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

# REPORT

OF

# PROGRESS OF STREAM MEASUREMENTS

FOR

# THE CALENDAR YEAR 1904

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

**T. U. TAYLOR and JOHN C. HOYT**

PART IX—Western Gulf of Mexico and Rio Grande Drainages

WASHINGTON
GOVERNMENT PRINTING OFFICE
1905

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# ILLUSTRATIONS.

# LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
*Washington, D. C., March 20, 1905.*

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

The larger part of the original data for this report was collected under the direction of district hydrographers T. U. Taylor and W. M. Reed, and by the International (Water) Boundary Commission. The assembling of the data and its preparation for publication were done under the direction of John C. Hoyt, who has been assisted by R. H. Bolster, Robert Follansbee, Willis E. Hall, A. H. Horton, and H. T. Colvin.

I request that this manuscript be published as one of the series of Water-Supply and Irrigation Papers.

Very respectfully,

F. H. NEWELL, *Chief Engineer.*

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

# PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1904.

## PART IX.

By T. U. Taylor and John C. Hoyt.

### INTRODUCTION.

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

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

*Annual appropriations for hydrographic surveys.*

| | |
|---|---|
| Year ending June 30, 1895 | $12,500 |
| Year ending June 30, 1896 | 20,000 |
| Year ending June 30, 1897 | 50,000 |
| Year ending June 30, 1898 | 50,000 |
| Year ending June 30, 1899 | 50,000 |
| Year ending June 30, 1900 | 50,000 |
| Year ending June 30, 1901 | 100,000 |
| Year ending June 30, 1902 | 100,000 |
| Year ending June 30, 1903 | 200,000 |
| Year ending June 30, 1904 | 200,000 |
| Year ending June 30, 1905 | 200,000 |
| Year ending June 30, 1906 | 200,000 |

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

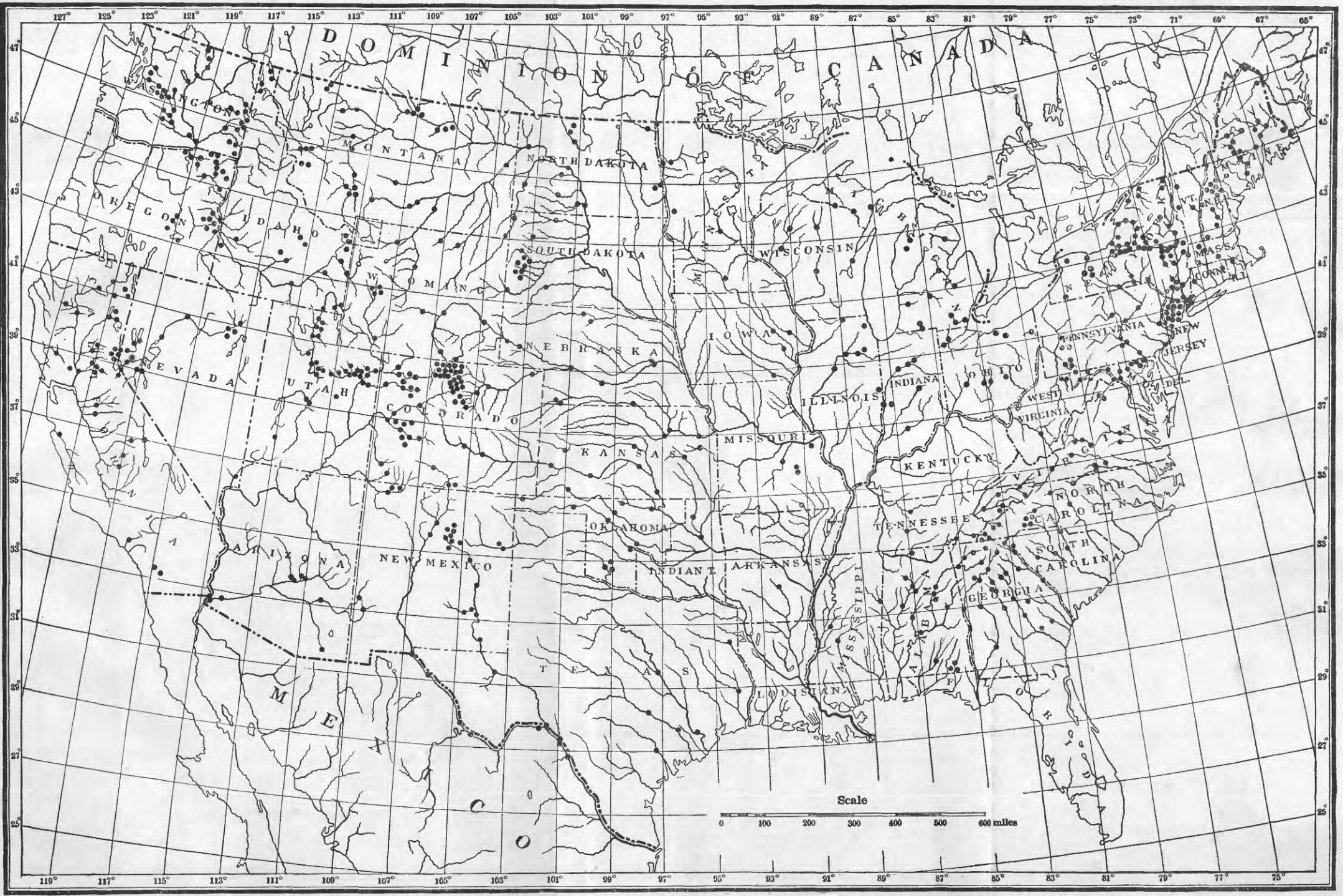
As a result of the increased appropriations since June 30, 1902, the work has been largely extended and thoroughly systemized. The various States have been grouped into districts, each of which is under the supervision of a district hydrographer who, with a corps of assistants, devotes his whole time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

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

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

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

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




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

ance—generally a secondary cable—is necessary to hold the meter in position below the surface.

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

On many of the larger rivers where water power is developed by dams, estimates of flow are obtained by observing the head on the crest and using a weir formula. On the smaller streams sharp-crested weirs are in some cases erected.

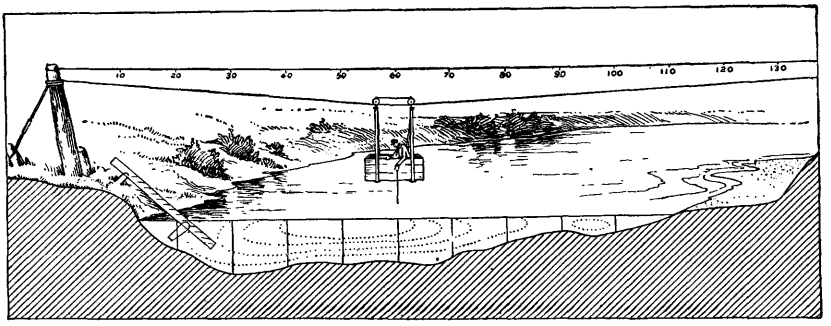



FIG. 1.—Cable station, showing section of river, car, gage, etc.

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

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

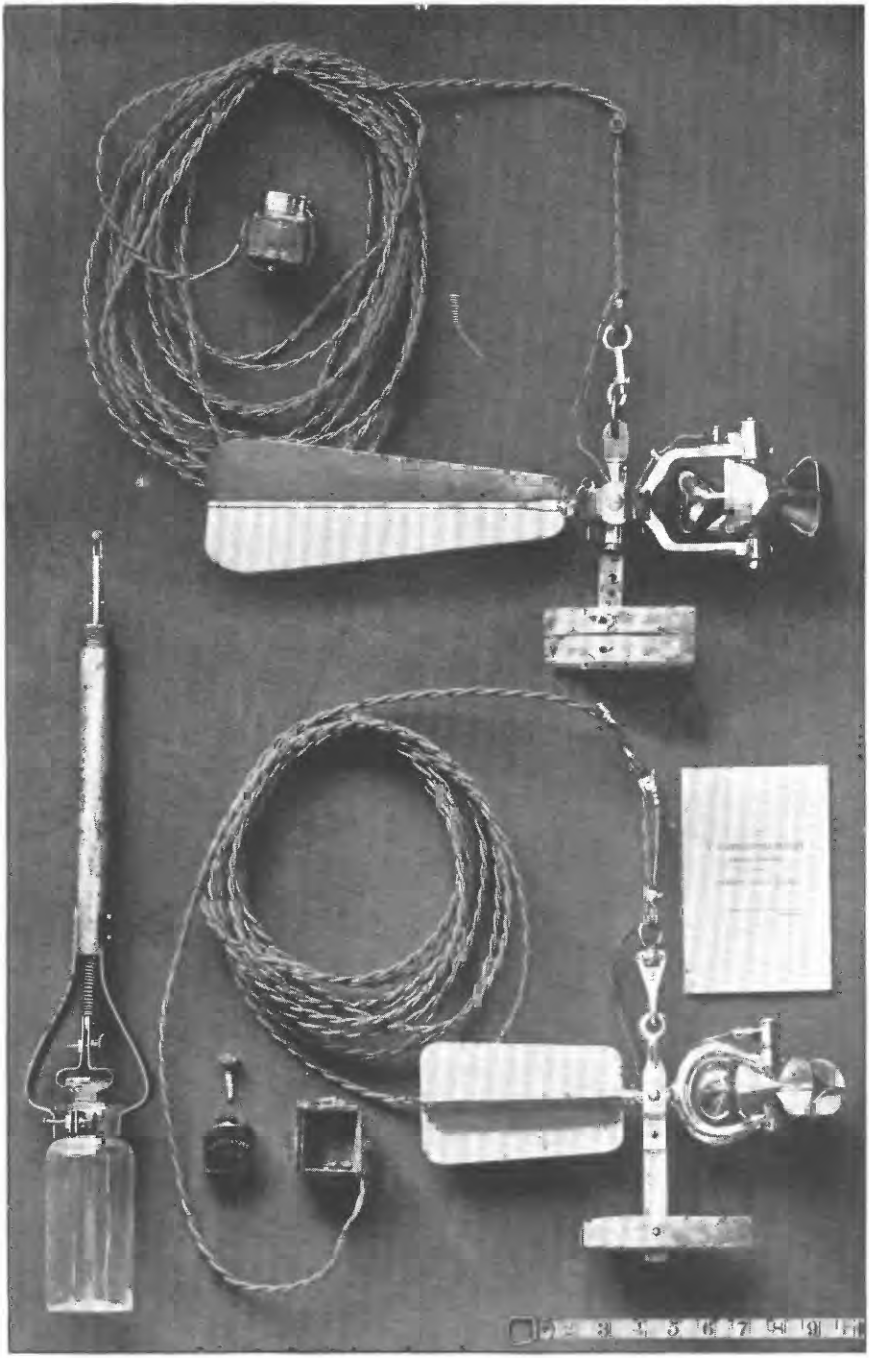
In making the measurement an arbitrary number of points are laid off perpendicular to the thread of the stream (see fig. 1). These points are usually at regular intervals varying from 2 to 20 feet, depending

upon the size and conditions of the stream. They are known as measuring points, and at them the observed data, the velocities and soundings, are taken. The perpendiculars dropped from the measuring points divide the gaging section into strips, and for each strip or pair of strips the mean velocity, area, and discharge are determined independently; thus conditions existing in one part of the stream are not distributed to parts where they do not apply.

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

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth, for which the coefficient for reducing to mean velocity has been determined. Extensive experiments by vertical velocity-curves show that the thread of mean velocity lies at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and it is at this depth that the meter is held in the majority of the measurements, this being known as the six-tenth depth method. It is found by a large number of vertical velocity-curve measurements, taken on various streams and under various conditions, that the coefficient for reducing the velocity obtained at six-tenths depth to mean velocity is practically unity, ranging, in a series of 910 measurements made at 39 gaging stations, between 0.94 and 1.04, with a mean for the 910 observations of 1.00. In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the action of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocities taken at the subsurface has been found by repeated experiments with vertical-velocity curves to be from .85 to .95, depending upon the depth of the stream and velocity and channel conditions. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

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



PRICE ELECTRIC CURRENT METERS, WITH BUZZERS.

are seldom used except for determining coefficients for purposes of comparison, and for measurements under ice.

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

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

The area, which is the other factor for determining the discharge of the stream, depends upon the stage of the river, which is taken on a gage, and the general contour of the bed of the stream, which is found by sounding. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For stations with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also used for obtaining the area for use in 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 the various points of measurements the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or double strip. The total discharge and area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work for which the data are needed. Those used in this report are "second-feet," "acre-feet," "run-off per square mile," and "run-off in depth in inches," and may be defined as follows:

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

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

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

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

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

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

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

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

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

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

In determining the daily discharge of streams with permanent beds, the results of the discharge measurements are plotted on cross-section paper, with gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which shows the discharge for any gage height, and from which a rating table is prepared.

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

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

In determining the flow for periods when the streams are frozen, special rating curves and tables have to be prepared from measurements taken under these conditions. The methods of constructing these curves and tables are the same as for open sections. The discharge measurements, however, are taken either by integration in verticals or by the vertical velocity-curve method, as sufficient experiments have not been made on ice-covered streams to determine the laws which govern the position of the thread of mean velocity.

The Report of Progress of Stream Measurements for the Calendar Year 1904, of which this is Part IX, is published in a series of twelve

Water-Supply Papers, Nos. 124–135, inclusive, under the following subtitles:

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

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

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

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

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

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

The discharge measurement table gives the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet.

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

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

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" gives the average flow for each second during the month. Upon this mean the computations for the three remaining columns which are defined on page 14 are based.

In the computations for the tables of this report, for stations maintained by the United States Geological Survey, the following general and special rules have been used:

*Fundamental rules for computation.*

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

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

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

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

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

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

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

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

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

*Special rules for computation.*

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

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

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

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

The results of the stream measurements made during previous years by the United States Geological Survey can be found in the following Survey publications. A detailed index of these reports (from 1888–1903) is given in Water-Supply Paper No. 119.

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

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

## COOPERATION AND ACKNOWLEDGMENTS.

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

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

*Indian Territory.*—District hydrographers, M. C. Hinderlider[a] and G. H. Matthes,[b] assisted by W. G. Russell. Acknowledgments are due to the Atchison, Topeka and

[a] Office, Chamber of Commerce Building, Denver, Colo.
[b] J. M. Giles has succeeded G. H. Matthes. Office, Carlsbad, N. Mex.

Santa Fe, the Missouri, Kansas and Texas, and the Chicago, Rock Island and Pacific Railway companies for annual passes issued to W. G. Russell.

*New Mexico.*—The work in northern New Mexico was carried on under the direction of M. C. Hinderlider, district hydrographer, assisted by W. G. Russell, G. B. Monk, and R. C. Prewitt. For many favors and courtesies in the form of free accommodations to hydrographers and for assistance in securing records of flow on Mora River, acknowledgments are due D. C. Duel, Hugh Loudon, and J. J. Baer, of La Cueva, N. Mex.; also to J. D. Hand, of Los Alamos, N. Mex., for similar favors. Transportation in the form of an annual pass was furnished Mr. Monk by the Denver and Rio Grande Railroad, and to W. G. Russell by the Chicago, Rock Island and El Paso Railroad. For the purpose of collecting data in New Mexico during the latter part of the year an annual pass over the Atchison, Topeka and Santa Fe Railway was issued to G. B. Monk, for which acknowledgments are due.

The work in southern New Mexico was carried on by district hydrographer W. M. Reed,[a] assisted by F. S. Dobson.

*Oklahoma.*—District hydrographers, M. C. Hinderlider and G. H. Matthes, assisted by W. G. Russell. Acknowledgments are due to the Atchison, Topeka and Santa Fe, the Missouri, Kansas and Texas, and the Chicago, Rock Island and Pacific Railway companies for annual passes issued to W. G. Russell.

*Texas.*—District hydrographer, Thomas U. Taylor,[b] assisted by H. H. Fox, E. C. H. Bantel, and B. M. Haberer. Acknowledgments are due to the Missouri, Kansas and Texas, the International and Great Northern, the Houston and Texas Central, the Southern Pacific, the Texas Pacific, the Fort Worth and Denver, the Gulf, Colorado and Santa Fe, the St. Louis and Southwestern (Cotton Belt), and the San Antonio and Aransas Pass railroads for transportation for the district hydrographers. Also to the army engineers for gage heights at Riverside and for maps of Brazos River from Gulf to Waco.

Special acknowledgment is due to Gen. Anson Mills, commissioner, and W. W. Follett, consulting engineer of the International (Water) Boundary Commission, for the results of the data collected at certain stations in the Rio Grande drainage basin.

## SABINE RIVER DRAINAGE BASIN.

Sabine River has its headwaters in Collin and Hunt counties, flows in a southeasterly direction to the State line, then south, forming the boundary between Texas and Louisiana, and empties into Sabine Lake, an arm of the Gulf, near Orange, Tex. The small tributaries in east Texas support many small water mills, and the Sabine itself is navigable for several hundred miles. The drainage area of the Sabine in Texas above Orange is 7,500 square miles, and its total drainage area above Orange in Louisiana and Texas is 10,400 square miles.

### SABINE RIVER NEAR LONGVIEW, TEX.

This station was established January 1, 1904, by Thomas U. Taylor. It is located at the bridge of the International and Great Northern Railway, about 3 miles southwest of Longview Junction, Tex. A standard chain gage is attached to the guard rail of the bridge. The gage is read twice each day by John Wadsack. Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is the east face of the west abutment.

[a] J. M. Giles has succeeded W. M. Reed. Office, Carlsbad, N. Mex.
[b] Office, Austin, Tex.

The channel is straight for 150 feet above and 400 feet below the station. The current is sluggish. The right bank is low and cleared along the right of way of the railroad. The left bank is high, and composed in its lower half of sandstone. It is cleared above and wooded below the station. The bed of the stream is rocky and fairly permanent. Old piles left from the false work used in erecting the bridge give trouble in making measurements at low water. Bench mark No. 1 is the top of abutment northeast corner, marked "U. S. G. S. 42.08 B. M." Its elevation is 42.08 feet above the gage datum. Bench mark No. 2 is the top of an iron rod buried in a vertical position in the yard of the bridge watchman, 6 feet from the southeast corner of his house, 3 feet east of the second post from the gate, and 8 inches from the wire fence. Its elevation is 47.00 feet above gage datum. Bench mark No. 3 is the top of tie at the gage. Its elevation is 45.00 feet above gage datum.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Sabine River near Longview, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| March 2 | E. C. H. Bantel | ..... | ..... | 9.10 | 512 |
| June 8 | H. H. Fox | 543 | 1.51 | 10.30 | 820 |
| June 9 | do | 763 | 1.83 | 12.25 | 1,390 |
| June 10 | do | 1,006 | 1.90 | 14.23 | 1,920 |
| June 11 | do | 1,334 | 1.90 | 16.95 | 2,530 |
| June 11 | do | 1,505 | 1.84 | 18.30 | 2,780 |
| June 12 | do | 1,593 | 1.89 | 19.00 | 3,010 |
| June 13 | do | 1,738 | 1.92 | 19.90 | 3,330 |
| June 15 | do | 1,895 | 1.95 | 21.00 | 3,703 |
| June 17 | do | 1,969 | 1.97 | 21.55 | 3,872 |
| June 18 | do | 1,810 | 1.84 | 20.40 | 3,340 |
| June 19 | do | 1,652 | 1.74 | 19.30 | 2,875 |
| June 20 | do | 1,483 | 1.63 | 18.10 | 2,420 |
| June 20 | do | 1,410 | 1.63 | 17.50 | 2,300 |
| June 21 | do | 1,140 | 1.52 | 15.30 | 1,730 |
| June 21 | do | 963 | 1.47 | 13.86 | 1,420 |
| June 21 | do | 822 | 1.47 | 12.72 | 1,204 |
| June 22 | do | 565 | 1.38 | 10.50 | 780 |
| June 22 | do | 453 | 1.24 | 9.42 | 560 |
| June 23 | do | 396 | 1.22 | 8.78 | 485 |
| June 24 | do | 355 | 1.10 | 8.30 | 392 |
| June 24 | do | 375 | 1.14 | 8.60 | 426 |
| Aug. 31 | T. U. Taylor | 186 | .23 | 6.00 | 44 |

*Mean daily gage height, in feet, of Sabine River near Longview, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.5 | 9.7 | 9.4 | 17.7 | 11.8 | 7.4 | 11.8 | 6.7 | 6.0 | 6.2 | 6.2 | 6.4 |
| 2 | 8.4 | 9.1 | 9.2 | 16.9 | 12.8 | 7.3 | 13.5 | 6.7 | 6.0 | 6.2 | 6.1 | 6.4 |
| 3 | 8.3 | 8.6 | 8.9 | 14.0 | 12.8 | 7.2 | 13.7 | 6.6 | 6.1 | 6.1 | 6.1 | 6.4 |
| 4 | 8.1 | 8.0 | 8.6 | 12.5 | 12.1 | 7.4 | 13.1 | 6.5 | 6.1 | 6.1 | 6.1 | 6.5 |
| 5 | 8.5 | 7.9 | 8.6 | 11.0 | 10.9 | 7.7 | 12.4 | 6.6 | 6.6 | 6.1 | 6.1 | 6.5 |
| 6 | 8.0 | 7.8 | 8.1 | 11.4 | 10.7 | 8.8 | 12.5 | 6.7 | 7.2 | 6.0 | 6.2 | 6.5 |
| 7 | 7.9 | 7.8 | 8.1 | 15.0 | 12.1 | 10.1 | 11.9 | 6.9 | 7.8 | 6.0 | 6.2 | 6.5 |
| 8 | 7.8 | 8.1 | 8.0 | 18.9 | 15.9 | 10.8 | 10.8 | 7.0 | 8.4 | 6.0 | 6.2 | 6.5 |
| 9 | 7.8 | 8.2 | 7.9 | 21.0 | 17.0 | 12.1 | 9.9 | 7.1 | 8.5 | 6.0 | 6.2 | 6.5 |
| 10 | 7.7 | 8.0 | 7.8 | 21.1 | 18.0 | 14.8 | 9.6 | 7.2 | 8.6 | 6.0 | 6.2 | 6.5 |
| 11 | 7.6 | 8.0 | 7.8 | 21.5 | 18.4 | 17.7 | 9.6 | 8.2 | 8.1 | 6.0 | 6.2 | 6.6 |
| 12 | 7.7 | 7.9 | 7.7 | 22.2 | 18.8 | 19.5 | 9.3 | 9.2 | 7.6 | 6.0 | 6.2 | 6.5 |
| 13 | 7.5 | 8.2 | 7.6 | 23.0 | 19.2 | 20.0 | 8.7 | 9.4 | 7.2 | 6.0 | 6.2 | 6.5 |
| 14 | 7.2 | 7.7 | 7.6 | 24.0 | 19.6 | 20.6 | 7.9 | 9.0 | 6.9 | 6.0 | 6.2 | 6.5 |
| 15 | 7.2 | 8.2 | 7.6 | 24.9 | 20.1 | 21.1 | 7.5 | 8.2 | 6.7 | 6.0 | 6.2 | 6.5 |
| 16 | 7.4 | 8.8 | 7.6 | 25.6 | 20.9 | 21.6 | 7.2 | 7.5 | 6.6 | 6.0 | 6.2 | 6.5 |
| 17 | 7.4 | 8.6 | 7.6 | 26.2 | 21.3 | 21.8 | 7.0 | 7.1 | 6.5 | 6.0 | 6.2 | 6.5 |
| 18 | 7.4 | 8.3 | 7.6 | 26.8 | 21.5 | 21.6 | 6.9 | 6.5 | 6.4 | 6.0 | 6.2 | 6.5 |
| 19 | 7.4 | 9.2 | 7.6 | 27.3 | 22.1 | 21.0 | 6.7 | 6.7 | 6.3 | 6.0 | 6.3 | 6.5 |
| 20 | 7.2 | 10.6 | 7.7 | 27.4 | 17.8 | 18.9 | 6.7 | 6.5 | 6.3 | 6.0 | 6.6 | 6.5 |
| 21 | 7.3 | 12.9 | 9.5 | 27.3 | 13.2 | 14.3 | 6.7 | 6.5 | 6.2 | 6.0 | 6.6 | 6.5 |
| 22 | 7.6 | 14.3 | 11.5 | 26.5 | 9.4 | 10.3 | 6.6 | 6.4 | 6.2 | 5.9 | 6.6 | 6.5 |
| 23 | 8.8 | 13.8 | 12.5 | 24.1 | 8.5 | 9.1 | 7.0 | 6.3 | 6.4 | 5.9 | 6.5 | 6.5 |
| 24 | 9.4 | 12.7 | 12.4 | 20.5 | 7.9 | 8.7 | 7.7 | 6.3 | 6.6 | 5.9 | 6.5 | 6.6 |
| 25 | 10.1 | 11.6 | 12.6 | 16.5 | 7.7 | 8.6 | 9.2 | 6.2 | 6.6 | 6.0 | 6.6 | 6.0 |
| 26 | 10.6 | 10.8 | 13.8 | 12.7 | 7.6 | 8.7 | 9.1 | 6.2 | 6.5 | 6.1 | 6.6 | 8.2 |
| 27 | 11.6 | 10.3 | 14.5 | 10.4 | 7.6 | 8.7 | 9.0 | 6.2 | 6.5 | 6.0 | 6.5 | 10.4 |
| 28 | 12.6 | 9.6 | 15.7 | 9.6 | 7.5 | 8.9 | 8.2 | 6.1 | 6.4 | 6.0 | 6.5 | 10.8 |
| 29 | 13.0 | 9.6 | 16.5 | 9.8 | 7.4 | 10.0 | 7.1 | 6.1 | 6.4 | 6.0 | 6.5 | 10.0 |
| 30 | 12.5 | ..... | 17.2 | 10.8 | 7.6 | 10.6 | 7.0 | 6.1 | 6.3 | 6.0 | 6.4 | 9.7 |
| 31 | 10.6 | ..... | 17.3 | ..... | 7.6 | ..... | 6.9 | 6.0 | ..... | 6.2 | ..... | 8.8 |

*Rating table for Sabine River near Longview, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 5.90 | 35 | 7.90 | 300 | 10.60 | 826 | 15.50 | 1,975 |
| 6.00 | 44 | 8.00 | 317 | 10.80 | 869 | 16.00 | 2,103 |
| 6.10 | 53 | 8.10 | 335 | 11.00 | 913 | 16.50 | 2,233 |
| 6.20 | 63 | 8.20 | 353 | 11.20 | 957 | 17.00 | 2,366 |
| 6.30 | 74 | 8.30 | 371 | 11.40 | 1,001 | 17.50 | 2,501 |
| 6.40 | 85 | 8.40 | 389 | 11.60 | 1,045 | 18.00 | 2,640 |
| 6.50 | 97 | 8.50 | 407 | 11.80 | 1,090 | 18.50 | 2,785 |
| 6.60 | 109 | 8.60 | 426 | 12.00 | 1,136 | 19.00 | 2,938 |
| 6.70 | 122 | 8.70 | 445 | 12.20 | 1,182 | 19.50 | 3,100 |
| 6.80 | 135 | 8.80 | 464 | 12.40 | 1,228 | 20.00 | 3,269 |
| 6.90 | 148 | 8.90 | 483 | 12.60 | 1,274 | 20.50 | 3,446 |
| 7.00 | 162 | 9.00 | 502 | 12.80 | 1,320 | 21.00 | 3,630 |
| 7.10 | 176 | 9.10 | 521 | 13.00 | 1,366 | 21.50 | 3,824 |
| 7.20 | 190 | 9.20 | 540 | 13.20 | 1,413 | 22.00 | 4,030 |
| 7.30 | 205 | 9.40 | 580 | 13.40 | 1,461 | 22.50 | 4,244 |
| 7.40 | 220 | 9.60 | 620 | 13.60 | 1,509 | 23.00 | 4,464 |
| 7.50 | 235 | 9.80 | 660 | 13.80 | 1,557 | 24.00 | 4,919 |
| 7.60 | 251 | 10.00 | 700 | 14.00 | 1,605 | 25.00 | 5,386 |
| 7.70 | 267 | 10.20 | 742 | 14.50 | 1,725 | 26.00 | 5,863 |
| 7.80 | 283 | 10.40 | 784 | 15.00 | 1,850 | 27.00 | 6,348 |

The above table is based upon 23 discharge measurements made during 1904. It is well defined between gage heights 6 feet and 22 feet. The table has been extended beyond these limits.

*Estimated monthly discharge of Sabine River near Longview, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 1,366 | 190 | 464 | 28,530 |
| February | 1,677 | 267 | 613 | 35,260 |
| March | 2,447 | 251 | 787 | 48,390 |
| April | 6,544 | 620 | 3,425 | 203,800 |
| May | 4,072 | 220 | 1,683 | 103,500 |
| June | 3,946 | 190 | 1,571 | 93,480 |
| July | 1,533 | 109 | 556 | 34,190 |
| August | 580 | 44 | 166 | 10,210 |
| September | 426 | 44 | 145 | 8,628 |
| October | 63 | 36 | 46.2 | 2,841 |
| November | 109 | 53 | 76.1 | 4,528 |
| December | 869 | 44 | 199 | 12,240 |
| The year | 6,544 | 36 | 811 | 585,600 |

## NECHES RIVER AT EVADALE, TEX.

A gaging station was established on Neches River at Evadale, July 1, 1904, by Thomas U. Taylor. It is located at the bridge of the Gulf, Beaumont and Kansas City Railroad. Gage readings are made by reading down from the top of the tie to the water surface by means of a tape. The zero of the gage is 40.00 feet below the top of tie in the west arm of the draw span of the bridge. The observer is W. H. Whittemore. The clear span or waterway under each arm of the draw span is 50 feet, and the bridge continues each way on trestles. The left bank is high, whence the name of the railroad station, Fords Bluff, but the right or west bank is low and the trestle work continues about half a mile from the river channel. At low water the current is very sluggish, and discharge measurements are made at shoals above or below the station.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Neches River at Evadale, Tex., in 1902 and 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| 1902. | | *Feet.* | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second feet.* |
| September 10[a]. | T. U. Taylor..... | 22 | 15.6 | 1.67 | ..... | 26 |
| 1904. | | | | | | |
| July 16..... | T. U. Taylor..... | ..... | 1,800 | .63 | 10.00 | 1,140 |
| August 6 ..... | .....do ..... | ..... | 1,590 | .47 | 8.30 | 740 |
| August 15[a] .... | .....do ..... | 18 | 18 | 1.61 | ..... | 29 |
| October 23..... | E. C. H. Bantel.... | 100 | 1,360 | .203 | 5.70 | 278 |

[a]Two hundred yards below railway bridge, near Price, on the International and Great Northern Railroad.

*Mean daily gage height, in feet, of Neches River at Evadale, Tex., for 1904.*

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|
| 1 | 10.3 | 8.3 | 6.5 | 7.1 | 5.2 | 5.8 |
| 2 | 10.3 | 8.0 | 6.4 | 6.9 | 5.2 | 5.9 |
| 3 | 10.2 | 8.1 | 6.3 | 6.7 | 5.2 | 5.9 |
| 4 | 10.2 | 8.1 | 6.2 | 6.5 | 5.2 | 5.9 |
| 5 | 10.1 | 8.1 | 6.2 | 6.4 | 5.2 | 5.9 |
| 6 | 10.1 | 8.3 | 6.6 | 6.2 | 5.2 | 5.9 |
| 7 | 10.1 | 7.9 | 7.8 | 6.1 | 5.2 | 5.9 |
| 8 | 10.0 | 8.6 | 7.7 | 6.1 | 5.2 | 5.9 |
| 9 | 10.0 | 9.7 | 7.5 | 6.0 | 5.2 | 6.0 |
| 10 | 9.8 | 10.0 | 7.2 | 5.9 | 5.2 | 6.0 |
| 11 | 9.6 | 10.2 | 7.2 | 5.9 | 5.2 | 5.9 |
| 12 | 9.3 | 11.3 | 7.1 | 5.9 | 5.2 | 5.9 |
| 13 | 9.5 | 11.9 | 6.9 | 5.9 | 5.2 | 5.9 |
| 14 | 9.6 | 11.7 | 6.7 | 5.9 | 5.2 | 5.9 |
| 15 | 9.7 | 11.6 | 6.6 | 5.9 | 5.2 | 6.0 |
| 16 | 9.8 | 11.2 | 6.6 | 5.9 | 5.2 | 6.1 |
| 17 | 9.7 | 12.3 | 6.7 | 5.9 | 5.2 | 6.1 |
| 18 | 9.6 | 9.3 | 6.8 | 5.7 | 5.2 | 6.1 |
| 19 | 9.4 | 8.6 | 6.1 | 5.6 | 5.2 | 6.1 |
| 20 | 9.2 | 8.1 | 6.1 | 5.6 | 5.2 | 6.1 |
| 21 | 9.0 | 7.7 | 6.1 | 5.6 | 5.2 | 6.1 |
| 22 | 8.6 | 7.5 | 6.9 | 5.5 | 5.2 | 6.1 |
| 23 | 8.1 | 7.4 | 6.7 | 5.4 | 5.3 | 6.1 |
| 24 | 7.9 | 7.2 | 6.7 | 5.4 | 5.3 | 6.1 |
| 25 | 7.1 | 7.1 | 6.8 | 5.3 | 5.3 | 6.1 |
| 26 | 9.7 | 7.1 | 7.3 | 5.3 | 5.3 | 10.0 |
| 27 | 10.0 | 7.3 | 7.5 | 5.3 | 5.4 | 11.4 |
| 28 | 9.9 | 6.7 | 7.8 | 5.3 | 5.5 | 14.1 |
| 29 | 9.6 | 6.7 | 7.7 | 5.3 | 5.6 | 16.8 |
| 30 | 9.1 | 6.7 | 7.4 | 5.3 | 5.7 | 17.7 |
| 31 | 8.7 | 6.6 | ..... | 5.2 | ..... | 18.6 |

## TRINITY RIVER DRAINAGE BASIN.

Trinity River rises in a network of small streams in the counties of Montague, Wise, and Parker, but their combined capacity at Dallas is not sufficient to keep the bottom or bed of the stream moist. The United States Geological Survey maintained a station at Dallas for a time, but it was abandoned on account of the small discharge. Below Dallas the Trinity flows through a wooded country, and consequently it is not subject to the sudden floods with their quick run-offs.

### TRINITY RIVER AT RIVERSIDE, TEX.

A gaging station was established on Trinity River at Riverside, Tex., in December, 1902, by Thomas U. Taylor. The zero of the gage is 66.00 feet below the top of the ties (or base of rail) in the north arm of the draw span of the International and Great Northern Railroad bridge. The elevation of the top of the pivot pier above gage datum is 56.50 feet, and that of the top of the channel of the lower chord of the arms of the draw span of the bridge is 62.90 feet. According to the survey of the United States Army engineers the elevation of the top of the tie with reference to mean low tide of Gulf is 148.70 feet. The gage consists of a tagged plumber's chain, to which is attached a lead weight in the form of a frustum of a cone. The bottom of the lead weight is marked 66, and every foot above this is marked with a brass tag, giving its distance in feet above the bottom of the weight. The observer at Riverside is G. W. Higdon, who is in charge of the pumping plant of the International and Great Northern Railroad. In reading the gage it is only necessary to let the lead weight touch the water, and then read off the distance the mark or point is from the upper end or zero mark of the chain.

Measurements are made from the railroad bridge. The initial point for soundings is the north face of the south abutment for the south channel. For the north channel the north face of the pivot pier is the initial point. The channel is straight for 300 feet above and 1,000 feet below the bridge, and the current is sluggish at low stages and swift at high stages. The right bank is high and rocky. The left bank is lower than the right, a trestle being used to measure the overflow at flood stages. The bed of the stream consists of a tough mud or clay.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Trinity River at Riverside, Tex., in 1902 and 1903.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| 1902. | | *Feet.* | *Second-feet.* |
| September 10 | T. U. Taylor | 6.00 | 160 |
| 1903. | | | |
| March 18 | T. U. Taylor | 43.30 | 24,650 |
| July 1 | do | 13.30 | 3,730 |
| July 2 | do | 14.60 | 4,500 |
| July 2 | do | 15.20 | 5,160 |
| July 3 | do | 18.30 | 7,200 |
| July 12 | do | 22.20 | 8,800 |
| July 13 | do | 22.80 | 9,200 |
| July 15 | do | 23.60 | 10,800 |
| July 17 | do | 10.20 | 980 |
| December 7 | G. W. Higdon | 8.30 | 420 |
| December 12 | do | 9.30 | 500 |

*Mean daily gage height, in feet, of Trinity River at Riverside, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.4 | 10.2 | 11.9 | 17.7 | 16.0 | 11.1 | 11.0 | 9.3 | 7.4 | 8.2 | 8.4 | 7.8 |
| 2 | 9.4 | 9.9 | 10.9 | 18.1 | 16.1 | 10.6 | 10.9 | 9.2 | 7.3 | 8.9 | 8.4 | 7.7 |
| 3 | 9.2 | 9.6 | 10.2 | 19.5 | 14.7 | 11.5 | 10.6 | 8.9 | 7.2 | 8.7 | 9.5 | 7.6 |
| 4 | 9.2 | 9.4 | 9.9 | 20.8 | 23.7 | 12.3 | 10.6 | 8.7 | 7.1 | 8.3 | 10.8 | 7.6 |
| 5 | 9.2 | 9.3 | 9.6 | 22.8 | 23.2 | 12.0 | 12.2 | 8.5 | 7.2 | 8.1 | 10.2 | 7.6 |
| 6 | 9.0 | 9.2 | 9.4 | 22.5 | 25.0 | 11.5 | 13.0 | 8.2 | 7.4 | 7.8 | 9.5 | 7.6 |
| 7 | 8.9 | 9.2 | 9.3 | 21.0 | 32.2 | 11.2 | 13.2 | 8.1 | 7.4 | 7.8 | 8.9 | 7.6 |
| 8 | 8.9 | 10.0 | 9.2 | 19.0 | 32.9 | 12.3 | 13.5 | 8.5 | 8.6 | 7.8 | 8.6 | 7.6 |
| 9 | 8.9 | 10.2 | 9.1 | 17.0 | 33.2 | 14.8 | 13.5 | 10.1 | 12.5 | 7.8 | 8.6 | 7.5 |
| 10 | 9.0 | 10.5 | 9.1 | 15.2 | 31.9 | 16.5 | 13.2 | 11.5 | 13.9 | 7.7 | 8.5 | 7.5 |
| 11 | 9.0 | 10.2 | 9.0 | 14.7 | 29.9 | 18.2 | 12.7 | 10.9 | 14.6 | 7.5 | 8.4 | 7.5 |
| 12 | 9.0 | 10.1 | 8.9 | 15.5 | 27.7 | 19.2 | 12.0 | 10.9 | 14.0 | 7.4 | 8.2 | 7.5 |
| 13 | 9.0 | 10.2 | 8.9 | 16.1 | 26.5 | 19.8 | 11.0 | 10.9 | 13.0 | 7.3 | 8.1 | 7.5 |
| 14 | 8.9 | 10.6 | 8.8 | 16.4 | 26.0 | 20.5 | 10.2 | 11.1 | 11.2 | 7.2 | 7.9 | 7.4 |
| 15 | 8.8 | 10.7 | 8.7 | 17.0 | 26.0 | 20.9 | 9.6 | 11.0 | 10.2 | 7.2 | 7.8 | 7.4 |
| 16 | 8.8 | 10.5 | 8.7 | 18.5 | 26.5 | 21.5 | 9.2 | 10.0 | 9.2 | 7.2 | 7.7 | 7.4 |
| 17 | 8.7 | 10.2 | 8.6 | 18.4 | 26.9 | 22.2 | 9.1 | 10.0 | 8.2 | 7.1 | 7.6 | 7.4 |
| 18 | 8.6 | 10.0 | 8.7 | 18.5 | 27.4 | 22.5 | 8.8 | 9.6 | 9.2 | 7.1 | 7.5 | 7.4 |
| 19 | 8.6 | 12.1 | 8.6 | 18.5 | 27.8 | 22.8 | 8.5 | 9.3 | 8.9 | 7.1 | 7.5 | 7.4 |
| 20 | 8.6 | 17.8 | 8.7 | 18.5 | 27.9 | 23.1 | 8.5 | 9.3 | 8.9 | 7.1 | 7.5 | 7.4 |
| 21 | 8.5 | 20.1 | 9.1 | 18.8 | 27.8 | 23.1 | 8.5 | 9.5 | 8.7 | 7.1 | 7.5 | 7.4 |
| 22 | 8.6 | 20.5 | 9.1 | 19.1 | 26.8 | 23.0 | 8.5 | 9.4 | 8.5 | 7.1 | 7.5 | 7.4 |
| 23 | 8.6 | 20.3 | 9.6 | 19.9 | 13.5 | 22.6 | 9.4 | 9.2 | 8.4 | 7.0 | 7.5 | 7.5 |
| 24 | 8.8 | 19.3 | 9.1 | 20.6 | 17.5 | 21.4 | 9.2 | 8.7 | 9.4 | 7.0 | 7.5 | 7.7 |
| 25 | 8.9 | 17.5 | 9.5 | 20.1 | 13.7 | 19.4 | 9.2 | 8.4 | 9.9 | 7.0 | 7.5 | 8.0 |
| 26 | 9.0 | 16.4 | 10.5 | 18.1 | 12.1 | 16.7 | 8.7 | 8.2 | 9.5 | 7.0 | 7.5 | 11.6 |
| 27 | 8.9 | 15.7 | 13.5 | 17.1 | 11.7 | 14.2 | 8.5 | 8.1 | 9.5 | 7.0 | 7.5 | 19.3 |
| 28 | 9.0 | 14.3 | 15.5 | 17.1 | 13.6 | 12.5 | 9.5 | 8.0 | 9.5 | 7.0 | 7.5 | 19.5 |
| 29 | 10.0 | 13.0 | 16.7 | 16.9 | 14.2 | 11.5 | 8.8 | 7.8 | 9.5 | 7.0 | 7.5 | 20.1 |
| 30 | 10.7 | ..... | 17.4 | 16.2 | 12.2 | 11.2 | 9.3 | 7.7 | 9.4 | 7.0 | 7.5 | 17.5 |
| 31 | 10.6 | ..... | 17.6 | ..... | 11.7 | ..... | 9.5 | 7.6 | ..... | 7.0 | ..... | 13.4 |

*Rating table for Trinity River at Riverside, Tex., from January 1, 1903, to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet,* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 7.00 | 160 | 9.10 | 780 | 12.20 | 2,910 | 18.50 | 7,320 |
| 7.10 | 170 | 9.20 | 840 | 12.40 | 3,050 | 19.00 | 7,670 |
| 7.20 | 180 | 9.30 | 900 | 12.60 | 3,190 | 19.50 | 8,020 |
| 7.30 | 195 | 9.40 | 965 | 12.80 | 3,330 | 20.00 | 8,370 |
| 7.40 | 210 | 9.50 | 1,030 | 13.00 | 3,470 | 20.50 | 8,720 |
| 7.50 | 225 | 9.60 | 1,095 | 13.20 | 3,610 | 21.00 | 9,070 |
| 7.60 | 245 | 9.70 | 1,160 | 13.40 | 3,750 | 22.00 | 9,770 |
| 7.70 | 265 | 9.80 | 1,230 | 13.60 | 3,890 | 23.00 | 10,470 |
| 7.80 | 285 | 9.90 | 1,300 | 13.80 | 4,030 | 24.00 | 11,170 |
| 7.90 | 310 | 10.00 | 1,370 | 14.00 | 4,170 | 25.00 | 11,870 |
| 8.00 | 335 | 10.10 | 1,440 | 14.20 | 4,310 | 26.00 | 12,570 |
| 8.10 | 360 | 10.20 | 1,510 | 14.40 | 4,450 | 27.00 | 13,270 |
| 8.20 | 390 | 10.40 | 1,650 | 14.60 | 4,590 | 28.00 | 13,970 |
| 8.30 | 420 | 10.60 | 1,790 | 14.80 | 4,730 | 30.00 | 15,370 |
| 8.40 | 455 | 10.80 | 1,930 | 15.00 | 4,870 | 32.00 | 16,770 |
| 8.50 | 490 | 11.00 | 2,070 | 15.50 | 5,220 | 34.00 | 18,170 |
| 8.60 | 530 | 11.20 | 2,210 | 16.00 | 5,570 | 36.00 | 19,570 |
| 8.70 | 575 | 11.40 | 2,350 | 16.50 | 5,920 | 38.00 | 20,970 |
| 8.80 | 620 | 11.60 | 2,490 | 17.00 | 6,270 | 40.00 | 22,370 |
| 8.90 | 670 | 11.80 | 2,630 | 17.50 | 6,620 | 44.00 | 25,170 |
| 9.00 | 725 | 12.00 | 2,770 | 18.00 | 6,970 | 47.00 | 27,270 |

The above table is based upon discharge measurements made during 1903. It is not well defined.

*Estimated monthly discharge of Trinity River at Riverside, Tex., for 1904.*

[Drainage area, 16,000 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 | 1,860 | 490 | 779 | 47,900 | 0.049 | 0.056 |
| February | 8,720 | 840 | 3,232 | 185,900 | .202 | .218 |
| March | 6,690 | 530 | 1,724 | 106,000 | .108 | .124 |
| April | 10,330 | 4,660 | 7,185 | 427,500 | .449 | .501 |
| May | 17,610 | 2,560 | 10,090 | 620,400 | .631 | .728 |
| June | 10,540 | 1,790 | 6,272 | 373,200 | .392 | .437 |
| July | 3,820 | 490 | 1,648 | 101,300 | .103 | .119 |
| August | 2,420 | 245 | 973 | 59,830 | .061 | .070 |
| September | 4,590 | 170 | 1,244 | 74,030 | .078 | .087 |
| October | 670 | 160 | 240 | 14,760 | .015 | .017 |
| November | 1,930 | 225 | 462 | 27,490 | .029 | .032 |
| December | 8,440 | 210 | 1,389 | 85,410 | .087 | .100 |
| The year | 17,610 | 160 | 2,936 | 2,124,000 | .184 | 2.49 |

## BRAZOS RIVER DRAINAGE BASIN.

This river has its source in the Staked Plains region of western Texas and has a general southeasterly course, emptying into the Gulf of Mexico south of the mouth of Trinity River. Its drainage basin is entirely within the State of Texas.

Under the direction of Thomas U. Taylor the United States Geological Survey is maintaining stations in this basin at Waco and Richmond, Tex.

### BRAZOS RIVER AT WACO, TEX.

On September 14, 1898, a gage was established on the southwest bank of Brazos River at Waco. It consists of an inclined iron bar, 3 inches by 1 inch, reading from 0 to 4.3 feet, bolted to a hard-pine stick, 16 feet long, embedded in cement in the sloping limestone of the bank, flush with the surface, on which are painted the graduations above 4.3 feet.

This part of the gage is inclined to the horizontal at a slope of 27 horizontal to 5 vertical. In the summer of 1903 another section was added, with its lower end connected to the upper end of the first gage. It is similar to the first gage in construction, but is inclined at a slope of 9 horizontal to 4 vertical. It reads from 4.4 to 12 feet.

Three bench marks have been established. The first is on the lowest water table on the southwest pier of the suspension bridge and is

marked "U. S. G. S. 44.33 B. M." It is about on the level of the floor of the suspension bridge.

