DEPARTMENT OF THE INTERIOR
ALBERT B. FALL, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 478

SURFACE WATER SUPPLY OF THE UNITED STATES

1918

PART VIII. WESTERN GULF OF MEXICO BASINS

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Prepared in cooperation with the
STATE OF TEXAS

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SURFACE WATER SUPPLY OF WESTERN GULF OF MEXICO BASINS, 1918.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting records of measurements of flow made on streams in the United States during the year ending September 30, 1918.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid west. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1919.

1895	$12,500.00
1896	20,000.00
1897 to 1900, inclusive	50,000.00
1901 to 1902, inclusive	100,000.00
1903 to 1906, inclusive	200,000.00
1907	150,000.00
1908 to 1910, inclusive	100,000.00
1911 to 1917, inclusive	150,000.00
1918	175,000.00
1919	148,244.10

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 5.

Measurements of stream flow have been made at about 4,510 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1918, 1,180 gaging stations were

being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time.

DEFINITION OF TERMS.

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

"Second-feet" is an abbreviation for cubic feet per second. A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

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

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

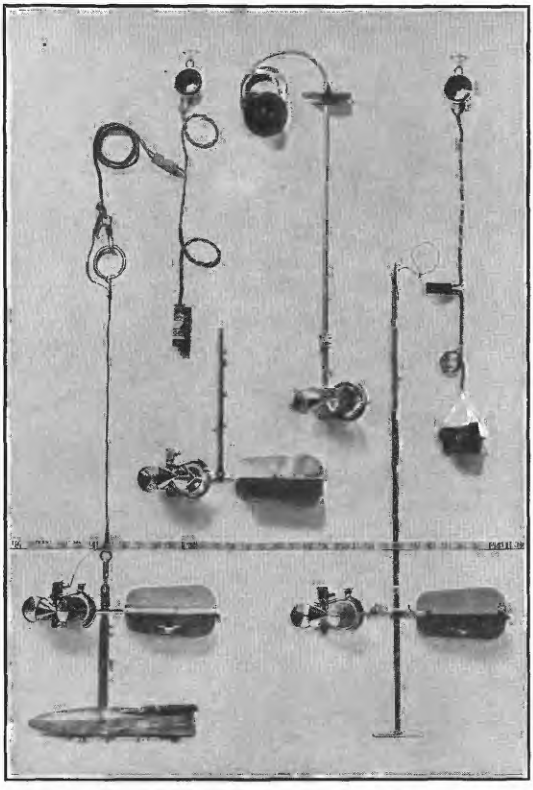
An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

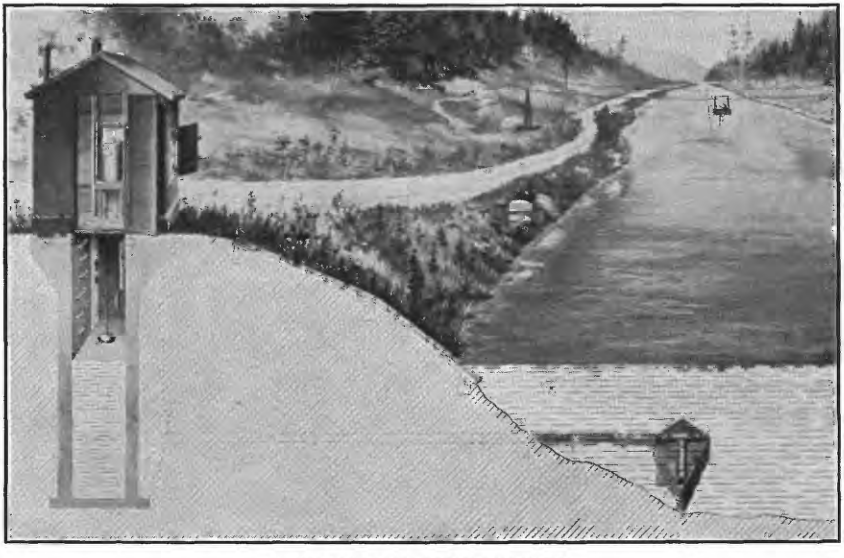
"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream channel below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

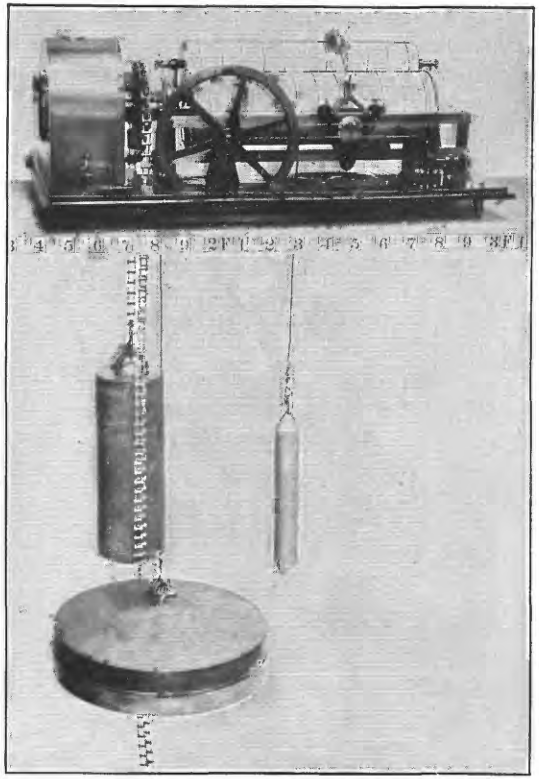
The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river falls when the discharge is reduced to zero.



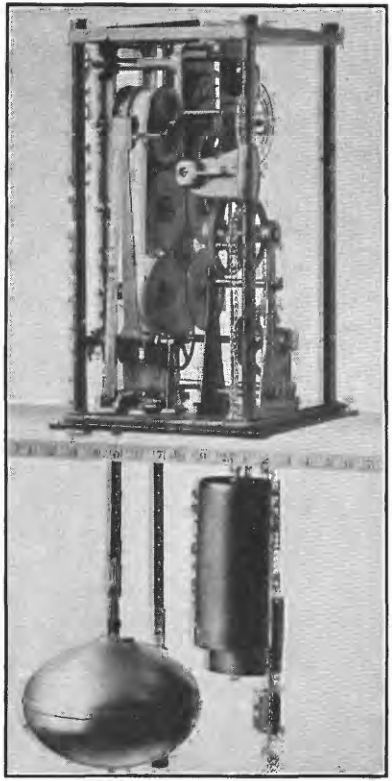
A .PRICE CURRENT METERS



B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



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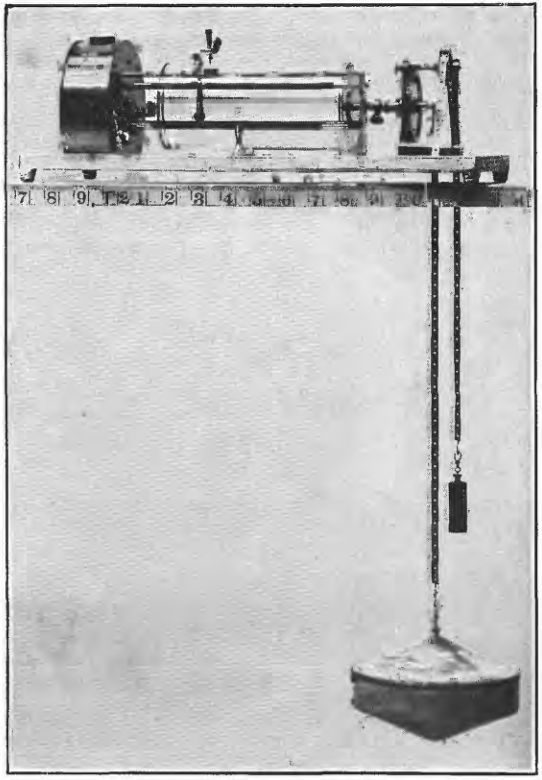

C. FRIEZ.

WATER-STAGE RECORDERS.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1917, and ending September 30, 1918. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the dicharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly means of discharge are determined.

The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving records of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage height and records of discharge measurements are published.

The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the permanence of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day.

If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month. On this average flow computations recorded in the remaining columns, which are defined on pages 2, are based.

ACCURACY OF FIELD DATA AND COMPUTED RECORDS.

The accuracy of stream-flow data depends primarily (1) on the permanence of the discharge relation and (2) on the accuracy of observation of stage, measurement of flow, and interpretation of records.

A paragraph in the description of the station gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage height to the rating table to obtain the daily discharge.

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off in inches" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and

"run-off in inches" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

During the year ending September 30, 1918, the work of measuring streams in Texas and the seepage investigations were carried on in cooperation with the State through the Board of Water Engineers, consisting of W. T. Potter, chairman; R. J. Windrow, C. S. Clark, John A. Norris, and James Hayes Quarles, secretary.

The United States Reclamation Service and the United States Weather Bureau furnished equipment and general assistance in the Rio Grande, Pecos, upper Trinity, and Brazos River basins. The United States Weather Bureau furnished most of the equipment for the evaporation station near Austin.

The cities of Austin, Corpus Christi, and Waco, the San Marcos Utilities Co., the Imperial Irrigation Co., and the Kansas City, Mexico & Orient Railroad, San Antonio, Uvalde & Gulf Railroad, Pecos Valley lines, Texas & Pacific Railway, Gulf, Colorado & Santa Fe Railway, and International & Great Northern Railway have aided in collecting records by furnishing funds or giving general assistance.

DIVISION OF WORK.

The data for stations in Texas were collected and prepared for publication under the direction of Glenn A. Gray and C. E. Ellsworth, district engineers, assisted by Russell J. Hank, C. E. McCashin, E. P. Congdon, A. K. Gowans, H. B. Kinnison, and W. H. Dodd, State hydrographer.

The manuscript was assembled and reviewed by W. R. King and E. L. Williams.

GAGING-STATION RECORDS.

TRINITY RIVER BASIN.

WEST FORK OF TRINITY RIVER AT BRIDGEPORT, TEX.[1]

LOCATION.—At suspension bridge on Belsora-Bridgeport road half a mile southwest of center of Bridgeport, Wise County, a quarter of a mile above Chicago, Rock Island & Gulf Railway Co.'s pumping plant and 1 mile below mouth of Gentry Creek.

DRAINAGE AREA.—1,060 square miles (revised).

RECORDS AVAILABLE.—October 1, 1914, to September 30, 1918. Records of stage have been obtained by United States Weather Bureau since August 16, 1908.

GAGE.—Weight and tape gage of the Mott type, fastened to downstream side of bridge, 56 feet from north end of guard rail; read by Mrs. U. E. Byers.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clay, gravel, and sand. Banks are high, slightly wooded, and are overflowed at a stage of 25 feet. Channel straight above and below station for 100 feet. Control is a rock outcrop three-quarters of a mile below station.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.35 feet at 6 p. m. April 17 (discharge, 5,850 second-feet); no flow October 11–12, October 15, November 27, February 21 to March 2, March 10-28, August 3–23.

1908–1918: Maximum stage recorded, 28.9 feet June 8, 1915 (discharge not determined); no flow in stream during several periods.

ICE.—None reported during year.

DIVERSIONS.—None. There are a few small pumping plants along the stream, but these produce little noticeable effect.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changes slightly. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good, except September 23–30, when gage was broken, and gage heights were estimated by observer.

Discharge measurements of West Fork of Trinity River at Bridgeport, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	Congdon and Gowans	0.73	0.0	Mar. 18	E. P. Congdon	.....	0.0
Nov. 26	A. K. Gowans	.....	.0	May 16	A. K. Gowans	1.97	36.6
Dec. 27	R. J. Hank	.93	[a].9	Sept. 6	.....do	4.42	524

[a] Estimated.

[1] Published in earlier reports as Trinity River at Bridgeport, Tex.

Daily discharge, in second-feet, of West Fork of Trinity River at Bridgeport, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.
1	3.1	0.0	3.5	1.6	0.8	0.0	21	13	1.6	2.0	0.3	0.1
2	2.4	.0	2.1	1.5	.7	.0	19	7.6	29	1.9	.1	.0
3	1.8	.0	2.0	1.3	.6	.8	18	3.9	8.2	34	.0	.6
4	1.1	.0	2.0	1.0	.5	.7	17	2.5	8.2	17.	.0	.4
5	1.1	.0	1.8	.7	.5	.4	449	1.9	4.8	7.6	.0	1.4
6	1.2	.0	1.6	.7	.5	.3	1,160	1.8	7.0	6.0	.0	112
7	.4	.0	2.4	.5	.5	.2	777	1.7	90	4.5	.0	580
8	2.0	.0	2.4	.5	.5	.2	465	1.6	751	3.3	.0	461
9	2.5	.0	2.5	.4	.6	.1	181	1.8	1,590	2.4	.0	119
10	.3	.0	2.4	.5	.6	.0	124	2.2	1,060	1.9	.0	34
11	.0	.0	2.2	.6	.7	.0	71	2.0	993	1.5	.0	19
12	.0	.0	2.0	.7	.7	.0	8.8	56	916	2.1	.0	10
13	1.0	.0	1.8	.7	.7	.0	921	38	385	268	.0	7.0
14	1.4	.0	1.6	.8	.7	.0	1,890	8.5	74	8.5	.0	4.8
15	.0	.0	1.5	1.1	.7	.0	1,370	2.2	51	4.8	.0	2.7
16	.0	.0	1.4	1.0	.6	.0	2,380	32	32	18	.0	2.0
17	.0	.0	1.5	1.1	.5	.0	5,620	26	12	14	.0	1.6
18	.0	.0	1.6	1.1	.4	.0	4,620	1,110	9.4	25	.0	1.2
19	.0	.0	1.8	1.1	.3	.0	3,130	1,180	6.8	42	.0	.9
20	.0	.0	1.6	1.1	.1	.0	1,360	849	4.5	25	.0	192
21	.0	.0	1.6	1.0	.0	.0	164	652	7.0	12	.0	17
22	.0	.0	1.8	1.1	.0	.0	23	206	4.3	7.6	.0	8.8
23	.0	.0	2.0	1.1	.0	.0	18	86	2.4	4.1	.0	4.5
24	.0	.0	2.1	1.4	.0	.0	21	49	2.1	2.2	89	2.9
25	.0	.0	2.2	1.2	.0	.0	23	26	1.8	2.0	16	2.0
26	.0	.0	2.0	1.0	.0	.0	12	8.8	1.4	1.6	3.5	2.3
27	.0	.0	2.0	.9	.0	.0	14	5.0	1.3	1.3	1.9	1.9
28	.0	6.8	1.8	.9	.0	.0	106	2.4	1.7	.9	1.5	1.5
29	.0	12.0	1.7	.9	.....	21	32	1.7	2.2	.7	1.0	1.3
30	.0	6.0	1.7	.9	.....	28	18	1.1	2.1	.4	.7	1.0
31	.0	.....	1.6	.8	.....	20	.....	.8	.....	.5	.3	.....

Monthly discharge of West Fork of Trinity River at Bridgeport, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	3.1	0.0	0.59	36.3
November	12	.0	.83	49.4
December	3.5	1.4	1.94	119
January	1.6	.4	.95	58.4
February	.8	.0	.40	22.2
March	28	.0	2.31	142
April	5,620	8.8	834	49,600
May	1,180	.8	141	8,670
June	1,590	1.3	202	12,000
July	268	.4	16.9	1,040
August	89	.0	3.69	227
September	580	.0	53.1	3,160
The year	5,620	.0	104	75,100

BRAZOS RIVER BASIN.

BRAZOS RIVER NEAR GRAHAM, TEX.

LOCATION.—At two-span steel highway bridge on Murray road 6 miles above mouth of Clear Fork and 10 miles west of Graham, Young County.

DRAINAGE AREA.—12,900 square miles.

RECORDS AVAILABLE.—November 13, 1915, to September 30, 1918.

GAGE.—Vertical staff on left downstream corner of middle pier; read by Mrs. John Timmons.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Channel straight above and below station. Bed is composed of sand and clay and is free from vegetation; shifting. Left bank high and not subject to overflow; right bank is of medium height and is overflowed during high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.5 feet at 9 a. m., September 5 (discharge, 4,100 second-feet; from extension of rating curve and subject to possible error); no flow October 21 to November 27, December 2 to April 4, April 30 to May 16, June 27 to July 10, July 13–14, July 17 to September 30.

1916–1918: Maximum stage recorded, 9.5 feet at 9 a. m., September 5, 1918, and at 6 p. m., April 2, 1916 (discharge, 4,100 second-feet; from extension of rating curve, and subject to possible error); no flow during several periods.

ICE.—Slight amount of ice reported in January.

DIVERSIONS.—No information available to show that water is diverted above station for irrigation in any large quantity; no diversions between station and mouth of Clear Fork.

REGULATION.—Number of power plants and controlling works above station not known; gage heights do not indicate that flow is regulated.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice during the year. Rating curve poorly defined. Gage read to hundredths once daily. Daily discharge ascertained by shifting-control method. Discharge determinations above 1,000 second-feet obtained from an extension of rating curve; subject to considerable error. Records poor.

Discharge measurements of Brazos River near Graham, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	Congdon and Gowans..	3.69	[a]0.5	May 18	A. K. Gowans.....	5.84	424
Nov. 27	A. K. Gowans.....	3.65	.0	19	.....do.....	5.02	73.1
Dec. 28	R. J. Hank.....	3.75	.0	21	.....do.....	4.57	16.0
Mar. 19	E. P. Congdon.....	3.20	.0	Sept. 7	.....do.....	6.69	1,520

[a] Estimated.

Daily discharge, in second-feet, of Brazos River near Graham, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26	0.0	3.0	0.0	0.0	0.0	0.0	0.0	13	0.0	0.0	0.0
2	18	.0	.0	.0	.0	.0	.0	.0	63	.0	.0	.0
3	16	.0	.0	.0	.0	.0	.0	.0	509	.0	.0	.0
4	13	.0	.0	.0	.0	.0	.0	.0	1,320	.0	.0	3,210
5	12	.0	.0	.0	.0	.0	17	.0	1,990	.0	.0	3,490
6	7.0	.0	.0	.0	.0	.0	804	.0	684	.0	.0	2,090
7	7.0	.0	.0	.0	.0	.0	55	.0	2,580	.0	.0	1,520
8	7.0	.0	.0	.0	.0	.0	13	.0	2,220	.0	.0	1,070
9	6.0	.0	.0	.0	.0	.0	9.4	.0	1,760	.0	.0	764
10	5.0	.0	.0	.0	.0	.0	4.0	.0	1,400	.0	.0	474
11	5.0	.0	.0	.0	.0	.0	1.0	.0	1,240	1.0	.0	231
12	6.6	.0	.0	.0	.0	.0	2.0	.0	884	3.4	.0	195
13	6.0	.0	.0	.0	.0	.0	649	.0	740	.0	.0	151
14	4.0	.0	.0	.0	.0	.0	1,060	.0	509	.0	.0	136
15	1.8	.0	.0	.0	.0	.0	1,360	.0	384	3.0	.0	82
16	1.2	.0	.0	.0	.0	.0	649	.0	166	1.0	.0	47
17	.8	.0	.0	.0	.0	.0	414	804	121	.0	.0	24
18	.8	.0	.0	.0	.0	.0	269	502	87	.0	.0	13
19	.5	.0	.0	.0	.0	.0	142	215	40	.0	.0	1,360
20	.8	.0	.0	.0	.0	.0	94	87	10	.0	.0	1,600
21	.0	.0	.0	.0	.0	.0	72	57	1	.0	.0	964
22	.0	.0	.0	.0	.0	.0	34	13	8	.0	.0	414
23	.0	.0	.0	.0	.0	.0	15	202	15	.0	.0	106
24	.0	.0	.0	.0	.0	.0	7.6	94	12	.0	.0	47
25	.0	.0	.0	.0	.0	.0	7.6	40	7	.0	.0	40
26	.0	.0	.0	.0	.0	.0	7.6	13	4	.0	.0	34
27	.0	.0	.0	.0	.0	.0	5.0	12	0	.0	.0	34
28	.0	29	.0	.0	.0	.0	3.4	11	0	.0	.0	17
29	.0	13	.0	.0	.....	.0	.5	11	0	.0	.0	12
30	.0	7.9	.0	.0	.....	.0	.0	10	0	.0	.0	10
31	.0	.....	.0	.0	.....	.0	.....	13	.....	.0	.0	.....

Monthly discharge of Brazos River near Graham, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	26	0.0	4.66	286
November	29	.0	1.66	98.8
December	3	.0	.10	5.95
January	.0	.0	.0	.0
February	.0	.0	.0	.0
March	.0	.0	.0	.0
April	1,360	.0	190	11,300
May	804	.0	67.2	4,130
June	2,580	.0	557	33,100
July	3.4	.0	.27	16.6
August	.0	.0	.0	.0
September	3,490	.0	604	35,900
The year	3,490	.0	117	84,800

BRAZOS RIVER AT BRAZOS, TEX.

LOCATION.—At Texas & Pacific Railway bridge half a mile northeast of Brazos, Palo Pinto County, and 1½ miles above Palo Pinto Creek.

DRAINAGE AREA.—20,200 square miles (revised).

RECORDS AVAILABLE.—October 1, 1914, to September 30, 1918. Records of stage have been obtained by the United States Weather Bureau since August 16, 1908.

GAGE.—Vertical staff on northwest side of center pier of railway bridge and 1 foot from upstream edge; graduations above 6 feet painted on the pier; read by L. W. Boyett.

DISCHARGE MEASUREMENTS.—Made from three-span highway bridge about 600 feet below railway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifts slightly. Right bank high, rocky, wooded, and not subject to overflow; left bank composed of sand, gravel, and clay, wooded, and medium in height, and subject to overflow at high water. Channel straight above and below for several thousand feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.00 feet at 7 a. m. June 10 (discharge, 27,000 second-feet; subject to error); no flow November 10–30, February 22–28, March 1–2, March 8 to April 5, and August 9 to September 3.

1908–1918: Maximum stage recorded, 22.0 feet May 24, 1908 (discharge not determined); no flow several times during period of record.

ICE.—Slight amount of ice reported in December, January, and February.

DIVERSIONS.—A few pumping plants have been installed along the stream for irrigating small areas, but do not greatly affect the flow of the stream.

REGULATION.—Flow unaffected by power plants, dams, or reservoirs above or immediately below station.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 12,000 second-feet; extended above 12,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table and by shifting-control method. Records poor.

Discharge measurements of Brazos River at Brazos, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 17	Congdon and Gowans	0.75	15.2	Mar. 21	E. P. Congdon		0.0
Nov. 25	A. K. Gowans	.30	.0	May 11	A. K. Gowans	0.72	16.7
Dec. 23	R. J. Hank	.40	*a* .2	24	do	4.02	2,820
Feb. 6	A. K. Gowans	.40	*a* .8	Sept. 5	do	6.38	10,500

a Estimated.

Daily discharge, in second-feet, of Brazos River at Brazos, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	220	6.2	3.0	0.3	0.8	0.0	0.0	105	126	75	3.0	0.0
2	220	5.0	22	.3	.8	.0	.0	105	220	71	3.0	.0
3	194	3.8	20	.3	.8	1.0	.0	81	298	53	2.0	.0
4	170	3.0	16	.3	.8	1.0	.0	89	246	890	1.0	4,200
5	170	3.0	16	.3	.8	.8	.0	35	740	530	1.0	16,000
6	146	3.0	12	.3	.8	.5	530	35	1,700	456	.8	16,000
7	126	2.0	11	.4	.8	.2	682	33	2,500	396	.5	6,820
8	126	2.0	11	.4	.8	.0	4,550	23	2,730	340	.2	7,400
9	105	1.4	11	.4	.8	.0	1,300	21	18,600	288	.0	2,960
10	90	.0	9.4	.4	.8	.0	1,190	13	23,000	236	.0	2,220
11	90	.0	9.4	.4	.9	.0	1,360	13	7,200	170	.0	1,560
12	75	.0	3.8	.4	.9	.0	1,190	13	4,200	90	.0	1,370
13	64	.0	3.8	.5	.9	.0	890	13	4,680	49	.0	1,290
14	64	.0	2.0	.5	.9	.0	5,200	12	3,540	146	.0	1,210
15	64	.0	2.0	.2	.9	.0	7,400	7.0	3,040	890	.0	1,300
16	53	.0	.9	.5	.9	.0	6,820	7.0	2,430	1,360	.0	1,220
17	39	.0	.9	.5	.4	.0	7,400	7.0	1,820	840	.0	1,150
18	29	.0	.9	.5	.4	.0	2,290	1,520	1,410	438	.0	474
19	29	.0	.6	.5	.4	.0	1,640	11,700	1,040	438	.0	1,010
20	23	.0	.6	.5	.4	.0	990	12,100	840	379	.0	1,760
21	23	.0	.2	.5	.2	.0	1,140	6,120	690	272	.0	3,320
22	21	.0	.2	.5	.0	.0	648	10,000	605	170	.0	3,810
23	18	.0	.2	.6	.0	.0	499	11,000	438	90	.0	1,660
24	15	.0	.2	.6	.0	.0	379	3,040	340	53	.0	1,300
25	13	.0	.2	.7	.0	.0	272	1,410	288	44	.0	1,150
26	12	.0	.2	.7	.0	.0	170	890	236	29	.0	992
27	10	.0	.2	.7	.0	.0	105	530	194	18	.0	838
28	10	.0	.2	.7	.0	.0	790	438	185	10	.0	684
29	8.2	.0	.2	.7	.....	.0	105	324	138	5.0	.0	530
30	7.0	.0	.2	.7	.....	.0	105	220	99	3.0	.0	376
31	7.0	.0	.2	.7	.....	.0	.....	170	.....	3.0	.0	.....

NOTE.—Discharge determined by shifting-control method Dec. 2 to Feb. 21; Sept. 11–24. No record Sept. 25–30; discharge interpolated.

Monthly discharge of Brazos River at Brazos, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	220	7.0	72.3	4,450
November	6.2	.0	.98	58.3
December	22	.2	5.11	314
January	.7	.2	.48	29.5
February	.9	.0	.54	30.0
March	1.0	.0	.11	6.8
April	7,400	.0	1,590	94,600
May	12,100	7.0	1,940	119,000
June	23,000	99.0	2,790	166,000
July	1,360	3.0	285	17,500
August	3.0	.0	.37	22.8
September	16,000	.0	2,750	164,000
The year	23,000	.0	781	566,000

BRAZOS RIVER AT WACO, TEX.

LOCATION.—At suspension bridge on Bridge Street, Waco, McLennan County, just below Southern Traction Co.'s bridge, 2½ miles below mouth of Bosque River, 4½ miles above mouth of Cottonwood Creek, and about 9 miles above Lock No. 8.

DRAINAGE AREA.—25,500 square miles (revised).

RECORDS AVAILABLE.—September 14, 1898, to December 31, 1911; October 1, 1914, to September 30, 1918. Record of stage has been obtained by United States Weather Bureau since August 9, 1900.

GAGE.—Gurley graph water-stage recorder installed March 29, 1918, on downstream side of pier of Souhern Traction Co.'s bridge 100 feet upstream from suspension bridge Gage used from September 14, 1898, to February 29, 1908, was an inclined staff under left end of suspension bridge. From March 1, 1908, to December 31, 1911, and October 1, 1914, to December 5, 1917, record was obtained from a chain gage on downstream side of suspension bridge. From December 6, 1917, to March 28, 1918, gage was a vertical staff painted on downstream side of pier of Southern Traction Co.'s bridge, the present location of the Gurley recorder. In 1902 a gage was marked off on the north pier of a new single span highway bridge about 300 feet above suspension bridge, and was used for high-water readings. From August 9, 1900, to May 21, 1902, the United States Weather Bureau used a vertical gage painted on pier nearest the center of the St. Louis Southwestern Railway bridge. From September 25, 1914, to March 23, 1915, during reconstruction of suspension bridge the chain gage was on highway bridge 300 feet upstream. All gages were installed at same datum, but readings probably differ slightly because of differences in location.

DISCHARGE MEASUREMENTS.—Made from downstream side of first single-span highway bridge above station.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifting. Banks are clay, medium in height, have been improved by the city, and are overflowed at extremely high water. Channel straight above and below for several thousand feet. No defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.50 feet at 2 p. m. April 15 (discharge, 30,000 second-feet); no flow August 20–21.

1898–1918: Maximum stage recorded, 39.7 feet December 3, 1913 (discharge not determined); no flow August 20–21, 1918.

ICE.—None reported during year.

DIVERSION.—No important diversions above station. Small areas of land are irrigated above, but quantity of water diverted is only a small percentage of the total flow.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 2,000 second-feet; poorly defined above that point. Gage read to half-tenths once daily October 1 to March 28, and from March 29 to September 30, gage heights obtained by means of 7-day Gurley recorder. Discharge determined by applying mean daily gage height to rating table, and by shifting-control method. Records fair.

Discharge measurements of Brazos River at Waco, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	Congdon and Gowans..	4.83	66.8	Mar. 8	E. P. Congdon.....	4.60	32.7
Nov. 8	Hank and Gowans.....	4.51	15.1	May 4	Gray and Hoyt.....	5.85	425
28	A. K. Gowans.....	4.78	62.5	June 20	E. P. Congdon.....	7.89	1,880
Dec. 6	.....do.....	4.75	65.6	Aug. 13	C. E. McCashin.....	3.85	1.3
29	R. J. Hank.....	4.55	18.5	Sept. 4	A. K. Gowans.....	3.77	*a* .6
Feb. 5	A. K. Gowans.....	4.60	31.0				

a Estimated.

Daily discharge, in second-feet, of Brazos River at Waco, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,420	9.8	349	28	39	23	165	932	584	1,230	11	1.1
2	836	9.8	226	28	37	23	165	662	877	800	8.2	.4
3	532	9.8	134	35	35	46	95	590	1,520	360	7.2	.5
4	365	12	81	35	37	53	374	468	1,880	236	6.2	.6
5	284	11	55	22	28	42	668	459	1,520	181	4.2	6.2
6	255	9.8	39	18	28	39	4,720	399	1,290	119	2.5	11,700
7	226	9.8	50	32	28	37	1,720	300	918	86	2.0	13,400
8	192	9.8	57	22	28	35	703	246	488	61	1.4	11,700
9	146	12	32	28	28	30	395	205	374	6	.8	6,650
10	134	12	32	22	26	26	763	178	5,130	162	.8	4,870
11	128	12	22	50	28	28	3,080	143	16,000	243	.9	3,470
12	105	11	21	46	28	28	2,190	143	11,400	181	.9	2,370
13	72	11	21	55	33	24	2,370	292	7,740	146	1.0	1,730
14	100	11	35	178	28	21	10,000	782	5,970	445	.7	1,330
15	86	10	22	50	28	14	16,300	445	5,330	320	.6	1,080
16	77	10	18	72	28	12	9,150	215	4,890	361	.1	884
17	68	14	22	50	28	11	7,430	137	3,620	265	.5	732
18	68	81	22	50	22	12	6,430	3,530	3,150	172	.1	606
19	42	59	28	50	22	14	10,800	7,870	2,410	95	.1	623
20	37	32	28	50	22	11	4,760	6,360	1,820	66	.0	1,100
21	42	23	28	42	22	12	3,200	10,500	1,390	152	.0	552
22	32	23	28	37	22	14	2,000	9,520	1,350	344	.5	918
23	28	18	28	42	22	12	1,540	7,190	1,320	246	3.4	836
24	18	14	37	46	23	11	1,290	9,960	1,300	185	1.5	2,750
25	18	18	37	46	21	9.8	1,140	10,000	1,270	146	7.6	3,290
26	26	21	37	46	18	11	1,680	5,310	1,260	143	6.4	3,690
27	26	21	32	37	14	15	1,250	2,900	1,450	116	3.8	2,740
28	18	59	37	42	16	10	836	1,810	1,310	86	4.8	1,610
29	16	59	37	37	.....	10	2,910	1,270	1,270	59	3.7	953
30	11	640	13	37	.....	9.2	1,230	932	1,250	32	2.2	697
31	9.6	.....	13	37	.....	8.6	.....	732	.....	18	1.1	.....

NOTE.—Discharge determined by shifting-control method Oct. 1 to Nov. 16. No flow Aug. 20–21. No record Aug. 9–12; discharge interpolated. Discharge on Oct. 6 interpolated as observed gage height is believed to be in error.

Monthly discharge of Brazos River at Waco, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,420	9.6	175	10,800
November	640	9.8	41.7	2,480
December	349	13	52.3	3,220
January	178	18	44.2	2,720
February	39	14	26.4	1,470
March	53	8.6	21	1,290
April	16,300	95	3,320	198,000
May	10,500	137	2,730	168,000
June	16,000	374	3,000	179,000
July	1,230	6.0	228	14,000
August	11	.0	2.72	167
September	13,400	.4	2,680	159,000
The year	16,300	.0	1,020	740,000

BRAZOS RIVER NEAR COLLEGE STATION, TEX.

LOCATION.—At Jones Bridge, 4 miles below Munson Shoals, 6 miles southwest of College Station, Brazos County, 19 miles above mouth of Yegua River, and 30 miles above mouth of Navasota River.

DRAINAGE AREA.—27,800 square miles.

RECORDS AVAILABLE.—February 23, 1918, to September 30, 1918.

GAGE.—Vertical staff in two sections on fourth pier from right bank. Section 0 to 14 feet is attached to sheet piling at base of pier. Section 14 to 52 feet is painted on pier; read by Will Reaves.

DISCHARGE MEASUREMENTS.—Made from bridge to which gage is attached.

CHANNEL AND CONTROL.—Bed of stream composed of sand and mud; shifting. No defined control. Banks high and free from vegetation. Right bank subject to overflow at extremely high stages (about 40 feet).

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 24.50 feet at 1.30 p. m., April 16 (discharge, 31,700 second-feet); minimum stage, 3.75 feet September 4 (discharge, 92 second-feet).

ICE.—None reported during period.

DIVERSION.—The second report of the State Board of Water Engineers shows a few small power and irrigation plants above the station, but these do not greatly affect the flow.

REGULATION.—None at present. A lock and dam under construction by the War Department near Port Sullivan, about 25 miles upstream, may eventually regulate the flow to a slight extent.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve is well defined. Gage read to half-tenths twice daily. Very little diurnal fluctuation. Discharge obtained by applying mean daily gage height to rating table and by shifting-control method. Records fair.

Discharge measurements of Brazos River near College Station, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 23	R. J. Hank	4.35	201	Apr. 11	A. K. Gowans	6.36	1,190
Mar. 20	A. K. Gowans	4.00	134	17	do	22.71	27,600
Apr. 8	do	13.49	9,150	18	do	21.93	26,000
9	do	10.27	4,780	May 4	Gray and Hoyt	7.22	1,810
9	do	9.33	3,570	June 22	E. P. Congdon	7.81	2,380
10	do	7.43	1,920	Aug. 15	C. E. McCashin	3.99	114
10	do	7.09	1,690				

Daily discharge, in second-feet, of Brazos River near College Station, Tex., for the year ending Sept. 30, 1918.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		166	127	4,970	1,730	861	202	122
2		239	140	3,120	1,410	748	186	115
3		239	122	2,210	1,550	849	170	102
4		251	239	1,760	1,640	921	166	92
5		305	340	2,210	3,810	781	150	130
6		260	528	2,110	4,570	764	140	122
7		210	2,240	1,520	3,090	627	140	1,550
8		195	9,290	1,760	2,950	514	140	10,100
9		180	4,280	1,340	3,240	448	140	11,400
10		170	1,840	1,060	3,470	380	122	7,050
11		170	1,110	915	3,770	330	118	4,420
12		170	798	776	13,400	289	115	3,480
13		160	1,500	704	11,900	260	115	2,870
14		130	3,100	649	7,400	340	115	2,340
15		146	13,700	776	5,960	360	115	2,020
16		140	25,800	676	4,800	305	118	1,700
17		130	27,700	952	4,860	372	122	1,480
18		140	25,600	814	4,240	427	127	1,240
19		130	20,600	666	3,570	460	130	1,156
20		134	17,900	8,200	3,200	420	127	933
21		130	13,500	5,530	2,710	352	115	837
22		130	6,490	5,920	2,410	287	115	1,600
23	202	140	4,150	7,400	2,230	257	115	1,210
24	221	130	3,180	5,790	1,730	233	108	1,020
25	195	130	2,660	5,490	1,390	242	115	1,270
26	170	130	3,070	9,810	1,200	336	122	1,920
27	195	122	3,850	7,720	997	287	122	2,920
28	154	140	2,870	5,640	885	263	134	3,300
29		140	2,680	3,640	945	236	134	3,550
30		122	2,800	2,650	1,220	266	146	1,790
31		122		2,080		215	127	

NOTE.—Discharge determined by shifting-control method June 25 to July 30 and Sept. 7–30.

