Quality of
Surface Waters of the United States

1964

Parts 7 and 8. Lower Mississippi River Basin and Western Gulf of Mexico Basins

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1957

Prepared in cooperation with the States
of Arkansas, Colorado, Kansas,
Louisiana, Mississippi, Missouri, New
Mexico, Oklahoma, Tennessee,
Texas, and with other agencies

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1969

UNITED STATES DEPARTMENT OF THE INTERIOR

WALTER J. HICKEL, Secretary

GEOLOGICAL SURVEY

William T. Pecora, Director

Library of Congress catalog card No. GS 43-68

For sale by the Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402 - Price $2.50 .(paper cover)

PREFACE

This report was prepared by the Geological Survey in co-operation with the States of Arkansas, Colorado, Kansas, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, Texas, and with other agencies, by personnel of the Water Resources Division, E. L. Hendricks, chief hydrologist, G. W. Whetstone, assistant chief for Reports and Data Processing, under the general direction of S. M. Lang, chief, Reports Section, and B. A. Anderson, chief, Data Reports Unit.

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WATER-QUALITY STATIONS, IN DOWNSTREAM

ORDER, FOR WHICH RECORDS ARE PUBLISHED

[Symbols after station name designate type of data: c, chemical; t3 water temperature; s 3 sediment]

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QUALITY OF SURFACE WATERS

OF THE UNITED STATES, 1964

PARTS 7 and 8

INTRODUCTION

The quality-of-water investigations of the United States Geo-logical Survey are concerned with chemical and physical charac-teristics of the surface and ground water supplies of the Nation. Most of the investigations carried on in cooperation with State and Federal agencies deal with the amounts of matter in solution and in suspension in streams.

The record of chemical analysis, suspended sediment, and temperature of surface waters given in this volume serve as a basis for determining the suitability of waters for various uses. The flow and water quality of a stream are related to variations in rainfall and other forms of precipitation. In general, lower concentrations of dissolved solids may be expected during periods of high flow than during periods of low flow. Conversely, the sus-pended solids in some streams may change materially with rel-atively small variations in flow, whereas for other streams the quality of the water may remain relatively uniform throughout large ranges in discharge.

The Geological Survey has published annual records of chem-ical quality, suspended sediment, and water temperature since 1941. The records prior to 1948 were published each year in a single volume for the entire country, and in two volumes in 1948 and 1949. From 1950 to 1958, the records were published in four volumes and from 1959 to 1963 in five volumes. Beginning with the 1964 water year, water quality records obtained by the Geo-logical Survey were published in a new series of annual releases on a state-boundary basis. These records are then published in six volumes in the Geological Survey water-supply paper series. The drainage basins covered in the six volumes are shown in Figure 1. The data given in this report were collected during the water year October 1,1963 to September 30,1964. The records are

QUALITY OF SURFACE WATERS, 1964

1-2; WSP1954
3-4; WSP 1955
5-6; WSP 1956
9-11; WSP 1958

Figure 1. Map of the United States showing basins
covered by the six water-supply papers on cuality
of surface waters in 1964. The shaded part repre-
sents the section of the country covered by this
volume; the unshaded part represents the section
of the country covered by other water-supply papers.

arranged by drainage basins in downstream order according to the Geological Survey method of reporting streamflow. Stations on tributary streams are listed between stations on the main stem in the order in which those tributaries enter the main stem.

A station number has been as signed as an added means of iden-tification for each stream location where regular measurements of water quantity or quality have been made. The numbers have been assigned to conform with the standard downstream order of listing gaging stations. The numbering system consists of 2 digits followed by a hyphen and a 6-digit number. The notation to the left of the hyphen identifies the Part or hydrologic region used by the Geological Survey for reporting hydrologic date.. The num-ber to the right of the hyphen represents the location of the sta-tion in the standard downstream order within each of the 15 parts (Fig. 1). The assigned numbers are in numerical order but are

COLLECTION AND EXAMINATION OF SAMPLES 3

not consecutive. They are so selected from the complete 6-digit-number scale that intervening numbers will be available for future assignments to new locations. The identification number for each station in this report is printed to the left of the station name and contains only the essential digits. For example, the number is printed as 4-100 for a station whose complete identification num-ber is 04-0100.00.

Descriptive statements are given for each sampling station where chemical analyses, temperature measurements, or sedi-ment determinations have been made. These statements include location of the station, drainage area, periods of records available, extremes of dissolved solids, hardness, specific conductance, tem-perature, sediment loads, and other pertinent data. Records of discharge of the streams at or near the sampling station are in-cluded in most tables of analyses.

During the water year ending September 30, 1964, the Geo-logical Survey maintained 228 stations on 114 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 206 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were meas-ured continuously at? and daily at 107 stations. All surface water samples collected and analyzed during the year have not been included. Single analyses made of daily samples before compositing have not been reported. The specific conductance of almost all daily samples was determined, and as noted in the table headings this information is available for reference at the district offices listed under Division of Work, on page 28.

Quantities of suspended sediment are reported for 48 stations during the year ending September 30, 1964. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 32 of the stations.

COLLECTION AND EXAMINATION OF SAMPLES

Quality of water stations usually are located at or near points on streams where streamflow is measured by the U.S. Geological Survey. The concentration of solutes and sediments at different

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locations in the stream-cross section may vary widely with dif-ferent rates of water discharge depending on the source of the material and the turbulence and mixing of the stream. In general, the distribution of sediment in a stream section is much more variable than the distribution of solutes. It is necessary to sample some streams at several verticals across the chanrel and es-pecially for sediment, to uniformly traverse the depth of flow. These measurements require special sampling equipment to adequately integrate the vertical and lateral variability of the concentration in the section. These procedures yield a velocity-weighted mean concentration for the section.

The near uniformly dispersed ions of the solute load move with the velocity of the transporting water. Accordingly, the mean sec-tion concentration of solutes determined from samples is a pre-cise measure of the total solute load. The mean section concen-tration obtained from suspended sediment samples is a less precise measure of the total sediment load, because the sediment samplers do not traverse the bottom 0.3 foot of th°. sampling vertical where the concentration of suspended sediment is great-est and because a significant part of the coarser particles in many streams move in essentially continuous contact with the bed and are not represented in the suspended sediment sample. Hence, the computed sediment loads presented in this report are usually less than the total sediment loads. For most streams the difference between the computed and total sediment loads will be small, in the order of a few percent.

CHEMICAL QUALITY

The methods of collecting and compositing water samples for chemical analysis are described by Rainwater and Thatcher (1960, 301 p.). No single method of compositing sarrples is ap-plicable to all problems related to the study of water quality. Although the method of 10-day periods or the equivalent of three composite samples per month generally is practiced, modifications usually are made on the basis of dissolved-solids content as in-dicated by measurements of conductivity of daily samples, sup-plemented by other information such as chloride content, river stage, weather conditions and other background information of the
stream.

COLLECTION AND EXAMINATIONS OF SAMPLES

TEMPERATURE

Daily water temperatures were measured at most of the sta-tions at the time samples were collected for chemical quality or sediment content. So far as practicable, the water temperatures were taken at about the same time each day in order that the data would be relatively unaffected by diurnal variations in temperature. Most large streams have a small diurnal variation in water temperature; small, shallow streams may have a daily range of several degrees and may follow closely the changes in air tem-perature. The thermometers used for determining water tem-perature were accurate to plus or minus 0.5°F.

At stations where thermographs are located, the recordr con-sist of maximum and minimum temperatures for each day, and the monthly averages of maximum daily and minimum daily temperatures.

SEDIMENT

In general, suspended-sediment samples were collected daily with depth-integrating cable-suspended samples (U.S. Inter-Agency, 1963, and 1952.) from a fixed sampling point at one ver-tical in the cross section. A hand sampler was used at many sta-tions during periods of low flow. Depth-integrated samples were collected periodically at three or more verticals in the cross section to determine the cross-sectional distribution of the con-centration of suspended sediment with respect to that at the daily sampling vertical. In streams where transverse distribution of sediment concentration ranges widely, samples were taken at two or more verticals to define more accurately the average concen-tration of the cross section. During periods of high or rapidly changing flow, samples were taken two or more times a day at most sampling stations.

Sediment concentrations were determined by filtration-evaporation method. At many stations the daily mean concentra-tion for some days was obtained by plotting the velocity-weighted instantaneous concentrations on the gage-height chart. The plot-ted concentrations, adjusted if necessary, for cross-sectional distribution were connected or averaged by continuous curves to obtain a concentration graph. This graph represented the esti-mated velocity-weighted concentration at any time, and for most periods daily mean concentrations were determined from the

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graph. The days were divided into shorter intervals when the concentration and water discharge were changing rapidly. During some periods of minor variation in concentration, the average concentration of the samples was used as the daily mean concen-tration. During extended periods of relatively uniform concen-tration and flow, samples for a number of days were composited to obtain average concentrations and average daily loads for each period.

For some periods when no samples were collected, daily loads of suspended sediment were estimated on thebaris of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge. The estimates were further guided by weather conditions and sediment discharge for other stations.

In many instances where there were no observations for several days, the suspended-sediment loads for individual days are not estimated, because numerous factors influencing the quantities of transported sediment made it very difficult to mal-e accurate estimates for individual days. However, estimated loads of sus-pended sediment for missing days in an otherwise continuous period of sampling have been included in monthly and annual totals in order to provide a complete record. For some streams, samples were collected weekly, monthly, or less frequently, and only rates of sediment discharge at the time of sampling are shown.

In addition to the records of quantities of suspended sediment transported, records of the particle sizes of sediment are in-cluded. The particle sizes of the suspended sediment for many of the stations, and the particle sizes of the bed materiel for some of the stations were determined periodically.

The size of particles in stream sediments commonly range from colloidal clay (finer than 0.001mm) to coarse sand or gravel (coarser than 1.0 mm). The common methods of particle-size analyses cannot accommodate such a wide range in particle size. Hence, it was necessary to separate most samples into two parts, one coarser than 0.062 mm and one finer than 0.062 mm. The separations were made by sieve or by a tube containing a settling medium of water. The coarse fractions were classified by sieve separation or by the visual accumulation tube (U.S. Inter-Agency, 1957). The fine fractions were classified by the pipet method (Kilmer and Alexander, 1949) or the bottom withdrawal tube method (U.S. Inter-Agency, 1943).

QUALITY OF SURFACE WATERS, 1964

EXPRESSION OF RESULTS

The quantities of solute concentrations analyzed in the labora-tory are measured by weight-volume units (milligrams per liter) and for reporting, are converted to weight-weight units (parts per million). For most waters, this conversion is made by assuming that the liter of water sample weighs 1 kilogram; and thus milli-grams per liter are equivalent to parts per million (ppm).

Equivalents per million are not reported, but they can be calculated easily from the parts per million data. An equivalent per million (epm) is a unit chemical combining weight of a constit-uent in a million unit weights of water. Chemical equivalence in equivalents per million can be obtained by (a) dividing the con-centration in parts per million by the combining weight of that ion, or (b) multiplying the concentration (in ppm) by the reciprocals of the combining weights. The following table lists the reciprocals of the combining weights of cations and anions generally reported in water analyses.

The conversion factors are computed from atomic weights based on carbon-12 (International Union of Pure and Applied Chemistry, 1961).

Conversion factors: Parts per million to equivalents per million

Ion

Aluminum (Al +3)......
Barium (Ba +2). ....
Bicarbonate (HCO3 -i) .
Bromide (fir'1) ....
Calcium (Ca+2).. .... Carbonate (CO 3-2) ...... Chloride (Cl'i)......... Chromium (Cr+6)...... Cobalt (Co +2) .... Copper (Cu + 2).... ...... Fluoride (F -i).......... Hydrogen (H +1)... ...... Hydroxide (OH -i) ..... Iodide (I -i)... ....

Multi-

ply by

0.11119
.01456
.01639
.01251
.04990
.03333
.02821
. 11539
.03394
.03148
.05264
.99209
.05880
.00788

Ion

Iron (Fe +3) ....
Lead (Pb +2). .... Lithium (Li +1)......... Magnesium (Mg+2)... Manganese (Mn+2).... Nickel (Ni +2)........... Nitrate (NO3-i) .... Nitrite (NO2 -1)... ...... Phosphate (PO4 -3).... Potassium (K+i) .... Sodium (Na + 1) .... Strontium (Sr +2) .... Sulfate(SO4 -2)... ...... Zinc (Zn +2) ....

Multi-

ply by

0.05372
.00965
. 14411
.08226
.03640
.03406
.01613
.02174
.C3159
.C2557
.C4350
.C2283
.C2082
.C3060

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Results given in parts per million can be converted to grains per United States gallon by dividing by 17.12.

The hardness of water is conventionally expressed in all water analyses in terms of an equivalent quantity of calcium carbonate. Such a procedure is required because hardness is caused by several different cations, present in variable proportions. It should be remembered that hardness is an expression in conven-tional terms of a property of water. The actual presence of cal-cium carbonate in the concentration given is not to be assumed. The hardness caused by calcium and magnesium (and other cations if significant) equivalent to the carbonate and bicarbonate is called carbonate hardness; the hardness in excess of this quan-tity is called noncarbonate hardness. Hardness or alkalinity val-ues expressed in parts per million as calcium carbonate may be converted to equivalents per million by dividing by 50.

The value usually reported as dissolved solids is the residue on evaporation after drying at 180°C for 1 hour. For some waters, particularly those containing moderately large quantities of soluble salts, the value reported is calculated from the quantities of the various determined constituents using the carbonate equivalent of the reported bicarbonate. The calculated sum of the constituents may be given instead of or in addition to the residue. In the analyses of most waters used for irrigation, the quantity of dis-solved solids is given in tons per acre-foot as well as in parts per million.

Specific conductance is given for most analyses end was de-termined by means of a conductance bridge and using a standard potassium chloride solution as reference. Specific conductance values are expressed in micromhos per centimeter at 25°C. Spe-cific conductance in micromhos is 1 million times the reciprocal of specific resistance at 25°C. Specific resistance is the resist-ance in ohms of a column of water 1 centimeter long and 1 square centimeter in cross section.

The discharge of the streams is reported in cubic feet per second (see Streamflow, p. 25) and the temperature in degrees Fahrenheit. Color is expressed in units of the platinum-cobalt scale proposed by Hazen (1892). A unit of color is produced by one milligram per liter of platinum in the form of the chloro-platinate ion. Hydrogen-ion concentration is expressed in terms of pH units. By definition the pH value of a solution is the negative logarithm of the concentration of gram ions of hydrogen.

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An average of analyses for the water year is given for most daily sampling stations. Most of these averages are arithmetical, time-weighted, or discharge-weighted; when analyses during a year are all on 10-day composites of daily samples with no miss-ing days, the arithmetical and time-weighted averages are equiv-alent. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the river each day for the water year. A discharge-weighted average approximates the com-position of water that would be found in a reservoir containing all of the water passing a given station during the year. A discharge-weighted average is computed by multiplying the discharge for the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. For most streams, discharge-weighted averages are lower than arithmetical averages because at times of high discharge the rivers generally have low concen-trations of dissolved solids.

A program for computing these averages on an electronic digital computer was instituted in the 1962 water year. This pro-gram extended computations to include averages for pH values expressed in terms of hydrogen ion and averages for the concen-tration of individual constituents expressed in tons per day. Con-centrations in tons per day are computed the same as daily sediment loads.

The concentration of sediment in parts per million is computed as 1,000,000 times the ratio of the weight of sediment to the weight of water-sediment mixture. Daily sediment loads are expressed in tons per day and except for subdivided days, are usually obtained by multiplying daily mean sediment concentrations in parts per million by the daily mean discharge in cubic feet per second, and the conversion factor, normally 0.0027.

Particle size analyses are expressed in percentages of material finer than classified sizes (in millimeters). The size classification used in this report agrees closely with recommen-dations made by the American Geophysical Union Subcommittee on sediment terminology (Lane and others, 1947). The particle size distributions given in this report are not necessarily rep-resentative of the particle sizes of sediment in transport in the natural stream. Most of the organic matter is removed and the sample is subjected to mechanical and chemical dispersion before analysis of the silt and clay.

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COMPOSITION OF SURFACE WATERS

All natural waters contain dissolved mineral matter. The

quantity of dissolved mineral matter in a natural wr.ter depends primarily on the type of rocks or soils with which the water has been in contact and the length of time of contact. Ground water is generally more highly mineralized than surface runoff because it remains in contact with the rocks and soils for much longer periods. Some streams are fed by both surface runoff and ground water from springs or seeps. Such streams reflect the chemical character of their concentrated underground sources during dry periods and are more dilute during periods of heavy rainfall. The dissolved-solids content in a river is frequently increased by drainage from mines or oil fields, by the addition of industrial or municipal wastes, or in irrigated regions by drainage from irrigated lands.

The mineral constituents and physical properties of natural waters reported in the tables of analyses include those that have a practical bearing on water use. The results of analyses generally include silica, iron, calcium, magnesium, sodium, potassium (or sodium and potassium together calculated as sodium), lithium, carbonate, bicarbonate, sulfate, chloride, fluoride, nitrate, boron, pH, dissolved solids, and specific conductance. Aluminum, man-ganese, color, acidity, dissolved oxygen, and other dissolved con-stituents and physical properties are reported for certain streams. Phenolic material and minor elements including strontium, chrom-ium, nickel, copper, lead, zinc, cobalt, and other trace elements are determined occasionally for a few streams in connection with specific problems and the results are reported. The source and significance of the different constituents and properties of natural waters are discussed in the following paragraphs. The constituents are arranged in the order that they appear in the tables.

MINERAL CONSTITUENTS IN SOLUTION

Silica (SiO2)

Silica is dissolved from practically all rocks. Some natural surface waters contain less than 5 parts per million c^ silica and few contain more than 50 parts, but the more common range is from 10 to 30 parts per million. Silica affects the usefulness of

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a water because it contributes to the formation of boiler scale; it usually is removed from feed water for high-pressure boilers. Silica also forms troublesome deposits on the blades of steam tur-bines.

Aluminum (Al)

Aluminum is usually present only in negligible quantities in natural waters except in areas where the waters have been in con-tact with the more soluble rocks of high aluminum content such as bauxite and certain shales. Acid waters often contain large amounts of aluminum. It may be troublesome in feed waters where it tends to be deposited as a scale on boiler tubes.

Iron (Fe)

Iron is dissolved from many rocks and soils. On exposure to the air, normal basic waters that contain more than 1 part per million of iron soon become turbid with the insoluble reddish ferric oxide produced by oxidation. Surface waters, therefore, seldom contain as much as 1 part per million of dissolved iron, although some acid waters carry large quantities of iron in solution, Iron causes reddish-brown stains on porcelain or enameled ware and fixtures and on fabrics washed in the water.

Manganese (Mn)

Manganese is dissolved in appreciable quantities from rocks in some sections of the country. It resembles iron in its chemical behavior and in its occurrence in natural waters. However, man-ganese in rocks is less abundant than iron. As a result the con-centration of manganese is much less than that of iron and is not regularly determined in many areas. It is especially objectionable in water used in laundry work and in textile processing. Concen-trations as low as 0.2 part per million may cause a dark-brcwn or black stain on fabrics and porcelain fixtures. Appreciable quan-tities of manganese are often found in waters containing objec-tionable quantities of iron.

Calcium (Ca)

Calcium is dissolved from almost all rocks and soils, but the highest concentrations are usually found in waters that have been in contact with limestone, dolomite, and gypsum. Calcium and magnesium make water hard and are largely responsible for the formation of boiler scale. Most waters associated with granite or silicious sands contain less than 10 parts per million of calcium;

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waters in areas where rocks are composed of dolomite and lime-stone contain from 30 to 100 parts per million; and waters that have come in contact with deposits of gypsum may contain several hundred parts per million.

Magnesium (Mg)

Magnesium is dissolved from many rocks, particularly from dolomitic rocks. Its effect in water is similar to that of calcium. The magnesium in soft waters may amount to only 1 or 2 parts per million, but water in areas that contain large quantities of dolomite or other magnesium-bearing rocks may contain from 20 to 100 parts per million or more of magnesium.

Strontium (Sr)

Strontium is a typical alkaline-earth element and is similar chemically to calcium. Strontium may be present in natural water in amounts up to a few parts per million much more frequently than the available data indicate. In most surface water the amount of strontium is small in proportion to calcium. However, in sea water the ratio of strontium to calcium is 1:30.

Sodium and potassium (Na and K)

Sodium and potassium are dissolved from practically all rocks. Sodium is the predominant cation in some of the more highly min-eralized waters found in the western United States. Natural waters that contain only 3 or 4 parts per million of the two together are likely to carry almost as much potassium as sodium. As the total quantity of these constituents increases, the proportion of sodium becomes much greater. Moderate quantities of sodiurr and potas-sium have little effect on the usefulness of the water for most purposes, but waters that carry more than 50 or 100 parts per million of the two may require careful operation of steam boilers to prevent foaming. More highly mineralized waters that contain a large proportion of sodium salts may be unsatisfactory for irrigation.

In this report, sodium and potassium values that are calculated and reported as sodium are indicated by footnote.

Lithium (Li)

Data concerning the quantity of lithium in water are scarce.
It is usually found in small amounts in thermal spring? and saline

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waters. Lithium also occurs in streams where some industries dump their waste water. The scarcity of lithium in rocks is re-sponsible more than other factors for relatively small amounts present in water.

Bicarbonate, carbonate and hydroxide (HCCL, CCL, OH)

Bicarbonate, carbonate, or hydroxide is sometimes reported as alkalinity. The alkalinity of a water is defined as its capacity to consume a strong acid to pH 4.5. Since the major causes of alkalinity in most natural waters are carbonate and bicarbonate ions dissolved from carbonate rocks, the results are usually re-ported in terms of these constituents. Although alkalinity may suggest the presence of definite amountsof carbonate, bicarbonate or hydroxide, it may not be true due to other ions that contribute to alkalinity such as silicates, phosphates, borates, possibly fluo-ride, and certain organic anions which may occur in colored waters. The significance of alkalinity to the domestic, agricultural, and industrial user is usually dependent upon the nature of the cations (Ca, Mg, Na, K) associated with it. However, alkalinity in moderate amounts does not adversely affect most users.

Hydroxide may occur in water that has been softened hy the lime process. Its presence in streams usually can be taken as an indication of contamination and does not represent the natural chemical character of the water.

Sulfate (SO)

Sulfate is dissolved from many rocks and soils--in especially large quantities from gypsum and from beds of shale. It is formed also by the oxidation of sulfides of iron and is therefore present in considerable quantities in waters from mines. Sulfate in waters that contain much calcium and magnesium causes the formation of hard scale in steam boilers and may increase the cost of softening the water.

Chloride (Cl)

Chloride is dissolved from rock materials in all parts of the country. Surface waters in the humid regions are usually low in chloride, whereas streams in arid or semiarid regions may con-tain several hundred parts per million of chloride leached from soils and rocks, especially where the streams receive return drainage from irrigated lands or are affected by ground-water-inflow carrying appreciable quantities of chloride. Large quan-

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tities of chloride in water that contains a high content of calcium and magnesium increases the water's corrosiveness.

Fluoride (F)

Fluoride has been reported as being present in some rocks to about the same extent as chloride. However, the quantity of fluo-ride in natural surface waters is ordinarily very small compared to that of chloride. Investigations have proved that fluoride con-centrations of about 0.6 to 1.7 ppm reduced the incidence of den-tal caries and that concentrations greater than 1.7 ppm also pro-tect the teeth from cavities but cause an undesirable black stain (Durfor and Becker, 1964, p. 20). Public Health Service, 1962 (p. 8), states, "When fluoride is naturally present in drinking water, the concentration should not average more than the appropriate upper control limit (0.6 to 1.7 ppm). Presence of fluoride in average concentration greater than two times the op-timum values shall constitute grounds for rejection of the supply." Concentration higher than the stated limits may cause mottled enamel in teeth, endemic cumulative fluorosis, and skeletal effects.

Nitrate (NCL)

Nitrate in water is considered a final oxidation product of nitrogenous material and may indicate contamination by sewage or other organic matter. The quantities of nitrate presert in surface waters are generally less than 5 parts per million (as NCL) and have no effect on the value of the water for ordinary uses.

It has been reported that as much as 2 parts per million of nitrate in boiler water tends to decrease intercrystalline cracking of boiler steel. Studies made in Illinois indicate that nitrates in excess of 70 parts per million (as NO,..) may contribute to methe-moglobinemia ("blue babies") (Faucett and Miller, 1946), and more recent investigations conducted in Ohio show that drinking water containing nitrates in the range of 44 to 88 ppm (as NO,,) may cause methemoglobinemia (Waring, 1949). A report pablisned by the National Research Council, Maxcy (1950) concludes that a nitrate content in excess of 44 parts per million (as NO,,) should be regarded as unsafe for infant feeding. U.S. Public Health Service (1962) sets 45 ppm as the upper limit.

Phosphate (PO)

Phosphorus is an essential element in the growth of plants and animals. Some sources that contribute nitrate, such as organic

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wastes are also important sources of phosphate. The addition of phosphates in water treatment constitutes a possible source, although the dosage is usually small. In some areas, phosphate fertilizers may yield some phosphate to water. A more important source is the increasing use of phosphates in detergents. Domestic and industrial sewage effluents often contain considerable amounts of phosphate.

Boron (B)

Boron in small quantities has been found essential for plant growth, but irrigation water containing more than 1 part per million boron is detrimental to citrus and other boron-sensitive crops. Boron is reported in Survey analyses of surface waters in arid and semiarid regions of the Southwest and West where irrigation is practiced or contemplated, but few of the surf ace waters analyzed have harmful concentrations of boron.

Dissolved solids

The reported quantity of dissolved solids--the residue on evap-oration--consists mainly of the dissolved mineral constituents in the water. It may also contain some organic matter and water of crystallization. Waters with less than 500 parts per million of dissolved solids are usually satisfactory for domestic and some industrial uses. Water containing several thousand parts per mil-lion of dissolved solids are sometimes successfully used for irrigation where practices permit the removal of soluble salts through the application of large volumes of water on well-drained lands, but generally water containing more than about 2,000 ppm is considered to be unsuitable for long-term irrigation under average conditions.

Chromium (Cr)

Few if any waters contain chromium from natural sources. Natural waters can probably contain only traces of chromium as a cation unless the pH is very low. When chromium is present in water, it is usually the result of pollution by industrial wastes. Fairly high concentrations of chromate anions are possible in waters having normal pH levels. Concentrations of more than 0.05 ppm of chromium in the hexavalent form constitute grounds for rejection of a water for domestic use on the basis of the standards of the U.S. Public Health Service (1962).

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Nickel and Cobalt (Ni, Co)

Nickel and cobalt are very similar in chemical behavior and also closely related to iron. Both are present in igneous rocks in small amounts and are more prevalent in silicic rocks. Any nickel in water is likely to be in small amounts and could be in a colloidal state. Cobalt may be taken into solution more readily than nickel. It may be taken into solution in small amounts through bacterio-logical activity similar to that causing solution of manganese. However, few data on the occurrence of either nickel or cobalt in natural water are available.

Copper (Cu)

Copper is a fairly common trace constituent of natural water. Small amounts may be introduced into water by solution of copper and brass water pipes and other copper-bearing equipment in contact with the water, or from copper salts added to control algae in open reservoirs. Copper salts such as the sulfate and chloride are highly soluble in waters with a low pH but in water of normal alkalinity these salts hydrolyze and the copper may be precipitated. In the normal pH range of natural water containing carbon dioxide, the copper might be precipitated as carbonate. The oxidized portions of sulfide-copper ore bodies contain other copper com-pounds. The presence of copper in mine water is common.

Copper imparts a disagreeable metallic taste to water. As little as 1.5 ppm can usually be detected, and 5 ppm can render the water unpalatable. Copper is not considered to be a cumulative systemic poison like lead and mercury; most copper ingested is excreted by the body and very little is retained. T'-e patholog-ical effects of copper are controversial, but it is generally be-lieved very unlikely that humans could unknowingly ingest toxic quantities from palatable drinking water. The U.S. Public Health Service (1962) recommends that copper should not exceed 1.0 ppm in drinking and culinary water.

Lead (Pb)

Lead is only a minor element in most natural waters, but industrial or mine and smelter effluents may contain relatively large amounts of lead. Many of the commonly used lead salts are water soluble.

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Traces of lead in water usually are the result of solution of lead pipe through which the water has passed. Amounts of lead of the order of 0.05 ppm are significant, as this concentration is the upper limit for drinking water in the standards adopted by the U.S. Public Health Service (1962). Higher concentrations rray be added to water through industrial and mine-waste disposal. Lead in the form of sulfate is reported to be soluble in water to the extent of 31 ppm (Seidell, 1940) at 25°C. In natural water this concentration would not be approached, however, since a pH of less than 4.5 would probably be required to prevent formation of lead hydroxide and carbonate. It is reported (Pleissner, 1907) that at 18 C water free of carbon dioxide will dissolve the equiv-alent of 1.4 ppm of lead and the solubility is increased nearly four fold by the presence of 2.8 ppm of carbon dioxide in the solu-tion. Presence of other ions may increase the solubility of lead.

Zinc (Zn)

Zinc is abundant in rocks and ores but is only a minor con-stituent in natural water because the free metal and its oxides are only sparingly soluble. In most alkaline surface waters it is present only in trace quantities, but more may be present in acid water. Chlorides and sulfates of zinc are highly soluble. Zinc is used in many commercial products, and industrial waster may contain large amounts.

Zinc in water does not cause serious effects on health, but produces undesirable esthetic effects. The U.S. Public Health Service (1962, p. 55) recommends that the zinc content not exceed 5 ppm in drinking and culinary water.

Barium (Ba)

Barium may replace potassium in some of the igneour rock minerals, especially feldspar and barium sulfate (barite) is a common barium mineral of secondary origin. Only traces of barium are present in surface water and sea water. Because natural water contains sulfate, barium will dissolve only in trace amounts. Barium sometimes occurs in brines from oil-well wastes.

The U.S. Public Health Service (1962) states that water con-taining concentrations of barium in excess of 1 ppm is not suitable for drinking and culinary use because of the serious toxic effects of barium on heart, blood vessels, and nerves.

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Bromide (Br)

Bromine is a very minor element in the earth's crust and is normally present in surface waters in only minute quantities. Measurable amounts may be found in some streams that receive industrial wastes, and some natural brines may contain rather high concentrations. It resembles chloride in that it tends to be concentrated in sea water.

Iodide (I)

Iodide is considerably less abundant both in rocks and water than bromine. Measurable amounts may be found in sme streams that receive industrial wastes, and some natural brines may con-tain rather high concentrations. It occurs in sea water to the extent of less than 1 ppm. Rankama and Sahama (1950) report iodide present in rainwater to the extent of 0.001 to 0.003 ppm and in river water in about the same amount. Few waters will contain over 2.0 ppm.

PROPERTIES AND CHARACTERISTICS OF WATER

Hardness

Hardness is the characteristic of water that receives the most attention in industrial and domestic use. It is commonly recog-nized by the increased quantity of soap required to produce lather. The use of hard water is also objectionable because it contributes to the formation of scale in boilers, water heaters, radiators, and pipes, with the resultant decrease in rate of heat transfer, pos-sibility of boiler failure, and loss of flow.

Hardness is caused almost entirely by compounds1 of calcium and magnesium. Other constituents--such as iron, manganese, aluminum, barium, strontium, and free acid--also caueeharuness, although they usually are not present in quantities large enough to have any appreciable effect.

Generally, bicarbonate and carbonate determine the propor-tions of "carbonate" hardness of water. Carbonate hardness is the amount of hardness chemically equivalent to the amount of bicarbonate and carbonate in solution. Carbonate hardness is approximately equal to the amount of hardness that is removed from water by boiling.

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Noncarbonate hardness is the difference between the hardness calculated from the total amount of calcium and magnesium in solution and the carbonate hardness. If the carbonate hardness (expressed as calcium carbonate) equal the amount of calcium and magnesium hardness (also expressed as calcium carbonate) there is no noncarbonate hardness. Noncarbonate hardness is about equal to the amount of hardness remaining after water is boiled. The scale formed at high temperatures by the evaporation of water containing noncarbonate hardness commonly is tough, heat re-sistant, and difficult to remove.

Although many people talk about soft water and hard water, there has been no firm line of demarcation. Water that seems hard to an easterner may seem soft to a westerner. In this report hardness of water is classified as follows:

Hardness range
(calcium carbonate
in ppm)

0-60
61-120
121-180
more than 180

Hardness description

Soft
Moderately hard
Hard
Very hard

For public use, water with hardness above 200 parts per million generally requires softening treatment (Durfor and Decker, 1964, p. 23-27).

Acidity (H+l)

The use of the terms acidity and alkalinity is widespread in the literature of water analysis and is a cause of confusion to those who are more accustomed to seeing a pH of 7.0 used as a neutral point. Acidity of a natural water represents the content of free carbon dioxide and other uncombined gases, organic acids and salts of strong acids and weak bases that hydrolyze to give hydro-gen ions. Sulfates of iron and aluminum in mine and industrial wastes are common sources of acidity. The presence of acidity is reported in those waters which have a pH below 4.5.

Sodium adsorption ratio (SAR)

The term "sodium adsorption ratio (SAR)" was introduced by the U.S. Salinity Laboratory Staff (1954). It is a ratio express-ing the relative activity of sodium ions in exchange reaction with

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soil and is an index of the sodium or alkali hazard to the soil. Sodium adsorption ratio is expressed by the equation:

N+ SAR = "

Ca +Mg

where the concentrations of the ions are expressed in milliequiv-alents per liter (or equivalents per million for most irrigation waters).

Waters are divided into four classes with respect to sodium or alkali hazard: low, medium, high, and very high, depending upon the SAR and the specific conductance. At a conductance of 100 micromhos per centimeter the dividing points are at SAR values of 10, 18, and 26, but at 5,000 micromhos the corresponding dividing points are SAR values of approximately 2.5, 6.5, and 11. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Specific conductance (micromhos per centimeter at 25°C)

Specific conductance is a convenient, rapid determination used to estimate the amount of dissolved solids in water. It is a meas-ure of the ability of water to transmit a small electrical current (see p. 8). The more dissolved solids in water that can transmit electricity the greater the specific conductance of the water. Com-monly, the amount of dissolved solids (in parts per million) is about 65 percent of the specific conductance (in micrcmhos). This relation is not constant from stream to stream or from well to well and it may even vary in the same source with changes in the composition of the water (Durfor and Becker, 1964 p. 27-29).

Specific conductance of most waters in the eastern United States is less than 1,000 micromhos, but in the arid western parts of the country, a specific conductance of more than 1,000 micro-mhos is common.

Hydrogen-ion concentration (pH)

Hydrogen-ion concentration is expressed in terms of pH units (see p. 8). The values of pH often are used as a measure of the solvent power of water or as an indicator of the chemical behavior certain solutions may have toward rock minerals.

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The degree of acidity or alkalinity of water, as indicated by the hydrogen-ion concentration, expressed as pH, is related to the corrosive properties of water and is useful in determining the proper treatment for coagulation that may be necessary at water-treatment plants. A pH of 7.0 indicates that the water is neither acid nor alkaline. pH readings progressively lower thar 7.0 denote increasing acidity and those progressively higher than 7.0 denote increasing alkalinity. The pH of most natural surf ace waters ranges between 6 and 8. Some alkaline surface waters have pH values greater than 8.0 and waters containing free mineral acid or organic matter usually have pH values less than 4.5.

The investigator who utilizes pH data in his interpretations of water analyses should be careful to place pH values in their proper perspective.

Color

In water analysis the term "color" refers to the appearance of water that is free from suspended solids. Many turbid waters that appear yellow, red, or brown when viewed in the stream rhow very little color after the suspended matter has been removed. The yellow-to-brown color of some waters is usually caused by organic matter extracted from leaves, roots, and other organic substances in the ground. In some areas objectionable color in water results from industrial wastes and sewage. Clear deep water may appear blue as the result of a scattering of sunlight by the water molecules. Water for domestic use and some industrial uses should be free from any perceptible color. A color less than 15 units generally passes unnoticed (U.S. Public Health Service, 1962). Some swamp waters have natural color in excess of 300 units.

The extent to which a water is colored by material in solution is commonly reported as a part of a water analysis because a sig-nificant color in water may indicate the presence of organic mater-ial that may have some bearing on the dissolved solids content. Color in water is expressed in terms of units between 0 and 500 or more based on the above standard (see p. 8).

Oxygen consumed

Oxygen consumed is a measure of the amount of oxygen re-quired to oxidize unstable materials in water and may be corre-lated with natural-water color or with some carbonaceous organic pollution from sewage or industrial wastes.

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Tolerances for oxygen consumed in feed water for low- and high-pressure boilers are 15 and 3 ppm, respectively (Northeast Water Works Association, 1940). Wash water containing more than 8 ppm has been reported to import a bad odor to textiles; concentrations for water used in beverages and brewing range from 0.5 to 5.0 ppm (California State Water Pollution Control Board, 1952, 1954).

Dissolved oxygen (DO)

Adequate dissolved oxygen is necessary for the life of fish and other aquatic organisms and is an indicator for corrosivity of water, photosynthetic activity, and septicity. It is one of the most important indicators of the condition of a water supply for biological, chemical and sanitary investigations (Rose, 1965).

Biochemical oxygen demand (BOD)

Biochemical oxygen demand is a measure of the oxygen re-quired to oxidize the carbonaceous organic material usable as a source of food by aerobic organisms.

Chemical oxygen demand (COD)

Chemical oxygen demand indicates the quantity of oxidizable compounds present in a water and will vary with water com-positions, concentration of reagent, temperature, period of contact, and other factors.

Organics

Phenols. Phenolic material in water resources is invariably the result of pollution. Phenols are widely used as disinfectants and in the synthesis of many organic compounds. Wf.ste products from oil refineries, coke areas, and chemical plants may contain high concentrations. Fortunately, phenols decompose in the pres-ence of oxygen and organic material, and their persistence down-stream from point of entry is relatively short lived. The rate of decomposition is dependent on the environment.

Very low concentrations impart such a disagreeable taste to water that it is highly improbable that harmful amounts could be consumed unknowingly. Reported thresholds of detection of taste and odor range from 0.001 to 0.01 ppm.

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Most probable number (MPN). An index for determining the extent of pollution in water is the most probable number which is a direct count of coliform colonies per 100 milliliters of water.

Detergents (MBAS).--Anionic surfactants (methylene blue active substance, MBAS) in detergents resist chemical oxidation and biological breakdown. Their persistence in water over long periods of time contributes to pollution of both ground water and surface water. Some of the effects produced from detergent pollution are unpleasant taste, odor, and foaming (Wayman, and others, 1962). Although the physiological implicatiors of MBAS to human beings is unknown, prolonged ingestion of this material by rats is believed to be nontoxic (Paynter, 1960). The U.S. Public Health Service (1962) recommends that MBAS should not exceed 0.5 ppm in drinking and culinary waters.

Temperature

Temperature is an important factor in property determining the quality of water. This is very evident for such a direct use as an industrial coolant. Temperature is also important, but per-haps not so evident, for its indirect influence upon aquatic b'ota, concentrations of dissolved gases, and distribution of chemical solutes in lakes and reservoirs as a consequence of thermal stratification and variation.

Surface water temperatures tend to change seasonally and daily with air temperatures, except for the outflow of large springs. Superimposed upon the annual temperature cycle is a daily fluctu-ation of temperature which is greater in warm seasons than in cold and greater in sunny periods than with a cloud cover. Natu-ral warming is due mainly to absorption of a solar radiation by the water and secondarily to transfer of heat from the air. Condensation of water vapor at the water surface is reported to furnish measurable quantities of heat. Heat loss takes place largely through radiation, with further losses through evaporation and conduction to the air and to the stream bed. Thus the temperature of a small stream generally reaches a maximum in mid- to late afternoon due to solar heating and reaches a minimum from early to mid-morning after nocturnal radiation.

Temperature variations which commonly occur during summer in lakes and reservoirs of temperate regions result in a separation of the water volume into a circulating upper portion and a non-circulating lower portion. Separating the two is a stratum of water of variable vertical thickness in which the temperature

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decreases rapidly with increasing depth. This physical division of the water mass into a circulating and a stagnant portion is the result of density differences in the water column associated with the temperature distribution. Knowledge of the stratification in a body of water may result in increased utility by locating strata of more suitable characteristics. For example, the elevation of an intake pipe may be changed to obtain water of lower temperature, higher pH, less dissolved iron, or other desirable properties.

Temperature is a major factor in determining the effect of pollution on aquatic organisms. The resistance of fish to certain toxin substances has been shown to vary widely with temperature. The quantity of dissolved oxygen which the water can contain is also temperature dependent. Oxygen is more soluble in cold water than in warm water, hence the reduction of oxygen concentrations by pollution is especially serious during periods of high temper-ature when oxygen levels are already low. Increased temperatures also accelerate biological activity including that of the oxygen-utilizing bacteria which decompose organic wastes. These pol-lutional effects may be especially serious when low flow con-ditions coincide with high temperatures. Summary temperature data of water are essential for planning multiple uses of water.

Turbidity

Turbidity is the optical property of a suspension with refer-ence to the extent to which the penetration of light is inhibited by the presence of insoluble material. Turbidity is a function on both the concentration and particle size of the suspended material. Although it is reported in terms of parts per million of silica, it is only partly synonymous with the weight of sediment per unit volume of water.

Turbid water is abrasive in pipes, pumps, and turbine blades. In process water, turbidities much more than 1 ppm are not tol-erated by several industries, but others permit up to 50 ppm or higher (Rainwater, Thatcher, 1960, p. 289). Although turbidity does not directly measure the safety of drinking water, it is re-lated to the consumers acceptance of the water. A level of 5 units of turbidity becomes objectionable to a considerable number of people (U.S. Public Health, 1962).

Sediment

Fluvial sediment is generally regarded as that sediment which is transported by, suspended in, or deposited by water. Suspended

STREAMFLOW 25

sediment is that part which remains in suspension in water owing to the upward components of turbulent currents or by colloidal suspension. Much fluvial sediment results from the natural process of erosion, which in turn is part of the geologic cycle of rock transformation. This natural process may be accelerated by agricultural practices. Sediment is also contri-buted by a number of industrial and construction activities. In certain sections, waste materials from mining, logging, oil-field, and other industrial operations introduce large quantities of suspended as well as dissolved material.

The quantity of sediment, transported or available for trans-portation, is affected by climatic conditions, form or nature of precipitation, character of the solid mantle, plant cover, topo-graphy, and land use. The mode and rate of sediment erosion, transport, and deposition is determined largely by the size dis-tribution of the particles or more precisely by the fall velocities of the particles in water. Sediment particles in the sandsize (larger than 0.062 mm) range do not appear to be affected by flocculation or dispersion resulting from the mineral constituents in solution. In contrast, the sedimentation diameter of clay and silt particles in suspension may vary considerably from point to point in a stream or reservoir, depending on the mineral matter in solution and in suspension and the degree of turbulence present. The size of sediment particles in transport at any point depends on the type of erodible and soluble material in the drainage area, the degree of flocculation present, time in transport, and character-istics of the transporting flow. The flow characteristics include velocity of water, turbulence, and the depth, width, and roughness of the channel. As a result of these variable characteristics, the size of particles transported, as well as the total sediment load, is in constant adjustment with the characteristics and physical features of the stream and drainage area.

STREAMFLOW

Most of the records of stream discharge, used in conjunction with the chemical analyses and in the computation of sed'ment loads in this volume, are published in The Geological Survey water-supply paper series, "Surface Water Supply of the United States, 1961-65." The discharge reported for a composite sample is usually the average of daily mean discharges for the composite period. The discharges reported in the tables of single analyses

26 QUALITY OF SURFACE WATERS, 1964

are either daily mean discharges or discharges obtained at the time samples were collected and computed from a stage-discharge relation or from a discharge measurement.

The water-supply papers and numbers which contain more complete records of stream discharge for this report are listed below:

Part 7

Volume 1
Volume 2

WSP

1920
1921

Part 8

Volume 1
Volume 2

WSP

1922
1923

PUBLICATIONS

Reports giving records of chemical quality and temperatures of surface waters and suspended-sediment loads of streams in the area covered by this volume for the water years 1941-64, are listed below:

Numbers of water-supply papers containing records for Parts 7 and 8, 1941-64

Year

1941
1942
1943
1944
1945
1946

WSP

942
950
970
1022
1030
1050

Year

1947
1948
1949
1950
1951
1952

WSP

1102
1133
1163
1188
1199
1252

Year

1953
1954
1955
1956
1957
1958

WSP

1292
1352
1402
1452
1522
1573

Year

1959
1960
1961
1962
1963
1964

WSP

1644
1744
1884
1944
1950
1957

Geological Survey reports containing chemical quality, tem-perature, and sediment data obtained before 1941 are listed below. Publications dealing largely with the quality of ground-water supplies and only incidentally covering the chemical composition of surface waters are not included. Publications that are out of print are preceded by an asterisk.

PROFESSIONAL PAPER

*135. Composition of river and lake waters of the United States, 1924.

PUBLICATIONS 27

BULLETINS

*479. The geochemical interpretation of water analyses, 1911.
770. The data of geochemistry, 1924.

WATER-SUPPLY PAPERS

* 108. Quality of water in the Susquehanna River drainage basin,
with an introductory chapter on physiographic features.
1904.

*161. Quality of water in the upper Ohio River basin and at
Erie, Pa., 1906.
*193. The quality of surface waters in Minnesota, 1907.
*236. The quality of surface waters in the United States,
Part 1, Analyses of waters east of the one hundredth meridian, 1909.
*237. The quality of the surface waters of California, 1910.
*239. The quality of surface waters of Illinois, 1910.
*273. Quality of the water supplies of Kansas, with a prelimin-
ary report on stream pollution by mine waters in southeastern Kansas, 1911.
*274. Some stream waters of the western United States, with
chapters on sediment carried by the Rio Grande and
the industrial application of water analyses, 1911.
*339. Quality of the surface waters of Washington, 1914.
*363. Quality of the surface waters of Oregon, 1914.
*418. Mineral springs of Alaska, with a chapter on the chemical
character of some surface waters of Alaska, 1917.
*596-B. Quality of water of Colorado River in 1925-26, 1928. *596-D. Quality of water of Pecos River in Texas, 1928. *596-E. Quality of the surface waters of New Jersey, 1928. *636-A. Quality of water of the Colorado River in 1926-28, 1930. *636-B. Suspended matter in the Colorado River in 1925-28,1930. *638-D. Quality of water of the Colorado River in 1928-30, 1932.
*839 Quality of water of the Rio Grande basin above Fort
Quitman, Tex., 1938.
*889-E. Chemical character of surface water of Georgia, 1944.
*998. Suspended sediment in the Colorado River, 1925-41,
1947.

1048. Discharge and sediment loads in the Boise River drainage
basin, Idaho, 1939-40, 1948. 1110-C. Quality of water of Conchas Reservoir, New Mexico, 1939-49, 1952.

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Many of the reports listed are available for consultation in the larger public and institutional libraries. Copies of Geological Survey publications still in print may be purchased at a nominal cost from the Superintendent of Documents, Government Printing Office, Washington D.C. 20402, who will, upon request, furnish lists giving prices.

COOPERATION

Many Municipal, State, and Federal agencies assisted in col-lecting records for these quality-of-water investigations. Many of the investigations were supported by funds appropriated directly to the Geological Survey. Studies of suspended-sediment loads in the middle Rio Grande in New Mexico were started in 1948 as a Federal project.

Financial assistance was furnished by the Bureau of Recla-mation, U.S. Department of the Interior for some investigations in the Arkansas River basin in Kansas and Oklahoma, and the Rio Grande basin in New Mexico. The Soil Conservation Service, U.S. Department of Agriculture assisted with special sediment studies in the Arkansas River basin in Arkansas, and the Rio Grande basin in New Mexico. The Corps of Engineers, U.S. Army provided funds and determined the sediment concentration and par-ticle size of bed material in connection with the sediment investi-gations of the Mississippi River at St. Louis, Mo. The Corps also assisted in investigations in Texas and for the operation of some stations in the Rio Grande basin in New Mexico.

Records of 10 stations in the Rio Grande basin were furnished by the U.S. Department of Agriculture, in cooperation with the International Boundary and Water Commission.

DIVISION OF WORK

The quality-of-water program was conducted by the Water Resources Division of the Geological Survey, E. L. Hendricks, chief hydrologist, and G. W. Whetstone, assistant chief for Reports and Data Processing, under the general direction of S. M. Lang, chief, Reports Section, and B. A. Anderson, chief, Data Reports Unit. The data were collected and prepared for publication under the supervision of district chiefs, district chemists, or engineers as follows: In Arkansas and Missouri, J. H. Hubble; Colorado, R. H. Langford; Arkansas River basin in Kansas, D. M. Culbertson;

State Cooperating agency

Arkansas Arkansas Geological Commission,
W. F. Williams, State geologist.

Colorado Colorado Conservation Board,
Felix Sparks, director.

Kansas Kansas State Department of
Health, Environmental
Health Service, J. L. Mayes,
chief engineer and director.
Kansas Water Resources Board,
D. F. Metzler, secretary.
State Geological Survey.

Louisiana Louisiana Department of Public
Works, Leon Gary, director.

Drainage basin

Lower Mississippi River

Lower Mississippi River
Western Gulf of Mexico

District office

Room 2301, Federal Bld£
700 West Capitol Ave.
Little Rock, Ark. 72201

7200 West Alameda
Unit 198, Room 206
Denver, Colo. 80226

P. O. Box 768

U.S.G.S, Bldg.
West of 19th and
Iowa Sts.
Lawrence, Kans. 66044

Room 215

Prudential Bldg.
6554 Florida Blvd.
Baton Rouge, La. 70806

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to
CO

State Cooperating agency Drainage basin District office

w
o

Mississippi

Missouri

New Mexico

Mississippi Board of Water
Commissioners,
R. H. Henderson, chairman.
Mississippi Research and
Development Center,
Dr. R. F. Dye, acting director.
Harrison County Board of
Supervisors and Development
Commission, N. B. French,
president.

Missouri Department of Public
Health and Welfare, Missouri
Water Pollution Board,
J. K. Smith, executive secretary.

New Mexico State Engineer,
S. E. Reynolds.
New Mexico Interstate Stream

Commission, S. E. Reynolds,
secretary.

Lower Mississippi River

Lower Mississippi River,
Western Gulf of Mexico

302 Post Office
Jackson, Miss. 39205

P. O. Box 340
103 West Tenth St.
Rolla, Mo. 65401

P. O. Box 4217

Albuquerque, N. Mex.
87106

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Cfl

to

State Cooperating agency Drainage basin District office

Tennessee Tennessee Department of Public
Health, R. H. Hutcheson,
commissioner, through Stream
Pollution Control Division,
S. L. Jones, director.

Texas Texas Water Development Board, J. G. Moore, Jr., executive
director; J. J. Vandertulip,
chief engineer.
Brazos River Authority, Canadian
River Municipal Water Authority,
Chambers-Liberty Counties
Navigation District, Colorado
River Municipal Water District,
Dow Chemical Company,
Lower Colorado River
Authority, Lower Neches
Valley Authority, Red Bluff
Water Power Control
District, Sabine River
Authority,

Lower Mississippi River

Lower Mississippi River,
Western Gulf of Mexico

Federal Bldg.
300 East 8th Ave.
Austin, Tex. 78701

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State Cooperating agency Drainage basin District office

Texas Tarrant County Water
Control and Improvement
District No. 1, Texas Electric
Service Company, West Central
Texas Municipal Water District,
and cities of Austin, Dallas,
Fort Worth, Houston, and
Wichita Falls.

Lower Mississippi River,
Western Gulf of Mexico

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Louisiana and Mississippi, F. K. Kapustka succeeded by R. L. McAvoy; New Mexico, J. M. Stow; Oklahoma, R. P. Orth; Tennes-see, J. S. Cragwell, Jr.; and in Texas, C. H. Hembree and Trigg Twichell.

Correspondence regarding the records on this report or any additional information should be directed to the district chief of the appropriate Geological Survey Water Resources Division offices indicated in the table on page 35. Because of reorganization in recent years, the offices now administering water-quality pro-grams in most of the States differ from those that were adminis-tering the programs in 1964.

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MISSISSIPPI RIVER MAIN STEM Continued

7-100. MISSISSIPPI RIVER AT ST. LOUIS, MO. Continued

Periodic determinations of suspended sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 22...........

Time

(24 hour)

1020
1350
0945
1155
1100

1450
1450
1100
1100
1010
1010

1100
1020
1200

Water
tem-

per-
ature

(°F)

70
48
44
42
48

47
47
47
47
51
51

84
79
74

Sam-

pling
point

Discharge
(cfs)

66300
64900
46600
68400
75700

227000
227000
206000
206000
144000
144000

87900
55900
110000

Sediment

concen-

tration

(ppm)

232
276
58
85
94

1270
1270
1010
1010
621
621

758
263
376

Sediment

discharge
(tons per day)

41500
48400
7300
15700
19200

778000
778000
562000
562000
241000
241000

180000
39700
112000

Suspended sediment

Percent finer than size indicated, in millimeters

D.002

30
33

19
41
22
39
17
38

0.004

32
48

31
48
33
51
29
45

0.008 0.016

43
76

64
65
62
68
63
66

0.033 0.062

69
93
67
51
53

84
84
84
84
87
87

0.125

73
94
69
56
59

90
90
90
90
92
92

0.250

88
100
83
68
87

99
99
100
100
100
100

0.50C

99

94
96
96

100
100
100

1.000

100

100
100
100

2.000

Method
of

analysis

VPWC
VPWC
VWC
VWC
VWC

VPN
PWC
VPN
PWC
VPN
PWC

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Apr. 11........... .

Time

(24 hour)

1350
1125
1200

Water
tem-

per-
ature

(°F)

Sam-

pling
point

15
18
18

Discharge
(cfs)

64900
89700
182000

Sediment

concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

0
0
0

0.125

0
3
1

0.250

44
47
55

0.500

80
83
86

1.0

95
96
95

2.0

98
98
96

4.0

99
100
97

8.0

100

98

16.0

100

32.0

Method
of

analysis

SV
SV
SV

MERAMEC RIVER BASIN Continued

7-145. MERAMEC RIVER NEAR SULLIVAN, MO. Continued

Chemical analyses, in parts per million, August 1963 to September 1964 Continued

Date of collection

Feb. 12... ....

Sept. 10.. ....

Dissolved oxygen

Parts
per
million

8.2
9.1
11.0
13.9

12.2
12.6
10.5
10.8
8.6

7.9
9.0
7.7
8.8
8.3

Percent
satu-
ration

91
96
93
95

88
93
82
96
86

95
111
96
107
102

Organics

Phenols
as
C6 H.OH

Detergent
(MBAS)

0.0
. 0
. 0
. 0
. 0

. 0
. 0

.1
. 0
. 0

. 0
. 0
. 0
. 0
. 0

Organic
and
ammonia
nitrogen
(N)

2.6
. 00
2.2
. 08
. 92

. 15
1.1
. 84
. 28
. 52

. 55
. 40
. 37
. 71
1.0

Nitrite
(N02)

Cyanide
(CN)

Turbid-

ity

4
9
6
4
9

8
2
400
10
7

4
1
5
5
1

Tempera-
ture

85
70
65
47
32

36
37
41
50
60

77
80
81
78
80

Chemical analyses, in parts per million, August 1963 to September 1964 Continued

Date of collection

June 10. ....

Discharge
(cfs)

238
249
624
376

Chromium

Total
Cr

0.00
.00
.00

Cr6

Nick-

el

(Ni)

0.00
.00
.00
.00

Cop-
per

(Cu)

0.00
.00
.00
.00

Lead

(Pb)

0.00
.00
.00

Zinc

(Zn)

<.H
.05
<.06

Co-

balt

(Co)

0.00
.00
.00

Ar-
se-

nic

(As)

Sel-

en-

ium

(Se)

Cad-

mium

(Cd)

Bar-

ium

(Ba)

0.14
.09
.07
.05

Be-

ryl-
lium

(Be)

0.00
.00
.00

Rubi-
dium

(Rb)

0.00
.00
.00
.00

Vana-
dium
(V)

0.00
.00
.00

MERAMEC RIVER BASIN Continued

7-164. BOURBEUSE RIVER ABOVE UNION, MO. Continued

Chemical analyses, in parts per million, August 1963 to September 1964 Continued

Date of collection

July 7 ....

Sept. 10.. ....

Dissolved oxygen

Parts
per
million

8.0
8.0
10.3
13.4
12.9
11.2
10.6

11.7
8.4
8.0
8.5
6.0
6.4
6.6

Percent
satu-
ration

92
85
86
92
88
83
86

96
86
98
104
75
77
80

Organics

Phenols
as

C6 H,OH

Detergent
(MBAS)

0.0
. 0

. 0
. 0
. 0
. 0
. 1

. 0
. 0
. 0
. 0
. 0
. 0
. 1

Organic
and
ammonia
nitrogen
(N)

3.4
. 08
2.3
. 16
. 60
. 12
. 33
. 80

. 35
. 46
. 50
. 87
. 42
. 77
. 39

Nitrite
(N02)

Cyanide
(CN)

Turbid-

ity

10
9
6
6
5
10
7
400

30
15
6
15
25
6
2

Tempera-
ture

84
73
66
46
32
32
37
44

46
63
78
78
81
77
77

MERAMEC RIVER BASIN Continued
7-190.45. MERAMEC RIVER AT PAULINA HILLS, MO. Continued
Chemical analyses, in parts per million, August 1963 to September 1964 Continued
Sept. 10. ....
Dissolved oxygen
per
million
7.2
8.4
9.2
13.7
15.3
13.4
10.3
11.1
8.4
8.3
7.4
6.2
8.4
4.9
satu-ration
89
95
79
94
108
99
83
91
88
100
89
80
109
60
Organics
Phenols
as
CtHBOH
Detergent
(MBAS)
0.0
.0
.1
.0
.0
.1
.0
.0
.0
.0
.0
.0
.0
.0
.0
Organic
and
ammonia
nitrogen
(N)
3.0
.60
3.2
.56
1.0
.46
.66
.65
1.2
.14
.48
.75
.53
1.0
.91
Nitrite
(N02)
Cyanide
(CN)
Turbid-ity
20
20
20
25
5
10
25
400
30
50
19
35
35
20
5
Tempera-ture
88
80
72
48
32
34
37
43
46
65
80
77
84
84
79

WHITE RIVER BASIN

7-545. WHITE RIVER AT BULL SHOALS DAM, ARK.

LOCATION. At dam on White River, 6.3 miles northeast of Flippin, Marion County, and 12.5 miles downstream from Little North Fc DRAINAGE AREA. 6,036 square miles.
RECORDS AVAILABLE. Chemical analyses: July 1954 to September 1957, October 1959 to September 1964.
Specific conductance and chloride; October 1957 to September 1959.
Water temperatures: October 1954 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 156 ppm Apr. 1-30; minimum, 144 ppm Feb. 1-29.
Maximum, 136 ppm Oct. 1-31; minimum, 132 ppm Aug. 1-31, Sept. 1-30. iiaraness: Hardnes n 00 u ±j± uz 0 s iju
Specific conductance: Maximum daily, 303 micromhos Apr. 12; minimum daily, 236 micromhos Oct. 10
Water temperatures: Maximum, 46°F on many days during the year; minimum, 44°F June 24.
EXTREMES, 1959-64. Dissolved solids: Maximum, 180 ppm Mar. 1-31, 1960; minimum, 130 ppm Feb. 1-28, 1963 Hardness: Maximum, 150 ppm Oct. 1-10, 1960; minimum, 116 ppm Aug. 1-31, 1961.
Specific conductance: Maximum daily, 310 micromhos Jan. 24, 1961; minimum daily, 222 micromhos Apr. 13
Water temperatures: Maximum, 55°F on many days during July and August 1961; minimum, 42°F on many days durini REMARKS. Records of specific conductance of daily samples available in district office at Little Rock, Ark. Ri station near Flippin, Ark. Flow completely regulated by Bull Shoals Reservoir since July 1951.

, 1960.
ring March to June 1960.
:ecords of discharge are given for gaging

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31,
1963... ....

Dec. 1-31....

Feb. 1-29....

Apr. 1-30....

July 1-31....
Aug. 1-31....
Sept. 1-30...

Weighted
average. .

Time-weight-
ed average

Tons per day

Mean

discharge
(cfs)

1934
1977

1019

1359
1098
1977
1679
4434
2885
2267

2054

-

Silica

(Si02)

5.5
5.7
6.2

4.9
5.0

7.9
5.0
5.0
5.5
5.8
4.7
4.8

5.5

5.5

30

Alu-
mi-

num

(Al)

Iron

(Fe)

0.01
.02
.03

.02

_
_

__

~

Man-

ga-

nese

(Mn)

0.00
.00
.02

.00
. 00

.00
.00
.00
.00
.00
.00
.00

0.00

0.00

0.01

Cal-

cium

(Ca)

38
36
35

35
36

34
35
35
35
36
35
35

36

35

197

Mag-
ne-

sium

(Mg)

10
11
11

11
11

12
11
11
11
11
11
11

11

11

61

Sodium

(Na)

2.5
3.0
2.7

2.7
2.7

3.0
3.1
2.5
2.7
2.6
3.0
2.8

2.7

2.8

15

Po-
tas-

sium

(K)

1.1
1.2
1.3

1.4
1.3

1.2
1.2
1.2
1.2
1.4
1.5
1.8

1.3

1.3

7.4

Lith-

ium

(Li)

TJS

car-

bon-

ate

^HCUjj

160
164
160

162
144

140
136
138
150
152
146
144

151

150

835

Car-
bon-

ate

p°0

0
0
0

0
8

8
10
8
4
2
4
4

3

4

18

Sulfate

(S0«)

9.2
8.2
6.4

6.0
5.6

4.8
6.0
7.6
7.2
5.8
6.0
6.0

6.6

6.6

37

Chloride

(Cl)

4.0
4.0
4.0

3.5
3.5

4.5
4.5
3.5
4.0
2.2
2.5
2.3

3.3

3.5

18

Fluo-

ride

(F)

0.0
.0
0

.0
.0

.0
. 0
. 0
. 0
. 2
.3
.2

0.1

0.1

0.5

Ni-

trate

(NOS)

1.2
1.2
. 9

.8
. 6

. 1
. 5
. 6
. 7
1.4
1.4
. 9

1.0

0.9

5.5

Phos-

phate
(P0«)

Dissolved
solids

(residue
at 180°C)

154
151
154

146
144

152
156
145
149
145
149
148

149

149

827

Cal-

cium,
mag-
nesium

136
135
133

133
135

135
133
133
133
135
132
132

134

134

Non-
car-

bon-

ate

5
0
2

0
4

7
5
6
3
7
6
7

5

4

To-

tal
acid

ity
as

H+l

Specific
conduct-

ance

(micro-
mhos at

25°C)

274
278
262

258
266

267
266
265
267
269
262
265

267

266

PH

6.9
7.6
7.1

7.7
8.5

8.5
8.6
8. E
8.4
8.4
8.4
8.5

7.5

7.6

~

Col-

or

5
5
5

5
8

5
5
5
5
7
6
7

5

5

WHITE RIVER BASIN Continued

7-600. NORTH FORK RIVER AT NORFORK DAM, NEAR NORFORK, ARK.