The hydrant at the corner of First and Austin streets is at an elevation (by gage) of 43.32 feet, while the top of the rail of the San Antonio and Aransas Pass Railroad a few feet from the hydrant is at an elevation of 41.12 feet. The bed of the river is shifting sand, and nearly every freshet modifies the cross section, so that at the same gage heights the river sometimes flows in one and sometimes in two channels under the suspension bridge from which the measurements are made.

At high water the gage reading is obtained by measuring to the water surface from the top rail of the stiffening truss of the suspension bridge at a certain point when there is no load upon the bridge and by taking this distance from 47.80 feet.

In the early part of 1902 a new camel-back truss bridge of one span was erected across the Brazos at Waco a few hundred feet above the suspension bridge. This new bridge crosses the river at an angle of 76°. It has a footway on the east or downstream side that affords excellent facilities for measuring the flow of the stream, and there are no midstream piers to render measurements troublesome or doubtful.

At the north end these bridges are 280 feet apart, and at the south end they are 380 feet apart. When the river is rising and drift prevents the use of the meter, good float measurements can be made by timing the drift as it passes from the upper to the lower bridge at the different panel points.

On the north pier of the new bridge a gage has been marked off by the city engineer to agree with the United States Geological Survey gage at the suspension bridge. The top of the cement floor of the new bridge at the southeast batter brace is at an elevation of 45.40 feet with respect to the United States Geological Survey gage. High-water gage heights can be read directly from the gage on the north pier, or the distance of the water surface can be measured from the cement floor, and this subtracted from 45.40 feet will give the height of the river referred to the gage.

The channel is straight for several hundred feet above and below the station and has a width at low stages of about 175 feet without piers. The bed is composed of firm sand, subject to some change. The current is rapid.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Brazos River at Waco, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| February 5 | T. U. Taylor | 189 | 1.00 | 2.50 | 188 |
| February 12 | do | | | 2.85 | 240 |
| March 8 | do | 113 | 0.64 | 2.10 | 73 |
| March 19 | E. C. H. Bantel | | | 2.05 | 80 |
| May 7 | L. C. Robertson | | | 10.50 | 12,300 |
| May 7 | do | | | 8.60 | 7,200 |
| June 21 | T. U. Taylor | | | 3.90 | 1,013 |
| July 7 | do | | | 5.70 | 3,190 |
| July 7 | H. H. Fox | 1,216 | 2.43 | 5.50 | 2,960 |
| July 8 | do | 1,140 | 2.25 | 5.28 | 2,564 |
| July 8 | do | 1,026 | 2.14 | 5.00 | 2,198 |
| July 9 | do | 912 | 1.99 | 4.74 | 1,812 |
| July 9 | do | 874 | 1.86 | 4.60 | 1,626 |
| July 10 | do | 798 | 1.81 | 4.38 | 1,436 |

*Mean daily gage height, in feet, of Brazos River at Waco, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.30 | 2.20 | 2.35 | 3.40 | 2.80 | 3.50 | 8.90 | 3.90 | 2.80 | 5.05 | 4.25 | 2.80 |
| 2 | 2.30 | 2.20 | 2.30 | 3.30 | 3.45 | 3.40 | 7.40 | 3.65 | 2.80 | 4.60 | 4.05 | 2.80 |
| 3 | 2.30 | 2.20 | 2.20 | 3.20 | 5.00 | 3.30 | 7.05 | 3.55 | 2.70 | 4.10 | 3.95 | 2.80 |
| 4 | 2.30 | 2.20 | 2.20 | 3.10 | 8.20 | 3.35 | 6.95 | 3.50 | 2.75 | 3.90 | 3.80 | 2.80 |
| 5 | 2.30 | 2.55 | 2.20 | 3.10 | 6.50 | 10.10 | 6.75 | 3.55 | 4.50 | 3.65 | 3.80 | 2.80 |
| 6 | 2.30 | 3.35 | 2.20 | 3.20 | 11.90 | 8.30 | 6.45 | 4.05 | 4.55 | 3.55 | 3.65 | 2.80 |
| 7 | 2.30 | 3.95 | 2.20 | 3.65 | 9.40 | 7.55 | 5.75 | 3.95 | 3.80 | 3.40 | 3.50 | 2.80 |
| 8 | 2.30 | 3.70 | 2.10 | 4.05 | 6.55 | 6.50 | 5.50 | 9.95 | 4.55 | 3.25 | 3.45 | 2.80 |
| 9 | 2.30 | 3.50 | 2.10 | 3.55 | 5.50 | 6.70 | 5.65 | 6.90 | 4.95 | 3.20 | 3.35 | 2.75 |
| 10 | 2.30 | 3.40 | 2.10 | 3.55 | 5.00 | 7.45 | 4.25 | 6.70 | 4.45 | 3.05 | 3.30 | 2.70 |
| 11 | 2.30 | 3.25 | 2.10 | 3.50 | 4.60 | 6.90 | 4.90 | 6.35 | 4.20 | 3.00 | 3.20 | 2.70 |
| 12 | 2.30 | 3.80 | 2.10 | 3.20 | 4.10 | 8.00 | 3.95 | 6.75 | 4.35 | 3.95 | 3.15 | 2.70 |
| 13 | 2.30 | 2.70 | 2.10 | 3.10 | 3.90 | 6.70 | 3.75 | 6.15 | 5.20 | 2.90 | 3.10 | 2.70 |
| 14 | 2.30 | 2.70 | 2.10 | 3.00 | 3.75 | 6.10 | 3.55 | 5.85 | 5.70 | 2.85 | 3.10 | 2.70 |
| 15 | 2.20 | 2.60 | 2.10 | 2.95 | 3.75 | 5.30 | 3.40 | 5.50 | 5.80 | 2.80 | 3.00 | 2.70 |
| 16 | 2.20 | 2.55 | 2.10 | 2.75 | 3.85 | 5.05 | 3.35 | 5.05 | 5.15 | 2.75 | 3.00 | 2.70 |
| 17 | 2.20 | 2.50 | 2.10 | 2.80 | 3.75 | 5.60 | 3.25 | 4.60 | 4.95 | 2.75 | 3.00 | 2.65 |
| 18 | 2.20 | 2.45 | 2.10 | 3.05 | 3.60 | 5.00 | 3.20 | 4.15 | 4.50 | 3.35 | 3.00 | 2.60 |
| 19 | 2.20 | 2.40 | 2.05 | 2.85 | 4.10 | 4.70 | 3.15 | 3.95 | 3.85 | 4.60 | 2.90 | 2.60 |
| 20 | 2.20 | 2.50 | 2.10 | 2.80 | 4.80 | 4.05 | 2.95 | 3.75 | 3.65 | 4.80 | 2.90 | 2.60 |
| 21 | 2.20 | 2.60 | 2.15 | 2.70 | 4.25 | 4.00 | 2.90 | 3.70 | 3.55 | 4.40 | 2.90 | 2.60 |
| 22 | 2.20 | 2.55 | 2.20 | 3.20 | 4.10 | 3.80 | 2.85 | 3.70 | 3.60 | 4.30 | 2.90 | 2.60 |
| 23 | 2.20 | 2.50 | 2.20 | 4.00 | 3.95 | 3.95 | 2.95 | 3.60 | 3.60 | 4.25 | 2.90 | 2.60 |
| 24 | 2.20 | 2.50 | 2.20 | 4.55 | 3.70 | 3.65 | 3.25 | 3.40 | 3.40 | 4.25 | 2.90 | 2.60 |
| 25 | 2.20 | 2.45 | 3.20 | 3.60 | 3.65 | 3.50 | 3.20 | 3.25 | 3.40 | 4.55 | 2.90 | 2.60 |
| 26 | 2.20 | 2.40 | 5.25 | 3.15 | 3.45 | 4.10 | 3.15 | 3.10 | 2.95 | 9.75 | 2.85 | 2.60 |
| 27 | 2.20 | 2.40 | 4.15 | 3.05 | 3.35 | 3.85 | 2.95 | 3.10 | 2.90 | 10.30 | 2.80 | 2.60 |
| 28 | 2.20 | 2.40 | 4.95 | 3.00 | 3.50 | 3.65 | 2.70 | 3.30 | 2.90 | 8.90 | 2.80 | 2.50 |
| 29 | 2.20 | 2.40 | 4.50 | 3.00 | 5.90 | 8.25 | 2.60 | 3.10 | 2.80 | 6.70 | 2.80 | 2.50 |
| 30 | 2.20 | ..... | 4.05 | 2.85 | 3.90 | 12.75 | 3.15 | 3.00 | 4.25 | 5.20 | 2.80 | 2.50 |
| 31 | 2.20 | ..... | 3.80 | ..... | 3.60 | ..... | 4.45 | 2.90 | ..... | 4.60 | ..... | 2.50 |

*Rating table for Brazos River at Waco, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 2.00 | 62 | 3.50 | 665 | 5.00 | 2,005 | 7.00 | 4,645 |
| 2.10 | 82 | 3.60 | 740 | 5.10 | 2,115 | 7.20 | 4,955 |
| 2.20 | 104 | 3.70 | 820 | 5.20 | 2,225 | 7.40 | 5,275 |
| 2.30 | 128 | 3.80 | 900 | 5.30 | 2,340 | 7.60 | 5,605 |
| 2.40 | 155 | 3.90 | 980 | 5.40 | 2,455 | 7.80 | 5,945 |
| 2.50 | 184 | 4.00 | 1,065 | 5.50 | 2,575 | 8.00 | 6,300 |
| 2.60 | 215 | 4.10 | 1,150 | 5.60 | 2,700 | 8.50 | 7,225 |
| 2.70 | 248 | 4.20 | 1,235 | 5.70 | 2,825 | 9.00 | 8,200 |
| 2.80 | 284 | 4.30 | 1,320 | 5.80 | 2,955 | 9.50 | 9,230 |
| 2.90 | 323 | 4.40 | 1,410 | 5.90 | 3,085 | 10.00 | 10,320 |
| 3.00 | 365 | 4.50 | 1,500 | 6.00 | 3,220 | 11.00 | 12,640 |
| 3.10 | 410 | 4.60 | 1,595 | 6.20 | 3,490 | 12.00 | 15,130 |
| 3.20 | 460 | 4.70 | 1,695 | 6.40 | 3,770 | | |
| 3.30 | 520 | 4.80 | 1,795 | 6.60 | 4,055 | | |
| 3.40 | 590 | 4.90 | 1,900 | 6.80 | 4,345 | | |

The above table is based upon discharge measurements made during 1900 to 1904, and is well defined. There was, however, a very slight change in the bed during 1904.

*Estimated monthly discharge of Brazos River at Waco, Tex., for 1904.*

[Drainage area, 30,750 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 | 128 | 104 | 115 | 7,010 | 0.0037 | 0.0043 |
| February | 1,022 | 104 | 305 | 17,540 | .0099 | .011 |
| March | 2,282 | 72 | 376 | 23,120 | .012 | .014 |
| April | 1,548 | 248 | 528 | 31,420 | .017 | .019 |
| May | 14,880 | 284 | 2,245 | 138,000 | .073 | .084 |
| June | 17,180 | 520 | 3,341 | 198,800 | .109 | .122 |
| July | 8,000 | 215 | 1,697 | 104,400 | .055 | .063 |
| August | 10,200 | 323 | 1,757 | 108,000 | .057 | .066 |
| September | 2,955 | 248 | 1,128 | 67,120 | .037 | .041 |
| October | 11,010 | 266 | 1,922 | 118,200 | .063 | .073 |
| November | 1,278 | 284 | 508 | 30,230 | .017 | .019 |
| December | 284 | 184 | 238 | 14,630 | .0077 | .0089 |
| The year | 17,180 | 72 | 1,180 | 858,500 | .038 | .525 |

BRAZOS RIVER AT RICHMOND, TEX.

This station was established January 1, 1903, by Thomas U. Taylor. It is located at the bridge of the Southern Pacific Railway Company. During 1903 the elevations of the water surface were determined by measuring down from a reference point on the bridge by means of a plumber's chain. During 1904 gage heights have been taken by means of a standard chain gage attached to the bridge. The gage is read once each day by A. O. Blum. Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is the east face of the pier under the west end of the middle span. The channel is straight for 200 feet above and 900 feet below the station; has a width of about 175 feet at low water, without piers, and about 500 feet at ordinary high water, broken by three piers. During very high floods the left bank overflows and the width of the stream is 900 feet. The bed of the stream is sandy except around the piers, where it is stony, and is slightly shifting. The current is obstructed somewhat by old piles. The zero of the gage is 50 feet below the top of the guard rail in the middle of the sixth panel of the midspan on the downstream side of the bridge. Bench mark No. 1 is a point marked "R. F.," on the southeast corner of the tie seat of west abutment. Its elevation is 49.28 feet above the datum of the gage. Bench mark No. 2 is the top of the north bolt in flange of hydrant at corner of Railroad and First streets, 6 inches below the top of the hydrant. Its elevation is 47.26 feet above the datum of the gage. Bench mark No. 3 is the top of the northeast corner of base stone of "Our Heroes" monument in the court-house square. Its elevation is 53.52 feet above gage datum. The lowest gage height yet recorded is 1.80 feet above gage datum, or 45 feet above mean low sea level.

Above and at Waco the river rises rapidly, and when it gets above the gage height of 30 feet overflows the bottom lands below the town. When the floods spread out over the bottom lands, as they do from Waco to Richmond, the river stays up longer in its lower stretches than it does in the upper sections, as the bottoms and the lowlands serve as storage reservoirs for the backwater and are drained slowly as the river recedes. Above Waco the surface water rushes off into the stream more rapidly, and the river rises more suddenly and falls almost as suddenly. For this reason it is possible for the maximum discharge at Waco to be greater than it is at Richmond.

At Hearne and below the river in 1899 was several miles in width. Its maximum height at Richmond occurred on July 7, 1899, when it stood 4 feet below the top of the guard rail, or at a gage height of 46 feet. The water was out over the bottoms above, and in Richmond it covered the tracks of the Southern Pacific Railway.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Brazos River at Richmond, Tex., in 1904.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| | | *Feet.* | *Second-feet.* |
| February 4 | H. H. Fox | 1.50 | 820 |
| March 1 | do | 2.76 | 1,750 |
| June 15 | T. U. Taylor | 7.70 | 7,500 |
| June 24 | do | 4.30 | 3,090 |
| August 5 | do | 2.30 | 1,520 |
| August 9 | do | 2.70 | 1,950 |

*Mean daily gage height, in feet, of Brazos River at Richmond, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.60 | 1.50 | 2.80 | 3.00 | 3.20 | 4.20 | 3.60 | 2.60 | 1.80 | 2.60 | 6.40 | 1.70 |
| 2 | 2.60 | 1.50 | 2.90 | 3.90 | 3.30 | 5.20 | 3.60 | 2.60 | 1.80 | 2.60 | 5.50 | 1.80 |
| 3 | 2.40 | 1.50 | 2.70 | 5.40 | 3.50 | 5.10 | 11.70 | 2.60 | 1.60 | 1.90 | 5.50 | 1.90 |
| 4 | 2.00 | 1.50 | 2.60 | 5.10 | 3.60 | 4.60 | 10.40 | 2.50 | 1.60 | 1.60 | 5.70 | 2.00 |
| 5 | 1.80 | 1.50 | 2.50 | 5.00 | 6.70 | 4.40 | 8.50 | 2.40 | 1.50 | 1.60 | 4.70 | 1.80 |
| 6 | 1.70 | 1.50 | 2.40 | 5.00 | 15.30 | 4.10 | 8.10 | 3.10 | 1.80 | 1.60 | 4.60 | 1.70 |
| 7 | 1.80 | 1.50 | 2.30 | 5.20 | 18.80 | 3.80 | 7.50 | 3.10 | 1.80 | 2.40 | 4.50 | 1.60 |
| 8 | 1.80 | 1.50 | 2.10 | 4.90 | 21.60 | 5.60 | 7.70 | 3.10 | 1.70 | 2.70 | 4.40 | 1.50 |
| 9 | 1.80 | 1.50 | 2.00 | 4.70 | 23.80 | 9.30 | 8.00 | 2.70 | 1.70 | 2.40 | 4.20 | 2.10 |
| 10 | 1.80 | 1.50 | 1.90 | 4.50 | 25.50 | 10.30 | 6.20 | 3.00 | 3.10 | 2.20 | 4.10 | 1.80 |
| 11 | 1.80 | 1.50 | 1.80 | 4.10 | 25.50 | 9.60 | 5.70 | 3.10 | 3.80 | 2.10 | 4.00 | 1.60 |
| 12 | 1.80 | 2.00 | 1.70 | 4.00 | 23.00 | 9.00 | 5.10 | 8.70 | 3.20 | 1.90 | 3.90 | 1.50 |
| 13 | 1.90 | 2.40 | 1.60 | 3.70 | 19.40 | 8.40 | 4.70 | 7.40 | 3.20 | 1.70 | 3.80 | 1.60 |
| 14 | 1.90 | 2.60 | 1.60 | 3.60 | 14.30 | 8.60 | 4.20 | 6.50 | 4.10 | 1.60 | 3.80 | 1.60 |
| 15 | 1.90 | 2.50 | 1.60 | 3.40 | 11.80 | 7.30 | 4.00 | 6.10 | 4.40 | 1.50 | 3.60 | 1.70 |
| 16 | 1.80 | 2.40 | 1.60 | 3.00 | 11.00 | 6.90 | 3.70 | 6.10 | 4.10 | 1.50 | 3.40 | 1.60 |
| 17 | 1.80 | 2.30 | 1.60 | 2.90 | 10.40 | 6.60 | 3.90 | 5.60 | 3.50 | 1.50 | 3.30 | 1.50 |
| 18 | 1.80 | 2.30 | 1.60 | 2.80 | 9.20 | 6.30 | 3.30 | 5.10 | 3.20 | 1.50 | 3.20 | 1.50 |
| 19 | 1.80 | 9.60 | 1.60 | 2.70 | 9.80 | 5.90 | 3.10 | 4.60 | 4.40 | 1.50 | 3.10 | 1.50 |
| 20 | 1.80 | 4.60 | 1.60 | 2.60 | 9.10 | 5.20 | 3.00 | 3.00 | 4.20 | 1.50 | 3.00 | 1.70 |
| 21 | 1.80 | 6.10 | 1.50 | 2.60 | 8.50 | 5.10 | 2.70 | 3.80 | 4.10 | 1.50 | 2.90 | 1.50 |
| 22 | 1.70 | 4.80 | 1.50 | 2.50 | 8.00 | 5.00 | 2.60 | 3.50 | 3.50 | 1.50 | 2.80 | 1.50 |
| 23 | 1.80 | 3.40 | 1.50 | 2.50 | 6.90 | 4.70 | 2.60 | 3.30 | 3.20 | 1.50 | 2.00 | 1.60 |
| 24 | 1.80 | 3.80 | 1.50 | 2.70 | 6.50 | 4.40 | 2.70 | 2.90 | 3.10 | 1.50 | 1.90 | 1.60 |
| 25 | 1.70 | 3.50 | 1.50 | 2.70 | 7.00 | 4.10 | 2.60 | 2.70 | 3.30 | 1.60 | 1.80 | 1.60 |
| 26 | 1.80 | 3.30 | 1.50 | 2.50 | 5.70 | 4.10 | 2.90 | 2.50 | 3.70 | 3.60 | 1.70 | 1.60 |
| 27 | 1.80 | 3.00 | 1 50 | 2.50 | 4.40 | 4.10 | 3.10 | 2.40 | 3.30 | 3.60 | 1.70 | 2.20 |
| 28 | 1.80 | 3.00 | 1.50 | 2.70 | 4.30 | 4.00 | 4.30 | 2.30 | 3.10 | 3.10 | 1.70 | 6.20 |
| 29 | 1.60 | 2.80 | 1.50 | 3.00 | 3.90 | 3.90 | 4.00 | 2.00 | 2.50 | 8.30 | 1.70 | 3.00 |
| 30 | 1.60 | ..... | 1.50 | 3.10 | 3.70 | 3.70 | 3.00 | 1.90 | 2.60 | 10.30 | 1.70 | 3.40 |
| 31 | 1.50 | ..... | 1.50 | ..... | 4.60 | ..... | 2.80 | 1.80 | ..... | 8.00 | ..... | 2.00 |

*Rating table for Brazos River at Richmond, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.50 | 820 | 3.40 | 2,180 | 6.20 | 5,380 | 13.00 | 17,590 |
| 1.60 | 870 | 3.50 | 2,270 | 6.40 | 5,660 | 13.50 | 18,790 |
| 1.70 | 920 | 3.60 | 2,370 | 6.60 | 5,940 | 14.00 | 19,990 |
| 1.80 | 980 | 3.70 | 2,470 | 6.80 | 6,220 | 15.00 | 22,390 |
| 1.90 | 1,040 | 3.80 | 2,570 | 7.00 | 6,500 | 16.00 | 24,790 |
| 2.00 | 1,100 | 3.90 | 2,670 | 7.20 | 6,780 | 17.00 | 27,190 |
| 2.10 | 1,160 | 4.00 | 2,770 | 7.40 | 7,060 | 18.00 | 29,590 |
| 2.20 | 1,220 | 4.10 | 2,870 | 7.60 | 7,350 | 19.00 | 31,990 |
| 2.30 | 1,290 | 4.20 | 2,980 | 7.80 | 7,650 | 20.00 | 34,390 |
| 2.40 | 1,360 | 4.30 | 3,090 | 8.00 | 7,950 | 21.00 | 36,790 |
| 2.50 | 1,430 | 4.40 | 3,200 | 8.50 | 8,700 | 22.00 | 39,190 |
| 2.60 | 1,500 | 4.60 | 3,420 | 9.00 | 9,480 | 23.00 | 41,590 |
| 2.70 | 1,580 | 4.80 | 3,640 | 9.50 | 10,280 | 24.00 | 43,990 |
| 2.80 | 1,660 | 5.00 | 3,880 | 10.00 | 11,120 | 26.00 | 48,790 |
| 2.90 | 1,740 | 5.20 | 4,120 | 10.50 | 12,020 | 28.00 | 53,590 |
| 3.00 | 1,820 | 5.40 | 4,360 | 11.00 | 13,020 | 30.00 | 58,390 |
| 3.10 | 1,910 | 5.60 | 4,600 | 11.50 | 14,120 | 33.00 | 65,590 |
| 3.20 | 2,000 | 5.80 | 4,860 | 12.00 | 15,270 | | |
| 3.30 | 2,090 | 6.00 | 5,120 | 12.50 | 16,420 | | |

The above table is based upon 27 discharge measurements made during 1902 to 1904, inclusive, and is well defined. Above gage height 13 feet the rating curve is a tangent, the difference being 240 per tenth. Above gage height 10 feet this table is the same as that for 1903.

*Estimated monthly discharge of Brazos River at Richmond, Tex., for 1904.*

[Drainage area, 44,000 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 | 1,500 | 820 | 1,017 | 62,530 | 0.023 | 0.026 |
| February | 10,440 | 820 | 1,914 | 110,100 | .044 | .047 |
| March | 1,740 | 820 | 1,024 | 62,960 | .023 | .026 |
| April | 4,360 | 1,430 | 2,399 | 142,800 | .055 | .061 |
| May | 47,590 | 2,000 | 15,040 | 924,800 | .342 | .394 |
| June | 11,660 | 2,470 | 5,056 | 300,900 | .115 | .128 |
| July | 14,580 | 1,500 | 4,052 | 249,100 | .092 | .106 |
| August | 9,000 | 980 | 2,645 | 162,600 | .060 | .069 |
| September | 3,200 | 820 | 1,891 | 112,500 | .043 | .048 |
| October | 11,660 | 820 | 1,932 | 118,800 | .044 | .051 |
| November | 5,660 | 920 | 2,424 | 144,200 | .055 | .061 |
| December | 5,380 | 820 | 1,135 | 69,790 | .026 | .030 |
| The year | 47,590 | 820 | 3,377 | 2,461,000 | .077 | 1.05 |

## COLORADO RIVER (OF TEXAS) DRAINAGE BASIN.

Colorado River rises in the extreme western portion of the State, within a few miles of the eastern boundary of New Mexico, and flows in a general southeasterly direction, emptying into the Gulf of Mexico in Matagorda County. The drainage area above Austin is 37,000 square miles and above Columbus 40,000 square miles, and it extends into the corner of New Mexico. Its main tributaries are the Concho, the San Saba, and the Llano. The Concho has a reliable flow above its junction with the Colorado, and if the stream below the junction were to receive its name from the one that contributed the most water the river below the junction would be known as the Concho instead of the Colorado. The Concho furnishes water for irrigation and water power, and supports in Irion and Tom Green counties some excellent irrigation systems, described in Water-Supply Paper No. 71. San Saba and Llano rivers are described in the same paper.

The Colorado at Austin emerges from a canyon. From Austin to the Gulf it traverses a rather flat country, and its waters are utilized for many power plants; 60,000 acres of rice were sowed during the season of 1902 in the counties of Colorado, Wharton, and Matagorda, under canals that obtained their water from the Colorado.

Under the direction of Thomas U. Taylor the United States Geological Survey is maintaining gaging stations in this basin at Columbus and Austin, Tex.

COLORADO RIVER AT AUSTIN, TEX.

The flood of April 7, 1900, carried away the great masonry dam at Austin. This flood was general over southwest Texas, but its only disaster was limited to the demolition of that structure. A full discussion of this failure will be found in Water-Supply Paper No. 40.

Prior to the flood of April 7, 1900, the discharge of the river at the station below the dam was at low stages absolutely under the control of the turbines at the power house at the dam; and measurements made opposite the city, at the station between the two bridges, did not give the unobstructed flow of the river.

Gage heights were first taken on the crest of the Austin dam on August 13, 1895, and were continued from that date until the failure of the dam occurred in April, 1900. The first discharge measurement was made on December 21, 1897. In February, 1899, the gage was placed on Congress Avenue Bridge, south of the city. This gage consisted of a plain staff attached to a bath house. During 1904 a standard chain gage was attached to the bridge at the same elevation as the old one. The gage is read twice each day by W. Peterson. A gage is also marked off on the first pier from the north. Discharge measurements are made by means of a cable and car 3 miles above Congress Avenue Bridge, to which the gage is attached, and about one-eighth mile above the ruins of the Austin dam and power house. The cable has a span of about 730 feet, but the width of the river at low water is less than half this distance. The channel is straight for 400 feet above and below the station. The velocity is moderately rapid. Neither bank has overflowed since the dam was washed away. The bed of the stream is composed of sand and is slightly shifting. Bench mark No. 1 is a United States Coast and Geodetic Survey copper bolt on the top of the west end of the south pier of Congress Avenue Bridge, 475 feet above mean sea level. Its elevation is 48.00 feet above the datum of the gage. Bench mark No. 2 is a similar bolt in the southwest wall of the post-office at Austin, 508 feet above mean sea level, about 4 feet above the walk. Its elevation is 81.00 feet above the datum of the gage. Bench mark No. 3 is on the first flange above the cribwork of the north pier of the bridge, marked "U. S. G. S. B. M. 4.78." Its elevation is 4.78 feet above gage datum and 431.78 feet above mean sea level.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Colorado River at Austin, Tex., in 1904.*

| Date. | Hydrographer | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| February 6 | E. C. H. Bantel | | | 1.22 | 358 |
| May 5 | do | 2,554 | 4.08 | 5.50 | 10,520 |
| May 5 | do | 2,322 | 3.94 | 5.30 | 9,150 |
| May 5 | do | 2,394 | 3.79 | 5.20 | 9,073 |
| May 5 | do | 2,327 | 3.80 | 5.20 | 8,853 |
| May 6 | do | 3,107 | 4.26 | 6.00 | 13,230 |
| May 6 | do | 2,796 | 4.20 | 5.70 | 11,640 |
| May 6 | do | 2,660 | 4.05 | 5.60 | 10,780 |
| May 6 | do | 2,608 | 3.85 | 5.30 | 10,060 |
| May 7 | do | 2,075 | 3.60 | 4.90 | 7,492 |
| May 7 | do | 2,116 | 3.47 | 4.90 | 7,350 |
| May 7 | do | 2,008 | 3.51 | 4.80 | 7,180 |
| May 7 | do | 2,019 | 3.58 | 4.80 | 7,239 |
| May 10 | T. U. Taylor | 278 | 1.62 | 1.45 | 452 |
| December 13 | H. H. Fox | 271 | 1.60 | 1.32 | 429 |
| December 23 | do | 256 | 1.23 | 1.20 | 325 |

*Mean daily gage height, in feet, of Colorado River at Austin, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.20 | 1.20 | 1.40 | 1.50 | 1.80 | 5.75 | 7.10 | 2.00 | 0.80 | 2.40 | 2.35 | 1.30 |
| 2 | 1.20 | 1.20 | 1.38 | 1.45 | 1.70 | 3.55 | 5.25 | 1.90 | .70 | 2.30 | 2.00 | 1.30 |
| 3 | 1.20 | 1.20 | 1.30 | 1.30 | 5.00 | 3.10 | 4.75 | 1.60 | .70 | 2.15 | 1.95 | 1.30 |
| 4 | 1.20 | 1.20 | 1.30 | 1.35 | 2.80 | 2.75 | 5.90 | 2.15 | .70 | 1.95 | 1.75 | 1.30 |
| 5 | 1.20 | 1.20 | 1.20 | 1.55 | 5.80 | 2.60 | 3.80 | 2.05 | 5.95 | 1.75 | 1.70 | 1.30 |
| 6 | 1.20 | 1.20 | 1.25 | 1.45 | 6.00 | 6.50 | 3.80 | 1.75 | 4.60 | 1.70 | 1.70 | 1.40 |
| 7 | 1.20 | 2.00 | 1.20 | 1.30 | 5.30 | 9.35 | 2.85 | 1.90 | 3.05 | 1.55 | 1.65 | 1.40 |
| 8 | 1.20 | 2.45 | 1.20 | 1.20 | 5.05 | 10.35 | 2.50 | 4.95 | 3.00 | 1.50 | 1.60 | 1.50 |
| 9 | 1.20 | 2.65 | 1.20 | 1.20 | 4.80 | 8.05 | 2.25 | 3.05 | 2.85 | 1.50 | 1.50 | 1.50 |
| 10 | 1.20 | 2.35 | 1.20 | 1.10 | 3.35 | 6.20 | 2.15 | 2.70 | 2.25 | 1.40 | 1.50 | 1.50 |
| 11 | 1.20 | 2.10 | 1.15 | 1.10 | 3.80 | 5.40 | 2.10 | 2.25 | 2.00 | 1.40 | 1.40 | 1.40 |
| 12 | 1.20 | 1.85 | 1.15 | 1.05 | 2.45 | 4.25 | 1.80 | 1.85 | 2.00 | 1.30 | 1.40 | 1.30 |
| 13 | 1.20 | 1.70 | 1.15 | 1.00 | 2.20 | 3.15 | 1.75 | 1.75 | 4.45 | 1.20 | 1.40 | 1.30 |
| 14 | 1.20 | 1.55 | 1.15 | 1.00 | 2.00 | 3.55 | 1.70 | 1.60 | 2.80 | 1.20 | 1.40 | 1.30 |
| 15 | 1.20 | 1.50 | 1.00 | 1.00 | 1.90 | 2.95 | 1.70 | 1.95 | 4.45 | 1.10 | 1.40 | 1.30 |
| 16 | 1.20 | 1.40 | 1.10 | .90 | 1.95 | 2.65 | 1.50 | 1.80 | 3.60 | 1.00 | 1.30 | 1.30 |
| 17 | 1.20 | 1.30 | 1.17 | .90 | 1.95 | 2.50 | 1.40 | 1.75 | 3.00 | 1.00 | 1.30 | 1.30 |
| 18 | 1.20 | 1.30 | 1.10 | .90 | 1.85 | 2.40 | 1.30 | 1.70 | 2.40 | 1.50 | 1.30 | 1.20 |
| 19 | 1.20 | 1.40 | 1.10 | .90 | 1.70 | 2.35 | 1.20 | 1.55 | 2.40 | 1.50 | 1.30 | 1.20 |
| 20 | 1.20 | 1.50 | 1.10 | .90 | 3.35 | 2.25 | 1.10 | 1.50 | 2.00 | 1.30 | 1.30 | 1.20 |
| 21 | 1.20 | 1.50 | 1.70 | .90 | 2.65 | 2.20 | 1.10 | 1.55 | 1.90 | 1.20 | 1.30 | 1.20 |
| 22 | 1.20 | 1.50 | 1.75 | 1.60 | 2.35 | 2.05 | 1.10 | 1.65 | 1.80 | 1.10 | 1.30 | 1.50 |
| 23 | 1.20 | 1.50 | 1.95 | 1.75 | 2.45 | 2.70 | 1.10 | 1.40 | 1.70 | 2.30 | 1.30 | 1.30 |
| 24 | 1.20 | 1.80 | 1.70 | 3.70 | 2.30 | 2.70 | 1.55 | 1.25 | 1.70 | 2.10 | 1.30 | 1.20 |
| 25 | 1.20 | 1.85 | 1.55 | 3.90 | 2.05 | 3.10 | 1.30 | 1.05 | 3.55 | 2.10 | 1.30 | 1.25 |
| 26 | 1.20 | 1.65 | 1.45 | 2.70 | 2.00 | 3.05 | 1.60 | 1.00 | 4.05 | 2.45 | 1.30 | 1.25 |
| 27 | 1.20 | 1.52 | 1.27 | 2.10 | 2.00 | 2.55 | 1.40 | 1.00 | 3.10 | 5.25 | 1.30 | 1.20 |
| 28 | 1.20 | 1.50 | 1.22 | 1.65 | 1.90 | 2.30 | 1.25 | 1.00 | 2.90 | 4.10 | 1.20 | 1.20 |
| 29 | 1.20 | 1.40 | 1.35 | 1.80 | 1.80 | 2.15 | 1.55 | .90 | 2.90 | 3.15 | 1.25 | 1.20 |
| 30 | 1.20 | ..... | 1.55 | 1.70 | 3.55 | 3.90 | 1.90 | .85 | 2.60 | 3.15 | 1.30 | 1.20 |
| 31 | 1.20 | ..... | 1.55 | ..... | 2.95 | ..... | 1.90 | .80 | ..... | 2.75 | ..... | 1.20 |

*Rating table for Colorado River at Austin, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.70 | 200 | 2.00 | 760 | 3.30 | 2,650 | 5.20 | 8,850 |
| .80 | 223 | 2.10 | 840 | 3.40 | 2,880 | 5.40 | 9,850 |
| .90 | 248 | 2.20 | 930 | 3.50 | 3,120 | 5.60 | 10,920 |
| 1.00 | 275 | 2.30 | 1,030 | 3.60 | 3,365 | 5.80 | 12,050 |
| 1.10 | 305 | 2.40 | 1,140 | 3.70 | 3,615 | 6.00 | 13,220 |
| 1.20 | 339 | 2.50 | 1,260 | 3.80 | 3,870 | 6.50 | 16,320 |
| 1.30 | 377 | 2.60 | 1,390 | 3.90 | 4,130 | 7.00 | 19,670 |
| 1.40 | 419 | 2.70 | 1,530 | 4.00 | 4,395 | 8.00 | 27,000 |
| 1.50 | 465 | 2.80 | 1,680 | 4.20 | 4,955 | 9.00 | 34,900 |
| 1.60 | 515 | 2.90 | 1,840 | 4.40 | 5,595 | 10.00 | 43,170 |
| 1.70 | 568 | 3.00 | 2,020 | 4.60 | 6,315 | | |
| 1.80 | 625 | 3.10 | 2,220 | 4.80 | 7,090 | | |
| 1.90 | 688 | 3.20 | 2,430 | 5.00 | 7,930 | | |

The above table is based upon 30 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.20 feet and 6 feet. The table has been extended beyond these limits. Between gage heights 2 feet and 4.7 feet the table is the same as that for 1903.

*Estimated monthly discharge of Colorado River at Austin, Tex., for 1904.*

[Drainage area, 37,000 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 | 339 | 339 | 339 | 20,840 | 0.0092 | 0.011 |
| February | 1,460 | 339 | 558 | 32,100 | .015 | .016 |
| March | 724 | 275 | 394 | 24,230 | .011 | .013 |
| April | 4,130 | 248 | 661 | 39,330 | .018 | .020 |
| May | 13,220 | 568 | 2,900 | 178,300 | .078 | .090 |
| June | 46,140 | 800 | 6,904 | 410,800 | .187 | .209 |
| July | 20,370 | 305 | 2,311 | 142,100 | .062 | .072 |
| August | 7,715 | 223 | 843 | 51,830 | .023 | .026 |
| September | 12,920 | 200 | 2,254 | 134,100 | .061 | .068 |
| October | 9,095 | 275 | 1,129 | 69,420 | .031 | .036 |
| November | 1,085 | 339 | 466 | 27,730 | .013 | .014 |
| December | 465 | 339 | 376 | 23,120 | .010 | .012 |
| The year | 46,140 | 200 | 1,595 | 1,154,000 | .043 | .587 |

COLORADO RIVER AT COLUMBUS, TEX.

This station was established in December, 1902, by Thomas U. Taylor. There is a gage marked on the downstream side of the pier on the west side of the river. Gage datum is taken as 50 feet below the top of this pier, and the observer, W. E. Bridge, measures down from this point with a tagged chain and lead weight. Discharge measurements are made from the 3-span highway bridge at which the gage is located. The channel is straight for 200 feet above and 600 feet below the stream and has a width of 140 feet at low water, unobstructed by piers, and a width of 450 feet at ordinary high water, broken by two piers. At very high stages the left bank overflows for several hundred feet, but the water passes under the iron trestle approach to the bridge. The bed is composed of gravel and sand and is fairly permanent. Bench mark No. 1 is the top of pier at west end of mid span of bridge. Its elevation is 50.00 feet above the zero of the gage. Bench mark No. 2 is the east end of top of the top stone step at south door of Columbus jail. Its elevation is 53.22 feet above gage datum. Bench mark No. 3 is the north end of top stone step at east door of Columbus court-house. Its elevation is 53.91 feet above the datum of the gage. Bench mark No. 4 is the top of rail over the extreme west pier of Southern Railway Bridge crossing the river above the gaging station. Its elevation is 51.13 feet above gage datum.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Colorado River at Columbus, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| February 5 | H. H. Fox | 306 | 1.48 | 5.50 | 454 |
| February 5 | do | | | 5.50 | 450 |
| March 1 | E. C. Murphy | 387 | 2.10 | 6.05 | 820 |
| May 6 | H. H. Fox | | | 25.80 | 23,800 |
| May 7 | do | | | 22.20 | 17,230 |
| May 8 | do | | | 19.90 | 13,710 |
| May 8 | do | | | 17.80 | 10,900 |
| May 8 | do | | | 16.50 | 8,956 |
| May 9 | do | | | 14.55 | 7,135 |
| May 11 | do | | | 13.30 | 6,172 |
| May 12 | do | | | 11.90 | 4,940 |
| May 12 | do | | | 11.10 | 4,112 |
| May 13 | do | 1,208 | 2.45 | 9.60 | 2,963 |

*Mean daily gage height, in feet, of Colorado River at Columbus, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.00 | 6.00 | 6.10 | 5.55 | 7.40 | 7.50 | 8.70 | 6.40 | 6.00 | 9.15 | 11.10 | 6.60 |
| 2 | 6.00 | 6.00 | 6.00 | 5.55 | 7.65 | 10.20 | 10.05 | 6.50 | 6.00 | 9.05 | 9.80 | 6.60 |
| 3 | 6.00 | 6.00 | 5.80 | 8.20 | 8.00 | 13.45 | 16.85 | 7.05 | 5.90 | 8.85 | 9.05 | 6.60 |
| 4 | 6.00 | 5.50 | 5.70 | 7.90 | 20.15 | 11.85 | 14.55 | 7.35 | 5.90 | 8.15 | 8.40 | 6.05 |
| 5 | 6.00 | 5.50 | 5.70 | 7.70 | 28.50 | 10.45 | 13.35 | 7.35 | 5.80 | 7.95 | 8.05 | 6.05 |
| 6 | 6.00 | 5.50 | 5.60 | 7.60 | 26.15 | 9.85 | 12.05 | 6.90 | 6.15 | 7.70 | 7.75 | 5.90 |
| 7 | 6.00 | 5.50 | 5.60 | 6.10 | 23.00 | 9.20 | 10.50 | 6.85 | 8.90 | 7.55 | 7.60 | 5.90 |
| 8 | 6.00 | 5.50 | 5.45 | 5.95 | 19.00 | 21.40 | 10.60 | 14.65 | 12.75 | 7.20 | 7.45 | 5.90 |
| 9 | 6.00 | 5.50 | 5.45 | 5.80 | 14.95 | 24.60 | 8.90 | 13.00 | 11.55 | 7.10 | 7.20 | 5.90 |
| 10 | 6.00 | 5.50 | 5.50 | 5.70 | 14.30 | 25.50 | 8.55 | 11.95 | 10.35 | 6.80 | 6.95 | 6.00 |
| 11 | 6.00 | 5.95 | 5.50 | 5.70 | 14.60 | 20.35 | 8.20 | 12.20 | 10.20 | 6.70 | 6.90 | 6.00 |
| 12 | 5.80 | 7.35 | 5.50 | 5.70 | 11.75 | 17.00 | 8.00 | 10.35 | 9.05 | 6.55 | 6.75 | 6.30 |
| 13 | 5.80 | 7.40 | 5.35 | 5.60 | 10.10 | 14.95 | 7.70 | 9.25 | 8.40 | 6.50 | 6.60 | 6.20 |
| 14 | 5.50 | 7.00 | 5.50 | 5.60 | 9.25 | 12.90 | 7.45 | 8.35 | 8.10 | 6.40 | 6.60 | 6.10 |
| 15 | 5.50 | 6.40 | 5.40 | 5.55 | 8.75 | 11.40 | 7.35 | 7.95 | 9.50 | 6.30 | 6.50 | 6.00 |
| 16 | 5.50 | 6.30 | 5.40 | 5.50 | 8.30 | 10.60 | 7.25 | 7.75 | 10.85 | 6.30 | 6.50 | 6.00 |
| 17 | 5.50 | 6.20 | 5.50 | 5.40 | 10.10 | 10.10 | 6.95 | 7.20 | 10.50 | 6.15 | 6.50 | 6.00 |
| 18 | 5.50 | 6.75 | 5.50 | 5.40 | 9.75 | 9.60 | 6.90 | 7.15 | 11.45 | 6.10 | 6.40 | 6.00 |
| 19 | 5.50 | 6.45 | 5.40 | 5.40 | 9.40 | 9.40 | 6.90 | 7.50 | 10.25 | 6.10 | 6.40 | 6.00 |
| 20 | 5.50 | 6.25 | 5.40 | 5.40 | 8.65 | 8.45 | 6.70 | 7.30 | 9.25 | 6.05 | 6.40 | 6.00 |
| 21 | 5.50 | 6.25 | 5.40 | 5.40 | 7.70 | 8.40 | 7.50 | 7.25 | 8.50 | 6.00 | 6.50 | 6.00 |
| 22 | 5.50 | 6.00 | 5.40 | 5.40 | 7.50 | 8.35 | 6.95 | 7.20 | 11.00 | 6.00 | 6.60 | 6.00 |
| 23 | 5.50 | 6.00 | 5.60 | 5.50 | 9.25 | 8.60 | 6.90 | 7.05 | 10.80 | 6.00 | 6.50 | 6.00 |
| 24 | 6.00 | 6.00 | 5.40 | 5.50 | 8.70 | 9.80 | 9.05 | 6.55 | 8.60 | 6.00 | 6.40 | 6.00 |
| 25 | 6.00 | 6.00 | 5.40 | 5.50 | 8.20 | 9.70 | 9.15 | 6.45 | 7.80 | 8.10 | 6.40 | 6.05 |
| 26 | 6.00 | 6.00 | 5.85 | 6.00 | 8.05 | 8.75 | 8.10 | 6.45 | 7.30 | 12.25 | 6.40 | 22.00 |
| 27 | 6.00 | 6.00 | 6.10 | 10.65 | 8.05 | 8.70 | 7.05 | 6.40 | 7.10 | 11.05 | 6.30 | 15.00 |
| 28 | 6.00 | 6.00 | 5.90 | 9.10 | 7.65 | 9.15 | 6.75 | 6.35 | 11.65 | 8.85 | 6.30 | 9.00 |
| 29 | 6.00 | 6.25 | 5.75 | 9.60 | 7.40 | 9.85 | 6.55 | 6.30 | 11.60 | 15.75 | 6.30 | 7.35 |
| 30 | 6.00 | ..... | 5.50 | 7.75 | 7.30 | 8.85 | 6.50 | 6.00 | 10.00 | 14.30 | 6.30 | 6.95 |
| 31 | 6.00 | ..... | 5.60 | ..... | 7.65 | ..... | 6.50 | 6.00 | ..... | 12.25 | ..... | 6.60 |

*Rating table for Colorado River at Columbus, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 5.40 | 510 | 7.10 | 1,340 | 9.20 | 2,710 | 13.50 | 6,160 |
| 5.50 | 550 | 7.20 | 1,400 | 9.40 | 2,850 | 14.00 | 6,610 |
| 5.60 | 590 | 7.30 | 1,460 | 9.60 | 2,990 | 14.50 | 7,090 |
| 5.70 | 630 | 7.40 | 1,520 | 9.80 | 3,130 | 15.00 | 7,590 |
| 5.80 | 680 | 7.50 | 1,580 | 10.00 | 3,270 | 16.00 | 8,660 |
| 5.90 | 730 | 7.60 | 1,640 | 10.20 | 3,410 | 17.00 | 9,860 |
| 6.00 | 780 | 7.70 | 1,700 | 10.40 | 3,570 | 18.00 | 11,140 |
| 6.10 | 830 | 7.80 | 1,760 | 10.60 | 3,730 | 19.00 | 12,520 |
| 6.20 | 880 | 7.90 | 1,820 | 10.80 | 3,890 | 20.00 | 13,970 |
| 6.30 | 930 | 8.00 | 1,880 | 11.00 | 4,050 | 21.00 | 15,470 |
| 6.40 | 980 | 8.10 | 1,940 | 11.20 | 4,210 | 22.00 | 17,030 |
| 6.50 | 1,030 | 8.20 | 2,010 | 11.40 | 4,370 | 23.00 | 18,700 |
| 6.60 | 1,080 | 8.30 | 2,080 | 11.60 | 4,530 | 24.00 | 20,420 |
| 6.70 | 1,130 | 8.40 | 2,150 | 11.80 | 4,690 | 25.00 | 22,200 |
| 6.80 | 1,180 | 8.60 | 2,290 | 12.00 | 4,850 | 26.00 | 24,070 |
| 6.90 | 1,230 | 8.80 | 2,430 | 12.50 | 5,260 | 27.00 | 25,980 |
| 7.00 | 1,280 | 9.00 | 2,570 | 13.00 | 5,710 | 28.00 | 27,920 |

The above table is based upon 24 discharge measurements made during 1902 to 1904, inclusive. It is fairly well defined.