Monthly discharge of Brazos River near College Station, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
February 23–28	221	154	190	2,266
March	305	122	165	10,100
April	27,700	122	6,720	400,000
May	9,810	649	3,190	196,000
June	13,400	885	3,540	211,000
July	921	215	435	26,700
August	202	108	133	8,180
September	11,400	92	2,390	142,000
The period				996,000

CLEAR FORK OF BRAZOS RIVER NEAR ELIASVILLE, TEX.

LOCATION.—At new highway suspension bridge 2½ miles northeast of Eliasville, Young County, 4½ miles southwest of South Bend, 6 miles above mouth of stream and below all tributaries.

DRAINAGE AREA.—5,650 square miles.

RECORDS AVAILABLE.—November 12, 1915, to September 30, 1918.

GAGE.—Chain gage attached to downstream side of bridge; read by Gilmer Vaughn.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Banks high, wooded, composed of clay and gravel, not subject to overflow. Bed composed of sand and gravel; free from vegetation. Channel straight above and below station. Control for the low and medium stages is a shoal about 600 feet below station; shifts during changing stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 20.9 feet at 12.30 p. m., May 18 (discharge, 8,240 second-feet); no flow October 14 to April 4 and August 6 to September 3.

1916–1918: Maximum stage recorded, May 18, 1918; no flow for extended periods.

ICE.—None reported during year.

DIVERSIONS.—Much of the land now irrigated above the station is in Jones and Taylor counties; two diversions are made for irrigation between station and mouth. Quantity of water diverted unknown. The second report of the State Board of Water Engineers shows the Sweetwater Light & Power Co. has declared a storage of 216 acre-feet, and Abilene Water Co. a continuous use of 1.5 second-feet of water, in the headwater regions.

REGULATION.—No large reservoirs above or below station. The operation of a water-power grist mill 5 miles upstream produces some effect at the station.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 9,000 second-feet. Gage read to hundredths twice daily; observer's work not entirely satisfactory; mean daily gage height may not be a true index of daily flow because of regulation. Daily discharge ascertained by applying mean daily gage height to rating table, and by indirect method for shifting control. Records fair.

Discharge measurements of Clear Fork of Brazos River near Eliasville, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Congdon and Gowans	.....	0.0	May 20	A. K. Gowans	16.30	5,700
Nov. 27	A. K. Gowans	.....	.0	21	do	18.05	6,710
Dec. 28	R. J. Hank	.....	.0	22	do	10.47	2,520
Mar. 19	E. P. Congdon	1.60	.0	22	do	8.60	1,760
May 18	A. K. Gowans	20.82	8,200	22	do	7.45	1,420
19	do	19.31	7,260	22	do	6.41	1,010
19	do	17.79	6,300	Sept. 7	do	5.73	873
20	do	15.91	5,250				

Daily discharge, in second-feet, of Clear Fork of Brazos River near Eliasville, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.2	.....	6.0	17	225	1.7	.....
2	1.8	.....	10	53	141	2.3	.....
3	1.8	.....	6.4	232	86	2.9	.....
4	1.4	.....	1.2	585	86	1.4	1,500
5	1.4	52	.5	405	43	.4	5,930
6	1.1	4,850	.6	405	37	.....	1,200
7	1.1	565	.6	1,990	20	.....	585
8	.5	1,280	2.0	5,900	20	.....	260
9	.5	805	3.5	4,260	15	.....	208
10	.4	295	1.4	3,160	11	.....	133
11	.3	67	.3	2,300	11	.....	86
12	.2	52	.3	2,300	118	.....	72
13	.2	3,510	.3	1,680	278	.....	52
14	.1	3,070	.2	348	155	.....	31
15	.1	3,660	.2	86	260	.....	24
16	.....	2,260	.0	72	190	.....	12
17	.....	405	3,210	62	72	.....	10
18	.....	485	8,060	62	31	.....	10
19	.....	225	6,660	52	20	.....	10
20	.....	14	5,430	14	24	.....	2,530
21	.....	48	6,490	.5	27	.....	260
22	.....	35	3,360	.5	20	.....	62
23	.....	27	365	3.5	20	.....	39
24	.....	20	155	10	20	.....	31
25	.....	13	155	10	3.5	.....	17
26	.....	8.4	155	10	8.0	.....	11
27	.....	6.0	155	10	14	.....	6.4
28	.....	6.0	72	6.0	14	.....	5.0
29	.....	3.5	35	6.0	2.3	.....	3.8
30	.....	4.8	31	1,020	.4	.....	3.5
31	.....	.....	24	.....	.9	.....	.....

NOTE.—Discharge determined by shifting-control method, Oct. 1–10; no flow on days for which discharge is not given.

Monthly discharge of Clear Fork of Brazos River near Eliasville, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2.2	0.0	0.42	25.8
November	.0	.0	.00	.0
December	.0	.0	.00	.0
January	.0	.0	.00	.0
February	.0	.0	.00	.0
March	.0	.0	.00	.0
April	4,850	.0	726	43,200
May	8,060	.0	1,110	68,200
June	5,900	.5	835	49,700
July	278	.4	63.6	3,910
August	2.9	.0	.28	17.2
September	5,930	.0	436	25,900
The year	8,060	.0	264	191,000

LITTLE RIVER AT CAMERON, TEX.

LOCATION.—200 feet below city pumping plant half a mile south of Cameron, Milam County, 1 mile above Gulf, Colorado & Santa Fe Railway bridge, about 6 miles below mouth of San Gabriel River, and 25 miles above confluence with Brazos River.

DRAINAGE AREA.—7,010 square miles.

RECORDS AVAILABLE.—November 1, 1916, to September 30, 1918.

GAGE.—Vertical and inclined staff; three sections attached to trees on left bank a short distance below home of pump man; read by T. A. Crawford.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of rock, gravel, and sand; free from vegetation and permanent during normal flow. Banks are clay and gravel; medium height; wooded; subject to overflow during extreme stages. Control for low and medium stages is rock and gravel shoal 100 feet below gage; shifts during flood stages. At stage of about 18 feet (discharge, 6,530 second-feet) water enters an old channel 1 mile above gage, and the flow through this channel is diverted around the station and enters the river again below the gage. All records above 6,500 second-feet do not include the flow in this flood channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 30.40 feet at 6 p. m. April 17 (discharge, 13,300 second-feet); minimum stage, 0.78 foot at 7 a. m. September 3, 5, and 7 (discharge, 2.6 second-feet).

1916–1918: Extremes occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Small areas are irrigated in the upper drainage basin, but diversions have little effect on flow. Second report of the State Board of Water Engineers shows Cameron Power & Light Co. has continuous use of 5 second-feet with a declared consumption of 3,650 acre-feet yearly for waterworks, light, and power in Cameron. During low water this has an appreciable effect upon flow at station. At stage of 18 feet some water is diverted around the station through an old channel of the river.

REGULATION.—Apparently none.

ACCURACY.—Stage-discharge relation did not change during the year. Rating curve well defined below 13,000 second-feet; gage read to hundredths twice daily and oftener during floods. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Little River at Cameron, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	A. K. Gowans	1.60	13.0	Apr. 19	A. K. Gowans	13.23	4,430
Feb. 6	E. P. Congdon	1.19	34.3	19	do	11.98	3,350
7	G. A. Gray	1.20	30.6	20	do	14.56	5,090
Mar. 19	A. K. Gowans	1.12	25.6	June 21	E. P. Congdon	3.28	511
Apr. 15	do	22.41	8,630	Aug. 14	C. E. McCashin	.92	9.7
16	do	28.08	a12,400				

a Surface velocity observed by floats and coefficient of 0.75 used to reduce to mean velocity.

Daily discharge, in second-feet, of Little River at Cameron, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	13	32	34	34	47	27	642	146	180	19	5.4
2	30	13	32	32	34	67	142	407	134	146	12	4.6
3	28	13	32	30	34	112	534	447	142	98	13	4.2
4	28	13	32	30	32	76	115	391	1,980	76	13	5.0
5	26	13	30	32	32	55	627	469	2,040	68	13	5.0
6	24	13	34	32	32	48	2,140	550	1,590	64	12	4.2
7	23	15	32	32	33	42	6,060	407	1,800	62	10	19
8	22	15	30	32	34	40	2,300	373	2,220	54	10	31
9	21	15	30	32	36	37	565	342	2,620	47	10	25
10	20	15	30	32	36	34	302	264	2,790	43	9.4	21
11	19	15	29	34	36	34	214	93	1,700	40	8.6	16
12	19	17	28	36	36	32	134	58	1,080	37	7.0	12
13	19	19	26	36	36	32	115	244	674	35	7.8	11
14	19	20	26	36	34	30	2,140	244	565	31	8.6	8.6
15	19	20	26	36	34	30	8,680	136	500	29	7.0	7.0
16	19	21	28	39	37	28	12,100	118	753	26	7.8	40
17	19	23	26	43	62	26	13,200	112	627	26	7.0	51
18	19	30	28	49	553	26	10,900	110	550	23	7.0	41
19	19	736	30	53	612	26	4,940	106	429	22	6.2	34
20	19	209	30	54	169	26	4,440	106	267	22	6.6	31
21	19	140	30	51	70	28	1,760	148	453	20	6.6	25
22	19	66	30	47	58	30	553	173	522	19	6.6	22
23	17	51	32	44	53	28	357	138	223	17	6.2	314
24	17	43	32	41	46	28	231	934	136	15	5.8	162
25	16	37	32	40	44	28	868	1,670	102	15	8.6	204
26	14	34	32	40	43	28	1,670	2,320	87	15	6.2	214
27	13	32	34	38	42	28	391	2,200	77	13	6.2	194
28	13	33	34	38	42	28	559	836	69	14	6.6	289
29	13	34	34	38	.....	26	1,140	280	103	13	7.0	256
30	13	33	34	36	.....	26	918	158	127	12	6.2	534
31	13	.....	34	34	.....	26	.....	150	.....	12	5.8	.....

NOTE.—See "Channel and control" in station description.

Monthly discharge of Little River at Cameron, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	30	13	19.7	1,210
November	736	13	53.4	3,180
December	34	26	30.6	1,880
January	54	30	38.1	2,340
February	612	32	83.7	4,650
March	112	26	37.2	2,290
April	13,200	27	2,600	155,000
May	2,320	58	472	29,000
June	2,790	69	807	48,000
July	180	12	41.5	2,550
August	13	5.8	8.32	512
September	534	4.2	86.3	5,140
The year	13,200	4.2	354	256,000

NOTE.—See "Channel and control" in station description

COLORADO RIVER BASIN.

COLORADO RIVER NEAR BRONTE, TEX.

LOCATION.—At wagon bridge 400 feet below Kansas City, Mexico & Orient Railroad bridge, 1½ miles above mouth of Kickapoo Creek and below mouth of Live Oak Creek, and 2½ miles south of Bronte, Coke County.

DRAINAGE AREA.—5,550 square miles.

RECORDS AVAILABLE.—September 19, 1915, to September 30, 1918.

GAGE.—Chain attached to downstream side of bridge near left bank; read by F. G. Owen. A vertical staff gage attached to left bank of railroad bridge 400 feet above present site and referred to same datum was used prior to October 29, 1915.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of hardpan mixed with gravel; shifting; channel straight about 500 feet above and below station. Right bank wooded, sloping, and subject to overflow at extreme stages; left bank high, clean, and not likely to overflow. Control probably at shoal 300 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.70 feet at 7 a. m., May 17 (discharge not determined); no flow during several periods throughout the year.

1915–1918: Maximum stage recorded 15.0 feet, 2 a. m., September 25, 1916, and 1.30 p. m., October 15, 1916 (discharge not determined).

ICE.—Some ice reported in January.

DIVERSIONS.—Some water is diverted for irrigating small areas in Coke and Mitchell counties and for the city of Robert Lee. The second report of the State Board of Water Engineers records a small storage project at Robert Lee, but this storage will not affect the flow.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 400 second-feet; extended above 450 second-feet, and subject to error. Gage read to hundredths twice daily. Daily discharge determined by shifting-control method or by applying mean daily gage height to rating table. Records poor.

Discharge measurements of Colorado River near Bronte, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 31	E. P. Congdon	1.58	*a* 0.1	May 26	E. P. Congdon	1.77	12.8
Dec. 18	....do	1.60	*a* .1	July 18	R. J. Hank	1.76	12.6
Jan. 29	R. J. Hank	1.60	*a* .1	Aug. 7	E. P. Congdon	.....	.0
Feb. 26	E. P. Congdon	1.62	*a* .2				

a Estimated.

Daily discharge, in second-feet, of Colorado River near Bronte, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1	.....	0.1	0.1	0.1	0.1	0.1	0.1	0.1	4.8	0.3	.....	.....
2	.....	.1	.1	.1	.1	.1	.1	.1	4.8	.3	.....	.....
3	.....	.1	.1	.1	.1	.1	.1	.1	940	.3	.....	.....
4	.....	.1	.1	.1	.1	.1	.1	33	572	.....	.....	1,350
5	.....	.1	.1	.1	.1	.1	.1	49	429	.....	.....	367
6	.....	.1	.1	.1	.1	.1	.1	21	389	.....	.....	572
7	.....	.1	.1	.1	.1	.1	.1	7.5	292	.....	.....	547
8	.....	.1	.1	.1	.1	.1	.1	7.5	526	.....	.....	367
9	.....	.1	.1	.1	.1	.1	.1	6.6	1,370	.....	.....	290
10	.....	.1	.1	.1	.1	.1	.1	5.6	1,800	.....	.....	26
11	.....	.1	.1	.1	.1	.1	.1	4.8	541	.....	.....	26
12	.....	.1	.1	.1	.1	.1	.1	4.1	262	.....	.....	20
13	.....	.1	.1	.1	.1	.1	.1	4.1	93	.....	.....	9.5
14	.....	.1	.1	.1	.1	.1	.1	4.1	23	.....	.....	2.2
15	.....	.1	.1	.1	.1	.1	.1	4.1	9.0	.....	.....	.....
16	.....	.1	.1	.1	.1	.1	.1	4.5	7.0	107	.....	.....
17	.....	.1	.1	.1	.1	.1	.1	1,430	4.8	41	.....	.....
18	.....	.1	.1	.1	.1	.1	.1	203	4.5	14	.....	1.4
19	.....	.1	.1	.1	.1	.1	.1	581	2.8	3.4	.....	3.4
20	.....	.1	.1	.1	.1	.1	.1	54	2.6	.3	.....	1.4
21	.....	.1	.1	.1	.1	.1	.1	28	1.4	.....	.....	.....
22	.....	.1	.1	.1	.1	.1	.1	17	1.2	.....	.....	.....
23	.....	.1	.1	.1	.1	.1	.1	15	1.0	.....	.....	.....
24	.....	.1	.1	.1	.1	.1	.1	10	.7	.....	.....	.....
25	.....	.1	.1	.1	.1	.1	.1	6.6	.5	.....	1.4	.....
26	.....	.1	.1	.1	.1	.1	.1	15	.3	.....	.....	.....
27	.....	.1	.1	.1	.1	.1	.1	6.6	.2	.....	.....	.....
28	.....	.1	.1	.1	.1	7.5	.1	6.6	18	.....	.....	.....
29	.....	.1	.1	.1	.....	.2	.1	4.8	1.8	.....	.....	.....
30	.....	.1	.1	.1	.....	.1	.1	4.8	1.6	.....	.....	.....
31	0.1	.....	.1	.1	.....	.1	.....	4.8	.....	.....	.....	.....

NOTE.—Discharge determined by shifting-control method May 6 to June 2 and June 8 to Sept. 30. No flow on days for which discharge is not given.

Monthly discharge of Colorado River near Bronte, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	0.1	0.0	0.0	0.0
November	.1	.1	.1	6.0
December	.1	.1	.1	6.1
January	.1	.1	.1	6.1
February	.1	.1	.1	5.6
March	7.5	.1	.34	20.9
April	.1	.1	.1	6.0
May	1,430	.1	82	5,040
June	1,800	.2	243	14,500
July	107	.0	537	330
August	1.4	.0	.05	3.1
September	1,350	.0	119	7,080
The year	1,800	.0	37.3	27,000

COLORADO RIVER AT BALLINGER, TEX.

LOCATION.—At Hutchins Avenue highway bridge, 300 feet below Gulf, Colorado & Santa Fe Railway bridge in Ballinger, Runnels County, and 1 mile above mouth of Elm Creek.

DRAINAGE AREA.—6,460 square miles (revised).

RECORDS AVAILABLE.—December 11, 1915, to September 30, 1918. Records of stage obtained by the United States Weather Bureau since July 1, 1903; current-meter measurements began May 29, 1915.

GAGE.—Chain gage attached to downstream handrail of bridge; read by A. J. Voelkel.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Banks consist of clay and gravel; medium height and wooded; subject to overflow at extremely high stages. Bed composed of hard clay, sand, and gravel; slightly shifting. Control is shoal about 1,000 feet below gage; subject to change.

ICE.—Small amount reported in December.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.15 feet at 7.30 a. m. June 4 (discharge not determined). No flow during several periods throughout the year.

1916–1918: Maximum stage recorded in 1918; no flow during several periods.

DIVERSIONS.—During low stages a large part of the flow is diverted above the station by gravity or pumping. The second report of the State Board of Water Engineers shows 3,307 acres in Runnels County, above the station, declared irrigated with 6,614 acre-feet of water; also filings for waterworks by cities of Ballinger and Winters for continuous use of 1 and 4 second-feet, respectively.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Changes materially affect low-water rating but probably do not seriously affect that for high and medium stages. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating curve and by shifting-control method. Records good except during low stages, when they may be considerably in error.

Discharge measurements of Colorado River at Ballinger, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	E. P. Congdon	0.50	*a* 0.1	May 18	E. P. Congdon	2.09	594
Dec. 17	....do	.64	*a* .3	24	....do	1.02	68.2
Jan. 30	R. J. Hank	.61	*a* .5	July 19	R. T. Hank	.70	10.1
Feb. 25	E. P. Congdon	.52	*a* .3	Aug. 6	E. P. Congdon		.0
Apr. 26	R. T. Hank		.0				

a Estimated.

Daily discharge, in second-feet, of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May.	June.	July.	Aug.	Sept.
1	1.4	0.5	0.5	0.9	.7	0.1	.....	2.2	4.6	.....	.....
2	.9	.5	.5	.9	.7	10	.....	1,680	.2	.....	.....
3	.5	.9	.5	.9	.5	3.6	.....	603	.....	.....	.....
4	.3	.9	1.0	.9	.1	2.8	.....	6,300	.....	.....	5,830
5	.1	.9	.7	.9	.1	2.0	186	568	.....	.....	1,020
6	.1	1.0	.5	.9	.3	1.6	38	477	.....	.....	890
7	.1	1.2	.5	.9	.3	.9	20	404	.....	.....	897
8	.1	1.2	.5	.9	.1	.5	21	295	.....	.....	750
9	.0	1.2	.5	.9	.1	.1	4.0	3,330	.....	.....	512
10	.1	1.2	.1	.9	.1	.1	.3	5,520	.....	.....	215
11	.1	1.6	.1	.9	.5	.....	.....	1,760	.....	.....	118
12	.1	1.6	.1	.9	.5	.....	.....	1,090	.....	.....	65
13	.1	1.6	.1	1.2	.5	.....	.....	416	.....	.....	41
14	.1	1.6	.1	1.2	.1	.....	.....	190	.....	.....	26
15	.1	2.0	.1	1.2	.1	.....	.....	107	.....	.....	20
16	.1	2.0	.3	.9	.3	.....	.....	68	.....	.....	12
17	.1	1.6	.3	.5	.1	.....	3,150	45	.4	.....	8.8
18	.1	2.0	.3	.5	.3	.....	876	30	19	.....	7.6
19	.1	1.2	.5	.5	1.2	.....	1,130	20	6.4	.....	5.8
20	.1	1.2	.7	.3	1.0	.....	659	14	1.2	.....	107
21	.1	1.2	.7	.7	.5	.....	434	7.6	.5	.....	16
22	.1	1.2	.7	.9	.5	.....	186	3.6	1.9	.....	7.6
23	.1	1.2	.7	.9	.5	.....	83	3.6	.....	.....	4.6
24	.1	.9	.5	.9	.5	.....	55	3.0	.....	.....	2.2
25	.1	1.2	.1	.9	.5	.....	34	.2	.....	1,150	.5
26	.1	1.2	.1	.9	.3	.....	24	.....	.....	92	.4
27	.1	1.2	.1	.9	.1	.....	15	.....	.....	15	.3
28	.1	.9	.1	.5	.1	.....	11	.....	.....	18	.1
29	.1	1.2	.1	.9	.....	.....	7.0	.....	.....	37	.2
30	.1	.9	.1	.5	.....	.....	5.8	12	.....	14	.1
31	.1	.....	.1	.5	.....	.....	3.3	.....	.....	3.0	.....

NOTE.—Discharge, Oct. 1-5, and Nov. 13 to Feb. 18, determined by shifting-control method; June 12, interpolated. No flow on days for which discharge is not given.

Monthly discharge of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1.4	0.0	0.18	11.1
November	2.0	.5	1.23	73.2
December	1.0	.1	.36	22.1
January	1.2	.3	.83	51.0
February	1.2	.1	.38	21.1
March	10	.0	.70	43.0
April	.0	.0	.0	.0
May	3,150	.0	224	13,800
June	6,300	.0	765	45,500
July	19	.0	1.10	67.6
August	1,150	.0	42.9	2,640
September	5,880	.0	354	21,100
The year	6,300	.0	115	82,300

COLORADO RIVER NEAR CHADWICK, TEX.

LOCATION.—At Gulf, Colorado & Santa Fe Railway bridge half a mile below Chadwick dam, 1 mile above mouth of Elliott Creek, 2 miles west of Chadwick, on county line between San Saba and Lampasas counties, and 2½ miles below mouth of San Saba River.

DRAINAGE AREA.—26,400 square miles.

RECORDS AVAILABLE.—October 21, 1915, to September 30, 1918.

GAGE.—Inclined staff attached to rock ledge on left bank about 75 feet upstream from railway bridge; high-water section is painted on left bridge pier; a vertical staff on right bank directly opposite inclined gage is used during low water; gages referred to same datum; read by A. G. Walker.

DISCHARGE MEASUREMENTS.—Made from cable 400 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; not likely to shift. Channel straight above and below station for 1,000 feet. Left bank high, rocky, wooded, and not subject to overflow; right bank clay and gravel, medium in height, wooded, and subject to overflow during extreme stages. Position of control not known, but current-meter measurements indicate that it is practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.0 feet at 11 a. m. June 4 (discharge, 22,500 second-feet); minimum stage, 0.16 foot August 22 and 23 (discharge, 1.5 second-feet).

1916–1918: Maximum and minimum stages occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Numerous tracts ranging in size from 5 to 1,500 acres are irrigated by diversions from the main stream and tributaries. A large part of the irrigated area is Runnels, Brown, and Mills counties and along Concho and San Saba rivers. Several small dams have been constructed in the drainage basin above station; Chadwick dam, half a mile above, creates a small pond and diverts to a water wheel not now in use.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Slight changes occur during floods. Rating curve well defined between 10 and 3,000 second-feet, and fairly well defined between 3,500 and 14,000 second-feet. Extensions of curve below 10 second-feet and above 14,000 second-feet subject to error. Gage read to hundredths once daily, but observations are doubtful. Daily discharge ascertained by applying gage height to rating table, or by shifting-control method. Records fair.

Discharge measurements of Colorado River near Chadwick, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	Congdon and Gowans..	0.54	37.3	May 21	E. P. Congdon.....	5.61	2,510
Dec. 8	A. K. Gowans.....	.70	63.1	July 13	A. K. Gowans.....	.38	18.0
Feb. 27	E. P. Congdon.....	.76	57.1	Aug. 9	McCashin and Kinnison	.34	4.0
May 20	.....do.....	13.52	11,100	29	A. K. Gowans.....	.22	*a* 2.5

a Estimated.

Daily discharge, in second-feet, of Colorado River near Chadwick, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	78	39	213	52	42	36	26	62	68	36	2.6	370
2	70	39	150	52	40	36	26	62	68	34	2.2	111
3	61	39	122	50	40	36	25	60	68	34	2.0	85
4	55	39	122	50	42	36	21	56	22,400	32	1.8	67
5	50	39	116	50	41	34	21	84	10,400	30	9.4	61
6	43	39	111	50	41	34	8,040	111	3,510	28	10	1,920
7	41	38	98	50	41	34	640	138	1,220	26	9.4	1,250
8	39	38	87	50	39	34	203	166	602	26	8.2	1,130
9	36	36	54	48	39	34	100	194	2,730	26	4.0	820
10	43	36	39	50	39	34	68	222	580	46	4.0	780
11	42	36	48	50	39	34	51	240	3,710	20	3.2	700
12	40	36	46	48	41	36	48	249	4,230	19	2.8	613
13	39	36	46	76	41	34	338	269	2,780	15	3.0	440
14	38	36	42	72	38	32	18,000	263	1,480	46	2.6	293
15	38	36	42	68	35	31	8,150	129	880	33	2.6	266
16	38	38	42	64	35	30	4,360	111	1,600	107	2.4	168
17	35	39	42	64	35	29	566	102	880	104	2.0	138
18	35	40	42	61	38	26	422	1,270	720	96	1.8	98
19	35	40	40	58	40	26	283	9,240	566	45	1.6	85
20	35	39	40	55	40	25	216	13,000	422	30	1.6	1,580
21	35	38	40	54	40	23	153	2,420	352	26	1.7	4,200
22	35	58	40	51	36	21	126	1,040	494	22	1.5	3,660
23	36	78	41	51	36	20	100	920	346	18	1.5	3,060
24	38	74	41	50	36	19	76	680	216	16	1.8	2,460
25	36	45	42	47	36	19	566	494	100	14	2.0	1,860
26	35	42	43	46	36	20	100	360	68	14	2.4	800
27	38	42	43	43	36	20	72	297	62	7.0	2.8	200
28	35	89	43	40	39	23	68	229	39	3.2	213	100
29	35	181	51	40	.....	28	66	165	38	2.6	363	89
30	35	280	60	40	.....	28	62	118	37	2.6	255	61
31	36	.....	55	42	.....	26	.....	72	.....	2.4	147	.....

NOTE.—No gage-height record Apr. 5, 14, 16, 23, May 1, 5–11, 30, June 2–3, 29–30, Sept. 22–28; discharge interpolated. Discharge determined by shifting-control method, Oct. 6 to Jan. 15 and Jan. 21 to Aug. 27.

Monthly discharge of Colorado River near Chadwick, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	78	35	41.5	2,550
November	289	36	56.2	3,340
December	213	39	65.8	4,050
January	76	40	52.3	3,220
February	42	35	38.6	2,140
March	36	19	29.0	1,780
April	18,000	21	1,430	85,100
May	13,000	56	1,060	65,200
June	22,400	37	2,020	120,000
July	107	2.4	31.0	1,910
August	363	1.5	34.5	2,120
September	4,260	61	918	54,600
The year	22,400	1.5	478	346,000

COLORADO RIVER AT MARBLE FALLS, TEX.

LOCATION.—At steel highway bridge one-fourth mile south of Marble Falls, Burnet County, 10 miles below mouth of Sandy Creek, 16 miles below mouth of Llano River, and 23 miles above mouth of Pedernales River.

DRAINAGE AREA.—32,200 square miles.

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1918. Miscellaneous discharge measurements were made in 1902. Records of stage have been obtained by the United States Weather Bureau since January 1, 1908.

GAGE.—Vertical staff in several sections painted on piers of bridge; read by M. M. Berry. Prior to December 12, 1917, weight and tape gage of Mott type on upstream side of bridge was used.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock. Banks, rock, gravel, and clay; wooded; not subject to overflow. Rapids just below gage serve as permanent control for low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.0 feet at 5.30 p. m., April 15 (discharge, 57,400 second-feet); no flow August 11–25.

1900–1918: Maximum stage, 23.9 feet April 7, 1900 (discharge not determined); no flow in August, 1918.

ICE.—None reported during year.

DIVERSIONS.—Several large projects have been proposed in the drainage basin above station, but none have been developed. Water is diverted for irrigating small tracts adjacent to the main river and tributaries. Most of the irrigated land lies along the Concho, San Saba, and Llano rivers. The second report of the State Board of Water Engineers shows that the Llano Milling & Mining Co. has declared a continuous use of 833 second-feet for hydraulic power and waterworks, and M. H. Reed an unstated quantity for water works for Marble Falls.

REGULATION.—Flow is regulated to some extent by diversions for irrigation and power immediately above station.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 50,000 second-feet. Gage read to hundredths twice daily. Mean of two readings daily may not be true mean because of operation of power plant just above gage. Daily discharge ascertained by applying mean daily gage height to rating table, October 1, 1916, to September 30, 1918. Records good.

Records of daily and monthly discharge for 1917, based on revised rating curve, are published herewith, and supersede those previously published.

Discharge measurements of Colorado River at Marble Falls, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	Congdon and Gowans	0.80	116	Apr. 16	E. P. Congdon	9.27	[a] 23,000
Nov. 10	E. P. Congdon	.42	65.6	16	do	7.36	[a] 14,600
Dec. 12	do	1.05	134	17	do	6.12	[a] 10,100
14	do	.98	109	July 25	McCashin and Gowans	.73	68.2
Feb. 21	do	1.20	152	Aug. 11	McCashin and Kinnison	−1.10	.0
Apr. 15	do	13.01	[a] 44,800				
15	do	14.50	[a] 65,800	11	do	− .10	3.0

[a] Surface velocity observed and coefficient of 0.90 used to reduce to mean velocity. Subject to possible error.

Daily discharge, in second-feet, of Colorado River at Marble Falls, Tex., for the years ending Sept. 30, 1917, and 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1916–17.												
1	762	268	182	158	182	182	158	438	388	304	100	118
2	438	208	182	182	182	182	158	344	344	388	62	344
3	438	208	182	182	182	208	158	344	5,930	344	58	492
4	438	182	182	182	158	182	137	344	3,010	236	51	653
5	344	182	208	182	158	182	137	344	4,740	158	37	14,900
6	344	158	236	182	158	182	158	344	6,890	158	15	8,450
7	236	158	236	182	158	182	158	344	3,010	137	15	3,930
8	208	158	236	182	208	182	182	304	2,800	97	22	2,970
9	182	118	236	182	208	182	208	304	1,300	80	28	2,560
10	182	118	208	158	182	182	208	208	762	76	15	2,230
11	158	118	208	158	158	182	208	208	492	39	29	2,270
12	158	118	182	158	208	182	208	208	492	37	18	2,370
13	118	100	182	158	208	182	182	304	304	23	62	968
14	118	137	182	158	208	182	182	268	268	37	46	848
15	118	137	182	158	208	182	137	2,230	182	12	46	946
16	268	118	182	182	208	182	137	1,300	158	23	44	1,300
17	268	118	182	182	208	182	137	1,060	158	83	37	1,300
18	344	118	182	182	208	182	137	688	118	118	31	897
19	4,740	118	182	182	208	182	118	438	118	148	23	725
20	17,100	118	182	182	208	1,300	118	344	83	62	22	585
21	8,980	208	182	182	208	1,060	118	344	83	137	18	552
22	3,010	182	182	182	208	848	118	438	68	23	12	522
23	3,010	208	182	208	208	552	1,300	11,200	56	29	21	438
24	1,300	208	182	208	208	438	762	5,620	46	51	12	413
25	1,300	208	182	208	182	344	492	3,010	37	39	42	268
26	1,180	158	182	208	182	208	438	1,880	37	56	252	203
27	1,180	158	182	208	182	208	438	1,180	22	23	242	158
28	848	158	182	208	182	208	438	946	46	12	208	128
29	618	158	158	208	.....	208	438	762	388	33	208	118
30	492	158	158	182	.....	208	438	492	304	118	195	148
31	344	.....	158	182	.....	182	.....	438	.....	109	148	.....
1917–18.												
1	118	31	104	100	118	137	100	312	236	137	9.0	4.0
2	182	26	465	109	118	137	104	312	187	118	4.0	141
3	158	37	388	100	118	137	100	268	2,640	109	4.0	203
4	154	39	304	100	118	141	100	268	8,100	83	4.0	286
5	137	46	236	100	118	158	2,020	268	23,000	80	4.0	1,500
6	118	46	236	100	118	158	688	268	12,200	68	4.0	1,570
7	118	44	208	100	118	148	1,180	230	6,960	68	.....	946
8	118	39	195	100	118	137	1,600	632	4,460	62	.....	605
9	118	35	148	100	118	137	1,200	762	2,760	62	4.0	1,570
10	104	37	104	114	128	118	565	605	1,540	56	4.0	1,300
11	100	37	118	118	137	118	336	353	3,810	54	.....	1,280
12	80	37	109	118	137	118	252	552	2,410	42	.....	1,080
13	58	39	109	137	137	118	236	1,180	5,080	37	.....	848
14	68	51	109	137	137	118	5,780	1,570	3,180	26	.....	805
15	66	68	109	137	137	118	41,700	848	2,050	21	.....	585
16	56	71	107	137	158	100	20,400	585	1,430	14	.....	465
17	44	83	104	137	158	100	8,810	398	968	9.0	.....	605
18	37	1,720	100	158	170	100	4,460	297	1,480	12	.....	252
19	37	565	100	158	158	100	2,450	297	1,030	12	.....	230
20	37	413	100	158	158	100	1,570	12,800	779	9.0	.....	208
21	37	242	100	158	170	100	1,240	9,270	465	9.0	.....	208
22	37	152	100	137	141	100	725	2,580	353	9.0	.....	1,330
23	39	141	100	137	141	100	618	1,750	230	16	.....	3,180
24	37	118	100	128	141	100	585	1,390	187	39	.....	1,460
25	44	128	100	118	158	83	540	1,080	104	63	.....	1,300
26	46	118	100	118	154	83	552	905	86	66	946	1,080
27	42	100	100	118	137	83	492	658	71	48	104	725
28	37	97	100	118	137	83	438	465	926	44	54	831
29	37	83	100	118	.....	128	413	379	398	20	46	398
30	37	83	100	118	.....	118	465	297	324	15	22	275
31	37	.....	100	118	.....	100	.....	268	.....	9.0	4.0	.....

NOTE.—No flow past gage Aug. 7–8 and 11–25, 1918; water was stored above gage.