LOCATION. At gaging station at Norfork Dam, 4.3 miles northeast of Norfork, Baxter County.
DRAINAGE AREA. 1,806 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1946 to September 1964.
REMARKS.--Flow completely regulated by Norfork Reservoir. Records of discharge for water year October 1963 to September 1964 furnished by Corps of Engineers, and reviewed by Geological Survey.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 15, 1964..

Sept. 15.......

Mean

discharge
(cfs)

1300
233
306
1750
2600

1680
1610
1460
400

Silica

(SiO.)

5.0
4.1
3.3
3.9
3.3

3.6
3.4
5.6
5.2

Alum-
inum

(Al)

Iron

(Fe)

Man-

ga-
nese

(Mn)

0.00
.00
.00
.00
.00

.00
.00
.00
.00

Cal-
cium

(Ca)

32
32
32
33
33

32
32
32
32

Mag-
ne-

sium

(Mg)

22
22
23
20
20

20
20
20
19

Sodium

(Na)

.5
.4
.5
.5
.4

.4
.5
.3
.3

Pot-
tas-
sium

(K)

1.2
1.4
1.4
1.4
1.4

1.5
1.5
1.1
1.1

Bicar-
bonate

(HC03)

197
199
203
194
194

192
190
198
194

Sulfate

(S04)

4.6
4.4
6.2
4.2
4.4

4.8
4.6
5.6
5.6

Chloride

(CD

3.5

3.0
1.6
1.4

1.7
1.8
1.6
1.7

Fluo-

ride

(F)

O.C
.0
.0
.1
.1

.1
.2
.0
.0

Ni-

trate

(N03)

1.0
.8
1.3
.8
1.0

1.5
1.3
1.8
1.8

Dissolved
solids

(residue
at 180°C)

168
164
174
168
167

168
166
175
167

Hardness

as CaCO,

Cal-

cium,
magne-
sium

171
171
175
165
165

165
162
162
158

Non-
carbon-

ate

9
8
8
6
6

4
6
0
0

Total
acid-

ity
as

H*'

Specific
conduct -

ance

(micro-
mhos at

25°C)

319
315
332
312
314

316
316
308
307

PH

7.8
8.0
7.9
8.2
7.9

7.7
7.7
7.5
7.4

Col-

or

5
5
5
1
3

5
8
3
4

WHITE RIVER BASIN Continued

7-760. LITTLE RED RIVER NEAR HEBER SPRINGS, ARK.

LOCATION. At gaging station on right bank, 1,600 feet downstream from Greers Ferry Dam and 3 miles northeast of Heber Springs, Cleburne County. DRAINAGE AREA. 1,146 square miles.
RECORDS AVAILABLE. Chemical analyses: November 1949 to September 1952, October 1954 to September 1964.
Water temperatures: November 1949 to September 1952.
REMARKS. Flow completely regulated since Mar. 30, 1962 by Greers Ferry Reservoir. Some regulation October 1960 to February 1962 by construction of Greers Ferry Dam. Records of discharge for water year October 1963 to September 1964 furnished by Corps of Engineers and reviewed by Geological Survey. Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 4, 1963...

Apr. 15, 1964..

Sept. 16.......

Mean

discharge
(cfs)

64
97
188
21

61
2960
43

Silica

(Si02)

6.4
4.2
2.2
2.6

3.1
1.9
2.4

Alum-
inum

(Al)

Iron

(Fe)

0.30
.04
.05

1.3
. 17

Man-

ga-

nese

(Mn)

0.00
.40
.00
.00

.00
. 10
.00

Cal-
cium

(C3)

7.3
S.3
7.3
8.4

8.1
7.2
8.6

Mag-
ne-

sium

(Mg)

.6
.2
.4
. 5

.6
.9
.3

Sodium

(Na)

1.2
2.0
1.5
3.3

2.2
2.6
2.0

Pot-
tas-
sium

(K)

.1
.2
.5
.5

.4
.4
.2

Bicar -
bonate

(HCO,)

26
32
29
37

32
31
36

Sulfate

(SOJ

5.2
2.6
3.2
3.4

3.8
3.6
3.9

Chloride

(ci)

3.0
3.0
2.0
1.6

1.1
1.5
1.7

Fluo-

ride

(F)

0.0
.0

.1
.1

.1
.2
.0

Ni-
trate

(NO,)

0.2
. 1
.2
. 1

.4
.4
. 1

Dissolved
solids

(residue
at 180°C)

39
46
37
44

42
36
42

Hardness

as CaCOj

Cal-

cium,
magne-
sium

24
26
24
27

26
26
27

Non-
carbon-

ate

3
0
0
0

0
1
0

Total
acid-

ity
as

H+'

Specific
conduct-

ance

(micro-
mhos at

25'C)

65
62
63
75

69
63
69

PH

6.9
6.4
7.1
7.1

7.4
7.0
7.3

Col-

or

5
5
5
5

28
5
3

WHITE RIVER BASIN Continued

7-770. WHITE RIVER AT DeVALLS BLUFF, ARK.

LOCATION. Temperature recorder at gaging station near center of span on downstream side of pier of bridge on U.S. Highway 70, 1 mile northeast of DeValls Bluff, Prairie County, 7.5 miles downstream from Wattensaw Bayou, 24.1 miles upstream from Cache River, and at mile 125.3.
DRAINAGE AREA. 23,421 square miles.
RECORDS AVAILABLE. Water temperatures: May 1963 to September 1964.
EXTREMES, May 1963 to September 1964. Water temperatures: Maximum, 87°F July 20-22, 1963; minimum, freezing point Dec. 25, 1963. REMARKS. Flow regulated by upstream reservoirs.

Temperature (*F) of water, May to September 1963
(Recorder with temperature attachment, continuous ethyl alcohol-actuated thermograph)

May

June
Maximum ....
Minimum ....
July
Maximum ....
Minimum ....
August
Maximum ....
Minimum ....
September
Maximum ....
Minimum ....

1

71
70

84
S3

80
78

82
81

2

73
71

84
83

82
80

81
81

3

73
7?

8?
81

83
82

81
80

4

74
73

83
8?

84
82

81
80

5

75
74

84
83

85
83

81
80

6

77
75

86
84

85
84

81
80

7

77
7ft

8ft
85

85
84

81
80

8

79
77

85
84

84
83

80
79

9

80
79

85
83

84
83

81
80

10

81
80

83
8?

84
83

8?
81

11

81
80

8?
8?

83
8?

82
81

12

80
80

8?
81

82
8?

8?
82

13

81
80

81
81

82
80

8?
80

14

81
80

81
81

80
79

80
78

15

82
81

81
80

79
78

78

Day

16

82
81

8?
81

79
77

77

17

81
Rl

83
8?

79
78

7ft

18

8C

81
80

85
83

79
79

76

19

80
79

85
84

79
79

76

20

79
77

87
85

79
78

7ft

21

70

77
77

87
8ft

78
77

77

22

78
77

87
86

79
78

77

23

78
77

8ft
84

80
79

76

24

78
77

R4
S?

80
79

74
73

25

79
7R

8?
81

80
80

74
72

26

80
79

81
80

81
80

73
72

27

GJ

81
80

80
79

82
81

73
72

28

69

8?
81

80
79

83
8?

73
72

29

83
8?

80
79

83
8?

7?
71

30

83
R?

79
77

8?
Rl

71
70

31

7R
76

8?
Rl

~

79
78

83
82

82
80

78
77

ARKANSAS RIVER BASIN Continued

7-1220. ARKANSAS RIVER NEAR LA JUNTA, COLO.

LOCATION. At diversion of Fort Lyon Canal, 0.5 mile above headgate, and approximately 3 miles west of La Junta, Otero County. DRAINAGE AREA. 12,210 square miles.
RECORDS AVAILABLE. Chemical analyses: January to September 1964.
REMARKS. Discharges obtained by adding mean daily flow in the Fort Lyon Canal to the mean daily flow in the Arkansas River at La Ju Chemical analyses, in parts per million, January to September 1964

Date
of
collection

July 7.... ....

Sept . 1 ....

Discharge
(cfs)

219
276
188
188

53
656
313
687
109

Silica

(SiO,)

13
12
12
12

11
13
12
15
12

Iron

(Fe)

Cal-

cium

(Ca)

176
176
192
182

281
86
102
131
180

Mag-
ne-

sium

(Mg)

66
71
73
67

105
19
32
29
61

Sodium

(Na)

120
124
148
136

207
35
59
52
115

Po-
tas-
sium

(K)

6.5
6.6
7.5
7.9

8.1
3.2
5.2
6.0
6.2

Bi-
car-

bon-

ate

(HCO,)

271
280
256
254

282
186
158
196
222

Car-
bon-
ate

(CO,)

Sulfate

(SO.)

686
702
828
764

1250
199
344
378
703

Chloride

(Cl)

38
31
36
34

59
9.4
16
11
32

Fluo-
ride

(F)

1.0
1.0
1.2
1.0

1.2
.7
.6
.6
.8

Ni-
trate

(NO,)

4.8
2.4
11
11

9.9
2.5
5.2
3.5
7.2

Bo-

ron

(B)

0.19
. 17
. 18

.36
. 10
. 14
. 15
.22

Dissolved solids
(residue at 180°C)

Parts

per
million

A 1240
1320
1510
1390

2240
491
696
767
1260

Tons

per
acre-

foot

1.69
1.80
2.05
1.89

3.05
.67
.95
1.04
1.71

Tons

per

day

733
984
766
706

321
870
588
1420
371

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

710
730
780
730

1130
294
384
444
700

Non-
car-

bon-

ate

488
500
570
522

899
141
254
283
518

So-

dium
ad-

sorp-
tion
ratio

2.0
2.0
2.3
2.2

2.7
.9
1.3
1.1
1.9

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1610
1620
1700
1690

2440
685
920
987
1560

PH

7.0
7.7
7.7
8.1

7.7
8.1
7.9
8.0
7.4

A Calculated from sum of determined constituents.

ARKANSAS RIVER BASIN Continued

7-1305. ARKANSAS RIVER BELOW JOHN MARTIN RESERVOIR, COLO.

LOCATION. At gaging station, 1.1 miles upstream from Caddoa Creek, 1.7 miles downstream from John Martin Dam, Bent County, and 2.9 miles southeast of Hasty. DRAINAGE AREA. 18,917 square miles, of which 785 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: August 1942 to August 1943, October 1945 to July 1949, January 1951 to September 1964.
Water temperatures: January 1951 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 4,460 ppm Jan. 1-31; minimum, 636 ppm May 27.
Hardness: Maximum, 1,880 ppm Jan. 1-31; minimum, 390 ppm May 25, 26.
Specific conductance: Maximum daily, 4,640 micromhos Dec. 16; minimum daily, 848 micromhos May 27.
Water temperatures: Maximum, 76°F July 7; minimum, 34°F Dec. 10.
EXTREMES, 1951-64. Dissolved solids: Maximum, 4,510 ppm Nov. 3-13, 1961; minimum, 470 ppm July 6, 1960.
Hardness: Maximum, 1,910 ppm Aug. 8, 1955; minimum, 224 ppm July 6, 1960.
Specific conductance: Maximum daily, 5,180 micromhos Apr. 21, 1955; minimum daily, 643 micromhos July 6, 1960.
Water temperatures: Maximum, 85°F Aug. 6, 1951; minimum, freezing point on several days during winter months.
REMARKS. Additional samples were collected to further define the quality of water at this station. Records of specific conductance of daily samples available in district office at Salt Lake City, Utah.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. -31, 1963...

Jan. -31, 1964.. .
Feb. -29. ....

May 21-24.. ....

June 26-28. ....

Mean

discharge
(cfs)

37.5
39.4
9.9
2.9
2.5
2.9

185
38.0
104
390
556
721

10.8
4.2
42.9
939
125
145

Silica

(Si02)

"

Iron

(Fe)

Cal-

cium

(Ca)

-

Mag-
ne-

sium

(Mg)

-

Sodium

(Na)

398
427
569
578
535
540

506
491
318
129
8.3
120

322
490
588
136
345
131

Po-
tas-

sium

(K)

-

Bi-
car-

bon-

ate

(HCO.)

234
256
266
255
280
244

242
258
263
202
192
243

226
217
276
153
318
184

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
7
0
0
0

0
0
0
0
0
0

Sulfate

(S04)

1860
1970
2500
2590
2460
2380

2230
2170
1520
449
291
664

1440
2140
2520
636
1620
646

Chloride

(Cl)

125
118
140
165
165
168

128
126
87
26
16
25

90
141
155
34
91
40

Fluo-

ride

(F)

"

Ni-

trate

(NO,)

"

Bo-

ron

(B)

Dissolved solids

(residue at 180°C)

Parts

per
million

3300
3350
4280
4460
4360
4310

3810
3720
2670
904
636
1250

2520
3700
4280
1130
2850
1210

Tons

per
acre-

foot

4.49
4.56
5.82
6.07
5.93
5.86

5.18
5.06
3.63
1.23
.86
1.70

3.43
5.03
5.82
1.54
3.88
1 65

Tons

per

day

334
356
114
34.9
29.4
33.8

1900
382
750
952
955
2430

73.5
42.0
496
2860
962
474

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

1440
1500
1780
1880
1860
1740

1600
1580
1240
390
465
665

1110
1540
1790
540
1320
595

Non-
car-

bon-

ate

1250
1290
1560
1670
1630
1540

1400
1370
1010
224
307
466

925
1360
1560
414
1060
444

So-

dium
ad-

sorp-
tion
ratio

4.6
4.8
5.9
5.8
5.4
5.6

5.5
5.4
3.9
2.8
.2
2.0

4.2
5.4
6.0
2.5
4.1
9. 3

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

3600
3590
4360
4540
4510
4490

3990
3890
2940
1190
848
1500

2800
3900
4420
1440
3080
1510

PH

7.5
7.4
8.0
7.9
7.7
8.1

8.0
8.0
8.3
8.2
7.0
7.5

7.3
7.4
7.2
7.1
6.6
7 ?,

ARKANSAS RIVER BASIN Continued

7-1375. ARKANSAS RIVER NEAR COOLIDGE, KANS. Continued

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

AUK. 21.............

Time

(24 hour)

1610
0950

Water
tem-
per-
ature

(°F)

82

Sam-

pling
point

Discharge
(cfs)

318
1.2

Sediment
concen-

tration

(ppra)

643
191

Sediment
discharge
(tons per day)

552
.6

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of
analysis

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

AUK. 21.. ....

Time

(24 hour)

1610
0950

Water
tem-
per-
ature

(°F)

Sam-

pling
point

8
6

Discharge
(cfs)

318
1.2

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062 0.125

0
0

0.250

7
2

0.500

48
35

1.000

78
75

2.000

89
«q

4.000

97
08

8.000

100
100

16.00 32.00 64.00

Method
of
analysis

SV
sv

ARKANSAS RIVER BASIN Continued

7-1400. ARKANSAS RIVER NEAR KINSLEY, KANS.

LOCATION. At gaging station at bridge on U.S. Highway 50, 2 miles east of Klnsley, Edwards County, and at mile 920.3. DRAINAGE AREA. 31,066 square miles, of which 5,660 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
Water temperatures: October 1960 to September 1964.
Sediment records: October 1960 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 94°F Aug. 4-6; minimum, freezing point, Dec. 12, 24.
Sediment concentrations: Maximum daily, 1,800 ppm June 5; minimum daily, 7 ppm Nov. 15.
Sediment loads: Maximum daily, 2,800 tons June 5; minimum daily, 1 ton on many days during October to December, July to September.
EXTREMES, 1960-64. Water temperatures: Maximum, 97°F July 8, 9, 1963; minimum, freezing point on many days during winter months.
Sediment concentrations: Maximum daily, 2,770 ppm July 15, 1961; minimum daily, 2 ppm Mar. 9, 1961.
Sediment loads: Maximum daily, 5,250 tons Aug. 15, 1961; minimum daily, 1 ton on many days each year.
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm are calculated from the determined constituents unless otherwise noted. Flow affected by ice Dec. 10-14, 18-24, Jan. 11-18.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Oct. 17, 1963

Feb. 17, 1984

June 5 :
At 1155....
At 1230....

July 14......

Sept. 16.....

Discharge
(cfs)

28
45
A25
82
76

51
38
59

506
570

926
40
12
26

Silica

(SiO.)

11
15
21
13
12

10
9.0
18

14
16

15
13
11
12

Alu-
mi-

num

(Al)

Iron

(Fe)

0.03

.02

Man-

ga-
nese

(Mn)

0.00

.00

Cal-

cium

(Ca)

139
144
168
182
170

138
130
138

96
84

115
134
158
131

Mag-
ne-

sium

(Mg)

47
43
51
60
51

42
43
35

18
33

23
40
40
38

Sodium

(Na)

132
121
140
178
162

125
132
125

66
49

91
132
160
108

Po-
tas-

sium

(K)

9.7
9.4
11
10
9.2

9.2
10
13

12
13

14
12
14
11

Bi-
car-

bonate

(HCO,)

222
278
273
276
234

246
261
288

161
183

171
244
249
256

Car-
bon-

ate

(CO,)

17
0
34
0
24

24
0
0

0
0

0
0
0
0

SuUate

(SO.)

532
477
557
739
641

458
492
441

294
228

399
501
612
442

Chloride

(Cl)

54
51
63
76
69

55
54
56

23
19

31
53
64
52

Fluo-

ride

(F)

0.9
.9
1.0
.9
1.0

1.0
1.0
1.0

.6
.6

.6
1.0
1.0
.9

Ni-

trate

(NO,)

0.8
6.2
15
11
10

4.9
1.2
5.8

1.5
.9

1.2
.0
. 1
3.6

Boron

(B)

0.23
.24
.30
.31
.31

.23
.21
. 16

. 12
. 15

. 15
.28
.32
.28

Dissolved
solids

1050
1010
1200
1410
1260

B990
980
990

608
526

782
1010
1180
946

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

540
536
628
700
634

517
501
488

314
295

382
499
558
483

Non-
car -

bon-

ate

330
308
347
474
402

275
287
252

182
145

242
299
354
273

Sodium
ad-

sorp-
tion
ratio

2.5
2.3
2.4
2.9
2.8

2.4
2.6
2.5

1.6
1.1

2.0
2.6
2.9
2.1

Specific
conduct-

ance

(micro -
mhos at

25° C)

1450
1410
1600
1840
1670

1410
1420
1400

890
780

1100
1470
1700
1330

pH

8.4
8.0
8.3
7.8
8.3

8.3
8.2
7.5

7.3
7.3

7.3
7.8
7.7
7.6

Col-

or

A Daily mean discharge.
B Calculated from determined constituents.

ARKANSAS RIVER BASIN Continued

7-1400. ARKANSAS RIVER NEAR KINSLEY, KANS.--Continued

Periodic determinati ons of suspended-sediment discharge and particle size, water year October 1963 to September (Methods of analysis; B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water;
P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

June 6. ....

Time

(24 hour)

1155
2145
1230

Water
tem-

per-
ature

(°F)

65
68
72

Sam-

pling
point

Discharge
(cfs)

506
1140
926

Sediment
concen-

tration

(ppm)

1940
1010
518

Sediment

discharge
(tons per day)

2650
3110
1300

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

79
77
62

0.004

88
85

0.008 0.016

92

69

0.031 0.062

95
89
93

0.125

96
90
93

0.250

99
91
95

0.500

100
99
100

1.000

100

2.000

Method
of

analysis

VPWC
VPWC
VPWC

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

1020
1245
1430
1520
1500

1750
1655
1155
2145
1230

1845
1815
1200

Water
tem-

per-
ature

(°F)

Sam-

pling
point

10
10
9
6
8

10
10
16
11
11

9
7
11

Discharge
(cfs)

42
51
84
76
51

38
59
506
1140
926

40
12
26

Sediment
concen-

tration

(ppra)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

0
2

2

0

0.125

0
0
0
0
0

0
1
2
0
4

3
0
0

0.250

4
6
3
1
4

7
6
16
3
6

26
4
6

0.500

41
49
30
31
30

37
33
64
40
32

45
37
34

1.000

73
78
64
66
66

61
59
85
68
58

59
61
57

2.000

89
89
83
81
84

77
75
93
83
74

74
79
74

4.000

99
96
98
95
97

93
92
98
95
88

79
97
93

8.000

100
100
100
100
100

100
99
100
99
93

81
100
98

16.00

100

100
95

96

100

32.00

100

100

64.00

Method
of

analysis

SV
SV
SV
SV
SV

SV
SV
sv
sv
sv

sv
sv
sv

ARKANSAS RIVER BASIN Continued

7-1412. PAWNEE RIVER NEAR LARNED, KANS.

LOCATION. At bridge on U.S. Highway 156, 0.8 mile south of gaging station and 14 miles west ol Lamed, Pawnee County.
DRAINAGE AREA. 2,148 square miles upstream from gaging station, of which 138 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans. No flow Oct. 7-16, May 26, 27, July 6, 7, 10-28, Aug. 6 to Sept. 30. Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Nov. 2, 1963.

Jan. 9, 1964.

July 2 ....

Discharge
(els)

1.8

3.2

2 3

1

0

. 2

Silica

(810.)

13

25

18

Alu-
mi-
num

(Al)

Iron

(Fe)

Man-
ga-
nese

(Mn)

Cal-
cium

(Ca)

41

110

CQ

61

Mag-
ne-

sium

(Mg)

4.3

14

6.8

Sodium
(Na)

4.8

24
33

12

Po-
tas-
sium

(K)

12
13
12

13

14

Bi-
car-

bonate

IHCO,)

156

400
403

227

Car-
bon-
ate

(CO,)

0

0

0

Sulfate
(SOJ

9.0

29

16

Chloride
(Cl)

5.0

24

39

13

Fluo-
ride

(F)

0.3

. 3

.4

Ni-
trate

(NOS)

1.8

.8

4.4

Boron

(B)

0.12

. 13

. 19

Dissolved
solids
(residue
at 180°C)

177

440
496

262

Hardness
as CaCO,
Cal-
cium,
mag-
nesium
120

332

357

180

Non-
car -

bon-
ate
0

4

0

Sodium
ad-
sorp-
tion
ratio

0.2

.6

.4

.4

Specific
conduct-

ance

(micro-
mhos at
25"C)
280

680

430

PH

8.0

7.5

7,4
7 6
7.5

Col-

or

ARKANSAS RIVER BASIN--Continued

7-1412. PAWNEE RIVER NEAR LARNED, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to Sept (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; _______________________P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)______________

;ember 1964

Date of collection

Feb. 17........ .....

June 4 ....

Time

(24 hour)

1240
1400
1525
1440
1210

1230
1350
1345
1230
1230

1500
2010

Water
tem-

per-
ature

(°F)

64
51
32
32
32

41
55

73
73

Sam-

pling
point

Discharge
(cfs)

800
1.8
.4
3.2
3.6

2.3
1.8
.9
226
226

1030
905

Sediment
concen-

tration

(ppm)

5340
192
26
50
42

17
92
250
4470
4470

4100
2660

Sediment

discharge
(tons per day)

11500
.9
T
.4
.4

. 1
.4
.6
2730
2730

11400
6500

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

48

72
8

64
73

0.004

77

86
26

76
84

0.008 0.016

94

97
98

95
97

0.031 0.062

100

100
100

100
100

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

PWC

PWC
PN

VPWC
PWC

T Less than 0.05 ton.

ARKANSAS RIVER BASIN Continued

7-1413. ARKANSAS RIVER AT GREAT BEND, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to Septembe (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantatlon; N, in native water;
P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 15. ....

Time

(24 hour)

1600
1550
1705
0950
1050

1035
1055
1435
1510
1510

1125
1200
1140
1340
1325

Water
tem-

per-
ature
(°F)

73

32
32
38

39
57
61
61
61

69
80
79
81
69

Sam-

pling
point

Discharge
(cfs)

17
22
D 14
D 40
75

37
14
475
470
470

20
470
D 8.4
D 4.7
D 2.3

Sediment
concen-

tration

(ppm)

3
662
9
18
58

23
10
2660
2580
2580

16
507
24
15
11

Sediment

discharge
(tons per day)

0.1
39
.3
1.9
12

2.3
.4
3410
3270
3270

.9
643
.5
.2
. 1

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

72
27

71

0.004

89
57

82

0.008 0.016

95
96

89

0.031 0.062

99
99

98

0.125

99
99

98

0.250

100
100

99

0.500

100

1.000 2.000

Method
of

analysis

VPWC
VPN

VPWC

D Daily mean discharge.

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantatlon; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

July 14. ....

Time

(24 hour)

1055
1510
1125
1200
1140

Water
tem-

per-
ature

(°F)

Sam-

pling
point

9
14
6
18
10

Discharge
(cfs)

14
470
20
470
D 8.4

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

1
1

0.125

2
2
0
0
0

0.250

14
12
7
10
4

0.500

40
42
30
38
24

1.000

61
66
53
58
45

2.000

71
78
67
73
62

4.000

82
90
86
88
81

8.000

91
97
96
96
91

16.00

95
100
100
100
100

32.00

100

64.00

Method
of

analysis

SV
SV
SV
SV
SV

D Daily mean discharge.

ARKANSAS RIVER BASIN Continued

7-1419. WALNUT CREEK AT ALBERT, KANS.

LOCATION. At gaging station at highway bridge, 0.2 mile north of Albert, Barton County, 14 miles northwest of Great Bend, and at mile 43.0. DRAINAGE AREA. 1,410 square miles, approximately, of which 104 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
Water temperatures: October 1963 to September 1964.
Sediment records: October 1963 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 89°F July 21; minimum, freezing point on many days during December and January. Sediment concentrations: Maximum daily, 5,200 ppm Apr. 22; minimum daily, no flow on many days during July to September. Sediment loads: Maximum daily, 2,800 tons Apr. 22; minimum daily, 0 tons on many days during July to September.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to Septembe 1964

Date of
collection

Nov. 2, 1963.

Jan. 9, 1964.

Discharge
(cfs)

4.1
4.8
8.7
6.2
8.9

7.6
7.4
7.4
19
6.6

13
.2
.2

Silica

(SiO,)

16
26
24
25
17

10
9.5
15
16
15

14
16
14

Alu-
mi-

num

(Al)

Iron

(Fe)

0.01

Man-

ga-
nese

(Mn)

0.00

Cal-

cium

(Ca)

69
139
115
131
107

110
104
114
120
72

63
55
86

Mag-
ne-

sium

(Mg)

11
18
17
24
22

20
13
17
20
9.9

6.1
5.6
9.1

Sodium

(Na)

19
45
52
59
49

45
49
50
49
12

24
21
31

Po-
tas-

sium

(K)

13
16
14
16
12

10
11
13
15
14

13
12
16

Bi-
car-

bonate

(HCO,)

232
432
368
415
339

351
327
361
390
242

203
217
266

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

0
0
0

Sulfate

(SOJ

42
105
117
135
116

102
104
106
105
22

40
22
63

Chloride

(Cl)

22
46
52
60
53

45
43
50
49
24

27
14
32

Fluo-

ride

(F)

0.3
. 5
. 5
. 5
.5

.5
.4
. 5
.6
.5

.4
.4
.4

Ni-

trate

(NO,)

l.l
.4
. 5
.5
.4

1.0
.4
.4
1.1
2.2

5.8
2.3
1.2

Boron

(B)

0.18
. 21
. 23
.21
. 19

.21
. 18
. 16
. 19
. 15

. 10
. 15
. 30

Dissolved
solids

(residue
at 180" C)

326
636
606
692
572

525
486
560
563
295

286
247
400

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

217
421
357
426
358

356
313
354
382
220

182
160
252

Non-
car -

bon-

ate

27
67
55
86
80

68
45
58
62
21

15
0
34

Sodium
ad-

sorp-
tion
ratio

0.6
1.0
1.2
1.2
1.1

1.0
1.2
1.2

1.1
.4

.8
.7
.8

Specific
conduct-
ance

(micro-
mhos at

25°C)

480
950
970
1100
910

830
780
880
900
510

460
420
650

PH

8.3
7.8
7.8
8.1
8.2

8.0
8.2
.8
.6
. 5

.4
.3
.3

Col-

or

ARKANSAS RIVER BASIN--Continued

7-1426.2. RATTLESNAKE CREEK NEAR RAYMOND, KANS.

LOCATION. At gaging station at highway bridge, 3.5 miles south of Raymond, Rice County, and 5.4 miles upstream from mouth.
DRAINAGE AREA. 1,167 square miles, of which 569 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans. No flow July 19-25, July 27 to Aug. 13, Sept. 5, 10, 13, 14.

Chemical analyses, in parts per millic water year October 1963 to September 1964

Date at
collection

Nov. 12, 1963

Jan. 6, 1964.

Sect. 25.....

Discharge
(cfs)

32
A20
59
46
34

29
35
16
9.1
.2

A. 2
1.1

Silica

(S10,)

12
15
12
11
8.5

11
12
15
14
12

8.2
11

Alu-
mi-

num

(Al)

Iron

(Fe)

0.03

.00

Man-

ga-
nese

(Mn)

0.00

.00

Cal-

cium

(Ca)

67
98
75
72
101

86
94
96
130
45

101
122

Mag-
ne-

sium

(Mg)

19
19
17
16
23

22
16
19
46
17

42
41

Sodium

(Na)

384
441
349
360
760

606
680
738
1900
645

1350
1430

Po-
tas-

sium

(K)

9.3
10
6.9
5.2
9.8

9.8
12
13
23
7.7

13
15

Bi-
car-

bonate

(HCO,)

210
290
239
215
237

232
207
224
137
168

207
237

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

0
0

Sulfate

(S0«)

78
88
69
74
157

118
144
146
381
123

266
292

Chloride

(Cl)

590
685
535
560
1190

940
1070
1130
2980
950

2080
2200

Fluo-

ride

(F)

0.5
.5
.3
.3
.4

.5
. 5
.6
.6
.5

.5
.5

Ni-

trate

(NO,)

1.8
4.1
2.6
1.6
2.6

2.8
1.6
1.2
4.9
.5

.3
.9

Boron

(B)

0.16
. 10
. 19
.23
. 15

. 19
.23
.31
.30
. 18

.23
.24

Dissolved
solids

(calcu-
lated)

1270
1500
1180
1210
2370

1910
2130
2270
5550
1880

3960
4230

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

245
322
257
246
346

305
300
318
514
182

424
473

Non-
car-

bon-

ate

73
84
61
70
152

115
130
134
402
44

254
279

Sodium
ad-

sorp-
tion
ratio

11
11
9.5
10
18

15
17
18
37
21

29
29

Specific
conduct-

ance

(micro-
mhos at

25°C)

2240
2640
2120
2180
4240

3530
3950
4270
10200
3580

7150
7380

PH

7.8
8.1
7.8
7.7
8.0

7.6
7.6
7.4
7.1
7.5

7.3
7.6

Col-

or

A Daily mean discharge.

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water;
P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Mav 7. 1964. ....

Time

(24 hour)

1015

Water
tem-

per-
ature

(°F)

70

Sam-

pling
point

Discharge
(cfs)

35

Sediment
concen-

tration

(ppm)

388

Sediment

discharge
(tons per day)

37

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of

analysis

ARKANSAS RIVER BASIN--Continued

7-1433. COW CREEK NEAR LYONS, KANS.--Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 3.............

Time

(24 hour)

1650
1745
0810
0920
0825

0820
0925
1305
1630
1630

0930
0930
1700
1730
0930

1000
1300
1335

Water
tem-

per-
ature
(°F)

55

32
42
39

55
68
71
62
64

67
67
68
68
72

74
78
67

Sam-

pling
point

Discharge
(cfs)

7.0
6.2
6.2
8.8
8.8

8.3
5.3
4.1
160
307

140
140
672
1220
76

1.9
2.0
.4

Sediment
concen-

tration

(ppm)

35
88
46
194
59

141
152
117
1580
1240

2070
2070
3980
1150
614

232
96
186

Sediment

discharge
(tons per day)

0.7
1.5
.8
4.6
1.4

3.2
2.2
1.3
682
1030

782
782
7220
3790
120

1.2
.5
. 2

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

"

45

77
41
63
84
92

0.004

75
50

79
50
71
86
95

0.008 0.016

85
63

88
91
85
91
98

0.031 0.062

100
98

100
100
99
100
100

0.125

100

100

0.250 0.500 1.000 2.000

Method
of

analysis

VPWC
VPWC

VPWC
VPN
VPWC
PWC
PWC

ARKANSAS RIVER BASIN Continued

7-1433.3. ARKANSAS RIVER NEAR HUTCHINSON, KANS.

4.5 miles nstream from Cow Creek, 11 miles southeast of Hutchinsc

Jan. 6, 9, 11-13.

LOCATION. At gaging station at bridge on State Highway 96, 3
Reno County, and at mile 800.3.
DRAINAGE AREA. 38,910 square miles, of which 7,186 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
Water temperatures: October 1960 to September 1964.
Sediment records: October 1960 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 97°F June 20, July 8, 22, 28; minimum, freezing
Sediment concentrations: Maximum daily, 4,800 ppm Apr. 25; minimum daily, 1 ppm Dec. 30, Sept. 20.
Sediment loads: Maximum daily, 7,200 tons Apr. 25; minimum daily, less than 0.50 ton Dec. 30, Sept. 6-8, 20.
EXTREMES, 1960-64. Water temperatures: Maximum, 97°F June 20, July 8, 22, 28, 1964; minimum, freezing point on many days during wi
Sediment concentrations: Maximum daily, 4,800 ppm Apr. 25, 1964; minimum daily, 1 ppm Dec. 30, 1963, Sept. 20, 1964.
Sediment loads: Maximum daily, 38,600 tons Sept. 21, 1962; minimum daily, less than 0.50 ton Dec. 30, 1963, Sept. 6-8, 20, 1964.
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm are calculated from constituents unless otherwise noted. Chemical analyses by Kansas State Department of Bealth, Topeka, Kans. Flow affected by ice Dec. 11-31, Jan. 13-20.

Chemical analyses, in parts per million, water year October 1963 to September 1964

nter

the deter ned

Date of
collection

Oct. 15, 1963

Dec. 13......
Jan. 21, 1964

May 8:
At 1040....
At 1700.. ..

Sept. 16.....

Discharge
(cfs)

180
225
A100
185
220

165
150
494

245
215

386
764
A255
155
210
60

Silica

(Sip,)

10
12
11
10
11

8.5
7.5
9.0

12
10

22
15
14
9.5
4.5
5.4

Alu-
mi-

num

(Al)

Iron

(Fe)

0.06

. 00

. 09

Man-

ga-
nese

(Mn)

0.00

. 00

. 05

Cal-

cium

(Ca)

106
101
138
109
121

121
110
66

104
105

86
104
62
75
66
99

Mag-
ne-

sium

(Mg)

22
24
35
26
29

29
24
9.1

26
28

18
25
13
14
14
24

Sodium

(Na)

490
340
738
430
506

560
544
128

455
429

204
198
222
355
355
493

Po-
tas-

sium

(K)

14
12
16
10
11

11
12
11

13
14

15
15
13
14
11
12

Bi-
car-

bonate

(HCO.)

244
249
239
249
264

264
271
193

244
256

207
205
134
178
146
224

Car-
bon-

ate

(C03)

0
0
24
0
0

0
0
0

0
0

0
0
0
0
0
0

Sulfate

(SOJ

201
176
247
204
258

249
219
74

205
218

174
302
121
123
116
194

Chloride

(Cl)

740
510
1130
660
745

845
790
188

685
640

280
228
324
535
545
745

Fluo-

ride

(F)

0.5
. 5
. 5
. 5
. 6

. 6
. 6
. 5

. 6
. 6

. 7
. 7
. 4
. 5
. 4
. 5

Ni-

trate

(NO,)

1.8
2.8
6.2
4.1
2.8

2.5
1.8
1.1

3.2
4.0

. 9
3.8
1.8
. 8
. 3
. 3

Boron

(B)

0.27
. 19
. 28
. 21
. 30

. 23
. 21
. 13

. 16
. 24

. 10
. 19
. 27
. 15
. 18
. 23

Dissolved
solids

1710
1300
2470
1580
1820

1960
1840
577

1630
1580

916
B994
870
1220
1180
1690

Hardness

as CaCOj
Cal-

cium,
mag-
nesium

355
350
488
379
421

421
373
202

366
377

288
362
208
244
222
346

Non-
car-

bon-

ate

155
146
252
175
204

204
151
44

166
167

118
194
98
98
102
162

Sodium
ad-

sorp-
tion
ratio

11
7.9
15
9.6
11

12
12
3.9

10
9.6

5.2
4.5
6.7
9.9
10
12

Specific
conduct-
ance

(micro-
mhos at

25°C)
2890
2240
4300
2750
3070

3320
3280
990

2910
2750

1530
1600
1560
2270
2200
2810

PH

7.7
7.9
8.3
7.6
7.5

8.0
7.6
7.3

7.5
7.6

7.4
7.2
7.2
7.2
7.4
7.2

Col-

or

A Daily mean discharge.
B Calculated from determined constituents.

ARKANSAS RIVER BASIN Continued

7-1450. SOUTH FORK NINNESCAH RIVER NEAR PRATT, KANS. Continued

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

AUK. 26. ....

Time

(24 hour)

0840
1135
1130

Water
tem-
per-
ature

(°F)

63
78
75

Sam-

pling
point

Discharge
(cfs)

25.0
20.0
23.5

Sediment
concen-

tration

(ppm)

332
220
181

Sediment
discharge
(tons per day)

22
12
11

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of
analysis

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

June 23. ....

Time

(24 hour)

0840
1135

Water
tem-
per-
ature

CF)

Sam-

pling
point

8
8

Discharge
(cfs)

25.0
20.0

Sediment
concen-

tration

(ppm)

Sediment
discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062 0.125

0
0

0.250

7
11

0.500

46
54

1.000

79
86

2.000

91
95

4.000

98
100

8.000

100

16.00 32.00 64.00

Method
of
analysis

SV
SV

ARKANSAS RIVER BASIN--Continued

7-1451.3. SOUTH FORK NINNESCAH RIVER NEAR CALISTA, KANS.--Continued

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aug. 26. ....

Time

(24 hour)

1015
1000
0955

Water
tem-
per-
ature

(°F)

66
72
68

Sam-

pling
point

Discharge
(cfs)

81
140
77

Sediment

concen-

tration

(ppm)

197
1600
180

Sediment
discharge
(tons per day)

43
605
37

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of
analysis

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

June 23. ....

Time

(24 hour)

1015
1000

Water
tem-
per-
ature

(°F)

Sam-

pling
point

8
10

Discharge
(cfs)

81
140

Sediment

concen-

tration

(ppm)

Sediment
discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

3

0.125

0
6

0.250

24
28

0.500

83
77

1.000

97
95

2.000

99
99

4.000

100
100

8.000 16.00 32.00 64.00

Method
of
analysis

SV
SV

ARKANSAS RIVER BASIN Continued

7-1451.5. SOUTH FORK NINNESCAH RIVER NEAR KINGMAN, KANS. Continued

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aue. 26. ....

Time

(24 hour)

1150
1505
0835

Water
tem-
per-
ature

(°F)

71
87
67

Sam-

pling
point

Discharge
(cfs)

96
62
69

Sediment

concen-

tration

(ppm)

85
122
146

Sediment

discharge
(tons per day)

22
20
27

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of
analysis

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

June 22 ....

Time

(24 hour)

1150
1505

Water
tem-
per-
ature

(°F)

Sam-

pling
point

17
10

Discharge
(cfs)

96
62

Sediment

concen-

tration

(ppm)

Sediment
discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062 0.125

0
0

0.250

25
17

0.500

76
71

1.000

96
93

2.000

98
97

4.000

100
100

8.000 16.00 32.00 64.00

Method
of
analysis

SV
SV

ARKANSAS RIVER BASIN Continued

7-1452. SOUTH FORK NINNESCAH RIVER NEAR MURDOCK, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

May 8.. ....

Sept. 24.. ....

Time

(24 hour)

1655
1120
1510
1125
1250

1235
1125
1400
1230
1435

1555
1535
1330

Water
tem-

per-
ature

(°F)

68
50
32
38
44

38
60
69
87
97

69
86
78

Sam-

pling
point

Discharge
(cfs)

146
160
95
139
209

145
124
119
70
24

70
118
84

Sediment

concen-

tration

(ppm)

262
50
92
34
154

64
74
124
108
46

185
596
208

Sediment

discharge
(tons per day)

103
22
24
13
87

25
25
40
20
3.0

35
190
47

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

61

73

0.004

69

80

0.008 0.016

84

93

0.031 0.062

100

100

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

PWC

VPWC

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

July 8........ ......

Sept. 24. ....

Time

(24 hour)

1120
1510
1125
1250
1235

1125
1400
1230
1615
1435

1555
1535
1330

Water
tem-

per-
ature

(°F)

Sam-

pling
point

12
10
9
9
9

9
13
8
10
10

15
15
9

Discharge
(cfs)

160
95
139
209
145

124
119
70
58
24

70
118
84

Sediment

concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

1

0

0

0.125

0
0
0
0
0

0
0
2
0
1

1
0
0

0.250

17
16
13
14
14

18
19
21
17
16

20
17
17

0.500

83
76
66
68
66

71
65
72
68
66

70
77
77

1.000

96
93
93
93
89

92
88
96
89
89

92
94
94

2.000

98
98
98
98
96

96
93
99
93
97

96
96
98

4.000

99
100
100
99
98

99
96
100
94
100

98
99
100

8.000

100

100
100

100
99

94

100
100

16.00

100

96

32.00

100

64.00

Method
of

analysis

SV
SV
SV
SV
SV

SV
SV
SV
SV
SV

SV
SV
SV

ARKANSAS RIVER BASIN Continued

7-1455. NINNESCAH RIVER NEAR PECK, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 23. ....

Time

(24 hour)

1215
1420
1100
1100
1050

1045
1550
1550
1110
1630

1950
1135
1210
2010
201O
1235

Water
tem-

per-
ature

(°F)

58
32
32
38

41
69
69
69
71

86
90
80
72
72
74

Sam-

pling
point

Discharge
(cfs)

229
244
D 170
D 290
292

250
482
482
202
622

253
46
301
1950
1950
214

Sediment

concen-

tration

(ppm)

115
74
23
19
56

18
742
742
109
920

160
31
496
2560
2560
262

Sediment

discharge
(tons per day)

71
49
10
15
44

12
966
966
59
1540

109
3.8
403
13500
13500
151

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

39
66

65

74
53

0.004

56
71

68

80
69

0.008 0.016

90
86

76

90
91

0.031 0.062

97
97

98

97
97

0.125

98
98

98

98
98

0.250

99
99

99

100
100

0.500

100
100

100

1.000 2.000

Method
of

analysis

VPN
VPWC

VPWC

VPWC
VPN

D Daily mean discharge.

ARKANSAS RIVER BASIN Continued

7-1465. ARKANSAS RIVER AT ARKANSAS CITY, KANS.

LOCATION. At gaging station at bridge on U.S. Highway 166, 0.1 mile downstream from St. Louis-San Francisco Railway Co. bridge, 0.5 mile west of Arkansas City, Cowley County, 5.4 miles upstream from Walnut River, and at mile 701.4.
DRAINAGE AREA. 43,713 square miles, of which 7,607 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1951 to September 1964.
Water temperatures: October 1951 to September 1964.
Sediment records: September 1961 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,490 ppm Jan. 13-15; minimum, 210 ppm Aug. 29-31.
Hardness: Maximum, 450 ppm Jan. 13-15; minimum, 56 ppm Aug. 29-31.
Specific conductance: Maximum daily, 2,760 micromhos Jan. 13; minimum daily, 311 micromhos Aug. 29.
Water temperatures: Maximum, 100°F July 25, Aug. 5; minimum, freezing point on several days during December and January. Sediment concentrations: Maximum daily, 3,500 ppm Aug. 29; minimum daily, not determined.
Sediment loads: Maximum daily, 57,000 tons Aug. 29; minimum daily, 20 tons Dec. 21-23.
EXTREMES, 1951-64. Dissolved solids: Maximum, 3,380 ppm Jan. 16, 1957; minimum, 165 ppm May 31, 1962.
Hardness: Maximum, 760 ppm Jan. 16, 1957; minimum, 56 ppm Aug. 29-31, 1964.
Specific conductance: Maximum daily, 5,770 micromhos Jan. 16, 1957; minimum daily, 227 micromhos Aug. 28, 1960.
Water temperatures: Maximun), 100°F July 25, Aug. 5, 1964; minimum, freezing point on many days during winter months.
Sediment concentrations (1961-64): Maximum daily, 4,450 ppm Sept. 16, 1962; minimum daily, not determined.
Sediment loads (1961-64): Maximum daily, 267,000 tons June 3, 1962; minimum daily, 20 tons Dec. 21-23, 1963.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla. Flow affected by ice Dec. 13 to Jan. 3, Jan. 11-16.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 1-12, 1964...

Mean

discharge
(cfs)

771
808
563
1880
2830

2115
2617
1146
712
615

582
672
589
357
526
779

Silica

(S102)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

240
154
224
138
58

104
73
145
215
190

248
233
259
333
246
250

Po-
tas-
sium

(K)

Bl-

ear -

bon-

ate

(HCO,)

208
188
200
194
114

128
118
178

116

Car-
bon-
ate

(coj

8
0
4
4
0

0
0
2

0

Sulfate

(S0«)

130
90
128
82
35

59
41
81
119
128

128
120
135
165
130
122

Chloride

(Cl)

322
238
345
192
73

149
97
232
320
355

370
350
390
530
372
355

Fluo-

ride

(F)

Ni-

trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(residue at 180° C)

Parts

per
million

974
721
960
640
296

477
345
692
951
1020

1000
950
1060
1370
1030
1020

Tons

per
acre-

foot

1.32
.98
1.31
.87
.40

.65
.47
.94
.29
.39

.36
.29
.44
.86
.40
.39

Tons

per

day

2030
1570
1460
3250
2260

2720
2440
2140
1830
1690

1570
1720
1690
1320
1460
2150

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

274
228
282
216
114

150
124
220
280
314

320
300
340
415
330
305

Non-
car-

bon-

ate

90
74
111
50
20

45
27
71

219

So-

dium
ad-

sorp-
tion
ratio

6.3
4.4
5.8
4.1
2.4

3.7
2.9
4.3
5.6
4.7

6.0
5.9
6.1
7.1
5.9
6.2

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

1580
1210
1620
1070
489

806
587
1170
1540
1690

1750
1670
1840
2410
1770
1710

PH

8.5
8.2
8.4
8.4
8.0

8.1
8.0
8.3

8.0

ARKANSAS RIVER BASIN Continued

7-1465. ARKANSAS RIVER AT ARKANSAS CITY, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 22.. ....

Time

(24 hour)

1030
2150
2150
0915
0915

1610
1610
1200
1020
1020
1045

Water
tem-

per-
ature

(°F)

60
56
56
52
52

66
66
82
76
74
73

Sam-

pling
point

Discharge
(cfs)

804
2980
2980
2080
2080

1930
1930
2270
1000
6400
960

Sediment
concen-

tration

(ppra)

870
2360
2360
2160
2160

1610
1610
2420
1310
3780
450

Sediment

discharge
(tons per day)

1890
19000
19000
12100
12100

8390
8390
14800
3540
65300
1170

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

75
25
60
31
65

22
68
74
80
68
79

0.004

89
42
66
52
72

42
77
79
89
74
80

0.008 0.016

97
82
80
88
88

84
87
90
96
84
91

0.031 0.062

100
96
96
98
98

96
96
97
100
94
99

0.125

97
97
99
99

97
97
98

96
100

0.250

100
100
100
100

99
99
99

98

0.500

100
100
100

100
~~

1.000 2.000

Method
of

analysis

PWC
VPN
VPWC
VPN
VPWC

VPN
VPWC
VPWC
PWC
VPWC
VPWC

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Dec. 20.............

Apr. 27........... ..

Time

(24 hour)

1135
1350
1240
0940
0940

1000
1510
1700
1550
1220

1040
1140
1050

Water
tem-

per-
ature

(°F)

Sam-

pling
point

17
14
10
9
19

9
12
9
13
9

11
8
14

Discharge
(cfs)

804
642
350
560
544

2080
496
1930
400
2270

255
6400
960

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

1
o

0

0.125

0
0
0
0
0

4
2
0
1
0

0
0
0

0.250

9
14
10
9
9

34
22
19
17
21

16
16
12

0.500

61
75
55
56
49

80
55
71
61
73

74
66
66

1.000

87
93
79
86
79

94
76
90
85
90

94
90
89

2.000

95
97
89
86
89

97
85
96
93
96

99
96
96

4.000

98
99
96
94
97

99
94
99
98
99

100
99
100

8.000

100
100
100
99
100

100
99
100
100
100

100

16.00

100

100

"

32.00 64.00

Method
of

analysis

SV
SV
SV
SV
SV

SV
SV
SV
SV
SV

SV
SV
SV

ARKANSAS RIVER BASIN Continued

7-1469. WALNUT RIVER NEAR AUGUSTA, KANS. Continued

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

June 17. ....

Time

(24 hour)

1430
2030
1440

Water
tem-
per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

1780
1180
330

Sediment
concen-

tration

(ppm)

651
509
204

Sediment
discharge
(tons per day)

3130
1620
182

Suspended sed iment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of

analysis

ARKANSAS RIVER BASIN Continued

7-1470.7. WHITEWATER RIVER AT TOWANDA, KANS.--Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 21. ....

Time

(24 hour)

2100
2320
1900
1945
2045

0320
1300
1110
1230
1600

0115
0920
1340

Water
tem-

per-
ature

(°F)

69

Sam-

pling
point

Discharge
(cfs)

1000
1000
698
922
1320

2560
2100
800
1120
1760

3160
250
71

Sediment
concen-

tration

(ppm)

3140
2180
1050
5440
4040

6800
1520
2920
2870
2740

2270
544
762

Sediment

discharge
(tons per day)

8480
5890
1980
13500
14400

47000
8620
6310
8680
13000

19400
367
150

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

54

77

71

0.004

60

82

78

0.008 0.016

76

97

82

0.031 0.062

100

100

100

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

VPWC

VPWC

PWC

ARKANSAS RIVER BASIN Continued

7-1471. WHITEWATER RIVER AT AUGUSTA, KANS.

LOCATION. At bridge, 1.1 miles west of Augusta, Butler County, and about 2 miles upstream from mouth.
RECORDS AVAILABLE. Chemical analyses: April 1962 to September 1964 (discontinued).
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180'°C, and values more than 1,000 ppm are calculated from the determined constituents unless otherwise noted. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Oct. 8, 1963.

Jan. 16, 1964

Sept. 17.....

Discharge
(cfs)

9.4
10.0
11.7
15.0
17.0

13.8
20.0
17.5
24.5
22.5

618
10.3
10.0
43.8

Silica

(SiO.)

12
15
12
13
10

5.5
3.0
5.0
5.5
7.5

11
3.6
6.0
7.5

Alu-
mi-

num

(Al)

Iron

(Fe)

0.03

Man-

ga-
nese

(Mn)

0.08

Cal-

cium

(Ca)

211
216
213
160
259

274
226
248
147
160

46
198
190
95

Mag-
ne-

sium

(Mg)

61
64
64
41
64

82
64
72
44
45

10
69
60
15

Sodium

(Na)

339
339
339
231
220

264
216
237
168
192

27
330
349
66

Po-
tas-

sium

(K)

12
12
12
10
13

6.9
9.8
6.1
9.0
10

6.5
10
9.0
8.8

Bi-
car-

bonate

(HCO,)

290
305
290
300
376

376
312
295
244
278

134
261
251
168

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

0
0
0
0

Sulfate

(SOJ

301
303
299
173
418

508
409
476
256
236

40
326
236
105

Chloride

(Cl)

690
700
710
470
454

545
445
495
335
381

49
680
730
23

Fluo-

ride

(F)

0.3
.2
.2
.3
.4

. 3
. 3
.4
.4
.4

.4
. 3
.3
.5

Ni-

trate

(NO,)

0.8
.7
1.0
3.2
6.6

1.8
. 7
. 5
. 7
1.8

6.2
. 1
. 8
6.2

Boron

(B)

0.32
. 31
.28
.21
.24

. 28
. 28
. 34
. 16
.28

. 08
. 36
. 24
. 13

Dissolved
solids

1770
1800
1790
1250
1630

1870
1530
1690
1090
1170

264
1750
1700
504

Hardness
as CaCOs
Cal-

cium,
mag-
nesium

777
802
794
568
909

1020
827
915
548
584

156
778
720
274

Non-
car-

bon-

ate

539
552
556
322
601

712
571
673
348
356

46
564
514
136

Sodium
ad-

sorp-
tion
ratio

5.3
5.2
5.2
4.2
3.2

3.6
3.3
3.4
3.1
3.5

.9
5.1
5.7
1.7

Specific
conduct-
ance

(micro-
mhos at

25'C)
3060
3110
3160
2150
2600

2850
2430
2550
1830
2030

440
2950
3000
860

PH

.5
.6
. 5
.9
. 2

. 7
.8
.7
.5
. 6

.3
.3
.4
.3

Col-

or

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; ____________________ P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)______________________
tir«4..

Date of collection

Time

(24 hour)

1245

Water
tem-

per-
ature
(°F)

74

Sam-

pling
point

Discharge
(cfs)

618

Sediment
concen-

tration

(ppm)

688

Sediment

discharge
(tons per day)

1150

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

85

0.004

86

0.008 0.016

92

0.031 0.062 |o.!25

ioo|

0.250 0.500 1.000 2.000

Method
of

analysis

PWC

ARKANSAS RIVER BASIN Continued

7-1475. WALNUT RIVER NEAR DOUGLASS, KANS.

LOCATION. At county road bridge, about 2 miles southwest of Douglass, Butler County.
RECORDS AVAILABLE. Chemical analyses: April 1962 to September 1964.
REMARKS.--Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm are calculated from the determined constituents unless otherwise noted. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Oct. 9, 1963.

Jan. 16, 1964

June 16:
At 1545....
At 2350. .. .

July 23. .....

Sept. 17.....

Discharge
(cfs)

24.6
32.8
36.4
34.0
42.2

29.1
73.1
46.0

5600
7077

1368
23.7
22.5
112

Silica

(SiQ,)

0.5
7.0
9.5
9.5
1.5

4.5
9.0
6.0

7.5
7.5

8.2
.9
2.0
3.0

Alu-
mi-

num

(Al)

Iron

(Fe)

0.03

Man-

ga-
nese

(Mn)

0.00

Cal-

cium

(Ca)

184
190
206
272
194

232
106
108

37
30

35
157
132
86

Mag-
ne-

sium

(Mg)

52
44
44
60
48

52
21
35

5.2
4.6

6.9
45
35
25

Sodium

(Na)

243
153
243
270
216

250
102
147

14
9.3

22
216
180
192

Po-
tas-

sium

(K)

9.3
11
10
9.3
7.2

7.8
5.8
7.8

3.3
4.0

4.7
9.5
8.1
10

Bi-
car-

bonate

(HCO.)

'222
232
293
366
234

283
212
193

117
100

115
200
161
137

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0

0
0

0
0
0
0

Sulfate

(scg

285
360
305
439
359

376
116
163

23
13

26
258
198
104

Chloride

(Cl)

510
306
480
520
430

500
200
289

20
15

33
442
380
365

Fluo-

ride

(F)

0.5
. 5
.5
.8
.5

.7
. 5
.4

.4
.4

.4
.8
. 7
.5

Ni-

trate

(NOS)

0.9
2.1
11
19
5.8

7.1
16
.4

2.2
6.2

6.2
. 2
.6
1.4

Boron

(B)

0.32
. 30
. 24
.30
.24

. 30
. 13
.23

.05
.07

.07
. 27
. 27
. 12

Dissolved
solids

1390
1190
1450
1780
1380

1570
706
896

172
146

208
1230
1020
882

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

672
655
695
925
682

792
351
414

114
94

116
576
474
318

Non-
car-

bon-

ate

490
465
455
625
490

560
177
256

18
12

22
412
342
206

Sodium
ad-

sorp-
tion
ratio

4.1
2.6
4.0
3.9
3.6

3.9
2.4
3.1

.6
.4

.9
3.9
3.6
4.7

Specific
conduct-

ance

(micro-
mhos at

25°C)

2400
1910
2410
2850
2210

2550
1170
1530

280
210

330
2150
1810
1560

PH

7.6
8.2
7.3
7.2
7.3

7.5
7.8
7.4

7.4
7.3

7.3
7.4
7.5
7.4

Col-

or

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantatlon; N, in native water; _____________ P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)_____________

Date of collection

June 17. ....

Time

(24 hour)

1710
2330
1850

Water
tem-

per-
ature
(°F)

Sam-

pling
point

Discharge
(cfs)

7080
5600
1350

Sediment

concen-

tration

(ppm)

2160
1930
1000

Sediment

discharge
(tons per day)

41300
29200
3640

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

62
72
82

0.004

68
78
82

0.008 0.016

83
89
90

0.031 0.062

100
100
100

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

VPWC
PWC
PWC

ARKANSAS RIVER BASIN Continued

7-1478. WALNUT RIVER AT WINFIELD, KANS.

LOCATION. At gaging station at bridge on U.S. Highway 77, 1 mile south of Winfield, Cowley County, 1 mile upstream from Black Crook Creek, and at mile 24.8. DRAINAGE AREA. 1,872 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1959 to September 1964.
Water temperatures: October 1961 to September 1964.
Sediment records: September 1961 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,490 ppm Jan. 1-31; minimum, 254 ppm Apr. 7-8.
Hardness: Maximum, 742 ppm Jan. 1-31; minimum, 96 ppm June 17.
Specific conductance: Maximum daily, 2,770 micromhos Jan. 21; minimum daily, 240 micromhos June 17.
Water temperatures: Maximum, 94°F Aug. 5; minimum, freezing point Dec. 21, 22, 31, Jan. 12.
Sediment concentrations: Maximum daily, 2,600 ppm Apr. 5; minimum daily, 5 ppm Jan. 5.
Sediment loads: Maximum daily, 36,000 tons June 17; minimum daily, 1 ton on many days during October, January to March, July to September. EXTREMES, 1961-64. Dissolved solids: Maximum, 1,490 ppm Jan. 1-31, 1964; minimum, 200 ppm July 12-16, 1963.
Hardness: Maximum, 742 ppm Jan. 1-31, 1964; minimum, 96 ppm June 17, 1964.
Specific conductance: Maximum daily, 2,770 micromhos Jan. 21, 1964; minimum daily, 206 micromhos July 15, 1963.
Water temperatures: Maximum, 94°F Aug. 5, 1964; minimum, freezing point on many days during winter months.
Sediment concentrations: Maximum daily, 4,100 ppm Oct. 10, 1961; minimum daily, 2 ppm Dec. 6, 1962.
Sediment loads: Maximum daily, 179,000 tons Oct. 10, 1961; minimum daily, 1 ton on many days in 1962 and 1964.
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm are calculated from the determined constituents unless otherwise noted. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). Maximum observed during water year: Dissolved solids, 1,620 ppm Jan. 16; hardness, 834 ppm Jan. 8. Minimum observed during water year: Dissolved solids, 178 ppm June 18. Chemical analyses by Kansas State Department of Health, Topeka, Kans. Daily samples for chemical analysis composited by discharge. Records of specific conductance of daily samples available in Project Office at Topeka, Kans. Additional samples were collected for more comprehensive definition of water quality at this station.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 9-31, 1963...

Jan. -31, 1964...

Mav 1-2. ....

Mean

discharge
(cfs)

58.4
45.7
44.2
45.8
47.9

36.9
220
3670
813
140

918
146
295

Silica

(S10a)

Iron

(Fe)

Cal-

cium

(Ca)

146
146
147
200
181

158
176
94
39
56

136
80
85

Mag-
ne-

sium

(Mg)

45
44
44
59
53

49
55
20
9.6
11

28
20
21

Sodium

(Na)

204
184
227
247
224

216
226
113
34
44

135
65
101

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

195
227
163
229
193

156
200
173
107
139

251
161
198

Car-
bon-
ate

(COJ

Sulfate

(SO.)

244
251
279
383
374

342
363
116
46
57

158
117
92

Chloride

(Cl)

410
353
437
490
430

410
432
212
53
76

267
120
184

Fluo-
rlde

(F)

Ni-

trate

(NOJ

0.4
.4
.4
.4

Bo-

ron

(B)

Dissolved solids

Parts

per
million

1150
1090
1210
1490
1360

1250
1350
748
254
349

954
544
608

Tons

per
acre-

foot

1.56
1.48
1.65
2.03
1.85

1.70
1.84
1.02
.35
.47

1.30
. 74
.83

Tons

per

day

181
135
144
184
176

125
802
7410
558
132

2360
214
484

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

549
545
548
742
670

596
665
316
137
184

454
282
298

Non-
car-

bon-

ate

389
359
414
554
512

468
501
174
49
70

248
150
136

So-

dium
ad-

sorp-
tion
ratio

3.8
3.4
4.2
3.9
3.8

3.8
2.8
1.3
1.4

2.8
1.7
2.5

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1980
1890
2160
2430
2260

2150
2320
1180
420
560

1520
850
1060

pH

ARKANSAS RIVER BASIN Continued

7-1515. CHIKASKIA RIVER NEAR CORBIN, KANS.

LOCATION. At gaging station at bridge on State Highway 49, 1 mile upstream from Prairie Creek, 3 miles west of Corbin, Sumner County, and at mile 67.5. DRAINAGE AREA. 794 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
Water temperatures: January 1963 to September 1964.
Sediment records: August 1962 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 98°F July 7; minimum, freezing point on several days during December and January.
Sediment concentrations: Maximum daily, 5,100 ppm Aug. 30; minimum daily, no flow on many days during July and August.
Sediment loads: Maximum daily, 26,000 tons Aug. 30; minimum daily, 0 tons on many days during July and August.
EXTREMES, 1962-64. Water temperatures (January 1963 to September 1964): Maximum, 99°F July 25, 1963; minimum, freezing point on several days during winter months.
Sediment concentrations: Maximum daily, 5,110 ppm Sept. 22, 1962; minimum daily, no flow on many days in 1963-64.
Sediment loads: Maximum daily, 44,000 tons July 11, 1963; minimum daily, 0 tons on many days in 1963-64.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans. Flow affected by ice Dec. 9 to Jan. 22.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Oct. 3, 1963.

Jan. 20, 1964

Sept. 23.....