*Estimated monthly discharge of Colorado River at Columbus, Tex., for 1904.*

[Drainage area, 40,000 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 | 780 | 550 | 699 | 42,980 | 0.017 | 0.020 |
| February | 1,520 | 550 | 840 | 48,320 | .021 | .023 |
| March | 830 | 390 | 587 | 36,090 | .015 | .017 |
| April | 3,770 | 510 | 1,046 | 62,240 | .026 | .029 |
| May | 28,900 | 1,460 | 5,572 | 342,600 | .139 | .160 |
| June | 23,140 | 1,580 | 5,627 | 234,800 | .141 | .157 |
| July | 9,675 | 1,030 | 2,494 | 153,400 | .062 | .071 |
| August | 7,240 | 780 | 1,965 | 120,800 | .049 | .056 |
| September | 5,485 | 680 | 2,705 | 161,000 | .068 | .076 |
| October | 8,390 | 780 | 2,102 | 129,200 | .053 | .061 |
| November | 4,130 | 930 | 1,396 | 83,070 | .035 | .039 |
| December | 17,030 | 730 | 1,664 | 102,300 | .042 | .048 |
| The year | 28,900 | 390 | 2,225 | 1,517,000 | .056 | .757 |

### LIPAN SPRING NEAR SAN ANGELO, TEX.

Lipan Spring is 18 miles from San Angelo in southeasterly direction. Its discharge in the latter part of December, 1904, was 1 second-foot. The water is used for irrigation purposes on a few small farms.

### KICKAPOO SPRING NEAR SAN ANGELO, TEX.

Kickapoo Spring is located in Tom Green County, Tex., about 20 miles in a southeast direction from San Angelo. This spring forms the headwaters of Kickapoo Creek and the waters are used for stock and irrigation purposes. The creek flows in a northeast direction for 30 miles to its junction with Concho River, 2 miles above Paint Rock. The discharge was measured at the head spring December 20, 1904, by O. L. Sims and a flow of 4 second-feet was found.

### SAN SABA RIVER AT SAN SABA, TEX.

San Saba River rises in two springs near Fort McKavett, in the western part of Menard County, Tex., and flows in an easterly direction for over 100 miles to its junction with Colorado (of Texas) River. It is fed by many springs between Fort McKavett and Menardville, the largest of which is the one that feeds or is the source of Clear Creek.

A gaging station was established on San Saba River at the suspension bridge 1 mile northwest of the town of San Saba, Tex., December 30, 1904, by E. C. H. Bantel. The elevations of the water surface are determined by measuring down by means of a tape from a certain casting on the upstream face in the flooring of the bridge, the zero elevation being 40.00 feet below the same. Discharge measurements are made from the single-span bridge at which the gage is located. The initial point for soundings is the north face of the south pier. The channel is straight for 150 feet above and 1,000 feet below the station. The current is swift at high and sluggish at low stages. Both banks are high and liable to overflow at high stages. The bed of the stream is composed of sand and gravel. There is but one channel at all stages. Bench mark No. 1 is a large wire nail driven into a tree 50 feet from the south end of the bridge. Its elevation is 37.63 feet above the zero of the gage. Bench mark No. 2 is a wire nail driven into a water elm 70 feet from the north end of the bridge, on the east side of the road. Its elevation is 37.16 feet above the zero of the gage. Bench mark No. 3 is a wire nail driven into a live oak tree 200 feet from the south end of the bridge and 50 feet from the edge of the south bank of the stream. Its elevation is 37.16 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of San Saba River at San Saba, Tex., in 1902 and 1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| 1902. | | *Second-feet.* |
| August | T. U. Taylor | [a] 26 |
| 1904. | | |
| December 20 [b] | O. L. Sims | [a] 15 |

[a] One mile below Fort McKavett.
[b] The measurement of December 20, 1904, can be regarded as the probable minimum flow, as all the streams in the northern part of the Edwards Plateau were at very low stages at this period of the year 1904.

## BARTONS SPRINGS NEAR AUSTIN, TEX.

These springs are located about 2 miles southwest of Austin, Tex., and are similar in behavior and in flow to the Comal, San Felipe, and San Marcos. They respond in increased flow to the rainfall in the Edwards Plateau, but this response is always delayed some months. About a quarter of a mile from the head spring, the Walsh Spring formerly was active and operated a small mill, but it went dry several years ago, but revived in the wet season of 1900 and continued flowing till the early part of 1901, when it again ceased flowing. It continued dry till the early part of 1903 when it again revived. On June 6, 1903, the flow of the Walsh Spring was 8.5 second-feet, but it stopped flowing in the latter part of 1903 and has since remained dry.

*Discharge measurements of Bartons Springs, near Austin, Tex., 1894–1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| | | *Second-feet.* |
| 1894 | C. C. Babb | 17 |
| 1895 | do | 25 |
| March, 1898 | T. U. Taylor | 20 |
| May, 1898 | do | 30 |
| August, 1900 | do | 69 |
| December 1900 | do | 33 |
| June, 1902 | do | 19 |
| August, 1902 | do | 19 |
| June, 1903 | A. A. Cother | 69 |
| June, 1904 | T. U. Taylor | 43 |

### MORMON SPRINGS NEAR AUSTIN, TEX.

About 1 mile above the Austin dam on the left or east bank of the river are some springs known from some former campers as Mormon Springs. These springs were in the lake formed by the backwater from the Austin dam. At present they break out in several places, and the only way to get their total flow is to follow along the river edge and measure the discharge of each as it enters Colorado River. The flow of these springs as they existed in August, 1904, was measured by Thomas U. Taylor, and the full capacity of the three outlets was 3 second-feet.

## GUADALUPE RIVER DRAINAGE BASIN.

Guadalupe River rises in the southern central part of Texas, flows southeast, and empties into San Antonio Bay. During the summer of 1902 its discharge was the least in its observed history, causing much loss above New Braunfels, where half a dozen power plants were forced to shut down or to run on short time. The flow at this time was so low that special efforts were made to obtain measurements at several points along its course.

Under the direction of Thomas U. Taylor the United States Geological Survey is maintaining a station in this basin near Cuero, Tex.

### GUADALUPE RIVER NEAR CUERO, TEX.

The Guadalupe, while the best water-power stream in Texas, has a drainage area above Cuero of only 5,100 square miles. Its efficiency is due almost entirely to the canal at New Braunfels. Below New Braunfels the largest tributary is San Marcos River.

This station was established by Thomas U. Taylor December 26, 1902. The original location of the gage was at the dam at Carl Buchel's power house, 3 miles north of Cuero, Tex. This gage is a vertical staff mounted on the wall of the power house near the dam, and was read twice each day by Carl Buchel.

For the old station the initial point for soundings was on the left bank. The channel is straight for about one-fourth of a mile above and 400 feet below the station. The right bank is low and liable to overflow; the left bank is high and rocky. The bed of the stream is of clay. The bench mark is on the crest of the dam. Its elevation is the same as the zero of the gage.

As it proved impossible to measure flood discharges at this point, a new station was established in July, 1903, at the bridge of the San Antonio and Aransas Pass Railroad 3 miles west of Cuero. A standard chain gage is attached to the bridge. The gage is read twice each day by Robert Miller. Discharge measurements are made from the highway bridge, 200 feet below the railway bridge, when the gage is above

7 feet, but at lower stages the discharge is measured on the crest of the Buchel dam, 3 miles upstream. The crest of this dam is 110 feet long and 4 feet wide. The initial point for soundings at the bridge is the east face of the tubular pier under the west end of the highway bridge. The channel is straight and has a width of 125 feet at low stages. The right bank is low and overflows for several hundred feet at high stages. The section is deep and the flow is sluggish. The bed is composed of soft material and may change somewhat. Bench mark No. 1 is the top of the tie in the third panel from the east end of the bridge. Its elevation is 50.00 feet above the datum of the gage. Bench mark No. 2 is the seat of the valve, about 100 feet from the pump house, on the line of pipe that leads from the pump to the water tank. Its elevation is 44.85 feet above the datum of the gage. Bench mark No. 3 is the top of a vertical iron rod buried in the ground 4 feet east of mulberry tree near the left end of the bridge. Its elevation is 42.18 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Guadalupe River near Cuero, Tex., in 1904.*

| Date. | Hydrographer. | Gage height. | Discharge. |
|---|---|---|---|
| | | *Feet.* | *Second-feet.* |
| March 2 | H. H. Fox | 6.60 | 640 |
| August 4 [a] | T. U. Taylor | 6.10 | 540 |
| October 23 | do | 6.10 | 407 |

[a] At San Antonio and Aransas Pass Railroad.

*Mean daily gage height, in feet, of Guadalupe River near Cuero, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.70 | 6.60 | 6.50 | 6.45 | 9.98 | 7.65 | 6.18 | 6.05 | 6.43 | 6.52 | 6.70 | 6.20 |
| 2 | 6.70 | 6.60 | 6.60 | 6.40 | 7.75 | 7.35 | 6.25 | 6.00 | 6.43 | 6.62 | 6.60 | 6.20 |
| 3 | 6.75 | 6.70 | 6.60 | 6.45 | 7.63 | 6.90 | 6.65 | 6.05 | 6.30 | 6.67 | 6.60 | 6.20 |
| 4 | 6.70 | 6.60 | 6.55 | 8.75 | 8.80 | 6.75 | 6.70 | 6.00 | 6.05 | 6.55 | 6.45 | 6.50 |
| 5 | 6.80 | 6.60 | 6.50 | 8.20 | 11.00 | 6.65 | 7.60 | 6.05 | 6.22 | 6.40 | 6.45 | 6.50 |
| 6 | 6.70 | 6.70 | 6.50 | 7.00 | 18.60 | 6.95 | 6.85 | 5.80 | 6.32 | 6.45 | 6.30 | 6.55 |
| 7 | 6.70 | 6.60 | 6.55 | 6.80 | 20.78 | 7.22 | 6.85 | 5.85 | 6.40 | 6.40 | 6.20 | 6.40 |
| 8 | 6.70 | 6.65 | 6.50 | 6.65 | 11.38 | 7.15 | 6.75 | 6.00 | 6.10 | 6.62 | 6.20 | 6.20 |
| 9 | 6.80 | 6.65 | 6.50 | 6.58 | 14.18 | 7.75 | 6.20 | 7.85 | 7.55 | 6.15 | 6.15 | 6.35 |
| 10 | 6.70 | 6.60 | 6.50 | 6.48 | 11.38 | 7.57 | 6.05 | 7.20 | 7.40 | 6.37 | 6.05 | 6.20 |
| 11 | 6.70 | 6.60 | 6.50 | 6.48 | 9.38 | 7.30 | 6.20 | 6.50 | 6.75 | 6.05 | 6.10 | 6.20 |
| 12 | 6.75 | 6.65 | 6.40 | 6.43 | 8.20 | 7.50 | 5.95 | 6.25 | 6.57 | 6.37 | 6.10 | 6.20 |
| 13 | 6.70 | 6.70 | 6.40 | 6.43 | 7.78 | 7.05 | 6.00 | 6.15 | 6.47 | 6.30 | 6.10 | 6.20 |
| 14 | 6.70 | 6.65 | 6.55 | 6.33 | 7.50 | 6.88 | 5.80 | 6.20 | 6.52 | 6.15 | 6.10 | 6.20 |
| 15 | 6.70 | 6.65 | 6.45 | 6.38 | 7.38 | 6.68 | 5.95 | 6.25 | 10.90 | 6.60 | 6.10 | 6.20 |
| 16 | 6.70 | 6.70 | 6.45 | 6.35 | 7.40 | 6.55 | 6.05 | 6.25 | 16.95 | 6.37 | 6.10 | 6.20 |
| 17 | 6.60 | 6.70 | 6.45 | 6.25 | 7.38 | 6.55 | 5.95 | 6.15 | 11.10 | 6.37 | 6.10 | 6.20 |
| 18 | 6.70 | 6.70 | 6.40 | 6.53 | 9.65 | 6.58 | 6.15 | 6.35 | 11.25 | 6.62 | 6.10 | 6.10 |
| 19 | 6.70 | 6.70 | 6.45 | 6.33 | 12.45 | 6.60 | 6.10 | 6.25 | 8.37 | 6.62 | 6.10 | 6.10 |
| 20 | 6.70 | 6.65 | 6.60 | 6.20 | 11.83 | 6.50 | 6.10 | 6.30 | 7.37 | 6.60 | 6.05 | 6.10 |
| 21 | 6.80 | 6.70 | 6.50 | 6.33 | 7.78 | 6.55 | 6.05 | 6.25 | 7.37 | 6.52 | 6.10 | 6.10 |
| 22 | 6.70 | 6.70 | 6.50 | 6.28 | 7.20 | 6.55 | 6.00 | 6.20 | 8.10 | 6.47 | 6.10 | 6.10 |
| 23 | 6.70 | 6.80 | 6.50 | 6.33 | 7.05 | 6.60 | 5.95 | 6.15 | 8.35 | 6.25 | 6.10 | 6.20 |
| 24 | 6.60 | 6.70 | 6.45 | 6.18 | 6.90 | 7.30 | 6.05 | 6.05 | 7.85 | 6.35 | 6.20 | 6.20 |
| 25 | 6.70 | 6.70 | 6.45 | 6.38 | 7.00 | 9.20 | 6.05 | 6.15 | 6.90 | 6.65 | 6.20 | 6.20 |
| 26 | 6.60 | 6.70 | 6.45 | 6.45 | 6.85 | 7.40 | 6.05 | 6.00 | 6.60 | 10.85 | 6.20 | 20.15 |
| 27 | 6.70 | 6.70 | 6.35 | 6.43 | 6.75 | 6.75 | 6.10 | 6.00 | 6.55 | 14.35 | 6.20 | 11.80 |
| 28 | 6.60 | 6.70 | 6.45 | 6.48 | 6.85 | 6.60 | 6.00 | 6.20 | 6.70 | 10.15 | 6.20 | 14.15 |
| 29 | 6.65 | 6.60 | 6.30 | 6.45 | 7.10 | 6.50 | 5.90 | 6.74 | 6.65 | 8.10 | 6.20 | 9.10 |
| 30 | 6.70 | ..... | 6.30 | 6.33 | 7.10 | 6.48 | 5.90 | 6.60 | 6.67 | 7.50 | 6.20 | 9.00 |
| 31 | 6.60 | ..... | 6.45 | ..... | 7.75 | ..... | 5.85 | 6.30 | ..... | 7.15 | ..... | 16.65 |

*Rating table for Guadalupe River near Cuero, Tex., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 5.80 | 465 | 8.10 | 1,133 | 11.80 | 2,426 | 20.00 | 6,340 |
| 5.90 | 490 | 8.20 | 1,166 | 12.00 | 2,500 | 21.00 | 7,040 |
| 6.00 | 515 | 8.30 | 1,199 | 12.20 | 2,574 | 22.00 | 7,840 |
| 6.10 | 540 | 8.40 | 1,232 | 12.40 | 2,650 | 23.00 | 8,680 |
| 6.20 | 566 | 8.50 | 1,265 | 12.60 | 2,726 | 24.00 | 9,630 |
| 6.30 | 592 | 8.60 | 1,298 | 12.80 | 2,803 | 25.00 | 10,690 |
| 6.40 | 619 | 8.70 | 1,332 | 13.00 | 2,881 | 26.00 | 11,840 |
| 6.50 | 646 | 8.80 | 1,366 | 13.20 | 2,959 | 27.00 | 13,070 |
| 6.60 | 673 | 8.90 | 1,400 | 13.40 | 3,038 | 28.00 | 14,370 |
| 6.70 | 701 | 9.00 | 1,434 | 13.60 | 3,118 | 29.00 | 15,730 |
| 6.80 | 729 | 9.20 | 1,502 | 13.80 | 3,198 | 30.00 | 17,200 |
| 6.90 | 758 | 9.40 | 1,570 | 14.00 | 3,280 | 31.00 | 18,950 |
| 7.00 | 787 | 9.60 | 1,640 | 14.50 | 3,487 | 32.00 | 21,000 |
| 7.10 | 817 | 9.80 | 1,710 | 15.00 | 3,700 | 33.00 | 23,320 |
| 7.20 | 847 | 10.00 | 1,780 | 15.50 | 3,920 | 34.00 | 26,000 |
| 7.30 | 878 | 10.20 | 1,850 | 16.00 | 4,150 | 35.00 | 29,690 |
| 7.40 | 909 | 10.40 | 1,920 | 16.50 | 4,400 | 36.00 | 34,200 |
| 7.50 | 940 | 10.60 | 1,992 | 17.00 | 4,650 | 38.00 | 44,800 |
| 7.60 | 972 | 10.80 | 2,064 | 17.50 | 4,900 | 40.00 | 55,400 |
| 7.70 | 1,004 | 11.00 | 2,136 | 18.00 | 5,150 | 43.00 | 71,300 |
| 7.80 | 1,036 | 11.20 | 2,208 | 18.50 | 5,440 | | |
| 7.90 | 1,068 | 11.40 | 2,280 | 19.00 | 5,740 | | |
| 8.00 | 1,100 | 11.60 | 2,352 | 19.50 | 6,040 | | |

The above table is based upon 21 discharge measurements made during 1903 and 3 low-water measurements made in 1904. It is well defined.

NOTE.—There has been a slight change in stream bed, beginning the latter part of 1903 and extending over low-water periods in 1904. The 1903 curve below gage height, 17 feet, has been changed to conform to the 1904 measurements.

*Estimated monthly discharge of Guadalupe River near Cuero, Tex., for 1904.*

[Drainage area, 5,100 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 | 729 | 673 | 700 | 43,040 | 0.137 | 0.158 |
| February | 729 | 673 | 691 | 39,750 | .135 | .146 |
| March | 673 | 592 | 639 | 39,290 | .125 | .144 |
| April | 1,349 | 560 | 671 | 39,930 | .132 | .147 |
| May | 6,886 | 715 | 1,639 | 100,800 | .321 | .370 |
| June | 1,502 | 641 | 794 | 47,250 | .156 | .174 |
| July | 972 | 465 | 569 | 34,990 | .112 | .129 |
| August | 1,052 | 465 | 585 | 35,970 | .115 | .133 |
| September | 4,625 | 527 | 1,032 | 61,410 | .202 | .225 |
| October | 3,424 | 527 | 839 | 51,590 | .165 | .190 |
| November | 701 | 527 | 570 | 33,920 | .112 | .125 |
| December | 6,445 | 540 | 1,095 | 67,330 | .215 | .248 |
| The year | 6,886 | 465 | 819 | 595,300 | .161 | 2.20 |

## COMAL RIVER AT NEW BRAUNFELS, TEX.

Comal River has been fully described in Water-Supply Papers Nos. 71 and 105. It is formed by numerous big springs that issue from the foothills west of the town of New Braunfels, Tex., and the joint discharge of these form Comal River, which is formed by Comal Springs Creek and Comal Creek. The water from the head springs naturally flows down Comal Springs Creek, but a gravel dam deflects part of this flow into the Landa mill race. These waters again join about a fourth of a mile above the highway bridge north of the courthouse, forming Comal River. The following table shows the result of current meter measurements on Comal River at various times.

*Discharge measurements of Comal River at New Braunfels, Tex., 1895–1904.*

| Date. | Hydrographer. | Discharge. | Remarks. |
|---|---|---|---|
| | | *Second-feet.* | |
| 1895 | C. C. Babb | 328 | At highway bridge. |
| 1898 | T. U. Taylor | 320 | Do. |
| 1899 | do | 310 | In park. |
| 1900 | do | 374 | Do. |
| 1901 | do | 343 | Do. |
| 1902 | do | 333 | Do. |
| 1903 | do | 412 | In park (recent rains). |
| 1904 | do | 375 | In park. |

## SAN ANTONIO RIVER DRAINAGE BASIN.

### SAN ANTONIO RIVER AT SAN ANTONIO, TEX.

San Antonio River began failing in 1885, and by 1895 the flow above the city in the park had entirely ceased. But like many of the other big springs of the Edwards Plateau it has gone through experience. There is no doubt about the river and the artesian wells having the same underground source, but the river regained its former efficiency in 1900, shortly after the celebrated flood (Water-Supply Paper No. 105), but in two years the discharge had dropped to a depth of the discharge of 1900.

The following table shows the list of discharge measurements that have been made on this stream:

*Discharge measurements of San Antonio River at San Antonio, Tex., 1895–1904.*

| Date. | Hydrographer. | Discharge | Remarks. |
|---|---|---|---|
| | | *Second-feet.* | |
| December, 1895 | C. C. Babb | 49 | Upper canal. |
| November, 1896 | do | 41 | Do. |
| December, 1897 | T. U. Taylor | 0 | Lower canal. |
| December, 1897 | do | 11 | Hot wells. |
| March, 1898 | do | 0 | Lower canal. |
| March, 1898 | do | 9 | Hot wells. |
| June, 1899 | do | 10 | Do. |
| June, 1899 | do | 0 | Lower canal. |
| September, 1900 | do | 125 | Hot wells. |
| September, 1900 | do | 103 | Lower canal. |
| October, 1901 | do | 41 | Hot wells. |
| March, 1904 | do | 65 | Do. |
| June, 1904 | do | 61 | Do. |

## NUECES RIVER DRAINAGE BASIN.

### LEONA RIVER AT UVALDE, TEX.

The flow of the Leona at Uvalde is a very variable factor, and it has often occurred that it has stopped flowing altogether near Uvalde. It was dry in 1885, but soon revived and continued flowing till 1893, when it again ceased flowing for a time. Its history at the brickyard crossing, 1½ miles below town on the road to Pearsall, is given in the following table:

*Discharge measurements of Leona River at Uvalde, Tex., 1885–1904.*

| Date. | Hydrographer. | Discharge. | Remarks. |
|---|---|---|---|
| | | *Second-feet.* | |
| 1885 | | | Had flow. |
| 1893 | | | No flow. |
| December, 1895 | C. C. Babb | 11 | |
| June, 1899 | T. U. Taylor | | Do. |
| September, 1900 | do | 5 | |
| March, 1904 | do | 22 | |

## RIO GRANDE DRAINAGE BASIN.

The Rio Grande rises in southern Colorado, in the Rocky Mountains, flows south through New Mexico and thence southeast, forming the boundary between Texas and Mexico. Pecos River, which rises in northern New Mexico and flows south across eastern New Mexico and western Texas, is its longest tributary from the north, although Devils River delivers to the Rio Grande about the same amount of water as does the Pecos. Conchos River is its principal tributary from the Mexican side. The determination of the amount of water in the Rio Grande is of importance, both on account of its use in irrigation and from its bearing upon interstate and international distribution of water. Most of the New Mexico and Texas stations are maintained by the International (Water) Boundary Commission. The data are collected by W. W. Follett, consulting engineer for the commission, and have been furnished through the courtesy of Gen. Anson Mills, commissioner. On account of the shifting character of the river beds at the International (Water) Boundary stations, no rating tables have been prepared. The estimated monthly discharges are from daily discharges computed by Mr. Follett directly from the discharge measurements.

RIO GRANDE NEAR DEL NORTE, COLO.

Measurements and observations were first begun in the vicinity of Del Norte in 1889 by George T. Quinby. The object of the measurements was to obtain the flow of the river before water was diverted for the agricultural region of San Luis Valley, and by a comparison of this with the figures obtained at Embudo to acquire data as to the effect of the numerous ditches taking out water between the two points. The river 25 miles above Del Norte flows out of the canyon at Wagon Wheel Gap. Little water, however, is diverted until the edge of the San Luis Valley is reached, the largest canal heading near the town of Del Norte. During freshets the river divides into a number of channels, making it difficult to obtain measurements near town. In order to avoid the expense of establishing a station during time of high water the first measurements—those about June 1—were made from several bridges crossing the numerous branches. The results were not wholly satisfactory, and on June 25 a station was established above the branches. Later a locality about 2 miles farther up was chosen.

The station is about 2 miles west of the town of Del Norte, above the main canal, taking water from the Rio Grande, and is above all the irrigating ditches of importance. The river flows in one channel, about 175 feet wide and of very regular section. The banks on each side are steep, and the water is reported never to overflow. The course of the stream is straight for 100 yards both above and below the section. The old inclined gage was set at an angle of about 30° to the horizontal on the right bank. On April 1, 1904, a new gage was placed in the same position and at the same datum as the old gage. As noted on October 10, 1891, bench mark No. 1 is a large nail in the root of a tree 15 feet northwest of the end of the cable on right bank of river. Bench mark No. 2 is a large nail in the root of a tree 25 feet southwest of the end of the inclined gage. Both bench marks are 7.54 feet above the datum of the gage.

On June 16, 1900, the gage rod was connected with an iron bench mark of the U. S. Geological Survey set in the ground about 25 feet south of the rod; the zero of the rod is 8.25 feet below the bench mark.

Gagings were first made from a flatboat, 4 feet wide and 14 feet long, attached by rope and tackle to a $\frac{5}{8}$-inch wire cable fastened to a large cottonwood tree on the left bank and to a sand anchor on the right bank. They are now made by means of a car which travels across the river along a steel cable, the distance being marked on a tag wire. The channel is excellent, the water, although falling rapidly, seldom scouring, and the bed therefore remaining practically the same from year to year. The bed of the channel is covered with small bowlders, and the sides, although not high, have never been known to overflow. The observer is Richard Adams.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

*Discharge measurements of Rio Grande near Del Norte, Colo., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| April 1 | G. B. Monk | 93 | 2.25 | 1.15 | 209 |
| May 5 | do | 175 | 3.33 | 1.80 | 584 |
| June 20 | do | 196 | 3.51 | 1.90 | 687 |
| June 25 | do | 188 | 3.29 | 1.85 | 618 |
| July 14 | do | 111 | 2.33 | 1.40 | 259 |
| July 20 | do | 108 | 2.27 | 1.30 | 245 |
| July 30 | do | 141 | 2.99 | 1.70 | 420 |
| August 22 | do | 179 | 3.27 | 1.99 | 585 |
| August 22 | do | 179 | 3.12 | 1.98 | 558 |
| August 23 | do | 164 | 2.98 | 1.90 | 488 |
| August 23 | do | 170 | 3.53 | 1.90 | 598 |

*Mean daily gage height, in feet, of Rio Grande near Del Norte, Colo., for 1904.*

| Day. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|
| 1 | 1.15 | 2.25 | 2.20 | 1.70 | 1.80 | 2.60 | 3.60 |
| 2 | 1.25 | 2.25 | 2.20 | 1.70 | 1.90 | 2.50 | 3.10 |
| 3 | 1.26 | 2.50 | 2.10 | 1.65 | 1.85 | 2.38 | 2.90 |
| 4 | 1.25 | 1.85 | 2.50 | 1.60 | 1.88 | 2.35 | 2.70 |
| 5 | 1.31 | 1.80 | 2.00 | 1.58 | 1.95 | 2.20 | 2.60 |
| 6 | 1.35 | 1.80 | 2.00 | 1.51 | 1.80 | 2.10 | 2.70 |
| 7 | 1.35 | 2.10 | 2.00 | 1.50 | 1.75 | 2.10 | 3.60 |
| 8 | 1.31 | 2.40 | 2.20 | 1.49 | 1.80 | 2.00 | 4.00 |
| 9 | 1.31 | 2.30 | 2.25 | 1.46 | 1.85 | 1.95 | 4.35 |
| 10 | 1.39 | 2.50 | 2.20 | 1.45 | 1.75 | 1.90 | 3.85 |
| 11 | 1.50 | 2.70 | 2.10 | 1.45 | 1.80 | 1.90 | 3.60 |
| 12 | 1.65 | 3.00 | 2.10 | 1.46 | 1.85 | 1.85 | 3.50 |
| 13 | 1.91 | 3.35 | 2.10 | 1.41 | 1.90 | 1.85 | 3.30 |
| 14 | 2.50 | 3.40 | 2.00 | 1.40 | 1.90 | 1.80 | 3.25 |
| 15 | 2.20 | 2.95 | 2.00 | 1.35 | 1.90 | 1.75 | 3.15 |
| 16 | 2.50 | 2.85 | 2.00 | 1.32 | 1.88 | 1.80 | 3.00 |
| 17 | 2.40 | 2.65 | 2.10 | 1.35 | 1.85 | 1.80 | 2.90 |
| 18 | 2.45 | 3.00 | 2.10 | 1.39 | 2.30 | 1.75 | 2.80 |
| 19 | 2.55 | 3.25 | 2.50 | 1.33 | 2.35 | 1.70 | 2.70 |
| 20 | 2.35 | 3.50 | 1.95 | 1.30 | 2.20 | 1.70 | 2.60 |
| 21 | 2.20 | 2.75 | 1.95 | 1.31 | 2.50 | 1.70 | 2.60 |
| 22 | 1.95 | 2.70 | 2.50 | 1.33 | 2.00 | 1.70 | 2.50 |
| 23 | 1.85 | 2.75 | 2.00 | 1.48 | 1.95 | 1.90 | 2.40 |
| 24 | 1.75 | 2.75 | 1.95 | 1.39 | 2.00 | 2.10 | 2.35 |
| 25 | 1.80 | 2.65 | 1.85 | 1.50 | 2.00 | 1.95 | 2.35 |
| 26 | 2.30 | 2.60 | 1.75 | 1.50 | 2.20 | 1.90 | 2.20 |
| 27 | 2.65 | 2.50 | 1.80 | 1.52 | 2.25 | 1.90 | 2.15 |
| 28 | 2.94 | 2.40 | 1.80 | 1.50 | 2.20 | 1.90 | 2.10 |
| 29 | 2.75 | 2.30 | 1.75 | 1.49 | 2.15 | 2.50 | 2.50 |
| 30 | 2.40 | 2.30 | 1.70 | 1.70 | 2.50 | 2.90 | 2.00 |
| 31 | ..... | 2.30 | ..... | 1.72 | 2.50 | ..... | 2.00 |

*Rating table for Rio Grande near Del Norte, Colo., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.15 | 195 | 1.90 | 605 | 2.70 | 1,225 | 3.50 | 2,040 |
| 1.20 | 210 | 2.00 | 675 | 2.80 | 1,315 | 3.60 | 2,160 |
| 1.30 | 245 | 2.10 | 745 | 2.90 | 1,410 | 3.70 | 2,280 |
| 1.40 | 290 | 2.20 | 815 | 3.00 | 1,510 | 3.80 | 2,400 |
| 1.50 | 345 | 2.30 | 890 | 3.10 | 1,610 | 3.90 | 2,520 |
| 1.60 | 405 | 2.40 | 970 | 3.20 | 1,710 | 4.00 | 2,640 |
| 1.70 | 465 | 2.50 | 1,050 | 3.30 | 1,810 | | |
| 1.80 | 535 | 2.60 | 1,135 | 3.40 | 1,920 | | |

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1903 and 1904. It is not well defined.

*Estimated monthly discharge of Rio Grande near Del Norte, Colo., for 1904.*

[Drainage area, 1,400 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. |
| April | 1,450 | 195 | 652 | 38,800 | 0.466 | 0.520 |
| May | 2,040 | 535 | 1,158 | 71,200 | .827 | .953 |
| June | 1,050 | 465 | 716 | 42,600 | .511 | .570 |
| July | 479 | 245 | 336 | 20,660 | .240 | .277 |
| August | 1,050 | 500 | 689 | 42,360 | .492 | .567 |
| September | 1,410 | 465 | 692 | 41,180 | .494 | .551 |
| October | 3,100 | 675 | 1,449 | 89,090 | 1.04 | 1.20 |
| The period | | | | 345,900 | | |

### RIO GRANDE NEAR LOBATOS, COLO.

This station was located on June 28, 1899, by A. L. Fellows. It is at the State bridge across the Rio Grande, at a point near the Colorado-New Mexico State line and about 10 miles east of Lobatos, Colo. The station is favorably located for the purpose, the cross section being fairly uniform, the channel regular and not liable to overflow. There are two gages, one for high water and the other for low water. The high-water gage is a scale graduated to feet and tenths marked with white paint on the central downsteam cylinder of the bridge. The low-water gage is a scale, marked in feet and tenths, on the perpendicular face of a large bowlder about a hundred yards below the bridge. The channel is in most respects an excellent one. The bed consists of bowlders and rock, and is subject to little change; the banks are high and are not subject to overflow; one channel except at very low stages. Gagings can be made at the bridge, but during low water they are usually made by wading. On June 22, 1900, both gages were referred to a bench mark consisting of a chiseled point marked "B. M." on the face of the lava bluff under the west end of the bridge 7.42 feet above gage datum. The station is an extremely important one, giving, as it does, the discharge of the river at the Colorado State line, including practically all of the Colorado drainage. Roman Mondragon, a storekeeper at the west end of the bridge, has kept the records during the last year.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

*Discharge measurements of Rio Grande near Lobatos, Colo., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Square ft.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| May 4 | G. B. Monk | 42 | 26 | 0.92 | 0.80 | 24 |
| May 13 | do | 42 | 25 | 1.00 | .80 | 25 |
| May 26 | do | 41 | 20 | .70 | .70 | 14 |
| June 9 | do | 41 | 20 | .75 | .70 | 16 |
| June 18 | do | 47 | 27 | 1.04 | .80 | 28 |
| June 27 | do | 41 | 20 | .80 | .70 | 16 |
| July 21 | do | 41 | 20 | .70 | .70 | 14 |
| July 29 | do | 38 | 20 | .70 | .70 | 14 |
| August 24 | do | 60 | 51 | 2.37 | 1.20 | 121 |

*Mean daily gage height, in feet, of Rio Grande near Lobatos, Colo., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.60 | 1.60 | 1.60 | 0.90 | 0.70 | 0.70 | 0.70 | 0.70 | 1.40 | 2.90 | 2.10 | 0.90 |
| 2 | 1.60 | 1.60 | 1.60 | .90 | .70 | .70 | .70 | .70 | 1.40 | 3.00 | 2.00 | .90 |
| 3 | 1.60 | 1.60 | 1.50 | .90 | .70 | .70 | .70 | .70 | 1.60 | 2.95 | 2.00 | .90 |
| 4 | 1.60 | 1.60 | 1.40 | .90 | .80 | .70 | .70 | .75 | 1.80 | 3.00 | .90 | 2.00 |
| 5 | 1.60 | 1.60 | 1.40 | .90 | .80 | .70 | .70 | .80 | 1.85 | 2.90 | .90 | 2.00 |
| 6 | 1.60 | 1.60 | 1.30 | .90 | .80 | .75 | .70 | .90 | 1.80 | 2.70 | .90 | 2.00 |
| 7 | 1.60 | 1.60 | 1.20 | .90 | .80 | .70 | .70 | .90 | 1.75 | 2.60 | .90 | 2.00 |
| 8 | 1.60 | 1.70 | 1.20 | .90 | .80 | .75 | .70 | .90 | 1.70 | 2.90 | .90 | 2.00 |
| 9 | 1.60 | 1.50 | 1.20 | .90 | .80 | .85 | .70 | 1.55 | 1.55 | 3.30 | .90 | 2.00 |
| 10 | 1.60 | 1.60 | 1.10 | .90 | .80 | .80 | .70 | 2.20 | 1.50 | 3.75 | .90 | 2.10 |
| 11 | 1.60 | 1.60 | 1.10 | .90 | .80 | .80 | .90 | .90 | 1.50 | 3.95 | 1.45 | 2.10 |
| 12 | 1.60 | 1.60 | 1.10 | .80 | .80 | .80 | .90 | .90 | 1.35 | 3.95 | 1.45 | 2.20 |
| 13 | 1.60 | 1.60 | 1.10 | .80 | .80 | .80 | .80 | .90 | 1.30 | 3.70 | 2.00 | 2.20 |
| 14 | 1.60 | 1.60 | 1.10 | .90 | .80 | .80 | .70 | .90 | 1.30 | 3.50 | 2.00 | 2.35 |
| 15 | 1.60 | 1.60 | 1.10 | .90 | .80 | .80 | .70 | .90 | 1.20 | 3.20 | 2.00 | 2.40 |
| 16 | 1.60 | 1.60 | 1.10 | .90 | .90 | .80 | .70 | .90 | 1.20 | 3.20 | 2.00 | 2.45 |
| 17 | 1.60 | 1.90 | 1.10 | 2.00 | .80 | .80 | .70 | .90 | 1.20 | 3.00 | 2.00 | 2.50 |
| 18 | 1.60 | 1.90 | 1.10 | 2.00 | .85 | .80 | .70 | 1.90 | 1.20 | 3.00 | 2.00 | 2.60 |
| 19 | 1.60 | 2.00 | 1.10 | 2.20 | .80 | .80 | .70 | 1.90 | 1.20 | 2.90 | 2.00 | 2.60 |
| 20 | 1.60 | 2.10 | 1.10 | 2.10 | .80 | .80 | .70 | 2.05 | 1.20 | 2.80 | 2.00 | 2.60 |
| 21 | 1.60 | 2.10 | 1.10 | 2.00 | .70 | .80 | .70 | 1.00 | 1.10 | 2.60 | 2.00 | 2.60 |
| 22 | 1.60 | 2.10 | 1.20 | 2.00 | .75 | .80 | .70 | 1.00 | 1.10 | 2.60 | 2.00 | 2.60 |
| 23 | 1.60 | 2.10 | 1.20 | .90 | .70 | .70 | .90 | 1.00 | 1.10 | 2.50 | 2.00 | 2.60 |
| 24 | 1.60 | 2.00 | 1.20 | .80 | .70 | .70 | .70 | 1.10 | 1.10 | 2.50 | 2.00 | 2.60 |
| 25 | 1.60 | 2.00 | 1.20 | .80 | .70 | .70 | .70 | 1.20 | 1.10 | 2.40 | 2.00 | 2.60 |
| 26 | 1.60 | 1.90 | 1.20 | .80 | .70 | .70 | .70 | 1.20 | 1.10 | 2.20 | 2.00 | 2.60 |
| 27 | 1.60 | 1.90 | 1.20 | .80 | .70 | .70 | .70 | 1.15 | 1.10 | 2.20 | 2.00 | 2.60 |
| 28 | 1.60 | 1.80 | 1.00 | .80 | .70 | .70 | .70 | 1.20 | 1.10 | 2.10 | 2.00 | 2.60 |
| 29 | 1.60 | 1.70 | 1.00 | .80 | .70 | .70 | .70 | 1.20 | 1.20 | 2.10 | 2.00 | 2.60 |
| 30 | 1.60 | ..... | 1.00 | .70 | .70 | .70 | .70 | 1.15 | 1.50 | 2.10 | .90 | 2.60 |
| 31 | 1.60 | ..... | .90 | ..... | .70 | ..... | .70 | 1.40 | ..... | 2.10 | ..... | 2.60 |

*Rating table for Rio Grande near Lobatos, Colo., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.70 | 14 | 1.60 | 306 | 2.50 | 1,062 | 3.40 | 2,345 |
| .80 | 26 | 1.70 | 366 | 2.60 | 1,181 | 3.50 | 2,500 |
| .90 | 42 | 1.80 | 432 | 2.70 | 1,308 | 3.60 | 2,655 |
| 1.00 | 62 | 1.90 | 503 | 2.80 | 1,443 | 3.70 | 2,810 |
| 1.10 | 88 | 2.00 | 580 | 2.90 | 1,585 | 3.80 | 2,965 |
| 1.20 | 121 | 2.10 | 662 | 3.00 | 1,732 | 3.90 | 3,120 |
| 1.30 | 159 | 2.20 | 751 | 3.10 | 1,882 | 4.00 | 3,275 |
| 1.40 | 203 | 2.30 | 847 | 3.20 | 2,035 | | |
| 1.50 | 252 | 2.40 | 951 | 3.30 | 2,190 | | |

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1900 to 1904, inclusive. It is well defined between gage heights 0.70 foot and 2.00 feet. Above gage height 2.00 feet the curve is not well defined. Above gage height 3.20 feet the rating curve is a tangent, the difference being 155 per tenth.

*Estimated monthly discharge of Rio Grande near Lobatos, Colo., for 1904.*

[Drainage area, 7,695 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 | 306 | 306 | 306 | 18,820 | 0.040 | 0.046 |
| February | 662 | 252 | 417 | 23,990 | .054 | .058 |
| March | 306 | 42 | 123 | 7,563 | .016 | .018 |
| April | 751 | 14 | 153 | 9,104 | .020 | .022 |
| May | 42 | 14 | 21.5 | 1,322 | .0028 | .0032 |
| June | 34 | 14 | 20.3 | 1,208 | .0026 | .0029 |
| July | 42 | 14 | 17.5 | 1,076 | .0023 | .0027 |
| August | 751 | 14 | 140 | 8,608 | .018 | .021 |
| September | 468 | 88 | 196 | 11,660 | .025 | .028 |
| October | 3,198 | 662 | 1,590 | 97,770 | .207 | .239 |
| November | 662 | 42 | 416 | 24,750 | .054 | .060 |
| December | 1,181 | 42 | 867 | 53,310 | .113 | .130 |
| The year | 3,198 | 14 | 356 | 259,200 | .046 | .631 |

RIO GRANDE NEAR SAN ILDEFONZO, N. MEX.

Three miles below Embudo the Rio Grande emerges into Espanola Valley, through which it continues for a few miles and then enters White Rock Canyon, flowing through that canyon for 30 miles. At the lower end of this canyon the river emerges into Albuquerque Valley, and so continues down to about Socorro. This valley averages from 1 to 3 miles in width, and has been irrigated for a great many years by the Mexican settlers. Their primitive methods of irrigation are very wasteful of the waters, so that the duty of water in this section—about 17 acres per second-foot—is not as high as it might be. During the last few years, however, a number of important and modern irrigation systems have been planned and built in the vicinity of Albuquerque. The gaging station, established February 3, 1895, is located on the Denver and Rio Grande Railroad bridge over the Rio Grande, about 9 miles below Espanola. It was established by A. P. Davis and P. E. Harroun. It has been called by the following names: Rio Grande, Buckman, and Water Tank. The original gage at this station was located on the left bank, 180 feet above the bridge. It was made in two sections and graduated to feet and tenths. The inclined portion read from 1 to 10 feet and the vertical portion from 10 to 16 feet. It was found that this gage was not well located, and on March 30, 1904, a vertical rod was established by M. C. Hinderlider on the downstream side of the north pier of the bridge. This

is known as the new gage, and all the discharge measurements made in 1904 are referred to it. During the flood of September, 1904, this rod was cut off from the water by the filling in of the channel. On October 29, 1904, a standard chain gage was established by George B. Monk on the downstream running-board of the bridge, at the same datum as the new rod gage. Length of chain from marker to lower end of weight is 23.28 feet. The gage is read twice each day by A. L. Martinez. During 1904 the changes in the channel made it necessary for him to use first the old rod and then the new rod at irregular intervals. The 1903 rating table should be applied to all the observations on the old gage. The 1904 table should be used on all observations on the new gage. The discharge measurements are made from a cable 200 feet above the bridge, except during very high water, when the bridge is used. The initial point for soundings is at the end of the cable on the left bank, where it is fastened to two small trees. The channel is straight for 150 feet above and for 300 feet below the station. The current is swift, and there is but one channel at high and low water. The right bank is low and wooded. The left bank is high, rocky, and wooded. Neither bank is subject to overflow. The cable has a span of 220 feet. The bed of the stream is sandy and free from vegetation, with a few bowlders near the left bank. The bed of the stream shifts rapidly from day to day, but the relation between area, velocity, and gage height is believed to be nearly constant except under very unusual conditions.

The bench mark for the new gage is a United States Geological Survey tablet set in the top of a granite bowlder 5 feet square and 2 feet high, located in a clump of cedars on the right bank of the river about 75 feet from the west end of the north pier of the railroad bridge. The bench mark is 11.37 feet above the zero of the new gage. The zero of the old gage is 2.019 feet lower than the zero of the new gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

*Discharge measurements of Rio Grande near San Ildefonzo, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height.[a] | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Feet per sec.* | *Feet.* | *Second ft.* |
| April 30 | G. B. Monk | 54 | 165 | 3.19 | 2.30 | 526 |
| May 7 | do | 50 | 147 | 2.84 | 2.00 | 418 |
| May 18 | do | 55 | 152 | 2.72 | 2.05 | 413 |
| May 28 | do | 50 | 140 | 2.84 | 1.90 | 398 |
| June 6 | do | 49 | 119 | 2.77 | 1.50 | 330 |
| June 14 | do | 46 | 111 | 1.66 | 1.40 | 184 |
| June 29 | do | 47 | 117 | 1.74 | 1.50 | 203 |
| July 16 | do | 42 | 52 | 1.48 | 1.20 | 77 |
| July 23 | do | 70 | 174 | 3.57 | 2.55 | 621 |
| August 27 | do | 115 | 197 | 3.67 | 3.10 | 723 |
| August 27 | do | 115 | 197 | 3.25 | 3.04 | 640 |
| October 4 | do | 120 | 397 | 6.54 | 4.00 | 2,596 |
| October 5 | do | 120 | 436 | 5.83 | 4.00 | 2,541 |
| October 7 | do | 128 | 445 | 5.57 | 3.90 | 2,478 |
| October 7 | do | 128 | 471 | 5.39 | 4.10 | 2,540 |
| October 17 | do | 126 | 518 | 5.63 | 4.50 | 2,916 |
| October 28 | do | 96 | 314 | 4.07 | 3.30 | 1,281 |
| November 7 | do | 92 | 221 | 3.47 | 2.80 | 767 |

[a] Gage heights refer to new rod.

