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DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1905

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

PART XII.—The Great Basin Drainage

BY

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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.

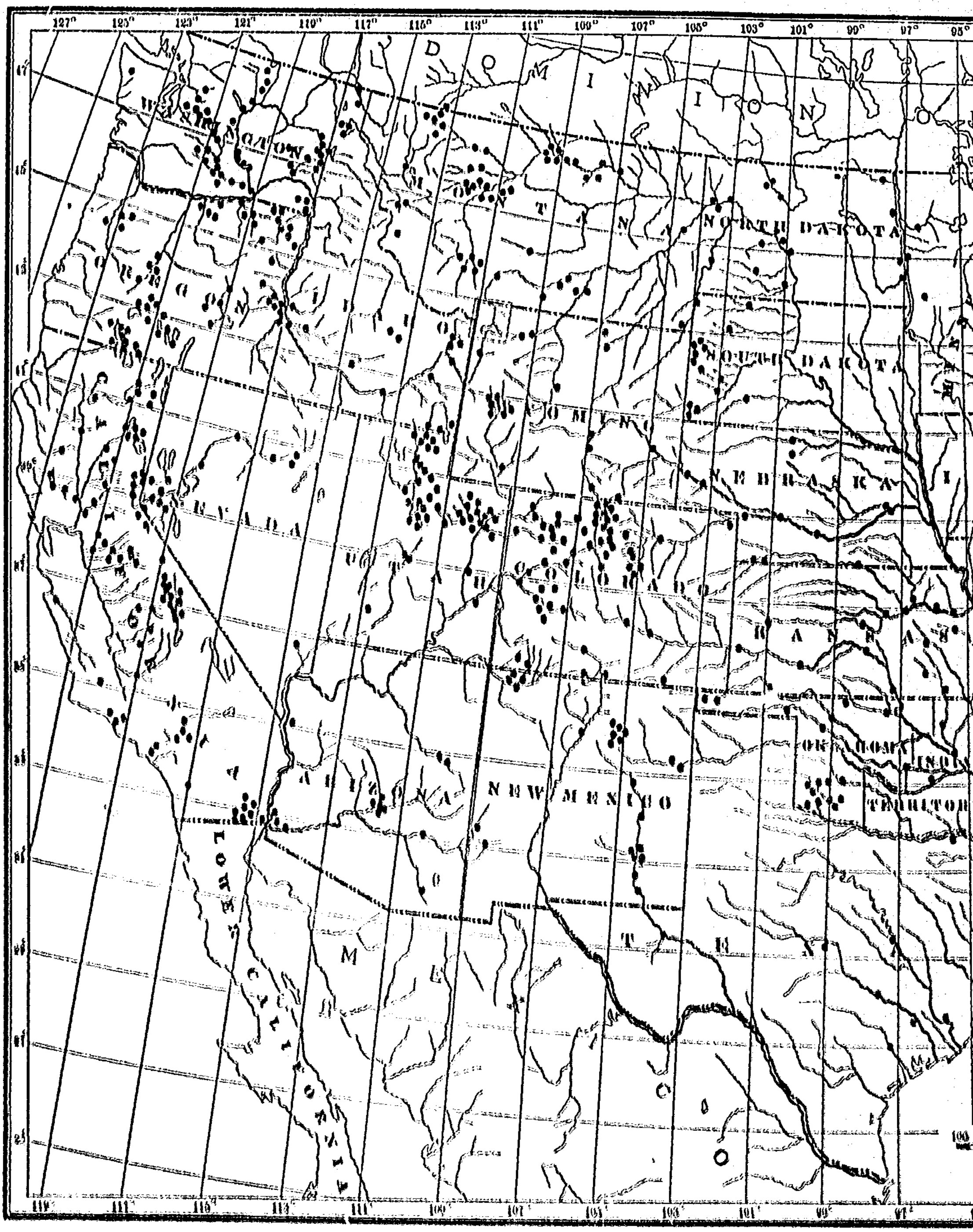
Drainage basins in the United States.

NORTHERN ATLANTIC DRAINAGE BASINS.

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

SOUTHERN ATLANTIC DRAINAGE BASINS.

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



MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIP

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.	Guadelupe.
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-feet.

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

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

4. Second-feet per square mile and depth in inches for the individual months shall be carried out to at least three significant figures, except in the case of decimals where the first significant figure is preceded by one or more naughts (0), when the quantity shall be carried out to two significant figures. Example: 1.25, 0.125, 0.012, 0.0012. The yearly means for these quantities are always to be expressed in three significant figures and at least two decimal places.

CONVENIENT EQUIVALENTS.

1 second-foot equals 50 California miner's inches.
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet deep; 13.572 inches deep.
1 second-foot for one year equals 0.000214 cubic mile; equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot falling 10 feet equals 1.136 horsepower.
100 California miner's inches equal 15 United States gallons per second.
100 California miner's inches equal 77 Colorado miner's inches.
100 California miner's inches for one day 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 147,198,000,000 cubic feet.
1 cubic mile equals 4,667 second-feet for one year.
1 gallon equals 3.7854 liters.
1 gallon equals 8.36 pounds of water.
1 gallon equals 231 cubic inches (liquid measure).
1 pound equals 0.4536 kilogram.
1 avoirdupois pound equals 7,000 grains.
1 troy pound equals 5,760 grams.
1 meter equals 39.37 inches. Log. 1.5951654.
1 meter equals 3.280833 feet. Log. 0.5159842.
1 meter equals 1.093611 yards. Log. 0.0388629.
1 kilometer equals 3,281 feet; equals five-eighths mile, nearly.