Discharge
(cfs)

37
68
A35
A105
78

68
280
112
82
A. 3

66
40

Silica

(sicg

12
8.5
10
11
9.0

5.0
7.5
15
14
9.8

12
13

Alu-
mi-

num

(Al)

Iron

(Fe)

0.03

.03

Man-

ga-
nese

(Mn)

0.00

. 00

Cal-

cium

(Ca)

58
62
64
59
69

61
34
75
75
42

42
53

Mag-
ne-

sium

(Mg)

15
15
21
13
16

14
6.6
13
10
20

11
13

Sodium

(Na)

31
33
35
27
33

35
15
35
34
50

24
24

Po-
tas-

sium

(K)

4.2
2.9
3.2
1.5
. 8

1.5
3.0
4.2
4.2
4.5

5.3
5.3

Bi-
car-

bonate

(HCO,)

215
237
259
222
251

227
124
254
249
173

146
195

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

0
0

Sulfate

(SOJ

44
42
50
35
41

44
24
42
35
88

47
37

Chloride

(CD

36
33
38
30
43

42
14
47
45
51

26
25

Fluo-

ride

(F)

0.3
.3
.2
.2
. 3

.3
.3
.4
.4
.5

. 5
.5

Ni-

trate

(NO,)

2.8
.4
5.8
3.0
2.6

1.9
4.9
.8
.2
.3

1.4
1.8

Boron

(B)

0.13
. 15
. 16
. 13
. 16

. 10
.07
. 13
. 10
. 19

.27
. 15

Dissolved
solids

(residue
at 180° C)

306
324
364
285
344

325
173
360
348
349

262
270

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

206
216
246
200
238

210
112
240
228
187

150
18fi

Non-
car -

bon-

ate

30
22
34
18
32

24
10
32
24
45

30
2fi

Sodium
ad-

sorp-
tion
ratio

0.9
1.0
1.0
.8
. 9

1. 1
.6
1.0
1.0
1.6

.9
. 8

Specific
conduct-

ance

(micro-
mhos at

25° C)

ooooc

1010*310 locqtoio *r ^

PH

8.2
8.0
8.2
8.2
8.2

8.0
7.7
8.2
7.9
7.4

7.3
7.fi

Col-

or

A Daily mean discharge.

ARKANSAS RIVER BASIN Continued

7-1515. CHIKASKIA RIVER NUAR CORBIN, KANS. Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aug. 30. ....

Time

(24 hour)

1145
1145
1640
1220
0800

1220
1840

Water
tem-

per-
ature

(°F)

48
48
72
73
64

67
77

Sam-

pling
point

Discharge
(cfs)

289
289
526
985
1420

526
508

Sediment

concen-

tration

(ppm)

782
782
1090
5610
5420

4420
2830

Sediment

discharge
(tons per day)

610
610
1550
14900
20800

6280
3880

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

53
77
52
79
60

67
84

0.004

70
84
68
86
67

76
90

0.008 0.016

90
93
76
96
82

86
95

0.031 0.062

96
96
83
100
99

99
99

0.125

97
97
84

100

100
99

0.250

99
99
85

100

0.500

100
100
94

1.000

100

2.000

Method
of

analysis

VPN
VPWC
VPWC
VPWC
VPWC

VPWC
VPWC

Particle-size analyses of bed material, water year October 1963 to September 1964
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

July 21.. ....

Sept. 23. ....

Time

(24 hour)

1520
0945
1525
1510
1455

1520
1145
1505
1115
1445

1440
1220
0930

Water
tem-

per-
ature

(°F)

Sam-

pling
point

12
13
9
14
7

8
13
8
14
4

9
10
10

Discharge
(cfs)

37
68
D 35
D 105
76

68
289
\\V
82
1.2

66
526
40

Sediment

concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062

0

2

0.125

1
0
0
0
0

0
0
0
0
0

0
4
0

0.250

4
4
4
4
3

5
14
fi
5
5

7
10
6

0.500

21
43
64
52
40

39
59
51
47
45

48
52
49

1.000

52
75
91
85
86

80
92
84
83
89

85
88
86

2.000

66
86
96
93
96

91
99
91
92
96

95
96
95

4.000

81
93
99
97
99

98
99
96
98
100

99
98
99

8.000

95
98
100
99
99

100
100
100
100

100
100
100

16.00

100
100

100
100

32.00 64.00

Method
of

analysis

SV
SV
SV
SV
SV

SV
SV
SV
SV
SV

SV
SV
SV

D Daily mean discharge.

ARKANSAS RIVER BASIN Continued

7-1520. CHIKASKIA RIVER NEAR BLACKWELL, OKLA.

LOCATION. At gaging station, near left bank on downstream side of pier of St. Louis-San Francisco Railway Co. bridge at northeast edge of city of Blackwell, Kay County, 0.2 mile downstream from Bitter Creek, and at mile 28.2.
DRAINAGE AREA. 1,859 square miles.
RECORDS AVAILABLE. Chemical analyses: September 1951 to September 1964 (discontinued).
Water temperatures: November 1959 to September 1964 (discontinued).
EXTREMES, 1963-64. Dissolved solids: Maximum, 7,580 ppm Aug. 1-7; minimum, 95 ppm Aug. 29-31.
Hardness: Maximum, 2,420 ppm Aug. 1-7; minimum, 48 ppm Aug. 29-31.
Specific conductance: Maximum daily, 11,500 micromhos Aug. 3-6; minimum daily, 151 micromhos Aug. 29-31.
Water temperatures: Maximum, 97°F Aug. 5; minimum, 33°F on several days during December and January.
EXTREMES, 1959-64. Dissolved solids: Maximum, 7,580 ppm Aug. 1-7, 1964; minimum, 95 ppm Aug. 29-31, 1964. Hardness: Maximum, 2,420 ppm Aug. 1-7, 1964; minimum, 48 ppm Aug. 29-31, 1964.
Specific conductance: Maximum daily, 11,500 micromhos Aug. 3-6, 1964; minimum daily, 146 micromhos July 12, 1963. Water temperatures: Maximum, 97°F Aug. 5, 1964; minimum, freezing point Feb. 28, Mar. 6, 1960, Jan. 15, 20, 1962. REMARKS. Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-3, 1963....

Jan. 1-15, 1964...

Feb. 16-29.. ......

Mean

discharge
(cfs)

44.3
33.4
25.6
47.3
371

172
86.3
72.7
67.8
70.2

69.8
57.5
37.3
56.3
88.5

90.1
70.8
92.2
97.4
96.4

Silica

(S10,)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

105
136
180
122
32

60
88
95
108 .
90

96
130
174
141
95

88
115
82
86
88

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(HCO,)

~

Car-
bon-
ate

(CO,)

--

Sulfate

(SO.)

"

Chloride

(Cl)

242
320
418
300
67

115
190
230
270
200

218
320
440
330
200

172
302
150
175
165

Fluo-

rlde

(F)

Ni-

trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

650
884
1060
810
260

466
574
647
695
551

590
846
1090
830
585

529
754
495
560
550

Tons

per
acre-

foot

0.88
1.20
1.44
1.10
. 35

.63
. 78
.88
.95
. 75

.80
1.15
1.48
1.13
.80

. 72
1.03
.67
. 76
. 75

Tons

per

day

77.8
79.7
73.3
103
260

216
134
127
127
104

111
131
110
126
140

129
144
123
147
143

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

324
410
480
410
128

272
315
312
340
268

292
400
470
395
288

232
340
224
268
268

Non-
car-

bon-

ate

"

So-

dium
ad-

sorp-
tion
ratio

2.5
2.9
3.6
2.6
1.2

1.6
2.2
2.3
2.5
2.4

2.4
2.8
3.5
3.1
2.4

2.5
2.7
2.4
2.3
2.3

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1140
1420
1720
1370
435

784
1020
1080
1220
980

1060
1390
1740
1440
1010

886
1260
821
934
939

pH

-

ARKANSAS RIVER BASIN Continued

7-1530. BLACK BEAR CREEK AT PAWNEE, OKLA.

LOCATION. At gaging station, on downstream side of left pier of bridge on State Highway 18 in north Pawnee, Pawnee County, 300 feet downstream from Skedee Creek, and at mile 23.4.
DRAINAGE AREA. 576 square miles.
RECORDS AVAILABLE. Chemical analyses: November 1951 to August 1952, October 1955 to September 1959, October 1962 to August 1964.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Chemical analyses, in parts per million, October 1963 to August 1964

Date
of
collection

Discharge
(cfs)

5.7
9.7
4.9
10.3
10.3

7.3
5.9
7.0
12.7
99.1

405
20.7
8.2
136

Silica

(Si02)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

212
224

163

177
227

59
43

9.9
174

48

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(HCOj)

220
378

196

308
204

168
108

94
168

80

Car-
bon-

ate

(COJ

6
0

4

4
0

0
2

0
6

0

Sulfate

(S0«)

31
42

38

38
48

32
21

17
53

22

Chloride

(Cl)

545
470
660
790
395

395
498
458
122
91

36
365
335
100

Fluo-

ride

(P)

Ni-
trate

(NOJ

Bo-

ron

(B)

Dissolved solids
(residue at 180° C)

Parts

per
million

1350
1160
1510

966

989
1030

398
321

171
887

278

Tons

per
acre-

foot

1.84
1.58
2.05

1.31

1.35
1.40

.54
.44

. 23
1.21

.38

Tons

per

day

20.8
30.4
20.0

26.9

19.5
16.4

13.7
85.9

187
49.6

102

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

530
530
615

410

470
425

214
148

124
340

124

Non-
car-

bon-

ate

340
220

243

211
258

76
56

47
192

58

So-

dium
ad-

sorp-
tion
ratio

4.0
4.2

3.5

3.6
4.8

1.8
1.5

.4
4.1

1.9

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

2010
2020
2550
2680
1570

1720
1900
1920
700
514

291
1480
1380
479

PH

8.3
8.1

8.3

8.3
8.1

8.2
8.4

7.7
8.5

7.2

ARKANSAS RIVER BASIN Continued

7-1535. CIMARRON RIVER NEAR GUY, N. HEX.

LOCATION. At gaging station, 1.5 miles upstream from Baker damsite, 1.7 miles northwest of Valley filling station, 12 miles north of Guy, Union County, and 27 miles northwest of Kenton, Okla.
DRAINAGE AREA. 545 square miles.
RECORDS AVAILABLE. Sediment records: April 1963 to September 1964.
REMARKS. Records of specific conductance available at district office in Albuquerque, N. Mex. Reported as a miscellaneous station for period April to September 1963.

Periodic determinations of suspended-sediment discharge and particle-size, water year October 1963 to September 1964

(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

1330
1300
1340
1335
1215

1400
1200
1235
1340
1335

Water
tem-

per-
ature

(°F)

52
38
35
48
55

70
80
86
75
70

Sam-

pling
point

Discharge
(cfs)

1.4
1.9
2.2
1.5
2.4

1.1
. 7
. 1
2.7
.9

Sediment

concen-

tration

(ppm)

30
25
4
24
14

70
117
66
63
88

Sediment

discharge
(tons per day)

0.11
. 13
.02
. 10
.09

.21
. 22
.02
.46
.21

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

83

0.004

89

0.008 0.016

89

0.031 0.062

97

0.125

100

0.250 0.500 1.000 2.000

Method
of

analysis

VPWC

ARKANSAS RIVER BASIN Continued

7-1644. ARKANSAS RIVER AT SAND SPRINGS BRIDGE, NEAR TULSA, OKLA.

LOCATION. At bridge on State Highway 33 in Sand Springs, 7 miles downstream from Cimarron River and 10 miles upstream from gaging station at Tulsa, Tulsa County.
DRAINAGE AREA. 74,615 square miles upstream from gaging station, of which 12,541 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1946 to September 1964.
Water temperatures: October 1946 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 3,770 ppm Feb. 13-20; minimum, 241 ppm Sept. 1-2.
Hardness: Maximum, 530 ppm Mar. 8-31; minimum, 84 ppm Aug. 29-30.
Specific conductance: Maximum daily, 7,540 micromhos Feb. 18; minimum daily, 387 micromhos Sept. 2.
Water temperatures: Maximum, 94°F July 21; minimum, freezing point on several days during December and January.
EXTREMES, 1946-64. Dissolved solids: Maximum, 13,500 ppm Oct. 19, 1956; minimum, 232 ppm July 18-20, 1950.
Hardness: Maximum, 2,600 ppm Oct. 19, 1956; minimum, 84 ppm Aug. 29-30, 1964.
Specific conductance: Maximum daily, 21,200 micromhos Oct. 19, 1956; minimum daily, 379 micromhos July 19, 1950, July 26, 1959.
Water temperatures; Maxinfum, 96°F Aug. 7, 1947; minimum, freezing point on many days during winter months.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla. Records of discharge are given for Arkansas River at Tulsa, Okla. No appreciable inflow between sampling point and gaging station except during periods of heavy local runoff.

Chemical analyses, in rts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-3, 1963....

Dec 22 31

Jan. 1-9, 1964....

Feb. 21-29........

Mean

discharge
(cfs)

2460
1895
2760
7960
8960

4707
2568
1790
1426
1345

936
«m
1404
1067
1432

1632
1981
1532
1394

Silica

(Si02)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

457
612
292
150
393

211
377
459
560
636

802
726
595
1020
667

900
682
1210
877

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCOJ

210
232
128
140
196

132
176
218
212
238

256
256
236
244
224

220
216
220
214

Car-
bon-
ate

(COJ

0
0
0
0
2

0
0
0
0
8

4
10
12
14
14

10
10
8
10

Sulfate

(S0«)

130
155
78
61
123

101
105
130
155
185

190
200
175
208
190

195
188
232
222

Chloride

(Cl)

710
960
455
235
615

305
585
720
890
995

1290
1180
945
1600
1060

1430
1130
1920
1420

Fluo-
ride

(F)

Ni-

trate

(NOJ

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

1530
1960
916
584
1330

712
1240
1560
1820
2060

2410
2500
2160
3110
2320

2920
2380
3770
2850

Tons

per
acre-

foot

2.08
2.67
1.25
. 79
1.81

. 97
1.69
2.12
2.48
2.80

3.28
3.40
2.94
4.23
3.16

3.97
3.24
5.13
3.88

Tons

per
day

10160
10030
6830
12550
32180

9050
8600
7540
7010
7480

6090
5630
8190
8960
8970

12870
12730
15590
10730

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

316
376
192
184
306

184
258
332
372
422

490
520
435
480
450

460
500
520
520

Non-
car-

bon-

ate

144
186
87
69
142

76
114
153
198
213

273
293
221
256
243

263
306
326
328

So-

dium
ad-

sorp-
tion
ratio

11
14
9.2
4.8
9.8

6.8
10
11
13
14

16
14
12
20
14

18
13
23
17

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

2710
3480
1770
1070
2340

1300
2260
2700
3310
3620

4510
4350
3620
5250
3950

4980
4080
6460
4910

pH

7.9
7.8
8.2
7.9
8.3

8.0
8.0
8.2
8.1
8.3

8.3
8.4
8.6
8.6
8.6

8.4
8.4
8.5
8 5

ARKANSAS RIVER BASIN Continued

7-1644. ARKANSAS RIVER AT SAND SPRINGS BRIDGE, NEAR TULSA, OKLA. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date
of
collection

Sept. 7-15, 1964..

Weighted average

Time-weighted

Tons per day. . . .

Mean

discharge
(eta)

2387
2546
2070

- -

2419

-

Silica
(S10,)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

425
189
329

415

562

2710

Po-
tas-
sium

(K)

Bl-

car-

bon-
ate

(HCO,)

140
124
136

157

183

1020

Car-
bon-
ate

(CO,)

0
0
0

--

--

-

SuUate

(SO,)

102
80
88

118

152

773

Chloride
(Cl)

675
300
530

655

894

4280

FluOn
ride

(F)

Ni-
trate

(NO,)

Bo-
ron

(B)

Dissolved solids
(residue at 180°C)

Parts
per
million

1430
743
1180

1410

1870

-

Tons
per
acre-

foot

1.94
1.01
1.60

1.92

- -

--

Tons
per

day

9220
5110
6600

9230

-

- -

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

248
196
236

280

356

--

Non-
car-

bon-
ate

133
94
124

142

194

-

So-
dium
ad-
sorp-
tion
ratio

12
5.9
J.3

10

13

- -

Specific
con-

duct-

ance

(micro-
mhos at
25°C)

2510
1300
2070

2470

3260

--

PH

8.0
8.0
7.9

8.2

8.2

-

ARKANSAS RIVER BASIN Continued

7-1660. VERDIGRIS RIVER NEAR COYVILLE, KANS.

LOCATION. At gaging station on county highway bridge, 1.2 miles upstream from Meadow Creek, 1.5 miles northwest of Coyville, Wilson County, 2.5 miles down-stream from Pig Creek, and at mile 268.0.
DRAINAGE AREA. 747 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Oct. 23, 1963

Jan. 3, 1964.

Sept. 8......

Discharge
(cfs)

11.0
8.6
6.8

13

Silica
(S10.)

1.5

. 5

4.8

Alu-
mi-
num

(Al)

Iron

(Fe)

_
_ _

.00

Man-
ga-
nese

(Mn)

__
__

.00

Cal-
cium

(Ca)

65
69
71

43

Mag-
ne-

sium

(Mg)

16

18

7.9

Sodium
(Na)

54

64

35

Po-
tas-
sium

(K)

4.8

4.1

3 3

3 1

3.5

Bi-
car-

bonate

(HCO,)

185

217

139

132

Car-
bon-
ate

(CO,)

0

0

0

Sulfate
(SO,)

27

37
35
33

33

23
19

Chloride

(CD

118

126

67

Fluo-
ride
(F)

0.3

.2
3

2

.3

Ni-
trate

(NO,)

1.7

.4

1 2

1.9

Boron

(B)

0.08

. 10

08

. 13

Dissolved
solids
(residue
at 180° C)

414

456

252

Hardness
as CaCO,
Cal-
cium,
mag-
nesium
228

251

140

Non-
car-

bon-
ate
76

73

32

Sodium
ad-
sorp-
tion
ratio

1.6

1.8

1.3

Specific
conduct-

ance

(micro -
mhos at
25°C)
740
740
780

420

pH

7.7
7 7
7.8

7.3

Col-

or

ARKANSAS RIVER BASIN Continued

7-1670. FALL RIVER NEAR EUREKA, KANS.

LOCATION. At gaging station at bridge on State Highway 99, 3 miles southeast of Eureka, Greenwood County, 5 miles downstream from Spring Creek, and at mile 76.3
DRAINAGE AREA. 307 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans. No flow July 29 to Aug. 14.

Chemical analyses, in parts per million, water year October 1963 to September

Date of
collection

Oct. 23, 1963

Jan. 3, 1964.

Sect. 9......

Discharge
(cfs)

.6

.4

17.0

. 5

Silica
(SiO.)

9.0

1.0

. 5

Alu-
mi-
num

(Al)

Iron

(Fe)

_
_
_

.03

Man-
ga-
nese

(Mn)

_

_

.00

Cal-
cium

(Ca)

99

131

75

Mag-
ne-

sium

(Mg)

23

21

24

20

20

Sodium
(Na)

48
52
67

118

Po-
tas-
sium

(K)

5.7

8.9

3 5
3 2
2 7

6.5

Bi-
car-

bonate

IHCO,)

264

364

207

205

181

Car-
bon-
ate

(CO.)

0

0

0

Sulfate
(SOJ

49

74

58

Chloride
(Cl)

124

127

227

228

Fluo-
ride
(F)

0.2

. 5

2
2

.4

trate

(NO,)

0.8

11

2 3

1.0

Boron

(B)

0.21

.27
23

13

.24

Dissolved
solids
(residue
at 180° C)

508
504
640

620

Hardness
as CaCO,
Cal-
cium,
mag-
nesium
342
334
414

356
374

269

Non-
car -

bon-
ate
125

115

121

Sodium
ad-
sorp-
tion
ratio

. 1

.4

2 2

3.1

Specific
conduct-

ance

(micro-
mhos at
25"C)
880

1040

1080

pu

7.6

7.8

7 4

Col-

or

ARKANSAS RIVER BASIN Continued

- 7-1695. FALL RIVER AT FREDONIA, KANS.

LOCATION. At gaging station at bridge on State Highway 96, 0.8 mile upstream from Clear Creek, 1 mile downstream from Salt Creek, 1 mile south of Fredonia, Wilson County, and at mile 25.3.
DRAINAGE AREA. 827 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date at
collection

Oct. 23, 1963

Jan. 3, 1964.

Sept. 8......

Discharge
(cfs)

26

15

1 T

39

11

Silica
(810.)

2.5

1.5

3.6

Alu-
mi-
num

(Al)

Iron

(Fe)

__

_

.00

Man-
ga-
nese

(Mn)

_

.00

Cal-
cium

(Ca)

69

73

75

73

51

Mag-
ne-

sium

(Mg)

18

22

15
15

10

Sodium
(Na)

56

60

59

Po-
tas-
sium

(K)

4.5

3.5

3 3

4 2

5 3
4.8

Bi-
car-

bonate
(HCO,)

205

232

142

Car-
bon-
ate

(CO,)

0

0

0

Sulfate
(SOJ

41

41
37

33

32

Chloride
(Cl)

112

120

110

Fluo-
ride
(F)

0.2
3
. 2

2

2

.4

Ni-
trate

(NO,)

1.3
4 3
2.6

4.0

Boron

(B)

0.10

. 10

. 10

Dissolved
solids
(residue
at 180° C)

426

459

366

Hardness
as CaCO,
Cal-
cium,
mag-
nesium
246

272

168

Non-
car-

bon-
ate
78

82

52

Sodium
ad-
sorp-
tion
ratio

1.6

1.6

1 3

2.0

Specific
conduct-

ance

(micro-
mhos at
25°C)
750

780

620

PH

7.6

7.5

7 7

7.4

Col-

or

ARKANSAS RIVER BASIN Continued

7-1700. ELK RIVER NEAR ELK CITY, KANS.

LOCATION. At gaging station at highway bridge, 150 feet downstream from Salt Creek, 1.8 miles south of Elk City, Montgomery County, and at mile DRAINAGE AREA. 575 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Chemical analyses by Kansas State Department of Health, Topeka, Kans. No flow Oct. 1 to Feb. 7, July 21 to Aug. 27.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date of
collection

Feb. 26, 1964

Sept. 8......

Discharge
(cfs)

0.4

48

Silica
(SiO,)

5.5

6.8

Alu-
mi-
num

(Al)

Iron

(Fe)

__
_

. 00

Man-
ga-
nese

(Mn)

_

.02

cium

(Ca)

66

OC

62

Mag-
ne-

sium

(Mg)

9.6

12
10

Sodium
(Na)

28

143

45
33

Po-
tas-
sium

(K)

4.4

3.5

Bi-
car-

bonate

mccg

234

159

Car-
bon-
ate

(CO,)

0

0

Sulfate
(SOJ

22

22

66

Chloride
(Cl)

44

73

32

55

Fluo-
ride
(F)

0.2

3

3
. 5

Ni-
trate

(NO,)

0.4

1.3

Boron

(B)

0.12
13

. 13

Dissolved
solids
(residue
at 180°C)

316
323

722

323

Hardness
as CaCO,
Cal-
cium,
mag-
nesium
204
227

236
196

Non-
car-

bon -
ate
12

66

Sodium
ad-
sorp-
tion
ratio

0.9

1.0

Specific
conduct-

ance

(micro-
mhos at
25°C)
520

230

520

pH

8.0

7.4

Col-

or

ARKANSAS RIVER BASIN Continued

7-1705. VERDIGRIS RIVER AT INDEPENDENCE, KANS.

LOCATION. At gaging station at bridge on U.S. Highway 160, 1 (
and at mile 194.3.
DRAINAGE AREA. 2,892 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964. Water temperatures: October 1961 t
EXTREMES, 1963-64. Dissolved solids:

sed) mile east of Independence, Montgomery County, 3.6 miles dc Elk River,

September 1964.
Maximum, 563 ppm Jan. 1-13; minimum, 222 ppm Sept. 8. Hardness: Maximum, 300 ppm Jan. 1-13; minimum, 132 ppm Sept. 8.
Specific conductance: Maximum daily, 972 micromhos Jan. 8; minimum daily, 350 micromhos Sept. 8.
Water temperatures: Maximum, 94°F Aug. 4.
EXTREMES, 1961-64. Dissolved solids: Maximum, 563 ppm Jan. 1-13, 1964; minimum, 146 ppm Oct. 31, 1961.
Hardness: Maximum, 300 ppm Jan. 1-13, 1964; minimum, 108 ppm Oct. 31, 1961.
Specific conductance: Maximum daily, 972 micromhos Jan. 8, 1964; minimum daily, 168 micromhos Nov. 4, 1961.
Water temperatures: Maximum, 94°F July 6, 7, 1963, Aug. 4, 1964; minimum, freezing point on several days in 1963.
REMARKS. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). Chemical analyses by Kansas State Department of Health, Topeka, Kans. Daily samples for chemical analysis composited by discharge. Records of specific conductance of daily samples available in Project Office at Topeka, Kans. Additional samples were collected for more comprehensive definition of water quality at this station.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
at
collection

Oct. 1-31, 1963...

Jan. 1-13, 1964...

May 11-29. ....

Mean

discharge
(eta)

28.4
25.3
14.5
20.0
20.6

19.3
17.6
20.4
22.9
32.8

333
47.6
204
153
95.8

48.8
145
86.7
110

Silica

(sicg

Iron

(Fe)

Cal-
cium

(Ca)

78
78
80
88
86

92
84
83
78
82

79
68
74
74
76

75
77
76
64

Mag-
ne-

sium

(Mg)

16
20
16
18
20

17
20
16
19
18

18
15
14
14
13

15
17
12
13

Sodium

(Na)

88
75
94
74
78

86
80
68
72
62

53
58
63
64
65

64
57
72
59

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

217
222
234
246
251

254
246
239
249
244

239
215
210
210
220

227
229
234
210

Car-
bon-

ate

(CO,)

Sulfate

(SO,)

76
70
81
58
60

69
67
49
44
41

32
42
51
50
58

56
46
49
41

Chloride

(Cl)

137
129
136
135
139

145
136
122
126
120

110
96
107
110
100

100
105
106
90

Fluo-
ride

(F)

Ni-

trate

(NOJ

0.4
.4

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

506
500
532
524
530

563
528
466
500
470

462
405
444
446
434

436
451
442
389

Tons

per
acre-

foot

0.69
.68
.72
.71
.72

. 77
.72
.63
.68
.64

.63
. 55
.60
.61
.59

. 59
.61
.60
.53

Tons

per

day

38.8
34.2
20.8
28.3
29.5

29.3
25.1
25.7
30.9
41.6

415
52.1
245
184
112

57.5
177
103
116

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

260
276
266
294
296

300
292
273
272
278

271
231
242
242
243

248
262
239
213

Non-
car-

bon-

ate

82
94
74
92
90

92
90
77
68
78

75
55
70
70
63

62
74
47
41

So-

dium
ad-

sorp-
tion
ratio

2.4
2.0
2.5
1.9
2.0

2.2
2.0
. 8
.9
.6

.4
. 7
. 8
.8
.8

.8
. 5
2.0
1.8

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

900
860
910
890
890

950
910
830
850
830

810
710
770
790
750

770
780
780
670

pH

ARKANSAS RIVER BASIN Continued

7-1710. VERDIGRIS RIVER NEAR LENAPAH, OKLA.

LOCATION. At gaging station, near right bank on downstream side of pier of county highway bridge, 2.8 miles east of Lenapah, Nowata County, 4.5 upstream from Cedar Creek, and at mile 144.6,
DRAINAGE AREA. 3,639 square miles.
RECORDS AVAILABLE . Chemical analyses: October 1951 to September 1964 (discontinued).
Water temperatures: October 1951 to September 1964 (discontinued).
EXTREMES, 1963-64. Dissolved solids: Maximum, 695 ppm Jan. 16-31; minimum, 132 ppm June 13-16.
Specific conductance: Maximum daily, 1,110 micromhos Jan. 20, 30, Feb. 1; minimum daily, 173 micromhos June 14.
Water temperatures: Maximum, 86°F Aug. 19; minimum, 33°F Dec. 30, 31, Jan. 14, 16, 17.
EXTREMES, 1951-64. Dissolved solids: Maximum, 937 ppm Feb. 25-28, 1956; minimum, 114 ppm July 14-20, 1959.
Hardness (1951-63): Maximum, 370 ppm Nov. 21-30, 1959; minimum, 48 ppm Oct. 3-4, 1955.
Specific conductance: Maximum daily, 1,620 micromhos Feb. 27, 1957; minimum daily, 126 micromhos Sept. 16, 1961.
Water temperatures: Maximum, 94°F July 22, Aug. 15, 1957; minimum, freezing point on many days during winter months. REMARKS. Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per mi Hi water year October 1963 to September 1964

Date
of
collection

Oct. 1-14, 1963...

Jan. 1-15, 1964...

June 1-5. ....

Mean

discharge
(eta)

17.1
28.1
21.8
36.1
22.8

20.3
22.2
17.0
36.4
16.7

22.3
22.8
795
6970
245

320
168
193
790
514

Silica

(SiOa)

6.1

8.8

_

Iron

(Fe)

Cal-

cium

(Ca)

72

79

Mag-
ne-

sium

(Mg)

22

16

Sodium

(Na)

127

118

Po-
tas-

sium

(K)

6.0

5.7

Bi-
car-

bon-

ate

(HCO,)

172

164

Car-
bon-
ate

(CO,)

4

12

SuUate

(SO.)

150

125

Chloride

(Cl)

134
133

102

134
156
163
153
155

155
160
160
36

51
62
89
56
58

Fluo-
ride

(F)

-

0.1

. 6

-

Ni-
trate

(NO,)

--

16

16

~

Bo-

ron

(B)

-

0.12

. 18

"

Dissolved solids
(residue at 180°C)

Parts

per
million

484
491
490
464
508

596
657
695
692
687

620
626
628
164
301

227
261
342
224
214

Tons

per
acre-

foot

0.66
.67
. 67
.63
.69

.81
.89
.95
.94
.93

.84
.85
. 85
.22
.41

.31
.35
.47
.30
. 29

Tons

per

day

22.4
37.3
28.8
45.2
31.3

32.7
39.4
31.9
68.0
31.0

37.3
38.5
1350
3090
199

196
118
178
478
297

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

268

262

Non-
car-

bon-

ate

120

107

So-

dium
ad-

sorp-
tion
ratio

3.4

3.2

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

789
806
793
753
832

961
1010
1100
1050
1050

1020
1020
1060
293
522

414
481
S15
430
369

PH

8.4

8.6

ARKANSAS RIVER BASIN Continued

7-1786. VERDIGRIS RIVER NEAR INOLA, OKLA.

LOCATION. At gaging station, near right bank on downstream side of pier of bridge on State Highway 33, 6 miles downstream from Dog Creek, 6 miles west of Inola, Rogers County, and at mile 48.8.
DRAINAGE AREA. 7,911 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1947 to September 1964.
Water temperatures: October 1950 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,400 ppm Oct. 10-14; minimum, 181 ppm Apr. 4-6.
Hardness: Maximum, 346 ppm Nov. 6-14; minimum, 68 ppm Apr. 4-6.
Specific conductance: Maximum daily, 2,480 micromhos Jan.,9, 10; minimum daily, 282 micromhos Apr. 6.
Water temperatures: Maximum, 94°F Aug. 6-10; minimum, 38°F Dec. 22, 24-26.
EXTREMES, 1947-64. Dissolved solids: Maximum, 3,060 ppm Sept. 21-24, 1956; minimum, 91 ppm June 22-30, July 1-2, 1948.
Hardness: Maximum, 580 ppm Sept. 21-24, 1956; minimum, 48 ppm Oct. 4, 1953.
Specific conductance: Maximum daily, 6,030 micromhos Sept. 22, 1956; minimum daily, 127 micromhos Oct. 1, 2, 1959.
Water temperatures (1950-64): Maximum, 95°F on several days in 1954 and 1963; minimum, freezing point on many days during winter months.
REMARKS. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-9, 1963....

Jan. 1-5, 1964....

Mar. 1-5. ....

Mean

discharge
(efs)

28.7
22.2
35.2
44.5
49.0

27.5
25.3
28.2
32.0
77.0

68.0
- 12.2
45.7
46.2
45.4

48.0
44.9
85.0
42.5
54.6

Silica

(S10a)

"

Iron

(Fe)

Cal-
cium

(Ca)

-

Mag-
ne-

sium

(Mg)

"

Sodium

(Na)

236
341
201
278
176

241
183
269
180
257

130
161
197
151
206

330
224
161
230
172

Po-
tas-

sium

(K)

--

Bl-

car-

bon-

ate

(HCO,)

158
160
156
158
130

156
188
184
178
178

148
148
152
144
12

28
80
148
152
162

Car-
bon-

ate

(COJ

0
0
0
16
0

20
0
0
0
0

0
0
0
0
24

10
16
6
0
0

Sulfate

(S0t)

46
54
54
52
56

55
59
57
56
54

52
54
64
51
56

53
61
61
73
79

Chloride

(Cl)

445
630
370
490
328

435
315
510
330
455

250
315
368
302
370

595
420
312
445
350

Fluo-

rlde

(P)

-

Ni-

trate

(NOJ

3.8

1.2

12

17

19

.9

8.7

Bo-

ron

(B)

"

Dissolved solids

(residue at 180"C)

Parts

per
million

1050
1400
902
1120
827

1060
849
1230
875
1100

704
874
980
801
853

1340
1100
867
1190
976

Tons

per
a re-
oot

.43
.90
.23
.52
. 12

.44
. 15
.67
. 19
. 50

.96
. 19
.33
.09
. 16

.82
.50
. 18
.62
. 33

Tons

per

day

81.4
83.9
85.7
135
109

78.7
58.0
93.7
75.6
229

129
99.6
121
99.9
105

174
133
199
137
144

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

294
334
268
298
244

308
272
346
278
298

244
272
304
268
182

216
262
284
336
335

Non-
car-

bon-

ate

164
203
140
142
137

147
118
195
132
152

123
151
179
150
132

176
170
153
211
202

So-

dium
ad-

sorp-
tion
ratio

6.0
8.1
5.3
7.0
4.9

6.0
4.8
6.3
4.7
6.5

3.6
4.2
4.9
4.0
6.6

9.8
6.0
4.2
5.5
4.1

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1760
2320
1510
1900
1360

1780
1420
2000
1460
1860

1190
1400
1560
1350
1390

2070
1640
1390
1790
1520

PH

8.2
8.2
8.2
8.6
7.8

8.6
8.2
8.2
8.0
8.2

7.8
7.8
8.0
7.6
9.6

9.1
9.0
8.3
8.2
8.2

ARKANSAS RIVER BASIN Continued

7-1800. COTTONWOOD RIVER NEAR MARION, KANS.

frc South Cottonwood Riv nile LOCATION. At gaging station at county highway bridge, 1.1 miles downstr
mile 123.9.
DRAINAGE AREA. 329 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm constituents unless otherwise noted. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, water year October 1963 to September 1964

'est of Marion, Marion County, and at

calculated from the determined

Date of
collection

Nov. 22, 1963

Feb. 20, 1964

Sect. 18.....

Discharge
(cfs)

21

15

36 0

Silica
(SiO,)

12

2.5

9 0

10

Alu-
mi-
num

(Al)

Iron

(Fe)

- -

.03

Man-
ga-

nese

(Mn)

-

.00

clum
(Ca)

334
331
291

67

Mag-
ne-

sium

(Mg)

78

65

35

13

Sodium
(Na)

44

52

10

Po-
tas-
sium
(K)

7.2

3.6

7 5

6.5

Bi-
car-

bonate

:HCOS)

405

307

307

339

93

Car-
bon-
ate

(CO,)

0

0

0

Sulfate
(SOJ

785

732

772
140

Chloride
(Cl)

67

67

78

17

ride
(F)

0.3

.5

.4

trate

(N03)

2.6

.4

3

6.6

Boron

(B)

0.34
32

32
. 19

Dissolved
solids

1530

1370

332

Hardness
as CaCOj
Cal-
cium,
mag-
nesium
1150

993

220

Non-
car-

bon -
ate
818

741

778

144

Sodium
ad-
sorp-
tion
ratio

0.6

. 7

. 7

.3

Specific
conduct-

ance

(micro-
mhos at
25"C)
1910

1830

480

pH

7.7

.9

4

3

?

Col-

or

A Calculated from determined constituents.

riodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

May 6, 1964. ....

Time

(24 hour)

1220

Water
tem-
per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

430

Sediment

concen-

tration

(ppm)

5870

Sediment
discharge
(tons per day)

6820

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

66

0.004

76

0.008 0.016

92

0.031 0.062

100

0.125 0.250 0.500 1.000 2.000

Method
of
analysis

VPWC

ARKANSAS RIVER BASIN Continued

7-1800.5. MUD CREEK NEAR MARION, KANS.

LOCATION. At county road bridge, 3.5 miles north of Marion, Marion County.
DRAINAGE AREA. 165 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964 (discontinued).
REMARKS.--Values reported for dissolved solids less than 1,000 ppm are residues at 180 C, and values more than 1,000 ppm ar constituents unless otherwise noted. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

alculated fi the determined

Chemical analy nillic ter year October 1963 to September 1964

Date of
collection

Oct. 2, 1963.

Dec 27
Jan. 23, 1964

Sept. 18. ....

Discharge
(cfs)

2.0

3.7

2.6

Silica
(SiO,)

13

7.0

10

Alu-
mi-
num

(Al)

Iron

(Fe)

_

-

.03

Man-
ga-
nese

(Mn)

_

- -

.00

cium

<Ca)

152
237
242
205

67

Mag-
ne-

sium

(Mg)

36
54

44
4 5

4 2

13

Sodium
(Na)

54

63

35

10

Po-
tas-
sium

(K)

6.3

3 3
2.0

6.5

Bi-
car-

bonate
iHCO,)

278

251
261

1 9 9
212

93

Car-
bon-
ate

(CO,)

0

0

0

Sulfate
(S04)

215

389

140

Chloride
(Cl)

131

154

17

ride
(F)

0.5

. 5

.4

trate

(NO,)

2.6

3 2
2.7

6.6

Boron
(B)

0.13
23

. 19

27

. 19

Dissolved
solids

756

1230
A996

870
332

Hardness
as CaCO3
Cal-
cium,
mag-
nesium
527

692

493

220

Non-
car-

bon -
ate
299

478

144

Sodium
ad-
sorp-
tion
ratio

1.0

1.0

.7
.8

1.6
.3

Specific
conduct-

ance

(micro -
mhos at
25°C)
1130

1560

430

1340
480

pH

.7

.8

.8

.4

.4
.3

Col-

or

A Calculated from determined constituents.

riodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Mav 6. 1964. ....

Time

(24 hour)

1330

Water
tem-
per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

E 98

Sediment
concen-

tration

(ppm)

862

Sediment

discharge
(tons per day)

228

Suspended sediment

Percent finer than size indicated, in millimeters

0.002
"")

0.004

73

0.00810.016

S3

0.031 0.062

100

0.125 0.250 0.500 1.000 2.000

Method
of
analysis

PWC

E Estimated.

ARKANSAS RIVER BASIN Continued

7-1822.5. COTTONWOOD RIVER NEAR PLYMOUTH, KANS.

LOCATION. At gaging station at county highway bridge, 0.8 mile downstream from Buckeye Creek, 1.5 miles southwest of Plymouth, Chase County, and at
mile 39.2.
DRAINAGE AREA. 1,740 square miles.
RECORDS AVAILABLE. Chemical analyses: September 1963 to September 1964.
REMARKS. Values reported for dissolved solids less than 1,000 ppm are residues at 180°C, and values more than 1,000 ppm are calculated from the determined constituents unless otherwise noted. Chemical analyses by Kansas State Department of Health, Topeka, Kans.

Chemical analyses, in parts per million, September 1963 to September 1964

Date of
collection

Sept. 27,

Jan. 20, 1964

Sept. 18.....

Discharge
(cfs)

48
122
76.0
47.0
A61

47.0
A55
498
2200
1225

95.0
A37
40.0
60.0

Silica

(SiO,)

7.0
9.5
10
10
5.0

2.5
1.0
10
12
9.0

9.0
9.0
6.8
6.8

Alu-
mi-

num

(Al)

Iron

(Fe)

0.00

.00

Man-

ga-

nese

(Mn)

0.00

.00

Cal-

cium

(Ca>

82
139
120
204
198

170
165
69
91
104

98
94
128
144

Mag-
ne-

sium

(Mg)

18
36
23
55
50

47
52
7.8
17
26

30
29
33
32

Sodium

(Na)

18
33
31
51
51

45
51
10
16
23

28
26
41
55

Po-
tas-

sium

(K)

5.3
8.0
6.6
5.1
3.8

3.4
4.7
2.7
8.1
3.0

3.8
4.7
5.0
6.2

Bi-
car-

bonate

(HCO,)

185
227
251
364
354

310
271
205
281
307

268
283
261
234

Car-
bon-

ate

(CO,)

0
0
24
0
0

0
0
0
0
0

0
0
0
0

Sulfate

(SOJ

124
297
152
414
389

341
384
42
67
116

140
114
225
302

Chloride

(Cl)

30
54
51
86
84

76
86
11
23
33

48
41
72
71

Fluo-

ride

(F)

0.4
.4
.4
.3
.3

.3
.4
.5
.4
.4

.4
.4
.4
.3

Ni-

trate

(NO,)

2.6
2.3
2.0
.4
1.8

.4
.5
4.9
12
.9

.2
.0
.9
3.0

Boron

(B)

0.15
. 18
.21
.23
.24

. 19
.23
.08
. 10
. 16

. 16
.21
.24
.27

Dissolved
solids

400
725
554
1010
980

852
928
270
394
478

500
468
672
734

Hardness

as CaCO,
Cal-

cium,
mag-
nesium

278
495
394
735
700

617
625
204
297
366

368
354
455
491

Non-
car-

bon-

ate

126
309
148
436
410

363
403
36
66
114

148
122
241
299

Sodium
ad-

sorp-
tion
ratio

0.5
.6
.7
.8
.8

.8
.9
.3
.4
.5

.6
.6
.8
1.1

Specific
conduct-

ance

(micro-
mhos at

25"C)

620
1030
850
1390
1390

1240
1290
430
630
770

810
720
1050
1070

pH

.8
.5
. 4
. 7
.9

.9
.5
.6
.3
.8

.5
.6
.5
.5

Col-

or

A Daily mean discharge.

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to Sej (Methods o{ analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; ____________________P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)____________

eptember 1964

Date o{ collection

May 6. 1964. ....

Time

(24 hour)

1445

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

1450

Sediment
concen-

tration

(ppm)

1700

Sediment

discharge
(tons per day)

6660

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

46

0.004

53

O.OOs! 0.016

72

0.031 0.062

TOO

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

VPWC

ARKANSAS RIVER BASIN--Contir

7-1835. NEOSHO RIVER NEAR PARSONS, KANS.

LOCATION. At gaging station at bridge on U.S. Highway 160, 0.4 mile upstream from Hickory Creek, 2.7 miles 8 miles east of Parsons, Labette County, and at mile 204.1.
DRAINAGE AREA. 4,905 square miles, includes that of Hickory Creek.
RECORDS AVAILABLE. Chemical analyses: October 1961 to September 1964.
Water temperatures: October 1963 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 600 ppm Jan. 1-31; minimum, 190 ppm June 1-27.
Hardness: Maximum, 422 ppm Jan. 1-31; minimum, 124 ppm June 1-27.
Specific conductance: Maximum daily, 1,090 micromhos Dec. 31, Jan. 3; minimum daily, 216 micromhos June 15.
REMARKS. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). mj.iu.iu Dissolved solids, 105 ppm June 14; hardness, 70 ppm June 14; specific conductance, 170 micromhos June 14. Chemical analyse Health, Topeka, Kans. Daily samples for chemical analysis composited by discharge. Records of specific conductance of dai^y Office at Topeka, Kans. Additional samples were collected for more comprehensive definition of water quality at this station

Chemical analyses, in parts per million, water year October 1963 to September 1964

earn from dam of Kansas Ordnance Plant,

Minimum observed

l samples

during water year
State Department

Date
of
collection

Jan. -31, 1964...

Apr. -23.........

June 1-27. ....

Mean

discharge
(cfs)

19
24
56.8
79.0
78.8

80.4
80.1
60.5
272
3278

961
4840

Silica

(SiOa)

5.5
6.5

Iron

(Fe)

Cal-

cium

(Ca)

70
78
74
81
98

118
106
104
74
72

52
40

Mag-
ne-

sium

(Mg)

16
17
21
16
27

31
41
42
17
21

9.8
5.8

Sodium

(Na)

17
25
24
36
39

45
40
37
35
23

19
26

Po-
tas-

sium

(K)

5.8
4.8

Bi-
car-

bon-

ate

(HCO,)

200
205
215
229
261

268
251
246
173
166

171
132

Car-
bon-

ate

(COJ

0
0

Suliate

(SO,)

68
99
90
93
145

199
159
163
126
116

45
47

Chloride

(Cl)

30
36
37
43
53

65
58
52
41
41

17
17

Fluo-
ride

(F)

0.3
.3

Ni-

trate

(NOJ

0.4
7.5

Bo-

ron

(B)

0.13
. 16

Dissolved solids
(residue at 180 r C)

Parts

per
million

333
394
369
392
500

600
522
528
370
380

245
19O

Tons

per
acre-

foot

0.45
.54
.50
.53
.68

.82
. 71
.72
.50
.52

. 33
. 26

Tons

per

day

17.1
25.5
56.6
83.6
106

130
113
86.3
272
3360

636
2480

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

240
264
271
268
356

422
367
364
254
266

170
124

Non-
car-

bon-

ate

76
96
95
80
142

202
161
162
112
130

TO
16

So-

dium
ad-

sorp-
tion
ratio

0.5
.7
.6
1.0
.9

1.0
.8
.8
1.0
.6

. 6
1 .O

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

540
610
580
620
780

920
840
830
610
610

TQO
300

pH

8.0
7.5

ARKANSAS RIVER BASIN Continued

7-1850. NEOSHO RIVER NEAR COMMERCE, OKLA.

LOCATION. At gaging station, on downstream side of left pier of highway bridge, 1.2 miles upstream from Mud Creek, 2.2 (revised) miles downstream from Four Mile Creek, 4.5 miles west of Commerce, Ottawa County, and at mile 153.4.
DRAINAGE AREA. 5,876 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1947 to September 1954, December 1959 to September 1960, October 1963 to August 1964.
Water temperatures: November 1947 to September 1954.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Che ical analyses, in parts per million, October 1963 to August 1964

Date
of
collection

May 27

Aue. 27. ....

Discharge
(cfs)

14.1
66.3
93.9
80.2
78.6

74.6
70.1
711
110
2970

229
184
76.8
37.6
126

Silica

(S102)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

15
32

41

38
32
3.2

15

21

19

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(HCO,)

168
216

102

118
180
76

152

166

164

Car-
bon-

ate

(CO,)

4
0

2

2
2
0

0

0

0

Sulfate

(SO,)

55
91
88
199
238

160
150
82
155
78

56
103

108
56

Chloride

(Cl)

20
46

63

55
52
14

20

14
93
16

Fluo-
ride

(F)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids

(residue at 180"C)

Parts

per
million

260
391

554

504
526
235

287

324

341

Tons

per
acre-

foot

0.35
.53

.75

.69
.72
.32

.39

.44

.46

Tons

per

day

9.90
70.0

120

102
99.6
451

2300

161

34.6

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

196
266

294

262
312
160

200

216

228

Non-
car-

bon-

ate

52
89

207

162
161
98

75

80

93

So-

dium
ad-

sorp-
tion
ratio

0.5
.9

1.0

1.0
.8
. 1

.5

.6

.5

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

438
620
482
741
1000

687
756
336
499
437

415
484
486
516
429

PH

8.4
8.2
8.4
8.2

8.3
8.3
7.4

7.6

7.9

7.7

ARKANSAS RIVER BASIN Continued

7-1864. CENTER CREEK NEAR CARTERVILLE, MO. Continued

Chemical analyses, in parts per million, August 1963 to September 1964 Continued

Date of collection

June 8........ ....

Sept. 11. ....

Dissolved

Parts
per
million

9.4
9.2

7.8

6.1

5.7

oxygen

Percent
satu-
ration

115

95

74

66

Orga

Phenols
as
Ct H.OH

nics

Detergent
(MBAS)

. 2

Organic
and
ammonia
nitrogen
(N)

22

27

9 3

12

Nitrite
(N0 2)

Cyanide
(CN)

Turbid-

ity

25

30

3

Tempera-
ture

74

Chemical analyses, in parts per million, August 1963 to September 1964 Continued

Date of collection

Aug . 6 ....

Discharge
(cfs)

26
23
33
90

Chromium

Total
Cr

0.03
.03
.06
.02

Cr&

Nick-

el

(Ni)

0.10
.01
.01
.02

Cop-
per

(Cu)

0.00
.00
.04
.00
.07

Lead

(Pb)

0.00
.00
.00
.00

Zinc

(Zn)

1.5
.92
.90
.06
1.3

Co-

balt

(Co)

0.00
.00
.00

Ar-
se-

nic

(As)

Sel-

en-

ium

(Se)

Cad-

mium

(Cd)

Bar-

ium

(Ba)

0.03
.02
.02
.04

Be-

ryl-
lium

(Be)

0.00
.00
.00

Rubi
dium
(Rb)

0.00
.00
.00

Vana-
dium
(V)

0.00
.01
.00

ARKANSAS RIVER BASIN Continued

7-1910. BIG CABIN CREEK NEAR BIG CABIN, OKLA.

LOCATION. At gaging station, on downstream side of right pier of highway bridge, 2.3 miles upstream from Mustang Creek, 5 miles southeast of Big Cabin, Craig County, and 8.5 miles upstream from mouth.
DRAINAGE AREA. 466 square miles.
RECORDS AVAILABLE. Chemical analyses: September 1951 to September 1955, January to August 1964.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Chemical analyses, in parts per million, January to August 1964

Date
of
collection

Feb. 24...........

Discharge
(cfs)

2.0
1.6
1.8
1.7
1.4

28.4
3.1
18.5
118
24.4

5.2
1.1

Silica

(SiOa)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

48

65

51

16
15
4.1

8.7
8.7

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(HCO,)

196

220

148

88
68
62

100
160

Car-
bon-

ate

(CO,)

6

0

0

0
0
0

0
0

Sulfate

(S04)

61
62
64
77
69

79
76
71
123
51

30
21

Chloride

(Cl)

48

58

48

11
9.4
5.0

8.5
10

Fluo-
ride

(F)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

336

396

322

209
262
141

149
183

Tons

per
acre-

foot

0.46

.54

.44

.28
.36
. 19

.20
.25

Tons

per
day

1.81

1.82

24.7

10.4
83.5
9.29

2.09
.54

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

196

200

160

126
164
102

106
148

Non-
car-

bon-
ate

25

20

39

54
108
51

24
17

So-

dium
ad-

sorp-
tion
ratio

1.5

2.0

1.8

.6
.5
.2

.4
.3

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

584
627
605
662
600

536
417
326
400
224

242
320

pH

8.5

7.5

7.9

.4
.4
.2

.6
.9

ARKANSAS RIVER BASIN Continued

7-1980. ILLINOIS RIVER NEAR GORE, OKLA.

LOCATION. At Tenkiller Ferry Dam, 4.3 miles upstream from gaging station and 6 miles northeast of Gore, Sequoyah County.
DRAINAGE AREA. 1,610 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1953 to September 1964.
Water temperatures: October 1953 to September 1963.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na). No appreciable inflow between sampling point and gaging station except during periods of heavy local runoff.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Discharge
(cfs)

24
21
144
19
13

18
18
A210
A94
18

12
1570
15
20
25

49
21
A495
21
25

36
25

Silica

(S10,)

Iron

(Fe)

Cal-

cium

(Ca)

34
34

Mag-
ne-

sium

(Mg)

1.7
2.7

Sodium

(Na)

1.4

2.5
21
4.6

5.8
20

4.1

5.5

12

7.4

14

5.8
12

6.4

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

108

108
146
104

108
108

108

108

108

108

108

102
114

114

Car-
bon-
ate

(CO,)

0

0
0
0

0
0

0

0

0

0

0

2
0

0

Sulfate

(SO.)

7.1

6.8
5.8
7.4

7.2
12

11

9.0

10

8.0

9.0

9.0
7.0

8.0

Chloride

(Cl)

3.7

5.7
9.2
9.0

11
28

6.5

10

20

12

25

10
17

11

Fluo-
ride

(F)

Ni-
trate

(NO,)

1.2

1.2
.0

.0

.0

. 1

.0

.0

. 1
.0

. 5

Bo-

ron

(B)

Dissolved solids
(residue at 180° C)

Parts

per
million

118

110
119
123

124
110

119

118

125

129

135

119
129

135

Tons

per
acre-

foot

0.16

. 15
. 16
. 17

. 17
. 15

. 16

. 16

. 17

. 18

. 18

. 16
. 18

. 18

Tons

per

day

7.65

42.8
6.10
4.32

6.03
5.35

30.2

3.82

5.06

8.71

7.65

6.75
8.71

9.11

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

98

98
92
96

100
96

100

100

100

98

102

98
98

104

Non-
car-

bon-

ate

9

9
0
11

11
7

11

11

11

9

13

11
4

10

So-

dium
ad-

sorp-
tion
ratio

0.1

. 1
1.0
.2

.3
.9

.2

.2

. 5

.3

.6

. 3
. 5

.3

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

195
240
195
204
205

211
209
208
205
202

212
196
245
225
226

270
263
212
218
236

226
223

pH

7.7

7.9
7.4
7.8

7.6
8.1

8.1

8.2

8.2

8.2

8.3
7.9

7.8

A Daily mean discharge.

ARKANSAS RIVER BASIN Continued

7-2233. CONCHAS CANAL BELOW CONCHAS DAM, N. MEX.

LOCATION. At gaging station on left bank, at upstream end of tunnel transition section, approximately 1 mile downstream from headgates in Conchas Dam, San Miguel County, and 22 miles north of Newkirk.
RECORDS AVAILABLE. Chemical analyses, April to September 1964.
REMARKS. No flow during most of each winter.

Chemical analyses, in parts per million, April to September 1964

Date
of
collection

Sept. 10.... ......

Mean

discharge
(cfs)

463
242
180
287
284

194
207
237
242
193

Silica

(SiOj)

12

14

Iron

(Fe)

-

0.01

.00

Cal-

cium

(Ca)

73

81

Mag-
ne-

sium

(Mg)

-

38

37

Sodium

(Na)

A69

72

77

Po-
tas-

sium

(K)

5.1

5.3

Bi-
car-

bon-

ate

(HCO,)

170
173
172

169

155
167
171
169
172

Car-
bon-

ate

(CO,)

0
0
0

0

0
0
0
0
0

Sulfate

(S04)

306

334

340

Chloride

(ci)

17
18
18
19
19

19
19
20
20
20

Fluo-

ride

(F)

0.5

.5

. 5

Ni-

trate

(NOJ

0.5

.4

.3

Bo-

ron

(B)

0.14

. 15

Dissolved solids

(calculated)

Parts

per
million

630

660

Tons

per
acre-

foot

86

90

Tons

per

day

330

343

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

334
340
340
316
346

338
344
352
352
356

Non-
car-

bon-

ate

195
198
199
205
207

211
207
212
213
215

So-

dium
ad-

sorp-
tion
ratio

1.6

1.7

1.8

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

890
916
924
904
947

939
960
969
971
977

pH

7.9
8.0
7.9
8.3
7.8

7.9
7.9
7.8
8.0
8.1

A Calculated Na plus K, reported as Na.

ARKANSAS RIVER BASIN -Continued

7-2265. UTE CREEK NEAR LOGAN, N. HEX.

LOCATION. At gaging station 0.2 mile downstream from Logan-Trigg Ranch road crossing, Harding County, 5.5 miles upstream from mouth, and 6 miles northwest of Logan, Quay County.
DRAINAGE AREA. 2,073 square miles, of which 617 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1950 to September 1953, April 1963 to September 1964.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Sept. 23..........

Mean

discharge
(cfs)

0.2
. 1
.2
.2
.2
.3

.2
.2
.3
.2
. 1
. 1

. 1
13.3
11.8
1.7
2.8
98.9

Silica

(SiOa)

35

18

Iron

(Fe)

~

~

0.00

.01

Cal-

cium

(Ca)

60

31

Mag-
ne-

slum

(Mg)

"

30

12

Sodium

(Na)

A 89

A107

105

70

Po-
tas-

sium

(K)

~

- -

5.5

4.2

Bi-
car-

bon-

ate

(HCO,)

263
260
273
298
219
408

264
269
247
227
294
301

306
426
461
185
200
202

Car-
bon-
ate

(cog

0
0
0
0
4
0

0
0
0
0
0
0

0
0
0
0
0
0

Sulfate

(S04)

-

154

180

167

-

91

Chloride

(Cl)

50
54
55
53
45
73

49
52
56
58
64
64

59
22
23
20
26
15

Fluo-
ride

(P)

- -

1.0

1.1

1.1

1.1

Ni-
trate

(Ncg

--

--

1.5

.5

1.5

.4

Bo-

ron

(B)

"

0.22

-

. 19

Dissolved solids

(calculated)

Parts

per
million

E

--

614

342

Tons

per
acre-

foot

E

::

-

0.84

.47

Tons

per
day

- -

-

0.13

91.3

Hardness

as CaCOj

Cal-

cium, Mag-

ne-

sium

235
249
266
286
220
396

257
276
253
239
286
295

274
192
198
112
130
128

Non-
car-

bon-

ate

20
36
42
42
34
62

40
56
50
53
45
48

23
0
0
0
0
0

So-

dium
ad-

sorp-
tion
ratio

-

2.4

2.7

2.8

2.7

Specific
con-

duct-

ance

micro-

mhos at
' 25°C)

808
846
869
899
727
1220

813
840
840
829
960
980

966
770
803
642
679
548

pH

8.1
7.9
8.0
8.1
8.3
7.9

8.1
8.0
7.9
7.7
8.2
7.9

8.2
7.8
7.8
8.0
8.0
7.9

A Calculated Na PJ.US K, reported as Na.
B Sample taken at upper gage.

ARKANSAS RIVER BASIN Continued

7-2271. REVUELTO CREEK NEAR LOGAN, N. HEX.

LOCATION. At bridge on State Highway 39, which is 0.2 mile downstream from gaging station, 2 miles upstream from mouth, and 2 miles southeast of Logan, Quay County.
DRAINAGE AREA. 786 square miles upstream from gaging station.
RECORDS AVAILABLE. Chemical analyses: July 1959 to September 1964.
Water temperatures: July 1959 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 2,240 ppm Jan. 24-27; minimum, 307 ppm Sept. 5.
Hardness: Maximum, 532 ppm Apr. 22; minimum, 32 ppm July 29, 30.
Specific conductance: Maximum daily, 3,950 micromhos Jan. 26; minimum daily, 485 micromhos Sept. 5.
Water temperatures: Maximum, 71°F Aug. 9; minimum, freezing point on several days during December to February.
EXTREMES, 1959-64. Dissolved solids: Maximum, 2,240 ppm Jan. 24-27, 1964; minimum, 250 ppm July 6, 9, 1960.
Hardness: Maximum, 532 ppm Apr. 22, 1964; minimum, 29 ppm Sept. 23, 1960.
Specific conductance: Maximum daily, 3,950 micromhos Jan. 26, 1964; minimum daily, 385 micromhos July 6, 1960.
Water temperatures: Maximum, 95°F June 18, 1960; minimum, freezing point on many days of each year.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples avail-able in district office at Albuquerque, N. Hex. No Flow Oct. 13-19, 26-31, Nov. 5 to Dec. 12, Jan. 5-15, 28-30, Feb. 2, 3, Mar. 2, 3, Mar. 11 to Apr. 18, Apr. 21, June 7 to July 17, July 22-28, July 31 to Aug. 5, Aug. 10-13, 16, 17, Aug. 22 to Sept. 4, Sept. 4, Sept. 6-13, 26-30.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-7, 1963....

DGC 27 31

Jan. 1-4, 1964....

Feb. 4-9..........

Mean

discharge
(cfs)

31.4
2.8
1.0
31.0
25.0
12.5

2.0
1.0
1.7
1.0
6.0
2.8

1.8
3.6
1.0
1.0
1.0
2.3

Silica

(810,)

13
14
17
15
14
14

15
13
14
12
12
13

12
13
12
12
13
15

Iron

(Fe)

Cal-

cium

(Ca)

89
76
80
65
26
65

70
59
73
81
69
85

82
85
78
78
80
84

Mag-
ne-

sium

(Mg)

31
31
54
27
4.9
27

33
30
38
48
40
48

45
51
51
44
46
54

Sodium

(Na)

148
257
356
286
169
296

391
242
350
398
290
376

332
470
676
401
402
526

Po-
tas-

sium

(K)

-

~

-

_

Bl-

car-

bon-

ate

(HCOJ

218
266
424
256
216
266

324
220
274
330
244
316

300
340
450
312
324
416

Car-
bon-

ate

(CO,)

0
0
0
0
0
0

0
0
0
0
8
0

0
0
0
0
0
0

Sulfate

(SO.)

418
408
374
402
222
496

370
428
494
552
548
664

610
635
438
556
566
482

Chloride

(Cl)

48
176
324
199
33
134

364
128
268
298
130
200

184
355
760
294
296
522

Fluo-

rlde

(F)

Ni-

trate

(NOJ

0.3
.5
. 5
. 5
1.1
.6

.5
. 1
.0
. 1
. 1
1.4

1.5
1.2
. 2
. 7
.9
.8

Bo-

ron

(B)

0.17
.23
. 22
. 23
. 21
.29

.27
.20
.29
.26
. 23
. 28

.25
.29
.31
.25
. 37
. 35

Dissolved solids

(calculated)

Parts

per
million

854
1090
1410
1120
576
1160

1400
1010
1370
1550
1220
1540

1410
1780
2240
1540
1560
1890

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

348
318
420
272
85
275

312
270
340
400
335
408

390
422
404
375
390
432

Non-
car-

bon-

ate

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

[micro-
mhos at

25'C)

1240
1690
2250
1760
899
1750

2280
1530
2120
2390
1810
2300

2120
2730
3700
2380
2400
3020

pH

7.4
8.0
8.0
8.0
8.1
8.1

8.0
8.2
7.6
8.1
8.4
8.1

8.2
8.2
8.1
8.2
8.1
8.1

ARKANSAS RIVER BASIN Continued

7-2271. REVUELTO CREEK NEAR LOGAN, N. MEX. Continued

Temperature (°F) of water, water year October 1963 to September 1964 Continued

Month

November .....
December .....

March ....

April ....
May...........

July...........

September .....

Day

1

57
46

34
33
34

56
52

-

2

58

42

35

52
56

3

57
44

36

48
61

4

55
44

33
32

50
63

5

55

32

53
61

6

53

32

43
64

7

55

32

52

8

53

- -

32

42

9

53

32

47

10

55

34

55

1 1

55

33

50

12

54

35

49

13

32

33

14

32

3S

15

32

33

16

32

33

17

32

35

18

32

34

19

33

33

20

32

33

47

21

32

33

22

32

33

45

23

3?

34

4ft

24

33

34

4R

25

34

34

4fc

b ?

26

33

13

4"

27

14

31

4S

28

33

3)

SO

29

35

34

M

30

33

- -

49

31

33

63

Aver-

age

- -

33

i6

7-2271.25. CANADIAN RIVER NEAR GLENRIO, N. MEX.

LOCATION. At gaging station 300 feet downstream from Martin Draw, 0.5 mile downstream from Rana Canyon, approximately 6 miles upstream from New Mexico-Texas State,line, and 13 miles north of Glenrio, Quay County.
RECORDS AVAILABLE. Chemical analyses: July to September 1964.

Chemical analyses, in parts per million, July to September 1964

Date
of
collection

Sept. 25..........

