
20		1.35	1.45		2.35	1.6	1.25	1.2	1.2	1.17	1.2	1.23
21		1.35	1.4	1.62	2.4	1.53	1.3	1.15	1.2	1.2	1.2	1.22
22		1.35	1.4	1.65	2.45	1.5	1.3	1.12	1.25	1.2	1.25	
23	1.35	1.35	1.4	1.7	2.4	1.55	1.25	1.16	1.2	1.2	1.22	
24		1.35	1.4	1.7	2.25	1.5	1.2	2.06	1.2	1.2	1.23	
25	1.35	1.35	1.35	1.7	2.2	1.5	1.8	1.25	1.2	1.2	1.2	1.15
26		1.35	1.35	1.85	2.1	1.55	1.2	1.27	1.2	1.18	1.2	1.15
27	1.33	1.35	1.45	1.95	2.0	1.5	1.2	1.25	1.2	1.18	1.25	1.25
28		1.35	1.4	2.0	1.9	1.45	1.15	1.25	1.2	1.17	1.25	1.22
29			1.4	2.0	1.7	1.42	1.15	1.3	1.25	1.2	1.25	
30	1.33		1.4		1.7	1.4	1.15	1.2	1.2	1.2	1.25	1.23
31	1.35		1.35		1.7		1.2	1.2		1.22		

Station rating table for Hobble Creek near Springville, Utah, from January 1, to May 30, 1905.

Gage height.		Discharge.		Gage height.		Discharge.		Gage height.		Discharge.	
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.30	22.0	1.60	40.5	1.90	68	2.20	100				
1.40	27.5	1.70	48.5	2.00	78	2.30	112				
1.50	33.5	1.80	58	2.10	89	2.40	125				

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

Station rating table for Hobble Creek near Springville, Utah, from May 31, to December 31, 1905.

Gage height.		Discharge.		Gage height.		Discharge.		Gage height.		Discharge.	
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.10	7.0	1.40	30.5	1.70	61	2.00	99				
1.20	14.5	1.50	40	1.80	73	2.10	113				
1.30	22.0	1.60	50	1.90	86						

NOTE.—The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1905. It is well defined between gage heights 1.2 feet and 1.8 feet.

*Estimated monthly discharge of Hobble Creek near Springville, Utah, for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	24	22	22.8	1,402
February.....	28	24	25.0	1,422
March.....	30	24	27.0	1,600
April.....	78	28	45.2	2,630
May.....	132	48	81.0	4,980
June.....	99	30	59.4	3,534
July.....	26	11	18.6	1,144
August.....	107	8	18.3	1,125
September.....	26	14	17.1	1,018
October.....	16	7	12.5	769
November.....	22	13	16.9	1,006
December.....	18	7	14.6	838
The year.....	132	7	29.9	21,650

NOTE.—Open-channel conditions assumed throughout the year. Discharge interpolated for missing gage heights.

#### SPANISH FORK BASIN.

##### SPANISH FORK NEAR SPANISH FORK, UTAH.

Spanish fork rises in the Wasatch Mountains and flows northwestward into Utah Lake. The area is generally barren, with but little timber or brush. The stream is confined to a steep, narrow canyon, with a very few small openings in which are irrigated farms. The tributaries are all short and many of them are intermittent. The most important are Diamond Fork and Thistle Creek, which enter about 8 and 10 miles, respectively, above the gaging station, and which, like the main stream, occupy steep narrow canyons. The normal flow comes largely from springs, scattered over the entire basin; the flood discharge is direct surface run-off from melting snow.

There are no storage reservoirs on the stream and but little of the flow is diverted above the station. The entire normal flow is, however, diverted at the mouth of the canyon, immediately below the station, and used for the irrigation of lands near Utah Lake.

The station was established May 23, 1900, and reestablished March 26, 1903. It is located 600 feet above the dam of the East Bench Irrigation Company, 5 miles southeast of Spanish Fork, and 300 feet southwest of the main line of the Rio Grande Western Railway.

Records at this station are of importance in connection with the Strawberry Valley storage reservoir project, under a plan to divert water from that basin into Spanish Fork near its head and carry it to distribution canals below.

The channel is straight for about 150 feet above and below the station. Both banks slope gradually, are covered with small brush, and are sufficiently high to prevent overflow. The bed is composed of loose gravel and sand, and is smooth but somewhat shifting, especially at flood stages. The velocity is high. There is a free flow, the current being uninterrupted by dams or other obstructions.

Discharge measurements are made by means of a cable and car. The cable is graduated with paint, beginning at the right cable post, which is the initial point for soundings.

The gage, which is read daily by Levi Thorp, a section foreman on the Rio Grande Western Railway, consisted originally of a vertical staff located on the right bank of the stream. In April, 1905, it was replaced by a new 6 by 6 inch inclined gage having the same datum. The bench mark is on a limestone rock 29 feet S. 36° E. from the gage, marked with black paint "U. S. G. S."; elevation above gage datum, 7.16 feet; elevation above mean sea level, 4,785 feet.

SPANISH FORK BASIN.

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 145; 133, p 271.
- Discharge: WS 100, p 145; 133, p 271.
- Discharge, monthly: Ann 13, iii, p 97; WS 100, p 147; 133, p 273.
- Discharge, yearly: Ann 13, iii, p 99; 20, iv, p 61.
- Gage heights: WS 100, p 146; 133, p 272.
- Rating table: WS 100, pp 146-147; 133, pp 272-273.

*Discharge measurements of Spanish Fork near Spanish Fork, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Discharge.
			section.	velocity.	height.	
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
January 27	H. S. Kleinschmidt	37	30	2.68	1.42	79
February 15	do.	35	28	2.66	1.38	74
March 10	do.	37	29	2.51	1.40	72
April 19	W. G. Swendsen	39	39	3.17	1.70	111
May 11	W. P. Hardesty	36	44	3.50	1.90	154
May 15	W. G. Swendsen	37	49	4.04	2.00	200
May 22	do.	40	85	4.34	2.32	369
May 22	do.	40	85	4.42	2.32	376
May 22	do.	40	85	4.00	2.32	360
June 3	A. B. Larson	38	68	4.59	2.45	314
June 9	do.	37	49	3.99	2.04	195
June 26	do.	35	30	2.85	1.60	86
July 31	Beers and Schow	34	25	2.19	1.40	54
August 9	G. S. Schow	40	21	1.99	1.32	43
August 30	A. B. Larson	34	20	2.60	1.41	52
September 7	G. S. Schow	35	25	2.56	1.47	64
September 10	do.	34	20	2.39	1.38	49
September 28	A. B. Larson	34	22	2.35	1.41	52
October 12	W. D. Beers	33	24	2.46	1.48	50

*Daily gage height, in feet, of Spanish Fork near Spanish Fork, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	1.46	1.6	1.5	2.06	2.56	1.52	1.36	1.36	1.64	1.48	1.46
2	1.26	1.56	1.56	1.48	2.04	2.52	1.5	1.34	1.36	1.56	1.48	1.44
3	1.5	1.5	1.62	1.48	2.02	2.48	1.5	1.4	1.36	1.44	1.48	1.4
4	1.32	1.5	1.54	1.46	1.96	2.38	1.46	1.36	1.61	1.44	1.48	1.44
5	1.4	1.5	1.5	1.48	1.92	2.26	1.44	1.36	1.42	1.42	1.48	1.5
6	1.56	4.48	1.5	1.48	1.82	2.24	1.46	1.36	1.4	1.44	1.48	1.4
7	1.4	1.46	1.48	1.5	1.82	2.14	1.46	1.3	1.44	1.45	1.48	1.44
8	1.4	1.46	1.48	1.52	1.84	2.1	1.46	1.3	1.42	1.42	1.48	1.44
9	1.4	1.4	1.46	1.54	1.98	2.02	1.4	1.3	1.4	1.42	1.48	1.44
10	1.42	1.42	1.46	1.76	1.96	2.02	1.42	1.36	1.4	1.48	1.48	1.4
11	1.44	1.44	1.46	1.7	1.9	2.0	1.42	1.5	1.4	1.48	1.48	1.3
12	1.4	1.26	1.44	1.7	1.84	1.96	1.4	1.4	1.4	1.48	1.48	1.24
13	1.38	1.6	1.46	1.66	2.0	1.88	1.38	1.38	1.4	1.46	1.4	1.25
14	1.42	1.4	1.48	1.64	2.0	1.82	1.4	1.38	1.4	1.46	1.44	1.4
15	1.42	1.4	1.48	1.62	2.0	1.76	1.4	1.36	1.4	1.48	1.44	1.3
16	1.44	1.34	1.44	1.7	2.04	1.76	1.4	1.34	1.4	1.48	1.44	1.25
17	1.42	1.44	1.46	1.7	2.22	1.74	1.4	1.34	1.34	1.48	1.46	1.3
18	1.42	1.42	1.46	1.66	2.41	1.76	1.38	1.34	1.34	1.46	1.46	1.3
19	1.34	1.4	1.5	1.74	2.54	1.78	1.38	1.32	1.38	1.44	1.46	1.3
20	1.44	1.44	1.6	1.72	2.64	1.78	1.36	1.32	1.38	1.44	1.44	1.3

*Daily gage height, in feet, of Spanish Fork near Spanish Fork, Utah, for 1905—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	1.44	1.48	1.6	1.72	2.74	1.78	1.34	1.32	1.36	1.44	1.44	1.4
22.....	1.44	1.48	1.52	1.7	2.84	1.74	1.36	1.3	1.36	1.48	1.5	1.35
23.....	1.46	1.46	1.5	1.74	2.94	1.72	1.34	1.3	1.36	1.48	1.5	1.4
24.....	1.44	1.48	1.5	1.76	2.84	1.66	1.34	1.32	1.34	1.48	1.5	1.4
25.....	1.40	1.48	1.5	1.78	2.74	1.6	1.34	1.66	1.44	1.48	1.46	1.4
26.....	1.42	1.48	1.48	1.80	2.8	1.6	1.34	1.42	1.48	1.48	1.46	1.4
27.....	1.30	1.46	1.5	1.92	2.74	1.58	1.34	1.46	1.5	1.48	1.5	1.4
28.....	1.38	1.5	1.5	1.98	2.78	1.58	1.34	1.48	1.46	1.48	1.46	1.5
29.....	1.44	.....	1.52	1.97	2.7	1.56	1.34	1.4	2.22	1.48	1.46	1.7
30.....	1.46	.....	1.54	2.0	2.6	1.54	1.34	1.38	1.64	1.48	1.46	1.45
31.....	1.44	.....	1.46	.....	2.56	.....	1.34	1.34	.....	1.5	.....	1.45

NOTE.—January 3 and 6 and February 13, backwater caused by ice; open-channel conditions during the remainder of the winter months. Gage February 6 probably in error.

*Daily discharge, in second-feet, of Spanish Fork near Spanish Fork, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	57	80	112	70	192	330	50	48	45	92	60	61
2.....	30	106	104	76	187	320	54	46	45	76	60	59
3.....	43	95	115	75	182	322	54	54	45	54	61	53
4.....	47	95	100	71	168	292	48	48	80	54	61	59
5.....	57	95	92	74	158	258	47	48	53	50	61	69
6.....	50	91	92	74	130	252	40	48	50	53	62	53
7.....	60	87	88	77	130	224	50	42	50	50	62	50
8.....	61	87	88	81	140	212	51	42	53	50	62	50
9.....	62	76	84	83	172	190	43	42	52	50	62	59
10.....	66	70	83	127	168	188	46	46	52	60	62	53
11.....	70	83	82	114	154	180	47	68	52	60	63	41
12.....	64	62	78	113	145	168	44	52	52	50	63	35
13.....	60	64	81	100	180	147	43	46	52	55	50	36
14.....	60	70	85	100	165	132	40	46	52	55	56	54
15.....	60	77	84	96	200	118	40	46	52	59	56	42
16.....	74	65	70	112	203	116	46	44	52	59	56	36
17.....	71	74	80	112	242	110	47	44	44	59	59	42
18.....	72	71	70	102	286	112	44	44	44	56	59	42
19.....	58	70	80	110	315	115	45	41	48	54	59	42
20.....	77	83	105	114	355	113	43	41	48	54	57	42
21.....	78	91	105	114	355	111	42	41	45	54	57	55
22.....	70	91	80	111	375	102	43	38	45	59	67	48
23.....	81	85	84	110	410	96	42	38	45	59	67	55
24.....	80	80	84	122	384	81	42	41	43	59	67	55
25.....	83	80	83	127	360	68	43	55	55	59	60	56
26.....	70	89	70	144	382	67	43	53	62	60	60	56
27.....	67	85	82	158	368	64	44	58	60	60	68	56
28.....	70	64	82	172	383	65	44	62	58	60	61	74
29.....	82	.....	85	170	364	62	45	50	228	60	61	114
30.....	85	.....	88	178	340	58	45	47	92	60	61	65
31.....	82	.....	72	.....	331	.....	46	43	.....	65	.....	65

NOTE.—Daily discharge obtained by indirect method for shifting channels. Discharge January 3 and 6 and February 13 reduced on account of backwater from ice. Discharge February 6 interpolated between February 5 and 7 on assumption that gage height of February 6 was in error.

*Estimated monthly discharge of Spanish Fork River near Spanish Fork, Utah, for 1905.*

[Drainage area, 670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January.....	85	30	67.7	4,163	0.101	0.116
February.....	100	52	83.2	4,621	.124	.129
March.....	115	72	88	5,411	.131	.151
April.....	178	71	111	6,005	.160	.185
May.....	410	130	257	15,800	.384	.443
June.....	330	58	150	9,283	.233	.260
July.....	50	42	46.1	2,835	.069	.080
August.....	95	38	48.0	2,088	.073	.084
September.....	228	43	50.3	3,520	.080	.090
October.....	92	50	58.5	3,597	.087	.100
November.....	68	50	60.7	3,012	.091	.102
December.....	114	35	54.7	3,303	.082	.094
The year.....	410	35	60.0	65,810	.130	1.84

#### SPANISH FORK NEAR LAKE SHORE, UTAH.

This station was established December 10, 1903, at the highway bridge on the road between Spanish Fork and Lake Shore, about 3 miles west of Spanish Fork. In May, 1904, it was reestablished at a point about 800 feet above the bridge.

As the entire normal summer flow is diverted at a point above, the station is maintained only during the spring and winter, the object being the determination of the amount of water discharged by Spanish Fork into Utah Lake.

The channel is straight for about 75 feet above and is slightly curved for 100 feet below the station. Both banks are barren and sufficiently high to prevent overflow. The bed at this point is composed of fine gravel and sand, smooth but continually shifting. The velocity ranges from 2 to 4 feet per second, and the depth from 1 foot to 3 feet. Information in regard to winter conditions are incomplete.

Discharge measurements are made from a cable and car. The cable is marked at 4-foot intervals, beginning at the right cable post, which is the initial point for soundings.

Daily gage readings are made by J. W. Bowen, a farmer. The original gage was a vortical staff driven into the bed of the stream about 10 feet below the bridge. This was abandoned at the beginning of 1905, and readings have since been taken from the new vortical gage located on the right bank near the cable. It consists of a 2 by 4 inch fir post, driven into the bed of the stream and supported at the top by a horizontal piece buried in the bank. The datum is the same as that of the old gage, but simultaneous readings will not agree, as there is considerable fall to the stream between the two gages. The gage is referred to bench marks as follows: (1) A 30-penny nail driven into a log on the west abutment of the bridge, near the northwest corner, 10.5 feet S. 18° 30' W., from the old gage; elevation above gage datum, 11.68 feet. (2) A 20-penny nail driven into the north side of a cedar fence post, 91 feet, S. 85° 30' E., from the gage; elevation above gage datum, 21.95 feet. (3) A United States Geological Survey standard metallic post set 197 feet S. 21° 45' E. from the old gage; elevation above gage datum, 21.76 feet.

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

Description: 133, p 274.

Discharge: 100, p. 224; 133, p. 275.

Discharge, monthly: 133, p. 276.

Gage heights: 133, p 275.

Rating table: 133, p 276.

## Discharge measurements of Spanish Fork near Lake Shore, Utah, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Dis-charge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
January 27	H. S. Kleinschmidt	30	26	2.57	4.61	66
February 15	do	26	21	2.31	4.37	49
March 10	do	28	18	2.27	4.12	42
April 6	W. G. Swendsen	28	23	2.41	4.35	66
April 20	do	32	30	2.67	4.78	66
May 4 <sup>a</sup>	W. P. Hardesty	6	6.7	2.84	3.85	19
May 22	W. G. Swendsen	24	15	2.55	4.05	38
December 4	do	28	18	2.16	4.12	38

<sup>a</sup> 30 feet below regular station.

## Daily gage height, in feet, of Spanish Fork near Lake Shore, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.
1	4.0	4.07	4.52	4.5	4.75	.....	4.0	17	4.02	4.6	4.08	4.0	3.4	.....	4.3
2	4.1	4.97	4.58	4.35	4.3	.....	4.2	18	4.6	4.0	4.1	5.0	4.0	.....	4.3
3	4.2	4.85	4.52	4.33	4.2	.....	4.2	19	4.5	4.59	4.15	4.9	4.02	.....	4.1
4	4.2	4.8	4.5	4.3	3.85	.....	4.2	20	4.6	4.58	4.3	4.85	3.7	.....	4.1
5	4.1	4.73	4.55	4.31	3.6	.....	4.18	21	4.6	4.6	4.25	4.72	3.7	.....	4.1
6	4.4	4.7	4.53	4.35	3.48	.....	4.1	22	4.63	4.61	4.3	4.71	3.0	.....	4.1
7	4.2	4.08	3.9	4.48	3.43	.....	4.05	23	4.7	4.55	4.3	4.63	4.3	.....	4.2
8	4.45	4.61	4.1	4.58	3.42	.....	4.0	24	4.63	4.55	4.2	4.73	4.03	.....	4.2
9	4.45	4.5	4.11	4.08	3.43	.....	4.0	25	4.62	4.55	4.2	4.65	3.5	.....	4.2
10	4.2	4.58	4.15	5.1	3.4	.....	4.0	26	4.61	4.58	4.0	4.68	3.55	.....	4.3
11	4.62	4.6	4.05	4.08	3.42	.....	4.1	27	4.6	4.58	4.15	4.79	3.5	.....	4.3
12	4.7	4.2	4.1	4.88	3.43	.....	4.2	28	4.59	4.51	4.1	4.82	3.53	.....	4.2
13	4.6	4.1	4.12	4.8	3.4	.....	4.2	29	4.58	.....	4.1	4.8	3.4	.....	4.3
14	4.8	4.39	4.2	4.85	3.38	.....	4.3	30	4.6	.....	4.12	4.72	3.0	4.0	4.25
15	4.6	4.38	4.15	4.88	3.38	.....	4.3	31	4.61	.....	4.11	.....	3.0	.....	.....
16	4.6	4.52	4.1	4.0	3.38	.....	4.1								

## Daily discharge, in second-feet, of Spanish Fork near Lake Shore, Utah, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	May.	Nov.	Dec.
1	53.0	71.0	67.0	77.0	83.0	.....	31.5	17	62.0	67.0	41.5	108.0	7.5	.....	51.5
2	22.5	65.5	71.5	65.0	46.0	.....	44.5	18	61.0	67.5	43.0	116.0	33.5	.....	51.5
3	28.0	85.5	68.0	63.5	38.2	.....	44.5	19	53.0	67.0	46.5	108.0	35.0	.....	39.0
4	29.5	81.2	67.0	61.0	19.0	.....	38.5	20	61.0	67.0	58.0	66.0	18.5	.....	38.0
5	20.0	76.0	72.0	62.5	10.3	.....	43.5	21	62.0	69.0	54.0	89.5	19.3	.....	38.0
6	41.0	73.0	71.5	66.0	7.0	.....	38.0	22	65.0	70.5	58.0	88.0	28.5	.....	38.0
7	29.5	72.2	27.5	76.0	6.5	.....	34.7	23	71.0	66.0	58.0	80.0	54.5	.....	44.5
8	45.5	66.0	39.0	83.5	6.0	.....	32.0	24	65.5	66.5	51.0	88.0	36.5	.....	44.5
9	46.0	58.0	41.5	92.0	6.5	.....	32.0	25	64.5	67.5	51.5	80.5	11.2	.....	44.5
10	30.0	64.5	42.0	129.0	6.0	.....	32.0	26	65.0	70.5	38.0	82.0	13.0	.....	51.5
11	58.5	66.0	37.5	117.5	6.5	.....	38.0	27	66.0	71.5	48.0	90.0	11.0	.....	51.5
12	66.0	36.0	41.0	108.0	7.0	.....	44.5	28	64.5	65.5	45.0	91.0	12.0	.....	44.5
13	58.5	39.5	42.5	100.0	6.5	.....	44.5	29	63.5	.....	45.2	89.0	7.5	0.0	51.5
14	75.0	50.0	48.5	104.0	6.2	.....	51.5	30	65.0	.....	46.5	80.0	0.0	32.5	48.0
15	59.0	49.0	45.5	106.5	6.5	.....	51.5	31	65.5	.....	46.0	.....	0.0	.....	48.0
16	60.0	59.5	42.0	108.0	6.8	.....	38.5								

NOTE.—Total flow of river diverted for irrigation May 30 to November 29. Daily discharge obtained by indirect method for shifting channels. Discharge interpolated December 9 and 31.

*Estimated monthly discharge of Spanish Fork near Lake Shore, Utah, for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	75	22.5	54.2	3,333
February.....	95.5	30.5	66.0	3,665
March.....	72	27.5	50.1	3,080
April.....	129	61	90.1	5,361
May.....	83	0	17.9	1,101
June.....	0	0	0	0
July.....	0	0	0	0
August.....	0	0	0	0
September.....	0	0	0	0
October.....	0	0	0	0
November.....	32.5	0	1.08	64
December.....	51.5	31.5	42.7	2,626
The year.....	129	0	26.8	19,230

## SEVIER RIVER BASIN.

## SEVIER RIVER NEAR GUNNISON, UTAH.

Sevier River rises in the northwestern part of Kane County, in southern Utah, flows northeastward to a point near Gunnison, northwestward nearly to Leamington, and then turns sharply to the southwest and discharges into Sevier Lake.

Tributary streams are few, San Pitch River and Salina Creek being the most important. The San Pitch joins the main stream about 3 miles above the gaging station, but since its flow is used for irrigation and is completely controlled by storage reservoirs, it furnishes little of the supply. Salina Creek, which enters about 15 miles above the station, is subject to rapid run-off and during flood seasons carries an immense amount of sediment.

There is considerable irrigation from the Sevier above Gunnison, and a few small storage reservoirs control the flood discharge.

The station was established June 29, 1900. It is located at the wagon bridge over the Sevier about 4 miles west of Gunnison, on the road to Westview precinct.

The channel is straight for about 300 feet above and below the station, with banks sufficiently high to prevent overflow. The bed of the stream is composed of sand and gravel and is smooth and apparently permanent. The current is sluggish at low water, but at ordinary stages ranges from 2 to 3 feet per second. At the high-water section the velocity is greatest at the right side, decreasing somewhat uniformly toward the left, where it is low. Floating ice during the winter season may make records at certain stages impossible. There is a free flow at the low-water but not at the high-water section.

During ordinary stages discharge measurements are made from the upstream side of the bridge, the floor of which is marked at 5-foot intervals, beginning at the bridge pile to which the gage is attached, this being the initial point for soundings. At extreme low water the velocity at this point is too low for favorable results, and measurements are made by wading at a point about 75 feet below the bridge, marked by a 2 by 4 inch post on each bank. The initial point for soundings at this section is the post on the left bank.

The gage is read daily by L. H. Erickson, a farmer. The original gage is a 1 by 4 inch piece of redwood nailed vertically to a bridge pier on the right bank on the upstream side of the bridge. In January, 1905, a new 6 by 6 inch inclined gage was established at a point about 25 feet below the old one. It is fastened to double posts set in the bank. Both gages have the same datum and are referred to bench marks as follows: (1) A large spike driven into the side of a cedar post 46 feet S. 74° E. from the gage; elevation, 8.55 feet. (2) A nail in the top of railing post at the northeast corner of the bridge 13 feet north of the gage; elevation, 13.18 feet. (3) A United States Geological Survey standard iron post set in the ground 153 feet S. 84° 30' E. from the old gage; elevation, 10.10 feet. Elevations are above datum of 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 51, p 425; 60, p 126; 85, p 88; 100, pp 147-148; 133, pp 277-278.

Discharge: WS 51, p 425; 60, p 126; 85, p 88; 100, p 148; 133, p 278.

Discharge, monthly: Ann 22, iv, p 420; WS 75 p 197; 85, p 90; 100, p 149; 133, p 280.

Gage heights: WS 51, p 426; 60, p 126; 85, p 89; 100, pp 148-149; 133, p 279.

Hydrograph: Ann 22, iv, p 420.

Rating tables: WS 52, p 521; 60, p 176; 85, p 89; 100, p 148; 133, p 280.

*Discharge measurements of Sevier River near Gunnison, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.		Mean velocity.	Gage height.	Dis-charge.
			Feet.	Square feet.			
January 19 <sup>a</sup> .....	C. Tanner.....	50	123	2.60	2.25	320	
February 7 <sup>a</sup> .....	.....do.....	50	120	2.50	2.20	301	
April 23.....	W. G. Swendsen.....	36	35	1.47	.80	52	
June 19.....	C. S. Jarvis.....	35	32	1.51	.76	49	
July 1.....	.....do.....	30	22	.89	.42	20	
August 11.....	.....do.....	29	25	1.17	.53	30	

<sup>a</sup> Measured at bridge.

*Daily gage height, in feet, of Sevier River near Gunnison, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....			2.4	1.1	.72	2.8	.4	.5	.7	.86		1.14
2.....			2.4	1.1	.7	2.86	.4	.5	.7	1.0	1.16	1.3
3.....			2.44	1.1	.7	2.96	.4	.5	.9	1.0	1.16	1.2
4.....			2.34	1.1	.72	2.7	.4	.5	.86	1.02	1.16	1.2
5.....			2.28	1.14	.7	2.46		.5	.7	1.06	1.14	1.14
6.....		2.3	2.1	1.1	.7	2.38	.4	.5	.7	1.06	1.14	1.16
7.....		2.2	1.88	1.1	.7	2.36	.4	.54	.74	1.08	1.16	1.16
8.....		2.2	1.7	1.12	.76	2.24	.42	.54	.74	1.1	1.16	1.18
9.....		2.16	1.76		.78	2.2	.4	.54	.76	1.1	1.14	1.16
10.....		2.22	1.96	1.12	.84	1.76	.4	.54	.9	1.14	1.14	
11.....		2.18	1.9	1.12	.96	1.76	.42	.54	.86	1.16	1.12	1.16
12.....		2.26	1.88	1.06	.98	1.56	.4	.56	.7	1.18	1.12	1.18
13.....		2.6	1.84	1.0	1.0	1.2	.4	.56	.7	1.18	1.12	1.2
14.....		3.1	1.8	.9	1.04	1.1	.4	.56	.72	1.2	1.12	1.2
15.....		2.0	1.76	.9	1.24	.9	.4	.56	.7	1.18	1.14	1.18
16.....		2.0		.86	1.56	.9	.42	.56	.7	1.14	1.12	
17.....		2.02	1.64	.84	1.58	.8	.42	.56	.7	1.1	1.12	
18.....	2.0	2.0	1.6	.78	1.6	.82	.4	.56	.7	1.1	1.1	
19.....	2.25	2.0	1.58	.8	1.66	.82	.4	.56	.7	1.1	1.1	
20.....	2.2	2.0	1.62	.8	1.7	.76	.4	.58	.7	1.1	1.1	
21.....	2.2	2.12	1.56	.78	1.74	.7		.58	.7	1.12	1.1	
22.....	2.2	2.22		.78	1.76	.56	.4	.58	.7	1.16	1.1	
23.....	2.06	2.26	1.5		1.94	.52	.4	.6	.72	1.16	1.12	
24.....	2.2	2.38	1.4	.9	2.44	.5	.4	.6	.74	1.16	1.12	
25.....	2.22	2.38	1.4	.82	3.25	.46	.4	.6	.74	1.16	1.12	
26.....	2.24	2.38	1.34	.78	3.23	.44	.44	.86	.78	1.14	1.12	
27.....	2.26	2.3	1.24	.78	3.3	.42	.44	.96	.78	1.14	1.14	
28.....	2.22	2.3		.74	3.32	.4	.52	.8	.8	1.16	1.14	
29.....	2.22		1.16	.7	3.22	.4	.52	.74	.82	1.16	1.14	
30.....	2.26		1.1	.7	3.24	.4	.5	.7	.86	1.16	1.14	
31.....	2.24		1.14		2.6		.5	.7		1.18		

NOTE.—River frozen January 1-17 and December 16-31.

Station rating table for Sevier River near Gunnison, Utah, from January 18 to December 15, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.40	17	1.20	101	2.00	254	2.80	474
0.50	24	1.30	116	2.10	278	2.90	506
0.60	32	1.40	132	2.20	303	3.00	539
0.70	41	1.50	149	2.30	329	3.10	573
0.80	51	1.60	168	2.40	356	3.20	608
0.90	62	1.70	188	2.50	384	3.30	644
1.00	74	1.80	209	2.60	413	3.40	681
1.10	87	1.90	231	2.70	443		

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905. It is well defined between gage heights 0.4 foot and 1 foot and fairly well defined above 1 foot.

*Estimated monthly discharge of Sevier River near Gunnison, Utah, for 1905.*

[Drainage area, 3,980 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 18-31.....	319	254	303	8,414	0.076	0.040
February.....	573	254	318	17,000	.080	.083
March.....	367	87	199	12,240	.050	.058
April.....	92	41	67.0	3,087	.017	.029
May.....	651	41	222	13,050	.056	.065
June.....	525	17	104	9,750	.041	.046
July.....	26	17	18.4	1,131	.0040	.0053
August.....	69	24	32.3	1,986	.0081	.0093
September.....	62	41	46.2	2,740	.012	.013
October.....	101	58	89.3	5,401	.022	.025
November.....	95	87	91.4	5,430	.023	.026
December 1-15.....	110	93	98.3	2,925	.025	.014
The period.....				85,430		

NOTE.—Discharge interpolated on days when gage heights were missing.

#### SAN PITCH RIVER NEAR GUNNISON, UTAH.

San Pitch River, which enters Sevier River from the north, flows throughout its course in a well-defined channel with no overflow. Over the lower portions of the area evaporation and seepage doubtless exceed inflow to the stream. There are small tracts of irrigated land at various points along the river, and a storage reservoir about 10 miles above the gaging station completely controls the flow. The tributaries are few and mostly intermittent. Manti Creek, which enters at a point about 11 miles above the station, drains a barren area and is subject to rapid run-off. Its discharge may vary from 4 to 150 second-feet, but it enters above the reservoir dam and is thus completely controlled before reaching the gaging station.

The station was established June 30, 1900. It is located 4 miles northeast of Gunnison about one-eighth mile west of the Rio Grande Western Railway, west of the second farmhouse along the railroad track north of Gunnison station.

The channel is straight for about 100 feet above and is slightly curved below the station. Both banks slope gradually and are sufficiently high to prevent overflow. The bed of the stream is composed of sand and gravel, and is smooth and apparently permanent. The velocity is high. Information in regard to winter conditions is indefinite.

Discharge measurements are made by wading at a point near the gage, where a tagged wire is stretched. The initial point for soundings is the west side of the supporting post on the left bank.

The gage, which is read daily by Oliver Peterson, is a vertical staff driven into the stream bed. It is referred to bench marks as follows: (1) The top of a cedar post set about 45.5 feet west from the gage; elevation, 5.96 feet. (2) Top of nail driven into top of stake set about 150 feet S. 84° E. from the initial point; elevation, 10.36 feet. Elevations are above datum of 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 51, p 425; 66, p 125; 85, p 94; 100, p 150; 133, p 281.

Discharge: WS 51, p 425; 66, p 125; 85, p 94; 100, p 150; 133, p 281.

Discharge, monthly: Ann 22, iv, p 419; WS 75, p 196; 85, p 96; 100, p 152; 133, p 283.

Gage heights: WS 51, p 425; 66, p 125; 85, p 95; 100, p 151; 133, p 282.

Hydrograph: Ann 22, iv, p 419.

Rating tables: WS 52, p 521; 66, p 176; 85, p 95; 100, p 151; 133, p 282.