1 square meter equals 10.764 square feet; equals 1.196 square yards.
1 hectare equals 2.471 acres.
1 cubic meter equals 35.314 cubic feet; equals 1.308 cubic yards.
1 liter equals 1.0567 quarts.
1 gram equals 15.43 grains.
1 kilogram equals 2.2046 pounds.
1 tonneau equals 2,204.6 pounds.
1 foot per second equals 1.097 kilometers per hour.
1 foot per second equals 0.68 mile per hour.
1 cubic meter per minute equals 0.5886 second-foot.
1 atmosphere equals 15 pounds per square inch; equals 1 ton per square foot; equals 1 kilogram per square centimeter.
Acceleration of gravity equals 32.16 feet per second every second.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.8 feet.
$1\frac{1}{3}$ horsepowers equal about 1 kilowatt.

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

Quick formula for computing discharge over weirs: Cubic feet per minute equals $0.4025\, l\sqrt{h^3}$; l=length of weir in inches; h=head in inches flowing over weir, measured from surface of still water.

To change miles to inches on map:

Scale 1:125000, 1 mile=0.50688 inch.
Scale 1:90000, 1 mile=0.70400 inch.
Scale 1:62500, 1 mile=1.01376 inches.
Scale 1:45000, 1 mile=1.40800 inches.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. 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 backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Paper No. 150); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

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

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

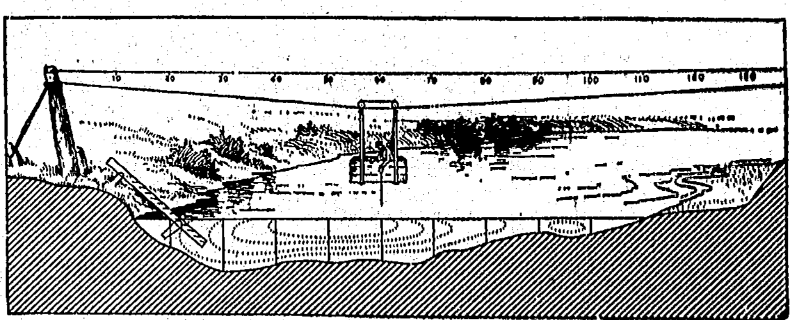


FIG. 1.—Cable station showing section of river, car, gage, etc.

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

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

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

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally 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.

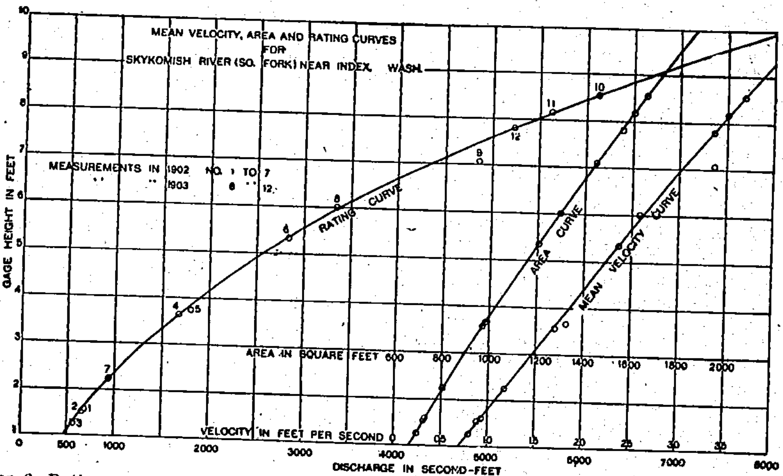


FIG. 2—Rating, area, and mean-velocity curves for South Fork of Skykomish River near Index, Wash.

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

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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:

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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.

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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 seperated 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 valleys 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 Hobble 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 suppply. 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 12.20 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; 138, 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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 13 [a]	C. Tanner	92	136	1.43	[b] 4.45	194
March 24	W. G. Swendson	107	210	1.80	4.22	379
September 19	....do	97	136	.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.

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	3.6	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	4.65	3.4	3.3	3.4	3.5	3.55	4.5
10	4.5	......	......	4.1	4.1	4.6	3.45	3.3	3.4	3.5	3.55	4.25
11	4.6	4.6	4.4	4.1	4.05	4.6	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	3.65	3.3	3.35	3.5	3.5	......
14	4.6	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	4.6
18	......	4.45	4.4	4.2	4.0	4.9	3.6	3.3	3.35	3.5	......	......
19	......	......	4.4	4.2	3.9	5.05	3.6	3.3	3.45	3.5	3.55	......
20	......	......	4.4	4.2	3.9	4.95	3.6	3.2	3.5	3.5	3.55	......
21	4.7	......	4.4	4.2	3.9	4.8	3.6	3.2	3.5	3.5	3.5	4.9
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	3.6	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.10	60	3.90	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 90 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, 1899, 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 409; 66, p 117; 85, p 82; 100, pp 133–134; 133, p 241.

Discharge: Ann 18, iv, p 314; Bull 131, pp 53, 92; 140, p 226; WS 16, p 157; 28, p 153; 35, pp 18–19; 38, p 333; 51, p 409; 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 96; 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 69; 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 316; 19, iv, p 433; 20, iv, p 460; 22, iv, p 407; 75 p 191.

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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 25	W. G. Swendsen	188	348	1.78	1.60	617
February 17[a]	C. Tanner	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

[a] 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.

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	Gage height.	Discharge.	Gage height	Discharge.	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	288	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 bowlders 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; 38, 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 69; 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; 38, 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 461; 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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet*	*Second-feet.*
February 10	O. Tanner	270	486	2.46	1.75	1,195
March 29	W. G. Swendsen	275	711	2.73	2.50	1,943
March 29	do	275	711	2.78	2.50	1,976
May 17	do	275	684	2.79	2.45	1,910
September 7[a]	A. B. Larson	19	19	1.64	.37	31
October 31	W. G. Swendsen	268	466	2.32	1.60	1,039

[a] 350 feet below regular station.