*Mean daily gage height, in feet, of Rio Grande near San Ildefonzo, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.85 | 3.85 | 4.60 | 3.80 | 4.25 | 1.55 | 1.55 | 5.15 | 5.30 | 18.20 | 3.05 | 2.70 |
| 2 | 3.95 | 3.90 | 4.55 | 3.75 | 4.25 | 1.55 | 1.50 | 5.80 | 5.20 | 6.15 | 3.00 | 2.70 |
| 3 | 3.85 | 3.95 | 4.55 | 3.80 | 4.05 | 1.50 | 1.45 | 6.15 | 5.15 | 4.70 | 2.90 | 2.70 |
| 4 | 3.85 | 3.95 | 4.30 | 3.80 | 4.05 | 1.50 | 1.40 | 5.40 | 4.95 | 4.15 | 2.90 | 2.70 |
| 5 | 3.95 | 4.10 | 4.35 | 3.80 | 4.05 | 1.45 | 1.40 | 5.05 | 5.25 | 4.05 | 2.80 | 2.60 |
| 6 | 3.95 | 4.15 | 4.25 | 3.70 | 4.00 | 1.40 | 1.40 | 5.40 | 5.60 | 3.95 | 2.80 | 2.60 |
| 7 | 3.85 | 4.20 | 4.25 | 3.55 | 4.05 | 1.45 | 1.30 | 6.10 | 5.75 | 4.75 | 2.80 | 2.35 |
| 8 | 3.85 | 4.20 | 4.20 | 3.45 | 4.05 | 1.50 | 1.20 | 6.45 | 5.70 | 8.25 | 2.75 | 2.20 |
| 9 | 3.95 | 4.10 | 4.15 | 3.40 | 4.25 | 1.40 | 1.20 | 5.45 | 5.65 | 6.90 | 2.70 | 2.35 |
| 10 | 3.95 | 3.95 | 4.00 | 3.40 | 4.35 | 1.45 | 1.20 | 4.55 | 5.40 | 5.75 | 2.80 | 2.35 |
| 11 | 4.05 | 4.05 | 3.95 | 3.30 | 4.25 | 1.40 | 1.20 | 4.60 | 5.25 | 5.50 | 2.80 | 2.35 |
| 12 | 4.10 | 4.05 | 3.95 | 3.30 | 4.25 | 1.45 | 1.10 | 4.25 | 5.10 | 5.50 | 2.80 | 2.25 |
| 13 | 4.15 | 4.15 | 4.00 | 3.35 | 4.20 | 1.55 | 1.10 | 4.10 | 5.15 | 5.45 | 2.70 | 2.20 |
| 14 | 4.05 | 4.10 | 3.90 | 3.70 | 4.15 | 1.60 | 1.10 | 4.10 | 5.00 | 5.15 | 2.65 | 2.25 |
| 15 | 3.90 | 4.10 | 3.90 | 5.00 | 4.25 | 1.60 | 1.20 | 6.05 | 5.00 | 5.45 | 2.70 | 2.35 |
| 16 | 4.10 | 4.10 | 3.85 | 5.20 | 4.25 | 1.75 | 2.05 | 5.95 | 4.95 | 4.75 | 2.80 | 2.35 |
| 17 | 4.10 | 4.20 | 3.85 | 5.15 | 4.25 | 1.95 | 1.30 | 6.00 | 4.85 | 4.50 | 2.80 | 2.25 |
| 18 | 4.10 | 4.30 | 3.70 | 5.10 | 4.25 | 2.05 | 1.30 | 7.45 | 4.70 | 4.35 | 2.90 | 2.35 |
| 19 | 4.10 | 4.35 | 3.60 | 5.10 | 2.15 | 1.90 | 1.30 | 7.45 | 4.75 | 4.15 | 2.90 | 2.40 |
| 20 | 4.05 | 4.35 | 3.60 | 5.15 | 2.05 | 2.00 | 1.70 | 6.45 | 7.35 | 4.00 | 2.80 | 2.40 |
| 21 | 3.95 | 4.30 | 3.70 | 4.70 | 2.00 | 2.15 | 1.45 | 5.85 | 7.10 | 3.85 | 2.80 | 2.40 |
| 22 | 3.85 | 4.30 | 3.75 | 4.95 | 2.05 | 2.30 | 1.65 | 5.20 | 5.45 | 3.85 | 2.75 | 2.40 |
| 23 | 3.95 | 4.25 | 3.80 | 4.55 | 2.05 | 2.10 | 2.60 | 4.95 | 6.10 | 3.80 | 2.80 | 2.45 |
| 24 | 4.05 | 4.35 | 3.85 | 4.45 | 2.05 | 1.85 | 2.85 | 4.95 | 7.75 | 3.65 | 2.70 | 2.45 |
| 25 | 3.85 | 4.45 | 3.80 | 4.30 | 2.05 | 1.70 | 5.00 | 5.95 | 7.80 | 3.60 | 2.70 | 2.45 |
| 26 | 3.85 | 4.55 | 3.75 | 4.30 | 1.95 | 1.55 | 4.60 | 6.65 | 10.45 | 3.50 | 2.70 | 2.35 |
| 27 | 3.80 | 4.60 | 3.70 | 4.45 | 1.85 | 2.25 | 3.80 | 6.25 | 10.70 | 3.40 | 2.75 | 2.30 |
| 28 | 3.90 | 4.55 | 3.65 | 4.40 | 1.85 | 2.05 | 3.80 | 5.55 | 10.70 | 3.30 | 2.80 | 2.15 |
| 29 | 3.80 | 4.55 | 3.60 | 4.45 | 1.80 | 1.65 | 3.50 | 5.30 | 12.10 | 3.35 | 2.80 | 2.05 |
| 30 | 3.80 | ..... | 3.60 | 4.40 | 1.65 | 1.75 | 3.45 | 4.80 | 9.95 | 3.35 | 2.75 | 2.15 |
| 31 | 3.90 | ..... | 3.75 | ..... | 1.65 | ..... | 3.75 | 6.00 | ..... | 3.10 | ..... | 2.25 |

NOTE.—Gage heights referred to new gage May 19 to July 24 and October 2 to December 31. Gage heights referred to old gage January 1 to May 18 and July 25 to October 1.

*Rating table for Rio Grande near San Ildefonso, N. Mex., from August 1, 1903, to May 18, 1904, and July 25 to October 1, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 3.30 | 190 | 4.40 | 485 | 5.50 | 1,210 | 6.60 | 2,640 |
| 3.40 | 210 | 4.50 | 520 | 5.60 | 1,340 | 6.70 | 2,770 |
| 3.50 | 230 | 4.60 | 560 | 5.70 | 1,470 | 6.80 | 2,900 |
| 3.60 | 250 | 4.70 | 600 | 5.80 | 1,600 | 6.90 | 3,030 |
| 3.70 | 275 | 4.80 | 645 | 5.90 | 1,730 | 7.00 | 3,160 |
| 3.80 | 300 | 4.90 | 695 | 6.00 | 1,860 | 7.20 | 3,420 |
| 3.90 | 325 | 5.00 | 755 | 6.10 | 1,990 | 7.40 | 3,680 |
| 4.00 | 355 | 5.10 | 825 | 6.20 | 2,120 | 7.60 | 3,940 |
| 4.10 | 385 | 5.20 | 905 | 6.30 | 2,250 | 7.80 | 4,200 |
| 4.20 | 415 | 5.30 | 995 | 6.40 | 2,380 | 8.00 | 4,460 |
| 4.30 | 450 | 5.40 | 1,095 | 6.50 | 2,510 | | |

The table is fairly well defined above 4.00 feet gage height. The table nas been extended below 4.00 feet. The upper portion of the curve is determined by July discharge measurements made by the International (Water) Boundary Commission. Above gage height 5.50 feet the rating curve is a tangent, the difference being 130 per tenth. The table applies only between the dates given above.

*Rating table for Rio Grande near San Ildefonso, N. Mex., from May 19 to July 24, and October 2 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.10 | 65 | 2.20 | 484 | 3.30 | 1,288 | 4.40 | 3,135 |
| 1.20 | 94 | 2.30 | 530 | 3.40 | 1,400 | 4.50 | 3,340 |
| 1.30 | 129 | 2.40 | 579 | 3.50 | 1,520 | 4.60 | 3,550 |
| 1.40 | 165 | 2.50 | 633 | 3.60 | 1,650 | 4.70 | 3,760 |
| 1.50 | 202 | 2.60 | 693 | 3.70 | 1,800 | 4.80 | 3,970 |
| 1.60 | 240 | 2.70 | 759 | 3.80 | 1,970 | 4.90 | 4,180 |
| 1.70 | 278 | 2.80 | 831 | 3.90 | 2,150 | 5.00 | 4,400 |
| 1.80 | 317 | 2.90 | 909 | 4.00 | 2,340 | 6.00 | 6,800 |
| 1.90 | 357 | 3.00 | 994 | 4.10 | 2,535 | | |
| 2.00 | 398 | 3.10 | 1,085 | 4.20 | 2,730 | | |
| 2.10 | 440 | 3.20 | 1,183 | 4.30 | 2,930 | | |

The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1904. It is based on rather doubtful measurements, the channel shifting rapidly and is not well defined. It applies only to observations on the new rod between the dates given above.

*Estimated monthly discharge of Rio Grande near San Ildefonso, N. Mex., for 1904.*

[Drainage area, 14,050 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. |
| January | 400 | 300 | 340 | 20,910 | 0.024 | 0.028 |
| February | 560 | 310 | 421 | 24,220 | .030 | .032 |
| March | 560 | 250 | 347 | 21,340 | .025 | .029 |
| April | 905 | 190 | 459 | 27,310 | .033 | .037 |
| May | 465 | 259 | 393 | 24,160 | .028 | .032 |
| June | 530 | 165 | 286 | 17,020 | .020 | .022 |
| July | 870 | 62 | 246 | 15,130 | .018 | .021 |
| August | 3,745 | 385 | 1,496 | 91,990 | .106 | .122 |
| September | 9,790 | 600 | 2,493 | 148,300 | .177 | .198 |
| October | 17,700 | 1,085 | 4,111 | 252,800 | .293 | .338 |
| November | 1,040 | 726 | 831 | 49,450 | .059 | .066 |
| December | 759 | 419 | 576 | 35,420 | .041 | .047 |
| The year | 17,700 | 62 | 1,000 | 728,000 | .071 | .972 |

RIO GRANDE NEAR SAN MARCIAL, N. MEX.

This station is located about one-half mile south of San Marcial, N. Mex., at the bridge of the Atchison, Topeka and Santa Fe Railway. The original gage was established by Arthur P. Davis on January 29, 1895. The observer was Bert Halseth, San Marcial, N. Mex., who lives about one-half mile distant. The gage was of hard pine timber, 9 by 5 inches by 25 feet, anchored and bolted to the east end of the second pier from the south. It was inclined and painted white. The distance between the footmarks was 1.6 feet. The 13-foot mark was level with the extension of the pier, to which the gage was anchored. The 15-foot mark was level with the top of the capstone on which the bridge truss rests. Measurements were made from the same bridge. On August 8, 1889, a station was established near San Marcial, and a measurement was made which gave a discharge of 19 second-feet. Soon after this date, however, the river gage was destroyed and the locality was abandoned until 1895.

In 1896 the inclined gage was carried away and a wire gage was put in its place. The wire gage was attached to the guard rail of the bridge in the south span on the lower side. Bench mark No. 1 is the top of the capstone on which the bridge truss rests, and is at an elevation of 15.00 feet above gage datum; bench mark No. 2 is the top of the extension of the pier to which the old vertical gage was fastened,

and is at an elevation of 13.00 feet above gage datum. The wire gage has been abandoned and the gage heights are now measured with a graduated rod from the deck of the bridge, but using the old gage datum. The channel is sandy and shifting. A number of bridge piers interfere with the current to a certain extent, but not with the observed gage heights. They sometimes affect the discharge measurements.

Since January 1, 1901, this station has been maintained under the charge of the International (Water) Boundary Commission.

*Discharge measurements of Rio Grande near San Marcial, N. Mex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| January 4 [a] | J. R. Nisbet | 127 | 2.46 | 7.8 | 313 |
| January 12 [a] | do | 116 | 2.57 | 8.0 | 298 |
| January 16 [a] | do | 110 | 2.30 | 8.0 | 253 |
| January 31 | do | 124 | 2.46 | 7.8 | 305 |
| February 4 | do | 133 | 2.27 | 7.8 | 302 |
| February 8 | do | 135 | 2.32 | 8.0 | 313 |
| February 12 | do | 168 | 2.16 | 7.9 | 363 |
| February 17 | do | 163 | 2.03 | 7.7 | 331 |
| February 21 | do | 153 | 2.06 | 7.8 | 315 |
| February 25 | do | 183 | 1.91 | 7.8 | 350 |
| February 29 | do | 144 | 2.06 | 7.8 | 296 |
| March 4 | do | 149 | 2.01 | 7.9 | 300 |
| March 7 | do | 110 | 1.84 | 7.9 | 202 |
| March 10 | do | 59 | 1.56 | 7.4 | 92 |
| March 13 | do | 49 | 1.57 | 7.2 | 77 |
| March 16 | do | 39 | 1.56 | 6.9 | 61 |
| March 19 | do | 27 | 0.96 | 6.4 | 26 |
| July 23 | do | 367 | 2.54 | 8.75 | 932 |
| July 23 | do | 1,116 | 2.55 | 10.65 | 2,841 |
| July 25 | do | 140 | 2.51 | 7.9 | 352 |
| July 25 | G. B. Monk | 138 | 2.11 | 7.8 | 291 |
| July 28 | J. R. Nisbet | 230 | 2.15 | 8.2 | 495 |
| July 31 | do | 84 | 2.15 | 7.3 | 181 |
| August 2 | do | 210 | 2.91 | 7.85 | 612 |
| August 5 | do | 429 | 3.86 | 9.4 | 1,656 |
| August 7 | do | 351 | 3.87 | 9.2 | 1,357 |
| August 10 | do | 242 | 2.69 | 8.2 | 651 |
| August 13 | do | 83 | 2.27 | 7.2 | 188 |
| August 16 | do | 32 | 1.59 | 6.6 | 51 |

[a] River full of floating ice.

*Discharge measurements of Rio Grande near San Marcial, N. Mex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| September 23 | C. E. Mead | 153 | 3.99 | 9.5 | 610 |
| September 26 | do | 129 | 3.50 | 8.6 | 452 |
| September 28 | do | 440 | 5.75 | 10.2 | 2,529 |
| October 1 | do | 1,270 | 6.89 | 12.0 | 8,753 |
| October 3 | do | 3,342 | 4.00 | 11.75 | 13,368 |
| October 7 | do | 840 | 3.48 | 9.0 | 2,920 |
| October 10 | do | 2,645 | 8.16 | 12.6 | 21,584 |
| October 13 | do | 3,612 | 6.10 | 9.55 | 22,048 |
| October 17 | do | 470 | 3.41 | 8.7 | 1,602 |
| October 21 | do | 404 | 4.29 | 8.2 | 1,734 |
| October 25 | do | 367 | 3.87 | 8.2 | 1,422 |
| October 29 | do | 311 | 3.73 | 8.1 | 1,160 |
| November 2 | do | 308 | 4.64 | 8.1 | 1,430 |
| November 3 | G. B. Monk | 268 | 4.92 | 8.1 | 1,318 |
| November 5 | C. E. Mead | 267 | 3.70 | 8.0 | 989 |
| November 7 | do | 220 | 3.81 | 7.9 | 838 |
| November 10 | do | 274 | 3.62 | 7.9 | 991 |
| November 12 | do | 242 | 3.60 | 7.9 | 872 |
| November 15 | do | 241 | 3.23 | 7.9 | 778 |
| November 17 | do | 187 | 3.68 | 7.8 | 689 |
| November 19 | do | 218 | 3.28 | 7.9 | 716 |
| November 22 | do | 216 | 3.79 | 8.0 | 818 |
| November 24 | do | 196 | 3.61 | 8.0 | 708 |
| November 26 | do | 207 | 3.36 | 8.0 | 696 |
| November 30 | do | 211 | 3.10 | 8.0 | 654 |
| December 2 | do | 241 | 2.74 | 8.0 | 661 |
| December 5 | do | 250 | 3.78 | 8.1 | 946 |
| December 8 | do | 265 | 3.09 | 8.0 | 820 |
| December 11 | do | 222 | 4.44 | 7.9 | 986 |
| December 14 | do | 228 | 3.50 | 7.8 | 798 |
| December 17 | do | 219 | 2.40 | 7.8 | 525 |
| December 23 | do | 241 | 2.38 | 7.9 | 574 |
| December 28 [a] | do | 198 | 2.08 | 7.8 | 411 |
| December 31 [a] | do | 167 | 2.14 | 7.7 | 357 |

[a] Ice in river.

*Mean daily gage height, in feet, of Rio Grande near San Marcial, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.7 | 7.7 | 7.9 | ..... | ..... | ..... | ..... | 7.35 | 8.75 | 11.95 | 8.2 | 8.0 |
| 2 | 7.7 | 7.8 | 7.9 | ..... | ..... | ..... | ..... | 7.65 | 8.8 | 13.1 | 8.1 | 8.0 |
| 3 | 7.7 | 7.9 | 7.9 | ..... | ..... | ..... | ..... | 8.35 | 9.0 | 12.7 | 8.1 | 8.0 |
| 4 | 7.7 | 7.8 | 7.9 | ..... | ..... | ..... | ..... | 8.65 | 8.3 | 9.5 | 8.1 | 8.0 |
| 5 | 7.55 | 7.95 | 7.9 | ..... | ..... | ..... | ..... | 9.7 | 8.3 | 8.9 | 8.0 | 8.1 |
| 6 | 7.8 | 8.0 | 7.95 | ..... | ..... | ..... | ..... | 9.2 | 7.8 | 8.6 | 8.0 | 8.25 |
| 7 | 7.7 | 8.0 | 7.9 | ..... | ..... | ..... | ..... | 9.15 | 7.35 | 9.1 | 7.9 | 8.1 |
| 8 | 7.6 | 8.0 | 7.9 | ..... | ..... | ..... | ..... | 8.9 | 7.15 | 8.95 | 7.9 | 8.0 |
| 9 | 7.75 | 8.1 | 7.8 | ..... | ..... | ..... | ..... | 8.35 | 6.95 | 11.55 | 8.0 | 8.1 |
| 10 | 7.75 | 8.0 | 7.4 | ..... | ..... | ..... | ..... | 8.35 | 6.75 | 12.85 | 7.9 | 8.1 |
| 11 | 7.85 | 8.0 | 7.5 | ..... | ..... | ..... | ..... | 8.25 | ..... | 13.75 | 7.9 | 7.9 |
| 12 | 8.0 | 7.9 | 7.4 | ..... | ..... | ..... | ..... | 8.0 | ..... | 10.6 | 7.9 | 7.8 |
| 13 | 7.8 | 7.8 | 7.3 | ..... | ..... | ..... | ..... | 7.5 | ..... | 9.45 | 7.8 | 7.8 |
| 14 | 7.8 | 7.8 | 7.2 | ..... | ..... | ..... | ..... | 7.3 | ..... | 9.0 | 7.8 | 7.8 |
| 15 | 7.9 | 7.8 | 7.1 | ..... | ..... | ..... | ..... | 6.85 | ..... | 8.9 | 7.9 | 7.9 |
| 16 | 8.0 | 7.8 | 6.9 | ..... | ..... | ..... | ..... | 6.6 | ..... | 8.75 | 7.8 | 7.9 |
| 17 | 7.95 | 7.7 | 6.8 | ..... | ..... | ..... | ..... | 6.4 | ..... | 8.65 | 7.8 | 7.8 |
| 18 | 7.95 | 7.7 | 6.6 | ..... | ..... | ..... | ..... | 7.45 | ..... | 8.65 | 7.8 | 7.9 |
| 19 | 7.95 | 7.7 | 6.4 | ..... | ..... | ..... | ..... | 8.45 | ..... | 8.55 | 7.9 | 7.9 |
| 20 | 8.05 | 7.7 | (a) | ..... | ..... | ..... | ..... | 9.0 | ..... | 8.4 | 8.0 | 7.9 |
| 21 | 8.2 | 7.8 | ..... | ..... | ..... | ..... | ..... | 8.1 | 7.95 | 8.2 | 8.0 | 7.85 |
| 22 | 8.05 | 7.85 | ..... | ..... | ..... | ..... | (a) | 9.05 | 7.95 | 8.3 | 8.0 | 7.8 |
| 23 | 8.0 | 7.8 | ..... | ..... | ..... | ..... | 8.9 | 9.35 | 9.1 | 8.25 | 8.0 | 7.9 |
| 24 | 7.95 | 7.85 | ..... | ..... | ..... | ..... | 8.85 | 8.9 | 9.0 | 8.1 | 8.0 | 7.9 |
| 25 | 7.9 | 7.8 | ..... | ..... | ..... | ..... | 8.1 | 8.8 | 9.35 | 8.15 | 8.0 | 7.8 |
| 26 | 7.9 | 7.85 | ..... | ..... | ..... | ..... | 8.45 | 8.95 | 8.6 | 8.25 | 8.0 | 7.8 |
| 27 | 7.8 | 7.8 | ..... | ..... | ..... | ..... | 8.9 | 9.45 | 9.1 | 8.1 | 8.1 | 7.8 |
| 28 | 7.25 | 7.8 | ..... | ..... | ..... | ..... | 8.2 | 9.8 | 10.4 | 8.1 | 8.1 | 7.8 |
| 29 | 7.25 | 7.8 | ..... | ..... | ..... | ..... | 7.45 | 8.8 | 10.5 | 8.1 | 8.0 | 7.8 |
| 30 | 7.7 | ..... | ..... | ..... | ..... | ..... | 7.2 | 8.5 | 11.7 | 8.1 | 8.0 | 7.75 |
| 31 | 7.8 | ..... | ..... | ..... | ..... | ..... | 7.3 | 8.45 | ..... | 8.25 | ..... | 7.7 |

(a) No flow from March 19 to July 23.

*Mean daily discharge, in second-feet, of Rio Grande near San Marcial, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr.[a] | May.[a] | June.[a] | July.[b] | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 300 | 270 | 330 | ..... | ..... | ..... | ..... | 220 | 950 | c8,550 | 1,330 | 660 |
| 2 | 300 | 300 | 320 | ..... | ..... | ..... | ..... | c450 | 970 | 18,400 | c1,430 | c660 |
| 3 | 300 | 330 | 310 | ..... | ..... | ..... | ..... | 950 | 1,050 | c19,070 | 1,330 | 660 |
| 4 | c300 | c300 | c300 | ..... | ..... | ..... | ..... | 1,150 | 630 | 5,000 | 1,230 | 660 |
| 5 | 270 | 310 | 265 | ..... | ..... | ..... | ..... | c2,110 | 630 | 3,200 | c990 | c945 |
| 6 | 310 | 315 | 245 | ..... | ..... | ..... | ..... | 1,360 | 380 | 2,600 | 990 | 1,130 |
| 7 | 290 | 315 | c200 | ..... | ..... | ..... | ..... | c1,320 | 200 | c3,000 | c840 | 945 |
| 8 | 270 | c315 | 200 | ..... | ..... | ..... | ..... | 1,150 | 140 | 2,880 | 890 | c820 |
| 9 | 280 | 360 | 180 | ..... | ..... | ..... | ..... | 760 | 80 | 12,000 | 1,040 | 1,010 |
| 10 | 280 | 355 | c90 | ..... | ..... | ..... | ..... | c760 | 40 | c24,000 | c990 | 1,100 |
| 11 | 290 | 375 | 110 | ..... | ..... | ..... | ..... | 680 | 0 | 33,000 | 930 | c990 |
| 12 | c300 | c365 | 95 | ..... | ..... | ..... | ..... | 560 | 0 | 24,800 | c870 | 880 |
| 13 | 260 | 350 | c85 | ..... | ..... | ..... | ..... | c330 | 0 | c21,750 | 740 | 840 |
| 14 | 250 | 350 | 75 | ..... | ..... | ..... | ..... | 240 | 0 | 15,900 | 710 | c800 |
| 15 | 250 | 350 | 70 | ..... | ..... | ..... | ..... | 110 | 0 | 11,100 | c780 | 810 |
| 16 | c250 | 350 | c60 | ..... | ..... | ..... | ..... | c50 | 0 | 6,250 | 690 | 720 |
| 17 | 250 | c330 | 55 | ..... | ..... | ..... | ..... | 20 | 0 | c1,550 | c690 | c525 |
| 18 | 260 | 320 | 40 | ..... | ..... | ..... | ..... | 310 | 0 | 1,710 | 690 | 620 |
| 19 | 270 | 310 | c25 | ..... | ..... | ..... | ..... | 830 | 0 | 1,770 | c720 | 610 |
| 20 | 310 | 300 | ..... | ..... | ..... | ..... | ..... | 1,220 | 0 | 1,780 | 820 | 600 |
| 21 | 370 | c315 | ..... | ..... | ..... | ..... | ..... | 600 | 300 | c1,730 | 820 | 550 |
| 22 | 315 | 335 | ..... | ..... | ..... | ..... | ..... | 1,280 | 300 | 1,750 | c820 | 500 |
| 23 | 300 | 335 | ..... | ..... | ..... | ..... | ..... | c1,070 | 1,580 | c530 | 1,620 | 770 | c575 |
| 24 | 290 | 355 | ..... | ..... | ..... | ..... | ..... | 1,020 | 1,150 | 510 | 1,390 | c710 | 565 |
| 25 | 280 | c350 | ..... | ..... | ..... | ..... | ..... | c490 | 1,080 | 580 | c1,370 | 700 | 455 |
| 26 | 280 | 350 | ..... | ..... | ..... | ..... | ..... | 680 | 1,180 | c450 | 1,430 | c700 | 440 |
| 27 | 260 | 320 | ..... | ..... | ..... | ..... | ..... | 990 | 1,730 | 950 | 1,240 | 790 | 425 |
| 28 | 115 | 305 | ..... | ..... | ..... | ..... | ..... | c500 | 2,260 | c3,030 | 1,200 | 780 | c410 |
| 29 | 115 | c295 | ..... | ..... | ..... | ..... | ..... | 230 | 1,080 | 3,280 | c1,160 | 660 | 410 |
| 30 | 270 | ..... | ..... | ..... | ..... | ..... | ..... | 150 | 870 | 7,550 | 1,120 | c650 | 380 |
| 31 | c305 | ..... | ..... | ..... | ..... | ..... | ..... | c180 | 830 | ..... | 1,230 | ..... | c355 |

[a] No flow during this month.
[b] No flow previous to the 22d.
[c] Meter measurements.

*Estimated monthly discharge of Rio Grande near San Marcial, N. Mex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 370 | 115 | 274 | 16,840 |
| February | 375 | 270 | 329 | 18,902 |
| March | 330 | 0 | 99 | 6,060 |
| April | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 |
| July | 1,070 | 0 | 171 | 10,532 |
| August | 2,260 | 20 | 910 | 55,974 |
| September | 7,550 | 0 | 752 | 44,727 |
| October | 33,000 | 1,120 | 7,534 | 463,240 |
| November | 1,430 | 650 | 870 | 51,769 |
| December | 1,130 | 355 | 679 | 41,752 |
| The year | 33,000 | 0 | 968 | 709,796 |

RIO GRANDE NEAR EL PASO, TEX.

This station was located at the pumping house of the smelter company, 3 miles north of El Paso, Tex. The bed of the stream here is composed of mud, constantly shifting and changing. May 1, 1897, the station was placed under the charge of W. W. Follett, consulting engineer, International (Water) Boundary Commission, and by him removed 1 mile farther up the river, to Courchesne's limekiln. The river heights were measured at the masonry pump foundation pier, 150 feet above the kiln. The top of the downstream chisel draft on this pier was assumed to be at a gage height of 15.00 feet, and the distance of the surface of the water below it was measured with a carefully graduated rod. This pier was torn down in October, 1902, and an inclined wooden gage established some 60 feet upstream. This is a 2 by 4 inch timber bolted to 1¼-inch steel bars set with cement in holes drilled in solid rock. The graduations are notches cut in the scantling. The bench mark is a ½-inch iron bolt set in solid rock at the head of the gage. Its elevation is 13.00 feet above the zero of the gage. The left bank of the river is formed by the loose rock fill of the Atchison, Topeka and Santa Fe Railway embankment, and will not overflow. The right bank, however, is not so good, being made ground and subject to overflow. The bottom of the river here has also proved unstable, scouring on a rise and filling on a falling river. It is probably the best site for a station in the vicinity of El Paso, however, as the entire river bed is constantly shifting for many miles

above and below. On account of this shifting character of the stream, the only accurate method of estimating the daily discharges is by taking a large number of measurements.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Rio Grande near El Paso, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| August 10 | T. M. Courchesne | 221 | 2.62 | 5.8 | 579 |
| August 12 | do | 175 | 1.78 | 5.2 | 311 |
| August 14 | do | 137 | 1.57 | 4.9 | 215 |
| August 16 | do | 89 | 1.26 | 4.4 | 112 |
| August 18 | do | 35 | .97 | 3.9 | 34 |
| August 20 | do | 18 | .83 | 3.6 | 15 |
| August 25 | do | 59 | 1.25 | 4.2 | 74 |
| August 27 | do | 172 | 1.75 | 5.4 | 301 |
| August 30 | do | 136 | 1.48 | 5.0 | 201 |
| September 3 | do | 135 | 1.51 | 5.2 | 204 |
| September 12 | do | 35 | 1.06 | 4.2 | 37 |
| September 15 | do | 174 | 1.68 | 5.5 | 293 |
| September 17 | do | 44 | 1.07 | 4.4 | 47 |
| September 24 | do | 46 | 1.04 | 4.4 | 48 |
| September 26 | do | 44 | 1.09 | 4.4 | 48 |
| September 28 | do | 137 | 1.53 | 5.2 | 210 |
| September 30 | do | 199 | 2.15 | 5.9 | 428 |
| October 3 | do | 1,478 | 3.77 | 10.95 | 5,577 |
| October 5 | do | 1,630 | 4.27 | 12.2 | 6,965 |
| October 6 | do | 1,725 | 4.62 | 12.7 | 7,969 |
| October 10 | do | 2,272 | 5.01 | 13.3 | 11,372 |
| October 12 | do | 2,289 | 5.25 | 13.4 | 12,010 |
| November 7 | do | 398 | 2.49 | 7.4 | 990 |
| November 11 | do | 381 | 2.03 | 7.0 | 774 |
| November 12 | do | 384 | 2.35 | 7.0 | [a]901 |
| November 14 | do | 348 | 2.24 | 7.0 | 778 |
| November 17 | do | 320 | 2.31 | 6.9 | 739 |
| November 21 | do | 248 | 2.23 | 6.6 | 554 |
| November 24 | do | 254 | 2.29 | 6.7 | 582 |
| November 30 | do | 300 | 1.97 | 6.8 | 590 |
| December 3 | Valmore Courchesne | 303 | 2.05 | 6.8 | 622 |
| December 6 | do | 393 | 2.56 | 7.65 | 1,008 |
| December 9 | do | 402 | 2.28 | 7.5 | 918 |
| December 12 | do | 377 | 2.22 | 7.2 | 837 |

[a]Too large; not used in computing daily discharge.

*Discharge measurements of Rio Grande near El Paso, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| December 15 | Valmore Courchesne | 301 | 2.06 | 6.8 | 620 |
| December 18 | do | 242 | 1.94 | 6.6 | 469 |
| December 21 | do | 253 | 1.93 | 6.6 | 489 |
| December 24 | do | 250 | 1.96 | 6.5 | 491 |
| December 28 | do | 243 | 1.72 | 6.4 | 417 |
| December 31 | do | 242 | 1.79 | 6.4 | 432 |

*Mean daily gage height, in feet, of Rio Grande near El Paso, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar.[a] | Apr.[a] | May.[a] | June.[a] | July.[a] | Aug.[a] | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.1 | 3.6 | | | | | | | 5.55 | 7.45 | 7.9 | 6.8 |
| 2 | 4.1 | 3.6 | | | | | | | 5.35 | 9.55 | 7.8 | 6.8 |
| 3 | 4.1 | 3.6 | | | | | | | 5.2 | 10.8 | 7.65 | 6.8 |
| 4 | 3.95 | 3.6 | | | | | | | 5.35 | 11.55 | 7.6 | 6.8 |
| 5 | 3.75 | 3.55 | | | | | | | 5.7 | 12.1 | 7.45 | 6.8 |
| 6 | 3.6 | 3.5 | | | | | | | 6.1 | 12.75 | 7.4 | 7.45 |
| 7 | 3.6 | 3.4 | | | | | | | 5.55 | 11.5 | 7.4 | 7.6 |
| 8 | 3.6 | 3.4 | | | | | | (a) | 4.9 | 11.1 | 7.3 | 7.6 |
| 9 | 3.5 | 3.4 | | | | | | 4.35 | 4.8 | 12.55 | 7.2 | 7.55 |
| 10 | 3.4 | 3.4 | | | | | | 5.6 | 4.7 | 13.3 | 7.1 | 7.5 |
| 11 | 3.4 | 3.4 | | | | | | 5.4 | 4.35 | 13.15 | 7.0 | 7.3 |
| 12 | 3.4 | 3.4 | | | | | | 5.35 | 4.2 | 13.4 | 7.0 | 7.2 |
| 13 | 3.4 | 3.4 | | | | | | 5.15 | 4.2 | 13.6 | 7.0 | 7.0 |
| 14 | 3.4 | 3.4 | | | | | | 4.85 | 5.3 | 13.9 | 7.0 | 7.0 |
| 15 | 3.4 | 3.4 | | | | | | 4.65 | 5.25 | 13.95 | 6.95 | 6.8 |
| 16 | 3.4 | 3.4 | | | | | | 4.35 | 4.5 | 11.35 | 6.9 | 6.7 |
| 17 | 3.4 | 3.4 | | | | | | 4.1 | 4.35 | 10.35 | 6.9 | 6.65 |
| 18 | 3.4 | 3.4 | | | | | | 3.85 | 4.05 | 9.85 | 6.95 | 6.6 |
| 19 | 3.4 | 3.4 | | | | | | 3.65 | 3.9 | 9.55 | 6.9 | 6.6 |
| 20 | 3.4 | 3.4 | | | | | | 3.55 | 3.7 | 9.25 | 6.8 | 6.6 |
| 21 | 3.4 | 3.4 | | | | | | 3.4 | 3.6 | 9.05 | 6.65 | 6.6 |
| 22 | 3.4 | 3.4 | | | | | | 3.25 | 3.6 | 8.8 | 6.6 | 6.6 |
| 23 | 3.4 | 3.4 | | | | | | 3.2 | 4.3 | 8.65 | 6.65 | 6.5 |
| 24 | 3.4 | 3.4 | | | | | | 3.6 | 4.6 | 8.5 | 6.7 | 6.5 |
| 25 | 3.4 | 3.4 | | | | | | 4.3 | 4.4 | 8.65 | 6.8 | 6.5 |
| 26 | 3.4 | 3.4 | | | | | | 4.8 | 4.4 | 8.35 | 6.9 | 6.5 |
| 27 | 3.5 | 3.4 | | | | | | 5.35 | 4.7 | 8.15 | 6.9 | 6.55 |
| 28 | 3.6 | 3.4 | | | | | | 5.0 | 5.35 | 8.0 | 6.9 | 6.4 |
| 29 | 3.6 | 3.4 | | | | | | 5.0 | 5.8 | 8.0 | 6.9 | 6.55 |
| 30 | 3.6 | | | | | | | 5.1 | 6.05 | 8.0 | 6.8 | 6.55 |
| 31 | 3.6 | | | | | | | 5.35 | | 7.9 | | 6.4 |

[a] No flow March 1 to August 8.

*Mean daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar.[a] | Apr.[a] | May.[a] | June.[a] | July.[a] | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 75 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | 380 | 1,730 | 1,490 | 600 |
| 2 | 75 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | 280 | 4,040 | 1,390 | 610 |
| 3 | 70 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | [b]205 | [b]5,410 | 1,240 | [b]620 |
| 4 | 45 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | 280 | 6,230 | 1,190 | 620 |
| 5 | 15 | 10 | ..... | ..... | ..... | ..... | ..... | ..... | 455 | [b]6,850 | 1,040 | 620 |
| 6 | 15 | 10 | ..... | ..... | ..... | ..... | ..... | ..... | 655 | [b]8,170 | 990 | [b]890 |
| 7 | 15 | 5 | ..... | ..... | ..... | ..... | ..... | ..... | 380 | 6,180 | [b]990 | 980 |
| 8 | 15 | 5 | ..... | ..... | ..... | ..... | ..... | ..... | 140 | 5,740 | 920 | 980 |
| 9 | 10 | 5 | ..... | ..... | ..... | ..... | ..... | 105 | 120 | 7,670 | 860 | [b]950 |
| 10 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]480 | 100 | [b]11,370 | 810 | 920 |
| 11 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 390 | 55 | 10,550 | [b]770 | 870 |
| 12 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]370 | [b]35 | [b]12,010 | 770 | [b]840 |
| 13 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 290 | 35 | 13,800 | 780 | 730 |
| 14 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]205 | 245 | 16,200 | [b]780 | 730 |
| 15 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 165 | [b]230 | 17,100 | 760 | [b]620 |
| 16 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]105 | 65 | 9,300 | 740 | 550 |
| 17 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 65 | [b]45 | 6,300 | [b]740 | 510 |
| 18 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]30 | 30 | 5,050 | 740 | [b]470 |
| 19 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 20 | 25 | 4,300 | 700 | 475 |
| 20 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]15 | 15 | 3,550 | 640 | 480 |
| 21 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 10 | 10 | 3,150 | [b]570 | [b]490 |
| 22 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 5 | 10 | 2,700 | 550 | 500 |
| 23 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 5 | 40 | 2,460 | 570 | 480 |
| 24 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 15 | [b]80 | 2,250 | [b]580 | [b]490 |
| 25 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | [b]90 | 50 | 2,460 | 620 | 480 |
| 26 | 5 | 5 | ..... | ..... | ..... | ..... | ..... | 170 | [b]50 | 2,040 | 660 | 470 |
| 27 | 10 | 5 | ..... | ..... | ..... | ..... | ..... | [b]285 | 110 | 1,800 | 650 | 475 |
| 28 | 15 | 5 | ..... | ..... | ..... | ..... | ..... | 200 | [b]280 | 1,620 | 640 | [b]415 |
| 29 | 15 | 5 | ..... | ..... | ..... | ..... | ..... | 200 | 500 | 1,620 | 630 | 475 |
| 30 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | [b]225 | [b]620 | 1,620 | [b]590 | 480 |
| 31 | 15 | ..... | ..... | ..... | ..... | ..... | ..... | 285 | ..... | 1,500 | ..... | [b]430 |

[a] No flow. [b] Meter measurement.

*Estimated monthly discharge of Rio Grande near El Paso, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 75 | 5 | 16 | 972 |
| February | 15 | 5 | 7 | 387 |
| March | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 |
| August | 480 | 0 | 120 | 7,398 |
| September | 655 | 10 | 184 | 10,959 |
| October | 17,100 | 1,500 | 5,960 | 366,486 |
| November | 1,490 | 550 | 813 | 48,397 |
| December | 980 | 415 | 621 | 38,182 |
| The year | 17,100 | 0 | 643 | 472,781 |

## RIO GRANDE ABOVE PRESIDIO, TEX.

This station was established April 4, 1900, by the International (Water) Boundary Commission. It is 7 miles above Presidio and above the mouth of Conchos River, one of the principal tributaries of the Rio Grande, and is about 200 miles below El Paso. Its location is far enough above the mouth of Conchos River to be free from the effects of backwater from that stream.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Rio Grande above Presidio, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| June 19 | Jas. P. Hague | 183 | 1.43 | 2.6 | 261 |
| June 24 | do | 29 | 0.31 | 1.5 | 9 |
| June 27 | do | 473 | 3.90 | 6.75 | 1,845 |
| June 30 | do | 49 | 0.41 | 1.8 | 20 |
| September 5 | do | 420 | 3.84 | 6.1 | 1,614 |
| September 7 | do | 232 | 3.35 | 4.6 | 778 |
| October 8 | do | 341 | 3.53 | 5.2 | 1,205 |
| October 10 | do | 506 | 4.28 | 7.3 | 2,166 |
| October 12 | do | 549 | 4.47 | 7.6 | [a] 2,454 |
| October 14 | do | 603 | 5.01 | 7.65 | [a] 3,024 |
| October 18 | do | 693 | 5.21 | 8.2 | [a] 3,616 |
| October 20 | do | 632 | 5.27 | 8.0 | [a] 3,331 |
| October 22 | do | 619 | 5.25 | 8.2 | [a] 3,251 |
| October 25 | do | 500 | 4.71 | 7.5 | 2,357 |
| October 26 | do | 487 | 4.60 | 7.3 | 2,242 |
| October 28 | do | 452 | 4.45 | 7.0 | 2,012 |
| November 1 | do | 411 | 3.82 | 6.1 | 1,570 |
| November 3 | do | 382 | 3.87 | 5.9 | 1,478 |
| November 6 | do | 335 | 3.76 | 5.7 | 1,258 |
| November 9 | do | 269 | 3.21 | 4.9 | 864 |
| November 11 | do | 257 | 3.19 | 4.6 | 821 |
| November 14 | do | 251 | 2.80 | 4.3 | 704 |
| November 16 | do | 241 | 2.79 | 4.2 | 672 |
| November 18 | do | 203 | 3.16 | 4.0 | 641 |
| November 21 | do | 196 | 3.10 | 3.9 | 607 |
| November 23 | do | 187 | 2.91 | 3.8 | 545 |
| November 26 | do | 172 | 2.96 | 3.6 | 509 |
| November 29 | do | 160 | 2.77 | 3.5 | 443 |
| December 2 | do | 164 | 2.59 | 3.5 | 424 |
| December 5 | do | 191 | 2.72 | 3.7 | 520 |
| December 7 | do | 191 | 2.84 | 3.8 | 543 |
| December 9 | do | 174 | 2.65 | 3.6 | 461 |
| December 12 | do | 172 | 2.70 | 3.6 | 464 |
| December 15 | do | 149 | 2.53 | 3.5 | 377 |
| December 18 | do | 171 | 2.65 | 3.6 | 453 |
| December 21 | do | 207 | 2.98 | 3.9 | 616 |
| December 24 | do | 190 | 2.35 | 3.8 | 446 |
| December 27 | do | 184 | 2.16 | 3.8 | 398 |
| December 29 | do | 180 | 2.14 | 3.8 | 386 |
| December 31 | do | 176 | 2.10 | 3.75 | 369 |

[a] Measurement in channel only; bottom overflowed.

*Mean daily gage height, in feet, of Rio Grande above Presidio, Tex., for 1904.*

| Day. | Jan.[a] | Feb.[a] | Mar.[a] | Apr.[a] | May.[a] | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | (a) | (a) | (a) | (a) | (a) | 6.15 | 3.5 |
| 2 | | | | | | (a) | (a) | (a) | (a) | (a) | 6.0 | 3.5 |
| 3 | | | | | | (a) | (a) | (a) | (a) | (a) | 5.9 | 3.5 |
| 4 | | | | | | (a) | (a) | (a) | 2.25 | (a) | 5.45 | 3.8 |
| 5 | | | | | | (a) | (a) | (a) | 3.75 | (a) | 7.85 | 3.75 |
| 6 | | | | | | (a) | (a) | (a) | 7.25 | (a) | 6.0 | 3.8 |
| 7 | | | | | | (a) | (a) | (a) | 6.2 | 2.7 | 5.2 | 3.8 |
| 8 | | | | | | (a) | (a) | (a) | 4.9 | 5.45 | 5.1 | 3.7 |
| 9 | | | | | | (a) | (a) | (a) | 4.15 | 6.4 | 4.95 | 3.65 |
| 10 | | | | | | (a) | (a) | (a) | 3.5 | 7.15 | 4.8 | 3.6 |
| 11 | | | | | | (a) | (a) | (a) | 2.95 | 7.55 | 4.65 | 3.6 |
| 12 | | | | | | (a) | (a) | (a) | 2.55 | 7.65 | 4.5 | 3.6 |
| 13 | | | | | | (a) | (a) | (a) | 2.2 | 7.7 | 4.4 | 3.6 |
| 14 | | | | | | (a) | (a) | (a) | 2.2 | 7.65 | 4.3 | 3.6 |
| 15 | | | | | | (a) | (a) | (a) | 2.4 | 7.6 | 4.3 | 3.5 |
| 16 | | | | | | (a) | (a) | (a) | 1.5 | 7.9 | 4.2 | 3.5 |
| 17 | | | | | | (a) | (a) | (a) | .85 | 8.25 | 4.1 | 3.45 |
| 18 | | | | | | (a) | (a) | (a) | 2.25 | 8.2 | 4.0 | 3.6 |
| 19 | | | | | | 2.9 | (a) | (a) | 2.65 | 8.2 | 4.0 | 3.95 |
| 20 | | | | | | 1.7 | (a) | (a) | 2.6 | 8.0 | 4.0 | 3.95 |
| 21 | | | | | | 1.95 | (a) | (a) | 4.05 | 8.0 | 3.9 | 3.9 |
| 22 | | | | | | (a) | (a) | (a) | 2.55 | 8.2 | 3.9 | 4.1 |
| 23 | | | | | | 5.15 | (a) | (a) | 2.5 | 7.95 | 3.8 | 4.0 |
| 24 | | | | | | .75 | 1.7 | (a) | 2.05 | 7.65 | 3.8 | 3.95 |
| 25 | | | | | | (a) | .9 | 1.2 | 1.0 | 7.5 | 3.7 | 3.9 |
| 26 | | | | | | 7.25 | (a) | (a) | 2.25 | 7.3 | 3.6 | 3.55 |
| 27 | | | | | | 6.55 | (a) | (a) | 1.95 | 7.3 | 3.6 | 3.7 |
| 28 | | | | | | 2.6 | (a) | (a) | .5 | 7.0 | 3.6 | 3.75 |
| 29 | | | | | | 2.5 | (a) | (a) | (a) | 6.65 | 3.5 | 3.8 |
| 30 | | | | | | 1.75 | (a) | (a) | (a) | 7.65 | 3.5 | 3.8 |
| 31 | | | | | | | (a) | (a) | | 7.3 | | 3.75 |

[a] No flow.

*Mean daily discharge, in second-feet, of Rio Grande above Presidio, Tex., for 1904.*

| Day. | Jan.[a] | Feb.[a] | Mar.[a] | Apr.[a] | May.[a] | June. | July. | Aug | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | (a) | (a) | [b]1,590 | 435 |
| 2 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | (a) | (a) | 1,520 | [b]425 |
| 3 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | (a) | (a) | [b]1,480 | 425 |
| 4 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 85 | (a) | 1,260 | 550 |
| 5 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | [b]525 | (a) | 2,780 | [b]535 |
| 6 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 2,140 | (a) | [b]1,530 | 550 |
| 7 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | [b]1,660 | 310 | 1,010 | [b]545 |
| 8 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 930 | [b]1,310 | 965 | 500 |
| 9 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 645 | 1,750 | [b]890 | [b]480 |
| 10 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 450 | [b]2,090 | 850 | 465 |
| 11 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 285 | 2,600 | [b]830 | 465 |
| 12 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 165 | [b]3,540 | 780 | [b]465 |
| 13 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 75 | 4,200 | 740 | 450 |
| 14 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 75 | [b]4,000 | [b]705 | 430 |
| 15 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 125 | 3,630 | 705 | [b]375 |
| 16 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 10 | 6,180 | [b]670 | 385 |
| 17 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 10 | 9,360 | 655 | 370 |
| 18 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 85 | [b]8,910 | [b]640 | [b]455 |
| 19 | ..... | ..... | ..... | ..... | ..... | [b]340 | (a) | (a) | 195 | 8,910 | 640 | 640 |
| 20 | ..... | ..... | ..... | ..... | ..... | 20 | (a) | (a) | 180 | [b]7,000 | 640 | 640 |
| 21 | ..... | ..... | ..... | ..... | ..... | 40 | (a) | (a) | 615 | 7,000 | [b]605 | [b]615 |
| 22 | ..... | ..... | ..... | ..... | ..... | (a) | (a) | (a) | 165 | [b]8,550 | 605 | 675 |
| 23 | ..... | ..... | ..... | ..... | ..... | 1,180 | (a) | (a) | 150 | 6,350 | [b]545 | 585 |
| 24 | ..... | ..... | ..... | ..... | ..... | [b]5 | 40 | (a) | 45 | 3,540 | 545 | [b]520 |
| 25 | ..... | ..... | ..... | ..... | ..... | (a) | 10 | 20 | 10 | [b]2,410 | 530 | 480 |
| 26 | ..... | ..... | ..... | ..... | ..... | 2,100 | (a) | (a) | 85 | [b]2,240 | [b]510 | 290 |
| 27 | ..... | ..... | ..... | ..... | ..... | [b]1,760 | (a) | (a) | 35 | 2,240 | 500 | [b]350 |
| 28 | ..... | ..... | ..... | ..... | ..... | 260 | (a) | (a) | 5 | [b]2,010 | 490 | 365 |
| 29 | ..... | ..... | ..... | ..... | ..... | 230 | (a) | (a) | (a) | 1,800 | [b]445 | [b]385 |
| 30 | ..... | ..... | ..... | ..... | ..... | [b]20 | (a) | (a) | (a) | 3,540 | 445 | 385 |
| 31 | ..... | ..... | ..... | ..... | ..... | ..... | (a) | (a) | ..... | 2,010 | ..... | [b]370 |

[a] No flow.