*Discharge measurements of San Pitch River near Gunnison, Utah, in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
January 18.....	C. Tanner.....	23	20	0.60	1.76	12
June 19.....	C. S. Jarvis.....	31	40	2.92	2.46	116
July 1.....	do.....	29	36	2.63	2.40	96
August 12.....	do.....	29	40	2.88	2.46	114

*Daily gage height, in feet, of San Pitch River near Gunnison, Utah, for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.78	1.78	1.8	1.76	2.44	3.0	2.44	2.54	2.0	2.08	1.96	1.9
2.....	1.78	1.9	1.78	1.78	2.4	2.9	2.56	2.5	2.06	2.04	1.96	1.9
3.....	1.78	1.9	1.78	1.78	2.3	2.76	2.54	2.52	2.04	2.04	2.0	1.9
4.....	1.78	1.9	1.76	1.78	2.3	2.8	2.54	2.5	2.06	2.02	2.0	1.9
5.....	1.8	1.88	1.76	1.78	2.3	3.1	2.5	2.5	2.08	2.02	1.98	1.9
6.....	1.8	1.88	1.76	1.78	2.36	2.82	2.58	2.5	2.08	2.02	1.96	1.92
7.....	1.8	1.86	1.74	1.8	2.3	2.88	2.6	2.5	2.02	2.0	1.96	1.9
8.....	1.78	1.84	1.7	1.8	2.32	2.9	2.68	2.5	2.04	2.0	1.96	1.88
9.....	1.78	1.8	1.7	1.8	2.5	2.88	2.66	2.5	2.02	2.0	1.98	1.88
10.....	1.78	1.74	1.68	1.84	2.5	2.86	2.64	2.5	2.02	2.0	1.96	1.88
11.....	1.8	1.74	1.68	1.8	2.5	3.0	2.66	2.5	2.04	1.94	1.92	1.88
12.....	1.8	1.72	1.7	1.8	2.5	3.14	2.64	2.56	2.02	1.94	1.92	1.88
13.....	1.73	1.7	1.72	1.8	2.52	2.88	2.64	2.46	2.0	1.94	1.92	1.9
14.....	1.78	1.7	1.73	1.8	2.6	2.9	2.6	2.44	2.06	1.94	1.92	1.9
15.....	1.76	1.7	1.78	1.8	2.6	2.88	2.64	2.44	2.06	1.94	1.92	1.9
16.....	1.78	1.68	1.78	1.8	2.78	2.8	2.64	2.46	2.04	1.92	1.92	1.9
17.....	1.78	1.68	1.78	1.82	2.74	2.7	2.6	2.42	2.03	1.94	1.92	1.92
18.....	1.76	1.68	1.78	1.84	2.52	2.78	2.6	2.4	2.02	1.94	1.94	1.92
19.....	1.78	1.68	1.78	1.84	2.8	2.6	2.6	2.36	2.02	1.94	1.94	1.94
20.....	1.76	1.68	1.8	1.84	2.34	2.52	2.6	2.36	2.02	1.96	1.96	1.96

Daily gage height, in feet, of San Pitch River near Gunnison, Utah, for 1905—Continued.

Daily.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	1.74	1.68	1.8	1.84	2.54	2.4	2.6	2.36	2.02	1.96	2.0	1.96
22.....	1.74	1.78	1.8	1.8	3.24	2.5	2.6	2.36	2.02	1.96	2.0	1.96
23.....	1.74	1.72	1.78	1.82	2.8	2.42	2.58	2.36	2.02	1.96	1.88	1.96
24.....	1.74	1.74	1.78	1.88	2.78	2.44	2.54	2.36	2.0	1.96	1.88	1.9
25.....	1.74	1.78	1.78	1.8	2.7	2.38	2.54	2.36	2.0	1.96	1.88	1.86
26.....	1.74	1.78	1.66	1.9	2.6	2.34	2.54	2.3	2.0	1.96	1.9	1.86
27.....	1.74	1.78	1.66	2.0	2.5	2.42	2.54	2.24	2.0	1.96	1.92	1.86
28.....	1.76	1.8	1.68	2.34	2.6	2.4	2.54	2.22	1.96	1.96	1.9	1.86
29.....	1.74		1.66	2.34	2.4	2.42	2.56	4.15	2.3	1.96	1.9	1.86
30.....	1.74		1.68	2.36	2.32	2.42	2.56	2.36	2.08	1.96	1.9	1.86
31.....	1.74		1.73		2.6		2.56	2.2		1.96		1.86

Station rating table for San Pitch River near Gunnison, Utah, from January 1 to December 31, 1905.

Gage height.	Discharge.						
Fect.	Second-feet.	Fect.	Second-feet.	Fect.	Second-feet.	Fect.	Second-feet.
1.70	10	2.10	40	2.50	123	2.90	227
1.80	15	2.20	64	2.60	146	3.00	258
1.90	24	2.30	82	2.70	171	3.10	290
2.00	35	2.40	102	2.80	198	3.20	324

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902-1905. It is well defined between gage heights 1.65 feet and 2.5 feet.

Estimated monthly discharge of San Pitch River near Gunnison, Utah, for 1905.

[Drainage area, 836 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.....	15	11	13.3	818	0.016	0.018
February.....	24	9	14.1	783	.017	.018
March.....	15	8	12.1	744	.014	.016
April.....	64	13	24.2	1,440	.029	.032
May.....	338	82	130	8,362	.163	.188
June.....	304	90	179	10,650	.214	.239
July.....	166	110	143	8,793	.171	.197
August.....	720	64	126	7,747	.151	.174
September.....	82	30	40.5	2,410	.048	.054
October.....	40	26	32.0	1,968	.038	.044
November.....	35	22	28.1	1,672	.034	.038
December.....	30	20	23.0	1,470	.029	.033
The year.....	338	8	64.3	46,860	.077	1.05

NOTE.—Open-channel curve assumed to apply throughout the year as the stream is known to freeze but slightly at this station.

## HUMBOLDT SINK DRAINAGE.

The only stream of importance draining into Humboldt Sink is Humboldt River, the basin of which is described below.

## HUMBOLDT RIVER BASIN.

## DESCRIPTION OF BASIN.

Humboldt River rises in the extreme northeastern part of Nevada, flows west and southwest across the structural features of the country, and enters Humboldt Lake, whence its waters find their way into Humboldt Sink. The tributaries follow the general direction of the mountain ranges and flow either to the north or to the south. During low stages the water of the river is almost wholly diverted, and for the future development of the country recourse must be had to the construction of storage reservoirs.

Of the tributaries, North Fork enters the stream west of Peko, Nev., and South Fork about 10 miles below Elko. Pine Creek comes in from the south near Palisade, Nev. Marys River is one of the headwater branches.

## NORTH FORK OF HUMBOLDT RIVER NEAR ELBURZ, NEV.

This station was established October 10, 1902. It is located about one-fourth mile above the junction of North Fork with the main River and 150 feet below the Southern Pacific Railroad bridge. It is 2 miles west of the Southern Pacific Railroad station at Elburz. The nearest post-office is Halleck, Nev.

The channel is straight for 150 feet above and below the station. Both banks are high, but the left will overflow at extreme flood stages. The bed of the stream is composed of gravel and silt and changes slightly. There is but one channel at all stages, and the current is sluggish.

Discharge measurements are made by means of a cable and ear. The initial point for soundings is the zero on the tagged wire.

The gage, which is read once each day by A. R. Blevins, is an inclined 4 by 4 inch timber fastened to the left bank just above the cable. The bench mark is a 4 by 4 inch timber driven into the ground on the left bank 20 feet upstream from the gage; elevation above zero of gage, 6.99 feet.

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

Description: 100, p 163; 133, p 283.

Discharge: 100, p 164; 133, p 284.

Discharge, monthly: 133, p 285.

Gage heights: 100, p 164; 133, p 284.

Rating table: 133, p 285.

*Discharge measurements of North Fork of Humboldt River near Elburz, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
April 27.....	W. A. Wolf.....	37	20	1.13	3.30	29.5
May 20.....	do.....	37	27	1.18	3.35	32
June 4.....	do.....	37	32	1.25	3.50	40
July 14.....	do.....				2.80	a 1

<sup>a</sup> Discharge estimated.

HUMBOLDT RIVER BASIN.

Daily gage height, in feet, of North Fork of Humboldt River near Elburz, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.0	3.5	3.4	3.5	3.4	3.55	2.85	2.2	2.55	2.0	3.3	3.0
2.....	3.0	3.5	3.4	3.5	3.5	3.55	2.85	2.2	2.55	2.0	3.3	3.0
3.....	3.0	3.45	3.45	3.45	3.55	3.5	2.8	2.2	2.55	2.0	3.3	3.0
4.....	3.0	3.4	3.45	3.45	3.55	3.55	2.8	2.2	2.55	2.0	3.3	3.0
5.....	3.0	3.35	3.5	3.4	3.0	3.5	2.8	2.2	2.55	2.0	3.2	3.0
6.....	3.55	3.35	3.5	3.35	3.0	3.5	2.8	2.15	2.55	2.0	3.1	3.0
7.....	3.55	3.35	3.5	3.35	3.0	3.5	2.8	2.15	2.55	2.0	3.0	3.0
8.....	3.0	3.3	3.5	3.3	3.05	3.5	2.8	2.15	2.55	2.0	3.0	3.0
9.....	3.0	3.25	3.5	3.3	3.7	3.0	2.85	2.15	2.55	2.0	2.0	3.0
10.....	3.55	3.2	3.5	3.3	3.05	3.45	2.85	2.15	2.55	2.0	2.0	3.0
11.....	3.55	3.15	3.5	3.3	3.0	3.4	2.85	2.15	2.5	2.0	3.0	3.0
12.....	3.55	3.3	3.4	3.3	3.05	3.35	2.85	2.15	2.5	2.0	3.0	3.0
13.....	3.55	3.35	3.4	3.25	3.7	3.3	2.8	2.15	2.5	2.0	2.0	3.0
14.....	3.55	3.4	3.4	3.25	3.0	3.3	2.8	2.15	2.5	2.0	2.0	3.0
15.....	3.0	3.4	3.4	3.2	3.5	3.35	2.8	2.15	2.5	2.0	2.8	3.0
16.....	3.0	3.4	3.45	3.25	3.5	3.4	2.75	2.15	2.5	2.0	2.8	3.0
17.....	3.0	3.35	3.45	3.25	3.45	3.4	2.75	2.15	2.5	2.0	2.7	3.1
18.....	3.0	3.3	3.5	3.3	3.4	3.3	2.75	2.15	2.5	2.0	2.7	3.1
19.....	3.0	3.3	3.5	3.3	3.35	3.25	2.75	2.15	2.55	2.0	2.7	3.1
20.....	3.8	3.3	3.5	3.3	3.35	3.2	2.7	2.15	2.55	2.0	2.7	3.2
21.....	3.8	3.3	3.5	3.35	3.3	3.15	2.7	2.15	2.0	2.0	2.7	3.2
22.....	3.8	3.3	3.5	3.35	3.35	3.15	2.7	2.2	2.0	2.0	2.7	3.3
23.....	3.75	3.25	3.5	3.3	3.4	3.15	2.05	2.3	2.0	2.7	2.7	3.4
24.....	3.7	3.3	3.45	3.3	3.45	3.15	2.05	2.4	2.0	2.7	2.7	3.4
25.....	3.0	3.3	3.45	3.25	3.55	3.1	2.0	2.5	2.0	2.8	2.7	3.5
26.....	3.0	3.3	3.5	3.3	3.55	3.1	2.55	2.5	2.0	2.0	2.8	3.5
27.....	3.0	3.25	3.5	3.3	3.0	3.1	2.4	2.5	2.0	2.0	2.85	3.5
28.....	3.0	3.3	3.45	3.3	3.0	3.0	2.32	2.55	2.0	3.0	2.0	3.5
29.....	3.0	.....	3.45	3.35	3.0	3.0	2.3	2.55	2.0	3.1	3.0	3.5
30.....	3.55	.....	3.45	3.4	3.55	3.0	2.25	2.0	2.0	3.2	3.0	3.5
31.....	3.5	.....	3.5	.....	3.0	.....	2.2	2.0	.....	3.3	.....	.....

NOTE.—Ice conditions exist at this station during the winter months. Ice 8 inches thick January 20.

Station rating table for North Fork of Humboldt River near Elburz, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.30	0.0	2.70	0.8	3.10	14	3.50	41
2.40	.2	2.80	1.	3.20	20	3.60	49
2.50	.4	2.90	3.	3.30	27	3.70	57
2.60	.6	3.00	8.	3.40	34	3.80	60

NOTE.—The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1905. Estimates based on this table can be considered only as approximate, and especially so for low stages. Zero flow at 2.3 feet is based on observer's statement.

*Estimated monthly discharge of North Fork of Humboldt River near Elburz, Nev., for 1905.*

[Drainage area, 1,020 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.....	66	41	53.3	3,277	0.082	0.000
February.....	41	17	29.0	1,611	.028	.020
March.....	41	34	38.8	2,380	.038	.044
April.....	41	20	28.0	1,720	.028	.031
May.....	57	27	43.8	2,093	.043	.050
June.....	45	8	28.0	1,600	.027	.030
July.....	2	.0	.00	80	.00004	.0011
August.....	.0	.0	.12	7	.00012	.00014
September.....	.6	.4	.50	30	.00040	.00055
October.....	27	.6	2.0	178	.0028	.0032
November.....	27	.8	7.8	404	.0076	.0085
December.....	41	8	10.1	1,173	.010	.022
The year.....	66	0	21.1	15,270	.021	.270

NOTE.—Open-channel rating table applied to the winter months without correction. Winter estimates liable to some error.

#### SOUTH FORK OF HUMBOLDT RIVER NEAR ELKO, NEV.

This station was established August 20, 1890. It is located 10 miles southwest of the town of Elko, at Cislini's (formerly Mason's) ranch, and about 6 miles above the junction of South Fork with the main stream.

The channel is straight for some distance above and below the station and the banks are high. The bed of the stream is composed of gravel and is stable. There is a good site for a reservoir a short distance above the station.

Discharge measurements are made from a cable and suspended car at a point 1 mile above the gage.

The gage, which is placed near the farm of the observer, M. Cislini, for his convenience, is inclined and is spiked to posts driven firmly into the right bank. An inclined gage was installed November 22, 1902, at the site of the old one, the 4-foot marks of the old and new gages coinciding. The bench mark is a 4 by 4 inch timber driven 4 feet south of the gage; elevation above gage datum, 6.29 feet. A new gage was installed May 21, 1905, below a dam which was built just below the old gage. All gage heights for 1905 have been referred to this new datum.

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

Description: Ann 18, iv, p 311; WS 16, p 156; 28, p 146; 38 pp 327-328; 51, p 306; 66, p 105; 85, p 101; 100, p 161; 133, p 294.

Discharge: Ann 18, iv, p 311; WS 16, p 156; 28, p 153; 38, p 328; 51, p 306; 66, p 105; 85, p 102; 100, p 161; 133, p 295.

Discharge, monthly: Ann 10, iv, p 430; 20, iv, p 440; 21, iv, p 391; 22, iv, p 400; WS 75, p 182; 85, p 103; 100, p 163; 133, p 296.

Discharge, yearly: Ann 20, iv, p 60.

Gage heights: WS 11, p 70; 16, p 165; 28, pp 148-149; 38, p 328; 51, p 307; 66, p 106; 85, p 102; 100, p 162; 133, p 295.

Hydrographs: Ann 10, iv, p 430; 20, iv, p 441; 21, iv, p 391; 22, iv, p 400.

Rating tables: Ann 10, iv, p 420; WS 28, p 154; 39, p 452; 52, p 520; 66, p 174; 85, p 102; 100, p 162; 133, p 296.

HUMBOLDT RIVER BASIN.

Discharge measurements of South Fork of Humboldt River near Elko, Nev., in 1905.

Date.	Hydrographer.	Width.	A. ea of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		Feet.	Square feet.	Feet per second.	Feet.	Second- feet.
April 20.....	W. A. Wolf.....		109	2.24	1.55	244
May 21.....	do.....	47	167	3.81	3.85	636
June 4.....	do.....	46	157	3.62	3.60	568
June 16.....	do.....	46	181	4.30	4.31	779
June 27.....	do.....	45	122	2.89	2.88	324
July 14.....	do.....	45	86	1.40	1.95	120
September 7.....	do.....				.60	a.5

a Estimated.

NOTE.—Beginning May 21 gage heights refer to new datum.

Daily gage height, in feet, of South Fork Humboldt River near Elko, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	0.5	0.85	(a)	0.4	2.3	3.55	2.75	1.0	1.0	0	1.0	1.1
2.....	.5	1.15	(a)	.5	2.1	3.6	2.75	1.0	1.0	0	1.0	1.1
3.....	.5	1.15	(a)	.5	2.3	3.6	2.8	1.0	1.0	0	1.0	1.1
4.....	.5	1.5	(a)	1.15	2.55	3.7	2.9	1.0	1.0	0	1.0	1.1
5.....	.5	1.5	(a)	1.15	2.55	3.7	3.0	1.0	1.0	0	1.0	1.1
6.....	.5	1.5	0.4	1.5	2.55	3.6	3.7	1.0	1.0	0	1.1	1.1
7.....	.5	1.15	.4	1.65	2.75	3.7	2.9	1.0	1.0	0	1.1	1.1
8.....	.5	.5	(a)	1.8	2.9	3.8	2.7	1.0	.6	0	1.1	1.1
9.....	.5	.5	(a)	1.8	3.0	3.9	2.6	1.0	.6	0	1.1	1.1
10.....	.5	.5	.4	2.1	3.15	3.8	2.5	1.0	.6	0	1.1	1.1
11.....	.5	.5	.4	2.3	3.15	3.8	2.4	1.0	.6	0	1.1	1.1
12.....	.5	.5	.4	2.1	3.3	3.9	2.4	1.0	.6	0	1.1	1.1
13.....	.5	.4	.4	2.1	3.35	4.0	2.4	1.0	.6	0	1.1	1.1
14.....	.5	.4	.4	1.8	3.4	4.1	2.4	1.0	.6	0	1.1	1.1
15.....	.5	(a)	.4	1.8	3.5	4.2	2.45	1.0	.6	1.0	1.1	1.1
16.....	.5	(a)	.4	2.1	3.65	4.3	2.4	1.0	.6	1.0	1.1	1.1
17.....	.5	(a)	.4	2.1	3.75	4.4	2.2	1.0	.6	1.0	1.1	1.1
18.....	.5	(a)	.4	2.2	3.85	4.3	2.1	1.0	.6	1.0	1.1	1.1
19.....	.5	(a)	.4	2.2	3.85	4.1	2.0	1.0	.6	1.0	1.1	1.1
20.....	.5	(a)	.4	2.3	3.85	4.0	1.8	1.0	.6	1.0	1.1	1.1
21.....	.5	(a)	.4	2.3	3.8	3.8	1.7	1.0	.6	1.0	1.1	1.1
22.....	.5	(a)	.4	2.55	3.7	3.7	1.6	1.0	.6	1.0	1.1	1.1
23.....	.5	(a)	.4	2.55	3.7	3.5	1.5	1.0	.6	1.0	1.1	1.1
24.....	.5	(a)	.4	2.55	3.6	3.3	1.4	1.0	0	1.0	1.1	1.1
25.....	.5	(a)	.4	2.55	3.6	3.2	1.4	1.0	0	1.0	1.1	1.1
26.....	.5	.4	.4	2.55	3.5	3.1	1.4	1.0	0	1.0	1.1	1.1
27.....	.5	.4	.4	2.55	3.5	3.0	1.3	1.0	0	1.0	1.1	1.1
28.....	.5	.4	.4	2.55	3.6	3.0	1.3	1.0	0	1.0	1.1	1.1
29.....	.5		.4	2.55	3.5	2.9	1.2	1.0	0	1.0	1.1	1.1
30.....	.5		.5	2.3	3.55	2.8	1.1	1.0	0	1.0	1.1	1.1
31.....	.5		.4		3.55		1.1	1.0		1.0		

a No flow.

Station rating table for South Fork Humboldt River near Elko, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.50	0	1.70	88	2.90	350	4.10	720
.60	1	1.80	102	3.00	380	4.20	752
.70	3	1.90	117	3.10	410	4.30	784
.80	7	2.00	133	3.20	440	4.40	816
.90	12	2.10	150	3.30	470	4.50	848
1.00	18	2.20	168	3.40	500	4.60	880
1.10	25	2.30	189	3.50	530	4.70	912
1.20	33	2.40	212	3.60	560	4.80	944
1.30	42	2.50	238	3.70	592	4.90	976
1.40	52	2.60	264	3.80	624	5.00	1,008
1.50	63	2.70	292	3.90	656		
1.60	75	2.80	320	4.00	688		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1905. It is fairly well defined between gage heights 2 feet and 4 feet. Below 2 feet the table is based on one measurement at 0.6 foot.

Estimated monthly discharge of South Fork Humboldt River near Elko, Nev., for 1905.

[Drainage area, 1,150 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.....	0	0	0	0	0	0
February.....	63	0	10.2	567	.0089	.0093
March.....	0	0	0	0	0	0
April.....	251	0	149	8,866	.130	.145
May.....	640	150	465	28,590	.494	.466
June.....	816	320	588	34,990	.511	.570
July.....	592	25	187	11,500	.163	.188
August.....	18	18	18	1,107	.016	.018
September.....	18	0	4.7	280	.0041	.0040
October.....	18	0	9.0	608	.0086	.0089
November.....	25	18	24.7	1,470	.021	.023
December.....	25	25	25	1,537	.022	.025
The year.....	816	0	123	89,520	.167	1.46

#### HUMBOLDT RIVER AT PALISADE, NEV.

This station was established November 27, 1902. It is located at the single-span high-way bridge one-fourth mile from the hotel at Palisade, Nev. There is a railroad bridge about 500 feet below.

The channel is straight for 200 feet above and 300 feet below the station. The right bank is low and liable to overflow; the left is high. The bed of the stream is composed of gravel and sand and is permanent. There is but one channel at all stages.

Discharge measurements are made by means of a cable and car about one-fourth mile above the gage. At very low stages, when the current becomes sluggish at the cable, measurements are made by wading a short distance above. The initial point for soundings is the zero on the tagged wire.

The gage, which is read once each day by T. H. Jewell, the hotel keeper, is a vertical 1 by 4 inch board spiked to the right abutment of the bridge. The bench mark consists

of a spike and three nails driven into the bridge abutment to which the gage is fastened; elevation above zero of gage, 7.00 feet.

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

- Description: 83, p 100; 100, p 157; 133, p 286.
- Discharge: 100, p 158; 133, p 286.
- Discharge, monthly: 100, p 150; 133, p 288.
- Gage heights: 83, p 100; 100, p 158; 133, p 287.
- Rating table 100, p 160; 133, p 287.

*Discharge measurements of Humboldt River at Palisade, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 27.....	W. A. Wolf.....	103	258	1.88	3.10	485
May 20.....	do.....	105	305	2.33	4.10	850
June 4.....	do.....	105	414	2.33	4.20	923
June 20.....	do.....	105	358	2.12	3.85	750
June 27.....	do.....	105	358	2.11	3.85	750
July 15.....	do.....	07	201	1.40	2.35	284
September 8.....	do.....	10	10	1.30	.60	13

*Daily gage height, in feet, of Humboldt River at Palisade, Nev., for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.0	2.0	2.4	2.0	2.05	4.0	3.2	1.0	1.1	1.15	1.4	1.4
2.....	1.95	2.1	2.4	2.0	3.0	4.0	3.2	1.0	1.1	1.15	1.4	1.4
3.....	1.95	2.1	2.4	2.0	3.05	4.0	3.15	1.0	1.1	1.15	1.4	1.40
4.....	1.95	2.2	2.4	2.0	3.1	4.55	3.1	1.0	1.1	1.15	1.4	1.40
5.....	1.95	2.2	2.4	2.0	3.15	4.55	3.1	1.55	1.1	1.2	1.4	1.40
6.....	1.95	2.2	2.4	2.0	3.2	4.55	3.0	1.55	1.1	1.2	1.4	1.40
7.....	1.95	2.2	2.4	2.0	3.3	4.5	2.0	1.5	1.1	1.2	1.4	1.40
8.....	1.9	2.2	2.4	2.0	3.3	4.5	2.85	1.5	1.1	1.2	1.4	1.40
9.....	1.9	2.1	2.4	2.0	3.35	4.5	2.8	1.5	1.1	1.2	1.4	1.40
10.....	1.8	2.1	2.4	2.0	3.4	4.45	2.75	1.5	1.1	1.2	1.4	1.4
11.....	1.8	2.1	2.4	2.05	3.5	4.35	2.7	1.5	1.1	1.2	1.4	1.4
12.....	1.7	2.0	2.4	2.75	3.5	4.4	2.0	1.5	1.1	1.2	1.4	1.4
13.....	1.7	2.0	2.4	2.8	3.0	4.2	2.5	1.5	1.1	1.2	1.4	1.4
14.....	1.7	2.0	2.4	2.8	3.05	4.0	2.4	1.5	1.1	1.2	1.4	1.4
15.....	1.7	2.0	2.4	2.8	3.7	4.0	2.3	1.5	1.1	1.2	1.4	1.4
16.....	1.7	2.0	2.4	2.9	3.8	4.0	2.3	1.5	1.1	1.25	1.4	1.4
17.....	1.7	2.0	2.4	2.9	3.9	3.95	2.3	1.4	1.1	1.25	1.4	1.45
18.....	1.7	2.1	2.4	2.9	4.0	3.9	.2	1.3	1.1	1.3	1.4	1.45
19.....	1.75	2.1	2.4	2.9	4.0	3.9	2.1	1.25	1.1	1.3	1.4	1.45
20.....	1.75	2.1	2.4	2.95	4.2	3.85	2.0	1.2	1.1	1.3	1.4	1.5
21.....	1.8	2.2	2.45	2.95	4.2	3.85	2.0	1.15	1.1	1.3	1.4	1.5
22.....	1.8	2.2	2.5	2.95	4.2	3.8	1.9	1.1	1.1	1.35	1.4	1.5
23.....	1.8	2.2	2.5	2.95	4.2	3.8	1.9	1.1	1.1	1.35	1.4	1.5
24.....	1.85	2.3	2.5	2.95	4.3	3.7	1.9	1.1	1.1	1.35	1.4	1.55
25.....	1.95	2.3	2.55	2.95	4.4	3.7	1.8	1.1	1.1	1.35	1.4	1.55
26.....	1.9	2.4	2.0	2.95	4.5	3.0	1.75	1.1	1.1	1.35	1.4	1.55
27.....	1.9	2.4	2.0	2.95	4.0	3.5	1.75	1.1	1.1	1.4	1.4	1.0
28.....	1.9	2.4	2.0	2.95	4.7	3.4	1.75	1.1	1.1	1.4	1.4	1.0
29.....	1.9	.....	2.0	2.95	4.8	3.3	1.75	1.1	1.1	1.4	1.4	1.05
30.....	2.0	.....	2.0	2.95	4.7	3.2	1.75	1.1	1.1	1.4	1.4	1.7
31.....	2.0	.....	2.0	.....	4.0	.....	1.0	1.1	.....	1.4	.....	1.7

Station rating table for Humboldt River at Palisade, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.10	34	2.10	203	3.10	498	4.00	850
1.20	46	2.20	227	3.20	534	4.10	895
1.30	59	2.30	253	3.30	570	4.20	940
1.40	72	2.40	280	3.40	607	4.30	985
1.50	86	2.50	308	3.50	645	4.40	1,030
1.60	102	2.60	337	3.60	684	4.50	1,075
1.70	120	2.70	367	3.70	724	4.60	1,120
1.80	139	2.80	398	3.80	765	4.70	1,170
1.90	159	2.90	430	3.90	807	4.80	1,220
2.00	180	3.00	463				

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

Estimated monthly discharge of Humboldt River at Palisade, Nev., for 1905.

[Drainage area, 5,014 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.....	180	120	149	9,162	0.030	0.035
February.....	280	180	216	12,000	.043	.045
March.....	337	280	296	18,200	.059	.068
April.....	446	337	397	23,020	.079	.088
May.....	1,220	446	703	48,760	.158	.182
June.....	1,120	534	884	52,600	.176	.196
July.....	534	102	286	17,580	.057	.066
August.....	102	34	66.6	4,095	.013	.015
September.....	34	34	34.0	2,023	.0068	.0076
October.....	72	40	54.7	3,363	.011	.013
November.....	72	72	72.0	4,284	.014	.016
December.....	120	72	85.2	5,239	.017	.020
The year.....	1,220	34	278	200,900	.055	.0752

NOTE.—Ice conditions not known. Open-channel rating table applied to the winter months without correction.

#### HUMBOLDT RIVER NEAR GOLCONDA, NEV.

This station was established October 24, 1894. It is located  $1\frac{1}{4}$  miles north of the town of Golconda, near the great northern bend of Humboldt River and below the central valley, and is about 12 miles above the mouth of Little Humboldt River.

The channel is straight for 300 feet above and 100 feet below the station. The banks are moderately high, but are liable to overflow at extreme high water. The bed of the stream is of gravel and sand and is somewhat shifting. There is but one channel at all stages.

Measurements prior to 1904 were made from a cable and suspended car. Subsequent measurements have been made from the upper side of a wagon bridge, constructed during the winter of 1903-4, 10 feet above the cable. At low stages, when the current is sluggish, measurements can be made by wading above or below the cable.

The gage was read during 1905 by Charles Shallenberger. A new gage and bench mark were established October 4, 1904, replacing the inclined gage installed November 28, 1902, which was fastened to the left bank by 4 by 4 inch stakes, and the zero of which had the same elevation as the original gage. The new gage is a 4 by 4 inch timber, driven vertically into the river bed, and its upper end is securely fastened to a stringer on the downstream side of the north or right end of the wagon bridge. The bench mark of the old gage was a 4 by 4 inch timber, driven 4 feet north of the cable post on the left bank, at an elevation of 10.75 feet above the zero of the gage. The new bench mark is the head of the lowest rivet of the strut at the northwest corner of the bridge; elevation above zero of new gage, 13.42 feet. The new bench mark is 0.48 foot lower than the old bench mark, so that the new gage zero is 3.15 feet below the old zero.

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

Description: Ann 18, iv, pp 303-304; Bull 131, p 52; 140, pp 217-218; WS 16, p 154; 28, p 146; 38, p 329; 51, p 307; 60, p 106; 85, p 98; 100, p 155; 133, pp 288-289.

Discharge: Ann 18, iv, pp 304-305; Bull 131, p 92; 140, p 218; WS 16, p 154; 28, p 153; 38, p 329; 51, p 307; 60, p 100; 85, p 98; 100, p 155; 133, p 289.

Discharge, monthly: Ann 18, iv, p 306; 19, iv, p 427; 20, iv, p 438; 21, iv, p 392; 22, iv, p 401; Bull 140, p 220; WS 75, p 182; 85, p 100; 100, p 157; 133, p 291.

Discharge, yearly: Ann 20, iv, p 59.

Gage heights: Bull 140, p 219; WS 11, p 74; 16, p 154; 28, p 148; 38, p 329; 51, p 398; 60, p 107; 85, p 99; 100, p 150; 133, p 290.

Hydrographs: Ann 10, iv, p 429; 20, iv, p 439; 21, iv, p 392; 22, iv, p 401.

Rating tables: Ann 19, iv, p 427; WS 28, p 154; 39, p 452; 52, p 520; 66, p 175; 85, p 99; 100, p 156; 133, p 291.

*Discharge measurements of Humboldt River near Golconda, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
April 25.....	W. A. Wolf.....	63	200	0.58	6.55	116
May 10.....	do.....	73	234	1.30	6.95	302
June 2.....	do.....	62	153	1.33	5.98	203
June 15.....	do.....	62	160	1.60	6.40	257
June 28.....	do.....	60	166	1.43	6.30	238
July 13.....	do.....	59	172	1.46	6.35	252
September 6.....	do.....				3.10	a. 5

a Estimated.

Daily gage height, in feet, of Humboldt River near Golconda, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	5.7	6.2				7.4		4.7		3.0	3.0	3.0
2.			6.2		7.0			4.7				
3.	5.5					5.0		4.0		3.0		3.0
4.		6.0		6.4	7.1	6.0	6.5	4.3		3.0		3.0
5.	5.3	5.9	6.2	6.4	7.0		6.5			3.0		3.0
6.			6.3		6.9	5.9	6.5	4.1	3.1		3.0	
7.	5.5		6.3	6.0	7.0	6.2		4.1	3.1		3.0	
8.	5.5	5.9		5.8			6.3		3.1		3.0	
9.		6.0		6.5	6.8				3.1		3.0	2.9
10.		6.1			6.4	6.2	6.3					
11.	5.6					6.4		3.9				
12.	5.3	6.0	6.2	6.8	6.4	6.2	6.0	3.9				2.9
13.	5.0		6.2	7.0		6.0	6.0	3.7	3.0		3.0	2.9
14.						6.0		3.7	3.0		3.0	2.9
15.	5.0	5.8	6.1	7.0			5.9	3.6	2.9		3.0	2.9
16.			6.3	7.0			5.7		2.8	2.9	3.0	
17.		5.6		7.0	6.9							
18.	5.3	5.6			6.9	6.0		3.4	2.9	3.0		
19.		5.6	5.6	6.8	6.9	6.0	5.5			2.9		
20.	5.6				7.0					3.0	3.0	
21.	6.3						5.4	3.3	3.0			3.0
22.	5.8	5.7	6.0	6.5	7.0	6.3	5.4	3.3	3.0		2.9	3.0
23.			6.0			6.5			3.0	2.9	3.0	3.0
24.		5.0	6.0	6.5	7.1			3.2		2.9	3.0	3.0
25.	5.4	5.9	6.2	6.4	7.3	6.9	5.1			3.0		
26.		6.0	5.9				5.1	3.0	3.0		3.0	3.0
27.	5.2			6.8	7.3	6.9		3.1			3.0	2.9
28.	5.4		6.0			6.5	5.0		3.0			3.0
29.				7.0			4.9	3.1	3.0	3.0		3.0
30.	5.4		6.4		7.4	6.5		3.0	2.9	3.0		
31.	6.0		6.4		7.4			3.1		3.0		

Station rating table for Humboldt River near Golconda, Nev., from January 1 to December 31, 1905.

