

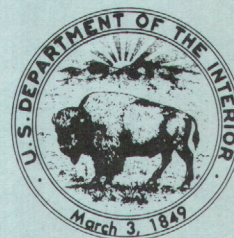
U. S. GEOLOGICAL SURVEY
LIBRARY COPY

WATER TYPE AND SUITABILITY OF OKLAHOMA SURFACE WATERS FOR PUBLIC SUPPLY AND IRRIGATION

PART 4: RED RIVER MAINSTEM AND NORTH FORK RED RIVER BASIN THROUGH 1979

U.S. GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS 82-9

Prepared in cooperation with the
OKLAHOMA WATER RESOURCES BOARD



REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. Recipient's Accession No.
4. Title and Subtitle WATER TYPE AND SUITABILITY OF OKLAHOMA SURFACE WATERS FOR PUBLIC SUPPLY AND IRRIGATION, PART 4: RED RIVER MAINSTEM AND NORTH FORK RED RIVER BASIN THROUGH 1979			5. Report Date May 1981 (issuing date)
7. Author(s) Jerry D. Stoner			6.
9. Performing Organization Name and Address U.S. Geological Survey, Water Resources Division Room 621, Old Post Office Building 215 Dean A. McGee Avenue Oklahoma City, Oklahoma 73102			8. Performing Organization Rept. No. USGS/WRI 82-9
			10. Project/Task/Work Unit No. 05000
			11. Contract(C) or Grant(G) No. (C) (G) N/A
12. Sponsoring Organization Name and Address U.S. Geological Survey, Water Resources Division Room 621, Old Post Office Building 215 Dean A. McGee Avenue Oklahoma City, Oklahoma 73102			13. Type of Report & Period Covered Final through Sept. 1979
15. Supplementary Notes Prepared in cooperation with the Oklahoma Water Resources Board			14.
16. Abstract (Limit: 200 words) Water-quality data for the Red River mainstem and North Fork Red River through 1979 are examined for water type and suitability for public water supply and for irrigation use. The classification of water type is based on the relation of the major ions -- calcium, magnesium, sodium, carbonate/bicarbonate, sulfate, and chloride -- to each other within the range of measured specific conductance. The evaluation of suitability for use as a public supply is based on the concentration levels and distribution of selected constituents. The Wilcox irrigation classification scheme is used to relate sodium concentrations and the salinity distribution to the use of the water for irrigation. The possibility of phytotoxic boron effects is discussed where data are available.			
17. Document Analysis a. Descriptors Water chemistry, public supply, irrigation, surface water(s) b. Identifiers/Open-Ended Terms Suitability for use, trace elements, water hardness, water utilization c. COSATI Field/Group			
18. Availability Statement No restriction on distribution		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 235
		20. Security Class (This Page) UNCLASSIFIED	22. Price

**WATER TYPE AND SUITABILITY OF
OKLAHOMA SURFACE WATERS FOR
PUBLIC SUPPLY AND IRRIGATION**

**PART 4: RED RIVER MAINSTEM AND
NORTH FORK RED RIVER BASIN
THROUGH 1979**

By Jerry D. Stoner

**U. S. GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS 82-9**

**Prepared in cooperation with the
OKLAHOMA WATER RESOURCES BOARD**



UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

James H. Irwin, District Chief
U.S. Geological Survey
Water Resources Division
Rm. 621, Old Post Office Bldg.
215 Dean A. McGee Avenue
Oklahoma City, Ok 73102
Telephone: 405-231-4256

CONTENTS

	Page
Abstract-----	1
Introduction-----	2
Acknowledgments-----	2
Station selection-----	2
Station order-----	3
Data presentation-----	6
Explanation of station summary-----	7
Location-----	7
Drainage area-----	7
Period of record-----	7
Water type-----	7
Cation and anion ratio plots-----	8
Trend-----	8
Public water supply-----	10
Hardness-----	10
Constituents with recommended maximum concentrations-----	11
Constituents with maximum contaminant levels-----	12
Irrigation-----	13
Salinity and sodium hazard classifications-----	13
Irrigation diagram-----	14
Boron-----	16
Univariate statistics-----	17
Frequency distribution-----	19
Station numbering system-----	19
References-----	20
Station summaries-----	21
Red River mainstem-----	22
Beaver Creek near Waurika, Okla.-----	22
Blue River at Connerville, Okla.-----	26
Blue River at Milburn, Okla.-----	30
Blue River near Blue, Okla.-----	34
Blue Beaver Creek near Cache, Okla.-----	38
Caney Boggy Creek near Ashland, Okla.-----	42
Chickasaw Creek near Stringtown, Okla.-----	46
Clear Boggy Creek near Tupelo, Okla.-----	50
Clear Boggy Creek near Caney, Okla.-----	54
Coal Creek near Lehigh, Okla.-----	58
Cow Creek at Waurika, Okla.-----	62
Deep Red Run near Randlett, Okla.-----	66
East Cache Creek near Walters, Okla.-----	70
Glover Creek near Glover, Okla.-----	74
Kiamichi River near Big Cedar, Okla.-----	78
Kiamichi River near Antlers, Okla.-----	82

CONTENTS

	Page
Red River mainstem--Continued	
Kiamichi River near Belzoni, Okla.-----	86
Kiamichi River near Sawyer, Okla.-----	90
Lebos Creek near Eldorado, Okla.-----	94
Little River below Lukfata Creek, near Idabel, Okla.-----	98
Little River near Horatio, Ark.-----	102
Little Beaver Creek near Duncan, Okla.-----	106
McGee Creek near Farris, Okla.-----	110
Mountain Fork near Eagletown, Okla.-----	114
Mountain Fork below Eagletown, Okla.-----	118
Mud Creek near Grady, Okla.-----	122
Mud Creek near Courtney, Okla.-----	126
Muddy Boggy Creek at Atoka, Okla.-----	130
Muddy Boggy Creek near Farris, Okla.-----	134
Red River near Gainesville, Tex.-----	138
Red River at Denison Dam, near Denison, Tex.-----	142
Red River at Arthur City, Tex.-----	146
Red River near New Boston, Okla.-----	150
Red River at Index, Ark.-----	154
Salt Fork Red River near Wellington, Tex.-----	158
Salt Fork Red River near Vinson, Okla.-----	162
Salt Fork Red River at Mangum, Okla.-----	166
Salt Fork Red River near Elmer, Okla.-----	170
Simon Creek near Oswalt, Okla.-----	174
Turkey Creek at Olustee, Okla.-----	178
Walnut Bayou near Burneyville, Okla.-----	182
West Cache Creek near Cookietown, Okla.-----	186
North Fork Red River basin-----	190
Elk Creek near Hobart, Okla.-----	190
Elm Fork North Fork Red River at Salton Crossing, Okla.-----	194
Elm Fork North Fork Red River near Carl, Okla.-----	198
Elm Fork North Fork Red River near Mangum, Okla.-----	202
Fish Creek near Vinson, Okla.-----	206
North Fork Red River near Erick, Okla.-----	210
North Fork Red River near Carter, Okla.-----	214
North Fork Red River below Lake Altus Dam, near Lugert, Okla.-----	218
North Fork Red River near Headrick, Okla.-----	222
Otter Creek near Snyder, Okla.-----	226
Otter Creek near Tipton, Okla.-----	230

ILLUSTRATIONS

	Page
Figure 1. Station location map-----	4
2. Cation-ratio plot for Arkansas River at Tulsa, Okla.-----	9
3. Anion-ratio plot for Arkansas River at Tulsa, Okla.-----	9
4. Irrigation diagram for Bird Creek near Barnsdall, Okla.-----	15
5. Diagram illustrating skewness and the normal distribution-----	18
6. Diagram illustrating kurtosis and the normal distribution-----	18

TABLES

	Page
Table 1. Boron tolerance of certain plants-----	16
2. Ninety-five percent probability limits for skewness and kurtosis for selected sample sizes-----	19
3. List of stations in downstream order-----	234

CONVERSION FACTORS

Inch-pound units used in this report may be converted to International System of Metric Units (SI) by the following conversion factors:

<u>MULTIPLY INCH-POUND UNIT</u>	<u>BY</u>	<u>TO OBTAIN SI UNIT</u>
Foot (ft)	0.3048	Meter
Mile (mi)	1.609	Kilometer
Square mile (mi ²)	2.590	Square kilometer
Degree Fahrenheit (°F)	(°F-32) 5/9	Degree Celsius (°C)
Micromho per centimeter (umho/cm)	1.000	Microsiemen per centimeter

WATER TYPE AND SUITABILITY OF OKLAHOMA SURFACE WATERS
FOR PUBLIC SUPPLY AND IRRIGATION

PART 4: RED RIVER MAINSTEM AND NORTH FORK RED RIVER BASIN THROUGH 1979

By Jerry D. Stoner

ABSTRACT

Water-quality data for the Red River mainstem and the North Fork Red River basin within Oklahoma, through 1979, were examined for water type and suitability for public water supply and irrigation use. Of 96 stations with available data, 53 stations or 55 percent were considered to have sufficient data for analysis. The classification of water type was based on the relation of the major ions: calcium, magnesium, sodium, carbonate, bicarbonate, sulfate, and chloride to each other within the range of measured specific conductance. The suitability of the water for use as a public supply was based on the concentration distribution of selected constituents. The constituents selected were those with maximum contaminant levels established by regulation, or constituents for which recommended maximum limits have been established and for which historic data are available. The irrigation-classification method of Wilcox was used to relate sodium, calcium, and magnesium concentrations and the salinity distribution to the use of the water for irrigation. If data are available, the chance of phytotoxic effects by boron is discussed.

INTRODUCTION

Surface-water-quality data for Oklahoma have been collected and published on a regular basis for the past 30 years. These data represent 2,733 station-years of record from 527 stations through 1975 (Stoner, 1977). These data consist of tabulations of water-quality analyses of varying suites of constituents, but the data are not readily usable to water planners and managers. The purpose of this report is to summarize the data at selected stations to provide information on water type, water-quality trends, and suitability for use as public and irrigation supplies. A water-quality report on selected Oklahoma surface waters that is of a more general statistical nature recently has been published (Kurklin, 1979). A statistical summary of streamflow records is provided in a report by Mize (1975), therefore, streamflow data were not included in this report.

ACKNOWLEDGMENTS

Water-quality data in Oklahoma have been collected and published on a cooperative basis with many Federal, State, county, district, and city agencies during the past 30 years. Two of the principal cooperators are the Oklahoma Water Resources Board and the U.S. Army Corps of Engineers. The author thanks all of the agencies, past and present, for their part in the collection of surface-water-quality data in Oklahoma.

STATION SELECTION

The stations included in this report were selected using two criteria. First, stations listed in the report by Stoner (1977) were eliminated if less than 10 samples had been collected and if the stations had not been operated during 1976-79. Statistical analysis of data from less than 10 samples generally is inadequate to determine frequencies and variations during the annual hydrologic cycle. Second, only data in the U.S. Geological Survey's WATSTORE (National Water Data Storage and Retrieval System) were used. WATSTORE was accessed for each station to determine data availability. A deletion of stations was made from WATSTORE information using the same criterion of less than 10 samples. Very few of the selected stations had 10 analyses for each of the selected water-quality constituents. Most of the stations lacked data on the toxic metals -- arsenic, cadmium, chromium, lead, and mercury.

STATION ORDER

In order to reduce the physical size of the report and to make it more useable on a regional and hydrologic basis to water planners and managers, the report has been divided into five parts. The river basins included within each part are as follows:

- Part 1: Arkansas River Mainstem and Verdigris, Neosho, and Illinois River basins (Stoner, 1981).
- Part 2: Salt Fork Arkansas and Cimarron River basins (Stoner, 1981).
- Part 3: Canadian, North Canadian, and Deep Fork River basin (Stoner, 1981).
- Part 4: Red River Mainstem and North Fork Red River basin.
- Part 5: Washita River basin.

Within each part the stations are grouped by river basin. All rivers and streams within Oklahoma are tributary to either the Arkansas River or the Red River. Mainstem stations are those stations on the Arkansas or Red River or are on streams whose basins are directly tributary to the Arkansas or Red River and are too small to be listed as a separate basin. The stations are arranged in alphabetical order within each basin or mainstem designation. Where more than one station on a stream is reported, those stations are arranged in downstream order.

The location of each station is shown in figure 1, and the stations are identified by their station numbers. All of the assigned station numbers in Oklahoma begin with the digits 07. These two digits are omitted from the station numbers shown in figure 1. For example, station number 07332350 is shown in figure 1 as 332350. A listing of the stations by number that provides cross-indexing of stations shown in figure 1 with their station summaries is provided in table 3, which follows the station summaries.

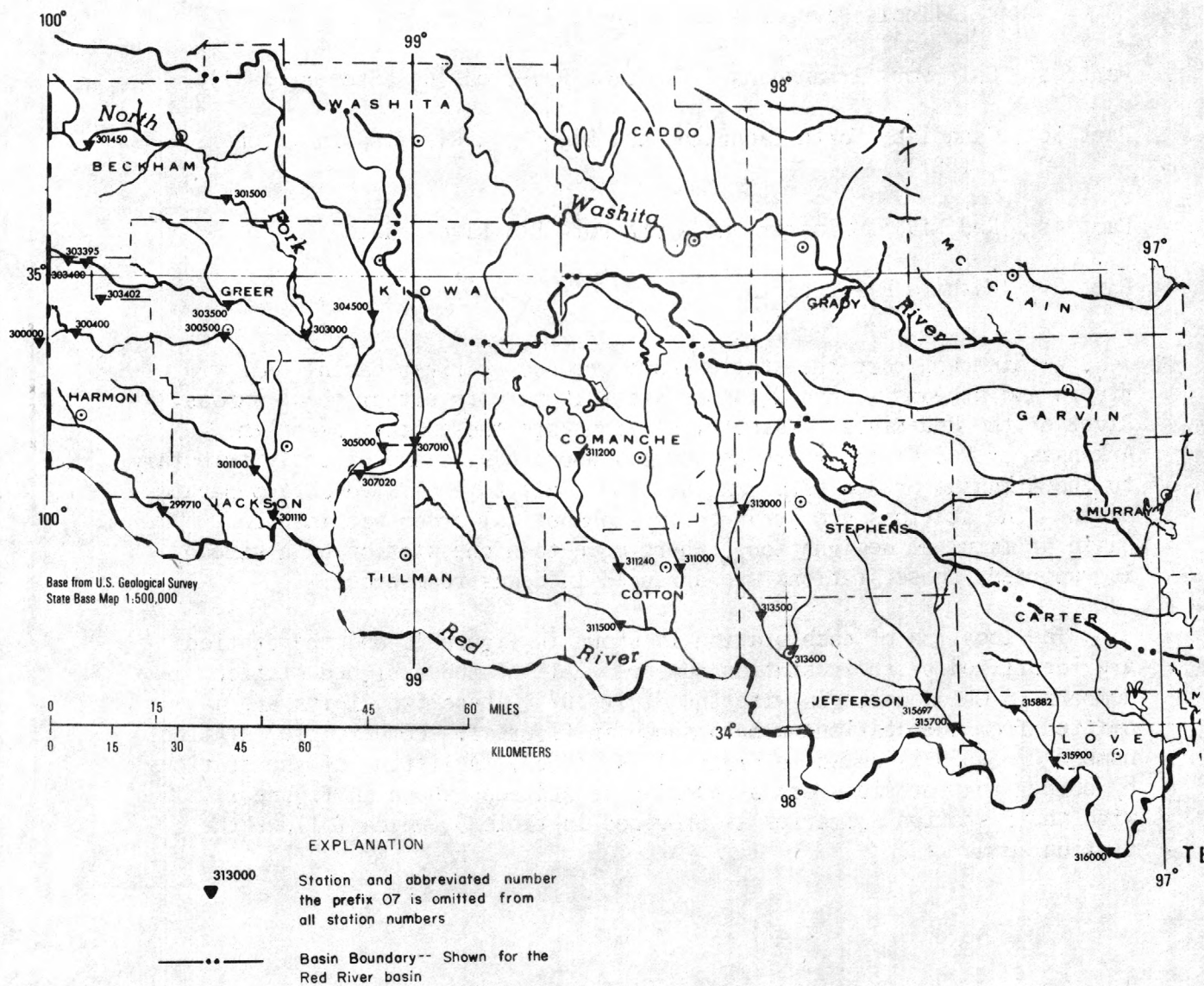
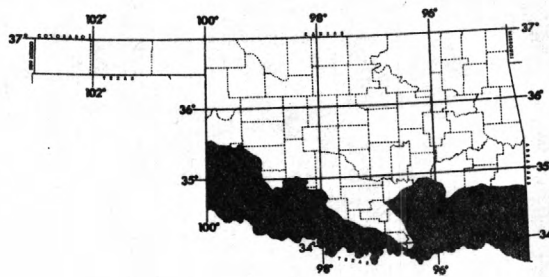
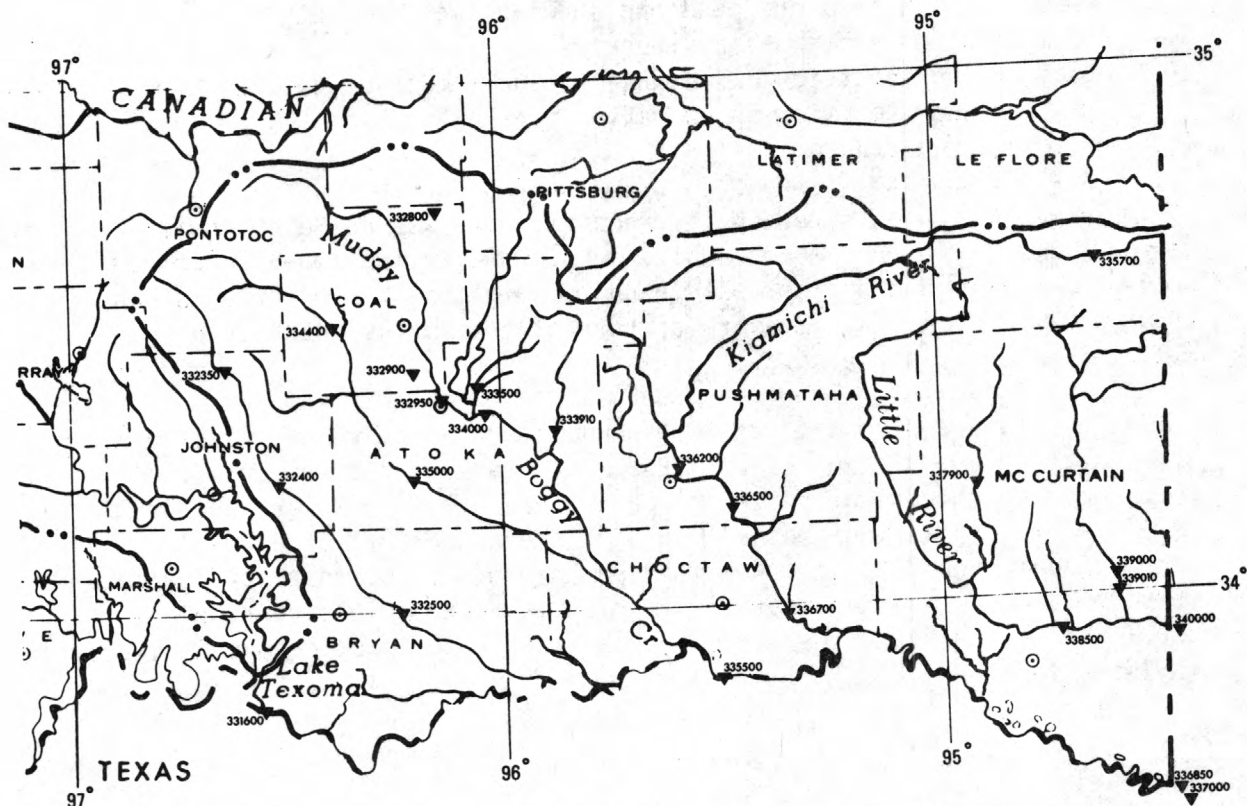


Figure 1.-Station location map



DATA PRESENTATION

Each station summary is in the following format:

1. Station location.
2. Drainage area.
3. Period of water-quality record.
4. Pertinent remarks if any.
5. A discussion of water types.
6. Trend analysis where sufficient current data are available.
7. A discussion of water quality related to use as a public water supply.
8. A discussion of water quality related to use for irrigation.
9. Two tables; one providing the univariate statistics for the selected constituents, and one showing the frequency distribution for the constituents.
10. Plots of the specific conductance versus the major-cation ratios and the major-anion ratios.
11. An irrigation diagram.