[b] Meter measurements.

*Estimated monthly discharge of Rio Grande above Presidio, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January [a] | 0 | 0 | 0 | 0 |
| February [a] | 0 | 0 | 0 | 0 |
| March [a] | 0 | 0 | 0 | 0 |
| April [a] | 0 | 0 | 0 | 0 |
| May [a] | 0 | 0 | 0 | 0 |
| June | 2,100 | 0 | 198 | 11,812 |
| July | 40 | 0 | 2 | 100 |
| August | 20 | 0 | 1 | 40 |
| September | 2,140 | 0 | 292 | 17,355 |
| October | 9,360 | 0 | 3,403 | 209,216 |
| November | 2,780 | 445 | 870 | 51,769 |
| December | 675 | 290 | 471 | 28,969 |
| The year | 9,360 | 0 | 436 | 319,261 |

[a] No flow.

## RIO GRANDE BELOW PRESIDIO, TEX.

This station was established April 8, 1900, by the International (Water) Boundary Commission. It is 6 miles below Presidio; also below the mouth of Conchos River and about 215 miles below El Paso. It is at the western end of the canyon section of the Rio Grande. The discharge at this station, minus the discharge at the station above Presidio, Tex., gives the discharge of the Conchos, except at rare intervals, when some rain water enters the Rio Grande from the north.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Rio Grande below Presidio, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| January 19 | Jas. P. Hague | 185 | 0.89 | 4.5 | 165 |
| January 22 | do | 185 | .88 | 4.5 | 163 |
| January 25 | do | 195 | .89 | 4.5 | 174 |
| January 28 | do | 181 | .89 | 4.5 | 161 |
| January 30 | do | 179 | .86 | 4.5 | 154 |
| February 2 | do | 165 | .76 | 4.4 | 125 |
| February 5 | do | 161 | .75 | 4.4 | 120 |

*Discharge measurements of Rio Grande below Presidio, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| February 8 | Jas. P. Hague | 156 | 0.75 | 4.4 | 117 |
| February 11 | do | 155 | .74 | 4.4 | 114 |
| February 14 | do | 157 | .74 | 4.4 | 116 |
| February 18 | do | 152 | .79 | 4.4 | 120 |
| February 22 | do | 150 | .84 | 4.4 | 126 |
| February 26 | do | 138 | .82 | 4.4 | 113 |
| February 29 | do | 130 | .82 | 4.4 | 106 |
| March 2 | do | 130 | .79 | 4.3 | 103 |
| March 5 | do | 118 | .73 | 4.3 | 86 |
| March 8 | do | 111 | .96 | 4.3 | 107 |
| March 12 | do | 100 | .83 | 4.2 | 83 |
| March 16 | do | 99 | .83 | 4.15 | 82 |
| March 20 | do | 93 | .78 | 4.1 | 73 |
| March 23 | do | 94 | .81 | 4.1 | 76 |
| March 26 | do | 71 | .72 | 3.9 | 51 |
| March 28 | do | 70 | .71 | 3.9 | 50 |
| March 31 | do | 63 | .70 | 3.85 | 44 |
| April 3 | do | 76 | .53 | 3.8 | 40 |
| April 7 | do | 71 | .55 | 3.8 | 39 |
| April 10 | do | 65 | .48 | 3.7 | 31 |
| April 13 | do | 52 | .38 | 3.6 | 20 |
| April 16 | do | 52 | .38 | 3.6 | 20 |
| April 19 | do | 54 | .35 | 3.6 | 19 |
| April 22 | do | 47 | .38 | 3.6 | 18 |
| April 25 | do | 45 | .31 | 3.5 | 14 |
| April 29 | do | 44 | .30 | 3.5 | 13 |
| May 3 | do | 39 | .15 | 3.4 | 6 |
| May 7 | do | 34 | .15 | 3.4 | 5 |
| May 11 | do | 34 | .15 | 3.4 | 5 |
| May 14 | do | 23 | .13 | 3.3 | 3 |
| May 19 | do | 117 | 1.03 | 4.3 | 120 |
| May 21 | do | 80 | .80 | 4.0 | 64 |
| May 25 | do | 242 | .99 | 4.8 | 239 |
| May 27 | do | 174 | .79 | 4.5 | 138 |
| May 30 | do | 116 | 1.03 | 4.3 | 120 |
| June 1 | do | 164 | .79 | 4.5 | 130 |
| June 4 | do | 245 | .98 | 4.8 | 241 |
| June 7 | do | 168 | .82 | 4.5 | 137 |
| June 9 | do | 386 | .39 | 5.6 | 152 |
| June 11 | do | 499 | 1.03 | 7.05 | 512 |

*Discharge measurements of Rio Grande below Presidio, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| June 14 | Jas. P. Hague | 268 | 1.16 | 6.3 | 311 |
| June 16 | do | 236 | 1.18 | 6.1 | 278 |
| June 18 | do | 147 | 1.24 | 5.85 | 182 |
| June 20 | do | 800 | 2.12 | 7.85 | 1,696 |
| June 23 | do | 851 | 2.23 | 8.1 | 1,900 |
| June 26 | do | 1,755 | 2.70 | 11.1 | 4,737 |
| June 29 | do | 287 | 1.34 | 6.5 | 385 |
| July 2 | do | 339 | 1.30 | 6.5 | 441 |
| July 6 | do | 159 | 1.38 | 5.4 | 220 |
| July 8 | do | 184 | 1.30 | 5.5 | 239 |
| July 10 | do | 189 | 1.30 | 5.5 | 245 |
| July 13 | do | 351 | 1.62 | 6.3 | 567 |
| July 16 | do | 938 | 1.64 | 8.7 | 1,537 |
| July 19 | do | 938 | 1.68 | 8.7 | 1,573 |
| July 22 | do | 563 | 1.63 | 7.4 | 917 |
| July 25 | do | 557 | 1.62 | 7.35 | 903 |
| July 28 | do | 540 | 1.62 | 7.3 | 875 |
| July 31 | do | 659 | 1.74 | 7.6 | 1,149 |
| August 3 | do | 467 | 1.76 | 7.0 | 821 |
| August 6 | do | 460 | 1.76 | 7.0 | 808 |
| August 9 | do | 295 | 1.49 | 6.15 | 439 |
| August 12 | do | 210 | 1.51 | 5.8 | 317 |
| August 15 | do | 298 | 1.47 | 6.2 | 438 |
| August 18 | do | 288 | 1.42 | 6.15 | 409 |
| August 21 | do | 629 | 1.59 | 7.5 | 1,003 |
| August 24 | do | 969 | 2.22 | 8.95 | 2,156 |
| August 27 | do | 832 | 1.94 | 8.1 | 1,614 |
| August 30 | do | 622 | 1.60 | 7.5 | 997 |
| September 3 | do | 593 | 1.57 | 7.3 | 933 |
| September 6 | do | 2,179 | 4.56 | 11.95 | 9,936 |
| November 2 | do | 1,623 | 3.28 | 9.0 | 5,319 |
| November 5 | do | 1,592 | 3.10 | 8.9 | 4,936 |
| November 7 | do | 1,340 | 2.25 | 8.4 | 3,016 |
| November 10 | do | 1,346 | 2.28 | 8.35 | 3,070 |
| November 12 | do | 1,262 | 2.06 | 7.9 | 2,602 |
| November 15 | do | 1,145 | 2.02 | 7.7 | 2,316 |
| November 17 | do | 1,141 | 1.98 | 7.65 | 2,260 |
| November 20 | do | 1,120 | 1.58 | 7.4 | 1,765 |
| November 22 | do | 1,072 | 1.63 | 7.3 | 1,745 |
| November 25 | do | 1,092 | 1.59 | 7.3 | 1,740 |
| November 28 | do | 1,061 | 1.52 | 7.2 | 1,615 |

*Discharge measurements of Rio Grande below Presidio, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| December 1 | Jas. P. Hague | 1,045 | 1.57 | 7.1 | 1,637 |
| December 3 | do | 1,033 | 1.51 | 7.1 | 1,558 |
| December 6 | do | 1,008 | 3.27 | 8.1 | 3,301 |
| December 8 | do | 966 | 3.10 | 7.9 | 2,995 |
| December 10 | do | 964 | 3.21 | 8.0 | 3,099 |
| December 13 | do | 972 | 3.16 | 7.95 | 3,068 |
| December 16 | do | 930 | 3.19 | 7.9 | 2,963 |
| December 19 | do | 876 | 2.90 | 7.55 | 2,542 |
| December 22 | do | 855 | 2.81 | 7.45 | 2,399 |
| December 26 | do | 847 | 1.70 | 7.05 | 1,441 |
| December 28 | do | 854 | 1.74 | 7.1 | 1,484 |
| December 30 | do | 825 | 1.65 | 7.0 | 1,364 |

*Mean daily gage height, in feet, of Rio Grande below Presidio, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.6 | 4.4 | 4.3 | 3.85 | 3.5 | 4.65 | 6.5 | 7.45 | 7.35 | 9.7 | 9.2 | 7.1 |
| 2 | 4.6 | 4.4 | 4.3 | 3.85 | 3.5 | 5.35 | 6.45 | 7.25 | 7.25 | 9.25 | 9.0 | 7.1 |
| 3 | 4.6 | 4.4 | 4.3 | 3.8 | 3.45 | 5.15 | 6.25 | 7.05 | 7.15 | 8.6 | 8.7 | 7.1 |
| 4 | 4.6 | 4.4 | 4.3 | 3.8 | 3.4 | 4.9 | 6.2 | 7.0 | 7.6 | 8.65 | 8.4 | 7.65 |
| 5 | 4.6 | 4.4 | 4.3 | 3.8 | 3.4 | 4.8 | 5.9 | 7.0 | 7.45 | 8.75 | 8.75 | 8.35 |
| 6 | 4.6 | 4.4 | 4.3 | 3.8 | 3.4 | 4.55 | 5.5 | 7.0 | 12.05 | 8.55 | 8.6 | 8.15 |
| 7 | 4.6 | 4.4 | 4.3 | 3.8 | 3.4 | 4.45 | 5.4 | 6.8 | 13.35 | 8.8 | 8.45 | 8.05 |
| 8 | 4.6 | 4.4 | 4.25 | 3.8 | 3.4 | 6.6 | 5.55 | 6.4 | 16.3 | 9.65 | 8.3 | 7.95 |
| 9 | 4.6 | 4.4 | 4.2 | 3.8 | 3.4 | 7.9 | 5.45 | 6.1 | 20.8 | 9.75 | 8 2 | 7.9 |
| 10 | 4.6 | 4.4 | 4.2 | 3.7 | 3.4 | 10.2 | 5.45 | 6.0 | 24.0 | 9.5 | 8.3 | 8.0 |
| 11 | 4.6 | 4.4 | 4.2 | 3.7 | 3.4 | 6.8 | 5.3 | 5.95 | 26.35 | 10.0 | 8.15 | 8.0 |
| 12 | 4.5 | 4.4 | 4.2 | 3.6 | 3.4 | 6.65 | 5.35 | 5.8 | 23.35 | 11.1 | 7.95 | 8.0 |
| 13 | 4.5 | 4.4 | 4.2 | 3.6 | 3.4 | 6.85 | 5.9 | 5.8 | 18.05 | 12.2 | 7.9 | 7.95 |
| 14 | 4.5 | 4.4 | 4.15 | 3.6 | 3.4 | 6.45 | 5.95 | 6.15 | 14.2 | 12.3 | 7.85 | 7.9 |
| 15 | 4.5 | 4.4 | 4.15 | 3.6 | 3.9 | 6.4 | 8.05 | 6.15 | 12.75 | 12.6 | 7.75 | 7.9 |
| 16 | 4.5 | 4.4 | 4.15 | 3.6 | 4.3 | 6.15 | 9.0 | 6.2 | 12.05 | 12.75 | 7.7 | 7.9 |
| 17 | 4.5 | 4.4 | 4.15 | 3.6 | 4.15 | 5.95 | 8.7 | 6.15 | 11.0 | 12.65 | 7.65 | 7.8 |
| 18 | 4.5 | 4.4 | 4.15 | 3.6 | 3.9 | 5.85 | 7.65 | 6.55 | 11.2 | 12.4 | 7.55 | 7.7 |
| 19 | 4.5 | 4.4 | 4.15 | 3.6 | 4.65 | 8.1 | 9.0 | 6.9 | 11.75 | 12.0 | 7.45 | 7.55 |
| 20 | 4.5 | 4.4 | 4.1 | 3.6 | 4.3 | 9.1 | 7.4 | 7.5 | 12.0 | 11.45 | 7.4 | 7.6 |
| 21 | 4.5 | 4.4 | 4.1 | 3.6 | 4.0 | 6.4 | 7.55 | 7.65 | 11.0 | 11.05 | 7.4 | 7.5 |
| 22 | 4.5 | 4.4 | 4.1 | 3.6 | 4.0 | 6.25 | 7.45 | 7.7 | 9.95 | 10.6 | 7.3 | 7.45 |
| 23 | 4.5 | 4.4 | 4.05 | 3.6 | 4.1 | 7.4 | 7.7 | 7.65 | 10.3 | 10.35 | 7.3 | 7.4 |
| 24 | 4.5 | 4.4 | 3.95 | 3.5 | 5.5 | 6.6 | 7.35 | 8.95 | 9.95 | 9.85 | 7.3 | 7.35 |
| 25 | 4.5 | 4.4 | 3.9 | 3.5 | 5.0 | 6.6 | 7.35 | 9.0 | 9.65 | 9.45 | 7.3 | 7.2 |
| 26 | 4.5 | 4.4 | 3.9 | 3.5 | 4.8 | 11.3 | 7.3 | 8.7 | 9.45 | 9.25 | 7.3 | 7.05 |
| 27 | 4.5 | 4.4 | 3.9 | 3.5 | 4.55 | 10.05 | 7.3 | 8.25 | 9.4 | 9.05 | 7.2 | 7.1 |
| 28 | 4.5 | 4.4 | 3.9 | 3.5 | 4.55 | 7.85 | 7.3 | 7.95 | 9.6 | 9.5 | 7.2 | 7.1 |
| 29 | 4.5 | 4.4 | 3.9 | 3.5 | 4.5 | 6.75 | 7.4 | 7.85 | 9.4 | 9.8 | 7.1 | 7.1 |
| 30 | 4.5 | ..... | 3.85 | 3.5 | 4.35 | 6.5 | 7.5 | 7.6 | 9.1 | 10.1 | 7.1 | 7.0 |
| 31 | 4.5 | ..... | 3.85 | ..... | 4.3 | ..... | 7.6 | 7.5 | ..... | 9.4 | ..... | 7.0 |

*Mean daily discharge, in second-feet, of Rio Grande below Presidio, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 210 | 130 | 105 | 45 | 10 | a185 | 420 | 1,070 | 950 | 7,770 | 6,000 | a1,640 |
| 2 | 210 | a125 | a105 | 45 | 10 | 445 | a430 | 960 | 920 | 6,200 | a5,320 | 1,600 |
| 3 | 210 | 125 | 95 | a40 | a10 | 370 | 390 | a850 | a890 | 3,920 | 4,270 | a1,560 |
| 4 | 210 | 120 | 90 | 40 | 5 | a280 | 380 | 820 | 1,170 | 4,100 | 3,220 | 2,520 |
| 5 | 210 | a120 | a85 | 40 | 5 | 240 | 320 | 815 | 1,050 | 4,450 | a4,350 | 3,740 |
| 6 | 200 | 120 | 90 | 40 | 5 | 155 | a240 | a810 | a10,340 | 3,750 | 3,780 | a3,390 |
| 7 | 200 | 120 | 95 | a40 | a5 | a120 | 220 | 720 | 15,600 | 4,630 | a3,200 | 3,220 |
| 8 | 200 | a115 | a95 | 40 | 5 | 900 | a250 | 545 | 30,600 | 7,600 | 2,950 | a3,070 |
| 9 | 200 | 115 | 85 | 40 | 5 | a150 | 230 | a425 | 75,100 | 7,950 | 2,880 | 3,000 |
| 10 | 190 | 115 | 85 | a30 | 5 | 330 | a240 | 385 | 115,500 | 7,080 | a3,010 | a3,100 |
| 11 | 190 | a115 | 85 | 30 | a5 | a445 | 220 | 365 | 149,200 | 8,830 | 2,860 | 3,100 |
| 12 | 170 | 115 | a85 | 20 | 5 | 405 | 220 | a315 | 106,700 | 12,680 | a2,650 | 3,100 |
| 13 | 170 | 115 | 85 | a20 | 5 | 460 | a400 | 315 | 45,000 | 16,700 | 2,600 | a3,070 |
| 14 | 170 | a115 | 80 | 20 | a5 | a350 | 420 | 425 | 22,000 | 17,100 | 2,530 | 2,960 |
| 15 | 170 | 115 | 80 | 20 | 55 | 335 | 1,280 | a425 | 18,900 | 18,300 | a2,390 | 2,960 |
| 16 | 170 | 120 | a80 | a20 | 120 | a285 | a1,660 | 440 | 16,100 | 18,900 | 2,320 | a2,960 |
| 17 | 165 | 120 | 80 | 20 | 95 | 220 | 1,560 | 420 | 12,320 | 18,500 | a2,260 | 2,840 |
| 18 | 165 | a120 | 80 | 20 | 55 | a180 | 1,050 | a585 | 13,040 | 17,500 | 2,060 | 2,720 |
| 19 | a165 | 120 | 80 | a20 | a205 | 1,900 | a1,720 | 735 | 15,020 | 15,900 | 1,860 | a2,540 |
| 20 | 165 | 125 | a75 | 20 | 120 | a2,800 | 920 | 1,000 | 15,900 | 13,920 | a1,770 | 2,610 |
| 21 | 165 | 125 | 75 | 20 | a65 | 595 | 995 | a1,100 | 12,320 | 12,480 | 1,770 | 2,470 |
| 22 | a165 | a125 | 75 | a20 | 65 | 460 | a945 | 1,140 | 8,650 | 10,900 | a1,740 | a2,400 |
| 23 | 165 | 125 | a70 | 20 | 85 | a1,340 | 1,080 | 1,100 | 9,870 | 10,020 | 1,740 | 2,280 |
| 24 | 170 | 120 | 55 | 15 | 470 | 745 | 905 | a2,160 | 8,650 | 8,270 | 1,740 | 2,160 |
| 25 | a175 | 115 | 50 | a15 | a290 | 745 | a905 | 2,200 | 7,600 | 6,870 | a1,740 | 1,800 |
| 26 | 170 | a115 | a50 | 15 | 240 | a4,960 | 875 | 2,000 | 6,900 | 6,180 | 1,720 | a1,440 |
| 27 | 165 | 110 | 50 | 15 | a150 | 3,660 | 875 | a1,710 | 6,720 | 5,490 | 1,640 | 1,480 |
| 28 | a160 | 110 | a50 | 15 | 150 | 1,575 | a875 | 1,470 | 7,420 | 7,050 | a1,620 | a1,480 |
| 29 | 160 | a105 | 50 | a10 | 140 | a585 | 970 | 1,360 | 6,720 | 8,100 | 1,540 | 1,480 |
| 30 | a155 | ..... | 45 | 10 | a125 | 385 | 1,060 | a1,100 | 5,670 | 9,150 | 1,540 | a1,360 |
| 31 | 155 | ..... | a45 | ..... | 120 | ..... | a1,150 | 1,000 | ..... | 6,700 | ..... | 1,360 |

a Meter measurements.

*Estimated monthly discharge of Rio Grande below Presidio, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 210 | 155 | 179 | 10,998 |
| February | 130 | 105 | 118 | 6,813 |
| March | 105 | 45 | 76 | 4,671 |
| April | 45 | 10 | 25 | 1,517 |
| May | 470 | 5 | 85 | 5,227 |
| June | 4,960 | 120 | 853 | 50,787 |
| July | 1,720 | 220 | 749 | 46,026 |
| August | 2,200 | 315 | 928 | 57,055 |
| September | 149,200 | 890 | 24,894 | 1,481,296 |
| October | 18,900 | 3,750 | 9,903 | 608,906 |
| November | 6,000 | 1,540 | 2,636 | 156,833 |
| December | 3,740 | 1,360 | 2,433 | 149,574 |
| The year | 149,200 | 5 | 3,573 | 2,579,703 |

## RIO GRANDE NEAR LANGTRY, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is located one-half mile south of Langtry station, on the Southern Pacific Railway, and is about 440 miles below El Paso, Tex., at the eastern end of the canyon section of the Rio Grande and a short distance to the west of the mouth of Pecos River, one of the principal tributaries of the Rio Grande.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Rio Grande near Langtry, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| January 5 | J. D. Dillard | 412 | 1.39 | 0.9 | 573 |
| January 9 | do | 410 | 1.38 | .9 | 567 |
| January 14 | do | 408 | 1.38 | .9 | 564 |
| January 19 | do | 401 | 1.34 | .85 | 538 |
| January 25 | do | 393 | 1.31 | .8 | 513 |
| January 30 | do | 396 | 1.25 | .8 | 495 |
| February 4 | do | 388 | 1.26 | .8 | 487 |
| February 9 | do | 390 | 1.23 | .8 | 478 |
| February 14 | do | 392 | 1.23 | .8 | 482 |
| February 19 | do | 390 | 1.22 | .8 | 477 |
| February 24 | do | 384 | 1.21 | .75 | 465 |
| February 29 | do | 384 | 1.18 | .75 | 453 |
| March 5 | do | 374 | 1.13 | .7 | 421 |
| March 10 | do | 374 | 1.13 | .7 | 424 |
| March 15 | do | 367 | 1.11 | .65 | 406 |
| March 21 | do | 355 | 1.09 | .6 | 386 |
| March 26 | do | 353 | 1.06 | .55 | 375 |
| March 31 | do | 349 | 1.08 | .55 | 377 |
| April 5 | do | 344 | .98 | .5 | 388 |
| April 9 | do | 344 | .99 | .5 | 339 |
| April 15 | do | 563 | 2.47 | 1.8 | 1,390 |
| April 20 | do | 332 | .96 | .5 | 318 |
| April 25 | do | 324 | .93 | .45 | 300 |
| April 30 | do | 327 | .92 | .45 | 302 |
| May 5 | do | 327 | .90 | .45 | 294 |
| May 9 | do | 318 | .84 | .4 | 268 |
| May 14 | do | 341 | .97 | .5 | 332 |
| May 18 | do | 328 | .92 | .45 | 302 |
| May 23 | do | 780 | 3.34 | 2.6 | 2,606 |
| May 27 | do | 912 | 3.67 | 3.1 | 3,344 |

*Discharge measurements of Rio Grande near Langtry, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| May 31 | J. D. Dillard | 623 | 3.09 | 2.1 | 1,927 |
| June 4 | do | 407 | 1.58 | 1.0 | 644 |
| June 9 | do | 494 | 2.19 | 1.5 | 1,080 |
| June 10 | do | 1,306 | 4.81 | 4.8 | 6,284 |
| June 14 | do | 590 | 2.89 | 2.0 | 1,703 |
| June 18 | do | 382 | 1.64 | 1.0 | 628 |
| June 24 | do | 571 | 2.81 | 1.95 | 1,604 |
| June 30 | do | 909 | 4.37 | 3.5 | 3,972 |
| July 3 | E. E. Winter | 490 | 1.57 | 1.8 | 768 |
| July 13 | do | 351 | 1.55 | .9 | 543 |
| July 15 | do | 366 | 1.62 | 1.0 | 594 |
| July 19 | do | 441 | 1.68 | 1.4 | 740 |
| July 24 | do | 501 | 1.96 | 1.8 | 981 |
| July 29 | do | 472 | 1.86 | 1.6 | 880 |
| August 2 | do | 465 | 1.55 | 1.3 | 722 |
| August 8 | do | 504 | 1.60 | 1.4 | 808 |
| August 12 | do | 439 | 1.61 | 1.2 | 706 |
| August 16 | do | 407 | 1.48 | 1.0 | 602 |
| August 22 | do | 392 | 1.64 | 1.1 | 642 |
| August 26 | do | 508 | 1.93 | 1.6 | 980 |
| August 29 | do | 662 | 2.80 | 2.4 | 1,852 |
| September 2 | do | 561 | 2.42 | 2.0 | 1,358 |
| September 8 | do | 2,483 | 9.12 | 9.4 | 22,657 |
| November 2 | do | 1,614 | 5.87 | 5.0 | 9,467 |
| November 6 | do | 1,347 | 4.33 | 4.1 | 5,835 |
| November 10 | do | 1,156 | 3.67 | 3.5 | 4,245 |
| November 15 | do | 919 | 3.54 | 2.7 | 3,253 |
| November 17 | do | 834 | 3.49 | 2.6 | 2,907 |
| November 21 | do | 870 | 3.25 | 2.3 | 2,827 |
| November 25 | do | 921 | 2.35 | 2.2 | 2,166 |
| November 29 | do | 817 | 2.33 | 1.9 | 1,904 |
| December 4 | do | 754 | 2.17 | 1.7 | 1,638 |
| December 8 | do | 1,062 | 3.61 | 3.0 | 3,836 |
| December 12 | do | 797 | 3.06 | 2.5 | 2,435 |
| December 16 | do | 797 | 2.92 | 2.6 | 2,329 |
| December 20 | do | 962 | 2.86 | 2.7 | 2,755 |
| December 28 | do | 590 | 2.11 | 1.8 | 1,247 |

*Mean daily gage height, in feet, of Rio Grande near Langtry, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.9 | 0.8 | 0.75 | 0.55 | 0.45 | 1.5 | 1.55 | 1.3 | 2.15 | 5.65 | 5.2 | 1.75 |
| 2 | .9 | .8 | .75 | .55 | .45 | 1.25 | 1.8 | 1.3 | 1.95 | 4.95 | 4.9 | 1.7 |
| 3 | .9 | .8 | .75 | .55 | .45 | 1.1 | 1.75 | 1.3 | 1.85 | 4.9 | 4.7 | 1.7 |
| 4 | .9 | .8 | .75 | .55 | .45 | 1.0 | 1.55 | 1.55 | 2.15 | 4.95 | 4.3 | 1.75 |
| 5 | .9 | .8 | .75 | .55 | .45 | .9 | 1.4 | 1.7 | 2.9 | 4.55 | 4.2 | 1.75 |
| 6 | .9 | .8 | .7 | .5 | .45 | 2.45 | 1.3 | 1.7 | 5.6 | 4.0 | 4.05 | 2.45 |
| 7 | .9 | .8 | .7 | .5 | .45 | 1.25 | 1.25 | 1.45 | 7.1 | 3.9 | 4.0 | 3.15 |
| 8 | .9 | .8 | .7 | .5 | .4 | .9 | 1.2 | 1.35 | 9.4 | 3.8 | 3.95 | 2.95 |
| 9 | .9 | .8 | .7 | .5 | .4 | 1.35 | 1.3 | 1.3 | 6.7 | 3.8 | 3.85 | 2.8 |
| 10 | .9 | .8 | .7 | .5 | .4 | 4.6 | 1.1 | 1.3 | 7.95 | 4.15 | 3.5 | 2.6 |
| 11 | .9 | .8 | .7 | .5 | .4 | 3.5 | 1.1 | 1.3 | 16.95 | 5.4 | 3.4 | 2.6 |
| 12 | .9 | .8 | .7 | .5 | .4 | 1.7 | 1.0 | 1.25 | 28.4 | 6.15 | 3.35 | 2.5 |
| 13 | .9 | .8 | .7 | .5 | .4 | 1.9 | .95 | 1.1 | 34.25 | 6.75 | 3.25 | 2.4 |
| 14 | .9 | .8 | .7 | .5 | .5 | 2.05 | .9 | 1.1 | 27.75 | 8.3 | 3.0 | 2.5 |
| 15 | .9 | .8 | .65 | 1.7 | .5 | 1.55 | 1.1 | 1.0 | 19.15 | 8.95 | 2.7 | 2.7 |
| 16 | .9 | .8 | .65 | .6 | .5 | 1.25 | 1.0 | 1.0 | 11.7 | 8.25 | 2.6 | 2.65 |
| 17 | .9 | .8 | .65 | .6 | .5 | 1.2 | 1.1 | .95 | 11.45 | 8.9 | 2.55 | 2.65 |
| 18 | .9 | .8 | .65 | .6 | .45 | 1.0 | 1.95 | .85 | 12.6 | 9.0 | 2.5 | 2.7 |
| 19 | .9 | .8 | .65 | .5 | .45 | 1.0 | 1.3 | .8 | 11.95 | 10.3 | 2.5 | 2.7 |
| 20 | .85 | .8 | .6 | .5 | .45 | 2.8 | 1.15 | .8 | 11.9 | 8.55 | 2.45 | 2.65 |
| 21 | .85 | .8 | .6 | .5 | .45 | 2.35 | 1.5 | .8 | 10.7 | 8.1 | 2.25 | 2.6 |
| 22 | .85 | .8 | .6 | .5 | .6 | 2.5 | 1.9 | 1.1 | 8.65 | 8.45 | 2.25 | 2.55 |
| 23 | .85 | .8 | .55 | .5 | 2.45 | 2.3 | 2.1 | 1.25 | 7.9 | 7.5 | 2.2 | 2.35 |
| 24 | .8 | .75 | .55 | .45 | 1.65 | 1.95 | 1.8 | 1.4 | 6.9 | 6.8 | 2.2 | 2.15 |
| 25 | .8 | .75 | .55 | .45 | 3.3 | 1.85 | 1.55 | 1.65 | 6.45 | 6.45 | 2.2 | 2.05 |
| 26 | .8 | .75 | .55 | .45 | 1.3 | 4.55 | 1.2 | 1.6 | 6.25 | 6.1 | 2.2 | 2.0 |
| 27 | .8 | .75 | .55 | .45 | 2.9 | 7.5 | 1.8 | 1.7 | 6.35 | 5.3 | 2.15 | 1.8 |
| 28 | .8 | .75 | .55 | .45 | 5.15 | 7.4 | 1.7 | 2.4 | 6.15 | 4.8 | 2.0 | 1.8 |
| 29 | .8 | .75 | .55 | .45 | 4.1 | 4.75 | 1.45 | 2.4 | 5.55 | 4.75 | 1.9 | 1.75 |
| 30 | .8 | ..... | .55 | .45 | 2.4 | 3.15 | 1.3 | 2.35 | 5.35 | 5.05 | 1.8 | 1.7 |
| 31 | .8 | ..... | .55 | ..... | 2.1 | ..... | 1.2 | 2.3 | ..... | 5.7 | ..... | 1.7 |

*Mean daily discharge, in second-feet, of Rio Grande near Langtry, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 590 | 490 | 450 | 375 | 300 | 1,200 | 705 | 720 | 1,540 | 11,350 | 10,000 | 1,710 |
| 2 | 585 | 490 | 450 | 375 | 300 | 910 | 770 | a720 | a1,300 | 9,250 | a9,000 | 1,640 |
| 3 | 580 | 485 | 445 | 375 | 300 | 750 | a755 | 720 | 1,180 | 9,100 | 8,200 | 1,640 |
| 4 | 575 | a485 | 440 | 375 | 295 | a640 | 705 | 940 | 1,540 | 9,250 | 6,600 | a1,720 |
| 5 | a575 | 485 | a435 | a375 | a295 | 560 | 670 | 1,070 | 3,040 | 8,050 | 6,200 | 1,720 |
| 6 | 575 | 485 | 420 | 340 | 295 | 2,320 | 645 | 1,070 | 9,250 | 6,400 | a5,660 | 2,900 |
| 7 | 570 | 480 | 420 | 340 | 295 | 870 | 630 | 850 | 13,150 | 6,100 | 5,500 | 4,090 |
| 8 | 565 | 480 | 420 | 340 | 270 | 560 | 620 | a780 | a22,660 | 5,800 | 5,350 | a3,750 |
| 9 | a565 | a480 | 425 | a340 | a270 | a950 | 645 | 750 | 12,110 | 5,800 | 5,080 | 3,280 |
| 10 | 565 | 480 | a425 | 340 | 270 | a5,940 | 595 | 750 | 14,950 | 6,850 | a4,240 | 2,720 |
| 11 | 565 | 480 | 425 | 340 | 270 | 4,020 | 595 | 750 | 47,100 | 10,600 | 4,110 | 2,720 |
| 12 | 565 | 480 | 425 | 340 | 270 | 1,370 | 570 | a730 | 99,900 | 12,850 | 4,050 | a2,440 |
| 13 | 565 | 480 | 420 | 340 | 270 | 1,590 | a560 | 650 | 132,000 | 14,650 | 3,920 | 2,240 |
| 14 | a565 | a480 | 420 | 340 | a330 | a1,750 | 545 | 650 | 96,600 | 19,300 | 3,610 | 2,320 |
| 15 | 565 | 480 | a405 | a1,290 | 330 | 1,190 | a630 | 600 | 56,200 | 21,250 | a3,250 | 2,540 |
| 16 | 565 | 480 | 405 | 380 | 330 | 860 | 595 | a600 | 29,570 | 19,150 | 3,030 | a2,410 |
| 17 | 565 | 480 | 400 | 380 | 330 | 810 | 640 | 580 | 28,820 | 21,100 | a2,860 | 2,470 |
| 18 | 565 | 475 | 400 | 380 | a300 | a630 | 1,070 | 520 | 32,270 | 21,400 | 2,860 | 2,620 |
| 19 | a565 | a475 | 400 | 320 | 300 | 630 | a700 | 500 | 30,320 | 25,300 | 2,910 | 2,690 |
| 20 | 540 | 475 | 385 | a320 | 300 | 2,860 | 640 | 500 | 30,170 | 20,050 | 2,920 | a2,680 |
| 21 | 540 | 475 | a385 | 320 | 300 | 2,160 | 790 | 500 | 26,570 | 18,700 | a2,780 | 2,600 |
| 22 | 540 | 475 | 385 | 320 | 390 | 2,390 | 1,040 | a640 | 20,420 | 19,750 | 2,640 | 2,520 |
| 23 | 540 | 475 | 375 | 320 | a2,400 | 2,090 | 1,160 | 740 | 18,170 | 16,900 | 2,450 | 2,180 |
| 24 | 515 | a465 | 375 | 300 | 1,310 | a1,600 | a980 | 840 | 15,170 | 14,800 | 2,310 | 1,840 |
| 25 | a515 | 465 | 375 | a300 | 3,840 | 1,480 | 860 | 1,020 | 13,820 | 13,750 | a2,170 | 1,670 |
| 26 | 515 | 460 | a375 | 300 | 840 | 6,000 | 730 | a980 | 13,220 | 12,700 | 2,170 | 1,590 |
| 27 | 510 | 460 | 375 | 300 | a3,050 | 14,200 | 980 | 1,090 | 13,520 | 10,300 | 2,120 | 1,250 |
| 28 | 505 | 455 | 375 | 300 | 8,460 | 14,000 | 930 | 1,850 | 12,920 | 8,800 | 1,990 | a1,250 |
| 29 | 500 | a455 | 375 | 300 | 5,840 | 6,400 | a820 | a1,850 | 11,120 | 8,650 | a1,900 | 1,180 |
| 30 | a495 | ..... | 375 | 300 | 2,350 | a3,410 | 760 | 1,800 | 10,520 | 9,550 | 1,810 | 1,110 |
| 31 | 495 | ..... | a375 | ..... | a1,930 | ..... | 720 | 1,750 | ..... | 11,500 | ..... | 1,110 |

a Meter measurements.

*Estimated monthly discharge of Rio Grande near Langtry, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 590 | 495 | 550 | 33,798 |
| February | 490 | 455 | 476 | 27,392 |
| March | 450 | 375 | 405 | 24,912 |
| April | 1,290 | 300 | 369 | 21,947 |
| May | 8,460 | 270 | 1,182 | 72,654 |
| June | 14,200 | 560 | 2,805 | 166,889 |
| July | 1,160 | 545 | 744 | 45,729 |
| August | 1,850 | 500 | 887 | 54,565 |
| September | 132,000 | 1,180 | 27,304 | 1,624,700 |
| October | 25,300 | 5,800 | 13,194 | 811,239 |
| November | 10,000 | 1,810 | 4,056 | 241,369 |
| December | 4,090 | 1,110 | 2,213 | 136,066 |
| The year | 132,000 | 270 | 4,515 | 3,261,260 |

## RIO GRANDE BELOW MOUTH OF DEVILS RIVER, TEXAS.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is alongside the Southern Pacific Railway track, about a half mile below the mouth of Devils River and about 480 miles below El Paso.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Rio Grande below mouth of Devils River, Texas, in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| January 2 | J. D. Dillard | 1,128 | 1.55 | 3.65 | 1,753 |
| January 7 | do | 1,115 | 1.50 | 3.6 | 1,678 |
| January 12 | do | 1,115 | 1.47 | 3.6 | 1,638 |
| January 18 | do | 1,089 | 1.46 | 3.55 | 1,592 |
| January 23 | do | 1,069 | 1.44 | 3.5 | 1,537 |
| January 28 | do | 1,066 | 1.43 | 3.5 | 1,528 |
| February 2 | do | 1,093 | 1.41 | 3.5 | 1,542 |
| February 6 | do | 1,078 | 1.39 | 3.5 | 1,494 |
| February 11 | do | 1,063 | 1.37 | 3.5 | 1,453 |
| February 16 | do | 1,090 | 1.37 | 3.5 | 1,492 |
| February 22 | do | 1,096 | 1.37 | 3.5 | 1,503 |
| February 27 | do | 1,100 | 1.38 | 3.5 | 1,515 |
| March 3 | do | 1,065 | 1.31 | 3.4 | 1,392 |
| March 8 | do | 1,071 | 1.32 | 3.45 | 1,418 |
| March 13 | do | 1,060 | 1.30 | 3.4 | 1,376 |
| March 18 | do | 1,058 | 1.28 | 3.4 | 1,358 |
| March 24 | do | 1,057 | 1.26 | 3.4 | 1,331 |
| March 29 | do | 1,044 | 1.22 | 3.35 | 1,276 |
| April 4 | do | 1,054 | 1.26 | 3.4 | 1,330 |
| April 8 | do | 1,043 | 1.22 | 3.35 | 1,277 |
| April 13 | do | 1,031 | 1.18 | 3.3 | 1,217 |
| April 18 | do | 1,031 | 1.20 | 3.3 | 1,241 |
| April 23 | do | 1,050 | 1.28 | 3.4 | 1,339 |
| April 28 | do | 1,031 | 1.16 | 3.25 | 1,193 |
| May 3 | do | 1,039 | 1.19 | 3.35 | 1,235 |
| May 7 | do | 1,048 | 1.22 | 3.4 | 1,277 |
| May 12 | do | 999 | 1.12 | 3.25 | 1,116 |
| May 17 | do | 1,046 | 1.25 | 3.4 | 1,308 |
| May 21 | do | 1,019 | 1.17 | 3.3 | 1,189 |
| May 24 | do | 1,342 | 2.15 | 4.4 | 2,885 |
| May 28 | do | 1,484 | 2.62 | 4.8 | 3,893 |
| June 2 | do | 1,192 | 2.00 | 4.05 | 2,389 |
| June 7 | do | 1,885 | 4.19 | 6.2 | 7,899 |
| June 12 | do | 1,501 | 3.19 | 5.0 | 4,792 |

*Discharge measurements of Rio Grande below mouth of Devils River, Texas, in 1904*—Con.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| June 16 | J. D. Dillard | 1,208 | 2.06 | 4.1 | 2,489 |
| June 21 | do | 1,112 | 1.62 | 3.7 | 1,798 |
| June 28 | do | 4,402 | 7.47 | 13.0 | 32,871 |
| July 6 | E. E. Winter | 1,433 | 2.12 | 4.2 | 3,031 |
| July 12 | do | 1,231 | 1.74 | 3.7 | 2,147 |
| July 15 | do | 1,196 | 1.62 | 3.6 | 1,939 |
| July 22 | do | 1,333 | 1.93 | 4.2 | 2,579 |
| July 26 | do | 1,295 | 1.90 | 4.0 | 2,461 |
| July 30 | do | 1,245 | 1.77 | 3.9 | 2,209 |
| August 4 | do | 1,210 | 1.52 | 3.7 | 1,845 |
| August 8 | do | 1,263 | 1.74 | 3.9 | 2,203 |
| August 13 | do | 1,222 | 1.55 | 3.7 | 1,894 |
| August 17 | do | 1,028 | 1.53 | 3.6 | 1,577 |
| August 23 | do | 1,010 | 1.51 | 3.6 | 1,527 |
| August 26 | do | 1,126 | 1.66 | 4.0 | 1,869 |
| August 30 | do | 1,308 | 2.02 | 4.4 | 2,638 |
| September 6 | do | 1,739 | 3.91 | 5.7 | 6,795 |
| September 10 | do | 2,739 | 5.78 | 8.3 | 15,842 |
| September 13 | do | 11,651 | 9.93 | 24.3 | 115,750 |
| September 19 | do | 3,795 | 7.27 | 10.5 | 27,578 |
| September 24 | do | 3,399 | 6.47 | 9.0 | 21,986 |
| September 27 | do | 2,686 | 6.31 | 7.5 | 16,957 |
| October 3 | do | 2,565 | 6.10 | 7.4 | 15,657 |
| October 7 | do | 2,437 | 5.96 | 7.3 | 14,523 |
| October 13 | do | 2,227 | 6.08 | 7.4 | 13,539 |
| October 18 | do | 3,604 | 7.12 | 10.5 | 25,676 |
| October 25 | do | 2,599 | 6.28 | 10.2 | 16,323 |
| November 5 | do | 2,612 | 3.18 | 6.9 | 8,307 |
| November 9 | do | 2,650 | 2.77 | 6.7 | 7,333 |
| November 13 | do | 1,838 | 2.84 | 5.8 | 5,225 |
| November 16 | do | 1,597 | 2.61 | 5.4 | 4,171 |
| November 19 | do | 1,479 | 2.47 | 5.0 | 3,649 |
| November 23 | do | 1,486 | 2.30 | 4.7 | 3,423 |
| November 28 | do | 1,426 | 2.13 | 4.5 | 3,034 |
| December 3 | do | 1,503 | 1.95 | 4.5 | 2,935 |
| December 7 | do | 1,779 | 2.46 | 5.7 | 4,370 |
| December 10 | do | 1,613 | 2.41 | 5.3 | 3,886 |
| December 15 | do | 1,686 | 2.21 | 5.1 | 3,733 |
| December 19 | do | 1,723 | 2.49 | 5.3 | 4,284 |
| December 23 | do | 1,653 | 2.23 | 4.7 | 3,694 |
| December 31 | do | 1,270 | 2.22 | 4.3 | 2,814 |

*Mean daily gage height, in feet, of Rio Grande, below mouth of Devils River, Texas, for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.65 | 3.5 | 3.5 | 3.4 | 3.3 | 4.3 | 5.15 | 3.75 | 4.25 | 7.65 | 8.8 | 4.5 |
| 2 | 3.65 | 3.5 | 3.5 | 3.4 | 3.3 | 4.0 | 4.7 | 3.7 | 4.2 | 7.25 | 8.1 | 4.5 |
| 3 | 3.6 | 3.5 | 3.5 | 3.4 | 3.4 | 3.8 | 4.45 | 3.7 | 4.0 | 7.2 | 7.45 | 4.5 |
| 4 | 3.6 | 3.5 | 3.45 | 3.4 | 3.4 | 3.65 | 4.4 | 3.7 | 4.3 | 6.9 | 7.15 | 4.5 |
| 5 | 3.6 | 3.5 | 3.45 | 3.4 | 3.55 | 4.5 | 4.25 | 3.8 | 4.3 | 6.5 | 6.7 | 4.65 |
| 6 | 3.6 | 3.5 | 3.4 | 3.35 | 3.5 | 4.35 | 4.15 | 3.9 | 5.7 | 6.65 | 6.35 | 5.05 |
| 7 | 3.6 | 3.5 | 3.4 | 3.35 | 3.4 | 5.95 | 4.1 | 3.7 | 6.5 | 6.95 | 7.0 | 5.6 |
| 8 | 3.6 | 3.5 | 3.4 | 3.35 | 3.3 | 5.15 | 4.05 | 3.9 | 8.4 | 6.3 | 6.8 | 5.5 |
| 9 | 3.6 | 3.5 | 3.4 | 3.3 | 3.3 | 4.15 | 4.0 | 3.9 | 9.15 | 6.15 | 6.6 | 5.55 |
| 10 | 3.6 | 3.5 | 3.4 | 3.3 | 3.3 | 5.0 | 3.85 | 3.8 | 8.45 | 6.3 | 6.2 | 5.3 |
| 11 | 3.6 | 3.5 | 3.45 | 3.3 | 3.3 | 5.35 | 3.8 | 3.75 | 10.2 | 7.2 | 5.95 | 5.15 |
| 12 | 3.6 | 3.5 | 3.45 | 3.3 | 3.25 | 5.2 | 3.7 | 3.7 | 16.0 | 7.5 | 5.8 | 5.0 |
| 13 | 3.6 | 3.5 | 3.4 | 3.3 | 3.3 | 4.55 | 3.7 | 3.7 | 22.75 | 7.7 | 5.8 | 4.95 |
| 14 | 3.6 | 3.5 | 3.4 | 3.3 | 3.45 | 4.55 | 3.6 | 3.6 | 26.75 | 9.35 | 5.7 | 4.95 |
| 15 | 3.6 | 3.5 | 3.4 | 3.3 | 3.55 | 4.3 | 3.6 | 3.6 | 23.55 | 11.3 | 5.45 | 5.0 |
| 16 | 3.6 | 3.5 | 3.4 | 3.75 | 3.4 | 4.05 | 3.65 | 3.6 | 14.6 | 10.3 | 5.35 | 5.1 |
| 17 | 3.55 | 3.5 | 3.4 | 3.35 | 3.4 | 3.85 | 3.65 | 3.6 | 10.5 | 10.55 | 5.15 | 5.25 |
| 18 | 3.55 | 3.5 | 3.4 | 3.3 | 3.4 | 3.75 | 3.75 | 3.6 | 11.15 | 10.45 | 5.05 | 5.25 |
| 19 | 3.55 | 3.5 | 3.4 | 3.3 | 3.4 | 3.7 | 4.05 | 3.6 | 10.1 | 11.45 | 4.95 | 5.25 |
| 20 | 3.55 | 3.5 | 3.4 | 3.3 | 3.4 | 3.7 | 3.85 | 3.6 | 10.8 | 11.1 | 4.9 | 5.05 |
| 21 | 3.55 | 3.5 | 3.4 | 3.3 | 3.3 | 3.8 | 3.9 | 3.6 | 12.65 | 10.25 | 4.85 | 4.85 |
| 22 | 3.55 | 3.5 | 3.4 | 4.1 | 3.3 | 4.65 | 4.2 | 3.95 | 12.55 | 10.5 | 4.75 | 4.8 |
| 23 | 3.5 | 3.5 | 3.4 | 3.4 | 3.9 | 4.45 | 4.35 | 4.0 | 10.35 | 10.4 | 4.65 | 4.7 |
| 24 | 3.5 | 3.5 | 3.4 | 3.35 | 4.35 | 4.35 | 4.45 | 3.6 | 9.0 | 10.25 | 4.6 | 4.55 |
| 25 | 3.5 | 3.5 | 3.4 | 3.3 | 4.15 | 4.15 | 4.25 | 3.8 | 8.35 | 10.2 | 4.6 | 4.45 |
| 26 | 3.5 | 3.5 | 3.4 | 3.3 | 4.45 | 3.85 | 4.1 | 4.25 | 8.0 | 10.1 | 4.55 | 4.35 |
| 27 | 3.5 | 3.5 | 3.35 | 3.3 | 4.9 | 8.85 | 3.9 | 4.3 | 7.5 | 10.05 | 4.5 | 4.3 |
| 28 | 3.5 | 3.5 | 3.35 | 3.3 | 4.7 | 11.35 | 4.0 | 4.4 | 7.5 | 9.75 | 4.5 | 4.3 |
| 29 | 3.5 | 3.5 | 3.35 | 3.3 | 7.15 | 7.35 | 4.0 | 4.4 | 7.35 | 9.55 | 4.5 | 4.3 |
| 30 | 3.5 | ..... | 3.35 | 3.3 | 5.35 | 5.5 | 3.9 | 4.35 | 7.3 | 9.5 | 4.5 | 4.3 |
| 31 | 3.5 | ..... | 3.35 | ..... | 4.5 | ..... | 3.8 | 4.3 | ..... | 9.4 | ..... | 4.25 |