Gage height.		Discharge.		Gage height.		Discharge.		Gage height.		Discharge.	
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.80	0.0	4.00	39.0	5.20	132.0	6.40	247.0				
2.90	0.1	4.10	46.0	5.30	141.0	6.50	257.0				
3.00	.3	4.20	53.0	5.40	150.0	6.60	268.0				
3.10	.5	4.30	60.0	5.50	159.0	6.70	279.0				
3.20	2.0	4.40	67.0	5.60	168.0	6.80	290.0				
3.30	5.0	4.50	75.0	5.70	177.0	6.90	301.0				
3.40	8.0	4.60	83.0	5.80	187.0	7.00	312.0				
3.50	12.0	4.70	91.0	5.90	197.0	7.10	323.0				
3.60	16.0	4.80	99.0	6.00	207.0	7.20	334.0				
3.70	21.0	4.90	107.0	6.10	217.0	7.30	345.0				
3.80	27.0	5.00	115.0	6.20	227.0	7.40	356.0				
3.90	33.0	5.10	123.0	6.30	237.0						

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905 and the form of previous curves. It is well defined between gage heights 6 feet and 7 feet. Below gage height 6 feet it is only approximate.

*Estimated monthly discharge of Humboldt River near Golconda, Nev., for 1905.*

[Drainage area, 10,780 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.....	237	115	155	9,531	0.014	0.016
February.....	227	168	196	10,880	.018	.019
March.....	247	168	218	13,400	.020	.023
April.....	312	187	272	16,180	.025	.028
May.....	356	247	308	18,940	.029	.033
June.....	356	197	239	14,220	.022	.024
July.....	257	95	184	11,310	.017	.020
August.....	91	.3	25.0	1,537	.0023	.0026
September.....	.5	.0	.33	19.6	.000031	.000035
October.....	.3	.1	.23	14.1	.000021	.000024
November.....	.3	.1	.29	17.3	.000027	.000030
December.....	.3	.1	.22	13.5	.000020	.000023
The year.....	356	0	133	96,060	.012	.166

NOTE.—Ice conditions not known. Open-channel rating table applied to the winter months without correction. Discharge interpolated on days when gage was not read.

#### HUMBOLDT RIVER NEAR OREANA, NEV.

This station was established January 27, 1896. It is located near Oreana, Nev., about 12 miles northeast of Lovelocks. The results of the observations at this locality show the amount of water available for storage at the possible reservoir sites in the vicinity of Humboldt station, and also for the six canal systems now in operation below Oreana.

The channel is straight for 300 feet above and 200 feet below the station. The right bank is high and will not overflow; the left bank will overflow only at extreme high water. There is but one channel at all stages. The bed of the stream is sandy and shifting.

Discharge measurements are made at high water by means of a cable and car located at the gage. At low water measurements are made by wading a short distance below the station.

The gage was read once each day during 1905 by J. J. McCarthy. The original gage was located at the old Oreana highway bridge. The abutment to which the gage was fastened was undermined and fell May 26, 1897. A temporary gage was used until September 8, 1897, when a new inclined one was placed on the left bank of the river, about 1½ miles above the site of the old gage and opposite the section house of the Central Pacific Railroad. This gage was washed out. The present gage was established November 29, 1902. It is vertical, in two sections, and is spiked to piles at the site of the old dam. The bench mark consists of four nails driven into the pile to which the upper section of the gage is fastened; elevation above zero of gage, 5.00 feet. On October 1, 1904, the gage rod was lowered 2.00 feet, and the elevation of the bench mark is now 7.00 feet above the zero of the gage.

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

Description: Ann 18, iv, p 306; Bull 140, p 220; WS 16, p 155; 28, p 146; 38, p 330; 51, p 398; 66, p 107; 85, p 96; 100, pp 152-153; 133, p 292.

Discharge: Ann 18, iv, p 307; WS 16, p 155; 28, p 153; 38, p 330; 51, p 398; 66, p 107; 85, p 97; 100, p 153; 133, p 292.

Discharge, monthly: Ann 18, iv, p 308; 19, iv, p 428; 20, iv, p 430; 21, iv, p 393; 22, iv, p 402; WS 75, p 183; 85, p 98; 100, p. 154; 133, p 294.

Discharge, yearly: Ann 20, iv, p 60.

Gage heights: WS 11, p 75; 16, p 155; 28, p 148; 38, p 330; 51, p 399; 66, p 108; 85, p 97; 100, p 153; 133, p 293.

Hydrographs: Ann 18, iv, p 309; 19, iv, p 429; 20, iv, p 440; 21, iv, p 393; 22, iv, p 402; WS 75, p 183.

Rating tables: Ann 18, iv, p 307; 19, iv, p 428; WS 28, p 154; 39, p 452; 52, p 520; 66, p 175; 85, p 97, 100, p 154; 133, p 293.

*Discharge measurements of Humboldt River near Oreana, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 25.....	W. A. Wolf.....	60	39	1.34	2.11	52
May 18.....	do.....	22	12	1.12	1.71	13.4
May 30.....	do.....	20	10	1.08	1.61	10.8
July 12.....	do.....	100	112	1.77	2.95	198
July 31.....	do.....	100	100	1.70	2.75	178
September 5.....	do.....	16	16	0.90	1.78	14

*Daily gage height, in feet, of Humboldt River near Oreana, Nev., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.0	3.0	3.75	2.6	1.8	1.6	1.0	2.75	1.8	1.75	1.9	2.1
2.....	3.0	2.9	3.1	2.6	1.95	1.55	1.0	2.7	1.8	1.75	1.9	2.1
3.....	3.4	3.0	3.1	2.65	1.8	1.55	1.0	2.6	1.85	1.7	1.9	2.1
4.....	3.5	2.9	3.1	2.7	1.75	1.55	1.55	2.6	1.85	1.7	1.9	2.1
5.....	3.5	2.9	3.1	2.7	1.75	1.55	1.6	2.55	1.8	1.75	1.95	2.15
6.....	3.4	2.8	3.1	2.7	1.6	1.5	1.65	2.55	1.8	1.75	1.95	2.15
7.....	3.4	2.8	3.1	2.7	1.65	1.5	1.8	2.6	1.85	1.75	1.95	2.1
8.....	3.5	2.7	3.12	2.6	1.65	1.5	1.8	2.6	1.85	1.75	1.9	2.1
9.....	3.4	2.7	3.11	2.6	1.64	1.5	2.05	2.55	1.8	1.75	1.9	2.1
10.....	3.2	3.0	3.11	2.6	1.65	1.45	3.45	2.55	1.8	1.8	1.9	2.1
11.....	3.1	3.1	3.1	2.55	1.75	1.4	3.3	2.5	1.75	1.8	1.9	2.1
12.....	3.1	3.45	3.45	2.5	1.7	1.4	2.25	2.5	1.75	1.75	1.9	2.1
13.....	3.2	3.3	3.3	2.4	1.7	1.4	2.9	2.55	1.75	1.75	1.95	2.05
14.....	3.1	2.94	3.1	2.4	1.75	1.35	2.85	2.5	1.8	1.8	1.95	2.05
15.....	3.3	3.1	3.11	2.3	1.75	1.35	2.8	2.45	1.75	1.8	1.9	2.1
16.....	3.4	3.3	3.0	2.3	1.73	1.35	3.1	2.4	1.7	1.8	1.9	2.1
17.....	3.2	3.4	3.0	2.25	1.72	1.35	3.3	2.35	1.75	1.75	1.9	2.1
18.....	3.2	3.35	3.0	2.2	1.73	1.3	3.35	2.3	1.75	1.75	1.9	2.1
19.....	3.2	3.4	2.8	2.25	1.73	1.1	3.35	2.2	1.7	1.8	1.9	2.05
20.....	3.2	3.1	2.8	2.2	1.73	1.1	2.8	2.2	1.75	1.8	1.9	2.1
21.....	3.2	3.75	2.0	2.2	1.73	1.2	2.7	2.25	1.75	1.8	1.95	2.1
22.....	3.0	3.5	2.7	2.1	1.73	1.0	2.75	2.25	1.75	1.85	1.95	2.15
23.....	2.8	3.0	2.75	2.5	1.7	1.0	2.85	2.3	1.7	1.85	1.95	2.2
24.....	2.8	2.95	2.7	2.5	1.7	1.0	2.7	2.3	1.7	1.85	1.95	2.25
25.....	2.0	2.93	2.7	2.1	1.65	1.0	2.75	2.25	1.7	1.85	1.95	2.3
26.....	2.0	3.75	2.65	2.0	1.65	1.0	2.8	2.2	1.75	1.9	2.0	2.3
27.....	2.8	3.7	2.7	2.0	1.6	1.0	2.7	2.1	1.75	1.9	2.0	2.35
28.....	2.8	3.5	2.7	2.0	1.65	1.0	2.85	2.0	1.75	1.9	2.05	2.35
29.....	2.0	.....	2.54	2.0	1.65	1.0	2.95	1.9	1.75	1.9	2.05	2.4
30.....	3.0	.....	2.51	1.8	1.65	1.0	2.8	1.9	1.75	1.85	2.05	2.4
31.....	2.9	.....	2.6	.....	1.6	.....	2.75	1.9	.....	1.85	.....	2.4

NOTE.—Ice conditions January 1 to February 10. Water stood in pools June 22 to July 3.

Station rating table for Humboldt River near Oreana, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.10	0.0	1.90	20.0	2.70	152.0	3.50	335.0
1.20	.5	2.00	40.0	2.80	172.0	3.60	360.0
1.30	1.0	2.10	53.0	2.90	193.0	3.70	385.0
1.40	2.0	2.20	67.0	3.00	215.0	3.80	412.0
1.50	3.5	2.30	82.0	3.10	238.0	3.90	440.0
1.60	7.0	2.40	98.0	3.20	261.0		
1.70	12.0	2.50	115.0	3.30	285.0		
1.80	20.0	2.60	133.0	3.40	310.0		

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905. It is fairly well defined between gage heights 1.6 feet and 3 feet. It is only approximate below gage height 1.6 feet.

*Estimated monthly discharge of Humboldt River near Oreana, Nev., for 1905.*

[Drainage area, 13,800 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.....	440	172	260	15,900	0.019	.022
February.....	368	152	252	14,000	.018	.019
March.....	308	117	209	12,850	.015	.017
April.....	152	20	96.0	5,712	.0070	.0078
May.....	34	7	13.2	812	.00096	.0011
June.....	7	0	1.94	115	.00014	.00016
July.....	322	0	156	9,692	.011	.013
August.....	102	29	95.3	5,860	.0069	.0080
September.....	24	12	17.3	1,029	.0013	.0014
October.....	29	12	20.0	1,230	.0014	.0016
November.....	46	29	33.1	1,970	.0024	.0027
December.....	98	46	62.7	3,855	.0045	.0052
The year.....	440	0	101	73,020	.0073	.009

NOTE.—Ice conditions January 1 to February 19. Open-channel rating table applied to the winter months without correction. Winter estimates liable to considerable error.

## SIERRA NEVADA DRAINAGE.

### PRINCIPAL STREAMS.

The Sierra Nevada drainage area includes the western part of Nevada, the eastern part of California, and a small part of south-central Oregon. The principal rivers of the area, with the bodies of water into which they discharge, are the following: Truckee River into Pyramid and Winnemucca lakes, Walker River into Walker Lake, Carson River into Carson Sink, Susan River into Honey Lake, and Owens River into Owens Lake.

## TRUCKEE RIVER BASIN.

## DESCRIPTION OF BASIN.

Upper Truckee River rises on the eastern slopes of the Sierra Nevada, in Eldorado County, Cal., and flows northward, entering Lake Tahoe from the south. The main Truckee leaves the lake, of which it forms the outlet, at the town of Tahoe, in eastern Placer County, Cal., flows north and northeast, and discharges, in Washoe County, Nev., into Pyramid and Winnemucca lakes, which have no outflowing streams. The drainage basin is wild and mountainous, the highest peaks reaching altitudes exceeding 10,000 feet. Lake Tahoe, which lies at an elevation of 6,225 feet above sea, has an area of 193 square miles and is the largest body of fresh water in the United States at this altitude.

In the lower part of its course the Truckee receives several important tributaries, among which may be mentioned Donner and Prosser creeks and Little Truckee River, the latter uniting with the main stream at the town of Boca. Independence Creek is a branch of the Little Truckee.

## TRUCKEE RIVER NEAR WADSWORTH, NEV.

This station was established November 6, 1902. It is located one-fourth mile west of the school at the Indian agency and is 18 miles north of Wadsworth, Nev.

The channel is straight for 200 feet above and below the cable. The right bank is low and is liable to overflow beyond the cable support at very high water; the left bank is high and will not overflow. The bed of the stream is composed of sand and gravel and is permanent. There is but one channel at all stages. The current is swift.

Discharge measurements are made by means of a cable and car about 200 feet below the gage. The initial point for soundings is the zero of the tagged wire.

The gage, which was read during 1905 twice each day by Edward C. Wood, is a 4 by 4 inch vertical timber spiked to a cottonwood tree on the right bank. The bench mark consists of three nails driven into the root of a cottonwood tree 18 feet north of the gage; elevation above gage zero, 12.07 feet. The gage was disturbed by a flood early in February, 1904, and settled 0.31 foot, so that the elevation of the bench mark is 12.38 feet above the zero of the present gage datum.

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

Description: 100, p 188; 133, pp 298-299.

Discharge: 100, p 188; 133, p 299.

Discharge, monthly: 100, p 190; 133, p 300.

Gage heights: 100, pp 188-189; 133, p 299.

Rating table: 100, p 189; 133, p 300.

*Discharge measurements of Truckee River near Wadsworth, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
May 18.....	W. A. Wolf.....	124	528	2.48	6.42	1,314
June 8.....	do.....	127	418	2.15	5.85	898
July 11.....	do.....	120	254	1.26	4.58	321

Daily gage height, in feet, of Truckee River near Wadsworth, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.3	5.38	6.35	5.52	6.65	6.38	4.85	3.85	4.05	4.77	5.1	4.97
2.....	6.1	5.57	6.38	5.6	6.55	6.4	4.82	3.82	4.1	4.7	5.02	5.0
3.....	6.0	5.6	6.4	5.6	6.58	6.3	4.78	3.82	4.1	4.65	5.0	5.05
4.....	6.0	5.7	6.4	5.8	6.75	6.22	4.05	3.8	4.07	4.52	4.9	5.07
5.....	6.0	5.65	6.4	5.8	6.4	6.15	4.8	3.8	4.05	4.0	4.9	5.07
6.....	6.0	5.65	6.48	5.88	6.35	5.98	4.82	3.8	4.25	4.4	4.8	4.9
7.....	5.9	5.4	6.5	6.0	6.2	5.92	4.75	3.9	4.22	4.05	4.82	4.95
8.....	5.85	5.35	6.55	6.0	6.2	5.89	4.04	3.8	4.25	4.75	4.82	4.9
9.....	5.85	5.3	6.58	6.0	6.2	5.85	4.04	3.8	4.4	4.87	4.75	4.82
10.....	5.85	5.38	6.55	6.1	6.25	5.82	4.52	3.8	4.4	4.95	4.7	4.8
11.....	5.85	5.55	6.48	6.18	6.02	6.08	4.52	3.8	4.4	5.0	4.72	4.77
12.....	5.98	5.48	6.5	5.98	5.95	6.15	4.4	3.8	4.3	5.0	4.7	4.77
13.....	5.9	5.4	6.48	5.82	5.9	6.4	4.36	3.8	4.3	5.12	4.72	4.87
14.....	5.9	5.4	6.58	5.78	5.95	6.18	4.35	4.05	4.25	5.02	4.7	4.97
15.....	5.9	5.6	6.5	5.7	6.05	6.12	4.4	4.0	4.25	5.05	4.0	5.0
16.....	5.55	5.5	6.35	5.7	6.22	6.1	4.36	4.0	4.25	5.27	4.6	5.0
17.....	5.5	5.5	6.0	5.65	6.5	6.0	4.22	3.95	4.15	5.25	4.92	4.85
18.....	5.4	5.55	6.0	5.65	6.95	6.12	4.1	3.95	4.17	5.2	4.92	4.7
19.....	5.32	5.55	6.0	5.65	6.8	5.92	4.1	4.0	4.17	5.25	5.0	4.72
20.....	5.3	5.58	6.0	5.52	6.7	5.95	4.0	4.0	4.2	5.1	5.07	4.87
21.....	5.3	6.0	6.0	5.3	6.7	5.85	3.98	4.0	4.2	5.2	5.22	4.85
22.....	5.55	5.85	6.0	5.2	6.82	5.85	3.98	4.05	4.4	4.92	5.0	5.1
23.....	5.68	6.02	5.7	5.18	6.6	5.7	3.95	4.18	4.34	5.0	5.0	4.05
24.....	5.6	6.05	5.65	5.25	6.12	5.58	4.0	4.25	4.22	4.95	5.12	4.7
25.....	5.55	6.2	5.7	5.35	6.5	5.45	3.9	4.25	4.4	4.9	5.2	4.77
26.....	5.42	6.3	5.65	5.84	6.5	5.32	3.88	4.25	4.51	5.05	5.0	4.9
27.....	5.4	6.35	6.1	7.12	6.68	5.15	3.9	4.2	4.4	5.1	5.0	4.97
28.....	5.4	6.38	6.0	6.8	6.45	5.1	3.9	4.12	4.52	5.1	5.02	5.0
29.....	5.38	.....	5.88	6.68	6.6	4.92	3.88	4.0	4.52	5.05	4.95	5.0
30.....	5.3	.....	5.78	6.7	6.52	4.82	3.85	4.07	4.5	5.05	4.95	4.85
31.....	5.3	.....	5.55	.....	6.5	.....	3.85	4.05	.....	4.95	.....	4.92

Station rating table for Truckee River near Wadsworth, Nev., from January 1 to December 31, 1905.

Gage height	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.80	108	4.70	358	5.60	770	6.60	1,350
3.90	131	4.80	394	5.70	825	6.60	1,430
4.00	155	4.90	432	5.80	885	6.70	1,510
4.10	180	5.00	472	5.90	945	6.80	1,595
4.20	206	5.10	515	6.00	1,005	6.90	1,685
4.30	233	5.20	560	6.10	1,070	7.00	1,775
4.40	262	5.30	610	6.20	1,135	7.10	1,865
4.50	292	5.40	660	6.30	1,205	7.20	1,955
4.60	324	5.50	715	6.40	1,275		

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 4.6 feet and 8 feet.

*Estimated monthly discharge of Truckee River near Wadsworth, Nev., for 1905.*

[Drainage area, 2,130 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.....	1,205	610	826	50,700	0.388	0.447
February.....	1,261	610	827	45,930	.388	.404
March.....	1,414	742	1,133	69,070	.532	.613
April.....	1,883	551	935	55,040	.439	.490
May.....	1,730	945	1,306	80,300	.613	.707
June.....	1,275	402	935	55,040	.439	.490
July.....	413	120	241	14,820	.113	.130
August.....	220	108	148	9,100	.069	.080
September.....	208	108	220	13,630	.108	.120
October.....	595	262	457	28,100	.215	.248
November.....	570	324	434	25,820	.204	.228
December.....	515	341	433	26,620	.203	.234
The year.....	1,883	408	650	470,100	.309	4.10

Note.—Ice conditions not known; open-channel rating table applied to the winter months without correction.

#### TRUCKEE RIVER AT VISTA, NEV.

This station was established August 18, 1890. It is located 7 miles east of Reno, Nev., and one-fourth mile from the Southern Pacific Railroad station at Vista.

The channel is straight for 150 feet above and 400 feet below the station. Both banks are high; the left is liable to overflow at extreme high stages only. There is but one channel at all stages.

Discharge measurements are made by means of a cable and car below the railroad bridge. The initial point for soundings is the zero of the tagged wire.

During 1905 the gage was read once each day by Patrick Fay. The original gage was replaced November 12, 1902, by a new gage, which was installed on the left bank 150 feet above the railroad bridge, its zero having the same elevation as that of the original gage. April 3, 1903, another new gage was established, consisting of a 4 by 4 inch vertical timber located on the left bank and having the same datum as the previous gages. June 23, 1903, this gage was torn out and moved 3 feet farther into the river, in order to place it in deeper water, and the zero of the gage was lowered 2.72 feet. The bench mark is the head of a bolt set in the concrete of the upstream side of the left abutment of the Southern Pacific Railroad bridge, 300 feet from the gage; elevation above zero of gage, 19.74 feet. February 21, 1904, the gage rod was washed out by a flood. A new gage was established in the same position as the old gage, but with its zero 1.54 feet above that of the old 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 38, pp 331-332; 51, p 404; 66, p 113; 85, pp 117-118; 100, pp 185-186; 133, p 301.  
 Discharge: WS 38, p 332; 51, p 404; 66, p 113; 85, p 118; 100, p 186; 133, pp 301-302.  
 Discharge, monthly: Ann 11, II, p 102; 12, II, p 351; 13, III, p 69; 22, IV, p 405; WS 75, p 186; 85, p 119; 100, p 187; 133, p 303.  
 Discharge, yearly: Ann 13, III, p 69; 20, IV, p 59.  
 Gage heights: WS 38, p 332; 51, p 405; 66, p 114; 85, p 118; 100, pp 186-187; 133, p 302.  
 Hydrographs: Ann 12, II, p 324; 22, IV, p 405; WS 75, p 186.  
 Rating tables: WS 52, p 521; 66, p 176; 85, p 119; 100, p 187; 133, p 303.

*Discharge measurements of Truckee River at Vista, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 6.....	W. A. Wolf.....	117	518	1.08	5.25	1,027
April 13.....	do.....	115	480	1.70	5.00	816
April 28.....	do.....	117	593	2.86	6.28	1,608
May 25.....	do.....	117	563	2.45	5.85	1,381
June 14.....	do.....	118	510	1.98	5.30	1,009
June 22.....	do.....	114	368	1.04	4.07	381
July 5.....	do.....	114	368	1.07	4.10	394
July 17.....	do.....	113	327	.70	3.55	221
September 16.....	do.....	113	337	.79	3.70	266

*Daily gage height, in feet, of Truckee River at Vista, Nev., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.0	4.8	5.8	.....	5.0	5.7	4.1	3.4	3.4	4.0	4.3	4.3
2.....	5.4	5.1	5.8	5.0	5.8	5.0	4.1	3.4	3.5	4.0	4.3	4.4
3.....	5.4	5.0	5.0	5.0	6.0	5.4	4.1	3.4	3.5	4.0	4.1	4.4
4.....	5.4	4.8	5.0	4.9	6.2	5.7	4.1	3.4	3.5	4.0	4.1	4.4
5.....	5.3	4.8	6.0	5.3	5.8	5.6	4.1	3.4	3.5	4.0	4.1	4.4
6.....	5.3	4.8	6.0	5.4	5.6	5.3	4.1	3.4	3.6	4.0	4.2	4.4
7.....	5.2	4.8	6.0	5.5	5.5	5.3	4.0	3.4	3.6	4.1	4.2	4.4
8.....	5.2	4.8	6.0	5.5	5.5	5.2	3.9	3.4	3.7	4.1	4.2	4.4
9.....	5.2	4.7	6.0	5.3	5.5	5.3	3.9	3.4	3.7	4.1	4.2	4.4
10.....	5.1	4.9	5.8	5.5	5.5	5.0	3.8	3.4	3.7	4.1	4.2	4.0
11.....	5.1	4.8	5.0	5.4	5.3	5.3	3.7	3.4	3.7	4.2	4.3	4.2
12.....	5.1	4.8	5.0	5.2	5.2	5.5	3.7	3.4	3.7	4.2	4.3	4.1
13.....	5.0	4.8	6.1	5.0	5.0	5.0	3.7	3.4	3.7	4.2	4.3	4.1
14.....	5.0	4.0	6.0	5.0	4.8	5.0	3.5	3.4	3.7	4.2	4.3	4.2
15.....	5.0	4.9	5.8	5.1	5.0	5.4	3.5	3.5	3.7	4.2	4.2	4.1
16.....	4.9	5.0	5.5	5.0	5.7	5.4	3.5	3.5	3.7	4.2	4.2	4.1
17.....	5.8	4.9	5.5	4.9	5.3	5.3	3.4	3.5	3.7	4.2	4.2	4.1
18.....	4.8	4.9	5.5	4.8	5.4	5.3	3.4	3.6	3.7	4.2	4.2	4.1
19.....	4.7	5.0	5.5	4.8	6.3	5.3	3.4	3.6	3.7	4.2	4.2	4.1
20.....	4.8	5.5	5.5	4.9	6.2	5.0	3.4	3.6	3.7	4.2	4.3	4.1
21.....	5.2	5.3	5.5	5.0	6.2	5.0	3.4	3.6	3.7	4.2	4.3	4.0
22.....	5.3	5.4	5.5	4.5	6.0	4.8	3.4	3.7	3.7	4.2	4.4	3.7
23.....	5.0	5.4	5.3	4.7	5.8	4.8	3.4	3.7	3.8	4.2	4.4	3.7
24.....	5.0	5.9	5.3	4.5	5.7	4.4	3.4	3.7	3.8	4.3	4.3	3.1
25.....	4.9	5.8	5.0	4.5	6.0	4.6	3.2	3.7	3.9	4.3	4.2	3.9
26.....	4.8	5.8	5.0	6.0	5.0	4.6	3.2	3.7	3.9	4.3	4.2	4.2
27.....	4.8	5.8	5.5	6.5	5.7	4.4	3.3	3.7	3.9	4.2	4.2	4.1
28.....	4.7	5.8	5.4	6.3	5.8	4.2	3.4	3.6	3.9	4.2	4.2	4.1
29.....	4.8	.....	5.4	6.2	5.7	4.0	3.4	3.6	4.0	4.2	4.2	4.1
30.....	4.7	.....	4.9	6.2	5.7	4.0	3.4	3.5	4.0	4.2	4.2	4.1
31.....	4.7	.....	.....	.....	5.8	.....	3.4	3.5	.....	4.3	.....	4.1

Station rating table for Truckee River at Vista, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
3.20	150	4.10	405	5.00	850	5.80	1,350
3.30	171	4.20	445	5.10	910	5.90	1,420
3.40	195	4.30	485	5.20	970	6.00	1,490
3.50	220	4.40	525	5.30	1,030	6.10	1,560
3.60	245	4.50	570	5.40	1,090	6.20	1,635
3.70	275	4.60	620	5.50	1,155	6.30	1,710
3.80	305	4.70	675	5.60	1,220	6.40	1,785
3.90	335	4.80	730	5.70	1,285	6.50	1,860
4.00	370	4.90	790				

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 3.5 feet and 6.5 feet.

*Estimated monthly discharge of Truckee River at Vista, Nev., for 1905.*

[Drainage area, 1,510 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.....	1,220	675	804	54,070	0.380	0.670
February.....	1,420	675	943	52,370	.621	.647
March.....	1,500	790	1,237	70,060	.814	.698
April.....	1,800	570	1,003	60,680	.660	.730
May.....	1,710	730	1,270	78,040	.842	.671
June.....	1,285	370	630	65,340	.612	.683
July.....	405	150	260	15,060	.171	.167
August.....	275	105	224	13,770	.147	.170
September.....	370	195	270	16,600	.184	.205
October.....	485	370	430	20,440	.283	.326
November.....	525	405	460	27,370	.363	.338
December.....	525	130	421	25,800	.277	.310
The year.....	1,800	130	697	503,100	.450	0.21

NOTE.—Ice conditions not known; open-channel rating table applied to the winter months without correction.

**TRUCKEE RIVER AT NEVADA-CALIFORNIA STATE LINE.**

This station was established September 7, 1899. It is located at the State line, 17 miles west of Reno, Nev.

The channel is straight for 60 feet above and 75 feet below the cable. Both banks are high and rocky and are not liable to overflow. The bed of the stream is composed of boulders and cobblestones. The current is swift.

Discharge measurements are made by means of a cable and ear, 2½ miles below the gage at Linham Siding and 100 feet below bridge No. 2. The initial point for soundings is the zero of the tagged wire.

The gage was read once each day during 1905 by H. E. Dickinson. The original gage was vertical, driven into the bed of the river and wired to a granite boulder. November 11, 1902, a new gage was established on the right bank, 400 feet below the point at which the old gage was located. The new gage consists of two sections of 4 by 4 inch timber. The upper section is vertical and is spiked to a cottonwood tree; the lower section is inclined and is immediately under the vertical section. The gage datum is the same as that of the old gage. The bench mark consists of two spikes driven into the root of the cottonwood tree to which the vertical section of the gage is attached; elevation above zero of gage, 5.99 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 38, p 331; 51, p 403; 66, p 112; 85, pp 110-120; 100, pp 192-193; 133, p 304.

Discharge: WS 38, p 331; 51, p 403; 66, p 112; 85, p 120; 100, p 103; 133, p 304.

Discharge, monthly: Ann 22, iv, p 404; WS 75, p 185; 85, p 121; 100, p 104; 133, p 306.

Gage heights: WS 38, p 331; 51, p 404; 66, p 113; 85, p 120; 100, pp 193-194; 133, p 305.

Hydrograph: Ann 22, iv, p 404.

Rating tables: WS 52, p 521; 66, p 175; 85, p 120; 100, p 104; 133, p 306.

*Discharge measurements of Truckee River at Nevada-California State line in 1905.*

Date.	Hydrographer.	Width.		Mean	Gage	Dis-
		of section.	area of	velocit'y.	height.	
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 17.....	W. A. Wolf.....	80	344	2.76	2.85	949
May 13.....	do.....	80	370	2.91	2.95	1,078
May 26.....	do.....	87	441	4.00	3.65	1,761
June 6.....	do.....	81	378	3.10	3.08	1,170
June 21.....	do.....	80	340	2.66	2.80	905
July 10.....	do.....	80	300	1.93	2.25	580
July 18.....	do.....	76	277	1.97	2.15	544
July 25.....	do.....	76	277	1.95	2.12	539
September 13.....	do.....	74	274	1.52	1.97	410

*Daily gage height, in feet, of Truckee River at Nevada-California State line for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.3	3.3	2.4	3.45	3.3	2.3	2.0	2.05	2.02	2.02	1.95
2.....	2.8	2.3	3.3		3.35	3.25	2.35	2.07	2.1	2.02	1.9	1.9
3.....	2.8	2.3	3.3	2.6	3.25	3.25	2.35	2.1	2.05	2.05	1.95	1.87
4.....	2.8	2.3	3.3	2.6	3.2	3.08	2.32	2.07	2.1	2.05	2.0	1.9
5.....	2.7	2.28	3.3	2.7	3.15	3.05	2.35	2.5	2.1	2.05	1.95	1.8
6.....	2.7	2.3	3.3	2.85	3.08	3.25	2.32	2.15	2.05	2.15	1.87	1.8
7.....	2.7	2.3	3.3	2.9	3.3	3.05	2.3	2.1	2.1	2.1	1.95	1.9
8.....		2.3	3.3	2.88	3.05	3.05	2.3	2.1	2.1	2.05	1.9	1.9
9.....	2.65	2.3	3.3		3.0	3.05	2.25	2.1	2.1	2.1	1.95	1.9
10.....	2.7	2.35	3.2	3.25	2.95	3.35	2.2	2.1	2.1	2.1	1.95	1.9
11.....	2.6	2.3	3.2	2.85	2.95	3.3	2.2	2.1	2.05	2.2	1.95	1.9
12.....	2.6	2.35	3.2	2.8	2.9	3.3	2.1	2.18	2.05	2.15	1.87	1.85
13.....	2.6	2.25	3.2	2.8	2.9	3.25	2.1	2.15	2.05	2.1	1.95	1.92
14.....	2.2	2.25	3.25	2.8	2.98	3.17	2.25	2.1	2.05	2.1	1.7	1.87
15.....	2.4	2.3	3.25	2.85	3.45	3.2	2.25	2.1	2.02	2.05	1.7	1.97
16.....	2.4	2.35	2.7	2.85	3.65		2.25	2.12	2.0	2.05	1.85	1.87
17.....	2.2	2.4	2.7	2.85	3.95	3.22	2.18	2.1	2.05	2.05	1.98	1.9
18.....	2.2	2.47	2.75	2.85	3.7	3.08	2.15	2.15	2.05	2.05	1.97	1.77
19.....	2.2	2.4	2.75	2.82	3.75	3.05	2.15	2.1	2.15	2.05	1.8	1.8
20.....	2.2	2.65	2.78		3.75	3.0	2.02	2.1	2.1	2.05	1.95	1.8
21.....	2.6	2.45	2.8	2.65	3.7	2.8	2.15	2.15	2.05	2.1	1.97	1.7
22.....	2.7	2.85	2.8	2.65	3.7	2.8	2.15	2.15	2.05	2.05	2.0	1.7
23.....	2.5	2.62	2.6	2.7	3.65	2.75	2.15	2.12	2.05	2.05	1.97	1.8
24.....	2.5	3.02	2.45	2.9	3.65	2.6	2.15	2.1	2.05	2.2	2.0	1.8
25.....	2.32	3.02	2.4	3.1	3.5	2.6	2.1	2.1	2.05	2.0	1.95	1.8
26.....	2.32	3.08	2.95	4.02	3.4	2.5	2.1	2.02	2.05	2.02	1.9	1.82
27.....	2.3	3.12	2.95	3.8	3.3	2.45	2.1	2.05	2.05	2.0	1.85	1.82
28.....	2.5	3.05	2.5	3.8	3.35	2.4	2.1	2.1	2.05	2.02	1.9	1.8
29.....			2.3	3.72	3.38	2.38	2.1	2.05	2.05	2.02	1.95	1.82
30.....	2.4		2.4		3.4	2.35	2.1	2.1	2.05	2.0	1.95	1.78
31.....	2.3		2.4		3.3		2.0	2.02		2.5		1.75

Station rating table for Truckee River at Nevada-California State line from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.70	300	2.30	610	2.90	1,042	3.50	1,580
1.80	346	2.40	673	3.00	1,126	3.60	1,676
1.90	394	2.50	740	3.10	1,213	3.70	1,772
2.00	444	2.60	810	3.20	1,302	3.80	1,870
2.10	496	2.70	884	3.30	1,393	3.90	1,970
2.20	551	2.80	961	3.40	1,486	4.00	2,070

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1905. It is well defined. Above gage height 3 feet it is the same as 1904 table.