Monthly discharge of Colorado River at Marble Falls, Tex., for the years ending Sept. 30, 1917 and 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1916–17.				
October	17,100	118	1,590	97,800
November	268	100	159	9,460
December	236	158	189	11,600
January	208	158	182	11,200
February	208	158	192	10,700
March	1,300	182	298	18,300
April	1,300	118	274	16,300
May	11,200	208	1,180	72,600
June	6,890	22	1,090	64,900
July	388	12	103	6,330
August	252	12	68.4	4,210
September	14,900	118	1,730	103,000
The year	17,100	12	588	426,000
1917–18.				
October	182	37	75.4	4,640
November	1,720	26	159	9,460
December	465	100	147	9,040
January	158	100	122	7,500
February	170	118	138	7,660
March	158	83	115	7,070
April	41,700	100	3,320	198,000
May	12,800	230	1,340	82,400
June	23,000	71	2,910	173,000
July	137	9.0	46.0	2,830
August	946	.0	39.1	2,400
September	3,180	4.0	842	50,100
The year	41,700	.0	766	554,000

COLORADO RIVER AT AUSTIN, TEX.

LOCATION.—At Congress Avenue concrete viaduct in Austin, Travis County, half a mile below Shoal Creek and above mouth of Waller Creek, 1 mile below mouth of Barton Creek, and 3½ miles below Austin dam.

DRAINAGE AREA.—34,200 square miles (revised).

RECORDS AVAILABLE.—February 15, 1898, to December 31, 1911; October 1, 1914, to September 30, 1918; September 1, 1895, to April 7, 1900, at Austin dam. Records of stage have been obtained by United States Weather Bureau since July 1, 1903.

GAGE.—Stevens water-stage recorder installed April 26, 1918, on downstream side of pier of viaduct. Gage used February 15, 1898, to December 31, 1911, was a vertical staff attached to bathhouse on left bank of river 150 feet above Congress Avenue Bridge; during the period high-stage readings were made by means of a gage painted on first pier from left end of bridge and a chain gage attached to bridge. From October 1, 1914, to June 18, 1915, the vertical gage of United States Weather Bureau was read. June 18, 1915, to April 25, 1918, Dexter water-stage recorder installed at end of viaduct was used. All gages referred to same datum. Record of depth of water on crest of dam, 3½ miles above Austin, was kept August 13, 1895, to April 7, 1900.

DISCHARGE MEASUREMENTS.—Made by wading or from upstream side of Montopolis highway bridge, 4 miles downstream.

CHANNEL AND CONTROL.—Channel straight for 1,000 feet above and 500 feet below station. Right bank of medium height, composed of clay and gravel, clean, improved by city, subject to overflow; left bank similar to right bank, but high and nearly vertical in places. Bed composed of rock and gravel, clean, shifts. Control is a gravel and rock shoal 500 feet below gage; changes during high water and also during low water because of the removal of sand for municipal use.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.0 feet at 6 a. m. April 16 (discharge, 51,500 second-feet); minimum stage, −0.18 foot at 6 p. m. August 18 (discharge, 2.2 second-feet).

1898–1911; 1914–1918: Maximum stage recorded, 33.5 feet April 7, 1900 (discharge, 122,000 second-feet); minimum stage, −0.50 foot December 13–17, 1914 (discharge, 2 second-feet).

ICE.—None during year.

DIVERSIONS.—The second report of the State Board of Water Engineers shows about 36,000 acres of land declared irrigated above the station, most of which lies in the upper drainage of the main stream and its tributaries. The report also shows 4,000 acre-feet annually, with a storage of 30,000 acre-feet declared by the city of Austin; 160 acre-feet annually by Winchell waterworks; 2,000 acre-feet for waterworks by Brownwood; and an unknown quantity for Marble Falls waterworks; all above station.

REGULATION.—Flow regulated by the Austin dam, about 3½ miles upstream. At 4 p. m. January 24, gates at Austin dam were opened, and reservoir was empty at 6 p. m. January 27. Reservoir empty until filled by high water, April 7. Water released for irrigation below Columbus July 5 to July 24, when reservoir was emptied; reservoir was refilled September 5.

ACCURACY.—Stage-discharge relation not permanent. Numerous measurements made throughout year. Two rating curves were used during the year, one applicable from October 1 to April 25, well defined between 20 and 38,900 second-feet, and the other for the remainder of the year well defined between 20 and 21,700 second-feet. The change in ratings was caused by the Stevens' recorder being located at a different position, in the section, from the Dexter recorder. These curves are coincident below 2 second-feet. Mean daily gage height determined by inspecting gage-height graph. Gage heights from Dexter recorder obtained to half-tenths; from Stevens' recorder to hundredths. Daily discharge ascertained by shifting-control method. Records good.

Discharge measurements of Colorado River at Austin, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	Gowans and Congdon	0.56	192	June 5	Congdon and McCashin	3.16	5,570
24	A. K. Gowans	.46	142	5	do	5.66	14,900
Nov. 13	E. P. Congdon	.48	153	6	do	8.68	19,800
Dec. 1	Congdon and Gowans	.47	152	7	do	5.22	11,800
18	A. K. Gowans	.47	148	18	Gowans and McCashin	1.75	1,560
Jan. 2	do	.74	276	July 2	Gowans and Congdon	1.04	392
Feb. 4	do	.51	173	6	do	1.28	722
23	do	.55	191	18	McCashin and Gowans	1.28	652
26	do	.48	161	29	Hank and Kinnison	.12	40
27	do	.47	150	31	Congdon and Kinnison	.08	87.6
Mar. 7	E. P. Congdon	.48	177	Aug. 1	R. J. Hank	.27	71.3
16	A. K. Gowans	.36	113	6	H. B. Kinnison	.63	31.1
28	E. P. Congdon	.22	84.3	10	E. P. Congdon	−.02	26.9
Apr. 4	do	.44	150	16	A. K. Gowans	−.08	21.8
16	Gray and Hank	14.96	a51,200	22	H. B. Kinnison	−.12	20.8
17	do	8.03	21,100	29	Gowans and Kinnison	1.26	783
20	E. P. Congdon	2.59	3,590	Sept. 5	Congdon and Kinnison	.68	199
May 4	Congdon and Gowans	1.11	414	20	A. K. Gowans	.93	412
21	Hank and McCashin	4.12	9,330	30	Gowans and Congdon	1.25	756

a Surface velocity observed and coefficient of 0.84 used to reduce to mean velocity.

Daily discharge, in second-feet, of Colorado River at Austin, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	174	128	148	280	192	196	196	716	400	590	68	165
2	174	128	162	280	188	216	220	702	354	342	60	122
3	174	128	148	280	171	220	200	490	336	248	50	148
4	196	142	162	280	171	200	168	408	1,070	232	50	105
5	180	156	177	280	171	204	264	500	11,200	220	39	168
6	184	156	192	289	188	204	1,660	636	22,400	786	33	450
7	171	156	174	280	188	184	440	636	11,400	912	38	1,030
8	171	156	159	280	171	168	135	490	6,780	896	32	1,010
9	171	156	159	280	171	153	135	392	3,420	928	34	330
10	171	159	145	280	171	153	159	450	2,050	864	27	2,520
11	171	159	159	280	171	159	159	624	1,590	832	29	1,400
12	138	159	156	280	171	165	758	552	2,120	730	29	1,160
13	138	159	171	280	171	156	3,380	510	2,330	674	28	688
14	138	159	156	280	171	150	2,960	758	4,490	648	25	520
15	135	174	142	280	171	138	500	978	3,820	688	24	716
16	135	174	142	280	156	122	38,400	1,090	2,520	688	25	158
17	135	174	142	280	232	110	18,500	960	1,940	636	22	432
18	132	145	142	280	252	110	9,150	730	1,490	648	22	1,010
19	132	145	162	280	272	125	5,280	552	1,620	832	22	424
20	132	145	177	280	292	125	3,460	450	1,510	1,010	23	368
21	130	162	284	280	272	138	2,280	8,730	1,120	744	24	138
22	130	177	284	280	232	112	1,440	9,690	716	588	25	132
23	128	177	264	300	192	128	1,050	4,120	564	716	24	130
24	140	162	272	490	188	90	800	2,550	540	410	22	122
25	140	148	348	3,460	184	78	730	1,680	636	74	29	112
26	140	148	354	3,880	168	80	716	1,280	510	63	30	120
27	128	177	324	2,280	156	80	1,010	1,010	330	52	60	2,970
28	128	196	324	256	174	80	912	816	232	45	702	3,050
29	128	196	300	236	.....	95	816	660	318	38	928	2,830
30	128	162	280	232	.....	120	786	540	600	36	996	716
31	128	.....	280	212	.....	177	.....	470	.....	39	530	.....

Monthly discharge of Colorado River at Austin, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	196	128	148	9,100
November	196	128	159	9,460
December	354	142	209	12,900
January	3,880	212	565	34,700
February	292	156	193	10,700
March	220	78	143	8,790
April	38,400	135	3,220	192,000
May	9,690	392	1,420	87,300
June	22,400	232	2,950	176,000
July	1,010	36	520	32,000
August	996	22	131	8,060
September	3,050	105	775	46,100
The year	38,400	22	865	627,000

EVAPORATION NEAR AUSTIN, TEX.

LOCATION.—At reservoir on Hill's ranch, 1,000 feet from ranch house, 5 miles south of Austin, Travis County. Elevation 475 feet above sea level.

RECORDS AVAILABLE.—April, 1916, to September 30, 1918.

EQUIPMENT.—Two evaporation pans, one floating on surface of reservoir and the other on land about 30 feet from reservoir; auxiliary equipment consists of hook gages, rain gage, anemometer, maximum and minimum thermometers, and psychrometer.

Evaporation near Austin, Tex., for the year ending Sept. 30, 1918.

Month.	Temperature (°F.).					Mean relative humidity (per cent).	Wind.		Rainfall (inches).	Evaporation (inches).	
	Air.			Water.			Average miles per hour.	Prevailing direction.		Floating pan.	Land pan.
	Mean maximum.	Mean minimum.	Mean.	Floating pan (mean).	Land pan (mean).						
October	81.5	49.1	65.3	62.0	55.6	66.3	2.8	South..	0.42	5.41	7.15
November	74.7	41.8	58.2	53.5	48.6	75.4	2.1	South..	1.47	2.68	4.05
December	57.6	33.1	45.4	[f] 51.3	[i] 48.4	[e] 76.4	3.8	North..	T.	2.80	1.92
January	57.9	25.8	41.8	[n] 43.2	.....	.....	4.5	West...	.86	.....	.....
February	65.1	39.4	52.2	[d] 51.3	[d] 50.5	[d] 84.4	4.3	South..	1.83	1.28	3.42
March	[d] 76.7	50.6	[b] 63.6	58.4	55.4	[a] 75.1	3.9	South..	.96	4.22	6.40
April	77.7	54.0	65.8	65.4	60.8	84.1	1.8	East...	4.22	4.71	6.05
May	85.6	65.5	76.6	73.9	69.7	86.7	1.5	South..	2.20	6.03	7.03
June	[a] 96.6	71.0	83.8	79.0	75.7	80.3	1.4	South..	1.39	8.25	9.05
July	99.7	72.3	86.0	78.7	74.9	72.1	2.3	South..	.09	10.22	12.34
August	99.2	72.6	85.9	78.1	74.5	80.5	2.2	South..	.26	8.53	10.26
September	88.5	61.1	74.8	69.7	64.6	78.1	2.6	South..	2.21	6.13	8.75
The year..	80.1	53.0	66.6	63.7	.....	.....	2.8	South..	15.91	.....	.....

NOTE.—Reference letters [a], [b], [c], etc., appearing in the table indicate number of days for which no record was obtained. For example, [b] represents 2 days, etc.

COLORADO RIVER AT COLUMBUS, TEX.

LOCATION.—At county highway bridge half a block from county jail, 400 feet below Galveston, Harrisburg & San Antonio Railway bridge, in eastern edge of Columbus, Colorado County.

DRAINAGE AREA.—37,000 square miles (revised).

RECORDS AVAILABLE.—January 1, 1903, to December 31, 1911; May 2, 1916, to September 30, 1918. Records of stage have been obtained by the United States Weather Bureau since January 1, 1903. (Occasional discharge measurements, beginning August 2, 1902.)

GAGE.—Chain gage attached to downstream railing of bridge; read by A. S. Lowrey. From January 1, 1903, to December 16, 1907, gage heights were obtained by measuring with a tagged chain and lead weight from point on top of bridge pier to water surface. Mott tape and weight gage on downstream handrail of bridge was read from December 17, 1907, to February 9, 1917, when regulation chain gage was installed. Mott gage and chain gage were referred to same datum.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Channel straight above and below station for 400 feet. Right bank composed of firm earth; high and not subject to overflow; left bank of medium height; likely to overflow. Bed of stream clean and sandy; shifts during high stages. A sand and gravel section about 350 feet below gage serves as low-water control, and the stage-discharge relation during medium and high stages may be controlled by a bend in river below bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 22.7 feet at 7 a. m. April 18 (discharge, 30,100 second-feet); minimum stage, 5.18 feet from 7 a. m. to 6 p. m. September 1 (discharge, 93 second-feet).

1903–1911; 1916–1918: Maximum stage recorded, 35.8 feet April 27, 1908 (discharge, 43,100 second-feet); minimum stage, 4.2 feet September 9 and 10, 1910 (discharge, 10 second-feet).

ICE.—None reported during year.

DIVERSIONS.—Considerable diversions for irrigation in the basin above Austin, but between Austin and Columbus little water is taken out. The station is above the irrigated rice belt, which comprises several thousand acres. Declarations reported by the State Board of Water Engineers for continuous use of water for Smithville, Bastrop, and La Grange waterworks; all above station. Smithville reported a consumption of 193,000,000 gallons during 1916.

REGULATION.—Flow at Columbus during ordinary stages controlled by storage at Lake Austin.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well-defined below 45,000 second-feet. Gage read to hundredths twice daily. Mean of two readings may not be a true index of daily discharge because of regulation above station. Daily discharge ascertained by shifting-control method. Records fair.

COOPERATION.—Morning gage readings furnished by United States Weather Bureau.

Discharge measurements of Colorado River at Columbus, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	Hank and Gowans	5.84	168	July 12	E. P. Congdon	7.23	834
Jan. 5	A. K. Gowans	6.26	331	28	do	6.90	715
Mar. 3	do	6.14	273	Aug. 11	A. K. Gowans	5.51	144
May 10	Hank and McCashin	8.08	1,290	Sept. 16	H. B. Kinnison	7.79	1,180
July 8	C. E. McCashin	6.30	444				

Daily discharge, in second-feet, of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	376	173	206	310	750	285	384	5,330	1,010	640	328	93
2	328	168	206	302	590	278	299	7,720	878	520	282	147
3	344	168	206	376	500	274	328	3,190	770	480	260	625
4	336	170	206	274	425	296	368	1,970	938	655	220	580
5	320	170	206	274	384	340	515	1,230	620	650	195	410
6	310	173	200	302	368	332	1,670	7,610	550	575	185	296
7	292	180	209	316	348	282	3,240	5,520	4,460	490	173	241
8	274	180	203	313	340	260	3,860	2,330	15,600	450	168	217
9	268	180	198	324	356	274	2,290	1,670	8,780	400	160	200
10	257	180	198	320	450	235	1,680	1,360	6,530	540	149	178
11	254	187	200	324	360	223	884	1,130	4,720	342	145	630
12	247	187	200	340	320	223	580	890	3,490	824	143	830
13	238	187	200	356	288	223	440	715	2,640	860	138	848
14	235	187	200	376	274	209	372	974	2,160	836	136	1,540
15	229	185	200	372	274	206	328	1,110	2,300	824	130	1,350
16	214	187	203	368	260	203	2,440	914	2,800	715	125	1,180
17	212	190	203	352	247	198	17,100	745	4,060	670	118	818
18	195	198	209	352	268	198	26,200	932	3,410	680	118	1,090
19	195	212	209	352	348	192	12,700	1,050	2,640	715	128	755
20	195	217	209	328	316	185	7,910	1,100	2,210	725	123	2,380
21	187	220	220	340	620	182	4,860	932	1,780	720	115	2,040
22	187	244	220	336	570	625	4,040	760	1,680	720	107	1,930
23	187	278	220	332	450	620	3,000	2,360	1,630	926	105	605
24	187	244	220	332	384	229	2,290	6,620	1,460	1,030	102	415
25	182	214	220	328	368	282	2,050	4,430	1,240	824	107	336
26	173	214	214	324	336	274	1,800	3,280	950	735	185	268
27	173	203	209	328	313	205	1,710	2,520	830	800	138	198
28	173	208	244	1,210	299	190	1,440	2,040	775	660	108	190
29	170	203	313	2,440	.....	200	2,770	1,660	775	530	104	138
30	164	203	306	1,950	.....	260	15,400	1,380	675	398	97	380
31	182	.....	299	1,340	.....	560	.....	1,190	.....	382	95	.....

Monthly discharge of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	376	164	235	14,400
November	278	168	197	11,700
December	313	198	218	13,400
January	2,440	274	513	31,500
February	750	247	386	21,400
March	625	182	276	17,000
April	26,200	299	4,100	244,000
May	7,720	715	2,410	148,000
June	15,600	550	2,750	164,000
July	1,030	332	670	41,200
August	328	95	151	9,280
September	2,380	93	667	39,700
The year	26,200	93	1,040	756,000

COLORADO RIVER AT WHARTON, TEX.

LOCATION.—Just below highway bridge in west edge of Wharton, Wharton County, 200 feet below Galveston, Harrisburg & San Antonio Railway bridge.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 12, 1916, to August 4, 1918. Station maintained only when water is being released from Austin Lake for rice irrigation.

GAGE.—Vertical staff attached to tree on right bank about 75 feet below highway bridge; read by Henry Marsh.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Channel straight above and below station for a few hundred feet. Bed of stream composed of sand and clay. Banks medium in height, composed of clay, and subject to overflow during extreme stages. Discharge measurements show control to be fairly permanent but at times subject to shift.

EXTREMES OF DISCHARGE.—1916–1918: Maximum stage recorded during periods of record, 3.27 feet at 3.30 p. m. July 25, 1916 (discharge, 1,680 second-feet); minimum stage, −0.90 foot at 7 a. m. August 1, 1917 (discharge, 62 second-feet).

ICE.—None reported.

DIVERSIONS.—Station is in area of rice irrigation and considerable water is diverted above for that purpose. The second report of the State Board of Water Engineers shows 51,126 acres were declared irrigated in Colorado and Wharton counties by using 102,252 acre-feet of water. A large part of this area is irrigated by water pumped from Colorado River above the station.

REGULATION.—Flow is regulated by diversions for rice irrigation and storage in Austin Lake.

ACCURACY.—Stage-discharge relation subject to change. Rating curve fairly well defined. Gage read to hundredths twice daily. Mean of two readings may not be a true index of daily discharge because of regulation above station. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Colorado River at Wharton, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
July 11	E. P. Congdon	0.28	235	Aug. 13	E. P. Congdon	−0.90	21.5
14	do	1.24	618	Sept. 18	H. B. Kinnison	1.89	877
27	do	.81	503				

Daily discharge, in second-feet, of Colorado River at Wharton, Tex., for the year ending Sept. 30, 1918.

Day.	July.	Aug.	Day.	July.	Aug.	Day.	July.	Aug.
1		221	11	234		21	551	
2		166	12	409		22	506	
3		155	13	616		23	465	
4		137	14	625		24	449	
5			15	635		25	611	
6			16	592		26	655	
7			17	524		27	515	
8			18	493		28	582	
9			19	489		29	590	
10			20	538		30	425	
						31	276	

NOTE.—Mean discharge, July 11–31, 510 second-feet (total 21,200 acre-feet); Aug. 1–4, 170 second-feet (total 1,350 acre-feet).

COLORADO RIVER SEEPAGE INVESTIGATIONS.

MEASUREMENTS.—An investigation of gains and losses from seepage in Colorado River between Robert Lee, Tex., and the mouth was made in August, 1918. The stream was divided into five sections, and a hydrographer detailed to each section. The discharge was measured at various intervals along the main stream, at the mouth of each tributary, and at the point of each diversion. Gages at Bronte, Ballinger, Chadwick, Marble Falls, and Columbus are read twice daily, and at Austin a continuous recorder is maintained. Although data were insufficient to warrant a correction of discharge for time interval these gages showed the stream to be at a practically constant stage, with no floods to interfere with the investigation, so that few corrections for time interval were necessary.

These data represent natural conditions as they were found above Columbus, but below that point the flow was practically all diverted for rice irrigation. It is therefore difficult to draw definite conclusions from the measurements made below Columbus. During the investigation the reservoir, formed by the Austin dam, was empty, and the natural flow was passing through the dam. An extremely low stage existed throughout the course of the stream. The following table gives the results of the measurements:

Seepage measurements, in second-feet, on Colorado River from Robert Lee, Tex., to mouth of stream in August, 1918.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Colorado River	Robert Lee	0	7	0				
Liveoak Creek	Mouth	12	7		0			
Colorado River	Gaging station near Bronte.	14	7	0			0	0
Kickapoo Creek	Mouth	15	7		0			
Colorado River	Maverick-Miles highway bridge.	20	7	0			0	0
Oak Creek	Mouth	21	7		0			
Mule Creek	Mouth	22	7		0			
Valley Creek	Mouth	36	7		0			
Colorado River	Gaging station at Ballinger.	42	7		0		0	0
Elm Creek	Mouth	43	7		0			
Colorado River	Mouth of Concho River	61	7	0			0	0
Concho River	Mouth	61	7		0			
Elm Creek	Mouth	70	7		0			
Mustang Creek	Mouth	74	7		0			
Colorado River	Stacy	80	7	0			0	0
Salt Creek	Mouth	81	7		0			
Colorado River	Waldrip	96	7	0			0	0
Buhl Creek	Mouth	99	7		0			

Seepage measurements, in second-feet, on Colorado River from Robert Lee, Tex., to mouth of stream in August, 1918—Continued.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Colorado River	Whan	110	8	0			0	0
Home Creek	Mouth	118	8		0			
Colorado River	Milburn	126	8	0			0	0
Clear Creek	Mouth	131	8		0			
Colorado River	Brownwood - Richland Springs crossing.	134	8	0			0	0
Buffalo Creek	Mouth	148	7		0			
Rough Creek	Mouth	149	7		0			
J. W. Perkins ditch.	one-quarter mile above Regency.	150	7			2.0		
S. M. Jones ditch	1 mile below Regency	151	7			1.6		
Cottonwood Creek	Mouth	154	7		0			
Spring Creek	Mouth	157	7		0			
King Creek	Mouth	163	7		0			
Pecan Bayou	Mouth	164	7		0			
Colorado River	Mouth of Pecan Bayou	164	7	.2			+ 3.8	+ 3.8
Oglesby - Dawson ditch.	6 miles below Pecan Bayou.	170	8			1.4		
Horse Creek	Mouth	173	8		0			
E. H. Hopgood ditch.	Warrens crossing	174	8			.4		
Prescott Creek	Mouth	174	8		0			
Bull Creek	Mouth	176	8		0			
Yarbrough ditch	11 miles northwest of San Saba.	176	8			2.0		
Nabors Creek	Mouth	180	8		0			
Edmondson ditch	1½ miles above San Saba	188	8			.8		
Bennet ditch	1 mile above San Saba	189	8			1.0		
San Saba River	Mouth	190	8		2.9			
Colorado River	Below mouth of San Saba River.	190	8	5.2			+ 7.7	+ 11.5
Colorado River	Gaging station near Chadwick.	193	9	4.0			− 1.2	+ 10.3
Elliott Creek	Mouth	194	9		.0			
Red Bluff Creek	Mouth	196	9		.0			
Antelope Creek	Mouth	198	9		.0			
Rough Creek	Mouth	204	9		.1			
Brazil ditch	3½ miles above Bend	205	9			1.4		
McCourry ditch	1½ miles above Bend	206	9			2.6		
Colorado River	Bend	208	9	0			− .1	+ 10.2
Cherokee Creek	Mouth	210	9		.0			
Colorado River	Tow	232	9	3.5			+ 3.5	+ 13.7
Colorado River	Bluffton	241	10	3.5			.0	+ 13.7
Morgan Creek	Mouth	241	10		0			
Colorado River	Bluffton-Kingsland road	248	10	2.6			− .9	+ 12.8
Spring Creek	Mouth	252	10		0			
Llano River	Mouth	263	10		.2			
Colorado River	Below Llano River	263	10	3.7			+ .9	+ 13.7
Colorado River	1 mile above Sandy Creek.	268	10	3.6			− .1	+ 13.6
Sandy Creek	Mouth	269	10		0			
Pecan Creek	Mouth	272	10		0			
Colorado River	3½ miles above Marble Falls.	276	11	3.0			− .6	+ 13.0
Spareib Creek	Mouth	280	11		0			
Flatrock Creek	Mouth	281	11		0			
Little Cypress Creek	Mouth	295	9		0			
Pedernales River	Mouth	304	9		0			
Colorado River	Mouth of Pedernales River.	304	9	9.0			+ 6.0	+ 19.0
Cow Creek	Mouth	305	9		0			
Colorado River	Cat Hollow ford	310	9	9.2			+ .2	+ 19.2
Bee Creek	8 miles below mouth of Pedernales River.	312	9		0			
Colorado River	Lohman Ford	314	9	7.8			− 1.4	+ 17.8
Williams pump	Above Sandy Creek	322	9			.2		
Sandy Creek	Mouth	322	9		.1			
Colorado River	Watson Ford	322½	9	6.6			− 1.1	+ 16.7
Colorado River	Cameron Ford	336	10	8.0			+ 1.4	+ 18.1
Santa Monica Springs.	1 mile below Cameron Ford.	337	10		.0			
Bull Creek	Mouth	344	10		.0			
Morman Springs	1 mile above Austin dam.	347	10		1.0			
Colorado River	Below Austin dam	348	10	20.5			+11.5	+ 29.6
Colorado River	One-quarter mile below Deep Dddy.	349	10	24.2			+ 3.7	+ 33.3
Barton Creek	Mouth	350	10		14.3			
Austin water supply.	Austin	350½	10			12.0		
Colorado River	Gaging station at Austin.	351	10	26.9			+ .4	+ 33.7

Seepage measurements, in second-feet, on Colorado River from Robert Lee, Tex., to mouth of stream in August, 1918—Continued.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Walker property pump.	5 miles below Austin	356	10			3.2		
Colorado River	Platts Ferry	362	10	51.1			+27.4	+ 61.1
Avery pump	One-half mile below Platts Ferry.	362½	10			1.1		
Shapard pump	3 miles above Onion Creek.	366	10			1.3		
Colorado River	Mouth of Onion Creek	369	10	48.6			− .1	+ 61.0
Colorado River	One-quarter mile above Utley Ferry.	383	10	63.5			+14.9	+ 75.9
Big Sandy Creek	Mouth	395	10		0			
Piney Creek	Mouth	400	10		0			
Colorado River	Bastrop	403	10	83.7			+20.2	+ 96.1
Colorado River	Smithville	426	10	101			+17.3	+113.4
Pine Oak Creek	Mouth	437	11		0			
Colorado River	2 miles north of West Point.	438	11	102			+ 1.0	+114.4
Colorado River	La Grange	453	11	123			+21.0	+135.4
Buckner's Creek	5 miles below La Grange.	458	11		0			
Williams Creek	10 miles below La Grange.	463	11		0			
Colorado River	2½ miles south of Ellinger	470	11	132			+ 9.6	+144.4
Columbine Creek	1 mile above Columbus	486	11		0			
Colorado River	Gaging station at Columbus.	487	11	144			+12.0	+156.4
Lakeside plant	Near Eagle Lake	510	12			71.6		
Colorado River	Below Lakeside plant	510	12	99.6			+27.2	+183.6
Bunges plant	6 miles below Lakeside plant.	516	12			5.0		
Garwood plant	Garwood	520	12			70.6		
Colorado River	Below Garwood plant	520	12	30.2			+ 6.2	+189.8
Colorado River	Glenflora	541	13	80.2			+50	+239.8
Pierce estate	3 miles above Wharton	544	13			73.5		
Colorado River	Wharton	547	13	21.5			+14.8	+254.6
Southern Irrigation Co.	Flume	555	14			99.3		
Jones Creek	Mouth	561	14		0			
Henry Miat pump	Dry Creek	569	14			6.1		
Carlson diversion	1 mile above Blue Creek	571	14			1.3		
Colorado River	Bay City	575	14	0			+85.2	+339.8
Colorado River	4 miles above Matagorda.	593	14	.8			+ .8	+340.6

INTERPRETATION OF RESULTS.—Above the mouth of San Saba River the stream was dry with the exception of a flow of 0.2 second-foot at the mouth of Pecan Bayou. The course of the Colorado from Chadwick gaging station to Austin is through a rough and rugged country; most of the distance is through canyons and gorges, with a few stretches of valleys. Between the Chadwick and Marble Falls gaging stations there was a slight gain. From Marble Falls to Austin dam the flow increased from 3 to 21 second-feet. Between the Austin dam and Austin gaging station there was a sectional gain of 3.5 second-feet, and from the Austin gage to Platts Ferry, a distance of 11 miles, the sectional gain was 27 second-feet. From Platts Ferry to Columbus the flow increased from 51 to 144 second-feet, or a gain of 93 second-feet in 125 miles. As previously stated, the flow below Columbus is practically all diverted. Lack of sufficient data for time interval correction makes records below this point of little value. The sectional gain of 32 second-feet between Austin dam and Platts Ferry, a distance of 14 miles, is due, in all probability, to fissure streams or springs located in the Balcones fault zone, which tend to raise the level of the water table and increase the seepage into the river.

NORTH CONCHO RIVER AT SAN ANGELO, TEX.

LOCATION.—At the concrete viaduct in San Angelo, Tom Green County, 1 mile above confluence with South Concho River.

DRAINAGE AREA.—7,530 square miles.

RECORDS AVAILABLE.—October 27, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to web of three spans from left bank; auxiliary staff on left bank 75 feet upstream from bridge referred same datum read during low and medium stages; read by T. R. Lyle.

DISCHARGE MEASUREMENTS.—Made by wading 400 feet below viaduct.

CHANNEL AND CONTROL.—Bed composed of solid rock which is, to some extent, covered in high-water channel with grass and moss. Channel straight for several hundred feet above and below gage. Banks are sloping, clean, composed of rock and clay, and not subject to overflow except during high floods. About 20 feet below gage and at downstream side of viaduct is a concrete dam about 4½ feet high, formerly used as a low-water crossing, which forms the control and insures a permanent stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.86 feet at 1.30 p. m. May 18 (discharge, 880 second-feet); no flow during several periods throughout the year.

1916-1918: Maximum stage, 4.90 feet at 8.30 a. m. April 18, 1917 (discharge, 1,900 second-feet; obtained from extension of rating curve and possibly subject to considerable error); no flow during several periods of each year.

ICE.—None reported during year.

DIVERSIONS.—The second report of the State Board of Water Engineers shows some water is diverted above station, but the quantity is not known.

REGULATION.—Flow not regulated.

ACCURACY.—Stage-discharge relation permanent. Rating curve well-defined below 200 second-feet, but subject to error above that point; gage read to hundredths daily, oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of North Concho River at San Angelo, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	E. P. Congdon		0.0	Apr. 27	R. J. Hank		0.0
Dec. 17	do		.0	May 26	E. P. Congdon	.38	.2
Jan. 31	R. J. Hank		.0	July 18	R. J. Hank	.72	6.6
Feb. 26	E. P. Congdon		.0	Aug. 22	A. K. Gowans		.0
Mar. 27	A. K. Gowans		.0				

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1918.

Day.	May.	June.	July.	Sept.	Day.	May.	June.	July.	Sept.
1					16		2.4	126	
2					17	880	1.2	10	
3					18	86	.8	5.6	
4	174	150			19	28	.5	3.1	
5	142	33			20	7.1	.4	1.6	
6	28	10		3.8	21	4.2	.3	.8	
7	7.9	24		94	22	3.1	.2	.2	
8	5.1	302		6.3	23	1.9	.1		
9	3.1	118		4.2	24	1.1			
10	1.9	24		2.1	25	.5			
11	1.2	9.1		.8	26	.3			
12	.8	6.3		.4	27	.3			
13	.1	4.2		.1	28	.2			
14	.1	50			29	.1			
15		5.6	214		30				
					31				

NOTE.—Discharge on May 18 obtained by extension of rating curve and subject to error. No flow on days for which no discharge is given.

Monthly discharge of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May	880	0.0	44.4	2,730
June	302	.0	24.7	1,470
July	214	.0	11.7	719
September	94	.0	3.72	221
The year	880	.0	7.10	5,140

CONCHO RIVER NEAR SAN ANGELO, TEX.

LOCATION.—Half a mile below confluence of North Concho and South Concho rivers and 1¾ miles southeast of San Angelo, Tom Green County.

DRAINAGE AREA.—10,800 square miles.

RECORDS AVAILABLE.—September 17, 1915, to September 30, 1918.

GAGE.—Stevens water-stage recorder installed August 9, 1917, on right bank, 1,500 feet below an old ford. Prior to August 9, 1917, a vertical staff gage in several sections attached to trees on left bank directly across river from site of present gage. Both gages referred to same datum.

DISCHARGE MEASUREMENTS.—Made by wading or from cable near gage.

CHANNEL AND CONTROL.—Bed composed of solid rock and gravel. Channel straight for 1,000 feet above and below station. Right bank high, rocky, wooded, and not subject to overflow. Left bank clay and gravel, of medium height, covered with scattered growth of trees, and subject to overflow at high stages. Control for medium and low stages is rapids just below gage; control for high stages not known. Stage-discharge relation affected by moss during low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.8 feet at 1.30 p. m. May 17 (discharge not determined); minimum stage, 0.38 foot from 8 to 10 p. m. August 18 (discharge, 0.2 second-foot).

1915–1918: Maximum and minimum stages occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted above and below the station. Second report of the State Board of Water Engineers shows that a total of 22,000 acre-feet annually is taken from the stream. The water-supply storage dam constructed by the San Angelo Light & Power Co., about a mile above mouth of South Concho River has a small capacity and will not greatly affect the natural flow of the stream.

REGULATION.—Storage at the dam of the San Angelo Light & Power Co. has slight effect on flow at station; no regulation by storage on North Concho River.

ACCURACY.—Stage-discharge relation permanent except during low stages when affected by moss. Rating curve well defined below 600 second-feet. Mean daily gage heights obtained by inspecting graph, or, during days of considerable fluctuation, by planimeter. Operation of recorder good except for periods, November to January, when stage was practically constant. Daily discharge determined by applying mean daily gage height to rating table, except shifting-control method was used when stage-discharge relation was affected by moss. Records good below 600 second-feet; others subject to considerable error.