Mean

discharge
(cfs)

0.1
2.6
23.8
2.7

. 1
1.4
19.8
10.9

Silica

(SiOa)

16

18

14

Iron

(Fe)

0.00

.00

.00

Cal-
cium

(Ca)

95

73

48

Mag-
ne-

sium

(Mg)

45

87

21

Sodium

(Na)

1060

1100

570

Po-
tas-
sium

(K)

9.9

9.3

5.8

Bi-
car-

bon-

ate

(HCO,)

243
276
269
250

368
279
202
229

Car-
bon-
ate

(CO,)

0
0
0
0

0
0
8
0

SuUate

(SO.)

616

432

358

Chloride

(Cl)

1250
1200
1340
1020

1560
1300
650
1340

Fluo-
ride

(F)

0.8

.9

.7

Ni-
trate

(NO,)

1.6

1.0

4.3

Bo-

ron

(B)

0.57

.50

.38

Dissolved solids

(calculated)

Parts

per
million

3320

3460

1780

Tons

per
acre-

foot

- -

4.52

4.71

2.42

Tons

per

day

-

213

.93

95.2

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

384
384
420
400

538
440
208
386

Non-
car-

bon-
ate

185
158
199
195

236
211
29
198

So-
dium
ad-

sorp-
tion
ratio

23

21

17

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

4960
4670
5570
4140

5960
4900
3080
5020

pH

7.7
8.0
7.8
8.1

8.1
8.1
8.6
8.2

ARKANSAS RIVER HASIN Continued

7-2300. LITTLE RIVER BELOW HOG CREEK, NEAR NORMAN, OKLA.

LOCATION. At gaging station, on bank underneath and near left end of bridge on county road just downstream from Hog Creek, 0.8 mile upstream from Prairie Creek, 13 miles east of Norman, Cleveland County, and at mile 96.0.
DRAINAGE AREA. 257 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1953 to September 1964.
Water temperatures: October 1953 to September 1963.
Sediment records: May 1956 to September 1958.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Discharge
(cfs)

1.6
2.5
2.0
5.4
22.9

2.6
13.7
.5
1.3
48.6

931
2.3
3.4
2.3
2.2
. 2

Silica

(810,)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

151

88

31

27
631
38

5.8

51
34
103

Po-
tas-
sium

(K)

Bl-

car-

bon-

ate

(HCOJ

350

212
268
276

260
238
212
276

174

286
122
152

bon-

ate

(CO,)

6

12
8
0

8
4
0
4

0

0
0
0

Sulfate

(SO.)

95

53

25

27
372
42

29

45
35
68

Chloride

(Cl)

210
121
120
74
58

110
42
880
67
130

9.8
26
47
80
50
115

Fluo-
rlde

(F)

Ni-

trate

(Ncg

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

757

464
396
380

467
331
2140
399

189

415
236
464

Tons

per
acre-

foot

1.03

. 63
. 54
.52

.64
.45
2.91
. 54

.26

. 56
. 32
.63

Tons

per

day

3.27

2.51
5.77
23.5

3.28
12.2
2.89
1.40

475

2.58
1.40
.25

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

364

226
258
266

250
230
430
288

174

284
134
178

Non-
car-

bon-

ate

67

32
25
40

23
28
256
55

31

49
34
53

So-

dium
ad-

sorp-
tion
ratio

3.4

2.5

.8

. 8
13
1.0

.2

1.3
1.3
3.4

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

1300
840
808
699
615

815
527
3640
682
444

314
530
496
718
401
8X4

pH

8.4
8.6
8.6
8.5
8.1

8.5
8.3
8.1
8.3

7.8

8.2
7.6
8.t

ARKANSAS RIVER BASIN Continued

7-2420. NORTH CANADIAN RIVER NEAR WETUMKA, OKLA.

LOCATION. At gaging station, near left bank on downstream side of pier of bridge on U.S. Highway 75, 2.3 miles upstream from Wewoka Creek, 2.5 miles northeast of Wetumka, Hughes County, and at mile 84.4.
DRAINAGE AREA. 14,290 square miles, of which 4,899 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1953 to September 1964.
Water temperatures: October 1953 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 2,620 ppm Oct. 1-12; minimum, 157 ppm May 11-12.
Hardness: Maximum, 540 ppm Feb. 19-29; minimum, 76 ppm Aug. 18.
Specific conductance: Maximum daily, 4,860 micromhos Oct. 4; minimum daily, 262 micromhos May 11.
Water temperatures: Maximum, 99°F July 4, Aug. 6; minimum,.freezing point on several days during December and January.
EXTREMES, 1953-64. Dissolved solids (1953-57, 1961-64); Maximum, 25,800 ppm Feb. 8, 1955; minimum, 157 ppm May 11-12, 1964.
Hardness (1953-57, 1961-64): Maximum, 4,640 ppm Dec. 31, 1954; minimum, 76 ppm Aug. 18, 1964.
Specific conductance: Maximum daily, 37,100 micromhos Dec. 31, 1954; minimum daily, 262 micromhos May 11, 1964.
Water temperatures: Maximum, 100°F July 21, 1963; minimum, freezing point on many days during winter months.
REMARKS. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). Records of specific conductance of dally samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-12, 1963...

Jan. 1-13, 1964...

Feb. 1-4. ....

Mean

discharge
(cfs)

20.5
10.6
16.8
10.1
20.3

32.0
85.1
97
90.5
72

64
54.3
58.8
58.0
67.2

56.2
29.0
55.7
68.2

Silica

(S103)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

718
439
396
540
358

451
359
269
179
341

423
235
388
422
^55

385
496
394
373

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

146
192
180
176
192

198
188
128
128
164

164
194
220
224
216

136
148
98
218

Car-
bon-
ate

(ccg

0
0
0
6
0

0
2
0
0
4

0
0
0
0
0

18
16
14
8

Sulfate

(SO.)

134
116
150
167
130

147
128
69
64
132

113
89
141
142
152

156
188
158
148

Chloride

(Cl)

1300
770
650
920
600

790
620
490
325
600

825
410
690
770
340

670
890
700
65 O

Fluo-
ride

(F)

Ni-
trate

(NO,)

3.6

2.4

18

28

24

22

1H

Bo-

ron

(B)

0.22

. 18

.44

.26

.23

. 35

- R7

Dissolved solids
(residue at 180°C)

Parts

per
million

2620
1740
1520
1940
1480

1850
1550
1130
799
1530

1800
1000
1640
1860
1550

1720
2230
1710
173O

Tons

per
acre-

foot

3.56
2.37
2.07
2.64
2.01

2.52
2.11
1.54
1.09
2.08

2.45
1.36
2.23
2.53
2.11

2.34
3.03
2.33

) > as

Tons

per

day

145
49.8
69.0
52.9
81.1

160
356
296
195
297

311
147
260
291
281

261
175
257
31Q

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

535
410
360
454
362

448
398
284
240
406

495
320
475
500
465

430
520
400
4KB

Non-
car-

bon-

ate

415
252
212
300
204

286
240
179
135
265

360
161
295
316
288

288
372
296
973

So-
dium
ad-

sorp-
tion
ratio

14
9.4
9.1
11
8.2

9.3
7.8
6.9
5.0
7.4

8.3
5.7
7.7
8.2
7.2

8.1
9.5
8.6
7.5

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

4370
2880
2560
3310
2410

2980
2470
1910
1380
2380

2980
1720
2730
3000
2610

2660
3330
2660
9finn

pH

7.4
8.2
8.0
8» 3
8.2

8.0
8.3
8.2
7.9
8.3

8.1
7.7
8.1
8.2
8.1

8.9
8.8
9.1
8.5

ARKANSAS RIVER BASIN Continued

7-2435. DEEP FORK NEAR BEGGS, OKLA.

LOCATION. At gaging station, near left bank on downstream side of pier of highway bridge, 3 miles upstream from Adams Creek, 4 miles south of Beggs, Okmulgee County, 8 miles downstream from Flat Rock (Checkerboard) Creek, and at mile 85.0.
DRAINAGE AREA.~2,018 square miles.
RECORDS AVAILABLE. Chemical analyses: November 1951 to September 1964.
Water temperatures: November 1951 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,490 ppm Oct. 24-26; minimum, 130 ppm Apr. 4-8.
Hardness: Maximum, 460 ppm Oct. 24-26; minimum, 60 ppm May 11-15.
Specific conductance: Maximum daily, 3,100 micromhos July 31; minimum daily, 175 micromhos Apr. 6.
Water temperatures: Maximum, 95°F Aug. 5; minimum, 33°F Dec. 18-20, Jan. 12, 14.
EXTREMES, 1951-64. Dissolved solids: Maximum, 5,340 ppm Mar. 26, 1954, Jan. 11-17, 1955; minimum, 87 ppm Sept. 27, 1955.
Hardness: Maximum, 1,310 ppm July 21, 1955; minimum, 16 ppm Sept. 27, 1955.
Specific conductance: Maximum daily, 10,500 micromhos Jan. 12, 1955; minimum daily, 113 micromhos May 27, 1957.
Water temperatures: Maximum, 97°F July 28, Aug. 6, 16, 18, 1956; minimum, freezing point on many days during winter months.
REMARKS. Where no potassium (K) is reported, sodium (Na) and potassium (K) are calculated and reported as sodium (Na). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-17, 1963...

Jan. 1-7, 1964....

Mar. 21-31........

Mean

discharge
(cfs)

11.5
4.8
1.0
1.1
2.5

11.2
39
43.2
56.1
33.8

30.8
40.1
31.4
35.8
69.5

140
80.1
47.6
191
73.4

Silica

(S10a)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

135
182
248
323
272

190
308
194
197
183

202
238
206
227
230

186
146
174
130
174

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCOJ

192
220
168
188
188

194
140
198
206
198

200
166
136
122
206

230
208
184
132
194

Car-
bon-
ate

(cog

4
0
0
0
0

0
0
0
0
0

0
30
24
26
16

12
10
14
4
8

Sulfate

(SO,)

70
43
32
33
31

47
75
101
105
83

85
104
94
101
91

91
75
73
43
58

Chloride

(Cl)

225
360
520
690
535

348
615
332
318
302

348
400
328
370
400

300
235
292
230
315

Fluo-

rlde

(F)

Ni-

trate

(Ncg

0.8

.2

.2

3.9

.8

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

665
910
1200
1490
1200

830
1350
896
883
824

914
1150
960
1020
1090

916
729
795
598
828

Tons

per
acre-

foot

0.90
1.24
1.63
2.03
1.63

1.13
1.84
1.22
1.20
1.12

1.24
1.56
1.31
1.39
1.48

1.25
.99
1.08
.81
1.13

Tons

per

day

20.7
11.8
3.24
4.43
8.10

25.1
142
105
134
75.2

76.0
125
81.4
98.6
205

346
158
102
308
164

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

262
338
365
460
350

286
390
312
298
280

304
340
9,64
276
354

324
280
284
204
300

Non-
car-

bon-

ate

98
158
227
306
196

127
275
150
129
118

140
154
111
133
158

115
93
110
89
128

So-

dium
ad-

sorp-
tion
ratio

3.6
4.3
5.6
6.6
6.3

4.9
6.8
4.8
5.0
4.8

5.0
5.6
5.5
5.9
5.3

4.5
3.8
4.5
4.0
4.4

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

1120
1520
1900
2440
1960

1440
2210
1500
1470
1380

1520
1780
1450
1600
1720

1460
1210
1350
1040
1400

pH

8.3
8.2
8.1
8.2
8.2

7.7
8.0
8.1
7.7
8.1

8.1
9.0
Q.I
9.1
8.7

8.6
8.5
8.7
8.5
8.5

ARKANSAS RIVER BASIN--Continued

7-2450. CANADIAN RIVER NEAR WHITEFIELD, OKLA.

LOCATION. At gaging station, near right bank on downstream side of pier of bridge on State Highway 2, 0.8 mile north of Whitefield, Haskell County, 5.5 miles upstream from Kings Creek (corrected), 8.2 miles downstream from Eufaula Dam, and at mile 18.8.
DRAINAGE AREA. 47,576 square miles, of which 9,700 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: September 1944 to February 1945, September 1946 to September 1964.
Water temperatures: September 1944 to February 1945, September 1946 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,200 ppm Dec. 1-6, Feb. 1-6; minimum, 76 ppm May 12.
Hardness: Maximum, 388 ppm Feb. 1-6; minimum, 40 ppm May 12.
Specific conductance: Maximum daily, 2,150 micromhos Dec. 5; minimum daily, 95 micromhos May 12.
Water temperatures: Maximum, 82°F June 11, 22, July 5-8; minimum, freezing point on several days during December and January. EXTREMES, 1944-45, 1946-64. Dissolved solids: Maximum, 15,000 ppm Nov. 10-11, 1957; minimum, 76 ppm May 12, 1964.
Hardness: Maximum, 3,080 ppm Nov. 10, 1956; minimum, 18 ppm Feb. 17, 1948.
Specific conductance: Maximum daily, 22,900 micromhos Nov. 11, 1956; minimum daily, 71.7 micromhos Jan. 2, 1948.
Water temperatures: Maximum, 88°F Sept. 4, 1944; minimum, freezing point on many days during winter months.
REMARKS. Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Cbemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-15, 1963...

Jan. 1-13, 1964...

Apr. 1-3..........

Mean

discharge
(eta)

42.7
24.5
33.0
133
157

179
155
148
127
200

447
7.2
19.5
31.8
17.0

34.7
10.5
54.9

Silica

(Si02)

13

10

9.4

9.0

16

14

16

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)*

181
203
204
278
273

184
265
262
243
265

218
167
167
77
114

69
112
142

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

188
180
158
196
194

192
228
188
212
198

218
136
126
122
140

128
178
114

Car-
bon-

ate

(CO,)

4
0
0
2
6

0
0
0
8
14

10
0
4
6
4

0
4
2

Sulfate

(S0«)

46
48
40
89
94

73
89
100
102
98

96
43
44
29
32

32
37
37

Chloride

(Cl)

330
380
388
490
490

325
470
460
425
475

375
325
3.5
140
220

132
215
270

Fluo-
ride

(F)

0.3

.4

.4

.5

. 2

Ni-

trate

(NO,)

1.9

2.2

8.4

5.9

.9

Bo-

ron

(B)

0.46

.38

.23

.30

.05

Dissolved solids
(residue at 180° C)

Parts

per
million

835
886
886
1140
1200

866
1190
1110
1090
1200

960
772
723
411
564

399
595
610

Tons

per
acre-

foot

. 14
.20
.20
.55
.63

. 18
.62
.51
.48
.63

.31
.05
.98
.56
.77

.54
.81
.83

Tons

per

day

96.3
58.6
78.9
409
509

419
498
444
374
648

1160
15.0
38.1
35.3
25.9

37.4
16.9
90.4

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

282
292
274
346
364

292
384
354
364
388

336
252
238
170
216

176
250
208

Non-
car-

bon-

ate

121
144
144
182
195

134
197
200
177
202

140
140
128
60
94

71
97
111

So-
dium
ad-

sorp-
tion
ratio

4.7
5.2
5.4
6.5
6.2

4.7
5.9
6.1
5.5
5.9

5.2
4.6
4.7
2.6
3.4

2.3
3.1
4.3

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1420
1560
1550
1990
2000

1450
1960
1960
1900
2030

1640
1360
1300
719
994

705
1040
1080

PH

8.3
8.1
8.0
8.3
8.4

8.1
8.2
8.5
8.4
8.6

8.5
8.2
8 3
8.4
8 3

8.2
8.4
8 4

A Calculated Na plus K, reported as Na.

RED RIVER BASIN Continued
7-3150. LITTLE WICHITA RIVER NEAR HENRIETTA, TEX. Continued Temperature (°F) of water, water year October 1963 to September 1964

July...........
September .....

1 2 3 4 5 6 7

sn

8

°

9 10 11 12 13 14 15

Day
16

68

17

69

18

Tt

19

77

20

75

21

88
76

22

75

23

73

24

73

25

72

26

73

27

69

28

65

29

67

30

69

31

Aver-
age

- -

RED RIVER BASIN Continued

LOCATION. At gaging station, near right end of dam on Washita Ri
north of Foss, and at mile 474.4.
DRAINAGE AREA. 1,496 square miles.
RECORDS AVAILABLE. Chemical analyses: Hay 1963 to September 1964.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

7-3243. FOSS RESERVOIR NEAR FOSS, OKLA.

, 700 feet upstream from Oak Creek, 3.5 miles west of Stafford, Custer County, 6 miles

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Lake
content

(acre-
feet)

75610
74640
74050
73670
75220

74440
74640
76000
75220
71000
69870

Silica

(SiO,)

Iron

(Fe)

Cal-

cium

(Ca)

190
192

Mag-
ne-

sium

(Mg)

104
105

Sodium

(Na)

65
62
45
34
62

59
66
65
57
77
39

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCOJ

166
168
172
168
172

176
152
184
180
152
152

Car-
bon-

ate

(ccg

0
0
0
2
0

0
0
0
2
0
0

Sulfate

<SO«)

825
825
795
830
815

840
845
840
830
875
865

Chloride

(Cl)

33
34
34
33
32

34
34
35
34
36
35

Fluo-
ride

(F)

0.4
.4
.4

. 3
. 3
. 3
.4
.3
.2

Ni-
trate

(NOJ

0.0
.4
.6

. 6
. 0
. 1
.0
.0
.0

Bo-

ron

(B)

0.48
.31
.31

. 31
. 30
. 30
.30
.36
.34

Dissolved solids
(residue at 180°C)

Parts

per
million

A1300
A1300
1450
1690
1460

1470
1450
1470
1470
1520
1500

Tons

per
acre-

foot

1.77
1.77
1.97
2.30
1.99

2.00
1.97
2.00
2.00
2.07
2.04

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

900
910
920
980
900

940
910
935
940
870
990

Non-
car-

bon-

ate

764
772
779
839
759

796
785
784
789
745
865

So-

dium
ad-

sorp-
tion
ratio

0.9
.9
. 6
. 5
.9

. 8
1.0
.9
.8
1.1
. 5

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1650
1680
1690
1710
1700

1700
1710
1720
1730
1800
1780

pH

8.2
8.1
8.1
8.3
8.1

7.9
8.2
8.2
8.3
7.8
8.0

A Calculated from determined constituents.

RED RIVER BASIN Continued

7-3255. WASHITA RIVER AT CARNEGIE, OKLA.

LOCATION. At gaging station, on downstream side of right pier of bridge on State Highway 9, 1,300 feet upstream from Running Creek, 2.7 miles east of Carnegie, Caddo County, and at mile 353.9.
DRAINAGE AREA. 3,129 square miles, includes that of Running Creek.
RECORDS AVAILABLE. Chemical analyses: October 1953 to September 1964.
Water temperatures: October 1953 to September 1964.
Sediment records: Hay 1947 to September 1950.
EXTREMES, 1963-64. Dissolved solids: Maximum, 2,380 ppm Aug. 5; minimum, 225 ppm Sept. 28.
Hardness: Maximum, 1,310 ppm Aug. 5; minimum, 136 ppm Sept. 28.
Specific conductance: Maximum daily, 2,870 micromhos Aug. 5; minimum daily, 330 micro-ihos Sept. 28.
Water temperatures: Maximum, 85°F July 19; minimum, freezing point on several days during December and January.
EXTREMES, 1953-64. Dissolved solids: Maximum, 2,460 ppm May 9-10, 1956; minimum, 163 ppm Sept. 21, 1957.
Hardness: Maximum, 1,480 ppm May 9-10, 1956; minimum, 120 ppm Sept. 21, 1957.
Specific conductance: Maximum daily, 3,530 micromhos Aug. 26, 1954; minimum daily, 222 micromhos Sept. 21, 1957.
Water temperatures: Maximum, 90°F July 14, 30, 31, 1955, July 5, 1956; minimum, freezing point on many days during winter months.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla. No flow July 20 to Aug. 2, Aug. 13.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
at
collection

Oct. 1-15, 1963...

Jan. 1-16, 1964...

Feb. 13-29........

Mean

discharge
(cfs)

27.3
51.9
98
104
60.2

32.0
29.0
37.6
46
35.5

31.8
35.5
41.4
46.1
76.6

382
364
97.2
59.2

Silica

(810,)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

114
164
78
25
48

44
68
106
57
81

108
99
97
118
104

75
28
44
90

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

152
130
182
156
142

178
104
92
138
208

124
114
86
94
74

146
132
108
92

Car-
bon-

ate

(cog

0
0
4
4
0

4
0
0
4
0

0
0
0
0
0

8
2
4
0

Sulfate

(S0«)

800
880
935
675
312

450
550
910
625
790

930
995
1000
1000
900

460
340
640
950

Chloride

(Cl)

149
194
78
34
50

56
82
155
81
108

125
118
113
113
105

93
40
46
100

Fluo-

rlde

(F)

Ni-

trate

(NO,)

Bo-

ron

(B)

0.26

.62

. 70

.44

.05

Dissolved solids
(residue at 180°C)

Parts

per
million

1560
1780
1740
1250
692

968
1100
1760
1240
1610

1780
1850
1760
1810
1610

10^0
726
1180
1730

Tons

per
acre-

foot

2.12
2.42
2.37
1.70
.94

1.32
1.50
2.39
1.69
2.19

2.42
2.52
2.39
2.46
2.19

1.40
.99
1.60
2.35

Tons

per

day

115
249
460
351
112

83.6
86.1
179
154
154

153
177
197
225
333

1060
714
310
277

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

920
940
1070
830
408

605
625
1010
760
970

1010
1080
1060
1020
920

530
460
730
1010

Non-
car-

bon-

ate

795
833
914
695
292

452
540
935
640
799

908
987
989
943
859

il"

348
635
935

So-

dium
ad-

sorp-
tion
ratio

1.6
2.3
1.0
.4
1.0

.8
1.2
1.5
.9
1.1

1.5
1.3
1.3
1.6
1.5

1.4
. 6
. 7
1.2

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1930
2170
1940
1440
931

1220
1350
2080
1520
1880

2070
2100
2030
2080
1880

13SO
959
1420
1970

pH

8.1
8.1
8.3
8.3
8.1

8.3
8.0
8.1
8.4
8.1

7.8
8.1
8.1
8.0
8.1

3.5
8.4
8.3
8.2

RED RIVER BASIN Continued

7-3295. RUSH CREEK NEAR MAYSVILLE, OKLA.

LOCATION. At gaging station, near right bank on downstream side of pier of bridge on State Highway 74, 2.8 miles downstream from Panther Creek, 5.3 miles south of Maysville, Garvin County, and at mile 14.2.
DRAINAGE AREA. 206 square miles.
RECORDS AVAILABLE. Chemical analyses: December 1953 to September 1955, October 1957 to August 1959, October 1962 to September 1964.
Water temperatures: October 1954 to September 1955.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Discharge
(cfs)

10.5
10.4
8.9
23.7
9.5

224
33
37.4
624

Silica

(S10,)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(KB)

Sodium

(Na)

178

176
87

26

60
68

Po-
tas-

sium

(K)

Bl-

car-

bon-

ate

(HCO,)

292
232
234
264

230

218
264

Car-
bon-
ate

(CO,)

0
0
4
0

0

0
0

SuUate

(S0«)

210

210
132

75

105
27

Chloride

(CD

358
358
352
150
410

39
92
110
150

Fluo-
rlde

(F)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(residue at 180° C)

Parts

per
million

1330
1210
1250
669

369

539
535

Tons

per
acre-

foot

1.81
1.65
1.70
.91

.50

.73
.73

Tons

per

day

37.7
34.0
30.0
42.8

223

54.4
901

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

575
555
530
376

266

312
308

Non-
car-

bon-

ate

335
365
331
159

77

133
91

So-
dium
ad-

sorp-
tion
ratio

3.2

3.3
2.0

. 7

1.5
1.7

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

1870
1780
1800
1060
2010

610
783
873
906

PH

8.0
8.2
8.3

7.8

7.9
7.6

RED RIVER BASIN Continued

7-3310. WASHITA RIVER NEAR DURWOOD, OKLA.

side of pier of bridge on State Highway 18, 1.3 miles downstream from Caddo Creek, 4 miles north LOCATION. At gaging station, near left bank on downstre of Durwood, Carter County, and at mile 63.4.
DRAINAGE AREA. 7,202 square miles.
RECORDS AVAILABLE. Chemical analyses: May 1944 to September 1964.
Water temperatures: April 1947 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,440 ppm May 1-3; minimum, 190 ppm Aug. 18.
Hardness: Maximum, 805 ppm May 1-3; minimum, 124 ppm Aug. 18.
Specific conductance: Maximum daily, 2,120 micromhos Nov. 15; minimum daily, 328 micromhos Aug. 18.
Water temperatures: Maximum, 98°F July 8; minimum, freezing point on several days during December and January.
EXTREMES, 1944-64. Dissolved solids (1944-49, 1950-64): Maximum, 1,450 ppm July 23-28, 1963; minimum, 70 ppm Nov. 2, 1951.
Hardness (1944-49, 1950-64): Maximum, 805 ppm May 1-3, 1964; minimum, 41 ppm Nov. 2, 1951.
Specific conductance: Maximum daily, 2,120 micromhos Nov. 15, 1963; minimum daily, 94.9 micromhos Nov. 2, 1951.
Water temperatures (1947-64): Maximum, 98°F July 8, 1964; minimum, freezing point on many days during winter months.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na). Records of specific conductance of daily samples available in district office at Oklahoma City, Okla.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-7, 1963....

Jan. 1-10, 1964...

Mar. 1-10. ....

Mean

discharge
(cfs)

60.7
29.8
17.2
17.8
36.2

116
218
160
134
109

104
106
114
108
162

321
202
158
170

Silica

(S10,)

Iron

(Fe)

Cal-

cium

(Ca)

78
94
90
102

Mag-
ne-

sium

(Mg)

28
36
41
57

Sodium

(Na)

58
82
107
121
146

94
65
124
59
82

108
108
112
118
103

89
66
86
99

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(Hccg

132
160
184
184
168

174
178
96
190
214

196
200
132
180
198

164
156
178
196

Car-
bon-

ate

(ccg

0
0
0
0
0

2
10
2
10
8

12
2
4
10
14

8
4
8
12

Sulfate

(S04)

210
285
275
342
585

298
262
460
302
425

460
460
520
560
475

445
338
470
500

Chloride

(CD

77
96
135
174
178

133
79
218
90
125

145
148
140
155
155

115
98
112
130

Fluo-
rlde

(F)

Ni-

trate

(NOJ

Bo-

ron

(B)

0.28
. 32
. 38
. 37
. 34

. 26

. 47

. 34

. 52

Dissolved solids
(residue at 180°C)

Parta

per
million

571
727
794
963
1360

838
692
1430
744
1050

1120
1090
1130
1290
1200

1050
838
1080
116O

Tons

per
acre-

foot

0.78
. 99
1.08
1.31
1.85

1.14
. 94
1.94
1.01
1.43

1.52
1.48
1.54
1.75
1.63

1.43
1.14
1.47
1.58

Tons

per
day

93.6
58.5
36.9
46.3
133

262
407
618
269
309

315
312
348
376
525

910
457
461
532

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

308
384
395
490
680

440
405
600
485
630

630
620
610
710
675

580
480
620
670

Non-
car-

bon-

ate

200
253
244
339
542

294
242
518
312
441

449
453
495
546
489

432
345
461
489

So-

dium
ad-

sorp-
tion
ratio

1.4
1.8
2.3
2.4
2.4

2.0
1.4
2.2
1.2
1.4

1.9
1.9
2.0
1.9
1.7

1.6
1.3
1.5
1.7

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

871
1050
1180
1410
1800

1220
991
1630
1110
1420

1540
1520
1540
1700
1620

1400
1160
1440
1540

PH

8.2
8.2
8.2
8.2
8.2

8.3
8.6
8.3
8.5
8.4

8.6
8.3
8.4
8.5
8.6

8.4
8.3
8.5
8.6

RED RIVER BASIN--Continued

7-3350. CLEAR BOGGY CREEK NEAR CANEY, OKLA.

LOCATION. At gaging station, on downstream side of left pier of bridge on old U.S. Highways 69 and 75, 0.5 mile downstream from Caney Creek, 1.5 miles north of Caney, Atoka County, and at mile 24.1.
DRAINAGE AREA. 720 square miles.
RECORDS AVAILABLE.--Chemical analyses: October 1955 to September 1959, October 1961 to September 1964.
Water temperatures: October 1955 to September 1959.
REMARKS. Sodium (Na) and potassium (K) values are calculated and reported as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

June 10. ....

Discharge
(cfs)

8.6
9.9
9.2
10
11

8.6
20
17
14
11

11
52
666
90
31

1650
89
50
34
29

2670
326
68
50
28

Silica

(S10a)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(MB)

Sodium

(Na)

62
28

38

46

11

16

32

13

24

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCOj)

262
270

196

162

108

176

260

136

242

Car-
bon-

ate

(CO,)

4
0

4

4

0

0

0

0

0

Sulfate

(S0«)

23
27

21

35

21

20

33

15

31

Chloride

(Cl)

52
58
140
65
67

82
76
81
80
137

95
46
21
30
80

27
34
86
64
80

18
17
26
37
40

Fluo-
ride

(F)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(residue at 180°C)

Parts

per
million

480
379

322

366

192

233

445

159

328

Tons

per
acre-

foot

0.65
.52

.44

. 50

.26

.32

.61

. 22

.45

Tons

per

day

11.9
10.2

17.4

10.9

345

1040

34.8

1150

24.8

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

308
280

214

210

116

168

292

124

234

Non-
car-

bon-

ate

86
59

47

70

27

24

79

12

35

So-

dium
ad-

sorp-
tion
ratio

1.5
.7

1.1

1.4

.4

. 5

.8

. 5

.7

Specific
con-

duct-

ance

[micro-

jnhos at
25°C)

631
658
878
639
527

689
563
648
675
858

644
507
284
422
612

393
470
693
624
709

293
341
442
497
530

pH

8.4

8.4

8.4

7.6

8.1

8.1

8.0

8 ?.

RED RIVER BASIN Continued

7-3640.8. OUACHITA RIVER NEAR FELSENTHAL, ARK.

LOCATION. At. U.S. Engineers Lock No. 6, 3 miles south of Felsenthal, Union Coun DRAINAGE AREA. 10,787 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1949 to September 1964. Water temperatures: October 1949 to September 1964.
EXTREMES, 1963-64 Specific conductance: Maximum daily, 1,710 micromhos Oct. 20; Water temperatures: Maximum, 92°F July 25; minimum, freezing point Dec. 22. EXTREMES, 1949-64. Specif ic conductance: Maximum daily, 7,610 micromhos Oct. 7, Water temperatures: Maximum, 96°F June 9, 1953, Aug. 29, 1954; minimum, fre REMARKS. Records of specific conductance of daily samples available in distri near Arkansas-Louisiana State line for stages below bankfull, about 19 feet

ty.

num daily, 63 micromhos May 7.

, 1954; minimum daily, 44 micromhos May 19, 1958.
ing point Feb. 8, 12, 13, 1958, Dec. 22, 1963.
office at Little Rock, Ark. Records of discharg< re given for Ouachita Riv

Chemic tlyses, in parts per million, water year October 1963 to Septembe

Date
of
collection

Oct. 17-22,

Jan. 4-7, 1964.

Sept. 25-30. . . .

Mean

discharge
(cfs)

1040
1314
3462
1792
5835

1302
1372
1372
3085

Silica

(SiO,)

6.4
6.0
6.8
5.3
7.9

7.3
5.8
6.9
6.3
6.2
8.6
5.9

Alum-
inum

(Al)

Iron

(Fe)

0.04
.09
. 15
. 14

Man-

ga-

nese

(Mn)

0.04
.54
.00
.08
.00

.00
.00
.00
.00
.00
.00
.00

Cal-

cium

(Ca)

49
40
12
21
15

7.6
6.0
6.0
14
16
8.9
9.8

Mag-
ne-

sium

(Mg)

12
13
3.3
7.5
2.6

.9
1.3
1.0
4.8
3.8
2.3
2.3

Sodium

(Na)

243
212
34
84
39

13
11
5.5
46
55
21
25

Pot-
tas-

sium

(K)

3.5
3.1
2.0
1.8
2.0

2.0
2.0
2.0
1.7
2.0
1.0
1.2

bonate

(HC03)

16
2
24
4
21

16
15
19
14
4
26
18

Sulfate

(S04)

10
15
9.4
21
16

8.8
5.4
4.6
26
11
9.0
7.6

Chloride

(ci)

480
400
64
160
68

22
20
9.5
78
103
30
42

Fluo-

ride

(F)

0.1
.3
. 1
. 1
.3

.2
.2
.2
.3
.4
. 1
.0

Ni-
trate

(N03)

17
19
3.0
18
4.0

1.1
1.6
.9
11
24
6.0
6.4

Dissolved
solids

(residue
at 180°C)

894
802
172
356
187

94
88
72
238
242
111
128

Hardness
as CaCO3

Cal-

cium,
magne-
sium

172
154
44
84
48

22
20
19
54
56
32
34

Non-
carbon-
ate

158
152
24
80
31

10
8
4
43
52
10
19

Total
acid-

ity
as

H+1

Specific
conduct-

ance

(micro-
mhos at

25"C)

1630
1470
292
638
329

127
108
72
366
432
180
214

PH

6.3
5.0
7.2
5.2
7.3

7.2
6.9
7.1
7.0
6.5
7.7
7.5

Col-

or

5
10
30
10
27

48
80
70
25
16
10
11

RED RIVER BASIN--Continued

7-3641.5. BAYOU BARTHOLOMEW NEAR McGEHEE, ARK.

LOCATION. At gaging station near center of stream on downstream side of pier of bridge
17.5 miles downstream from Abies Creek.
DRAINAGE AREA. 592 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1959 to September 1964.
Water temperatures: October 1959 to September 1963.

on State Highway 4, 2.7 miles west of McGehee, Desha County, and

Chemical analys in parts per million, water year October 1963 to September 1964

Date
of
collection

Nov. 14, 1963..

Feb. 18, 1964..

Sept. 2. ....

Mean

discharge
(cfs)

44
532
290
768
2710

270
23
23
46

Silica

(Si02)

17
7.8
8.8
1.0
5.1

9.3
18
18
16

Alum-
inum

(Al)

Iron

(Fe)

0.77
.96

3.0
.83
.40
.20

Man-

ga-

nese

(Mn)

0.00
.00
.00
.00
.00

.00
.00
.40
.00

Cal-

cium

(Ca)

24
5.9
6.4
6.0
4.1

8.3
22
24
25

Mag-
ne-

sium

(Mg)

7.5
2.4
2.8
2.7
1.5

2.9
6.9
8.8
___ 8_'_4

Sodium

(Na)

13
3.6
5.2
3.9
2.1

3.3
13
16
18

Pot-
tas-
sium

(K)

3.1
2.9
2.6
4.4
3.4

3.8
1.8
3.2
3.4

Bicar-
bonate

(HC03)

128
30
24
26
21

42
110
129
135

Sulfate

(S04)

5.6
6.0
12
11
2.6

3.6
5.8
5.6
6.2

Chloride

(CD

10
5.0
6.5
4.5
2.1

3.3
14
13
17

Fluo-
ride

(F)

0.2
. 1
. 1
. 1
.2

.2
.3
.2
.0

Ni-
trate

(N03)

. 1
.2
.2
.9
.7

1.2
.2
. 3
. 1

Dissolved
solids

(residue
at 180°C)

144
55
66
60
32

60
138
153
167

Hardness

as CaCO3

Cal-

cium,
magne-
sium

91
24
2t
26
It

3;
8^

9(
97

Non-
carbon-

ate

0
0
8
4
0

0
0
0
0

Total
acid-

ity
as

H+'

Specific
conduct-

ance

(micro-
mhos at

25°C)

238
75
85
80
50

91
239
251
282

PH

7.7
7.5
6.7
6.6
6.7

6.7
7.4
7.6
7.7

Col-

or

5
15
18
25
12

160
10
5
4

Water samples were collected for chemical analys
Harrison, and Marion Counties in the 49 mile

RED RIVER BASIN--Continued

LITTLE CYPRESS CREEK BASE-FLOW INVESTIGATION IN TEXAS

es and discharge measurements were made at 62 sites on Little Cypress Creek and its tributaries in Texas in Upshur reach from the bridge on State Highway 155, near Gilmer to the bridge on Farm Road 134, southeast of Jefferson. Chemical analyses, in parts per million, January and June, 1964

Date

June 10

10

11

10

Jan. 2

June 10
11

Jan. 2

June 11
10

11

Sampling site

Little Cypress Creek at bridge
on State Highway 155,
3.0 miles northeast of
Gilmer .
Sugar Creek at bridge on Farm
Road 1403, 1.0 mile southeast
of Gilmer.
Tributary to Sugar Creek in
ditch along St. Louis South-
western Railway tracks at
Plttsburg Standard Pipe
Company, Gilmer.
Sugar Creek at bridge on State
Highway 154, 0.2 mile east
of Gilmer.
Little Cypress Creek at bridge
on Farm Road 555, 4.2 miles
east of Gilmer.
Do........................

Gum Creek at bridge on Farm
Road 1649, 3.0 miles north-
west of Diana.
Little Cypress Creek at bridge
on Farm Road 1650 below lake,
4.3 miles east of Gilmer.
Do........................

Barton Lake at bridge on Farm
Road 1650 below lake,
4.3 miles east of Gilmer.
Clear Creek at bridge on Farm
Road 1973, 7.0 miles south-
east of Gilmer.

Dis-

charge
(cfs)

B2.0

B.01

. 842

1.0

9.51

4.18

10.7

4.14
. 02

B.20

Silica
(Si02)

22

27

19

21

27

21

27

22

Cal-
cium
(Ca)

4.2

5.8

8.8

5.2

5.8

Mag-
ne-

sium
(Mg)

2.1

1.8

3.7

2.0

2.3

So-
dium
(Na)

8.3

125

17

34

14

23

Po-
tas-
sium
(K)

2.7

1.5

__

Bicar-
bonate
(HCC-3)

20

26

0

0

5

0
23

4

8
20

11

Sul
fate
(S04)

9.4

780

526

35

106

30

48

Chlo-
ride
(Cl)

8.7

11

21

21

11

13
13

12

11
17

IS

Fluo-
ride
(F)

0.1

0.0

. 3

0.0

. 3

Ni-
trate

(N03)

1.2

18

13

3.0

2.8

1.0

2.2

Dissolved
solids*

Parts
per
mil-
lion

C69

85

D980

D810

103

C190
99

93

C119
88

93

Tons
per
acre-

foot

0.09

2.64

. 26

2.69

. 16

Hardness
as CaC03

Ca,
Mg

19

24

22

24

22

37
30

21

24
24

24

Non-

bon-
ate

4

3

22

18

37
11

18

17
8

13

So-
dium
ad-

tion
ratio

0.8

12

1.6

2.4

1.3

2.0

Spe-
cific
conduct-
ance

mhos at
180°C)

84

113

2980

1770

142

323
134

130

179
118

12-S

pH

5.8

5.9

2.4

2.6

5.8

4.2
5 8

5.7

5.4
5.9

5.<5

RED RIVER BASIN Continued

LITTLE CYPRESS CREEK BASE-FLOW INVESTIGATION IN TEXAS Continued

Chemical analyses, in parts per million, January and June, 1964 Continued

Date

June 11

Jan. 2

June 10
11

11

11

10

11

10

11

11

Sampling site

Clear Creek at bridge on Farm
Road 1650, 3.5 miles south-
west of Diana.
Little Cypress Creek at bridge
on U.S Highway 259, 9.9 miles
south of Ore City.
Do........................

Reservoir on unnamed tributary
to Little Cypress Creek at
low-water crossing; 6.0 miles
northwest of Judson.
Unnamed tributary to Glade
Creek at bridge on Farm
Road 1650, 10.0 miles south
of Ore City.
Glade Creek at bridge on Farm
Road 1650, 4.5 miles north
of Judson.

Glade Creek at bridge on U.S.
Highway 259, 9.5 miles south
of Ore City.
Unnamed tributary to Glade
Creek at culvert on North
Ridge Road, 0.5 mile east of
U.S. Highway 259 junction,
4.0 miles north of Judson.
Caney Creek 0.1 mile above
mouth and 2.5 miles south of
Ashland.

Unnamed tributary to Little
Cypress Creek at culvert on
North Ridge Road, 3.5 miles
east of U.S. Highway 259
junction and 4.5 miles north-
east of Judson.
Panther Creek 0.1 mile above
mouth and 4.8 miles north-
east of Judson.

Dis-

charge
(cfs)

0.16

16.3

4.45

. 10

. 17

. 17

. 15

. 11

. 025

. 06

Silica
(Si02)

_

27

30

33

__

Cal-
cium
(Ca)

_

5.8

__

Mag-
ne-

sium
(Mg)

_

2.3

_

_

So-
dium
(Na)

_

16

23

_

__

Po-
tas-
sium
(K)

_

2.8

_

_

Bicar-
bonate
(HC03)

16

2

10

0

0

0

14

18

21

Sul-
fate

(S04)

_

35

31

_

_

Chlo-
ride
(Cl)

12

B17

21
7.1

332

1110

1200

5.6

8.4

7.2

7.5

Fluo-
ride
(F)

_

. 0

_

_

Ni
trate

(N03)

_

. 2

_

_

Dissolved
solids*

Parts
per
mil-
lion

81

107

57

C1980

48

70

61

50

Tons
per
acre-

foot

_

4.71

__

_

__

_

Hardness
as CaCO3

Ca,
Mg

24

24

28
16

81

184

187

16

21

19

12

Non-
car-

bon-
ate

11

22

17
8

81

184

187

5

6

2

4

So-
dium
ad-

sorp-
tion
ratio

_

1.4

_

__

_

__

_

Spe-
cific
conduct-
ance

(micro-
mhos at
180"C)

108

156

182
76

1390

3510

3730

64

84

81

66

pH

5.8

5.2

5.6
5 8

2.7

4.2

3.7

6.0

6.3

5.9

5.9

A Calculated from specific conductance. B Estimated. C Calculated from determined constituents. D Residue at 180°C.

RED RIVER BASIN Continued

LITTLE CYPRESS CREEK BASE-FLOW INVESTIGATION IN TEXAS Continued

Chemical analyses, in parts per million, January and June, 1964 Continued

Date

June 10

10

10

11

Jan. 3

June 11
12

12

12

Jan. 3

June 12
13

13

13

Sampling site

Little Cypress Creek at bridge
on county road, 4.2 miles
southeast of Ashland.
Unnamed tributary to Eagle
Creek at culvert on County
Road, 3.5 miles west of
Harleton.
Eagle Creek at bridge on
county road, 4.0 miles west
of Harleton.
Moccasin Creek at bridge on
Farm Road 449, 6.0 miles
south of Harleton.
Little Cypress Creek at bridge
on Farm Road 450, 4.0 miles
south of Harleton.
Do........................

Page Creek at bridge on Farm
Road 449, 5.5 miles south of
Harleton.
Gum Creek 0.5 mile below Farm
Road 449, 5.5 miles south of
Harleton.
Caney Creek at bridge on
county road, 5.5 miles south
of Harleton.
Little Cypress Creek 0.3 mile
below bridge on State High-
way 154, 4.9 miles southeast
of Harleton.
Do........................

Lawrence Creek at bridge on
State Highwav 154, 4.5 miles
northwest of Marshall.
Tributary to Lawrence Creek at
bridge on State Highway 154,
5.3 miles northwest of
Marshall.
Ray Creek 0.7 mile above mouth
and 7.0 miles north of
Marshall.

Dis-

charge
(cfs)

5.70

. 009

. 18

. 033

26.5

5.93
. 23

. 26

. 50

30.0

5.79
. 04

. 001

. 048

Silica
(SiOa)

22

27

28

~

Cal-
cium
(Ca)

8.5

14

__

13

Mag-
ne-

(MgT

3.6

3.7

3.8

So-
dium
(Na)

59

74

75

Po-
tas-
sium
(K)

3.0

__

Bicar-
bonate
(HC03)

16

14

9

24

3

14
20

10

16

3

15
15

5

27

Sul-
fate
(S04)

20

39

36

36

56

Chlo-
ride
(CD

91

9.4

5.1

12

120

63
7.2

5.1

6.7

121

56
7.1

8.1

5.1

Fluo-
ride
(F)

0.2

0.1

_

0.1

- -

Ni-
trate

(N03)

1.0

0.0

_

0.0

Dissolved
solids*

Parts
per
mil-
lion

C213

64

39

81

282

186
74

46

56

278

195
63

44

81

Tons
per
acre-

foot

0.29

20.2

__

22.5

Hardness
as CaCO3

Ca,
Mg

36

16

10

24

50

36
19

13

12

48

43
16

6

31

Non-
car-

bon-
ate

23

5

3

4

48

25
3

5

0

46

31
4

2

9

So-
dium
ad-
sorp-
tion
ratio

4.3

4.6

__

4.7

Spe-
cific
conduct-
ance

(micro-
mhos at
180°C)

392

85

52

108

506

338
98

62

74

500

355
84

59

108

pH

5.8

5.7

5.8

5.7

5.4

5.8
5.7

5.6

5.9

5.3

5.9
6.1

5 2

5.9

RED RIVER BASIN Continued

LITTLE CYPRESS CREEK BASE-FLOW INVESTIGATION IN TEXAS Continued

Chemical analyses, in parts per million, January and June, 1964 Continued

Date

June 12

12

Jan. 3

June 13
13

13

13

13

13

13

Jan. 3

June 12
12

12

Sampling site

Unnamed tributary to Little
Cypress Creek at bridge on
county road, 5.5 miles west
of Woodlawn.
Unnamed tributary to Little
Cypress Creek at bridge on
county road, 5.6 miles west
of Woodlawn.
Little Cypress Creek 0.1 mile
below bridge on county road
and 4.6 miles west of
Woodlawn.
Do........................
Holmes Lake 2.0 miles north of
Marshall.
Grays Creek at bridge on county
road, 2.5 miles north of
Marshall.
Tributary to Grays Creek at
bridge on county road,
3.0 miles southwest of
Woodlawn.
Tributary to Grays Creek at
bridge on U.S. Highway 59,
1.8 miles south of Woodlawn.
Tributary to Grays Creek on
private road, 2.1 miles
southwest of Woodlawn.
Grays Creek at bridge on Farm
Road 1997, 1.0 miles west of
Woodlawn.
Little Cypress Creek at bridge
on U.S. Highway 59, 3.5 miles
south of Jefferson.
Do........................

Unnamed tributary to Little
Cypress Creek at bridge on
county road, 0.5 mile east
of U.S. Highway 59, 4.0 miles
south of Jefferson.
Little Cypress Creek at bridge
bridge on Farm Road 134,
3.0 miles southeast of
Jefferson.

Dis-

charge
(cfs)

0.12

034

30.2

7.75
B.10

B.10

. 006

B.005

. 045

. 123

33.6

10.6
. 240

11.6

Silica
(Si02)

27

21

12

26

22

21

Cal-
cium
(Ca)

14

10

20

12

13

Mag-
ne-

sium
(Mg)

3.2

5.1

4.9

3.7

3.3

So-
dium
(Na)

71

62

92

52

51

Po-
tas-
sium
(K)

__

_

__

Bicar-
bonate
(HC03)

14

3

17
20

21

4

36

0

24

3

20
10

24

Sul-
fate
(S0 4)

38

33

281

11

41

22

18

Chlo-
ride
(CD

7.3

5.1

113

93
7.8

7.7

1.9

5.9

21200

970

159

83
4.6

82

Fluo-
ride
(F)

. 1

. 3

. 1

. 2

. 3

Ni-
trate

(N03)

. 0

. 2

. 0

. 5

1.8

Dissolved
solidsA

Parts
per
mil-
lion

78

46

267

C233
68

63

15

75

344

C205
37

C202

Tons
per
acre-

foot

21.8

. 32

31.2

. 28

. 27

Hardness
as CaCOg

Ca,
Mg

14

10

48

46
26

24

4

39

9560

450

70

45
10

46

Non-
car-

bon-
ate

3

0

46

32
10

7

1

10

9560

430

68

29
2

26

So-
dium
ad-

sorp-
tion
ratio

4.5

4.0

4.8

3.4

3.3

Spe-
cific
conduct-
ance

(micro-
mhos at
180°C)

104

61

484

428
91

84

20

100

E47300

3080

642

373
49

362

PH

6.2

6.2

6.0

6.0
6.3

6.5

5.8

6.3

4.5

6.0

5.4

5.8
6.5

6.3

A Calculated from specific conductance. B Estimated. C Calculated from determined constituents. E Density, 1.025 g/ml.

MISCELLANEOUS ANALYSES OF STREAMS IN LOWER MISSISSIPPI RIVER BASIN Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

Water
tem-

per-
ature
(°F)

Sam-

pling
point

Discharge
(cfs)

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.03l| 0.062 0.125 0.250 0.500] 1.000 2.000

Method
of

analysis

ARKANSAS RIVER BASIN

WHITEWOMAN CREEK NEAR MODOC, KANS.

E 300
E 900
E 1600

34300
158000
75100

28800
427000
336000

34
32
24

42
44
28

62
75
43

95
100
93

96

97

97

100

100 VPWC
VPWC
VPWC

7-1390. ARKANSAS RIVER AT GARDEN CITY, KANS.

1355
0815

82
72

12
3.3

64
54

2.1
. 5

7-1448.5. SOUTH FORK SOUTH FORK NINNESCAH RIVER NEAR PRATT, KANS.

0140
0400

33
472

30600
16600

2730
21200

49
50

56
57

77
80

97
99

98
99

99
100

100 VPWC
VPWC

7-1465.7. COLE CREEK NEAR DE GRAFF, KANS.

0800
1800
1830
0230
0300

254
254
654
254
654

3530
1400
3570
2600
6430

2420
960
6300
1780
11400

7-1567.5. CIMARRON RIVER NEAR LIBERAL, KANS.

Aug. 20.............

1335
1000
1245

73
72
83

16
19
15

95
60
54

4.1
3.1
2.2

MISCELLANEOUS ANALYSES OF STREAMS IN LOWER MISSISSIPPI RIVER BASIN Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 Continued (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 JO. 004 0.008 JO. 016 0.031J0.062 0.125 J0.250 0. 500 | 1.000 2.000

Method
of

analysis

MISSISSIPPI RIVER DELTA Continued

7-3804'.5. LAFOURCHE AT BELLEROSE, LA. Continued

1135
1010
1000

0930

177
274
562
105
88

7-3805. BAYOU LAFOURCHE AT

Dec. 18...........

1335
1630
1445
0945
0900

1225
1035
1020

0955

33
35
132
44
111

126
88
222
32
68

47 68 74 76 95 99 100 BNC

NAPOLEONVILLE, LA.

7-3808. BAYOU LAFOURCHE AT LABADIEVILLE, LA.

Dec. 4, 1963......

Jan. 28, 1964.....

1315
1055
1415
1005
0840

1300
1100
1040

23
138
42
54
129

148
119
126
56
72

MISCELLANEOUR ANALYSES OF STREAMS IN LOWER MISSISSIPPI RIVER BASIN Continued

Particle-size analyses of bed material, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

Sediment

concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062 0.125 0.250 0.500 1.000 2.000 4.000 8.000 16.00 32.00 64.00

Method
of

analysis

ARKANSAS RIVER BASIN

7-1380. ARKANSAS RIVER AT SYRACUSE, KANS.

Aug. 21.... ....

1420
0900

9
7

79
3.8

0
0

8
12

44
26

73
52

86
71

96
94

100
100

SV
SV

7-1390. ARKANSAS RIVER AT GARDEN CITY, KANS.

1355
0815

9
7

12
3.3 1

0
2

7
6

23
27

48
58

70
76

89
92

99
98

100
100

SV
SV

7-1567.5. CIMARRON RIVER NEAR LIBERAL, KANS.

1000
1245

9
10

19
15

0
0

1
1

29
30

84
84

97
98

99
100

100 SV
SV

WESTERN GULF OF MEXICO BASINS

PART 8. WESTERN GULF OF MEXICO BASINS

MERMENTAU RIVER BASIN

8-124. MERMENTAU RIVER AT LAKE ARTHUR, LA.

LOCATION. At bridge on State Highway 14, 0.5 mile Lake Arthur, Jefferson Davis
Parish.
RECORDS AVAILABLE. Chemical analyses: January 1949 to September 1964.
Water temperatures: October 1949 to September 1951, September 1959 to September 1964. EXTREMES, 1963-64. Specific conductance: Maximum daily, 734 micromhos Dec. 2; minimum daily, 68 micromhos Mar. 14-16.
Water temperatures: Maximum, 89°F May 22, July 8; minimum, 38°F Dec. 23.
EXTREMES, 1949-64. Specific conductance: Maximum daily, 6,330 micromhos June 30, 1952; minimum daily, 22 micromhos Sept. 12, 1957, Jan. 7, 1962.
Water temperatures (1959-64): Maximum, 90°F July 24, 1962; minimum, 33°F Jan. 12, 1962.

Specific conductance and chloride, in parts per million,
water year October 1963 to September 1964

Day

1
2
3
4
5

6
7
8
9
10

11
12
13
14
15

16
17
18
19
20

21
22
23
24
25

26
27
28
29
30
31

OCTOBER

Specific
conduct-
ance

(micro-
mhos at

25"C)

138
139
139
143
143

141
145
141
143
166

147
146
148
152
147

145
146
146
147
159

151
150
149
148
148

149
148
152
153
152
153

Chlo-

ride

(Cl)

16

_

17

18

_
__

__
_

_

__

18

_
_

NOVEMBER

Specific
conduct-
ance

(micro-
mhos at

25°C)

154
153
153
154
153

155
153
157
152
153

160
165
166
174
189

208
198
205
209
194

214
188
205
203
244

272
301
472
493
600

Chlo-
ride

(Cl)

_

~

_

20

21
__

__

26
30

_
_

__

~

__
_

__

54
_

_
_

155

DECEMBER

Specific
conduct-
ance

(micro -
mhos at

25°C)
610
734
613
571
472

336
239
239
189
190

249
249
245
246
247

303
197
187
161
183

173
173
163
165
164

154
153
189
190
187
187

Chlo-

ride

(Cl)

_

193

121

_

__
_
_
_

73
43

__

~

__

37

_

__
_
_
_

40

JANUARY

Specific
conduct-
ance

(micro-
mhos at

25'C)
184
178
177
180
179

135
131
277
228
170

155
156
154
124
126

102
109
121
136
126

124
118
98
100
111

103
91
91
93
93
81

Chlo-

ride

(Cl)

_

.

_
__

66
49

__

30
_

_

_
_

21

_

24

__

_

__
_
_
_
_

TRINITY RIVER BASIN

8-503. ELM FORK TRINITY RIVER NEAR MUENSTER, TEX.

Road 373, 2.5 miles south of Muenster, Cooke County, 2.5 miles downstream from Long Branch,

od-detention structures.

LOCATION. At gaging station (on left bank) at bridge on State Fa
and 6.5 miles upstream from Brushy Elm Creek.
DRAINAGE AREA. 46.0 square miles, of which 31.0 square miles is above fl
RECORDS AVAILABLE. Water temperatures: October 1956 to September 1958.
Sediment records: October 1956 to September 1964.
EXTREMES, 1963-64. Sediment concentratione: Maximum daily, 1,900 ppm Sept. 16; minimum daily, Sediment loads: Maximum daily, 1,800 tons Sept. 21; minimum daily, 0 tons on many days.
EXTREMES, 1956-64. Sediment concentrations: Maximum daily, 3,020 ppm May 2, 1958; minimum daily, no flow on Sediment loads: Maximum daily, 16,000 tons Hay 1, 1958; minimum daily, 0 tons on many days.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na).
Aug. 17, 19-21, 24, 25, 28 to Sept. 2.

flow on many days.

ny days.

No flow Oct. 1 to Nov. 18, Jan. 1-12, June 21 to Aug. 15,

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 21, 1964....

Sept. 25.........

Discharge
(cfe)

0.02
.6
100

Silica

(810,)

10
8.9
8.9

Iron

(Fe)

Cal-
cium

(Ca)

775
298
37

Mag-
ne-

sium

(Mg)

65
30
2.1

Sodium
(Na)

957
303
16

Po-
tas-
sium

(K)

Bi-
car-

bon-
ate

(HCO,)

190
234
112

Car-
bon-
ate

(CO,)

0
0
0

Sulfate

(SO.)

61
62
12

Chloride

(Cl)

2880
900
22

Fluo-
ride
(F)

0.2

Ni-
trate

(NO,)

0.8
.2

Bo-
ron

(B)

Dissolved solids

(calculated)

Parts

per
million

4840
1720
153

Tons
per
acre-

foot

6.58
2.34
.21

Tons

per

day

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

2200
867
101

Non-
car-

bon-
ate

2050
675
9

So-
dium
ad-
sorp-
tion
ratio

8.9
4.5
. 7

Specific
con-

duct-

ance

(micro-
mhos at
25°C)

8450
3230
275

pH

7.3
7.0
6.8

TRINITY RIVER BASIN Continued

8-503. ELM FORK TRINITY RIVER NEAR MUENSTER, TEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 16.. ....

Sent. 27............

Time

(24 hour)

0930
1800
1245
0815
0930

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

5.4
95
222
268
512

Sediment
concen-

tration

(ppm)

1300
17500
8600
9300
950

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

86
54
50
52
51

0.004

88
60
57
59
55

0.008

94
64
64
66
60

0.016

96
73
72
73
67

0.031

100
80
86
87
76

0.062

97
98
98
84

0.125

99
100
99
92

0.250

100

100
99

0.350 0.500

100

1.000

Method
of

analysis

BWC
SPWC
SPWC
SPWC
SBWC

WESTERN GULF OF MEXICO BASINS

TRINITY RIVER BASIN Continued

8-632. PIN OAK CREEK NEAR HUBBARD, TEX.

LOCATION. At gaging station (on right bank) at bridge on State Highway 171, 5.8 miles southeast of Hubbard, Hill County, and 9 miles upstream from Elm Creek,
DRAINAGE AREA. 17.6 square miles.
RECORDS AVAILABLE. Water temperatures: January 1957 to September 1960.
Sediment records: October 1956 to September 1960, September 1962 to September 1964. EXTREMES, 1963-64. Sediment concentrations: Maximum daily, 820 ppm Sept. 17; minimum daily, no flow on many days.
Sedimennt loads: Maximum daily, 64 tons Sept. 17; minimum daily, 0 tons on many days. EXTREMES, 1956-60, 1962-64. Sediment concentrations: Maximum daily, 5,160 ppm June 4, 1957; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 12,200 tons Apr. 20, 1957; minimum daily, 0 tons on many days.

Suspended sediment, water year October 1963 to September 1964 (Flow occurred only on days indicated)

Date

Total ....

Total. ....

Total. ....

Total discharge for year (cfs-ds Total load for year (tons) .....

Time

(24 hr)

iys)

Water
tem-

per-

ature (°F)

Discharge
(cfs)

0.1

0.1

5.3

5.3

14
25

39

Suspended sediment

Mean
concen-

tration

(ppm)

750

405

_

730
820

Discharge
(tons pe- day)

T

T

S 7

7

S 53
S 64

117

. . . . 44.4

.. .. 124

S Computed by subdividing day.
T Less than 0.50 ton.

TRINITY RIVER BASIN Continued

8-632. PIN OAK CREEK NEAR HUBBARD, TEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 17.......... ..

Time

(24 hour)

1215
0800

Water
tem-
per-
ature

(°F)

78
71

Sam-

pling
point

Discharge
(cfs)

8.7
36

Sediment
concen-

tration

(ppm)

1490
892

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

90
90

0.004

93
92

0.008

95
94

0.016

97
95

0.031

99
96

0.062

100
100

0.125 0.250 0.350 0.500 1.000

Method
of
analysis

SPWC
SPWC

TRINITY RIVER BASIN Continued

8-645. CHAMBERS CREEK NEAR CORSICANA, TEX.

LOCATION. At gaging station (on right bank) at bridge on State Highway 31, 500 feet upstream from St. Louis Southwestern Railway Lines bridge, 6,000 feet upstream from city of Corsicana diversion dam, 6 miles east of Corsicana, Navarro County, and 17 miles upstream from Richland Creek.
DRAINAGE AREA. 963 square miles.
RECORDS AVAILABLE. Chemical analyses: September 1961 to September 1964.
Water temperatures: September 1961 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,510 ppm Feb. 1; minimum, 223 ppm June 1-18.
Hardness: Maximum, 492 ppm Mar. 12; minimum, 116 ppm Sept. 25-30.
Specific conductance: Maximum daily, 2,350 micromhos Feb. 1; minimum daily, 306 micromhos May 2, Sept. 28.
Water temperatures: Maximum, 88°F June 23; minimum, 35°F Jan. 16.
EXTREMES, 1961-64. Dissolved solids: Maximum, 1,510 ppm Feb. 1, 1964; minimum, 114 ppm June 30, 1962.
Hardness: Maximum, 492 ppm Mar. 12, 1964; minimum, 66 ppm June 30, 1962.
Specific conductance: Maximum daily, 2,350 micromhos Feb. 1, 1964; minimum daily, 180 micromhos Sept. 8, 1961.
Water temperatures: Maximum, 91°F July 24, Aug. 9, 13, 1962; minimum, freezing point Jan. 11, 1962.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. No flow Oct. 1-31, Nov. 1-30, Dec. 1-31, Jan. 1-5, May 24-29, June 26, July 1-31, Aug. 1-31, Sept. 1-24. Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 6-15, 1964...

May 1-9...........

Mean

discharge
(cfs)

0.1
2.5
3.1
7.5
15.5

3.6
5.9
6.2
98.0
47.0

75.9
10.1
24.5
361
90.3

Silica

(S10a)

16
14
12
16
16

10
13
6.8
13
9.3

10
10
8.9
10
14

Iron

(Fe)

Cal-

cium

(Ca)

83
58
55
58
57

62
68
65
176
102

66
74
84
63
55

Mag-
ne-

sium

(Mg)

6.1
4.7
7.5
6.7
4.9

3.8
5.0
8.3
13
5.7

6.7
3.8
5.0
1.9
3.6

Sodium

(Na)

334
236
405
504
334

124
187
154
192
59

33
46
95
26
31

Po-
tas-

sium

(K)

6.3

5.0

Bi-
car-

bon-

ate

(HCO,)

546
396
624
616
460

296
380
312
198
182

148
190
284
156
168

Car-
bon-
ate

(CO,)

0
0
0
55
28

0
0
8
0
0

0
0
0
0
0

Sulfate

(S0«)

288
187
285
352
230

95
144
135
428
193

103
102
120
69
48

Chloride

(CD

162
110
170
212
151

66
93
82
212
38

19
34
55
14
18

Fluo-

ride

(F)

2.5

2.4

1.3

.6

.6

Ni-

trate

(NO,)

1.4
3.9
1.5
8.1
6.7

5.2
6.2
2.8
4.5
4.5

9.1
.0
. 8
2.8
4.8

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

1170
809
1240
1510
1060

512
703
616
1140
501

320
368
509
264
258

Tons

per
acre-

foot

1.59
1.10
1.69
2.05
1.44

.70
.96
.84
1.55
. 68

.44
.50
.69
.36
.35

Tons

per

day

0.32
5.46
10.4
30.6
44.4

4.98
11.2
10.3
302
63.6

65.6
10.0
33.7
257
62.9

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

232
164
168
172
162

170
190
196
492
278

192
200
230
165
152

Non-
car-

bon-

ate

0
0
0
0
0

0
0
0
330
129

70
44
0
37
14

So-

dium
ad-

sorp-
tion
ratio

9.5
8.0
14
17
11

4.1
5.9
4.8
3.8
1.5

1.0
1.4
2.7
.9
1.1

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1840
1300
1960
2350
1670

856
1150
985
1680
791

526
621
833
434
425

PH

7.9
7.9
7.9
8.6
8.5

7.8
7.4
8.4
8.0
7.8

7.8
8.2
7.6
7.4
7.4

BRAZOS RIVER BASIN Continued

8-814. SALT CROTON CREEK AT WEIR D, NEAR ASPERMONT, TEX.