Estimated monthly discharge of Truckee River at Nevada-California State line for 1905.

[Drainage area, 955 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.....	961	551	755	40,420	0.701	0.012
February.....	1,228	580	754	41,880	.789	.822
March.....	1,393	610	1,006	67,300	1.15	1.33
April.....	2,090	673	1,114	66,290	1.17	1.30
May.....	2,020	1,042	1,453	89,340	1.52	1.75
June.....	1,439	642	1,115	66,350	1.17	1.30
July.....	642	444	548	33,700	.574	.662
August.....	540	444	503	30,930	.527	.608
September.....	524	444	477	28,380	.499	.557
October.....	551	444	487	29,940	.510	.588
November.....	454	300	405	24,100	.424	.473
December.....	429	300	366	22,500	.383	.442
The year.....	2,090	300	756	547,200	.792	10.74

NOTE.—Ice conditions not known; open-channel rating table applied to the winter months without correction. Discharge interpolated on days when gage was not read.

## TRUCKEE RIVER AT TAHOE, CAL.

This station was established June 17, 1900, with a view to ascertaining the actual overflow from Lake Tahoe and the real value of the lake as a storage reservoir. It is located at the city of Tahoe. About 500 feet from the lake there is a timber dam across the river, which has been maintained for more than twenty years for the purpose of controlling the discharge from the lake.

The channel is nearly straight for 300 feet above and below the station. At the point of measurement the right bank is low and is subject to overflow at very high stages of the stream; the left bank is rather high. The bed of the stream, which is of gravel and coarse sand, is smooth and stable. The current has a moderate velocity.

Discharge measurements are made from a cable and suspended ear about one-fourth mile below the gage. In June, 1904, a new cable was put in 1 mile below the gage.

The gage, which is read once each day by J. U. Haley, is located about 300 feet below the dam, as near the city of Tahoe as possible, for the convenience of the observer. It consists of a vertical timber driven into the stream bed and spiked to the root of a cottonwood tree growing on the bank. November 18, 1902, a new gage was established in the exact position of the old gage and with its zero at the same elevation. It is a 4 by 4

inch vertical timber. The bench mark is cut in the side of the tree and is 4.00 feet above gage datum.

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

- Description: Bull 140, pp 210-211; WS 51, p 402; 66, p 111; 85, pp 115-116; 100, p 183; 133, p 307.
- Discharge: Ann 11, II, pp 64, 108; WS 51, p 402; 66, p 111; 85, p 116; 100, p 183; 133, p 307.
- Discharge, monthly: Ann 22, IV, p 403; Bull 140, p 212; WS 75, p 184; 85, p 117; 100, p 185; 133, p 309.
- Gage heights: Bull 140, p 211; WS 51, p 403; 66, p 112; 85, p 116; 100, p 184; 133, p 308.
- Hydrograph: Ann 22, IV, p 403.
- Rating tables: WS 62, p 520; 66, p 176; 85, p 117; 100, p 184; 133, p 308.

*Discharge measurements of Truckee River at Tahoe, Cal., in 1905.*

Date	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 14.....	W. A. Wolf.....	20	15.2	1.01	0.30	15.4
May 24.....	do.....	73	120	1.61	1.27	203
June 13.....	do.....	72	125	1.61	1.30	211
June 19.....	do.....	72	125	1.60	1.30	205
July 26.....	do.....	70	108	1.95	1.80	328

*Daily gage height, in feet, of Truckee River at Tahoe, Cal., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	a 2.7	b 1.6	a 2.55	0.4	0.3	1.3	1.45	1.9	2.0	2.0	1.8	1.7
2.....	a 2.7	b 1.6	a 2.55	.4	.3	1.3	1.45	2.0	2.0	2.0	1.8	1.7
3.....	a 2.7	b 1.65	a 2.55	.4	.3	1.3	1.45	2.0	2.0	2.0	1.8	1.7
4.....	a 2.7	b 1.65	a 2.5	.4	.7	1.3	1.5	2.0	2.0	2.1	1.8	1.7
5.....	a 2.7	b 1.65	a 2.5	.4	1.0	1.3	1.5	2.0	2.0	2.1	1.7	1.7
6.....	a 2.0	e 1.65	a 2.5	.4	1.0	1.3	1.5	2.0	2.0	2.1	1.7	1.7
7.....	a 2.0	e 2.0	a 2.5	.4	1.25	1.3	1.5	2.0	2.0	2.1	1.7	1.7
8.....	a 2.0	e 2.0	a 2.5	.4	1.25	1.3	1.5	2.0	2.0	2.1	1.7	1.7
9.....	a 2.0	e 2.0	a 2.5	.4	1.25	1.3	1.5	1.95	2.0	2.1	1.7	1.6
10.....	a 2.0	e 2.0	a 2.5	.4	1.25	1.3	1.5	2.0	2.0	2.1	1.7	1.6
11.....	b 1.0	e 2.0	a 2.5	.4	1.25	1.3	1.5	2.0	1.9	2.1	1.7	1.6
12.....	b 1.0	e 2.0	2.5	.3	1.25	1.3	1.5	2.0	1.9	2.1	1.7	1.6
13.....	b 1.0	e 2.0	2.5	.3	1.25	1.3	1.6	2.0	1.9	2.0	1.7	1.6
14.....	b 1.0	e 2.0	2.5	.3	1.25	1.3	1.6	2.0	1.9	2.0	1.7	1.6
15.....	b 1.0	e 2.0	1.6	.3	1.25	1.3	1.6	2.0	1.9	2.0	1.7	1.6
16.....	b 1.0	e 2.0	1.6	.3	1.25	1.3	1.6	2.0	1.9	2.0	1.7	1.6
17.....	b 1.0	e 2.0	1.6	.3	1.25	1.3	1.6	2.0	1.9	2.0	1.7	1.5
18.....	b 1.0	e 2.0	1.6	.3	1.25	1.3	1.6	2.0	2.0	2.0	1.7	1.5
19.....	b 2.5	a 2.55	1.6	.3	1.25	1.3	1.9	2.0	2.0	2.0	1.7	1.5
20.....	b 2.5	a 2.55	1.15	.3	1.25	1.3	1.9	2.0	2.0	2.0	1.7	1.5
21.....	b 2.5	a 2.55	1.15	.3	1.25	1.3	1.9	2.0	2.0	2.0	1.7	1.5
22.....	b 1.0	a 2.55	1.15	.3	1.25	1.3	1.9	2.0	2.0	1.9	1.7	1.5
23.....	b 1.0	a 2.55	.4	.3	1.3	1.3	1.9	2.0	2.0	1.9	1.7	1.5
24.....	b 1.0	a 2.55	.4	.3	1.3	1.35	1.9	2.0	2.0	1.9	1.7	1.5
25.....	b 1.0	a 2.55	.4	.3	1.3	1.35	1.9	2.0	2.0	1.9	1.7	1.5
26.....	b 1.0	a 2.55	.4	.3	1.3	1.45	1.9	2.0	2.0	1.9	1.6	1.5
27.....	b 1.0	a 2.55	.4	.3	1.3	1.45	1.9	2.0	2.0	1.9	1.6	1.5
28.....	b 1.0	a 2.55	.4	.3	1.3	1.45	1.9	2.0	2.0	1.9	1.6	1.5
29.....	b 1.0	.....	.4	.3	1.3	1.45	1.9	2.0	2.0	1.9	1.6	1.4
30.....	b 1.0	.....	.4	.3	1.3	1.45	1.9	2.0	2.0	1.9	1.6	1.4
31.....	b 1.0	.....	.4	.....	1.3	.....	1.9	2.0	.....	1.8	.....	1.4

a All gates up.

b One gate up.

c Two gates up.

Station rating table for Truckee River at Tahoe, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
0.30	15	1.00	139	1.60	279	2.20	453
0.40	31	1.10	160	1.70	306	2.30	485
0.50	47	1.20	182	1.80	334	2.40	518
0.60	64	1.30	205	1.90	363	2.50	552
0.70	82	1.40	229	2.00	392	2.60	588
0.80	100	1.50	253	2.10	422	2.70	622
0.90	119						

The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905 and the form of previous curves. It is not well defined.

*Estimated monthly discharge of Truckee River at Tahoe, Cal., for 1905.*

[Drainage area, 519 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.....	622	279	410	25,210	0.790	0.911
February.....	569	279	433	24,050	.834	.868
March.....	569	31	321	19,740	.618	.712
April.....	31	15	20.0	1,244	.040	.045
May.....	205	15	173	10,640	.333	.384
June.....	241	205	212	12,620	.408	.455
July.....	363	241	303	18,630	.584	.673
August.....	392	363	391	24,040	.763	.868
September.....	392	363	385	22,910	.742	.828
October.....	422	334	390	23,980	.761	.866
November.....	334	270	305	18,150	.588	.656
December.....	306	229	271	16,660	.522	.602
The year.....	622	15	301	217,900	.580	7.87

NOTE.—Ice conditions not known. Open-channel rating table applied to the winter months without correction.

#### LAKE WINNEMUCCA INLET NEAR WADSWORTH, NEV.

This station was established November 7, 1902. It is located 3 miles north of Pyramid Lake Indian School and 21 miles north of Wadsworth, Nev.

The channel is straight for 150 feet above and below the cable. Both banks are high and not subject to overflow. The bed is composed of gravel and silt and may change slightly. There is but one channel at all stages. The current is moderate.

Discharge measurements are made by means of a cable and car near the gage. The initial point for soundings is the zero of the tagged wire.

The gage, which was read three times each day during 1905 by Edward C. Wood, is a 4 by 4 inch vertical timber spiked to a willow tree on the right bank. The bench mark consists of two spikes driven into the tree to which the gage is attached; elevation above zero of gage, 6.00 feet.

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

Description: 100, p 190; 133, p 309.

Discharge: 100, p 191; 133, p 310.

Discharge, monthly: 100, p 192; 133, p 311.

Gage heights: 100, p 191; 133, p 310.

Rating table: 100, p 192; 133, p 311.

Discharge measurements of Lake Winnemucca Inlet near Wadsworth, Nev., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
May 18.....	W. A. Wolf.....	46	118	1.60	3.30	196
June 8.....	do.....	46	114	1.61	3.20	185
July 11.....	do.....	46	85	1.75	2.75	149

Daily gage height, in feet, of Lake Winnemucca Inlet near Wadsworth, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.88	2.21	2.27	2.21						2.2	2.1	
2.....	2.77			2.21		3.45	2.45	2.65	2.35			1.05
3.....			2.27		3.15				2.35			1.0
4.....	2.66	2.29				3.25	2.35			2.2	2.1	
5.....		2.27		2.23				2.55			2.0	
6.....	2.66		2.3		3.1			2.6	2.3	2.15		
7.....					3.08	3.12						1.8
8.....		2.24		2.24		3.1	2.32	2.05		2.2	1.9	
9.....	2.21		2.29	2.24			2.6		2.3			1.8
10.....					3.1	3.0		2.65	2.3		1.8	1.8
11.....	2.21	2.21	2.28			2.3				2.3	1.75	
12.....			2.28	2.24			2.65	2.65			1.75	
13.....	2.22				3.05			2.7	2.25			1.85
14.....					3.05	2.15				2.3		
15.....	2.0			2.22			2.75	2.75		2.2		
16.....	2.0	2.24	2.26	2.2			2.75		2.3		1.8	1.8
17.....					3.2	2.15		2.7	2.3			2.2
18.....	2.0	2.25	2.2			2.2				2.25	1.85	
19.....	2.22	2.24	2.24	2.18			2.7	2.75			1.9	
20.....	1.19				3.25				2.5	2.25		2.1
21.....					3.25	2.1				2.2		
22.....	1.19	2.26	2.24	2.17			2.68			2.2	1.9	
23.....				2.19			2.6	2.6	2.2			2.1
24.....					3.15	2.05			2.2			2.0
25.....	2.0	2.20	2.2	2.36		2.9				2.15	1.95	
26.....		2.25	2.22				2.6	2.6				
27.....	2.0			2.58	3.5			2.5	2.3			2.0
28.....	2.0				3.45	2.65				2.1		
29.....			2.23	2.55			2.58			2.15	1.9	
30.....	2.0			3.2		2.55	2.6	2.5	2.2			2.1
31.....					3.45							

Station rating table for Lake Winnemucca Inlet near Wadsworth, Nev., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.20	27	1.80	67	2.40	116	3.00	170
1.30	33	1.90	75	2.50	125	3.10	179
1.40	39	2.00	83	2.60	134	3.20	188
1.50	46	2.10	91	2.70	143	3.30	197
1.60	53	2.20	99	2.80	152	3.40	206
1.70	60	2.30	107	2.90	161	3.50	216

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

*Estimated monthly discharge of Lake Winnemucca Inlet near Wadsworth, Nev., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	159	26	93.9	5,774
February.....	106	100	103	5,720
March.....	107	99	103	6,333
April.....	188	97	107	6,367
May.....	216	174	189	11,020
June.....	211	87	130	8,003
July.....	148	109	132	8,116
August.....	148	121	135	8,301
September.....	116	99	105	6,248
October.....	107	91	99.0	6,087
November.....	91	64	75.5	4,493
December.....	99	67	79.6	4,894
The year.....	216	26	113	82,040

NOTE.—Ice conditions not known; open-channel rating table applied to the winter months without correction. Discharge interpolated on days when gage was not read.

#### LITTLE TRUCKEE RIVER AT PINE STATION, CAL.

Little Truckee River rises on the eastern slope of the Sierra Nevada Mountains, in north-western Nevada County, Cal., flows north, then east, and then south, and unites with the Truckee at the town of Boca, Cal.

The station was established June 25, 1903. The cable station is located about one-fourth mile upstream from Bruhn's mill, known also as Pine station. The road which follows the Little Truckee north from Boca crosses the river at a ford about 150 feet below the cable and the same distance above the gage rod. Pine station, on the Boca and Loyaltan Railroad, about one-fourth of a mile distant, is the nearest railroad point.

Above the station the channel is straight for 100 feet at high water and for 30 feet at low water; below the station it is straight for 200 feet at high and low water. The right (south) bank is high, steep, and rocky and is not subject to overflow. It supports some underbrush and a few trees. The left (north) bank is composed of gravel for 40 feet back from the high-water channel, is low, and may be overflowed. The bed of the stream consists of coarse gravel and is free from vegetation. There is but one channel at all stages. The current is swift.

Discharge measurements are made from a wooden car running on a three-eighth-inch steel cable which is stretched across the river about 5½ feet above the high-water level. A tag wire is stretched just above the cable. The initial point for sounding is the post which supports the cable on the left bank.

The gage, which is read twice each day by S. Wallace, is located about 300 feet below the cable, and consists of a vertical 2 by 6 inch board. The bench mark is the head of a large nail driven into a 2 by 4 inch timber set in the ground in a clump of small willows 8 feet from the gage; willows surrounding the bench mark are blazed and marked "B. M., U. S. G. S."; elevation of bench mark above zero of gage, 4.83 feet.

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

- Description: 100, p. 195; 133, p. 312.
- Discharge: 100, p. 195; 133, p. 313.
- Discharge, monthly: 100, p. 197; 133, p. 314.
- Gage heights: 100, p. 196; 133, p. 313.
- Rating table: 100, p. 196; 133, p. 314.

## Discharge measurements of Little Truckee River at Pine Station, Cal., in 1905.

Date.	Hydrographor.	Width.	Area of section.	Mean velocity.	Gage height.	Dis-charge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 16.....	W. A. Wolf.....	66	104	2.78	1.85	280
May 11.....	do.....	66	101	2.71	1.80	274
May 27.....	do.....	67	126	2.90	2.05	366
June 7.....	do.....	68	109	3.15	2.00	343
June 23.....	do.....	60	75	1.84	1.36	138
July 8.....	do.....	54	58	1.70	1.12	98
July 24.....	do.....	52	51	1.69	1.03	81

## Daily gage height, in feet, of Little Truckee River at Pine Station, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.28	1.13	1.36	1.53	2.40	2.26	1.28	0.75	0.58	0.7	0.71	1.12
2.....	1.25	1.19	1.44	1.6	2.5	2.22	1.4	.75	.6	.7	.71	1.2
3.....	1.24	1.09	1.43	1.64	2.50	2.14	1.4	.73	.58	.7	.7	1.13
4.....	1.0	1.04	1.46	1.65	2.43	2.09	1.38	.73	.6	.7	.71	1.1
5.....	0.99	1.0	1.54	1.75	2.29	1.99	1.32	.72	.6	.68	.66	1.15
6.....	1.14	1.0	1.59	1.76	2.22	1.97	1.22	.7	.6	.68	.65	1.18
7.....	1.16	1.0	1.6	1.83	2.24	1.96	1.18	.7	.6	.68	.71	1.2
8.....	1.14	.82	1.62	1.84	2.15	2.04	1.18	.7	.6	.7	.69	1.13
9.....	1.06	.86	1.6	1.85	2.12	2.12	1.14	.68	.6	.7	.67	1.15
10.....	1.12	.94	1.59	1.84	1.99	2.16	1.12	.68	.61	.7	.67	1.13
11.....	1.1	1.02	1.6	1.78	1.95	2.21	1.1	.68	.6	.68	.71	1.26
12.....	1.06	.94	1.56	1.94	1.9	2.3	1.04	.7	.61	.68	.82	1.23
13.....	1.01	1.0	1.68	1.74	1.90	2.26	1.04	.7	.61	.68	.8	1.3
14.....	1.08	1.0	1.58	1.76	2.12	2.19	1.1	.7	.61	.68	.81	1.3
15.....	1.25	1.02	1.53	1.85	2.1	2.16	1.1	.68	.6	.68	.79	1.3
16.....	1.25	1.06	1.55	1.8	2.35	2.14	1.06	.65	.6	.69	.83	1.25
17.....	1.25	1.04	1.56	1.72	2.62	2.16	0.98	.65	.62	.67	.83	1.18
18.....	1.19	1.02	1.5	1.82	2.58	2.03	.93	.65	.63	.7	.81	1.23
19.....	1.12	1.1	1.52	1.7	2.5	1.99	.9	.64	.63	.69	.79	1.2
20.....	1.13	1.18	1.56	1.63	2.5	1.98	.9	.63	.63	.69	.81	1.2
21.....	1.06	1.05	1.56	1.62	2.52	1.93	.9	.66	.63	.69	.83	1.0
22.....	1.11	1.05	1.48	1.62	2.44	1.8	.86	.7	.63	.69	.9	1.2
23.....	1.26	1.06	1.51	1.69	2.25	1.76	.85	.7	.63	.69	.87	1.16
24.....	1.29	1.14	1.58	1.8	2.29	1.72	1.02	.65	.64	.69	.79	1.2
25.....	1.23	1.24	1.56	2.46	2.26	1.66	.9	.65	.65	.7	.74	1.25
26.....	1.3	1.28	1.82	2.74	2.36	1.65	.88	.63	.65	.7	.73	1.3
27.....	1.26	1.32	1.62	2.69	2.12	1.66	.82	.62	.65	.7	.83	1.25
28.....	1.14	1.38	1.54	2.72	2.24	1.34	.8	.6	.69	.7	1.0	1.12
29.....	1.13	.....	1.43	2.85	2.2	1.3	.8	.6	.7	.7	1.2	1.15
30.....	1.06	.....	1.52	2.59	2.22	1.28	.8	.6	.73	.7	1.12	.....
31.....	1.14	.....	1.49	.....	2.2	.....	.75	.68	.....	.7	.....	1.23

Station rating table for Little Truckee River at Pine Station, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.60	35	1.20	107	1.80	270	2.40	531
0.70	45	1.30	126	1.90	307	2.50	580
0.80	55	1.40	148	2.00	347	2.60	630
0.90	66	1.50	174	2.10	390	2.70	681
1.00	78	1.60	203	2.20	436	2.80	733
1.10	91	1.70	235	2.30	483	2.90	786

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 2.1 feet.

Estimated monthly discharge of Little Truckee River at Pine Station, Cal., for 1905.

[Drainage area, 166 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.....	126	77	101	6,210	.608	.701
February.....	144	57	89.0	4,943	.536	.558
March.....	277	139	188	11,560	1.13	1.30
April.....	760	183	334	19,870	2.01	2.24
May.....	640	307	477	29,330	2.87	3.31
June.....	483	122	337	20,050	2.03	2.26
July.....	148	50	86.3	5,306	.520	.600
August.....	60	33	42.1	2,589	.254	.293
September.....	48	33	37.4	2,226	.225	.251
October.....	45	42	44.2	2,718	.266	.307
November.....	107	40	55.4	3,296	.334	.373
December.....	126	78	106	6,518	.637	.734
The year.....	760	33	158	114,600	.952	12.93

NOTE.—Ice conditions not known; open-channel rating table applied to the winter months without correction.

#### INDEPENDENCE CREEK BELOW INDEPENDENCE LAKE, CAL.

Independence Creek flows from the east end of Independence Lake northeastward into Little Truckee River.

The gaging station was established October 24, 1902. It is located about one-eighth of a mile below the dam at the lower end of Independence Lake, Cal.

The channel is straight for 50 feet above and below the station. The banks are low and subject to overflow. The bed of the stream is permanent, being composed of gravel and clay, but during high water large quantities of sand are washed down the creek. The current is moderately rapid and the discharge is controlled by the dam at the end of the lake.

Discharge measurements are made from a cable and car.

The gage, which is read twice daily by William Schweinberger, consisted originally of a vertical 4 by 4 inch timber, located about 200 feet upstream from the cable. For the convenience of the observer a new vertical gage, made of 2 by 4 inch timber, was established July 1, 1904, on the left bank of the stream 75 feet below the outlet of the lake. Simultaneous readings taken on the two gages give identical results for the fluctuations of 1904. The bench mark for the original gage consists of three nails driven into the root of a pine tree 55 feet northwest of the gage; elevation above zero of gage, 5.82 feet. The bench mark for

the new gage is the head of four nails driven into the tree stump to which the new gage rod is fastened; elevation above zero of new gage, 3.00 feet.

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

Description: 85, p 121; 100, p 197; 133, p 315.  
 Discharge: 85, p 122; 100 p 197; 133, p 315.  
 Discharge, monthly: 100, p 199; 133, p 317.  
 Gage heights: 85, p 122; 100, p 198; 133, p 316.  
 Rating table: 100, p 199; 133, p 317.

*Discharge measurements of Independence Creek below Independence Lake, Cal., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
June 12.....	W. A. Wolf.....	28	62	1.24	3.25	77
June 26.....	do.....		3	1.00	1.80	3
July 7.....	do.....	11	9	1.67	2.30	15
August 3.....	do.....	6	3	1.48	2.00	4.3
September 11.....	do.....				1.70	a.5

a Estimated.

*Daily gage height, in feet, of Independence Creek below Independence Lake, Cal., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.1	2.7	2.5	2.7	3.28	3.2	1.88	2.0	1.65	1.5	1.5	2.18
2.....	2.1	2.58	2.5	2.7	3.5	3.2	2.0	2.0	1.65	1.5	1.5	2.15
3.....	2.15	2.4	2.5	2.45	3.5	3.1	2.1	2.0	1.65	1.5	1.45	2.12
4.....	2.15	2.3	2.5	2.25	3.5	3.1	2.2	2.0	1.65	1.5	1.45	2.1
5.....	2.15	2.2	2.5	2.25	3.5	3.1	2.25	2.0	1.65	1.5	1.45	2.3
6.....	2.18	2.2	2.5	2.25	3.35	3.1	2.3	2.0	1.65	1.5	1.45	2.5
7.....	2.2	2.2	2.5	2.25	3.15	3.05	2.3	1.95	1.65	1.5	1.45	2.25
8.....	2.2	2.2	2.5	2.28	3.1	3.08	2.3	1.95	1.65	1.5	1.45	2.0
9.....	2.2	2.2	2.5	2.3	3.05	3.1	2.3	1.95	1.65	1.5	1.45	2.0
10.....	2.2	2.2	2.5	2.3	3.15	3.15	2.25	1.95	1.65	1.5	1.38	1.98
11.....	2.22	2.2	2.5	2.3	2.7	3.18	2.25	1.9	1.65	1.5	2.35	1.96
12.....	2.25	2.2	2.5	2.3	2.7	3.2	2.25	1.9	1.6	1.5	2.3	1.95
13.....	2.32	2.2	2.5	2.3	2.7	3.2	2.2	1.9	1.6	1.5	2.25	1.92
14.....	2.52	2.22	2.5	2.3	2.7	3.2	2.18	1.9	1.6	1.5	2.2	1.9
15.....	2.6	2.25	2.5	2.3	2.7	3.22	2.1	1.9	1.6	1.5	2.2	1.88
16.....	2.6	2.25	2.5	2.3	2.7	3.22	2.1	1.85	1.6	1.5	2.15	1.88
17.....	2.6	2.25	2.5	2.3	2.88	3.2	2.1	1.85	1.55	1.5	2.15	1.85
18.....	2.62	2.25	2.5	2.65	3.08	3.2	2.05	1.85	1.55	1.5	2.1	1.85
19.....	2.65	2.38	2.5	3.05	3.08	3.2	2.05	1.85	1.55	1.5	2.1	1.9
20.....	2.68	2.48	2.6	3.05	3.28	3.2	2.05	1.85	1.55	1.5	2.15	1.9
21.....	2.88	2.5	2.7	3.05	3.45	3.15	2.08	1.85	1.55	1.5	2.1	1.9
22.....	2.98	2.5	2.7	3.2	3.45	3.15	2.1	1.85	1.55	1.5	2.1	1.85
23.....	2.98	2.5	2.7	3.1	3.45	3.15	2.15	1.85	1.55	1.5	2.1	1.85
24.....	3.02	2.5	2.7	3.1	3.0	3.1	2.2	1.8	1.55	1.5	2.5	1.82
25.....	3.12	2.5	2.8	3.1	2.55	3.08	2.2	1.75	1.55	1.5	2.5	1.84
26.....	3.25	2.5	2.72	3.1	2.55	2.4	2.15	1.75	1.55	1.5	2.25	1.8
27.....	3.25	2.5	2.75	3.1	2.55	1.8	2.1	1.7	1.55	1.5	2.12	1.85
28.....	3.08	2.5	2.75	3.1	3.05	1.8	2.1	1.7	1.5	1.5	2.15	1.85
29.....	2.85		2.75	3.1	3.08	1.82	2.05	1.68	1.5	1.5	2.2	1.9
30.....	2.85		2.75	3.1	3.18	1.88	2.05	1.65	1.5	1.5	2.2	1.9
31.....	2.85		2.75		3.2		2.05	1.65		1.5		1.98

Station rating table for Independence Creek below Independence Lake, Cal., from January 1, 1904, to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.30	0.3	1.00	3.4	2.50	23	3.10	107
1.40	.4	2.00	4.7	2.60	30	3.20	127
1.50	.5	2.10	6.7	2.70	40	3.30	148
1.60	.9	2.20	9.5	2.80	53	3.40	170
1.70	1.5	2.30	13	2.90	69	3.50	192
1.80	2.3	2.40	17	3.00	87		

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 3.25 feet. Below 2 feet the table is rather uncertain.

Estimated monthly discharge of Independence Creek below Independence Lake, Cal., for 1905.  
[Drainage area, 8.5 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-foot per square mile.	Depth in inches.
January.....	137	6.7	43.0	2,644	5.06	5.83
February.....	40	9.5	16.4	911	1.93	2.01
March.....	53	23	30.7	1,888	3.61	4.16
April.....	127	11	52.7	3,136	6.20	6.92
May.....	192	26	107	6,579	12.59	14.52
June.....	131	2.3	98.9	5,885	11.64	12.98
July.....	13	3.2	8.2	504	.965	1.11
August.....	4.7	1.2	3.1	191	.365	.419
September.....	1.2	.5	.90	54	.106	.118
October.....	.5	.5	.50	31	.059	.068
November.....	23	.4	7.0	417	.824	.919
December.....	23	2.3	5.1	314	.600	.692
* The year.....	102	.4	31.1	22,550	3.66	49.75

NOTE.—Ice conditions not known; open-channel rating table applied to the winter months without correction.

#### PROSSER CREEK NEAR HOBART MILLS, CAL.

Prosser Creek rises on the eastern slope of the Sierra Nevada in central Sierra County, Cal., flows in a general southeasterly direction, and unites with Truckee River near Prosser.

The station was established June 27, 1903. It is located about 150 feet below the wagon bridge and the road house on the Boca and Truckee highway, 4 miles from Truckee and 3 miles from Hobart Mills. Alder Creek joins Prosser Creek about 200 feet above the station. The nearest dam is located at the ice pond about 2 miles below the station.

The channel is straight for 150 feet above and 200 feet below the cable. The creek bends at the highway bridge. Both banks are high and are not subject to overflow. The right bank is wooded; the left is cleared except for a few willows. The bed is composed of coarse gravel and is free from vegetation. There is but one channel at all stages.

Discharge measurements are made from a wooden car running on a three-eighths inch steel cable, which is stretched across the river about 5 feet above high-water level. A tag wire is stretched just above the cable.

The original gage consisted of a 2 by 4 inch vertical timber. It was located on the left or north bank 50 feet upstream from the cable. The old gage, the zero of which was 9.87 feet below the bench mark, was washed out by a flood February 24, 1904. A new gage was established at the same point, with its zero 9.58 feet below the bench mark. The bench

mark is on the northeast pier of the steel wagon bridge, and is the top of the steel casing of the concrete pier above the arrow mark.

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

Description: 100, pp 200-201; 133, p 318.

Discharge: 100, p 201; 133, p 318.

Discharge, monthly: 133, p 320.

Gage heights: 100, p 201; 133, p 319.

Rating table: 133, p 319.

*Discharge measurements of Prosser Creek near Hobart Mills, Cal., in 1905.*

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	Feet per second.	Feet.	Second-feet.
May 12.....	W. A. Wolf.....	57	2.22	2.05	129
May 23.....	do.....	69	2.60	2.30	179
June 12.....	do.....	68	2.43	2.25	165
June 26.....	do.....	55	2.20	2.00	120
July 7.....	do.....	55	1.91	1.90	101
July 27.....	do.....			1.25	11

**DONNER CREEK NEAR TRUCKEE, CAL.**

Donner Creek flows from the east end of Donner Lake eastward into Truckee River.

The gaging station was established October 23, 1902. It is located about 150 feet below the dam of the Donner Creek Ice Company and  $1\frac{1}{2}$  miles west of Truckee, Cal.

The channel is straight for 150 feet above and below the cable. Both banks are high and will not overflow. The bed of the stream is composed of gravel, is permanent, and is free from vegetation. There is but one channel at all stages and the current is swift.

Discharge measurements are made by means of a cable and car 50 feet downstream from the gage.

The gage, which is read twice each day by F. R. Williams, is a 4 by 4 inch vertical timber located on the left bank. The bench mark consists of four nails driven into the root of a pine tree 12 inches in diameter 35 feet north of the gage; elevation above zero of gage, 6.30 feet.

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

Description: 85, p 123; 100, p 202; 133, p 320.

Discharge: 51, p 405; 85, p 123; 100, p 202; 133, p 321.

Discharge, monthly: 100, p 204; 133, p 322.

Gage heights: 85, p 123; 100, pp 202-203; 133, p 321.

Rating table: 100, p 203; 133, p 322.