Discharge measurements of Concho River near San Angelo, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 17	E. P. Congdon	0.49	1.4	Apr. 27	R. J. Hank	0.70	2.0
Jan. 8	do	.54	1.4	May 19	E. P. Congdon	2.94	505
31	R. J. Hank	1.03	13.4	24	do	.75	6.7
Feb. 26	E. P. Congdon	1.02	12.2	July 18	R. J. Hank	.88	8.1
Mar. 27	A. K. Gowans	.79	5.1	Aug. 22	A. K. Gowans	.52	2.6

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.9	4.2	2.8	2.2	7.0	3.6	5.8	2.3	2.3	3.6	0.7	0.5
2	3.0	3.4	2.7	2.2	6.5	7.2	5.8	2.8	2.5	2.4	.6	.5
3	2.9	3.8	2.6	1.9	7.2	10	5.2	6.0	221	2.5	.5	.5
4	2.8	3.7	2.5	1.7	9.2	5.0	3.8	131	805	1.9	.4	.6
5	2.8	3.6	2.5	1.7	7.8	8.9	2.8	445	120	1.8	.4	2.0
6	2.8	3.6	2.4	1.2	6.2	6.2	4.4	164	48	1.2	.5	13
7	2.3	3.5	2.3	1.3	4.2	5.0	3.4	85	72	1.1	.4	41
8	2.5	3.5	2.2	1.4	3.8	3.4	3.0	39	461	1.1	.5	19
9	2.6	3.4	2.1	1.3	4.0	3.6	4.4	22	316	1.1	.5	6.8
10	2.6	3.4	2.0	1.6	12	5.0	3.2	13	537	1.3	.5	3.4
11	2.5	3.3	1.9	2.2	11	3.4	4.0	12	625	1.1	.4	2.5
12	2.4	3.3	1.8	2.9	13	3.8	3.4	13	193	1.0	.4	1.9
13	2.4	3.2	1.7	2.6	10	4.4	3.6	11	340	.8	.4	1.4
14	2.2	3.2	1.6	2.4	7.5	5.2	2.5	12	785	.7	.4	1.0
15	2.2	3.1	1.5	2.4	13	9.6	2.4	7.8	77	27	.6	.6
16	2.5	3.0	1.3	5.8	13	11	2.5	6.8	43	39	.7	.7
17	2.6	3.0	1.6	7.2	7.5	8.9	2.3	2680	38	25	.6	.8
18	2.6	3.4	1.9	9.0	16	6.5	2.6	2860	21	11	.4	.6
19	2.6	3.4	1.8	11	12	4.2	2.0	485	17	5.2	.5	.7
20	2.6	3.4	1.8	10	11	4.0	2.0	210	15	2.8	.6	1.3
21	2.4	2.9	1.8	10	12	5.0	1.9	152	85	1.7	.6	1.1
22	2.3	2.8	1.7	9.0	14	9.6	1.8	79	31	1.9	1.0	.6
23	2.6	3.0	1.6	9.0	12	7.0	2.4	16	16	1.1	.6	.6
24	2.6	3.2	1.5	8.6	11	7.0	2.4	8.2	11	.7	.6	.8
25	2.8	3.0	1.4	9.0	5.8	6.0	2.4	4.8	6.5	.6	.6	1.0
26	2.6	2.9	1.3	10	11	6.0	2.4	3.4	3.8	.5	.5	.8
27	2.9	3.0	1.3	12	7.0	4.8	2.3	2.8	3.8	.5	.6	1.1
28	2.9	3.4	1.4	14	3.6	5.2	1.8	2.6	2.5	.5	.7	.8
29	2.5	3.0	1.9	16	.....	4.6	2.0	2.5	12	.5	.5	.5
30	4.2	2.9	2.0	14	.....	4.6	2.5	2.4	5.0	.6	.5	.5
31	4.0	.....	2.0	12	.....	5.0	.....	2.6	.....	.8	.5	.....

NOTE.—No gage record Nov. 4–14; Nov. 30 to Dec. 15, Dec. 21–26, Jan. 11, 18, 20–24, 25–28, and 30; discharge interpolated. Dec. 16 to May 3 and June 24 to Sept. 30, discharge determined by shifting-control method.

Monthly discharge of Concho River near San Angelo, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	4.2	2.2	2.70	166
November	4.2	2.8	3.28	195
December	2.8	1.3	1.90	117
January	16	1.2	6.31	388
February	16	3.6	9.22	512
March	11	3.4	5.93	365
April	5.8	1.8	3.03	180
May	2,860	2.3	241	14,800
June	805	2.3	164	9,760
July	39	.5	4.55	280
August	1.0	.4	.54	33.2
September	41	.5	3.55	211
The year	2,860	.4	37.4	27,000

CONCHO RIVER NEAR PAINT ROCK, TEX.

LOCATION.—At Concho, San Saba & Llano Valley Railroad bridge a quarter of a mile below mouth of Kickapoo Creek and 2 miles northwest of Paint Rock, Concho County.

DRAINAGE AREA.—11,800 square miles.

RECORDS AVAILABLE.—September 20, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to middle pier at downstream side of bridge; read by Oscar Skaggs.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Bed composed of solid rock, smooth, clean, and free from vegetation. Channel straight for 500 feet above and below gage. Right bank 30 feet high, solid rock, clean, and not subject to overflow; left bank of medium height, sloping, wooded, and subject to overflow during high water. Control for low and medium stages is at a rock shoal 400 feet below gage; permanent, but affected by moss.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.5 feet at 9.30 a. m. May 18 (discharge, 7,150 second-feet); no flow during several periods of year.

1915–1918: Maximum stage recorded, 8.6 feet 11.30 a. m. September 24, 1915 (discharge, 7,300 second-feet); no flow during periods of each year.

ICE.—None reported during year.

DIVERSIONS.—A considerable amount of water is diverted for irrigation both above and below the station.

REGULATION.—Ten small storage reservoirs located between this station and San Angelo; have little effect on flow at the station except during extremely low water.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined below 6,500 second-feet; poorly defined above that point. Gage read to hundredths once daily; oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table and by shifting-control method, when stage-discharge relation was affected by moss. Records good.

Discharge measurements of Concho River near Paint Rock, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	E. P. Congdon	0.65	0.0	Apr. 26	R. J. Hank	.75	a.1
Dec. 18	....do	.70	a.1	May 18	E. P. Congdon	7.55	5,720
Jan. 30	R. J. Hank		.0	19	....do	3.50	904
Feb. 25	E. P. Congdon	.78	a.3	July 19	R. J. Hank	.60	.0
Mar. 28	A. K. Gowans	.81	a.7				

a Estimated.

Daily discharge, in second-feet, of Concho River near Paint Rock, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.0			0.1		0.2	0.7		2.5	0.3	0.8	
2	.6					.4	.6		1.0			
3	.3					.4	.5		1,140			
4	.3					.4	.4	1.2	2,980			
5	.3					.4	.8	114	500			
6	.3					.4	.8	302	137			
7	.3					.4	.7	195	108			
8	.3	.3				.2	.5	57	55			
9	.3	.3		.1		.2	.5	27	315			
10	.3	.3		.1		.2	.5	14	900			
11	.3	.2		.1		.4	.5	11	374	52		
12	.3	.2		.1		.4	.5	11	250	25		
13	.3	.2		.1		.5	.5	9.4	96	1.3		
14	.3	.2				.5	.4	5.4	1,640	1.2		
15	.3	.2				.5	.2	4.5	137	.8		
16	.3	.2				.6	.2	3.5	14	.4		
17	.3	.2				.6	.3	2,940	7.0	.3		
18	.3	.2	.1			.6	.2	6,320	6.1			
19	.3	.2	.1			.6	.1	834	4.7			
20	.3	.2	.1			.6	.1	195	2.5			178
21	.3	.1	.1			.7	.1	166	42			15
22	.3	.1	.1			.7		137	11			4.7
23	.3	.1	.1			.7		83	7.0			4.2
24	.3		.1			.7		34	5.6			1.0
25	.3		.4		.3	.7		20	4.7		4.7	.8
26	.3		.1		.3	.7	.1	4.5	4.2		1.4	.7
27	.3		.1		.2	.7		3.5	.6	12	.8	.5
28	.3		.1		.1	.7		4.7	.4	11		.3
29			.1			.7		4.5		2.3		
30			.1			.7		4.0	.4	1.7		
31			.1			.7		3.7		1.0		

NOTE.—Discharge determined by shifting-control method, Nov. 11 to 20 and Feb. 25 to May 3. No flow on days for which discharge is not given.

Monthly discharge of Concho River near Paint Rock, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1.0	0.0	0.30	18.4
November	.3	.0	.11	6.55
December	.4	.0	.05	3.07
January	.1	.0	.02	1.23
February	.3	.0	.03	1.67
March	.7	.2	.52	32.0
April	.8	.0	.31	18.4
May	6,320	.0	371	22,800
June	2,980	.0	292	17,400
July	52	.0	3.53	217
August	4.7	.0	.25	15.4
September	178	.0	6.84	407
The year	6,320	.0	56.5	40,900

CONCHO RIVER SEEPAGE INVESTIGATIONS.

Seepage investigation on Concho River, including Spring Creek and North and South Concho rivers, was made March 27 and 28, 1918. With the exception of the Middle Concho, numerous pumping plants are situated along each of the above streams and during the investigation there was a large amount of irrigating. This is the only factor that would affect results. Data were insufficient to warrant a correction of discharge for time interval, but in all the streams there was a constant stage previous to and at the time of the investigation so that correction for time interval was in most cases not necessary.

In Spring Creek there was a gain of 10 second-feet in a distance of 27 miles. Above Spring Creek the Middle Concho was dry, but from the mouth of Spring Creek to the confluence with South Concho River there was a gain of 2 second-feet in 2 miles. The North Concho from a point above Sterling City to Water Valley showed a gain of 7.5 second-feet, but from Water Valley to the mouth there was a loss of 2.5 second-feet, making a net gain of 5 second-feet in 77 miles. In the South Concho from Christoval to the confluence with the North Concho there was a gain of 12 second-feet in 20 miles. In the main Concho there was a gain of 5 second-feet, but throughout the lower half of the river's course the measurements show there was a seepage loss. From the gaging station near San Angelo to the Paint Rock gage there are 10 dams and reservoirs which affect the accuracy of a seepage investigation. Interpretations of the measurements on the main Concho are therefore somewhat doubtful.

Seepage measurements, in second-feet, of Concho River from confluence of North and South Concho rivers near San Angelo, Tex., to the mouth, in March, 1918.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Concho River	Confluence of North and South Concho rivers.	0	27	3.8				
Do	Gaging station ½ mile mile below confluence.	.2	27	5.1			+1.3	+1.3
Newton pumping plant.	Northeast of San Angelo.	8.8	28			2.2		
Red Bank Creek	Mouth	9.2	28		0.0			
Pumping plant	Southwest of Miles	12.8	28			2.0		
Crownest Creek	Mouth	14	28		.0			
Pumping plant	4½ miles southwest of Miles.	16	28			2.0		
Concho River	South of Miles	17	28	.0			+1.1	+2.4
Pumping plant	do	17.1	28			2.2		
Concho River	4 miles south of Miles	18	28	1.5			+3.7	+6.1
Lipan Creek	Mouth	26.5	28		.0			
Kickapoo Creek	do	31.5	28		.0			
Concho River	Gaging station 2 miles west of Paint Rock.	32	28	.7			− .8	+5.3
Do	Mouth	51.5	28	.0			− .7	+4.6

Seepage measurements, in second-feet, of South Concho River from Christoval, Tex., to confluence with North Concho River, in March, 1918.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Christoval canal	Christoval	0	27	.....	.....	9.7	.....	.....
South Concho River	300 feet below Christoval canal diversion.	0	27	3.4	.....	.....	.....	.....
Pecan Creek	Mouth	9	27	.....	0.0	.....	.....	.....
South Concho River	Just above mouth of Middle Concho River.	11.8	28	5.8	.....	.....	+2.4	+ 2.4
Middle Concho River.	Mouth	12	28	.....	3.9	.....	.....	.....
South Concho River	½ mile below confluence with Middle Concho.	12.5	28	11.9	.....	.....	+2.2	+ 4.6
Hank pumping plant	½ mile above Metcalfe diversion.	15	28	.....	.....	2.7	.....	.....
Metcalfe canal	3½ miles below mouth Middle Concho River.	15.5	28	.....	.....	12.0	.....	.....
South Concho River	Just below Metcalfe diversion dam.	15.5	28	.0	.....	.....	+2.8	+ 7.4
Do	Christoval road crossing	16.5	28	.4	.....	.....	+ .4	+ 7.8
Lovelace pumping plant.	½ mile below Christoval road crossing.	16.8	28	.....	.....	.9	.....	.....
San Angelo Light & Power Co.'s pumping plant.	½ mile above mouth of South Concho River.	19.3	28	.....	.....	1.2	.....	.....
South Concho River	Just below San Angelo Light & Power Co.'s dam.	19.3	28	1.0	.....	.....	+2.7	+10.5
Do	Mouth	19.8	28	3.8	.....	.....	+2.8	+13.3

Check data, South Concho River, April, 1918.

South Concho River	Just above mouth of Middle Concho River.	11.8	27	2.0	.....	.....	.....	.....
Middle Concho River.	Mouth	12	27	.....	1.8	.....	.....	.....
South Concho River	¾ mile below confluence with Middle Concho River.	12.8	27	6.0	.....	.....	+2.2	.....
Metcalfe canal	Diversion	15.5	27	.....	.....	5.2	.....	.....

Seepage measurements, in second-feet, of Middle Concho River from San Angelo-Mertzon road crossing to mouth, in March, 1918.

Stream or diversion.	Location.	Approximate distance in miles.	Date.	Discharge of main stream.	Inflow.	Diversions.	Section gain or loss.	Total gain or loss.
Middle Concho River.	San Angelo and Mertzon road crossing near Arden.	0	27	0.0	.....	.....	.....	.....
Do	Mouth	22	28	3.9	.....	.....	+3.9	+3.9

Seepage measurements, in second-feet, on North Concho River from point above Sterling City to confluence with South Concho River, in March, 1918.

Stream or diversion.	Location.	Approximate distance in miles.	Date.	Discharge of main stream.	Inflow.	Diversions.	Section gain or loss.	Total gain or loss.
North Concho River.	At McIntyre's dam, 13¼ miles above Sterling City.	0	25	0.2	.....	.....	.....	.....
Do.....	13 miles above Sterling City.	¼	25	1.2	.....	.....	+1.0	+1.0
MacIntyre pump...	1 mile below dam.....	1.0	25	.....	.....	2.3	.....	.....
North Concho River.	11 miles above Sterling City.	2¼	25	.3	.....	.....	+1.4	+2.4
Do.....	½ mile above Slaton dam.	3¾	25	.1	.....	.....	− .2	+2.2
Slaton pump.....	9½ miles above Sterling City.	4	.....	.....	.....	.2	.....	.....
North Concho River.	Slaton dam.....	4¼	25	.2	.....	.....	+ .3	+2.5
Do.....	7½ miles above Sterling City.	6¼	25	0	.....	.....	− .2	+2.3
Mrs. Byers pump..	7 miles above Sterling City.	6¾	25	.....	.....	1.8	.....	.....
North Concho River.	Mrs. Byers dam.....	7¼	25	.1	.....	.....	+1.9	+4.2
Do.....	5 miles above Sterling City.	8¾	25	.3	.....	.....	+ .2	+4.4
H. K. Ray pump...	4¾ miles above Sterling City.	9	25	.....	.....	.4	.....	.....
Allen pump.....	4½ miles above Sterling City.	9¼	25	.....	.....	.3	.....	.....
North Concho River.	4 miles above Sterling City.	9¾	25	.2	.....	.....	+ .6	+5.0
Do.....	3 miles above Sterling City.	10¾	25	.2	.....	.....	.0	+5.0
Do.....	1 mile above Sterling City.	12¾	25	.1	.....	.....	− .1	+4.9
Do.....	Sterling City.....	13¾	25	.0	.....	.....	− .1	+4.8
Sterling Creek.....	3 miles below Sterling City.	16¾	25	.....	0	.....	.....	.....
North Concho River.	6 miles below Sterling City.	19¾	25	0	.....	.....	0	+4.8
Do.....	9 miles below Sterling City.	22¾	25	0	.....	.....	.0	+4.8
Do.....	10 miles below Sterling City.	23¾	25	.3	.....	.....	+ .3	+5.1
Do.....	18 miles below Sterling City.	31¾	25	.0	.....	.....	− .3	+4.8
Do.....	25 miles below Sterling City.	38¾	25	.0	.....	.....	.0	+4.8
Do.....	30 miles below Sterling City.	43¾	25	.9	.....	.....	+ .9	+5.7
Do.....	Water Valley.....	44¾	26	1.8	.....	.....	+ .9	+6.6
Do.....	31½ miles below Sterling City.	45¼	26	2.7	.....	.....	+ .9	+7.5
Do.....	Road crossing 7½ miles below Water Valley.	51¼	26	1.7	.....	.....	−1.0	+6.5
Pump Carlsbad sanitarium.	Carlsbad.....	55¼	26	.....	.....	.1	.....	.....
North Concho River.	.....do.....	55¾	26	1.5	.....	.....	− .1	+6.4
Do.....	½ mile below Carlsbad....	56¼	26	1.5	.....	.....	.0	+6.4
Do.....	4½ miles below Carlsbad.	60¼	26	1.3	.....	.....	− .2	+6.2
Do.....	9 miles below Carlsbad..	64¾	26	.0	.....	.....	−1.3	+4.9
Do.....	12 miles above San Angelo.	65¾	26	.2	.....	.....	+ .2	+5.1
Do.....	6 miles above San Angelo.	10¾	26	.1	.....	.....	− .1	+5.0
Do.....	San Angelo.....	77	26	.2	.....	.....	+ .1	+5.1
Do.....	Mouth.....	78	26	.2	.....	.....	.0	+5.1

Seepage measurements, in second-feet, on Spring Creek from Seven Springs, above Mertzon, Tex., to mouth, in March, 1918.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Spring Creek	Just above Seven Springs, 3 miles above Mertzon.	0	27	1.9				
Do	Just below Seven Springs, 3 miles above Mertzon.	0	27	9.9			+8.0	+8.0
Mertzon canal	Mertzon	3	27			9.3		
Spring Creek	100 feet below Mertzon canal diversion.	3	27	.0			−.6	+7.4
Return water from Mertzon canal.	1,500 feet below Mertzon.	3.4	27		.2			
Spring Creek	1,500 feet below Mertzon, below return water.	3.4	27	.2			.0	+7.4
Do	¼ mile North Sherwood	7	27	.5			+.3	+7.7
Do	Sherwood - Tankersly road crossing.	11	27	1.6			+1.1	+8.8
Hager pumping plant.	1½ miles south of Tankersly.	16	27			.8		
Spring Creek	Just below Hager pumping plant.	16	27	1.9			+1.1	+9.9
Do	Just above Dove Creek mouth.	20	27	2.1			+.2	+10.1
Mottel canal	2 miles above mouth of Spring Creek.	25	27			5.9		
Spring Creek	Just below Mottel canal diversion.	25	27	.8			+4.6	+14.7
Do	Mouth	27	27	.8			.0	+14.7
Dove Creek	do	20	27		4.2			

PECAN BAYOU AT BROWNWOOD, TEX.

LOCATION.—Near pumping plant of city of Brownwood, 600 feet above lower dam, at City Park, 1 mile north of Brownwood, Brown County, 2 miles above mouth of Adams Branch, and 30 miles above confluence with Colorado River.

DRAINAGE AREA.—1,560 square miles.

RECORDS AVAILABLE.—May 24, 1917, to June 30, 1918, when station was discontinued.

GAGE.—Vertical staff in two sections attached to trees on right bank about 200 feet below pumping plant; read by C. N. Davis. From May 25 to June 3, 1917, readings were taken from an inclined and vertical staff gage located at right end of lower dam. This gage was destroyed June 4 and present gage installed June 8. Present gage referred to datum 1.04 feet lower than original one to avoid negative readings.

DISCHARGE MEASUREMENTS.—Conditions will not allow measurements at low stages, but high and medium stage measurements can be made from upstream side of highway bridge 800 feet below lower city dam.

CHANNEL AND CONTROL.—Bed composed of mud and clay, free from vegetation; channel straight above and below station. Banks are wooded, subject to overflow during extremely high stages. When stream is nearly bank-full there is likely to be flow through a slough which leaves the river a short distance above the gage and connects with Adams Branch. One channel at all stages when flow is confined by banks of main stream. City dam 600 feet below gage serves as a control for stages when flow is confined within banks. Dam has opening of 140 feet, crest regular. Location of control not known when banks are submerged.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of records, 4.40 feet at 6 p. m. September 3, 1917 (discharge, 3,340 second-feet, determined by formula using the dam as a weir; possibly subject to considerable error); no flow from June 13 to August 19, August 26 to September 2, and September 16–30, 1917, October 1 to May 17, May 24 to June 1 and June 17–30, 1918.

ICE.—None reported.

DIVERSIONS.—The second report of the State Board of Water Engineers shows 590 acres declared irrigated by use of 1,180 acre-feet of water diverted from Pecan Bayou above the station. This report also shows a storage of 2,000 acre-feet for waterworks by the city of Brownwood. During 1916 the city of Brownwood reported a consumption of 310 million gallons, which was pumped from the stream just above the station. Two pumping plants are operated below the control dam near Brownwood, but the quantity pumped is not known.

REGULATION.—Flow at station regulated during normal flow by storage reservoir and pumping plants above. Two miles above the station the city of Brownwood has constructed a dam to impound water for municipal use. Water is released from this reservoir when the supply is short in pond at the gage from which the city supply is pumped. Backwater from the lower dam extends to the upper dam.

RECORD OF FLOW.—No flow October 1 to May 17, May 24 to June 1, June 17–30. Water ran over dam from May 18 to 23, and June 2 to 16. Station discontinued on June 30. Not sufficient information available to determine daily discharge.

Discharge measurements of Pecan Bayou at Brownwood, Tex., during the year ending, Sept. 30, 1918.

[Made by E. P. Congdon.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Feb. 25	0.0	0
Aug. 8	.0	0

Daily gage height, in feet, of Pecan Bayou at Brownwood, Tex., for the year ending Sept. 30 1918.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1			11		4.64	21		
2		4.81	12		4.48	22		
3		4.86	13		4.41	23	4.28	
4		4.84	14		4.34	24		
5		4.47	15		4.28	25		
6		4.44	16		4.26	26		
7		5.11	17			27		
8		5.78	18	10.99		28		
9		5.24	19			29		
10		5.71	20			30		
						31		

NOTE.—No flow on days for which gage heights are not given except for period May 19 to 22 when gage heights are missing.

SAN SABA RIVER AT MENARD, TEX.

LOCATION.—At steel highway bridge in Menard, Menard County, about 80 miles above mouth of stream.

DRAINAGE AREA.—1,140 square miles.

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1918.

GAGE.—Chain gage attached to floor on downstream side of highway bridge; read by H. A. Cannon.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Channel straight 800 feet above and 100 feet below station; water flows through a series of shoals and ponds; channel above gage somewhat obstructed by reeds and grass, but below gage only slightly obstructed at times. Banks of gravel and clay, wooded; the right sloping, high, and not subject to overflow; the left low, and subject to overflow during high stages. A sand and gravel ford just below gage forms control during low and medium stages; shifts considerably.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.90 feet at 7.30 a. m. June 3 (discharge not determined); no flow July 12–14 and 19–31; August 1–4 and 26–31.

1915–1918: Maximum stage recorded, 13.6 feet at 2.30 a. m. September 16, 1915 (discharge not determined); no flow in 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable land is irrigated above station. Noyes canal diverts a short distance above gage, and irrigates considerable area of land on right side of river. Several pumping plants are above and below gage. The second report of the State Board of Water Engineers shows 5,807 acres declared irrigated by 11,614 acre-feet of water annually in Schleicher and Menard counties; over half of this area is above the station.

REGULATION.—Flow largely controlled at low stages during irrigation season by diversion to Noyes canal.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined below 90 second-feet. Determinations of discharge above 90 second-feet subject to considerable error. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by shifting-control method. Records fair for low and medium stages.

Discharge measurements of San Saba River at Menard, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Congdon and Gowans..	1.83	a1.0	May 22	E. P. Congdon.....	1.87	7.2
Dec. 10	A. K. Gowans.....	2.05	23.7	July 12	A. K. Gowans.....	1.45	.0
Feb. 24	E. P. Congdon.....	2.17	31.9	Aug. 24	.....do.....	1.47	.6
Mar. 29	A. K. Gowans.....	2.18	21.7				

aEstimated.

Discharge measurements of Noyes canal[a] at Menard, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Congdon and Gowans..	.....	0.0	May 22	E. P. Congdon.....	.....	12.4
Dec. 10	A. K. Gowans.....	.....	10.9	July 12	A. K. Gowans.....	.....	17.8
Feb. 24	E. P. Congdon.....	.....	.0	Aug. 24	.....do.....	.....	7.8

aSee description of San Saba River at Menard, Tex.

Daily discharge, in second-feet, of San Saba River at Menard, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.1	3.5	150	28	21	34	8.5	18	9.9	11	.....	0.8
2	1.8	4.1	36	26	19	30	9.2	16	11	4.4	.....	.8
3	1.8	4.1	23	26	23	32	9.2	73	.....	2.9	.....	.8
4	1.9	4.4	20	29	22	30	10	121	.....	2.6	.....	.9
5	2.0	4.4	20	38	21	30	10	91	.....	2.3	1.3	2.6
6	2.3	5.0	18	32	21	32	9.2	32	60	2.6	13	114
7	2.6	4.4	19	34	21	35	2.6	24	20	3.5	18	121
8	2.0	5.0	15	35	23	38	7.8	24	11	1.8	16	107
9	1.8	7.1	19	35	23	41	4.4	22	12	1.7	14	104
10	1.7	7.1	22	36	23	44	1.2	22	11	.9	13	97
11	1.6	8.5	22	34	32	32	1.3	19	11	10	11	85
12	1.5	8.5	20	36	35	30	1.6	19	11	.....	12	78
13	1.4	9.2	22	40	38	30	1.6	18	20	.....	19	77
14	1.1	9.2	23	40	40	21	1.8	18	55	.....	4.4	72
15	1.1	9.2	20	41	40	23	.....	14	1.4	15.0	7.1	70
16	1.3	9.9	26	40	38	21	.....	16	11	4.7	5.7	65
17	1.4	9.9	29	40	36	20	.....	16	18	1.7	7.1	62
18	1.4	11	28	40	40	22	130	15	11	.6	5.0	55
19	1.4	11	28	23	40	21	26	15	29	.....	.8	48
20	1.8	9.9	28	21	40	21	26	18	28	.....	.8	40
21	1.8	11	26	13	36	21	26	15	22	.....	5.7	32
22	1.9	12	28	14	34	21	34	11	20	.....	3.8	23
23	1.8	11	28	13	32	23	35	9.2	20	.....	1.4	20
24	1.8	13	28	20	29	23	28	8.5	19	.....	.6	20
25	1.8	13	24	18	30	23	28	9.2	18	.....	.8	20
26	2.3	14	24	14	30	24	26	7.8	14	.....	.....	20
27	2.9	16	23	14	29	24	18	9.2	11	.....	.....	20
28	2.3	22	23	13	30	23	16	9.9	11	.....	.....	20
29	2.9	19	24	14	.....	22	18	8.5	11	.....	.....	20
30	2.9	18	28	14	.....	20	18	8.5	9.9	.....	.....	20
31	2.9	.....	26	20	.....	10	.....	9.9	.....	.....	.....	.....

NOTE.—Discharge interpolated or estimated Feb. 12 and 21–23; Mar. 8–10; Aug. 24, and Sept. 24–30. On Apr. 15–17, and June 3–5 discharge beyond limits of rating curve; gage heights were as follows: 7.48 feet, 6.64 feet, 3.78 feet, 8.40 feet, 5.49 feet, and 3.50 feet, respectively. During periods of no flow at gage (July 12–14, 19–31, and Aug. 1–4) entire flow of river was diverted into Noyes canal.

Monthly discharge of San Saba River at Menard, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2.9	1.1	1.88	116
November	22	3.5	9.81	584
December	36	15	23.7	1,460
January	41	13	27.1	1,670
February	40	19	30.2	1,680
March	44	10	26.5	1,630
April	.....	1.2	.....	.....
May	121	7.8	23.2	1,430
June	.....	1.4	.....	.....
July	15	.0	1.83	113
August	19	.0	5.18	319
September	121	.8	47.2	2,810

SAN SABA RIVER NEAR SAN SABA, TEX.

LOCATION.—200 feet above Beveridge highway bridge, 1 mile below mouth of China Creek, 2 miles northwest of San Saba, San Saba County, 3 miles below mouth of Richland Creek, and 4 miles above mouth of Simpson Creek.

DRAINAGE AREA.—3,000 square miles.

RECORDS AVAILABLE.—December 30, 1904, to December 31, 1906; September 11, 1915, to September 30, 1918. Miscellaneous discharge measurements previous to 1904.

GAGE.—Vertical and inclined staff, on right bank; read by G. M. Pool. From December 30, 1904, to December 31, 1906, gage heights were obtained by measuring with a tape from a reference point on the bridge to the water surface. Relation between datums of the two gages unknown.

DISCHARGE MEASUREMENTS.—Made by wading or from downstream side of bridge.

CHANNEL AND CONTROL.—Channel straight above and below station for 100 feet. Bed composed of rock and gravel; shifts. Left bank composed of gravel, clay, wooded, high, and not subject to overflow; right bank composed of clay and gravel, wooded, sloping, medium in height, and subject to overflow during high water. A shoal at a ford about 75 feet below gage serves as control during medium and low stages; control is free from vegetation and is fairly permanent during low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 28.5 feet 1.30 a. m. June 3 (discharge, 10,900 second-feet); no flow July 6, 27, August 9, and 10.

1904–1906; 1915–1918: Maximum stage recorded, 31.7 feet August 7, 1906 (discharge not determined); no flow during 1918, as shown above.

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted or pumped from the stream and tributaries above and below station. The second report of the State Board of Water Engineers shows approximately 11,000 acres of land declared irrigated, and approximately 23,000 acre-feet of water used each year from San Saba River. A large part of this water is diverted above the station. Flood water from Brady Creek at Brady is stored for municipal uses; capacity of reservoir not known but probably small. City of Menard uses small amount for waterworks.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent during low and medium stages. Rating curve well defined between 5 and 6,900 second-feet. Two rating tables used, one October 12 to December 17, and one December 18 to September 30. Gage read to hundredths twice daily; oftener during floods. Daily discharge ascertained by applying mean daily gage height to rating table except for periods of shifting control. Records good above 5 second-feet.

High-water discharge measurements of October, 1918, permit the determination of discharge omitted from previous publications: September 16 and 17, 1915, 4,150 and 6,020 second-feet, respectively.

Discharge measurements of San Saba River near San Saba, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	Congdon and Gowans	1.19	27.3	May 20	E. P. Congdon	1.42	36.4
Dec. 8	A. K. Gowans	1.36	38.5	July 13	A. K. Gowans	.81	6.3
Feb. 27	E. P. Congdon	1.49	46.6	Aug. 25	.....do.....	1.10	13.1
Mar. 30	R. J. Hank	1.30	33				

Daily discharge, in second-feet, of San Saba River near San Saba, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	30	41	47	38	40	34	36	7.3	12	13	27
2	26	30	40	47	35	38	32	34	366	5.8	7.6	8.5
3	26	31	42	47	34	48	31	38	4,430	5.2	6.0	8.3
4	24	31	39	47	36	47	29	46	4,130	5.1	9.7	7.3
5	22	31	38	48	37	39	64	51	1,090	2.4	8.8	9.7
6	24	30	39	47	36	40	730	66	412	.0	6.0	12
7	24	35	42	46	39	46	83	100	232	5.8	4.5	16
8	25	33	39	47	40	42	45	114	160	6.8	2.1	15
9	25	33	40	50	38	42	34	83	188	5.6	.0	12
10	27	34	45	50	38	40	29	63	98	5.8	.0	12
11	28	34	42	66	40	32	28	59	77	6.0	2.3	13
12	28	33	46	69	42	33	26	838	68	5.2	8.8	16
13	27	33	45	63	39	31	29	703	59	6.0	4.8	15
14	29	34	45	64	42	34	2,990	136	55	8.2	4.9	14
15	29	35	45	64	40	37	3,490	83	51	12	1.5	15
16	29	36	43	62	36	33	1,130	63	68	8.5	5.3	13
17	29	41	43	60	38	37	1,160	56	164	5.4	6.4	10
18	29	40	45	57	44	34	387	47	104	5.4	9.4	12
19	27	41	45	57	44	32	220	43	63	5.5	9.1	15
20	27	40	46	57	44	25	146	36	52	5.3	13	16
21	28	38	44	62	44	64	111	32	34	10	6.9	16
22	29	37	43	48	44	32	88	27	285	8.8	8.2	16
23	29	37	43	43	44	36	78	22	142	5.8	6.8	17
24	28	44	45	43	56	39	70	21	70	4.9	7.9	16
25	29	46	45	43	50	35	66	15	42	4.9	14	16
26	29	48	43	40	48	31	55	19	27	1.4	17	18
27	30	44	43	40	47	33	48	19	27	.0	12	17
28	30	116	45	38	46	33	52	13	22	9.4	10	15
29	29	63	47	36	.....	39	43	10	19	10	11	17
30	28	50	45	36	.....	38	42	8.2	18	5.5	12	18
31	30	.....	47	36	.....	42	.....	6.8	.....	4.1	11	.....

NOTE.—Discharge determined by shifting-control method, Oct. 6 to Dec. 8 and Mar. 9 to Apr. 5. One rating table used, Oct. 1 to Dec. 17; new rating table used, Dec. 18 to Sept. 30.

Monthly discharge of San Saba River near San Saba, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	30	22	27.4	1,680
November	116	30	40.3	2,400
December	47	38	43.2	2,660
January	69	36	50.3	3,090
February	56	34	41.4	2,300
March	64	25	37.8	2,320
April	3,490	26	379	22,600
May	838	6.8	93.2	5,730
June	4,430	7.3	417	24,800
July	12	.0	6.02	370
August	17	.0	7.74	476
September	27	7.3	14.4	857
The year	4,430	.0	957	69,300

NOTE.—Discharge for Sept. 16 and 17, 1915, omitted from previous publications, is given on the preceding page.

SAN SABA RIVER SEEPAGE INVESTIGATIONS.

The seepage investigation on San Saba River was carried on from March 29 to 31. From McKavett Springs to the Rector dam and canal at San Saba, Tex., natural conditions were found. Below the Rector dam a correction should be applied, but owing to lack of sufficient data this correction was not made. Results below the Rector dam are therefore doubtful. In the Fort McKavett-Menard Valley there was a gain of 24 second-feet, and in the San Saba Valley a gain of 12 second-feet up to the Rector dam. Between these two valleys the stream is confined largely to wide, deep canyons. Measurements at the beginning and end of this stretch show that there was a slight gain.

Seepage measurements, in second-feet, on San Saba River from Fort McKavett Springs, above Menard, Tex., to the mouth, in March, 1918.

Stream or diversion.	Location.	Approximate distance (miles).	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
San Saba River	1 mile below Fort McKavett Springs.	0	29	8.6				
Rocky Creek	Mouth	10	29		0.5			
Clear Creek	do	13	29		11.9			
San Saba River	¾ mile below mouth of Clear Creek.	13.8	29	26.7			+5.7	+5.7
Ellis pumping plant.	1 mile below mouth of Clear Creek.	14	29			5.2		
Russell Bros. pumping plant.	2½ miles above Menard	18.5	29			2.6		
Los Moras Creek	Mouth	20.5	29		.8			
San Saba River	Menard	21	29	21.7			+ 2.0	+7.
Kitchen canal	5 miles below Menard	26	30			4.4		
McWilliams pumping plant.	10 miles below Menard	31	30			2.4		
San Saba River	Hext-Brady road crossing.	41	30	30.9			+ 16.0	+23.7
Do	Brady-Camp San Saba road crossing.	56	30	28.0			− 2.9	+20.8
Do	100 feet above mouth of Brady Creek.	76	30	34.9			+ 6.9	+27.7
Brady Creek	Mouth	76	30		1.7			
San Saba River	Concrete crossing near Doran's ranch.	81	30	34.0			− 2.6	+25.1
Sloan Springs outlet.	2 miles below concrete crossing.	83	30		4.7			
Jobs Creek	Mouth	87	30		.0			
Wallace Creek	do	90	30		.0			
A. J. Harkey pumping plant.	Half a mile above railroad bridge.	91	30			3.4		
Gunter Bros. pumping plant.	Half a mile below railroad.	92	30			2.2		
Richland Creek	Mouth	92.1	30		.0			
Young Pierce pumping plant.	2½ miles northwest of San Saba.	94	30			1.1		
San Saba River	1¾ miles northwest of San Saba.	95	30	33.0			+ 1.0	+26.1
Rectors canal	Half a mile above mouth of Mill Creek.	97.5	30			2.5		
San Saba River	Just below Rectors diversion.	97.6	31	32.5			+ 2.0	+28.1
Mill Creek	Mouth	98	30		22.9			
San Saba River	Three-fourths mile below mouth of Mill Creek.	98.8	30	55.4			.0	+28.1
R. Becker pumping plant.	1 mile below mouth of Mill Creek.	99	30			1.8		
San Saba River	1 mile above mouth	104	31	23.0			−30.6	− 2.5
Do	Mouth	105	31	23.0			.0	− 2.5

NORTH LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—500 feet above remains of old Wilson dam, 1 mile below mouth of Bear Creek, 2½ miles above North Llano highway bridge, 3 miles northwest of Junction, Kimble County, and 4 miles above confluence with South Llano River.