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	2.15	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second feet.*	*Feet.*	*Second feet.*	*Feet.*	*Second feet.*	*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	356	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	1,960	1,320	1,605	98,690	.268	.309
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	49,560	.134	.154
November	1,035	909	976	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.

Th 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 bowlders 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 bowlders 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 bowlders 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 316-317; 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; 66, p 118; 85, pp 86-87; 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.
		Feet.	*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. Beers	52	56	2.79	4.55	155
August 24 [a]	do	39	59	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 26	do	51	42	3.02	4.37	126

[a] 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	4.46	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	4.49	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	109	5.00	350	5.70	675	6.40	1,052
4.40	136	5.10	394	5.80	726	6.50	1,108
4.50	164	5.20	438	5.90	779	6.60	1,164
4.60	195	5.30	483	6.00	833	6.70	1,222
4.70	230	5.40	529	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	996		

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	96	131	7,275	.601	.626
March	157	131	144	8,854	.661	.762
April	208	139	177	10,530	.812	.906
May	500	230	368	22,630	1.69	1.95
June	615	382	496	29,510	2.28	2.54
July	394	195	248	15,250	1.14	1.31
August	195	150	176	10,820	.807	.930
September	173	150	158	9,402	.725	.809
October	160	130	143	8,793	.656	.756
November	130	100	129	7,676	.592	.660
December	130	96	118	7,256	.541	.624
The year	615	96	202	146,700	.930	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 19, 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 car 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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per 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	3.6	3.6	3.3	3.2
16	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	3.6	3.6	3.3	3.3
17	3.5	3.5	3.5	3.7	3.9	3.8	3.6	3.6	3.6	3.6	3.3	3.3
18	3.5	3.5	3.5	3.7	4.0	3.8	3.6	3.6	3.6	3.6	3.3	3.3
19	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	3.6	3.6	3.3	3.2
20	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	3.6	3.6	3.3	3.2
21	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	3.6	3.6	3.3	3.2
22	3.5	3.5	3.5	3.8	4.0	3.8	3.6	3.6	3.6	3.5	3.3	3.3
23	3.5	3.4	3.6	3.9	4.1	3.8	3.6	3.6	3.6	3.3	3.3	3.3
24	3.5	3.4	3.6	3.9	4.1	3.8	3.6	3.6	3.6	3.3	3.3	3.3
25	3.5	3.4	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
26	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
27	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
28	3.5	3.5	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
29	3.5	......	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
30	3.5	......	3.6	4.0	4.1	3.7	3.6	3.6	3.6	3.3	3.3	3.3
31	3.5	......	3.6	......	4.1	......	3.6	4.8	......	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.	Gage height.	Discharge.	Gage height	Discharge.	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.	Gage height.	Discharge.	Gage height.	Discharge.	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.	8,985
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 con, tained 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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
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	3,886
May	66	51	57.6	3,542
June	66	51	59.9	3,564
July	66	66	66.0	4,058
August 1-30	66	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	44,190

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 bowlders 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 bowlders, 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.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
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	4.92	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	4.95	4.3	4.05	4.3	4.15	4.0
3	......	......	......	4.2	5.05	6.3	4.9	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	4.6	4.2	4.1	4.2	4.1	5.15
14	......	......	4.15	4.3	4.7	6.3	4.6	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	5.65	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.	Gage height.	Discharge.	Gage height.	Discharge.	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	53	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.

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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 31 [a]	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 19	W. D. Beers	89	56	.92	1.40	51
November 16	W. G. Swendsen	91	88	1.76	1.75	155

[a] 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		1.95	1.95	1.95	2.65	2.85	1.9	1.4	1.4	1.65	1.8	1.8
2		1.95	1.95	2.0	2.8	3.0	1.9	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		1.95	2.1	1.95	2.6	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	1.95	2.55	3.35	1.7	1.4	1.5	1.6	1.8	1.6
7		1.9	2.2	1.95	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	1.95	2.5	3.9	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		1.65	2.1	2.25	2.4	3.4	1.5	1.5	1.5	1.6	1.75	1.6
13		1.65	2.05	2.2	2.4	3.4	1.5	1.5	1.5	1.6	1.75	1.6
14		1.65	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	1.55	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	1.6	1.8	1.6
23		1.9	1.9	2.2	2.95	2.6	1.8	1.4	1.5	1.7	1.85	1.5
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	1.5
26		1.95	2.0	2.4	2.85	2.3	1.6	1.4	1.5	1.75	1.75	1.6
27		[illegible]	2.0	2.6	2.85	2.2	1.5	1.4	1.5	1.75	1.8	1.7
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.	Gage height.	Discharge.	Gage height.	Discharge.	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	1,160
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	35,290
June	1,650	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.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 13	C. Tanner	127	564	2.45	8.30	1,382
May 18	W. G. Swendsen	132	789	2.40	9.30	1,894
September 8[a]	A. B. Larson	19	5.1	.92	2.80	4.7
November 17	W. G. Swendsen	105	110	1.04	4.00	115

[a] 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	4.9	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	3.0	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.	Gage height.	Discharge.	Gage height.	Discharge.	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 1903-4 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	58,190
June	1,007	13	501	29,810
July	26	5	8.3	510
August	5	5	5.0	307
September	26	5	12.9	708
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 1¼ 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 [a]	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	2.60	10

[a] 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.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
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	1.58	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	1.2	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.	Gage height.	Discharge.	Gage height.	Discharge.	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	16	26.0	1,599	.105	.121
April	118	22	55.4	3,296	.223	.249
May	274	68	139	8,547	.560	.646
June	197	9	95.2	5,665	.384	.428
July	28	4.8	11.0	676	.044	.051
August	6	3.6	4.8	295	.019	.022
September	15	3.6	5.9	351	.024	.027
October	29	10	20.9	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 259.
Discharge. WS 51, p 418; 66, p 124; 100, p 140.
Discharge, daily mean: WS 133, p 260.
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 259.
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	0.39	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	.39	.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	......	.49	.38	......	.38	......	.32