*Mean daily discharge, in second-feet, of Rio Grande below mouth of Devils River, Texas, for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,720 | 1,540 | 1,490 | 1,330 | 1,220 | 3,020 | 5,150 | 1,990 | 2,350 | 17,000 | 12,680 | 3,000 |
| 2 | a1,750 | a1,540 | 1,480 | 1,330 | 1,220 | a2,300 | 4,110 | 1,890 | 2,250 | 15,510 | 11,070 | 2,970 |
| 3 | 1,700 | 1,530 | a1,470 | 1,330 | a1,280 | 1,970 | 3,560 | 1,870 | 1,870 | a15,060 | 9,570 | a2,940 |
| 4 | 1,690 | 1,520 | 1,430 | a1,330 | 1,280 | 1,730 | 3,450 | a1,850 | 2,450 | 13,960 | 8,880 | 2,940 |
| 5 | 1,690 | 1,510 | 1,430 | 1,330 | 1,460 | 3,540 | 3,140 | 2,020 | 2,450 | 12,560 | a7,850 | 3,120 |
| 6 | 1,680 | a1,500 | 1,390 | 1,280 | 1,400 | 3,160 | a2,940 | 2,200 | a6,800 | 12,810 | 6,910 | 3,600 |
| 7 | a1,680 | 1,490 | 1,390 | 1,280 | a1,280 | a7,250 | 2,850 | 1,850 | 9,440 | a13,510 | 8,280 | a4,250 |
| 8 | 1,680 | 1,480 | a1,380 | a1,280 | 1,180 | 5,180 | 2,760 | a2,200 | 16,240 | 11,300 | 7,690 | 4,130 |
| 9 | 1,670 | 1,470 | 1,380 | 1,220 | 1,180 | 2,620 | 2,670 | 2,200 | 19,900 | 10,640 | a7,100 | 4,190 |
| 10 | 1,660 | 1,460 | 1,380 | 1,220 | 1,170 | 4,790 | 2,410 | 2,040 | a16,440 | 10,880 | 6,160 | a3,890 |
| 11 | 1,650 | a1,450 | 1,420 | 1,220 | 1,170 | 5,700 | 2,320 | 1,970 | 26,460 | 13,370 | 5,580 | 3,750 |
| 12 | a1,640 | 1,460 | 1,420 | 1,220 | a1,120 | a5,310 | a2,150 | 1,890 | 54,100 | 14,060 | 5,230 | 3,610 |
| 13 | 1,640 | 1,470 | a1,380 | a1,220 | 1,190 | 3,640 | 2,150 | a1,890 | a102,300 | a14,440 | a5,230 | 3,550 |
| 14 | 1,630 | 1,480 | 1,380 | 1,220 | 1,370 | 3,640 | 1,940 | 1,670 | 138,800 | 20,360 | 4,960 | 3,550 |
| 15 | 1,630 | 1,490 | 1,370 | 1,220 | 1,490 | 3,000 | a1,940 | 1,640 | 109,100 | 28,880 | 4,300 | a3,610 |
| 16 | 1,620 | a1,490 | 1,370 | 1,900 | 1,310 | a2,400 | 1,990 | 1,610 | 46,300 | 24,880 | a4,100 | 3,730 |
| 17 | 1,590 | 1,490 | 1,360 | 1,300 | a1,310 | 2,050 | 1,990 | a1,580 | 27,600 | 25,880 | 3,840 | 4,140 |
| 18 | a1,590 | 1,490 | a1,360 | a1,240 | 1,310 | 1,880 | 2,100 | 1,580 | 30,200 | a25,480 | 3,710 | 4,200 |
| 19 | 1,590 | 1,500 | 1,360 | 1,240 | 1,310 | 1,800 | 2,420 | 1,570 | a25,980 | 29,500 | a3,610 | a4,230 |
| 20 | 1,580 | 1,500 | 1,350 | 1,240 | 1,310 | 1,800 | 2,210 | 1,560 | 28,740 | 26,740 | 3,570 | 4,030 |
| 21 | 1,580 | 1,500 | 1,350 | 1,240 | a1,190 | a1,970 | 2,260 | 1,550 | 36,640 | 21,980 | 3,530 | 3,830 |
| 22 | 1,570 | a1,500 | 1,340 | 2,420 | 1,190 | 3,900 | a2,580 | 1,840 | 36,180 | 21,620 | 3,460 | 3,780 |
| 23 | a1,540 | 1,500 | 1,340 | a1,340 | 2,000 | 3,390 | 2,910 | a1,870 | 27,000 | 19,860 | a3,320 | a3,690 |
| 24 | 1,540 | 1,510 | a1,330 | 1,290 | a2,800 | 3,130 | 3,130 | 1,530 | a21,990 | 17,900 | 3,230 | 3,360 |
| 25 | 1,540 | 1,510 | 1,330 | 1,240 | 2,490 | 2,620 | 2,630 | 1,700 | 19,800 | a16,320 | 3,230 | 3,140 |
| 26 | 1,530 | 1,510 | 1,330 | 1,240 | 3,000 | 2,060 | a2,520 | a2,350 | 18,630 | 16,020 | 3,130 | 2,920 |
| 27 | 1,530 | a1,510 | 1,290 | 1,240 | 4,140 | 15,070 | 2,210 | 2,450 | a16,960 | 15,870 | 3,040 | 2,810 |
| 28 | a1,530 | 1,520 | 1,280 | a1,240 | a3,640 | a27,500 | 2,460 | 2,640 | 16,960 | 14,970 | a3,030 | 2,810 |
| 29 | 1,530 | 1,520 | a1,280 | 1,240 | 10,900 | 11,000 | 2,460 | 2,640 | 16,510 | 14,370 | 3,030 | 2,810 |
| 30 | 1,530 | ..... | 1,270 | 1,240 | 5,280 | 6,090 | a2,210 | a2,540 | 16,360 | 14,220 | 3,030 | 2,810 |
| 31 | 1,530 | ..... | 1,270 | ..... | 3,130 | ..... | 2,100 | 2,450 | ..... | 13,920 | ..... | a2,700 |

a Meter measurements.

*Estimated monthly discharge of Rio Grande below mouth of Devils River, Texas, for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 1,750 | 1,530 | 1,614 | 99,233 |
| February | 1,540 | 1,450 | 1,498 | 86,162 |
| March | 1,490 | 1,270 | 1,368 | 84,099 |
| April | 2,420 | 1,220 | 1,323 | 78,704 |
| May | 10,900 | 1,120 | 2,107 | 129,560 |
| June | 27,500 | 1,730 | 4,784 | 284,648 |
| July | 5,150 | 1,940 | 2,636 | 162,089 |
| August | 2,640 | 1,530 | 1,956 | 120,258 |
| September | 138,800 | 1,870 | 29,893 | 1,778,777 |
| October | 29,500 | 10,640 | 17,544 | 1,078,750 |
| November | 12,680 | 3,030 | 5,412 | 322,016 |
| December | 4,250 | 2,700 | 3,487 | 214,393 |
| The year | 138,800 | 1,120 | 6,135 | 4,438,689 |

## RIO GRANDE NEAR EAGLE PASS, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is a half mile above the highway bridge between Eagle Pass and Ciudad Porfirio Diaz, Mexico, and about 540 miles below El Paso, Tex.

The observations at this station during 1904 have been made under the direction of the International (Water) Boundary Commission.

*Discharge measurements of Rio Grande near Eagle Pass, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| January 4 | J. K. Wilson | 1,436 | 1.50 | 2.0 | 2,147 |
| January 7 | do | 1,393 | 1.46 | 1.9 | 2,027 |
| January 11 | do | 1,380 | 1.43 | 1.9 | 1,973 |
| January 14 | do | 1,387 | 1.51 | 1.9 | 2,088 |
| January 18 | do | 1,390 | 1.48 | 1.9 | 2,061 |
| January 21 | do | 1,384 | 1.42 | 1.9 | 1,963 |
| January 25 | do | 1,361 | 1.41 | 1.8 | 1,914 |
| January 28 | do | 1,346 | 1.42 | 1.8 | 1,907 |
| January 31 | do | 1,347 | 1.40 | 1.8 | 1,882 |
| February 3 | do | 1,321 | 1.38 | 1.8 | 1,821 |
| February 7 | do | 1,323 | 1.39 | 1.8 | 1,834 |
| February 10 | do | 1,348 | 1.39 | 1.8 | 1,875 |

*Discharge measurements of Rio Grande near Eagle Pass, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| February 14 | J. K. Wilson | 1,321 | 1.41 | 1.8 | 1,862 |
| February 17 | do | 1,323 | 1.39 | 1.8 | 1,844 |
| February 20 | do | 1,311 | 1.41 | 1.8 | 1,843 |
| February 23 | do | 1,306 | 1.40 | 1.8 | 1,824 |
| February 26 | do | 1,306 | 1.42 | 1.8 | 1,854 |
| February 29 | do | 1,305 | 1.41 | 1.8 | 1,836 |
| March 3 | do | 1,279 | 1.35 | 1.8 | 1,731 |
| March 7 | do | 1,281 | 1.36 | 1.8 | 1,738 |
| March 10 | do | 1,274 | 1.33 | 1.8 | 1,700 |
| March 14 | do | 1,256 | 1.32 | 1.7 | 1,660 |
| March 25 | do | 1,235 | 1.32 | 1.6 | 1,633 |
| March 28 | do | 1,243 | 1.31 | 1.6 | 1,625 |
| March 31 | do | 1,224 | 1.32 | 1.6 | 1,618 |
| April 4 | do | 1,425 | 1.46 | 1.95 | 2,074 |
| April 7 | do | 1,367 | 1.40 | 1.8 | 1,916 |
| April 11 | do | 1,254 | 1.28 | 1.6 | 1,604 |
| April 14 | do | 1,229 | 1.27 | 1.6 | 1,555 |
| April 18 | do | 1,243 | 1.25 | 1.6 | 1,553 |
| April 20 | do | 1,175 | 1.17 | 1.5 | 1,378 |
| April 23 | do | 1,211 | 1.24 | 1.6 | 1,498 |
| April 27 | do | 1,151 | 1.16 | 1.5 | 1,340 |
| April 30 | do | 1,133 | 1.13 | 1.4 | 1,282 |
| May 3 | do | 1,146 | 1.12 | 1.4 | 1,283 |
| May 7 | do | 1,321 | 1.36 | 1.7 | 1,798 |
| May 10 | do | 1,162 | 1.14 | 1.4 | 1,323 |
| May 13 | do | 1,124 | 1.11 | 1.3 | 1,248 |
| May 17 | do | 1,281 | 1.32 | 1.6 | 1,691 |
| May 21 | do | 1,075 | 1.21 | 1.4 | 1,303 |
| May 25 | do | 1,551 | 1.71 | 2.5 | 2,651 |
| June 2 | do | 1,499 | 2.33 | 2.7 | 3,496 |
| June 5 | do | 1,475 | 1.60 | 1.9 | 2,365 |
| June 8 | do | 2,093 | 3.65 | 4.05 | 7,643 |
| June 11 | do | 1,587 | 2.25 | 2.8 | 3,577 |
| June 14 | do | 1,669 | 2.23 | 2.95 | 3,723 |
| June 17 | do | 1,576 | 2.04 | 2.4 | 3,220 |
| June 19 | do | 1,364 | 1.67 | 2.0 | 2,277 |
| June 23 | do | 1,812 | 2.44 | 3.0 | 4,427 |
| June 25 | do | 1,559 | 2.09 | 2.6 | 3,260 |
| June 28 | do | 3,764 | 8.27 | 7.4 | 31,122 |
| June 29 | do | 5,128 | 6.81 | 8.75 | 34,928 |
| July 3 | do | 2,275 | 2.44 | 2.9 | 5,555 |

*Discharge measurements of Rio Grande near Eagle Pass, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| July 7 | J. K. Wilson | 2,111 | 1.33 | 2.15 | 2,809 |
| July 11 | do | 1,866 | 1.20 | 1.9 | 2,238 |
| July 14 | do | 1,791 | 1.07 | 1.6 | 1,923 |
| July 18 | do | 1,714 | 1.07 | 1.5 | 1,842 |
| July 21 | do | 1,827 | 1.17 | 1.9 | 2,130 |
| July 25 | do | 2,606 | 2.34 | 3.75 | 6,100 |
| July 27 | do | 1,916 | 1.25 | 2.1 | 2,393 |
| July 30 | do | 1,892 | 1.24 | 2.1 | 2,348 |
| August 3 | do | 1,719 | 1.09 | 1.8 | 1,866 |
| August 6 | do | 1,726 | 1.09 | 1.8 | 1,883 |
| August 9 | do | 1,775 | 1.15 | 2.0 | 2,035 |
| August 13 | do | 1,705 | 1.01 | 1.5 | 1,726 |
| August 17 | do | 1,677 | 0.99 | 1.5 | 1,658 |
| August 20 | do | 1,666 | 1.05 | 1.7 | 1,755 |
| August 23 | do | 1,690 | 0.98 | 1.4 | 1,664 |
| August 26 | do | 1,816 | 1.08 | 1.9 | 1,961 |
| August 29 | do | 1,923 | 1.01 | 2.0 | 1,948 |
| August 31 | do | 1,925 | 1.17 | 2.4 | 2,249 |
| September 3 | do | 2,017 | 1.35 | 2.1 | 2,715 |
| September 7 | do | 4,458 | 3.26 | 6.4 | 14,534 |
| September 9 | do | 5,237 | 7.23 | 7.95 | 37,852 |
| September 14 [a] | do | 11,924 | 8.95 | 19.0 | 106,697 |
| September 16 [a] | do | 17,063 | 9.00 | 22.0 | 153,568 |
| September 18 [a] | do | 6,992 | 4.58 | 10.2 | 32,056 |
| September 20 | do | 6,258 | 4.75 | 8.85 | 29,753 |
| September 23 | do | 7,387 | 5.33 | 11.1 | 39,349 |
| September 26 | do | 5,090 | 3.74 | 6.2 | 19,025 |
| September 28 | do | 5,055 | 3.86 | 6.6 | 19,520 |
| September 30 | do | 4,544 | 3.06 | 6.2 | 13,900 |
| October 4 | do | 4,327 | 2.45 | 5.75 | 10,596 |
| October 7 | do | 3,968 | 2.22 | 5.2 | 8,802 |
| October 11 | do | 4,059 | 2.32 | 5.3 | 9,403 |
| October 15 | do | 5,886 | 5.51 | 9.0 | 32,435 |
| October 20 | do | 6,012 | 5.23 | 9.2 | 31,417 |
| October 22 | do | 5,392 | 4.89 | 8.4 | 26,383 |
| October 25 | do | 5,353 | 4.84 | 8.1 | 25,912 |
| October 28 | do | 4,555 | 3.74 | 6.5 | 17,035 |
| October 31 | do | 4,250 | 3.68 | 6.2 | 15,628 |
| November 4 | do | 3,758 | 3.33 | 5.65 | 12,516 |
| November 8 | do | 3,520 | 3.14 | 5.35 | 11,047 |

[a] Float measurement.

*Discharge measurements of Rio Grande near Eagle Pass, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| November 11 | J. K. Wilson | 3,408 | 3.09 | 4.9 | 10,521 |
| November 14 | do | 3,170 | 2.57 | 4.6 | 8,136 |
| November 17 | do | 2,973 | 2.47 | 4.3 | 7,357 |
| November 20 | do | 2,830 | 2.38 | 4.1 | 6,729 |
| November 23 | do | 2,941 | 1.90 | 3.9 | 5,580 |
| November 26 | do | 2,822 | 1.70 | 3.8 | 4,785 |
| November 30 | do | 2,756 | 1.62 | 3.6 | 4,467 |
| December 4 | do | 2,676 | 1.62 | 3.6 | 4,338 |
| December 8 | do | 3,255 | 2.52 | 4.45 | 8.207 |
| December 12 | do | 2,949 | 2.01 | 4.05 | 5,929 |
| December 16 | do | 2,979 | 1.74 | 3.8 | 5,191 |
| December 19 | do | 2,941 | 1.91 | 4.0 | 5,620 |
| December 22 | do | 2,789 | 1.89 | 3.9 | 5,268 |
| December 24 | do | 2,778 | 1.79 | 3.8 | 4,960 |
| December 28 | do | 2,695 | 1.69 | 3.4 | 4,553 |
| December 31 | do | 2,644 | 1.61 | 3.3 | 4,256 |

*Mean daily gage height, in feet, of Rio Grande near Eagle Pass, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.0 | 1.8 | 1.8 | 1.6 | 1.4 | 2.7 | 3.9 | 1.85 | 2.4 | 6.55 | 6.3 | 3.6 |
| 2 | 2.0 | 1.8 | 1.8 | 1.75 | 1.4 | 2.7 | 3.2 | 1.8 | 2.25 | 6.35 | 6.4 | 3.6 |
| 3 | 2.0 | 1.8 | 1.8 | 1.9 | 1.4 | 2.2 | 2.8 | 1.75 | 2.1 | 5.95 | 6.4 | 3.6 |
| 4 | 2.0 | 1.8 | 1.8 | 1.95 | 1.4 | 2.0 | 2.5 | 1.65 | 2.5 | 5.7 | 5.7 | 3.6 |
| 5 | 1.9 | 1.8 | 1.8 | 1.8 | 1.4 | 1.9 | 2.5 | 1.7 | 2.45 | 5.95 | 5.5 | 3.6 |
| 6 | 1.9 | 1.8 | 1.8 | 1.8 | 1.4 | 2.75 | 2.35 | 1.85 | 2.35 | 5.35 | 5.35 | 3.6 |
| 7 | 1.9 | 1.8 | 1.8 | 1.8 | 1.7 | 2.7 | 2.15 | 2.0 | 7.1 | 5.15 | 5.7 | 4.35 |
| 8 | 1.9 | 1.8 | 1.8 | 1.7 | 1.5 | 3.85 | 2.0 | 2.2 | 6.65 | 5.1 | 5.4 | 4.45 |
| 9 | 1.9 | 1.8 | 1.8 | 1.7 | 1.45 | 3.45 | 2.0 | 1.95 | 8.0 | 5.2 | 5.3 | 4.4 |
| 10 | 1.9 | 1.8 | 1.8 | 1.6 | 1.4 | 2.4 | 2.1 | 2.0 | 7.0 | 5.2 | 5.05 | 4.4 |
| 11 | 1.9 | 1.8 | 1.75 | 1.6 | 1.35 | 3.5 | 1.9 | 1.75 | 6.85 | 5.45 | 4.85 | 4.25 |
| 12 | 1.9 | 1.8 | 1.7 | 1.6 | 1.3 | 3.65 | 1.8 | 1.5 | 9.3 | 6.1 | 4.7 | 4.1 |
| 13 | 1.9 | 1.8 | 1.7 | 1.6 | 1.3 | 3.45 | 1.65 | 1.65 | 12.1 | 6.35 | 4.65 | 3.9 |
| 14 | 1.9 | 1.8 | 1.7 | 1.6 | 1.4 | 2.75 | 1.6 | 1.5 | 18.15 | 7.25 | 4.55 | 3.9 |
| 15 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 | 2.9 | 1.6 | 1.5 | 23.1 | 8.8 | 4.4 | 3.8 |
| 16 | 1.9 | 1.8 | 1.7 | 1.5 | 1.6 | 2.55 | 1.6 | 1.45 | 22.6 | 8.6 | 4.45 | 3.8 |
| 17 | 1.9 | 1.8 | 1.7 | 1.65 | 1.6 | 2.3 | 1.55 | 1.45 | 13.75 | 8.5 | 4.3 | 4.0 |
| 18 | 1.9 | 1.8 | 1.65 | 1.55 | 1.55 | 2.15 | 1.5 | 1.4 | 10.0 | 8.55 | 4.3 | 4.0 |
| 19 | 1.9 | 1.8 | 1.6 | 1.5 | 1.5 | 2.0 | 1.5 | 1.35 | 9.05 | 8.75 | 4.2 | 4.05 |
| 20 | 1.9 | 1.8 | 1.6 | 1.5 | 1.4 | 1.85 | 1.7 | 1.5 | 8.75 | 9.2 | 4.1 | 4.0 |
| 21 | 1.9 | 1.8 | 1.6 | 1.4 | 1.4 | 1.7 | 1.9 | 1.4 | 9.2 | 8.7 | 4.0 | 3.95 |
| 22 | 1.9 | 1.8 | 1.6 | 1.4 | 1.4 | 2.25 | 1.85 | 1.4 | 10.7 | 8.45 | 3.9 | 3.9 |
| 23 | 1.9 | 1.8 | 1.6 | 1.9 | 1.4 | 2.95 | 2.2 | 1.6 | 10.55 | 8.5 | 3.85 | 3.9 |
| 24 | 1.8 | 1.8 | 1.6 | 1.55 | 1.4 | 2.75 | 4.1 | 1.55 | 8.5 | 7.95 | 3.8 | 3.8 |
| 25 | 1.8 | 1.8 | 1.6 | 1.5 | 2.45 | 2.55 | 3.4 | 1.55 | 6.85 | 8.05 | 3.8 | 3.7 |
| 26 | 1.8 | 1.8 | 1.6 | 1.5 | 2.25 | 2.3 | 2.35 | 1.6 | 6.1 | 7.35 | 3.8 | 3.6 |
| 27 | 1.8 | 1.8 | 1.6 | 1.45 | 2.6 | 2.1 | 2.1 | 1.7 | 6.95 | 6.9 | 3.7 | 3.45 |
| 28 | 1.8 | 1.8 | 1.6 | 1.4 | 3.4 | 7.3 | 1.85 | 1.95 | 6.6 | 6.45 | 3.7 | 2.4 |
| 29 | 1.8 | 1.8 | 1.6 | 1.4 | 3.75 | 8.5 | 2.15 | 2.1 | 6.45 | 6.1 | 3.65 | 3.4 |
| 30 | 1.8 | ..... | 1.6 | 1.4 | 4.7 | 5.15 | 2.05 | 2.3 | 6.15 | 5.85 | 3.6 | 3.4 |
| 31 | 1.8 | ..... | 1.6 | ..... | 3.3 | ..... | 1.9 | 2.4 | ..... | 6.1 | ..... | 3.3 |

*Mean daily discharge, in second-feet, of Rio Grande near Eagle Pass, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2,080 | 1,860 | 1,800 | 1,620 | 1,280 | 3,500 | 8,860 | 1,950 | 2,480 | 15,400 | 16,100 | 4,430 |
| 2 | 2,100 | 1,840 | 1,770 | 1,810 | 1,280 | a3,500 | 6,550 | 1,870 | 2,600 | 14,640 | 16,570 | 4,400 |
| 3 | 2,120 | a1,820 | a1,730 | 2,000 | a1,280 | 2,780 | a5,190 | a1,830 | a2,720 | 11,880 | 16,570 | 4,370 |
| 4 | a2,140 | 1,820 | 1,730 | a2,070 | 1,280 | 2,500 | 4,080 | 1,750 | 3,720 | a10,430 | a12,770 | a4,340 |
| 5 | 2,040 | 1,830 | 1,730 | 1,920 | 1,280 | a2,360 | 4,080 | 1,790 | 3,600 | 11,600 | 11,800 | 4,340 |
| 6 | 2,030 | 1,830 | 1,740 | 1,920 | 1,280 | 4,440 | 3,530 | a1,920 | 3,350 | 9,280 | 11,060 | 4,340 |
| 7 | a2,030 | a1,830 | a1,740 | a1,920 | a1,800 | 4,320 | a2,810 | 2,040 | a17,330 | a8,640 | 12,770 | 7,640 |
| 8 | 2,020 | 1,840 | 1,720 | 1,760 | 1,480 | a6,990 | 2,470 | 2,200 | 15,530 | 8,470 | a11,300 | a8,210 |
| 9 | 2,010 | 1,860 | 1,710 | 1,760 | 1,400 | 5,690 | 2,470 | a2,000 | a38,050 | 8,800 | 10,990 | 7,920 |
| 10 | 1,990 | a1,870 | a1,700 | 1,600 | a1,320 | 3,040 | 2,700 | 2,040 | 18,100 | 8,800 | 10,700 | 7,920 |
| 11 | a1,970 | 1,870 | 1,680 | a1,600 | 1,280 | a5,850 | a2,240 | 1,890 | 17,200 | a10,000 | a10,320 | 7,070 |
| 12 | 2,010 | 1,870 | 1,660 | 1,590 | 1,250 | 6,300 | 2,130 | 1,730 | 46,000 | 13,900 | 9,420 | a6,210 |
| 13 | 2,050 | 1,860 | 1,660 | 1,570 | a1,250 | 5,600 | 1,970 | a1,830 | 62,800 | 15,400 | 8,780 | 5,480 |
| 14 | a2,090 | a1,860 | a1,660 | a1,560 | 1,390 | a3,540 | a1,920 | 1,710 | a100,700 | 20,800 | a7,960 | 5,480 |
| 15 | 2,080 | 1,860 | 1,660 | 1,560 | 1,540 | 3,680 | 1,920 | 1,690 | 172,300 | a31,000 | 7,570 | 5,190 |
| 16 | 2,070 | 1,850 | 1,660 | 1,400 | 1,690 | 3,360 | 1,920 | 1,650 | a163,800 | 29,600 | 7,700 | a5,190 |
| 17 | 2,060 | a1,840 | 1,660 | 1,630 | a1,690 | a2,990 | 1,880 | a1,640 | 60,500 | 28,560 | a7,360 | 5,620 |
| 18 | a2,060 | 1,840 | 1,650 | a1,460 | 1,590 | 2,630 | a1,840 | 1,620 | a31,720 | 28,420 | 7,360 | 5,620 |
| 19 | 2,020 | 1,840 | 1,640 | 1,380 | 1,500 | a2,280 | 1,840 | 1,600 | 30,110 | 29,170 | 7,050 | a5,770 |
| 20 | 1,990 | a1,840 | 1,640 | a1,380 | 1,300 | 2,040 | 1,980 | a1,690 | a29,580 | a31,420 | a6,730 | 5,620 |
| 21 | a1,960 | 1,840 | 1,640 | 1,280 | a1,300 | 1,800 | a2,130 | 1,660 | 31,220 | 28,420 | 6,250 | 5,440 |
| 22 | 1,960 | 1,840 | 1,630 | 1,280 | 1,300 | 2,780 | 2,090 | 1,660 | 37,550 | a26,580 | 5,770 | a5,270 |
| 23 | 1,960 | a1,830 | 1,630 | a1,980 | 1,300 | a4,300 | 2,730 | a1,800 | a36,920 | 26,780 | a5,440 | 5,270 |
| 24 | 1,910 | 1,830 | 1,630 | 1,420 | 1,300 | 3,690 | 6,940 | 1,770 | 28,450 | 25,090 | 5,120 | a4,960 |
| 25 | a1,910 | 1,840 | a1,630 | 1,350 | a2,570 | a3,120 | a5,260 | 1,770 | 21,680 | a25,640 | 4,960 | 4,850 |
| 26 | 1,910 | a1,850 | 1,630 | 1,340 | 2,300 | 2,990 | 2,910 | a1,800 | a18,520 | 21,720 | a4,790 | 4,750 |
| 27 | 1,910 | 1,850 | 1,630 | a1,310 | 2,900 | 2,810 | a2,390 | 1,830 | 22,000 | 19,240 | 4,630 | 4,600 |
| 28 | a1,910 | 1,840 | a1,630 | 1,280 | 4,900 | a30,600 | 2,070 | 1,950 | a19,520 | a16,800 | 4,630 | a4,550 |
| 29 | 1,900 | a1,840 | 1,620 | 1,280 | 6,220 | a34,180 | 2,410 | a2,020 | 16,950 | 15,160 | 4,550 | 4,520 |
| 30 | 1,890 | ..... | 1,620 | a1,280 | 10,300 | 12,930 | a2,280 | 2,170 | a13,650 | 13,980 | a4,470 | 4,490 |
| 31 | a1,880 | ..... | a1,620 | ..... | 4,640 | ..... | 2,130 | a2,250 | ..... | a15,160 | ..... | a4,260 |

a Meter measurements.

*Estimated monthly discharge of Rio Grande near Eagle Pass, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 2,140 | 1,880 | 2,002 | 123,094 |
| February | 1,870 | 1,820 | 1,844 | 106,096 |
| March | 1,800 | 1,620 | 1,673 | 102,843 |
| April | 2,070 | 1,280 | 1,577 | 93,838 |
| May | 10,300 | 1,250 | 2,167 | 133,269 |
| June | 34,180 | 1,800 | 5,886 | 350,261 |
| July | 8,860 | 1,840 | 3,088 | 189,858 |
| August | 2,250 | 1,600 | 1,843 | 113,296 |
| September | 172,300 | 2,480 | 35,622 | 2,119,636 |
| October | 31,420 | 8,470 | 18,735 | 1,151,960 |
| November | 16,570 | 4,470 | 8,716 | 518,658 |
| December | 8,210 | 4,260 | 5,423 | 333,461 |
| The year | 172,300 | 1,250 | 7,381 | 5,336,270 |

## CONEJOS RIVER NEAR MOGOTE, COLO.

This station was established August 25, 1899, by A. L. Fellows. The gage is located 500 feet below the highway bridge 4 miles above Mogote, Colo. The gage is an inclined pine timber, 2 by 6 inches, painted white and graduated in vertical feet and tenths with black paint and brass tacks. It is securely spiked to the stump of a dead tree on the right bank. It is read twice each day by Miss Nellie King. Discharge measurements are made from the downstream side of the highway bridge. The initial point for soundings is the inside face of the abutment on the right bank, downstream side. The channel is straight above and below the station, and the banks, though low, are not liable to overflow. The bed of the stream is composed of gravel and cobblestones. There is but one channel, broken by the central pier of the two-span bridge.

There is one bench mark at this station. It is composed of three 20-penny nails driven into the root of a large cottonwood about 300 feet south of the gage and 7.87 feet above its zero.

*Discharge measurements of Conejos River near Mogote, Colo., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| May 3 | G. B. Monk | 85 | 170 | 1.79 | 2.22 | 305 |
| June 8 | do | 88 | 179 | 2.31 | 2.40 | 412 |
| June 17 | do | 88 | 179 | 2.37 | 2.45 | 424 |
| June 27 | do | 87 | 144 | 1.31 | 1.95 | 188 |
| July 21[a] | do | 63 | 74 | .53 | 1.45 | 39 |
| July 29 | do | 89 | 124 | .81 | 1.85 | 101 |
| August 25 | do | 85 | 143 | 1.11 | 1.90 | 159 |

[a] Measured at different section.

*Mean daily gage height, in feet, of Conejos River near Mogote, Colo., for 1904.*

| Day. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|
| 1 | 1.60 | 2.50 | 2.55 | 1.90 | 2.45 | 2.55 | 3.60 |
| 2 | 1.75 | 2.35 | 2.45 | 1.90 | 2.35 | 2.45 | 3.00 |
| 3 | 1.60 | 2.15 | 2.35 | 1.80 | 2.35 | 2.35 | 2.75 |
| 4 | 1.60 | 2.10 | 2.15 | 1.80 | 2.60 | 2.30 | 2.60 |
| 5 | 1.55 | 2.10 | 2.10 | 1.70 | 2.75 | 2.20 | 2.50 |
| 6 | 1.65 | 2.15 | 2.10 | 1.65 | 2.25 | 2.20 | 2.40 |
| 7 | 1.55 | 2.20 | 2.20 | 1.55 | 2.35 | 2.10 | 3.00 |
| 8 | 1.60 | 2.35 | 2.45 | 1.55 | 2.45 | 2.00 | 3.00 |
| 9 | 1.60 | 2.35 | 2.50 | 1.50 | 2.25 | 2.00 | 3.25 |
| 10 | 1.55 | 2.45 | 2.30 | 1.50 | 2.10 | 1.90 | 3.05 |
| 11 | 1.80 | 2.60 | 2.30 | 1.50 | 2.10 | 1.90 | 2.95 |
| 12 | 1.85 | 2.65 | 2.45 | 1.50 | 2.00 | 1.80 | 2.85 |
| 13 | 2.20 | 2.80 | 2.30 | 1.45 | 2.00 | 1.80 | 2.75 |
| 14 | 2.40 | 2.80 | 2.35 | 1.40 | 2.15 | 1.70 | 2.65 |
| 15 | 2.50 | 2.50 | 2.30 | 1.40 | 2.20 | 1.70 | 2.55 |
| 16 | 2.40 | 2.55 | 2.40 | 1.40 | 2.20 | 1.70 | 2.55 |
| 17 | 2.50 | 2.55 | 2.45 | 1.40 | 2.10 | 1.70 | 2.50 |
| 18 | 2.50 | 2.75 | 2.30 | 1.30 | 2.10 | 1.65 | 2.45 |
| 19 | 2.50 | 2.85 | 2.20 | 1.40 | 2.25 | 1.60 | 2.30 |
| 20 | 2.45 | 2.80 | 2.15 | 1.40 | 2.20 | 1.60 | 2.20 |
| 21 | 2.45 | 2.80 | 2.10 | 1.50 | 2.10 | 1.60 | 2.20 |
| 22 | 2.10 | 2.65 | 2.25 | 1.50 | 2.00 | 1.60 | 2.15 |
| 23 | 2.15 | 2.80 | 2.00 | 1.50 | 2.00 | 1.65 | 2.10 |
| 24 | 2.00 | 2.80 | 2.10 | 1.60 | 2.05 | 1.80 | 2.10 |
| 25 | 2.15 | 2.55 | 1.90 | 1.70 | 2.00 | 1.80 | 2.10 |
| 26 | 2.50 | 2.50 | 1.95 | 1.60 | 2.05 | 1.80 | 2.10 |
| 27 | 2.55 | 2.55 | 2.00 | 1.65 | 2.05 | 1.70 | 1.95 |
| 28 | 2.75 | 2.50 | 2.05 | 1.80 | 2.00 | 1.80 | 1.90 |
| 29 | 2.55 | 2.50 | 1.90 | 2.10 | 2.00 | 2.02 | 1.90 |
| 30 | 2.45 | 2.55 | 1.85 | 2.10 | 2.45 | 4.00 | 1.90 |
| 31 | ..... | 2.50 | ..... | 1.95 | 2.50 | ..... | 1.80 |

*Rating table for Conejos River near Mogote, Colo., from January 1 to December 31, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 1.30 | 10 | 1.90 | 160 | 2.50 | 480 | 3.20 | 1,045 |
| 1.40 | 20 | 2.00 | 205 | 2.60 | 550 | 3.30 | 1,135 |
| 1.50 | 40 | 2.10 | 255 | 2.70 | 620 | 3.40 | 1,235 |
| 1.60 | 60 | 2.20 | 305 | 2.80 | 700 | 3.50 | 1,335 |
| 1.70 | 90 | 2.30 | 360 | 2.90 | 780 | 3.60 | 1,435 |
| 1.80 | 120 | 2.40 | 420 | 3.00 | 865 | 3.70 | 1,545 |

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 1.50 feet and 2.50 feet. The table has been extended beyond these limits. Above gage height 3.75 feet the rating curve is a tangent, the difference being 120 per tenth.

*Estimated monthly discharge of Conejos River near Mogote, Colo., for 1904.*

[Drainage area, 282 square miles.]

| Month. | Discharge in second-feet. | | | Total in acre-feet. | Run-off. | |
|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | | Second-feet per square mile. | Depth in inches. |
| April | 660 | 50 | 283 | 16,840 | 1.00 | 1.12 |
| May | 740 | 255 | 509 | 31,300 | 1.80 | 2.08 |
| June | 515 | 140 | 320 | 19,040 | 1.13 | 1.26 |
| July | 255 | 10 | 76.1 | 4,679 | .270 | .311 |
| August | 660 | 205 | 316 | 19,430 | 1.12 | 1.29 |
| September | 1,900 | 60 | 233 | 13,860 | .826 | .922 |
| October | 1,435 | 120 | 515 | 31,670 | 1.83 | 2.11 |

PECOS RIVER AT SANTA ROSA, N. MEX.

This station was established May 5, 1903, by H. C. Hurd. It was originally located at the bridge of the Chicago, Rock Island and Pacific Railway. The gage rod is a 2 by 4 inch timber, graduated to feet and tenths. It is bolted to the masonry footing of the east tower. Daily readings are made by L. M. Shely, a bank clerk. The initial point for soundings was the end of the girder at the east end of the bridge. Both banks are high and can not overflow. The bed of the river is solid rock overlaid by quicksand to the depth of 2 or 3 feet. The current is never sluggish and becomes very swift during time of floods. The channel is straight for one-fourth mile above and below the station. Bench mark No. 1 is a shelf cut in the east abutment at an elevation of 29.7 feet above the zero of the gage. A cable was established later in the year at a point 335 feet above the railroad bridge. Distances across the river are marked on the cable with white paint. During the great flood of September 29 and 30, 1904, the upper portion of the gage rod was torn away but the lower portion was left intact. A new gage was installed by W. G. Russell on the east side of the seeond pier to replace the one which was torn out. This new portion of the gage is 2 by 6 inch by 16 feet pine timber, graduated in feet and tenths and bolted to the east face of the second pier from the north end of the bridge. The same flood cut away the earth from the face of the north abutment leaving the bench mark about 25 feet above the ground and inaccessible, so in establishing the new gage reference was made to the old gage which had not been moved by the flood. A second bench mark was placed by W. G. Russell on the east side of the first pier from the north end of the bridge. It is a chiseled surface near the top of the second stone from the downstream end of the pier, and in the second tier of stones from the bed rock, and is marked "B. M." Its elevation is 6.41 feet above the zero of the present gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

*Discharge measurements of Pecos River at Santa Rosa, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| April 2 | W. G. Russell | 45 | 11 | 0.84 | 1.50 | 9 |
| August 7 | Russell and Shely | 90 | 78 | 3.08 | 2.50 | 240 |
| August 9 | do | 94 | 64 | 1.64 | 2.10 | 105 |
| August 23 | L. M. Shely | 94 | 75 | 1.83 | 2.10 | 137 |
| October 30 | do | 60 | 41 | 1.88 | 2.10 | 77 |

*Mean daily gage height, in feet, of Pecos River near Santa Rosa, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.65 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 3.50 | 1.30 | 1.60 | 6.00 | 0.70 | 0.50 |
| 2 | .65 | 1.65 | 1.60 | 1.70 | 1.40 | 1.40 | 2.50 | 3.50 | 1.60 | 3.00 | .70 | .50 |
| 3 | .65 | 1.65 | 1.60 | 1.70 | 1.40 | 1.40 | 2.50 | 4.00 | 1.60 | 3.00 | .70 | .50 |
| 4 | .65 | 1.65 | 1.60 | 1.50 | 1.40 | 1.40 | 2.00 | 3.00 | 2.00 | 2.00 | .70 | .50 |
| 5 | .65 | 1.65 | 1.65 | 1.50 | 1.40 | 1.40 | 2.50 | 2.40 | 1.60 | 2.00 | .70 | .50 |
| 6 | .65 | 1.70 | 1.65 | 1.50 | 1.40 | 1.40 | 1.50 | 2.40 | 1.60 | 2.00 | .60 | .50 |
| 7 | .65 | 1.70 | 1.65 | 1.45 | 1.40 | 1.40 | 1.40 | 2.50 | 1.60 | 2.00 | .60 | .50 |
| 8 | .65 | 1.70 | 1.65 | 1.45 | 1.40 | 1.40 | 1.40 | 2.20 | 1.60 | 2.00 | .60 | .50 |
| 9 | .65 | 1.70 | 1.65 | 1.45 | 1.40 | 1.40 | 1.20 | 2.20 | 1.60 | 2.00 | .60 | .50 |
| 10 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 1.40 | 1.10 | 4.00 | 1.60 | 2.00 | .60 | .50 |
| 11 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 1.40 | 1.10 | 2.00 | 1.40 | 2.00 | .60 | .50 |
| 12 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 1.90 | 1.10 | 2.00 | 1.40 | 2.00 | .60 | .50 |
| 13 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 1.40 | 1.10 | 2.00 | 1.40 | 2.00 | .60 | .50 |
| 14 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 3.00 | 1.10 | 2.00 | 1.40 | 2.00 | .60 | .50 |
| 15 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 2.00 | 1.10 | 1.20 | 1.40 | 2.00 | .60 | .50 |
| 16 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 2.00 | 1.10 | 1.80 | 1.40 | 2.00 | .60 | .50 |
| 17 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 2.00 | 3.50 | 1.80 | 1.40 | 2.00 | .60 | .50 |
| 18 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 1.30 | 2.00 | 1.50 | 1.40 | 1.50 | .60 | .50 |
| 19 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 3.00 | 3.00 | 1.50 | 1.40 | 1.50 | .60 | .50 |
| 20 | 1.65 | 1.70 | 1.65 | 1.40 | 1.40 | 2.00 | 2.00 | 1.70 | 1.40 | 1.50 | .60 | .50 |
| 21 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 1.70 | 2.50 | 1.90 | 1.40 | 1.40 | .60 | .50 |
| 22 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 4.00 | 2.50 | 1.80 | 1.40 | 1.40 | .60 | .50 |
| 23 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 1.90 | 2.00 | 1.20 | 1.40 | 1.30 | .60 | .50 |
| 24 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 1.40 | 2.00 | 1.60 | 1.40 | 1.00 | .60 | .50 |
| 25 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 1.40 | 2.00 | 1.80 | 1.40 | .90 | .60 | .50 |
| 26 | 1.65 | 1.60 | 1.60 | 1.40 | 1.40 | 1.30 | 1.50 | 1.60 | 1.40 | .90 | .50 | .50 |
| 27 | 1.65 | 1.60 | 1.55 | 1.40 | 1.40 | 1.20 | 1.20 | 1.60 | 1.40 | .90 | .50 | .50 |
| 28 | 1.65 | 1.60 | 1.55 | 1.40 | 1.40 | 1.20 | 1.20 | 1.60 | 4.00 | .90 | .50 | .50 |
| 29 | 1.65 | 1.60 | 1.55 | 1.40 | 1.40 | 1.10 | 1.20 | 1.60 | 13.00 | .80 | .50 | .50 |
| 30 | 1.65 | ..... | 1.55 | 1.40 | 1.40 | 1.40 | 1.30 | 1.60 | 23.00 | .80 | .50 | .50 |
| 31 | 1.65 | ..... | 1.55 | ..... | 1.40 | ..... | 1.30 | 1.60 | ..... | .70 | ..... | .50 |

PECOS RIVER NEAR FORT SUMNER, N. MEX.

This station was established June 12, 1904, by Earl Patterson. It is located about 12 miles northwest of Fort Sumner, N. Mex., and 45 miles south of Santa Rosa, N. Mex., the nearest railway station. It is also 1 mile upstream from the spring, trees, and houses known as Arinosa. A plain vertical staff gage, graduated to feet and tenths, is securely bolted and braced to the solid rock of a sandstone bluff on the right bank of the river. Graduations to the half foot are continued on the rock above the gage. The gage is read twice each day by Earl Patterson. Discharge measurements are made at low water by wading 20 feet below the gage, and at high stages by means of floats. The cross section has been ascertained by means of a level and rod. The initial point for soundings is a 2 by 4 inch pine stake driven into the right bank about 20 feet from the gage rod and 100 feet east of a small spring. The channel is straight for about 600 feet above and 200 feet below the station, and is very narrow. The current is swift.

Both banks are high, vertical, and not subject to overflow. The right bank is of earth and the left bank is of rock. The bed of the stream is composed of sand, and is shifting. The bench mark is a cross cut in a point of rock directly above the gage rod, on the right bank. Its elevation is 14.75 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. M. Reed, district hydrographer.

*Discharge measurements of Pecos River near Fort Sumner, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| June 14 [a] | E. Patterson | 194 | 166 | 1.88 | 3.30 | 313 |
| June 14 [b] | do | 170 | 145 | 1.88 | 3.20 | 276 |
| June 16 [a] | do | 171 | 88 | 1.63 | 3.10 | 144 |
| June 16 [b] | do | 265 | [c] 333 | 3.82 | 4.00 | 1,273 |
| June 16 [b] | do | 268 | [c] 413 | 5.28 | 4.30 | 2,183 |
| June 20 [a] | do | 63 | 54 | 1.54 | 2.85 | 84 |
| June 21 [d] | do | 63 | 102 | 3.23 | 2.80 | 330 |
| June 21 [b] | do | 256 | [e] 324 | 3.44 | 3.80 | 1,118 |
| June 22 [b] | do | 265 | [e] 717 | 6.96 | 5.30 | 4,993 |
| June 23 [b] | do | 258 | [e] 395 | 4.22 | 4.10 | 1,671 |
| June 23 [f] | do | 190 | 170 | 1.76 | 3.10 | 302 |
| June 24 [g] | do | 190 | 132 | 1.68 | 3.00 | 222 |
| June 27 [h] | do | 77 | 68 | 1.35 | 2.50 | 92 |
| June 29 | do | 77 | 52 | 1.46 | 2.40 | 76 |
| July 1 [i] | do | 120 | 70 | 1.51 | 2.60 | 106 |
| July 1 [b] | do | 259 | [j] 495 | 5.08 | 4.40 | 2,519 |
| July 1 [b] | do | 261 | [j] 536 | 4.95 | 4.50 | 2,657 |
| July 1 [b] | do | 262 | [j] 560 | 5.43 | 4.60 | 3,046 |
| July 2 [b] | do | 270 | [j] 730 | 6.95 | 5.20 | 5,076 |
| July 2 [b] | do | 261 | [j] 642 | 6.05 | 4.90 | 3,889 |
| July 2 [b] | do | 262 | [j] 547 | 5.37 | 4.55 | 2,942 |
| July 2 [b] | do | 259 | [j] 370 | 3.74 | 3.90 | 1,420 |
| July 3 | do | 216 | [k] 238 | 2.21 | 3.35 | 528 |
| July 4 | do | 210 | [k] 177 | 2.23 | 3.30 | 395 |
| July 5 | do | 167 | 122 | 1.84 | 3.05 | 225 |
| July 6 | do | 126 | 82 | 1.70 | 2.80 | 139 |
| July 15 | do | 49 | 40 | 1.54 | 2.40 | 62 |
| July 17 | do | 44 | 42 | 1.46 | 2.40 | 61 |
| October 15 [l] | do | 401 | 5,473 | 8.25 | 17.95 | 45,160 |
| October 15 [m] | do | 241 | 254 | 2.99 | 1.40 | 761 |

[a] Wading.
[b] Float measurement.
[c] Sounding July 17.
[d] Made after 5-foot rise.
[e] Sounding July 24.
[f] Made after long flood.
[g] Immediately after 2¾-foot rise.
[h] After flood.
[i] After small local rain.
[j] Soundings July 3.
[k] Bottom of channel changing.
[l] Kutter's formula.
[m] Wading after 18-foot rise.