The selection of water-quality constituents was based on their significance to water use for public supply and irrigation. Dissolved solids as determined by the residue on evaporation at 180° Celsius was included because it is a measure of the total amount of dissolved material present in the water.

The data are discussed in the summaries on a per value basis rather than a percentage of time basis. For some stations the percentage of values can be thought of as the percentage of time. However, when the period of record is less than 3 years or the number of values is less than 40, care needs to be taken in assuming this relationship. The data were analyzed using the Statistical Analysis System, 1976 version^{1/} developed by Barr and others (1976), and the system's supplemental library (Helwig, 1977).

^{1/} The use of brand names in this report is for identification only and does not imply endorsement by the U.S. Geological Survey.

EXPLANATION OF STATION SUMMARY

Location

The location for each station is given in at least three ways: (1) by latitude (lat) and longitude (long); (2) by the township, range, and section; and (3) by distance and direction from local geographic features such as bridges, tributary streams, and towns. The location also is described, where information is available, by river mile, the distance the station is upstream from the mouth of the stream.

Drainage Area

The drainage area of a stream at a specific location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the river upstream from the specified point. Drainage-area values given include all closed basins and noncontributing areas within the area, unless otherwise noted.

Period of Record

The period of record in this report is the period of water-quality record by water year; that is, the 12-month period ending September 30. The water year is designated by the calendar year in which it ends and includes 9 of the 12 months. The period of record for the water-quality data used in this report includes all available WATSTORE data through the 1978 water year. A water year was included in the period of record when at least one sample was available for that water year.

Water Type

Water can be typed according to the percentage of each of the major ions in solution. For example, if the calcium and sulfate ions are predominant, the water would be described as calcium sulfate type. In this report a cation or anion was considered to be a predominant ion if it constituted at least 50 percent of its respective cation or anion group. The major cations, calcium, magnesium, sodium, and potassium, which are electropositive, and the major anions, carbonate, bicarbonate, chloride, and sulfate, which are electro-negative, generally constitute more than 95 percent of the total ions in solution.

Ordinarily the concentration of the potassium ion is very small in relation to the sodium-ion concentration. Potassium is grouped with the sodium because of its small concentration and because it is chemically similar to sodium; and the ions are referred to as sodium rather than sodium plus potassium.

The relation between the carbonate and bicarbonate ions is pH dependent. Both carbonate and bicarbonate ions are considered to be present in solution when the pH is greater than 8.3, and when the pH is equal to or less than 8.3 only the bicarbonate ion is considered present. Because the relation between pH and specific conductance at each station was not determined, the carbonate and bicarbonate ions are referred to as carbonate/bicarbonate.

The concentration and relationship of the major ions in solution will, to a large extent, be determined by the geology of the terrane through which the water flowed and how the constituents in the water reacted to mixing with other waters.

Cation and Anion Ratio Plots

The cation-ratio plot presents the ratio of each major cation, expressed in milliequivalents per liter, to the sum of the major cations, in milliequivalents per liter, plotted versus the specific conductance. The anion-ratio plot was prepared in the same manner using the major anions. Each ion-ratio plot requires complete data for all major cations or all major anions. In many instances, an analysis with complete anion data will not have complete cation data. Some confusion in the comparison of the ion-ratio plots can result from the different data requirements for the cation and anion plots. However, to provide as complete a water-quality summary as possible, all data that met the various plotting requirements were included. These plots were constructed to determine whether the ionic distributions changed with changes in the total concentration of dissolved materials. Example plots of the cation and anion ratios are shown in figures 2 and 3.

Trend

Trend analyses were made to determine whether the concentration of a constituent was increasing (positive trend) or decreasing (negative trend) with time. Only data collected after October 1, 1960, were used in the trend analyses. This was done because of the format in which SAS stores the dates and because it was believed that 19 years was a sufficient time span to adequately determine the presence of trend. Trend analysis was made only for those stations that had current data (data from 1977, 1978, or 1979 water years) because trend analyses based on historical data could be misleading. Trend analysis is significant because it indicates what is occurring in the present, and what possible effects may occur in the future.

Plots, not included in this report, of dissolved solids, hardness, sulfate, and chloride concentrations versus time were generated where current data were available. The plots were examined to determine if there were data for a minimum time span, 5 years, to make a statistical test for trend and to see

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=ARKANSAS RIVER AT TULSA, OK

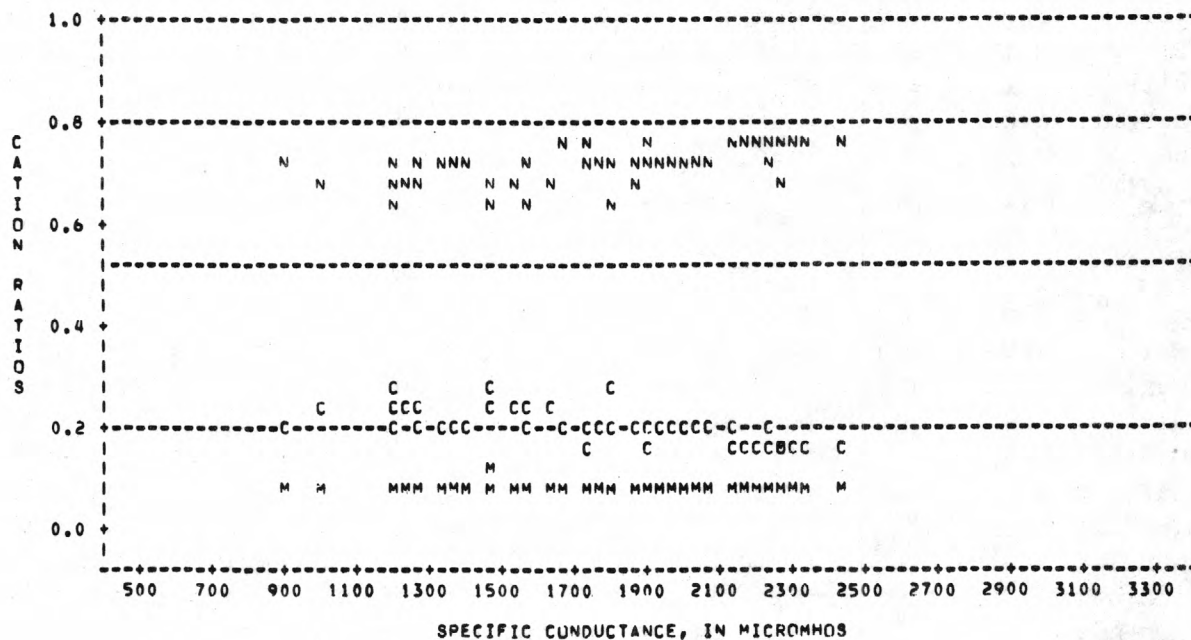


Figure 2.- Cation ratio plot for Arkansas River at Tulsa, Oklahoma.

ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=ARKANSAS RIVER AT TULSA, OK

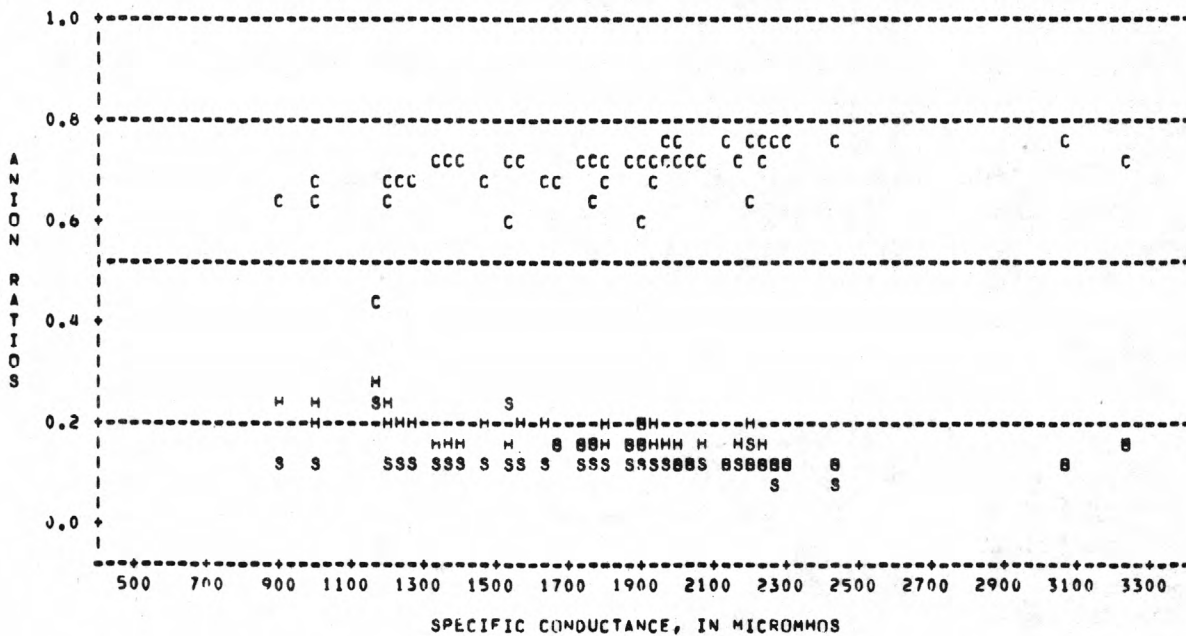


Figure 3.- Anion ratio plot for Arkansas River at Tulsa, Oklahoma.

if there were any indication of trend. The test chosen for trend analysis was a Spearman's rho technique and is fully described by Conover (1971). The test is two sided and indicates whether a trend, if any, is positive or negative. The test was made for the four constituents at the 95-percent probability level. The technique does not indicate the cause of a trend, only that a trend is or is not occurring. A trend may be the result of an extended period of drought or a period of much precipitation.

Public Water Supply

This section includes a discussion of water hardness, constituents for which maximum concentrations have been recommended, and constituents for which maximum contaminant levels have been established by regulation. Where adequate data were available, an evaluation was made as to the suitability for use as a public supply. Suitability for use as a public supply is based on available water-quality criteria and is an evaluation of the fitness of the water for its intended use. Water evaluated as unsuitable because a water-quality constituent(s) exceeds established criteria may or may not be acceptable for use by the population to be supplied. The acceptability of water for public supply depends a great deal on the availability, or more importantly, the non-availability of a more suitable supply source. In many parts of the United States, particularly in the arid West, the public water supply is accepted by the majority of the population served even though the concentrations of such constituents as sulfate and chloride commonly exceed the recommended limits, simply because a more suitable source is not available. Because the acceptability of a water supply depends on many factors other than the water quality, no evaluation of acceptability was made. All evaluations of the suitability for use were based on the water as a raw untreated source and do not reflect any evaluation of suitability after treatment. However, these evaluations need to be used with caution because, for many stations, the data were more than 10 years old and need to be updated to determine the existing water quality. Furthermore, important data were missing for many stations, particularly the toxic metals. The suitability evaluations were provided to show whether the existing data indicated a constituent concentration which might preclude the use of the water for public supply.

Hardness

Hardness was included because, in relation to public water supply, it is one of the most noticeable water-quality characteristics. No maximum hardness concentration has been recommended because hardness is not generally considered a human health hazard. As hardness increases, the efficiency of soaps and detergents decreases. When the concentration of hardness is large, deposition or scaling occurs, thereby reducing the efficiency of hot water tanks and

restricting the flow of water in plumbing systems. Additional information on hardness is given by Durfor and Becker (1964), and Hem (1970). The concentration of hardness is expressed in milligrams per liter as calcium carbonate. The hardness classification used in this report and given in the following table is that used by Durfor and Becker (1964, p. 27).

Hardness range (milligrams per liter as calcium carbonate)	Description
0 to 60	Soft
61 to 120	Moderately hard
121 to 180	Hard
Greater than 180	Very hard

Constituents with recommended maximum concentrations

Maximum concentrations for several water-quality constituents that have not had maximum contaminant levels set by regulation have been recommended by the National Academy of Sciences and National Academy of Engineering (1973). These constituents generally are not toxic to humans at their recommended limits. Particular constituents affect such qualities as color, taste, and odor; some may cause staining of clothes and plumbing fixtures; and others produce laxative effects in humans. The selected water-quality constituents in this group are chloride, sulfate, pH, and iron. Other components such as color, odor, oil and grease, silver, and zinc, were excluded because of the lack of analytical data. Following is a brief summary of reasons for selecting each constituent:

Chloride.--Affects taste. Normal water-treatment processes do not remove chloride.

Sulfate.--Affects taste and produces laxative effects. Normal water-treatment processes do not remove sulfate.

pH.--Contributes to the corrosion of plumbing and water distribution systems. The cost of treatment for waters with pH in excess of the recommended limits may be uneconomical.

Iron.--Causes staining of plumbing fixtures and clothing, accumulation of deposits in water distribution systems, and objectional taste.

Data in the following table were taken from the National Academy of Sciences and National Academy of Engineering (1973) report.

Constituent	Recommended concentration limit(s)
Chloride	250 milligrams per liter
Sulfate	250 milligrams per liter
pH	5.0 and 9.0 units
Iron	300 micrograms per liter

Constituents with maximum contaminant levels

The U.S. Environmental Protection Agency through the Safe Drinking Water Act (Public Law 93-523) announced regulations for maximum contaminant levels in public water supplies for certain constituents (U.S. Environmental Protection Agency, 1976). The constituents, fluoride, arsenic, cadmium, chromium, lead, and mercury are included in this report; however, barium, selenium, and silver were not selected because of the almost total lack of historic data. Nitrate-nitrogen was not selected because changes in analytical methods and onsite preservation techniques have produced data that probably are not comparable.

The maximum contaminant level for fluoride is based on the annual average maximum daily air temperature at the water source and is tabulated below. The maximum contaminant levels for fluoride given in the following table are from the U.S. Environmental Protection Agency (1976).

Temperature (Degrees Farenheit)	Maximum contaminant level (milligrams per liter)
53.7 and below	2.4
53.8 to 58.3	2.2
58.4 to 63.8	2.0
63.9 to 70.6	1.8
70.7 to 79.2	1.6
79.3 to 90.5	1.4

Although the amount of data available at most stations was limited, the toxic metals were included because of their significance to human health. The following table lists the maximum contaminant levels established by regulation for the toxic metals, U.S. Environmental Protection Agency (1976).

Constituent	Maximum contaminant level (micrograms per liter)
Arsenic	50
Cadmium	10
Chromium	50
Lead	50
Mercury	2.0

Irrigation

The irrigation section of each station summary is based primarily on the irrigation waters classification system developed by Wilcox (1955). This system describes the utility of waters for irrigation based on their respective salinity and sodium hazards. Where boron data were available an evaluation was made on the possible phytotoxic effects of this trace element, based in the information contained in the National Academy of Sciences and National Academy of Engineering report (1973).

Salinity and sodium hazard classifications

The Wilcox classification system depicts a salinity hazard based on the specific conductance, and a sodium hazard based on the SAR (sodium adsorption ratio). The SAR is based on the ratio of sodium to calcium and magnesium and expresses the relative activity of sodium ion in exchange reactions with soil. Complete discussions of the SAR and the method for its computation are provided in Hem (1970) and Wilcox (1955).

The following descriptions of the effects of the different salinity and sodium hazard classes are taken directly from Wilcox (1955).

"Low-salinity water (C1) can be used for irrigation with most crops on most soils, with little likelihood that a salinity problem will develop. Some leaching is required, but this occurs under normal irrigation practices except in soils of extremely low permeability.

Medium-salinity water (C2) can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most instances with special practices for salinity control.

High-salinity water (C3) cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very high salinity water (C4) is not suitable for irrigation under ordinary conditions but may be used occasionally under very special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and very salt-tolerant crops should be selected."

"Low sodium water (S1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops, such as stone-fruit trees and avocados, may accumulate injurious concentrations of sodium.

Medium-sodium water (S2) will present an appreciable sodium hazard in fine textured soils of high cation-exchange capacity, especially under low-leaching conditions, unless gypsum is present in the soil. This water may be used on coarse textured or organic soils that have good permeability.

High-sodium water (S3) may produce harmful levels of exchangeable sodium in most soils and will require special soil management--good drainage, high leaching, and additions of organic matter. Gypsiferous soils may not develop harmful levels of exchangeable sodium from such waters.

Very high sodium water (S4) is generally unsatisfactory for irrigation purposes except at low and perhaps medium salinity where the solution of calcium from the soil or the use of gypsum or other amendments may make the use of this water feasible."

Additional information on the effect of salinity and sodium on water use for irrigation is given by Wilcox (1955) and the National Academy of Sciences and National Academy of Engineering (1973).

Irrigation diagram

An irrigation diagram is included for each station where sufficient data are available. On the diagram the SAR of a sample is plotted against its specific conductance and the appropriate salinity and sodium hazards are determined (example, fig. 4). In the irrigation diagram the salinity hazard is along the horizontal axis and ranges from C1 to C4. All specific conductance values given in this report are in micromhos per centimeter at 25° Celsius and are hereafter abbreviated as umho. The specific-conductance ranges for the salinity hazard classes are: less than 250 umho, low salinity hazard; 250 to 750 umho, medium salinity hazard; 751 to 2,250 umho, high salinity hazard; and greater than 2,250 umho, very high salinity hazard. The sodium hazard is along the vertical axis and the class breakpoints S1 through S4 vary with the specific conductance and are delineated by the sloping lines.

IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=BIRD CREEK NR BARNSDALL, OK

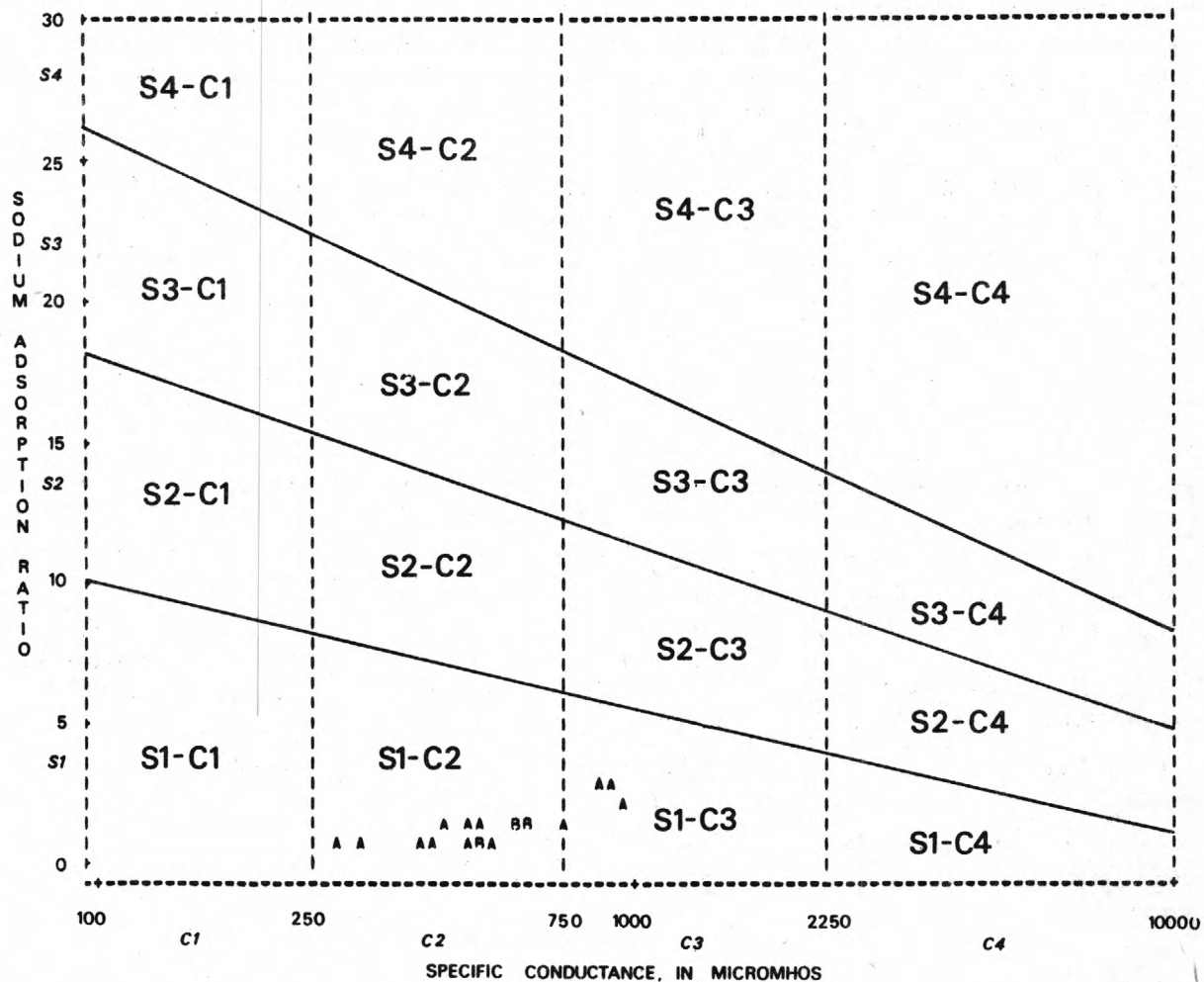


Figure 4.- Irrigation diagram for Bird Creek near Barnsdall, Oklahoma.

Boron

Boron has long been recognized as a phytotoxic trace element. The recommended maximum boron concentrations for use on all soils from the National Academy of Sciences and National Academy of Engineering (1973) report are: boron sensitive plants, 750 ug/L (micrograms per liter); boron semitolerant plants, 1,000 ug/L; and boron tolerant plants, 2,000 ug/L. The relative boron tolerances of certain plants are shown in table 1. This table was taken directly from the Wilcox (1955) report and lists many plants that are not native to or commercially grown in Oklahoma; however, it is possible that most or all of these plants may be grown in Oklahoma on a non-commercial basis.

Table 1.--Relative boron tolerance of certain plants
[From Wilcox (1955). In each group, the plants first named are considered as more tolerant; the last named, more sensitive]

Tolerant	Semitolerant	Sensitive
Athel (<u>Tamerix aphylla</u>)	Sunflower (native)	Pecan
Asparagus	Potato	Walnut (Black; and Persian or English)
Palm (<u>Phoenix canariensis</u>)	Cotton (Acala and Pima)	Jerusalem artichoke
Date Palm (<u>P. dactylifera</u>)	Tomato	Navy bean
Sugar beet	Sweet pea	American Elm
Mangel	Radish	Plum
Garden beet	Field pea	Pear
Alfalfa	Ragged robin rose	Apple
Gladiolus	Olive	Grape (Sultaninia and Malaga)
Broad bean	Barley	Kadota fig
Onion	Wheat	Persimmon
Turnip	Corn	Cherry
Cabbage	Milo	Peach
Lettuce	Oat	Apricot
Carrot	Zinnia	Thornless blackberry
	Pumpkin	Orange
	Bell pepper	Avocado
	Sweet potato	Grapefruit
	Lima bean	Lemon

Univariate Statistics

The station summaries show the univariate statistics for each constituent. The units of concentration in the summary are those units that have already been described for the constituents. The standard deviation, skewness, and kurtosis were not computed for constituents with less than 10 values. When only one value was available for a constituent, that value is listed in the mean column. In many instances the number of values for one constituent are two to three or more times greater than the number of values for another constituent. Therefore, comparison of statistics, particularly minimums and maximums, between constituents needs to be done with care.

The following are brief descriptions of the headings in the univariate statistics summary for each station.

N.--The number of values available for the period of record for that constituent.

MEAN.--The arithmetic average, except for pH which is the median or middle value.

MIN.--The minimum value recorded.

MAX.--The maximum value recorded.

STD.--The standard deviation of the constituent distribution.

SKEW.--The skewness of the constituent distribution. Skewness is a measure of the asymmetry of the distribution of the data when compared to the symmetrical normal distribution. Detailed information on the theory, use, and computational methods for the skewness and kurtosis (described in the next section) are given by Fisher (1973) and Snedecor (1956). A positive value for the skewness statistic indicates there are more values smaller than the mean than values greater than the mean, and for negative skewness values the converse is true (fig. 5). Although the statistic computed for the skewness cannot be used to determine the shape of the distribution, the skewness statistic can indicate whether the distribution curve is significantly different from a normal distribution. If the sample distribution is significantly different, tests that are based on normality are not applicable. The 95-percent probability range, plus and minus, for skewness for various sample sizes is shown in table 2. As an example: For a sample size of 100, if the skewness statistic greatly exceeded plus or minus 0.47, the distribution is not considered normal at the 95-percent probability level.

KURT.--The kurtosis of the sample distribution. Kurtosis is a measure of the deviation of the sample distribution from the normal distribution. In general, kurtosis measures the relative peakness or flatness of the sample distribution curve with respect to the normal distribution. A positive kurtosis indicates peakness and a negative kurtosis indicates flatness (fig. 6). Values for the 95-percent probability limits for kurtosis for selected sample sizes are given in table 2.

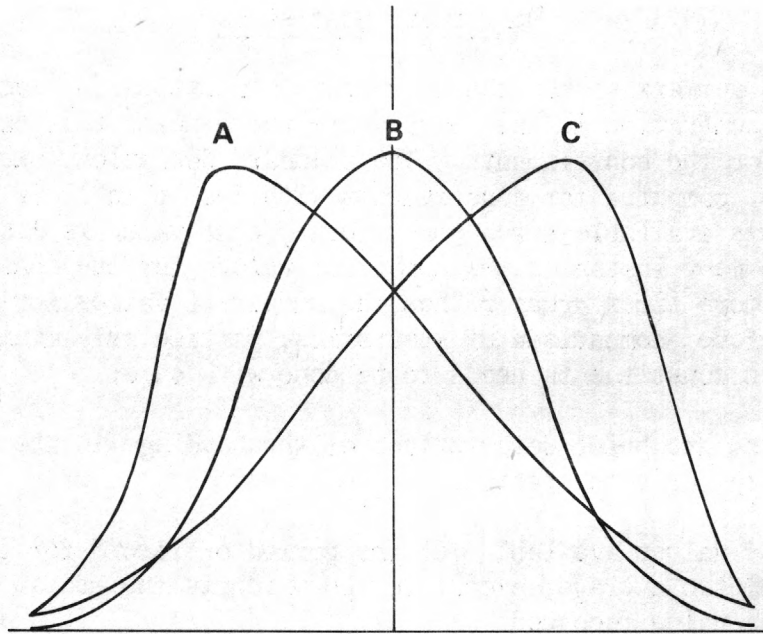


Figure 5 Skewness and the normal distribution. Curve A is positive skewness, curve B is normal distribution, and curve C is negative skewness.

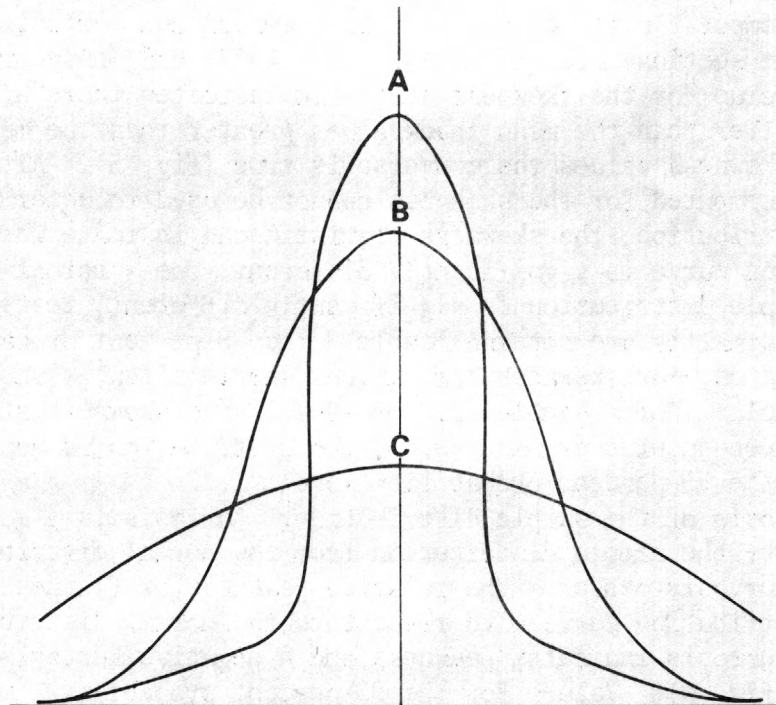


Figure 6 Kurtosis and the normal distribution. Curve A is positive kurtosis, curve B is normal distribution, and curve C is negative kurtosis.

Table 2.--Ninety-five percent probability limits for skewness and kurtosis for selected sample sizes

Sample size	95 percent of probability limits (plus or minus)	
	Skewness	Kurtosis
10	1.35	2.61
25	.91	1.77
50	.66	1.30
75	.54	1.07
100	.47	.94
150	.39	.77
200	.34	.67
300	.28	.55
400	.24	.48
500	.21	.43
600	.20	.39
700	.18	.36

Frequency Distribution

The frequency distribution table shows selected percentile concentrations from the cumulative frequency distributions of constituents for which 10 or more values were available. The concentration units in the table are the same as previously described for the constituents. The percentile concentrations in the table are explained in the following example: The concentration shown in the 25th percentile column is that concentration for which 25 percent of the samples had concentrations less than or equal to the column value.

STATION NUMBERING SYSTEM

Stations numbers are assigned in a downstream sequence so that as one progresses downstream the numbers become larger. Station numbers on a tributary are assigned on a rank-order basis. Station numbers on a first-rank tributary are assigned so that the numbers are larger than any number assigned to an upstream station on the mainstem and are smaller than any station number assigned to a station downstream on the mainstem. The station numbers on the tributary are assigned in the same downstream method as on the mainstem. A first-rank tributary is one that flows directly into the mainstem, a second-rank tributary is one which flows into a first-rank tributary, and so on for the greater ranked tributaries. The numbering system is followed from the mainstem up through the greater ranked tributaries, first rank, second rank, third rank, and so on.

REFERENCES

- Barr, A. J., Goodnight, J. H., Sall, J. P., and Helwig, J. R., 1976, A user's guide to SAS 76: Raleigh, N. C., SAS Institute, Inc., 329 p.
- Conover, W. J., 1971, Practical nonparametric statistics: New York, John Wiley and Sons, p. 245-253.
- Durfor, C. N., and Becker, Edith, 1964, Public water supplies of the 100 largest cities in the United States: U.S. Geological Survey Water-Supply Paper 1812, 364 p.
- Fisher, R. A., 1973, Statistical methods for research workers (14th ed.): New York, Hafner Publishing Co., 187 p.
- Helwig, J. T., ed., 1977, SAS supplemental library user's guide: Raleigh, N. C., SAS Institute, Inc., 171 p.
- Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural waters: U.S. Geological Survey Water-Supply Paper 1473 (2d ed), 363 p.
- Kurklin, J. K., 1979, Statistical summaries of surface-water-quality data for selected sites in Oklahoma through the 1975 water year: U.S. Geological Survey Open-File Report 79-219, 171 p.
- Mize, L. D., 1975, Statistical summaries of streamflow records, Oklahoma, through 1974: U.S. Geological Survey Open-File Report, 399 p.
- National Academy of Sciences and National Academy of Engineering, 1973, Water quality criteria, 1972: U.S. Government Printing Office, stock no. 5501-05520, 594 p.
- Piper, A. M., 1944, A graphic procedure in the geochemical interpretation of water analyses: American Geophysical Union Transactions, v. 25, p. 914-923.
- Snedecor, G. W., 1956, Statistical methods, 5th edition: Ames, Iowa State University Press, 534 p.
- Stoner, Jerry D., 1977, Index of published surface-water-quality data for Oklahoma, 1946-1975: U.S. Geological Survey Open-File Report 77-204, 212 p.
- _____, 1981a, Water type and suitability of Oklahoma surface waters for public supply and irrigation. Part 1: Arkansas River mainstem and Verdigris, Neosho, and Illinois River basins through 1978: U.S. Geological Survey Water-Resources Investigations 81-33, 297 p.

1981b, Water type and suitability of Oklahoma surface waters for public supply and irrigation. Part 2: Salt Fork Arkansas and Cimarron River basins through 1978: U.S. Geological Survey Water-Resources Investigations 81-39, 150 p.

1981c, Water type and suitability of Oklahoma surface waters for public supply and irrigation. Part 3: Canadian, North Canadian, and Deep Fork River basins through 1979: U.S. Geological Survey Water-Resources Investigations 81-80, 210 p.

U.S. Environmental Protection Agency, 1976, National interim primary drinking water regulations: U.S. Environmental Protection Agency EPA-570/9-76-003, 159 p.

Wilcox, L. V., 1955, Classification and use of irrigation waters: U.S. Department of Agriculture Circular 969, 19 p.

STATION SUMMARIES

All constituent values except for pH and specific conductance are for the dissolved phase. Specific conductance and pH are measured on unfiltered samples. The values for the standard deviation, skewness, and kurtosis for pH represent the distribution of the pH values and not the distribution of the hydrogen ion concentrations and were computed from the arithmetic mean of the pH values.

The units of concentration for selected constituents in the following station summaries are as follows:

Milligrams per liter (mg/L) - dissolved solids, total hardness, chloride, sulfate, and fluoride.

Micrograms per liter (ug/L) - iron, arsenic, cadmium, chromium, lead, mercury, and boron.

Micromhos per centimeter at 25° Celsius (umho) - specific conductance.

Standard units - pH.

Unitless - SAR.

RED RIVER MAINSTEM

07313500 - Beaver Creek near Waurika, Okla.

LOCATION.--Lat 34°13'00", long 98°02'57", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T.4 S., R.8 W., Jefferson County, at bridge on State Highway 5, 4.5 mi northwest of Waurika, 6.2 mi upstream from Cow Creek, and at mile 25.8.

DRAINAGE AREA.--563 mi².

PERIOD OF RECORD.--1953 to 1956, 1975 to 1979.

WATER TYPE.--The water type at this location shifts with change in the specific conductance. For specific conductance less than 800 μ mho, 35 percent of the samples, the water was calcium carbonate/bicarbonate type. In the specific conductance range of 800 to 1,300 μ mho, about 40 percent of the samples, the water was generally calcium sulfate type. For specific conductance greater than 1,300 μ mho, the water varied between sodium chloride type and mixed type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time do not clearly indicate the presence of any trends. The Spearman's rhos at the 95-percent probability level for the three constituents indicate no trends. There are no current dissolved-solids data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 370 mg/L, and for 84 percent of the hardness values the concentration was greater than 180 mg/L. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 5 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 26 percent of the sulfate values. No toxic metal data are available. Because of the frequency by which the recommended maximum sulfate concentration was exceeded, the suitability of this water for use as a public supply may be marginal.

IRRIGATION.--The salinity hazard ranged from low to high with 68 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with more than 98 percent of the SAR values equivalent to a low sodium hazard. The data indicate that phytotoxic effects from boron should not occur.