*Discharge measurements of Donner Creek near Truckee, Cal., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
April 15.....	W. A. Wolf.....	36	48	3.27	3.06	157
May 12.....	do.....	36	48	3.25	3.01	156
May 23.....	do.....	38	56	4.00	3.42	224
June 26.....	do.....	20	17	2.18	2.12	37
July 6.....	do.....	10	12	1.34	1.74	16.0
July 31.....	do.....				1.15	1.0
August 2.....	do.....				.90	.2
September 9.....	do.....				1.00	.5

Daily gage height, in feet, of Donner Creek near Truckee, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.9	1.7	3.0	2.7	3.0	3.3	1.0	1.1	1.0	1.0	0.65	2.2
2.....	1.9	1.8	3.0	2.6	3.5	3.2	1.0	.95	2.25	1.0	.75	.0
3.....	1.9	1.8	3.0	2.6	3.45	3.15	1.0	.0	2.2	.95	.8	.0
4.....	1.7	1.8	3.0	2.65	3.4	3.05	1.85	.9	1.1	.95	.8	.0
5.....	1.7	1.8	3.05	2.75	3.35	3.0	1.8	1.0	1.2	.95	.8	.0
6.....	1.7	1.8	3.1	2.8	3.3	3.0	1.75	1.05	1.15	.5	.85	.9
7.....	1.7	1.8	3.1	2.8	3.3	3.0	1.7	1.0	1.0	.45	.9	.9
8.....	1.7	1.7	3.0	2.9	3.3	3.0	1.7	1.0	1.0	1.0	.9	.9
9.....	1.7	1.7	3.0	3.0	3.25	3.0	1.65	1.0	1.0	1.5	.9	.9
10.....	1.6	1.7	3.0	3.1	3.15	3.0	1.6	1.0	1.0	1.6	.9	.9
11.....	1.6	1.7	3.0	3.0	3.1	3.0	1.55	1.0	1.0	1.75	.9	.9
12.....	1.6	1.9	3.0	3.1	3.05	3.0	1.55	1.0	1.0	1.6	.9	.9
13.....	1.6	2.2	3.0	3.1	3.0	2.95	1.5	1.0	1.0	1.8	.9	.9
14.....	1.9	2.	2.9	3.1	3.1	2.95	1.45	1.0	1.0	1.8	.9	.9
15.....	1.9	2.2	2.9	3.1	3.25	2.9	1.5	1.0	1.0	1.55	.9	.9
16.....	1.9	2.2	2.8	3.1	3.5	2.85	1.4	1.0	1.0	1.35	1.2	.9
17.....	1.9	2.2	2.8	3.1	3.55	2.85	1.35	1.0	1.0	1.15	1.15	.9
18.....	1.8	2.2	2.8	3.05	3.6	2.85	1.3	1.0	1.0	1.05	.95	.9
19.....	1.8	2.25	2.8	3.0	3.6	2.8	1.3	1.0	1.0	1.05	.9	.9
20.....	1.7	2.5	2.8	3.0	3.5	2.8	1.25	1.0	1.0	1.0	.9	.9
21.....	1.7	2.4	2.8	3.0	3.5	2.7	1.2	1.0	1.0	1.0	.9	.9
22.....	1.9	2.3	2.8	3.0	3.5	2.55	1.15	1.0	1.0	1.0	.9	.9
23.....	1.8	2.35	2.8	3.05	3.4	2.35	1.1	1.0	1.0	1.45	.9	.9
24.....	1.8	2.35	2.8	3.1	3.4	2.25	1.2	1.0	1.0	1.8	.9	.9
25.....	1.8	3.2	2.8	3.1	3.4	2.2	1.15	1.0	1.0	1.0	.9	.9
26.....	1.7	3.15	2.8	3.5	3.4	2.15	1.15	1.0	1.0	.0	.9	.95
27.....	1.7	3.05	2.8	3.7	3.35	2.1	1.15	1.0	1.0	.0	.9	1.0
28.....	1.8	3.0	2.8	3.6	3.3	2.1	1.15	1.0	1.0	.0	.9	1.0
29.....	1.8	.....	2.8	3.65	3.3	2.0	1.15	1.0	1.0	.15	.9	1.0
30.....	1.7	.....	2.7	3.6	3.3	2.0	1.15	1.0	1.0	.45	.9	1.0
31.....	1.7	.....	2.7	.....	3.3	.....	1.12	1.0	.....	.55	.....	1.0

Station rating table for Donner Creek near Truckee, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.70	0.0	1.50	8.3	2.30	52	3.10	166
.80	.1	1.60	11.5	2.40	62	3.20	185
.90	.2	1.70	15	2.50	73	3.30	206
1.00	.5	1.80	19	2.60	86	3.40	227
1.10	1.1	1.90	24	2.70	100	3.50	248
1.20	2.0	2.00	29	2.80	115	3.60	269
1.30	3.5	2.10	35	2.90	131	3.70	290
1.40	5.7	2.20	43	3.00	149	.....	.....

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

*Estimated monthly discharge of Donner Creek near Truckee, Cal., for 1905.*

[Drainage area, 30 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.....	24	11.5	17.8	1,094	0.593	0.684
February.....	185	15	53.1	2,949	1.77	1.84
March.....	166	100	130	7,993	4.33	4.99
April.....	290	86	163	9,699	5.43	6.06
May.....	269	148	218	13,400	7.27	8.38
June.....	206	29	114	6,783	3.80	4.24
July.....	24	1.1	8.6	529	.287	.331
August.....	1.1	.2	.51	31	.017	.020
September.....	48	.5	3.6	214	.120	.134
October.....	19	0	4.4	270	.147	.170
November.....	2	0	.29	17	.0097	.011
December.....	43	0	1.6	98	.053	.061
The year.....	290	0	59.6	43,290	1.98	26.92

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

## WALKER RIVER BASIN.

### DESCRIPTION OF BASIN.

Walker River is formed by two branches—East and West forks—which rise on the eastern slopes of the Sierra Nevada, in Mono County, Cal., flow in a general northerly direction, and unite in Lyon County, Nev. From the point of junction the main stream flows northward through Mason Valley, at the upper end of which it turns to the east and south-east and discharges into the north end of Walker Lake.

### WEST FORK OF WALKER RIVER NEAR COLEVILLE, CAL.

This station was established October 5, 1902. The cable is located about 1 mile east of the point where the main road from Topaz to Bridgeport crosses Lost Canyon Creek and is 600 feet from the road. The gage is about one-half mile above the cable.

The channel is straight for 150 feet above and below the station. The right bank is low and rocky and is liable to overflow; the left is high and rocky and will not overflow. The bed of the stream is rocky and uneven. There is but one channel at all stages and the current is swift.

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, which is read once each day by J. S. Trumbull, is a 4 by 4 inch vertical timber on the left bank, about 300 feet from the observer's house. The bench mark is a spike driven into the tree to which the gage is fastened; elevation above zero of gage, 6.00 feet.

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

Description: 85, p 108; 100, pp 172-173; 133, p 323.

Discharge: 85, p 108; 100, p 173; 133, p 323.

Discharge, monthly: 100, p 174; 133, p 325.

Gage heights: 85, p 108; 100, p 173; 133, p 324.

Rating table: 100, p 174; 133, p 324.

*Discharge measurements of West Fork of West Walker River near Coleville, Cal., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
May 3.....	J. L. Brambila.....	51	100	3.20	2.50	340
May 11.....	do.....	48	08	2.37	2.15	232
May 24.....	do.....	55	105	5.13	3.45	846
June 6.....	do.....	55	160	4.11	3.10	657
June 20.....	do.....	55	160	4.35	3.20	604
July 8.....	do.....	55	147	4.40	3.10	645
July 24.....	do.....	47	99	2.04	2.00	202
July 25.....	do.....	54	134	2.48	2.30	333
August 30.....	W. A. Wolf.....	50	82	.09	1.30	81

*Daily gage height, in feet, of West Fork of Walker River near Coleville, Cal., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.3	1.4	1.5	1.7	2.0	3.1	2.0	1.0	1.2	1.2	1.1	0.0
2.....	1.3	1.4	1.5	1.7	2.7	3.1	2.0	1.0	1.1	1.2	1.1	.0
3.....	1.2	1.4	1.5	1.8	2.7	3.0	2.8	1.8	1.2	1.2	1.1	1.1
4.....	1.2	1.4	1.0	1.8	2.0	3.1	2.7	1.8	1.2	1.2	1.0	1.1
5.....	1.2	1.3	1.7	2.0	2.1	3.1	2.6	1.8	1.2	1.2	1.1	1.1
6.....	1.2	1.3	1.7	2.1	2.3	3.0	2.7	1.7	1.2	1.05	1.1	1.1
7.....	1.2	1.4	1.7	2.1	2.3	2.9	2.7	1.6	1.2	1.1	1.1	1.1
8.....	1.2	1.4	1.7	2.1	2.2	3.0	2.8	1.6	1.2	1.1	1.1	1.1
9.....	1.2	1.4	1.7	2.2	2.2	3.1	2.8	1.0	1.2	1.05	1.1	1.2
10.....	1.2	1.3	1.7	2.1	2.1	3.2	2.7	1.6	1.1	1.05	1.1	1.2
11.....	1.2	1.3	1.7	2.1	2.1	3.5	2.7	1.5	1.1	1.05	1.1	1.1
12.....	1.2	1.3	1.7	2.1	2.2	3.7	2.6	1.5	1.1	1.05	.0	1.1
13.....	1.2	1.3	1.7	2.1	2.3	3.0	2.5	1.5	1.1	1.05	.0	1.1
14.....	1.2	1.3	1.7	2.1	2.0	3.0	2.5	1.5	1.1	1.05	.8	1.1
15.....	1.2	1.3	1.7	2.0	3.4	3.8	2.4	1.5	1.1	1.05	.8	1.2
16.....	1.2	1.4	1.7	2.1	3.5	3.6	2.4	1.5	1.1	1.0	.8	1.2
17.....	1.2	1.4	1.7	2.1	3.5	3.6	2.3	1.4	1.1	1.0	.0	1.1
18.....	1.2	1.3	1.8	2.2	3.6	3.7	2.2	1.4	1.1	1.0	.0	1.1
19.....	1.2	1.3	1.8	2.2	3.5	3.8	2.1	1.4	1.1	1.0	.0	1.1
20.....	1.3	1.3	1.8	2.1	3.5	3.9	2.1	1.4	1.05	1.0	.0	1.1
21.....	1.3	1.3	1.7	2.0	3.4	3.8	2.2	1.4	1.05	1.0	.0	1.1
22.....	1.3	1.3	1.7	2.1	3.3	3.7	2.2	1.4	1.05	1.0	.8	1.1
23.....	1.3	1.3	1.6	2.2	3.2	3.5	2.2	1.4	1.05	1.0	.0	1.1
24.....	1.4	1.3	1.6	2.2	3.3	3.3	2.2	1.4	1.05	1.0	.0	1.2
25.....	1.4	1.4	1.6	2.4	3.3	3.1	2.2	1.3	1.05	1.0	.8	1.2
26.....	1.3	1.4	1.6	2.5	3.2	3.0	2.1	1.3	1.05	1.0	.0	1.2
27.....	1.3	1.4	1.6	2.4	3.0	2.9	2.1	1.2	1.05	1.0	.0	1.1
28.....	1.3	1.5	1.6	2.0	2.9	2.8	2.1	1.2	1.2	1.0	.0	1.1
29.....	1.3		1.6	3.1	2.8	2.8	2.0	1.2	1.2	1.0	1.1	.0
30.....	1.3		1.8	3.1	3.0	2.9	2.0	1.2	1.2	1.0	1.1	.0
31.....	1.3		1.7		3.1		2.0	1.2		1.0		.0

Station rating table for West Fork of Walker River near Coleville, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
<i>Fect.</i>	<i>Second-feet.</i>	<i>Fect.</i>	<i>Second-feet.</i>	<i>Fect.</i>	<i>Second-feet.</i>	<i>Fect.</i>	<i>Second-feet.</i>
0.80	44	1.60	121	2.40	317	3.20	702
.90	50	1.70	138	2.50	353	3.30	762
1.00	56	1.80	157	2.60	393	3.40	823
1.10	62	1.90	178	2.70	436	3.50	886
1.20	70	2.00	201	2.80	483	3.60	952
1.30	80	2.10	226	2.90	534	3.70	1,020
1.40	92	2.20	254	3.00	588	3.80	1,090
1.50	106	2.30	284	3.10	644	3.90	1,160

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905. It is well defined between gage heights 1.2 feet and 3.5 feet.

Estimated monthly discharge of West Fork of Walker River near Coleville, Cal., for 1905.  
[Drainage area, 306 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.....	92	70	75.3	4,630	0.246	0.284
February.....	106	80	86.1	4,782	.281	.293
March.....	157	106	133	8,178	.435	.502
April.....	644	138	266	15,830	.800	.970
May.....	952	226	558	34,310	1.82	2.10
June.....	1,160	483	701	47,070	2.58	2.88
July.....	534	201	334	20,540	1.09	1.26
August.....	178	70	107	6,570	.350	.404
September.....	70	50	64.1	3,814	.209	.233
October.....	70	50	59.4	3,052	.194	.224
November.....	178	44	58.1	3,457	.190	.212
December.....	70	50	61.0	3,800	.202	.233
The year.....	1,160	44	216	150,600	.706	0.60

NOTE.—Ice conditions not known. Open-channel rating table applied to winter months without correction.

#### WEST FORK OF WALKER RIVER NEAR YERINGTON, NEV.

This station was established October 6, 1902. It is located at Ross Ranch, about 10 miles southeast of Yerington, Nev., just above the point where the road crosses the river.

The channel is straight for 200 feet above and for 100 feet below the station. At low water the sand bar in the middle of the stream divides the channel into two parts. Both banks are low and are liable to overflow. The bed of the stream is composed of sand and clay and shifts somewhat. The current has a moderate velocity.

Discharge measurements are made by means of a cable and ear. The initial point for soundings is the zero of the tagged wire.

The gage, which is read once each day by I. A. Strosnider, the ranch owner, is a vertical 4 by 4 inch timber fastened to the right bank just below the cable. The bench mark consists of three nails and a spike in a stump 6 inches in diameter 15 feet east of the gage; elevation above zero of gage, 5.85 feet.

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

Description: 85, p 107; 100, p 170; 133, p 325.  
Discharge: 85, p 108; 100, p 170; 133, p 326.

Discharge, monthly: 100, p 172; 133, p 327.  
 Gage heights: 85, p 108; 100, pp 170-171; 133, p 326.  
 Rating table: 100, p 171; 133, p 327.

*Discharge measurements of East Fork of Walker River near Yerington, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
May 4.....	J. L. Brambila.....	50	36	1.86	1.80	67
May 9.....	do.....	73	36	1.92	1.79	69
May 18.....	do.....	73	54	2.10	2.50	113
May 23.....	do.....	54	37	2.20	1.92	81
June 5.....	do.....	49	28	2.14	1.90	60
June 15.....	do.....	72	70	2.43	2.40	170
June 19.....	do.....	73	99	2.04	2.75	291
June 30.....	do.....	71	69	2.27	2.35	156
July 7.....	do.....	72	64	2.19	2.30	141
July 26.....	do.....	71	48	1.73	2.08	82
July 28.....	do.....	72	51	1.66	2.05	84

*Daily gage height, in feet, of East Fork of Walker River near Yerington, Nev., for 1905.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.1	2.2	2.4	2.2	1.5	2.1	2.3	1.9	1.6	1.7	1.9	2.0
2.....	2.1	2.2	2.4	2.2	1.5	2.1	2.35	1.9	1.6	1.7	1.9	2.0
3.....	2.1	2.2	2.4	2.2	1.5	2.05	2.4	1.9	1.6	1.7	1.9	2.0
4.....	2.1	2.2	2.4	2.2	1.5	2.05	2.4	1.8	1.7	1.7	1.9	1.9
5.....	2.1	2.3	2.35	2.2	1.45	2.0	2.4	1.8	1.7	1.7	1.9	1.9
6.....	2.1	2.3	2.3	2.2	1.4	1.9	2.3	1.8	1.7	1.7	1.9	1.9
7.....	2.1	2.3	2.3	2.2	1.4	1.9	2.3	1.8	1.7	1.7	1.9	1.9
8.....	2.1	2.3	2.3	2.2	1.4	1.9	2.25	1.8	1.7	1.7	1.9	1.9
9.....	2.1	2.3	2.3	2.2	1.4	1.9	2.2	1.8	1.7	1.7	1.9	1.9
10.....	2.1	2.3	2.3	2.2	1.4	1.9	2.2	1.7	1.6	1.6	1.9	1.9
11.....	2.1	2.3	2.3	2.2	1.4	2.0	2.2	1.7	1.6	1.6	1.9	1.9
12.....	2.1	2.3	2.3	2.1	1.4	2.1	2.3	1.7	1.6	1.6	1.9	1.9
13.....	2.15	2.3	2.3	2.1	1.45	2.2	2.3	1.7	1.6	1.6	1.9	1.9
14.....	2.2	2.3	2.3	2.1	1.45	2.3	2.2	1.7	1.6	1.6	1.9	1.9
15.....	2.2	2.3	2.3	2.1	1.65	2.4	2.1	1.7	1.6	1.6	1.9	1.9
16.....	2.2	2.3	2.2	2.1	1.75	2.5	2.0	1.7	1.6	1.7	1.9	1.9
17.....	2.2	2.3	2.2	2.1	2.0	2.65	2.0	1.6	1.7	1.7	1.9	1.9
18.....	2.2	2.3	2.2	2.0	2.2	2.7	2.0	1.6	1.7	1.7	1.9	1.9
19.....	2.2	2.4	2.2	2.0	2.2	2.7	2.0	1.6	1.7	1.7	1.9	1.9
20.....	2.2	2.4	2.2	2.0	2.2	2.75	1.95	1.6	1.7	1.7	2.0	1.9
21.....	2.2	2.4	2.2	1.9	2.1	2.75	1.9	1.6	1.7	1.7	2.0	1.9
22.....	2.2	2.4	2.2	1.9	2.1	2.75	1.95	1.75	1.7	1.7	2.0	1.9
23.....	2.2	2.4	2.2	1.9	2.1	2.85	2.1	1.8	1.7	1.8	2.0	1.9
24.....	2.2	2.4	2.2	1.8	2.0	2.85	2.1	1.8	1.7	1.8	2.0	1.9
25.....	2.2	2.4	2.2	1.8	2.0	2.75	2.1	1.8	1.7	1.8	2.0	1.9
26.....	2.2	2.4	2.2	1.7	2.0	2.55	2.1	1.7	1.7	1.8	2.0	1.9
27.....	2.2	2.4	2.2	1.7	2.0	2.4	2.1	1.7	1.7	1.9	2.0	1.9
28.....	2.2	2.4	2.2	1.75	2.2	2.3	2.05	1.7	1.7	1.9	2.0	1.9
29.....	2.2	.....	2.2	1.6	2.2	2.35	2.0	1.7	1.8	1.9	2.0	1.9
30.....	2.2	.....	2.2	1.6	2.1	2.4	2.0	1.6	1.8	1.9	2.0	1.9
31.....	2.2	.....	2.2	.....	2.1	.....	1.9	1.6	.....	1.9	.....	1.9

Daily discharge, in second-feet, of East Fork of Walker River near Yerington, Nev., for 1905.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1.....	37	91	140	12.....	15	109	134	22.....	94	280	69
2.....	37	91	150	13.....	18	125	134	23.....	110	304	90
3.....	37	84	160	14.....	18	150	116	24.....	95	304	90
4.....	37	79	162	15.....	25	170	100	25.....	95	275	83
5.....	32	72	162	16.....	34	191	80	26.....	87	210	83
6.....	27	60	143	17.....	46	237	80	27.....	87	170	83
7.....	27	60	143	18.....	69	262	80	28.....	118	150	84
8.....	25	66	130	19.....	69	291	80	29.....	115	156	78
9.....	25	60	123	20.....	81	306	73	30.....	98	156	78
10.....	25	72	123	21.....	82	306	63	31.....	98	.....	65
11.....	25	80	115								

NOTE.—Discharge applied by indirect method for shifting channels. As no measurements were made January–April and August–December no estimates for these months can be made.

Estimated monthly discharge of East Fork of Walker River near Yerington, Nev., for 1905.

[Drainage area, 1,103 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.....	118	15	57.7	3,548	0.052	0.060
June.....	300	60	167	9,937	.151	.168
July.....	166	63	107	6,579	.097	.112

#### WALKER RIVER NEAR WABUSKA, NEV.

This station was established July 22, 1902, and equipped December 12, 1902. It is located about 300 feet above the Carson and Colorado Railroad bridge, near the section house at Clever station, and about 2½ miles east of Wabuska.

The channel is straight for 150 feet above the station and slightly curved for the same distance below. Both banks are high and are not liable to overflow. The bed of the stream is sandy and shifting. There is but one channel at all stages. The current has a moderate velocity, and the discharge is small from August to October.

Discharge measurements are made by means of a cable and car 35 feet below the gage. The initial point for soundings is the zero of the tagged wire.

The gage is read twice each day by Charles Nelson. The original gage was washed out December 30, 1903. A new gage, consisting of a 1 by 4 inch board fastened to a vertical 4 by 4 inch timber, was installed January 17, 1904. It is on the left bank, 15 feet below the point at which the old gage was located and 150 feet south of the section house. The datum is the same as that of the original gage. The bench mark consists of four nails driven into the northwest corner of the pump platform 35 feet east of the gage; elevation above zero of gage, 6.94 feet.

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

- Description: 85, p 106; 100, p 167; 133, p 328.
- Discharge: 85, p 107; 100, p 168; 133, p 328.
- Discharge, monthly: 100, p 169; 133, p 330.
- Gage heights: 85, p 107; 100, p 168; 133, p 329.
- Rating table: 100, p 169; 133, p 329–330.

## Discharge measurements of Walker River near Wabuska, Nev., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
May 5.....	J. L. Brambilla.....	74	64	1.46	1.58	94
May 8.....	do.....	73	50	1.42	1.39	71
May 19.....	do.....	78	136	2.43	2.30	330
May 22.....	do.....	72	118	2.55	2.30	304
June 4.....	do.....	70	69	1.79	1.60	124
June 18.....	do.....	74	186	2.08	2.80	536
July 1.....	do.....	70	64	1.78	1.40	114
July 6.....	do.....	67	37	1.54	1.10	57
July 27.....	do.....	15			.60	a 34

a Estimated.

## Daily gage height, in feet, of Walker River, near Wabuska, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.1	1.02	1.98	1.95	1.28	1.72	1.4	0.6	0.45	0.5	0.45	0.75
2.....	2.05	2.0	2.0	2.0	1.68	1.7	1.4	.55	.45	.5	.45	.75
3.....	2.05	2.05	2.0	2.0	1.75	1.7	1.33	.55	.45	.5	.45	.7
4.....	2.0	2.1	2.0	1.98	1.7	1.62	1.28	.55	.45	.5	.45	.75
5.....	2.0	2.1	2.0	1.94	1.63	1.6	1.2	.55	.45	.5	.45	.8
6.....	2.0	2.05	2.02	1.92	1.58	1.65	1.2	.55	.45	.5	.45	.95
7.....	2.0	2.05	2.05	1.82	1.48	1.72	1.13	.65	.45	.5	.45	.95
8.....	2.0	2.02	2.05	1.8	1.4	1.82	1.1	.5	.45	.5	.45	1.0
9.....	2.0	2.0	2.05	1.8	1.4	1.92	1.1	.5	.45	.5	.45	1.0
10.....	2.0	1.95	2.05	1.8	1.35	1.95	1.1	.5	.45	.5	.45	1.0
11.....	2.0	1.92	2.05	1.8	1.35	1.98	1.08	.5	.45	.45	.45	1.0
12.....	2.0	1.9	2.05	1.8	1.28	2.13	1.02	.5	.45	.45	.45	1.0
13.....	2.0	1.87	2.08	1.7	1.25	2.33	1.0	.5	.45	.45	.45	1.0
14.....	1.95	1.85	2.1	1.6	1.25	2.05	1.0	.5	.45	.45	.45	.95
15.....	1.95	1.82	2.1	1.62	1.3	2.88	.95	.5	.45	.45	.45	.95
16.....	1.9	1.78	2.1	1.48	1.3	2.83	.9	.5	.45	.45	.45	.95
17.....	1.85	1.75	2.1	1.42	1.3	2.78	.85	.5	.45	.45	.45	.95
18.....	1.85	1.72	2.15	1.4	1.58	2.78	.85	.5	.45	.45	.45	.95
19.....	1.8	1.8	2.15	1.38	2.38	2.78	.8	.5	.45	.45	.45	.95
20.....	1.8	1.85	2.15	1.35	2.4	2.7	.8	.45	.45	.45	.45	.95
21.....	1.85	1.85	2.15	1.35	2.3	2.63	.8	.45	.45	.45	.5	.95
22.....	1.9	1.88	2.15	1.32	2.3	2.6	.8	.45	.45	.45	.55	.95
23.....	1.9	1.9	2.15	1.3	2.15	2.6	.75	.48	.45	.45	.7	.95
24.....	1.9	1.9	2.1	1.28	1.9	2.55	.68	.5	.45	.45	.65	.95
25.....	1.9	1.9	2.1	1.22	1.85	2.43	.68	.5	.45	.45	.65	.95
26.....	1.9	1.9	2.08	1.2	1.9	2.15	.6	.5	.45	.45	.7	.95
27.....	1.9	1.9	2.02	1.2	2.05	1.7	.6	.5	.45	.45	.7	1.0
28.....	1.9	1.95	2.0	1.2	2.05	1.45	.6	.5	.45	.45	.7	1.0
29.....	1.9		2.0	1.15	2.0	1.38	.6	.45	.45	.45	.7	1.0
30.....	1.9		2.0	1.15	1.9	1.33	.6	.45	.5	.45	.75	1.0
31.....	1.9		2.0		1.82		.6	.45		.45		1.0

NOTE.—Ice conditions not known.

Station rating table for Walker River near Wabuska, Nev., from May 1 to June 15, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.20	40	1.70	135	2.20	280	2.60	440
1.30	56	1.80	159	2.30	316	2.70	488
1.40	73	1.90	185	2.40	354	2.80	538
1.50	92	2.00	214	2.50	395	2.90	588
1.60	113	2.10	246				

The above table is based on six discharge measurements made during 1905. Estimates only approximate owing to shifting character of stream bed.

Station rating table for Walker River near Wabuska, Nev., from June 16 to July 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.60	30	1.20	84	1.80	180	2.40	306
0.70	36	1.30	97	1.90	210	2.50	405
0.80	44	1.40	111	2.00	236	2.60	447
0.90	53	1.50	127	2.10	264	2.70	491
1.00	62	1.60	144	2.20	295	2.80	538
1.10	72	1.70	164	2.30	329		

The above table is based on four discharge measurements made during 1905. Estimates only approximate owing to shifting character of stream bed.

Estimated monthly discharge of Walker River near Wabuska, Nev., for 1905.

[Drainage area, 2,420 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.....	354	48	140	9,162	0.082	0.071
June.....	578	101	295	17,550	.122	.136
July.....	111	30	58.3	3,585	.024	.028

## CARSON RIVER BASIN,

### DESCRIPTION OF BASIN.

Carson River has its sources on the eastern slopes of the Sierra Nevada in Alpine County, Cal. Flowing northward into Nevada, East and West forks unite near Genoa, in the upper Carson Valley. At Empire, 3 miles east of the city of Carson, the river turns to the northeast and enters a deep canyon, through which it flows for several miles, emerging into a second, smaller valley a short distance above the town of Dayton. After leaving this valley it passes through two shorter canyons and one rather large valley before entering lower Carson Valley, or Carson Sink Valley, as it is also known, and discharging its waters into Carson Sink.

## WEST FORK OF CARSON RIVER NEAR WOODFORDS, CAL.

West Fork of Carson River rises in Alpine County, Cal., flows in a general northerly direction, and unites with East Fork in Douglas County, Nev.

The gaging station was established October 18, 1900. It is located about three-fourths of a mile above the post-office at Woodfords, Cal., and 200 feet from the main road between Woodfords and Blue Lakes.

The channel is straight for 100 feet above and below the cable. Both banks are high and rocky and are not liable to overflow. The bed of the stream is rocky and uneven and is permanent. There is but one channel at all stages. At high water the velocity of the current is too great for accurate measurement.

Discharge measurements are made by means of a cable and car just below the gage. The initial point for soundings is the zero of the tagged wire.

The gage, which is read once each day by Miss Bernice Merrill, is a vertical board nailed to a cottonwood tree on the left bank.

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

Description: WS 51, p 400; 66, p 109; 85, pp 113-114; 100, p.180; 133, p 331.

Discharge: WS 66, p 109; 85, p 114; 100, p 181; 133, p 331.

Discharge, monthly: Ann 11, II, p 102; 12, II, pp 351, 360; 13, III, p 90, 14, II, p 118; WS 75, p 188; 85, p 115; 100, p.182; 133, p 333.

Discharge, yearly: Ann 13, III, p 90; 20, IV, p 59.

Gage heights: WS 51, p 401; 66, p 110; 85, p 114; 100, p 181; 133, p 332.

Rating tables: WS 66, p 175; 85, p 115; 100, p 182; 133, p 332.

*Discharge measurements of West Fork of Carson River near Woodfords, Cal., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
April 1.....	W. A. Wolf.....	28	53	1.60	2.85	88
April 20.....	do.....	31	72	2.59	3.55	186
May 2.....	J. L. Brambila.....	30	89	3.60	3.95	328
May 12.....	do.....	29	80	2.61	3.50	210
May 16.....	do.....	35	113	3.50	4.40	308
May 25.....	do.....	30	95	3.19	4.15	305
May 30.....	do.....	30	95	3.11	4.00	298
June 7.....	do.....	30	80	2.77	3.75	223
June 12.....	do.....	30	95	3.04	4.10	288
June 22.....	do.....	30	70	2.48	3.60	188
June 28.....	do.....	30	57	2.09	3.20	110
July 10.....	do.....	30	52	2.00	2.90	104
July 22.....	do.....	29	46	1.57	2.50	72
July 30.....	do.....	28	34	1.30	2.35	44
August 29.....	W. A. Wolf.....	28	26	.66	2.10	25

Daily gage height, in feet, of West Fork of Carson River near Woodfords, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		2.07	3.05	2.03	4.10	3.85	3.1	2.3	2.0	2.2	2.2	2.3
2.		3.01	3.18	2.93	4.2	3.8	3.05	2.35	2.0	2.15	2.2	2.3
3.		3.01	3.05	2.97	3.0	3.75	3.05	2.2	2.0	2.1	2.2	2.3
4.		2.97	3.05	2.89	3.85	3.55	2.97	2.3	2.0	2.1	2.2	2.3
5.		2.93	3.05	2.80	3.7	3.5	2.8	2.25	2.05	2.1	2.2	2.4
6.		3.01	2.07	2.07	3.7	3.55	2.80	2.25	2.0	2.15	2.2	2.4
7.		3.05	3.01	3.05	3.05	3.7	2.80	2.25	2.0	2.15	2.2	2.5
8.	2.77	3.05	3.05	3.14	3.0	3.05	2.75	2.15	2.0	2.2	2.2	2.4
9.	2.81	3.05	3.23	3.23	3.0	3.0	2.80	2.15	2.0	2.2	2.2	2.5
10.	2.81	3.14	3.23	3.41	3.05	3.7	3.14	2.25	2.0	2.2	2.2	2.5
11.	2.85	3.05	3.14	3.41	3.0	3.75	3.05	2.2	2.0	2.2	2.2	2.5
12.	2.80	3.05	3.05	3.30	3.05	3.8	3.05	2.2	2.0	2.2	2.2	2.5
13.	2.85	2.97	3.05	3.30	3.8	3.75	2.85	2.15	2.0	2.2	2.2	2.5
14.	2.85	3.01	3.14	3.30	3.0	3.75	2.75	2.1	2.0	2.2	2.2	2.55
15.	2.80	2.80	3.23	3.81	4.12	3.75	2.05	2.1	2.0	2.15	2.2	2.0
16.	2.81	2.80	3.18	3.85	4.08	3.0	2.05	2.1	2.0	2.15	2.2	2.55
17.	2.81	2.85	3.5	3.75	4.24	3.05	2.55	2.0	2.0	2.1	2.2	2.0
18.	2.85	2.83	3.41	3.7	4.4	3.05	2.0	2.1	2.05	2.15	2.2	2.0
19.	2.85	2.81	3.28	3.0	4.30	3.0	2.55	2.1	2.05	2.15	2.2	2.0
20.	2.85	2.81	3.23	3.5	4.30	3.5	2.5	2.1	2.1	2.15	2.2	2.55
21.	2.81	2.85	3.14	3.85	4.30	3.5	2.5	2.1	2.1	2.2	2.2	2.55
22.	2.80	2.80	3.14	3.85	4.30	3.41	2.45	2.15	2.1	2.2	2.2	2.55
23.	2.93	2.80	3.23	3.05	4.12	3.30	2.45	2.1	2.1	2.2	2.2	2.05
24.	3.05	2.85	3.14	4.12	4.10	3.32	2.5	2.1	2.1	2.2	2.2	2.05
25.	2.97	2.80	3.14	4.10	4.10	3.32	2.45	2.1	2.1	2.2	2.2	2.55
26.	2.93	2.97	3.23	4.10	4.10	3.28	2.4	2.05	2.2	2.2	2.2	2.55
27.	2.85	2.97	3.28	4.24	4.0	3.23	2.45	2.0	2.2	2.2	2.2	2.55
28.	2.81	3.05	3.14	4.32	3.0	3.23	2.4	2.0	2.2	2.2	2.4	2.5
29.	2.81		3.05	4.32	3.8	3.14	2.5	2.0	2.2	2.2	2.45	2.5
30.	2.85		2.80	4.28	3.85	3.18	2.35	2.0	2.2	2.2	2.3	2.5
31.	2.80		2.80		3.0		2.3	2.0		2.2		2.5

Station rating table for West Fork of Carson River near Woodfords, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.00	20	2.70	74	3.30	148	3.00	261
2.10	26	2.80	84	3.40	161	4.00	272
2.20	33	2.90	95	3.50	177	4.10	304
2.30	40	3.00	107	3.60	194	4.20	318
2.40	48	3.10	119	3.70	212	4.30	343
2.50	56	3.20	132	3.80	231	4.40	370
2.60	65						

NOTE.—The above table is applicable only for open channel conditions. It is based on 18 discharge measurements made during 1905. It is fairly well defined.