*Mean daily gage height, in feet, of Pecos River near Fort Sumner, N. Mex., for 1904.*

| Day. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|
| 1 | ..... | 3.60 | 3.25 | 1.70 | a 4.20 | 0.50 | 0.20 |
| 2 | ..... | 4.70 | 3.20 | 1.65 | b 10.00 | .50 | .20 |
| 3 | ..... | 3.37 | 4.25 | 3.15 | 2.70 | .50 | .20 |
| 4 | ..... | 3.30 | 3.80 | 1.70 | 2.60 | .40 | .40 |
| 5 | ..... | 3.07 | 3.70 | 1.75 | 1.65 | .40 | .40 |
| 6 | ..... | 2.77 | 3.70 | 1.65 | 2.20 | .40 | .40 |
| 7 | ..... | 2.60 | 3.10 | 1.60 | 1.50 | .40 | .40 |
| 8 | ..... | 2.50 | 3.75 | 1.50 | 1.30 | .40 | .40 |
| 9 | ..... | 2.40 | 2.70 | 1.50 | 2.00 | .30 | .40 |
| 10 | ..... | 2.40 | 3.80 | 1.50 | 2.65 | .30 | .40 |
| 11 | ..... | 2.40 | 2.55 | 1.50 | 2.20 | .30 | ..... |
| 12 | 3.00 | 3.20 | 1.95 | 1.60 | 1.85 | .30 | ..... |
| 13 | 3.12 | 2.55 | 1.80 | 1.60 | 1.55 | .30 | ..... |
| 14 | 3.25 | 2.40 | 1.65 | 2.20 | 1.70 | .30 | ..... |
| 15 | 3.25 | 2.40 | 1.50 | 1.65 | c 10.00 | .30 | ..... |
| 16 | 4.00 | 2.50 | 1.50 | 1.60 | 1.20 | .30 | ..... |
| 17 | 3.20 | 2.40 | 1.70 | 1.60 | 1.15 | .30 | ..... |
| 18 | 2.97 | b 2.80 | 1.90 | 1.60 | 1.05 | .30 | ..... |
| 19 | 2.92 | b 5.50 | 1.90 | 1.60 | .90 | .30 | ..... |
| 20 | 2.85 | 3.60 | 1.75 | 1.60 | .90 | .30 | ..... |
| 21 | 3.32 | 3.20 | 1.65 | 1.60 | .90 | .30 | ..... |
| 22 | 4.90 | 4.52 | 2.40 | 1.70 | .85 | .30 | ..... |
| 23 | 3.77 | 3.10 | 2.20 | 1.70 | .80 | .30 | ..... |
| 24 | 3.05 | 3.55 | 2.15 | 1.70 | .80 | .30 | ..... |
| 25 | 2.62 | 3.37 | 1.85 | 1.90 | .75 | .30 | ..... |
| 26 | 2.50 | 3.27 | 1.75 | 1.80 | .60 | .30 | ..... |
| 27 | 2.50 | 3.70 | 1.70 | 1.70 | .60 | .20 | ..... |
| 28 | 2.45 | 3.30 | 1.60 | 2.85 | .60 | .20 | ..... |
| 29 | 2.40 | 3.07 | 1.60 | 1.40 | .60 | .20 | ..... |
| 30 | 2.40 | 2.90 | 1.60 | 4.50 | .60 | .20 | ..... |
| 31 | ..... | 2.70 | 1.60 | ..... | .60 | ..... | ..... |

a Night of Oct. 1 gage reading 17.85. b Flood. c Morning of Oct. 15 gage reading 17.95.

*Mean daily discharge, in second-feet, of Pecos River near Fort Sumner, N. Mex., for 1904.*

| Day. | June. | July. | Aug. | Day. | June. | July. | Aug. | Day. | June. | July. | Aug. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ..... | 760 | 380 | 12 | 180 | 310 | ..... | 23 | 1,000 | 285 | ..... |
| 2 | ..... | 3,340 | 345 | 13 | 220 | 84 | ..... | 24 | 260 | 695 | ..... |
| 3 | ..... | 540 | 2,050 | 14 | 295 | 62 | ..... | 25 | 110 | 490 | ..... |
| 4 | ..... | 395 | 1,070 | 15 | 250 | 62 | ..... | 26 | 90 | 400 | ..... |
| 5 | ..... | 235 | 910 | 16 | 1,275 | 76 | ..... | 27 | 90 | 910 | ..... |
| 6 | ..... | 130 | 910 | 17 | 320 | 61 | ..... | 28 | 80 | 420 | ..... |
| 7 | ..... | 93 | 285 | 18 | 180 | 140 | ..... | 29 | 72 | 270 | ..... |
| 8 | ..... | 76 | 985 | 19 | 140 | 5,670 | ..... | 30 | 72 | 193 | ..... |
| 9 | ..... | 62 | 132 | 20 | 84 | 760 | ..... | 31 | ..... | 132 | ..... |
| 10 | ..... | 62 | 1,070 | 21 | 600 | 345 | ..... | | | | |
| 11 | ..... | 62 | 100 | 22 | 3,940 | 2,820 | ..... | | | | |

Daily discharge obtained from discharge measurements, taking into account the time interval, gage height, and the change in bed.

*Estimated monthly discharge[a] of Pecos River near Fort Sumner, N. Mex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| June 12–30 | 3,940 | 72 | 487 | 18,350 |
| July | 5,670 | 61 | 643 | 39,540 |
| August 1–11 | 2,050 | 100 | 749 | 16,340 |

[a] See footnote to daily discharges.

PECOS RIVER NEAR ROSWELL, N. MEX.

This station was established April 24, 1903, by W. M. Reed. It is located at the highway bridge 8 miles southeast of Roswell, N. Mex., and about 200 feet below the mouth of Hondo River. The gage is painted on the right side of the right pier of the bridge. It is read twice each day by Miss Dovie Goldsmith. Discharge measurements are made from the highway bridge at the gage. The initial point for soundings is a zero marked on the guard rail at the west end and north side of the bridge. The channel is straight for one-half mile above and below the station, and has a width at low water of about 50 feet and at ordinary high water of 430 feet. The channel is broken by three iron piers. The current is rapid except near the mouth of Hondo River, where it becomes sluggish. At high water the Pecos and the Hondo join above the bridge. The gage heights on the Pecos may be effected by back water at periods when the Pecos is low and the Hondo is high. Both banks are high and free from timber, but overflow at extreme flood stages. The bed is sandy and shifting and the cross section changes during each flood. The bench mark is the top of the pier upon which the gage is painted. Its elevation is 20.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. M. Reed, district hydrographer.

*Discharge measurements of Pecos River near Roswell, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| March 5 | H. C. Hurd | 46 | [a] 37 | 1.30 | 3.30 | 48 |
| March 29 | F. L. Dobson | 35 | 27.5 | 1.06 | 3.20 | 29 |
| May 20 | do | 120 | 98 | .45 | 3.20 | 44 |
| June 24 | J. M. Roberts | 365 | 805 | 2.88 | 5.40 | 2,322 |
| July 27 | F. L. Dobson | 70 | 160 | 3.14 | 4.50 | 505 |
| September 1 | do | 40 | [b] 62 | .81 | 2.96 | 50 |
| September 16 | do | 70 | 134 | 2.18 | 3.70 | 291 |
| November 28 | do | 876 | 22,236 | 2.50 | 17.40 | [c] 55,690 |

[a] River bottom filled with quicksand which is constantly changing; this accounts for changing area
[b] Low water cross section changed owing to recent floods.
[c] Kutter's formula.

*Mean daily gage height, in feet, of Pecos River near Roswell, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.00 | 3.85 | 3.45 | 3.35 | 3.20 | 3.25 | 4.45 | 4.00 | 2.96 | 16.45 | 2.60 |
| 2 | 4.00 | 3.85 | 3.45 | 3.35 | 3.10 | 3.20 | 3.80 | 4.00 | 2.96 | 15.00 | 2.60 |
| 3 | 4.00 | 3.85 | 3.45 | 3.35 | 3.15 | 3.20 | 5.80 | 4.45 | 3.80 | ..... | 2.60 |
| 4 | 4.00 | 3.85 | 3.40 | 3.35 | 3.20 | 3.15 | 4.60 | 5.00 | 5.50 | ..... | 2.60 |
| 5 | 4.00 | 3.85 | 3.40 | 3.35 | 3.20 | 3.10 | 4.40 | 4.20 | 4.05 | 4.00 | 2.60 |
| 6 | 4.00 | 3.80 | 3.35 | 3.40 | 3.25 | 3.10 | 4.45 | 5.10 | 3.90 | 3.90 | 2.60 |
| 7 | 4.00 | 3.80 | 3.30 | 3.60 | 3.25 | 3.10 | 3.80 | 4.80 | 3.70 | 3.75 | 2.60 |
| 8 | 4.00 | 3.80 | 3.25 | 3.50 | 3.25 | 3.10 | 3.65 | 4.70 | 3.70 | ..... | 2.60 |
| 9 | 4.00 | 3.80 | 3.25 | 3.45 | 3.20 | 3.10 | 3.60 | 5.20 | 3.50 | 6.45 | 2.60 |
| 10 | 4.00 | 3.80 | 3.20 | 3.45 | 3.20 | 3.10 | 3.60 | 5.00 | 3.20 | 4.45 | 2.60 |
| 11 | 4.00 | 3.75 | 3.20 | 3.45 | 3.20 | 3.10 | 3.55 | 5.00 | 3.20 | 5.00 | 2.60 |
| 12 | 4.00 | 3.75 | 3.20 | 3.40 | 3.20 | 3.10 | 3.55 | 5.00 | 3.20 | 4.45 | 2.55 |
| 13 | 4.00 | 3.75 | 3.20 | 3.40 | 3.20 | 4.00 | 3.40 | 5.00 | 3.20 | 4.00 | 2.55 |
| 14 | 4.00 | 3.75 | 3.10 | 3.35 | 3.20 | 4.45 | 3.35 | 5.00 | 3.95 | 3.35 | 2.55 |
| 15 | 4.00 | 3.75 | 3.10 | 3.35 | 3.25 | 4.45 | 3.30 | 4.70 | 4.45 | 3.20 | 2.55 |
| 16 | 4.00 | 3.75 | 3.15 | 3.35 | 3.25 | 4.15 | 3.20 | 4.60 | 3.70 | 4.00 | 2.40 |
| 17 | 4.00 | 3.70 | 3.20 | 3.45 | 3.20 | 4.10 | 3.20 | 4.00 | 3.95 | 3.00 | 2.40 |
| 18 | 4.00 | 3.65 | 3.20 | 3.35 | 3.20 | 4.20 | 3.10 | 4.10 | 3.45 | 3.00 | 2.40 |
| 19 | 4.00 | 3.65 | 3.25 | 3.35 | 3.20 | 4.00 | 3.65 | 3.88 | 3.00 | 2.80 | 2.35 |
| 20 | 4.00 | 3.60 | 3.25 | 3.35 | 3.20 | 4.00 | 5.45 | 3.88 | 2.95 | 2.70 | 2.35 |
| 21 | 3.85 | 3.55 | 3.25 | 3.30 | 3.25 | 3.75 | 5.10 | 3.88 | 2.45 | 2.70 | 2.30 |
| 22 | 3.85 | 3.50 | 3.25 | 3.30 | 3.35 | 3.70 | 5.00 | 3.63 | 2.90 | 2.70 | 2.30 |
| 23 | 3.85 | 3.45 | 3.25 | 3.30 | 3.40 | 5.75 | 5.45 | 3.63 | 3.20 | 2.65 | 2.30 |
| 24 | 3.85 | 3.45 | 3.30 | 3.30 | 3.75 | 6.00 | 4.45 | 3.29 | 3.45 | 2.65 | 2.30 |
| 25 | 3.85 | 3.45 | 3.30 | 3.25 | 3.60 | 4.45 | 4.45 | 3.13 | 3.50 | 2.65 | 2.20 |
| 26 | 3.85 | 3.45 | 3.35 | 3.50 | 3.65 | 4.25 | 4.50 | 3.13 | 3.90 | 2.65 | 2.00 |
| 27 | 3.85 | 3.45 | 3.25 | 3.30 | 3.75 | 3.80 | 4.30 | 2.96 | 3.50 | 2.65 | ..... |
| 28 | 3.85 | 3.45 | 3.35 | 3.25 | 3.65 | 3.75 | 4.10 | 2.96 | 3.65 | 2.65 | ..... |
| 29 | 3.80 | 3.45 | 3.35 | 3.25 | 3.45 | 3.65 | 4.10 | 2.96 | 5.50 | 2.65 | ..... |
| 30 | 3.80 | ..... | 3.35 | 3.25 | 3.25 | 3.55 | 4.00 | 3.13 | 16.45 | 2.80 | ..... |
| 31 | 3.00 | ..... | 3.35 | ..... | 3.20 | ..... | 4.00 | 3.13 | ..... | 2.80 | ..... |

PECOS RIVER AT CARLSBAD, N. MEX.

This station was established May 20, 1903, by V. L. Sullivan, acting under the direction of W. M. Reed. It is located at the Green Street Bridge, Carlsbad, N. Mex., and is about 500 feet below the station of the Pecos Valley and Northeastern Railway and 2,000 feet below the Hagerman power dam. The gage consists of a 2 by 8 inch plank securely spiked at an inclination of 10° with the vertical to the timbers of the third bent from the west end of the bridge. It is painted white and graduated in black to vertical feet and tenths. Readings are taken twice daily by V. L. Sullivan, a civil engineer in the employ of the Pecos Valley Irrigation Company. Discharge measurements are made by wading when the stage of the river will permit, and from the lower side of the bridge during floods. The initial point for soundings is on the south side of the bridge at the west abutment, and 10-foot intervals are marked on the rail. Both banks are high and not subject to overflow. The bed of the river is solid rock, much corrugated, which makes low-water measurements subject to considerable inaccuracy. The channel is straight for some distance above and below the station. The current is swift at the station, but sluggish both above and below. The only bench mark is the initial point for soundings, which is 22.30 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. M. Reed, district hydrographer.

*Discharge measurements of Pecos River at Carlsbad, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| March 30 | F. S. Dobson | 100 | 45 | 1.17 | 0.55 | 52 |
| May 27 | V. L. Sullivan | 100 | 54 | 2.85 | .75 | 112 |
| August 15 | do | 125 | 113 | 2.36 | 1.10 | 267 |

*Mean daily gage height, in feet, of Pecos River at Carlsbad, N. Mex., for 1904.*

| Day | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.64 | 0.84 | 0.68 | 0.68 | 0.67 | 0.67 | 0.70 | 0.73 | 0.74 | 3.45 | 2.80 | 1.87 |
| 2 | .64 | .74 | .68 | .68 | .67 | .67 | .70 | .73 | .74 | a11.00 | 2.80 | 1.87 |
| 3 | .65 | .70 | .68 | .67 | .67 | .67 | .70 | .73 | .74 | ..... | 2.63 | 1.87 |
| 4 | ..... | .70 | .68 | .67 | .69 | .67 | .70 | .73 | .74 | ..... | 2.42 | 1.86 |
| 5 | .65 | .70 | .68 | .67 | .75 | ..... | .70 | .73 | .74 | ..... | 2.39 | 1.86 |
| 6 | .65 | .70 | .68 | .67 | .70 | .69 | .70 | 1.40 | .74 | ..... | 2.28 | 1.85 |
| 7 | .65 | .70 | .30 | .67 | .68 | .69 | .70 | .74 | .74 | ..... | 2.19 | 1.84 |
| 8 | .65 | .70 | .41 | .67 | .34 | .72 | .70 | .74 | .74 | ..... | 2.15 | 1.83 |
| 9 | .65 | .70 | .56 | .67 | .00 | .69 | .70 | .74 | .74 | ..... | 2.11 | 1.82 |
| 10 | .65 | .69 | .68 | .67 | .67 | .69 | .70 | .74 | .74 | ..... | 1.80 | 1.81 |
| 11 | .66 | .69 | .63 | .67 | .67 | .69 | .70 | .74 | .74 | 7.60 | 1.18 | 1.80 |
| 12 | .66 | .69 | .83 | .67 | .67 | .79 | .70 | .74 | .74 | 5.90 | 1.13 | 1.79 |
| 13 | .66 | ..... | ..... | .67 | .67 | .69 | .70 | 1.13 | .74 | 5.45 | 1.15 | 1.20 |
| 14 | .66 | .69 | .69 | .67 | .67 | .69 | .70 | 1.13 | .98 | 4.85 | 1.10 | 1.19 |
| 15 | .66 | .69 | .69 | .67 | .67 | .69 | .70 | 1.13 | 1.00 | 5.05 | 1.10 | 1.18 |
| 16 | .67 | .68 | .69 | .67 | .67 | .69 | .70 | .75 | 1.03 | 4.30 | 1.10 | 1.18 |
| 17 | .67 | .68 | .69 | .67 | .67 | .69 | .70 | .74 | 1.03 | 4.07 | 1.10 | 1.18 |
| 18 | .67 | .68 | .69 | .67 | .67 | .69 | .70 | .74 | 1.03 | 4.00 | 1.30 | 1.18 |
| 19 | .67 | .68 | .69 | .67 | .67 | .72 | .74 | .74 | 1.03 | 3.75 | 1.40 | 1.18 |
| 20 | .67 | .68 | .69 | .67 | .67 | .69 | .73 | .74 | 1.03 | 3.55 | 1.40 | 1.18 |
| 21 | .67 | .68 | .69 | .67 | .67 | .69 | .70 | .74 | .98 | 3.33 | 1.40 | 1.19 |
| 22 | .67 | .68 | .69 | .67 | .67 | .62 | .70 | .74 | .98 | 3.05 | 1.40 | 1.20 |
| 23 | .88 | .68 | .69 | .67 | .67 | .62 | .70 | .74 | .95 | 2.85 | 1.40 | 1.21 |
| 24 | .88 | .68 | .69 | .67 | .67 | .62 | .70 | .74 | .93 | 2.66 | 1.68 | 1.22 |
| 25 | .86 | .68 | .69 | .67 | .67 | .62 | .70 | .74 | .93 | 2.52 | 1.90 | ..... |
| 26 | .77 | .68 | .69 | .67 | .67 | .75 | .70 | .74 | .88 | 2.41 | 1.88 | ..... |
| 27 | .73 | .68 | .69 | .67 | .67 | .69 | .70 | .74 | .83 | 2.40 | 1.88 | ..... |
| 28 | .75 | .68 | .59 | .67 | .67 | .69 | .72 | .74 | .83 | 2.40 | 1.88 | ..... |
| 29 | .76 | .68 | .58 | .67 | ..... | .69 | .72 | .74 | .83 | 2.40 | 1.88 | ..... |
| 30 | .89 | ..... | .58 | .67 | .67 | .70 | .72 | .74 | .83 | 2.41 | 1.88 | ..... |
| 31 | .88 | ..... | .58 | ..... | .67 | ..... | .72 | .74 | ..... | 2.65 | ..... | ..... |

a Gage and bridge washed out.

## PECOS RIVER AND MARGUERETTA FLUME NEAR PECOS, TEX.

The summer flow of Pecos River is largely dependent upon numerous springs which occur in the limestone country in the vicinity of Roswell and Carlsbad. Owing to the numerous diversions for irrigating purposes, however, the river would be dry in the summer where it crosses into Texas were it not for the waters which are gradually returning to the river through seepage and for the various springs that occur below Carlsbad, N. Mex. This water, unfortunately, is impregnated to a considerable extent with alkali, which renders it undesirable for irrigating purposes.

The station on Pecos River was established January 1, 1898, by Thomas U. Taylor, and is located about 6 miles above Pecos, Tex., at the flume of the Barstow Irrigation Company (old Margueretta Canal Company). This canal diverts the water from Pecos River 3 miles above the flume from the west side of the river. The main canal flows for 3 miles on the west side of the river and then is taken by the

flume across Pecos River to the east side. However, before it reaches the flume the West Valley canal is taken out of the main canal and is made to carry water to the alfalfa farms on the west side of the river. The gage consists of a graduated strip of wood attached to one of the vertical bents of the flume on the upper side of the same. Discharge measurements are made by means of a cable and car, about 600 feet below the flume. No measurements were made during the flood of October, 1904, on account of the cable support and anchorage at the west end being completely washed out. The channel is straight for 75 feet above and several hundred feet below the station. Its width at low water is about 20 feet and at high water is 200 feet. The bed is sandy and shifting. The velocity is poorly distributed and is affected by the aqueduct. In the flume conditions are favorable for accurate measurement. The gage heights on the flume are obtained by measuring the depths of the water in the flume at the west end. The zero of this gage is at the bottom of the flume. The gages of the river have no connection with each other except that they are geographically at the same place on the river and have the same observer, Willard H. Denis, who reads both gages. For the years 1901 to 1904 Mr. Denis has also taken the measurements of the flow of the Pecos and the flume at this station. The canal measurements are made above the flume by wading, a wire being stretched across the river and tagged every 4 feet. Flood discharge measurements are made at a highway bridge east of Pecos. Bench mark No. 1 is the top of the west abutment or pier on the north side. Its elevation is 21.70 feet above the datum of the gage, and is marked "U. S. G. S. B. M. 21.70." Bench mark No. 2 is on the south side of the canal under the window of the water master of the irrigation company, and is marked "U. S. G. S. B. M. 20.95." Its elevation is 20.95 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of Thomas U. Taylor, district hydrographer.

*Discharge measurements of Pecos River near Pecos, Tex., in 1904.*

| Date. | Hydrographer. | Gage height. | Discharge in second-feet. | | |
|---|---|---|---|---|---|
| | | | River. | Flume. | West Valley ditch. |
| | | *Feet.* | | | |
| July 20 | T. U. Taylor | 0.90 | 5.5 | ..... | ..... |
| August 24 | W. H. Denis | 5.60 | 763 | 248 | 0 |
| August 25 | .....do | 4.50 | 473 | 240 | 0 |
| September 25 | .....do | 6.30 | 1,000 | 95 | 0 |
| September 26 | .....do | 5.40 | 760 | 95 | 0 |

*Mean daily discharge, in second-feet, of West Valley ditch near Pecos, Tex., for 1904.*

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

*Mean daily gage height, in feet, of Pecos River near Pecos, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.70 | 2.50 | 1.40 | 1.20 | 0.90 | 0.90 | 2.20 | 0.90 | 1.10 | 3.50 | 5.90 | 4.10 |
| 2 | 1.70 | 2.50 | 1.40 | 1.20 | .90 | .90 | 1.30 | .90 | 1.10 | 3.50 | 5.80 | 4.10 |
| 3 | 1.70 | 2.50 | 1.40 | 1.20 | .90 | .90 | 1.00 | .90 | 1.10 | 7.00 | 6.00 | 4.10 |
| 4 | 1.70 | 2.50 | 1.40 | 1.20 | .90 | .90 | 1.00 | .90 | 6.00 | 9.00 | 6.00 | 5.30 |
| 5 | 1.70 | 2.50 | 1.30 | 1.00 | .90 | .90 | 1.00 | 1.00 | 4.00 | 19.00 | 5.90 | 5.00 |
| 6 | 1.50 | 2.40 | 1.40 | 1.00 | .90 | .90 | 1.00 | 1.50 | 3.20 | 17.00 | 5.50 | 5.00 |
| 7 | 1.50 | 1.80 | 1.30 | 1.00 | .90 | .90 | 1.00 | 1.50 | 3.00 | 15.50 | 5.50 | 5.00 |
| 8 | 1.50 | 1.80 | 1.30 | 1.00 | .90 | .90 | 1.00 | 5.50 | 3.00 | 13.00 | 5.50 | 4.90 |
| 9 | 1.50 | 1.80 | 1.30 | 1.00 | .90 | .90 | 1.00 | 4.20 | 3.00 | 13.00 | 5.50 | 4.90 |
| 10 | 1.80 | 1.80 | 1.30 | 1.00 | .90 | .90 | .90 | 2.00 | 3.00 | 11.00 | 5.40 | 4.90 |
| 11 | 1.90 | 1.80 | 1.30 | 1.00 | .90 | .90 | .90 | 1.50 | 2.60 | 10.50 | 5.40 | 4.80 |
| 12 | 2.00 | 1.80 | 1.30 | 1.00 | .90 | .90 | .90 | 1.30 | 2.40 | 14.00 | 5.20 | 4.60 |
| 13 | 2.00 | 1.80 | 1.30 | 1.00 | .90 | .90 | .90 | 1.30 | 3.00 | 13.00 | 4.10 | 4.40 |
| 14 | 2.00 | 1.80 | 1.30 | 1.00 | .90 | .90 | .90 | 1.30 | 3.50 | 12.00 | 4.10 | 3.80 |
| 15 | 2.00 | 1.30 | 1.30 | 1.00 | .90 | .90 | .90 | 1.30 | 5.00 | 9.00 | 4.10 | 3.80 |
| 16 | 2.00 | 1.30 | 1.30 | 1.00 | .90 | .90 | .90 | 1.30 | 4.50 | 8.40 | 4.00 | 3.80 |
| 17 | 2.00 | 1.30 | 1.30 | 1.00 | .90 | .90 | .90 | 1.60 | 4.50 | 8.20 | 4.00 | 3.50 |
| 18 | 2.00 | 1.30 | 1.30 | 1.00 | .90 | .90 | .90 | 1.50 | 3.00 | 8.10 | 3.90 | 3.30 |
| 19 | 1.90 | 1.30 | 1.30 | 1.00 | .90 | .90 | .90 | 1.40 | 3.00 | 7.80 | 3.90 | 3.00 |
| 20 | 1.90 | 1.30 | 1.10 | 1.00 | .90 | .90 | .90 | 1.30 | 2.90 | 7.30 | 4.10 | 2.80 |
| 21 | 1.90 | 1.30 | 1.10 | 1.00 | 1.00 | .90 | 2.10 | 1.00 | 2.80 | 7.00 | 4.00 | 2.60 |
| 22 | 1.90 | 1.30 | 1.10 | 1.00 | 1.00 | .90 | 1.50 | 1.00 | 2.80 | 7.00 | 4.00 | 2.40 |
| 23 | 1.80 | 1.30 | 1.10 | 1.00 | 6.50 | .90 | 1.30 | 1.00 | 3.00 | 6.90 | 4.00 | 2.10 |
| 24 | 1.80 | 1.30 | 1.10 | .90 | 4.50 | .90 | 1.30 | 6.00 | 3.00 | 6.80 | 3.90 | 2.10 |
| 25 | 1.80 | 1.30 | 1.10 | .90 | 2.40 | .90 | 1.30 | 3.00 | 7.00 | 6.50 | 3.90 | 2.0 |
| 26 | 1.80 | 2.50 | 1.10 | .90 | 2.20 | .90 | 1.10 | 2.50 | 5.20 | 5.00 | 3.90 | 2.00 |
| 27 | 2.40 | 1.30 | 1.20 | .90 | 1.80 | 4.00 | 1.10 | 2.00 | 4.50 | 5.00 | 4.00 | 2.00 |
| 28 | 2.40 | 1.30 | 1.20 | .90 | 1.00 | 4.50 | 1.10 | 1.50 | 4.20 | 5.00 | 4.00 | 2.00 |
| 29 | 2.30 | 1.30 | 1.20 | .90 | .90 | 3.00 | 1.00 | 1.50 | 3.50 | 4.90 | 4.00 | 2.00 |
| 30 | 2.30 | ..... | 1.20 | .90 | .90 | 3.00 | .90 | 1.40 | 3.00 | 6.00 | 4.00 | 2.00 |
| 31 | 2.30 | ..... | 1.20 | ..... | .90 | ..... | .90 | 1.30 | ..... | 6.00 | ..... | 2.00 |

*Mean daily gage height, in feet, of flume of the Barstow Irrigation Company[a] near Pecos, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.1 | 2.0 | 2.0 | 1.8 | 0.9 | 1.4 | 2.0 | 0.6 | 2.1 | 1.8 |
| 2 | 2.1 | 2.0 | 2.0 | 1.8 | .9 | 1.2 | 1.6 | .6 | 2.0 | 1.7 |
| 3 | 2.1 | 2.0 | 2.0 | 1.1 | .9 | 1.0 | 2.0 | .7 | 2.1 | 1.8 |
| 4 | 2.1 | 2.0 | 2.0 | 1.2 | .9 | 1.0 | 2.0 | .7 | 2.5 | 1.8 |
| 5 | 2.1 | 2.0 | 2.0 | 1.5 | .9 | 1.0 | 2.0 | 2.1 | 2.4 | (b) |
| 6 | 2.0 | 2.0 | 1.4 | 1.4 | .9 | .9 | 1.9 | 2.5 | 2.4 | ..... |
| 7 | 2.0 | 2.1 | 1.3 | 1.4 | 1.0 | .8 | 1.9 | 2.3 | 1.4 | ..... |
| 8 | 2.1 | 2.1 | 1.3 | 1.4 | 1.0 | .7 | 1.8 | 3.2 | 1.4 | ..... |
| 9 | 2.1 | 2.1 | 1.3 | 1.4 | 1.4 | .7 | 1.3 | 3.1 | 1.4 | ..... |
| 10 | 2.0 | 2.1 | 1.3 | 1.5 | 1.4 | .7 | 1.3 | 3.0 | 1.0 | ..... |
| 11 | 1.8 | 2.1 | 1.2 | 1.4 | 1.5 | 1.4 | 1.3 | 3.0 | 1.0 | ..... |
| 12 | 1.8 | 2.1 | 1.1 | 1.4 | 1.6 | 1.4 | 1.3 | 2.0 | 1.6 | ..... |
| 13 | 1.8 | 2.1 | 1.2 | 1.4 | 1.3 | 1.4 | 1.3 | 1.6 | 1.0 | ..... |
| 14 | 1.8 | 2.1 | 1.2 | 1.4 | 1.0 | 1.4 | 1.2 | 1.6 | .4 | ..... |
| 15 | 1.8 | 2.3 | 1.2 | 1.9 | 1.0 | 1.4 | 1.0 | 1.6 | .4 | ..... |
| 16 | 1.8 | 2.3 | 1.4 | 2.1 | .4 | 1.3 | .9 | 2.0 | .4 | ..... |
| 17 | 1.8 | 2.3 | 1.4 | 2.1 | .4 | 1.3 | 1.3 | 1.9 | .6 | ..... |
| 18 | 1.8 | 2.3 | 1.4 | 2.0 | .4 | 1.0 | 1.9 | 1.9 | 1.3 | ..... |
| 19 | 1.8 | 2.3 | 1.4 | 1.0 | .5 | 1.4 | 1.6 | 1.9 | .9 | ..... |
| 20 | 1.8 | 2.3 | 1.4 | 1.5 | .9 | 1.5 | 1.5 | 2.2 | .9 | ..... |
| 21 | 1.8 | 2.3 | 1.4 | 1.6 | 1.0 | 1.3 | 2.6 | 1.9 | 1.0 | ..... |
| 22 | 1.8 | 2.3 | 1.4 | 1.6 | 1.5 | 1.3 | 2.0 | 1.9 | 1.0 | ..... |
| 23 | 2.0 | 2.3 | 1.4 | 1.5 | 2.2 | 1.3 | 2.1 | 1.9 | 1.8 | ..... |
| 24 | 2.0 | 2.3 | 1.4 | 1.0 | 2.2 | 1.3 | 1.9 | 2.8 | 1.7 | ..... |
| 25 | 2.0 | 2.3 | 1.4 | 1.0 | 2.3 | 1.1 | 1.5 | 3.0 | 1.9 | ..... |
| 26 | 2.0 | 0.5 | 1.4 | 1.0 | 2.0 | 1.5 | 1.6 | 2.8 | 1.7 | ..... |
| 27 | 2.0 | 2.2 | 1.1 | 1.0 | 1.9 | 2.5 | 1.5 | 2.7 | 1.7 | ..... |
| 28 | 2.0 | 2.0 | 1.8 | 1.0 | 1.6 | 3.3 | 1.5 | 2.6 | 1.8 | ..... |
| 29 | 2.0 | 2.0 | 1.8 | 1.0 | 1.5 | 3.3 | 1.0 | 2.6 | 1.8 | ..... |
| 30 | 1.8 | ..... | 1.8 | 1.0 | 1.5 | 3.3 | .9 | 2.5 | 1.8 | ..... |
| 31 | 2.0 | ..... | 1.8 | ..... | 1.4 | ..... | .6 | 2.4 | ..... | ..... |

[a] Old Margueretta Canal Company.

[b] Flume destroyed by flood.

*Rating table for Pecos River near Pecos, Tex., from January 1 to October 4, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.90 | 6 | 2.20 | 79 | 3.50 | 255 | 4.80 | 550 |
| 1.00 | 9 | 2.30 | 88 | 3.60 | 274 | 4.90 | 577 |
| 1.10 | 12 | 2.40 | 98 | 3.70 | 294 | 5.00 | 604 |
| 1.20 | 16 | 2.50 | 108 | 3.80 | 315 | 5.20 | 660 |
| 1.30 | 20 | 2.60 | 119 | 3.90 | 336 | 5.40 | 718 |
| 1.40 | 25 | 2.70 | 131 | 4.00 | 358 | 5.60 | 779 |
| 1.50 | 30 | 2.80 | 143 | 4.10 | 380 | 5.80 | 842 |
| 1.60 | 36 | 2.90 | 156 | 4.20 | 403 | 6.00 | 907 |
| 1.70 | 42 | 3.00 | 170 | 4.30 | 426 | 6.50 | 1,080 |
| 1.80 | 49 | 3.10 | 185 | 4.40 | 450 | 7.00 | 1,265 |
| 1.90 | 56 | 3.20 | 201 | 4.50 | 474 | | |
| 2.00 | 63 | 3.30 | 218 | 4.60 | 499 | | |
| 2.10 | 71 | 3.40 | 236 | 4.70 | 524 | | |

The above table is based upon 5 discharge measurements made during 1904 and the general form of the 1903 curve. The section has filled materially during the low-water periods of 1903 and 1904, but the curve can be considered as representing the flow fairly well to October 4, 1904. Owing to the probable change in section during the October floods estimates for the last three months are withheld.

*Rating table for flume of the Barstow Irrigation Company near Pecos, Tex., from January 1 to October 4, 1904.*

| Gage height. | Discharge. | Gage height. | Discharge. | Gage height. | Discharge. | Gage height | Discharge. |
|---|---|---|---|---|---|---|---|
| *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* | *Feet.* | *Second-feet.* |
| 0.40 | 7 | 1.20 | 37 | 2.00 | 107 | 2.80 | 233 |
| .50 | 10 | 1.30 | 43 | 2.10 | 120 | 2.90 | 252 |
| .60 | 13 | 1.40 | 50 | 2.20 | 134 | 3.00 | 271 |
| .70 | 16 | 1.50 | 57 | 2.30 | 149 | 3.10 | 291 |
| .80 | 19 | 1.60 | 65 | 2.40 | 164 | 3.20 | 311 |
| .90 | 23 | 1.70 | 74 | 2.50 | 180 | 3.30 | 332 |
| 1.00 | 27 | 1.80 | 84 | 2.60 | 197 | | |
| 1.10 | 32 | 1.90 | 95 | 2.70 | 215 | | |

The above table is based upon discharge measurements made during 1903 and 1904. It is fairly well defined.

NOTE.—Flume was carried away by the flood of October 5, 1904.

*Estimated monthly discharge[a] of Pecos River near Pecos, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 205 | 140 | 157 | 9,654 |
| February | 215 | 118 | 173 | 9,951 |
| March | 132 | 48 | 78.3 | 4,814 |
| April | 129 | 33 | 64.3 | 3,826 |
| May | 1,214 | 13 | 111 | 6,825 |
| June | 806 | 22 | 116 | 6,902 |
| July | 268 | 19 | 83.7 | 5,146 |
| August | 1,140 | 19 | 238 | 14,630 |
| September | 1,360 | 119 | 357 | 21,240 |
| October 1–4 | 1,749 | 329 | 1,022 | 8,108 |

[a] Includes flume of the Barstow Irrigation Company, but not West Valley ditch.

## PECOS RIVER NEAR MOORHEAD, TEX.

This station was established by the International (Water) Boundary Commission in April, 1900. It is near Moorhead, immediately above the high bridge of the Southern Pacific Railway.

The observations at this station during 1904 have been made under the direction of the International (Water) Boundary Commission.

*Discharge measurements of Pecos River near Moorhead, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| January 4 | J. D. Dillard | 659 | 0.36 | 0.9 | 234 |
| January 8 | do | 660 | .35 | .9 | 228 |
| January 13 | do | 654 | .31 | .85 | 201 |
| January 19 | do | 653 | .31 | .85 | 201 |
| January 24 | do | 650 | .29 | .8 | 191 |
| January 29 | do | 650 | .29 | .8 | 191 |
| February 3 | do | 647 | .29 | .8 | 190 |
| February 8 | do | 644 | .28 | .8 | 178 |
| February 13 | do | 646 | .28 | .8 | 183 |
| February 18 | do | 668 | .34 | .9 | 225 |
| February 23 | do | 659 | .31 | .9 | 204 |
| February 28 | do | 662 | .32 | .9 | 213 |
| March 4 | do | 645 | .28 | .8 | 180 |
| March 9 | do | 644 | .28 | .8 | 181 |
| March 14 | do | 644 | .27 | .8 | 174 |

*Discharge measurements of Pecos River near Moorhead, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| March 19 | J. D. Dillard | 638 | 0.25 | 0.75 | 162 |
| March 28 | do | 618 | .25 | .65 | 157 |
| April 2 | do | 614 | .21 | .6 | 128 |
| April 7 | do | 625 | .20 | .6 | 126 |
| April 14 | do | 625 | .20 | .6 | 128 |
| April 19 | do | 609 | .20 | .55 | 123 |
| April 25 | do | 609 | .21 | .55 | 130 |
| April 29 | do | 612 | .20 | .55 | 125 |
| May 4 | do | 624 | .19 | .55 | 121 |
| May 8 | do | 641 | .25 | .75 | 161 |
| May 13 | do | 591 | .19 | .5 | 112 |
| May 19 | do | 619 | .19 | .5 | 117 |
| May 26 | do | 958 | 2.33 | 3.6 | 2,230 |
| May 30 | do | 828 | 1.34 | 2.5 | 1,110 |
| June 3 | do | 682 | .49 | 1.25 | 335 |
| June 8 | do | 1,092 | 3.11 | 4.8 | 3,401 |
| June 13 | do | 811 | 1.02 | 2.0 | 831 |
| June 17 | do | 717 | .50 | 1.3 | 355 |
| June 22 | do | 696 | .36 | 1.05 | 254 |
| June 29 | do | 1,083 | 2.98 | 4.35 | 3,223 |
| July 7 | E. E. Winter | 764 | .84 | 1.6 | 639 |
| July 13 | do | 781 | .86 | 1.7 | 675 |
| July 16 | do | 667 | .42 | 1.0 | 283 |
| July 23 | do | 674 | .42 | 1.0 | 286 |
| July 27 | do | 677 | .43 | 1.0 | 289 |
| July 31 | do | 677 | .44 | 1.0 | 296 |
| August 5 | do | 625 | .38 | .8 | 235 |
| August 10 | do | 636 | .35 | .8 | 223 |
| August 15 | do | 636 | .36 | .8 | 229 |
| August 19 | do | 660 | .43 | .85 | 285 |
| August 24 | do | 638 | .41 | .75 | 261 |
| August 27 | do | 636 | .39 | .75 | 250 |
| August 31 | do | 630 | .38 | .75 | 238 |
| September 3 | do | 631 | .35 | .7 | 221 |
| September 8 | do | 964 | 1.57 | 2.5 | 1,513 |
| September 15 | do | 766 | .66 | 1.5 | 508 |
| September 17 | do | 809 | .75 | 1.9 | 609 |
| September 22 | do | 899 | 1.53 | 2.5 | 1,379 |
| September 24 | do | 828 | 1.22 | 2.1 | 1,007 |
| September 29 | do | 826 | .78 | 1.9 | 646 |

*Discharge measurements of Pecos River near Moorhead, Tex., in 1904*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Feet per sec.* | *Feet.* | *Second-feet.* |
| October 5 | E. E. Winter | 805 | 0.84 | 1.7 | 674 |
| October 8 | do | 844 | 1.07 | 2.6 | 902 |
| October 10 | do | 1,004 | 1.98 | 3.5 | 1,986 |
| October 14 | do | 1,058 | 2.00 | 3.8 | 2,116 |
| October 17 | do | 1,154 | 2.99 | 4.5 | 3,451 |
| October 23 | do | 1,294 | 4.40 | 5.4 | 5,695 |
| October 30 | do | 1,028 | 3.05 | 4.2 | 3,138 |
| November 3 | do | 946 | 2.10 | 3.2 | 1,983 |
| November 7 | do | 842 | 1.81 | 2.8 | 1,521 |
| November 11 | do | 872 | 2.20 | 3.0 | 1,919 |
| November 15 | do | 822 | 2.03 | 2.9 | 1,667 |
| November 18 | do | 794 | 1.77 | 2.7 | 1,404 |
| November 22 | do | 812 | 1.21 | 2.3 | 983 |
| November 26 | do | 824 | 1.47 | 2.5 | 1,215 |
| November 30 | do | 801 | 1.26 | 2.3 | 1,013 |
| December 5 | do | 824 | 1.07 | 2.3 | 882 |
| December 9 | do | 822 | 1.08 | 2.3 | 889 |
| December 13 | do | 808 | .99 | 2.2 | 797 |
| December 17 | do | 805 | .99 | 2.2 | 798 |
| December 21 | do | 802 | 1.01 | 2.2 | 813 |
| December 29 | do | 719 | .94 | 1.75 | 674 |

*Mean daily gage height, in feet, of Pecos River near Moorhead, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.85 | 0.8 | 0.9 | 0.6 | 0.55 | 1.6 | 2.0 | 0.9 | 0.7 | 2.05 | 3.35 | 2.3 |
| 2 | .85 | .8 | .85 | .6 | .55 | 1.25 | 2.0 | .85 | .7 | 2.25 | 3.25 | 2.0 |
| 3 | .85 | .8 | .8 | .7 | .55 | 1.25 | 2.0 | .85 | .7 | 1.95 | 3.2 | 2.2 |
| 4 | .9 | .8 | .8 | .7 | .55 | 1.05 | 2.0 | .8 | .7 | 1.8 | 3.05 | 2.3 |
| 5 | .9 | .8 | .8 | .7 | 1.15 | 1.25 | 1.9 | .8 | .9 | 1.75 | 3.0 | 2.3 |
| 6 | .9 | .8 | .8 | .65 | 1.1 | 4.85 | 1.85 | .8 | 3.25 | 1.7 | 2.95 | 2.25 |
| 7 | .9 | .8 | .8 | .6 | .8 | 5.95 | 1.8 | .8 | 10.1 | 1.6 | 2.85 | 2.25 |
| 8 | .9 | .8 | .8 | .6 | .75 | 3.75 | 1.8 | .8 | 2.4 | 2.1 | 3.75 | 2.25 |
| 9 | .85 | .8 | .8 | .6 | .7 | 2.0 | 1.75 | .8 | 2.45 | 2.9 | 3.7 | 2.3 |
| 10 | .85 | .8 | .8 | .6 | .7 | 1.95 | 1.65 | .9 | 1.4 | 3.3 | 3.45 | 2.3 |
| 11 | .85 | .8 | .8 | .6 | .65 | 2.55 | 1.5 | .8 | 1.7 | 3.3 | 3.0 | 2.25 |
| 12 | .85 | .8 | .8 | .6 | .6 | 2.9 | 1.55 | .8 | 1.7 | 3.45 | 2.9 | 2.25 |
| 13 | .85 | .8 | .8 | .6 | .5 | 1.95 | 1.55 | .8 | 1.75 | 3.65 | 2.9 | 2.25 |
| 14 | .85 | .8 | .8 | .6 | .5 | 1.65 | 1.1 | .75 | 1.65 | 3.75 | 2.9 | 2.2 |
| 15 | .85 | .8 | .8 | .6 | .5 | 1.5 | 1.05 | .8 | 1.6 | 4.1 | 2.85 | 2.2 |
| 16 | .85 | .8 | .8 | .6 | .5 | 1.45 | 1.0 | .8 | 1.5 | 4.3 | 2.8 | 2.2 |
| 17 | .85 | .8 | .75 | .55 | .5 | 1.35 | 1.0 | .8 | 1.75 | 4.45 | 2.75 | 2.2 |
| 18 | .85 | .9 | .75 | .55 | .5 | 1.25 | 1.05 | .8 | 1.95 | 4.6 | 2.6 | 2.2 |
| 19 | .85 | .9 | .75 | .55 | .5 | 1.2 | 1.1 | .8 | 1.85 | 4.75 | 2.45 | 2.2 |
| 20 | .85 | .9 | .7 | .55 | .6 | 1.15 | 1.05 | .8 | 13.6 | 4.9 | 2.4 | 2.2 |
| 21 | .85 | .95 | .7 | .55 | .55 | 1.1 | 1.0 | .8 | 4.6 | 5.0 | 2.3 | 2.2 |
| 22 | .85 | 1.1 | .7 | .75 | .5 | 1.05 | 1.0 | .8 | 3.25 | 5.05 | 2.3 | 2.2 |
| 23 | .85 | .95 | .7 | .65 | .5 | 1.0 | 1.0 | .8 | 2.95 | 5.35 | 2.2 | 2.05 |
| 24 | .8 | .9 | .7 | .6 | .5 | .95 | 1.1 | .75 | 2.1 | 5.3 | 2.1 | 1.95 |
| 25 | .8 | .9 | .7 | .55 | .5 | .9 | 1.1 | .75 | 2.0 | 5.2 | 2.2 | 1.9 |
| 26 | .8 | .9 | .7 | .55 | 2.5 | .8 | 1.0 | .75 | 2.0 | 5.05 | 2.5 | 1.8 |
| 27 | .8 | .9 | .65 | .55 | 1.55 | 11.45 | 1.0 | .75 | 1.9 | 4.8 | 2.5 | 1.8 |
| 28 | .8 | .9 | .65 | .5 | 1.55 | 11.4 | 1.0 | .75 | 1.9 | 4.4 | 2.4 | 1.8 |
| 29 | .8 | .9 | .65 | .6 | 4.0 | 4.2 | 1.0 | .75 | 1.9 | 4.0 | 2.35 | 1.75 |
| 30 | .8 | ..... | .6 | .6 | 2.6 | 2.75 | 1.0 | .75 | 2.35 | 3.9 | 2.3 | 1.75 |
| 31 | .8 | ..... | .6 | ..... | 1.95 | ..... | 1.0 | .75 | ..... | 3.55 | ..... | 1.75 |

*Mean daily discharge, in second-feet, of Pecos River near Moorhead, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 210 | 190 | 215 | 140 | 120 | 565 | 860 | 265 | 220 | 980 | 2,040 | 985 |
| 2 | 210 | 190 | 200 | a130 | 120 | 335 | 860 | 250 | 220 | 1,150 | 2,000 | 660 |
| 3 | 210 | a190 | 185 | 150 | 120 | a335 | 860 | 250 | a220 | 890 | a1,980 | 830 |
| 4 | a235 | 190 | a180 | 150 | a120 | 255 | 860 | 235 | 220 | 760 | 1,810 | 905 |
| 5 | 235 | 185 | 180 | 150 | 300 | 335 | 800 | a235 | 270 | a715 | 1,750 | a880 |
| 6 | 230 | 185 | 180 | 140 | 285 | 3,460 | 770 | 235 | 1,980 | 675 | 1,690 | 830 |
| 7 | 230 | 180 | 180 | a125 | 180 | 4,790 | a740 | 230 | 10,600 | 590 | a1,580 | 835 |
| 8 | a230 | a180 | 180 | 125 | a160 | a2,300 | 740 | 230 | a1,410 | a700 | 2,700 | 840 |
| 9 | 210 | 180 | a180 | 125 | 150 | 830 | 710 | 225 | 1,460 | 1,260 | 2,680 | a890 |
| 10 | 205 | 180 | 180 | 125 | 150 | 800 | 660 | a255 | 450 | a1,740 | 2,420 | 890 |
| 11 | 205 | 180 | 180 | 125 | 140 | 1,270 | 580 | 225 | 710 | 1,740 | a1,920 | 845 |
| 12 | 200 | 180 | 175 | 130 | 130 | 1,550 | 600 | 225 | 710 | 1,830 | 1,770 | 845 |
| 13 | a200 | a185 | 175 | 130 | a110 | a800 | a600 | 225 | 760 | 2,050 | 1,740 | a845 |
| 14 | 200 | 185 | a175 | a130 | 110 | 595 | 335 | 210 | 660 | a2,095 | 1,700 | 795 |
| 15 | 200 | 185 | 175 | 130 | 115 | 490 | 310 | a230 | a610 | 2,630 | a1,600 | 795 |
| 16 | 200 | 185 | 170 | 130 | 115 | 455 | a285 | 230 | 510 | 3,010 | 1,530 | 800 |
| 17 | 200 | 185 | 160 | 125 | 115 | a390 | 285 | 235 | a570 | a3,340 | 1,470 | a800 |
| 18 | 200 | a225 | 160 | 125 | a115 | 335 | 310 | 240 | 650 | 3,680 | a1,290 | 800 |
| 19 | a200 | 225 | a160 | a125 | 115 | 315 | 335 | a245 | 590 | 4,040 | 1,130 | 805 |
| 20 | 200 | 225 | 160 | 125 | 135 | 295 | 310 | 250 | 17,500 | 4,410 | 1,080 | 810 |
| 21 | 200 | 240 | 160 | 125 | 125 | 275 | 285 | 260 | 3,180 | 4,660 | 980 | a815 |
| 22 | 200 | 285 | 160 | 150 | 115 | a255 | 285 | 270 | a1,980 | 4,790 | a980 | 815 |
| 23 | 200 | a225 | 160 | 140 | 115 | 240 | a285 | 280 | 1,740 | a5,570 | 880 | 770 |
| 24 | a190 | 205 | 160 | 135 | 115 | 225 | 335 | a260 | a1,010 | 5,460 | 780 | 740 |
| 25 | 190 | 205 | 160 | a130 | 115 | 210 | 335 | 260 | 830 | 5,220 | 890 | 720 |
| 26 | 190 | 210 | 160 | 130 | a1,110 | 180 | 285 | 255 | 830 | 4,880 | a1,210 | 690 |
| 27 | 190 | 210 | 155 | 130 | 530 | 13,000 | a290 | a250 | 650 | 4,360 | 1,210 | 690 |
| 28 | 190 | a215 | a155 | 120 | 530 | 12,900 | 290 | 250 | 650 | 3,520 | 1,110 | 690 |
| 29 | a190 | 215 | 155 | a130 | 2,630 | a3,070 | 290 | 245 | a650 | 2,780 | 1,060 | a675 |
| 30 | 190 | ..... | 150 | 130 | a1,210 | 1,430 | 295 | 240 | 1,240 | a2,620 | a1,010 | 675 |
| 31 | 190 | ..... | 150 | ..... | 795 | ..... | a295 | a240 | ..... | 2,130 | ..... | 675 |

a Meter measurements.