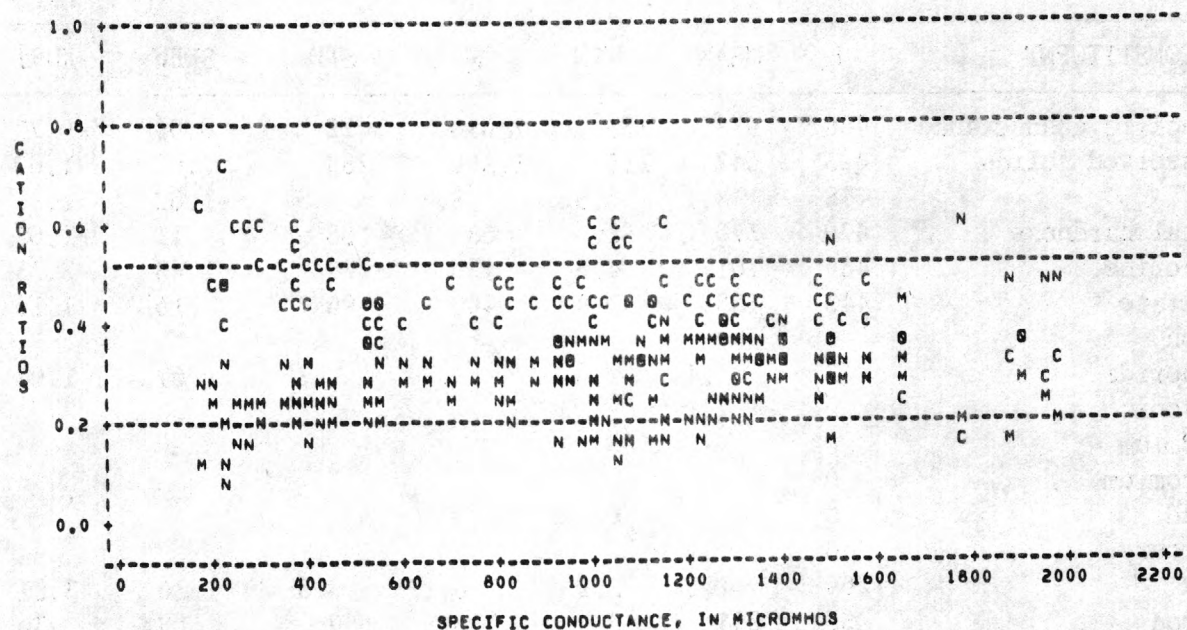
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	488	978	153	2,080	422	0.04	-0.77
Dissolved solids	423	642	115	1,360	288	.02	-1.00
pH	478	8.1	6.5	8.7	.3	-1.02	1.90
Total hardness	479	370	58	680	156	-.11	-1.07
Chloride	486	101	4.5	450	78	1.43	2.73
Sulfate	443	168	7.8	400	96	.16	-1.16
Iron	0						
Fluoride	62	.4	.0	.8	.2	-.61	1.04
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	268	1.5	.2	6.1	.8	1.36	3.81
Boron	55	294	0	730	150	.08	.36

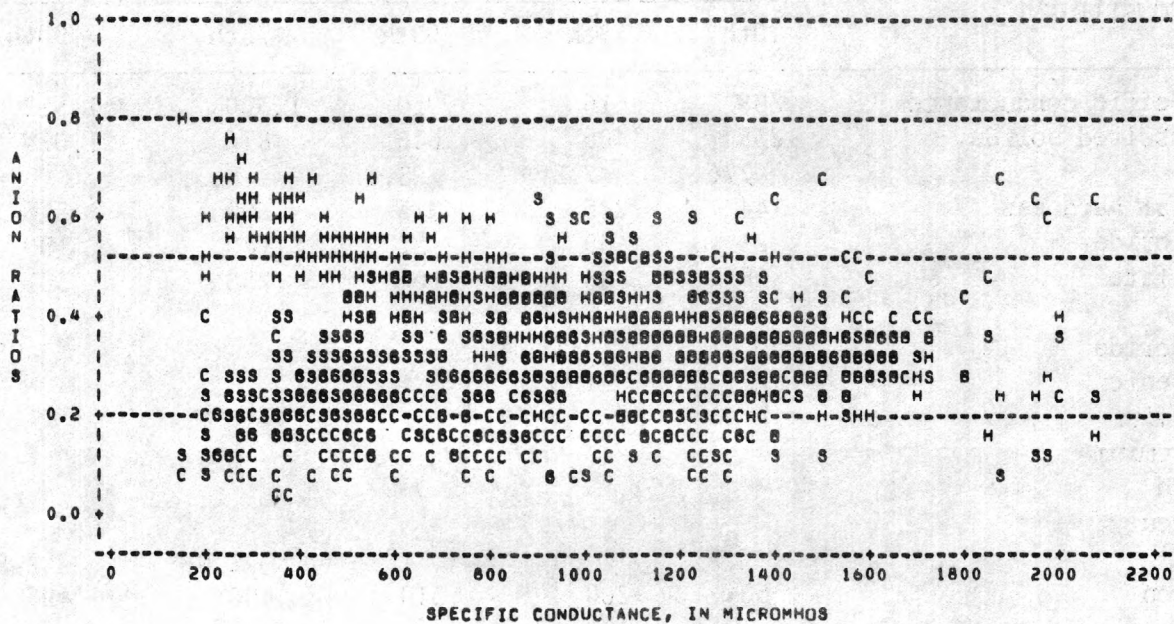
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	388	616	1,010	1,300	1,512
Dissolved solids	238	406	646	872	1,020
pH	7.6	7.8	8.1	8.3	8.4
Total hardness	144	240	375	500	575
Chloride	23	39	82	140	199
Sulfate	40	85	164	255	301
Iron					
Fluoride	.1	.3	.4	.5	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.7	.9	1.4	2.0	2.5
Boron	60	200	310	400	494

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=BEAVER CREEK NR WAURIKA, OK



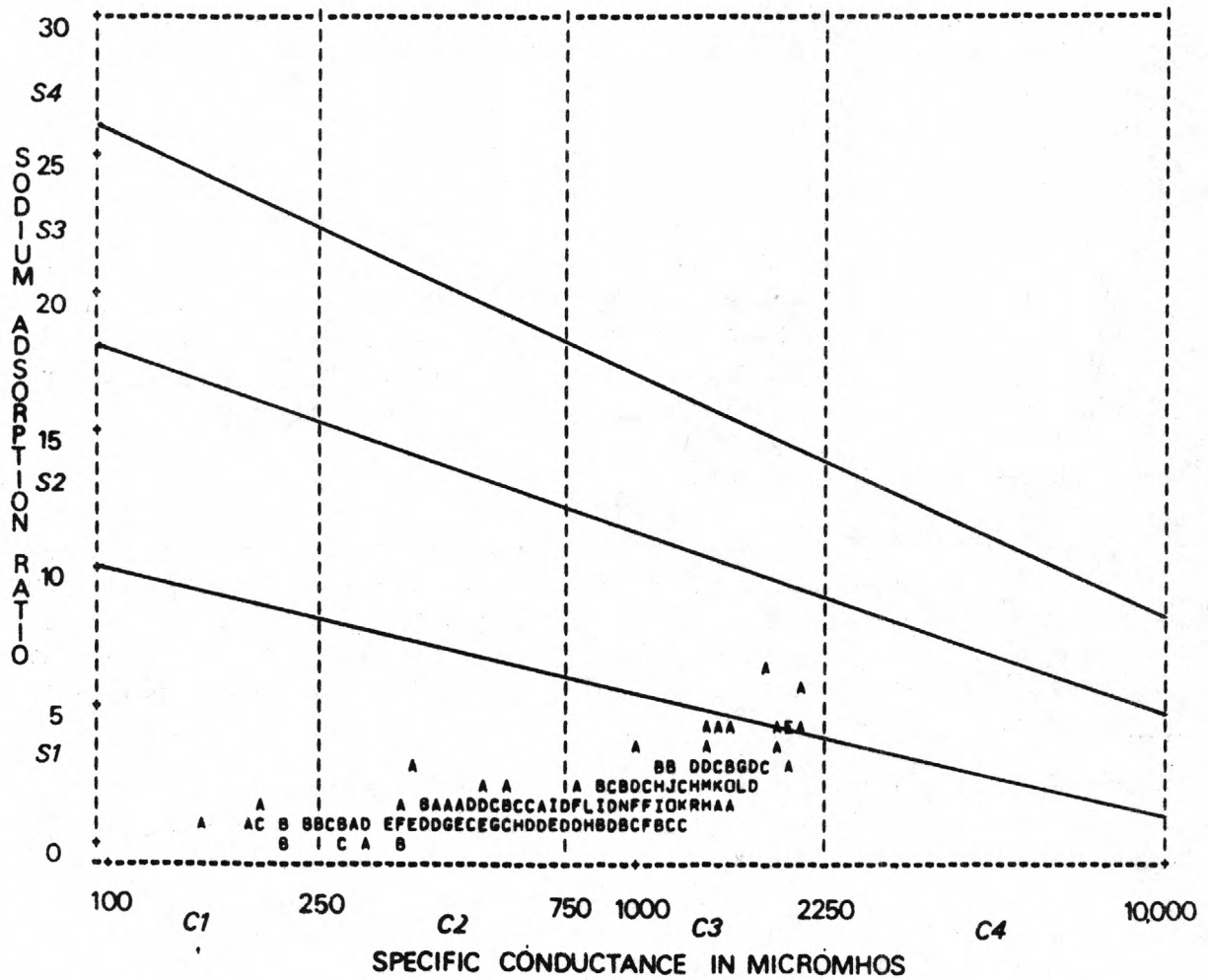
ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=BEAVER CREEK NR WAURIKA, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=BEAVER CREEK NR WAURIKA, OK



RED RIVER MAINSTEM

07332350 - Blue River at Connerville, Okla.

LOCATION.--Lat 34°27'14", long 96°38'08", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 23, T.1 S., R.6 E., Johnston County, at bridge on State Highway 99, 0.5 mi north of Connerville.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1951 to 1957, 1962.

WATER TYPE.--For specific conductance less than 425 umho, about 26 percent of the samples, the water was magnesium carbonate/bicarbonate type. When the specific conductance was greater than 425 umho the water varied between calcium type and magnesium type. No anion distribution data are available for specific conductance greater than 425 umho.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 287 mg/L and for 93 percent of the hardness values the concentration was greater than 180 mg/L. The hardness classification for this water is very hard. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was medium for all samples. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

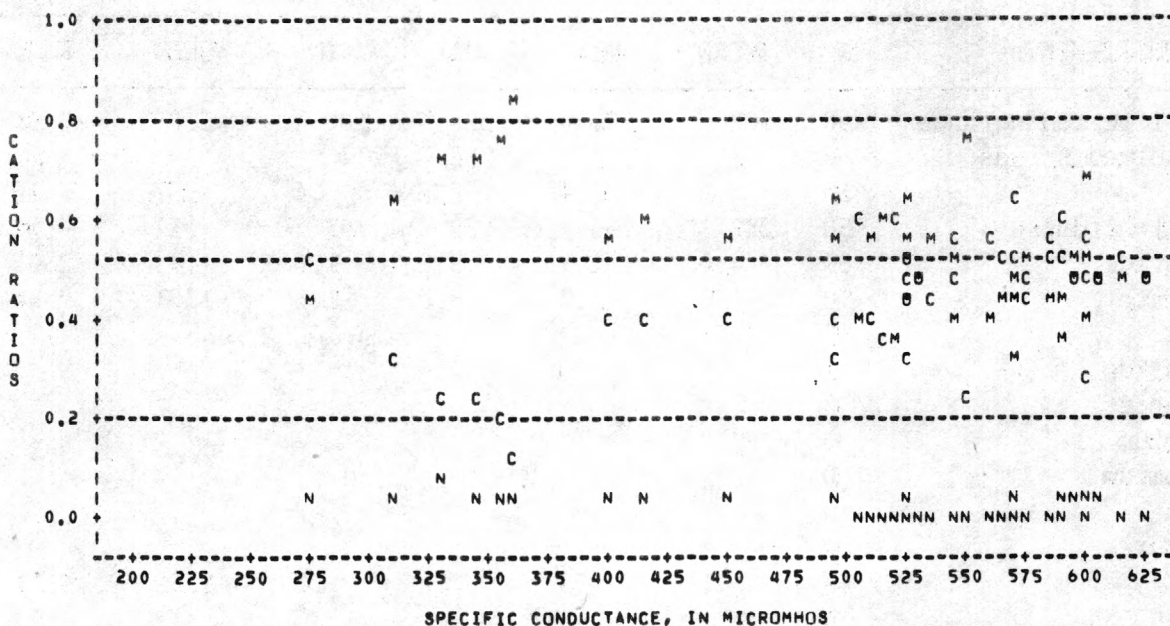
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	50	502	276	624	100	-0.85	-0.59
Dissolved solids	7	191	151	232			
pH	50	8.0	6.9	8.5	.4	-.97	1.30
Total hardness	50	287	153	420	63	-.37	-.66
Chloride	50	4.0	2.1	9.5	1.6	1.42	2.05
Sulfate	10	5.9	2.2	8.0	1.8	-1.01	.84
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	48	.1	.0	.2	.0	1.39	9.71
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	333	416	529	580	601
Dissolved solids					
pH	7.4	7.8	8.0	8.2	8.4
Total hardness	195	234	299	335	355
Chloride	2.4	2.8	3.5	5.0	6.0
Sulfate	2.4	4.6	6.4	7.1	8.0
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.1	.1	.1	.1	.1
Boron					

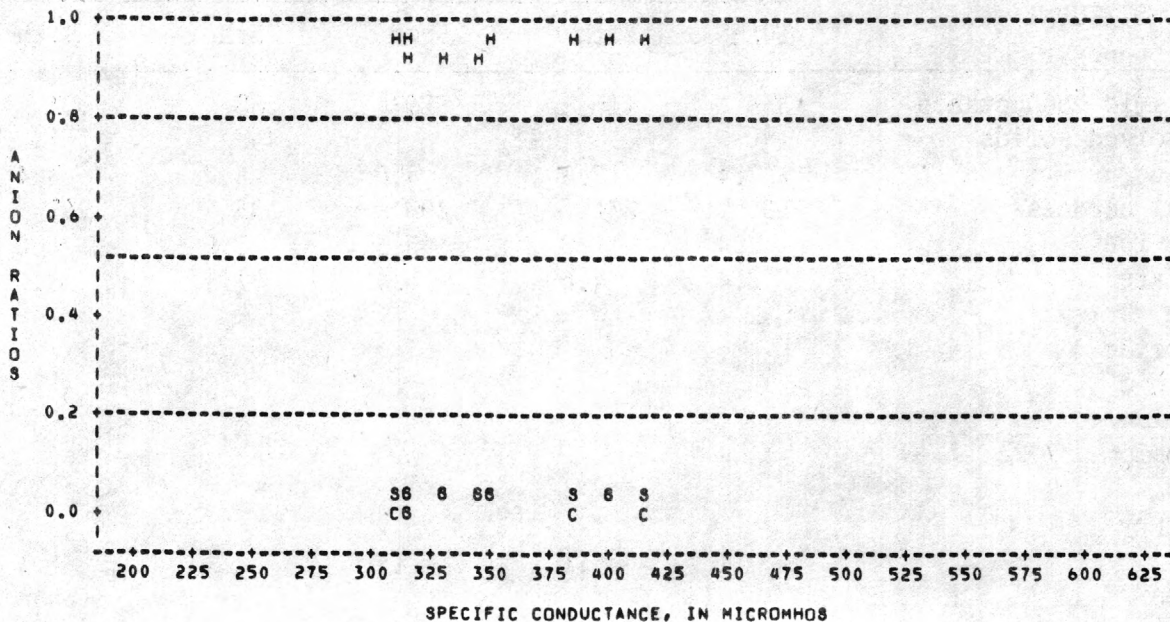
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER AT CONNERVERVILLE, OK



ANION RATIO PLOT

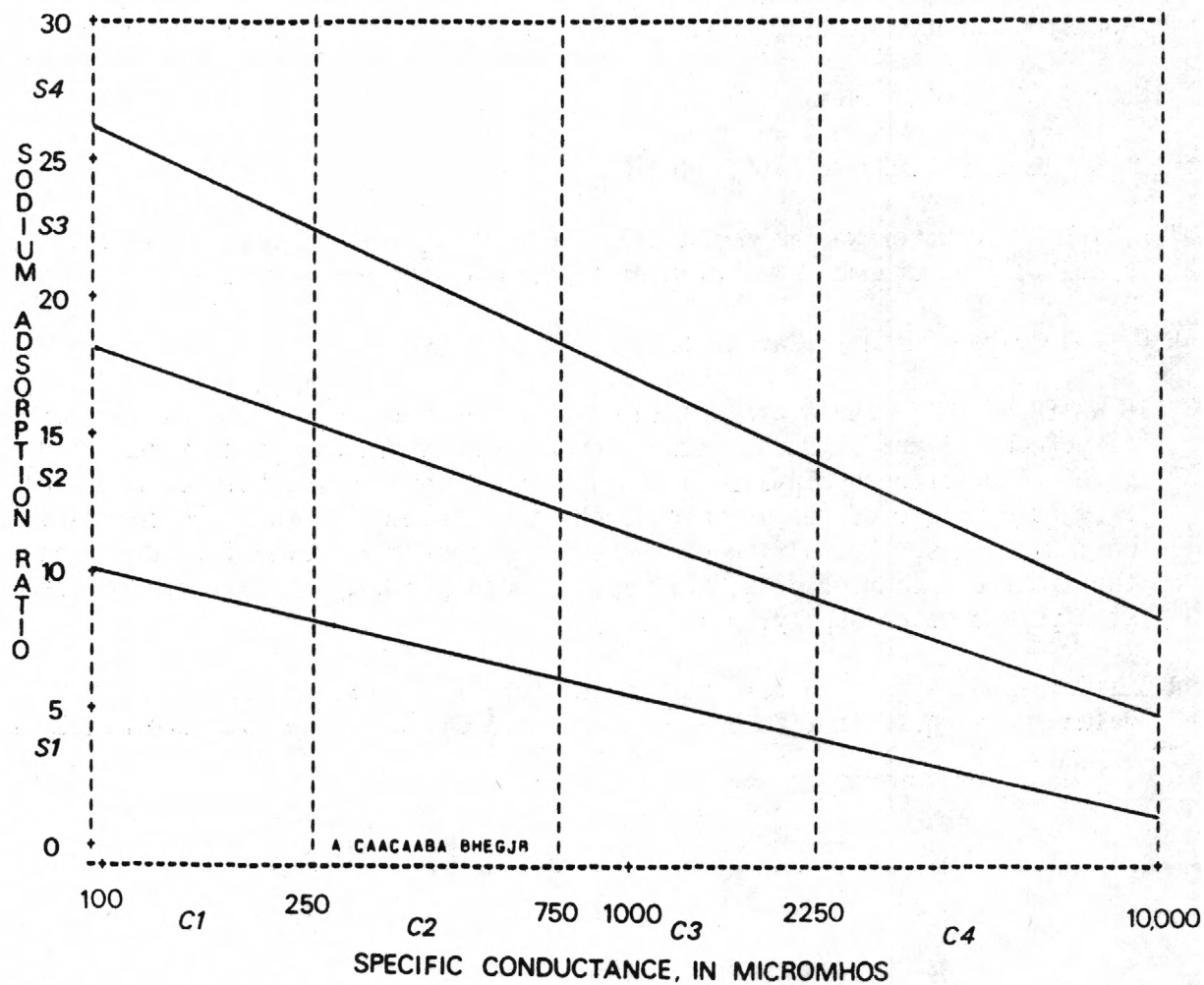
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER AT CONNERVERVILLE, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OSS, B = 2 OSS, C = 3 OSS

STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER AT CONNERVILLE, OK



RED RIVER MAINSTEM

07332400 - Blue River at Milburn, Okla.

LOCATION.--Lat 34°15'04", long 96°33'05", in SW¹/₄SW¹/₄ sec. 35, T.3 S., R.7 E., Johnston County, at bridge on State Highway 48A, 0.5 mi north of Milburn.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1956 to 1960.

WATER TYPE.--The water was magnesium type throughout the range of measured specific conductance. No anion distribution data are available.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 195 mg/L and for 62 percent of the hardness values the concentration was greater than 180 mg/L. The hardness classification for this water varies between hard and very hard. None of the measured constituents exceeded their recommended maximum limits. No sulfate or toxic metal data are available. Based on the limited amount of data, this water would probably be suitable for use as a public water supply.