DRAINAGE AREA.—803 square miles.

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1918.

GAGE.—Cantilever chain gage on left bank; read by J. L. Sparkman.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge 2½ miles below station.

CHANNEL AND CONTROL.—Bed composed of solid rock; clean and permanent. Channel straight for 400 feet above and below gage, with a series of pools and rapids. Left bank high, clean, and not subject to overflow; right bank low, wooded, and subject to overflow during high stages. One channel at all stages; current sluggish at gage during low and medium stages. A solid rock ledge having 2 feet vertical fall at site of old dam forms a permanent control for medium and low stages. Growth of mass on control affects gage heights during low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.2 feet at 7 a. m. April 15 (discharge not determined); no flow October 1–24, 26–31, November 1 to December 18, July 9–13, July 17 to September 4.

1915–1918: Maximum stage recorded, 18.00 feet during night of September 15, 1915 (discharge not determined); no flow during periods of 1917 and 1918.

ICE.—None reported during year.

DIVERSIONS.—No large irrigated areas above or below station.

REGULATION.—No indication that flow at station is regulated.

ACCURACY.—Stage-discharge relation permanent during low and medium stages except when affected by growth of mass. Rating curve well defined below 100 second-feet, but poorly defined above that point. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table and by shifting-control method. Records good for medium and low stages but subject to considerable error at high stages.

Discharge measurements of North Llano River near Junction, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	Congdon and Gowans..	0.35	0.0	Apr. 1	A. K. Gowans.....	1.18	5.2
Dec 10	A. K. Gowans.....	.....	.0	July 11	.....do.....	.....	.0
Feb 24	E. P Congdon.....	1.23	7.6				

Daily discharge, in second-feet, of North Llano River near Junction, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.
1			6.0	5.1	9.0	5.1	13	4.5	1.4	
2			6.0	5.1	9.6	4.5	13	4.5	1.3	
3			6.0	5.7	9.6	4.5	14	142	1.3	
4			6.0	6.0	9.0	4.5	93	14	1.0	
5			7.8	6.0	9.0	14	16	5.7	.9	180
6			7.8	6.0	9.0	7.8	15	4.5	.9	77
7			7.8	6.0	9.0	5.7	14	1,050	.8	11
8			5.7	6.0	6.6	5.4	14	30	.7	4.5
9			5.7	6.0	6.6	4.5	13	19		3.7
10			5.1	7.2	6.6	4.5	13	16		2.9
11			5.7	7.2	6.6	4.5	13	14		1.6
12			5.7	7.2	6.6	4.5	13	7.8		1.5
13			6.6	7.2	6.6	4.5	13	6.6		1.5
14			6.0	5.7	6.0	4.5	11	5.7	13	1.4
15			7.2	5.7	6.6	3,860	11	6.6	2.5	1.4
16			7.2	5.7	6.6	840	11	6.6	.5	1.4
17			6.0	6.6	6.0	131	11	5.7		1.3
18			6.0	6.6	6.0	73	10	5.7		1.3
19		1.6	6.0	6.6	6.0	42	10	5.4		1.3
20		2.3	6.0	6.6	6.0	25	9.0	4.5		1.3
21		2.3	7.2	6.6	5.7	23	9.0	4.5		1.5
22		2.3	7.2	6.6	5.7	21	7.2	2.8		1.5
23		3.9	7.2	6.6	5.7	19	7.2	2.5		1.5
24		5.1	5.7	7.2	5.1	18	7.2	2.5		1.4
25	0.5	5.1	5.7	7.2	5.1	17	6.6	2.3		1.4
26		5.1	6.6	7.2	5.1	17	6.6	1.7		1.3
27		6.6	6.6	7.8	5.1	14	5.7	1.6		1.2
28		5.7	6.6	7.8	5.1	14	5.1	1.5		1.2
29		5.7	6.6		12	13	5.1	1.5		1.2
30		5.1	5.7		6.0	13	4.5	1.5		1.3
31		5.7	5.7		6.0		4.5			

NOTE.—Discharge determined by shifting-control method, Jan. 4 to Sept. 30; discharge Apr. 15–16 and June 7, obtained by extension of rating curve and subject to considerable error. No flow on days for which no discharge is given.

Monthly discharge of North Llano River near Junction, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	0.5	0.0	0.02	1
November	.0	.0	.00	.0
December	6.6	.0	1.82	112
January	7.8	5.1	6.36	391
February	7.8	5.1	6.51	362
March	12	5.1	6.89	424
April	3,860	4.5	174	10,400
May	93	4.5	12.9	793
June	1,050	1.5	46.0	2,740
July	13	.0	.78	48.0
August	.0	.0	.00	.0
September	180	.0	10.2	607
The year	3,860	.0	21.9	15,900

LLANO RIVER NEAR JUNCTION, TEX.

LOCATION.—100 feet north of Kerrville-Junction road, a quarter of a mile northeast of Oliver ranch house, 3 miles below confluence of North Llano and South Llano rivers, 3½ miles east of Junction, Kimble County, and 4 miles above creek entering river from south.

DRAINAGE AREA.—1,700 square miles.

RECORDS AVAILABLE.—September 13, 1915, to September 30, 1918.

GAGE.—Vertical staff, 0 to 7.5 feet, attached to tree on right bank, and inclined staff, 7.6 to 19.5 feet, several feet upstream; read by Miss Sadie Oliver.

DISCHARGE MEASUREMENTS.—Made by wading at Mason road crossing a quarter of a mile above gage or from cable 400 feet above station.

CHANNEL AND CONTROL.—Bed composed of solid rock, clean, and permanent. Channel straight for 700 feet above and 350 feet below the gage. Left bank of medium height, slightly wooded, and subject to overflow during high water; right bank clean, high, and not subject to overflow. One channel except during extreme floods, when a small part of the flow may follow a slough that leaves the river a short distance above the gage, passes to the south of Oliver ranch house, and enters the main stream below the gage; this condition occurs only at intervals of 10 to 15 years and will not greatly affect results. Rock ledge about 75 feet below gage, having a fall of 3 feet, serves as permanent control for low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.5 feet during night of April 14 (discharge not determined); minimum stage, 1.32 feet August 23–28 (discharge, 13 second-feet).

1915–1918: Maximum stage recorded, 26.3 feet at 3 a. m. September 16, 1915 (discharge not determined); minimum stage occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—The second report of the State Board of Water Engineers shows 4,741 acres of land above the station declared irrigated, requiring 9,482 acre-feet of water annually from Llano River and tributaries. A large part of this land is in the vicinity of Junction, near the confluence of North Llano and South Llano rivers. A declared use of 500 second-feet for power by the Junction Gin & Water Co. is also shown.

REGULATION.—No apparent regulation of the flow at this point.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 20 and 300 second-feet. Gage read to hundredths once daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent for medium and low stages; poor above 400 second-feet.

Discharge measurements of Llano River near Junction, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	Congdon and Gowans..	1.43	38.2	Apr. 1	A. K. Gowans.....	1.46	42.6
Dec. 11	A. K. Gowans.....	1.46	52.3	July 11	.....do.....	1.37	24.4
Feb. 23	E. P. Congdon.....	1.44	42.5				

Daily discharge, in second-feet, of Llano River near Junction, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	43	41	38	41	41	45	41	69	45	36	20	20
2	43	41	41	41	41	45	41	144	45	32	20	20
3	43	41	41	41	41	45	41	224	660	32	20	20
4	43	41	45	41	41	45	41	240	232	27	20	82
5	38	41	45	41	41	45	41	224	144	27	29	105
6	38	41	45	41	41	45	41	200	41	27	20	361
7	34	41	45	41	41	45	45	144	152	24	20	50
8	34	45	45	41	41	45	45	144	82	24	22	32
9	34	45	45	41	41	45	45	144	76	24	22	32
10	34	45	45	41	41	45	45	144	50	24	24	27
11	34	45	41	41	41	45	45	144	45	24	24	32
12	34	41	41	41	41	45	45	136	32	24	24	32
13	34	41	41	45	45	45	45	136	32	24	24	32
14	32	41	41	45	45	45	1,010	128	36	22	24	32
15	36	41	41	45	45	45	2,100	128	36	22	24	32
16	36	41	41	45	45	45	710	128	36	20	24	32
17	41	41	41	45	45	41	325	128	32	20	24	32
18	36	41	41	45	41	41	240	128	32	20	24	32
19	36	41	41	45	41	41	184	120	240	20	24	36
20	36	41	41	45	41	41	160	105	152	20	24	36
21	36	41	41	41	41	41	144	45	76	24	20	36
22	36	41	41	41	41	41	144	45	50	24	17	36
23	41	41	41	41	41	41	144	45	45	22	13	36
24	41	41	41	41	45	41	112	45	45	24	13	36
25	41	41	41	41	45	41	105	45	41	24	13	36
26	41	41	41	41	45	41	105	41	41	20	13	36
27	41	41	41	41	45	41	82	41	41	22	13	36
28	41	38	41	41	45	41	82	41	41	22	13	36
29	41	38	41	41	.....	56	69	45	41	20	17	36
30	41	38	41	41	.....	45	69	45	41	20	20	36
31	41	.....	41	41	.....	45	.....	45	.....	20	20	.....

NOTE.—Apr. 14 and 15 discharge determined by extension of rating curve.

Monthly discharge of Llano River near Junction, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	43	32	38.1	2,340
November	45	38	41.2	2,450
December	45	38	41.8	2,570
January	45	41	42.0	2,580
February	45	41	42.4	2,350
March	56	41	43.8	2,690
April	2,100	41	212	12,600
May	240	41	111	6,820
June	660	32	88.7	5,280
July	36	20	23.7	1,460
August	24	13	20.0	1,230
September	361	20	47.9	2,850
The year	2,100	13	62.5	45,200

LLANO RIVER SEEPAGE INVESTIGATION.

The investigation of seepage in the Llano River basin included the South Llano and the main stream from Junction, Tex., to the confluence with the Colorado. From the mouth of Big Paint Creek to the confluence with the North Llano there was practically no gain or loss in the South Llano. In Llano River from the gaging station near Junction, Tex., to Beaver Creek there was a loss of 10 second-feet; from Beaver Creek to Little Llano River there was a gain of 28 second-feet; and a loss of 7 second-feet from Little Llano River to the confluence with the Colorado, with a net gain of 11

second-feet from the junction of North and South Llano rivers to the confluence with Colorado River, a distance of 105 miles.

Data were insufficient to warrant a correction of discharge for time interval, but prior to and during the period of each investigation the stage was practically permanent so that a correction for time interval was generally not necessary.

Seepage measurements, in second-feet, on South Llano River from Telegraph, Tex., to confluence with North Llano River at Junction, Tex., in April, 1918.

Stream or diversion.	Location.	Approximate distance in miles.	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Big Paint Creek	Mouth	0	1		23.1			
South Llano River	1½ miles above Telegraph	.5	1	34.8				
Theo. Hunger diversion	2 miles below Telegraph	4	1			1.9		
Llano Land & Irrigation Co.'s diversion	6 miles above Junction	13				7.0		
Cedar Creek	Mouth	18.5	1		1.0			
South Llano River	Just above mouth of North Llano River.	19	1	29.2			+2.3	+2.3

Seepage measurements, in second-feet, on Llano River from Junction, Tex., to the mouth at Kingsland, Tex., March 31 to April 3, 1918.

Stream or diversion.	Location.	Approximate distance in miles.	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
South Llano River	Just above North Llano River.	0	1	29.2				
North Llano River	Mouth	0	1		1.8			
Llano River	3 miles below Junction	3	1	42.6			+11.6	+13.9
Neals pumping plant	¾ mile above mouth of Johnson Fork.	6.2	2			0.5		
Westervelt pumping plant	½ mile above Johnson Fork.	6.5	2			.8		
Johnson Fork	Mouth	7	2		7.5			
Llano River	Just below mouth of Johnson Fork.	7	2	47.9			− .9	+13.0
J. W. White (Damtown) diversion	Diversion	19.5	2			1.8		
Llano River	South of London at Damtown.	20	2	42.5			− 3.6	+ 9.4
Do	Southeast of Streeter	35	2	40.2			− 2.3	+ 7.1
James River	Mouth	43	3		.5			
Llano River	Just below mouth of James River.	43	3	42.3			+ 1.6	+ 8.7
Comanche Creek	Mouth	51	3		.0			
Llano River	½ mile above mouth of Beaver Creek.	54	3	37.4			− 4.9	+ 3.8
Beaver Creek	Mouth	54.5	3		.5			
Willow Creek	do	55.5	3		.0			
Llano River	Castell	64	3	45.3			+ 7.4	+11.2
Hickory Creek	Mouth	72.5	3		.0			
Llano River	9 miles above Llano	73.5	3	50.8			+ 5.5	+16.7
Do	¾ mile above Llano dam	81.8	31	56.4			+ 5.6	+22.3
Do	¼ mile below Llano dam	83	31	65.7			+ 9.3	+31.6
Little Llano River	Mouth	90.5	31		.0			
Llano River	Just above mouth of Miller Creek.	92	31	65.7			.0	+31.6
Miller Creek	Mouth	92			.1			
Honey Creek	do	101.5	31					
Llano River	do	106	31	58.8			− 7.0	+24.6

BARTON CREEK AT AUSTIN, TEX.

LOCATION.—200 feet below Barton Springs, 1,100 feet above Bee Cave highway bridge, half a mile above mouth, and half a mile southwest of Austin, Travis County.

DRAINAGE AREA.—Indeterminate. Normal flow of stream comes from Barton Springs; drainage area of stream not applicable.

RECORDS AVAILABLE.—April 25, 1917, to September 30, 1918. Miscellaneous discharge measurements from 1894 to 1906, and during 1916 and 1917.

GAGE.—Vertical staff, two sections, reading from 0 to 10.1 feet and 10.2 to 20.3 feet, attached to large tree on left bank; read by M. L. Farquhar. April 25 to May 23, 1917, vertical staff gage located 300 feet downstream. Relation between datums not known.

DISCHARGE MEASUREMENTS.—Made by wading about 800 feet below gage.

CHANNEL AND CONTROL.—Bed composed of rock and gravel. Banks high, wooded, and not subject to overflow. One channel at all stages; composed of rock, gravel, and sand. Shoal just below gage forms control during ordinary flow, but growth of weeds in channel affects stage-discharge relation. Floods of Colorado River cause backwater at station.

EXTREMES OF DISCHARGE.—Maximum mean daily flow during year, April 20–21 (discharge, 24 second-feet, or 12,900,000 gallons per day); minimum mean daily flow, February 25 (discharge, 12 second-feet, or 7,760,000 gallons per day).

1894–1906 and 1916–1918: Maximum flow recorded August 31, 1900, and June, 1903 (discharge, 69 second-feet, or 44,600,000 gallons per day); minimum flow occurred in 1918.

ICE.—None reported.

DIVERSIONS.—None reported above or below station.

REGULATION.—Flow not affected by water-power plants or controlling works. Discharge of Barton Springs governs flow during normal conditions. Flow is perennial at station, but from a point 3 miles northeast of Oak Hill to Barton Springs the flow occurs only after heavy precipitation.

ACCURACY.—Stage-discharge relation affected by growth of weeds in channel. Daily discharge determined by interpolation between discharge measurements. Gage read to hundredths twice daily, October 1 to March 31. Frequent discharge measurements increase accuracy of estimates. Records good.

Discharge measurements of Barton Creek at Austin, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	Hank and Gowans	1.49	16.4	May 20	C. E. McCashin	1.66	19.4
26	Gowans and Congdon	1.47	12.9	June 5	Congdon and McCashin	1.73	13.2
Nov. 16	Gray and Gowans	1.49	15.6	22	C. E. McCashin	1.78	16.7
Dec. 1	Congdon and Gowans	1.47	14.0	July 2	Gowans and Congdon	1.76	15.5
19	Hank and Gowans	1.45	14.2	18	McCashin and Gowans	1.65	14.7
Jan. 2	E. P. Congdon	1.47	12.7	29	Hank and Kinnison	1.66	13.3
Feb. 4	R. J. Hank	1.51	13.8	31	Congdon and Kinnison	1.71	14.1
23	Gray and Gowans	1.53	13.2	Aug. 1	E. P. Congdon	1.70	14.0
26	Gray and Hank	1.54	12.1	10	do	1.72	14.3
27	R. J. Hank	1.52	13.8	16	A. K. Gowans	1.71	14.6
Mar. 7	Gray and Congdon	1.54	13.4	27	C. E. McCashin	1.73	13.0
16	Hank and Gowans	1.55	12.6	Sept. 11	H. B. Kinnison	1.75	12.7
Apr. 4	E. P. Congdon	1.66	16.7	20	Kinnison and Gowans	1.78	14.0
20	do	1.64	23.8	30	Gowans and Congdon	1.80	12.7
May 4	Congdon and Gowans	1.62	19.7				

Daily discharge, in second-feet, of Barton Creek at Austin, Tex., for the year ending Sept. 30, 1918.

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

Monthly discharge of Barton Creek at Austin, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	17	13	14.9	916
November	16	14	15.0	893
December	14	13	13.8	849
January	14	13	13.1	805
February	14	12	13.6	755
March	16	13	13.6	836
April	24	17	20.6	1,230
May	21	15	18.6	1,140
June	17	13	15.3	910
July	16	13	15.0	922
August	15	13	14.1	867
September	14	13	13.3	791
The year	24	12	15.1	10,900

GUADALUPE RIVER BASIN.

GUADALUPE RIVER NEAR COMFORT, TEX.

LOCATION.—On Comfort-Kerrville road 100 feet upstream from Boerner Crossing, and 3½ miles west of Comfort, Kerr County.

DRAINAGE AREA.—909 square miles.

RECORDS AVAILABLE.—December 16, 1917, to September 30, 1918.

GAGE.—Vertical staff in two sections on left bank; read by Christoph Flach.

DISCHARGE MEASUREMENTS.—Made by wading; no provision has been made for making high-water measurements.

CHANNEL AND CONTROL.—Bed composed of rock, and forms permanent control. Left bank composed of clay, slightly wooded, and not subject to overflow. Right bank low, wooded, and subject to overflow. Stage-discharge relation affected by moss and weeds during low water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.5 feet during night of April 5 (discharge not determined); minimum stage, 0.87 foot (discharge, 0.6 second-foot).

ICE.—None reported.

DIVERSIONS.—There are some pumping plants about 7 miles above station. The second report of the State Board of Water Engineers shows total of 575 acre-feet of water appropriated, but only very small amount of land irrigated.

REGULATION.—The Kerrville and Center Point mill dams have only slight effect on the flow.

ACCURACY.—Stage-discharge relation permanent except when affected by growth of weeds during low water. Rating curve well defined below 200 second-feet. Gage read to hundredths once daily except on Sundays. Daily discharge ascertained by applying gage heights to rating table and by shifting-control method. Discharge above 200 second-feet subject to error. Records fair.

Discharge measurements of Guadalupe River near Comfort, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16	R. J. Hank	1.55	27.5	July 11	C. E. McCashin	0.90	1.8
Jan. 8	do	1.59	28.5	Aug. 2	A. K. Gowans	.80	.4
Mar. 2	A. K. Gowans	1.49	22.2	6	G. A. Gray	.87	.7
May 1	Gray and Hoyt	1.58	43.5	Sept. 19	E. P. Congdon	1.20	12.9
June 11	C. E. McCashin	1.09	7.1	20	do	2.38	166

Daily discharge, in second-feet, of Guadalupe River near Comfort, Tex., for the year ending Sept. 30, 1918.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		30	30	24	28	42	7.0	1.4	1.1	12.0
2		30	30	22	31	32	7.0	2.0	.8	7.0
3		30	26	20	30	30	7.0	2.0	.6	7.0
4		30	22	19	28	32	7.0	2.0	1.2	3.6
5		30	23	22	51	43	7.0	1.4	1.7	204
6		30	24	25	2,520	54	8.0	1.1	.6	106
7		30	24	23	1,300	40	8.0	1.2	.8	68
8		30	26	23	80	32	8.0	1.4	1.0	50
9		34	30	23	77	32	8.0	1.4	1.0	38
10		34	29	21	56	32	8.6	1.4	.8	28
11		34	28	19	45	32	4.0	2.0	1.3	23
12		34	28	20	43	35	4.0	2.0	1.8	24
13		36	26	20	40	38	4.0	1.7	1.8	23
14		34	30	20	40	32	4.0	1.6	2.4	23
15		37	27	22	321	32	3.6	1.4	3.2	16
16	28	36	29	21	111	20	10	1.7	2.8	9.8
17	28	36	30	20	80	25	16	1.4	2.8	12
18	31	34	30	21	54	20	17	1.4	2.5	12
19	34	33	30	21	36	18	16	2.0	2.2	13
20	31	32	30	22	32	16	17	2.0	1.7	138
21	30	30	33	22	32	20	13	1.7	1.4	54
22	27	30	31	25	32	17	11	1.4	1.1	43
23	27	30	30	28	30	16	11	1.4	1.0	32
24	27	30	30	22	30	15	11	1.4	.6	26
25	30	30	28	21	30	15	9.4	1.4	337	27
26	30	29	24	22	29	13	4.0	1.4	1,600	131
27	30	25	25	26	30	11	4.0	1.4	60	27
28	30	21	24	25	30	10	3.6	1.4	33	25
29	30	34	.....	48	167	10	3.6	1.4	23	18
30	30	21	.....	29	66	8	2.0	1.1	14	10
31	30	22	.....	29	.....	7	.....	1.1	16	.....

NOTE.—Discharge determined by shifting-control method, Dec. 16 to Apr. 5, Aug. 6–25, Sept. 5–19. Discharge Apr. 6–7, 15, Aug. 25–26 obtained from extension of rating curve and subject to error. Discharge interpolated on Dec. 30–31; Jan. 20, 27; Feb. 3, 10, 17; Mar. 3, 10; Apr. 7, 21, 28; May 5, 12, 19, 30; June 1–9, 16, 23, 30; July 7, 14, 21, 28; Aug. 4, 11, 18; Sept. 8, 15, 22, and 29.

Monthly discharge of Guadalupe River near Comfort, Tex., for the year ending Sept. 30 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
December 16–31	34	27	29.6	938
January	37	21	30.8	1,890
February	33	22	27.8	1,540
March	48	19	23.4	1,440
April	2,520	28	183	10,900
May	54	7.0	25.1	1,540
June	17	2.0	8.13	484
July	2.0	1.1	1.54	94.7
August	1,600	.6	68.4	4,210
September	204	3.6	40.2	2,390
The period	.....	.....	.....	25,400

GUADALUPE RIVER AT NEW BRAUNFELS, TEX.

LOCATION.—At highway bridge on San Antonio-Austin post road 700 feet below International & Great Northern Railway bridge, 1 mile below mouth of Comal River, and 1 mile northeast of center of New Braunfels, Comal County.

DRAINAGE AREA.—1,760 square miles.

RECORDS AVAILABLE.—March 13, 1898, to December 30, 1899; January 27, 1915, to September 30, 1918.

GAGE.—Stevens water-stage recorder attached to downstream side of middle pier of bridge. A vertical staff gage in three sections attached to trees on left bank 200 feet below highway bridge and one section on east side of left pier of highway bridge was used from January 27, 1915, to September 28, 1917, when recorder was installed. March 13, 1898, to December 30, 1899, inclined staff gage near the present highway bridge was used; relation between datum of inclined gage and that of the vertical staff gage not known. During normal flow levels show 0.08 foot fall between intake of recorder and vertical staff gage location. Vertical staff gage in well of recorder set to read same as vertical staff downstream.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of solid rock with pockets of coarse gravel; banks gravel, clay, and rock, slightly wooded, high, and not subject to overflow. Rock and gravel shoal just below gage serves as control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.72 feet at 3 a. m., April 7 (discharge, 7,600 second-feet); minimum mean daily stage, 1.47 feet, July 20, 22, 24, and 26 (discharge, 270 second-feet). Minimum stage, 1.23 feet at 6.20 p. m. May 30 (discharge, 188 second-feet).

1898–1899 and 1915–1918: Maximum stage recorded, 27.2 feet at 9.30 p. m., September 17, 1915, determined by leveling from flood marks (discharge not determined); minimum stage recorded in 1918.

ICE.—None reported during year.

DIVERSIONS.—Some water diverted for irrigation above station in Kerr and Comal counties, and for water power, waterworks, and other municipal uses in Kerr, Kendall, and Comal counties; amount not known.

REGULATION.—Flow at this point slightly regulated by operation of power plants.

ACCURACY.—Stage-discharge relation changes slightly. Rating curve for 1918 well defined below 2,500 second-feet. Gage heights from recorder chart determined by planimeter. Daily discharge ascertained by applying mean daily gage height to rating table except for period during shifting control. Records good.

Discharge measurements of Guadalupe River at New Braunfels, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	Hank and Gowans	1.52	307	July 19	Gray and McCashin	1.48	288
Nov. 20	Gray and Gowans	1.53	313	Aug. 23	E. P. Congdon	1.46	256
Apr. 2	E. P. Congdon	1.54	312	Sept. 13	Gray and Kinnison	1.57	309
6	Gray and Congdon	2.32	609	23	A. K. Gowans	1.88	422
May 17	Gray and McCashin	1.65	336				

Daily discharge, in second-feet, of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	294	312	322	336	332	350	315	560	304	287	280	322
2	298	315	329	336	326	350	312	488	308	280	273	315
3	294	312	329	336	322	343	315	426	312	280	280	298
4	294	308	326	329	322	336	315	386	308	280	280	290
5	290	315	322	329	326	336	418	1,240	304	287	280	298
6	294	315	322	326	332	332	1,720	1,040	301	280	284	287
7	290	315	326	329	329	332	3,250	570	304	276	276	422
8	298	312	326	329	332	332	939	480	301	287	280	452
9	294	312	322	329	332	340	610	439	301	284	280	402
10	294	312	326	332	326	340	493	410	308	280	276	354
11	294	318	326	332	329	340	422	398	304	280	280	329
12	294	315	322	332	332	336	382	378	298	273	280	312
13	294	315	322	332	326	336	362	362	294	273	284	308
14	294	315	322	332	332	336	346	354	294	276	280	294
15	298	322	322	332	336	326	343	346	294	284	276	284
16	301	318	322	332	332	326	340	343	301	280	280	290
17	298	326	322	329	340	326	326	336	298	280	280	287
18	301	354	326	326	362	332	430	332	298	276	280	284
19	301	350	326	332	354	326	398	336	298	280	284	280
20	294	326	322	329	336	326	398	332	290	270	284	294
21	287	318	326	329	336	329	362	329	287	273	287	290
22	294	315	329	329	358	322	336	322	287	270	284	444
23	290	318	326	332	346	318	318	318	287	273	280	430
24	294	322	326	332	343	315	318	318	287	270	280	370
25	301	322	326	332	336	312	326	312	290	273	378	336
26	301	322	329	336	329	315	410	312	290	270	390	332
27	304	322	329	340	332	312	374	312	290	276	547	346
28	308	326	332	329	336	312	343	312	290	273	646	457
29	304	326	343	329	.....	315	493	308	284	276	448	394
30	308	326	340	326	.....	312	529	308	284	273	374	362
31	308	.....	336	329	.....	315	.....	301	.....	273	336	.....

NOTE.—Discharge determined by shifting-control method Oct. 9 to Apr. 5.

Monthly discharge of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	308	287	297	18,300
November	354	308	320	19,000
December	343	322	327	20,100
January	340	326	331	20,400
February	362	322	335	18,600
March	350	312	328	20,200
April	3,250	312	542	32,300
May	1,240	301	420	25,800
June	312	284	297	17,700
July	287	270	277	17,000
August	646	273	318	19,600
September	457	280	339	20,200
The year	3,250	270	344	249,000

GUADALUPE RIVER NEAR GONZALES, TEX.

LOCATION.—Just below Guadalupe highway bridge, 1 mile below power house of Gonzales Water Power Co., 1¼ miles south of Gonzales, Gonzales County, and 2½ miles below mouth of San Marcos River.

DRAINAGE AREA.—3,620 square miles (revised).

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1918. The United States Weather Bureau has records from a gage at a power house of Gonzales Water Power Co. since September 1, 1904.

GAGE.—Vertical staff in three sections on right bank just below bridge; read by R. G. Wilson. Relation between this gage and United States Weather Bureau gage not known.

DISCHARGE MEASUREMENTS.—Made from cable one-fourth mile below gage or by wading below cable.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; channel below station is straight for 500 feet, but above is broken by an island and is straight for not more than 50 feet. Banks composed of gravel and clay; medium height; wooded along edge on the right and for some distance back on the left; subject to overflow only during extremely high stages. Position of control not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.8 feet 5.25 p. m. April 30 (discharge, 8,640 second-feet); minimum stage, 0.02 foot from 6.40 a. m. to 8.30 p. m. August 18 (discharge, 182 second-feet).

1915–1919: Maximum stage recorded, 23.25 feet at 7 a. m. May 25, 1916 (discharge, 22,800 second-feet, from extension of rating curve and subject to error); minimum stage occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Some water diverted for irrigation above station but the amount is small in comparison with the total run-off. As rainfall is nearly sufficient for general farming irrigation is intermittent, and it is extremely difficult to estimate the amount of water used.

REGULATION.—Flow regulated to some extent by operation of water-power plants above. Power house of Gonzales Water Power Co. is 1 mile above station.

ACCURACY.—Stage-discharge relation changed during high water of March 28 and 29. Rating curve used before March 28 well defined between 350 and 1,000 second-feet; rating curve used March 28 to September 30 well defined between 210 and 800 second-feet and fairly well defined between 800 and 9,510 second-feet. Gage read to hundredths twice daily. Mean of two readings daily may not be true mean due to power regulation above. Gage-height record prior to May 15 unreliable, but from May 15 to September 30 record is good. Daily discharge determined by applying gage heights to rating table and by shifting-control method. Records fair.

Discharge measurements of Guadalupe River near Gonzales, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	R. J. Hank	0.79	420	Mar. 30	E. P. Congdon	13.98	5,900
31	Hank and Gowans	.74	360	Apr. 7	R. J. Hank	17.65	9,180
Nov. 28	E. P. Congdon	.90	422	May 10	Hank and McCashin	1.74	846
Jan. 22	R. J. Hank	.94	436	June 11	Gray and Congdon	.78	363
Mar. 5	A. K. Gowans	.98	413	Aug. 5	A. K. Gowans	.63	310
29	E. P. Congdon	13.20	5,710	Sept. 22	E. P. Congdon	.41	254

Daily discharge, in second-feet, of Guadalupe River near Gonzales, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	365	421	362	373	442	436	1,340	6,130	362	306	288	372
2	368	418	394	360	442	430	1,600	1,660	365	306	281	376
3	403	370	436	360	442	418	2,630	886	368	309	270	379
4	394	365	439	355	442	415	2,210	1,110	488	324	265	368
5	388	368	412	370	457	406	2,010	1,730	634	321	278	368
6	382	360	362	358	451	403	4,470	4,120	568	312	278	398
7	382	394	388	360	436	400	8,610	6,740	435	309	280	407
8	379	352	382	365	436	406	6,700	2,150	376	303	365	368
9	373	394	394	360	451	406	1,470	1,230	348	295	379	337
10	376	391	391	358	457	406	842	882	348	309	372	372
11	379	397	388	352	448	403	790	762	348	300	206	368
12	368	370	370	348	448	403	678	742	494	303	324	379
13	370	352	376	365	448	397	575	726	502	303	456	407
14	365	350	385	382	430	394	554	726	354	290	407	435
15	368	352	403	388	430	382	592	575	340	303	365	189
16	362	355	433	403	436	376	522	572	368	298	418	306
17	362	355	415	418	457	376	502	558	386	298	376	390
18	360	467	415	424	436	370	494	564	368	290	182	368
19	358	430	427	433	418	368	477	572	390	298	202	368
20	355	467	439	433	421	370	463	572	351	295	185	814
21	350	400	412	436	424	376	460	480	344	315	228	650
22	352	457	403	439	421	544	456	474	354	280	234	300
23	365	352	403	436	412	481	449	477	344	282	424	354
24	362	360	403	445	412	406	446	463	354	300	250	407
25	355	385	409	448	412	409	442	446	327	290	208	376
26	350	474	406	451	418	409	449	404	334	280	290	368
27	358	403	412	451	424	412	456	400	330	289	393	372
28	421	474	406	445	448	1,400	463	390	334	280	234	372
29	400	403	406	445	.....	5,020	1,050	386	321	288	250	234
30	348	379	412	457	.....	5,870	7,130	396	315	275	452	379
31	345	.....	382	464	.....	1,200	.....	390	.....	280	368	.....

NOTE.—Discharge ascertained by shifting-control method Oct. 1 to Mar. 27 and May 1 to June 5.

Monthly discharge of Guadalupe River near Gonzales, Tex., for the year ending Sept 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	421	345	370	22,800
November	474	350	394	23,400
December	439	362	402	24,700
January	457	348	403	24,800
February	457	412	436	24,200
March	5,870	368	790	48,600
April	8,610	442	1,640	97,600
May	6,740	386	1,220	75,000
June	634	315	395	23,500
July	324	275	297	18,300
August	456	182	307	18,900
September	814	189	386	23,000
The year	8,610	182	586	424,000

GUADALUPE RIVER BELOW CUERO, TEX.

LOCATION.—Three-fourths mile upstream from Heard's Bridge on Arneckville road, 1 mile south of Dietze farmhouse, 2 miles below Clinton Bridge, 2½ miles southeast of Cuero, Dewitt County, and 8 miles below power dam.

DRAINAGE AREA.—5,020 square miles.

RECORDS AVAILABLE.—August 6, 1916, to September 30, 1918. From December 26, 1902, to December 31, 1906, and August 19, 1915, to August 6, 1916, a station was maintained at Schleicher Bridge, 4 miles above this point. Discharge at two sites practically the same.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from cable 40 feet upstream from gage or by wading below low-stage control.

CHANNEL AND CONTROL.—Channel straight above and below station for 1,000 feet. Bed composed of gravel and small rock; clean and practically permanent. Banks sand and dirt, covered with brush and open timber. Right bank not subject to overflow; left bank subject to overflow above a gage height of 20 feet, for a distance of one-fourth mile back from river. Rock and gravel rapids 250 feet below gage form permanent control during low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.68 feet at 10.30 a. m. March 31 (discharge, 10,200 second-feet); minimum stage recorded, about 0.58 foot from 9 to 10 a. m. November 1 (discharge about 80 second-feet, determined from extension of rating curve).

1916–1918: Maximum and minimum stages occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Small diversions for irrigation in upper part of the Guadalupe River basin do not greatly affect flow at station. The second report of the State Board of Water Engineers declares a continuous use of 4,277 second-feet of water for municipal and manufacturing plants, 730 acre-feet annually for the city of Cuero, 2,145 acre-feet annually for New Braunfels, Seguin, and Gonzales, and 2,900 acre-feet storage annually in the drainage basin above station.

REGULATION.—Flow regulated by operation of water-power plants upstream, of which one 8 miles above has the greatest effect.