LOCATION. About 500 feet upstream from Haystack Creek, 1,000 feet upstream from gaging station, and 20 miles northwest of Aspermont, Stonewall County. RECORDS AVAILABLE. Chemical analyses: October 1956 to September 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Values expressed in parts per million are multiplied by the density when computing loads.

Chemical analyses, in parts per million, water year October 1962 to September 1963

Date
of
collection

Sept. 25..........

Discharge
(cfs)

0.7
.6
.9
.5
. 9
.4
.7

.4
.4
.4
8.2
.2
.5
.9

Silica

(S103)

23
29
11

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

94800
47900
73700

85200
99500
99200

100000
99300
99300
5840
85600
99900
30100

Po-
tas-

sium

(K)

Bl-

ear -

bon-

ate

(HCO,)

Car-
bon-

ate

(CO,)

Sulfate

(SO.)

2980
3350
3470

3570
2730
2660

3040
2780
2680
1280
3800
2830
2130

Chloride

(Cl)

151000
76300
117000

135000
158000
158000

159000
158000
158000
9300
136000
158000
47800

Fluo-
rlde

(P)

Ni-

trate

(NO,)

Dissolved solids

Parts

per
million

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

9960
7020
8520

8950
9310
9890

9880
9890
9880
1760
9700
8730
4210

Non-
car-

bon-

ate

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

168000
126000
155000
164000
162000
169000
169000

168000
170000
167000
25600
162000
164000
88600

Den-

sity
(g/ral
at

20°C)

1.195
1.097
1.150

1.173
1.203
1.203

1.204
1.203
1.204
1.011
1.175
1.203
1.057

BRAZOS RIVER BASIN Continued

8-814.5. HAYSTACK CREEK NEAR ASPERMONT, TEX.

LOCATION. About 400 feet upstream from mouth and 20 miles northwest of Aspermont, Stonewall County. RECORDS AVAILABLE. Chemical analyses: October 1956 to September 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Values the density when computing loads.

expressed in parts per million should be multiplied by

Chemical analyses, in parts per million, water year Octobe 1963 to September 1964

Date
of
collection

Jan. 13, 1964. ....

July 10..........

Sept . 25 ....

Discharge
(cfs)

0.1
.3
.5
.2
.2
. 1

.2
. 1
B.I
.2
. 1
. 1
. 1

Silica

(310,)

23
8.3

50

Iron

(Pe)

0.00

Cal-
cium

(Ca)

1660

Mag-
ne-

sium

(Mg)

515

Sodium

(Na)

40800
33100
41900
35200
38200
41800

43200
55500
48300
36900
47200
54400
35600

Po-
tas-

sium

(K)

122

Bi-
car-

bon-
ate

(HCOJ

Sulfate

(S0«)

4570
4090
4300
4240
4590
4800

4750
5270
4260
4430
5880
5500
4150

Chloride

(Cl)

64600
52500
66000
55100
60400
66000

68100
87600
76900
58200
73700
85700
56400

Fluo-

rlde

(P)

1.2

Ni-

trate

(NO,)

Bo-

ron

(B)

4.9

Dissolved solids

(calculated)

Parts

per
million

96900

Tons

per
acre-

foot

141

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

7100
6280
6560
6260
6870
7150

7110
8360
7830
6380
7460
8300
6380

Non-
car-

bon-

ate

So-

dlum
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

113000
97700
114000
101000
109000
115000

112000
137000
126000
105000
122000
128000
99700

Den-

sity
(g/ml
at

20°C)

.084
.067
. 083
.071
.077
.084

.083
. 113
.099
.073
.093
. 108
.073

A Includes 0.9 ppm aluminum (Al), 0.03 ppm manganese (Hn), 0.00 ppm phosphate B Field estimate.

(PO4), 21 ppm bromide (Br), and 2.4 ppm iodide (I).

BRAZOS RIVER BASIN Continued

8-860.15. HUBBARD CREEK NEAR SEDWICK, TEX.

LOCATION. At gaging station at bridge on county road, 1.0 mile upst
of Albany.
DRAINAGE AREA. 127 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
Water temperatures: October 1963 to September 1964.
EXTREMES, 1963-64 . Dissolved solids: Maximum, 337 ppm Feb. 1-3; minimum, 118 ppro No
Hardness: Maximum, 186 ppm Feb. 1-3; minimum, 82 ppm Nov. 8-11, 19-20.
Specific conductance: Maximum daily, 811 micromhos Feb. 3; minimum daily, 174 micromhos Nov. 9. REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na) . Records district office at Austin, Tex. No flow Oct. 1-22, 26-31, Nov. 1-7, 12-18, 25-30, Dec. 1-31, Ja Sept. 15, Sept. 17, 18, 23-30.

from Reynolds Creek, 2.2 miles west of Sedwick, Shackelford County, and 9.2 miles south

8-11, 19-20.

_» specific conductance of daily samples avails]
1-29, Feb. 15 to June 11, June 13 to Aug. 21, Aug. 23

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 23-25, 1963..
Nov. 8-11, 19-20..

Jan. 30-31, 1964..

Feb. 4-14.........
June 12, Aug. 22..
Sept. 16, 19-22...

Weighted average

Time-weighted

Mean

discharge
(cfs)

11.0
34.4
2.0
.4
.2

20.1
. 1
1.1

A1.3

Silica

(SiO,)

10
7.7
6.4
7.1
8.7

9.5
6.8
12

8.7

8.9

n ?

Iron

(Fe)

Cal-

cium

(Ca)

38
30
34
54
60

55
46
24

42

43

Mag-
ne-

sium

(MB)

3-9
1.7
4.7
7.1
8.9

8.8
5.6
7.6

5.3

6.4

n 9

Sodium

(Na)

13
6.4
21
36
54

42
65
20

24

30

n a

Po-
tas-
sium

(K)

5.5
4.4

4.6

_

Bi-
car-

bon-

ate

(HCO,)

100
85
81
149
153

126
76
103

105

110

Car-
bon-

ate

(COJ

0
0
0
0
0

0
0
0

0

0

n

SuUate

(SO.)

19
8.8
13
13
15

24
21
8.8

17

16

n fi

Chloride

(Cl)

27
14
48
78
115

94
137
27

53

64

1 Q

Fluo-
ride

(F)

0.4
.0

.3
.2

. 2

_

Ni-
trate

(NOJ

4.2
2.5
1.8
1.2
.5

2.8
3.2
1.8

2.7

2.4

n i

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

170
118
169
274
337

298
322
152

207

226

Tons

per
acre-

foot

0.23
. 16
. 23
. 37
.46

.41
.44
.21

0.28

_

Tons

per

day

5.05
11.0
.91
.30
. 18

16.2
.09
.45

7.00

_

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

ill
82
104
164
186

173
138
91

127

132

Non-
car-

bon -

ate

29
12
38
42
60

70
76
7

41

43

So-

dium
ad-

sorp-
tion
ratio

0.5
.3
.9
1.2
1.7

1.4
2.4
.9

0.8

1.1

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

294
213
333
515
638

569
629
268

388

425

pH

7.2
6.6
6.4
7.8
7.8

7.3
6.6
7.1

6.8

6.9

A Mean discharge for 366 days; mean discharge for 36 days of actual flow, 13.2 cfs.

BRAZOS RIVER BASIN Continued

8-860.15. HUBBARD CREEK NEAR SEDWICK, TEX. Continued

Temperature (°F) of water, water year October 1963 to September 1964 (Many days of no flow)

November

July...........

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Day

16 17 18 19 20 21

7i

22 23 24 25 26 27 28 29 30 31

Aver-
age

BRAZOS RIVER BASIN Continued
8-861.2. SALT PRONG HUBBARD CREEK AT U.S. HIGHWAY 380, NEAR ALBANY, TEX. Continued Temperature (°F) of water, water year October 1963 to September 1964

April..........
June ....

July...........

1 2

66

3

70

4

64

5

64

6

68

7

61

8

64

9

68

10

65

11

70

12

68

13

71

14

'

15

Day
16

71

17

f,i

72

18

fj

75

19

73

20

74

21

77

22

74

23

*;

75

24

75

25

76

26 27

77

28

72

29

71

30 31

Aver-
age

71

BRAZOS RIVER BASIN Continued

8-862.1. SNAILUM CREEK NEAR ALBANY, TEX. Continued

Temperature (°F) of water, water year October 1963 to September 1964 (Many days of no flow)

January. ....
February. ......

July...........

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Day

16 17 18 19 20 21 22 23 24 25 26

<t5

27

t2

28

'(2

29

'(8

30

~

31

Aver-
age

45

BRAZOS RIVER BASIN Continued

8-863. BIG SANDY CREEK NEAR BRECKENRIDGE, TEX.

LOCATION.--At gaging station (on left bank) at bridge on Farm Road 576, 1.5 miles downstream from Battle Creek, 8.2 miles southwest of Breckenridge, Stephens County, and about 13 miles upstream from Hubbard Creek Reservoir.
DRAINAGE AREA. 298 square miles.
RECORDS AVAILABLE. Chemical analyses: February 1962 to September 1964.
Water temperatures: February 1962 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 11,200 ppm Apr. 5, 6, 10; minimum, 42 ppm Nov. 21.
Hardness: Maximum, 3,680 ppm Apr. 5, 6, 10; minimum, 28 ppm Nov. 21.
Specific conductance: Maximum daily, 17,200 micromhos Mar. 27; minimum daily, 59 micromhos Nov. 21.
EXTREMES, 1962-64. Dissolved solids: Maximum, 11,200 ppm Apr. 5, 6, 10, 1964; minimum, 42 ppm Nov. 21, 1963.
Hardness: Maximum, 3,680 ppm Apr. 5, 6, 10, 1964; minimum, 28 ppm Nov. 21, 1963.
Specific conductance: Maximum daily, 17,200 micromhos Mar. 27, 1964; minimum daily, 59 micromhos Nov. 21, 1963.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. Values expressed in parts per million should be multiplied by the density when computing loads. No flow Oct. 1-22, 30-31, Nov. 1-7, Jan. 12-17, 26-28, Feb. 21-29, Mar. 1, 3-8, Apr. 11-19, May 2-29, 31, June 1 to Aug. 14, Sept. 9-14.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 23, 1963..

Nov. 8-9, 19...

Dec. 8-31,
Jan. 1-11, 18-
25, 29. 1964.

Feb. 1-3... ....

Feb. 8-10......

Mean

discharge
(cfs)

11.0
181
9.4
.3
1176
4.8
323

39.0
9.4
1.4
. 7
.2
. 1

. 1
158
17.3
888
71.7
4.0

Sil-

ica

(SiO,)

8.9

8.5

10
10

11
LI
L4
9.3

11

9.3
LI
L2
LO
11

Iron

(Fe)

Cal-

cium

(Ca)

41

30

29

92

L80
48
52

Mag-,
ne-

sium

(Mg)

4.5

2.5

2.8

19

46
8.3
9.1

Stron-

tium

(Sr)

Sodium

(Na)

48

61
103

13

21

200

369
67
70
4.5
27

Po-
tas-

sium

(K)

5.1

"

Bi-
car-

bon-

ate

(HCOJ

77
118
84
107
32
92
92

26
80
100

94
140

184
85
86
64
84
119

Sulfate

(S04)

17
50
19
34
6.0
16
9.2

3.2
12
42
3 8
34
58

140
24
20
3.4
12

Chloride

(Cl)

106
5.0
128
210
3.2
45
17

1.1
35
188

130
400

810
142
160
4.4
60
352

Fluo-

ride

(F)

0.1

. 3

.3

.7
. 1

Ni-

trate

(NO,)

2.2

2.2

3.2

2.2

2.5

1.8
2.5
3.2
2.2
3.8

Dissolved solids
(calculated)

Parts

per
mil-

lion

271

130

42
152

852

1650
346
368

Tons

per
acre-

foot

0.37

. 18

.06
. 21

1.16

2.24
.47
.50

Tons

per

day

8.05

113

4.42
3.86

.23

.45
148
17.2

Hardness

as CaCO,

Cal-

cium,
mag-
ne-

sium

121
101
139
195
30
95
85

28
84
204
43
165
308

638
154
167
54
111
308

Non-
car-

bon-

ate

58
4
70
108
4
20
10

7
18
122
9
88
193

487
84
96
2
42
210

So-

dium
ad-

sorp-
tion
ratio

1.9

2.2
3.2

. 6

1.0

5.0

6.4
2.3
2.4
. 3

1.1

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

514
231
607
916
74
344
227

59
278
883
286
666
1610

2990
655
726
132
382
1430

PH

7.0
7.2
7.2
7.3
6.9
7.6
7.4

6.5
7.4
7.0
6.5
6.8
7.7

7.8
7.8
7.5
7.3
7.5
7.7

Den-

sity
(g/ml
at

20°C)

"

BRAZOS RIVER BASIN Continued

8-863. BIG SANDY CREEK NEAR BRECKENRIDGE, TEX. Continued

Temperature (°F) of water, water year October 1963 to September 1964 (Many days of no flow)

Month

November .....
December .....

June..........

July...........

September .....

Day

1

48

74

2

58

47

55

72

3

60

46

58

70

4

45

53

70

5

59

47

71

6

56

73

1

58

57

8

50

59

9

48

57

10

51

50

58

11

45

51

12

55

13

54

14 15 16

56

17

57

67

18

41

54

69

19

53
43

56

69

20

55
38

57

70
70

21

54
37

68
71

22

55
34

65
71

23

54

56

69
71

24

70
57

58

70
72

25

74
57

58

71
71

26

77
58

70
70

27

78

59

72

28

76

56

71
68

29

74

72
64

30

57

73
69

31

__

54

70

Aver-

age

__

Periodic determinations of suspended-sediment discharge and particle-size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aug. 22. ....

Time

(24 hour)

1000
1220

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

350
1630

Sediment
concen-

tration

(ppm)

9600
8800

Sediment

discharge
(tons per day)

9100
39000

Suspended sediment

Percent finer than sire indicated, in millimeters

0.002

49
39

0.004

62
51

0.008

69
57

0.016

77
64

0.031

88
79

0.062

94
87

0.125

97
95

0.250

99
99

0.350 0.500

100
100

1.000

Method
of

analysis

SPWC
SPWC

BRAZOS RIVER BASIN Continued

8-886. BRAZOS RIVER AT POSSUM KINGDOM DAM, NEAR GRAFORD, TEX.

LOCATION. Immediately below Possum Kingdom Dam, 2.6 miles upstream from Loving Creek, 11.3 miles southwest of Graford, Palo Pinto County, and 20 miles upstream from gaging station near Palo Pinto.
DRAINAGE AREA. 22,550 square miles, approximately, of which 9,240 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: January 1942 to September 1964.
Water temperatures: October 1949 to September 1955.
EXTREMES, 1963-64.--Dissolved solids: Maximum, 1,490 ppm Nov. 1-30; minimum, 1,350 ppm July 1-31.
Hardness: Maximum, 486 ppm June 1-30; minimum, 415 ppm July 1-31.
Specific conductance: Maximum daily, 2,820 micromhos Nov. 4; minimum daily, 2,160 micromhos Aug. 17.
EXTREMES, 1942-64. Dissolved solids: Maximum, 3,770 ppm Feb. 18-20, 1961; minimum, 331 ppm Apr. 26-30, May 1-10, 1957.
Hardness: Maximum, 928 ppm Feb. 18-20, 1961; minimum, 135 ppm Apr. 26-30, May 1-10, 1957.
Specific conductance: Maximum daily, 6,110 micromhos Feb. 20, 1961; minimum daily, 494 micromhos May 4, 1957.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. Records of discharge are given for gaging station near Palo Pinto. No appreciable inflow between dam and gaging station except during periods of heavy local rains.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31, 1963...

Jan. 1-31, 1964...

July 1-31.........

Sept. 1-30........

Weighted average

Time-weighted

Tons per day. . . .

Mean

discharge
(cfs)

56.3
63.1
75.8
159
141
122

77.6
56.2
385
803
518
303

231

-

Silica

(S10a)

12
12
10
11
11
11

14
10
13
11
11
11

11

11

7.1

Iron

(Fe)

Cal-
cium

(Ca)

141
137
131
130
129
128

124
130
132
125
128
130

129

130

80

Mag-
ne-

sium

(Mg)

26
27
23
26
25
29

29
28
38
25
26
25

27

27

17

Sodium

(Na)

341
358
343
323
328
320

317
328
300
313
333
346

323

329

201

Po-
tas-
sium

(K)

6.2

7.5

6.9

6.5

__

_

"

Bi-
car-

bon-

ate

(HCO,)

137
126
125
122
123
122

122
122
124
113
129
136

123

125

77

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

0

0

0

Sulfate

(S0«)

318
351
316
320
316
314

306
304
314
304
298
294

307

313

191

Chloride

(Cl)

545
540
520
510
500
500

508
520
500
510
520
540

515

518

321

Fluo-

ride

(F)

o.:

.'.
.e
.6

.6
.9
.6
.6
.4

O.S

0.5

0.4

Ni-

trate

(NO,)

1.8
.1
1.5
1.5
1.2
1.5

1.8
1.2
2.5
.8
.5
.8

1.1

1.3

0.7

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

1460
1490
1410
1390
1370
1360

1370
1380
1360
1350
1380
1410

1330

1390

-

Tons

per
acre-

foot

1.99
2.03
1.92
1.89
1.86
1.85

1.86
1.88
1.85
1.84
1.88
1.92

1.33

-

Tons

per

day

221
254
288
597
522
448

287
209
1410
2930
1930
1150

851

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

459
453
422
432
425
439

429
440
486
415
426
428

434

438

-

Non-
car-

bon-
ate

346
350
318
332
324
33<

329
340
384
322
321
316

333

335

-

So-

dium
ad-

sorp-
tion
ratio

6.J
7.;
7.:
6.(
6.!
6.7

6.7
6.8
5.9
6.7
7.0
7.3

6.S

6.9

-

Specific
con-

duct-

ance

(micro-
mhos at

25'C)

249C
2500
2370
233C
2330
2320

230(
2290
2300
2300
2320
2360

2320

2350

PH

7.0
6.7
7.3
7.9
7.3
6.8

7.4
7.2
7.1
7.3
7.4
7.4

7 _ }

7.1

-

BRAZOS RIVER BASIN Continued

8-926. BRAZOS RIVER AT WHITNEY DAM, NEAR WHITNEY, TEX.

LOCATION. Immediately below Whitney Dam, 4.0 miles upstream from Iron Creek, 3.4 miles upstream from gaging station near Whitney, and 7.4 miles southwest of Whitney, Hill County.
DRAINAGE AREA. 26,170 square miles, approximately, of which 9,240 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: October 1947 to May 1948, October 1948 to September 1964.
Water temperatures: October 1947 to May 1948, October 1948 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,220 ppm Nov, 1-30, Jan. 1-31; minimum, 944 ppm July 1-31.
Hardness: Maximum, 399 ppm Mar. 1-31; minimum, 315 ppm Sept. 1-30.
Specific conductance: Maximum daily, 2,130 micromhos Jan. 12; minimum daily, 1,590 micromhos June 16, July 13.
Water temperatures: Maximum, 84°F Sept. 19; minimum, 42°F Jan. 16.
EXTREMES, 1947-64. Dissolved solids: Maximum, 1,560 ppm Oct. 1-10, 1948; minimum, 183 ppm June 11-20, 1952.
Hardness: Maximum, 542 ppm Oct. 1-10, 1948; minimum, 96 ppm June 11-20, 1952.
Specific conductance: Maximum daily, 2,660 micromhos Oct. 1, 1948; minimum daily, 203 micromhos May 23, 1952.
Water temperatures: Maximum, 92°F July 21, 28, 29, 1957; minimum, freezing point Jan. 28, 29, 1948.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na) . Records of specific conductance of daily samples available in district office at Austin, Tex. Records of discharge are given for gaging station near Whitney. No appreciable inflow between dam and gaging station except during periods of heavy local rains.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. -31, 1963...

Jan . -31, 1964...

Sept. 1-30..... .. .

Weighted average

Time-weighted

Tons per day ....

Mean

discharge
(cfs)

614
305
224
212
234
238
292

568
693
730
707
379

434

--

Silica

(S103)

6.7
6.1
6.2
6.4
6.3
6.4
8.0

5.8
5.5
5.3
6.3
6.1

6.1

6.3

7.2

Iron

(Fe)

Cal-

cium

(Ca)

112
113
114
112
114
112
105

100
102
96
96
95

104

106

121

Mag-
ne-

slum

(Mg)

24
25
23
26
24
29
26

30
31
20
23
19

25

25

29

Sodium

(Na)

271
294
293
282
289
272
246

240
212
214
223
249

246

257

288

Po-
tas-

sium

(K)

6.1

6.4

5.8

5.1

_.

Bl-

car-

bon-

ate

(HCO,)

118
124
129
126
128
131
132

132
132
133
136
132

130

129

152

Car-
bon-
ate

(CO,)

0
0
0
0
0
0
0

0
0
0
0
0

0

0

0

Sulfate

(SO.)

254
262
260
264
258
250
239

223
208
196
198
209

226

235

265

Chloride

(Cl)

445
460
452
460
456
440
405

392
365
342
355
375

396

412

464

Fluo-

rlde

(F)

0.3
.3
.4
. 1
.5
.4
.4

.4
.7
.4
.4
.4

0.4

0.4

0.5

Ni-

trate

(NO,)

1.2
1.2
1.0
.8
1.0
1.2
1.0

1.8
1.8
.5
.5
1.0

1.1

1.1

1.3

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

1180
1220
1210
1220
1210
1180
1100

1060
991
944
969
1020

1070

1110

-

Tons

per
acre-

foot

.60
.66
.65
.66
.65
.60
.50

.44
.35
.28
.32
.39

1.46

__

-

Tons

per

day

1956
1005
732
698
764
758
867

1626
1854
1860
1850
1044

1250

_.

-

Hardness

as CaCOj

Cal-

cium,
Mag.
ne-

sium

378
385
379
386
383
399
369

373
382
322
334
315

361

367

- -

Non-
car-

bon-
ate

282
284
274
283
278
292
261

265
274
213
222
207

254

261

- -

So-

dium
ad-

sorp-
tion
ratio

6.1
6.5
6.5
6.2
6.4
5.9
5.6

5.4
4.7
5.2
5.3
6.1

5.6

5.8

--

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

2060
2090
2110
2120
2100
2040
1920

1850
1730
1660
1720
1760

1870

1930

-

pH

6.7
6.9
7.6
7.6
7.3
7.0
7.0

7.1
7.3
7.1
7.3
7.0

7.1

7.1

~

BRAZOS RIVER BASIN Continued

8-950. NORTH BOSQUE RIVER NEAR CLIFTON, TEX.

LOCATION. At gaging station (near left bank) at bridge on Farm Road 219, 0.5 mile northeast of Clifton, Bosque County, and 2.9 miles downstrea Meridian Creek.
DRAINAGE AREA (revised). 972 square miles.
RECORDS AVAILABLE. Chemical analyses: December 1961 to September 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na).

Chemical anal]

Date
of
collection

Jan. 29, 1964.....
Feb. 28...........

Sept. 1...........

Discharge
(cfs)

0.1
8.0
3.6
4.9
23.7

96.8
12.0
1.8
.3
1.7

Silica

(SiO,)

8.2
6.8
4.0
3.8
7.4

8.5
3.8
9.4
10
11

Iron

(Fe)

Cal-

cium

(Ca)

33
51
64
78
66

60
62
56
57
50

Mag-
ne-

sium

(Mg)

8.9
5.5
6.6
8.1
7.1

7.4
9.1
7.6
6.3
7.6

rses, in parts per million, water year October 1963 to September 1964

Sodium

(Na)

24
11
18
27
16

18
24
20
17
23

Po-
tas-
sium

(K)

Bi-
car-

bon-

ate

(HCO,)

151
149
199
242
206

192
213
196
192
174

Car-
bon-
ate

(cog

0
0
0
0
0

0
0
0
0
0

Sulfate

(SO.)

11
30
35
41
34

30
32
23
21
25

Chloride

(Cl)

25
13
18
32
17

21
26
20
18
26

Fluo-

ride

(F)

0.3
.4
. 3
.2
.3

.4
. 3
. 3
.3
.4

Ni-

trate

(NO,)

0.0
1.2
. 8
. 0
.0

.2
.0
. 0
. 5
.5

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

184
192
245
309
249

240
262
232
224
230

Tons

per
acre-

foot

0.25
. 26
. 33
.42
.34

.33
.36
. 32
.30
.31

Tons

per

day

0.05
4.15
2.38
4.09
15.9

62.7
8.49
1.13
. 18
1.06

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

119
150
187
228
194

180
192
171
168
156

Non-
car-

bon-

ate

0
28
24
30
25

23
18
10
11
13

So-
dium
ad-

sorp-
tion
ratio

1.0
.4
.6
.8
.5

.6
. 8
. 7
.6
.8

Specific
con-

duct-

ance

[micro-

jtnhos at
25"C)

335
348
439
523
418

429
463
410
394
406

pH

7.1
6.8
7.2
7.6
8.0

7.1
7.4
7.0
7.1
7.0

BRAZOS RIVER BASIN Continued

8-1025. LEON RIVER NEAR BELTON, TEX.

LOCATION. At gaging station (on left bank), 1,400 feet upstream from bridge on Farm Road 817, 2,000 feet upstream from concrete dam, 1 mile upstream from bridge on U.S. Highway 81, 2 miles northeast of Belton, Bell County, 3.2 miles downstream from Belton Dam, and 5 miles upstream from Nolan Creek DRAINAGE AREA. 3,572 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1962 to August 1964.
Water temperatures: March 1957 to September 1964.
EXTREMES, 1963-64.--Water temperatures: Maximum, 89°F Aug. 18, 19; minimum, 47°F Jan. 17, 18.
EXTREMES, 1957-64. Water temperatures: Maximum, 95°F Sept. 1, 1958; minimum, 45°F Feb. 25, Mar. 8-11, 1960.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 13, 1964.....

Aug . 10 ....

Discharge
(cfs)

6.6
6.4
5.4
5.4
21.0

9.1
2230
15.0
1330
5.0

Silica

(SiO,)

6.6
8.1
8.3
7.4
7.4

5.6
5.3
6.9
6.2
9.3

Iron

(Fe)

Cal-

cium

(Ca)

48
55
54
52
54

54
49
57
40
51

Mag-
ne-

sium

(Mg)

14
13
14
13
13

13
13
12
6.4
7.5

Sodium

(Na)

43
43
43
40
40

34
37
33
18
21

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCOJ

186
198
201
184
189

188
171
189
132
180

Car-
bon-
ate

(CO,)

0
0
0
0
0

0
0
0
0
0

Sulfate

(SO,)

37
36
36
36
36

34
37
35
21
17

Chloride

(Cl)

56
58
58
57
56

49
55
50
25
25

Fluo-

ride

(P)

0.4
.4
.5
.4
.4

.4
.4
.3
.4
.4

Ni-

trate

(NO,)

0.2
.8
.8
.8
1.8

1.8
.2
1.2
.0
2.8

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

296
311
314
297
302

284
281
288
182
223

Tons

per
acre-

foot

0.40
.42
.43
.40
.41

.39
.38
.39
.25
.30

Tons

per

day

5.27
5.37
4.58
4.33
17.1

6.98
1730
7.37
801
3.01

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

178
190
192
183
188

188
176
192
126
158

Non-
car-

bon-

ate

25
28
28
32
33

34
36
36
18
11

So-

dium
ad-

sorp-
tion
ratio

.4
.4
.4
. 3
.3

. 1
.2
1.0
. 7
. 7

Specific
con-

duct-

ance

[micro-

jnhos at
25°C)

543
567
566
543
537

521
513
531
335
392

pH

6.9
6.8
7.2
7.8
7.8

7.1
7.2
7.3
6.5
7.8

BRAZOS RIVER BASIN Continued

8-1041. LAMPASAS RIVER NEAR BELTON, TEX.

LOCATION. At gaging station (on left bank) at upstream bridge of three bridges on U.S. Highway 81, 3.5 miles downstream from Stillhouse Hollow Dam (under con-struction), 4.1 miles southwest of Belton, Bell County, and 13 miles upstream from confluence with Leon River.
DRAINAGE AREA. 1,325 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Apr. 21...........

Aug. 10...........

Discharge
(cfs)

3.2
6.2
10.2
10.5
44.7

171
1550
75.3
117
7.0
1.4

Silica

(S102)

7.9
6.3
6.8
4.1
6.9

8.0
13
6.6
5.3
8.1
8.9

Iron

(Fe)

Cal-

cium

(Ca)

38
44
59
84
61

53
63
43
60
55
37

Mag-
ne-

sium

(Mg)

16
11
18
37
18

11
14
8.9
23
18
17

Sodium

(Na)

191
20
55
176
47

19
14
24
81
38
14

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

259
158
207
262
227

184
230
152
213
226
185

Car-
bon-
ate

(CO,)

0
0
0
0
0

0
0
0
0
0
0

Sulfate

(SO,)

138
10
16
23
23

20
13
12
19
16
11

Chloride

(CD

156
40
108
358
80

32
29
41
160
64
19

Fluo-
ride

(F)

0.4
.3
.3
.3
.4

.4
.3
.3
.3
.4
. 3

Ni-

trate

(NO,)

0.2
1.5
.0
.2
4.2

2.5
1.5
1.5
.0
. 8
2.5

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

674
211
365
812
352

236
261
212
454
311
201

Tons

per
acre-

foot

0.92
.29
.50
1.10
.48

.32
. 35
.29
.62
.42
.27

Tons

per

day

5.82
3.53
10.1
23.0
42.5

109
1090
43.1
143
3.80
. 80

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

161
155
221
362
226

178
215
144
244
211
162

Non-
car-

bon-

ate

0
26
52
147
40

27
26
19
70
26
11

So-

dium
ad-

sorp-
tion
ratio

6.6
.7
1.6
4.0
1.4

.6
.4
.9
2.3
1.1
.5

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1160
395
716
1580
642

437
466
406
880
579
361

pH

7.2
6.8
7.3
7.9
7.8

7.0
7.2
7.1
7.1
6.8
7.6

BRAZOS RIVER BASIN Continued

8-1050. SAN GABRIEL RIVER AT GEORGETOWN, TEX.

LOCATION. At gaging station (on left bank), 100 feet downstream from Missouri-Kansas-Texas Railroad Co. bridge, 1.2 miles downstream from confluence of North and South Forks, and 1.8 miles northeast of Georgetown, Williamson County.
DRAIKAGE AREA. 399 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Where no potassium(K) is reported, sodium and potassium are calculated as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 27, 1964.....

Aug. 12...........

Discharge
(cfs)

2.4
10.2
11.3
14.6
34.1

41.6
923
45.4
13.3
2.8

Silica

(810,)

10
6.2
7.7
6.1
5.3

5.1
8.2
5.3
8.1
12

Iron

(Fe)

Cal-

cium

(Ca)

72
80
82
80
65

66
50
54
67
45

Mag-
ne-

sium

(Mg)

22
18
20
19
16

15
8.3
14
16
18

Sodium

(Na)

12
16
14
14
12

12
5.4
10
15
16

Po-
tas-
sium

(K)

2.9

Bi-
car-

bon-

ate

(HCO,)

292
288
289
280
226

229
174
206
255
204

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

Sulfate

(SO.)

16
28
32
37
34

29
17
20
21
19

Chloride

(Cl)

21
24
27
22
18

20
8.9
16
19
19

Fluo-
rlde

(F)

0.4
.3
.3
.2
.2

.3
.3
.3
.3
.3

Ni-

trate

(NO,)

11
10
9.2
10
8.4

5.7
2.8
2.2
7.2
7.1

Bo-

ron

(B)

Dissolved Bollds
(calculated)

Parts

per
million

308
324
334
326
270

266
190
223
279
236

Tons

per
acre-

foot

0.42
.44
.45
.44
.37

.36
.26
.30
.38
.32

Tons

per

day

2.00
8.92
10.2
12.9
24.9

29.9
473
27.3
10.0
1.78

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

270
274
287
278
228

226
159
192
233
186

Non-
car-

bon-

ate

30
38
50
48
43

38
16
24
24
19

So-

dium
ad-

sorp-
tion
ratio

0.3
.4
.4
.4
.3

.3
.2
.3
.4
.5

Specific
con-

duct-

ance

[micro-
mhos at

25"C)

556
565
589
569
478

482
342
413
496
419

PH

7.0
7.2
7.3
7.9
7.4

7.4
7.0
7.3
6.9
7.5

BRAZOS RIVER BASIN Continued

8-1087. BRAZOS RIVER AT STATE HIGHWAY 21, NEAR BRYAN, TEX.

LOCATION. At bridge on State Highway 21, 2 miles upstream from Little Brazos River, about 8 miles upstream from gaging station, and 11 miles southwest of Bryan, Brazos County.
DRAINAGE AREA. 38,400 square miles, approximately, at gaging station, of which 9,240 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: August 1961 to September 1964.
Water temperatures: August 1961 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,120 ppm Oct. 1-25; minimum, 196 ppm Sept. 25-30.
Hardness: Maximum, 372 ppm Oct. 1-25; minimum, 138 ppm Sept. 25-30.
Specific conductance: Maximum daily, 2,030 micrombos Oct. 1; minimum daily, 291 micromhos Sept. 25.
Water temperatures: Maximum, 89°F on several days during June to August; minimum, 35°F Jan. 17.
EXTREMES, 1961-64. Dissolved solids: Maximum, 1,200 ppm Apr. 11, 1963; minimum, 186 ppm Nov. 28-29, 1962.
Hardness: Maximum, 488 ppm Apr. 11, 1963; minimum, 110 ppm Nov. 28-29, 1962.
Specific conductance: Maximum daily, 2,030 micromhos Oct. 1, 1963; minimum daily, 291 micromhos Sept. 25, 1964.
Water temperatures: Maximum, 89°F on several days during summer months; minimum, 35°F Jan. 17, 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. Records of discharge are given for gaging station near Bryan. No appreciable inflow between sampling point and gaging station except during periods of heavy local rains.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
at
collection

Oct. 1-25, 1963...

Nov. 16-30........

Jan. 1-15, 1964...

Feb. 4-11, 14-15..
Feb. 12-13, 16-29.

Mar 15-20 .

Apr. 1-22.........
Apr. 23-30........

Mean

discharge
(cfs)

744
2003
775
672
911
827

466
376
459
790
883
648

971
1330
925
2403
991
2445

Silica

(S10,)

6.8
9.6
7.7
5.2
7.1
3.4

2.8
1.7
1.9
7.5
8.4
4.4

5.4
11
5.1
9.3
3.7
7.2

Iron

(Fe)

Cal-

cium

(Ca)

140
54
84
110
82
96

99
108
101
88
70
86

82
64
70
62
68
61

Mag-
ne-

sium

(Mg)

5.5
6.7
18
23
15
22

21
23
21
18
12
17

18
10
13
12
16
8.8

Sodium

(Na)

251
60
174
242
125
195

195
200
187
141
70
128

134
42
85
44
92
37

Po-
tas-
sium

(K)

6.2

5.6

4.3

Bl-

ear -

bon-

ate

(HCOJ

150
126
142
159
178
164

198
214
216
202
178
188

188
194
182
166
176
186

Car-
bon-

ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

0
0
0
0
0
0

Sulfate

(SO.)

234
62
155
221
120
181

182
196
176
136
82
131

134
58
88
65
95
46

Chloride

(Cl)

405
88
270
378
188
305

285
312
272
205
100
192

195
49
121
66
142
46

Fluo-
rlde

(F)

0.3

.4

.4
.5

.2

.4

.4

Ni-
trate

(NOJ

0.8
1.2
2.5
.0
1.8
.2

2.2
1.5
2.5
2.8
4.0
1.8

1.2
3.5
1.5
3.2
.8
2.5

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

1120
344
781
1060
627
884

884
953
867
698
434
652

662
332
473
344
509
300

Tons

per
acre-

foot

1.52
.47
1.06
1.44
.85
1.20

1.20
1.30
1.18
.95
.59
.89

.90
.45
.64
.47
.69
.41

Tons

per

day

2250
1860
1630
1920
1540
1500

1110
967
1070
1490
1030
1140

1740
1190
1180
2230
1360
1980

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

372
162
284
369
266
330

334
364
338
294
224
284

278
200
228
204
236
188

Non-
car-

bon-

ate

249
58
167
238
120
196

171
188
162
128
78
130

124
42
79
68
92
36

So-

dium
ad-

sorp-
tion
ratio

5.6
2.1
4.5
5.5
3.3
4.7

4.6
4.6
4.4
3.6
2.0
3.3

3.5
1.3
2.4
1.3
2.6
1.2

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1930
617
1380
1850
1130
1570

1540
1670
1530
1250
768
1180

1170
574
842
602
905
535

PH

6.9
7.3
7.5
6.9
7.5
7.4

7.9
7.5
7.5
8.0
7.5
7.0

7.1
8.1
7.1
7.1
7.0
6.9

BRAZOS RIVER BASIN Continued

8-1100. YEGUA CREEK NEAR SOMERVILLE, TEX.

LOCATION. At gaging station at bridge on State Highway 36, 760 feet downstream from Gulf, Colorado, and Santa Fe Railway Co. bridge, 2 miles south of Somerville, Burleaon County, and 5 miles upstream from Davidson Creek.
DRAINAGE AREA. 1,008 square miles.
RECORDS AVAILABLE. Chemical analyses: September 1961 to September 1964,
Water temperatures:: September 1961 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 540 ppm Apr. 1-25; minimum, 63 ppm Jan. 17.
Hardness: Maximum, 274 ppm Apr. 1-25; minimum, 26 ppm Dec. 21-22, Jan. 17.
Specific conductance: Maximum daily, 1,010 micromhos Apr. 25; minimum daily, 102 micromhos Jan. 17.
Water temperatures: Minimum, 35°F Jan. 14.
EXTREMES, 1961-64. Dissolved solids: Maximum, 884 ppm Apr. 1-15, 1962; minimum, 43 ppm Sept. 13-14, 1961.
Hardness: Maximum, 430 ppm Apr. 1-4, 1963; minimum, 18 ppm Sept. 13-14, 1961.
Specific conductance: Maximum daily, 1,380 micromhos Apr. 14, 1962; minimum daily, 53 micromhos Sept. 13, 1961.
Water temperatures (1962-64): Minimum, 35°F Jan. 14, 1964.
REMARKS.--Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. No flow Oct. 1 to Nov. 4, Dec. 9, July 6-9, 15-31, Aug. 1 to Sept. 16.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Nov. 5-8, 1963....

Dec. 1-8, 10-13...

Jan. 1-16, 1964...

Feb. 6-13.........

Feb. 25-Mar. 1....
Mar. 2-3..........

Mean

discharge
(cfs)

16.4
2.8
42.0
6.3
2.5
48.6

128
11.0
1.7
112
3.2
6.2

211
195
64.2
7.5
54.0
666

Silica

(SiO,)

10
15
12
13
15
11

8.8
10
12

13
12

11
11
12
14
19

Iron

(Fe)

Cal-

cium

(Ca)

24
30
16
22
20
15

12
16

22
34

17
24
48
30

Mag-
ne-

sium

(Mg)

4.4
7.3
2.9
5.4
4.9
3.5

3.4
4.9

5.9
8.5

4.3
6.1
13
6.8

Sodium

(Na)

23
39
18
31
32
25

12
28
30

29
51

>A

27
60
33
11

Po-
tas-

sium

(K)

4.5

Bi-
car-

bon-

ate

(HCO,)

23
30
14
33
44
32

18
40
47
16
37
49

26
34
42
63
57
52

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

0
0
0
0
0
0

Sulfate

(SO,)

73
95
54
58
55
45

22
40
47
19
57
96

44
14
61
126
64
17

Chloride

(Cl)

22
46
16
40
32
22

9.5
21
29
6.3
37
64

22
26
32
. 86
42
10

FluO-
ride

(F)

0.0

. 1

.2

Ni-

trate

(NO,)

2.0
1.0
1.2
1.0
1.2
1.5

1.2
1.2
.8

1.5
.5

1.5
1.5
1.2
1.5
2.0

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

169
248
127
186
182
139

136
167

183
290

145
184
377
219

Tons

per
acre-

foot

0.23
.34
. 17
.25
.25
. 19

. 18
.23

.25
.39

.20
.25
.51
.30

Tons

per

day

7.48
1.87
14.4
3.16
1.23
18.2

4.04
.77

1.58
4.85

76.3
31.9
7.63
31.9

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

78
105
52
77
70
52

26
44
60
26
79
120

58
60
85
174
103
52

Non-
car-

bon-
ate

59
80
40
50
34
26

11
11
22
13
49
80

37
32
51
122
56
9

So-

dium
ad-

sorp-
tion
ratio

1.1
1.7
1.1
1.5
1.7
1.5

1.0
1.8
1.7

1.4
2.0

1.3
1.3
2.0
1.4
.7

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

298
421
211
330
310
233

116
231
280
102
314
496

227
251
321
646
382
154

PH

6.5
6.6
6.6
6.4
7.3
7.1

7.5
7.3
7.4
7.0
7.1
7.3

7.1
6,7
6.5
7.3
6.9
7 4

BRAZOS RIVER BASIN Continued

8-1167. BRAZOS RIVER AT HARRIS RESERVOIR, NEAR ANGLETON, TEX.

LOCATION. At Harris Pumping Plant of Dow Chemical Company, 10 miles northwest of Angleton, Brazoria County.
DRAINAGE AREA. 44,000 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: January 1962 to September 1964.
EXTREMES, 1963-64. Specific conductance: Maximum daily, 7,190 mlcromhos Mar. 3; minimum daily, 274 micromhos Sept. 30.
EXTREMES, 1962-64. Specific conductance: Maximum daily, 7,190 micromhos Mar. 3, 1964; minimum daily, 274 micromhos Sept. 30, 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office Austin, Tex.

Chemical analyses, in parts per million, TOter year October 1963 to September 1964

Date
of
collection

Oct. 2-8, 1963....

J.an. 10-23, 1964..

Sept. 12-16.......

Mean

discharge
(cis)

Silica

(SiO,)

16
9.4
11
9.4
15
12

8.8
5.1
96
14
10
9.8

Iron

(Fe)

Cal-
cium

(Ca)

75
84
87
89
77
43

68
62
78
48
74
69

Mag-
ne-

sium

(Mg)

25
17
19
20
9.7
6.5

14
15
19
20
20
18

Sodium

(Na)

179
146
141
125
486
39

90
90
124
94
164
149

Po-
tas-

sium

(K)

4.8

4.2

4.6

3.5

Bi-
car-

bon-

ate

(HCO,)

176
188
226
248
122
120

193
186
204
170
184
160

Car-
bon-

ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

Sulfate

(so,)

157
126
120
117
130
46

81
74
100
63
128
122

Chloride

(CD

275
220
205
188
745
48

132
128
190
147
238
220

Fluo-

ride

(F)

0.4
.2
.3
.4
.2
. 3

.4
.5
.7
. 5
.4
.4

Ni-

trate

(NO,)

2.2
2.0
2.2
.8
2.2
4.2

1.0
.0
.2
. 1
3.2
1.5

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

821
697
696
676
1530
258

495
466
622
474
728
669

Tons

per
acre-

foot

1.12
.95
.95
.92
2.08
.35

.67
.63
.85
.64
. 99
.91

Tons

per

day

Hardness

as CaCO,

Cal-

cium, Mag-

ne-

sium

290
280
295
304
232
134

227
216
272
202
267
246

Non-
car-

bon-

ate

146
126
110
102
132
36

69
64
106
63
116
115

So-

dium
ad-

sorp-
tion
ratio

4.6
3.8
3.6
3.1
14
1.5

2.6
2.7
3.3
2.9
4.4
4.1

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1470
1220
1220
1170
2760
454

864
819
1100
943
1280
1180

PH

7.6
7.4
7.9
7.8
7.5
7.8

7.9
7.6
7.2
7.6
7.0
7.9

BRAZOS RIVER BASIN Continued

8-1172. BRAZOS RIVER AT BRAZORIA RESERVOIR, NEAR BRAZORIA, TEX.

LOCATION. At Brazorla Pumping Plant of Dow Chemical Company, 1.5 miles east of Brazoria, Brazoria County.
DRAINAGE AREA. 44,000 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: January 1962 to September 1964.
EXTREMES, 1963-64. Specific conductance: Maximum daily, 24,400 micromhos Aug. 25; minimum daily, 320 micromhos Sept. 30.
EXTREMES, 1962-64. Specific conductance: Maximum daily, 37,000 micromhos Aug. 28, 1963; minimum daily, 273 micromhos Jan. 4, 1963.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 3-4, 7-9,1963

Feb. 5-7..........

Aug. 1-14, 17-21,
24-28, 1964.....
Sept. 13-17.......

Mean

discharge
(cfs)

Silica

(SiO,)

15
10
10
12
8.7
16
12

9.9
4.2
5.4
4.8

5.7
7.0

Cal-

cium

(Ca)

149
78
81
85
91
68
42

68
68
108
189

184
170

Mag-
ne-

sium

(Mg)

260
16
19
66
21
9.4
7.6

14
30
124
369

328
347

Sodium

(Na)

2310
140
148
584
131
346
39

81
227
1040
3170

3400
3080

Po-
tas-

sium

(K)

77

4.2

4.6

L10

Bi-
car-

bon-

ate

(HCO,)

176
176
206
194
258
136
124

198
162
184
131

142
132

Car-
bon-

ate

(CO,)

0
0
0
0
0
0
0

0
0
0
0

0
0

Sulfate

(SO.)

634
118
118
188
123
107
47

73
118
302
823

817
824

Chloride

(Cl)

4060
210
218
990
194
520
47

121
375
1820
5770

5840
5370

Fluo-

rlde

(F)

0.4
.3

.3
.4
.4

.4
.5
.4

Ni-

trate

(NO,)

1.8
2.2
3.0
.8
2.8
4.0

1.0
1.2
.8

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

7590
661
698
2020
701
1140
260

470
904
3490
10500

10600
9860

Tons

per
acre-

foot

10.4
.90
.95
2.75
.95
1.55
. 35

. 64
1.23
4.75
14.4

14.5
13.5

Tons

per

day

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

1440
260
280
484
314
208
136

227
293
780
1990

1810
1850

Non-
car-

bon-

ate

1300
116
111
324
102
96
34

64
160
628
1880

1690
1740

So-

dium
ad-

sorp-
tion
ratio

27
3.8
3.8
12
3.2
10
1.5

2.3
5.8
16

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

12200
1160
1230
3580
1230
2050
460

825
1620
6040
16900

17000
15800

PH

7.8
7.3
8.0
7.9
7.9
7.9
7.6

7.6
7.1
7.1
7.0

6.9
6.8

Den-

sity
(g/ral
at

20°C)

1.003

1.006

1.006
1.005

BRAZOS RIVER BASIN Continued

SAN GABRIEL RIVER BASE-FLOW STUDY IN TEXAS

Water samples were collected for chemical analyses and discharge measurements were made on the San Gabriel River and its tributaries from the bridge on U.S. High-way 183, north of Leander, Tex., to the confluence of the San Gabriel and Little Rivers, a distance of 69 miles. Where no potassium is reported, sodium and potassium are calculated as sodium.

Chemical analyses, in parts per millic

Date

Mar. 16

16

16

16
16

16

16

16

16

16

V

Sampling site

North Fork San Gabriel River at
bridge on U.S. Highway 183,
9 miles north of Leander.
North Fork San Gabriel River,
1.6 miles upstream from mouth
of Sowes Creek.
North Fork San Gabriel River,
0.8 mile upstream from mouth
of Sowes Creek.

Unnamed tributary at mouth,
0.8 mile downstream from
from mouth of Sowes Creek.
Unnamed tributary at mouth,
1.2 miles downstream from
mouth of Sowes Creek.
North Fork San Gabriel River,
600 feet above county road
crossing, 9.0 miles northwest
of Georgetown.
Unnamed tributary at mouth,
7.5 miles northwest of
Georgetown.
Unnamed tributary at mouth,
6.0 miles northwest of
Georgetown.
North Fork San Gabriel River at
county crossing, 5.0 miles
northwest of Georgetown.
Unnamed tributary at mouth,
2.6 miles upstream from mouth
of Middle Fork San Gabriel
River.

Dis-

charge
(cfs)

8.48

7.65

7.42

A. 01
A. 24

. 18

8.56

A. 05

A. 06

9.96

A. 08

Silica
(Si02)

2.4

_

Cal-
cium
(Ca)

56

_

Mag-
ne-

sium
(Mg)

15

_

So-
dium
(Na)

8.3

_

Po-
tas-
sium
(K)

1.7

_

Bicar-
bonate
(HC03)

200

196

176

144
272

304

184

240

316

200

310

Sul-
fate
(SO,)

31

_

Chlo-
ride
(Cl)

15

15

15

22
20

16

15

20

14

22

12

Fluo-
ride
(F)

0.4

_

Ni-
trate

(N03)

2.2

_

Dissolved
solids6

Parts
per
mil-
lion

230

_

__

Tons
per
acre-

foot

0.31

_

Hardness
as CaCO3

Ca,
Mg

201

196

180

200
272

300

188

276

284

208

276

Non-
car-

bon-
ate

38

35

36

82
49

51

37

80

25

44

22

So-
dium
ad-
sorp-
tion
ratio

0.3

_

Spe-
cific
conduct-
ance

(micro-
mhos at
180°C)

418

410

384

432
546

589

398

555

550

441

529

PH

7.6

7.8

7.9

7,6
7.5

7.4

7.6

7.5

7.1

7.6

7.6

Mar. 17

17

17

16

16

16

16

16

17

18

17

17

17
17

Unnamed tributary at mouth,
0.6 mile upstream from mouth
of Middle Fork San Gabriel
River.
North Fork San Gabriel River,
200 feet upstream from mouth
of Middle Fork San Gabriel
River.
Middle Fork San Gabriel River
at mouth.
South Fork San Gabriel River at
bridge on U.S. Highway 183,
4.5 miles north of Leander.
Unnamed tributary at mouth,
8.8 miles upstream from
mouth of South Fork San
Gabriel River.
South Fork San Gabriel River,
8.2 miles from mouth.
South Fork San Gabriel River,
3.9 miles from mouth.
South Fork San Gabriel River
at bridge on State High-
way 29, at Georgetown.
San Gabriel River at gaging
station, 1.2 miles northeast
of Georgetown.
Smith Branch at bridge on
State Highway 29, 0.5 mile
east of Georgetown.
Berry Creek at county road
crossing, 0.5 mile east of
Georgetown.
Ranger Branch, 600 feet above confluence with Berry Creek.

San Gabriel River, 0.5 mile
upstream from county road
crossing at Jonah.

A i02

11.1

1.04

1.62

A. 12

2.14

3.39

3.16

28.6

A. 28

12.5

. 37

2.26
42.7

_

3.4

6.7

2.5

4.5

4.7

4.6

- -

6.2

4.2
5.1

_

53

52

54'

52

38

68

73

70
67

16

22

11

13

13

18

13

2.3
14

_

13

19

11

8.9

9.2

12

- -

12

- -

10
13

_

1.5

1.8

__

300

196

214

172

136

150

164

118

246

200

248

192

182
224

_

32

24

40

43

46

32

24

26
33

21

21

41

12

24

12

17

16

20

30

16

22

14
19

_

. 3

. 3

. 4

. 4

. 3

. 4

. 4

. 5
. 4

_

2.0

3.0

4.2

3.5

3.0

8.2

11

11
8.4

_

237

273

220

225

190

284

278

227
270

_

. 32

. 37

. 30

. 31

. 26

. 39

. 38

. 31
. 37

284

198

220

180

188

168

183

148

244

270

236

214

184
224

38

37

44

39

77

45

49

52

42

106

32

57

35
41

_

. 4

. 6

. 4

. 3

. 3

. 3

. 3

. 3
. 4

579

426

504

388

430

361

397

340

508

682

493

504

398
481

7.6

7.6

7.6

7.5

7.5

7.7

7.7

7.6

7.4

7.4

7.6

7.6

7.5
7.5

A Estimatsd.
B Calculated from determined constituents.

BRAZOS RIVER BASIN Continued

SAN GABRIEL RIVER BASE-FLOW STUDY IN TEXAS Continued

Chemical analyses, in parts per million, March 1964 Continued

Date

Mar,)7

17

17

18

17

17
17

18

18

18
18

17

18
18

18

Sampling site

San Gabriel River at bridge on
county road, 2.0 miles west
of Circleville.
San Gabriel River at bridge on
State Highway 95, at
Circleville.
Queen Branch at old highway
bridge, at Circleville.
Unnamed tributary at mouth,
0.5 mile east of Circleville.
San Gabriel River, 1.5 mile
south of Friendship.

San Gabriel River at county
road crossing, at Laneport.
San Gabriel River at bridge on
Farm Road 486, near San
Gabriel.
San Gabriel River at bridge on
county road, 3.5 miles east
of San Gabriel.

San Gabriel River, 2.0 miles
southwest of Tracy.
Brushy Creek at county road
crossing, 2.0 miles west of
Round Rock.

San Gabriel River at bridge on
Farm Road 487, near Rockdale.
San Gabriel River near mouth,
2.0 miles west of Minerva.

Dis-

charge
(cfs)

45.7

47.4

. 15

. 07

53.9

. 25
55.9

58.6

55.8

. 04
54.4

3.72

9.40
68.6

65.5

Silica
(Si02)

5.3

3.5
4.5

5.1

4.8

3.2

4.2

Cal-
cium
(Ca)

66

106
66

99

56

80

72

Mag-ncr
ne-

sium
(Hg)

14

9.1
15

32

13

10

13

So-
dium
(Na)

_ ~

13

60
15

128

13

103

28

Po-
tas-
sium
(K)

_

__

___

Bicar-
bonate
(HC03)

218

220

178

340

216

252
220

220

222

324
222

170

294
232

236

Sul-
fate
(S04)

33

80
37

155

42

101

48

Chlo-
ride
(CD

18

19

104

42

22

97
23

23

24

162
24

24

80
31

31

Fluo-
ride

(F)

__

0.4

. 6
. 5

. 5

. 3

. 8

. 5

Ni-
trate
(N03)

8.7

3.8
8.1

. 2

4.0

2.8

6.5

Dissolved
solidsB

Parts
per
mil-
lion

C266

267

C274

484
277

C279

C280

741
C281

241

526
C313

319

Tons
per
acre-

foot

0.36

. 66
. 38

1.01

. 33

. 72

. 43

Hardness
as CaCO3

Ca,
Hg

224

222

258

316

224

302
226

226

228

378
230

193

240
230

233

Non-
car-

bon -
ate

45

42

112

38

47

96
46

46

46

113
48

54

0
40

40

So-
dium
ad-

sorp-
tion
ratio

0.4

1.5
. 4

2.0

. 4

2.9

. 8

Spe-
cific
conduct-
ance

(micro-
mhos at
180°C)

472

472

758

739

486

837
493

496

497

1260
499

430

891
556

562

PH

7.6

7.8

7.3

7.4

7.6

7.4
7.7

7.7

7.7

7.4
7.6

7.6

7.7
7.7

7.7

A Estimated.
B Calculated from determined constituents.
C Calculated from specific conductance.

COLORADO RIVER BASIN Continued

Travls County, 0.5 mile downstream from

miles is probably noncontributing.

8-1580. COLORADO RIVER AT AUSTIN, TEX.

LOCATION. At raw water intake at Austin City Waterplant, just downstream from Lamar Boulevard bridge in Austin Barton Creek, and 4.5 miles upstream from gaging station at Montopolls Bridge on U.S. Highway 183.
DRAINAGE AREA. 38,400 square miles, approximately, upstream from gaging station, of which 11,900 squa
RECORDS AVAILABLE. Chemical analyses: October 1947 to September 1964.
Water temperatures: October 1947 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 389 ppm Dec. 1-31; minimum, 338 ppm July 1-31.
Hardness: Maximum, 253 ppm Dec. 1-31; minimum, 194 ppm Sept. 1-30.
Specific conductance: Maximum daily, 737 micromhos Jan. 12; minimum daily, 518 micromhos Sept. 28.
Water temperatures: Maximum, 87 °F Aug. 6; minimum 52°F Jan. 19.
EXTREMES, 1947-64. Dissolved solids: Maximum, 389 ppm Dec. 1-31, 1963; minimum, 184 ppm July 1-31, 1957.
Hardness: Maximum, 253 ppm Dec. 1-31, 1963; minimum, 120 ppm Oct. 8-31, 1959.
Specific conductance: Maximum daily, 737 micromhos Jan. 12, 1964; minimum daily, 243 micromhos Dec. 2, 1953.
Water temperatures: Maximum, 87°F on several days during summer months; minimum, 43°F Jan. 28, 1948, Feb. 4, 1949.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. No appreciable inflow between sampling point and gaging station except during periods of heavy local rains.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31, 1963...

Jan. 1-31, 1964...
Feb. 1-29.........

Sept. 1-30........

Weighted average

Time -weighted

Tons per day. . . .

Mean

discharge
(cfs)

157
41.5
43.9
61.8
49.7
55.0

1110
1599
1850
1568
1172
1037

- -

729

--

Silica

(S10a)

11
9.0
9.7
9.0
7.5
7.9

8.5
10
9.2
8.1
9.8
8.9

9.1

9.1

18

Iron

(Fe)

Cal-

cium

(Ca)

48
56
62
60
62
57

46
48
46
42
42
43

45

51

89

Mag-
ne-

sium

(Mg)

24
23
24
23
21
24

23
27
21
22
22
21

23

23

45

Sodium

(Na)

48
51
49
42
44
43

52
48
54
47
53
54

51

49

100

Po-
tas-

sium

(K)

4.1

3.3

4.8

4.1

~

Bl-

car-

bon-

ate

(HCO,)

196
226
245
234
237
231

186
194
182
174
177
172

183

204

361

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

0

0

0

Sulfate

(S0«)

47
46
47
46
45
45

48
48
46
45
45
46

46

46

91

Chloride

(CD

81
78
75
69
66
68

85
89
85
82
83
85

84

79

166

Fluo-
rlde

(F)

0.5
.3
.4
.4
. 1
.3

.4
.4
.4
.4
.5
.4

0.4

0.4

0.8

Ni-

trate

(NO,)

1.0
2.0
2.2
1.8
2.2
2.0

.5
.8
1.0
1.0
1.0
.5

0.9

1.3

1.7

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

361
376
389
370
365
361

359
366
352
338
343
344

351

360

692

Tons

per
acre-

foot

0.49
.51
.53
.50
.50
.49

.49
.50
.48
.46
.47
.47

0.48

"

Tons

per

day

153
42.1
46.1
61.7
49.0
53.6

1080
1580
1760
1430
1090
963

692

_

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

218
234
253
244
242
240

210
231
202
196
196
194

207

222

Non-
car-

bon-

ate

58
49
52
52
47
51

57
72
52
53
50
53

56

54

So-

dium
ad-

sorp-
tion
ratio

.4
.4
.3
.2
.2
.2

.6
.4
.7
.5
.6
.7

1.6

1.4

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

660
679
685
673
655
651

651
654
626
610
623
618

632

649

PH

7.6
7.4
7.9
7.9
7.7
7.8

7.5
7.7
7.6
7.5
8.2
7.3

7.6

7.6

COLORADO RIVER BASIN Continued

8-1610. COLORADO RIVER AT COLUMBUS, TEX.

LOCATION. At gaging station (near right bank) at bridge on U.S. Highway 90 at eastern edge of Columbus, Colorado County, 340 feet downstream from Texas and New Orleans Railroad Co. bridge, and 2.6 miles downstream from Cummins Creek.
DRAINAGE AREA. 41,070 square miles, approximately, of which 11,900 square miles is probably noncontributing.
RECORDS AVAILABLE. Water temperatures: March 1957 to June 1959, October 1960 to September 1964.
Sediment records: March 1957 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 88°F July 6; minimum, 33°F Dec. 23.
Sediment concentrations: Maximum daily, 1,900 ppm Sept. 18; minimum daily, 9 ppm Jan. 1.
Sediment loads: Maximum daily, 42,000 tons Sept. 18; minimum daily, 3 tons Jan. 1, 10, 11.
EXTREMES, 1957-64. Water temperatures: Maximum, 89°F July 27, 28, Aug. 11, 1957, July 22, 1962; minimum, freezing point Jan. 12, 1962.

Sediment concentrations: Maximum daily, 5,650 ppm Mar. 25, 1957; minimum daily, 2 ppm Mar. 1-5, 1962.
Sediment loads: Maximum daily, 497,000 tons Feb. 23, 1958; minimum daily, 3 tons Jan. 1, 10, 11, 1964.

Temperature (°F) of water, water year October 1963 to September 1964

November .....
December .....

April..........

July...........
August ....

1

62
50

41
54

51

65

71

84

2

58
47

45

59

67

75

86

3

62
49

4R
56
5B

67

75

83

4

64
48

49
55
5R

68

79

84

5

69
48

50
49
55

68

78

87

6

64
50

55

5R

66

79

85

7

66
55

50
4R
64

71

80

87

8

68
50

56
44
65

74

RO

83

9

65
47

4R

60

62

R?

86

10

62
55

41
54
54

60

85

86

11

62
60

50

56

66

81

86

12

61
41

4?
54
5ft

70

«1

85

13

61
45

15

61

68

84

86

14

57
43

15

67

70

R4

85

15

59
40

40
5?
57

68

RO

85

Day

16

69
43

40
50
58

71

RO

85

17

66
45

17
49
ftO

69

81

85

18

68
48

45
5?
6?

72

bl

86

19

67
44

55
49
61

75

flO

86

20

67
45

5?
48
6?

74

R?

86

21

7U
42

55

56

74

84

85

22

72
40

60
45
58

75

85

85

23

57
33

6?
44
60

76

85

82

24

59
35

65
49
67

78

85

82

25

59
38

54
48
7R

78

86

83

26

56
46

50
51
56

75

85

84

27

55
48

55
47
58

73

84

84

28

55
48

55

64

77

85

84
75

29

50
45

58

64

72

85

84
73

30

49
45

56

61

70

R5

85
72

31

44

55

6?

85

Aver-

age

62
46

50

60

71

82

85
80

COLORADO RIVER BASIN Continued

8-1610. COLORADO RIVER AT COLUMBUS, TEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept . 30 ....

Time

(24 hour)

0734
0734

Water
tem-
per-
ature

(°F)

74
72

Sam-

pling
point

Discharge
(cfs)

9000
3560

Sediment

concen-

tration

(ppm)

2220
835

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

69
63

0.004

70
79

0.008

77
83

0.016

86
89

0.031

94
92

0.062

97
99

0.125

98
99

0.250

100
100

0.350 0.500 1.000

Method
of

analysis

SPWC
SPWC

COLORADO RIVER BASIN Continued

8-1620. COLORADO RIVER AT WHARTON, TEX.