IRRIGATION.--The salinity hazard was medium for all samples. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

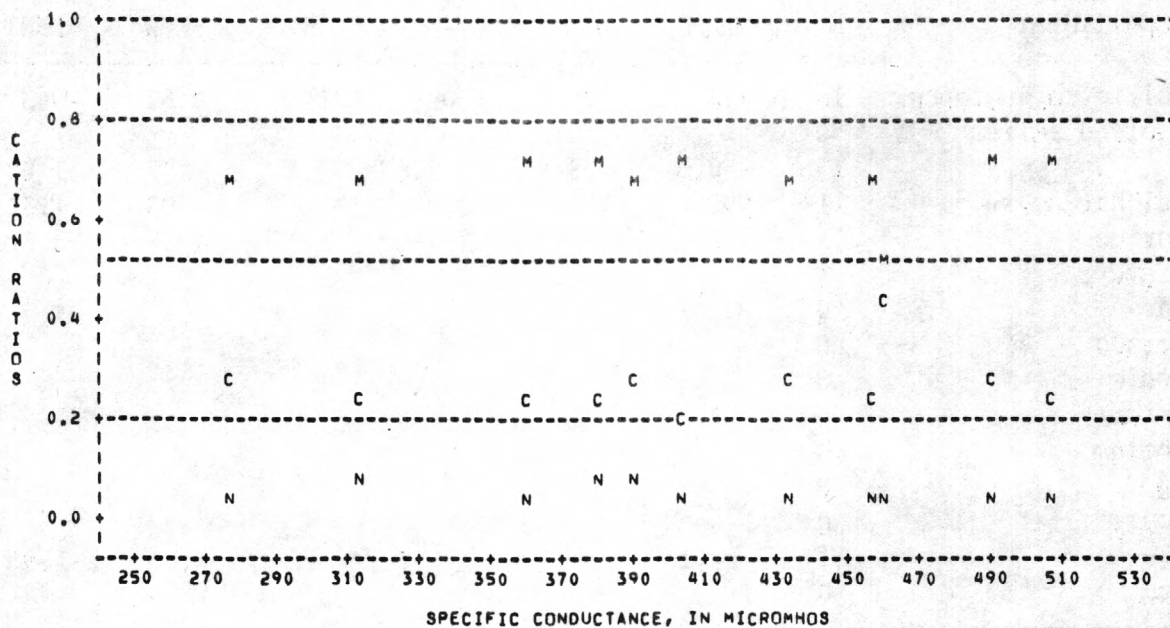
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	13	414	276	506	71	-0.52	-0.37
Dissolved solids	0						
pH	13	8.5	8.0	8.8	.3	-.37	-1.08
Total hardness	11	195	164	280	33	1.93	4.31
Chloride	11	6.1	4.5	9.0	1.2	1.37	3.21
Sulfate	0						
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	11	.1	.1	.2	.1	.66	-1.96
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	291	369	420	475	504
Dissolved solids					
pH	8.0	8.2	8.5	8.7	8.8
Total hardness	165	176	184	216	267
Chloride	4.6	5.2	6.2	6.5	8.5
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.1	.1	.1	.2	.2
Boron					

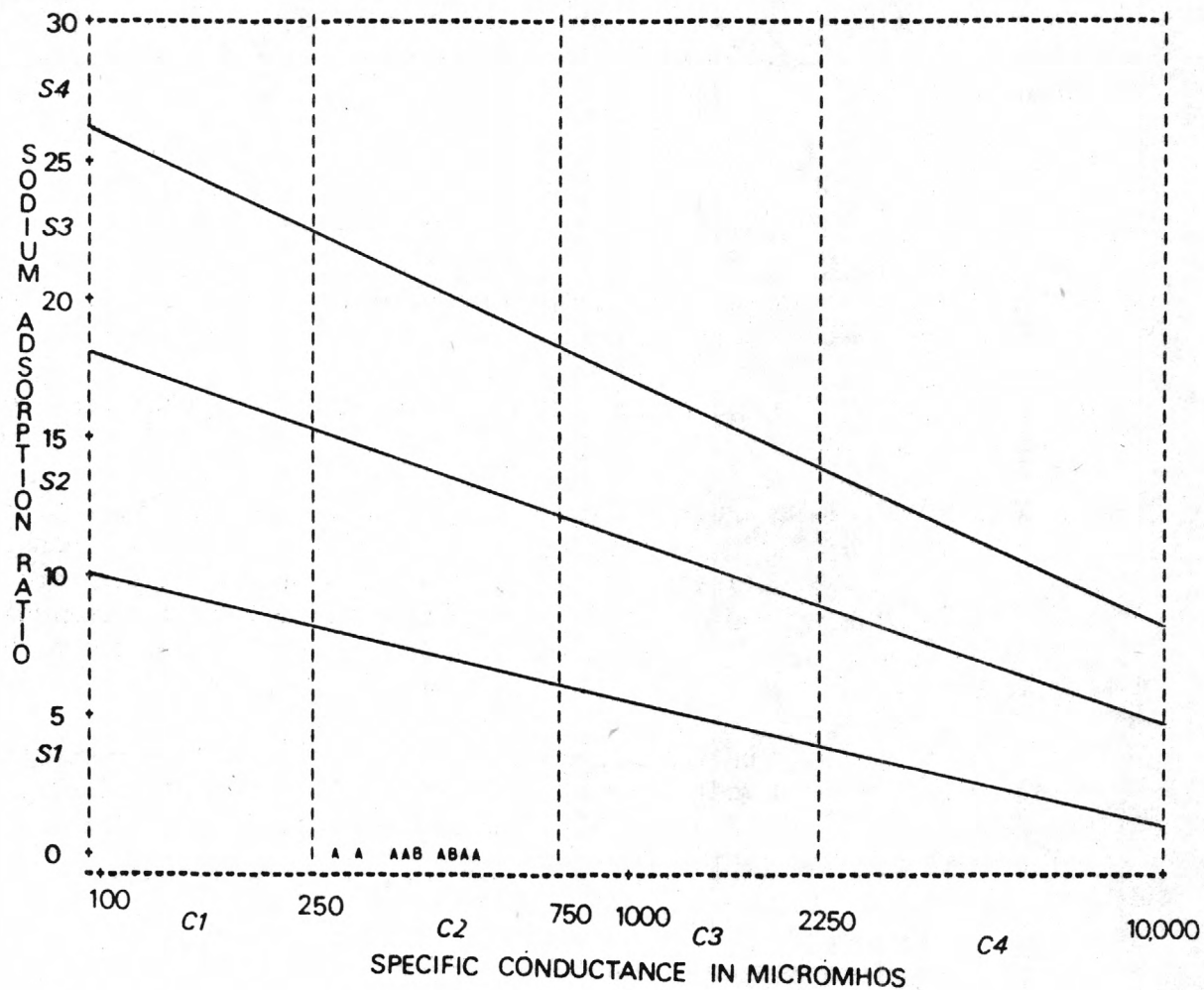
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER AT MILBURN, OK



No anion distribution data are available.

IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER AT MILBURN, OK



RED RIVER MAINSTEM

07332500 - Blue River near Blue, Okla.

LOCATION.--Lat 33°59'49", long 96°14'27", on line between sec. 27 and 34, T.6 S., R.10 E., Bryan County, at bridge on U.S. Highway 70, 1.0 mi west of Blue, 7.0 mi east of Durant, 7.7 mi upstream from Caddo Creek, and at mile 38.8.

DRAINAGE AREA.--476 mi².

PERIOD OF RECORD.--1951 to 1958, 1960 to 1963, 1976 to 1979.

WATER TYPE.--The water was calcium carbonate/bicarbonate type throughout the range of measured specific conductance.

TREND.--The current period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 210 mg/L and for 68 percent of the hardness values the concentration was greater than 180 mg/L. The hardness classification for this water varies between hard and very hard. None of the measured constituents exceeded their recommended maximum limits. There are no toxic metal data available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to medium with 93 percent of the samples having a medium salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that phytotoxic effects from boron should not occur.

UNIVARIATE STATISTICS

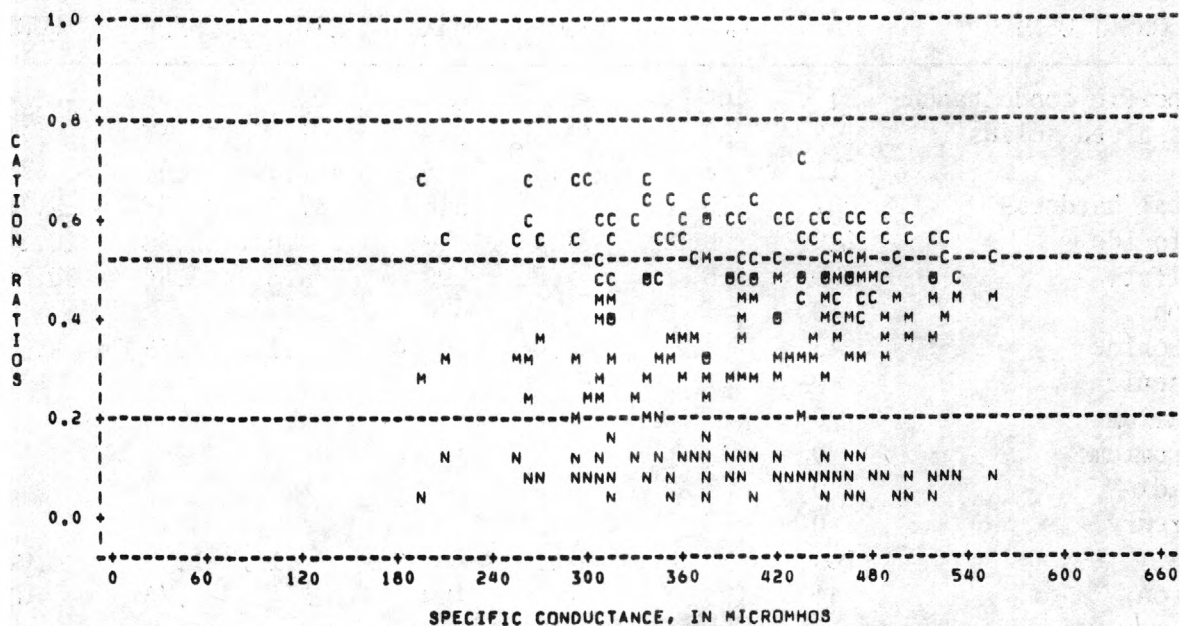
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	217	407	92	650	99	-0.49	-0.04
Dissolved solids	158	239	55	369	55	-.57	.25
pH	211	8.3	7.3	8.9	.3	-.60	.39
Total hardness	202	210	40	346	57	-.52	-.35
Chloride	219	9.0	1.4	39	4.6	2.38	10.56
Sulfate	190	16	4.0	90	8.5	3.86	30.39
Iron	0						
Fluoride	45	.2	.0	.4	.1	.53	-.31
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	168	.3	.1	.8	.1	1.39	4.00
Boron	44	175	0	480	108	.70	.01

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	267	338	430	479	519
Dissolved solids	165	201	244	282	307
pH	7.8	8.1	8.3	8.4	8.6
Total hardness	133	168	221	252	277
Chloride	4.5	6.1	8.1	11	13
Sulfate	7.4	9.8	14	20	24
Iron					
Fluoride	.0	.1	.1	.2	.3
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.2	.3	.3	.4
Boron	55	90	145	275	320

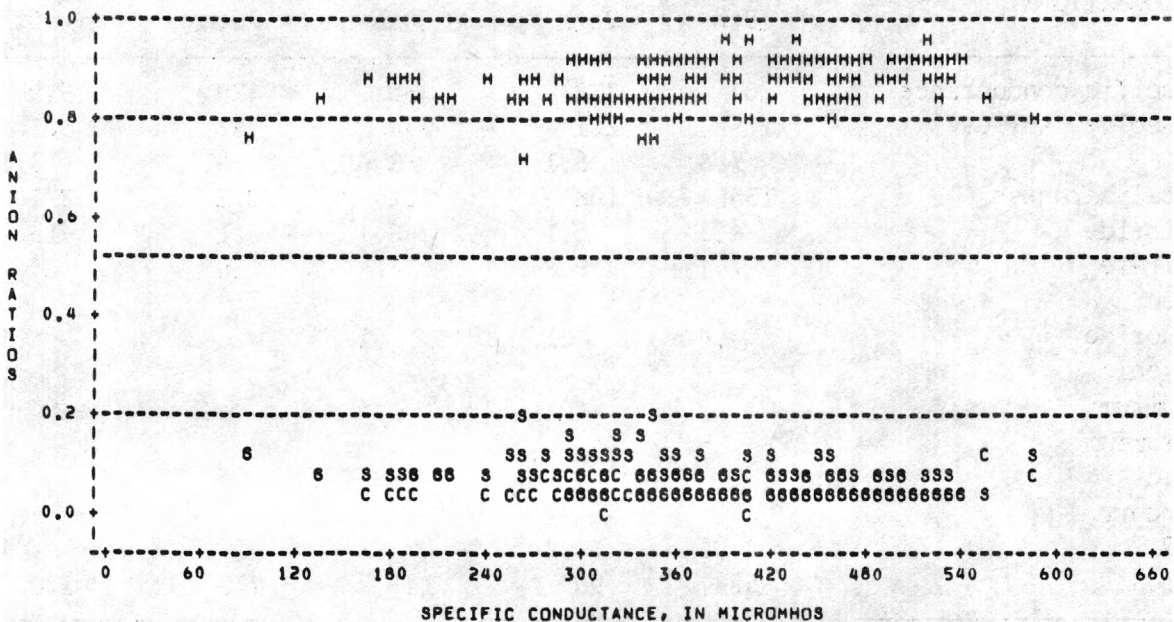
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER NEAR BLUE, OK

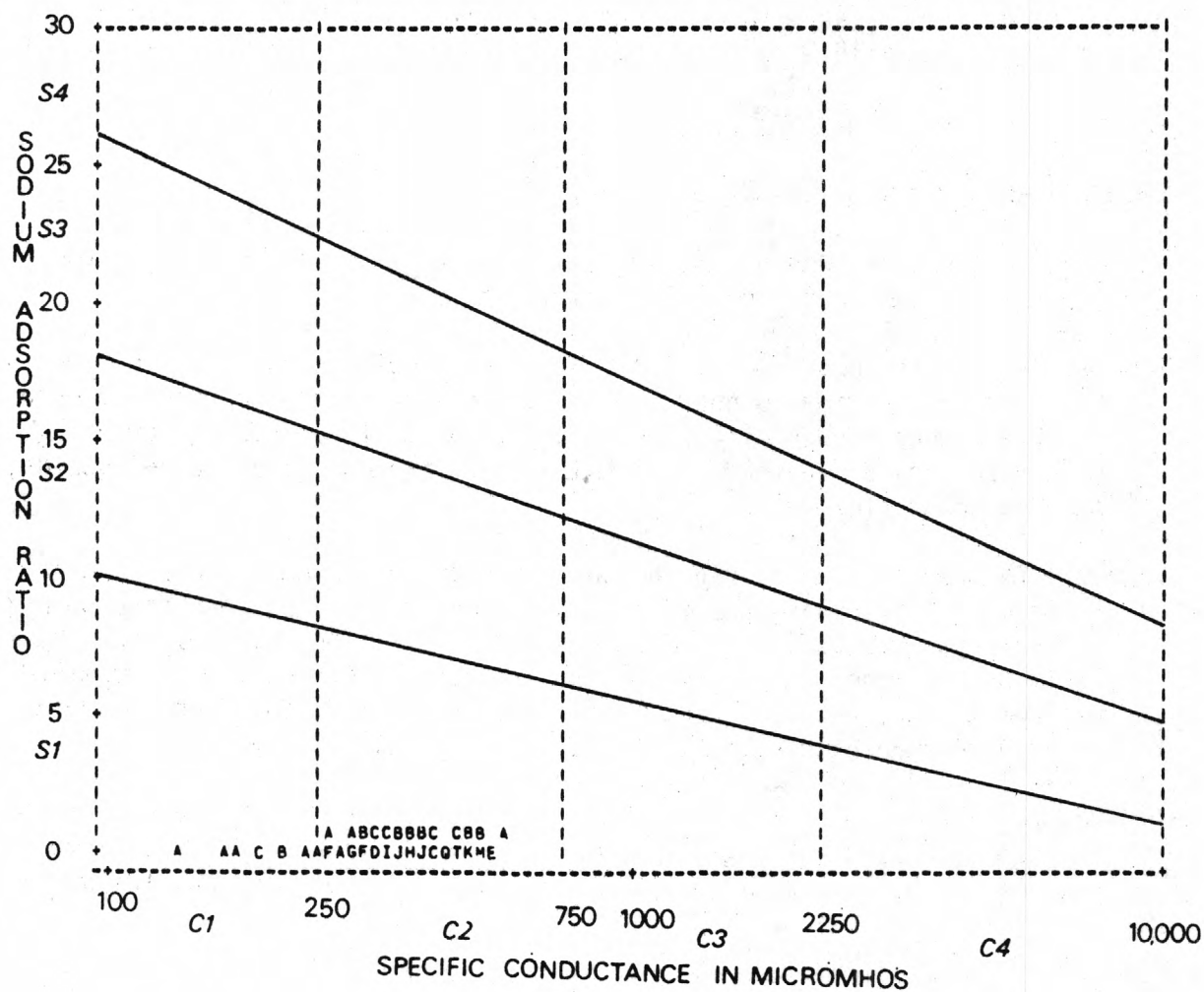


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER NEAR BLUE, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=BLUE RIVER NEAR BLUE, UK



RED RIVER MAINSTEM

07311200 - Blue Beaver Creek near Cache, Okla.

LOCATION.--Lat 34°33'24", long 98°33'48", in NE¹/₄NE¹/₄ sec. 28, T.2 N., R.13 W., Comanche County, at bridge on old U.S. Highway 62, 0.6 mi upstream from St. Louis-San Francisco Co. bridge, 4.0 mi east of Cache, and at mile 12.0.

DRAINAGE AREA.--24.6 mi².

PERIOD OF RECORD.--1965 to 1979.

WATER TYPE.--The water was a carbonate/bicarbonate mixed cation type throughout the range of measured specific conductance.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos at the 95-percent probability level indicate a positive trend (increasing concentration) for hardness and indicate no trends for dissolved solids, sulfate, and chloride.

PUBLIC WATER SUPPLY.--The average hardness concentration was 53 mg/L and for 67 percent of the hardness values the concentration was less than 60 mg/L. The hardness classification for this water varies between soft and moderately hard. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to medium with 95 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that phytotoxic effects from boron should not occur.