*Estimated monthly discharge of West Fork of Carson River near Woodfords, Cal., for 1905.*

[Drainage area, 70 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 8-31.....	113	81	91.0	4,332	1.30	1.16
February.....	124	85	102	5,665	1.46	1.52
March.....	177	04	125	7,686	1.79	2.06
April.....	348	04	202	12,620	2.80	3.22
May.....	370	194	271	16,660	3.87	4.46
June.....	241	124	187	11,130	2.67	2.98
July.....	124	40	75.8	4,661	1.08	1.24
August.....	44	20	28.7	1,765	.410	.473
September.....	33	20	23.7	1,410	.339	.378
October.....	33	26	31.3	1,925	.447	.515
November.....	52	33	34.4	2,047	.491	.548
December.....	70	40	56.5	3,474	.807	.930
The period.....				72,780		

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

#### EAST FORK OF CARSON RIVER NEAR GARDNERVILLE, NEV.

East Fork of Carson River rises in southeastern Alpine County, flows in a general north-erly direction, and joins West Fork in Douglas County, Nev.

The gaging station was established October 17, 1900. It is located about 5 miles south-east of Gardnerville, and one-half mile southwest of Rodenbah's ranch. It is within one-half mile of the main traveled road between Carson, Nev., and Bridgeport, Cal., and is about 400 feet above a bridge across the river.

The station is located at the place where measurements were made in 1890, 1891, and 1892.

The channel is straight for 300 feet above and below the station and is broad and shallow. Both banks are high and are not liable to overflow. The bed of the stream is composed of gravel and is permanent. There is but one channel at all stages and the current is moderate.

August 2, 1901, a loose-rock dam was raised a short distance below the gaging station, which affected the velocity at the latter point. This dam was washed out by a freshet December 4, 1901. On or about July 15, 1905, the dam was raised and tightened to such an extent that the water backed up to a point well above the old gage, and for this reason the readings from July 15 to October 8, 1905, are not indicative of the quantity of water flowing in the stream.

Discharge measurements are made by means of a cable and car located at the vertical gage about 400 feet above the bridge. The initial point for soundings is the zero of the tagged wire on the right bank.

The gage is read twice each day by Miss Susie Rodenbah. The original gage was an inclined timber securely fastened to posts set in the right bank of the stream. The bench mark was on a basalt rock in the edge of the stream, 20 feet from the gage and at an elevation of 6.30 feet above gage datum. A new gage was established March 10, 1901, a short distance downstream from the original gage, which had been destroyed. It consists of a vertical timber driven into the stream bed at the right bank and spiked to a cottonwood tree. October 3, 1902, a new inclined gage was installed at a point on the left bank of the

river 600 feet above the cable. During 1904 and up to and including October 8, 1905, gage heights were read on the vertical gage at the cable. On the latter date a new vertical gage was installed at a point about 300 yards above the old gage and firmly fastened to the rocks. The new gage was read from October 8 to the end of the year. The bench mark for the gage at the cable is the top of a granite boulder 20 feet south of the gage; elevation above zero of gage, 8.10 feet. The bench mark for the new gage is a cross cut in a boulder 8 feet northeast of the gage; elevation, 6.36 feet above zero of gage.

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

Description: Ann 14, II, p 110; WS 51, pp 300-400; 60, p 108; 85, pp 111-112; 100, pp. 177-178; 133, p 333-334.

Discharge: WS 66, p 108; 85, p 112; 100, p 178; 133, p 334.

Discharge, monthly: Ann 11, II, p 102; 12, II, pp 351, 360; 13, III, p 95; 14, II, pp. 110-117; WS 76, p. 187; 85, p 113; 100, p 180; 133, p 336.

Discharge, yearly: Ann 13, III, p 99; 20, IV, p 59.

Gage heights: WS 51, p 400; 60, p 109; 85, p 112; 100, pp 178-179; 133, p 335.

Hydrograph: Ann 14, II, p 116.

Rating tables: WS 66, p 175; 85, p 113; 100, p 179; 133, p 336.

*Discharge measurements of East Fork of Carson River near Gardnerville, Nev., in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
April 2.....	W. A. Wolf.....	88	170	1.15	3.80	200
April 21.....	do.....	80	201	1.93	4.15	380
May 2.....	J. L. Bramblin.....	93	256	3.00	4.05	707
May 11.....	do.....	88	206	2.15	4.15	444
May 16.....	do.....	94	277	3.48	5.00	908
May 25.....	do.....	88	201	4.10	5.22	1,205
May 30.....	do.....	88	258	3.40	4.85	877
June 7.....	do.....	80	204	3.48	4.00	826
June 13.....	do.....	90	297	4.00	5.22	1,180
June 21.....	do.....	89	270	3.25	4.85	870
June 28.....	do.....	85	207	2.33	4.25	862
July 9.....	do.....	87	187	1.62	4.00	364
July 24.....	do.....	80	108	.90	3.00	161
July 30.....	do.....	86	171	.61	3.00	105
August 7.....	W. A. Wolf.....	87	147	.70	3.05	60
August 9.....	do.....	87	176	.62	3.93	111
August 31.....	do.....	72	116	.51	3.20	60
November 2.....	John Smith.....	80	127	.59	2.10	71
November 4.....	do.....	80	120	.57	2.10	68

Daily gage height, in feet, of East Fork of Carson River near Gardnerville, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.3	3.58	5.19	3.85	4.5	4.71	4.37	3.79	3.4	3.33	3.3	3.1
2.....	2.32	3.58	5.19	4.3	5.1	4.08	4.25	3.8	3.39	3.33	3.25	3.1
3.....	2.34	3.58	5.2	4.25	5.5	4.3	4.2	3.8	3.39	3.32	3.2	3.1
4.....	2.25	3.6	5.2	4.1	5.2	4.35	4.2	3.82	3.38	3.33	3.2	3.05
5.....	2.24	3.58	4.88	4.15	4.95	4.45	4.19	3.78	3.37	3.4	3.3	3.04
6.....	2.24	3.54	4.8	4.2	4.6	4.56	4.15	3.78	3.37	3.4	3.25	3.04
7.....	2.24	3.54	4.78	4.12	4.15	4.66	4.12	3.72	3.37	3.4	3.2	3.04
8.....	2.65	3.55	4.68	4.12	4.0	4.00	4.12	3.60	3.36	3.3	3.2	3.04
9.....	2.8	3.56	4.62	4.1	3.9	4.75	4.11	3.66	3.36	3.3	3.2	3.03
10.....	2.88	3.58	4.6	3.9	3.8	4.75	4.1	3.95	3.33	3.3	3.2	3.04
11.....	2.08	3.58	4.6	3.85	4.08	4.8	4.05	4.23	3.32	3.32	3.2	3.05
12.....	3.2	4.0	4.45	3.85	3.95	4.9	4.0	.....	3.22	3.3	3.2	3.05
13.....	3.38	4.0	4.5	3.9	4.11	4.95	3.88	4.18	3.21	3.3	3.15	3.05
14.....	3.6	4.12	4.28	3.9	4.65	4.88	3.83	3.65	3.2	3.3	3.15	3.05
15.....	3.65	4.12	4.21	3.92	5.4	4.88	3.78	3.78	3.19	3.3	3.15	3.07
16.....	3.6	4.13	4.19	3.91	6.0	4.85	3.74	3.78	3.19	3.32	3.15	3.09
17.....	3.6	4.14	4.18	3.9	5.75	4.85	3.9	3.75	3.19	3.3	3.15	3.1
18.....	3.62	4.14	4.14	3.89	5.65	4.9	3.85	3.78	3.19	3.3	3.15	3.1
19.....	3.6	4.14	4.05	3.89	5.4	4.93	3.74	3.68	3.19	3.3	3.1	3.1
20.....	3.62	4.50	4.0	3.9	5.49	4.92	3.7	3.64	3.19	3.3	3.1	3.12
21.....	3.63	5.0	3.9	3.92	5.42	4.83	3.71	3.62	3.18	3.3	3.1	3.12
22.....	3.64	5.1	3.95	3.95	5.25	4.8	3.7	3.59	3.18	3.3	3.1	3.12
23.....	3.66	5.14	3.95	3.98	5.15	4.68	3.72	3.59	3.17	3.2	3.1	3.13
24.....	3.65	5.16	3.92	4.0	5.18	4.6	3.72	3.52	3.16	3.2	3.1	3.13
25.....	3.64	5.19	3.95	4.18	5.13	4.63	3.76	3.5	3.15	3.2	3.1	3.13
26.....	3.6	5.12	3.95	4.2	4.97	4.53	3.79	3.5	3.16	3.2	3.1	3.14
27.....	3.6	5.12	3.85	4.21	4.85	4.49	3.84	3.5	3.2	3.2	3.1	3.15
28.....	3.6	5.12	3.8	4.22	4.83	4.41	3.85	3.47	3.3	3.3	3.1	3.15
29.....	3.6	.....	3.8	4.28	4.85	4.39	3.85	3.41	3.4	3.3	3.1	3.16
30.....	3.6	.....	3.8	4.3	4.85	4.38	3.86	3.4	3.33	3.3	3.1	3.16
31.....	3.6	.....	3.85	.....	4.83	.....	3.86	3.4	.....	3.3	.....	3.15

NOTE.—October 8 to December 31, readings made on new gage and reduced to same datum as gage used during the first part of the year.

Station rating table for East Fork of Carson River near Gardnerville, Nev., from January 1 to July 15, 1905.

Gage height.	Discharge.						
Fect.	Second-feet.	Fect.	Second-feet.	Fect.	Second-feet.	Fect.	Second-feet.
2.00	8	2.80	43	3.40	158	4.40	527
2.10	9	2.90	51	3.70	180	4.50	600
2.20	11	3.00	60	3.80	218	4.60	675
2.30	14	3.10	71	3.90	254	4.70	753
2.40	18	3.20	83	4.00	295	4.80	833
2.50	23	3.30	97	4.10	342	4.90	915
2.60	29	3.40	114	4.20	397	5.00	1,000
2.70	36	3.50	134	4.30	459	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during first half of 1904 and 1905, and several low-water measurements of 1903. It is well defined between gage heights 3 feet and 5 feet. Above 5 feet the curve depends on one measurement at gage height 6.15 feet.

Daily gage height, in feet, of East Fork of Carson River near Gardnerville, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.3	3.58	5.10	3.85	4.5	4.71	4.37	3.70	3.4	3.33	3.3	3.1
2.....	2.32	3.58	5.10	4.3	5.1	4.08	4.25	3.8	3.39	3.33	3.25	3.1
3.....	2.34	3.58	5.2	4.25	5.5	4.3	4.2	3.8	3.39	3.32	3.2	3.1
4.....	2.25	3.6	5.2	4.1	5.2	4.35	4.2	3.82	3.38	3.33	3.2	3.05
5.....	2.24	3.58	4.88	4.15	4.95	4.45	4.19	3.78	3.37	3.4	3.3	3.04
6.....	2.24	3.54	4.8	4.2	4.6	4.50	4.15	3.78	3.37	3.4	3.25	3.04
7.....	2.24	3.54	4.78	4.12	4.15	4.66	4.12	3.72	3.37	3.4	3.2	3.04
8.....	2.05	3.55	4.68	4.12	4.0	4.60	4.12	3.66	3.36	3.3	3.2	3.04
9.....	2.8	3.50	4.62	4.1	3.9	4.75	4.11	3.60	3.36	3.3	3.2	3.03
10.....	2.88	3.58	4.6	3.9	3.8	4.75	4.1	3.95	3.33	3.3	3.2	3.04
11.....	2.08	3.58	4.6	3.85	4.08	4.8	4.05	4.23	3.32	3.32	3.2	3.05
12.....	3.2	4.0	4.45	3.85	3.95	4.0	4.0	.....	3.22	3.3	3.2	3.05
13.....	3.38	4.0	4.5	3.9	4.11	4.95	3.88	4.18	3.21	3.3	3.15	3.05
14.....	3.0	4.12	4.28	3.9	4.65	4.88	3.83	3.65	3.2	3.3	3.15	3.05
15.....	3.05	4.12	4.21	3.92	5.4	4.88	3.78	3.78	3.19	3.3	3.15	3.07
16.....	3.0	4.13	4.10	3.91	6.0	4.85	3.74	3.78	3.19	3.32	3.15	3.09
17.....	3.0	4.14	4.18	3.9	5.75	4.85	3.9	3.78	3.19	3.3	3.15	3.1
18.....	3.62	4.14	4.14	3.89	5.65	4.9	3.85	3.78	3.19	3.3	3.15	3.1
19.....	3.0	4.14	4.05	3.89	5.4	4.93	3.74	3.68	3.19	3.3	3.1	3.1
20.....	3.62	4.60	4.0	3.9	5.49	4.92	3.7	3.64	3.19	3.3	3.1	3.12
21.....	3.63	5.0	3.9	3.92	5.42	4.83	3.71	3.62	3.18	3.3	3.1	3.12
22.....	3.04	5.1	3.95	3.95	5.25	4.8	3.7	3.50	3.18	3.3	3.1	3.12
23.....	3.06	5.14	3.95	3.98	5.15	4.68	3.72	3.59	3.17	3.2	3.1	3.13
24.....	3.05	5.16	3.92	4.0	5.19	4.6	3.72	3.52	3.16	3.2	3.1	3.13
25.....	3.04	5.19	3.95	4.18	5.13	4.53	3.76	3.5	3.15	3.2	3.1	3.13
26.....	3.0	5.12	3.95	4.2	4.97	4.53	3.79	3.5	3.16	3.2	3.1	3.14
27.....	3.6	5.12	3.85	4.21	4.85	4.49	3.84	3.5	3.2	3.2	3.1	3.15
28.....	3.0	5.12	3.8	4.22	4.83	4.41	3.85	3.47	3.3	3.3	3.1	3.15
29.....	3.0	.....	3.8	4.28	4.85	4.39	3.85	3.41	3.4	3.3	3.1	3.16
30.....	3.0	.....	3.8	4.3	4.85	4.38	3.86	3.4	3.3	3.3	3.1	3.16
31.....	3.0	.....	3.85	.....	4.83	.....	3.86	3.4	.....	3.3	.....	3.15

NOTE.—October 8 to December 31, readings made on new gage and reduced to same datum as gage used during the first part of the year.

Station rating table for East Fork of Carson River near Gardnerville, Nev., from January 1 to July 15, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.00	8	2.80	43	3.60	158	4.40	527
2.10	9	2.90	51	3.70	186	4.50	600
2.20	11	3.00	60	3.80	218	4.60	675
2.30	14	3.10	71	3.90	254	4.70	753
2.40	18	3.20	83	4.00	295	4.80	833
2.50	23	3.30	97	4.10	342	4.90	915
2.60	29	3.40	114	4.20	397	5.00	1,000
2.70	36	3.50	134	4.30	450	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during first half of 1904 and 1905, and several low-water measurements of 1903. It is well defined between gage heights 3 feet and 5 feet. Above 5 feet the curve depends on one measurement at gage height 6.15 feet.

*Estimated monthly discharge of East Fork of Carson River near Gardnerville, Nev., for 1905.*

[Drainage area, 381 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.....	175.	12	110	6,763	0.289	0.333
February.....	1,166	144	496	27,550	1.30	1.35
March.....	1,175	218	533	32,770	1.40	1.61
April.....	459	236	322	10,160	.845	.943
May.....	1,930	218	940	58,350	2.40	2.87
June.....	958	459	742	44,160	1.05	2.18
July 1-15.....	507	212	340	10,200	.608	.606
The period.....				190,000		

NOTE.—Ice conditions not known. Open-channel rating table applied to winter months without correction.

#### CARSON RIVER NEAR EMPIRE, NEV.

This station was established October 21, 1900. It is located about three-fourths of a mile east of Brunswick Mill and 2½ miles east of Empire, Nev.

The channel is straight for 100 feet above and below the station. Both banks are high, rocky, and will not overflow. The bed of the stream is composed of solid rock, gravel, and cobblestones, and is not likely to shift. At flood stages the stream is too deep and swift for satisfactory measurement; at low water the current is sluggish.

Discharge measurements are made by means of a cable and ear just below the gage. The initial point for soundings is the zero of the tagged wire on the left bank. Low-water measurements are made by wading one-fourth mile below the cable.

The gage is read once each day by David Lloyd. The original gage was located upstream from the site of the present station. February 18, 1901, the erosion of a bar in the channel above the gage caused the division of the stream into two channels, and on this account the present gage was installed March 13, 1901. The gage consists of an inclined 4 by 4 inch timber spiked to a cottonwood tree on the left bank. November 11, 1903, the gage datum was lowered 1.3 feet to enable readings to be made at extreme low water. The gage is referred to bench marks as follows: (1) Top of a bowlder on the left bank 2 feet west of the gage. Its elevation is 7.10 feet above the zero of the gage as originally established and 8.40 feet above the gage in its present position. (2) Top of bowlder on the left bank 10 feet north of the gage. Elevation is 8.38 feet above the zero of the gage as originally established and 9.68 feet above the zero of the gage in its present position.

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 12, ii, p 325; Bull 140, p 212; WS 51, p 401; 60, p 110; 85, p 100; 100, p 175; 133, p 337.

Discharge: Bull 140, p 213; WS 66, p 111; 85, p 100; 100, p 175; 133, p 337.

Discharge, monthly: WS 75, p 189; 85, p 111; 100, p 177; 133, p 339.

Gage heights: Bull 140, p 213; WS 51, p 401; 60, p 111; 85, p 110; 100, p 176; 133, p 338.

Hydrographs: Ann 12, ii, p 324; WS 75, p 189.

Rating tables: WS 66, p 175; 85, p 110; 100, p 176; 133, p 338.

## Discharge measurements of Carson River near Empire, Nev., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Square feet.</i>	<i>Fect per second.</i>	<i>Fect.</i>	<i>Second-feet.</i>
April 3.....	W. A. Wolf.....	79	187	1.92	3.25	356
May 7.....	J. L. Brambila.....	85	266	2.75	4.05	731
May 13.....	.....do.....	85	233	2.08	3.50	480
May 20.....	.....do.....	86	327	3.88	4.80	1,270
May 27.....	.....do.....	85	321	3.54	4.60	1,138
June 3.....	.....do.....	85	275	3.01	4.15	830
June 9.....	.....do.....	83	250	2.51	3.90	642
June 17.....	.....do.....	86	288	3.11	4.30	901
June 24.....	.....do.....	80	231	2.33	3.70	530
July 2.....	.....do.....	80	182	1.85	3.18	338
July 11.....	.....do.....	67	124	.90	2.22	111
July 21.....	.....do.....	57	95	.55	1.05	53

## Daily gage height, in feet, of Carson River near Empire, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.35	2.0	3.1	3.3	4.0	4.4	3.1	1.4	1.1	1.4	2.1	2.2
2.....	3.3	3.2	3.1	3.3	4.5	4.4	3.2	1.4	.8	1.5	2.1	2.2
3.....	2.9	3.2	3.1	3.4	4.4	4.3	3.0	1.3	1.1	1.0	2.0	2.3
4.....	2.9	3.2	3.1	3.4	4.4	4.1	2.9	1.2	.7	1.0	2.0	2.3
5.....	3.0	3.2	3.2	3.4	4.3	4.0	2.7	1.3	.7	1.0	2.0	2.4
6.....	3.0	3.2	3.2	3.5	4.2	3.9	2.5	1.2	1.2	1.7	2.0	2.4
7.....	3.0	3.2	3.2	3.6	4.1	3.9	2.4	1.2	.8	1.8	2.0	2.4
8.....	2.9	3.2	3.2	3.6	4.0	3.9	2.5	1.2	.9	1.7	2.0	2.4
9.....	2.9	3.0	3.2	3.7	3.9	4.0	2.4	1.2	1.3	1.7	2.0	2.4
10.....	2.9	3.0	3.2	3.7	3.8	4.0	2.2	1.3	1.3	1.7	2.0	2.4
11.....	2.9	3.0	3.2	3.9	3.8	4.1	2.2	1.2	1.2	1.8	2.1	2.4
12.....	2.8	2.9	3.2	3.8	3.5	4.3	2.2	1.0	.8	1.8	2.1	2.4
13.....	2.8	3.1	3.2	3.6	3.5	4.5	2.1	1.0	1.2	1.8	2.1	2.4
14.....	2.8	3.1	3.3	3.5	3.5	4.6	2.1	1.1	.7	1.8	2.1	2.4
15.....	3.0	2.9	3.4	3.4	3.7	4.4	2.0	1.2	1.3	1.8	2.1	2.3
16.....	3.0	2.9	3.4	3.6	3.9	4.4	2.0	1.3	.9	1.9	2.1	2.4
17.....	3.0	3.0	3.3	3.6	4.5	4.3	2.0	1.2	1.3	1.9	2.1	2.5
18.....	2.9	3.0	3.3	3.5	4.9	4.3	1.9	1.3	1.3	1.9	2.1	2.4
19.....	2.9	3.0	3.3	3.5	5.0	4.2	1.9	1.3	.9	1.9	2.1	2.3
20.....	2.9	3.0	3.3	3.5	4.8	4.1	1.9	1.3	1.3	2.0	2.1	2.4
21.....	2.9	3.0	3.3	3.3	4.8	4.0	1.8	1.3	.8	2.0	2.1	2.5
22.....	2.9	3.1	3.3	3.3	4.9	3.9	1.8	1.3	1.3	2.0	2.1	2.5
23.....	3.0	3.0	3.2	3.3	4.8	3.9	1.7	1.4	1.4	2.0	2.1	2.5
24.....	3.1	3.0	3.2	3.4	4.4	3.7	1.5	1.5	1.1	2.0	2.2	2.5
25.....	3.0	3.0	3.1	3.6	4.5	3.6	1.5	1.5	1.4	2.0	2.2	2.4
26.....	2.9	3.0	3.2	4.1	4.0	3.5	1.5	1.0	1.2	2.0	2.2	2.4
27.....	2.9	3.1	3.4	4.2	4.6	3.5	1.5	1.2	1.3	2.0	2.2	2.7
28.....	2.9	3.1	3.4	4.5	4.5	3.4	1.5	1.0	1.3	2.0	2.3	2.7
29.....	2.9	.....	3.4	4.7	4.4	3.2	1.5	.8	1.4	2.0	2.3	2.6
30.....	2.9	.....	3.4	4.8	4.3	3.2	1.5	1.0	1.4	2.0	2.2	2.5
31.....	2.9	.....	3.3	.....	4.3	.....	1.4	.7	.....	2.0	.....	2.5

Station rating table for Carson River near Empire, Nev., from January 1, 1904, to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
1.00	3	2.10	77	3.10	313	4.10	705
1.10	4	2.20	93	3.20	347	4.20	825
1.20	6	2.30	110	3.30	384	4.30	880
1.30	8	2.40	129	3.40	423	4.40	956
1.40	12	2.50	150	3.50	464	4.50	1,026
1.50	16	2.60	173	3.60	508	4.60	1,100
1.60	23	2.70	197	3.70	554	4.70	1,180
1.70	31	2.80	223	3.80	603	4.80	1,260
1.80	40	2.90	251	3.90	654	4.90	1,345
1.90	51	3.00	281	4.00	708	5.00	1,430
2.00	63						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902-1905. It is well defined between gage heights 1.7 feet and 5.4 feet.

Estimated monthly discharge of Carson River near Empire, Nev., for 1905.

[Drainage area, 688 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.....	404	223	267	16,420	0.270	0.311
February.....	384	251	300	16,660	.304	.317
March.....	423	313	360	22,500	.370	.427
April.....	1,260	384	501	33,380	.508	.634
May.....	1,430	404	620	37,120	.640	1.08
June.....	1,100	347	728	43,320	.737	.822
July.....	347	12	65.4	5,860	.097	.112
August.....	10	0	0.0	424	.0070	.0081
September.....	12	0	5.5	327	.0050	.0062
October.....	63	12	45.8	2,810	.040	.053
November.....	110	63	78.1	4,647	.070	.088
December.....	197	63	135	8,361	.137	.153
The year.....	1,430	0	263	211,800	.280	4.02

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

SUSAN RIVER BASIN.

DESCRIPTION OF BASIN.

Susan River rises on the eastern slope of the Sierra Nevada in northeastern California, the rim of the basin having an elevation of 7,000 feet, flows eastward, and discharges into Honey Lake—one of the land-locked lakes of the Great Basin—at an elevation of about 4,000 feet.

The drainage basin is long and narrow, and though numerous small creeks enter the river from both the north and south there are no tributaries of any size. Willow Creek, which joins the stream about 12 miles below Susanville, is the most important.

In the upper reaches of the basin, at an elevation of about 6,000 feet, are numerous small lakes and this region has also good forest cover. Below Susanville, in the area surrounding Honey Lake, the soil deposit has considerable depth and is susceptible of high cultivation; elsewhere the basin is composed of lava rock with a thin covering of soil.

The summer flow of the stream is regulated by several small storage reservoirs, but these have inconsiderable capacity. There are, however, a number of good storage sites in the basin. The precipitation is mostly in the form of snow.

#### SUSAN RIVER NEAR SUSANVILLE, CAL.

This station was established June 3, 1900. It is located about three-fourths of a mile southwest of Susanville, at the electric-light plant.

The channel is straight for 150 feet above and 250 feet below the cable. The right bank is high and not liable to overflow and is composed of clay covered with vegetation. The left bank is low, is liable to overflow, and is covered with a sparse growth of willows. The bed of the stream is of gravel and cobblestone and is permanent. A short distance above the station a small irrigating ditch, known as the Masten ditch, is taken out on the right bank. There is a flume near its head in which a gage has been placed.

Discharge measurements are made by means of a cable and car. The initial point for soundings is a post in the fence in line with the cable. The cable support on the left bank is 34.8 feet from the initial point for soundings.

The gage is read once each day by James Branham. When the station was first established a temporary gage was installed on the right bank. December 20, 1903, the station at the electric-light plant was reestablished and a new gage was set which was made to read 2 feet more than the original gage. The gage is referred to bench marks as follows: (1) A nail in the fence post which is used as the initial point for soundings; elevation, 11.35 feet. (2) A nail in the cable post; elevation, 9.00 feet. (3) A nail in the cottonwood tree to which the cable is attached; elevation, 10.00 feet. Elevations are above 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: 51, p 408; 66, pp 115-116; 85, p 123; 100, pp 204-205; 133, p 330-346.

Discharge: 51, p 408; 66, p 116; 100, p 205; 133, p 340.

Discharge, monthly: 75, p 190; 133, p 341-342.

Gage heights: 51, p 408; 66, p 116; 85, p 124; 100, p 205; 133, p 340.

Rating table: 566, p 175; 133, p 341.

#### Discharge measurements of Susan River near Susanville, Cal., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
March 21.....	J. Branham.....	44	92	4.70	6.60	441
May 12.....	do.....	29	48	3.27	5.40	167
June 12.....	do.....	25	31	2.32	4.70	72
June 25.....	do.....	24	18	1.06	4.20	30
July 23.....	do.....	18	10.8	1.19	3.85	12.8
August 29.....	do.....	14	8.1	0.85	3.75	6.0
September 26.....	do.....	19	13.6	1.13	4.00	15.4

SUSAN RIVER BASIN.

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Daily gage height, in feet, of Susan River near Susanville, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.95	5.2	5.25	6.15	5.95	5.15	4.1	4.1	3.8	3.8	4.0	4.0
2.....	4.8	5.2	5.25	5.95	5.9	5.1	4.1	4.1	3.8	3.8	4.0	4.0
3.....	4.75	5.2	5.25	5.95	5.8	5.05	4.45	4.1	3.8	3.9	4.0	4.0
4.....	4.7	5.2	5.25	5.9	5.8	5.05	4.8	4.1	3.8	3.95	4.0	4.0
5.....	4.65	5.15	5.25	5.9	5.05	5.0	4.6	4.1	3.85	3.95	4.0	4.0
6.....	4.6	5.05	5.25	6.0	5.55	5.0	4.4	4.1	3.85	3.95	4.0	4.0
7.....	4.6	4.85	5.25	6.1	5.5	5.0	4.25	4.1	3.85	4.0	4.0	4.0
8.....	4.55	4.85	5.25	6.1	5.5	4.9	4.1	4.0	3.85	3.95	4.0	4.0
9.....	4.55	4.75	5.2	6.1	5.5	4.85	4.1	3.9	3.85	3.9	4.0	4.0
10.....	4.55	4.8	5.2	6.2	5.45	4.75	4.0	3.8	3.85	3.9	4.0	4.0
11.....	4.55	4.7	5.2	6.1	5.4	4.7	4.0	3.8	3.9	3.9	4.0	4.0
12.....	4.6	4.65	5.4	6.1	5.4	4.7	4.0	3.8	3.9	3.9	4.0	4.0
13.....	4.65	4.55	5.9	6.1	5.35	4.65	3.95	3.8	3.9	3.9	4.0	4.0
14.....	4.7	4.5	5.9	6.1	5.3	4.65	4.2	3.8	3.85	3.9	4.0	4.0
15.....	4.7	4.45	6.05	6.1	5.3	4.6	4.2	3.75	3.85	3.9	4.0	4.0
16.....	4.7	4.45	6.1	6.1	5.4	4.5	4.2	3.75	3.8	3.9	4.0	4.0
17.....	4.7	4.5	6.05	6.05	5.4	4.5	4.0	3.75	3.8	4.0	4.0	4.0
18.....	4.65	4.55	6.0	6.05	5.4	4.4	4.0	3.75	3.8	4.05	4.0	4.0
19.....	4.65	5.05	6.6	6.05	5.4	4.4	4.1	3.75	3.9	4.0	4.0	4.0
20.....	4.65	5.35	6.25	5.95	5.4	4.4	4.05	3.75	3.9	4.0	4.0	4.0
21.....	4.65	5.35	6.45	5.8	5.4	4.3	3.9	3.8	3.95	4.0	4.0	4.0
22.....	4.8	5.25	6.15	5.8	5.4	4.3	3.9	3.8	3.95	4.0	4.0	4.0
23.....	5.5	5.1	6.1	5.8	5.35	4.25	3.85	3.8	3.95	4.0	4.05	4.0
24.....	5.4	5.1	6.05	5.85	5.35	4.2	3.85	3.75	3.95	4.0	4.05	4.0
25.....	5.2	5.2	5.85	5.9	5.3	4.2	3.85	3.75	3.95	4.0	4.1	4.0
26.....	4.95	5.2	6.9	6.0	5.3	4.2	3.85	3.75	4.0	4.0	4.1	4.0
27.....	4.9	5.25	6.3	6.0	5.3	4.2	3.8	3.75	3.9	4.0	4.1	4.0
28.....	4.9	5.25	6.1	6.0	5.25	4.2	3.8	3.75	4.0	4.0	4.05	4.0
29.....	4.85	.....	6.0	6.0	5.25	4.15	3.75	3.8	3.95	4.0	4.05	4.0
30.....	4.8	.....	6.1	6.0	5.2	4.15	3.75	3.8	3.9	4.0	4.0	4.0
31.....	4.8	.....	6.0	.....	5.2	.....	4.1	3.8	.....	4.0	.....	4.0

Station rating table for Susan River near Susanville, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.75	7	4.60	59	5.40	152	6.20	307
3.80	9	4.70	68	5.50	168	6.30	331
3.90	13	4.80	77	5.60	185	6.40	356
4.00	18	4.90	87	5.70	203	6.50	382
4.10	24	5.00	98	5.80	222	6.60	410
4.20	30	5.10	110	5.90	242	6.70	440
4.30	37	5.20	123	6.00	262	6.80	470
4.40	44	5.30	137	6.10	284	6.90	500
4.50	51	.....	.....	.....	.....	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904-5, and is well defined.

*Estimated monthly discharge of Susan River near Susanville, Cal., for 1905.*

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-foot per square mile.	Depth in inches.
January.....	168	55	76.9	4,728	0.300	0.346
February.....	144	48	96.9	5,382	.379	.395
March.....	500	123	234	14,390	.914	1.05
April.....	307	222	264	15,710	1.03	1.15
May.....	252	123	160	9,838	.625	.721
June.....	116	27	61.3	3,648	.239	.267
July.....	77	7	23.4	1,439	.091	.105
August.....	24	7	12.1	744	.047	.054
September.....	18	9	12.3	732	.048	.054
October.....	21	9	15.7	965	.061	.070
November.....	24	18	19.0	1,131	.074	.083
December.....	18	18	18.0	1,107	.070	.081
The year.....	500	7	82.8	59,810	.323	4.38

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

#### WILLOW CREEK AT MERRILLVILLE, CAL.

Willow Creek rises from springs directly under Eagle Lake, presumably seepage from Eagle Lake, which has no surface outlet; it flows southward, joining Susan River about 12 miles below Susanville. Its only tributary of importance is Petes Creek, which drains a large area in the eastern portion of the basin. The drainage area of the main stream has good timber covering, while that tributary to Petes Creek is barren of timber. The entire basin is composed of lava rock with a light covering of soil, and contains large stretches of barren table-lands with scattered peaks of volcanic origin. There is a large area of cultivated land along Willow Creek above the gaging station at Standish and considerable water is diverted for irrigation of lands adjoining the stream.