NOTE.—January 1 to March 29 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	25	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	22	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	46	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	19	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	1,476	0.364	0.420
February	26	11	23.0	1,277	.348	.362
March	31	26	29.2	1,795	.442	.510
April	97	28	49.9	2,969	.756	.844
May	184	56	110	6,763	1.67	1.92
June	239	107	176	10,470	2.67	2.98
July	104	40	65.1	4,003	.986	1.14
August	40	27	32.7	2,011	.495	.571
September	38	25	27.4	1,630	.415	.463
October	29	22	24.5	1,506	.371	.428
November	23	17	21.5	1,279	.326	.364
December	20	16	17.8	1,094	.270	.311
The year	239	11	50.1	36,270	.759	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 bowlders, 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 projecting 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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 28 [a]	H. S. Kleinschmidt	70	144	1.51	3.73	217
March 3 [b]	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	469
August 28 [c]	A. B. Larson	67	94	1.46	3.62	136
September 27 [c]	W. G. Swendsen	67	85	1.64	3.57	139

[a] Measurement by wading 35 feet above cable.
[b] Measurement by wading approximately at present cable station.
[c] 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	3.9	3.85	4.4	5.15	4.0	3.9	3.7	3.65	3.75	3.9
2	4.1	4.0	3.85	4.4	5.4	3.95	3.85	3.6	3.65	3.75	3.9
3	3.9	4.0	3.85	4.5	5.5	3.95	3.9	3.6	3.65	3.75	3.9
4	3.9	4.1	3.85	4.4	5.6	3.95	3.8	3.6	3.65	3.75	3.9
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	3.65
7	3.85	4.0	3.85	4.1	5.4	3.95	3.8	3.6	3.65	3.75	3.6
8	3.85	3.95	3.85	4.1	5.8	3.95	3.8	3.6	3.65	3.75	3.6
9	3.8	3.9	3.85	4.25	6.1	3.95	3.8	3.6	3.55	3.8	3.55
10	3.8	3.9	3.95	4.2	5.9	3.95	3.8	3.6	3.65	3.8	3.55
11	3.8	3.9	4.1	4.2	5.4	3.95	3.8	3.6	3.6	4.0	3.6
12	5.8	3.9	4.0	4.1	5.15	3.95	3.85	3.6	3.6	4.0	3.6
13	5.1	3.9	4.0	4.1	5.15	3.95	3.85	3.6	3.6	3.8	3.6
14	5.1	3.9	4.0	4.1	5.2	3.95	3.8	3.6	3.6	3.85	3.6
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	3.85	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	3.8
22	3.8	4.0	4.1	4.7	4.45	3.9	3.7	3.6	3.6	3.9	3.7
23	3.8	3.95	4.1	4.8	4.4	3.9	3.7	3.55	3.6	3.9	3.7
24	3.8	3.9	4.1	4.85	4.35	3.9	3.7	3.55	3.65	3.9	3.7
25	3.8	3.9	4.1	4.8	4.35	3.9	3.7	3.55	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	3.6	3.65	3.85	3.8
29	....	3.9	4.3	5.1	4.0	3.85	3.65	3.55	3.65	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	269	254	446	763	301	245	163	159	193	244
2	335	301	254	446	879	285	237	135	159	194	245
3	269	301	254	485	926	285	243	136	160	194	245
4	269	335	254	446	973	285	212	136	160	194	245
5	269	318	238	371	1,054	284	211	137	160	194	230
6	254	318	254	335	926	284	210	137	160	194	170
7	254	301	254	335	879	283	209	138	160	194	156
8	254	285	254	335	1,069	282	208	138	132	210	143
9	238	269	254	389	1,215	281	207	139	161	210	143
10	238	269	285	371	1,117	280	206	139	147	273	157
11	238	269	335	371	879	280	221	140	147	273	157
12	238	269	301	335	763	279	220	140	147	210	157
13	238	269	301	335	763	278	203	141	147	226	157
14	238	269	301	335	786	277	187	141	147	227	158
15	238	269	301	335	740	292	187	142	148	227	216
16	238	269	335	301	717	275	200	142	148	227	216
17	238	254	335	335	651	274	200	143	148	227	216
18	238	254	335	389	608	273	168	143	148	242	216
19	238	254	335	446	525	256	167	144	148	242	216
20	238	269	335	466	466	255	167	144	148	243	216
21	238	269	353	525	446	255	166	145	149	243	187
22	238	301	335	566	466	254	165	132	149	243	187
23	238	285	335	608	446	254	164	133	163	243	187
24	238	269	335	630	427	253	163	133	163	228	217
25	238	269	335	608	427	253	162	147	163	228	217
26	238	254	408	608	446	236	161	147	163	229	218
27	254	301	408	651	335	236	144	147	164	229	218
28	269	269	408	695	318	237	158	132	164	244	218
29	....	269	408	740	301	237	146	173	178	244	218
30	....	285	485	651	301	238	162	173	178	244	218
31	....	269	....	630	....	245	162	....	193	....	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	249	13,830
March	335	254	279	17,160
April	485	238	319	18,980
May	740	301	468	28,780
June	1,215	301	687	40,880
July	301	236	267	16,420
August	245	144	190	11,680
September	173	132	143	8,569
October	193	132	157	9,654
November	273	193	226	13,450
December	245	143	200	12,300
The period	....	....	....	191,600

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.

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 bowlders 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 bowlder projecting 1 foot above the ground, 120 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 60; 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 201-202.