LOCATION. At gaging station at bridge on U.S. Highway 59, in Wharton, Wharton County, 1,000 feet downstream from Texas and New Orleans Railroad Co. bridge, and 12 miles upstream from Jones Creek.
DRAINAGE AREA. 41,380 square miles, approximately, of which 11,900 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: April 1944 to September 1964.
Water temperatures: October 1945 to September 1948, March 1950 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 399 ppm May 1-31; minimum, 222 ppm Mar. 1-15.
Hardness: Maximum, 252 ppm Dec. 17-31; minimum, 147 ppm Mar. 1-15.
Specific conductance: Maximum daily, 904 micromhos Oct. 29; minimum daily, 290 micromhos Mar. 23.
Water temperatures: Maximum, 88°F June 14; minimum, 35°F Dec. 23, Jan. 14.
EXTREMES, 1944-64, Dissolved solids: Maximum, 399 ppm May 1-31, 1964; minimum, 108 ppm Sept. 27-29, 1957.
Hardness: Maximum, 252 ppm Dec. 17-31, 1963; minimum, 66 ppm Sept. 27-29, 1957.
Specific conductance: Maximum daily, 904 micromhos Oct. 29, 1963; minimum daily, 146 micromhos Sept. 27, 1957.
Water temperatures (1945-48, 1950-64): Maximum, 95°F July 26, 1954; minimum, 35°F Dec. 23, 1963, Jan. 14, 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31, 1963...

Jan. 1-31, 1964...

May 1-31......... .

Sept . 19-30 ....

Weighted average

Time-weighted

Tons per day. . . .

Mean

discharge
(cfs)

353
264
230
415
244

224
382
836
762
637

848
1183
720
406
690
2278

615

~

Silica

(SiO,)

12
15
12
11
11

6.7
8.6
6.2
5.7
6.9

13
13
10
9.1
7.4
9.0

10

10

17

Iron

(Fe)

Cal-

cium

(Ca)

56
58
60
48
68

61
47
44
49
56

55
49
49
53
48
42

51

53

84

Mag-
ne-

sium

(Mg)

22
20
20
14
20

20
20
9.0
9.1
22

23
19
22
21
21
12

19

20

31

Sodium

(Na)

49
44
49
33
45

45
42
26
29
45

58
40
50
55
60
22

43

46

71

Po-
tas-

sium

(K)

4.6

4.2

4.8

4.1

~

Bi-
car-

bon-

ate

(HCO,)

224
236
248
184
268

242
206
156
167
217

200
172
196
213
202
150

193

208

320

Car-
bon-

ate

(CO,)

0
0
0
0
0

0
0
0
0
0

0
0
0
0
0
0

0

0

0

SuUate

(SO.)

44
40
42
32
44

47
41
29
35
48

51
44
46
44
46
27

42

43

69

Chloride

(Cl)

81
61
63
44
60

65
56
30
34
75

98
68
83
83
86
36

67

69

111

Fluo-

ride

(F)

0.3
. 3
. 3

. 3
. 2
. 3

. 3

. 5
. 5
. 5
. 3
. 5

0.4

0.4

0.7

Ni-

trate

(NO,)

0.5
. 2
1.2
3.0
. 8

1.5
1.2
1.0
. 8
. 0

2.5
2.5
. 7
. 2
. 2
. 8

1.2

1.0

1.9

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

379
354
370
275
381

370
317
222
245
365

399
321
361
371
368
223

328

346

Tons

per
acre-

foot

0.52
. 48
. 50
. 37
. 52

. 50
. 43
. 30
. 33
. 50

. 54
. 44
. 49
. 50
. 50
. 30

0.45

__

Tons

per
day

361
252
230
308
251

224
327
501
504
628

914
1030
702
407
686
1370

545

__

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

230
227
232
178
252

234
200
147
160
230

232
200
213
218
206
154

203

213

Non-
car-

bon-

ate

46
34
29
26
32

36
31
19
23
52

68
60
52
44
41
32

45

43

So-

dium
ad-

sorp-
tion
ratio

1.4
1.3
1.4
1.1
1.2

1.3
1.3
. 9
1.0
1.3

1.7
1.2
1.5
1.6
1.8
. 8

1.3

1.4

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

681
625
644
488
665

656
569
404
445
662

667
578
648
664
650
407

584

614

PH

7.3
7.5
8.0
7.5
7.8

8.0
7.5
7.8
7.5
8.0

7.9
7.2
7.8
7.4
7.3
6.9

7.4

7.5

GUADALUPE RIVER BASIN Continued

8-1770. COLETO CREEK NEAR SCHROEDER, TEX.

LOCATION. At gaging station at bridge on Farm Road 622, 2.5 miles northeast of Schroeder, Goliad County, 4.8 miles downstream from Cottonwood Creek, 8.0 miles upstream from Perdido Creek, and 11.5 miles west of Victoria.
DRAINAGE AREA. 365 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Nov. 13, 1963.....

Feb. 25, 1964.....

Sept. 25..........

Discharge
(cfs)

0.2
16.6
7.0
2.2
.2

3000
228
143
239
4.0

Silica

(HO,)

29
11
15
15
32

6.5
10

8.6
20

Iron

(Fe)

Cal-

cium

(Ca)

86
35
70
56
63

46
52

20
48

Mag-
ne-

sium

(Mg)

8.1
3.8
8.9
10
9.5

2.2
3.0

1.7
5.4

Sodium

(Na)

65
26
58
73
68

4.4
17

5.8
33

Po-
tas-

sium

(K)

3.0

3.2

Bi-
car-

bon-

ate

(HCO,)

280
104
208
170
216

154
172
136
73
158

Car-
bon-
ate

(CO,)

0
0
0
0
0

0
0
0
0
0

Sulfate

(S04)

20
12
27
25
20

3.6
6.6

3.0
12

Chloride

(CD

98
43
98
123
102

5.0
21
17
6.4
50

Fluo-
rlde

(F)

0.4
.2
.4
.3
.6

. 2
. 3

.2
.3

Ni-
trate

(NO,)

0.0
.5
.0
.0
.0

.0
. 0

1.2
.0

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

444
182
379
386
401

147
195

86
247

Tons

per
acre-

foot

0.60
.25
.52
.52
. 55

.20
. 27

. 12
.34

Tons

per

day

0.24
8.16
7.16
2.29
. 22

1190
120

55.5
2.K7

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

248
103
211
180
196

124
142
113
57
142

Non-
car-

bon-

ate

18
18
40
. 41
19

0
1
2
0
12

So-

dium
ad-

sorp-
tion
ratio

1.8
1.1
1.7
2.4
2.1

.2
.6

.3
1.2

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

773
338
682
713
694

266
349
287
147
433

PH

7.0
6.6
7.3
7.0
7.0

6.7
7.0
7.0
6.9
7.2

NUECES EIVER BASIN

8-2110. NUECES RIVER NEAR MATHIS, TEX.

LOCATION. At intake tower at Wesley E. Seale Dam, 0.6 mile upstream from gaging station at bridge on State Highway 359, and 4 miles southwest of Mathis, San Patricio County.
DRAINAGE AREA. 16,660 square miles.
RECORDS AVAILABLE. Chemical analyses: October 1947 to September 1964.
Water temperatures: October 1947 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 382 ppm Sept. 1-30; minimum, 341 ppm June 1-30.
Hardness: Maximum, 174 ppm Feb. 1-29; minimum, 122 ppm July 1-31, Aug. 1-31.
Specific conductance: Maximum daily, 788 micromhos Dec. 14; minimum daily, 555 micromhos Sept. 30.
Water temperatures: Maximum, 96°F Aug. 8; minimum, 50°F Dec. 23.
EXTREMES, 1947-64. Dissolved solids: Maximum, 548 ppm June 1-30, 1948; minimum, 175 ppm Apr. 27-30, 1949.
Hardness: Maximum, 201 ppm May 1-24, 1951; minimum, 85 ppm Apr. 27-30, 1949.
Specific conductance: Maximum daily, 1,040 micromhos July 1, 1948; minimum daily, 233 micromhos July 30, 1949.
Water temperatures: Maximum, 96°F Aug. 8, 1964; minimum, 38°F Jan. 31, 1948.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31, 1963...

Jan. 1-31, 1964...

Sept. 1-30........

Weighted average

Time-weighted

Tons per day ....

Mean

discharge
(cfs)

107
85.1
75.1
75.4
68.6
82.7

109
103
133
133
157
116

104

Silica

(SiO,)

18
18
14
15
16
14

16
17
17
19
19
23

18

17

4.9

Iron

(Fe)

Cal-

cium

(Ca)

52
52
51
53
52
52

47
45
42
38
38
39

45

47

Mag-
ne-

sium

(Mg)

6.7
6.4
7.8
6.6
11
6.9

6.2
12
7.5
6.6
6.6
6.4

7.4

7.6

13 j 2.1

Sodium

(Na)

68
78
75
63
63
69

66
66
74
73
88
93

74

73

21

Po-
tas-

sium

(K)

9.7

9.6

9.6

9.1

-

Bl-

ear -

bon-

ate

(HCO,)

222
230
229
223
222
220

212
212
198
192
197
208

211

214

59

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0
0

0

0

0

Sulfate

(SO.)

36
35
34
34
33
34

33
35
33
32
33
33

34

34

9.4

Chloride

(Cl)

71
70
69
67
67
64

66
66
69
74
82
84

72

71

20

Fluo-

rlde

(F)

0.5
.4
.3
.4
.4
.4

.3
.7
.8
.4
.4
.4

0.5

0.4

0.1

Ni-
trate

(NO,)

0.2
.8
.5
.5
.5
1.0

.8
.8
1.0
.5
1.5
1.2

0.8

0.8

0.2

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
million

371
374
365
359
352
349

349
346
341
347
366
382

358

358

Tons

per
acre-

foot

0.50
.51
.50
.49
.48
.47

.47
.47
.46
.47
.50
.52

0.49

__

Tons

per

day

107
85.9
74.0
73.1
65.2
77.9

103
96.2
122
125
155
120

100

__

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

157
156
159
159
174
158

143
162
136
122
122
124

144

148

Non-
car-

bon-

ate

0
0
0
0
0
0

0
0
0
0
0
0

0

0

So-

dium
ad-

sorp-
tion
ratio

2.4
2.7
2.6
2.2
2.1
2.4

2.4
2.3
2.8
2.9
3.5
3.6

2.7

2.7

Specific
con-

duct-

ance

'micro-

mhos at

25"C)

633
643
637
627
616
612

598
602
596
606
631
634

619

620

pH

7.7
7.2
7.9
8.2
8.1
8.0

7.8
7.7
7.3
7.8
7.8
7.7

7.7

7.7

RIO GRANDE BASIN

8-2492. RIO GRANDE ABOVE CULEBRA CREEK, NEAR LOBATOS, COLO.

LOCATION. Half a mile southeast of La Sauses, 7 miles upstream from Culebra Creek, and 15 miles upstream from gaging station near Lobatos, Conejos County. DRAINAGE AREA. 7,TOO square miles, approximately, upstream from gaging station (includes 2,940 square miles in closed basin in northern part of San Luis Valley, Colo.).
RECORDS AVAILABLE. Chemical analyses: October 1946 to September 1964.
Water temperatures: July to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 452 ppm May 1-8; minimum, 116 ppm Nov. 10-13.
Hardness: Maximum, 200 ppm June 17-19; minimum, 55 ppm Nov. 10-13.
Specific conductance: Maximum daily, 692 mlcromhos June 18; minimum daily, 152 micromhos Nov. 9.
EXTREMES, 1946-64. Dissolved solids: Maximum, 805 ppm Sept. 21, 1959; minimum, 100 ppm Nov. 10-12, 14, 1960.
Hardness: Maximum, 346 ppm June 9-14, 1993; minimum, 44 ppm Nov. 10-12, 14, 1960.
Specific conductance: Maximum daily, 1,110 micromhos Sept. 21, 1959; minimum daily, 122. micromhos June 1, 1949.
REMARKS.--Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Hex. Culebra Creek which enters the Rio Grande between the sampling point and the gaging station is usually dry at its mouth. Inflow from this and other sources between sampling point and gaging station occurs only after heavy local rainfall.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-14, 1963...
Oct. 15-31........

Jan. 1-31, 1964...
Feb. 1-29... ......

Mar. <!0, 31.......
Apr. 1-10. ....

Mean

discharge
(cfs)

16.8
37.1
41.8
55.4
258
65.3

44.0
43.0
45.9
50.0
59.0
103

114
129
171
242
31"

163

Silica

(SiO,)

37

33

Iron

(Fe)

0.04

.06

Cal-

cium

(Ca)

37
33
34
30
18
28

33
47
36
41
35
30

29
27
24
28
31
34

Mag-
ne-

sium

(Mg)

8.8
6.7
6.1
5.1
2.4
4.4

6.0
6.9
6.3
6.4
5.0
3.2

3.0
2.6
3.4
3.6
4.5
6.3

Sodium

(Na)

47
32
32
24
11
23

30
34
32
34
27
17

16
15
16
19
23
25

Po-
tas-

sium

(K)

7.4

5.3

Bl-
car-

bon-

ate

(HCOJ

204
166
166
140
72
130

160
232
166
158
134
112

112
106
102
104
115
130

Car-
bon-

ate

(CO,)

Sulfate

(S04)

51

15

22

Chloride

(Cl)

12

1.5

4.8

Fluo-
rlde

(F)

0.8

.3

Ni-

trate

(NO,)

0.0

.6

Bo-

ron

(B)

0.10

.06

Dissolved solids
(residue at 180°C)

Parts

per
million

308
245
249
211
116
198

242
282
250
284
236
188

176
169
166
186
209
234

Tons

per
acre-

foot

0.42
.33
. 34
.29
. 16
.27

.33
.38
.34
.39
. 32
.26

. 24
.23
.23
.25
.28
.32

Tons

per

day

14.0
24.5
28.1
31.6
80.8
34.9

28.8
32.8
31.0
38.3
37.6
52.3

54.2
58.9
76.6
122
122
103

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

127
110
110
96
55
88

107
146
116
129
108
88

85
78
74
85
96
111

Non-
car-

bon-

ate

0
0
0
0
0
0

0
0
0
0
0
0

0
0
0
0
2
4

So-

dium
ad-

sorp-
tion
ratio

1.8
1.3
1.3
1.1
.6
1.1

. 3
. 2
.3
.3
. 1
.8

.8
.7
.8
c

i!o
1.0

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

448
356
356
295
155
277

342
416
365
407
340
263

245
234
228
261
302
339

PH

7.9
7.7
8.2
7.1
7.1
7.9

8.2
7.9
7.9
7.4
7.5
7.4

7.4
7.3
7.4
7.2
7.1
7.2

RIO GRANDE BASIN Continued

8-2645. RED RIVER BELOW ZWERGLE DAMSITE, NEAR RED RIVER, N. MEX.
(Formerly published as 8-2640, Red River near Red River, N. Mex.)

LOCATION. At gaging station, 0.5 mile below mouth of Bear Canyon, and 4 miles southeast of Red River, Taos County.
DRAINAGE AREA. 25.7 square miles.
RECORDS AVAILABLE. Sediment records: October 1961 to September 1964.
REMARKS. Records of specific conductance of samples available in district office at Albuquerque, N. Mex. Prior to January 1964, samples were obtained at a site 5 miles upstream. Reported as a miscellaneous station for period October 1961 to September 1963.

Periodic determinations of suspended-sediment discharge and particle-size, water year October 1
(Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in n ______________ P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)_____

1963 to September 1964
ative water;

Date of collection

Feb. 4, 1964.......

May 20.............

Time

(24 hour)

1220
0925
1150
1025
1050
0945
1200
1330

0940
1715
1500
1450
1530
1330
1245
1000

1515
0900
1330
1620
1720
1640

Water
tem-

per-
ature

(°F)

50
39
44
34
32
32
34
32

33
35
45
41
44
45
55
51

52
49

51
57
46

Sam-

pling
point

Discharge
(cfs)

6.8
5.0
5.2
9.1
2.4
3.4
4.2
3.6

3.8
5.1
9.0
14.0
30.1
80.8
40.7
20.6

16.8
15.2
33.0
26.0
10.9
11.0

Sediment
concen-

tration

(ppm)

11
2
3
6
7
2
10
2

4
4
23
313
12
55
12
2

6
2
8
17
4
3

Sediment

discharge
(tons per day)

0.20
.03
.04
. 15
.04'

.02
. 11
.02

.04
.06
. 56
12
.98
12
1.3
. 11

. 27
.08
. 71
1.2
. 12
.09

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

28

0.004

32

0.008 0.016

52

0.031 0.062

86

0.125

93

0.250

97

0.500

100

1.000 2.000

Method
of

analysis

SPWC

RIO GRANDE BASIN continued

8-2682. RIO HONDO AT DAMSITE, AT VALDEZ. N. MEX.
(Formerly published as 8-2675. Rio Hondo near Valdez, N. Mex.)

LOCATION. At gaging station 1 mile west of Valdez, and 9 miles north of Taos, Taos County.
DRAINAGE AREA. 40.3 square miles.
RECORDS AVAILABLE. Sediment records: October 1961 to September J.964.
REMARKS. Records of specific conductance of samples available In district office at Albuquerque, N. Mex. During period October 1961 to May 1964, samples were collected 2.8 miles upstream. Reported as a miscellaneous station for period October 1961 to September 1963.

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water;
P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Apr. 28...............

July 28...............

Sept . 2 ....

Time

(24 hour)

1430
1130
1520
1650
0940
1050

1425
1500
0930
1645
0935
1450

1410
0830
1530
0740
1115
0920

Water
tem-

per-
ature

(°F)

47
44
38
33
33

32
38
37
54
46
57

60
54
60
68
52
49

Sam-

pling
point

Discharge
(da)

10.6
10.1
10.4
9.9
8.2
6.8

13.6
9.9
5.4
19.6
43.8
27.5

20.6
11.1
16.8
9.5
26.4
11.4

Sediment
concen-

tration

(ppm)

22
3
2
4
16
4

3
12
4
4
16
9

2
1
13
4
8
2

Sediment

discharge
(tons per day)

0.63
.08
.06
. 11
.35
.07

. 11
.32
.06
.21
1.9
.67

. 11
.03
.59
. 10
.57
.06

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of

analysis

RIO GRANDE BASIN Continued

8-2755. RIO GRANDE DE RANCHOS NEAR TALPA, N. MEX.

LOCATION. At gaging station 1.8 miles downstream from Rito de la Olla (locally known as Pot Creek), 3.0 miles south of Talpa, Taos County, and 3.5 miles upstream from Rio Chiquito.
DRAINAGE AREA. 83 square miles, approximately.
RECORDS AVAILABLE. Sediment records: October 1961 to September 1964.
REMARKS. Records of specific conductance of samples available in district office at Albuquerque, N. Mex. Reported as a miscellaneous station for period October 1961 to September 1963.

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Oct. 16.............

Time

(24 hour)

1645
0930
1700
1135
1130
1435
1240

1010
1135
1335
0830
1550
1520

1640
1035
0930
1145
1000
1455

Water
tem-

per-
ature

(°F)

48

35
38
32
33

32
36
41
37
40
60

65
57
60
68
48
59

Sam-

pling
point

Discharge
(cfs)

6.7
5.1
5.4
3.6
7.8
6.3
4.4

3.6
4.7
6.1
27.1
50.4
40.6

16.3
9.7
13.7
9.6
7.7
4.9

Sediment
concen-

tration

(ppm)

19
11
24
7
39
24
19

21
32
24
27
384
33

6
22
57
22
18
9

Sediment

discharge
(tons per day)

0.34
. 15
.35
.07
.82
.41
.23

.20
.41
.40
2.0
52
3.6

.26
.58
2.1
.57
.37
. 12

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

88

0.004

97

0.008 0.016

99

0.031 0.062

100

0.125 0.250 0.500 1.000 2.000

Method
of

analysis

PWC

RIO GRANDE BASIN Continued

8-2845. WILLOW CREEK NEAR PARK VIEW, N. MEX.

LOCATION. At gaging station, 400 feet upstream from Willow Creek damsite, 0.3 mile downstream from Horse Lake Creek, and 8.5 miles southwest of Park View, Rio Arriba County.
DRAINAGE AREA. 193 square miles.
RECORDS AVAILABLE. Chemical analyses: May to June 1963.
Sediment records: October 1961 to September 1964.
REMARKS. Records of specific conductance of samples available in district office at Albuquerque, N. Mex. Reported as a miscellaneous station for period October 1961 to September 1963.

Periodic determinations of suspended-sediment discharge and particle-size, April 1962 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water;
P, plpet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Apr. 16, 1962......

Dec . 13 ....
Dec 31
Mar. 30, 1964......

Time

(24 hour)

1445
1645
1030
1050
1015
1600

1030
0930
1400
1030
1700
1510

1455
1500
1350
1615
1200

Water
tem-

per-
ature

(°F)

52
54
43
32
32
37

43
40
58
60
67
71

77
66
78
66
58

Sam-

pling
point

Discharge
(cfs)

136
3.1
6.6
1.9
.6
29.8

7.1
2.0
. 1
12.6
6.2
1.6

8.7
8.0
3.1
2.8
.5

Sediment

concen-

tration

(ppm)

2580
56
84
85
32
7760

599
59
67
200
82
53

77
276
455
114
97

Sediment

discharge
(tons per day)

947
.47
1.5
.44
.05
624

11
.32
.02
6.8
1.4
. 23

1.8
6.0
3.8
.86
. 13

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

57

70

78

89

0.004

69

73

90

94

0.008 0.016

94

97

97

~

97

0.031 0.062

100

90

100

100

100

0.125

96

0.250

98

0.500

100

1.000 2.000

Method
of

analysis

PWC

S

PWC

PWC

PWC

RIO GRANDE BASIN Continued

8-2865. RIO CHAMA ABOVE ABIQUIU RESERVOIR, N. MEX.

LOCATION. At gaging station, 7.7 miles downstream from Rio Gallina, 10 miles northwest of Youngsville, Rio Arriba County, 16 miles upstream from Abiquiu Dam, and 30 miles downstream from El Vado Dam.
DRAINAGE AREA. 1,600 square miles, of which 100 square miles is probably noncontributing.
RECORDS AVAILABLE. Water temperatures: October 1962 to September 1964.
Sediment records: October 1962 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 89°F Aug. 19; minimum, freezing point on many days during winter months. Sediment concentrations: Maximum daily, 47,000 ppm July 30; minimum daily, 20 ppm Dec. 16-18, Jan. 20.
Sediment loads: Maximum daily, 160,000 tons Aug. 12; minimum daily, 1 ton on several days.
EXTREMES, 1962-64. Water temperatures: Maximum, 89°F Aug. 19, 1964; minimum, freezing point on many days during winter months. Sediment concentrations: Maximum daily, 47,000 ppm July 30, 1964; minimum daily, 20 ppm on several days during January and March 1963, Dec. 16-18, 1963, Jan. 20 1964.
Sediment loads: Maximum daily, 160,000 tons Aug. 12, 1964; minimum daily, 1 ton on several days during 1964.
REMARKS. Records furnished by Corps of Engineers, Albuquerque District.

Temperature (°F) of water, water year October 1963 to September 1964

October ....

December .....

January. ....

March.........

April ....
May...........
June ....

July...........
August ....
September .....

1

50
32
40

38

38

48

69

61
72

2

54

39

38

40

68

59
70

3

56

45
38

38

68

72
60

4

50

53

42

76

70
6*

5

48

42

40

55

70
62

6

"

40

48

64

70
65

7

52

35

44

65
67

8

56

32

45

72
60

9

55

38

44

76
6L

10

56

35

72
64

11

5C

35

72

12

52

34

65

13

52

32

65

14

46

35

66

15

49

32

70

Day

16

40

34

74

17

50

75

18

52

7R

19

52

89

20

45

71

21

43

hO

22

4*

7n

23

45

72

24

48

7^

25

50

7C

26

45

77

27

45

12

?n

28

45

15

29

46

18

70
52

30

49

32

32

52

bfa

72
59

31

45

32

34

__

- -

SO

Aver-
age

49

36

33

51

it)

73
59

RIO GRANDE BASIN Contlnued

8-2865. RIO CHAMA ABOVE ABIQUIU RESERVOIR, N. HEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 6.............

Time

(24 hour)

0800
0800
0700
1200
1230

1200
0830
1200
1000
1400

1200
1200
1145
1230
0730

Water
tem-

per-
ature

(°F)

45
48
40
44
52

44
64
74
65
70

70
72
65
75
65

Sam-

pling
point

Discharge
(cfs)

38
90
D 944
113
280

1080
835
25
119
269

134
158
956
938
392

Sediment
concen-

tration

(ppm)

3400
1800
5100
780
880

2200
1700
2800
72000
4100

19000
7400
41000
27000
7500

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004

42
20
7
64
62

12
9
84
60
53

77
62
48
43
43

0.008

76
28
9
74
71

16
14
96
83
70

89
76
59
55
62

0.016

96
35
17
81
78

21
21
97
95
79

97
85
68
64
76

0.031

98
43
28
86
87

22
27
98
98
88

98
79
78
71
86

0.062

99
53
44
96
91

34
61
99
99
98

99
94
93
94
91

0.125

100
74
71
99
94

62
91
100
100
100

100
98
98
99
98

0.250

97
91
100
96

87
98

99
100
100
100

0.500

93
99

97

97
99

100

1.000

100
98

99

99
100

2.000

100

100

100

Method
of

analysis

SPWC
SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC
SPWC

D Dally mean discharge.

RIO GRANDE BASIN Continued

8-2870. RIO CHAMA BELOW ABIQUIU DAM, N. MEX.

LOCATION. At gaging station, 0.5 mile downstream from Abiquiu Dam, and 6 miles northwest of Abiquiu, Rio Arriba County. DRAINAGE AREA. 2,147 square miles, of which about 100 square miles is probably noncontributing.
RECORDS AVAILABLE. Water temperatures: October 1962 to September 1964.
Sediment records: October 1962 to September 1964.
EXTREMES, 1963-64. Water temperatures: 83°F June 16; minimum, freezing point on many days during winter months. Sediment concentrations: Maximum daily, 38,000 ppm July 30; minimum daily, 10 ppm Dec. 21, 28, 29.
Sediment loads: Maximum daily, 77,000 tons Aug. 12; minimum daily, 1 ton Dec. 21, 28, 29.
EXTREMES, 1962-64. Water temperatures: Maximum, 83°F June 16, 1964; minimum, freezing point on many days during winter it Sediment concentrations: Maximum daily, 48,000 ppm Aug. 21, 1963; minimum daily, 10 ppm Dec. 21, 28, 29, 1964. Sediment loads: Maximum daily, 77,000 tons Aug. 12, 1964; minimum daily, 1 ton July 2, 29, 1963, Dec. 21, 28, 29, 1964. REMARKS. Records furnished by Corps of Engineers, Albuquerque District.

Temperature (°F) of water, water year October 1963 to September 1964

October ....

December .....

June ....

July...........
August ....
September .....

1
56

_
_

2
54

32

3
53

32

67

4
55

32

68

5

32

67

6

32

66

7

67

8

_

9

33

10

33

1 1

33

67

12

32

67

13

32

66

14

68

15
50

_

Day

16
50

32

17
53

32

67

18
53

33

76

19

32

67

20

32

67

21
55

_

67

22
52

_

23
51

32

24
53

32

59

25
56

59

26

32

59

27

33

59

28
48

55

29
51

_

30
51

32

31
50

32

60

Aver-
age

~

_

RIO GRANDE BASIN Continued

8-2870. RIO CHAMA BELOW ABIQUIU DAM, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Mar. 16.............

Sept. 23............

Time

(24 hour)

0800
0900
0800
0800

0800
0800
0800
1530

0800
0800
1510
0800

1535
0800
0800
0800

Water
tem-

per-
ature

(°F)

56
52
32
32

32
32
33
33

46
67
67
67

66
68
65

Sam-

pling
point

Discharge
(cfs)

D 31
60
D 32
D 37

D 35
65
104
90

502
214
85
188

973
D 920
67
197

Sediment

concen-

tration

(ppm)

410
2800
890
1700

250
1700
720
1100

410
6300
5200
3300

48000
280
2700
4700

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004

22
38
8
5

23
7
39
25

66
63
77
49

56
37
28
71

0.008

31
74
12
10

43
13
51
33

78
83
88
69

73
39
43
90

0.016

45
92
26
22

67
22
64
51

87
89
93
82

89
53
62
96

0.031

63
93
44
39

85
28
78
60

88
95
96
98

97
67
90
97

0.062

75
96
77
64

98
41
96
94

91
99
98
99

99
78
98
98

0.125

86
98
94
97

100
94
98
98

98
100
99
100

100
98
100
99

0.250

94
99
99
99

98
99
99

99

100

100

100

0.500

99
100
100
100

100
100
100

100

"

1.000

100

2.000

Method
of

analysis

SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

D Dally mean discharge.

RIO GRANDE BASIN Continued

8-2900. RIO CHAMA NEAR CHAMITA, N. MEX.

LOCATION. At gaging station 200 feet downstream from bridge on U.S. Highway 285, 0.5 mile west of Chamita, Rio Arriba County, 2.5 miles northwest of San Juan Pueblo, and 3 miles upstream from mouth.
DRAINAGE AREA. 3,144 square miles, of which at least 100 square miles is probably noncontributing.
RECORDS AVAILABLE. Chemical analyses: April 1963 to September 1964.
Water temperatures: October 1950 to September 1964.
Sediment records: October 1947 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 81°F July 21, 31; minimum, freezing point Jan. 8.
Sediment concentrations: Maximum daily, 34,000 ppm July 26, Aug. 13; minimum daily, 20 ppm Oct. 9, 11, 16-18.
Sediment loads: Maximum daily, 90,000 tons Aug. 13; minimum daily, less than 0.50 ton on several days during October and June.
EXTREMES, 1947-64. Water temperatures (1950-64): Maximum, 89"F July 19, 1951, Aug. 8, 1956; minimum, freezing point on many days during winter months. Sediment concentrations: Maximum daily, 55,500 ppm Aug. 21', 1955; minimum daily, no flow on several days during August 1950, August, September, and October 1951, September 1953, July 1955.
Sediment loads: Maximum dally 209,000 tons Aug. 7, 1957; minimum daily 0 tons on several days during August 1950, August, September and October 1951, September 1953, July 1955.
REMARKS. Records of water temperature and sediment furnished by Corps of Engineers, Albuquerque District.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Apr. 17...........

Mean

disc barge
(eta)

5.0
45.1
157
58.7
46.6
48.4

49.2
57.3
83.9
80.7
73.4

163
175

<«).i f,
286

Silica

(S10,)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

~

65

;;
__

Po-
tas-
sium

(K)

Bl-

car-

bon-

ate

(HCOJ

256
186
170
223
240
231

221
236
217
221
207

192
180
178
1<!<5
144

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

0
0
0
0
0

5
0
0
0
0

Sulfate

(SO.)

_

182

-

Chloride

(CD

20
35
8.5
16
19
17

17
24
20
23
18

19
12
16
16
7.7

FluO-

ride

(P)

0.5

Ni-

trate

(NOJ

--

0.4

~

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

236
302
236
275
305
299

294
267
257
234
229

229
228
234
203
183

Non-
car-

bon-

ate

26
149
97
92
108
110

113
73
79
53
59

63
80
88
53
65

So-

dium
ad-

sorp-
tion
ratio

1.8

Specific
con-

duct-

ance

[micro-
mhos at
r 25'C)

713
826
565
745
824
800

792
765
726
697
674

655
617
662
583
486

PH

8.1
7.5
7.5
7.6
8.0
7.8

7.5
7.7
8.2
7.1
7.8

8.5
7.4
7.5
7.4
7.4

RIO GRANDE BASIN--Continued

8-2900. RIO CHAMA NEAR CHAMITA, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aug. 21.............

Time

(24 hour)

1730
1715
1730
1150
1120

1205
1525
1500
0655

1830
1215
1115
1730

0720
1245
0850
1730

Water
tem-

per-
ature

(°F)

60

48
44
35

34
52
40
47

70
68
70
76

78
50
74
71

Sam-

pling
point

Discharge
(cfs)

39
38
95
75
40

55
136
106
566

47
160
90
198

180
958
944
50

Sediment
concen-

tration

(ppm)

1000
210
1600
170
130

190
1800
700
2800

19000
53000
16000
4400

12000
34000
3000
850

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004

72
61
67
36
27

6
79
44
14

88
35
82
41

60
67
12
46

0.008

89
68
86
51
37

15
91
54
27

96
45
94
54

80
76
20
66

0.016

90
78
94
64
58

22
92
62
40

97
57
97
71

89
79
27
82

0.031

91
83
95
77
64

82
93
63
57

98
69
98
80

94
94
35
90

0.062

96
92
98
94
87

89
97
97
70

99
81
99
86

96
99
86
97

0.125

99
97
99
99
97

91
99
99
84

100
98
100
98

99
100
96
99

0.250

100
99
100
100
99

97
100
100
98

99

99

100

98
100

0.500

100

100

100

99

100

100

100

1.000

100

2.000

Method
of

analysis

SPWC
SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

SPWC
SPWC
SPWC
SPWC

RIO GRANDE BASIN Continued

8-2943. RIO NAMBE AT NAMBE FALLS, NEAR NAMBE, N. HEX.

LOCATION. At gaging station 4.4 miles southeast of Narabe Pueblo, 5.1 miles southeast of Nambe, Santa Fe County, and 8.4 miles upstream f DRAINAGE AREA. 25.1 square miles, approximately.
RECORDS AVAILABLE. Sediment records; October 1961 to September 1964.
REMARKS. --Records of specific conductance of monthly samples available in district office at Albuquerque, N. Hex. Prior t
1.7 miles downstream at former station, 8-2950. Rio Nambe at Nambe, N. Hex. Reported as a miscellaneous station for per

Rio Tesuqu

March 1963, samples wer
d October 1961 to Septe

i collected
iber 1963.

Periodic determinations of suspended-sediment discharge, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water;
P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Oct. 10, 1963.......

Jan. 20.............

Mar. 3..............

May 11..............

Time

(24 hour)

1010
1425
1150
1155
1045

1345
1130
1000
1430
0955
1450

1455
1100
1100
1620
1355
1210

1015
1100
1045
1605
1015

Water
tem-

per-
ature

(°F)

78
62
32
32
34

32
33
32
33
32
46

49
42
48
54
60
62

64
60
63
64
59

Sam-

pling
point

Discharge
(cfs)

6.57
5.32
2.83
4.39
3.72

3.42
3.56
3.31
3.41
3.06
4.61

9.41
11.2
21.5
15.4
11.4
7.53

5.90
7.67
6.25
5.67
5.71

Sediment
concen-

tration

(ppm)

5
12
17
13
93

6
5
10
12
36
5

4
13
15
6
6
3

4
26
8
12
14

Sediment

discharge
(tons per day)

0.09
. 17
. 13
. 15
.93

.07
.05
.09
. 11
.31
.06

. 10
.39
.87
.25
. 18
.06

.06
.54
. 14
. 18
.22

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031 0.062 0.125 0.250 0.500 1.000 2.000

Method
of

analysis

RIO GRANDE BASIN Continued

8-3130. RIO GRANDE AT OTOWI BRIDGE, NEAR SAN ILDEFONSO, N. MEX.

LOCATION. At gaging station on pier of former railway bridge, 400 feet downstream from bridge on State Highway 4, 1.8 miles southwest of San Ildefonso Pueblo, 2.5 miles downstream from Pojoaque River, and 7 miles west of Pojoaque, Santa Fe County.
DRAINAGE AREA. 14,300 square miles, approximately (includes 2,940 square miles in closed basin in San Luis Valley, Colo.).
RECORDS AVAILABLE. Chemical analyses: October 1946 to September 1964.
Water temperatures: October 1948 to September 1964.
Sediment records: October 1947 to September 1964.
EXTREMES, 1963-64. Dissolved solids; Maximum, 724 ppm July 31; minimum, 153 ppm May 21-31.
Hardness: Maximum, 456 ppm July 31; minimum, 100 ppm May 21-31.
Specific conductance: Maximum daily, 1,010 micromhos July 31; minimum daily, 223 micromhos May 30.
Water temperatures: Maximum, 84°F July 22; minimum, freezing point on many days during December to February.
Sediment concentrations: Maximum daily, 39,000 ppm Aug. 13; minimum daily, 22 ppm June 23-30.
Sediment loads: Maximum daily, 130,000 tons Aug. 13; minimum daily, 8 tons June 28-30.
EXTREMES, 1946-64. Dissolved solids: Maximum, 1,030 ppm Aug. 5, 1963; minimum, T.T/ ppm June 11-20, 1952.
Hardness: Maximum, 702 ppm Aug. 5, 1963; minimum, 83 ppm May 22-26, 1960.
Specific conductance: Maximum daily, 1,310 micromhos Aug. 5, 1963; minimum daily, 165 micromhos June 13, 1952.
Water temperatures (1948-64): Maximum, 88°F Aug. 4, 5, 1954; minimum, freezing point on many days during winter months.
Sediment concentrations (1947-64): Maximum daily, 42,600 ppm Aug. 21, 1955; minimum daily, 11 ppm July 27, 1963.
Sediment loads (1947-64): Maximum daily, 366,000 tons Aug. 23, 1961; minimum daily, 3 tons July 27, 1963.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-21, 1963...
Oct. 22-31........

Jan. 1-31, 1964...

Mar. 1-31.........

May 21 31

July 14...........

Mean

discharge
(cfs)

205
301
573
355
429
454

566
652
789
1293
1699
769

235
439
210
257
336
348

Silica

(S10a)

28
28
25
26
31
28

28
25
20
19
18
21

24
22
25
44
27
27

Iron

(Fe)

Cal-

cium

(Ca)

43
46
49
50
43
40

41
45
40
36
34
38

42
39
45
84
50
66

Mag-
ne-

sium

(Mg)

6.4
9.0
9.1
9.5
7.9
7.1

6.2
8.4
6.6
4.1
3.6
5.1

7.3
5.0
6.2
8.4
6.8
9.4

Sodium

(Na)

27
32
31
31
27
25

25
28
19
13
11
17

26
18
27
25
27
40

Po-
tas-

sium

(K)

--

3.0

2.4

3.2

__

Bi-
car-

bon-

ate

(HCO,)

176
178
170
180
164
154

146
153
135
\">,">,
114
134

166
132
170
360
188
216

Car-
bon-
ate

(CO,)

Sulfate

(SO.)

40
64
72
68
55
48

55
71
50
30
26
39

46
41
48
4.0
48
102

Chloride

(Cl)

7.4
8.9
8.6
9.5
7.8
7.3

7.6
8.1
6.0
4.2
3.3
5.0

7.4
4.9
8.0
3.0
7.9
9.8

Fluo-

rlde

(F)

0.5

.4

.6

"

Ni-

trate

(NO,)

0.1

.1
.1
.1
. 8
.5

.6
1.4
.9
1.5
1.5
1.0

.5
.8
. 7
1.1
.8
.6

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

239
276
279
283
254
232

239
262
208
168
153
195

239
196
244
346
260
361

Tons

per
acre-

foot

0.33
.38
.38
.38
. 35
.32

.33
.36
.28
.23
. 21
.27

.33
.27
.33
.47
.35
.49

Tons

per

day

132
224
432
271
294
284

365
461
443
587
702
405

152
232
138
240
236
339

Hardness

aa CaCO,

Cal-

cium,
Mag-
ne-

sium

134
152
160
164
140
129

128
147
127
107
100
116

135
118
138
244
153
203

Non-
car-

bon-

ate

0
6
21
16
5
3

8
21
16
7
6
6

0
10
0
0
0
26

So-

dium
ad-

sorp-
tion
ratio

1.0
1.1
1.1
1.1
1.0
1.0

1.0
1.0
. 7
. 5
. 5
. 7

1.0
. 7
1.0
. 7
1.0
1.2

Specific
con-

duct-

ance

[micro-

jnhos at
25"C)

369
419
421
431
383
354

361
409
335
266
243
301

374
309
383
560
412
554

PH

7.9
8.0
8.1
8.2
8.2
8.2

8.2
8.0
7.9
7.9
7.9
7.9

8.0
7.8
7.9
7.5
7.7
7.7

RIO GRANDE BASIN Continued

8-3130. RIO GRANDE AT OTOWI BRIDGE, NEAR SAN ILDEFONSO, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 22............

Time

(24 hour)

1715
0700
0815
1600

1600
1600
1430
1605
1640

1640
1630
1600
1645

Water
tem-

per-
ature
(°F)

60
45
45
65

66
64
74
73
64

64
64
66
65

Sam-

pling
point

Discharge
(cfs)

266
1080
1180
1380

1950
958
406
482
482

482
989
261
439

Sediment

concen-

tration

(ppm)

2410
26500
1460
761

1440
88000
6980
64600
56200

56200
27500
1570
4200

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

17
41
20
24

22
25
46
28
30

1
34
73
40

0.004

21
51
26
28

24
36
62
35
37

6
39
80
45

0.008

-

45

29

0.016

32
78
40
32

36
56
77
48
60

58
59
95
59

0.031

"

;;
75

74

0.062

79
89
57
44

62
94
86
87
92

92
95
98
78

0.125

95
95
67
58

84
100
98
99
99

99
98
99
95

0.250

100
98
78
80

99

100
100
100

100
99
100
100

0.500

100
88
100

100

100

1.000

99

-

"

2.000

100

Method
of

analysis

VPWC
VPWC
VPWC
VPWC

VPWC
VPWC
VPWC
VPWC
VPWC

VPN
VPWC
VPWC
VPWC

RIO GRANDE BASIN Continued

8-3180. GALISTEO CREEK AT DOMINGO, N. MEX.

LOCATION. At gaging station on Santo Domingo Pueblo Grant, 160 feet downstream from highway bridge, 0.3 mile northeast of Domingo, Sandoval County, 2.8 miles east of Santo Domingo Pueblo, and 4 miles upstream from mouth.
DRAINAGE AREA. 640 square miles, approximately.
RECORDS AVAILABLE. Water temperatures: July 1961 to September 1964.
Sediment records: January 1948 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 94°F July 25; minimum, freezing point on many days during winter months. Sediment concentrations: Maximum daily, 67,000 ppm July 22; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 82,000 tons Aug. 1; minimum daily, 0 tons on many days.
EXTREMES, 1948-64. Water temperatures(1961-64): Maximum, 94°F July 25, 1964; minimum, freezing point on many days during December 1962, January 1963, December 1963, January 1964 and February 1964.
Sediment concentrations: Maximum daily, 96,300 ppm Oct. 20, 1957; minimum daily, no flow on many days each year.
Sediment loads: Maximum daily, 1,600,000 tons Sept. 25, 1955; minimum daily, 0 tons on many days each year.
REMARKS. Records fo specific conductance of daily samples available in district office at Albuquerque, N. Mex.

Temperature (°F) of water, water year October 1963 to September 1964

January. ....
February. ......

July...........

1

<vo
42

2

38
44

3

36
32

4

36
32

5

32
32

6

36
32

7

32
32

8

3*
32

9

32
38

10

32
44

11

32

12

32

13 14 15

Day

16 17 18 19 20 21 22 23 24 25

*

26 27 28 29

5?

30 31

- -

Aver-

age

<tO

RIO GRANDE BASIN Continued

8-3180. GALISTEO CREEK AT DOMINGO, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of ollection

Sept. 11............

Time

(24 hour)

1845
1400
0900
0330
1030
1730

0055
0055
1200
1530
1645

Water
tem-

per-
ature

(°F)

60
38
70
50
78
70

63
63
80
68
68

Sam-

pling
point

Discharge
(cfs)

320
1.9
3.2
280
106
2800

312
312
139
1610
1010

Sediment
concen-

tration

(ppm)

10800
15000
82500
71400
117000
216000

95700
95700
39400
76400
38000

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

53
33
70
48
59
29

0
41
42
25
34

0.004

68
37
89
59
75
40

1
54
53
32
44

0.008

- -

4
65

0.016

89
59
99
83
96
49

78
76
75
47
59

0.031

-

-

88
89

0.062

90
91
100
95
99
88

95
95
95
88
91

0.125

90
98

99
99
97

98
99
100
99
99

0.250

92
100

100
100
100

100
100

100
100

0.500

96

1.000

99

2.000

100

Method
of

analysis

SPWC
VPWC
SPWC
VPWC
VPWC
VPWC

VPN
VPWC
VPWC
VPWC
VPWC

RIO GRANDE BASIN Continued

8-3215. JEMEZ RIVER BELOW EAST FORK, NEAR JEMEZ SPRINGS, N. MEX.

LOCATION. At gaging station 0.4 mile downstream from East Fork and boundary of Santa Fe National Forest, and 5.3 miles northeast of Jemez Springs, Sandoval County.
DRAINAGE AREA. 173 square miles.
RECORDS AVAILABLE. Chemical analyses: April 1963 to September 1964.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Sept. 25..........

Mean

discharge
(cfs)

10.4
13.3
10.5
11.5
7.2

12.8
12.1
13.4
17.1
20.0

12.1
11.7
12.7
10.0
13

Silica

(SiO,)

-

56
52

Iron

(Fe)

~

0.05
.07

Cal-
cium

(Ca)

- -

14
14

Mag-
ne-

sium

(Mg)

2.9
2.2

Sodium

(Na)

A 21

19
17

Po-
tas-

sium

(K)

-

2.8
2.7

Bi-
car-

bon-

ate

(HCO,)

84
74
88
83
88

77
66
69
33
76

80
83
89
86
85

Car-
bon-

ate

(CO,)

0
3
0
0
0

0
0
3
0
0

2
6
3
3
0

Sulfate

(S0«)

-

12

7.6
8.8

Chloride

(Cl)

0.6

3.5

5.2

6.5

5.0

5.3
4.7

Fluo-
ride

(F)

- -

-

1.0

1.1
1.1

Ni-

trate

(NO,)

-

-

-

0.1

.2
. 1

Bo-

ron

(B)

-

0.08
.08

Dissolved solids

(calculated)

Parts

per
million

- -

-

154
145

Tons

per
acre-

foot

-

-

0.21
.20

Tons

per

day

~

-

4.16
5.09

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

44
41
43
39
43

36
38
38
28
51

46
52
58
47
44

Non-
car-

bon-

ate

0
0
0
0
0

0
0
0
1
0

0
0
0
0
0

So-

dium
ad-

sorp-
tion
ratio

-

1.3

1.2

1.1

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

158
153
169
159
174

157
154
155
88
175

174
192
204
178
168

pH

8.1
8.4
7.5
8.1
8.0

8.0
6.2
8.5
6.5
8.2

8.4
8.5
8.4
8.4
7.8

A Calculated Na plus K, reported as Na

RIO GRANDE BASIN Continued

8-3291. BERNALILLO FLOODWATER RETARDING RESERVOIR NO. 1 (PIEDRA LISA ARROYO), NEAR BERNALILLO, N. MEX.

d 422, and LOCATION (revised). At outflow pipe of reservoir, 0.3 mile east of intersection of State Highways 1.5 miles northeast of Bernalillo, Sandoval County.
DRAINAGE AREA. 4.1 square miles, of which 2.0 square miles has contour plowing, pitting and small dams to reduce surface runoff.
RECORDS AVAILABLE. Sediment records: July 1956 to September 1964.

Sediment outflow, water year October 1963 to September 1964

Date

July 8, 1964...
Sept. 26.......

Flow
event
No.

16
17

Flow
duration
(hours)

2.67
3.0

Discharge
(acre-
feet)

0.65
. 71

Mean

discharge
for period
(cfs)

2.99
2.88

Mean
concen-

tration

(ppm)

7740
6690

Outflow
sediment
load
(tons)

11
11

Outflow particle-size analyses of suspended sediment, water year October 1963
to September 1964
(Method of analysis: C, chemically dispersed; N; native water; P, pipet; V, visual accumulation tube; W, distilled water)

Date

July 8, 1964...

Time
(24-
hr.)

1720
1720
1740
1740
1630
1630
1745

Discharge
(cfs)

7.6
7.6
7.3
7.3
5.2
5.2
. 8

Concen-
tration

(ppm)

17800
17800
12600
12600
6810
6810
2890

Percent finer than indicated size,
in millimeters

0.002

42
4
54
6
61
5
76

0.004

64
12
75
16
84
14
94

0.008

86
41
93
72
96
59

0.016

98
96
99
99
99
97
98

0.031

100
99
100
100
100
99

0.062

100

100
100

Method

PWC
PN
PWC
PN
PWC
PN
PWC

Inflow particle-size analyses of suspended sediment, water year October 1963 to September 1964

North tributary
July 8, 1964.. .

South tributary
July 8, 1964...

Time
(24-
hr.)

1700
1700

1705
1705

Dis-

(cfs)

E 20
E 20

E 1
E 1

Concen-

(ppm)

81700
81700

81200
81200

Percent finer than indicated size, in millimeters

0.002

14
3

12
3

0.004

18
8

17
7

0.008

24
18

21
13

0.016

30
28

27
23

0.031

40
42

38
37

0.062

65
65

57
57

0.125

89
89

65
65

0.25

96
95

69
69

0.5

98
98

78
78

1.0

99
99

96
96

2.0

1OO
100

100
100

VPWC
VPN

VPWC
VPN

E Estimated.

RIO GRANDE BASIN Continued

8-3295. RIO GRANDE NEAR BERNALILLO, N. HEX.

LOCATION. At gaging station 2 miles northwest of Sandia Pueblo, 3 miles southwest of Bernalillo, Sandoval County, 3.5 miles down-stream from State Highway 44, and 8.5 miles downstream from Jemez River.
DRAINAGE AREA. 17,300 square miles, approximately (includes 2,940 square miles in closed basin in San Luis Valley, Colo.). RECORDS AVAILABLE. Water temperatures: October 1948 to September 1964.
Sediment records: November 1947 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 94°F Aug. 7; minimum, freezing point Jan. 14, 15.
Sediment concentrations: Maximum daily, 43,000 ppm Aug. 11; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 76,000 tons Aug. 14; minimum daily, 0 tons on many days.
EXTREMES, 1947-64. Water temperatures (1948-64); Maximum, 94°F Aug. 7, 1964; minimum, freezing point on many days during winter months.
Sediment concentrations: Maximum daily, 75,000 ppm Sept. 25, 1955; minimum daily, no flow on many days during July 1956,1959-61, August and September 1962, 1963 and 1964.
Sediment loads: Maximum daily, 1,680,000 tons Sept. 25, 1955; minimum daily, 0 tons on many days during July 1956, 1959-61, August and September 1962, 1963 and 1964.
REMARKS. Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Flow affected by ice Dec. 16-18, Jan. 1-27.

Temperature (°F) of water, water year October 1963 to September 1964

Month

October ....
November .....
December .....

January. ....
February. ......
March.........

April..........
May...........

July...........

Day

1

40

48

57
67
65

2

42

40

55
66
68

3

56

39

48
67
60

4

56

37

47
66
75

5

56

36

50
57
77

84

6

56

34

52
66
72

7

52

33

55
63
73

8

54

"

59

70

9

56

"

62

76

10

56

34

64

77

11

55

34

57

80

12

55

33

81

13

33

-

14

32

65

15

32

16

33

17

33

-,.,

18

34

19

34

20 21 22 23 24 25 26 27 28 29 30

60

31

62

Aver-

age

- -

i«

RIO GRANDE BASIN Continued

8-3295. RIO GRANDE NEAR BERNALILLO, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept . 6 ....

Time

(24 hour)

0600
0600
1700
1700
1900
1530

1730
0730
0700
0130
1030

Water
tem-

per-
ature

(°F)

44
35
47
59
57
75

88
64
69
69
73

Sam-

pling
point

Discharge
(cfs)

1350
314
412
238
135
2400

55.0
480
940
1410
131

Sediment
concen-

tration

(ppm)

5420
518
1130
4270
1320
14400

52000
33600
28900
27800
14900

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

25

56
68
45

66
57
55
54
65

0.004

31

73
73
52

86
78
72
66
80

0.008 0.016

48

95
94
71

00
93
92
90
98

0.031 0.062

84
93
66
99
100
90

100
98
97
99

0.125

94
98
92
100

98

99
98
99

0.250

100
99
100

100

100
99
100

0.500

100

"

100

1.000 2.000

Method
of

analysis

VPWC
S
V
SPWC
PWC
VPWC

PWC
PWC
VPWC
VPWC
SPWC

RIO GRANDE BASIN Continued

8-3320. RIO GRANDE NEAR BERNARDO, N. MEX.

LOCATION. At gaging station at bridge on U.S. Highway 60, 2 miles east of Bernardo, Socorro County, and 4.5 miles upstream from Rio Puerco. DRAINAGE AREA. 19,230 square miles, approximately (includes 2,940 square miles in closed basin in San Luis Valley, Colo.).
RECORDS AVAILABLE. Chemical analyses: October 1956 to September 1964.
Water temperatures: October 1958 to September 1964 (conveyance channel).
Sediment records: October 1947 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,320 ppm Oct. 4; minimum, 289 ppm June 1-5.
Hardness: Maximum, 530 ppm Oct. 23; minimum, 165 ppm May 11-31.
Specific conductance: Maximum daily, 1,930 micromhos Oct. 4; minimum daily, 426 micromhos May 26.
Water temberatures: Maximum 84°F June 20; minimum, 34°F Dec. 15.
Sediment loads: Maximum daily, 15,000 tons Nov. 15; minimum daily, less than 0.50 ton on many days during August and September.
EXTREMES, 1947-64. Dissolved solids (1956-64): Maximum, 1,780 ppm July 30, 1963; minimum 207 ppm June 1-9, 1958.
Hardness (1956-64): Maximum, 1,200 ppm Aug. 12, 13, 1961; minimum, 120 ppm July 1-4, 1957, June 1-9, 1958.
Specific conductance (1956-64): Maximum daily, 2,600 micromhos July 30, 1963; minimum daily, 292 micromhos June 3, 1958.
Water temperatures (1958-64): Maximum, 98°F Aug. 6, 1960; minimum, freezing point Dec. 13, 1961, Jan. 15, 1963.
Sediment loads: Maximum daily, 348,000 tons Sept. 26, 1955; minimum daily,0 tons on many days during summer months of most years.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Chemical records computed from sum of water discharge in the floodway, conveyance channel, and Bernardo interior drain. Records of specific conductance of daily samples available in district office at Albuquer-que, N. Mex. Sediment records are summation of water and sediment discharges from these three channels. Records of daily sediment figures for each channel are available in district office. Tables for particle-size analyses for conveyance channel and floodway are published separately and show water discharges and concentrations in the channel at the time of sampling.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-3, 1963....

Oct. 9-12.........

Oct 19 22

Nov. 1-7..........

Jan. 1-31, 1964...

May 1-7...........

Mean

discharge
(cfs)

5 0
5 4
9 3
18 0
13 7
8 1

24.0
40.0
21.2
16.0
58.4
438

315
402
474
234
156
159

Silica

(810,)

38
45
43
40
41
38

36
31
39
41
35
29

32
30
29
30
29
34

Iron

(Fe)

Cal-

cium

(Ca)

110
124
118
90
107
108

96
164
107
118
83
71

70
68
65
64
65
66

Mag-
ne-

sium

(Mg)

23
34
21
13
18
24

12
29
I7
18
11
11

10
8.4
8.8
7.9
9.2
10

Sodium

(Na)

149
258
152
103
136
159

109
216
140
147
67
46

52
50
48
46
52
56

Po-
tas-

sium

(K)

8.1

8.1

8.0
6.0
5.2

5.1
4.9
4.9
5.3
5.4
5.4

Bl-
car-

bon-

ate

(HCOJ

274
256
296
252
278
262

250
312
W>,
282
248
218

218
208
206
198
204
212

Car-
bon-

ate

(CO,)

Sulfate

(SO.)

338
534
341
206
275
355

221
562
fjfy
322
148
115

114
105
97
96
111
120

Chloride

(Cl)

94
195
93
62
84
110

64
110
80
93
32
22

26
24
25
24
27
27

Fluo-
ride

(P)

Ni-

trate

(NO,)

0.1
.0
.5
7.6
8.1
. 5

4.9
.2
3.9
1.8
1.8
1.8

4.8
4.7
4.7
2.4
.6
2.2

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

887
1320
923
646
806
932

666
1270
802
888
506
408

421
397
383
373
399
425

Tons

per
acre-

foot

1.21
1.80
1.26
.88
1.10
1.27

.91
1.73
1.09
1.21
.69
. 55

. 57
.54
.52
.51
. 54
. 58

Tons

per

day

12.0
19.3
23.2
31.4
29.8
20.4

43.2
137
45.9
38.4
79.8
483

358
431
490
236
168
182

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

370
450
380
278
340
370

288
530
335
370
252
224

216
204
198
192
200
206

Non-
car-

bon-

ate

145
240
137
71
112
155

83
274
104
139
49
45

37
33
29
30
33
32

So-

dium
ad-

sorp-
tion
ratio

3.4
5.3
3.4
2.7
3.2
3.6

2.8
4.1
3.3
3.3
1.8
1.3

1.5
1.5
1.5
1.4
1.6
1.7

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1300
1930
1330
983
1200
1370

1020
1790
1220
1310
766
625

637
602
585
570
608
649

PH

8.0
8.2
7.8
7.5
7.6
8.2

7.5
7.5
7.7
7.9
7.6
7.6

7.7
7.8
7.8
7.8
8.1
7.8

RIO GRANDE BASIN Continued

8-3320. RIO GRANDE NEAR BERNARDO, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

1800
1100
1515
1145
1200

1020
1220
1120
1150
1800

Water
tem-

per-
ature

(°F)

48
45
41
40
39

32
35
35
42
72

Sam-

pling
point

Discharge
(cfs)

Sediment
concen-

tration

(ppm)

8-3319.9. RIO GRANDE C

752
555
236
316
316

365
435
345
200
200

4310
2520
748
896
909

1010
2040
952
854
1410

discharge

ONVEYANCE CHANN

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

EL NBA

50

29

24

60

0.004

R BERK

66
62

39

30

68

0.008

ARDO,

0.016

N. MEX

83
81

54

43

82

0.031 0.062

91
88
62
61
62

49
55
55
74
89

0.125 J0.250

97
95
78
78
79

63
66
66
85
95

100
100
100
100
100

100
97
100
100
100

0.500

100

1.000 2.000

Method
of

analysis

VPWC
VPWC
V
VPWC
VPWC

V
VPWC
V
V
VPWC

8-3320.5. BERNARDO INTERIOR DRAIN AT BERNARDO, N. MEX.

Sept. 27...........

1600
1900
1700
1630
1700

63
64
84
83
74

39
114
50.5
30.8
21

17800
598
17100
2390
1520

75

82
56
72

89

88
63
87

97

98
81
98

97
88
100
90
100

97
96

92

98
100

94

100

100

VPWC
V
SPWC
VPWC
SPWC

Particle-size analyses of bed material, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

Sediment
concen-

tration

(ppm)

Sediment

discharge
(tons per day)

Bed material

Percent finer than size indicated, in millimeters

0.062 0.125 0.250 |0.500 pL.OOO 2.000 |4.000 p. 000 16.00

8-3319.9. RIO GRANDE CONVEYANCE CHANNEL NEAR BERNARDO, N. MEX.

Dec . 2' ....

1215
1330
1100

1
2
2

9
11
13

85
85
82

99
99
99

100
100
100

32.00 64.00

Method
of

analysis

V
V
V

RIO GRANDE BASIN Continued

8-3530. RIO PUERCO NEAR BERNARDO, N. MEX.

LOCATION. At gaging station at bridge on former U.S. Highway 85, 0.2 mile upstream from Interstate Highway 25, 1.2 miles southwest of Bernardo, Socorro County, 3 miles upstream from mouth, and 18 miles south of Belen.
DRAINAGE AREA. 7,350 square miles, approximately, of which at least 1,130 square miles does not contribute directly to surface runoff.
RECORDS AVAILABLE. Chemical analyses: July 1956 to September 1964.
Sediment records: October 1947 to September 1964.
EXTREMES, 1963-64. Sediment concentrations: Maximum daily, 170,000 ppm July 24; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 580,000 tons Aug. 14; minimum daily, 0 tons on many days each year.
EXTREMES, 1947-64. Sediment concentrations: Maximum daily, 230,000 ppm July 26, 1957; minimum daily, no flow on many days each year.
Sediment loads: Maximum daily, 2,240,000 tons Aug. 7, 1957; minimum daily, 0 tons on many days each year.
REMARKS. Values reported for sodium (Na) are determined by analyses and do not include potassium (K). Records of specific conductance of daily samples avail-able in district office at Albuquerque, N. Mex. Records of miscellaneous water temperatures available in district office at Albuquerque, N. Mex. No flow Oct. 3-19, Nov. 1, Nov. 13 to Mar. 22, Mar. 27 to Apr. 1, Apr. 15 to July 9, July 18, 19, Aug. 22 to Sept. 11, Sept. 15-18.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Sept. 24..........

Mean

discharge
(cfs)

224
78
20
94
505
160
153

Silica

(SiO,)

16
14

14

Iron

(Fe)

0.00
.04

.02

Cal-

cium

(Ca)

299
196

298

Mag-
ne-

sium

(Mg)

52
43

56

Sodium

(Na)

261
417
120
474
275

Po-
tas-

sium

(K)

8.2
4.5

12

Bl-

car-

bon-

ate

(HCO,)

304
324
221
353
225
184
158

Car-
bon-
ate

(cog

0
0
0
0
0
0
0

Sulfate

(S04)

1190
1160
178
1660
1310

Chloride

(Cl)

40
76
108
79
35
30
44

Fluo-
rlde

(F)

0.6
. 8
.7
.7
.7

Ni-

trate

(NO,)

2.2
.5
.3
.2
2.1

Bo-

ron

(B)

0.26
. 25

.28

Dissolved solids

(calculated)

Parts

per
million

2020
2070

2110

Tons

per
acre-

foot

2.75
2.82

2.87

Tons

per

day

1220
436

2880

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

960
665
260
1100
975
326
545

Non-
car-

bon-

ate

711
399
0
0
790
0
0

So-

dium
ad-

sorp-
tion
ratio

3.7
7.0
3.2
6.2
3.8

Specific
con-

duct-

ance

(micro -
mhos at

25°C)

2470
2690
1020
3440
2610
1350
2030

pH

7.1
7.2
7.2
6.9
7.0
7.4
7.7

RIO GRANDE BASIN Continued

8-3530. RIO PUERCO NEAR BERNARDO, N. HEX. Continued

Particle-size analyses of suspended sediment, .vater year October ig63 to September ig64 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 12............

Time

(24 hour)

0830
1700
0700
0145

0930
1030
0615
2355

2100
2100
1650
1800

Water
tem-

per-
ature

(°F)

60
49
65
48

50
60

eg
74

74
74
73
68

Sam-

pling
point

Discharge
(cfs)

112
80
376
1660

1730
85
20.4
1010

420
420
1820
28.5

Sediment
concen-

tration

(ppm)

8g700
104000
75800
71100

4gsoo
47500
31300

ig2000

113000
113000
102000
38300

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

62
67
63
58

63

eg
70
45

1
44
44
67

0.004

75
78
71
64

67
74
86
54

3
49
50
85

0.008

13
56

0.016

92
95
90
84

87
95
97
73

65
66
62
00

0.031

78
78

0.062

97

gg
gs
95

96

gs
100

gs

gi
gi
86

0.125

gg
100
100

gg

gg
gg

g?

gs
gs
98

0.250

100

100

100
100

100

100
100
100

0.500 1.000 2.000

Method
of

analysis

VPWC
VPWC
VPWC
VPWC

VPWC
VPWC
SPWC
VPWC

VPN
VPWC
VPWC
PWC

RIO GRANDE BASIN Continued

8-3540. RIO SALADO NEAR SAN ACACIA, N. MEX.