UNIVARIATE STATISTICS

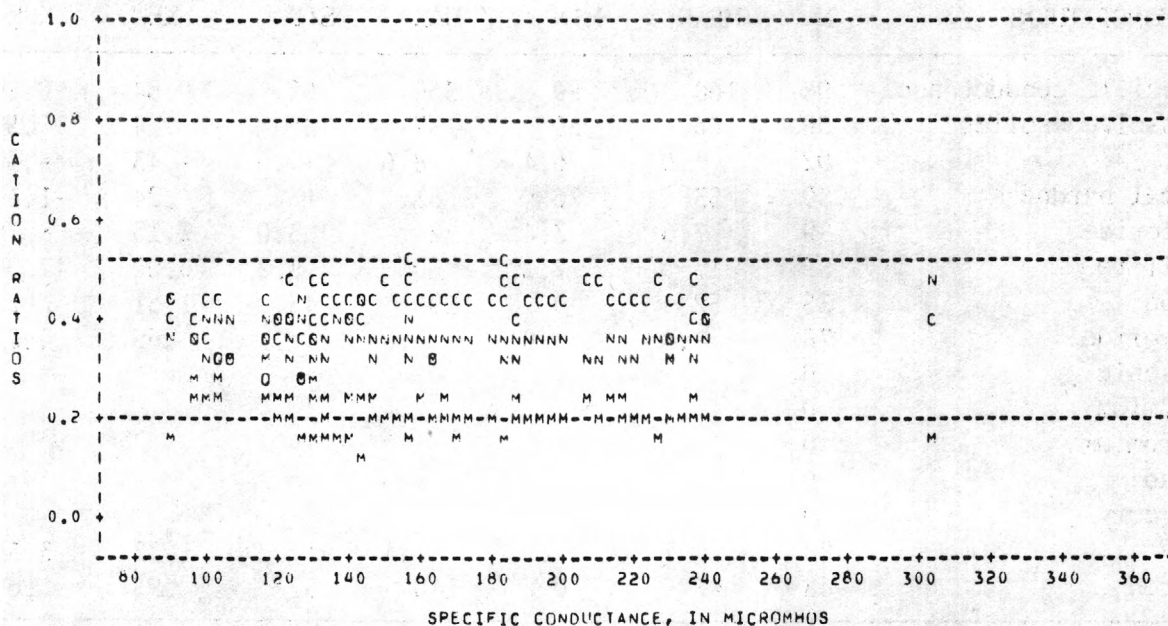
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	98	168	89	360	52	0.84	0.86
Dissolved solids	90	106	58	187	25	.74	.55
pH	92	7.6	6.4	8.6	.5	-.43	-.57
Total hardness	89	53	26	81	15	.24	-1.17
Chloride	89	7.6	3.4	24	3.0	2.13	8.78
Sulfate	89	17	7.2	90	9.2	6.02	47.07
Iron	35	52	0	190	45	1.51	2.25
Fluoride	78	.4	.0	.9	.1	.69	4.21
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	88	.7	.5	1.4	.2	1.22	3.34
Boron	68	47	0	140	31	.95	.67

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	104	128	156	211	236
Dissolved solids	77	85	102	126	141
pH	6.5	7.0	7.6	7.8	8.0
Total hardness	34	40	50	66	75
Chloride	5.0	5.5	7.0	9.5	11
Sulfate	10	13	15	18	21
Iron	0	30	40	70	134
Fluoride	.2	.3	.4	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.6	.6	.7	.8	.9
Boron	10	30	40	60	100

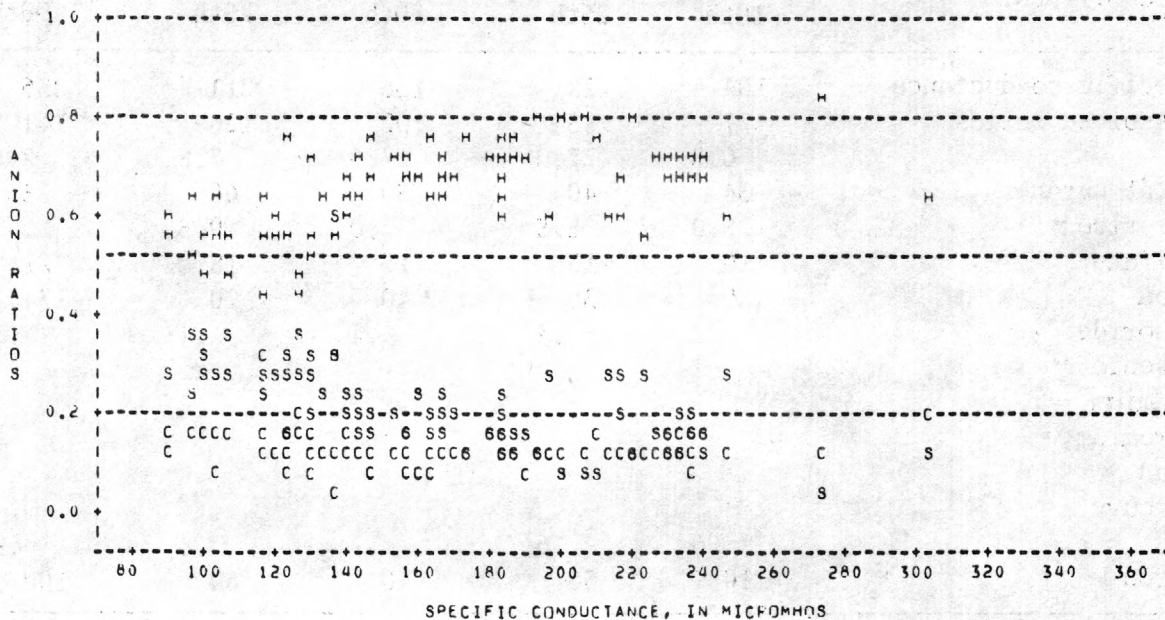
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE BEAVER CREEK NR CACHE, UK

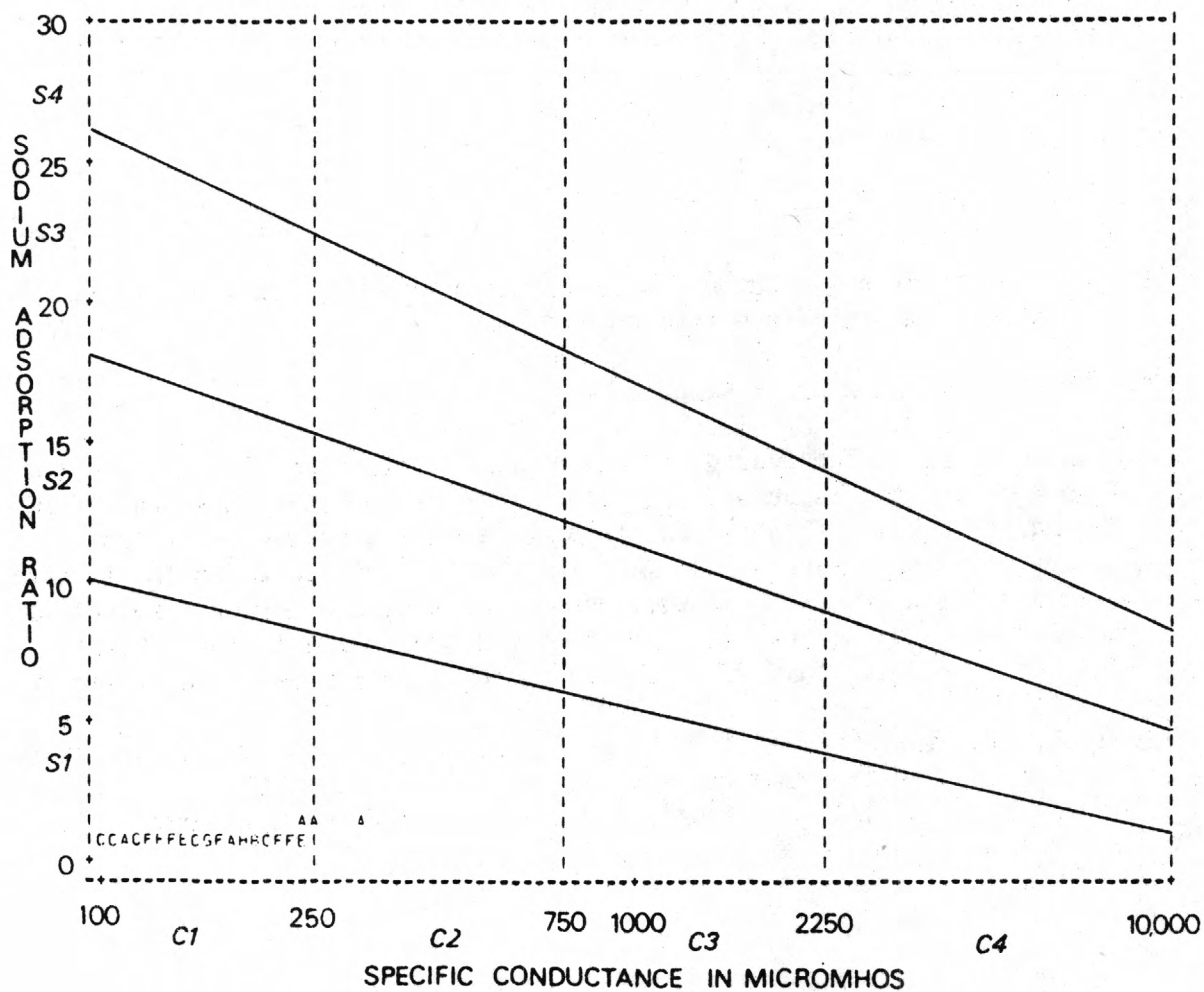


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=BLUE BEAVER CREEK NR CACHE, UK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 DRS, B = 2 DRS, C = 3 DRS
 STATION NAME OR LOCAL IDENTIFIER=BLUE HEAVEN CREEK NR CACHE, OK



RED RIVER MAINSTEM

07332800 - Caney Boggy Creek near Ashland, Okla.

LOCATION.--Lat 34°45'11", long 96°08'52", in SE¹₄SE¹₄ sec. 4, T.3 N., R.11 E., Coal County, at bridge on county road, 2 mi west of State Highway 31, 2.0 mi northeast of Parker, and 5.0 mi west of Ashland.

DRAINAGE AREA.--49 mi².

PERIOD OF RECORD.--1972 to 1975.

WATER TYPE.--The water was carbonate/bicarbonate mixed cation type throughout the range of measured specific conductance.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 72 mg/L and for 47 percent of the hardness values the concentration was less than 60 mg/L. The hardness classification for this water varies between soft and moderately hard. None of the measured constituents exceeded their recommended maximum limits. Cadmium, chromium, lead, and mercury did not exceed their maximum contaminant levels. No data are available for arsenic. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to medium with 71 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that phytotoxic effects from boron should not occur.

UNIVARIATE STATISTICS

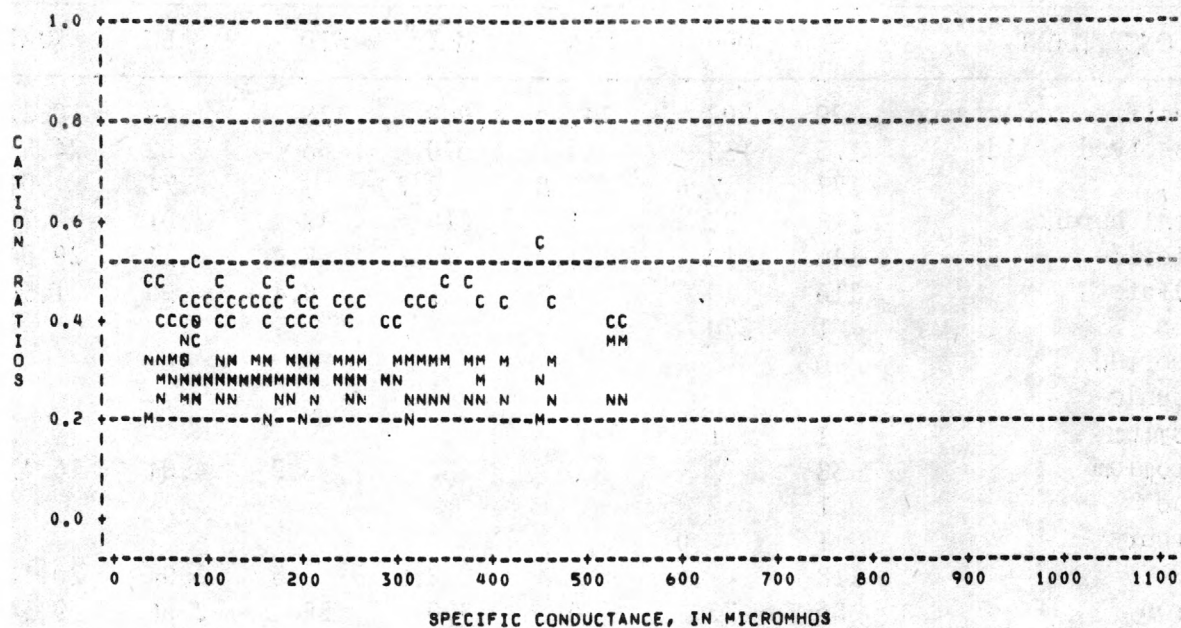
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	220	202	141	1,000	115	2.09	10.21
Dissolved solids	175	133	44	670	66	3.52	24.33
pH	177	7.6	5.8	8.7	.6	-.74	.04
Total hardness	118	72	15	210	42	1.01	.76
Chloride	146	10	1.9	70	7.4	4.23	29.04
Sulfate	116	19	3.7	51	8.4	.95	1.39
Iron	1	270					
Fluoride	0						
Arsenic	0						
Cadmium	1	1					
Chromium	38	2	0	30	5.9	4.04	16.47
Lead	1	2					
Mercury	1	.0					
SAR	118	.6	.3	2.6	.3	3.94	20.12
Boron	86	75	0	370	58	2.56	9.14

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	84	119	184	264	332
Dissolved solids	74	94	122	159	201
pH	6.5	7.2	7.6	8.0	8.3
Total hardness	26	38	66	98	130
Chloride	4.2	6.0	9.3	12	17
Sulfate	9.4	12	17	24	29
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium	0	0	0	0	2
Lead					
Mercury					
SAR	.4	.5	.6	.7	.8
Boron	27	40	65	90	120

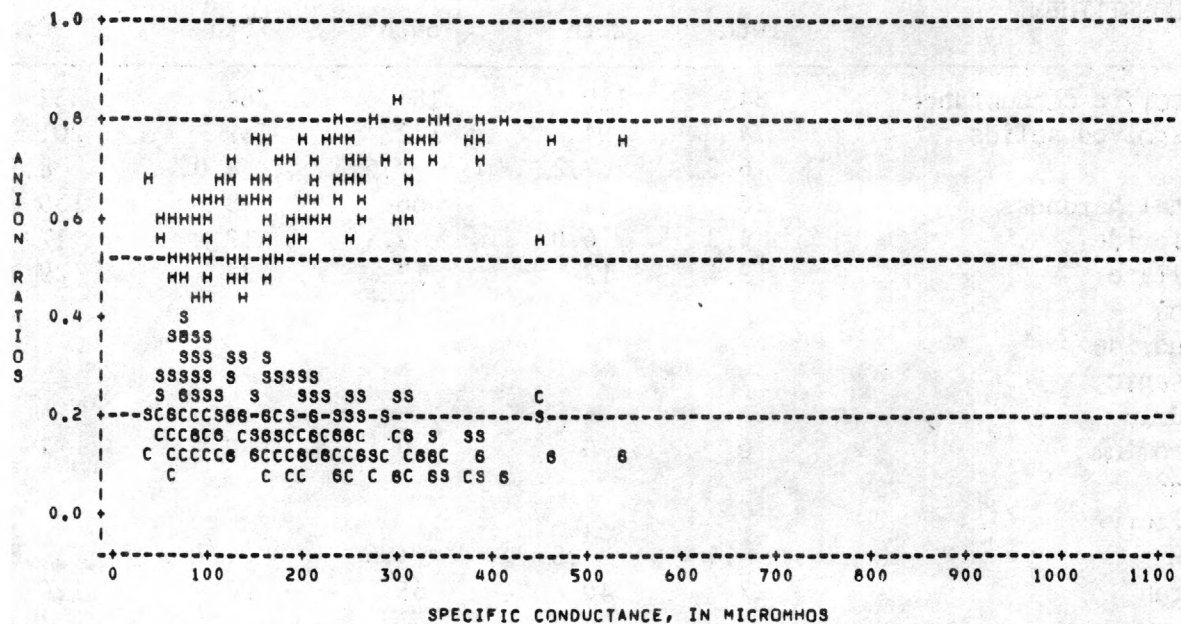
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=CANEY BOGGY CREEK NEAR ASHLAND, OK

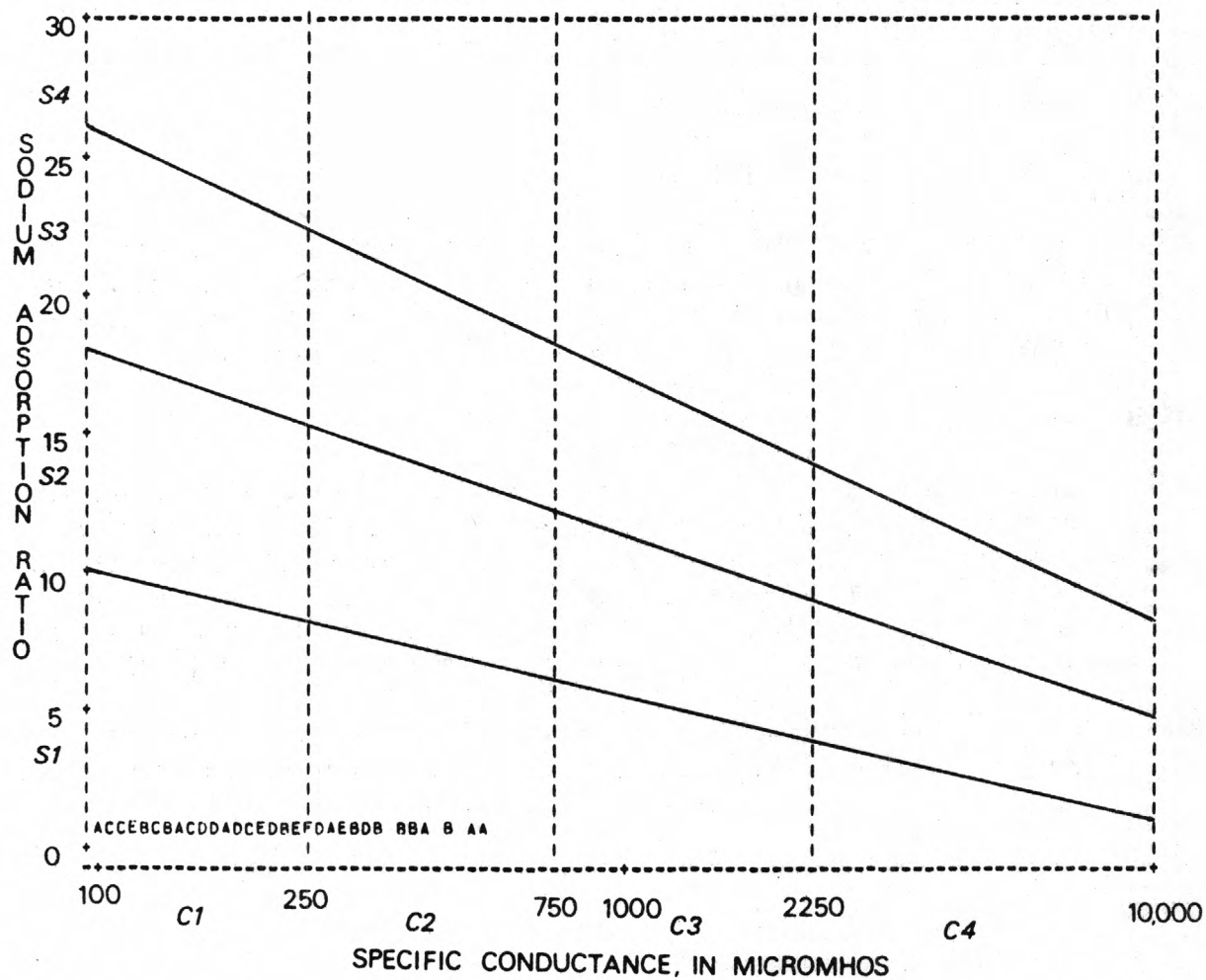


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=CANEY BOGGY CREEK NEAR ASHLAND, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=CANEY BOGGY CREEK NEAR ASHLAND, OK



RED RIVER MAINSTEM

07333500 - Chickasaw Creek near Stringtown, Okla.