Discharge: Ann 18, iv, p 326; Bull 131, p 62; 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 202.

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 390; 22, iv, p 416; Bull 140, p 235; WS 75, p 195; 100, pp 142, 144; 133, p 204.

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 152; 38, p 339; 51, p 417; 66, p 124; 100, p 141, 143-144; 133, p 203.

Hydrographs: Ann 12, ii, p 340; 14, ii, p 125; 18, iv, p 328; 19, iv, p 442; 20, iv, p 468; 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; 66, 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[a]	A. B. Larson	32	41	.62	3.55	25

[a] 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	4.56	4.34	4.8	5.63	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	3.56	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	[illegible]	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	4.08	4.46	5.65	3.63	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	3.56	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.	Gage height.	Discharge.	Gage height.	Discharge.	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	20	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	40	55	43	42	97	85	....	131	160	185
17	41	48	59	58	100	79	....	128	160	183
18	50	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	50	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	....	....

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	190	10,550	.297	.309
March	359	82	239	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	1,648	.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	1,368	.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 BRIGDE, 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-feet.*
January 25	H. S. Kleinschmidt	44	54	3.52	2.80	191
February 14[a]	do	37	38	3.12	2.53	120
February 16	do	43	49	3.49	2.74	170
March 9	do	43	49	3.36	2.70	166
June 21	W. G. Swendsen	17	8.5	1.52	2.00	12.9

[a] 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	2.65	2.75	2.0	3.05
2		3.1	2.75	2.55	2.8	3.05	18		2.7	2.65	2.7	2.0	2.8
3		3.15	2.8	2.52	2.8	3.5	19		2.7	2.7	2.6	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	2.9	2.15	Dry.
7		2.85	2.9	2.47	2.25	3.54	23		2.7	2.7	2.9	2.6	
8		2.8	2.8	2.45	2.2	3.65	24		2.7	2.65	2.9	2.62	
9		2.85	2.7	2.6	2.2	4.27	25		2.7	2.65	2.85	2.58	
10		2.85	2.7	2.75	2.4	4.2	26	2.8	2.68	2.65	2.75	2.62	
11		2.85	2.7	2.85	2.3	3.73	27	2.8	2.65	2.8	2.85	2.68	
12		2.8	2.7	2.8	2.15	3.55	28	2.8	2.65	2.7	2.9	2.75	
13		2.6	2.67	2.8	2.05	3.53	29	2.8		2.65	2.75	2.8	
14		2.55	2.7	2.75	2.1	3.45	30	2.8		2.7	2.7	2.65	
15		2.7	2.7	2.7	2.0	3.43	31	2.8		2.65		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 bowlders 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 29	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	13.0
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	1.75	1.25	1.2	1.25	1.17	......	1.15
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	1.35	1.2	1.25	......
30	1.33	......	1.4	......	1.75	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.	Gage height.	Discharge.
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.	Gage height.	Discharge.
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	25.6	1,422
March	30	24	27.0	1,660
April	78	28	45.2	2,690
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	898
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.

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 143; 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 section.	Mean velocity.	Gage height.	Discharge.
		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	2.82	369
May 22	do	40	85	4.42	2.82	376
May 22	do	40	85	4.00	2.82	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	59

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	1.46	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	1.86	2.8	1.6	1.34	1.42	1.48	1.48	1.46	1.4
27	1.36	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	86	112	79	192	336	56	48	45	92	60	61
2	39	106	104	76	187	329	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	89	54	61	59
5	57	95	92	74	158	258	47	48	53	50	61	69
6	59	91	92	74	136	252	49	48	50	53	62	53
7	60	87	88	77	136	224	50	42	59	50	62	59
8	61	87	88	81	140	212	51	42	53	50	62	59
9	62	75	84	83	172	190	43	42	52	50	62	59
10	66	79	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	52	78	113	145	168	44	52	52	59	63	35
13	60	64	81	109	189	147	43	49	52	55	50	36
14	69	76	85	100	195	132	46	49	52	55	56	54
15	69	77	84	96	200	118	46	46	52	59	56	42
16	74	65	76	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	79	102	286	112	44	44	44	56	59	42
19	58	76	86	119	315	115	45	41	48	54	59	42
20	77	83	105	114	335	113	43	41	48	54	57	42
21	78	91	105	114	355	111	42	41	45	54	57	55
22	79	91	89	111	375	102	43	38	45	59	67	48
23	81	85	84	119	410	96	42	38	45	59	67	55
24	80	89	84	122	384	81	42	41	43	59	67	55
25	83	89	83	127	360	68	43	95	55	59	60	56
26	76	89	79	144	382	67	43	53	62	60	60	56
27	67	85	82	158	368	64	44	58	66	60	68	56
28	70	94	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	39	67.7	4,163	0.101	0.116
February	106	52	83.2	4,621	.124	.129
March	115	72	88	5,411	.131	.151
April	178	71	111	6,605	.166	.185
May	410	136	257	15,800	.384	.443
June	336	58	156	9,283.	.233	.260
July	56	42	46.1	2,835	.069	.080
August	95	38	48.6	2,988	.073	.084
September	228	43	59.3	3,529	.089	.099
October	92	50	58.5	3,597	.087	.100
November	68	50	60.7	3,612	.091	.102
December	114	35	54.7	3,363	.082	.094
The year	410	35	90.9	65,810	.136	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 vertical 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 vertical 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.	Discharge.
		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	36	2.67	4.78	96
May 4 [a]	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