*Estimated monthly discharge of Pecos River near Moorhead, Tex., for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 235 | 190 | 204 | 12,555 |
| February | 285 | 180 | 201 | 11,544 |
| March | 215 | 150 | 170 | 10,463 |
| April | 150 | 120 | 132 | 7,845 |
| May | 2,630 | 110 | 332 | 20,420 |
| June | 13,000 | 180 | 1,743 | 103,706 |
| July | 860 | 285 | 486 | 29,911 |
| August | 280 | 210 | 243 | 14,945 |
| September | 17,500 | 220 | 1,769 | 105,283 |
| October | 5,570 | 590 | 2,719 | 167,157 |
| November | 2,700 | 780 | 1,533 | 91,220 |
| December | 985 | 660 | 795 | 48,873 |
| The year | 17,500 | 110 | 861 | 623,922 |

## THE PECOS FLOOD OF 1904.

During the latter part of September, 1904, a remarkably heavy rainfall (mostly on the 28th and 29th) occurred in New Mexico, the greater portion of which being in the eastern half of the Territory, and the heaviest rain in this section was in the northern part. Just west of Roswell, another separate area, about 125 miles long and 50 wide, had a similar increase of rainfall above the general average. Arrabella and Hot Springs, N. Mex., seemed to be the two centers of the greatest precipitation in the Pecos Valley drainage. An observer near the headwaters of Pecos River says:

> Between the 26th and 30th of September, 1904, very heavy steady rains fell over nearly the entire Territory. The greatest damage occurred on Thursday morning, September 29, over the eastern slopes of the mountains and along the valleys and lowlands of the northern portion, but the floods were nearly as destructive over the eastern slope of the several mountain ranges in the southwest portion and over the Hondo in the southeast. In an area 500 by 300 miles reports show that a rainfall of from 3 to 7 inches fell within the space of from twenty-four to forty-eight hours.

The flood waters reached Roswell, N. Mex., on September 29, and in the evening of that day the water broke over the banks of the Hondo at 8 p. m., and in fifteen minutes the main street of that city was under water, and the dike, erected for the protection of the city, swept away, likewise the railroad bridge north of the city. The flood at this place lasted about four days, but lines of communication were so damaged that no mail was delivered until October 10. The opera house and about fifteen dwellings were destroyed.

The crest of the flood reached Carlsbad, N. Mex., at 3 a. m., October 2. The irrigation works were badly damaged, the cotton gin and all bridges on Pecos River swept away, and the railway track for miles up and down the river was submerged.

On October 3 the water reached a height of 9 feet on the United States Geological Survey gage 6 miles above Pecos, N. Mex., and it continued to rise slowly for about forty-eight hours. This rise was so gradual that it could scarcely be noted from hour to hour. At 10 p. m. on October 4 it began to rise on the gage at the rate of about 1 foot per hour, and about this time four leaks occurred in the levees of the Barstow Irrigation Company 3½ miles above the flume, on the west side of the river, and which were built to protect the West Valley system from flood waters. This water soon entered the canals, and by 3 a. m., October 5, the canals were filled and soon overflowed so rapidly that many breaks were made in the West Valley canals. Daybreak of October 5 showed a sluggish flood of murky red and gray spread from one-half to 2½ miles in width on either side of the river. The current in the main channel of the river did not seem as boisterous as on the previous days, but at many points along the river currents were running out over the banks into and through the surrounding flats, covering the whole country to the foothills from 2 to 4 feet deep. At 8 a. m., with 19 feet by gage, the flume gave two little snaps, its center bowed downstream, the ends tore loose, the flume slowly rose, emptied its water, broke in two, and the two hulks floated downstream. These two parts, each about 100 feet in length, finally grounded, the one about 1¼ miles below the flume, and the other at a point about 5 miles below, where it had caught on the banks of the river and formed a perfect bridge across the river channel. This section of the flume held this position till the gage read 10.50, but on the night of October 12 a small rise raised the water on the gage to 14, and in the meantime drift had caught above this part of the flume, and the added force carried the broken flume on down the river to the highway bridge east of Pecos City, where it passed under in some almost miraculous manner and caught against the railroad bridge a few hundred feet below. It was soon wrecked sufficiently to allow it to pass under this bridge. It may be remarked here that these two bridges (about 1 mile east of Pecos City) were the only structures that remained across Pecos River during the flood. This was due to the fact that at high water a large portion of the flood waters (perhaps half) flow out on the east side of the river channel and through a quarter-mile trestlework on the Texas and Pacific Railway.

On October 15 the gage at the flume read 9 feet, thus showing that the flood that swept through Roswell, N. Mex., in about three days had spread out enough to make some ten days of extremely high water

near Pecos. About October 20 most of the outlying water had drained back and it had left a deposit of reddish clay and fine sand where the water was sluggish and coarse sand where the water was swift. The depth of this deposit varied from 0.20 to 0.40 feet, except at certain isolated points where a deposit of over 1 foot was left.

Above the main canal of the Barstow Irrigation Company, on the east side of the river, the water reached a depth of 4 feet, and it required a period of two weeks to drain this water off.

After the flume went out on October 5 the water level dropped about 0.30, showing that the flume had little effect on holding the water back. On the west side of the river two-thirds of the alfalfa was killed by the flood and about 50 per cent of the cotton was lost. Out of 900 acres 700 were flooded. On the east side some thousand acres were heavily flooded and as much more lightly flooded. The sorghum was injured very slightly, but from 25 to 50 per cent of the cotton heavily flooded was lost. Very few of the plants were killed, but the bolls were so soaked that they soured and were ruined.

This flood did its greatest damage at its inception in New Mexico, and the damage became less as it approached the Rio Grande. The flood was caused by concentrated floods in two localities in New Mexico, and below Carlsbad the rainfall was moderate, and it decreased in intensity to the south.

### GALLINAS RIVER NEAR LAS VEGAS, N. MEX.

This station was established August 13, 1903, by E. G. Marsh, assisted by R. B. Rice. It is located at Las Vegas Hot Springs, 6 miles above Las Vegas, N. Mex. There are 4 bridges about a quarter mile below the station, but it is impossible to establish a station on any of them for the reason that it would be within the backwater of a dam a quarter mile farther down. There is an adjustable ice dam with a 12-foot fall about 200 feet above the station, but it has no effect upon the measurements. The original gage was a vertical 1 by 8 inch pine board, 10 feet long and graduated to feet and tenths. It was bolted to the masonry wall on the right bank, which protects Hot Springs Nos. 16 and 17. This gage was washed out by the flood of September 29, 1904, and was replaced by a similar rod of 1 by 5 inch pine, by G. B. Monk on October 19, 1904. The new rod is 0.71 foot lower than the old one. All gage heights after September 29, 1904, have been reduced 0.70 foot to make them correspond with the readings on the original gage. The gage is read once each day by William Prager, except when rapid fluctuations make more frequent observations advisable. Discharge measurements are made at low water by wading 600 feet above the gage and at high water from one of the bridges. The initial point for soundings is a cross cut in the rock on the left bank 600 feet above the gage. The channel is straight for

about 200 feet above and 400 feet below the station. The current is swift. The bed and banks of the stream are of solid rock. The banks are high and not liable to overflow. There is but one channel at all stages. There are two bench marks at this station. Bench mark No. 1 is a bolt leaded into the rock on the left bank, 200 feet above the gage and 400 feet below the station; elevation, 19.17 feet above the zero of the new gage. Bench mark No. 2 is the top of the center stone of hot springs No. 17; elevation, 20.23 feet above the zero of the new gage.

This station was established for the purpose of determining the amount of water available for storage in the Sanguyjuella basin, about 6 miles northwest of Las Vegas, N. Mex. The observations during 1904 have been made under the direction of Mr. M. C. Hinderlider, district hydrographer. Owing to the extreme low stage of the river prior to the flood of September 29, 1904, it was impracticable to obtain any discharge measurements.

*Discharge measurements of Gallinas River near Las Vegas, N. Mex., in 1903 and 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height.[a] | Discharge. |
|---|---|---|---|---|---|---|
| 1903. | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| August 13 | E. G. Marsh | ..... | 1.85 | 1.59 | 0.50 | 2.9 |
| 1904. | | | | | | |
| October 11[b] | G. B. Monk | 43 | 54 | 2.50 | 1.60 | 135 |

[a] Gage heights refer to original gage.

[b] Measured from foot bridge.

*Mean daily gage height,[a] in feet, of Gallinas River near Las Vegas, N. Mex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.20 | 0.35 | 0.60 | 0.20 | 0.20 | 0.20 | 0.60 | 0.65 | 0.60 | ..... | 1.20 | 1.00 |
| 2 | .20 | .20 | .50 | .20 | .20 | .20 | .30 | .80 | .50 | ..... | 1.25 | .90 |
| 3 | .20 | .20 | .50 | .20 | .20 | .20 | .20 | .65 | .40 | ..... | 1.15 | .90 |
| 4 | .20 | .20 | .25 | .20 | .25 | .20 | .20 | .50 | .30 | ..... | 1.05 | .90 |
| 5 | .15 | .20 | .20 | .20 | .20 | .20 | .20 | .85 | .30 | ..... | 1.00 | .95 |
| 6 | .10 | .20 | .20 | .20 | .20 | .20 | .20 | .85 | .30 | ..... | 1.05 | 1.00 |
| 7 | .10 | .20 | .20 | .20 | .20 | .20 | .35 | 1.00 | .30 | ..... | 1.10 | 1.00 |
| 8 | .10 | .20 | .35 | .20 | .20 | .20 | .25 | .80 | .20 | 1.80 | 1.10 | .90 |
| 9 | .10 | .20 | .40 | .20 | .20 | .20 | .20 | .50 | .20 | 2.10 | 1.10 | 1.05 |
| 10 | .10 | .20 | .25 | .20 | .20 | .20 | .20 | .50 | .20 | 1.90 | 1.05 | 1.05 |
| 11 | .10 | .20 | .40 | .20 | .20 | .25 | .20 | .40 | .20 | 1.50 | 1.05 | 1.10 |
| 12 | .10 | .20 | .40 | .20 | .20 | .25 | .20 | .40 | .20 | 1.30 | 1.10 | 1.10 |
| 13 | .10 | .20 | .40 | .20 | .20 | .30 | .20 | .45 | .20 | 1.20 | 1.10 | 1.10 |
| 14 | .10 | .20 | .30 | .20 | .20 | .20 | .20 | .50 | .15 | 1.05 | 1.20 | 1.10 |
| 15 | .10 | .20 | .30 | .20 | .20 | .30 | .20 | .50 | .10 | .90 | 1.10 | 1.10 |
| 16 | .10 | .20 | .30 | .20 | .20 | .20 | .20 | .40 | .10 | .90 | .95 | 1.10 |
| 17 | .10 | .20 | .30 | .20 | .20 | .20 | .20 | .50 | .10 | .90 | 1.05 | 1.15 |
| 18 | .10 | .20 | .30 | .20 | .20 | .20 | .57 | 1.98 | .10 | .95 | 1.10 | 1.10 |
| 19 | .15 | .20 | .30 | .20 | .20 | .20 | .20 | .75 | .10 | .95 | 1.10 | 1.10 |
| 20 | .20 | .20 | .30 | .20 | .20 | .20 | .25 | .55 | .10 | 1.00 | 1.10 | 1.10 |
| 21 | .20 | .20 | .30 | .20 | .20 | .20 | .20 | .40 | .10 | 1.00 | 1.10 | 1.10 |
| 22 | .20 | .20 | .20 | .20 | .20 | .20 | .20 | .40 | .10 | 1.00 | 1.10 | 1.10 |
| 23 | .20 | .20 | .20 | .20 | .20 | .20 | .75 | .45 | .10 | 1.10 | 1.10 | 1.10 |
| 24 | .20 | .20 | .20 | .20 | .20 | .20 | .60 | .40 | .10 | 1.10 | 1.05 | 1.10 |
| 25 | .20 | .20 | .20 | .20 | .20 | .20 | .65 | .30 | .10 | 1.10 | 1.20 | 1.10 |
| 26 | .20 | .50 | .20 | .20 | .20 | .20 | .65 | 1.12 | .10 | 1.20 | 1.10 | 1.10 |
| 27 | .20 | .40 | .20 | .20 | .20 | .30 | .75 | 1.00 | .10 | 1.20 | 1.15 | 1.10 |
| 28 | .20 | .40 | .20 | .20 | .20 | .25 | 1.00 | .85 | 1.25 | 1.20 | 1.10 | 1.10 |
| 29 | .20 | .70 | .20 | .20 | .20 | .20 | .60 | .75 | ..... | 1.20 | 1.00 | 1.10 |
| 30 | .20 | ..... | .20 | .20 | .20 | .20 | .50 | .70 | ..... | 1.20 | 1.50 | 1.15 |
| 31 | .20 | ..... | .20 | ..... | .20 | ..... | .65 | .60 | ..... | 1.20 | ..... | 1.20 |

[a] All gage heights refer to original gage.

## HONDO RIVER AT ROSWELL, N. MEX.

This station was established April 25, 1903, by W. M. Reed. It is located at the bridge at the intersection of Main and Vegas streets, Roswell, N. Mex. The gage is a 4 by 4 inch inclined timber set on the right bank 150 feet below the bridge. It is read by members of the Geological Survey office force at Roswell. Discharge measurements are made from the highway bridge. The initial point for soundings is a zero marked on the east stringer at the north end of the bridge. The channel is nearly straight for 50 feet above and 450 feet below the bridge and has a width at ordinary high stages of 40 feet. The current has a moderate velocity. Both banks are low and overgrown with weeds, but are not liable to overflow. The bed of the stream is sandy loam, fairly permanent, and free from vegetation. There is but one channel at all stages. The bench mark is the initial point for soundings. Its elevation is 8.50 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. M. Reed, district hydrographer.

*Discharge measurements of Hondo River at Roswell, N. Mex., in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| May 28 | F. Dobson | 14 | 7 | 0.40 | 0.53 | 2.8 |
| July 3 | do | 25 | 65 | 2.55 | 2.80 | 167 |
| September 28 | do | 31 | 61 | 3.23 | 3.60 | 196 |
| September 28 | do | 22 | 24 | 2.57 | 2.30 | 61 |
| September 28 | do | 22 | 39 | 3.12 | 2.95 | 121 |
| September 29 | do | 32 | 112 | 3.71 | 4.50 | 415 |
| October 1 | do | 26 | 74 | 3.46 | 3.85 | 257 |
| October 10 | do | 29 | 85 | 3.95 | 4.20 | 336 |
| November 2 | do | 12 | 10.8 | 1.27 | .90 | 13.7 |

*Mean daily gage height, in feet, of Hondo River at Roswell, N. Mex., for 1904.*

| Day. | May. | July. | Aug. | Sept. | Oct. | Nov. | Day. | May. | July. | Aug. | Sept. | Oct. | Nov. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 3.90 | 0.70 | 17 | | | | | 1.75 | |
| 2 | | | 0.30 | | 3.25 | .60 | 18 | | 0.15 | | | 1.75 | |
| 3 | | 1.78 | .30 | 1.40 | 2.55 | .60 | 19 | | 1.50 | | | 1.70 | |
| 4 | | .30 | 1.30 | | 2.40 | .60 | 20 | | 1.05 | | | 1.60 | |
| 5 | | | 1.20 | | 2.20 | .60 | 21 | | .00 | | | 1.60 | |
| 6 | | | 1.35 | | 2.15 | .65 | 22 | | 1.25 | | | 1.60 | |
| 7 | | | 3.05 | | 2.65 | .70 | 23 | | 1.60 | | | 1.50 | |
| 8 | | | .50 | | 4.60 | .80 | 24 | | | | | 1.50 | |
| 9 | | | .50 | | 4.80 | .90 | 25 | | | | | 1.40 | |
| 10 | | | 2.95 | | 4.35 | .90 | 26 | | | | | .90 | |
| 11 | | | 1.25 | | 4.50 | .90 | 27 | 0.39 | | | | .90 | |
| 12 | | | | | 3.25 | .90 | 28 | .27 | | | 2.25 | 1.00 | |
| 13 | | | | | 2.70 | .90 | 29 | | | | 3.15 | 1.00 | |
| 14 | | | | .85 | 2.10 | .70 | 30 | | | | 4.30 | .90 | |
| 15 | | | | | 1.90 | .70 | 31 | | | | | .85 | |
| 16 | | | | | 1.75 | .65 | | | | | | | |

NOTE.—River dry during 1904 on days for which no gage height is given.

## HONDO RIVER AT HONDO RESERVOIR SITE, NEW MEXICO.

This station was established March 9, 1903, by W. A. Wilson. It is located at the first New Mexico reservoir dam site, 12 miles southwest of Roswell, N. Mex. A footbridge has been constructed 75 feet below the dam for the purpose of making discharge measurements. The gage is a 4 by 4 inch inclined timber which is located 10 feet north of this bridge. The gage is read twice each day by Lee Hall. The initial point for soundings is 1 foot south of the north end of the west stringer of the bridge. The channel is straight for 200 feet above and

below the station. The current is swift at high water and sluggish at low water. Both banks are high, without trees, and not liable to overflow. There is but one channel at all stages. The bed is composed of shifting sand, and the cross section changes during each flood. Bench mark No. 1 is the upper surface of the crosspiece which supports the stringer at the north end of the bridge. Its elevation is 8.50 feet above the zero of the gage. Bench mark No. 2 is on a ledge of rock which bears S. 45° W. and is 650 feet distant from the gage. Its elevation is 19.10 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. M. Reed, district hydrographer.

*Discharge measurements of Hondo River at Hondo reservoir site, New Mexico, in 1904.*

| Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|
| | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| July 4 | F. Dobson | 27 | 12 | 3.07 | 1.90 | 37 |
| July 19 | W. A. Wilson | 26 | 107 | 5.35 | 7.10 | 573 |
| July 19 | do | 28 | 135 | 5.33 | 7.75 | 720 |
| August 10 | do | 23 | 43 | 3.19 | 2.90 | 137 |
| September 3 | F. Dobson | 18 | 17 | 2.99 | 2.40 | 50 |
| September 23 | do | 22 | 24 | 2.57 | 2.30 | 61 |
| October 11[a] | do | 118 | 622 | 10.16 | 10.64 | 6,322 |
| November 11 | do | 12 | 7.6 | 2.50 | 1.00 | 19 |

[a] Computed by Kutter's formula.

*Mean daily gage height, in feet, of Hondo River at Hondo reservoir site, New Mexico, for 1904.*

| Day. | Jan. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.80 | ..... | ..... | ..... | ..... | 10.05 | 1.20 | 0.95 |
| 2 | .70 | ..... | 1.20 | 2.10 | ..... | 1.80 | 1.20 | .90 |
| 3 | .80 | ..... | 5.10 | 4.25 | 5.60 | 1.15 | 1.20 | .90 |
| 4 | .90 | ..... | 1.95 | 2.90 | 1.45 | 1.00 | 1.15 | .90 |
| 5 | 1.00 | ..... | 1.60 | 3.60 | 1.65 | .70 | 1.10 | 1.35 |
| 6 | 1.10 | ..... | 1.45 | 5.05 | 1.40 | .35 | 1.10 | .90 |
| 7 | 1.10 | ..... | .60 | 2.80 | .60 | 3.05 | 1.10 | .95 |
| 8 | 1.00 | ..... | ..... | 2.50 | ..... | [a]9.90 | 1.05 | .90 |
| 9 | .80 | ..... | ..... | 5.45 | ..... | 8.05 | 1.00 | .90 |
| 10 | .70 | ..... | ..... | 4.05 | ..... | 7.80 | 1.00 | 1.00 |
| 11 | .70 | ..... | ..... | 2.60 | ..... | 5.20 | 1.00 | .95 |
| 12 | .60 | ..... | ..... | 2.35 | ..... | 4.00 | 1.10 | .90 |
| 13 | .50 | ..... | ..... | 1.80 | ..... | 3.35 | 1.05 | .90 |
| 14 | .30 | ..... | ..... | 1.60 | 1.20 | 2.90 | 1.05 | .95 |
| 15 | .10 | ..... | ..... | 1.60 | ..... | 2.55 | .95 | 1.05 |
| 16 | ..... | ..... | ..... | 1.60 | ..... | 2.25 | 1.00 | .95 |
| 17 | ..... | ..... | 1.50 | 1.55 | ..... | 2.00 | 1.00 | 1.05 |
| 18 | .50 | ..... | 1.55 | 1.35 | ..... | 1.75 | 1.00 | 1.00 |
| 19 | .30 | ..... | 5.70 | .60 | ..... | 1.55 | .95 | 1.00 |
| 20 | ..... | ..... | 2.25 | 1.00 | ..... | 1.50 | .95 | 1.00 |
| 21 | ..... | 0.30 | 1.80 | 1.55 | ..... | 1.45 | .95 | 1.00 |
| 22 | ..... | 1.10 | 2.95 | .60 | ..... | 1.40 | 1.00 | .95 |
| 23 | ..... | 1.30 | 3.20 | 1.70 | ..... | 1.35 | 1.00 | .90 |
| 24 | ..... | .60 | 2.00 | 2.90 | 2.60 | 1.30 | .95 | .95 |
| 25 | .20 | ..... | 1.85 | 2.40 | 2.60 | 1.30 | 1.00 | .90 |
| 26 | ..... | ..... | 1.65 | 2.10 | 1.45 | 1.30 | 1.00 | .90 |
| 27 | ..... | ..... | 1.50 | 1.45 | 1.15 | 1.25 | .95 | [b]1.70 |
| 28 | ..... | ..... | 1.40 | .65 | 5.50 | 1.20 | 1.00 | [b]1.35 |
| 29 | ..... | .50 | 1.45 | ..... | 2.30 | 1.15 | 1.00 | [b]1.50 |
| 30 | ..... | ..... | .65 | .60 | [a]9.60 | 1.15 | .95 | [b]1.35 |
| 31 | .15 | ..... | ..... | ..... | ..... | 1.25 | ..... | [b]1.20 |

[a] River over its banks. [b] Ice conditions.

NOTE.—Dry during 1904 on days for which no gage height is given.

## TOYAH CREEK AT TOYAHVALE, TEX.

Toyah Creek is located in trans-Pecos, Texas, in Reeves County, and is fully described in Water-Supply Paper No. 105. It rises in a large spring 40 miles southwest of Pecos, Tex., and the water is used both for irrigation and power purposes, the power plants being a result of the irrigation as they are located upon the irrigation ditches.

About 100 yards north of Toyah Spring, on the land of C. W. Giffin, are two other springs (that derive their waters from a similar underground source), with a combined discharge of 8 second-feet. The location of these springs in arid Texas makes their waters very valuable, and they have been utilized in the excellent irrigation systems that are fully described in Water-Supply Papers Nos. 71 and 105.

The discharge of the main spring has been measured as follows:

*Discharge measurements of Toyah Creek at Toyahvale, Tex., 1900 and 1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| | | *Second-feet.* |
| September 5, 1900 | T. U. Taylor | 46 |
| July 21, 1904 | do | 46 |

### SANTA ROSA SPRING NEAR FORT STOCKTON, TEX.

Santa Rosa Spring is 9 miles from Grand Falls and 28 miles north of Fort Stockton. It rises suddenly in the mesquite prairie and is carried off in ditches to the irrigated farms of Ray and Scott, near the post-office of Santa Lucia. The discharge of the spring, as measured on July 27, 1904, at the irrigation ditch at Santa Lucia, was 4 second-feet.

### COMANCHE CREEK NEAR FORT STOCKTON, TEX.

Comanche Creek is located in Pecos County and has its source at the town of Fort Stockton, and this creek has long been a factor in the civilization of western Texas. It was here where one of the first United States Government forts was established, on account of the excellent water. The oldest irrigation systems in trans-Pecos, Texas, away from the Rio Grande are located here. The waters of this creek are used both for irrigation and power, the power plant being located upon the irrigation ditches.

Discharge measurements have been made as follows:

*Discharge measurements of Comanche Creek near Fort Stockton, Tex., 1899 and 1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| | | *Second-feet.* |
| Summer, 1899 | T. U. Taylor | 66 |
| July 26, 1904 | do | 64 |

### DEVILS RIVER AT DEVILSRIVER, TEXAS.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is opposite the Southern Pacific Railway station at Devilsriver. The river is about 50 miles in length, has a perennial flow, and during flood periods is subject to great fluctuations.

The observations at this station during 1904 have been made under the direction of International (Water) Boundary Commission.

*Discharge measurements of Devils River at Devilsriver, Tex., in 1904.*

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| January 6 | J. D. Dillard | 450 | 1.18 | 2.3 | 529 |
| January 11 | do | 441 | 1.22 | 2.3 | 537 |
| January 17 | do | 450 | 1.21 | 2.3 | 546 |
| January 27 | do | 449 | 1.21 | 2.3 | 542 |
| February 5 | do | 442 | 1.20 | 2.3 | 529 |
| February 15 | do | 446 | 1.15 | 2.3 | 513 |
| February 21 | do | 449 | 1.15 | 2.3 | 517 |
| February 26 | do | 438 | 1.18 | 2.3 | 516 |
| March 7 | do | 440 | 1.11 | 2.25 | 488 |
| March 17 | do | 447 | 1.15 | 2.3 | 512 |
| March 23 | do | 447 | 1.14 | 2.3 | 511 |
| March 30 | do | 438 | 1.12 | 2.25 | 490 |
| April 4 | do | 449 | 1.17 | 2.35 | 526 |
| April 12 [a] | do | 429 | 1.14 | 2.25 | 491 |
| April 22 | do | 664 | 2.68 | 3.7 | 1,777 |
| April 27 | do | 286 | 1.56 | 2.25 | 445 |
| May 6 | do | 317 | 1.54 | 2.25 | 489 |
| May 11 | do | 318 | 1.53 | 2.25 | 485 |
| May 16 | do | 361 | 1.64 | 2.4 | 593 |
| May 23 | do | 336 | 1.55 | 2.3 | 520 |
| May 27 | do | 334 | 1.52 | 2.3 | 509 |
| June 1 | do | 316 | 1.49 | 2.25 | 472 |
| June 6 | do | 590 | 2.31 | 3.25 | 1,361 |
| June 11 | do | 389 | 1.69 | 2.6 | 656 |
| June 20 | do | 339 | 1.57 | 2.4 | 532 |
| June 27 | do | 325 | 1.52 | 2.3 | 495 |
| July 5 | E. E. Winter | 369 | 1.39 | 2.3 | 512 |
| July 11 | do | 356 | 1.27 | 2.3 | 451 |
| July 22 | do | 351 | 1.17 | 2.25 | 412 |
| July 25 | do | 361 | 1.35 | 2.3 | 488 |
| July 29 | do | 362 | 1.33 | 2.3 | 482 |
| August 3 | do | 352 | 1.39 | 2.25 | 489 |
| August 12 | do | 347 | 1.39 | 2.25 | 483 |
| August 16 | do | 342 | 1.41 | 2.25 | 481 |
| August 22 | do | 345 | 1.29 | 2.25 | 444 |
| August 29 | do | 344 | 1.26 | 2.25 | 432 |
| September 9 | do | 647 | 2.23 | 3.3 | 1,443 |
| September 20 | do | 425 | 1.32 | 2.5 | 563 |
| October 4 | do | 422 | 1.44 | 2.5 | 609 |

[a] On April 17 the cable at this station was moved 150 feet downstream. The old gage is still used.

*Discharge measurements of Devils River at Devilsriver, Tex., in 1904.*—Continued.

| Date. | Hydrographer. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|
| | | *Square feet.* | *Ft. per sec.* | *Feet.* | *Second-feet.* |
| October 6 | E. E. Winter | 363 | 1.48 | 2.4 | 538 |
| October 24 | do | 411 | 1.45 | 2.5 | 596 |
| November 4 | do | 374 | 1.35 | 2.4 | 504 |
| November 12 | do | 376 | 1.36 | 2.4 | 513 |
| November 23 | do | 377 | 1.32 | 2.4 | 499 |
| November 27 | do | 352 | 1.29 | 2.35 | 454 |
| December 2 | do | 357 | 1.34 | 2.35 | 478 |
| December 14 | do | 364 | 1.34 | 2.3 | 489 |
| December 22 | do | 344 | 1.30 | 2.3 | 446 |
| December 30 | do | 345 | 1.28 | 2.3 | 443 |

*Mean daily gage height, in feet, of Devils River at Devilsriver, Tex., for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.25 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 |
| 2 | 2.3 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 |
| 3 | 2.3 | 2.3 | 2.25 | 2.35 | 2.3 | 2.25 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 |
| 4 | 2.3 | 2.3 | 2.25 | 2.35 | 2.3 | 2.25 | 2.3 | 2.25 | 2.3 | 2.5 | 2.4 | 2.3 |
| 5 | 2.3 | 2.3 | 2.25 | 2.35 | 2.25 | 2.8 | 2.3 | 2.25 | 2.3 | 2.5 | 2.4 | 2.3 |
| 6 | 2.3 | 2.3 | 2.25 | 2.3 | 2.25 | 3.2 | 2.3 | 2.25 | 2.35 | 2.45 | 2.4 | 2.3 |
| 7 | 2.3 | 2.3 | 2.25 | 2.3 | 2.25 | 2.6 | 2.3 | 2.25 | 2.5 | 2.5 | 2.4 | 2.3 |
| 8 | 2.3 | 2.3 | 2.25 | 2.3 | 2.25 | 2.45 | 2.3 | 2.25 | 2.85 | 2.5 | 2.4 | 2.3 |
| 9 | 2.3 | 2.3 | 2.25 | 2.3 | 2.25 | 2.45 | 2.3 | 2.25 | 3.0 | 2.5 | 2.4 | 2.3 |
| 10 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.45 | 2.3 | 2.25 | 2.8 | 2.5 | 2.4 | 2.3 |
| 11 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.7 | 2.3 | 2.25 | 2.5 | 2.5 | 2.4 | 2.3 |
| 12 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.7 | 2.3 | 2.25 | 2.55 | 2.5 | 2.4 | 2.3 |
| 13 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.6 | 2.3 | 2.25 | 2.35 | 2.5 | 2.4 | 2.3 |
| 14 | 2.3 | 2.3 | 2.3 | 2.25 | 2.5 | 2.5 | 2.3 | 2.25 | 2.3 | 2.5 | 2.4 | 2.3 |
| 15 | 2.3 | 2.3 | 2.3 | 2.25 | 2.5 | 2.5 | 2.3 | 2.25 | 2.3 | 2.5 | 2.4 | 2.3 |
| 16 | 2.3 | 2.3 | 2.3 | 2.25 | 2.45 | 2.4 | 2.3 | 2.25 | 2.3 | 2.45 | 2.4 | 2.3 |
| 17 | 2.3 | 2.3 | 2.3 | 2.25 | 2.4 | 2.4 | 2.25 | 2.25 | 2.3 | 2.4 | 2.4 | 2.3 |
| 18 | 2.3 | 2.3 | 2.3 | 2.25 | 2.3 | 2.4 | 2.25 | 2.25 | 2.5 | 2.4 | 2.4 | 2.3 |
| 19 | 2.3 | 2.3 | 2.3 | 2.25 | 2.3 | 2.4 | 2.25 | 2.25 | 2.5 | 2.4 | 2.4 | 2.3 |
| 20 | 2.3 | 2.3 | 2.3 | 2.25 | 2.3 | 2.4 | 2.25 | 2.25 | 2.5 | 2.4 | 2.4 | 2.3 |
| 21 | 2.3 | 2.3 | 2.3 | 2.25 | 2.3 | 2.4 | 2.25 | 2.25 | 2.5 | 2.4 | 2.4 | 2.3 |
| 22 | 2.3 | 2.3 | 2.3 | 3.4 | 2.3 | 2.4 | 2.25 | 2.25 | 2.75 | 2.4 | 2.4 | 2.3 |
| 23 | 2.3 | 2.3 | 2.3 | 2.35 | 2.3 | 2.35 | 2.25 | 2.25 | 2.95 | 2.5 | 2.4 | 2.3 |
| 24 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.35 | 3.2 | 2.25 | 2.5 | 2.5 | 2.35 | 2.3 |
| 25 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.35 | 2.3 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 26 | 2.3 | 2.3 | 2.3 | 2.25 | 2.25 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 27 | 2.3 | 2.3 | 2.25 | 2.25 | 2.3 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 28 | 2.3 | 2.3 | 2.25 | 2.25 | 2.3 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 29 | 2.3 | 2.3 | 2.25 | 2.25 | 2.35 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 30 | 2.3 | ..... | 2.25 | 2.25 | 2.35 | 2.3 | 2.25 | 2.25 | 2.5 | 2.4 | 2.35 | 2.3 |
| 31 | 2.3 | ..... | 2.25 | ..... | 2.3 | ..... | 2.25 | 2.25 | ..... | 2.4 | ..... | 2.3 |

*Mean daily discharge, in second-feet, of Devils River at Devilsriver, Texas, for 1904.*

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 530 | 535 | 515 | 510 | 470 | a 470 | 500 | 450 | 430 | 590 | 520 | 470 |
| 2 | 530 | 535 | 510 | 510 | 460 | 470 | 500 | 470 | 430 | 600 | 515 | a 480 |
| 3 | 530 | 530 | 490 | 525 | 490 | 470 | 510 | a 490 | 430 | 610 | 510 | 480 |
| 4 | 530 | 530 | 490 | a 525 | 500 | 470 | 510 | 490 | 480 | a 610 | a 505 | 440 |
| 5 | 530 | a 530 | 490 | 525 | 480 | 800 | a 510 | 490 | 480 | 610 | 505 | 445 |
| 6 | a 530 | 530 | 490 | 510 | a 490 | a 1,300 | 500 | 490 | 505 | a 575 | 505 | 450 |
| 7 | 530 | 525 | a 490 | 510 | 490 | 655 | 490 | 490 | 620 | 610 | 510 | 455 |
| 8 | 535 | 525 | 490 | 510 | 490 | 560 | 480 | 485 | 970 | 610 | 510 | 460 |
| 9 | 535 | 525 | 490 | 510 | 485 | 560 | 470 | 485 | a 1,120 | 610 | 510 | 465 |
| 10 | 535 | 520 | 510 | 490 | 485 | 560 | 460 | 485 | 910 | 610 | 510 | 470 |
| 11 | a 535 | 520 | 510 | 490 | a 485 | a 730 | a 450 | 485 | 600 | 600 | 510 | 475 |
| 12 | 535 | 520 | 510 | a 490 | 485 | 730 | 450 | a 485 | 650 | 600 | a 510 | 480 |
| 13 | 535 | 515 | 510 | 490 | 485 | 655 | 450 | 480 | 480 | 600 | 510 | 485 |
| 14 | 540 | 515 | 510 | 490 | 680 | 590 | 450 | 480 | 440 | 600 | 510 | a 490 |
| 15 | 540 | a 515 | 510 | 490 | 680 | 590 | 450 | 480 | 440 | 600 | 510 | 480 |
| 16 | 545 | 515 | 515 | 490 | a 630 | 530 | 450 | a 480 | 440 | 570 | 505 | 475 |
| 17 | a 545 | 515 | a 515 | 490 | 595 | 530 | 410 | 470 | 440 | 530 | 505 | 470 |
| 18 | 545 | 515 | 515 | 490 | 530 | 530 | 410 | 465 | 560 | 530 | 505 | 465 |
| 19 | 545 | 515 | 515 | 490 | 520 | 530 | 410 | 460 | 560 | 530 | 505 | 460 |
| 20 | 545 | 515 | 510 | 490 | 520 | a 530 | 410 | 455 | a 565 | 530 | 500 | 455 |
| 21 | 545 | a 515 | 510 | 490 | 520 | 530 | 410 | 450 | 570 | 530 | 500 | 450 |
| 22 | 545 | 515 | 510 | a 1,580 | 520 | 530 | a 410 | a 445 | 770 | 530 | 500 | a 445 |
| 23 | 545 | 515 | a 510 | 490 | a 520 | 510 | 410 | 445 | 930 | 595 | a 500 | 445 |
| 24 | 545 | 515 | 510 | 445 | 480 | 510 | 1,200 | 440 | 580 | a 595 | 460 | 445 |
| 25 | 545 | 515 | 510 | 445 | 480 | 510 | a 490 | 440 | 580 | 530 | 460 | 445 |
| 26 | 540 | a 515 | 510 | 445 | 480 | 495 | 450 | 440 | 580 | 530 | 460 | 445 |
| 27 | a 540 | 515 | 490 | a 445 | a 510 | a 495 | 450 | 435 | 580 | 530 | a 455 | 445 |
| 28 | 540 | 515 | 490 | 445 | 510 | 495 | 440 | 435 | 580 | 530 | 455 | 445 |
| 29 | 540 | 515 | 490 | 445 | 560 | 495 | a 440 | a 430 | 580 | 530 | 450 | 445 |
| 30 | 540 | ..... | a 490 | 445 | 560 | 495 | 440 | 430 | 580 | 530 | 450 | a 445 |
| 31 | 540 | ..... | 490 | ..... | 510 | ..... | 440 | 430 | ..... | 530 | ..... | 445 |

a Meter measurements.

*Estimated monthly discharge of Devils River at Devilsriver, Texas, for 1904.*

| Month. | Discharge in second-feet. | | | Total in acre-feet. |
|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | |
| January | 545 | 530 | 538 | 33,104 |
| February | 535 | 515 | 520 | 29,911 |
| March | 515 | 490 | 503 | 30,932 |
| April | 1,580 | 445 | 523 | 31,140 |
| May | 680 | 460 | 519 | 31,934 |
| June | 1,300 | 470 | 578 | 34,364 |
| July | 1,200 | 410 | 479 | 29,455 |
| August | 490 | 430 | 464 | 28,532 |
| September | 1,120 | 430 | 596 | 35,464 |
| October | 610 | 530 | 570 | 35,078 |
| November | 520 | 450 | 495 | 29,474 |
| December | 490 | 440 | 460 | 28,264 |
| The year | 1,580 | 410 | 520 | 377,652 |

SAN FELIPE CREEK AT DELRIO, TEX.

San Felipe Creek rises in four large springs northeast of Delrio, Tex., and flows south into the Rio Grande. The waters of these springs are used in two large irrigation systems, the one on the west side of the creek having been in use for many years, while the one to the east has recently been constructed by G. Bedell Moore. The following table shows the discharge measurements that have been taken on the combined flow of Madre ditch and the creek just south of the railroad bridge of the Southern Pacific Railway.

*Discharge measurements of San Felipe Creek at Delrio, Tex., 1895–1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| | | *Second-feet.* |
| December, 1895 | C. C. Babb | 99 |
| March, 1899 | T. U. Taylor | 113 |
| September, 1900 | do | [a] 149 |
| December, 1901 | C. N. Campbell | [b] 150 |
| September, 1902 | T. U. Taylor | 115 |
| March, 1904 | do | [c] 118 |

[a] Rainy season. [b] After Brackett flood. [c] Includes 38 second-feet in ditch.

LAS MORAS CREEK NEAR BRACKETTVILLE, TEX.

Las Moras, like its sister springs of the Edwards Plateau, rises very suddenly. It is located near the twin towns of Brackettville and Fort Clark, and threads its way between the two. It flows south, supporting many irrigation systems, and finally empties into the Rio Grande 25 miles above Eagle Pass. Its flow is very variable, being a reflex barometer of the season preceding, and, like the Leona at Uvalde, it gives a safe index of the rainfall on the Edwards Plateau for the months before. The following table shows the discharge measurements that have been taken:

*Discharge measurements of Las Moras Creek near Brackettville, Tex., 1895–1904.*

| Date. | Hydrographer. | Discharge. |
|---|---|---|
| | | *Second-feet.* |
| December, 1895 | C. C. Babb | [a] 21 |
| June, 1899 | T. U. Taylor | [b] 60 |
| September, 1900 | do | [b] 51 |
| September, 1902 | do | [b] 11 |
| September, 1902 | do | [b] 11 |
| March, 1904 | do | [b] 28 |

[a] At footbridge, Brackett. [b] Milligans Bend.

*Discharge of the big springs of Texas.*

| Stream.[a] | Minimum discharge in second-feet. | Location. |
|---|---|---|
| Bartons Springs | 20 | Austin. |
| Clear Creek | 15 | Menard County. |
| Comanche Creek | 65 | Fort Stockton. |
| Comal River | 320 | Comal County. |
| Devils River | 380 | Valverde County. |
| Kickapoo Spring | 4 | Tom Green County. |
| Lampasas River | 10 | Lampasas. |
| Las Moras Creek | 11 | Brackettville. |
| Leona River | 0 | Uvalde. |
| Lipan Spring | 1 | Tom Green County. |
| Mill Creek | 10 | San Saba. |
| Mormon Springs | 4 | Austin. |
| Salado Creek | 13 | Bell County. |
| San Antonio River | 10 | San Antonio (hot wells). |
| San Felipe Creek | 90 | Delrio. |
| San Marcos Creek | 150 | San Marcos. |
| San Pedro Creek | 9 | San Antonio. |
| Santa Rosa Spring | 4 | Santa Lucia. |
| San Saba River | 15 | Fort McKavett. |
| Toyah Creek | 46 | Toyahvale. |

[a] Stream leading from spring.

## MISCELLANEOUS MEASUREMENTS IN RIO GRANDE DRAINAGE BASIN.

*Discharge measurements at miscellaneous stations.*

| Stream. | Date. | Hydrographer. | Width. | Area of section. | Mean velocity. | Gage height. | Discharge. |
|---|---|---|---|---|---|---|---|
| | 1904. | | *Feet.* | *Sq. feet.* | *Ft. per sec.* | *Feet.* | *Second-ft.* |
| Rio Grande canal 200 feet above head-gate. | May 16 | G. B. Monk | 66 | 100 | 4.71 | 1.70 | 471 |
| Rio Grande at Monte Vista. | May 24 | do | 157 | 389 | 1.35 | 1.60 | 525 |
| Rio Grande Valley ditch 5 miles northwest of Monte Vista. | do | do | 14 | 16 | 4.00 | | 64 |
| Rio Grande at Monte Vista. | July 14 | do | 105 | 134 | .58 | .50 | 77 |
| Rio Grande at San Marcial. | July 25 | do | 155 | 138 | 2.11 | 7.80 | 291 |
| Rio Grande at Monte Vista. | July 30 | do | 44 | 40 | 2.05 | .60 | 82 |
| Rio Grande at Albuquerque | Oct. 22 | do | 102 | 600 | 3.75 | | 2,252 |
| Rio Grande at San Marcial. | Nov. 3 | do | 159 | 268 | 4.92 | 8.10 | 1,318 |

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