LOCATION. At gaging station 1.0 mile downstream from bridge on -Interstate Highway 25, 1.4 miles upstream from mouth, 2.0 miles northeast of San Acacia, Socorro County, and 15 miles north of Socorro.
DRAINAGE AREA. 1,380 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: July to September 1956.
Sediment records: July 1948 to September 1964.
REMARKS. Records of specific conductance available in district office at Albuquerque, N. Mex. Reported as a miscellaneous station for period July 1956 to September 1963.

ber 1964

Date of collection

Oct 27 1962

Sept. 12............

Time

(24 hour)

0900
2000
2108
2200
0600
0700
0800

1815
1430
0800
0900
0730
0830

Water
tem-

per-
ature

(°F)

55
70
63
64
64
65
66

66
78
78
78
66
66

Sam-

pling
point

Discharge
(cfs)

200
240
242
204
1290
768
502

156
20.0
242
123
1800
1060

Sediment
concen-

tration

(ppm)

70800
117000
109000
110000
111000
114000
88400

62200
55600
139000
141000
102000
109000

Sediment

discharge
(tons per day)

39600
81400
76500
65100
415000
254000
129000

27200
3110
101000
52000
532000
335000

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

49

43

41

0.004

63

54

-

50

0.008 0.016

84

~

73

68

0.031 0.062

93

91

90

0.125 0.250

96

- -

98

98

0.500

100

100

100

1.000 2.000

Method
of

analysis

VPWC

VPWC

VPWC

RIO GRANDE BASIN Continued

8-3548. RIO GRANDE CONVEYANCE CHANNEL AT SAN ACACIA, N. MEX.

LOCATION. At gaging station at railway crossing, 0.5 mile south of San Acacia, Socorro County, and 0.8 mile downstream from Acacia diversion dam, and 2.6 miles downstream from Rio Salado.
RECORDS AVAILABLE. Water temperatures: May 1959 to September 1964.
Sediment records: January 1959 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 94°F July 21; minimum, 33°F Jan. 13, 14.
Sediment concentrations: Maximum daily, 110,000 ppm Aug. 2, 3, 14; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 440,000 tons Aug. 14; minimum daily, 0 tons on many days.
EXTREMES, 1959-64. Water temperatures: Maximum, 94°F July 21, 1964; minimum, 33°F on several days during December 1960, Jan 1962, January 1963 and January 1964.
Sediment concentrations: Maximum daily, 131,000 ppm Aug. 10, 1959; minimum daily, no flow on many days during July 1959, September and October 1960, July and August 1963, 1964.
Sediment loads: Maximum daily, 440,000 tons Aug. 14, 1964; minimum daily, 0 tons on many days during July 1959, September October 1960, July and August 1963, 1964.
REMARKS. Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Records of composite discharge for Rio Grande conveyance channel at San Acacia, and Rio Grande floodway at San Acacia given as Rio Gr at San Acacia. Quality of water records for Rio Grande floodway at San Acacia given on page 485.

Temperature (°F) of water, water year October 1963 to September 1964

Month

November .....
December .....

January. ....

April ....
May...........

July...........
August ....
September .....

Day

1

73
58
48

42
47
52

61
68
68

75

2

72
0
7

0
4
8

55

71

75

3

72
59
46

39
37
45

5?

71

82

4

73
58

41
40
48

75

78

5

71
58

41
42
53

75

82

6

70
58

37
38
53

79

85
75

7

71
50

40
37
52

75

85
83

8

72
60

37
37
43

72

80
79

9

69
60

35
40
51

78

83
76

10

62

35

50

81

85

1 1

55

35

54

83
76

12

57

36

53

81

62
78

13

57

33

53

80

73
73

14

58

33

51

78

83
73

15

5

4

5

78

80
81

16

4

6

7

73
80

82
83

17

47

36

55

71
71

85
76

18

7

7

5

72
81

82
83

19

50

43

47

70
78

81
79

20

49

45

58

70
72

89
83

21

46

45

52

73
72

94

22

50

46

46

75
6fl

23

39

55

76
72

24

47

38

55

80
71

75

25

36

41

76

80

26

4B

42

50

70
70

27

46

52

75
63

90

28

'1

45
50
60

70

85

29

46
50
60

75

86

30

48

67

70
73

90

73

31

55

4B

62

66

85

Aver-

age

66
52
43

19
43
52

6?
69
74

RIO GRANDE BASIN Continued

8-3548. RIO GRANDE CONVEYANCE CHANNEL AT SAN ACACIA, N. HEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 27............

Time

(24 hour)

1640
1710
1710
1300
1730
0915

1650
1630
1655
1655
0615
1615

0800
1130
1327
0656
1815

Water
tem-

per-
ature

(°F)

65
65
65
60
45
42

44
38
48
46
45
73

64
72
78
66
65

Sam-

pling
point

Discharge
(cfs)

210
3.0
3.0
35.4
272
262

288
516
639
98.7
181
960

1370
1350
1710
1100
312

Sediment

concen-

tration

(ppm)

116000
9810
9810
29400
9400
9380

7480
10700
5660
5060
39300
5260

78100

61800
119000
117000
108000

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

54
86

77
14
12

11
15
20
14
71
42

58
51
52
40
53

0.004

68
98
2
92
17
15

14
16
23
17
83
51

66
63
61
49
60

0.008

99
9

"

.

0.016

87
99
98
98
22
21

20
23
35
21
99
67

85
80
73
64
82

0.031

100
100
99

0.062

95

100
46
43

41
46
74
46
99
92

94
93
94
88
91

0.125

96

66
63

63
64
92
74
99
99

97
98
99
96
97

0.250

100

93
91

92
94
100
94
100
100

100
100
100
99
100

0.500

100
99

99
100

100

100

1.000

100

100

2.000

Method
of

analysis

VPWC
PWC
PN
VPWC
VPWC
VPWC

VPWC
VPWC
VPWC
VPWC
VPWC
VPWC

VPWC
VPWC
VPWC
VPWC
VPWC

RIO GRANDE BASIN Continued

8-3549. RIO GRANDE FLOODWAY AT SAN ACACIA, N. MEX.

San rro County, 0.7 mile nstream Acacia diversion da

Valley, Colo.).

LOCATION. At gaging station, 0.1 mile southeast
and 2.5 miles downstream from Rio Salado.
DRAINAGE AREA. 26,770 square miles, approximately (includes 2,940 square miles in closed basin RECORDS AVAILABLE. Chemical analyses: July to December 1937, March 1939 to September 1956.
Water temperatures: October 1947 to August 1956, January 1959 to September 1964.
Sediment records: July 1946 to June 1956, January 1959 to September 1964.
EXTREMES, 1963-64. Water temperatures: Maximum, 83°F Aug. 7, 16; minimum, 33°F Jan. 13, 14.
Sediment concentrations: Maximum daily, 65,000 ppm Aug. 14; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 79,000 tons July 13; minimum daily, 0 tons on many days.
EXTREMES, 1946-56, 1959-64. Water temperatures (1947-56, 1959-64): Maximum, 93°F July 15, 1955; minimum (1947-56, 1959-62, 1963-64), freezing point on several days during winter months.
Sediment concentrations: Maximum daily, 196,000 ppm Aug. 11, 1946; minimum daily, no flow on many days each year. Sediment loads: Maximum daily, 1,760,000 tons Aug. 12, 1955; minimum daily, 0 tons on many days each year.
REMARKS. Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Records of composite discharge for Rio Grande conveyance channel at San Acacia and Rio Grande floodway at San Acacia given as Rio Grande at San Acacia. Quality of water records for Rio Grande conveyance channel at San Acacia given on page 481

Temperature (°F) of water, water year October 1963 to September 1964

November .....

January. ....

March ....

May...........

July...........

September .....

1

58

42

52

68

2

60

40

48

67

3

59

40

62

4

58

41

69

5

56

41

64

70

6

56

37

69

75

7

50

40

64

"

8

60

37

68

74

9

60

35

66

10

62

35

69

70

11

55

35

71

75

12

57

72

66

13

57

70

70

14

58

70

15

55

73

66

Day

16

54

73

76

17

47

71

75

18

47

72

75

19

50

70

72

20

49

70

73

21

46

73

71

22

50

75

23

49

76

70

24

47

81

68

25

46

76

69

26

48

70

27

47

75

65

28

51

70

67

29

45

75

70

30

46

73

73

31

66

Aver-
age

52

70

RIO GRANDE BASIN Continued

8-3549. RIO GRANDE FLOODWAY AT SAN ACACIA, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

1655
1900
1330
1745

1710
0630
1730
0815

1145
0942
0611
1830

Water
tem-

per-
ature

(°F)

65
58
51
45

46
45
75
64

72
70
65
65

Sam-

pling
point

Discharge
(cfs)

6.0
D .6
D .6
D .6

400
7.5
216
1180

1660
534
456
3.8

Sediment
concen-

tration

(ppm)

86800
3760
26
109

2990
38200
5870
71100

55100
120000
107000
89500

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

65
61

28
75
39
53

59
51
45
62

0.004

77
76

33
86
44
66

70
64
55
73

0.008 0.016

96
91

47
00
76
88

84
79
70
93

0.031 0.062

100
99
87
91

92

100
98

98
98
98
99

0.125

100
93
97

100

99

100
99
100
100

0.250

96
100

100

100

0.500

98

1.000

100

2.000

Method
of

analysis

SPWC
SPWC
S
S

VPWC
PWC
SPWC
VPWC

VPWC
VPWC
VPWC
VPWC

D Daily mean discharge.

RIO GRANDE BASIN Continued

8-3583. RIO GRANDE CONVEYANCE CHANNEL AT SAN MARCIAL, N. HEX.

LOCATION. At gaging station 1,800 feet west of San Marcial gage on railway bridge, about 18.5 miles southwest of San Antonio, and about 1 mile south of former site of San Marcial, Socorro County.
DRAINAGE AREA. Chemical analyses: March 1954 to September 1964.
Water temperatures: March 1954 to September 1964.
Sediment records: March 1954 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 2,000 ppm Aug. 3, 4; minimum, 342 ppm May 19-31.
Hardness: Maximum, 930 ppm Aug. 7; minimum, 174 ppm May 19-31.
Specific conductance: Maximum daily, 2,560 micromhos Aug. 4; minimum daily, 489 micromhos May 26.
Water temperatures: Maximum, 94°F July 21; minimum, freezing point Jan. 13-15.
Sediment concentrations: Maximum daily, 120,000 ppm Aug. 4, minimum daily, no flow on many days during June to September.
Sediment loads: Maximum daily, 380,000 tons Aug. 15; minimum daily, 0 tons on many days during June to September.
EXTREMES, 1954-65. Diseolved solids: Maximum, 2,010 ppm Aug. 2-8, 1956; minimum, 240 ppm Jan. 8-13, 1963.
Hardness: Maximum, 948 ppm Aug. 2-8, 1956; minimum, 108 ppm Jan. 8-13, 1963.
Specific conductance: Maximum daily, 2,860 micromhos Oct. 25, 1956; minimum daily, 353 micromhos Jan. 8, 1963.
Water temperatures: Maximum, 95°F June 21, 22, July 8, 15, 1955, July 13, 1963; minimum, freezing point on several days during December 1960, December 1961, January 1963 and January 1964.
Sediment concentrations: Maximum daily, 122,000 ppm Sept. 12, 1961; minimum daily, no flow on many days during July and September 1956, May 1958, July and August 1963, June to December 1964.
Sediment loads: Maximum daily, 380,000 tons Aug. 15, 1964; minimum daily,o tons on many days during July and September 1956, May 1958, July and August 1963, June to September 1964.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Records of composite discharge for Rio Grande conveyance channel at San Marcial and Rio Grande floodway at San Marcial given in surface water records as Rio Grande at San Marcial . Quality of water records for Rio Grande floodway given on page 495. No flow June 27 to July 11, Sept. 2-5, 9, 10.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1, 2, 1963...

Oct. 24, 25.......

Nov. 7............
Nov. 8-14.........

Mean

discharge
(cfs)

13.5
2.6
3.4
33.2
43.0
20.8

7.0
6.6
44.8
122
51.0
41.0

Silica

(S10a)

41

~

-

- -

Iron

(Fe)

0.00

::

Cal-

cium

(Ca)

97
105
73
156
198
132

114
106
89
232
147
106

Mag-
ne-

sium

(Mg)

19
27
11
33
33
23

21
22
14
40
24
18

Sodium

(Na)

143
343
98
292
202
206

274
250
110
282
212
184

Po-
tas-

sium

(K)

16

"

"

Bl-

car-

bon-

ate

(HCOJ

236
264
188
252
272
234

264
260
246
332
296
252

Car-
bon-
ate

(CO,)

0
0
0
0
0
0

o

8
0
0
0
0

Sulfate

(S04)

406

~

Chloride

(CD

350

- -

Fluo-
rlde

(F)

0.7

~

Ni-

trate

(NO,)

0.5

Bo-

ron

(B)

0.33

»

Dissolved solids

(residue at 180 °C)

Parts

per
million

882
1460
566
1540
1410
1170

1290
1260
717
1740
1200
972

Tons

per
acre-

foot

1.20
1.99
. 77
2.09
1.92
1.59

l.T 5
1.71
.98
2.37
1.63
1.32

Tons

per

day

32.2
10.3
5.20
138
164
65.7

24.4
22.5
86.7
573
165
108

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

320
372
228
524
628
424

372
356
280
744
464
340

Non-
car-

bon-

ate

126
155
74
317
405
232

155
129
78
472
221
133

So-

dium
ad-

sorp-
tion
ratio

3.5
7.7
2.8
5.5
3.5
4.4

S.2
5.8
2.9
4.5
4.3
4.4

Specific
con-

duct-

ance

[micro-
mhos at

25"C)

1290
2230
837
2170
1890
1650

1900
1780
1040
2290
1680
1400

PH

8.1
8.1
8.2
7.8
7.8
7.9

3.1
8.3
7.9
7.7
7.6
7.7

RIO GRANDE BASIN Continued

8-3583. RIO GRANDE CONVEYANCE CHANNEL AT SAN MARCIAL, N. MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

July 13.............

Sept. 28............

Time

(24 hour)

1600
1200
1630
1230
1030

1400
1600
1200
1530
1100

2000
2000
1215
1400
1000

Water
tem-

per-
ature

(°F)

63
65
44
43
39

35
55
52
73
75

82
75
74
76
65

Sam-

pling
point

Discharge
(cfs)

55.1
28.2
613
249
420

515
284
308
1300
498

54.6
830
1440
1300
302

Sediment
concen-

tration

(ppm)

66700
4320
19300
4940
7480

5420
1370
15700
92400
73300

590
72100
97100
106000
96000

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

70
78
25
20
19

16

70
42
57

63
50
47
60

0.004

76
93
29
24
20

20

80
54
68

67
55
51
67

0.008 0.016

98
99
38
36
31

24

93
74
88

85
72
68
90

0.031 0.062

100
100
77
69
67

60
63
95
94
93

96
99
92
88
98

0.125

94
84
88

83
86
97
99
96

99
100
98
97
99

0.250

100
100
99

99
100
100
100
100

100

100
100
100

0.500

100

100

:
~~

1.000 2.000

Method
of

analysis

PWC
PWC
VPWC
VPWC
VPWC

VPWC
V
VPWC
VPWC
VPWC

S
VPWC
VPWC
VPWC
VPWC

RIO GRANDE BASIN Continued

8-3584. RIO GRANDE FLOODWAY AT SAN MARCIAL, N. MEX.

LOCATION. At gaging station at Atchison, Topeka, and Santa Fe Railway bridge, 1.1 miles downstream from former site of san Marcial, Socorro County, and 18.5 miles southwest of San Antonio.
DRAINAGE AREA. 27,700 square miles, approximately (includes 2,940 square miles in closed basin in San Luis Valley, Colo.).
RECORDS AVAILABLE. Chemical analyses: May 1905 to April 1907, July 1946 to September 1964.
Water temperatures: January 1949 to September 1964.
Sediment records: July 1946 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 1,750 ppm Aug. 16-18; minimum, 505 ppm July 14.
Hardness: Maximum, 953 ppm July 19, 20; minimum, 306 ppm July 14.
Specific conductance: Maximum daily, 2,280 micromhos Aug. 16; minimum daily, 704 micromhos July 14.
Sediment concentrations: Maximum daily, 48,000 ppm Aug. 16; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 30,000 tons July 12; minimum daily 0 tons on many days.
EXTREMES, 1946-64. Dissolved solids: Maximum, 1,950 ppm Aug. 3-10, 1954, 233 ppm June 11-20, 1952.
Hardness: Maximum, 1,010 ppm Aug. 3-10, 1954; minimum, 132 ppm June 20, 1957, Apr. 22-27, 1960.
Specific conductance: Maximum daily, 2,730 micromhos Apr. 8, 1953; minimum daily, 311 micromhos June 14, 1952.
Water temperatures (1949-62): Maximum, 97°F Aug. 11, 1951; minimum, freezing point on many days.
Sediment concentrations: Maximum daily, 117,000 ppm Aug. 8, 1959; minimum daily, no flow on many days each year.
Sediment loads: Maximum daily, 966,000 tons Oct. 22, 1957; minimum dally, 0 tons on many days each year.
Remarks. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Hex. Records of chemical analyses and sediment loads for years prior to 1946 have been published in Water Bulletins of International Boundary and Water Commission. Records of composite discharge for Rio Grande conveyance channel at San Marcial and Rio Grande floodway at San Marcial given in surface water records as Rio Grande at San Marcial. Quality of water records for Rio Grande conveyance channel at San Marcial given on page 489. No flow Oct. 1-3, Oct. 9 to July 11, July 16-18, July 21 to Aug. 15, Aug. 19, Aug. 21 to Sept. 13, Sept. 17-30. Tabulation omitted for period January to June.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 4-8, 1963 A..

Weighted average

Time-weighted

Tons per day. . . .

Mean

discharge
(efs)

0.2
626
410
120

26.0
1.7
4.8
11.0
6.6

68.4

Silica

(SiO,)

41

16

23

Iron

(Fe)

0.00

.01

Cal-

cium

(Ca)

105
275
199
105

208
322
239
305
100

229

182

42

Mag-
ne-

sium

(Mg)

27
28
21
11

34
38
48
34
20

24

30

4.5

Sodium

(Na)

343
12
13
26

174
30
242
47
143

23

178

4.2

Po-
tas-

sium

(K)

16

6.5

7.2

Bi-
car-

bon-

ate

(HCO,)

264
200
168
110

174
178
352
88
242

181

233

34

Car-
bon-

ate

(CO,)

Sulfate

(S04)

406

237

938

Chloride

(Cl)

350

20

40

Fluo-
ride

(F)

0.7

.4

.6

Ni-
trate

(NOJ

0.5

3.7

2.1

Bo-

ron

(B)

0.33

. 15

.28

Dissolved solids

(residue at 180°C)

Parts

per
million

1460
1140
820
505

1420
1420
1750
1440
818

983

1290

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

372
800
582
306

660
953
795
900
332

670

577

Non-
car-

bon -

ate

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

2230
1350
1050
704

1850
1610
2280
1630
1260

1210

1750

pH

8.1
7.8
7.5
7.7

7.7
7.6
7.5
7.6
7.7

7.6

7.7

A Analysis estimated from conveyance channel at San Marcial.

RIO GRANDE BASIN Continued

8-3584. RIO GRANDE FLOODWAY AT SAN MARCIAL, N. MEX. Continued

Temperature (°F) of water, water year October 1963 to September 1964

July 12, 1964....... 65
13............. 66
14............. 68
15............. 90

July 19, 1964....... 80
Aug. 16............. 75
20............. 78

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Aug. 16.............

Time

(24 hour)

2400
0800

Water
tem-
per-
ature

(°F)

64
75

Sam-

pling
point

Discharge
(cfs)

376
35

Sediment
concen-

tration

(ppm)

11800
94400

Sediment
discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

57
88

0.004

79
95

0.008 0.016

97
100

0.031 0.062

99

0.125

100

0.250 0.500 1.000 2.000

Method
of
analysis

VPWC
PWC

RIO GRANDE BASIN Continued

8-3637. TORTUGAS ARROYO NEAR LAS CRUCES, N. MEX.

LOCATION. At gaging station, 30 feet below flood detention dam, 1.2 miles northeast of New Mexico State University, and 3.3 miles southeast of Las Cruces Post Office, Dona Ana County.
DRAINAGE AREA. 20.7 square miles (determined by SCS) .
RECORDS AVAILABLE. Sediment records: July 1963 to September 1964.
REMARKS. Records of specific conductance and water temperatures available in district office at Albuquerque, N. Mex.

Suspended sediment, July 1963 to September 1964

Date

July 3, 4, 1963..

June 24, 25, 1964

Sept. 11-14......

Flow
event
No.

1

3
4

6

Flow
duration
(hours)

18
31
35
20
15
72

Discharge
(acre-
feet)

6.4

6.9
6.5
3.6
52.2

Mean

discharge
for period
(cfs)

4.3

2.4
3.3
2.9
8.7

Mean
concen-

tration

(ppm)

3100

2000

_

2100

Outflow
sediment
load
(tons)

45
42
38
E 40

260

E Estimated.

Particle-size analyses of suspended sediment, July 1963 to September 1964
(C, chemically dispersed; N, native water; P, pipet; S, sieve; W, distilled wat

Date

July 3, 1963...

Sept. 11, 1964.

Time
(24-
hr.)

1930
1945
1945
0200
1630
1630
1400
1400
1530

1600
1600
0030
0230
1030
1230
0430

Dis-

charge
(cfs)

12.9
12.9
12.9
5.0
14.2
14.2
11.4
11.4
11.7

23.3
23.3
14.2
10.6
19.1
16.3
6.2

Concen-
tration

(ppm)

15300
10300
10300
3090
7450
7450
11800
11800
5140

15800
15800
3670
2630
2720
2280
675

Percent finer than indicated size, in millimeters

0.002

36
43
3
79
58
6
41
6
57

33
2
73
83
72
81
97

0.004

48
60
10
93
78
26
51
28
78

41
11
96
95
94
98
98

0.008

81
37

92
91
72
66

49
37

0.016

87
94
94
100
97
96
88
89
99

55
50
100
99
100
100
99

0.031

100
100

100
100
100
98

79
80

-

-

0.062

100

100
100

137
87

100

100

0.125

W
88

0.25

c»n
90

0.5

94
94

1.0

95
95

2.0

98
98

4.0

100
100

Method

PWC
PWC
PN
PWC
PWC
PN
PWC
PN
PWC

SPWC
SPN
PWC
PWC
PWC
PWC
PWC

RIO GRANDE BASIK Continued

8-3640. RIO GRANDE AT EL PASO, TEX.

5.6 miles upstream f Santa Fe Street-Jua anue Bridge be El Paso, Tex., and LOCATION. At gaging station on downstream side of Courchesne Bridge Cd. Juarez, and 1.7 miles upstream from American Dam.
DRAINAGE AREA. 29,267 square miles.
RECORDS AVAILABLE. Chemical analyses: 1933 to 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Service, U.S. Salinity Laboratory, Riverside, Calif. Records of specific conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Boundary and Water Commission Water Bulletins 33 and 34.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November ....
December. . . .
January 1964

February. . . .

Ma V

September.. .

Num-

ber
of

sam-

ples

31
30
31
31

29
31
30
31

30
30
31
29

Monthly
mean

discharge
(cfs)

99.0
76.7
68.1
57.1

40.4
128
202
19.6

106
157
169
158

Silica

(S102)

29

15

Iron

(Fe)

Cal-

cium

(Ca)

135
132
130
128

133
105
100
115

96
87
81
84

Mag-
ne-

sium

(MB)

29
31
29
29

34
23
22
30

22
19
18
18

Sodium

(Na)

353
360
368
382

421
219
200
497

223
183
161
158

Po-
tas-

sium

to

10

9.0

Bi-
car-

bon-

ate

(HCOJ

293
304
337
325

319
241
231
303

232
210
199
191

Car-
bon-
ate

(CO,)

6
10
0
0

0
0
0
0

0
0
0
0

Sulfate

(S04)

547
538
514
545

611
298
317
631

352
288
256
285

Chloride

(Cl)

296
310
308
320

356
232
185
425

190
159
138
132

Fluo-

ride

(F)

1.0

.9

Ni-

trate

(NO,)

0.6
. 6
. 6
1.2

.5
1.0
.6
1.2

.6
1.2
1.2
1.2

Bo-

ron

(B)

0.36
.39
.37
.45

.35
.22
.20
.54

.21
.21
. 12
. 17

Dissolved solids

Parts

per
million

1,654
1,625
,644
,683

,770
,069
,012
,916

1,090
880
808
812

Tons

per
acre-

foot

2.25
2.21
2.24
2.29

2.41
1.45
1.38
2.61

1.48
1.20
1.10
1.10

Tons

per

day

442
337
302
259

193
369
552
101

312
373
369
346

Hardness

aa CaCOj

Cal-

cium,
Mag-
ne-

sium

456
456
442
438

470
358
340
409

332
294
276
282

Non-
car-

bon-

ate

206
191
166
172

209
160
150
160

142
122
113
126

So-

dium
ad-

sorp-
tion
ratio

7.2
7.3
7.6
7.9

8.5
5.0
5.1
11

5.4
4.6
4.2
4.1

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

2,350
2,400
2,430
2,460

2,660
1,650
1,540
2,900

1,650
1,380
1,250
1,250

PH

8.2
8.3
8.0
7.9

7.8
7.7
8.0
8.1

7.8
7.8
8.2
8.0

RIO GRANDE BASIN Continued

8-3705. RIO GRANDE AT FORT QUITMAN, TEX.

1.5 miles nstream Old Fort Quitman and 81.1 LOCATION. At gaging station on the rectified channel of the Rio Grande
from the American Dam at El Paso, Tex.
DRAINAGE AREA. 32,035 square miles (United States and Mexico; from International Boundary and Water Commission Water Bulletin Number 31). RECORDS AVAILABLE. Chemical analyses: 1933 to 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Service, U.S. Salinity Laboratory, Riverside, Calif. Records o specific conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Boundary and Water Commission Water Bulletin Numbers 33 and 34.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November
December.

January 1964

February- -

June ....

September. . .

Number
of

samples

5
4
4
5

4

4

4

1

Monthly
mean

discharge
(cfs)

45.0
59.6
36.9
14.5

7.5
3.6
2.3

4.8

4.2

Silica

(SiQ.)

25

Iron

(Pe)

Cal-

cium

(Ca)

281
245
297
539

560
548
482

121

69

Mag-
ne-

sium

(Mg)

75
64
79
163

179
200
292
135

27

6.3
7.5

Sodium

(Na)

860
700
834
1,680

1,840
1,860
2,060

228

64
43

Po-
tas-

sium

(K)

13

Bi-
car-

bon-

ate

(HCOJ

270
326
362
286

272
247
232
203

251

214
250

Car-
bon-
ate

(COJ

6
0
0
0

0
0
0

0

0

Sulfate

(SO.)

905
795
917
1,610

1,660
1,640
1,810
1,230

210

84
63

Chloride

(CD

1,220
932
1,170
2,700

2,980
3,090
3,420
2,250

356

41
19

Fluo-
ride

(P)

1.1

Ni-

trate

(NOJ

3.7
3.1
.6
.5

.6
1.2
1.2
1.9

.6

3.7
1.2

Bo-

ron

(B)

0.53
.49
.58
.87

.93
.93
1.10
.68

.21

. 14
.06

Dissolved solids

Parts

per
million

3,771
3,091
3,735
7,260

7,664
7,964
8,740
5,792

1,170

406
357

Tons

per
acre-

foot

5.13
4.20
5.08
9.87

10.4
10.8
11.9
7.88

1.59

.55
.49

Tons

per

day

458
497
372
284

155
77.4
54.3
18.8

15.2

13.0
4.05

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

1,010
873
1 ,060
2,020

2,130
2,190
2,400
1,570

412

186
204

Non-
car-

bon-

ate

778
606
768
1,780

1,910
1,990
2,210
1,410

206

11
0

So-

dium
ad-

sorp-
tion
ratio

12
10
11
16

17
17
18
15

4.9

2.0
1.3

con-

duct-

ance

(micro-
mho* at

25"C)

5,520
4,520
5,390
10,300

11,100
11,000
12,400
8,360

1,840

622
570

PH

8.2
8.0
.7
.7

.8
' .9

.8
.8

8.0

8.2
8.1

RIO GRANDE BASIN Continued

8-3715. RIO GRANDE ABOVE RIO CONCHOS, NEAR PRESIDIO, TEX.

about 10 miles northwest of the towns of Presidio, Tex

31).

and Ojinaga, LOCATION: At gaging station 7.8 river miles upstream from confluence of the Rio Conchos, Chihuahua, and 285.7 river miles downstream from American Dam at El Paso.
DRAINAGE AREA. 34,988 square miles (United States and Mexico; from International Boundary and Water Commission Water Bulletin Numbe
RECORDS AVAILABLE. Chemical analyses: 1935 to 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Service, U.S. Salinity Laboratory, Riverside, Calif. Records of specific conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Boundary and Water Commission Water Bulletin Numbers 33 and 34. Records prior to 1964 were published under the title "Rio Grande at Upper Presidio."

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November. . . .
December. . . .
January 1964

February. . . .

April ....

September. . .

Number
of
samples

4
7
8

0
0

3

2

3

Monthly
mean

discharge
(cfs)

4.6
11.2
5.9
0

0
0
0
2.4

1.2
0
0
12.3

Silica

(S1Q.)

Iron

(Pe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

351
437
711

43

40

48

Po-
tas-
sium

(K)

Bl-
ear -

Don-
ate

(HCO,)

150
174
262

88

70

183

Car-
bon-
ate

(CO,)

0
0
0

0

0

0

Sulfate

(SO.)

Chloride

(Cl)

466
558
961

39

19

18

Fluo-
rlde
(P)

Ni-
trate

(NO,)

Bo-
ron

(B)

Dissolved solids

Parts
per
million

1 ,708
1,945
3,135

499

307

411

Tons
per
acre-

foot

2.32
2.65
4.26

.68

.42

.56

Tons

per

day

21.2
58.8

3.23

.99

13.6

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

513
539
828

273

127

207

Non-
car-

bon-
ate

390
396
613

200

70

57

So-
dium
ad-
sorp-
tion
ratio

6.7
8.2
11

1.1

1.6

1.5

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

2,560
2,990
4,620

749

435

610

pH

RIO GRANDE BASIN Conti

8-3750. RIO GRANDE AT JOHNSON RANCH, TEX.

iles downstream from Castolon, Br LOCATION. At Raging station about 2 miles upstream from Johnson Ranch, 14 from American Dam at El Paso, Tex.
DRAINAGE AREA. 70,715 square miles (United States and Mexico; from International Boundary
RECORDS AVAILABLE. Chemical analyses: 1948 to 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Servic conductance and records of discharge for water year October 1963 to September 1964 given
Numbers 33 and 34.

nd 392.9 river miles downstream

nd Water Commiss

U.S. Salinity Laboratory,
International Boundary a

Riverside
d Water C

Calif. Reco ds of specific
Bulletin

Chemical analyses, in parts per million, water year October 1963 to Septembe

Month

October 1963
November. . . .
December. . . .
January 1964

February. . . .

September. . .

Number
of
samples

10
8
7
9

7

9

Monthly
mean

discharge
(cfs)

848
517
470
395

408

1 290

1,230

Silica
(SiQ.)

__

28

_

~

Iron

(Fe)

Cal-
cium

(Ca)

__

106

_

125

- -

Mag-
ne-

sium

(Mg)

__

18

_

"

Sodium
(Na)

144
185
171
179

186

147

92

Po-
tas-
sium

(K)

__

7.0

_

-

Bi-
car-

bon-
ate

(HCO,)

179
181
200
189

196

165

186

Car-
bon-
ate

(CO,)

0
0
0
0

0

0

Sulfate

(SO.)

430

_

- -

Chloride

(Cl)

73
105
96
96

105

145

39

44

Fluo-
ride

(P)

2.3

_

-

Ni-
trate

(NO,)

3.7

_

~

Bo-
ron

(B)

0.34

_

-

Dissolved solids

Parts

per
million

946
1 ,013
1,000
1,011

1,006

614

Tons

per
acre-

foot

.29
.38
. 36
. 37

. 37

.84

Tons

per

day

2,170
1,410
1,270
1,080

1,100

956

2,360
1,100
1,470
2,040

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

330
332
344
340

358

257

Non-
car-

bon-
ate

183
184
180
186

198
1 54

131

104

So-
dium
ad-
sorp-
tion
ratio

3.5
4.4
4.0
4.2

4.3

2.5

con-

duct-

ance

(micro-
mhoB at

25"C)

,250
,440
,400
,400

,480

886

pH

7.9

_

- -

RIO GRANDE BASIN Continued

8-3775. RIO GRANDE AT LANGTRY, TEX.

ission Water Bulletin

LOCATION. At gaging station at Langtry, Val Verde County, 24.1 river miles upstream from confluence of Pecos Ri American Dam at El Paso, Tex.
DRAINAGE AREA. 84,795 square miles (United States and Mexico; from International Boundary and Water
RECORDS AVAILABLE. Chemical analyses: 1944 to 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Service, U.S. Salinity Laboratory, Riversid conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Bou Water Bulletin Numbers 33 and 34.

Chemical analyses, in parts per million, water year October 1963 to September 1964

and 614.1 river miles downstream from

Calif. Records of specific
ary and Water Commission

Month

October 1963
November. . . .
December ....
January 1964

February ....

September. . .

Number
of

samples

9
6
9
8

8
8
8
8

8
5
6
7

Monthly
mean

discharge
(cfs)

1,140
769
811
763

655
765
991
816

1,850
923
1,090
4,670

Silica

(SiQ.)

22

14

Iron

(Fe)

Cal-

cium

(Ca)

84
91
94
89

90
86
73
88

95
85
105
73

Mag-
ne-

sium

(Mg)

12
18
18
17

21
17
12
17

9.2
13
14
5.6

Sodium

(Na)

88
131
126
115

125
117
59
103

67
74
105
20

Po-
tas-

sium

(K)

5.5

5.5

Bi-
car-

bon-

ate

(HCO,)

192
194
205
195

196
187
189
198

221
195
189
207

Car-
bon-

ate

(CO,)

0
0
0
0

0
0
0
0

0
0
0
0

Sulfate

(S0«)

219
315
308
273

304
280
136
256

192
194
289
54

Chloride

(CD

45
78
74
71

76
66
42
65

34
46
62
14

Fluo-
ride

(P)

1.3

1.1

Ni-

trate

(NO,)

3,7
1,9
3.1
3.7

3.1
3.1
3.7
3.7

2. 5
1.9
3.7
1.2

Bo-

ron

(B)

0.19
.27
,22
.26

.22
. 25
. 11
.21

. 15
. 19
. 14
.06

Dissolved solids

Parts

per
million

632
779
783
725

746
719
463
666

573
539
722
286

Tons

per
acre-

foot

0.86
1.06
1.06
.99

1.01
.98
.63
.91

.78
.73
.98
.39

Tons

per

day

1,950
1,620
1,710
1,490

1,320
1,480
1,240
1,470

286
1,343
2,120
3,610

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

259
301
311
289

310
286
229
289

274
264
318
204

Non-
car-

bon-

ate

102
142
143
129

149
132
74
126

93
104
163
34

So-

dium
ad-

sorp-
tion
ratio

2.4
3.3
3.1
2.9

3.1
3.0
1.7
2.6

1.8
2.0
2.6
.6

Specific
con-

duct-

ance

(micro-
mhos at

25"C)

865
1,130
1,130
1,040

1,130
1,050
706
1 ,000

796
808
1,030
465

pH

8.0
7.9
7.8
7.7

8.0
7.7
8.0
7.9

7.8
8.0
8.2
8.0

RIO GRANDE BASIN Continued

8-3805. GALLINAS RIVER NEAR MONTEZUMA, N. HEX.

LOCATION. At gaging station on left bank, 2 miles west of Montezuma, San Miguel County, and 6 miles DRAINAGE AREA. 84 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: March to September 1964.

rthwest of Las Vegas.

Chemical analyses, in parts per million, March to September 1964

Date
of
collection

Sept. 23.... ......

Mean

discharge
(cfs)

4.0
5.4
20.8
18.6
18.0
22.6

4.8
2.6
6.4
18.0
5.8
2.8
4.2

Silica

(SiO,)

- -

17

11

Iron

(Fe)

0.02

.02

Cal-

cium

(Ca)

~

55

44

Mag-
ne-

sium

(Mg)

-

3.6

4.4

Sodium

(Na)

A 5.3
A 8.7
A 11

A 5.3

4.8

4.3

Po-
tas-

sium

(K)

2.0

.9

Bi-
car-

bon-

ate

(HCO,)

160
161
97
124

105

136
180
160
148
160
172
146

Car-
bon-

ate

(CO,)

0
0
9
0

0

0
0
0
0
0
2
4

SuUate

(S04)

13
12
15

9.4

13

10

Chloride

(Cl)

1.5
1.5
5.8

1.0

1.8
1.6

1.0

FhlO-
ride

(F)

0.3
. 8
1.0

.3

.3

.3

Ni-
trate

(NO,)

0.1
. 1
.2

.1

.4

.2

Bo-

ron

(B)

- -

0.06

.05

Dissolved solids

(calculated)

Parts

per
million

187

152

Tons

per
acre-

foot

0.25

.21

Tons

per

day

-

1.31

1.72

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

139
137
92
104
99
87

114
152
135
121
132
147
128

Non-
car-

bon-

ate

8
5
0
2
2
1

2
4
4
0
1
3
2

So-

dium
ad-

sorp-
tion
ratio

0.2
.4
.5

.2

.2

.2

Specific
con-

duct-

ance

(micro-
mhos at

1 25°C)

275
276
199
241
204
183

240
307
270
245
262
290
255

PH

8.0
7.9
8.8
8.2
8.3
8 2

7.1
7.5
7.5
7.7
8.2
8.3
8.4

A (Calculated Na plus K, reported as Na.

RIO GRANDE BASIN Continued

8-3810. GALLINAS RIVER AT MONTEZUMA, N. MEX.

LOCATION. At gaging station at downstream end of middle pier of highway bridge, 0.5 mile downstream from Montezuma, San Miguel County, and 5 miles northwest of Las Vegas.
DRAINAGE AREA. 87 square miles, approximately.
RECORDS AVAILABLE. Chemical analyses: September 1963 to July 1964 (discontinued).

Chemical analyses, in parts per million, September 1963 to July 1964

Date
of
collection

Sept. 25, 1963....

July 27...........

Mean

discharge
(eta)

26.5
1.9
1.2
1.4
1.2

1.8
1.8
16.2
14.4
11.0

19.3
2.8
1.3
7.0
15.0

Silica

(S10a)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

Po-
tas-

sium

(K)

Bl-
car-

bon-

ate

(HCOJ

106
191
170
148
165

149
162
117
106
130

118
154
184
140
176

Car-
bon-

ate

(CO,)

4
0
8
6
6

8
2
0
0
7

0
0
0
6
0

Sulfate

(S0«)

Chloride

(Cl)

3.1
28
48
42
46

34
32
5.5
2.0
7.2

4.4
21
44
13
7.5

Fluo-
rlde

(P)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids

Parts

per
million

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

95
156
150
129
144

140
138
100
92
117

99
124
144
124
146

Non-
car-

bon-

ate

2
0
0
0
0

4
2
4
5
0

2
0
0
0
2

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

210
460
545
479
517

445
437
233
192
271

222
372
530
315
330

PH

8.6
7.9
8.6
8.6
8.5

8.6
8.4
7.7
7.9
8.6

7.7
7.7
7.3
8.6
7.6

RIO GRANDE BASIN Continued

8-3830. PECOS RIVER AT SANTA ROSA, N. MEX.

LOCATION. At gaging station, 0.2 mile upstream from bridge on U.S. Highway 66, in Santa Rosa, Guadalupe County, and 1.7 miles up-stream from Rio Agua Negra Chiquita.
DRAINAGE AREA. 2,650 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: July 1905 to December 1906.
Water temperatures: October 1958 to September 1964.
Sediment records: October 1958 to September 1964.
EXTREMES, 1963-64, Water temperatures: Minimum, 34°P Jan. 24.
Sediment concentrations: Maximum daily, 4,200 ppm Sept. 11; minimum daily, 5 ppm Apr. 3, 4.
Sediment loads: Maximum daily, 15,000 tons Sept, 11; minimum daily, less than 0.50 ton Apr. 1-4, 14.
EXTREMES, 1958-64. Water temperatures: Maximum (1958-63), 90°F Aug. 8, 1962, July 19, 1963; minimum, freezing point on several days during winter months.
Sediment concentrations: Maximum daily, 30,800 ppm Aug. 18, 1961; minimum daily, 5 ppm Apr. 3, 4, 1964.
Sediment loads: Maximum daily, 276,000 tons Aug. 17, 1961; minimum daily, less than 0.50 ton Mar. 12, 1961, Apr. 1-4, 14, 1964. REMARKS. Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex.

Temperature (°F) of water, water year October 1963 to September 1964

Month

October ....
November .....
December .....

March.........

June ....

July...........

September .....

Day

1

71

47

45
38
42

52
64

2

70

47

40
39

57
74
74

3

72

46

45
48

80

4

70

44

45

5

70

48

42

6

41

39
39

7

45

40

8

70

43

40

9

70

39

40

10

70

44

53
42

1 1

47

50

12

4

5

13

53

42

14

50

43

15

47

41

16

50

49

17

43

50

18

49

49

19

48

48

41

20

53

45

68

21

49

49

50

22

49

49

48

68

23

62

50

50

24

5fl

34

49

25

64

50

52

26

60

47

~~

27

60

49

51

28

55

54

50

58

29

5?

49

49
5?

30

50

47

47

31

"

"

Aver-

age

47

43
45

RIO GRANDE BASIN Continued

8-3830. PECOS RIVER AT SANTA ROSA, N.MEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Sept. 10............

Time

(24 hour)

1900
1115
1600
2100

Water
tem-

per-
ature

(°F)

60

79
65

Sam-

pling
point

Discharge
(cfs)

889
55
14
309

Sediment

concen-

tration

(ppm)

8930
549
770
12500

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

21
42

49

0.004

26
52

60

0.008 0.016

52
72

83

0.031 0.062

94
86
74
98

0.125

100
90
93
100

0.250

96
99

0.500

100
100

1.000 2.000

Method
of

analysis

VPWC
SPWC
V
VPWC

RIO GRANDE BASIN Continued

8-3845. PECOS RIVER BELOW ALAMOGORDO DAM, N. MEX.

LOCATION. At gaging station 1,200 feet downstream from Alamogordo Dam, 1.5 miles downstream from Alamogordo Creek, and 4.5 miles northeast of Guadalupe, De Baca County.
DRAINAGE AREA. 4,390 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: June 1937 to September 1964.
Water temperatures: June 1959 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 2,340 ppra July 1-31; minimum, 990 ppm Oct. 1-22.
Hardness: Maximum, 1,590 ppra Sept. 1-15; minimum, 665 ppm Oct. 1-22.
Specific conductance: Maximum daily, 2,840 micromhos Aug. 3; minimum daily, 1,160 micromhos Oct. 1.
Water temperatures: Maximu, 78°F July 30, 31; minimum, 35°F on several days during January and February.
EXTREMES, 1937-64. Dissolved solids: Maximum, 2,730 ppm May 11-20, 1954; minimum, 435 ppm Oct. 1-8, 1941.
Hardness: Maximum, 1,910 ppra May 1-10, 1954; minimum, 294 ppm Oct. 1-8, 12-20, 1941.
Specific conductance: Maximum daily, 3,200 micromhos Jan. 14. 1948; minimum daily, 513 micromhos July 22, 1937.
Water temperatures (1959-64): Maximum, 79°F July 29, 30, 1960, July 28, 1962; minimum, freezing point Dec. 24, 1960, Jan. 24, 1961.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-22, 1963...

Jan. 1-31, 1964...

Sept. 16-30.......

Weighted average

Time-weighted

Tons per day. ...

Mean

discharge
(Cf8)

82.5
60.7
.4
.7
.6
6.2
70.0

512
78.7
210
302
75.5
76.1
74.8

117

Silica

(SiO,)

14
15
14
16
19
19
15

15
15
16
16
15
16
13

15

16

4.8

Iron

(Fe)

Cal-

cium

(Ca)

230
271
292
330
361
364
400

425
463
480
516
498
530
425

450

404

142

Mag-
ne-

sium

(Mg)

22
31
37
53
58
54
44

53
55
59
64
65
65
46

55

52

17

Sodium

(Na)

40
47
56
71
78
76
72

76
85
86
96
87
84
56

81

75

25

Po-
tas-

sium

(K)

3.5
4.1
3.3
4.0
2.7
2 8
3\l

3.3
3.3
3.6
3.6

3.4

3.3

1.1

Bl-

car-

bon-

ate

(HCO,)

134
138
152
166
176
169
143

136
131
124
112
110
120
103

127

139

40

Car-
bon-

ate

(CO,)

Sulfate

(S04)

568
694
764
925
1000
1010
1060

1170
1270
1330
1460
1400
1460
1150

1240

1110

393

Chloride

(Cl)

46
58
68
84
92
90
92

99
108
115
126
117
110
TO

105

94

33

Fluo-
rlde

(F)

Ni-
trate

(NO,)

0.3
.5
.7
. 7
.8
.7
1.0

.8
.9
2.7
1.4
1.8
2.0
3.6

1.4

1.2

0.4

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

990
1190
1310
1570
1700
1700
1760

1910
2060
2150
2340
2240
2330
1820

2020

1820

Tons

per
acre-

foot

1.35
1.62
1.78
2.14
2.31
2.31
2.39

2.60
2.80
2.92
3.18
3.05
3.17
2.48

2.75

Tons

per

day

221
195
1.41
2.97
2.75
28.5
333

2640
438
1220
1910
457
479
368

637

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

665
805
880
1040
1140
1130
1180

1280
1380
1440
1550
1510
1590
1250

1350

1220

Non-
car-

bon-
ate

555
692
755
904
996
991
1060

1170
1270
1340
1460
1420
1490
1160

1250

1110

So-

dium
ad-

sorp-
tion
ratio

0.7
.7
.8
1.0
1.0
1.0
.9

.9
1.0
1.0
1.1
1.0
.9
.7

0.9

0.9

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

1290
1520
1650
1920
2040
2050
2110

2230
2380
2500
2680
2580
2650
2130

2350

2160

pH

. 7
.9
.6
. 7
. 8
. 8
.8

.6
.7
. 7
. 5
. 5
. 5
.5

7.6

7.6

RIO GRANDE BASIN Continued

8-3965. PECOS RIVER NEAR ARTESIA, N. MEX.

LOCATION. At gaging station at bridge on State Highway 83, 4.3 miles east of Artesia, Eddy County, 7.0 miles north of mouth of Rio Penasco, and 17 miles north of McMillan Dam.
DRAINAGE AREA. 15,300 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: July 1937 to September 1964.
Water temperatures: April 1949 to September 1964.
Sediment records: January 1949 to September 1964.
EXTREMES, 1963-64.--Dissolved solids: Maximum, 12,800 ppm Sept. 24-27; minimum 1,290 ppm June 14-16.
Hardness: Maximum, 3,630 ppm Sept. 24-27; minimum, 710 ppm June 14-16.
Specific conductance: Maximum daily, 19,200 micromhos Sept. 24; minimum daily, 1,620 micromhos June. 14.
Water temperatures: Maximum, 91°F July 24; minimum, 33°F Dec, 23, Jan. 12.
Sediment concentrations: Maximum daily, 4,200 ppm Apr. 11; minimum daily, no flow on many days during July to September.
Sediment loads: Maximum dally, 6,800 tons Apr, 14; minimum daily, 0 tons on many days during July to September.
EXTREMES, 1937-64 . Dissolved solids: Maximum, 16,300 ppm June 22, 23, 1959; minimum, 461 ppm May 31, 1963.
Hardness: Maximum, 4,360 ppm June 22, 23, 1959; minimum, 235 ppm May 31, 1963.
Specific conductance: Maximum daily, 22,600 micromhos June 23, 1959; minimum daily, 682 micromhos Aug. 1, 1962.
Water temperatures (1949-64): Maximum, 95°F Aug. 23, 1962; minimum, freezing point on several days during February 1956, January 1959, January 1962, January 1963. Sediment concentrations (1949-64): Maximum daily, 20,900 ppm Aug. 1, 1962; minimum daily, no flow on many days during July 1953, July and August 1964, July 1957, July to September 1964.
Sediment loads (1949-64): Maximum daily, 183,000 tons Sept. 26, 1955; minimum daily, 0 tons on many days during July 1953, July and August 1954, July 1957. REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K) Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Values expressed in parts per million are multiplied by density when computing loads. No flow July 30, 31, Aug. 1-7, 10-31, Sept. 1-23.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-5, 1963....

Dec. 1-31.........
Jan. 1-31, 1964...

Mar. 1-8..........

Mar. 15-25........

Apr. 7-9..........
Apr . 10 ....

Mean

discharge
(eta)

13.6
13.5
20.3
29.5
36.6

50.9
46.8
54.5
44.1
46.3
32.8

30.3
34.4
21.7
8.0
8.7
430

Silica

(Si02)

19
18
20
15
14

14
13
12
16
12
12

9.5
8.7
11
14
15
41

Iron

(Fe)

Cal-

cium

(Ca)

693
759
658
601
562

550
590
597
595
572
618

634
63?
695
723
783
620

Mag-
ne-

sium

(Mg)

263
284
248
212
189

170
201
202
220
210
243

262
20-1
269
276
308
156

Sodium

(Na)

1750
2260
1520
1200
1020

814
1070
1120
1210
1180
1340

1560
1320
1620
1700
2350
692

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

151
151
160
136
132

148
184
218
186
150
148

140
141
144
149
155
236

Car-
bon-
ate

(COJ

Sulfate

(S04)

2420
2600
2290
2060
1920

1810
1900
1900
2000
1960
2160

2250
2190
2460
2600
2790
2040

Chloride

(Cl)

2840
3630
2500
1920
1640

1320
1780
1810
2000
1930
2190

2540
2110
2610
2700
3730
990

Fluo-
ride

(F)

Ni-

trate

(NO,)

1.0
.5
4.0
1.2
1.6

.5
.6
2.7
2.9
2.6
1.5

1.0
3.5
3.1
2.4
2.6
.2

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

8060
9630
7320
6080
5410

4750
5640
5750
6130
5940
6640

7330
6540
7740
8090
10100
4660

Tons

per
acre-

foot

11.0
13.1
9.96
8.27
7.36

6.46
7.67
7.82
8.34
8.08
9.03

9.97
8.89
10.5
11.0
13.7
6.34

Tons

per

day

296
351
401
484
535

653
713
846
730
743
588

600
607
453
175
237
5-110

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

2810
3060
2660
2370
2180

2070
2300
2320
2390
2290
2540

2660
2430
2840
2940
3220
2190

Non-
car-

bon-

ate

2690
2940
2530
2260
2070

1950
2150
2140
2240
2170
2420

2 5 SO
2310
2720
2820
3090
2000

So-

dium
ad-

sorp-
tion
ratio

14
18
13

11
9.5

7.8
9.7
10
11
11
12

13
12
13
14
18
6.4

Specific
con-

duct-

ance

[mlcro-
mhos at

25°C)

11500
13800
10400
8590
7620

6580
7970
8130
8610
8410
9250

10300
9170
10700
11200
14100
5900

PH

7.4
7.5
7.4
7.2
7.2

7.6
7.8
.9
. 7
. 6
.3

. 1
.4
. 1
.3
. 2
,4

sity
(g 'ml
at

20"C)

1.004
1.005
1.003

1.003

1.004
1.004
1.006

RIO GRANDE BASIN Continued

8-3965. PECOS RIVER NEAR ARTESIA, N. MEX. Continued

Particle-size analyses of suspended sediment , water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

July 10.............

Time

(24 hour)

1120
1100
1750
0400

1900
1200
1000

Water
tem-

per-
ature

(°F)

58
60
65
65

75
81
80

Sam-

pling
point

Discharge
(cfs)

440
D 680
724
713

390
525
615

Sediment

concen-

tration

(ppra)

3700
3440
2730
6440

390
2360
1690

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

43
37
35
39

36
41

0.004

61
48
42
43

46
50

0.008 0.016

88
72
59
65

67
75

0.031 0.062

99
90
86
93

76
89
99

0.125

100
98
96
100

94
98
100

0.250

100
100

100
100

0.500 1.000 2.000

Method
of

analysis

SPWC
VPWC
VPWC
VPWC

V
VPWC
SPWC

D Dally mean discharge.

WESTERN GULF OF MEXICO BASINS 521

RIO GRANDE BASIN Continued

8-3985. RIO PENASCO AT DAYTON, N. MEX.

LOCATION. At gaging station at abandoned diversion dam, 1 mile northeast of old Dayton railway station, 3.5 miles upstream from mouth, and 7 miles southeast of Artesia, Eddy County.
DRAINAGE AREA. 1,070 square miles, approximately.
RECORDS AVAILABLE. Sediment records: September 1961 to September 1964. EXTREMES, 1963-64. Sediment concentrations: Maximum daily, 1,300 ppm Jjne 14; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 2,400 tons June 13; minimum daily, 0 tons on many days.
EXTREMES, 1951-64. Sediment concentrations: Maximum daily, 30,000 ppm Oct. 7, 1954; minimum daily, no flow on many days.
Sediment loads: Maximum daily, 600,000 tons Oct. 7, 1954; minimum daily,
0 tons on many days.
REMARKS. Records of specific conductance of daily samples and water temperatures available in district office at Albuquerque, N. Mex. Flow occurred only on days indicated.

Suspended sediment, water year October 1963 to September 1964

Date

June 12,

Total

July 12,

Total

Sept. 15

Total

Total
Total

, 1964...................

discharge for year (cfs-da

Mean

discharge
(cfs)

2
114
157

273

99

99

104

104

Mean
concentration

(ppm)

540
1300

-

"

-

1100

-

ys)..........................

Tons p«;r day

E 10
K 2400
S 1700

4110

E 700

700

S 720

720

476
5530

E Estimated.
S Computed by subdividing day.
K Computed from estimated concentration graph and subdividing day.

RIO GRANDE BASIN Continued

8-3985. RIO PENASCO AT DAYTON, N. HEX. Continued

Particle-size analyses of suspended sediment, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water)

Date of collection

Time

(24 hour)

0055
1000
0240
0545

Water
tem-

per-
ature

(°F)

66
49
49

Sam-

pling
point

Discharge
(cfs)

1110
31.2
428
158

Sediment

concen-

tration

(ppm)

5300
749
3190
1930

Sediment

discharge
(tons per day)

Suspended sediment

Percent finer than size indicated, in millimeters

0.002

36
79
51
57

0.004

46
94
68
82

0.008 0.016

74
97
87
94

0.031 0.062

96
100
97
99

0.125

100

99
100

0.250

100

0.500 1.000 2.000

Method

analysis

VPWC
PWC
SPWC
SPWC

RIO GRANDE BASIN Continued

8-4010. PECOS RIVER BELOW McMILLAN DAM, N. MEX.

LOCATION. At gaging station 700 feet downstream from gates in McMillan Dam, and 3 miles southeast of Lakewood, Eddy County. DRAINAGE AREA. 16,900 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Reported as miscellaneous station in 1949, 1953 to 1957, and 1962 to 1963 water years. No flow during most of the year.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Aug. 12...........

Mean

discharge
(Cl8)

102
91
161
4

Silica
(SlOj)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

Po-
tas-
sium

(K)

Bl-

car-

bon-
ate

(HCO,)

102
95
92
144

Car-
bon-
ate

(ccg

0
0
0
0

Sulfate
(SO.)

Chloride
(Cl)

335
610
284
280

Fluo-
ride
(F)

Ni-
trate

(NOJ

Bo-
ron

(B)

Dissolved solids

Parts
per
million

Tons
per
acre-

foot

Tons

per

day

Hardness
as CaCOj

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-
ate

So-
dium
ad-
sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at
25"C)

3450
4790
3550
3050

PH

7.6
7.1
7.1
7.0

8-4013. PECOS RIVER AT FORD CROSSING ABOVE MAJOR JOHNSON SPRINGS, NEAR LAKEWOOD, N. MEX.

LOCATION. Approximately 3.5 miles downstream from gaging station below McMillan Dam, which is 700 feet downstream from gates in McMillan Dam, Eddy County, and 3 miles southeast of Lakewood.
DRAINAGE AREA. 16,900 square miles, approximately (contributing area lies above McMillan Dam).
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Reported as a miscellaneous station for period February 1944 to September 1963.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 24, 1963.....

Mar. 25...........

Aug. 12...........

Mean

discharge
(cfs)

Silica
(S1O2)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

Po-
tas-
sium

(K)

Bl-

car-

bon-
ate

(HCO,)

172
175
168
168
1^2

102
93
81
158

Car-
bon-
ate

(COJ

0
0
0
0
0

0
0
0
0

Sulfate
(SO.)

Chloride
(Cl)

725
685
730
720
720

350
610
270
665

Fluo-
ride
(F)

Ni-
trate

(NOJ

Bo-
ron

(B)

Dissolved solids

Parts
per
million

Tons
per
acre-

foot

Tons

per

day

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-
ate

So-
dium
ad-
sorp-
tion
ratio

Specific
con-

duct-

ance

[micro-
mhos at

25°C)

4870
4810
4880
4860
4880

3490
4790
3500
4790

PH

.5
. 5
. 5
.7
.6

. 7
. 1
.3
.1

RIO GRANDE BASIN Continued

8-4020. PECOS RIVER AT DAMSITE 3, NEAR CARLSBAD, N. MEX.

LOCATION. At gaging station at damsite 3 of Carlsbad project of Bureau of Reclamation, about 1 mile upstream from flow line of Lake Avalon, 1.3 miles downstream from Rocky Arroyo, and 8 miles northwest of Carlsbad, Eddy County.
DRAINAGE AREA.--17,980 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: July 1951 to September 1964.
REMARKS. Samples collected weekly. Values reported for sodium (Na) are calculated and include potassium (K).

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct 9

Mar. 13.... ....

Mean

discharge
(cfs)

55
50
48
45
42
40

40
39
40
39
39
40

39
39
39
40
36
36

35
36
37
37
33
33

Silica

(S102)

-

::

Iron

(Fe)

Cal-
cium

(Ca)

-

"

Mag-
ne-

sium

(Mg)

__

-

"

Sodium

(Na)

_

-

- -

Po-
tas-

sium

(K)

Bl-

car-

bon-

ate

(HCO,)

162
150
84
158
180
129

150
135
154
156
155
158

157
155
158
155
156
154

156
148
150
128
141
149

Car-
bon-
ate

(CO,)

Sulfate

(S04)

"

Chloride

(Cl)

725
735
735
725
735
745

735
735
740
745
745
735

740
735
750
735
745
735

735
740
725
740
740
745

Fluo-
rlde

(F)

Ni-
trate

(NO,)

- -

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

"

"

Tons

per
acre-

foot

- -

Tons

per

day

-

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

"

Non-
car-

bon-

ate

-

-

_

So-

dium
ad-

sorp-
tion
ratio

-

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

4880
4920
4870
4850
4900
4870

4880
4890
4890
4900
4910
4880

4900
4890
4940
4880
4910
4930

4840
4860
4860
4880
4880
4890

PH

7.2
7.1
7.4
7.8
7.3
7.9

7.3
8.1
7.7
7.8
7.7
7.4

7.3
7.7
7.5
8.1
7.5
7.8

7.7
8.0
7.8
7.9
8.1
7 5

RIO GRANDE BASIN Continued

8-4054. BLACK RIVER AT HARKEY CROSSING, NEAR MALAGA, N. MEX.

LOCATION. At Harkey Crossing, approximately 3.5 miles upstream from gaging station above Malaga, which is 0.6 mile upstream from Black River diversion dam, Eddy County, 4.8 miles west of Malaga, and 7 miles upstream from mouth.
DRAINAGE AREA. 343 square miles upstream from gaging station above Malaga.
RECORDS AVAILABLE. Chemical analyses: October 1963 to September 1964.
REMARKS. Reported as a miscellaneous station for period November 1947 to September 1963.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Jan. 17, 1964.....

Sept. 17..........

Mean

discharge
(eta)

Silica

(S102)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

Po-
tas-
sium

(K)

Bi-
car-

bon-
ate

(HCO,)

172
195
176
187
176
157

157
91
158
138
122

Car-
bon-
ate

(CO,)

ooo

Sulfate
(S04)

Chloride
(Cl)

20
20
35
18
32
24

22
2.9
20
14
12

Fluo-
rlde
(F)

Ni-
trate

(NO,)

Bo-
ron

(B)

Dissolved solids

Parts
per
million

Tons

per
acre-

foot

Tons

per

day

Hardness
as CaCOj

Cal-

cium,
Mag-
ne-

sium

Non-
car -

bon-
ate

So-
dium
ad-
sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at
25°C)

1590
1610
1910
1590
1850
1650

1590
719
1570
1580
1440

pH

7.6
7.6
7.7
7.7
7.6
7.7

7.6
7.4
7.4
7.2
7.2

RIO GRANDE BASIN Continued

8-4070. PECOS RIVER AT PIERCE CANYON CROSSING, NEAR MALAGA, N. MEX.

LOCATION. At Pierce Canyon Crossing, 0.2 mile downstream from gaging station, which is 6 miles southeast of Malaga, Eddy County. DRAINAGE AREA. 19,260 square miles, approximately (contributing area).
RECORDS AVAILABLE. Chemical analyses: March 1938 to September 1941, October 1951 to September 1964.
Water temperatures: October 1952 to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 21,600 ppm Sept. 1-14; minimum, 2,080 ppm Sept. 16.
Hardness: Maximum, 3,620 ppm Sept. 1-14; minimum, 820 ppm Sept. 16.
Specific conductance: Maximum daily, 32,600 micromhos Sept. 11; minimum daily, 2,950 micromhos June 14, 15.
Water temperatures: Maximum, 92°F July 25; minimum, 37°F Jan. 16.
EXTREMES, 1938-41, 1951-64. Dissolved solids: Maximum, 23,700 ppm Aug. 11-21, 1954; minimum, 280 Sept. 21, 1941.
Hardness: Maximum, 3,620 ppm Sept. 1-14, 1964; minimum, 202 ppm Sept. 21, 1941.
Specific conductance: Maximum daily, 34,400 micromhos Aug. 2, 1954; minimum daily, 433 micromhos Sept. 21, 1941.
Water temperatures (1952-64): Maximum, 92°F July 25, 1954; minimum, 35°F Jan. 13, 1963.
REMARKS. Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Records of specific conductance of daily samples available in district office at Albuquerque, N. Mex. Values expressed in parts per million are multiplied by density when computing loads. No appreciable inflow between gaging station and sampling point except during periods of heavy local rains.