[a] 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	4.6	4.67	4.52	4.5	4.75	......	4.0	17	4.62	4.6	4.08	4.9	3.4	......	4.3
2	4.1	4.97	4.58	4.35	4.3	......	4.2	18	4.6	4.6	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	3.9	......	4.1
7	4.2	4.68	3.9	4.48	3.43	......	4.05	23	4.7	4.55	4.3	4.63	4.2	......	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	4.68	3.43	......	......	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	4.98	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	4.9	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	95.5	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	106.0	35.0	......	39.0
4	29.5	81.2	67.0	61.0	19.0	......	38.5	20	61.0	67.0	58.0	96.0	18.5	......	38.0
5	23.0	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	30.5	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	5.2	......	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; 66, p 126; 85, p 88; 100, pp 147–148; 133, pp 277–278.
Discharge: WS 51, p 425; 66, 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; 66, p 126; 85, p 89; 100, pp 148–149; 133, p 279.
Hydrograph: Ann 22, iv, p 420.
Rating tables: WS 52, p 521; 66, 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.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 19[a]	C. Tanner	50	123	2.60	2.25	320
February 7[a]	do	50	120	2.50	2.20	301
April 23	W. G. Swendson	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

[a] 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.	Gage height.	Discharge.	Gage height.	Discharge.	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, 3,986 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	310	254	303	8,414	0.076	0.040
February	573	254	318	17,660	.080	.083
March	367	87	199	12,240	.050	.058
April	92	41	67.0	3,987	.017	.019
May	651	41	222	13,650	.056	.065
June	525	17	164	9,759	.041	.046
July	26	17	18.4	1,131	.0046	.0053
August	69	24	32.3	1,986	.0081	.0093
September	62	41	46.2	2,749	.012	.013
October	101	58	89.3	5,491	.022	.025
November	95	87	91.4	5,439	.023	.026
December 1-15	116	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	10	2.10	49	2.50	123	2.90	227
1.80	16	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	16	11	13.3	818	0.016	0.018
February	24	9	14.1	783	.017	.018
March	16	8	12.1	744	.014	.016
April	94	13	24.2	1,440	.029	.032
May	338	32	136	8,362	.163	.188
June	304	90	179	10,650	.214	.239
July	199	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	23.9	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 car. 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 103; 133, p 283.
Discharge: 100, p 104; 133, p 284.
Discharge, monthly: 133, p 285.
Gage heights: 100, p 104; 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 section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 27	W. A. Wolf	37	26	1.13	3.30	20.5
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

[a] Discharge estimated.

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	3.6	3.5	3.4	3.5	3.4	3.55	2.85	2.2	2.55	2.6	3.3	3.0
2	3.6	3.5	3.4	3.5	3.5	3.55	2.85	2.2	2.55	2.6	3.3	3.0
3	3.6	3.45	3.45	3.45	3.55	3.5	2.8	2.2	2.55	2.6	3.3	3.0
4	3.6	3.4	3.45	3.45	3.55	3.55	2.8	2.2	2.55	2.6	3.3	3.0
5	3.6	3.35	3.5	3.4	3.6	3.5	2.8	2.2	2.55	2.6	3.2	3.0
6	3.55	3.35	3.5	3.35	3.6	3.5	2.8	2.15	2.55	2.6	3.1	3.0
7	3.55	3.35	3.5	3.35	3.6	3.5	2.8	2.15	2.55	2.6	3.0	3.0
8	3.6	3.3	3.5	3.3	3.65	3.5	2.8	2.15	2.55	2.6	3.0	3.0
9	3.6	3.25	3.5	3.3	3.7	3.5	2.85	2.15	2.55	2.6	2.9	3.0
10	3.55	3.2	3.5	3.3	3.65	3.45	2.85	2.15	2.55	2.6	2.9	3.0
11	3.55	3.15	3.5	3.3	3.6	3.4	2.85	2.15	2.5	2.6	3.0	3.0
12	3.55	3.3	3.4	3.3	3.65	3.35	2.85	2.15	2.5	2.6	3.0	3.0
13	3.55	3.35	3.4	3.25	3.7	3.3	2.8	2.15	2.5	2.6	2.9	3.0
14	3.55	3.4	3.4	3.25	3.6	3.3	2.8	2.15	2.5	2.6	2.9	3.0
15	3.6	3.4	3.4	3.2	3.5	3.35	2.8	2.15	2.5	2.6	2.8	3.0
16	3.6	3.4	3.45	3.25	3.5	3.4	2.75	2.15	2.5	2.6	2.8	3.0
17	3.6	3.35	3.45	3.25	3.45	3.4	2.75	2.15	2.5	2.6	2.7	3.1
18	3.6	3.3	3.5	3.3	3.4	3.3	2.75	2.15	2.5	2.6	2.7	3.1
19	3.6	3.3	3.5	3.3	3.35	3.25	2.75	2.15	2.55	2.6	2.7	3.1
20	3.8	3.3	3.5	3.3	3.35	3.2	2.7	2.15	2.55	2.6	2.7	3.2
21	3.8	3.3	3.5	3.35	3.3	3.15	2.7	2.15	2.6	2.6	2.7	3.2
22	3.8	3.3	3.5	3.35	3.35	3.15	2.7	2.2	2.6	2.6	2.7	3.3
23	3.75	3.25	3.5	3.3	3.4	3.15	2.65	2.3	2.6	2.7	2.7	3.4
24	3.7	3.3	3.45	3.3	3.45	3.15	2.65	2.4	2.6	2.7	2.7	3.4
25	3.6	3.3	3.45	3.25	3.55	3.1	2.6	2.5	2.6	2.8	2.7	3.5
26	3.6	3.3	3.5	3.3	3.55	3.1	2.55	2.5	2.6	2.9	2.8	3.5
27	3.6	3.25	3.5	3.3	3.6	3.1	2.4	2.5	2.6	2.9	2.85	3.5
28	3.6	3.3	3.45	3.3	3.6	3.0	2.32	2.55	2.6	3.0	2.9	3.5
29	3.6	....	3.45	3.35	3.6	3.0	2.3	2.55	2.6	3.1	3.0	3.5
30	3.55	....	3.45	3.4	3.55	3.0	2.25	2.6	2.6	3.2	3.0	3.5
31	3.5	....	3.5	....	3.6	....	2.2	2.6	....	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.	Gage height.	Discharge.	Gage height.	Discharge.	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	66