ACCURACY.—Stage-discharge relation changes slightly during high water. Rating curve well defined between 200 and 10,000 second-feet. Operation of water-stage recorder unsatisfactory causing breaks in the gage-height record. Daily discharge ascertained by applying mean daily gage height determined by planimeter, to rating table, and by shifting-control method. Records fair.

Discharge measurements of Guadalupe River below Cuero, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	R. J. Hank	1.49	554	Apr. 10	R. J. Hank	4.66	2,940
31	Hank and Gowans	.81	197	10	do	4.02	2,410
Nov. 28	E. P. Congdon	1.68	597	10	do	3.61	2,150
Jan. 21	R. J. Hank	1.33	526	May 8	Hank and McCashin	10.78	7,810
Mar. 4	A. K. Gowans	1.82	602	9	do	5.15	3,250
31	E. P. Congdon	13.63	8,340	June 11	Gray and Congdon	1.90	855
Apr. 8	R. J. Hank	12.91	9,370	July 9	C. E. McCashin	1.25	428
9	do	11.44	8,270	Aug. 3	A. K. Gowans	1.29	465
9	do	9.67	6,370	Sept. 21	E. P. Congdon	1.47	587

Daily discharge, in second-feet, of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	344	262	382	377	500	380	3,180	6,340	562	366	340	488
2	360	306	399	394	458	400	930	7,840	608	377	340	394
3	372	311	524	322	404	450	770	2,290	530	382	340	410
4	366	165	382	344	482	543	2,340	2,360	595	350	340	410
5	382	399	422	344	518	382	1,220	5,210	640	345	344	434
6	355	289	410	366	388	355	3,630	5,810	673	340	333	404
7	372	422	355	388	536	404	6,970	5,150	699	335	289	230
8	410	333	289	382	530	294	9,110	7,420	690	330	289	289
9	306	422	267	416	520	322	7,660	3,410	680	325	322	360
10	416	306	476	416	500	320	3,020	1,330	660	322	294	220
11	355	256	410	422	480	320	1,320	1,010	666	316	388	350
12	316	512	372	394	470	330	993	916	556	316	344	422
13	289	294	322	300	470	340	846	937	874	315	338	476
14	195	355	328	602	450	300	712	686	718	320	294	410
15	416	377	300	394	430	300	751	680	416	320	338	372
16	344	350	316	410	420	310	660	744	654	320	333	388
17	458	338	366	382	400	330	634	673	1,100	340	410	205
18	410	311	382	434	380	320	621	692	818	340	440	366
19	360	602	377	350	370	330	673	595	718	340	289	446
20	344	543	388	322	380	330	410	580	530	349	289	366
21	195	388	399	434	360	328	382	570	518	340	350	318
22	428	434	434	388	350	316	536	560	306	350	294	1,440
23	355	464	256	388	380	909	562	550	458	350	190	744
24	372	366	399	428	390	986	530	550	440	360	311	488
25	322	215	416	338	380	543	500	570	530	369	322	422
26	355	488	410	372	360	410	576	540	718	360	284	588
27	344	388	382	372	350	338	958	530	410	360	225	624
28	440	382	338	500	360	1,100	640	550	289	340	377	1,150
29	388	422	306	506	.....	6,320	1,190	560	377	340	294	692
30	404	350	328	410	.....	7,740	2,840	560	452	340	245	536
31	416	.....	446	399	.....	9,800	.....	562	.....	340	518	.....

NOTE.—Discharge determined by shifting-control method Nov. 2 to Mar. 29. No record Feb. 8 to Mar. 3, Mar. 10-20, May 20-30, June 5, 8-10, July 5-9, 13-31, Aug. 1-4; discharge interpolated.

Monthly discharge of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	458	195	361	22,200
November	602	165	368	21,900
December	524	256	374	23,000
January	602	322	397	24,400
February	536	350	429	23,800
March	9,800	294	1,160	71,300
April	9,110	382	1,840	109,600
May	7,840	530	1,960	121,000
June	1,100	289	596	35,500
July	382	315	341	21,000
August	518	190	326	20,000
September	1,440	205	499	29,700
The year	9,800	165	722	523,000

SAN MARCOS RIVER AT SAN MARCOS, TEX.

LOCATION.—Just below Cape Ginning Co.'s mill, 300 feet southwest of main San Marcos-Luling highway, 1 mile southeast of San Marcos, Hays County, 1¼ miles above mouth of Blanco River, and 1½ miles below dam of San Marcos Utilities Co. and large springs that furnish a constant flow in the stream.

DRAINAGE AREA.—Not determined.

RECORDS AVAILABLE.—June 10, 1915, to September 30, 1918. Miscellaneous measurements from 1894 to 1903.

GAGE.—Stevens water-stage recorder on left bank, 300 feet below Cape Ginning Co.'s mill. June 10, 1915, to January 19, 1916, vertical staff gage attached to the sewer trestle of San Marcos Utilities Co., 1,000 feet below Austin-San Antonio highway bridge, 1¼ miles above present site. Relation between datum of staff gage and that of water-stage recorder not known.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Channel straight for 200 feet above and below the station. Water very clear and with scarcely any sediment except during floods caused by local rains. Left bank wooded, high, and not subject to overflow; right bank wooded, low, and subject to overflow, the water spreading back a short distance to a second bank. Position of control not known; discharge measurements indicate that it changes slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.12 feet at 8 p. m. April 5 (discharge not determined); minimum stage recorded, 0.34 foot at 12.50 p. m. September 26 (discharge, 11 second-feet, determined from extension of rating curve).

1915–1918: Maximum and minimum stages occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—A concrete dam just above the San Marcos-Luling road bridge makes a pond for Rogers's resort and serves as a diversion dam for an irrigation plant on left bank; diversion intermittent, but when used takes about 95 second-feet from river. A water wheel is used to pump the water for irrigation, and the water that passes through it is returned to the river above Cape Ginning Co.'s dam. A dam about 1,000 feet above the station creates a pond from which water is pumped to the south-bank lands. Only diversion between station and mouth of Blanco River is about 250 feet below gage. Beckman dam just below mouth of Blanco River is used to impound water for irrigation. During flood stages in Blanco River backwater is created at the station. The second report of the State Board of Water Engineers declares a continuous use of 1,978 acre-feet of water annually diverted from San Marcos River to irrigate 989 acres in Hayes County, a large part of which lies above the station, and 1,120 acre-feet annually for waterworks by San Marcos Utilities Co.

REGULATION.—Flow at station entirely regulated by dams above, the greatest effect being that produced by the power dam of San Marcos Utilities Co. in the upper part of San Marcos, near the springs. This dam backs water over the springs that are the source of supply of the river during ordinary stages; water is stored during the afternoon and evening and released during the morning. Large fluctuations are also caused by operation of water wheel at Cape Ginning Co.'s mill.

ACCURACY.—Stage-discharge relation affected by moss and weeds in channel; rating curve is fairly well defined between 35 and 200 second-feet. No periods of backwater from Blanco River during the year, and the constant flow of San Marcos River allows estimates of the discharge to be made without material reduction in accuracy. Gage-height record good. Mean daily gage height determined by use of planimeter. Discharge determined by shifting-control method. Records good.

Discharge measurements of San Marcos River at San Marcos, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	Gray and Walsh	1.02	47.8	Apr. 2	E. P. Congdon	1.89	89.9
Nov. 1	Hank and Gowans	1.71	102	6	Gray and Congdon	2.98	194
20	Gray and Gowans	1.58	87.8	May 17	Gray and McCashin	1.75	116
Dec. 28	do	1.70	94	June 12	Gray and Congdon	1.57	102
Feb. 6	R. J. Hank	1.64	88.3	July 19	Gray and McCashin	1.35	81.5
12	Gray and Congdon	1.70	88.3	Aug. 23	E. P. Congdon	1.41	98.9
16	E. P. Congdon	1.73	96	Sept. 13	McCashin and Kinnison	1.40	93.2
Mar. 23	Gray and McCashin	1.80	89.5				

Daily discharge, in second-feet, of San Marcos River at San Marcos, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	92	96	86	83	97	93	119	101	96	77	88
2	88	90	91	85	88	90	90	120	103	86	76	86
3	90	91	95	84	88	94	92	118	104	86	76	85
4	91	96	96	83	90	91	90	118	102	84	75	88
5	91	97	95	82	88	96	323	213	98	83	76	87
6	84	93	95	82	88	98	329	142	98	83	75	86
7	89	93	95	84	92	96	163	134	97	84	81	83
8	91	96	95	84	88	95	163	130	96	84	78	86
9	91	88	94	71	88	93	164	130	96	78	80	81
10	90	91	94	92	89	97	164	128	96	80	81	85
11	89	96	94	109	90	92	165	127	92	85	81	84
12	89	103	93	96	88	93	165	126	95	80	84	84
13	89	100	93	92	89	93	166	124	93	76	84	84
14	89	99	93	85	92	90	166	118	94	84	84	84
15	88	96	93	86	96	89	167	117	93	84	84	85
16	87	80	92	87	96	90	159	119	96	75	85	83
17	86	102	92	96	97	94	129	117	95	78	86	83
18	82	91	96	95	96	100	124	116	95	80	88	83
19	92	81	90	97	96	100	122	114	93	79	86	83
20	84	92	92	96	91	100	119	115	92	80	88	88
21	96	92	92	88	91	100	119	114	91	83	85	83
22	87	96	92	96	94	100	120	113	88	82	86	84
23	87	97	95	91	92	90	117	112	88	78	88	83
24	84	97	89	88	94	94	117	111	87	78	89	84
25	88	104	90	90	93	92	118	108	88	78	89	80
26	84	93	95	90	92	92	119	109	87	79	90	88
27	90	92	100	88	98	94	118	108	85	77	89	84
28	92	92	92	86	95	166	119	106	88	79	88	84
29	84	92	91	88	.....	106	142	101	84	76	89	84
30	93	89	89	87	.....	92	129	100	84	79	88	83
31	77	.....	88	87	.....	92	.....	100	.....	76	88	.....

NOTE.—Reporder did not operate Oct. 1-3, 9-14, Dec. 8-16, Dec. 29 to Jan. 3, Apr. 8-14, Aug. 22-25; discharge determined by interpolation.

Monthly discharge of San Marcos River at San Marcos, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	96	77	88.1	5,420
November	104	80	93.7	5,580
December	100	88	98.1	5,720
January	109	71	88.7	5,450
February	98	83	91.5	5,080
March	166	89	97.0	5,960
April	329	90	146	8,690
May	213	100	120	7,380
June	104	84	93.3	5,550
July	86	75	80.6	4,960
August	90	75	83.7	5,150
September	88	80	84.4	5,020
The year	329	71	96.6	70,000

SAN MARCOS RIVER AT OTTINE, TEX.

LOCATION.—Above highway bridge one-fourth mile southwest of Ottine, Gonzales County, 4 miles below mouth of Plum Creek, and 10 miles above confluence with Guadalupe River.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—June 22, 1915, to September 30, 1918.

GAGE.—Vertical staff in four sections attached to trees on left bank about 200 feet above bridge; read by J. H. Kaine. June 22 to October 12, 1915, vertical staff under the highway bridge was used; gage heights have been reduced to datum of present gage by means of a relation curve.

DISCHARGE MEASUREMENTS.—Made by wading at shoal 100 feet below gage or from downstream side of highway bridge.

CHANNEL AND CONTROL.—Bed composed of sand, rock, and gravel; slightly shifting. Banks high and wooded; not overflowed except by extremely high water. Channel straight above and below the station for 150 feet. Low-stage control formed by shoal 100 feet below gage; during high stages on Guadalupe River backwater destroys stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 29.5 feet at 6 p. m. April 6 (discharge, 8,750 second-feet). Minimum stage, 1.06 feet at 6.30 p. m. July 31 (discharge, 26 second-feet).

1915–1918: Maximum and minimum stages occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Small diversions for irrigation above station use only a small part of the total run-off.

REGULATION.—Flow regulated by the operation of a small cotton gin a short distance above station. The operation of several small water-power plants in the upper basin near San Marcos and Martindale does not materially affect the flow at this station.

ACCURACY.—Stage-discharge relation practically permanent. Gage read twice daily to hundredths; the mean of these readings may not be a true indication of the flow on account of diurnal fluctuation caused by regulation. Daily discharge ascertained by applying mean daily gage height to rating table and by shifting-control method.

RECORDS.—Good.

Discharge measurements of San Marcos River at Ottine, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	Hank and Gowans	1.51	87	Apr. 7	R. J. Hank	12.78	1,510
29	E. P. Congdon	1.59	95	8	do	3.53	343
Jan. 23	R. J. Hank	1.68	100	May 10	Hank and McCashin	2.38	220
Mar. 6	A. K. Gowans	1.69	100	June 12	Gray and Congdon	4.06	502
Apr. 7	R. J. Hank	23.38	5,460	Aug. 6	A. K. Gowans	1.50	79.4
7	do	15.47	2,040	Sept. 22	E. P. Congdon	1.31	67.6

Daily discharge, in second-feet, of San Marcos River at Ottine, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	71	79	93	106	92	104	175	574	107	76	71	62
2	71	82	93	98	92	95	2,080	288	93	78	68	65
3	70	79	97	92	86	93	2,180	183	97	81	75	78
4	87	82	97	95	107	92	124	150	411	80	89	80
5	78	80	98	92	99	102	113	536	186	72	73	65
6	77	84	93	92	93	93	5,320	6,800	154	78	71	89
7	74	79	96	97	93	92	3,600	975	148	78	73	80
8	75	76	96	91	97	92	375	388	114	74	77	67
9	72	82	88	88	103	93	273	287	95	71	80	73
10	70	76	95	91	104	88	220	215	96	72	75	74
11	78	84	96	104	106	97	153	175	93	72	66	90
12	77	80	96	124	98	97	143	161	395	76	65	82
13	77	77	91	104	104	91	135	154	103	74	148	84
14	76	96	97	130	96	97	126	148	92	74	156	87
15	76	90	98	129	90	92	124	145	150	72	80	70
16	77	89	98	124	91	78	132	143	124	71	64	88
17	74	89	93	102	103	78	124	130	96	74	74	60
18	74	93	87	97	130	93	114	132	99	74	66	71
19	77	87	83	103	129	90	111	138	102	72	67	71
20	79	84	89	96	129	90	117	116	103	73	62	199
21	84	84	95	101	97	91	116	114	96	80	59	68
22	87	79	93	98	92	95	122	113	89	70	80	67
23	88	82	93	97	92	98	104	111	80	73	69	66
24	82	81	107	97	98	90	288	110	83	71	83	77
25	72	86	97	102	99	83	148	110	79	63	64	84
26	71	92	97	99	99	82	135	103	78	37	69	104
27	81	97	88	92	96	81	129	102	83	71	60	103
28	77	87	93	99	97	1,480	134	106	78	77	76	92
29	84	88	95	97	.....	6,750	2,630	99	76	61	70	80
30	81	90	92	95	.....	1,450	5,570	101	74	80	70	68
31	78	.....	95	93	.....	214	.....	96	.....	62	66	.....

NOTE.—Discharge determined by shifting-control method Oct. 1 to Jan. 10 and May 1–31; April 6–8 and May 6–7, discharge determined from current-meter measurements made Apr. 6–8, as stage-discharge relation was destroyed by backwater from Guadalupe River.

Monthly discharge of San Marcos River at Ottine, Tex., for year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	88	70	77.3	4,750
November	97	76	84.5	5,030
December	107	83	94.2	5,790
January	130	91	101	6,210
February	130	86	100	5,550
March	6,750	78	399	24,500
April	5,570	104	837	49,800
May	6,800	96	419	25,800
June	411	74	122	7,260
July	87	61	73.8	4,540
August	156	59	76.3	4,690
September	199	62	81.5	4,850
The year	6,800	59	206	149,000

SAN ANTONIO RIVER BASIN.

SAN ANTONIO RIVER AT SAN ANTONIO, TEX.

LOCATION.—At Presa Street Bridge, just below office of San Antonio Water Supply Co., in San Antonio, Bexar County, 3 miles below San Antonio Springs, the source of the river.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—January 26, 1915, to September 30, 1918. Miscellaneous discharge measurements from 1895 to 1906.

GAGE.—Vertical staff attached to upstream side of second bent from right bank; installed February 28, 1916; read by G. H. Cumberland. October 23, 1914, to February 28, 1916, vertical staff gage attached to downstream side of middle pier, Commerce Street Bridge; relation of the datums of these gages not known.

DISCHARGE MEASUREMENTS.—Made from downstream side of Market Street Bridge, first bridge above station, or by wading just below gage.

CHANNEL AND CONTROL.—Channel straight for a short distance above and below station, but the general course is very crooked. Bed composed of gravel, sand, and silt. Banks high and clean; not subject to overflow except during extremely high stages, at which time the river spreads over a wide area. A rock and gravel shoal and remains of old concrete dam just below the station form control. Vegetation collects in channel and on control at times and affects stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.90 feet at 2.30 p. m. May 5 (discharge not determined); minimum stage, 0.60 foot at 5.10 p. m. August 10, and at 8.15 a. m. August 21 and 24 (discharge, 10 second-feet).

1914–1918: Maximum stage recorded, 14.0 feet at 5.30 p. m. October 23, 1914 (discharge, 4,700 second-feet; determined from extension of rating curve and subject to possible error); minimum stage occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable land is irrigated in San Antonio and vicinity south of the city; quantity of water diverted not known.

REGULATION.—Flow not regulated by permanent dams or controlling works, but at times temporary works constructed in improving channel have regulated the flow. Flow at station is dependent on discharge of San Antonio Springs.

ACCURACY.—Stage-discharge relation affected by moss and vegetation in stream, and occasional cleaning of channel. High water also causes changes. Two rating curves used; rating curves, October 1 to February 28 well defined between 20 and 300 second-feet, rating curve March 1 to September 30 is fairly well defined between 8 and 890 second-feet. Discharge above 900 second-feet subject to considerable error. Gage read to hundredths twice daily and oftener during high water, but mean of two readings daily may not be true mean. Discharge ascertained by applying mean daily gage height to rating table or by shifting-control method. Records fair.

Discharge measurements of San Antonio River at San Antonio, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	Hank and Gowans	0.84	17.5	Apr. 30	Gray and Hoyt	.91	37.8
Nov. 21	E. P. Congdon	.80	23.3	May 5	E. P. Congdon	3.68	742
Dec. 14	R. J. Hank	.72	23.5	June 10	C. E. McCashin	.70	13.1
Feb. 6	do	.81	23.2	July 10	do	.74	14.4
Mar. 1	A. K. Gowans	1.28	55.8	30	A. K. Gowans	.73	16.1
Apr. 1	E. P. Congdon	.92	11.1	Aug. 27	E. P. Congdon	.64	16.2
6	do	.94	33				

Daily discharge, in second-feet, of San Antonio River at San Antonio, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	24	23	23	23	49	31	31	12	13	14	14
2	23	24	23	23	23	16	32	30	32	13	12	16
3	23	23	23	23	23	16	30	28	42	12	12	21
4	23	23	23	23	23	16	33	29	12	13	15	16
5	23	23	23	23	22	17	309	1,860	12	13	14	16
6	23	23	23	23	23	17	155	46	13	13	14	16
7	23	23	23	24	22	16	21	32	13	13	12	15
8	23	23	23	24	23	17	21	31	13	20	13	14
9	23	24	23	24	24	14	19	33	13	14	12	13
10	24	24	23	24	23	18	19	32	14	14	12	15
11	24	23	24	24	23	18	18	29	13	14	12	14
12	24	23	24	24	23	18	19	29	12	15	13	13
13	25	23	24	24	23	19	18	28	13	14	13	13
14	24	23	24	24	22	19	19	24	13	13	14	14
15	24	23	24	24	22	19	25	24	17	16	14	13
16	24	23	24	23	25	18	20	35	46	14	14	18
17	24	23	24	24	23	21	20	22	16	15	14	12
18	27	30	24	24	23	19	19	22	15	15	16	12
19	25	23	24	24	22	19	145	14	14	16	20	13
20	24	23	24	24	22	21	22	22	21	14	14	16
21	24	23	24	23	24	19	19	21	13	14	14	12
22	24	23	25	23	23	21	21	16	14	19	15	12
23	25	23	25	23	23	21	24	16	12	14	16	15
24	26	23	25	23	23	24	21	16	14	14	16	11
25	24	23	25	23	22	29	29	16	16	14	513	12
26	24	23	24	23	22	29	19	16	13	16	24	12
27	24	23	24	23	23	26	19	15	13	14	16	12
28	24	23	24	23	24	28	19	14	14	14	16	12
29	23	23	24	23	.....	47	248	14	12	22	16	12
30	24	23	24	23	.....	29	26	12	13	18	16	12
31	24	.....	24	23	.....	29	.....	12	.....	16	16	.....

NOTE.—Discharge determined by shifting-control method Dec. 1 to Feb. 28, Mar. 6 to May 4, and July 16 to Sept. 30. Discharge for May 5 obtained by extension of rating curve and subject to error.

Monthly discharge of San Antonio River at San Antonio Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	27	23	23.9	1,470
November	30	23	23.4	1,390
December	25	23	23.8	1,460
January	24	23	23.4	1,440
February	25	22	22.9	1,270
March	49	14	22.2	1,360
April	309	18	48.3	2,870
May	1,860	12	82.9	5,100
June	46	12	16.5	982
July	22	12	14.8	910
August	513	12	30.9	1,900
September	21	11	14.0	833
The year	1,860	11	29.0	21,000

SAN ANTONIO RIVER AT CALAVERAS, TEX.

LOCATION.—One-fourth mile south of San Antonio & Aransas Pass Railway station in Calaveras, Wilson County, 1 mile below mouth of Calaveras Creek, and 10 miles below mouth of Medina River.

DRAINAGE AREA.—1,870 miles.

RECORDS AVAILABLE.—March 12 to September 30, 1918.

GAGE.—Vertical staff in three sections on left bank near old brick plant; read by J. W. Dodson.

DISCHARGE MEASUREMENTS.—Made by wading below gage. High-water measurements made from highway bridge half a mile upstream from gage.

CHANNEL AND CONTROL.—Bed composed of sand and clay and free from vegetation; shifts. Channel straight above and below station for 150 feet. Left bank high, wooded, and not subject to overflow; right bank steep, wooded, and subject to overflow only at extremely high stages. Old bricks piled into channel form a solid bottom, and serve as a control, which is practically permanent. Sand deposits on control during low water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period, 32.8 feet at 11.45 a. m. May 6 (discharge, 11,200 second-feet); minimum stage recorded, 0.14 foot, 8.30 a. m. September 14 (discharge, 15 second-feet).

ICE.—None reported during period.

DIVERSIONS.—Second report of State Board of Water Engineers shows a maximum of 3,538 acre-feet annually appropriated from San Antonio River above the station. The Medina reservoir having a storage capacity of 254,000 acre-feet is situated on Medina River about 20 miles above its confluence with San Antonio River and regulates the flow through the diversion works about 4 miles below. The project has a capacity of 850 second-feet and served 3,735 acres in 1916.

REGULATION.—No power plants above or below station. The normal flow may be slightly affected by storage and diversions on Medina River.

ACCURACY.—Stage-discharge relation changes during high water. Two rating curves are used, one applicable March 12 to May 3, well defined between 40 and 300 second-feet and fairly well defined between 300 and 2,000 second-feet; discharge above 2,000 second-feet subject to considerable error; the other applicable May 4 to September 30, rating curve fairly well defined between 30 and 5,000 second-feet; poorly defined above 5,000 second-feet. Gage read to hundredths twice daily and oftener during floods. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of San Antonio River at Calaveras, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 13	A. K. Gowans	0.88	50.7	May 7	A. K. Gowans	16.30	1,990
Apr. 7	E. P. Congdon	11.52	1,500	7	do	13.94	1,590
7	do	10.40	1,280	7	do	12.41	1,350
7	do	9.76	1,150	8	do	6.30	480
7	do	9.37	1,100	8	do	6.14	426
7	do	9.09	1,060	June 11	do	1.04	43.9
10	do	1.54	99	July 10	C. E. McCashin	.84	37.8
10	do	1.51	94.7	Aug. 2	A. K. Gowans	1.17	56.9
May 2	Gray and Hoyt	3.15	228	27	E. P. Congdon	2.46	151
6	A. K. Gowans	32.58	11,000				

Daily discharge, in second-feet, of San Antonio River at Calaveras, Tex., for the year ending Sept. 30, 1918.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	41	1,030	66	38	128	31
2	.....	40	224	58	40	54	20
3	.....	37	142	279	35	38	22
4	.....	38	116	183	34	38	17
5	.....	38	2,075	90	34	34	17
6	.....	1,580	10,700	68	33	37	19
7	.....	1,290	1,900	65	39	36	21
8	.....	290	470	56	36	36	20
9	.....	124	320	58	34	32	20
10	.....	108	205	54	38	29	20
11	.....	77	203	56	37	29	17
12	47	65	183	54	34	29	19
13	51	61	175	52	31	24	18
14	47	61	159	52	27	26	16
15	44	63	152	84	30	23	17
16	43	60	142	83	34	24	20
17	46	56	133	267	35	23	20
18	41	48	128	153	34	27	21
19	42	174	117	83	31	20	21
20	33	355	114	65	33	26	671
21	39	110	108	55	31	25	150
22	42	69	104	54	29	22	44
23	44	56	105	49	32	19	39
24	39	52	94	47	28	21	39
25	44	222	86	46	29	503	39
26	37	330	80	45	29	281	40
27	38	97	80	45	27	135	51
28	38	71	78	40	36	56	46
29	40	668	72	34	36	36	44
30	49	5,200	65	39	34	34	37
31	44	.....	59	.....	90	33	.....

Monthly discharge of San Antonio River at Calaveras, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
March 12–31	51	33	42.4	1,680
April	5,200	37	383	22,800
May	10,700	59	633	38,960
June	279	34	79.3	4,720
July	90	27	35.1	2,160
August	503	19	60.6	3,730
September	671	16	52.5	3,120
The period	.....	.....	.....	77,100

SAN PEDRO CREEK AT SAN ANTONIO, TEX.

LOCATION.—Commerce Street Bridge, 1½ blocks west of courthouse in San Antonio, Bexar County, 1½ miles above mouth of Salsamora and Martinez creeks, 1½ miles below San Pedro Springs, source of creek, and 3 miles above confluence with San Antonio River.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—July 20, 1916, to September 30, 1918.

GAGE.—Vertical staff, attached to wall of building No. 713 Commerce Street, on upstream side of bridge on left bank. Read by E. H. Elder and G. H. Cumberland.

DISCHARGE MEASUREMENTS.—Made by wading below gage.

CHANNEL AND CONTROL.—Bed composed of rock, gravel, and mud; shifting. Channel straight above and below station. Banks formed by walls of buildings. City improvements have confined the stream to a small channel during low and medium stages, but during floods the streets are covered with water for several blocks. A shifting shoal about 100 feet below gage serves as control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.80 feet at 10.30 p. m. April 5 (discharge, 40 second-feet; determined by extension of rating curve and subject to error); minimum discharge October 3–8, 2.2 second-feet.

1916–1918: Maximum stage recorded, 6.25 feet at 7.40 a. m. September 25, 1916 (discharge not determined); minimum discharge occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—None.

REGULATION.—No diurnal regulation of the flow. Fluctuations caused at times by improvement works along the channel above and below the gage.

ACCURACY.—Stage-discharge relation not permanent. Rating curve poorly defined. Gage read to hundredths twice daily. Daily discharge determined by shifting control method. Records poor.

Entire flow of San Pedro Creek, except during times of heavy precipitation, is furnished by San Pedro Springs, and the flow at this station is believed to reach San Antonio River. Martinez and Salsamora creeks carry no water except during heavy local rains, and have been known to be dry for several years at a time.

Discharge measurements of San Pedro Creek at San Antonio, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	Hank and Gowans	1.39	3.7	Apr. 6	E. P. Congdon	1.34	3.4
Nov. 21	E. P. Congdon	1.39	3.2	30	Gray and Hoyt	1.36	3.5
Dec. 14	R. J. Hank	1.40	2.9	June 10	C. E. McCashin	1.34	3.7
Feb. 6	do	1.40	3.6	July 10	do	1.32	3.4
Mar. 1	A. K. Gowans	1.52	7.6	30	A. K. Gowans	1.42	3.7
Apr. 1	E. P. Congdon	1.34	2.2	Aug. 27	E. P. Congdon	1.30	3.1

Daily discharge, in second-feet, of San Pedro Creek at San Antonio, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.4	3.7	3.2	3.2	3.5	6.4	2.5	3.5	3.9	4.2	2.6	3.2
2	2.4	3.7	3.2	2.9	3.5	6.1	2.4	3.5	4.1	4.2	2.6	3.2
3	2.2	3.7	3.2	2.9	3.5	5.8	3.0	3.5	6.0	4.4	2.6	3.2
4	2.2	3.7	3.0	3.2	3.5	5.7	2.4	3.5	4.0	4.2	2.8	3.2
5	2.2	3.7	3.0	3.2	3.5	5.6	16	19	3.9	4.1	2.7	3.4
6	2.2	3.4	3.0	3.2	3.6	5.5	2.8	4.9	4.1	4.0	2.7	3.2
7	2.2	3.4	3.0	3.4	3.6	5.4	2.6	4.4	4.0	4.0	2.7	3.2
8	2.2	3.6	3.0	3.4	3.6	5.2	2.6	4.5	3.9	4.0	2.8	3.2
9	2.5	3.5	3.0	3.6	4.6	5.1	2.6	4.6	3.9	3.9	2.8	3.2
10	2.5	3.7	3.0	3.7	4.2	5.0	2.6	4.4	3.7	3.8	2.9	3.2
11	2.6	3.7	2.9	3.7	4.2	4.9	2.6	4.5	3.7	3.8	2.8	3.0
12	2.8	3.7	2.9	3.7	4.2	4.8	2.6	4.5	3.7	3.7	2.9	3.0
13	2.9	3.4	2.9	3.7	4.2	4.7	2.6	4.2	3.7	3.5	3.0	3.0
14	2.9	3.4	2.9	3.7	4.2	4.6	2.6	4.1	3.7	3.4	2.9	3.0
15	3.0	3.4	2.9	3.9	4.2	4.5	3.2	4.1	3.7	3.4	3.0	3.0
16	3.0	3.4	2.9	3.9	5.4	4.4	2.7	4.2	10	3.3	3.0	2.9
17	3.2	3.3	2.9	3.9	5.0	4.2	2.7	4.0	3.9	3.4	4.8	3.0
18	8.2	6.4	2.9	3.9	4.9	3.9	2.6	4.1	3.9	3.2	3.0	2.9
19	3.3	3.5	2.9	4.2	4.9	3.8	14	4.1	3.9	3.2	3.0	3.0
20	3.3	3.3	2.9	4.2	4.7	3.7	2.8	4.1	3.9	3.0	3.2	3.0
21	3.4	3.0	2.9	4.2	6.0	3.6	2.7	4.1	4.0	3.3	3.2	3.0
22	2.9	3.0	2.9	4.2	5.6	3.5	2.8	4.1	3.9	3.0	3.2	3.0
23	2.9	3.3	3.0	4.2	5.6	3.4	2.8	4.1	4.1	3.0	3.2	3.0
24	3.0	3.3	3.0	4.5	5.4	3.3	2.8	4.1	3.9	3.2	3.4	2.9
25	3.4	3.3	3.0	4.5	5.4	3.2	7.6	4.1	4.1	3.0	3.7	3.0
26	3.4	3.2	3.0	4.5	5.4	3.0	3.2	4.0	4.2	3.0	3.4	2.9
27	3.3	3.2	3.0	4.7	5.4	2.9	3.0	4.1	4.5	3.0	3.2	2.9
28	3.3	3.2	3.0	4.8	6.4	2.8	3.2	4.0	4.2	3.2	3.2	2.9
29	3.6	3.2	3.0	3.5	.....	3.7	15	4.0	4.2	8.3	3.2	2.9
30	3.6	3.2	3.0	8.5	.....	2.6	3.6	4.0	4.2	7.1	3.2	2.9
31	3.6	.....	3.0	3.5	.....	2.5	.....	4.1	.....	2.6	3.2	.....

Monthly discharge of San Pedro Creek at San Antonio, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	8.2	2.2	3.05	188
November	6.4	3.6	3.52	209
December	3.2	2.9	2.98	183
January	4.8	2.9	3.79	233
February	6.4	3.5	4.58	254
March	6.4	2.5	4.32	266
April	16	2.4	4.15	247
May	19	3.5	4.59	282
June	10	3.7	4.23	252
July	7.1	2.6	3.63	223
August	4.8	2.6	3.06	188
September	3.4	2.9	3.05	181
The year	19	2.2	3.74	2,710

NUECES RIVER BASIN.

NUECES RIVER NEAR CINONIA, TEX.

LOCATION.—About 250 feet below suspension highway bridge near Oswald's ranch, 2 miles east of Cinonia, Zavalla County, 8 miles northeast of Crystal City, and 20 miles above Winter Garden ranch dam.

DRAINAGE AREA.—2,060 square miles.

RECORDS AVAILABLE.—July 5, 1915, to September 30, 1918.

GAGE.—Dexter water-stage recorder on right bank, 200 feet below highway bridge, operated October 1 to May 5 when recorder was removed owing to poor results. From May 6 to September 30 vertical staff read by C. C. Oswald.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading on crest of concrete control.

CHANNEL AND CONTROL.—Bed composed of clay and gravel and free from vegetation; subject to shift prior to September 23, 1917. Banks high, wooded, and not subject to overflow. Channel straight above and below station. September 23, 1917, a concrete artificial control was completed at the site of water-stage recorder installation; point of zero flow, 0.85 foot. The stage-discharge relation has been seriously affected at times prior to installation of artificial control by collection of logs, leaves, and brush below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.0 feet at 10 a. m. May 4 (discharge, 920 second-feet obtained by extension of rating curve and subject to error); no flow June 29 to August 26 and September 3-30.

1915-1918: Maximum stage recorded, 20.0 feet at 6.30 a. m. September 19, 1915 (discharge not determined); no flow during periods in 1917 and 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable water diverted above station for irrigation; amount not known.

REGULATION.—Available data indicate no regulation above station.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 400 second-feet. Gage heights from Dexter recorder October 1 to May 5; May 6 to September 30, staff gage read to hundredths twice daily. Mean daily gage height for period of recorder record determined by averaging hourly readings from recorder charts. Daily discharge ascertained by applying mean daily gage height to rating table. Discharge above 400 second-feet obtained by extension of rating curve and subject to error. Records good.

Backwater from a dam 40 feet high, about 20 miles below station, extends within 2 miles of station when reservoir is full. A large part of the flow of the river seeps into the bed just below Uvalde, and returns to the surface just above the station, The condition of the underground waters may have an effect on this return water and thus help to equalize the flow.