LOCATION.--Lat 34°27'41", long 96°01'36", in NE¼ sec. 22, T.1 S., R.12 E., Atoka County, at county road bridge, 1.5 mi east of Stringtown.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1955 to 1958, 1960.

WATER TYPE.--The water was generally mixed cation type when the specific conductance was less than 100 umho. For specific conductance greater than 100 umho, which accounted for 39 percent of the samples, the water was calcium type. There are no anion distribution data available.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 33 mg/L and for 90 percent of the hardness values the concentration was less than 60 mg/L. The hardness classification for this water is soft. None of the measured constituents exceeded their recommended maximum limits. No sulfate or toxic metal data are available. Based on the limited amount of data, this water would probably be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	23	94	40	161	33	0.36	-0.91
Dissolved solids	0						
pH	23	7.0	6.5	7.8	.3	.41	-.06
Total hardness	23	33	14	70	16	.98	-.16
Chloride	23	4.6	.4	8.0	1.8	-.09	.50
Sulfate	0						
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	23	.4	.2	.8	.2	.47	-.36
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	55	66	90	127	141
Dissolved solids					
pH	6.6	6.7	7.0	7.2	7.5
Total hardness	17	20	26	48	60
Chloride	2.2	3.8	4.2	5.5	7.5
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.3	.4	.6	.6
Boron					

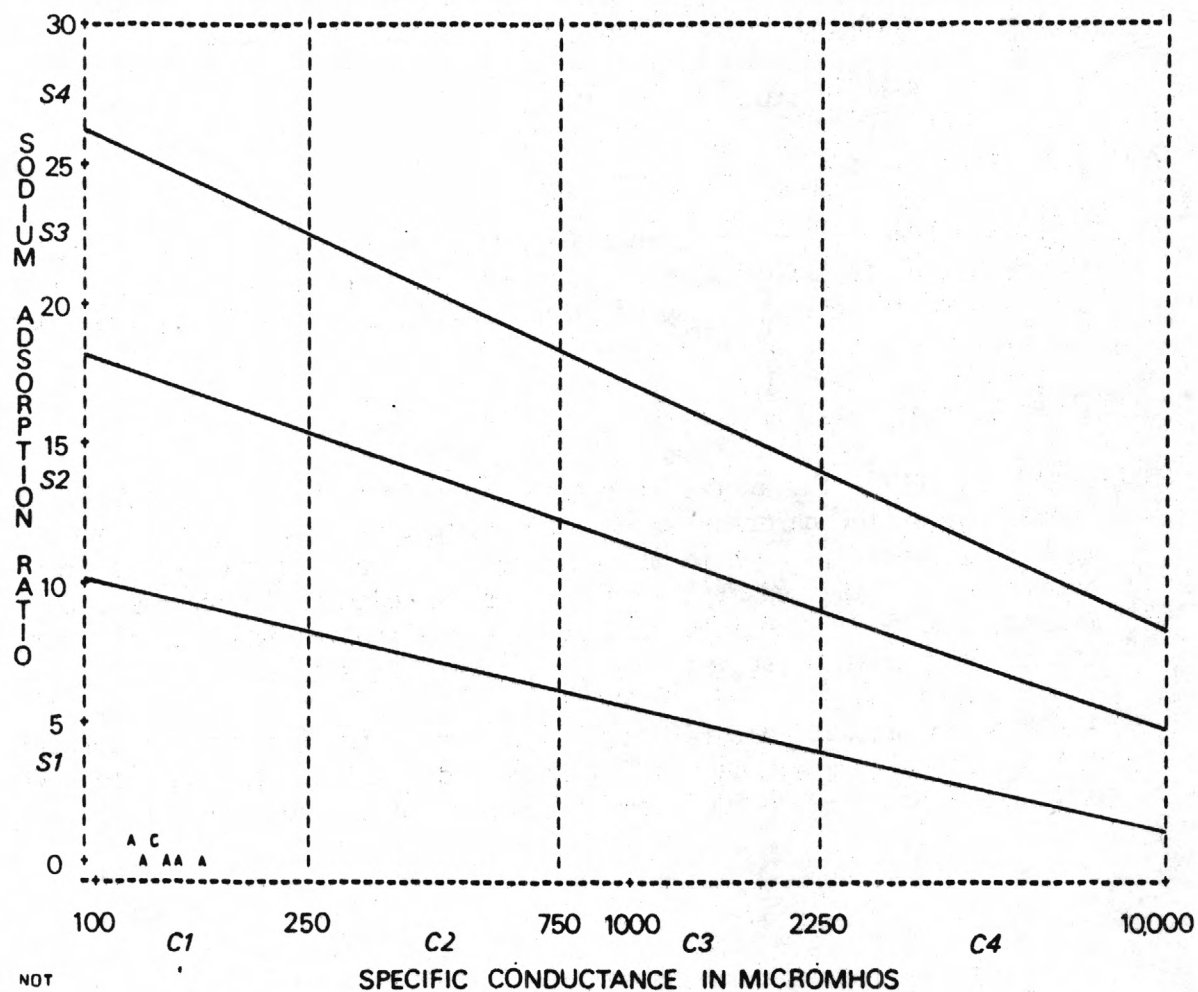
[illegible]

48

IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=CHICKASAW CREEK NR STRINGTOWN, OK



RED RIVER MAINSTEM

07334400 - Clear Boggy Creek near Tupelo, Okla.

LOCATION.--Lat 34°32'45", long 96°24'30", in NE $\frac{1}{4}$ sec. 24, T.1 N., R.8 E., Coal County, at bridge on State Highway 48, 4 mi south of Tupelo.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1958, 1960, 1962.

WATER TYPE.--For specific conductance less than 700 umho, which accounted for 58 percent of the samples, the water was calcium carbonate/bicarbonate type. When the specific conductance was greater than 700 umho the water was mixed cation chloride type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 211 mg/L and for 70 percent of the hardness values the concentration was greater than 180 mg/L. In general, the hardness classification for this water is very hard. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to high with 63 percent of the samples having a medium salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

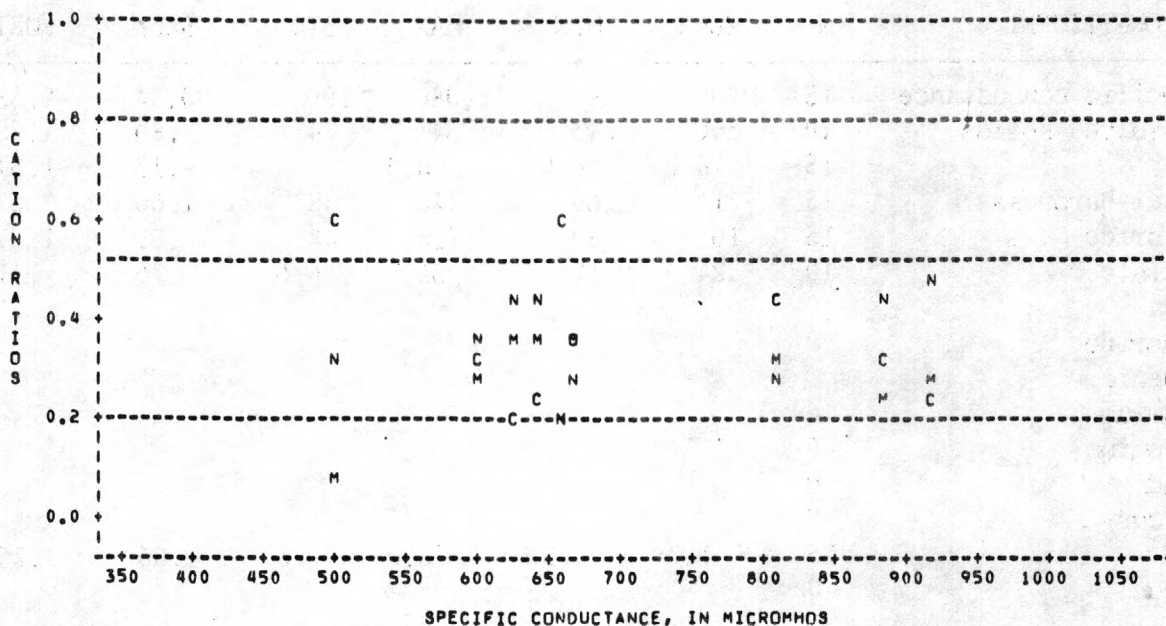
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	15	707	390	1,080	190	0.34	-0.38
Dissolved solids	10	360	243	541	84	.86	1.58
pH	15	8.2	8.0	8.4	.2	-.17	-1.51
Total hardness	15	211	160	340	48	1.60	2.67
Chloride	15	105	20	218	48	.53	1.21
Sulfate	10	24	11	33	6.6	-.76	.31
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	15	1.7	.5	3.0	.6	.06	.26
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	451	600	661	883	1,003
Dissolved solids	246	295	367	403	527
pH	8.0	8.0	8.2	8.3	8.4
Total hardness	167	180	194	234	304
Chloride	36	67	100	128	182
Sulfate	12	20	26	29	33
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.7	1.2	1.8	2.0	2.6
Boron					

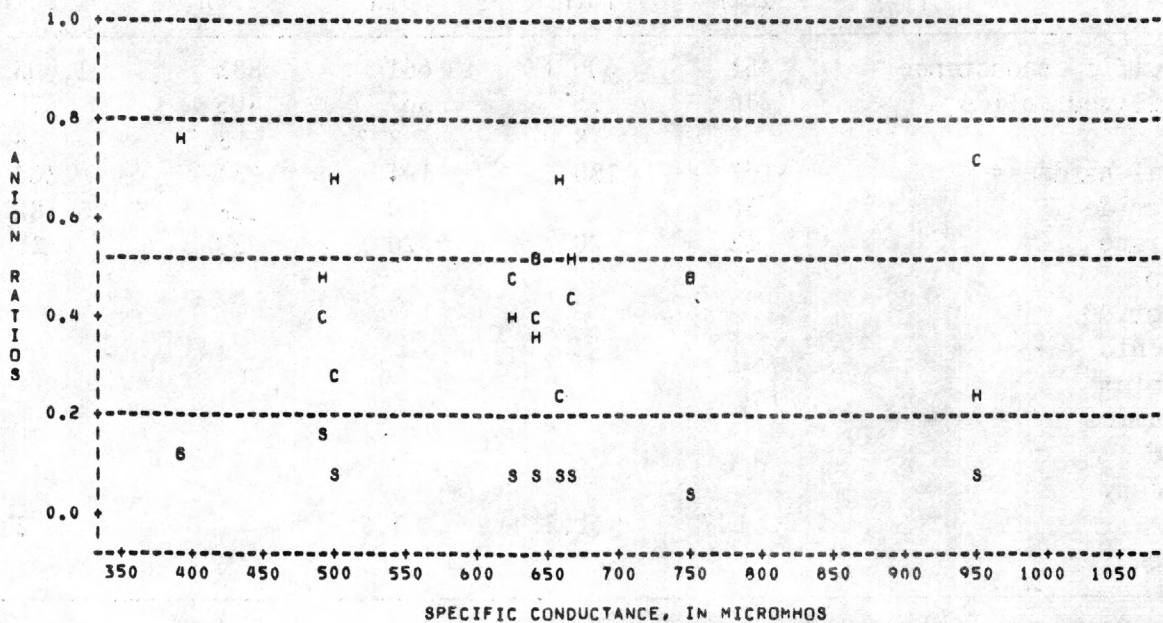
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=CLEAR BOGGY CREEK NR TUPELO, OK

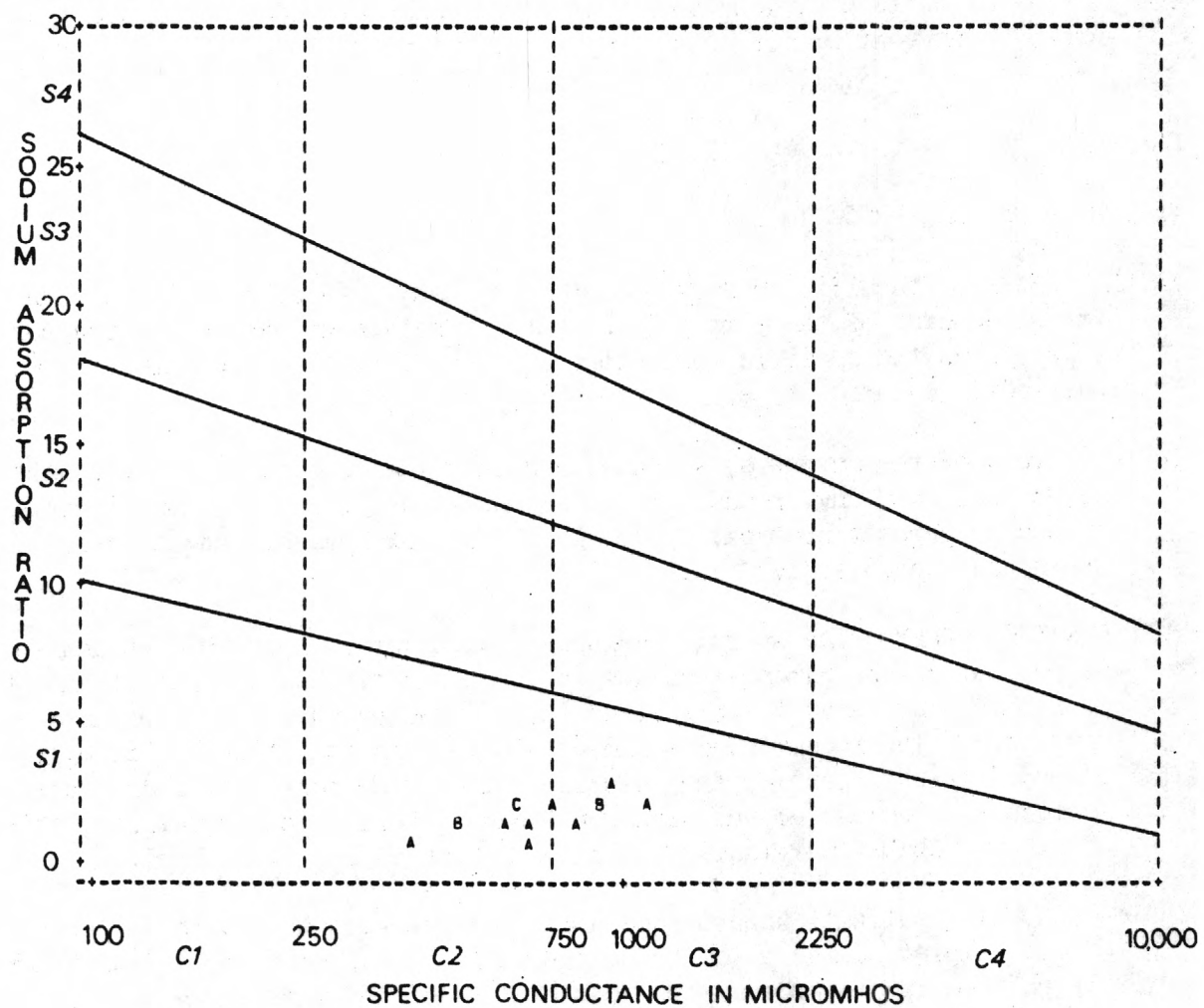


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=CLEAR BOGGY CREEK NR TUPELO, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=CLEAR BOGGY CREEK NR TUPELO, OK



RED RIVER MAINSTEM

07335000 - Clear Boggy Creek near Caney, Okla.

LOCATION.--Lat. 34°15'09", long 96°12'19", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 36, T.3 S., R.10 E., Atoka County, at bridge on old U.S. Highways 69 and 75, 0.5 mi downstream from Caney Creek, 1.5 mi north of Caney, and at mile 24.1.

DRAINAGE AREA.--720 mi².

PERIOD OF RECORD.--1952 to 1979.

WATER TYPE.--For specific conductance of less than 1,000 umho, which accounted for 91 percent of the samples, the water was calcium carbonate/bicarbonate type. When the specific conductance was greater than 1,000 umho the water was sodium chloride type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos for these constituents at the 95-percent probability level also do not indicate any trends. There are no current dissolved solids data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 200 mg/L and for 62 percent of the hardness values the concentration was greater than 180 mg/L. The hardness classification for this water varies between hard and very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 8 percent of the chloride values. No toxic metal data are available. Because of the occasional high chloride concentrations, this water is probably marginally suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 76 percent of the samples having a low or medium salinity hazard. The sodium hazard ranged from low to medium with about 95 percent of the SAR values equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects should not occur.