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	0.052	0.060
February	41	17	29.0	1,611	.028	.029
March	41	34	38.8	2,386	.038	.044
April	41	20	28.9	1,720	.028	.031
May	57	27	43.8	2,693	.043	.050
June	45	8	28.0	1,666	.027	.030
July	2	.0	.96	59	.00094	.0011
August	.6	.0	.12	7	.00012	.00014
September	.6	.4	.50	30	.00049	.00055
October	27	.6	2.9	178	.0028	.0032
November	27	.8	7.8	464	.0076	.0085
December	41	8	19.1	1,174	.019	.022
The year	66	0	21.1	15,270	.021	.279

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, 1896. 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 396; 66, p 105; 85, p 101; 100, p 161; 133, p 204.

Discharge: Ann 18, iv, p 311; WS 16, p 156; 28, p 153; 38, p 328; 51, p 396; 66, p 105; 85, p 102; 100, p 161; 133, p 205.

Discharge, monthly: Ann 19, 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 206.

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

Gage heights: WS 11, p 76; 16, p 165; 28, pp 148-149; 38, p 328; 51, p 397; 66, p 106; 85, p 102; 100, p 162; 133, p 205.

Hydrographs: Ann 19, iv, p 430; 20, iv, p 441; 21, iv, p 391; 22, iv, p 400.

Rating tables: Ann 19, iv, p 429; WS 28, p 154; 39, p 452; 52, p 520; 66, p 174; 85, p 102; 100, p 162; 133, p 206.

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

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 26	W. 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	770
June 27	do	45	122	2.80	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	1.05	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	......	1.1

a No flow.

Station rating table for South Fork Humboldt River near Elko, 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.*
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	261	0	149	8,866	.130	.145
May	640	150	465	28,590	.404	.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	.0046
October	18	0	9.9	608	.0086	.0099
November	25	18	24.7	1,470	.021	.023
December	25	25	25	1,537	.022	.025
The year	816	0	123	89,520	.107	1.46

HUMBOLDT RIVER AT PALISADE, NEV.

This station was established November 27, 1902. It is located at the single-span highway 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: 85, p 100; 100, p 157; 133, p 286.
Discharge: 100, p 158; 133, p 286.
Discharge, monthly: 100, p 159; 133, p 288.
Gage heights: 85, p 100; 100, p 158; 133, p 287.
Rating table 100, p 159; 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	102	258	1.88	3.10	485
May 20	do	105	365	2.33	4.10	850
June 4	do	105	414	2.23	4.20	923
June 20	do	105	358	2.12	3.85	759
June 27	do	105	358	2.11	3.85	756
July 15	do	97	204	1.40	2.35	284
September 8	do	10	10	1.30	.90	13

Daily gage height, in feet, of Humboldt River at Palisade, Nev., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	2.0	2.4	2.6	2.95	4.6	3.2	1.6	1.1	1.15	1.4	1.4
2	1.95	2.1	2.4	2.6	3.0	4.6	3.2	1.6	1.1	1.15	1.4	1.4
3	1.95	2.1	2.4	2.6	3.05	4.6	3.15	1.6	1.1	1.15	1.4	1.40
4	1.95	2.2	2.4	2.6	3.1	4.55	3.1	1.6	1.1	1.15	1.4	1.40
5	1.95	2.2	2.4	2.6	3.15	4.55	3.1	1.55	1.1	1.2	1.4	1.40
6	1.95	2.2	2.4	2.6	3.2	4.55	3.0	1.55	1.1	1.2	1.4	1.40
7	1.95	2.2	2.4	2.6	3.3	4.5	2.9	1.5	1.1	1.2	1.4	1.40
8	1.9	2.2	2.4	2.6	3.3	4.5	2.85	1.5	1.1	1.2	1.4	1.40
9	1.9	2.1	2.4	2.6	3.35	4.5	2.8	1.5	1.1	1.2	1.4	1.40
10	1.8	2.1	2.4	2.6	3.4	4.45	2.75	1.5	1.1	1.2	1.4	1.4
11	1.8	2.1	2.4	2.65	3.5	4.45	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	2.6	1.5	1.1	1.2	1.4	1.4
13	1.7	2.0	2.4	2.8	3.6	4.2	2.5	1.5	1.1	1.2	1.4	1.4
14	1.7	2.0	2.4	2.8	3.65	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	2.6	2.95	4.5	3.6	1.75	1.1	1.1	1.35	1.4	1.55
27	1.9	2.4	2.6	2.95	4.6	3.5	1.75	1.1	1.1	1.4	1.4	1.6
28	1.9	2.4	2.6	2.95	4.7	3.4	1.75	1.1	1.1	1.4	1.4	1.6
29	1.9	....	2.6	2.95	4.8	3.3	1.75	1.1	1.1	1.4	1.4	1.65
30	2.0	....	2.6	2.95	4.7	3.2	1.75	1.1	1.1	1.4	1.4	1.7
31	2.0	....	2.6	....	4.6	....	1.6	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.	Gage height.	Discharge.	Gage height.	Discharge.	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	23,620	.079	.088
May	1,220	446	793	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	.752

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 1½ 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 320; 51, p 307; 66, p 106; 85, p 98; 100, p 155; 133, pp 288-289.