Discharge measurements of Nueces River near Cinonia, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 22	E. P. Congdon	1.19	3.3	May 6	E. P. Congdon	2.84	86.3
Jan. 12	R. J. Hank	1.22	4.4	7	do	1.84	30.2
12	do	1.22	4.8	11	do	1.32	6.8
Mar. 5	do	1.20	3.3	June 14	C. E. McCashin	1.56	16.8
Apr. 9	E. P. Congdon	1.04	1.3	July 31	A. K. Gowans		.0
May 6	do	3.03	94.9	Sept. 17	E. P. Congdon		.0

Daily discharge, in second-feet, of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Aug.	Sept.
1	1.0	1.0	3.7	4.4	3.9	3.7	2.6	6.4	0.8	.....	0.4
2	1.0	1.1	3.7	4.7	3.9	3.7	2.4	8.9	.6	.....	.1
3	1.1	1.3	3.7	4.7	3.9	3.4	2.4	12	.5	.....	.....
4	1.1	1.4	3.7	4.7	3.9	3.4	2.4	920	.5	.....	.....
5	1.1	1.5	3.4	4.4	4.2	3.4	2.4	335	.5	.....	.....
6	1.1	1.5	3.4	4.7	4.2	3.0	1.9	112	.4	.....	.....
7	1.1	1.5	3.4	4.4	4.2	3.4	1.3	83	.3	.....	.....
8	1.1	1.5	3.4	4.4	4.2	3.7	1.1	17	159	.....	.....
9	1.1	1.5	3.4	4.4	4.2	3.0	1.0	12	11	.....	.....
10	1.1	1.5	3.7	4.4	4.2	2.8	1.0	9.4	3.4	.....	.....
11	1.1	1.4	3.7	4.4	4.2	2.6	.9	7.2	14	.....	.....
12	1.1	1.4	3.9	3.9	4.2	2.1	.9	5.7	11	.....	.....
13	1.1	1.4	4.2	3.9	4.4	1.9	.9	5.0	5.4	.....	.....
14	1.1	1.4	4.2	3.9	4.4	2.1	1.0	5.0	13	.....	.....
15	1.1	1.4	4.2	3.9	4.4	2.2	1.1	4.4	5.0	.....	.....
16	1.1	1.5	4.2	3.7	4.4	2.4	1.2	4.4	3.2	.....	.....
17	1.1	1.5	4.2	3.9	4.4	2.4	1.3	3.9	3.7	.....	.....
18	1.1	1.8	3.7	3.9	4.4	2.4	1.4	3.0	1.6	.....	.....
19	1.0	2.1	4.2	3.9	4.2	2.4	1.5	3.0	1.3	.....	.....
20	1.0	2.4	4.4	3.9	4.2	2.4	1.5	2.6	1.0	.....	.....
21	1.0	2.8	4.7	3.9	4.4	2.6	1.4	2.2	.9	.....	.....
22	1.0	3.0	4.7	3.9	4.4	2.4	1.3	2.2	.6	.....	.....
23	1.0	3.2	4.7	3.9	4.4	3.4	1.2	1.9	.5	.....	.....
24	1.0	3.2	4.7	3.9	4.2	3.4	1.1	1.9	.5	.....	.....
25	1.0	3.4	4.4	3.9	4.2	3.0	1.0	1.4	.4	.....	.....
26	1.0	3.4	4.4	3.9	3.9	2.4	.9	1.4	.2	.....	.....
27	1.0	3.4	4.4	3.9	3.9	2.4	.8	1.4	.2	32	.....
28	1.0	3.4	4.4	3.9	3.7	2.4	1.6	1.2	.1	16	.....
29	1.0	3.4	4.4	3.9	.....	2.6	3.0	1.2	.1	4.7	.....
30	1.0	3.4	4.4	3.9	.....	2.8	4.4	1.0	.....	1.8	.....
31	1.0	.....	4.4	3.9	.....	2.6	.....	.8	.....	.8	.....

NOTE.—No record Dec. 31 to Jan. 3 and Mar. 1-4; discharge interpolated. No flow on days for which no discharge is given.

Monthly discharge of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1.1	1.0	1.05	64.6
November	3.4	1.0	2.09	124
December	4.7	3.4	4.06	250
January	4.7	3.7	4.11	253
February	4.4	3.7	4.18	232
March	3.7	1.9	2.79	172
April	4.4	.8	1.56	92.8
May	920	.8	50.9	3,130
June	159	.0	7.99	475
July	.0	.0	.00	0
August	32	.0	1.76	108.
September	.4	.0	.02	1.2
The year	920	.0	6.77	4,900

NUECES RIVER NEAR COTULLA, TEX.

LOCATION.—At Hargus dam, 4 miles west of Cotulla, La Salle County.

DRAINAGE AREA.—5,030 square miles.

RECORDS AVAILABLE.—July 1, 1915, to June 13, 1918, when station was discontinued.

GAGE.—Vertical staff attached to trees on right bank just above dam; read by William Peoples.

DISCHARGE MEASUREMENTS.—Made by wading below dam. No facilities for measurements at medium and high stages, except at highway bridge 4 miles below gage.

CHANNEL AND CONTROL.—Bed composed of gravel, rock, and sand; channel straight above and below station. Banks wooded, medium in height, and not subject to overflow. Long concrete dam just below gage serves as a control; crest of dam irregular.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.90 feet at 5 p. m. May 5 (discharge, 7,980 second-feet, based on measurement May 10); no flow during a large part of the year.

1915–1918: Maximum stage recorded, 6.50 feet August 22, 1916 (discharge, 23,000 second-feet, from extension of rating curve and subject to error; no flow during large part of each year.

ICE.—None reported during year.

DIVERSIONS.—Large part of ordinary flow above station pumped or diverted for irrigation. The station is in upper end of an irrigated section near Cotulla. The second report of the State Board of Water Engineers shows diversion works of Winter Garden Irrigation Co. and Nueces Valley Irrigation Co., having capacities of 95 and 66 second-feet, respectively, each system irrigating 10,000 acres in Zavalla and Dimmit counties.

REGULATION.—Flow regulated by storage reservoirs and pumping plants above.

ACCURACY.—Station discontinued on June 13, 1918, on account of poor rating conditions. No section available for medium and high stage discharge measurements.

No flow from October 1 to June 13, except May 2 to 29, and runoff for that period estimated at 99,000 acre-feet. Daily discharge not published.

Discharge measurements of Nueces River near Cotulla, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 24	E. P. Congdon	0.00	0.0	Mar. 4	R. J. Hank	0.00	0.0
Jan. 13	R. J. Hank	.00	.0	May 10	E. P. Congdon	4.38	6,950

NUECES RIVER NEAR THREE RIVERS, TEX.

LOCATION.—At San Antonio, Uvalde & Gulf Railroad bridge 1 mile west of Kittie, 2 miles southeast of Three Rivers, Live Oak County, and half a mile below mouth of Frio River.

DRAINAGE AREA.—15,600 square miles.

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to center pier of railroad bridge; read by A. J. Sharpley and F. G. Seckinger.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge half a mile below gage.

CHANNEL AND CONTROL.—Bed composed of adobe shale; does not change greatly. Channel straight above and below station. Banks wooded, high, and not subject to overflow. Position of high-water control not known; shoal just below gage probably forms low-water control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 29.2 feet 12 to 1 p. m. September 21 (discharge, 14,600 second-feet); no flow, October 7 to November 17, November 28 to February 10, June 7–10, July 14–26, 28–31, August 4–25, September 3–6.

1915–1918: Maximum stage recorded, 30 feet August 25, 1916 (discharge, 15,500 second-feet); no flow during large part of each year.

ICE.—None reported during year.

DIVERSIONS.—Considerable land irrigated above station but none in the immediate vicinity.

REGULATION.—Flow regulated to some extent by storage reservoirs and pumping plants above, but the effect is not so pronounced as at the stations in the upper part of the basin. Any water-power plants existing in the area above the station are probably small.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 7,000 second-feet. Gage read to hundredths twice daily; oftener during floods and when flow fluctuates rapidly. Daily discharge ascertained by applying mean daily gage height to rating table except during periods when stage-discharge relation is affected by shifting control. Records fair.

Discharge measurements of Nueces River near Three Rivers, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 26	E. P. Congdon	0.33	[a] 0.2	June 12	C. E. McCashin	1.66	66.3
Jan. 18	R. J. Hank	.....	.0	Aug. 1	A. K. Gowans	.62	6.7
Mar. 8	....do	1.16	15.6	29	E. P. Congdon	1.04	27.3
May 9	E. P. Congdon	9.32	1,870				

[a] Estimated.

Daily discharge, in second-feet, of Nueces River near Three Rivers, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	.....	.....	0.2	27	6,320	20	6.4	7.4	1.7
2	3.6	.....	.....	104	11	1,370	20	4.0	5.2	.5
3	2.3	.....	.....	1,340	6.0	1,160	19	3.4	3.6	.....
4	1.4	.....	.....	1,890	2.6	1,330	181	4.6	.....	.....
5	.5	.....	.....	1,190	.9	2,940	24	6.4	.....	.....
6	.2	.....	.....	53	2,300	5,470	.2	5.2	.....	.....
7	.....	.....	.....	24	2,680	5,760	.....	3.6	.....	1,480
8	.....	.....	.....	16	566	3,590	.....	3.2	.....	295
9	.....	.....	.....	12	173	1,800	.....	1.8	.....	62
10	.....	.....	.....	8.8	158	2,380	.....	1.7	.....	221
11	.....	.....	68	7.4	84	2,500	452	1.7	.....	118
12	.....	.....	18	6.4	94	1,720	94	1.2	.....	26
13	.....	.....	8.4	5.4	81	2,220	398	.2	.....	22
14	.....	.....	4.8	4.4	42	3,650	288	.....	.....	18
15	.....	.....	2.8	3.2	25	4,650	77	.....	.....	14
16	.....	.....	1.5	3.4	17	5,030	1,610	.....	.....	8.6
17	.....	.....	.5	3.0	13	4,390	3,200	.....	.....	4.4
18	.....	110	.3	2.6	11	3,150	1,060	.....	.....	1.8
19	.....	1,030	.2	2.4	860	2,330	596	.....	.....	1.2
20	.....	278	.1	2.3	1,570	1,800	626	.....	.....	7,900
21	.....	22	.3	2.0	636	1,140	636	.....	.....	14,000
22	.....	8.1	7.2	1.7	456	213	647	.....	.....	4,390
23	.....	3.4	18	1.5	189	128	338	.....	.....	556
24	.....	.7	6.8	84	68	81	213	.....	.....	263
25	.....	.4	4.2	18	57	38	95	.....	.....	264
26	.....	.2	1.5	9.5	896	28	59	.....	18	4,140
27	.....	.1	.6	5.4	237	26	42	81	175	2,520
28	.....	.....	.2	3.6	94	22	51	.....	81	496
29	.....	.....	.....	2.9	52	18	30	.....	13	272
30	.....	.....	.....	16	6,460	18	24	.....	5.2	48
31	.....	.....	.....	99	.....	19	.....	.....	3.4	.....

NOTE.—Discharge determined by shifting-control method, Mar. 6 to Apr. 5; on Sept. 22 from rating curve drawn through measurements made on that date; Sept. 29, interpolated. No flow on days for which no discharge is given.

Monthly discharge of Nueces River near Three Rivers, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	3.6	0.0	0.28	17.2
November	1,030	.0	48.4	2,880
December	.0	.0	.0	.0
January	.0	.0	.0	.0
February	68	.0	5.12	284
March	1,890	.2	159	9,780
April	6,460	.9	596	35,500
May	6,320	18	2,110	130,000
June	3,200	.0	360	21,400
July	81	.0	4.01	247
August	175	.0	10.1	621
September	14,000	.0	1,240	73,800
The year	14,000	.0	378	275,000

NUECES RIVER AT CALALLEN, TEX.

LOCATION.—At old pump house for city of Corpus Christi, half a mile northwest of Calallen, Nueces County, half a mile above edge of tidewater and breakwater dam, 8 miles above Nueces Bay, and 18 miles west of Corpus Christi.

DRAINAGE AREA.—16,700 square miles.

RECORDS AVAILABLE.—August 12, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to pipe-line support of old pump house; read by Henry Wagner.

DISCHARGE MEASUREMENTS.—Made by wading at the breakwater or from cable 125 feet below gage.

CHANNEL AND CONTROL.—Bed composed of clay and gravel. Channel straight above and below station. Left bank wooded, low, and bordered by levee constructed to prevent overflow; right bank wooded, medium in height, and not subject to overflow. The breakwater, which is a loose rock dam half a mile below, serves as control; after each rise rock is piled on dam causing changes in stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.25 feet, June 19 (discharge, 6,230 second-feet); no flow August 23–28.

1915–1918: Maximum stage recorded, 8.38 feet September 5, 1916 (discharge, 6,190 second-feet); no flow August 23–28, 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable water taken from river for irrigation above station. The municipal water supply of Corpus Christi is pumped from the river just below the the gage; the report of the State Board of Water Engineers shows a continuous use of 0.93 second-foot and a storage of 675 acre-feet annually for this purpose, and a consumption of 218,000,000 gallons during 1916. A second small pump for private use installed between city intake and breakwater is seldom operated. The quantities pumped are small and do not greatly affect the natural flow during ordinary stages.

REGULATION.—No regulation of consequence above station.

ACCURACY.—Stage-discharge relation not permanent because of leakage and repairs in the breakwater dam. Low-water discharge measurements made at breakwater are poor because of leakage through dam. Rating curve is fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating tables and by shifting-control method. Allowances made for rising and falling stages in computing discharge. Records poor.

Discharge measurements of Nueces River at Calallen, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 27	E. P. Congdon	1.45	[a] 20.0	Mar. 7	R. J. Hank	2.94	833
Jan. 18	R. J. Hank	1.01	[a] 5.0	8	do	2.35	395
Mar. 6	do	3.80	1,710	May 8	E. P. Congdon	5.96	3,240
7	do	3.41	1,220	Sept. 23	C. E. McCashin	6.34	3,330
7	do	3.16	992	23	do	6.56	3,650

[a] Estimated.

Daily discharge, in second-feet, of Nueces River at Calallen, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.0	2.4	14	2.0	5.0	10	14	857	16	143	210	210
2	8.0	2.2	12	2.0	5.0	53	16	1,390	15	82	187	173
3	8.0	2.2	11	2.0	5.0	424	19	2,120	14	58	123	143
4	8.0	2.2	10	2.0	5.0	689	64	3,420	12	58	116	116
5	8.0	2.2	10	2.0	5.3	1,610	73	4,350	11	32	106	88
6	8.0	2.2	8.0	2.0	5.3	1,580	73	4,490	12	20	82	73
7	8.0	2.2	8.0	2.0	5.3	1,020	201	4,190	10	18	32	73
8	7.0	2.2	6.5	2.0	5.3	284	1,400	3,420	8.0	16	26	58
9	6.0	2.1	5.0	2.0	5.3	156	1,780	3,910	8.0	16.	20	37
10	6.0	2.0	5.0	2.0	5.3	88	950	4,440	8.0	14	20	30
11	6.0	1.8	5.0	1.0	5.6	73	284	3,850	8.0	12	16	73
12	5.5	1.6	5.0	1.0	5.6	53	164	2,370	17	10	13	201
13	5.5	1.5	3.5	2.6	5.6	32	164	2,070	82	10	12	268
14	5.5	1.4	3.5	4.4	5.6	26	2.0	1,420	143	8.0	12	338
15	5.0	1.4	3.5	5.0	6.2	20	1.0	1,160	310	6.5	10	299
16	4.8	1.4	2.6	5.0	6.2	20	1.0	2,190	588	6.5	10	210
17	4.2	1.4	2.0	5.0	6.5	16	4.4	3,250	1,190	5.0	8.0	173
18	4.0	1.4	2.0	5.3	6.2	16	2.0	3,780	5,630	5.0	6.5	258
19	4.0	1.4	2.0	5.3	5.9	13	182	4,410	6,230	5.0	5.6	234
20	4.0	2.4	2.0	5.0	5.6	7.4	279	4,480	5,390	5.0	5.0	550
21	4.0	284	2.0	5.0	5.6	5.0	349	3,990	2,010	3.5	4.4	1,720
22	3.5	565	2.0	5.0	5.6	5.0	305	2,310	454	3.5	2.0	2,370
23	3.2	284	2.0	5.0	5.6	5.0	120	1,080	625	3.5	.0	3,560
24	3.0	156	2.0	5.0	5.6	5.0	35	454	588	3.5	.0	4,540
25	3.0	95	2.0	5.0	5.6	5.0	20	73	412	3.5	.0	2,550
26	3.0	82	2.0	5.0	5.3	5.0	50	19	284	3.5	.0	657
27	2.9	25	2.0	5.0	5.0	5.0	102	18	201	3.5	.0	418
28	2.8	18	2.0	5.0	5.0	3.5	305	17	173	3.5	.0	1,160
29	2.5	17	2.0	5.0	.....	11	360	14	143	210	106	1,940
30	2.5	15	2.0	5.0	.....	26	580	13	95	234	248	544
31	2.4	.....	2.0	5.0	.....	15	.....	12	.....	234	210	.....

NOTE.—Discharge determined by shifting-control method Apr. 18 to June 15 and Sept. 19 to 30.

Monthly discharge of Nueces River at Calallen, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	8.0	2.4	5.04	310
November	565	1.4	52.6	3,130
December	14	2.0	4.6	283
January	5.0	1.0	3.7	228
February	6.5	5.0	5.5	305
March	1,610	3.5	203	12,500
April	1,780	1.0	260	15,500
May	4,490	12	2240	138,000
June	6,230	8.0	823	49,000
July	234	3.5	39.9	2,450
August	248	.0	51.3	3,150
September	4,540	30.	769	45,800
The year	6,230	.0	374	271,000

FRIO RIVER NEAR DERBY, TEX.

LOCATION.—At International & Great Northern Railway bridge 900 feet below mouth of Leona River and 4 miles south of Derby, Frio County.

DRAINAGE AREA.—3,500 square miles.

RECORDS AVAILABLE.—August 1, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to pier of railway bridge; read by John Speed.

DISCHARGE MEASUREMENTS.—Made from railway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rock, sand, and gravel; channel straight at gage for 150 feet. Banks wooded, high, and not subject to overflow. A concrete dam 50 feet below gage forms control during low and medium stages; position of high-water control not known. Point of zero flow, gage height 0.06 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.1 feet at 4 a. m. May 7 (discharge, 4,330 second-feet); no flow in stream during several long periods.

1915–1918: Maximum stage recorded, 13.0 feet at 10.30 a. m. April 3, 1916 (discharge not determined); no flow during parts of each year.

ICE.—None reported during year.

DIVERSIONS.—Small areas are irrigated by diversions and pumping at the headwaters, but available information does not show that water is taken from the stream immediately above the station.

REGULATION.—None so far as is known.

ACCURACY.—Stage-discharge relation practically permanent. Gage read to hundredths once daily; oftener during extreme fluctuations. Rating curve well defined below 2,200 second-feet. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Frio River near Derby, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Nov. 24	E. P. Congdon	0.07	0.0	Mar. 4	R. J. Hank		0.0
Jan. 13	R. J. Hank		.0	Apr. 8	E. P. Congdon	1.61	260

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the year ending Sept. 30, 1918.

Day.	Nov.	Apr.	May.	Aug.	Sept.
1			2,200		0.5
2			321		.1
3			189		
4			52		
5			321		
6			2,480		
7		737	2,700		
8		243	289		4.6
9		38	78		26
10		12	32		12
11		3.5	12		2.0
12		2.4	6.2		.5
13		.5	2.7		
14			2.7		
15			1.3		
16			1.0		
17			.4		
18					
19	4.6				
20	27				
21	3.8				
22	2.4	.2			41
23	.5	2.7			12
24		1.0			3.5
25					1.7
26					.2
27				46	
28				89	
29				21	
30		273		5.6	
31				2.4	

NOTE.—No flow on days and months for which discharge is not given.

Monthly discharge of Frio River near Derby, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	0.0	0.0	0.0	0.0
November	27	.0	1.28	76.2
December	.0	.0	.0	.0
January	.0	.0	.0	.0
February	.0	.0	.0	.0
March	.0	.0	.0	.0
April	737	.0	43.8	2,610
May	2,700	.0	280	17,200
June	.0	.0	.0	.0
July	.0	.0	.0	.0
August	89	.0	5.29	325
September	41	.0	3.47	206
The year	2,700	.0	28.2	20,400

FRIO RIVER AT FOWLERTON, TEX.

LOCATION.—At Frio River dam, about half a mile northeast of Fowlerton, La Salle County, 1½ miles below diversion for Frio Lake storage reservoir and 8 miles below mouth of Jahuey Creek.

DRAINAGE AREA.—4,350 square miles.

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to tree on right bank about 30 feet above dam; read by Joe McMains and J. F. Martin.

DISCHARGE MEASUREMENTS.—Made by wading below dam or from railroad bridge about a mile above.

CHANNEL AND CONTROL.—Channel straight for some distance above the station, but slightly curved below; banks about 5 feet high and not subject to overflow right bank cultivated; left bank wooded. Concrete dam about 20 feet below gage serves as permanent control at all stages. Point of zero flow, gage height 0.00 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2,87 feet May 8 (discharge, 1,500 second-feet); no flow for extended periods.

1915–1918: Maximum stage recorded, 3.9 feet at 6 a. m. April 19, 1916 (discharge, 4,120 second-feet); no flow during parts of each year.

ICE.—None reported during year.

DIVERSIONS.—Some water diverted for irrigation above station. A diversion for the Frio Lake reservoir is made 1½ miles above; other diversions are scattered and amount diverted and areas irrigated not known. A large part of the irrigated land in the drainage basin above the station is watered by wells.

REGULATION.—Flow regulated by the diversion into Frio Lake a short distance above gage; extent of regulation above Frio Lake diversion not known but probably small.

ACCURACY.—Stage-discharge relation practically permanent. Gage read to hundredths once daily; slight error may be introduced by the assumption that one reading gives the mean stage for the day. Rating curves well defined below 2,000 second-feet. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Frio River at Fowlerton, Tex., during the year ending Sept. 30, 1918.

[Made by E. P. Congdon.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 9	1.58	449
Aug. 28	.....	0

Daily discharge, in second-feet, of Frio River at Fowlerton, Tex., for the year ending Sept. 30, 1918.

Day.	Apr.	May.	Sept.	Day.	Apr.	May.	Sept.	Day.	Apr.	May.	Sept.
1	.....	.....	.....	11	14	30	.....	21	16	.....	37
2	.....	475	.....	12	7.0	16	.....	22	5.8	.....	.....
3	.....	825	.....	13	3.2	5.8	.....	23	1.5	.....	.....
4	.....	230	.....	14	1.5	3.2	.....	24	.2	.....	.....
5	.....	177	.....	15	.2	2.2	.....	25	.....	.....	.....
6	.....	500	.....	16	.....	.8	.....	26	.....	.....	.....
7	.....	857	.....	17	.....	.....	.....	27	.....	.....	.....
8	.....	1,500	.....	18	.....	.....	.....	28	.....	.....	.....
9	252	366	.....	19	.....	.....	.....	29	.....	.....	.....
10	46	92	.....	20	.....	.....	25	30	.....	.....	.....
								31	.....	.....	.....

NOTE.—No flow on days and months for which discharge is not given.

Monthly discharge of Frio River at Fowlerton, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	.0	.0	.0	0.0
November	.0	.0	.0	.0
December	.0	.0	.0	.0
January	.0	.0	.0	.0
February	.0	.0	.0	.0
March	.0	.0	.0	.0
April	252	.2	11.6	690
May	1,500	.8	164	10,100
June	.0	.0	.0	.0
July	.0	.0	.0	.0
August	.0	.0	.0	.0
September	37	.0	2.07	123
The year	1,500	.0	15.0	10,900

FRIO LAKE OUTLET NEAR FOWLERTON, TEX.

LOCATION.—At Frio Lake dam, 1½ miles northeast of gaging station on Frio River and 2 miles northeast of Fowlerton, La Salle County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1918.

GAGE.—Vertical staff attached to post on right bank about 100 feet above dam; read by Joe McMains and J. F. Martin.

DISCHARGE MEASUREMENTS.—Made by wading below dam or from railroad bridge about a mile above gage.

CHANNEL AND CONTROL.—Channel straight for some distance above and below station. Right bank clean, cultivated, about 8 feet high; left bank is wooded and is 5 to 8 feet high; neither bank subject to overflow. Concrete dam about 100 feet below gage serves as control at all stages. Point of zero flow, gage height 0.00 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.47 feet at 4.30 p. m. May 8 (discharge, 1,250 second-feet); no flow for extended periods.

1915–1918: Maximum stage recorded, 3.16 feet from 8.30 a. m. to 10 a. m. April 19, 1916 (discharge, 4,070 second-feet); no flow for extended periods each year.

ICE.—None reported during year.

DIVERSIONS. Lake is used for storage. Capacity not known.

REGULATION.—Flow controlled at intake on Frio River, some distance above; flow of Frio River above this diversion probably not regulated.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 5,000 second-feet. Gage read to hundredths once daily; one daily gage reading may not be a true index of the mean daily discharge. Daily discharge ascertained by applying the gage height to the rating table. Records good.

Frio Lake is a storage reservoir fed by a diversion from Frio River. The diversion is made 1½ miles above the Frio River dam and the gaging station on the river. The water released from the lake is used for irrigation. This station is maintained in conjunction with that on Frio River at Fowlerton to show the total run-off at that point.

Discharge measurements of Frio Lake outlet near Fowlerton, Tex., during the year ending Sept. 30, 1918.

[Made by E. P. Congdon.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 9	0.83	376
Aug. 28	.....	.0

Daily discharge, in second-feet, of Frio Lake outlet near Fowlerton, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Apr.	May.	Day.	Oct.	Apr.	May.	Day.	Oct.	Apr.	May.
1	400	.....	.....	11	.....	35	38	21	.....	1.6	.....
2	.....	.....	370	12	.....	41	25	22	.....	35	.....
3	.....	.....	800	13	.....	28	25	23	.....	12	.....
4	.....	.....	190	14	.....	22	5.5	24	.....	6.2	.....
5	.....	.....	128	15	.....	9.0	5.5	25	.....	2.0	.....
6	.....	.....	420	16	.....	6.2	1.8	26	.....	.....	.....
7	.....	.....	800	17	.....	2.0	1.4	27	.....	.....	.....
8	.....	.....	1,250	18	.....	1.6	.....	28	.....	.....	.....
9	.....	.....	460	19	.....	.....	.....	29	.....	.....	.....
10	.....	.....	96	20	.....	.....	.....	30	.....	.....	.....
								31	.....	.....	.....

NOTE.—No flow on days and months for which discharge is not given.

Monthly discharge of Frio Lake outlet near Fowlerton, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	400	.0	12.9	793
November	.0	.0	.0	0
December	.0	.0	.0	0
January	.0	.0	.0	0
February	.0	.0	.0	0
March	.0	.0	.0	0
April	41	.0	6.72	400
May	1,250	.0	149	9,160
June	.0	.0	.0	0
July	.0	.0	.0	0
August	.0	.0	.0	0
September	.0	.0	.0	0
The year	1,250	.0	14.3	10,400

RIO GRANDE BASIN.

RIO GRANDE AT SAN MARCIAL, N. MEX.

LOCATION.—In sec. 19, T. 7 S., R. 1 W., at Atchison, Topeka & Santa Fe Railway bridge 1 mile south of San Marcial, Socorro County. No important tributaries enter near station.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 29, 1895, to September 30, 1918.

GAGE.—Inclined staff installed January 29, 1895; destroyed by flood in 1896. Wire gage established in its place, at same datum, was soon abandoned and gage heights have since been obtained by measuring with a graduated rod from the bridge deck to the water surface. Gage datum unchanged.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Sandy and very shifting; broken by several bridge piers. No information on control section.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 3,320 second-feet on May 12; no flow August 6–15, 21–24, August 28 to September 30. 1895–1918: Maximum discharge recorded, 33,000 second-feet, on October 11, 1904; no flow for periods during several years.

DIVERSIONS.—Considerable water diverted for irrigation above station.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice. Owing to shifting control, daily discharges are based almost entirely on frequent current-meter measurements.

COOPERATION.—Records furnished by the United States Reclamation Service and reduced to three significant figures by the United States Geological Survey.

Daily discharge, in second-feet, of Rio Grande at San Marcial, N. Mex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	14	24	468	514	519	500	758	230	1,260	670	100
2	15	25	493	508	463	1,100	736	620	1,160	455	100
3	16	26	493	499	407	1,290	714	938	1,060	300	21
4	18	27	452	489	406	810	711	1,240	930	220	10
5	17	39	452	479	405	560	707	1,600	800	280	5
6	16	41	452	469	404	450	704	2,180	665	275	.....
7	15	48	508	485	404	415	693	2,280	665	360	.....
8	14	55	546	485	404	670	682	2,100	740	1,280	.....
9	13	65	564	485	390	790	672	2,040	1,160	1,310	.....
10	12	128	427	469	383	848	590	2,100	1,350	1,150	.....
11	12	164	427	469	376	874	508	3,140	1,350	640	.....
12	14	196	427	541	369	900	425	3,320	1,760	495	.....
13	14	259	322	477	383	926	446	3,120	930	420	.....
14	14	243	321	477	397	926	467	2,540	1,040	345	.....
15	14	183	356	469	412	820	487	2,000	1,280	234	.....
16	14	219	402	473	414	744	522	2,000	1,350	200	180
17	14	255	448	485	418	778	557	2,000	1,380	250	158
18	14	291	448	485	420	810	592	2,100	1,520	148	68
19	14	358	448	485	422	847	629	2,160	1,530	150	20
20	14	392	488	485	420	769	577	2,540	1,510	148	5
21	14	425	528	400	420	693	526	2,800	1,230	142	.....
22	15	425	528	280	420	617	475	2,320	1,300	140	.....
23	15	425	405	238	420	625	420	1,960	1,000	140	.....
24	22	425	405	198	420	634	364	1,810	1,100	139	.....
25	22	423	439	238	430	642	308	1,550	1,180	170	145
26	19	422	473	300	430	628	310	1,520	840	140	25
27	16	421	506	430	396	613	300	1,480	920	190	5
28	12	428	506	660	361	598	238	1,450	1,020	285	.....
29	18	435	526	580	.....	651	165	1,430	995	230	.....
30	24	443	526	563	.....	705	112	1,300	913	220	.....
31	24	.....	526	519	.....	758	.....	1,300	.....	186	.....

NOTE.—No flow on days and months for which discharge is not given.

Monthly discharge of Rio Grande at San Marcial, N. Mex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	24	12	15.8	972
November	443	24	244	14,500
December	564	321	462	28,400
January	660	198	456	28,000
February	519	361	411	22,800
March	1,290	415	742	45,600
April	758	112	513	30,500
May	3,320	230	1,910	117,000
June	1,760	665	1,130	67,200
July	1,310	139	365	22,400
August	180	0	27.2	1,670
September	0	0	0	0
The year	3,320	0	524	379,000

RIO GRANDE BELOW ELEPHANT BUTTE DAM, N. MEX.

LOCATION.—In T. 13 S., R. 4 W., 1 mile below Elephant Butte dam, Sierra County. Nearest tributary, Mescal Canyon, enters half a mile downstream.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1916, to September 30, 1918.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from car and cable at gage.

CHANNEL AND CONTROL.—Channel composed of compact gravel; probably permanent; control is gravel bar at mouth of Mescal Canyon which shifts.

ICE.—Stage-discharge relation not affected by ice.

REGULATION.—Flow controlled by Elephant Butte dam which forms reservoir having capacity of 2,638,000 acre-feet.

EXTREMES OF DISCHARGE.—No data.

COOPERATION.—Records furnished by the United States Reclamation Service and reduced to three significant figures by the United States Geological Survey.

Daily discharge, in second-feet, of Rio Grande below Elephant Butte dam, N. Mex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,800	.....	1,740	.....	1,900	1,320	1,420	1,560	1,720	1,420	1,140
2	1,800	.....	1,760	.....	1,880	1,380	1,500	1,560	1,710	1,400	1,120
3	1,800	.....	1,760	.....	1,880	1,390	1,560	1,560	1,710	1,510	1,120
4	1,800	.....	1,760	.....	1,880	1,390	1,530	1,580	1,720	1,870	1,280
5	1,800	.....	1,760	.....	1,880	1,410	1,530	1,570	1,710	1,780	1,280
6	1,800	.....	1,760	.....	1,680	1,480	1,530	1,590	1,680	1,580	1,220
7	1,800	.....	1,760	.....	1,540	1,650	1,530	1,580	1,680	1,540	1,120
8	1,800	.....	1,760	.....	1,540	1,650	1,530	1,570	1,660	1,500	1,100
9	1,800	.....	1,760	.....	1,390	1,650	1,530	1,580	1,680	1,500	1,220
10	1,800	.....	1,760	.....	1,200	1,650	1,540	1,590	1,660	1,500	1,380
11	1,800	.....	1,800	.....	1,200	1,630	1,560	1,580	1,650	1,590	1,260
12	1,800	.....	1,800	.....	1,020	1,630	1,560	1,590	1,640	1,460	1,310
13	1,800	.....	1,800	.....	695	1,630	1,530	1,560	1,620	1,450	1,470
14	1,800	.....	1,800	.....	695	1,630	1,530	1,480	1,620	1,270	1,540
15	1,800	630	1,800	1,250	770	1,610	1,510	1,590	1,590	973	1,500
16	1,800	1,000	.....	1,590	1,020	1,610	1,460	1,570	1,590	453	1,490
17	1,800	1,680	.....	1,940	1,020	1,590	1,470	1,590	1,610	453	1,550
18	1,800	1,830	.....	2,020	1,020	1,590	1,480	1,610	1,590	668	1,620
19	1,800	1,830	.....	1,950	1,020	1,590	1,480	1,610	1,580	964	1,590
20	1,800	1,800	.....	1,940	1,030	1,480	1,500	1,660	1,570	1,150	1,550
21	1,760	1,800	.....	1,940	1,020	1,460	1,560	1,710	1,560	1,130	1,540
22	1,760	1,800	.....	1,860	1,020	1,340	1,560	1,710	1,530	1,280	749
23	1,760	1,740	.....	1,860	1,030	1,370	1,570	1,740	1,540	1,160	100
24	1,760	1,720	.....	1,940	1,030	1,450	1,570	1,740	1,520	1,140	100
25	1,760	1,720	.....	1,940	1,140	1,450	1,580	1,740	1,490	1,240	100
26	1,750	1,720	.....	1,940	1,070	1,450	1,590	1,710	338	1,230	454
27	1,750	1,720	.....	1,940	1,070	1,440	1,580	1,740	88	1,220	1,080
28	1,750	1,720	.....	1,900	1,070	1,420	1,570	1,160	430	1,210	1,030
29	1,750	1,720	.....	.....	1,060	1,420	1,570	1,450	1,160	1,200	879
30	1,750	1,720	.....	.....	1,160	1,420	1,570	1,740	1,460	1,180	830
31	1,750	.....	.....	.....	1,260	.....	1,560	.....	1,460	1,170	.....

NOTE.—No flow on days and months for which discharge is not given.

Monthly discharge of Rio Grande below Elephant Butte dam, N. Mex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,800	1,750	1,780	109,000
November	1,830	0	872	51,900
December	1,800	0	857	52,700
January	0	0	0	0
February	2,020	0	929	51,600
March	1,900	695	1,230	75,600
April	1,650	1,320	1,510	89,800
May	1,590	1,420	1,530	94,100
June	1,740	1,160	1,600	95,200
July	1,720	88	1,470	90,400
August	1,870	453	1,260	77,500
September	1,620	100	1,120	66,600
The year	2,020	0	1,180	854,000

PECOS RIVER NEAR DAYTON, N. MEX.

LOCATION.—In sec. 13, T. 18 S., R. 26 E., 3 miles east of Dayton, Eddy County, and half a mile above mouth of Penasco River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24, 1905, to September 30, 1918.

GAGE.—Stevens water-stage recorder on right bank; installed August 27, 1914, at same site and datum as staff gage installed September 7, 1905. Original gage, 100 feet below the mouth of Penasco River and half a mile below present gage, was washed out September 6, 1905.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Shifts, especially during high stages. Right bank consists of clay, left bank of sand; both banks subject to overflow during extremely high stages. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.30 feet August 10 (discharge, 4,970 second-feet); minimum stage, 3.11 feet, July 4 (discharge, 40 second-feet).

1905–1918: Maximum discharge, 50,000 second-feet, July 25, 1905 (based on discharge at Lake McMillan and includes flow of Penasco River); minimum stage, 2.45 feet from 11 p. m. July 26 to 1 a. m. July 27, 1916 (discharge, 23 second-feet).