The gaging station at Merrillville was established June 18, 1904. It is located near the head of the creek, at the old bridge, 100 feet above the present wagon bridge, on the road from Merrillville to Eagle Lake.

The channel is straight above and below the bridge for a distance of 100 feet. The banks are low, but as there is very little fluctuation in the discharge of the creek, they are not subject to overflow. The bed of the stream is composed of gravel, and is comparatively permanent.

Discharge measurements are made from the bridge. The initial point for soundings is on the left bank of the stream. The distance across the creek is marked on the footbridge at intervals of 2 feet.

The gage, which is read once each day by R. W. Hurlburt, is a 2 by 4 inch vertical rod fastened to the left end of the bridge.

A description of this station, gage height, discharge data, and rating table are contained in Water-Supply Paper No. 133, of the United States Geological Survey, pp. 339-341.

Daily gage height, in feet, of Willow Creek at Merrillville, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.1	1.1	0.95	1.1	0.9	0.95	0.9	0.95	1.0	1.1	1.3	1.25
2.....	1.05	1.1	1.0	1.05	.9	.95	.9	.95	1.0	1.1	1.25	1.3
3.....	1.0	1.1	1.0	1.0	.95	.95	.9	.95	1.0	1.1	1.2	1.3
4.....	1.0	1.05	1.0	1.0	.95	.95	.9	.95	1.0	1.1	1.2	1.3
5.....	1.0	1.1	.95	1.0	.95	.95	.9	.95	1.0	1.1	1.2	1.3
6.....	1.0	1.05	.95	1.0	.95	.95	.9	.95	1.0	1.2	1.2	1.3
7.....	1.0	1.0	1.0	1.0	.95	.95	.9	.95	1.0	1.3	1.2	1.3
8.....	1.0	1.0	1.05	1.0	.95	1.0	.9	.95	1.0	1.2	1.2	1.3
9.....	1.0	1.0	1.0	1.0	.95	1.0	.9	1.0	1.0	1.2	1.2	1.3
10.....	1.0	1.0	1.0	.95	1.0	.95	.95	1.0	1.0	1.2	1.2	1.3
11.....	1.0	1.0	1.0	.95	1.05	.95	.95	1.0	1.0	1.2	1.2	1.3
12.....	1.0	1.0	1.0	.95	1.1	.95	1.05	1.0	1.0	1.2	1.2	1.3
13.....	1.0	1.0	1.05	1.0	1.05	.95	1.05	1.0	1.0	1.2	1.2	1.3
14.....	1.05	1.0	.95	1.0	1.0	.95	1.0	1.0	1.0	1.2	1.2	1.3
15.....	1.05	.95	1.05	1.0	.95	.95	1.0	1.0	1.0	1.2	1.2	1.3
16.....	1.05	1.0	1.1	1.0	.9	.95	1.0	1.0	1.0	1.2	1.2	1.3
17.....	1.05	1.0	1.1	1.0	.9	.95	.95	1.0	1.05	1.2	1.2	1.3
18.....	1.05	1.0	1.05	1.0	.9	.95	.95	1.0	1.05	1.2	1.2	1.3
19.....	1.05	1.25	1.1	1.0	.9	.95	.95	1.0	1.05	1.2	1.2	1.3
20.....	1.0	1.15	1.05	1.0	.9	.95	.95	1.0	1.05	1.2	1.2	1.3
21.....	1.05	1.05	1.05	1.0	.9	.95	.95	1.0	1.05	1.2	1.2	1.3
22.....	1.1	1.05	1.05	1.0	.95	.95	.95	1.0	1.05	1.25	1.2	1.3
23.....	1.1	1.05	1.05	.9	.95	.95	.95	1.0	1.05	1.25	1.2	1.3
24.....	1.1	1.0	1.0	.9	.95	.95	.95	1.0	1.05	1.25	1.2	1.3
25.....	1.05	1.0	1.0	.95	.95	.95	.95	1.0	1.05	1.25	1.2	1.3
26.....	1.0	1.05	1.1	.95	1.0	.95	.95	1.0	1.05	1.2	1.2	1.3
27.....	1.0	1.0	1.1	.95	1.0	.95	.95	1.0	1.1	1.2	1.2	1.3
28.....	1.0	1.0	1.0	.95	1.0	.95	.95	1.0	1.15	1.2	1.25	1.3
29.....	1.0	.....	1.1	.9	.95	.95	.95	1.0	1.2	1.2	1.25	1.3
30.....	1.0	.....	1.05	.9	.95	.9	.95	1.0	1.1	1.2	1.25	1.3
31.....	1.0	.....	1.05	.....	.95	.....	.95	1.0	.....	1.25	.....	1.3

Station rating table for Willow Creek at Merrillville, Cal., from July 1, 1904, to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.90	16	1.10	20	1.20	22	1.30	24
1.00	18						

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

*Estimated monthly discharge of Willow Creek at Merrillville, Cal., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	20	18	18.5	1,138
February.....	23	17	18.8	1,044
March.....	20	17	18.6	1,144
April.....	20	16	17.6	1,047
May.....	20	16	17.1	1,051
June.....	18	16	17.0	1,012
July.....	19	16	16.9	1,039
August.....	18	17	17.7	1,088
September.....	22	18	18.7	1,113
October.....	24	20	21.9	1,347
November.....	24	22	22.2	1,321
December.....	24	23	24.0	1,476
The year.....	24	16	19.1	13,820

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

#### WILLOW CREEK NEAR STANDISH, CAL.

This station was originally established June 4, 1900. It was reestablished January 1, 1905, and discontinued December 31, 1905. It is located at the bridge on the road from Susanville to Hot Springs and is about 1½ miles above the junction of the creek with Susan River. It is about 4 miles west of north from Standish.

The channel is straight for 300 feet above and 250 feet below the station. The right bank is rather low and is subject to overflow at extreme high water; the left bank is high and not liable to overflow. The stream bed is sandy and liable to shift somewhat.

Discharge measurements are made from the bridge. The initial point for soundings is on the end of the bridge on the left bank, the bridge being marked at 5-foot intervals across the stream.

The gage, which is read once each day by T. E. Ravenscroft, a farmer who lives near the station, is a 4 by 4-inch vertical timber and is fastened to the left abutment of the bridge.

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

Description: 51, p 407; 66, p 115.

Discharge: 51, p 407.

Gage heights: 51, p 407; 66, p 115.

#### *Discharge measurements of Willow Creek near Standish, Cal., in 1905.*

Date.	Hydrographer.	Width.	Area of section.		Gage height.	Discharge.
			Mean velocity.	Second-charge.		
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 24.....	J. Branham.....	57	117	0.80	6.15	94
January 29.....	do.....	57	87	.79	5.35	69
February 26.....	do.....	57	105	.79	5.75	83
April 23.....	do.....	32	21	.95	4.00	20
November 19.....	do.....	57	56	.61	4.80	34

Daily gage height, in feet, of Willow Creek near Standish, Cal., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.6	6.8	5.0	5.5	4.0	4.0	3.0	4.0	4.2	5.0	5.0	5.0
2.....	6.6	6.7	4.8	5.3	4.0	4.0	3.0	4.0	4.5	4.8	5.1	5.3
3.....	5.0	5.9	4.0	5.0	4.0	4.0	3.0	4.0	4.4	4.6	5.0	5.2
4.....	5.0	.....	4.0	5.0	4.0	4.0	6.0	4.0	4.4	4.3	5.0	5.0
5.....	4.6	5.8	4.0	4.8	4.0	4.0	5.8	4.0	4.4	4.0	5.0	5.1
6.....	4.6	6.0	4.4	4.5	4.0	4.0	4.8	4.0	4.4	4.0	5.1	5.0
7.....	4.6	6.0	4.4	4.0	4.0	4.0	4.0	4.0	4.4	4.0	5.2	5.2
8.....	4.6	5.8	4.4	4.0	4.0	4.2	4.0	4.0	4.4	4.2	5.0	4.1
9.....	4.6	5.6	4.0	4.0	4.0	4.1	4.0	4.0	4.4	4.2	5.0	4.1
10.....	4.6	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.1	5.2	4.4
11.....	4.6	5.0	4.4	4.0	4.2	4.0	4.0	4.2	4.0	4.1	5.1	4.4
12.....	4.7	5.0	4.0	3.8	4.2	4.0	6.0	4.0	4.0	4.0	4.6	4.4
13.....	4.7	5.0	4.0	4.0	4.0	4.0	6.0	4.0	4.0	4.0	4.4	4.3
14.....	4.7	5.0	4.0	4.0	4.0	4.0	5.8	4.0	6.0	4.0	4.4	4.5
15.....	5.8	4.6	4.4	4.0	4.0	4.0	5.0	4.0	5.8	4.0	4.4	4.1
16.....	5.8	4.7	4.4	4.0	4.0	4.0	5.8	4.0	5.0	4.1	4.6	4.1
17.....	6.0	4.7	4.4	4.0	4.0	4.0	5.8	4.0	5.0	4.5	4.8	4.3
18.....	6.0	4.7	4.4	4.0	4.0	4.0	5.8	4.2	5.0	4.5	4.8	4.3
19.....	6.4	5.1	5.0	4.0	4.0	4.0	6.0	4.2	5.0	4.5	5.0	4.3
20.....	6.35	6.0	5.0	4.0	4.0	4.0	6.0	4.6	5.0	4.5	5.0	4.3
21.....	6.0	7.8	5.2	4.0	4.1	4.0	6.0	4.5	4.8	4.5	4.8	4.0
22.....	7.6	7.8	5.2	4.0	4.1	4.0	5.0	4.6	4.8	4.5	4.6	5.0
23.....	7.8	7.0	5.0	4.0	4.0	4.0	5.0	4.2	4.8	5.0	4.6	5.0
24.....	6.0	6.2	4.8	4.0	4.0	4.0	4.8	4.0	4.6	5.1	4.5	5.2
25.....	6.0	6.0	4.6	4.0	4.0	4.0	4.1	4.0	4.5	5.2	4.4	5.0
26.....	5.8	6.3	5.3	4.0	4.0	6.2	4.0	4.2	5.0	5.2	4.8	5.2
27.....	5.6	5.0	5.0	4.0	4.0	5.0	4.0	4.2	6.0	5.1	4.8	5.3
28.....	5.6	5.0	5.0	4.0	3.8	4.0	4.0	4.2	5.8	5.5	5.0	5.3
29.....	5.7	.....	5.0	4.0	3.8	4.0	4.0	4.2	5.8	5.2	5.0	5.3
30.....	5.0	.....	5.0	4.0	3.8	3.6	4.0	4.3	5.0	5.0	5.0	5.3
31.....	5.6	.....	5.5	.....	.....	.....	4.0	4.2	.....	5.0	.....	5.3

Station rating table for Willow Creek near Standish, Cal., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
3.60	10	4.70	34	5.80	86	6.90	165
3.70	11	4.80	37	5.90	92	7.00	173
3.80	13	4.90	41	6.00	98	7.10	181
3.90	15	5.00	45	6.10	105	7.20	189
4.00	17	5.10	49	6.20	112	7.30	197
4.10	19	5.20	54	6.30	119	7.40	205
4.20	21	5.30	59	6.40	126	7.50	213
4.30	23	5.40	64	6.50	133	7.60	221
4.40	25	5.50	69	6.60	141	7.70	229
4.50	28	5.60	74	6.70	149	7.80	238
4.60	31	5.70	80	6.80	157	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905 between gage heights 4 feet and 6.15 feet. It is not well defined.

*Estimated monthly discharge of Willow Creek near Standish, Cal., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	238	31	80.4	4,944
February.....	238	31	80.4	4,965
March.....	69	17	33.5	2,060
April.....	69	17	22.9	1,363
May.....	21	13	17.0	1,045
June.....	112	10	21.1	1,256
July.....	98	0	46.2	2,841
August.....	31	17	19.6	1,205
September.....	98	17	41.0	2,440
October.....	69	17	31.8	1,955
November.....	54	25	39.6	2,356
December.....	59	17	38.7	2,380
The year.....	238	0	40.1	28,810

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction.

#### OWENS RIVER DRAINAGE BASIN.

Owens River has its source in the Sierra Nevada, in eastern California, and flows southeastward, parallel with this range, finally discharging its waters into Owens Lake. This basin has a length from north to south of approximately 150 miles and a width of from 20 to 25 miles. It lies between the Sierra Nevada on the west and the White Mountains on the east. Practically the entire flow of this river is derived from the Sierra Nevada, as it drains the eastern slope of this range from Mount Lyell, on the north, to a point some distance below Mount Whitney, on the south. The White Mountains furnish no water for this stream except in times of very heavy rain storms, which seldom occur on this range. Numerous tributaries enter Owens River from the west, which have their sources in the high elevations of the Sierra Nevada, extending from the northern to the southern limits of this basin. The topography of that portion of the Sierra Nevada which is drained by this stream is extremely rough and precipitous, the mountains rising abruptly from Owens Valley to elevations of 13,000 to 14,000 feet. The rock formation is of granite, with very little soil covering, and sparse timber growth. Numerous lakes and marshes lie in the upper reaches of this portion of the drainage basin. Owens River, a short distance below its source, enters a flat, swampy country known as Long Valley, where a considerable quantity of its flow is used for the irrigation of meadow lands for stock raising. This water returns to the river channel at the lower end of Long Valley, where the stream enters a deep, narrow gorge with heavy grade. As the river breaks from this canyon it enters Owens Valley, through which it flows for about 80 miles, finally discharging into Owens Lake. The gaging station at Round Valley is located at the lower end of this canyon. Below this point numerous diversions are made for the irrigation of land in Owens Valley, where the soil is extensively cultivated, and large areas are used for raising hay and grain. This country is particularly adapted to stock raising, which is carried on to a large extent throughout the valley. There are numerous opportunities for the construction of storage reservoirs within this basin, both on the main stream and on the upper reaches of its tributaries, though none have been constructed as yet. The precipitation is extremely light within the area of the basin, except on the high elevations of the Sierra Nevada, where there is a heavy fall of snow. The melting of the snow in spring and summer feeds the numerous tributaries of this river, insuring a continued flow throughout the year.

The results of data collected in Owens River Valley are contained in Water-Supply Paper No. 177, which presents the results of all the hydrographic data collected in the State of California during 1905.

MINOR GREAT BASIN DRAINAGE.

PRINCIPAL STREAMS.

The minor Great Basin drainage includes large areas in Oregon, Nevada, Utah, and California, in which the water supply is very limited, most of the streams being intermittent.

The work of the United States Geological Survey on this drainage in 1905 covered only the collection of data concerning streams in Oregon, which are here classified by the lakes into which they flow, as follows: Silvies River, discharging into Malheur Lake; Silver Creek, into Harney Lake; Silver Creek, Bridge Creek, and Bear Creek, into Silver Lake; Summer Lake and Ana River, into Summer Lake; and Chewaucan River, into Abert Lake.

MALHEUR LAKE BASIN.

MALHEUR LAKE AT THE NARROWS, OREGON.

This station was established May 14, 1903. It is located at the highway bridge across The Narrows. The station is maintained for the purpose of obtaining data in regard to the fluctuations of the lake, which has no outlet.

The gage is a 1 by 4 inch board, 10 feet long, fastened to a telegraph pole. It is read from the bridge once each week by R. J. Haines, the postmaster. The bench mark is a United States Geological Survey standard iron bench-mark post, set at the east end of the bridge, on the south side of the road, near the fence and about 200 feet from the gage; its elevation is 8.20 feet above the zero of the gage and 4,088 feet above sea level.

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

Description: 100, p 420; 133, pp 344-345.

Gage heights: 100, p 430; 133, p 345.

*Gage height, in feet, of Malheur Lake, at The Narrows, Oregon, for 1905.*

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2.....				4.2			2.7
4.....						3.0	
5.....			5.0				
7.....					3.45		
8.....		5.05					
9.....				4.0			2.65
11.....						2.9	
12.....			4.8				
14.....					3.3		
15.....		5.5					
16.....	5.7			3.85			2.65
18.....						2.8	
19.....			4.6				
21.....					3.2		
22.....		5.35					
23.....				3.6			
25.....						2.75	
26.....			4.4				
28.....					3.1		
29.....		5.2					
30.....				3.5			

## SILVIES RIVER NEAR SILVIES, OREG.

Silvies River rises at Soda Spring, in southern Grant County, Oreg., flows southwest, then southeast, and discharges into the north end of Malheur Lake.

A temporary station was established near Silvies, Oreg., May 8, 1903, and gage heights were read by John Craddock from May 8 to June 26, 1903. One discharge measurement was made at the temporary station. June 16, 1903, a permanent gage was established at the proposed dam site one-half mile below the temporary gage, 2 miles west of the stage road, and three-fourths of a mile below the mouth of Trout Creek. There is a dam  $1\frac{1}{2}$  mile upstream.

The channel is straight for 150 feet above and 200 feet below the station. The right bank is low, and will overflow at high water for a considerable distance; the left bank is high and rocky, and not liable to overflow. The bed of the stream is composed of gravel, is free from vegetation, and shifts somewhat. All the water passes beneath the cable at all stages.

Discharge measurements are made from a five-eighth inch galvanized-iron cable, with a span of 494 feet, located 75 feet downstream from the gage. It is supported in the center. The initial point for soundings is the zero of the tagged wire, 29 feet from the cable support.

The gage is an inclined 2 by 6 inch plank on the left bank. No bench marks have been established.

This station was not maintained regularly during 1905, but a few discharged measurements were made when measurements were made at Burns, a station on the same stream below this point.

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

Description: 100, p 434; 133, pp 345-346.

Discharge: 100, p 434; 133, p 346.

Discharge, monthly: 100, p 436; 133, p 348.

Gage heights: 100, p 435; 133, p 347.

Rating table: 100, p 435; 133, p 347-348.

*Discharge measurements of Silvies River, near Silvies, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
March 23.....	M. L. Lewis.....	47	174	0.96	4.55	166
April 13.....	.....do.....	47	165	.95	4.65	156
April 20.....	.....do.....	48	178	1.08	4.82	193
May 25.....	.....do.....	43	135	.70	3.90	94
October 24.....	.....do.....	18	6.5	.63	2.00	4.1

## SILVIES RIVER NEAR BURNS, OREG.

This station was established as a temporary station May 10, 1903, and was made permanent August 14, 1903. A new gage and a cable for discharge measurements were installed January 19, 1904. The station is located about 10 miles above Burns, Oreg.

The channel is straight for 75 feet above and below the cable. The right bank is low, and is liable to overflow for a considerable distance. The left bank is high and rocky, and will not overflow. Both banks have been cleared of brush. At the gage the bed of the stream is composed of clean sand and gravel. There is but one channel at low water; at high stages there are two or more channels. All the waters passes beneath the cable at all stages.

Discharge measurements are made from a five-eighths inch galvanized-iron cable, with a span of 300 feet, located at Lampshir's place, 1 mile above the gage. In addition to the timber supports at the ends, the cable is supported at a point 167 feet from the initial

point for soundings by a tree 10 inches in diameter. The initial point for soundings is the zero of the tagged wire, 22½ feet from the lower end of the turnbuckle. At low water, when the current is sluggish, discharge measurements are made by wading.

The gage, which is read once each day by Leonia Parker, is located 10 feet below the bridge near Parker's house. It is in two sections, both consisting of 2 by 6 inch timbers supported by a frame secured to the bank. The lower section is inclined and reads from 2 to 12.6 feet; the upper section is vertical and reads from 12.7 to 17 feet. The new gage has the same datum as the old one which it replaced. The bench mark is the highest point of a large rock on the right bank, directly across the river from the gage, from which it is 135 feet distant; elevation above zero of gage, 19.76 feet.

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

Description: 100, pp 431-432; 133, pp 348-349.

Discharge: 100, p 432; 133, p 349.

Discharge, monthly: 100, p 433; 133, p 351.

Gage height: 100, pp 432-433; 133, p 350.

Rating table: 100, p 433; 133, p 351.

*Discharge measurements of Silvies River near Burns, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
March 21.....	M. L. Lewis.....	56	476	0.95	7.55	450
April 11.....	.....do.....	55	400	.87	7.70	405
April 25.....	.....do.....	55	438	.80	0.65	352
May 17 <sup>a</sup> .....	.....do.....	57	520	.36	4.75	190
July 18.....	Ivan Landes.....	28	22	.89	2.54	20
October 3.....	M. L. Lewis.....	25	17	.78	2.40	13.4

<sup>a</sup> Water at cable backed up by dam one-half mile below, but no effect on gage height.

*Daily gage height, in feet, of Silvies River near Burns, Oreg., for 1905.*

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.5	2.9	.....	6.8	3.8	2.8	2.4	2.3	2.4	2.5	2.5
2.....	3.0	2.9	.....	6.5	3.8	2.8	2.4	2.3	2.4	2.5	2.5
3.....	3.4	2.9	.....	6.3	3.9	2.8	2.4	2.3	2.4	2.5	2.5
4.....	3.3	2.9	.....	6.25	3.9	2.8	2.4	2.3	2.4	2.5	2.5
5.....	3.1	2.9	.....	6.2	3.9	2.8	2.4	2.3	2.4	2.5	2.5
6.....	2.9	2.9	.....	6.0	3.9	2.8	2.4	2.3	2.4	2.5	2.5
7.....	2.8	.....	.....	5.9	3.9	2.8	2.4	2.3	2.4	2.5	2.5
8.....	2.7	.....	.....	5.2	3.8	2.6	2.4	2.3	2.4	2.5	2.5
9.....	2.7	.....	8.3	5.3	3.8	2.6	2.35	2.3	2.4	2.5	2.5
10.....	2.7	.....	8.0	5.4	3.8	2.6	2.35	2.3	2.4	2.5	2.5
11.....	2.7	.....	7.75	5.6	3.6	2.6	2.35	2.3	2.4	2.5	2.5
12.....	2.7	.....	7.35	5.6	3.5	2.6	2.3	2.3	2.4	2.5	2.5
13.....	2.7	.....	7.15	5.6	3.4	2.6	2.3	2.3	2.4	2.55	2.5
14.....	2.7	.....	7.05	5.5	3.4	2.6	2.3	2.3	2.4	2.55	2.5
15.....	.....	.....	6.65	5.0	3.4	2.6	2.3	2.3	2.4	2.55	2.5
16.....	.....	.....	6.05	4.9	3.3	2.6	2.3	2.3	2.4	2.55	2.5
17.....	.....	.....	6.9	4.8	3.3	2.6	2.3	2.3	2.4	2.55	2.45
18.....	.....	.....	7.0	4.4	3.2	2.6	2.3	2.3	2.4	2.55	2.45
19.....	.....	.....	7.0	4.2	3.2	2.55	2.3	2.3	2.4	2.55	2.4
20.....	.....	.....	7.0	4.2	3.0	2.55	2.3	2.3	2.4	2.5	2.4
21.....	.....	.....	7.2	4.2	3.0	2.5	2.3	2.3	2.4	2.5	2.4
22.....	.....	.....	7.3	4.2	2.9	2.5	2.3	2.3	2.4	2.5	2.4
23.....	.....	.....	7.15	4.2	2.8	2.55	2.3	2.3	2.4	2.5	2.4

## Daily gage height, in feet, of Silvies River near Burns, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
24.....			7.0	4.1	2.8	2.55	2.3	2.3	2.4	2.5	2.4
25.....			7.2	4.1	2.8	2.5	2.3	2.3	2.45	2.5	2.4
26.....			7.3	4.0	2.8	2.4	2.3	2.3	2.5	2.5	2.4
27.....			7.5	4.0	2.8	2.4	2.3	2.3	2.5	2.5	2.4
28.....			7.5	3.9	2.8	2.4	2.3	2.3	2.5	2.5	2.4
29.....	2.9		7.3	3.8	2.8	2.4	2.3	2.3	2.5	2.5	2.4
30.....	2.9		6.8	3.8	2.8	2.4	2.3	2.4	2.5	2.5	2.4
31.....	2.9			3.8		2.4	2.3		2.5		2.4

NOTE.—Ice conditions are known to exist frequently during the winter months.

## Station rating table for Silvies River near Burns, Oreg., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
2.30	9	3.00	110	5.40	242	6.00	376
2.40	13	4.00	124	5.50	250	7.00	385
2.50	18	4.10	132	5.60	259	7.10	394
2.60	23	4.20	140	5.70	268	7.20	404
2.70	29	4.30	148	5.80	277	7.30	414
2.80	35	4.40	156	5.90	286	7.40	424
2.90	42	4.50	165	6.00	295	7.50	434
3.00	49	4.60	173	6.10	304	7.60	444
3.10	56	4.70	181	6.20	313	7.70	454
3.20	63	4.80	190	6.30	322	7.80	464
3.30	70	4.90	198	6.40	331	7.90	474
3.40	77	5.00	207	6.50	340	8.00	484
3.50	85	5.10	216	6.60	349	8.10	494
3.60	92	5.20	224	6.70	358	8.20	504
3.70	100	5.30	233	6.80	367	8.30	514
3.80	108						

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during the year. It is well defined between gage heights 2.4 feet and 7.5 feet.

## Estimated monthly discharge of Silvies River near Burns, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January (17 days).....	116	29	47.7	1,608
February 1-6.....	42	42	42.0	600
April 9-30.....	514	353	408	17,800
May.....	367	108	205	12,600
June.....	116	35	73.8	4,391
July.....	35	13	22.9	1,408
August.....	13	9	10.2	627
September.....	13	9	9.1	542
October.....	18	13	14.0	861
November.....	20	18	18.5	1,101
December.....	18	13	15.7	965
The period.....				42,400

NOTE.—Open-channel rating table applied to the winter months without correction. January and February estimates subject to considerable error.

## HARNEY LAKE BASIN.

## SILVER CREEK, NEAR RILEY, OREG.

Silver Creek rises in the extreme northwestern part of Harney County, Oreg., and flows southeastward into the north end of Harney Lake.

The gaging station was established April 19, 1904. It is located 12 miles above Riley, Oreg., on the Burns-Shaniko stage line, and is 6 miles below the proposed reservoir site on Silver Creek.

The channels are straight for about 80 feet above and 50 feet below the station. There are three channels at high water and four or more at extreme floods. Both banks are low, covered with sagebrush, and subject to overflow. The bed of the stream is composed of sandy clay, is free from vegetation, and is shifting.

Discharge measurements are made from the three bridges over the three channels of the stream, in the line with the gage, and at high stages an additional slough is measured by wading. The initial point for soundings is the west end of the floor at each of the bridges.

The gage, which was read during 1905 by R. M. Cantrell and Miss Amy Bradford, is located at bridge No. 3, crossing the east or main channel of the creek. It is a plain staff gage, attached vertically to timbers on the lower side of the bridge at the left bank. From April 19 to September 10, 1904, when the permanent gage was established, readings were obtained by measuring down to the water surface from a mark on the bridge floor with a rod so graduated as to give gage readings direct. The bench mark is a United States Geological Survey standard iron bench-mark post on the north side of the road in front of the house of the observer. It is 20.19 feet above the zero of the gage and 4,345 feet above sea level, datum H. The top of the floor of bridge No. 1 at the 21-foot mark is 4,339.87 feet above sea level and 15.08 feet above the zero of the gage. The top of the floor of bridge No. 2 at the 20-foot mark is 4,338.69 feet above sea level and 13.88 feet above the zero of the gage. The top of the floor of bridge No. 3 at the 30-foot mark is 4,339.81 feet above sea level and 15.00 feet above the zero of the gage.

A description of this station, gage height, and discharge data, and rating table are contained in Water-Supply Paper No. 133 of the United States Geological Survey, pp. 352-354.

*Discharge measurements of Silver Creek near Riley, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.	velocity.	height.	charge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
March 14.....	M. L. Lewis.....	54	135	1.33	8.20	170
March 15.....	do.....	64	132	1.25	8.10	165
April 6.....	do.....	48	114	1.26	7.70	144
April 16.....	do.....	45	86	1.24	7.00	107
April 23.....	do.....	40	81	1.29	6.90	105
May 23.....	do.....	32	44	.83	5.65	36
July 21.....	King and Landes.....	4.5	1.2	1.33	4.45	1.6
October 13.....	M. L. Lewis.....	2.0	.73	1.30	4.50	.95

Daily gage height, in feet, of Silver Creek near Riley, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Dec.
1.	5.0	5.4	5.9	6.0	6.8	5.2	4.75	3.75	
2.		5.4	6.0	7.0	6.65	5.25		4.2	
3.	5.0	5.4	6.0		6.6	5.25	4.7	4.45	
4.	5.0	5.4	6.0	7.1	6.55		4.7	4.4	
5.	5.0	5.3	6.1	7.2	6.5	5.25	4.7	4.3	
6.	5.0			7.7	6.4	5.25	4.7	4.45	
7.	5.0	5.0	6.8	7.8		5.25	4.65	4.7	
8.	5.0	5.0	6.6	7.9	6.45	5.2	4.6		
9.		5.0	7.0	7.9	6.45	5.2			
10.	5.0	5.0	7.0		6.4	5.2			
11.	5.0	5.0	7.5	7.5	6.4				
12.	5.0	5.0	7.9	7.2	6.2	5.2			
13.	5.0			7.1	6.0	5.1			
14.	6.7	5.0	8.2	7.0		5.0			
15.	9.0	5.0	8.1	6.9	5.8	5.0			
16.		5.0	8.0	6.8	5.8	5.0			
17.	6.4	5.0	8.8		5.8	5.0			
18.	6.3	5.0	8.9	6.7	5.8				
19.	6.0	5.0	8.5	6.7	5.7	4.95			
20.	6.0			7.0	5.7	4.95			
21.	5.8	7.8	8.1	6.9		4.95			
22.	6.8	7.7	8.0	6.95	5.6	4.9			
23.		7.0	7.9	6.9	5.55	4.9			
24.	8.0	7.4	7.8		5.5	4.9			
25.	7.7	6.4	7.5	6.8	5.45				5.1
26.	6.4	6.0	7.5	7.0	5.45	4.9			5.1
27.	6.4			7.05	5.45	4.85			5.1
28.	6.0	6.2	7.4	6.9		4.85			5.1
29.	5.8		7.4	6.8	5.3	4.85			5.1
30.			6.8	6.7	5.3	4.85			5.1
31.	5.5		6.7		5.3				5.1

Station rating table for Silver Creek near Riley, Oreg., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
4.20	0.0	5.40	26	6.60	83	7.70	145
4.30	.2	5.50	30	6.70	89	7.80	151
4.40	.6	5.60	34	6.80	94	7.90	157
4.50	1.0	5.70	38	6.90	99	8.00	163
4.60	3	5.80	42	7.00	105	8.10	169
4.70	6	5.90	47	7.10	111	8.20	175
4.80	8	6.00	52	7.20	116	8.30	181
4.90	11	6.10	57	7.30	122	8.40	188
5.00	14	6.20	62	7.40	127	8.50	195
5.10	17	6.30	67	7.50	133	8.60	202
5.20	20	6.40	73	7.60	139	8.70	209
5.30	23	6.50	78				

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

*Estimated monthly discharge of Silver Creek near Riley, Oreg., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	230	14	58.8	3,616
February.....	151	14	41.0	2,327
March.....	223	47	128	7,870
April.....	167	80	110	6,545
May.....	94	23	51.0	3,136
June.....	23	10	15.5	922
The period.....				24,020

NOTE.—Ice conditions not known; open-channel rating table applied to winter months without correction. Discharge interpolated on days when gage was not read. Records fragmentary after July 8, as there was no regular observer. Creek was dry in August, September, and the greater part of July.

## SILVER LAKE BASIN.

## SILVER CREEK NEAR SILVERLAKE, OREG.

Silver Creek rises in the western part of Lake County, Oregon, flows northward to Pauline Lake and Marsh, then turns abruptly to the southeast and enters Silver Lake.

The gaging station was established December 20, 1904. It is located 0.9 mile above the county bridge, 1.6 miles southwest of Silver Lake, Oreg.

The channel is straight for 100 feet above and 75 feet below the cable. Both banks are high, rocky, clean, and not subject to overflow. The bed of the stream is composed of rock and gravel, is free from vegetation, and is permanent. There is but one channel at all stages. The current is swift.

Discharge measurements are made by means of a cable, ear, tagged wire, and stay wire, directly at the gage. The initial point for soundings is 0.2 feet west from the anchor bolt on the east end of the cable.

The gage, which was read during 1905 once each day by Henry Egli, is an inclined staff, set on the right bank. The bench mark is a copper bolt cemented in the solid rock on the east side of the stream, 43 feet downstream from the cable, and 12 feet from the edge of low water; elevation above zero of gage, 8.12 feet.