Chemical analys in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-7, 1963....

Jan. 1-23, 1964...

Feb. 13-15........

Apr. 1-30...... ...

Mean

discharge
(cfs)

27.6
27.0
41.6
37.6
41.0

53.8
58.6
53.4
22.5
24.7

36.0
43.1
21.5
19.3
14.5

Silica

(S102)

17
19
19
15
16

9.9
7.7
12
5.9
13

13
12
10
9.4
14

Iron

(Fe)

0.01

_

~

_

Cal-

cium

(Ca)

505
596
636
600
613

584
520
484
510
555

522
510
498
541
596

Mag-
ne-

sium

(Mg)

212
254
246
234
224

205
215
222
243
264

235
216
216
253
283

Sodium

(Na)

2010
2840
2830
2050
2130

1660
1500
1460
2180
2600

2120
1510
1890
2510
3010

Po-
tas-

sium

(K)

__

42

_

Bi-
car-

bon-

ate

(HCO,)

171
198
204
192
195

170
180
162
122
179

163
158
152
146
170

Car-
bon-

ate

(cog

Sulfate

(S0«)

1830
2200
2290
2110
2150

2020
1910
1850
2010
2170

2030
1850
1890
2130
2400

Chloride

(Cl)

3160
4500
4430
3260
3390

2630
2380
2300
3440
4130

3240
2450
3010
3960
4720

Fluo-
ride

(F)

1.0

Ni-

trate

(NO,)

3.2
3.8
4.3
4.1
5.4

4.5
4.4
4.0
4.7
4.6

4.9
4.5
2.7
2.9
1.6

Bo-

ron

(B)

0.44

Dissolved solids

(calculated)

Parts

per
million

7820
10500
10600
8370
8620

7200
6670
6410
8450
9820

8240
6630
7590
9480
11100

Tons

per
acre-

foot

10.6
14.4
14.5
11.4
11.8

9.81
12.0
8.74
11.5
13.4

11.3
9.04
10.4
13.0
15.2

Tons

per

day

794
770
1200
854
957

1050
1390
927
515
658

804
774
442
496
438

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

2130
2530
2600
2460
2450

2300
2180
2120
2270
2470

2270
2130
2130
2390
2650

Non-
car-

bon-

ate

1990
2370
2430
2300
2290

2160
2030
1990
2170
2320

2140
2030
2010
2270
2510

So-
dium
ad-

sorp-
tion
ratio

19
25
24
18
19

15
14
14
20
23

19
14
18
22
25

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

11800
15700
15700
12400
12600

10400
9640
9370
12700
15100

12300
9900
11400
14100
17200

pH

.4
.5
.7
.8
. 7

.9
.8
.4
.3
.6

. 5
. 5
.4
.4
,4

Den-

sity
(g/ral
at

20"C)

1.004
1.006
1.006
1.005
1.003

1.002

1.003
1.004
1.005

1.004
1.003
1.004
1.005
1.O07

RIO GRANDE BASIN Contiu

8-4465. PECOS RIVER NEAR GIRVIN, TEX.

LOCATION. At supplementary gage at bridge on U.S. Highway 67, about 0.5 mile downstream from Panhandle and Santa Fe Railway Co. bridge, 2.1 miles east of Girvin, Pecos County, 5.4 miles downstream from Comanche Creek, and 7.8 miles downstream from regular gaging station.
DRAINAGE AREA. 29,560 square miles, approximately (contributing area at supplementary gage).
RECORDS AVAILABLE. Chemical analyses: October 1939 to June 1941, October 1946 to September 1947, October 1953 to September 1964.
Water temperatures: October 1953 to January 1959, March to September 1964.
EXTREMES, 1963-64. Dissolved solids: Maximum, 28,800 ppm Sept. 1-19; minimum, 6,190 ppm Sept. 24-25.
Hardness: Maximum, 7,010 ppm Sept. 1-19; minimum, 1,940 ppm Aug. 8.
Specific conductance: Maximum daily, 37,200 micromhos Aug. 29; minimum daily, 7,580 micromhos Sept. 24.
Water temperatures: Maximum, 94°F Aug. 20.
EXTREMES, 1939-41, 1946-47, 1953-64. Dissolved solids (1960-64): Maximum, 28,800 ppm Sept. 1-19, 1964; minimum, 1,410 ppm Mar. 28-29, 1961. Hardness: Maximum, 7,010 ppm Sept. 1-19, 1964; minimum, 330 ppm May 18, 1957.
Specific conductance: Maximum daily, 37,200 micromhos Aug. 29, 1964; minimum daily, 790 micromhos Apr. 26, 1957.
Water temperatures (1953-59, 1964): Maximum, 94°F Aug. 20, 1964; minimum, 38°F Feb. 3, 4, 1956.
REMARKS. Where no potassium (K) is reported, sodium and potassium are calculated as sodium (Na). Records of specific conductance of daily samples available in district office at Austin, Tex. Values expressed in parts per million are multiplied by the density when computing loads.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Date
of
collection

Oct. 1-31, 1963

Jan. 1-31, 1964

Mar. 10-15.... .

Aug. 1-7.......

Mean

discharge
(cfs)

11.1
19.8
24.0
24.5
24.0

58.0
73.8
57.8
26.8
17.0

9.2
1.1
7.8
3.9
6.3

Sil-

ica

(SiO,)

8.8
7.9
15
19
14

8.3
4.3
2.7
2.7
4.2

6.6
1.0
1.2
3.3
3.7

Iron

(Fe)

Cal-

cium

(Ca)

987
851
803
812
842

850
715
666
724
831

908
713
946
1140
1180

Mag-
ne-

sium

(Mg)

624
602
549
567
549

374
330
321
458
602

672
540
805
877
896

Stron-

tium

(Sr)

Sodium

(Na)

4950
4150
4210
4290
4270

4900
2790
2650
3340
4200

5120
T9RO
5580
6120
6730

Po-
tas-

sium

(K)

71

52

55

77

Bi-
car-

bon-

ate

(HCO,)

49
57
144
246
242

211
136
147
179
166

75
6«
63
59
67

Sulfate

(S04)

4550
4060
3690
3700
3800

3750
2790
2660
3330
4010

4620
37RO
5300
6070
6410

Chloride

(Cl)

8090
6630
6700
6780
6730

7260
4390
4150
5210
6630

8000
6140
8670
9830
10300

Fluo-

rlde

(F)

Ni-

trate

(NO,)

Bo-

ron

(B)

Dissolved solids
(calculated)

Parts

per
mil-

lion

19300
16300
16000
16300
16300

17200
11100
10500
13200
16400

19400
15200
21300
24100
25600

Tons

per
acre-

foot

26.6
22. 4
22.0
22.4
22.4

23.7
15.2
14.4
18.1
22.6

26.7
20.9
29.4
33.3
35.4

Tons

per
day

586
880
1050
1090
1070

2730
2230
1650
963
761

488
323
455
258
443

Hardness

as CaCOj

Cal-

cium,
mag-
ne-

sium

5030
4600
4260
4360
4360

3660
3140
2980
3690
4550

5030
4000
5670
6450
6630

Non-
car-

bon-

ate

4990
4550
4140
4160
4160

3490
3030
2860
3540
4410

4970
3940
5620
6400
6570

So-

dium
ad-

sorp-
tion
ratio

30
27
28
28
28

35
22
21
24
27

31
27
32
33
36

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

24600
21500
21500
21600
21600

22800
15300
14400
17600
21400

24600
19700
26200
29700
31600

pH

. 4
. 0

' .'2

. 1

. 2

> .4
6.3
6.4
6.3

Den-

sity
(g/ml
at

20°C)

. 013
. 010
. 009
. 010
. 010

. 012
. 007
. 006
. 008
. 011

. 013
. 010
. 015
. 017
. 018

RIO GRANDE BASIN--Continued

8-4474. PECOS RIVER NEAR SHUMLA, TEX.

LOCATION. At gaging station 13.0 river miles upstream from t confluence is 638.2 river miles downstream from American Dam at El Pa DRAINAGE AREA. 35,162 square miles (from International Boundary and Wa RECORDS AVAILABLE. Chemical analyses: October 1954 to September 1964. REMARKS. Chemical analyses by U.S. Department of Agricult
conductance of daily samples and records of discharge fo
Water Bulletin Numbers 33 and 34.

Pecos High Bridge, and 18.5
.t aso, Tex.

iver

Bulletin Nu

ith Rio Grandc

water year Octobe

search Service, I
1963 to Septembe

3. Salinity Laboratory, Ri\
1964 given in Internationa

?rside, Calif. Records of
«Tater Commis

Chemic ilyses, in parts pe water year October 1963 to September 1964

Month

October 1963
November- -
December. . . .
January 1964

February r. . .

September .

Number

samples

4
3
5
3

4

3

3
4

Monthly
mean

discharge
(cfs)

91.2
105
121
136

125

82.0
2,990

Silica

(SiQ.)

_

10

_

Iron

(Fe)

Cal-

cium

(Ca)

117
117
135
154

162

187
1 54

125
115
83

Mag-
ne-

sium

(Mg)

56
51
55
67

75

84

59
53
13

Sodium

(Na)

350
320
359
437

502

601

399
362
91

Po-
tas-

sium

(K)

6.6

_

7.4

car-

bon-

ate

(HCOJ

156
170
189
174

172

171

145
139
186

Car-
bon-

ate

(COJ

0
0
0
0

0

0

0
4
0

Sulfate

(SO,)

323
303
335
417

470

548

368
335
92

Chloride

(Cl)

581
532
608
759

856

1,000

714
665
593
152

Fluo-

ride

(F)

__

1.0

_

.9

Ni-

trate

(NO,)

1.2
1.2
2.5
2.5

1.2

1.2

.6
A
.6
3.7

Bo-

ron

(B)

0.20
. 18
. 18
. 18

. 19

.30
.27

.22
.24
. 19
. 12

Dissolved solids

Parts

per
million

1,603
1,501
1,715
2,087

2,284

2 711

1 ,776
1,631
572

Tons

per
acre-

foot

2.18
2.04
2.33
2.84

3.11
3 72
3.69

2.67
2.42
2.22
.78

Tons

per

day

395
426
560
766

771

2,700
533

1,750
414
361
4,620

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

520
502
564
660

713

812

613
555
506
263

Non-
car-

bon-

ate

392
363
409
518

572

672

482
436
386
110

So-

dium
ad-

sorp-
tion
ratio

6.7
6.2
6.6
7.4

8.2

9.2

7.4
7.4
7.0
2.4

duct-

ance

(micro-
mhos at

25°C)

2,590
2,430
2,730
3,270

3,690

4,210

3,110
2,920
2,650
945

PH

8.0
V.8
7.8
7.7

7.7

7 9

7 7
7.9
8.2
8.2

A Less than 0.4 parts per million.

RIO GRANDE BASIN Continued

8-4590. RIO GRANDE AT LAREDO, TEX.

LOCATION. At gaging station 0.9 mile downstream from the highway bridge
the American Dam at El Paso, Tex.
DRAINAGE AREA. 135,976 square miles (United States and Mexico; from Int RECORDS AVAILABLE. Chemical analyses: July 1955 to September 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Researc conductance of daily samples and records of discharge for water year October 1963 Water Bulletin Numbers 33 and 34.

alipas, and 890.8 river miles dc tween Laredo, Texas and Nuevo Laredo, Ta ational Boundary and Water Commission Water Bulletin Number 31).

Service, U.S. Salin
to September 1964 gi

aboratory, Riverside, Calif. Records of specific
n International Boundary and Water Commission

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November. . . .
December ....
January 1964

February- - .

M fl V

September. . .

Number
of
samples

31
30
31
31

29
31

31

30

Monthly
mean

discharge
(cfs)

2,250
1,280
1,440
1 ,210

1,480

28,100

Silica

(SiQ.)

_

20

_

-

Iron

(Fe)

Cal-

cium

(Ca)

_
__
_

79

_

"

Mag-
ne-

sium

(Mg)

_

22

_

-

Sodium

(Na)

78
94
111
124

106
1 32

16

Po-
tas-

sium

(K)

_
__

4.3

_

-

car-

bon-

ate

(HCO,)

154
172
190
174

174

149
143

164
1 53

110

Car-
bon-
ate

(CO,)

0
0
0
0

0

0

Sulfate

(S0«)

__
_

_ _

233

_

"

Chloride

(CD

69
85
102
122

120
138
1 22

90

16

Fluo-

rlde

(F)

__
_
_

1.1

_

-

Ni-

trate

(NO,)

__
_
_

3.7

_

"

Bo-

ron

(B)

_
_

0.26

_

-

Dissolved solids

Parts

per
million

538
590
700
734

637

184

Tons

per
acre-

foot

0.73
.80
.95
1.00

.87

.25

Tons

per

day

3,268
2,040
2,720
2,400

2,540

13 , 960

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

214
233
282
286

276

2 52
232

121

Non-
car-

bon-

ate

88
92
126
143

134

30

So-
dium
ad-

sorp-
tion
ratio

2.3
2.7
2.9
3.2

2.8
3 4

. 6

duct-

ance

(micro-
mhos at

25°C)

775
907
1 ,040
1,120

1 ,030

929
962

309

pH

__
__
_

7.8

__

8 0

"

Water Bulletin Number 31).

RIO GRANDE BASIN Continued

8-4613. RIO GRANDE BELOW FALCON DAM, TEX.

LOCATION. U.S. Tailrace at Falcon Dam.
DRAINAGE AREA. 164,482 square miles (United States and Mexico; from International Boundary and Water Co
RECORDS AVAILABLE. Chemical analyses: July 1955 to September 1964.
REMARKS. Chemical analyses by U.S. Department of Agriculture, Agricultural Research Service, U.S. Laboratory, Riverside, Calif. Reco conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Boundary Water Bulletin Numbers 33 and 34.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November- . . -
December. . . .
January 1964

February ....

September.

Number
of
samples

8
7
11
11

8
13

10

Monthly
mean

discharge
(cfs)

1 ,000
481
739
961

739

816

Silica

(S1Q.)

__
_
_

13

_

g

- -

Iron

(Pe)

Cal-

cium

(Ca)

69
61
68
71

72

70

76

Mag-
rie-

sium

(Mg)

17
15
16
15

15

20

17

Sodium

(Na)

105
102
101
101

99

107

Po-
tas-

sium

(K)

_

6.3

_

-

car-

bon-

ate

(HCOJ

128
134
137
137

140

141

122

Car-
bon-
ate

(CO,)

0
0
0
0

0

0

Sulfate

(SO.)

208
206
204
201

206

211

212

Chloride

(Cl)

107
106
101
104

102

110

112

Fluo-
rlde

(F)

_

0.8

_

Ni-

trate

(NO,)

0.6
A
A
A

.6

. 6

Bo-

ron

(B)

0.17
. 19
.20
. 17

. 14

.20

. 22

Dissolved solids

Parts

per
million

649
588
603
604

579

595

Tons

per
acre-

foot

0.88
.80
.82
.82

. 79

.81

Tons

per

day

1,750
764
1,200
1,570

1,160

2 230
1,310

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

241
236
237
240

243

24 5

255
231

Non-
car-

bon-

ate

136
126
125
128

128

1 34

131

So-

dium
ad-

sorp-
tion
ratio

2.9
2.9
2.9
2.8

2.8

2.9

3.1

OrlafHf 1*»

duct-

ance

[micro-
mhos at

25°C)

953
945
932
941

933

957

PH

7.8
8.0
7.7
7.7

7.9

7.8

A Less than 0.4 parts per million.

RIO GRANDE BASIN Continued

8-4647. RIO GRANDE AT FORT RINGGOLD, RIO GRANDE CITY, TEX.

LOCATION. At gaging station about 1 river mile downstream from Rio Grande City, Starr County, 3.9 river miles do 1,014.3 miles below American Dam at El Paso, Tex.
DRAINAGE AREA.--180,396 square miles (United States and Mexico; from International Boundary and Water Comm RECORDS AVAILABLE. Chemical analyses: January 1959 to September 1964.
REMARKS. Chemical analyses by U.S.Department of Agriculture, Agricultural Research Service, U.S. Salinity conductance of daily samples and records of discharge for water year October 1963 to September 1964 give
Water Bulletin Numbers 33 and 34.

from confluence of Rio Sa

Water Bulletin Numbe

aboratory, Riverside, Calif,
in International Boundary am

Records
Water Co

>f specif!

Chemical analyses, in parts p water year October 1963 to September 1964

Month

October 1963
November. . . .
December-
January 1964

February- . . .

July........

September. . .

Number
of
samples

13
20
12
11

11

1 3

13

Monthly
mean

discharge
(cfs)

1,860
492
701
991

769

1,910

Silica

(S1Q.)

_

10

--

-

Iron

(Pe)

Cal-

cium

(Ca)

59
77
75
74

72

75

64

Mag-
ne-

sium

(Mg)

11
15
16
17

19

19
19
9.2

Sodium

(Na)

75
121
120
120

123

92

118

125
78

Po-
tas-
sium

(K)

_

6.3

-

car-

bon-

ate

(HCO,)

131
144
149
144

149
143
1 53

143

1 34
134

Car-
bon-

ate

(cog

0
0
0
0

0

0

Sulfate

(S04)

135
217
221
218

222

192

21 5

143

Chloride

(ci)

79
131
126
122

132
113

130
80

Fluo-
ride

(F)

_

__

0.8

"

Ni-

trate

(NO,)

1.9
.6
.6
.6

.6
A

A

1.2

Bo-

ron

(B)

0.19
.27
.25
.20

. 23

23

.24

Dissolved solids

Parts

per
million

492
673
676
670

681

459

Tons

per
acre-

foot

0.67
.92
.92
.91

.93

87
78

90

. 62

Tons

per

day

2,470
894
1,280
1,790

1,410

2,370

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

191
255
255
253

255
252

252
252

197

Non-
car-

bon-

ate

84
137
132
135

133

134

139
87

So-

dium
ad-

sorp-
tion
ratio

2.4
3.3
3.3
3.3

3.4

3 3
3 3
3 4
2.4

duct-

ance

(micro-
mhos at

25°C)

722
1,070
1,050
1 ,050

1,090

748

PH

7.9
7.8
7.8
7.7

7.8

8 2
7.9

A Less than 0.4 parts per million.

RIO GRANDE BASIN Continued

8-4692. RIO GRANDE BELOW ANZALDUAS DAM, TEX.

LOCATION. At gaging station, 0.5 mile downstream from Anzalduas Dam, Hidalgo County, 12.2 miles upstream from Hidalgo, and 1,077.1 ri at El Paso, Tex.
DRAINAGE AREA.--182,138 square miles (United States and Mexico; from International Boundary and Water Commission Water Bulletin Numbei RECORDS AVAILABLE. Chemical analyses: March 1959 to September 1964.
REMARKS. Chemical analyses by U.S.Department of Agriculture, Agricultural Research Service, U.S. Salinity Laboratory, Riverside, Call conductance of daily samples and records of discharge for water year October 1963 to September 1964 given in International Boundary Bulletin Numbers 33 and 34.

below Americ

Chemical analyses, in parts per million, water year October 1963 to September 1964

Month

October 1963
November. . . .
December. . . .
January 1964

February. . . .

April. ......
May- .... ..

September. -.

Number
of
samples

29
29
20
31

29

30

31

30

mean

discharge
(cfs)

1,140
327
266
568

495

1,210

820

Silica

(S1Q.)

_
_

12

_

_

-

Iron

(Pe)

Cal-

cium

(Ca)

69
81
89
90

90

77

71

Mag-
ne-

sium

(Mg)

18
17
24
23

27

19

25

18

Sodium

(Na)

121
168
189
184

204

134

155

tas-

sium

(K)

__
_

5.9

_

_

-

Bi-
car-

bon-

ate

(HCO,)

132
134
154
150

148

145
146

1 34

131
125

bon-
ate

(CO,)

0
0
0
0

0

0

0

Sulfate

(SO.)

194
206
280
272

291

229

220

Chloride

(Cl)

147
230
232
230

261

149

255
188

Fluo-
ride

(F)

__
_

0.8

_

_

Ni-

trate

(NO,)

1.2
A
.6
A

.6
^

A

^
^
^

.6

Bo-

ron

(B)

0.21
.45
.36
.41

.46

.30

4 5

.39

Dissolved solids

Parts

per
million

689
800
949
945

986

729

921

743

Tons

per
acre-

foot

0.94
1.09
1.29
1.29

1.34

.99

1 25

1 35
1.01

Tons

per

day

2,120
706
682
1,450

1,320

2,380

1,640

Hardness

as CaCO,

Cal-

cium,
Mag-
ne-

sium

245
273
320
320

336

269

31 5
252

Non-
car-

bon-

ate

137
163
194
198

214

150

150

So-

ad-

uorp-
tlon
ratio

3.4
4.4
4.6
4.5

4.9

3.5

4.2

con-

duct-

ance

(micro-
mhos at

25°C)

,050
,340
510
,470

, 590

,150

,210

PH

7.9
8.0
7.7
7.8

7.8

7.9

8.0

A Less than 0.4 parts per million.

RIO GRANDE BASIN Continued

PECOS RIVER WATER DELIVERY STUDY IN TEXAS

Water samples were collected for chemical analyses and discharge measurements were made on the Pecos River an Pecos Counties, from Red Bluff Reservoir to gaging station 8-4465, Pecos River near Girvin, a distance of 188.4 mi

its tributaries in Loving, Ward, Reeves, and

Chemical analys in parts per

Date

Mar. 3

3

3

3

3

3

4
4

4

Sampling site

Pecos River 1,500 feet down-
stream from Red Bluff Dam.
Salt (Screwbean) Draw 500 feet
above mouth.
Pecos River 600 feet below gage
8-4125 near Orla.
Pecos River 800 feet below
Reeves Co. WID No. 2 channel
dam.
Pecos River 1,000 feet below
Ward Co. WID No. 3 dam.
Pecos River 300 feet below
former gaging station, Pecos
River near Pecos.

Pecos River about 0.5 mile
below Grandf alls-Big Valley
diversion dam.
Pecos River 800 feet below
Pecos Co. WID No. 2 (upper
div.) dam.

Dis-

charge
(cfs)

129

. 17

124

110

102

77.6

0
81.2

74.2

Silica
(Si02)

2.5

__
__

. 3

Cal-
cium
(Ca)

565

_
__

606

Mag-
ne-

sium
(Mg)

212

__

__
_

223

So-
dium
(Na)

1830

__
_

2080

Po-
tas-
sium
(K)

56

Bicar-
bonate
(HC03)

114

168

112

105

106

104

107
109

103

Sul-
fate
(S04)

2030

__

2160

Chlo-
ride
(Cl)

A2950

6430

2990

2980

2990

3180

3180
3080

C3280

Dissolved solids
(Calculated)

Parts
per
mil-
lion

B7700

__

8400

Tons
per
acre-

foot

10.5

__

__

11.5

Hardness
as CaCO3

Ca,
Mg

2280

4150

2310

2350

2350

2470

2430
2430

2430

Non-
car-

bon -
ate

2190

4010

2220

2260

2260

2380

2340
2340

2340

So-
dium
ad-

sorp-
tion
ratio

17

__

18

Spe-
cific
conduct-
ance

(micro-
mhos at
180°C)

10900

20100

11000

11100

11100

11200

11300
11400

11400

PH

7.6

7.8

7.6

7.6

7.6

7.5

7.6
7.6

7.4

Den-

sity
(g/ml
at

20°C)

__

1.011

1.004

1.006

1.005

1.005

1.006
1.005

1.006

A Includes 1.4 ppm bromide (Br) and 0.7 ppm iodide (I). B Includes 0.6 ppm boron (B).
C Includes 1.5 ppm bromide (Br) and 0.7 ppm iodide (I).

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION

ANTON CHICO TO WALKER RANCH (RIVER RANCH), ABOVE SANTA ROSA, N. MEX.

A series of discharge measurements was made on April 29, 1964, to study gains and losses of the Pecos River from the regular gaging station "near Anton Chico" to the ford at Walker Ranch, 8 miles northwest of Santa Rosa, N. Mex. There are no surface diversions in this reach. Acequia del Bodo Juan Paiz diverts from the Pecos at river mile 324.5, and a portion of this diversion returns to the river at mile 311.4. Large channel losses below Colonias at river mile 287 resulted in no flow at river mile 285.4 and 284.4. Samples were collected for chemical analyses at all other measuring sites. River mile locations were obtained from the U.S. Geological Survey Plan and Profile maps of the Pecos River, Lake McMillan to Pecos, N. Mex., and Geological Survey topographic maps. Previous seepage investigations with samples for chemical analyses at measuring sites within this reach were made in December 1954, April 1961 and April 1963. Chemical analyses, in parts per million, water year October 1963 to September 1964

Stream or diversion Location (24
hr)

Tem-

ture
("F)

charge
(cfs)

cium
(Ca) sium
(Mg)

Bi-

bon-
ate

(HC03)

bon-
ate

(C03)

fate
(S0 4)

Chloride
(CD

Hardness
as CaCO3

Cal-

cium,
magne-
sium

Non-
car-

bon-
ate

So-
dium

sorp-
tion
ratio

Specific
conduct-

(micro-
mhos at
25°C)

pH

Apr. 29, 1964

Acequia del Bodo Juan Paiz*.

Acequia del Boco Juan Paiz
wasteway*.

Do. ....

southeast of Anton Chico (regular
gaging station), river mile 316.5.
Lat 35°11'15", long 105°06'20", opposite
Pecos River gaging station.

below Canyon Blanco, river mile 314.0.
Lat 35°10'30", long 105°02'20", 0.3 mile
above mouth, river mile 311.4.

irrigation at Dilia, river mile 310.5.

arroyo from left, river mile 308.3.

river mile 307.0.

Spring Creek, river mile 307.0.
Lat 35°11'35", long 104°58'20", at ford
at La Cueva ruins, river mile 305.1.

arroyo from left, river mile 303.3.

mile 302.0.

above Gallinas River, river mile 298.8.

0945

1230

1315

0915

52

56

57

51

28.1

11.1

52.8

43

41

45

43

45

2.6

3 4

4.5

5.2

128

134

148

148

0

0

0

16

18

35

20

1.2

1.3

4 5

1.7

113

131

123

134

g

8

10

12

243

233

245

269

250

275

7.8

8 0

7.8

7 8

7.7

A Left bank.

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

COLONIAS TO ALAMOGORDO RESERVOIR, N. HEX.

A series of discharge measurements was made Oct. 8-9, 1963 to study gains and losses on the Pecos River from a point about 1 8 miles southeast of Colonias (river mile 286.0), where water reappeared in the channel to the head of Alaraogordo Reservoir (river mile 223.8). The river channel is normally dry during winter months from the mouth of the Gallinas River 12 miles downstream to the sampling site. Channel gains occurred throughout most of the reach the create being in the Santa Rosa to Puerto de Luna area. The Puerto de Luna east ditch at river mile 251.8 is the only direct surface diversion from the Pecos River in the reach. Most of the ditches are fed by springs. River mile locations were obtained from the U.S. Geological Survey Plan and Profile maps of the Pecos River, Lake McMillan to Pecos, N. Mex. and U.S. Geological topographic map. Previous seepage investigations with samples for chemical analyses at measuring sites in the reach were made in March 1961 and October 1961.

Chemical analys million, water year October 1963 to September 1964

Stream or diversion Location

Time
(24 hr)

Tem-
pera-
ture
(°F)

Discharge
(els)

Bicar-
bonate
(HC0 3)

Sulfate
(S04)

Chloride
(Cl)

Hardness
as CaCO3

Calcium,
magne-
sium

Noncar-
bonate

Specific

ance

(micro-
mhos at
25"C)

pH

Oct. 8, 1963

River Lat 35°05'30", long 104°48'00", river mile 284.4.
Lat 35°05'05", long 104°47'20", river
mile 283.2.
NWj sec. 24, T.10 N. , R.20 E. , river
mile 281.8.
SE} sec. 24, T.10 N. , R.20 E. , river
mile 281.0.
NEj sec. 25, T.10 N. , R.20 E. , river
mile 279.7.
NWj sec. 32, T.10 N. , R.21 E. , at Walker
Ranch (River Ranch) (temporary recorder) ,
river mile 277.8.
NWj sec. 33, T.10 N. , R.21 E. , below irri-
gated field, river mile 276.4.
Lat 35*03'45", long 104°40'15", above mouth
of Esteros Creek, river mile 271.8.
Lat 35°02'30", long 104°40'55", above
unnamed arroyo from left, west of Asphalt
pit, river mile 267.7.
Lat 34*59'30", long 104°41'50", 4.0 mile
below Los Esteros damsite, river
mile 262.4.
SWj sec. 26, T.9 N. , R.21 E. , below Rattle-
snake Canyon, river mile 260.6.
NEj sec. 34, T 9 N. , R.21 E. , at mouth, river
mile 259.5.
SEj sec. 34, T.9 N. , R.21 E. , river
mile 259.4.

0855

1005

1050

1200

1255

0945

1055

1230

0750

0915

1115

1240

1220

65

68

69

74

76

80

78

80

53

59

70

63

74

4.74

14.0

14.2

16.8

17.1

19.8

18.8

22.7

18.8

17.2

17.3

. 65

19.6

167

163

172

156

149

173

163

131

148

148

164

161

152

3.1

3.5

3.2

4.2

4.6

4.0

4.2

4.4

4.4

4.2

4.3

42

7.1

374

648

472

929

917

918

926

989

978

967

964

2510

1100

7.8

7.9

7.9

7.6

7.6

7.6

7.7

7.5

7.8

7.8

8.1

7.4

7.9

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

COLONIAS TO ALAMOGORDO RESERVOIR, N. HEX.--Continued

Chemical analyses, in parts per million, water year 1963 to September 1964 Continued

Time

Tem-
pera-

(°F) (cfs)

Bicar-

(HC03) (S04) (Cl)

Hardness
as CaC0 3

Calcium,
magne-
sium

Noncar-
bonat e

Specific
conduct-

(micro-
mhos at
25°C)

pH

Oct. 8, 1963 Continued

Puerto de Luna east ditch**...

Puerto de Luna west ditch*...

NEj sec. 30, T.8 N. , R.22 E., at head (diver-
sion from Pecos River), river mile 251.8.

mile 249.7.
SEj sec. 31, T.8 N. , R.22 E. , adjacent to
river mile 249.7.

Negra, river mile 249.7.

1410

1530

72

74

8.08

6.97

169

137

155

94

254

2500

2920

2530

7.8

7.6

Oct. 9, 1963

Do. ....

Do........................

Do ....

Do. ....

Do '. ....

Negra, river mile 249.7.

Luna (temporary recorder) , river
mile 245.4.
SEj sec. 29, T. 7 N. , R.22 E. , below mouth of
Puerto Creek, river mile 242.6.
SWj sec. 36, T.7 N. , R.22 E. , river
mile 236.2.

Arroyo San Juan de Dios, river mile 230.4.

east of Puerto de Luna (regular station) ,
river mile 228.1.
SEj sec. 33, T.6 N. , R.23 E. , above head of
Alamogordo Lake, river mile 223.8.

1115

1330

0850

1020

1140

62

64

73

58

65

66

94.5

91.3

80.8

78.4

84.3

165

150

141

142

141

112

110

112

110

2560

2540

2530

2530

7.5

7.6

7.5

7.5

7.7

A Right bank.
B Left bank.

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

FORT SUMNER TO ACME, N. MEX.

A series of discharge measurements was made Oct. 10, 1963 and June 9, 1964 to study gains and losses on the Pecos River from the Pecos River from the (river mile 128.5), which was not operating during either investigation. Inflow at head of reach is essentially drain water from Fort Sumner Irrigation Project. Samples were collected for chemical analyses at each measuring site, except for sites with no flow below Bosque Draw (river mile 111.0) in June Hiver mile locations were obtained from U.S. Geological Survey Plan and Profile maps of the Pecos River, Lake McMillan to Pecos, N. Mex. and Geological Survey topographic maps. Previous seepage investigations of the reach were made in January 1959, June 1960, November 1960 and May 1962.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Stream or diversion Location

Time
(24
hr)

Tem-
per-
a-
ture
(°F)

charge
(cfs)

Bi-
car-

ate

(HCO3)

Car-

ate

(C03)

Sul-
fate
(S04)

Chloride
(CD

Hardness
as CaCO3

Cal-

cium,
magne-
sium

car-

bon-
ate

Specific
conduct-
ance

(micro-
mhos at
25°C)

pH

Oct. 10, 1963

Pecos River. ....

Arroyo de la Mora*....

"0................ .

A Right bank.

SWj sec. 36, T.2 N., R.26 S., below Ft. Sumner
(gaging station), river mile 176.6.
SWj sec.l, T.I N., R.26 E. , below Taiban
Creek, river mile 175.7.
NEj sec. 8, T.I S. , R.26 E. , above Arroyo Yeso,
river mile 165.8.
NEj sec. 17, T.I S. , R.26 E. , below Arroyo
Yeso, river mile 163.0.
SEj sec. 3, T.2 S. , R.25 E. , above Conejos
Creek, river mile 156.2.
SWj sec. 3, T.2 S., R.25 E. , at mouth, river
mile 156.1.
SEj sec. 3, T.2 S. , R.25 E. , below Conejos
Creek, river mile 155.9.
NEj sec. 22, T.2 S. , R.25 E. , below Cedar
Creek, river mile 152.8.
NWj sec. 10, T.3 S. , R.25 E. , above Arroyo
de la Mora, river mile 146.8.
SEj sec. 3, T.3 S. , R.24 E. , at road crossing,
6 miles above mouth, river mile 144.7.
NEj sec. 28 T.3 S. , R.25 E. , above Wylie Draw,
river mile 143.0.
NSj sec. 11, T.I S. , R.25 E. , above Hernandez
Draw, river mile 135.0.
SWj sec. 36, T.4 W. , R.25 E. , at Benedict's
pump (temporary recorder) river mile 128.5.

0810

0905

1030

1120

0920

0915

1020

1235

1340

1145

1300

1440

1600

54

58

64

67

59

65

63

73

73

68

73

75

70

41.8

41.2

35.4

36.8

37.2

. 07

35.6

33.5

33.9

. 04

33.5

25.0

25.1

218

218

157

154

142

178

142

127

119

58

114

105

101

150

154

192

214

280

232

280

282

294

168

298

286

294

2740

2740

2820

2860

3100

5450

3100

3150

3180

3890

3200

3100

3220

7.5

7.5

7.6

7.5

7.6

7.4

7.6

7.6

7.6

7.1

7.4

7.6

7.8

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

FORT SUMMER TO ACME, N. MEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Stream or diversion Location (24
hr)

Tem-

per
a-
ture
(°F)

charge
(cfs)

Bi-

bon-
ate

(HCO3)

bon-
ate

(C03)

fate
(S04)

Chloride
(CD

Hardness
as CaCO3

Cal-

cium ,
magne-
sium

Non-
car-

bon-
ate

Specific
conduct-

(micro-
mhos at
25'C)

pH

Oct. 10, 1963 Continued

Do. ....

Do........ ....

Pecos River. ....

Creek, river mile 124.4.

Draw, river mile 116.8.
NWj sec. 33, T.6 S. , R.26 E., below Bosque
Draw, river mile 113.0.
NEj sec. 5, T.7 S., R.26 E. , above Five Mile

pipeline crossing, river mile 106.8.

SWj sec.l, T.8 S., R.25 E. , at El Paso pipe-
line crossing, river mile 102.7.

river mile 97.5.

0800

0930

1050

1245
1340

1515

51

59

62

79
76

76

22.3

20.7

20.4

. 01
13.6

11.1

104

110

102

190
100

103

324

328

524
328

436

3240

3470

3450

5470
3450

6.8

7.2

8.2
7.7

7.6

June 9, 1964

Do.. ....

Pecos River ....

(gaging station), river mile 176.6.
SWj sec.l, T.I N., R.26 E. , below Taiban
Creek, river mile 175.7.

river mile 165.8.

Yeso, river mile 163.0

Creek, river mile 156.2.

mile 156.1.
SEj sec. 3, T.2 S. , R.25 E. , below Conejos
Creek, river mile, 155.9.

Creek, river mile 152.8.

0710

0820

0945

1040

0810

0840

62

63

76

76

64

66

26.5

27.6

20.8

20.6

. 003

17.6

208

198

146

140

125

0

0

0

0

0

0

1500

1500

1620

1640

1710

166

168

348

252

502

1580

1730

1430

1420

1540

163"

2940

2970

3620

6000

4140

7.5

7.6

7.8

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

ACME TO LAKE McMILLAN, N. MEX.

A series of discharge measurements was made Feb. 18-19, 1964, to study gains and losses on the Pecos River from the regular gage "near Acme" (river mile 94.0) to the head of Lake McMillan. Two river pumps, at ricer miles 47.1 and 27.7, were in operation during this investigation and reduced the flow as shown in the tabulation. All known tributary inflow was measured. Samples were collected at most measuring sites. River mile locations were obtained from U.S. Geological Survey Plan and Profile maps of the Pecos Riyer, Lake McMillan to Pecos, N. Mex. and Geological Survey topographic maps. Previous seepage investigations with samples for chemical analyses at measuring sites within the reach were made at least once each water year from 1956-60, 1962-63.

Chemical analyses, in parts per million, water year October 1963 to September 1964

Stream or diversion Location

Time
(24 hr)

Tem-
pera-
ture
(°F)

Discharge
(cfs)

Bicar-
bonate
(HC03)

Car-
bon-
ate

(C03)

Chloride
(CD

Specific
conduct-
ance

(micro-
mhos at
25'C)

pH

Den-

sity
g/ml
at
20°C

Feb. 18, 1964

Hagerman Irrigation
Co. well "b".
Hagerman Irrigation
Co. well "a".

NEiSWjNWj sec. 14, T.9 S. , R.25 E. , near Acme (regular gaging station), river mile 94.0.
VMSWjNEl sec. 22, T.9 S. , R.25 E. , at pipeline crossing, river mile 91.7.
SEjSWjSEj sec. 27, T.9 S. , R.25 E. , above Bitter Lakes, river mile 89.1.
NEjSWjSWj sec. 11, T.10 S. , R.25 E. , at Bitter Lakes, above inflow, river mile 84.9.
NEjswJSWl sec. 11, T.10 S. , R.25 E. , from old river channel at Bitter Lakes, river mile 84.9.
NEjNEjNEj sec. 33, T.10 S. , R.25 E. , above mouth of Bitter Creek, river mile 78.4.
NWjNEjSWj sec. 28, T.10 S. , R.25 E. , 0.9 mile above mouth.
NEjNEjNEj sec. 33, T.10 S. , R.25 E. , at mouth, river mile 78.4.
SEjSWjsWj sec. 34, T.10 S. , R.25 E. , below Tatum bridge, river mile 77.3.
SEjSEjNEj sec. 9, T.ll S. , R.25 E., above Rio Rondo, river mile 74.7.
NEjNEjNEj sec. 35, T.10 S. , R.24 E.

NEjNEjNEj sec. 35, T.10 S. , R.24 E.

NWjSWjNEj sec. 31, T.10 S. , R.25 E. , at head.
NE}SE}SE} sec. 8, T.ll S. , R.25 E. , at entrance to
Hagerman Canal.
NWjNWjSEj sec. 22, T.ll S. , R.25 E. , at entrance to Hagerman Canal.

0800

0910

1050

1200

1220

1425

0830

1450

1605

0800

0955

0950

0750
1200

1430

32

34

43

47

47

53

38

55

52

34

70

70

51
47

56

7.74

9.19

9.03

10.8

. 22

12.5

3.53

4.71

17.5

16.6

3.30

6.21

20.5
2.25

3.24

136

128

140

140

231

151

304

316

183

182

205

204

323
269

272

0

0

0

0

0

0

0

0

0

0

0

0

0
0

0

815

795

1150

1460

4160

1740

2060

2500

1920

1980

3420

3870

2100
625

133

5160

5080

6220

7190

15800

8060

8280

9580

8300

8630

11800

13200

3940
4180

2980

7.7

7.7

7.5

7.7

7.7

7.8

6.9

7.2

7.1

7.3

7.2

7.1

''.S

7.5

7.2

1.004

1.004

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

ACME TO LAKE McMILLAN, N. MEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Stream or diversion Location

Time
(24 hr)

Tem-

<"F)

Discharge
(cfs)

Bicar-
bonate
(HC03)

Car-
bon-
ate

(C03)

Chloride
(CD

Specific
conduct-
ance

(micro-
mhos at
25°C)

pH

Den-
sitv
g/ral
at
20°C

Feb. 18, 1964 Continued

Hagerman Drainage
District "D" line*.

mile 50.0.

SEiNWJNwf sec. 12, T.14 S. , R.26 E. , at mouth, river mile 47.4.

(temporary recorder), river mile 46.7.

1010
1050
1120

1200
0900

1330

1605

40
47
46

47
58

51

52
52
50

40.8
1.32
1.81

43.4
. 10

41.0

43.7

206
266
258

202
546

200

192

0
0
0

0
0

0

0

0

1260

2000

1300
58

1320

1430

6390
8000
8620

6460
1440

6580

6930

7.6
7.2

7.4
7.3

7.0

7.1

7.1

Feb. 19, 1964

Do..................
Cottonwood Creek"......

Artesia sewage
efflnentA.

Valley pump, river mile 39.8.

mile 35.1.

(regular gaging station), river mile 30.6.

NEjSEjNw} sec. 26, T.16 S., R.26 E., a mouth, river mile 20.6.

K»JNW|NW| sec. 12, T.17 S., R.26 E., a mouth, river mile 16.0.

(regular gaging station), river mile 12.4.

Lakewood (regular gaging station).

0810

1110

0825

1200

1055

36
37

44

41

34

44
50

39

40

50

44.6
44.2

. 05

44.4

. 34

40.9
. 42

40.2

41.7

202
196

328

214

151
352

146

136

0
0

0

0

0
0

0

0

0

1480
1500

9610

315

1750
365

1850

1880

1900

7100
7100

31900

4620

7930
3050

8O4O

8210
8170

8190

7.5
7.8

7.4

7.2

7.5
6.8

7.1

7.1

7.4

A Right bank. B Left bank.

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

CARLSBAD TO RED BLUFF, N. MEX.

A series of discharge measurements was made Feb. 6-7 and July 27-28, to study gains and losses on the Pecos River from the regular gage "at Carlsba regular gage "at Red Bluff, a distance of about 45 river miles. Black River above Malaga, N. Mex. is the only known perennial tributary in this reach, diversion in operation in February was Harroun Canal. Diversions during July include Harroun Canal, O'Cheskey pump (site No. 311.7), and Moutray pump (site No. 337). Locations of measuring sites were obtained from U.S. Geological Survey topographic maps or the U.S.G.S. Plan and Prolile map of Malaga Site numbers listed in this tabulation are used to establish the downstream order and have no relation to river mile. Previous seepage investigations samples for chemical analyses at measuring sites within the reach were made in January 1961, October 1961, and July 1963.

Chemical analyses, in parts per million, water year October 1963 to September 1964

The only

Bend.

Stream or diversion Location (24
hr)

Tem-

ture
(°F)

charge
(cfs)

Mag-
ne-

sium
(Mg)

Bi-

bon-
ate

(HC03)

bon-
ate

(C03)

fate
(S04)

Chloride
(CD

Hardness
as CaCO3

Cal-
cium.
magne-
sium

Non-

bon-
ate

Specific
conduct -

(micro-
mhos at
25°C)

pH

Den-

sity
g/ml
at
20 °C

Feb. 6, 1964

O'Cheskey well spill to
C.I.D. drain "A"A.

NWjSEj sec. 6, T.22 S. , R.27 E. , at Greene
St. Bridge (regular gage), site No. 308.

of Dark Canyon, site No. 309.2.

Carlsbad sewage inflow, site No. 310.

sewage inflow, site No. 311.
SWjNWi sec. 14 T.22 S., R.27 E. , site
No. 311.9.

at site No. 312.

at site No. 312.2.

Mile Dam, at site No. 313.

Dickson Crossing, at site No. 314.4.

at site No. 315.

Draw, site No. 315.2.

Harroun Dam, at site 315.6.

Engineer gage, site No. 316.

Harroun Dam, at site No. 318.

crossing, at site No. 318.3.

0750

0900

1010

1120

0925

1110

50

46

46

46

45

59

45

44

47

23.0

23.7

23.8

28.5

. 05

29.2

. 99

38.5

40.2

2.83

186

189

186

196

368

191

164

266

130

136

81

160

0

0

0

0

0

0

0

0

0

0

468

472

478

488

760

548

602

1550

655

760

780

1080

3300

3350

3350

3410

8900

3670

3910

7750

4140

4620

4610

5890

7.6

7.6

7.7

7.2

7.6

7.4

7.0

7.5

6.7

6.8

7.7

6.9

A Right bank.

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

CARLSBAD TO RED BLUFF. N. MEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Stream or diversion Location (24
hr)

Tem-

a-
ture
(°F)

charge
(cfs)

ne-

sium
(Mg)

Bi-

bon-
ate

(HC03)

Car-
bon-
ate

(C03)

Sul-
fate
(S04)

Chloride
(Cl)

Hardness
as CaC03

Cal-
cium,
magne-
sium

Non-
car-

bon-
ate

Specific
conduct-
ance

(micro-
mhos at
25°C)

pH

Den-

sity
g/ml
at
20°C

Feb. 6, 1964 Continued

Loving, at site No. 318.4.

above mouth, at site No. 332.

Harroun's Crossing, at site No. 333.

Malaga (regular gage), at site No. 333.5.

1345

1300 49

11.7

21.7

186

163

171

0

0

1260

1061

2121

2640

6420

6020

9020

10400

6.8

7.6

7.1

7.4 1.003

Feb. 7, 1964

Do...................

Malaga (regular gage) , at site
No. 333.5.

Rock Crossing, at site No. 334.

Dogtown drain, at site No. 335.

No. 337.

U.S.G.S. 11, at site No. 337.2.

Canyon Crossing (regular gage) , at site
No. 338.2.

wash, at site No. 338.3.

for-i, at site No. 338.5.

2nd ford, at site No. 339.5.

Reed's pump, at site No. 340.

43

43

25.6

26.1

169

179

171 0

2580

3530

10400

11800

13100

16000

16000

7.2

7.0

7.9

7.4

7.4

1.003

1.004

1.005

1.006

1.006

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

CARLSBAD TO RED BLUFF, N. HEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Stream or diversion Location (24
hr)

Tem-

a-
ture
<°F)

charge
(cfs)

ne-

sium
(Mg)

Bi-

bon-
ate

(HC03)

bon-
ate

(C03)

Sul-
fate
(S0 4)

Chloride
(Cl)

Hardness
as CaCO3

Cal-
cium,
magne-
sium

Non-
car-

bon-
ate

Specific
conduct-
ance

(micro-
mhos at
25°C)

PH

Den-

sity
g/ml
at
20°C

July 27, 1964 Continued

Loving, site No. 318.4.

above mouth, site No. 332.

Harroun's Crossing, site No. 333.

Malaga (regular gage), site No. 333.5.

88 169

7 3

1.005

July 28, 1964

Do. ....

Do...................

Malaga (regular gage), site No. 333.5.

Rock Crossing, site No. 334.

Doetown drain, site No. 335.

No. 337.

U.S.G.S. 11, site 337.2.

Canyon Crossing (regular gage) , site
No. 338.2.

wash, site No. 338.3.

1st ford, site No. 338.5.
* }SEl sec.S, T.25 S. , R.29 E. , above
Reed's pump, site No. 340.

Salt Draw, site No. 341.

(regular gage), site No. 342.

0745

1140

1110

82

84

79

86

90

10.7

10.3

4.46

o.Tl

174

153

144

113

64

0

0

0

n

0

2300

2640

3110

3200

3510

3540

5260

9280

9330

9480

9330

2690

3550

3900

2500

2560

2800

3280

3330

3430

3460

3850

13300

14200

29200

29400

29900

29600

28400

7 2

7 1

7 3

7 0

7.0

7 ?.

7 2

1.005

1.005

1.007

1.013

1.013

1.013

1.013

1.013

1.012

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

MAJOR JOHNSON SPRINGS TO SOAPBERRY DRAW, NEAR CARLSBAD, N. MEX.

Five discharge measurements were made Jan. 27, 1964, to study gains and losses on the Pecos River from below all known springs at Major Johnson Springs near Seven Rivers to the mouth of Soapberry Draw near Carlsbad, a distance of six river miles. No release from Lake McMillan and, no tributary inflow or diversion occurred through the reach. Locations for measuring sites were obtained from U.S. Geological Survey topographic maps. Site numbers included in the tabulation are used to establish downstream order and have no relation to the river mile. Previous seepage investigations, with samples for chemical analyses at each measuring site, have not been made. Samples were collected for chemical analyses at all sites where measurements were made.

Chemical analyses, in parts million, water year October 1963 to September 1964

Stream or diversion Location

Time
(24 hr)

Tem-
pera-
ture
(°F)

Discharge
(cfs)

Bicar-
bonate
(HC03)

Car-
bon-
ate

(C03)

Sulfate
(S0«)

Chloride
(CD

Specific
conduct-
ance

(micro-
mhos at
25°C)

pH

Jan. 27, 1964

springs, site No. 271.5.

site No. 272.

Arroyo, site No. 274.

gaging station), site No. 275.

Draw, site No. 275.9.

1100

1200

49

49

37.6

38.9

36.5

163

158

143

0

0

0

735

735

740

4900

4880

4910

7.7

7.7

7.7

QUALITY OF SURFACE WATERS, 1964

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

MALAGA BEND EXPERIMENTAL SALINITY ALLEVIATION PROJECT, EDDY COUNTY, N. MEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date Time
(24 hr)

Tem-
per-
a-

ture (°F)

Discharge
(cfs)

Chlo-
ride
(CD

Specific
conduct-
ance

(micro-
mhos at
25°C)

Den-

sity
g/ml

at 20°C

Site No. 337.2. Pecos Rive well U.S.G.S. 11 Continued

Apr. 10.. ....

July 17.....................

1510

1355

1325

0255

1130

1400
1435

1245

72

73
70

88

87

91

82

89

78

80

87

92
89
87

83

73

18

12

1 9

5.8

5.8

1.80

4.8
6.2

3980

4350

4890

6880
6880

14400

15700
16300

2140C

2260C

22600

_

_

Site No. 338. Pecos River NEjNEl sec.20 T.24 S., R.29 E., at lower wading station

Jan. 3, 1964................

Mar. 6......................

Mar . 27 ....

_
_

_

_

_

1115

_

_

_
_

_

_

_

_

58

_

_

_

_

_

_

4200

_

_

_
_
_

13800

15000

568 QUALITY OF SURFACE WATERS, 1964

RIO GRANDE BASIN Continued

PECOS RIVER SEEPAGE INVESTIGATION Continued

MALAGA BEND EXPERIMENTAL SALINITY ALLEVIATION PROJECT, EDDY COUNTY, N. MEX. Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date Time
(24 hr)

Tem-
per-
a-

ture (°F)

Discharge
(cfs)

Chlo-
ride
(Cl)

Specific
conduct-
ance

(micr->-
mhos at
25°C)

Den-

sity
B/ml

at 20°C

Site No. 338.2. Pecos River, at Pierce Canyon Crossing (regular gage) Continued

Sept. 25........... ....

1220

1255

1340
1145
1155

86

84

82
80
73

6.3

5.3

4.0
9.6
17

8790

10600
1620
4430

28000

27900

32600
6680
15400

Site No. 340. Pecos River sec. 6, T.25 S. , R.29 E. , above Reed's pump

Mar 27

1400

1255

_

_

1340

1200

1335

1145

_

1320

48

42

53

82

_
_

_

81

3100

3260

_

2290

_

_
_

3590

4950

_

_

6270

_

_

6780

_

9230

_

_
_

11100

_

12500

_

_

1320C

_

17100

_

18200

_

21100

_

_

22700

_
_

28700

_
_
_

34000

_

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date
of
collection

Discharge
(eta)

Silica

(Si02)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

Car-
bon-
ate

(CO,)

Sulfate

(SO,)

Chloride

(Cl)

Fluo-
ride

(F)

Ni-

trate

(NO,)

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-

ate

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

PH

NECHES RIVER BASIN Continued

PINE ISLAND BAYOU AT STATE HIGHWAY 105, NEAR SOUR LAKE, TEX.

A500
A200

3.9
7.8

9.2
16

1.7
2.9

28
37

23
38

LITTLE PINE ISLAND BAYOU

Mar. 3............

A50
A5

3.7
9.5

5.2
12

6.0
2.9
3.7

15
7.5
7.2

1.5
3.4

3.1
1.8
1.5

17
60

18
. 20

0.6
14

49
61

AT STATE HIGHWAY 326,

0.2
. 4

28
111

0.2
. 2

1.5
1.0

105
159

0.14
. 22

30
52

1
21

2.2
2.2

223
298

7.0
6.3

NEAR SOUR LAKE, TEX.

0.2
. 2

PINE ISLAND BAYOU AT VOTH, TEX.

64
53
21

2.5
1.7

32
10
22

5.6
. 2
. 4

114
97
35

0.3
. 1
. 3

1.2
1.5

66
208

0.09
. 28

0.0
. 2
1.5

227
169
82

0.31
. 23
. 11

19
44

4
28

1.7
3.9

50
26
24

24
18
6

3.9
4.5
1.9

137
426

445
360
166

6.1
6.0

6.9
5.9
6.3

TRINITY RIVER BASIN

8-430. BRIDGEPORT RESERVOIR ABOVE BRIDGEPORT, TEX.

Jan. 21, 1964..... 4.6 41
38

5.8
5 9

19 142 14
13

25 0.2
2

0.0 180 0.24 126 10 0.7 338 7.5

8-440. BIG SANDY CREEK NEAR BRIDGEPORT, TEX.

Jan. 21, 1964.....
Feb. 3............

May 15............

11.0 5.4 OQ
34
48

19

28

34
3
3

8-445. WEST FORK TRINITY RIVER NEAR BOYD, TEX.

Jan. 21, 1964.....
Feb. 3.. ....
Apr. 23...........

88.0

1520

39 23

3

3

0 25

25

129

108

0 a

3

345

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date
of
collection

Discharge
(cfs)

Silica

(S102)

Iron

(Pe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium
(Na)

Po-
tas-
sium
00

' Bl-

car-

bon-
ate

(HCO,)

Car-
bon-
ate

(CO,)

Sulfate
(80.)

Chloride
(Cl)

Pluo-
ride
(P)

Ni-
trate

(NO,)

Bo-
ron

(B)

Dissolved solids

(calculated)

Parts
per
million

Tons
per
acre-

foot

Tons

per

day

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-
ate

So-
dium
ad-
sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

PH

BRAZOS RIVER BASIN Continued

8-1020. BELTON RESERVOIR NEAR BELTON, TEX.

Nov. 13, 1963.....

Mar. 20, 1964.....

6.4
4.7

227
23.5

7.8
5.7

46
44

50
61

13
12

9.5
26

39
31

160
152

37
33

59
47

Q.4
. 3

0.2
. 2

8-1038. LAMPASAS RIVER NEAR KEMPNER, TEX.

20
148

170
195

16
17

36
285

0.2
. 3

0.8
. 2

280
247

0.38
. 34

204
639

0.30
. 87

168
159

164
259

38
35

24
99

1.3
1.1

511
455

7.3
7.6

0.7
4.0

418
1240

7.2
6.9

8-1089. LITTLE BRAZOS RIVER NEAR BRYAN, TEX.

Feb. 24, 1964..... 9.06 6.1
12

10

430 153

. 0 402 .55

182

161
148

38

0

1.9

3.0
1.4
3.8

488

7.2

8.4
6.8

WESTERN GULF OF MEXICO BASINS

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Continued

Chloride, in parts per million, and specific conductance, micromhos at 25°C,
water year October 1963 to September 1964

Date of coll ection DischE rge (cfs estinnated) Chloride (ppm) Specific

(micromhc

conductance
;s at 25"C)

BRAZOS RIVER BASIN Continued

BIG CREEK AT COUNTY ROAD, 9 MILES NORTHEAST OF GUY, TEX.

Feb 5

Mar 3

Mar 4
Mar 17

6.6

8,850

63

152

144

162
113

1,240

457

922

855

916

700

BIG CREEK AT FARM ROAD 762, NEAR GUY, TEX.

Mar 4
5.5 178

793

713

BIG CREEK AT FARM ROAD 1994, NEAR GUY, TEX.

Feb. 26. ....
Mar 2
Mar. 3. ....

July 24. ....

Sept. 17. ....

440

175

330

33

16

QUALITY OF SURFACE WATERS, 1964

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Con

Chloride, in parts per million, and specific conductance, micromhos at
water year October 1963 to September 1964

Date of collection Discharge (cfs estinmted) Chic>ride (ppm) Sp

(m

ecific co
icromhos

nductance
at 25°C)

BRAZOS RIVEB BASIN Continued

COW CREEK AT KITTY NASH BOAD, 8 MILES NORTHEAST OF DAMON, TFX.

Jan 14 1964

Mar 17

.7

2 2

418

VARNER GREEK 2 MILES NORTH OF WEST COLUMBIA, TEX. ABOUT 3 MILES ABOVE MOUTH.

22

17

136

VARNER CREEK AT STATE HIGHWAY 35, AT EAST COLUMBIA, TEX.

Sept. 17. ....

_

1.5
66

298

462
910

325

3.040

WEST COLUMBIA OIL FIELD WASTE DISCHARGE DITCH, ABOUT 2 MILES NORTH OF WEST COLUMBIA, TEX.

22

33

7,780

532

*

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Continued

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date
of
collection

Discharge
(els)

Silica
(S102)

Iron

(Fe)

Cal-
cium

(Ca)

Mag-
ne-

sium

(Mg)

Sodium

(Na)

Po-
tas-
sium

(K)

Bi-
car-

bon-
ate

(HCO,)

Car-
bon-
ate

(COJ

Sullate

(S0t)

Chloride

(Cl)

Fluo-
ride
(F)

Ni-
trate

(NO,)

Bo-
ron

(B)

Dissolved solids
(calculated)

Parts
per
million

Tons
per
acre-

loot

Tons
per

day

Hardness
as CaCO,

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-
ate

So-
dium
ad-
sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at
25°C)

pH

COLORADO RIVER BASIN Continued

8-1293. SPRING CREEK ABOVE TANKERSLY, TEX.

Sept. 22, 1964....
Sept. 23.........;

385
7.98

8.3
8.4

44
33

3.5 i:$

3.8 4.3
4.2

«7
114

9.0

11

5.6 0.2 ' .3 1.5
. 0
. 0

152
126

0.21
. 17
. 17

124
96
92

4
2
7

0.1
. 2
. 2

265
220
212

7.1
6.9
6.8

8-1340. NORTH CONCHO RIVER NEAR CARLSBAD, TEX.

2.18

115
3220

13.0

24
32
16

4.2

7.1

143

132

2.8 .8

. 0

145 .20

. 27

128
148

166
92

95

0
31

5
0

10

. 0

. 1
. 2

. 3

262
342

338

224

7.5
6.8

6.8
7.9

8.0

8-1365. CONCHO RIVER NEAR PAINT ROCK, TEX.

6.34 2.8

13 298

581

218

2.5

2.6

2020

1120

6.9

6.4

8-1370. MUKEWATER CREEK SUBWATERSHED NO. 9, NEAR TRICKHAM, TEX.

13.1
3.8

96 2
0

0.2
.5

?17
165

7 9
6.7

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Contin

Chemical analyses, in parts per million, water year October 1963 to September 1964 Continued

Date
of
collection

Discharge
(cfs)

Silica

(Si02)

Iron

(Fe)

Cal-

cium

(Ca)

Mag-
ne-

sium

(MB)

Sodium

(Na)

Po-
tas-

sium

(K)

Bi-
car-

bon-

ate

(HCO,)

Car-
bon-

ate

(CO,)

Sulfate

(SO.)

Chloride

(CD

Fluo-
ride

(F)

Ni-
trate

(NO,)

Bo-

ron

(B)

Dissolved solids

(calculated)

Parts

per
million

Tons

per
acre-

foot

Tons

per

day

Hardness

as CaCOj

Cal-

cium,
Mag-
ne-

sium

Non-
car-

bon-

ate

So-

dium
ad-

sorp-
tion
ratio

Specific
con-

duct-

ance

(micro-
mhos at

25°C)

pH

RIO GRANDE BASIN Continued

DRAIN DITCH 1.9 MILES SOUTH OF SANTA ROSA, N. MEX. (WEST OF PECOS RIVER)

179
168
147
174

0
0
0
0

330
178
180
262

3570
3060
3130
3240

7.4
7.6
7.6
7.3

HAGERMAN CANAL AT DEXTER, N. MEX.

Jan. 16, 1964.....

July 8............

Sept. 17..........

252
238
228
223

194
210
223
235
238

0
0
0
0

0
0
0
0
0

1500
1970
1420
1840

1700
1800
1920
2170
2250

6160
7750
6160
7580

7080
7390
7810
8660
8790

7.5
7.0
7.1
7.5

8.0
7.4
7.2
7.2
7.4

8-4005. LAKE McMILLAN AT McMILLAN DAM, NEAR LAKEWOOD, N. MEX.

Dec. 6............

Mar . 25 ....

7.9 512 173 798

78
102
118
104
106

0
0
0
0
0

1960

348
665
1040
1310
1560

0.9 4910 6.68 2240 2160 7.3

3410
4590
5840
6650
7590

. 1
. 0
. 5
. 4
. 5

MISCELLANEOUS ANALYSES OF STREAMS IN WESTERN GULF OF MEXICO BASINS Continued

Periodic determinations of suspended-sediment discharge and particle size, water year October 1963 to September 1964 (Methods of analysis: B, bottom withdrawal tube; C, chemically dispersed; D, decantation; N, in native water; p, plpet; S, sieve; V, visual accumulation tube; W, in displled water)

Date of collection

Time

(24 hour)

Water
tem-

per-
ature

(°F)

Sam-

pling
point

Discharge
(cfs)

Sediment

concen-

tration

(ppm)

discharge

Suspended sediment

Percent finer than size indicated, in millimeters

0.002 0.004 0.008 0.016 0.031J 0.062 0.125 0.250 0.35(J 0.500 1.000

Method
of

analysis

TRINITY RIVER BASIN

8-620. EAST FORK TRINITY RIVER NEAR CRANDALL, TEX.

Sept. 22. ....

0900
1540

458
1100

6400
3100

7900
9200

77
73

83
86

96
91

98
94

99
97

100
100

SPWC
SPWC

BRAZOS RIVER BASIN

8-1005. LEON RIVER AT GATESVILLE, TEX.

Sept. 23.. ....

1700
0640

3650
5920

1600
2700

16000
43000

52 70
63

81
83

88
83

94
96

99
98

100
99 100

SBWC
SPWC

COLORADO RIVER BASIN

8-1435. PECAN BAYOU AT BROWNWQOD, TEX.

Sept. 22.. ....

1500
1000

1030
36

350
2800

970
270 79 82 85 86 100

8-1515. LLANO RIVER AT LLANO, TEX.

Sept. 28. ....

1245
1700

618
498

250
210

420
280

80 84 93 97 98 100

SPWC

SBWC

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4

100

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