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted for irrigation above station; quantity not known. The Carlsbad project of the United States Reclamation Service, serves about 20,000 acres in the vicinity of Carlsbad, below the station, and stores part of the water in Lake McMillan, 10 miles below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; periods of change are covered by discharge measurements. Daily gage heights determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging hourly gage heights. Discharge determined by shifting-control method, or by applying mean gage height to rating table. Records fair.

COOPERATION.—Complete records furnished by the United States Reclamation Service.

Discharge measurements of Pecos River near Dayton, N. Mex., during the year ending Sept. 30, 1918.

[Made by engineers of United States Reclamation Service.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 17	3.20	74	May 1	3.37	94	July 6	4.15	191
Nov. 2	3.35	87	13	3.22	85	14	3.15	56
14	3.50	111	20	3.52	119	17	3.09	46
Dec. 1	3.88	160	27	3.78	154	31	3.08	45
18	4.11	205	June 3	3.97	190	Aug. 2	5.07	438
Jan. 19	4.25	206	8	5.75	556	10	10.3	4,968
Feb. 2	4.62	272	14	4.38	208	20	5.25	379
14	4.38	225	20	3.71	91	23	4.35	200
28	3.95	159	26	3.48	75	31	3.69	82
Mar. 16	3.59	107	29	3.26	56	Sept. 8	5.55	511
29	3.53	94	July 2	3.18	45	21	3.55	96
Apr. 20	3.55	115	5	4.83	355	30	3.36	73

Daily discharge, in second-feet, of Pecos River near Dayton, N. Mex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	145	103	160	216	299	160	91	93	152	46	42	75
2	137	93	165	220	273	160	92	93	145	44	256	70
3	122	93	166	225	244	152	93	101	179	42	208	70
4	108	101	161	225	237	149	94	109	187	40	137	70
5	93	115	159	230	248	145	92	110	211	254	100	70
6	85	123	158	235	248	137	85	109	1,278	190	75	77
7	83	127	158	225	286	137	85	113	994	155	60	928
8	84	125	157	224	283	138	85	113	785	123	56	875
9	91	116	160	222	257	137	95	99	505	102	60	725
10	85	107	177	227	244	137	91	95	565	84	3,860	333
11	80	103	196	283	244	136	92	83	455	71	2,242	230
12	75	103	204	299	239	130	95	82	264	56	944	191
13	73	108	206	316	235	119	98	82	235	55	535	160
14	73	111	194	333	227	110	95	80	204	56	359	142
15	81	117	170	378	219	109	96	75	186	58	309	121
16	81	133	186	244	214	108	99	74	165	51	351	111
17	74	133	196	208	214	108	97	70	145	46	1,596	106
18	70	132	205	203	219	106	100	112	131	47	1,410	100
19	67	132	181	204	208	106	113	135	107	67	825	90
20	67	134	181	204	201	106	116	128	90	52	525	79
21	73	144	174	283	200	106	116	118	84	45	316	85
22	81	146	172	600	203	106	115	114	97	76	244	90
23	82	145	172	620	195	105	110	106	118	88	202	82
24	77	147	172	610	188	104	103	92	118	64	235	82
25	75	150	204	595	190	102	102	86	95	63	186	75
26	76	148	216	410	192	101	97	106	82	83	152	67
27	75	150	224	366	179	100	97	153	72	67	128	65
28	84	154	224	478	162	100	97	152	62	55	107	65
29	91	155	218	398	.....	100	97	160	57	52	101	65
30	93	159	216	355	.....	100	96	136	52	53	88	73
31	103	.....	220	299	.....	99	.....	133	.....	44	80	.....

Monthly discharge of Pecos River near Dayton, N. Mex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	145	67	86.6	5,320
November	159	93	127	7,560
December	224	157	186	11,400
January	620	203	320	19,700
February	299	162	227	12,600
March	160	99	120	7,380
April	116	85	97.8	5,820
May	160	70	107	6,580
June	1,278	52	261	15,500
July	254	40	75.1	4,620
August	3,860	42	509	31,300
September	928	65	179	10,700
The year	3,860	40	191	138,000

PECOS RIVER AT CARLSBAD, N. MEX.

LOCATION.—In SE. ¼ sec. 6, T. 22 S., R. 27 E., at Green Street Bridge in Carlsbad, Eddy County, 300 feet downstream from Atchison, Topeka & Santa Fe Railway stations, 1,500 feet above mouth of Dark Canyon, 2,000 feet below Hagerman dam.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 28, 1903, to March 31, 1908, May 13, 1914, to September 30, 1918.

GAGE.—Vertical staff attached to the upstream side of middle bridge pier, installed May 18, 1914; an inclined staff gage at the present site was used from May 28, 1903, to October, 1904, October ,1904, to March 31, 1908, vertical staff gage at the same site was used.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and rock; changes may occur after high stages, and slight changes, caused by deposits of sand, have taken place during the lower stages. Banks of medium height; not subject to overflow. Position of control not known.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year,1.5 feet December 25, 30, and 31 (discharge, 291 second-feet); minimum stage, 1.00 foot September 30 (discharge, 30 second-feet).

1903–1908, and 1914–1918: Maximum stage recorded, about 21.0 feet August 7, 1916 (discharge, 85,700 second-feet[1]);minimum occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Large quantities of water are stored a few miles above station in lakes McMillan and Avalon by the United States Reclamation Service for irrigating lands near Carlsbad. Water is also diverted for irrigation in valley adjacent to river above Lake McMillan. Capacity of storage reservoirs in connection with the Carlsbad project, 58,500 acre-feet. Considerable water seeps into the river between the storage reservoirs and the gaging station, the quantity depending on the quantity being used for irrigation between the two points.

REGULATION.—Flow at this point completely controlled by storage reservoirs of the Carlsbad project.

[1] Discharge at Avalon dam; reported by engineers of United States Reclamation Service.

ACCURACY.—Stage-discharge relation not permanent. Standard rating curve fairly well defined between 50 and 200 second-feet. Gage read to half-tenths once daily. One daily reading may not be a true index of the mean daily discharge because of fluctuation due to operation of storage reservoirs. Daily discharge ascertained by shifting-control method and interpolated on days of no record. Records fair.

COOPERATION.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of Pecos River at Carlsbad, N. Mex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	U. S. R. S. engineers	0.95	83	Mar. 24	E. P. Congdon	0.91	46.6
Nov. 4	E. P. Congdon	.99	76.5	May 14	A. K. Gowans	1.16	88.4
Dec. 22	do	.92	57	Sept. 10	do	1.16	72.1
Feb. 10	A. K. Gowans	.89	47.8				

Daily discharge, in second-feet, of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	82	78	149	52	110	106	65	92	86	78	62	60
2	82	77	78	78	75	124	52	110	70	65	75	60
3	82	76	32	114	75	106	42	110	103	78	62	72
4	82	75	52	78	75	89	131	92	86	96	62	60
5	82	75	78	78	75	89	62	75	103	114	75	60
6	78	76	78	78	92	89	62	110	103	78	62	72
7	78	76	78	78	75	106	92	89	82	65	62	89
8	78	76	78	78	75	89	145	89	82	96	62	38
9	78	77	78	78	75	89	50	72	68	65	75	48
10	78	77	78	78	92	106	62	106	106	65	50	58
11	75	77	78	78	75	142	60	89	68	65	62	58
12	75	77	78	78	75	72	60	72	106	96	62	70
13	75	78	78	78	75	72	32	106	82	78	62	86
14	75	78	78	78	75	124	32	70	106	96	62	70
15	75	78	78	78	75	72	124	103	82	78	62	70
16	72	114	52	75	110	89	58	103	100	65	38	55
17	72	78	78	75	110	106	103	70	100	65	60	68
18	89	52	78	75	145	138	86	70	82	96	60	68
19	89	78	78	75	110	46	86	70	100	78	60	82
20	88	78	78	75	110	70	86	103	100	65	38	68
21	88	78	78	75	92	86	44	70	82	62	124	52
22	87	78	78	75	110	103	117	70	82	75	106	52
23	87	78	78	75	92	177	44	103	100	62	89	78
24	86	78	78	75	92	100	117	86	100	62	38	96
25	85	78	291	75	110	68	82	70	44	75	60	78
26	84	78	78	75	161	55	120	70	100	92	75	75
27	83	78	78	50	106	68	65	103	100	50	89	75
28	82	78	78	50	161	68	42	103	100	62	89	75
29	81	78	78	75	.....	68	114	103	100	62	89	62
30	80	78	291	75	.....	65	178	86	82	50	60	30
31	79	.....	291	110	.....	96	.....	103	.....	92	60	.....

NOTE.—Oct. 19 to Nov. 12 and Aug. 19, 25, and 26, discharge interpolated.

Monthly discharge of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	89	72	80.9	4,970
November	114	52	77.7	4,620
December	291	32	97.7	6,010
January	114	50	76.3	4,690
February	161	75	96.5	5,360
March	177	46	92.8	5,710
April	145	32	80.4	4,780
May	110	70	89.3	5,490
June	103	44	89.6	5,330
July	114	50	75.0	4,610
August	124	38	67.5	4,150
September	96	30	66.2	3,940
The year	291	30	82.4	59,700

PECOS RIVER NEAR ANGELES, TEX.

LOCATION.—In T. 26 S., R. 29 E., just below Pecos Valley Railroad bridge crossing Delaware Creek at its mouth, 2 miles north of New Mexico-Texas State line, 2½ miles southeast of Red Bluff, Eddy County, N. Mex., and 8½ miles northwest of Angeles, Reeves County, Tex.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 27, 1914, to September 30, 1918.

GAGE.—Stevens continuous water-stage recorder installed over a vertical float box drift-bolted to the first outcropping of rock on the right bank about 600 feet below railroad bridge and mouth of Delaware Creek.

DISCHARGE MEASUREMENTS.—Made by wading or from cable half a mile downstream.

CHANNEL AND CONTROL.—Bed and banks composed of sand, gravel, and rock; banks not subject to overflow. Control formed by a series of rapids about 200 feet below the gage; shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year, 1.60 feet at 11 p. m. June 6 (discharge, 1,030 second-feet obtained by extension of rating curve and subject to error); minimum mean daily stage 0.31 foot, March 19 (discharge 71 second-feet).

1914–1918: Maximum stage recorded, 21.5 feet 10 a. m. August 8, 1916, measured by leveling from flood marks (discharge not determined); minimum occurred in 1918.

ICE.—Stage-discharge relation not seriously affected by ice; open channel rating curve assumed applicable.

DIVERSIONS.—The Carlsbad project of the United States Reclamation Service, with reservoirs of a capacity of 58,500 acre-feet, diverts a large part of the natural run-off above Carlsbad, N. Mex. During the irrigation season a considerable amount of this water is returned to the stream by seepage. There are also other diversions along the stream above the Carlsbad project.

REGULATION.—The operation of a water-power plant of 300 horsepower capacity above station, just below Carlsbad, N. Mex., does not materially regulate flow at gage. The flow is, however, regulated to a large extent by waters stored in the reservoirs of the Carlsbad project. In the season of irrigation the effect of the regulation is decreased by return seepage waters, but during the winter the flow depends on water released at the reservoirs.

ACCURACY.—Stage-discharge relation changes during high water. Curve well defined between 70 and 260 second-feet. Operation of water-stage recorder excellent throughout year. Daily discharge determined by applying mean daily gage height to rating table, except for periods during which stage-discharge relation was affected by shifting control. Records good.

Discharge measurements of Pecos River near Angeles, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 3	E. P. Congdon	0.48	142	May 14	A. K. Gowans	0.36	93
Dec. 21	do	.43	122	28	E. P. Congdon	.34	81.7
Feb. 9	A. K. Gowans	.44	139	July 16	R. J. Hanks	.47	135
Mar. 23	E. P. Congdon	.50	159	Sept. 11	A. K. Gowans	.37	104

Daily discharge, in second-feet, of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	172	151	172	232	243	208	161	92	104	127	292	249
2	166	142	156	226	249	198	156	104	108	132	192	243
3	172	146	156	198	226	192	156	122	108	127	182	232
4	166	156	203	161	208	187	161	122	108	122	187	214
5	161	166	198	243	198	177	161	108	118	122	177	203
6	166	161	198	220	166	182	166	92	156	122	172	198
7	161	166	166	208	166	177	166	88	238	127	166	182
8	166	187	182	187	161	166	166	79	182	127	161	156
9	161	172	192	198	127	151	166	79	137	122	166	151
10	161	151	161	172	146	127	172	83	132	122	156	118
11	151	146	172	118	151	127	161	83	127	127	261	108
12	151	151	161	118	137	132	172	96	118	118	156	137
13	142	142	198	127	113	127	172	104	118	132	118	146
14	137	146	166	232	122	146	161	92	113	142	137	146
15	132	142	122	156	132	113	151	104	118	142	134	142
16	132	166	132	156	132	122	151	100	113	137	131	146
17	132	198	146	127	142	127	146	108	122	132	129	146
18	137	161	137	146	161	100	156	108	127	113	127	146
19	132	132	156	156	161	71	156	96	132	108	113	146
20	142	118	161	172	166	75	156	96	122	100	100	161
21	137	118	132	166	177	92	156	96	127	104	104	142
22	132	142	177	177	172	132	146	100	127	132	118	132
23	132	151	166	298	192	156	127	104	132	118	118	142
24	137	113	177	203	192	166	127	108	132	132	122	137
25	122	137	166	187	177	161	127	127	118	172	127	142
26	137	137	187	182	255	146	113	122	118	151	142	132
27	142	142	182	208	317	151	104	122	137	156	151	122
28	132	166	177	203	288	146	100	79	132	166	177	151
29	156	137	142	187	.....	151	104	108	132	146	208	146
30	166	151	187	226	.....	156	92	108	132	156	214	151
31	156	.....	243	243	.....	161	.....	104	.....	232	226	.....

NOTE.—Discharge determined by shifting-control method Oct. 1–20 and Sept. 1–20. No record, Aug. 15–17; discharge interpolated.

Monthly discharge of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	172	122	148	9,101
November	198	113	139	8,260
December	243	122	170	10,500
January	298	118	188	11,600
February	317	113	180	10,000
March	208	71	146	8,980
April	172	92	147	8,750
May	127	79	101	6,210
June	238	104	130	7,740
July	232	100	134	8,240
August	292	100	160	9,840
September	249	108	159	9,460
The year	317	71	151	110,000

PECOS RIVER ABOVE BARSTOW, TEX.

LOCATION.—Three-quarters of a mile below head gate of Biggs irrigation project, 1 mile east of Patrole siding on Pecos Valley Railway, 1½ miles above head gate of Barstow Irrigation Co., 10 miles northwest of Pecos, and 14 miles northwest of Barstow, Reeves County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 1, 1916, to September 30, 1918.

GAGE.—Stevens water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 150 feet below gage.

CHANNEL AND CONTROL.—Channel straight 100 feet above and 300 feet below station. Bed composed of gravel, clay, and sand; not permanent. Right bank is clay, clean, and fairly permanent; left bank loose and covered with salt cedar; both banks are overflowed at gage height about 10 feet. Shoal 250 feet below gage serves as control; shifts during high water.

EXTREMES OF DISCHARGE.—Maximum stage during year 2.58 feet at 3 a. m. January 15 (discharge, 176 second-feet); minimum discharge, May 2–5, 25 second-feet.

1916–1918: Maximum stage, 12.1 feet at 6 a. m. August 10, 1916 (discharge not determined); minimum stage, June 24, 1917, 0.88 foot (discharge, 22 second-feet).

ICE.—None reported during year.

DIVERSIONS.—In addition to water stored and lands irrigated in New Mexico by the Carlsbad project of the United States Reclamation Service, some lands in Texas are irrigated just above the station. Considerable water is returned to the river by seepage below the reservoirs. The second report of the State board of water engineers shows 28,800 acres declared irrigated above the station, the quantity of water assumed to be 86,400 acre-feet.

REGULATION.—Storage in connection with the Carlsbad project controls the run-off during parts of the year. The operation of a water-power plant of 300 horsepower capacity, below Carlsbad, does not affect the flow at this point.

ACCURACY.—Stage-discharge relation was not permanent. Rating curve well defined below 700 second-feet and poorly defined above. Mean daily gage height determined by inspecting the gage-height graph, or, for days of considerable fluctuation, by averaging the hourly gage height. Breaks in gage-height records caused by collection of silt in float box and by clock's stopping; records poor. Daily discharge ascertained by shifting-control method.

Discharge measurements of Pecos River above Barstow, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 2	E. P. Congdon	1.93	91.2	May 29	R. J. Hank	1.34	64.9
Dec. 20	do	2.12	117	" 29	E. P. Congdon	1.34	64.5
Feb. 8	A. K. Gowans	2.08	117	July 6	R. J. Hank	1.04	43.4
Mar. 22	E. P. Congdon	1.20	44.4	Sept. 10	A. K. Gowans	1.20	62.9
May 12	A. K. Gowans	1.30	57.8				

Daily discharge, in second-feet, of Pecos River above Barstow, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	102	84	99	83	160	156	59	70	37	44	45	56
2	94	82	102	114	160	116	61	25	37	39	45	57
3	88	80	105	126	170	101	61	25	38	42	44	57
4	86	82	108	119	165	100	61	25	40	44	44	58
5	83	84	111	116	155	96	62	25	39	44	50	59
6	80	86	114	87	140	93	63	60	55	44	52	60
7	76	89	110	101	125	91	65	60	52	44	53	61
8	75	92	106	114	112	90	65	60	112	45	55	62
9	77	94	104	108	111	91	65	60	96	44	56	63
10	79	95	104	89	119	84	65	60	90	45	57	63
11	81	88	104	63	119	80	64	60	64	45	58	65
12	83	81	104	61	113	78	61	60	52	44	59	65
13	84	74	111	66	119	74	64	59	52	44	59	61
14	81	67	118	75	114	70	60	58	52	42	59	57
15	89	60	125	147	106	67	72	49	52	44	58	57
16	86	70	123	136	106	65	71	50	52	44	58	59
17	83	82	121	109	107	61	70	49	52	44	58	63
18	80	93	119	104	108	58	61	49	52	43	57	68
19	77	109	117	91	110	53	56	50	52	49	57	70
20	74	106	117	93	118	50	55	50	52	50	56	69
21	71	85	110	94	114	47	63	53	52	48	56	71
22	69	75	114	95	128	44	68	54	52	48	56	71
23	68	94	108	117	127	44	67	72	51	49	55	72
24	65	96	118	111	118	63	60	54	51	48	55	70
25	62	91	116	128	126	77	72	57	51	49	55	70
26	60	88	111	135	120	78	72	101	42	66	54	72
27	61	91	107	127	109	79	72	91	42	65	54	76
28	61	103	107	119	99	70	76	72	44	56	53	74
29	62	90	111	114	.....	64	65	65	46	50	54	67
30	64	99	106	119	.....	62	69	58	46	48	54	64
31	75	.....	87	118	.....	61	.....	43	.....	48	55	.....

NOTE.—No record Oct. 8–13, 17–20, Nov. 4–17, Dec. 2–5, 7–8, 10–11, 13–19, Feb. 1–7, Apr. 3–10, May 2–11, Aug. 6–11, 13–27, 29–31, Sept. 1–9. Discharge on these dates determined by a study of record on Pecos River at Angelas and data furnished by engineers and observer.

Monthly discharge of Pecos River above Barstow, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	102	60	76.6	4,710
November	109	60	87.0	5,180
December	125	87	110	6,760
January	147	61	106	6,520
February	170	99	124	6,800
March	156	44	76.2	4,690
April	76	55	65.4	3,890
May	101	25	56.1	3,450
June	112	37	53.2	3,170
July	68	39	47.1	2,900
August	59	44	54.2	3,330
September	76	56	64.6	3,840
The year	170	25	76.4	55,300

PECOS RIVER NEAR GRANDFALLS, TEX.

LOCATION.—At site of old highway bridge where Grandfalls-Fort Stockton road formerly crossed Pecos River, 1½ miles upstream from present Grandfalls-Fort Stockton road crossing at Iron Bridge, 2 miles below diversion dam for silt-line canal of Imperial Irrigation Co., about 3 miles south of Grandfalls, Ward County, 4½ miles above diversion dam of Zimmerman project, and 21 miles south of Monahans.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 6, 1915, to September 30, 1918. Records were taken at Iron Bridge, 1½ miles downstream, from November 6, 1915, to August 3, 1917. Discharge at both points believed to be the same.

GAGE.—Stevens water-stage recorder attached to downstream side of old bridge pier near left bank. Prior to August 9, 1917, a Stevens water-stage recorder was operated at Iron Bridge, but that site was abandoned because of backwater from Zimmerman dam. Relation of gage datums not known.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet above gage or by wading; during extreme stages from Iron Bridge.

CHANNEL AND CONTROL.—Bed solid rock, clean, smooth, and permanent. Channel straight for 100 feet above and below station. One channel below gage height of 8 feet; above this stage both banks, which are dirt and wooded, are subject to overflow. Rock ledge extending diagonally across stream just below gage serves as low-water control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 0.96 foot 8 p. m. April 6 to noon April 7 (discharge, 71 second-feet); minimum stage, 0.36 foot March 30–31 and April 23–24 (discharge, 2.6 second-feet).

1915–1918: Maximum stage, 12.8 feet (old gage datum) at 8 a. m. August 29, 1916 (discharge, 4,370 second-feet, determined from extension of rating curve and subject to error); minimum stage, 0.38 foot (old gage datum) 1 a. m. April 17, 1916 (discharge not determined, but less than 0.7 second-foot).

ICE.—None reported during year.

DIVERSIONS.—Station is 2 miles below diversion of silt-line canal of Imperial Irrigation Co., 18½ miles below diversion for the Imperial reservoir (17,000 acre-feet capacity), 15½ miles below diversion for Grandfalls project, and 4½ miles above diversion for Zimmerman project. Available data show approximately 143,000 acres are irrigable between station and lower limits of Carlsbad project of United States Reclamation Service. Second report of State Board of Water Engineers shows total of 58,000 acres declared irrigated in Texas above the station, the amount of water required assumed to be 174,000 acre-feet. The effect of diversions is to some extent counterbalanced by water returned to stream by seepage.

REGULATION.—None beyond that caused by diversions for irrigation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 75 second-feet. Gage-height record good. Mean daily gage heights obtained by inspecting gage-height graph, or, for days of considerable fluctuations, by use of planimeter. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Pecos River near Grandfalls, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 6	E. P. Congdon	0.56	9.5	May 12	A. K. Gowans	0.38	3.1
Dec. 22	do	.48	4.2	30	R. J. Hank	.41	4.6
Feb. 11	A. K. Gowans	.41	9.3	July 17	do	.50	6.2
Mar. 25	E. P. Congdon	.38	2.7	Sept. 9	A. K. Gowans	.66	10.9

Daily discharge, in second-feet, of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.4	8.4	9.6	4.8	3.9	3.0	2.8	2.8	3.6	8.4	6.0	13
2	8.4	8.4	6.0	4.8	4.2	3.0	2.9	3.6	3.0	8.4	6.0	13
3	9.0	7.2	6.6	5.1	4.2	2.8	3.0	4.2	2.9	7.2	6.0	14
4	9.0	8.4	6.0	5.1	4.2	2.6	5.1	3.9	3.3	7.2	6.0	14
5	9.0	9.0	8.4	5.1	4.2	2.6	21	2.8	3.6	7.2	7.2	16
6	9.6	9.6	6.0	5.1	4.2	2.7	37	3.9	5.7	6.6	9.0	17
7	9.0	11	7.8	5.1	5.4	2.7	45	4.5	7.2	6.0	10	17
8	9.6	11	5.7	3.6	4.8	2.7	29	5.7	9.0	6.6	10	16
9	10	11	5.7	3.3	3.9	2.8	31	4.8	12	6.0	11	18
10	11	10	5.4	4.2	2.9	2.8	31	4.8	11	6.6	12	18
11	9.6	9.0	5.1	4.5	3.3	2.8	31	3.0	11	6.6	12	18
12	9.0	8.4	5.4	4.5	3.0	2.8	32	2.8	10	6.6	11	16
13	10	7.2	5.7	4.2	2.9	2.8	31	2.8	9.6	6.0	12	17
14	9.6	6.0	7.2	3.6	2.9	2.8	31	2.7	9.0	6.6	12	17
15	9.0	5.7	6.0	3.0	3.0	2.8	29	2.7	9.0	6.6	12	17
16	9.6	5.4	6.0	3.3	3.0	2.8	29	2.8	9.0	6.6	12	19
17	11	8.4	6.0	3.3	2.9	2.8	27	2.8	9.6	6.0	13	17
18	11	7.8	6.0	3.6	3.0	2.8	26	2.8	9.6	6.0	17	16
19	10	5.4	6.0	3.6	2.9	2.8	16	2.9	9.0	6.6	18	14
20	9.6	6.6	6.6	3.9	2.9	2.8	14	2.8	8.4	6.6	18	16
21	9.0	6.6	7.2	4.2	2.9	2.9	13	2.7	9.0	6.0	18	16
22	9.6	7.8	6.0	3.9	3.0	3.0	11	2.7	9.0	6.0	17	17
23	10	8.4	5.7	3.6	3.0	2.9	2.6	2.8	9.0	6.6	17	18
24	9.6	6.6	5.1	3.3	3.0	2.8	2.6	2.7	9.0	7.2	19	18
25	9.0	6.6	5.4	3.9	3.0	2.8	2.9	2.8	9.0	6.6	18	18
26	9.6	10	5.1	4.2	3.0	2.8	2.9	2.8	8.4	6.6	16	19
27	9.6	10	4.8	3.9	3.0	2.8	2.8	2.8	8.4	6.6	16	20
28	10	11	5.1	3.6	3.0	2.8	2.6	2.9	8.4	6.0	16	20
29	10	12	5.1	3.6	.....	2.7	2.8	3.0	8.4	5.4	16	19
30	9.6	12	4.8	3.6	.....	2.6	2.8	3.0	8.4	5.7	15	19
31	9.0	.....	5.1	3.6	.....	2.6	.....	4.5	.....	6.0	14	.....

Monthly discharge of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	11	8.4	9.56	588
November	12	5.4	8.50	506
December	9.6	4.8	6.04	371
January	5.1	3.0	4.04	248
February	5.4	2.9	3.41	189
March	3.0	2.6	2.79	172
April	45	2.6	17.3	1,030
May	5.7	2.7	3.28	202
June	12	2.9	8.08	481
July	8.4	5.4	6.53	402
August	19	6.0	13.0	799
September	20	13	16.9	1,010
The year	45	2.6	8.28	6,000

PECOS RIVER NEAR COMSTOCK, TEX.[1]

LOCATION.—At Pecos high bridge of Galveston, Harrisburg & San Antonio Railway Co., 11 miles west of Comstock, Val Verde County, 18 miles east of Langtry, and 14 miles by stream above confluence with Rio Grande; below all tributaries.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1900, to September 30, 1918. (Also gage heights for 1898.)

GAGE.—Vertical staff attached to the downstream side of bridge pier on left bank; read by W. A. Clare.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet above bridge.

CHANNEL AND CONTROL.—Banks and stream bed composed of rock and gravel; water flows through a series of rapids and pools in a canyon about 300 feet deep. Stage-discharge relation at the lower stages changes slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.90 feet at midnight August 15 (discharge, 7,140 second-feet); minimum stage, −0.12 foot July 29 to August 1 (discharge, 106 second-feet).

1900–1918: Maximum stage recorded, 35.75 feet April 6, 1900 (discharge not determined); minimum occurred in 1918.

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted and stored above the station for irrigation. Lake McMillan and Lake Avalon of the Carlsbad project of the United States Reclamation Service, having a combined capacity of 58,500 acre-feet, are situated on Pecos River a few miles above Carlsbad, N. Mex. In addition to the water stored in New Mexico, water from Pecos River is used to irrigate large areas of land in the vicinity of Barstow and Grandfalls, Tex. There are no diversions below the station. Return waters tend to equalize effects of diversions in lower part of drainage basin.

REGULATION.—Yearly run-off at this point controlled by storage and diversions for irrigation above station.

ACCURACY.—Stage-discharge relation subject to change. Gage read to hundredths twice daily; mean of two readings may not be a true index of mean daily discharge. Rating curve well defined between 100 and 4,000 second-feet. Daily discharge ascertained by applying mean daily gage height to rating table and by shifting-control method. Records good.

Discharge measurements of Pecos River near Comstock, Tex., during the year ending Sept. 30, 1918.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	H. T. Dodd	0.22	167	June 1	H. T. Dodd	0.10	142
Jan. 16	do	.28	205	Sept. 18	E. P. Congdon	.02	135
Mar. 25	do	.18	164				

[1] Published in earlier reports as Pecos River near Moorehead, Tex.

Daily discharge, in second-feet, of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1918.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	152	162	195	200	200	198	172	160	155	155	106	130
2	158	162	195	200	200	198	170	160	155	152	114	130
3	158	162	195	200	202	198	170	178	155	150	114	155
4	158	162	195	200	200	198	170	397	155	150	114	155
5	152	168	195	205	200	198	172	277	155	142	114	155
6	158	162	195	205	200	198	172	259	158	142	114	155
7	158	162	195	200	202	196	172	259	202	142	114	155
8	158	168	192	200	202	200	170	235	3,950	142	114	168
9	158	168	195	200	200	200	175	205	2,120	142	130	205
10	158	170	198	200	200	200	175	200	1,780	142	130	180
11	162	168	198	200	200	200	175	185	516	140	130	155
12	160	168	198	200	200	198	175	178	415	135	130	155
13	155	168	195	200	200	196	180	170	295	132	122	155
14	155	168	198	200	200	195	180	160	265	130	126	155
15	155	168	198	202	200	180	178	155	265	130	6,200	155
16	160	175	198	200	200	180	175	155	253	130	1,390	155
17	160	170	198	200	200	180	175	192	235	130	442	155
18	155	170	198	200	200	180	172	220	235	130	312	135
19	155	180	202	202	202	180	170	180	232	130	256	155
20	148	180	198	202	202	180	155	175	205	130	235	168
21	152	180	200	202	200	180	155	162	200	114	205	155
22	158	180	202	200	200	178	155	172	195	114	180	155
23	152	185	200	200	200	178	155	178	192	114	180	130
24	152	182	205	205	200	175	155	175	192	114	178	155
25	152	185	205	205	200	175	155	175	180	114	180	155
26	158	190	200	205	200	175	155	165	175	114	178	155
27	158	190	205	205	200	175	155	155	170	114	175	130
28	158	190	200	200	198	175	155	155	155	114	175	130
29	158	192	200	200	.....	175	155	155	155	106	180	130
30	158	192	200	202	.....	175	155	155	155	103	155	130
31	158	.....	200	202	.....	175	.....	155	.....	106	155	.....

NOTE.—Oct. 1 to Dec. 20 discharge determined by shifting-control method.

Monthly discharge of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	162	148	156	9,590
November	192	162	174	10,400
December	205	192	198	12,200
January	205	200	201	12,400
February	202	198	200	11,100
March	200	175	187	11,500
April	180	155	167	9,940
May	397	155	190	11,700
June	3,950	155	456	27,100
July	155	106	129	7,930
August	6,290	106	404	24,800
September	205	130	152	9,040
The year	6,290	106	218	158,000

PECOS RIVER SEEPAGE INVESTIGATIONS.

From May 28 to 30 a study of losses and gains from seepage was made on Pecos River between the New Mexico-Texas State line and Girvin, Tex. Automatic gages are maintained at Angeles (near State line), above Barstow, and near Grandfalls. Although data were insufficient to warrant a correction of discharge for time interval, the gages showed that the river was at a practically constant stage previous to and during the investigation so that few corrections for time interval were necessary. From Angeles gage to the Arno-Porterville highway bridge there was a gain of 25 second-feet; from Arno-Porterville highway bridge to Barstow gage there was a loss of 30 second-feet, and between Barstow and Girvin a gain of 48 second-feet. Between the Arno-Porterville highway bridge and Barstow the river flows over a bed of deep sand, the seepage into which, and the natural loss from evaporation might easily account for the loss of 30 second-feet between these points.

Seepage measurements, in second-feet, on Pecos River from New Mexico-Texas State line to below Girvin, Tex., in May, 1918.

Stream or diversion.	Location.	Approximate distance in miles.	Date.	Discharge of main stream.	Inflow.	Diversion.	Section gain or loss.	Total gain or loss.
Pecos River	Near Angeles gaging station.	0	28	81.7				
Do	Olds ranch, Angeles	22	29	73.9			− 7.8	− 7.8
Do	Riverton	43	29	86.8			+12.9	+ 5.1
Do	Arno	56	29	107			+20.2	+25.3
Farmers independent canal.	Head gate	75	29			12.5		
Pecos River	Above Barstow gaging station.	85	29	64.5			−30	− 4.7
Barstow canal	Head gate	86.5	29			64.4		
Pecos River	Below Barstow diversion	86.5	29	1.7			+ 1.6	− 3.1
Do	Above Margueretta flume.	90	29	2.9			+ 1.2	− 1.9
Do	Below Margueretta flume.	90	29	4.1			+ 1.2	− .7
Do	Texas & Pacific Railroad bridge.	102	29	5.0			+ .9	+ .2
Toyah Creek	Mouth	112	29		0			
Pecos River	Just below Big Valley dam.	117	29	13.1			+ 8.1	+ 8.3
Pasaino Creek	Mouth	130	29		0			
Imperial reservoir feeder canal.	Head gate	134	30			15.5		
Pecos River	Below Imperial feeder diversion.	134	30	9.0			+11.4	+19.7
Do	Below Grandfalls diversion dam.	137	29	8.4			− .6	+19.1
Second Imperial diversion.	Head gate	150	30			4.2		
Pecos River	Below second Imperial diversion.	150	30	3.4			− .8	+18.3
Do	Near Grandfalls gage	154	30	4.6			+ 1.2	+19.5
Zimmerman canal	Head gate	160	30			2.5		
Pecos River	Below Zimmerman diversion.	160	30	0			− 2.1	+17.4
Do	Near Buena Vista	180	30	16.0			+16.0	+33.4
Comanche Creek	Mouth	183	30		0			
Pecos River	Girvin	203	30	30.4			+14.4	+47.8

MISCELLANEOUS MEASUREMENTS.

Measurements at points other than regular gaging stations are listed in the following table:

Miscellaneous discharge measurements in Texas during the year ending Sept. 30, 1918.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Jan. 11	Neches River	Sabine Lake	6 miles above Beaumont, Tex.	891
Feb. 26	Colorado River		Above Austin dam	109
27	do		do	128
Mar. 7	do		do	159
20	San Bernard River		5 miles southwest of Damon oil field, Tex.	15.4
27	Little River	Brazos River	3 miles southeast of Little River, Tex.	17.0
Aug. 1	Colorado River		800 feet below Austin dam	65.6
1	do		¼ mile below Deep Eddy and 1½ miles above Austin gage.	73.1
6	do		800 feet below Austin dam	32.7
6	do		¼ mile below Deep Eddy	36.9
16	do		800 feet below Austin dam	15.4
21	do		125 feet above Austin dam	10.2
22	do		do	8.1
22	Llano River	Colorado	Castell, Tex	a.1
22	do	do	4-mile crossing above Castell, Tex.	5.5
22	do	do	10 miles south of Mason, Tex., at Hedwig mill.	7.9
22	do	do	White-Littlefield crossing	8.8
23	Colorado River		Bluffton, Tex	a2.0
26	do		125 feet above Austin dam	7.6
Sept. 16	Riverside canal	Colorado River	4 miles west of Eagle Lake, Tex.	75.5
25	Geronimo Creek	Guadalupe River	Seguin-Martindale road crossing.	a1.5

a Discharge estimated.

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