Discharge: Ann 18, iv, pp 304-305; Bull 131, p 62; 140, p 218; WS 16, p 154; 28, p 153; 38, p 320; 51, p 307; 66, p 106; 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 302; 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 320; 51, p 308; 66, p 107; 85, p 99; 100, p 156; 133, p 290.

Hydrographs: Ann 19, iv, p 429; 20, iv, p 439; 21, iv, p 302; 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.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 25	W. A. Wolf	63	200	0.58	6.55	116
May 19	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					5.9		4.6		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		5.9	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.	Gage height.	Discharge.
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 20, 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 308; 66, p 107; 85, p 96; 100, pp 152-153; 133, p 202.

Discharge: Ann 18, iv, p 307; WS 16, p 155; 28, p 153; 38, p 330; 51, p 308; 66, p 107; 85, p 97; 100, p 153; 133, p 202.

Discharge, monthly: Ann 18, iv, p 308; 19, iv, p 428; 20, iv, p 439; 21, iv, p 303; 22, iv, p 402; WS 75, p 183; 85, p 98; 100, p. 154; 133, p 204.

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 203.

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 203.

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	3.9	3.0	3.75	2.6	1.8	1.6	1.0	2.75	1.8	1.75	1.9	2.1
2	3.6	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	2.95	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	3.25	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	2.9	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	2.9	2.93	2.7	2.1	1.65	1.0	2.75	2.25	1.7	1.85	1.95	2.3
26	2.9	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	2.9	....	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	0.0	1.90	29.0	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	16,000	0.019	.022
February	308	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	9,592	.011	.013
August	162	20	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	40	20	33.1	1,970	.0024	.0027
December	98	40	62.7	3,855	.0045	.0052
The year	440	0	101	73,020	.0073	.099

NOTE.—Ice conditions January 1 to February 10. 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.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
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	4.68	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	4.65	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	4.6	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	4.65	4.82	4.95
8	5.85	5.35	6.55	6.0	6.2	5.89	4.64	3.8	4.25	4.75	4.82	4.9
9	5.85	5.3	6.58	6.0	6.2	5.85	4.64	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	4.6	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	4.62	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	4.67
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	4.65
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	6.50	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 4.0 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	50,790	0.388	0.447
February	1,261	610	827	45,930	.388	.404
March	1,414	742	1,133	69,670	.532	.613
April	1,883	551	935	55,640	.439	.490
May	1,730	945	1,306	80,300	.613	.707
June	1,275	402	935	55,640	.439	.490
July	413	120	241	14,820	.113	.130
August	220	108	148	9,100	.069	.080
September	298	168	229	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	108	659	476,100	.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, 1899. 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 95; 22, iv, p 405; WS 75, p 180; 85, p 119; 100, p 187; 133, p 303.

Discharge, yearly: Ann 13, iii, p 99; 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 180.

Rating tables: WS 52, p 521; 66, p 175; 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	1.98	5.25	1,027
April 13	do	115	480	1.70	5.00	816
April 28	do	117	593	2.86	6.28	1,698
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	5.6	4.8	5.8	....	5.6	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	5.6	4.1	3.4	3.5	4.0	4.3	4.4
3	5.4	5.9	5.9	5.0	6.0	5.4	4.1	3.4	3.5	4.0	4.1	4.4
4	5.4	4.8	5.9	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	5.6	3.8	3.4	3.7	4.1	4.2	4.0
11	5.1	4.8	5.9	5.4	5.3	5.3	3.7	3.4	3.7	4.2	4.3	4.2
12	5.1	4.8	5.9	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	5.6	3.7	3.4	3.7	4.2	4.3	4.1
14	5.0	4.9	6.0	5.0	4.8	5.6	3.5	3.4	3.7	4.2	4.3	4.2
15	5.0	4.9	5.8	5.1	5.6	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	5.9	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	4.3	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
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 6.3 feet.

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

[Drainage area, 1,519 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	1,220	675	894	54,970	0.589	0.679
February	1,420	675	943	52,370	.621	.647
March	1,560	790	1,237	76,060	.814	.938
April	1,860	570	1,003	59,680	.660	.736
May	1,710	730	1,279	78,640	.842	.971
June	1,285	370	930	55,340	.612	.683
July	405	150	260	15,990	.171	.197
August	275	195	224	13,770	.147	.170
September	370	195	279	16,600	.184	.205
October	485	370	430	26,440	.283	.326
November	525	405	460	27,370	.303	.338
December	525	130	421	25,890	.277	.319
The year	1,860	130	697	503,100	.459	6.21

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 bowlders and cobblestones. The current is swift.

Discharge measurements are made by means of a cable and car, 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 bowlder. 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 119-120; 100, pp 102-103; 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 103-104; 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.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 17	W. A. Wolf	80	344	2.76	2.85	940
May 13	do	80	370	2.91	2.95	1,078
May 26	do	87	441	4.00	3.05	1,701
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	2.16	544
July 25	do	76	277	1.95	2.12	539
September 13	do	74	274	1.52	1.97	416

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	1.97	1.8
7	2.7	2.3	3.3	2.9	3.3	3.05	2.3	2.1	2.1	2.1	1.85	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	2.16	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	3.05	......	2.25	2.12	2.0	2.05	1.85	1.87
17	2.2	2.4	2.7	2.85	3.05	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	2.05	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	2.05	3.7	2.8	2.15	2.15	2.05	2.1	1.97	1.7
22	2.7	2.85	2.8	2.05	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	3.05	2.75	2.15	2.12	2.05	2.05	1.97	1.8
24	2.5	3.02	2.45	2.9	3.05	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	2.05	4.02	3.4	2.5	2.1	2.02	2.05	2.02	1.9	1.82
27	2.3	3.12	2.05	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	3.4	......	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.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
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	46,420	0.791	0.912
February	1,228	580	754	41,880	.789	.822
March	1,393	610	1,096	67,390	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 car 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