*Discharge measurements of Silver Creek near Silver Lake, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 21....	I. Landos.....	21	26	0.08	1.00	26
February 23....	do.....	22	34	1.50	1.35	51
March 17.....	do.....	21	41	1.82	1.70	74
April 8.....	do.....	22	44	2.20	1.60	100
May 7.....	do.....	24	33	1.45	1.30	48
May 31.....	do.....	21	28	1.24	1.10	34
June 14 <sup>a</sup> .....	do.....	18	10	1.30	.60	24
August 7 <sup>b</sup> .....	do.....	10	0.2	2.17	.70	20
October 4 <sup>c</sup> .....	do.....	10	8.1	1.83	.74	14.8
October 24 <sup>d</sup> .....	do.....	9	0.8	2.12	.74	21
November 10.....	do.....	10	0.0	2.22	.03	22
November 24.....	do.....	0.5	0.2	1.59	.73	14.8
December 21 <sup>e</sup> .....	do.....	0.5	8.3	.05	.60	7.0

<sup>a</sup> Measurements made about 10 feet above cable; meter on rod.  
<sup>b</sup> Measurements made about 40 feet above cable; meter on rod.  
<sup>c</sup> Measurements made about 50 feet above cable; meter on rod.  
<sup>d</sup> Measurements made about 60 feet above cable; meter on cable.  
<sup>e</sup> Ice about 5 inches thick.

Daily gage height, in feet, of Silver Creek near Silver Lake, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.0	1.0	1.5	1.5	1.8	1.05	0.0	0.8	0.8	0.75	0.8	0.8
2.....	1.0	1.0	1.7	2.45	1.65	1.0	.85	.85	.75	.75	.75	.7
3.....	1.05	1.0	1.7	2.4	1.4	1.1	.85	.8	.75	.75	.75	.7
4.....	1.0	.95	1.0	2.4	1.3	1.2	.85	.8	.75	.75	.75	.7
5.....	.95	.95	1.5	2.8	1.4	1.15	.8	.8	.75	.75	.75	.7
6.....	.95	.95	1.85	2.5	1.3	1.1	.75	.8	.75	.8	.85	.75
7.....	1.0	.9	1.8	2.0	1.3	1.15	.7	.8	.75	.9	.95	.7
8.....	1.0	1.3	1.6	1.95	1.35	1.2	.7	.8	.75	.85	1.2	.75
9.....	1.0	1.2	1.4	1.7	1.65	1.1	.7	.8	.75	.85	1.2	.75
10.....	.95	1.1	1.45	1.75	1.35	1.05	.75	.8	.75	.8	1.25	.9
11.....	.95	1.0	1.6	1.6	1.4	1.05	.75	.75	.75	.75	1.2	1.0
12.....	1.25	1.05	1.55	1.5	1.7	1.0	.8	.8	.75	.75	1.2	1.0
13.....	1.25	1.05	1.55	1.75	1.55	1.0	.8	.8	.75	.75	1.15	1.05
14.....	1.5	1.0	1.5	1.5	1.4	1.0	.8	.8	.75	.75	.95	1.0
15.....	1.0	1.0	1.4	1.4	1.3	1.0	.8	.8	.75	.75	1.05	1.0
16.....	1.5	1.0	1.55	1.4	1.25	1.0	.8	.8	.75	.75	.85	1.0
17.....	1.25	1.1	1.7	1.3	1.25	1.0	.8	.8	.75	.8	.85	1.0
18.....	1.2	1.3	1.5	1.55	1.25	1.0	.8	.8	.75	.8	.8	1.0
19.....	1.1	1.05	1.5	1.5	1.2	.95	.8	.8	.75	.75	.8	.85
20.....	1.0	2.0	1.05	1.4	1.15	.95	.8	.85	.75	.75	.85	.85
21.....	1.0	2.25	1.55	1.4	1.2	.95	.8	.85	.75	.75	.75	.8
22.....	1.0	1.4	1.6	1.5	1.15	.95	.8	.8	.8	.75	.75	.8
23.....	1.05	1.8	1.6	2.0	1.1	.95	.8	.8	.75	.75	.75	.7
24.....	1.45	1.4	1.75	1.0	1.05	1.0	.8	.8	.75	.75	.75	.95
25.....	1.0	1.2	1.9	1.85	1.0	.95	.8	.8	.75	.75	.75	1.1
26.....	1.35	1.4	2.4	2.1	1.1	.95	.8	.8	.75	.75	.7	1.15
27.....	1.2	1.5	2.2	1.85	1.2	.9	.8	.8	.85	.75	.7	1.0
28.....	1.2	1.55	1.7	1.4	1.2	.9	.8	.8	.8	.75	.7	.9
29.....	1.1	.....	1.5	1.65	1.2	.9	.8	.8	.8	.75	.75	.9
30.....	1.05	.....	1.4	1.5	1.15	.9	.8	.8	.75	.75	.75	.9
31.....	1.05	.....	1.4	.....	1.1	.....	.8	.8	.....	.75	.....	1.15

Station rating table for Silver Creek near Silver Lake, Oreg., from January 1 to December 31, 1905.

Gage height.	Discharge.						
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
0.75	15	1.00	27	1.50	62	2.00	107
0.80	17	1.10	33	1.60	70	2.10	119
0.85	19	1.20	39	1.70	78	2.20	131
0.90	21	1.30	46	1.80	87	2.30	143
0.95	24	1.40	54	1.90	97	2.40	155

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 0.7 foot and 2 feet.

*Estimated monthly discharge of Silver Creek near Silver Lake, Oreg., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	70	24	36.8	2,263
February.....	137	21	43.9	2,438
March.....	155	54	73.0	4,544
April.....	203	40	89.0	5,340
May.....	87	27	47.2	2,902
June.....	39	21	27.3	1,654
July.....	21	13	16.7	1,027
August.....	19	15	17.1	1,051
September.....	19	15	15.4	916
October.....	21	15	16.7	965
November.....	42	13	21.4	1,273
December.....	30	13	21.0	1,328
The year.....	203	13	35.0	25,710

NOTE.—Ice is known to form at this station during the winter months, but the observer failed to note the length of time that ice conditions existed during 1905. The open-channel rating table was applied to the winter months without correction.

#### BRIDGE CREEK NEAR SILVER LAKE, OREG.

Bridge Creek rises in western Lake County, Oreg., and flows northeastward into Silver Creek near the town of Silver Lake.

The gaging station was established January 21, 1905. It is located at the county bridge 2 miles east of Silver Lake, Oreg.

The channel is straight for 50 feet above and 80 feet below the station. Both banks are low, clean, and liable to overflow. The bed of the stream is composed of sand, is free from vegetation, and is permanent. There is but one channel at all stages. The current is swift.

Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is the west end of the bridge, downstream side, and is marked by a 10-penny nail and black paint.

A vertical staff gage, which was read once each day during 1905 by M. S. Henderson and W. D. Robinson, is driven 2 feet into the bed of the stream and spiked to projecting timbers in the center of the bridge on the downstream side. The bench mark is a copper bolt cemented in a large boulder on the east side of the stream just above the bridge; elevation, 9.73 feet above zero of gage.

#### *Discharge measurements of Bridge Creek near Silver Lake, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
January 24....	I. Landes.....	7	3.2	1.23	2.05	4.0
February 22....	do.....	7	2.6	1.04	2.05	2.7
March 17 <sup>a</sup> .....	do.....	7.5	2.8	1.00	2.00	2.8
May 31 <sup>b</sup> .....	do.....	22	12.4	1.12	2.72	13.0
June 15.....	do.....	22	13.2	1.14	2.70	15.0
November 11....	do.....	3	.7	1.14	2.05	.8

<sup>a</sup> Measurement made 30 feet below bridge.

<sup>b</sup> Measurement made from bridge.

## Daily gage height, in feet, of Bridge Creek near Silver Lake, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.05	1.0	1.95	2.4	2.7	2.2		2.03	2.03	2.03	2.1
2.....		2.0	1.0	1.95	2.45	2.7	2.2		2.03	2.03	2.02	2.1
3.....		2.0	1.0	2.0	2.4	2.7	2.2		2.02	2.04	2.03	1.0
4.....		2.0	1.0	2.0	2.4	2.7	2.15		2.02	2.05	2.03	1.0
5.....		1.05	1.95	1.8	2.4	2.7	2.1		2.01	2.06	2.02	1.0
6.....		1.95	1.95	1.8	2.4	2.7	2.0		2.02	2.06	2.03	1.0
7.....		1.95	1.95	1.85	2.2	2.7		1.04	2.01	2.06	2.03	2.0
8.....		1.0	1.95	1.85	2.1	2.7		1.03	2.01	2.04	2.03	1.0
9.....		2.0	1.95	1.85	2.1	2.7		1.04	2.01	2.04	2.03	1.0
10.....		2.2	1.95	1.9	2.1	2.75		1.02	2.01	2.03	2.03	2.01
11.....		1.05	1.95	1.0	2.15	2.75		1.0	2.01	2.04	2.03	2.01
12.....		2.2	1.95	1.95	2.1	2.8		1.0	2.01	2.03	2.03	2.01
13.....		2.2	1.95	1.95	2.1	2.8		1.02	2.01	2.04	2.03	2.1
14.....		2.2	2.0	1.95	2.1	2.8		1.02	2.02	2.04	2.03	2.1
15.....		2.2	2.0	2.0	2.4	2.75		1.0	2.02	2.03	2.02	2.1
16.....		2.4	2.0	2.0	2.4	2.7		1.02	2.01	2.03	2.03	2.1
17.....		2.4	2.0	2.0	2.65	2.7		1.05	2.01	2.02	2.03	2.3
18.....		2.4	2.0	2.0	2.65	2.7		1.08	2.01	2.02	2.03	2.3
19.....		2.4	2.0	2.0	2.65	2.0		1.00	2.02	2.02	2.1	2.3
20.....			2.0	1.95	2.65	2.55		1.08	2.02	2.02	2.1	2.3
21.....	2.3		2.0	1.95	2.65	2.5		1.08	2.02	2.02	2.1	2.4
22.....	2.3		2.0	1.95	2.65	2.5		2.00	2.01	2.01	2.1	2.4
23.....	2.15		2.0	1.95	2.0	2.4		1.00	2.01	2.01	2.11	2.4
24.....	2.2	2.0	2.0	1.95	2.0	2.4		1.08	2.02	2.02	2.11	2.5
25.....	2.1	1.95	2.0	1.95	2.55	2.35		2.0	2.03	2.02	2.11	2.5
26.....	2.05	2.0	2.0	2.3	2.0	2.3		2.0	2.03	2.02	2.1	2.5
27.....	2.0	1.0	2.0	2.4	2.65	2.3		2.04	2.03	2.01	2.1	2.0
28.....	3.1	1.0	2.0	2.3	2.65	2.25		2.03	2.02	2.01	2.1	2.0
29.....	2.0		1.0	2.3	2.7	2.2		2.03	2.03	2.02	2.00	2.0
30.....	1.95		1.95	2.4	2.7	2.2		2.04	2.03	2.03	2.00	2.0
31.....	1.95		1.95		2.7			2.04		2.03		2.0

NOTE.—Increase in gage heights April 26 to December 31 caused by backwater from a dam. See conditions December 17-31.

## Station rating table for Bridge Creek near Silver Lake, Oreg., from January 1 to April 25, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.80	0.8	2.00	2.8	2.20	6.3	2.40	10.0
1.00	1.2	2.10	4.5	2.30	8.1		

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

## Station rating table for Bridge Creek near Silver Lake, Oreg., from April 26 to December 31, 1905.

Gage height.	Discharge.						
<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>	<i>Feet.</i>	<i>Second-feet.</i>
1.00	0.2	2.20	3.0	2.50	8.0	2.80	15.4
2.00	.6	2.30	4.7	2.60	10.7	3.00	20.0
2.10	1.3	2.40	6.6	2.70	12.0		

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

*Estimated monthly discharge of Bridge Creek near Silver Lake, Oreg., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 21-31.....	8.1	2.0	4.55	90
February 1-19, 24-28.....	10.0	1.2	4.33	206
March.....	2.8	1.2	2.23	137
April.....	0.0	.8	2.63	151
May.....	12.0	1.3	7.70	479
June.....	15.2	3.0	10.0	631
July 1-6.....	3.0	.0	2.18	26
August 7-31.....	.8	.2	.46	23
September.....	.7	.0	.60	30
October.....	.0	.0	.73	45
November.....	1.5	.7	.95	57
December a.....	1.3	.2	1.03	61
The period.....				1,054

a Ice conditions December 17-31; discharge estimated, 1.3 second-feet.

#### BEAR CREEK NEAR SILVER LAKE, OREG.

Bear Creek rises in western Lake County, Oreg., and flows northeastward into the western side of Paulino Lake and Marsh.

The gaging station was established January 21, 1905. It is located at the county bridge 3 miles northeast of Silver Lake, Oreg.

The channel is straight for 60 feet above and 25 feet below the station. Both banks are low, clean, and liable to overflow. The bed of the stream is composed of sand, is free from vegetation, and is shifting. There is but one channel, broken at high water by the two piers of the bridge. The current is moderate.

Discharge measurements are made from the upstream side of the bridge. The initial point for soundings is a 10-penny nail and paint mark at the west end of the bridge, upstream side.

The gage, which was read once each day during 1905 by Cliff Smith, is an inclined staff set on the right bank about 6 feet above the bridge. The bench mark is a copper bolt cemented in the solid rock 80 feet upstream from the bridge and 100 feet west of the west end of the bridge; elevation, 27.04 feet above the zero of the gage.

#### *Discharge measurements of Bear Creek near Silver Lake, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of	Mean	Gage	Dis-
			section.			
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 24.....	I. Landes.....	7	4.0	3.14	4.15	14.4
February 23 a.....	do.....	11	7.4	3.10	4.60	23.0
March 17 b.....	do.....	8	5.1	2.31	4.0	11.7
May 31 c.....	do.....	27	37.0	1.36	5.48	50.0
June 15.....	do.....	28	25.0	1.88	5.25	40.0
August 7 d.....	do.....	11	8.7	.72	3.00	6.3
October 4.....	do.....	10	7.0	.72	3.85	5.0
October 24.....	do.....	10	6.1	1.05	3.02	6.4
November 11.....	do.....	9	6.4	1.00	4.03	8.8

a 600 feet below bridge. b 400 feet below bridge. c 100 feet above bridge. d 300 feet below bridge.

Daily gage height, in feet, of Bear Creek near Silver Lake, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		4.1	3.95	4.1	5.0	5.45	5.05	3.9	3.8	3.85	3.9	3.9
2.....		4.1	4.35	4.0	4.95	5.4	5.0	3.9	3.8	3.85	3.9	3.9
3.....		4.1	4.55	3.95	4.9	5.45	4.95	3.85	3.8	3.85	3.9	3.9
4.....		4.1	4.0	3.55	4.9	5.45	4.95	3.85	3.8	3.85	3.9	3.9
5.....		4.1	4.0	3.95	4.9	5.35	4.9	3.8	3.8	3.85	3.6	3.9
6.....		4.1	3.95	4.0	4.55	5.25	4.9	3.9	3.8	3.85	3.6	3.9
7.....		4.1	3.95	4.0	4.95	5.2	4.9	3.9	3.8	3.95	3.8	3.9
8.....		4.1	3.95	4.0	5.05	5.4	4.85	3.9	3.8	3.95	3.95	3.9
9.....		4.1	3.95	4.0	5.05	5.4	4.8	3.85	3.8	3.95	4.1	3.9
10.....		4.1	3.95	4.0	5.0	5.4	4.8	3.85	3.8	3.9	4.1	3.7
11.....		4.1	3.95	4.0	4.95	5.45	4.8	3.8	3.8	3.9	4.1	3.65
12.....		4.1	3.95	4.0	5.0	5.45	4.75	3.8	3.8	3.9	4.0	3.65
13.....		4.1	4.0	4.0	4.95	5.4	4.75	3.8	3.8	3.9	4.0	3.7
14.....		4.1	4.0	4.85	4.95	5.35	4.8	3.8	3.8	3.9	3.9	3.85
15.....		4.1	3.95	4.85	5.05	5.3	4.8	3.8	3.8	3.9	3.9	3.9
16.....		4.1	4.0	4.85	5.25	5.2	4.8	3.85	3.8	3.9	3.9	3.95
17.....		4.55	4.0	4.85	5.05	5.05	4.8	3.85	3.8	3.9	3.9	3.95
18.....		4.55	4.0	4.8	5.15	5.05	4.8	3.85	3.75	3.9	3.85	3.95
19.....		4.5	4.0	4.8	5.15	5.0	4.8	3.85	3.75	3.9	3.75	4.0
20.....		4.85	4.0	4.8	5.1	4.95	3.9	3.8	3.75	3.9	3.7	4.0
21.....	4.2	5.0	4.0	4.8	5.0	5.35	3.9	3.8	3.75	3.9	3.7	4.1
22.....	4.2	4.8	4.0	4.8	4.95	5.35	3.9	3.8	3.75	3.9	3.6	4.1
23.....	4.2	4.6	4.05	4.75	4.9	5.3	3.9	3.8	3.75	3.9	3.65	4.0
24.....	4.4	4.4	3.95	4.8	5.0	5.3	3.9	3.8	3.75	3.9	3.7	3.6
25.....	4.4	4.4	3.95	4.95	5.1	5.25	3.9	3.8	3.75	3.9	3.7	4.0
26.....	4.2	4.0	3.95	4.9	5.2	5.2	3.9	3.8	3.75	3.9	3.85	4.0
27.....	4.2	4.1	3.95	4.9	5.4	5.2	3.9	3.8	3.75	3.9	3.85	4.6
28.....	4.1	4.0	3.95	4.95	5.4	5.3	3.9	3.8	3.75	3.9	3.9	4.2
29.....	4.1		3.95	4.75	5.4	5.25	3.9	3.8	3.75	3.9	3.9	4.2
30.....	4.1		3.85	5.0	5.5	5.05	3.9	3.8	3.75	3.9	3.9	4.2
31.....	4.1		3.75		5.5		3.9	3.8		3.9		4.2

NOTE.—Increased gage heights April 14 to July 19 caused by back water from dam. Dam removed July 20. Ice conditions last half of December.

### SUMMER LAKE BASIN.

#### ANA RIVER NEAR SUMMER LAKE, OREG.

Ana River, which discharges into the north end of Summer Lake, has its source in five large springs of almost constant flow and temperature throughout the year. The river is about 5 miles long.

The gaging station was established March 28, 1905. It is located in the NW.  $\frac{1}{4}$  SE.  $\frac{1}{4}$  sec. 6, T. 30 S., R. 17 E., near Summer Lake, Oreg.

The channel is straight for 50 feet above and below the station. Both banks are clean and do not overflow. The bed of the stream is composed of blue clay and is fairly permanent. There is but one channel at all stages. The current is swift. Gage readings may be affected somewhat by backwater from the lake and a temporary irrigation dam.

Discharge measurements are made from a foot log near the gage. The initial point for soundings is the edge of the water on the right bank of the river, and is marked on the foot log.

A vertical staff gage, on which, during 1905, observations were made at irregular intervals by the hydrographer, is set at the right bank of the river. The bench mark is a 60-penny nail in the base of a large yellow pine a short distance above the gage; elevation above zero of gage, 11.84 feet.

*Discharge measurements of Ana River near Summer Lake, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
March 28.....	I. Landes.....	27	54	2.72	3.50	148
April 6.....	do.....	27	54	2.73	3.50	149
June 8.....	do.....	27	61	2.41	a 3.68	148

a Gage height affected by irrigation dam.

## ALBERT LAKE BASIN.

## CHEWAUCAN RIVER AT PAISLEY, OREG.

Chewaucan River rises in south-central Lake County, Oreg., flows northwest, then northeast, and then southeast, and discharges into the south end of Abert Lake. The changes in course are very abrupt.

The gaging station was established January 4, 1905. It is located one-half mile above Paisley, Oreg.

The channel below the station is straight; above the station it is slightly curved for 75 feet and beyond this point there are rapids. The right bank is low, but it overflows only a little, there being no water beyond the cable except in very unusual floods. The left bank is high, is composed of clean gravel, and does not overflow. The bed of the stream is of gravel, is free from vegetation, and is permanent. There is but one channel at all stages. There is a low dam 250 feet below the cable, but it does not back the water up at the gage.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire, 60 feet below the gage. The initial point for soundings is the zero of the tagged wire, 7.1 feet from the clip to which the wire is attached at the left bank.

The gage, which was read once each day during 1905 by George Reed and Miss Lulu Banister, is a vertical rod attached to a tree on the right bank. The bench mark is a 60-penny spike in a notch in the base of a large cottonwood tree on the right bank, 22.5 feet upstream from the cable; elevation, 7.69 feet above zero of gage.

*Discharge measurements of Chewaucan River at Paisley, Oreg., in 1905.*

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Square feet.</i>	<i>Feet per second.</i>	<i>Feet.</i>	<i>Second-feet.</i>
January 5 <sup>d</sup> .....	I. Landes.....	35	64	.80	4.16	51
February 20.....	do.....	34	69	1.48	4.20	102
March 22.....	do.....	30	75	1.70	4.45	135
April 5.....	do.....	37	86	2.14	4.65	183
May 11.....	do.....	39	93	2.28	4.72	213
June 4.....	do.....	40	111	2.77	5.12	308
July 4.....	do.....	32	50	.85	3.80	42
July 26.....	do.....	32	37	.61	3.57	23
September 28.....	do.....	32	47	.89	3.67	41
November 3.....	do.....	32	42	.69	3.57	40
November 22.....	do.....	32	54	.78	3.72	29

a Slush ice running in river.

Daily gage height, in feet, of Chewaucan River at Paisley, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.3	4.2	4.4	5.0	4.8	4.0	3.5	3.4	3.6	3.5	3.6
2		4.1	4.3	4.5	4.65	4.75	3.9	2.5	2.4	2.6	3.5	3.7
3		4.0	4.25	4.5	4.85	4.8	3.82	3.4	3.4	2.6	2.6	3.7
4	4.0	4.0	4.25	4.5	4.8	5.15	3.75	3.4	3.4	3.6	3.5	3.7
5	4.15	4.0	4.3	4.65	4.85	5.0	3.7	3.4	3.5	3.6	3.5	3.5
6	4.2	3.85	4.3	4.8	4.8	4.8	3.7	3.4	3.5	3.6	3.6	3.6
7	4.2	3.6	4.35	4.9	4.8	4.7	3.7	3.4	3.5	3.7	3.6	3.6
8	4.3	3.5	4.3	4.9	4.9	4.8	3.7	3.4	3.5	3.7	3.6	3.8
9	4.3	3.5	4.3	4.9	4.85	4.8	3.6	3.4	3.5	3.6	3.6	4.0
10	5.0	3.6	4.25	4.8	4.7	4.7	3.6	3.4	3.5	3.6	3.6	4.2
11	5.15	3.5	4.4	4.75	4.7	4.6	3.6	3.4	3.5	3.6	3.5	4.1
12	5.2	4.1	4.5	4.8	4.8	4.7	3.6	3.4	3.5	3.6	3.5	4.1
13	4.9	4.2	4.65	4.9	4.75	4.6	3.6	3.4	3.5	3.6	3.6	4.0
14	5.2	4.0	4.6	4.7	4.75	4.6	3.6	3.4	3.5	3.6	3.7	4.0
15	4.5	4.65	4.5	4.8	4.85	4.5	3.6	3.4	3.5	3.6	3.6	4.0
16	4.4	3.9	4.6	4.8	4.95	4.5	3.6	3.4	3.5	3.6	3.7	3.9
17	4.3	3.9	4.65	4.7	5.05	4.4	3.6	3.4	3.5	3.6	3.7	3.8
18	4.1	3.9	4.6	4.75	5.0	4.3	3.6	3.4	3.5	3.6	3.7	3.8
19	4.65	4.65	4.6	4.7	5.0	4.3	3.6	3.4	3.5	3.5	3.7	3.7
20	4.0	4.25	4.5	4.7	4.55	4.3	3.7	3.4	3.5	3.5	3.6	3.8
21	3.95	4.1	4.65	4.75	4.85	4.2	3.7	3.4	3.5	3.5	3.6	4.2
22	3.9	3.95	4.45	4.8	4.85	4.2	3.7	3.4	3.5	3.5	3.6	4.5
23	4.5	4.0	4.45	4.9	4.85	4.2	3.6	3.4	3.5	3.5	3.7	4.0
24	4.4	4.1	4.4	5.0	4.8	4.2	3.6	3.4	3.5	3.6	3.6	4.8
25	4.2	4.1	4.35	5.05	4.7	4.2	3.6	3.4	3.5	3.6	3.6	4.6
26	4.0	4.1	4.8	5.15	4.9	4.2	3.7	3.4	3.5	3.6	3.7	4.0
27	4.2	4.1	4.45	5.1	5.0	4.1	3.6	3.4	3.6	3.6	3.6	4.0
28	3.9	4.15	4.4	5.1	4.0	4.0	3.6	3.5	3.7	3.6	3.7	4.0
29	4.0		4.3	5.1	4.8	4.0	3.6	3.6	3.6	3.6	3.6	4.0
30	4.1		4.0	5.15	4.8	3.9	3.5	3.4	3.6	3.6	3.6	4.0
31	4.5		4.15		4.8		3.5	3.4		3.6		4.1

NOTE.—Ice gorge January 10-13.

Station rating table for Chewaucan River at Paisley, Oreg., from January 1 to December 31, 1905.

Gage height.		Discharge.		Gage height.		Discharge.		Gage height.		Discharge.	
Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.	Feet.	Second-feet.
		3.80		43		4.30		111		4.80	223
3.90	19	3.90		53		4.40		131		4.90	249
3.90	23	4.00		61		4.50		152		5.00	276
3.90	27	4.10		77		4.60		174		5.10	304
3.70	36	4.20		93		4.70		198			

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 3.55 feet and 5.25 feet.

*Estimated monthly discharge of Chewaucan River at Paisley, Oreg., for 1905.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	332	53	94.1	5,786
February.....	111	23	64.6	3,588
March.....	223	64	130	8,362
April.....	318	131	230	13,690
May.....	200	108	238	14,630
June.....	318	53	154	9,164
July.....	64	23	33.2	2,041
August.....	23	19	19.5	1,169
September.....	36	19	23.5	1,398
October.....	36	23	28.5	1,752
November.....	36	23	29.7	1,767
December.....	223	23	70.8	4,353
The year.....	332	19	63.5	67,730

NOTE.—Ice gorge January 10-31; discharge assumed 77 second-feet. Ice conditions for the remainder of the winter months not known; open-channel rating table applied.

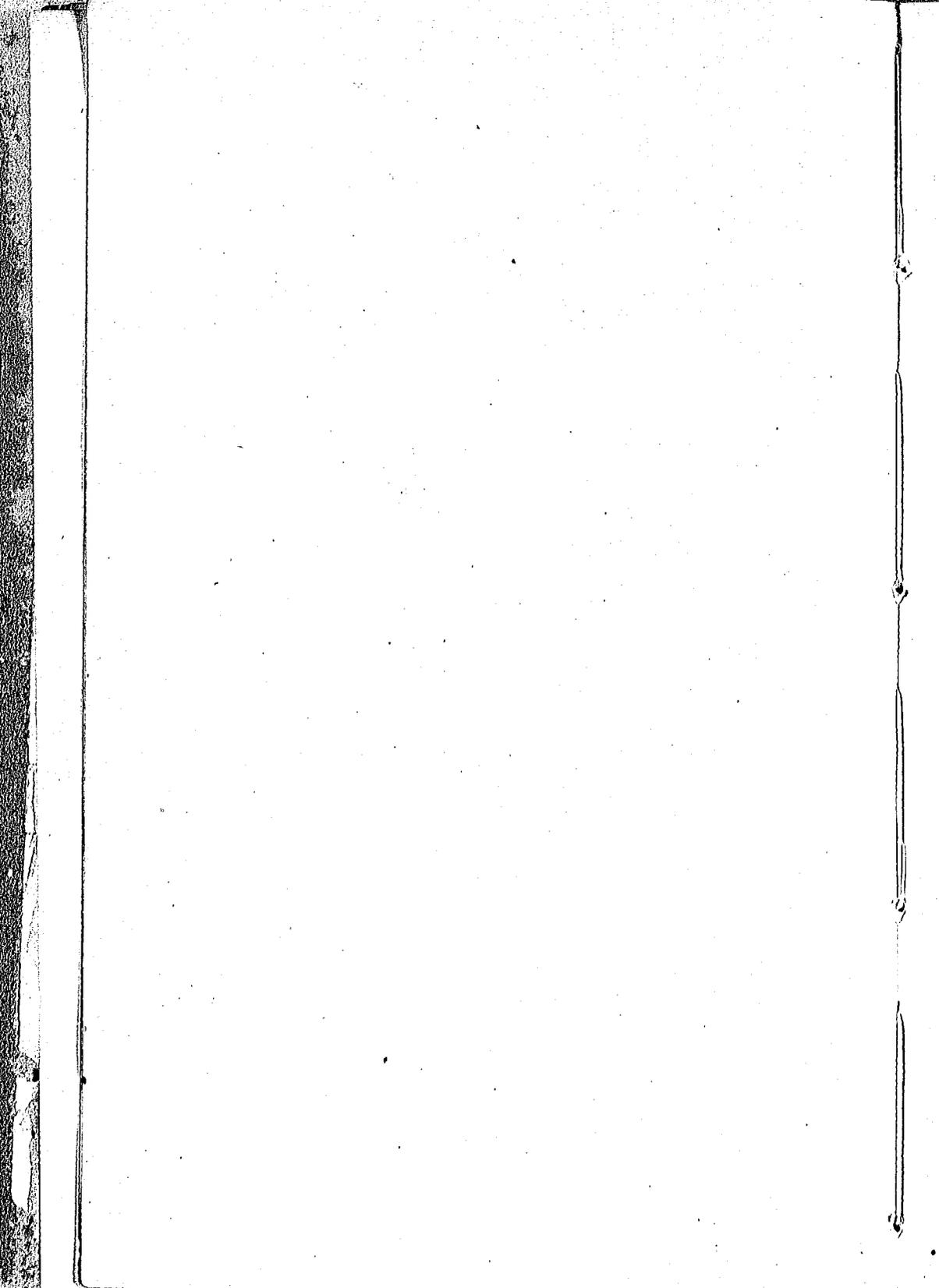
MISCELLANEOUS MEASUREMENTS IN GREAT BASIN.

The following miscellaneous measurements were made in the Great Basin in 1905 by W. G. Swendsen, H. S. Kleinschmidt, W. P. Hardesty, A. B. Larson, and I. Landes:

*Miscellaneous measurements in Great Basin, 1905.*

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	Square feet.	Feet per second.	Feet.	Second-feet.
March 21.....	Logan River....	Logan, Hydo Park and Smithfield Canal, near Logan, Utah.	10	5.0	0.83	3.85	4.7
March 8.....	Jordan River...	Near Lohi, Utah..	40	20	.83	.50	17
January 28....	Hobble Creek...	Springville, Utah, near mouth of creek.	23	13.6	1.40	.....	10
February 15....	.....do.....	.....do.....	16	9.8	1.52	.....	15
March 9.....	.....do.....	.....do.....	8	8.6	.83	.....	6.5
April 3.....	Peteetnee Creek.	At mouth of canyon near Payson, Utah.	10	.....	.....	.....	<sup>a</sup> 20.6
May 6.....	.....do.....	.....do.....	10	.....	.....	.....	<sup>a</sup> 11.4
August 31....	.....do.....	.....do.....	3.45	3.80	.62	.....	3.55
May 3.....	Summit Creek.	Near Santaquin, Utah.	11	7.3	2.05	.....	21.5
May 12.....	.....do.....	.....do.....	6	3.1	4.81	.55	15
June 10.....	.....do.....	.....do.....	6	6.5	3.71	1.08	24
August 31....	.....do.....	.....do.....	6	4.3	1.01	.72	7
July 21.....	Silver Creek....	At Spencer's, Riley, Oreg.	4	1.33	1.13	.....	1.5
January 8....	Ana River.....	County Bridge, Summer Lake, Oreg.	32	107	1.40	.....	150
May 11.....	George Conn's ditch.	Paisley, Oreg.....	7	3.5	1.03	.....	6.7
July 4.....	.....do.....	.....do.....	7	5.2	2.78	.....	14.6

<sup>a</sup>Weir measurement.



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## CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 176.]

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 76.  
West of Mississippi River, Water-Supply Papers Nos. 66 and 76.
- 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 Paper 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:

Boston, Mass., 6 Beacon street; Utica, N. Y., 75 Arcade; Atlanta, Ga., 409 Temple court; Austin, Tex., University of Texas; Chicago, Ill., 376 Federal Building; Belle Fourche, S. Dak.; Cody, Wyo.; Denver, Colo., Chamber of Commerce Building; Salt Lake, Utah; Los Angeles, Cal., 1108 Union Trust Building; Phoenix, Ariz.; Carlsbad, N. Mex.; El Paso, Tex.; Billings, Mont.; Huntley, Mont.; Hazen, Nev.; Boise, Idaho; North Yakima, Wash.; Portland, Oreg., 351 Washington street.

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