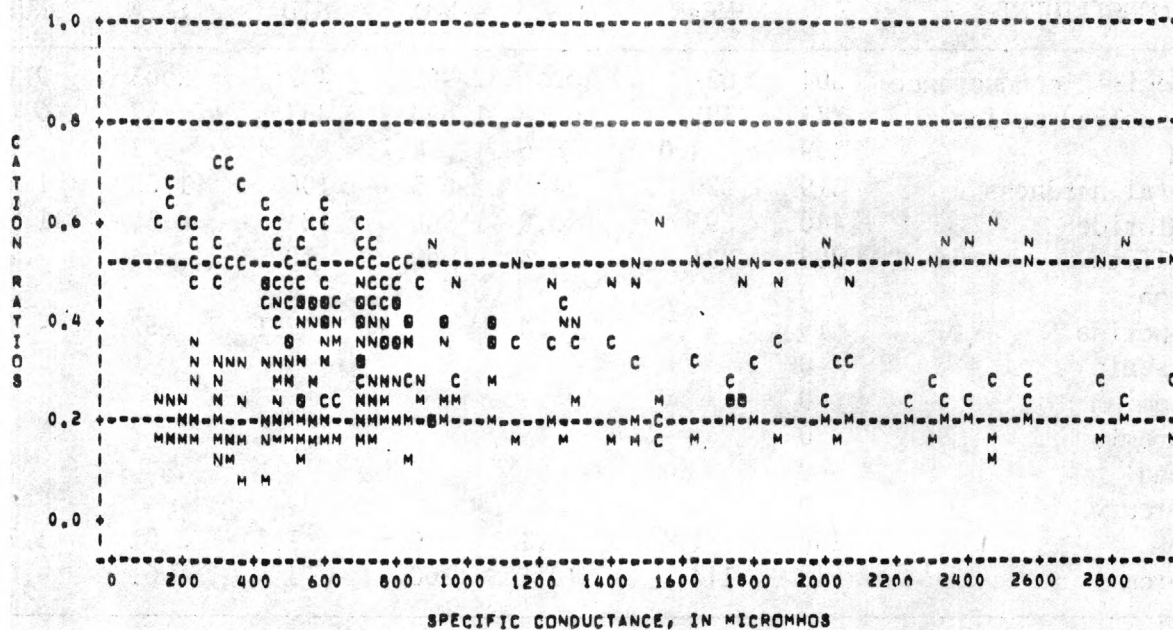
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	504	627	102	2,960	422	2.63	9.17
Dissolved solids	283	395	62	1,690	293	2.37	6.07
pH	399	8.0	6.6	8.7	.4	-.68	.62
Total hardness	319	220	24	675	106	1.05	1.90
Chloride	440	93	5.0	800	123	3.30	11.90
Sulfate	295	24	3.3	69	10	.54	.79
Iron	0						
Fluoride	19	.2	.0	.5	.1	.57	-.01
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	296	1.4	.1	6.5	1.3	2.01	3.75
Boron	18	114	10	260	71	.61	-.66

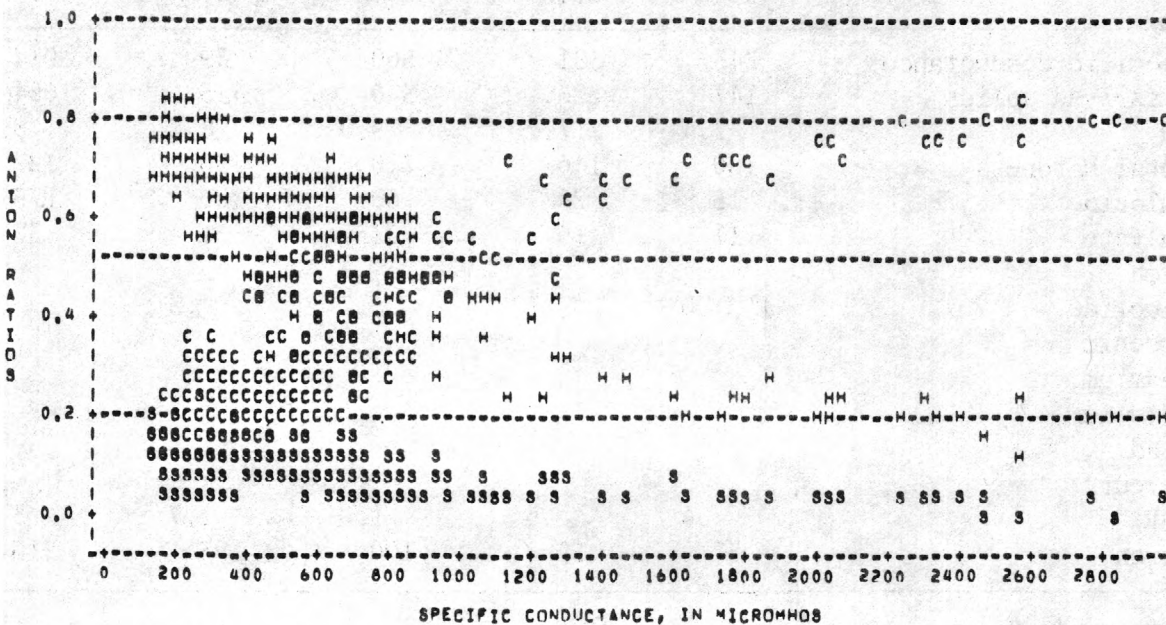
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	243	381	560	739	912
Dissolved solids	147	225	330	445	664
pH	7.4	7.7	8.0	8.2	8.3
Total hardness	100	146	210	280	322
Chloride	15	28	60	100	173
Sulfate	11	16	22	31	37
Iron					
Fluoride	.0	.1	.2	.3	.4
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.6	1.0	1.7	3.3
Boron	37	58	100	193	215

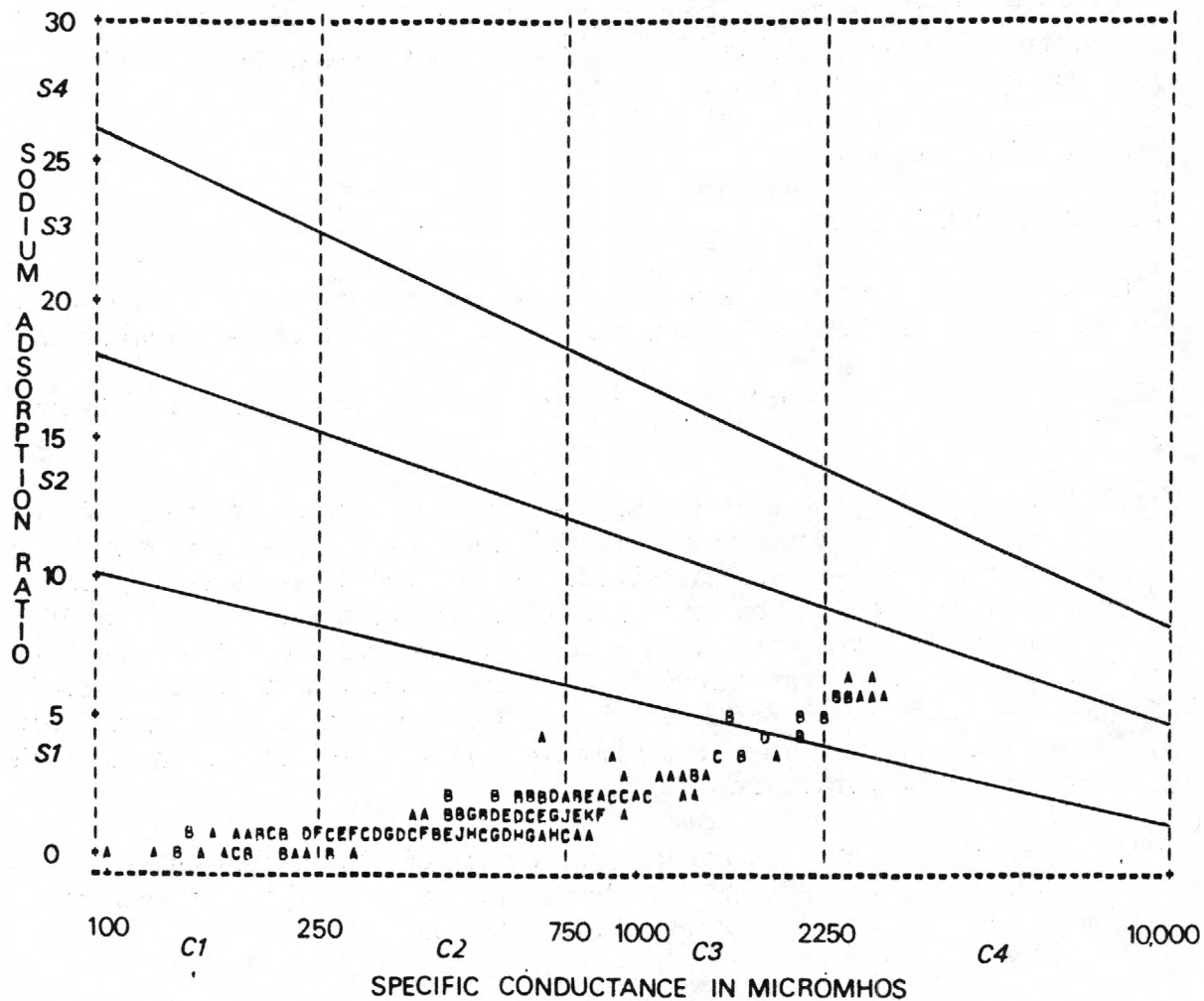
CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER= CLEAR BOGGY CREEK NR CANEY, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER= CLEAR BOGGY CREEK NR CANEY, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 DBS, B = 2 DBS, C = 3 DBS
 STATION NAME OR LOCAL IDENTIFIER=CLEAR BOGGY CREEK NR CANEY, OK



RED RIVER MAINSTEM

07332900 - Coal Creek near Lehigh, Okla.

LOCATION.--Lat 34°27'06", long 96°13'56", on west line of sec. 23, T.1 S., R.10 E., Coal County, at county road bridge, 1.5 mi southwest of intersection of county road and U.S. Highway 75 in Lehigh, 2.4 mi upstream from French Henry Creek, and at mile 6.4.

DRAINAGE AREA.--8.50 mi².

PERIOD OF RECORD.--1977 to 1979.

WATER TYPE.--The water was mixed cation type throughout the range of measured specific conductance. There are no anion distribution data available.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 41 mg/L and for 81 percent of the hardness values the concentration was less than 60 mg/L. In general, the hardness classification for this water is soft. The recommended maximum iron concentration of 300 ug/L was exceeded by 48 percent of the iron values. Arsenic, cadmium, chromium, lead, and mercury concentrations did not exceed their maximum contaminant levels. Based on the data, this water would be suitable for use as a public supply. However, staining of clothes and plumbing fixtures may occur because of the high iron concentrations.

IRRIGATION.--The salinity hazard was low for all of the samples and all of the SAR values were equivalent to a low sodium hazard. The data indicate that phytotoxic effects from boron should not occur.

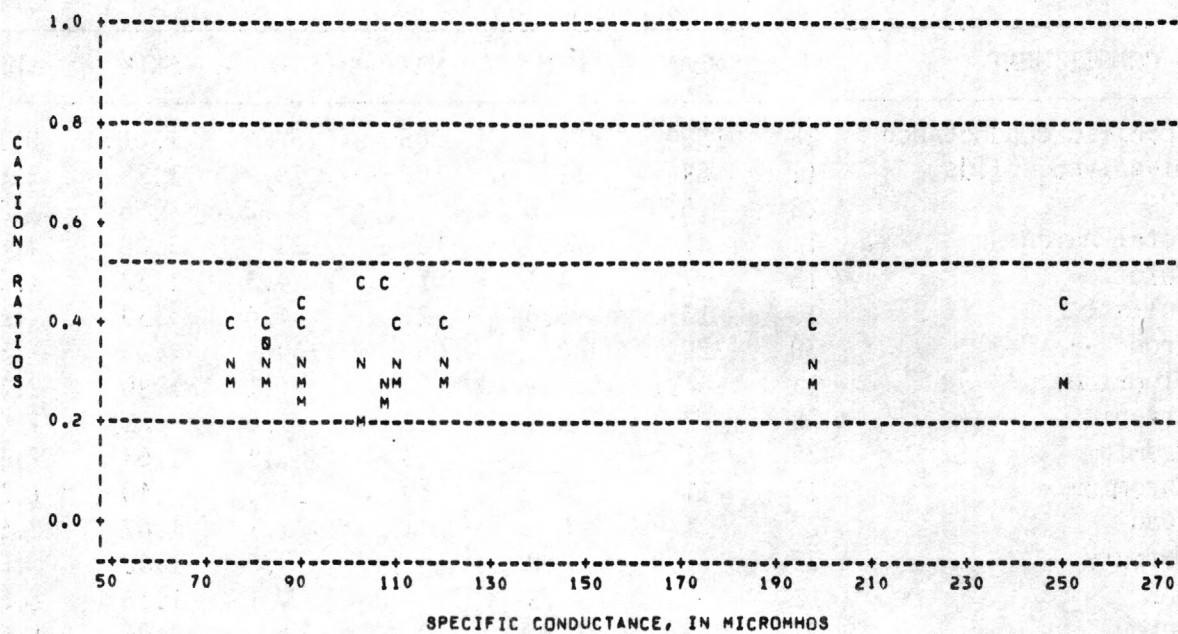
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	28	132	70	265	57	1.01	-0.16
Dissolved solids	11	88	58	160	28	1.88	3.92
pH	28	6.9	6.6	7.5	.2	.56	-.36
Total hardness	11	41	24	100	23	2.20	4.87
Chloride	13	7.0	3.1	17	4.3	1.32	1.09
Sulfate	13	13	5.6	21	4.0	.30	.61
Iron	30	329	80	660	160	.34	-.80
Fluoride	11	.1	.1	.3	.1	1.80	2.61
Arsenic	28	2	0	3	1.0	-.21	-1.06
Cadmium	25	1	0	3	.8	1.64	2.30
Chromium	27	11	0	30	11	.40	-1.34
Lead	27	1	0	4	1.1	1.67	2.53
Mercury	27	.0	.0	.1	.0	1.42	.00
SAR	11	.4	.3	.7	.1	1.65	1.65
Boron	27	67	30	90	14	-.94	1.63

FREQUENCY DISTRIBUTION

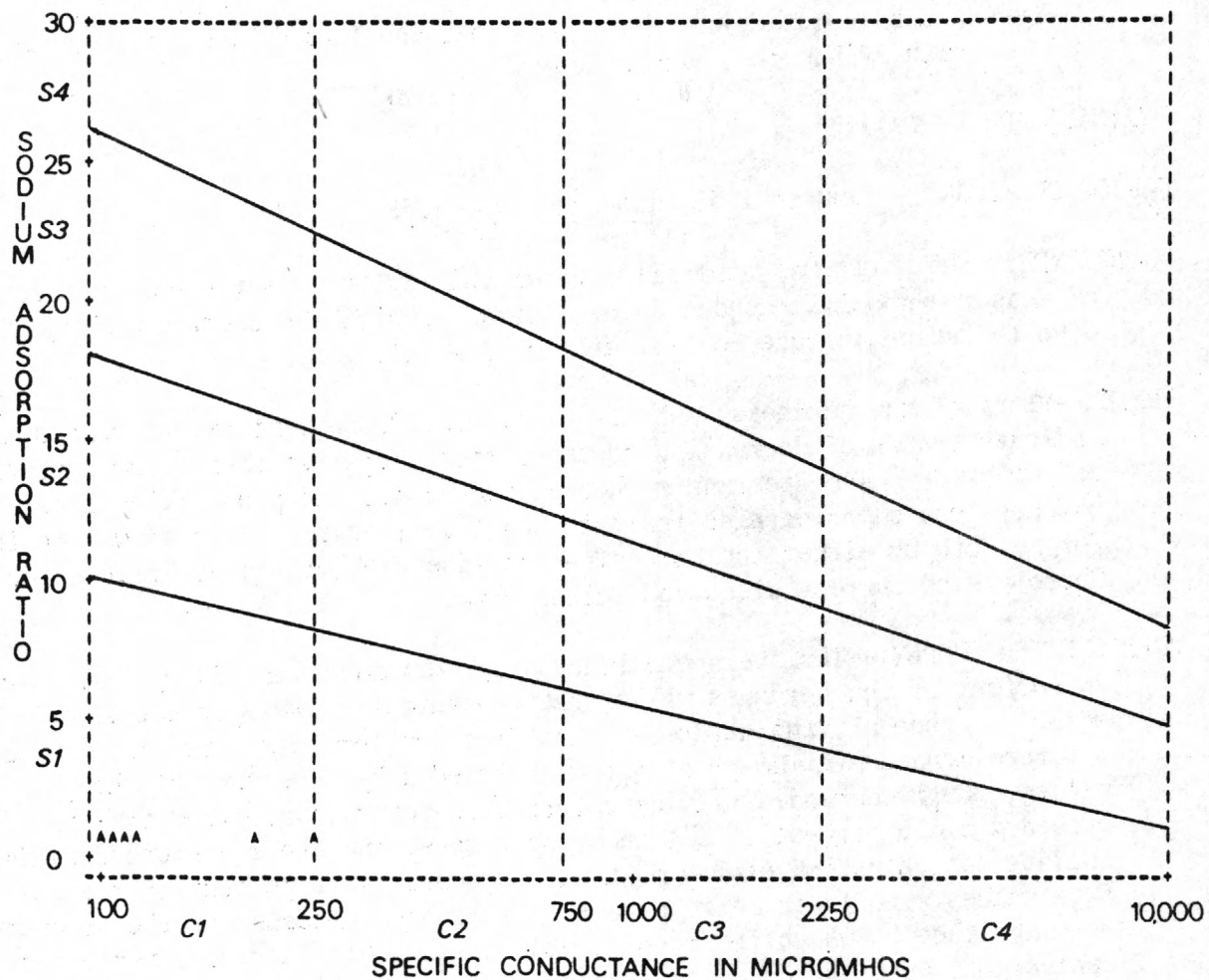
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	75	88	108	172	221
Dissolved solids	59	72	80	90	152
pH	6.7	6.8	6.9	7.1	7.4
Total hardness	24	29	32	45	93
Chloride	3.2	3.6	5.2	9.8	15
Sulfate	6.7	10	12	16	19
Iron	103	215	290	455	550
Fluoride	.1	.1	.1	.2	.3
Arsenic	0	1	2	2	3
Cadmium	0	0	0	1	2
Chromium	0	0	10	20	30
Lead	0	0	0	1	2
Mercury	.0	.0	.0	.0	.1
SAR	.3	.4	.4	.4	.7
Boron	46	60	70	80	82

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=COAL CREEK NEAR LEHIGH OK



No anion distribution data are available.

IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=COAL CREEK NEAR LEHIGH OK



RED RIVER MAINSTEM

07313600 - Cow Creek at Waurika, Okla.

LOCATION.--Lat 34°10'55", long 98°00'05", in NE¼ sec. 26, T.4 S., R.8 W., Jefferson County, at Chicago, Rock Island, and Pacific Railroad bridge, 0.7 mi north of Waurika, and at mile 1.9.

DRAINAGE AREA.--193 mi².

PERIOD OF RECORD.--1960 to 1963, 1967 to 1970, 1978 to 1979.

WATER TYPE.--The water was generally sodium chloride type throughout the range of measured specific conductance. Around specific conductance of 2,000 umho the anion sulfate occasionally predominates.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate trends of decreasing concentration, negative trend, for hardness and chloride. The Spearman's rhos at the 95-percent probability level for hardness and chloride also indicate negative trends. No trend was indicated for sulfate by either the concentration-time plot or the Spearman's rho. There are no current dissolved solids data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 459 mg/L and for 88 percent of the hardness values the concentration was greater than 180 mg/L. In general, the hardness classification for this water is very hard. The recommended minimum pH of 5.0 was exceeded by 2 percent of the pH values, the recommended maximum chloride concentration of 250 mg/L was exceeded by 56 percent of the chloride values, and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 32 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water probably would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 33 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with 10 percent of the SAR values equivalent to a high or very high sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

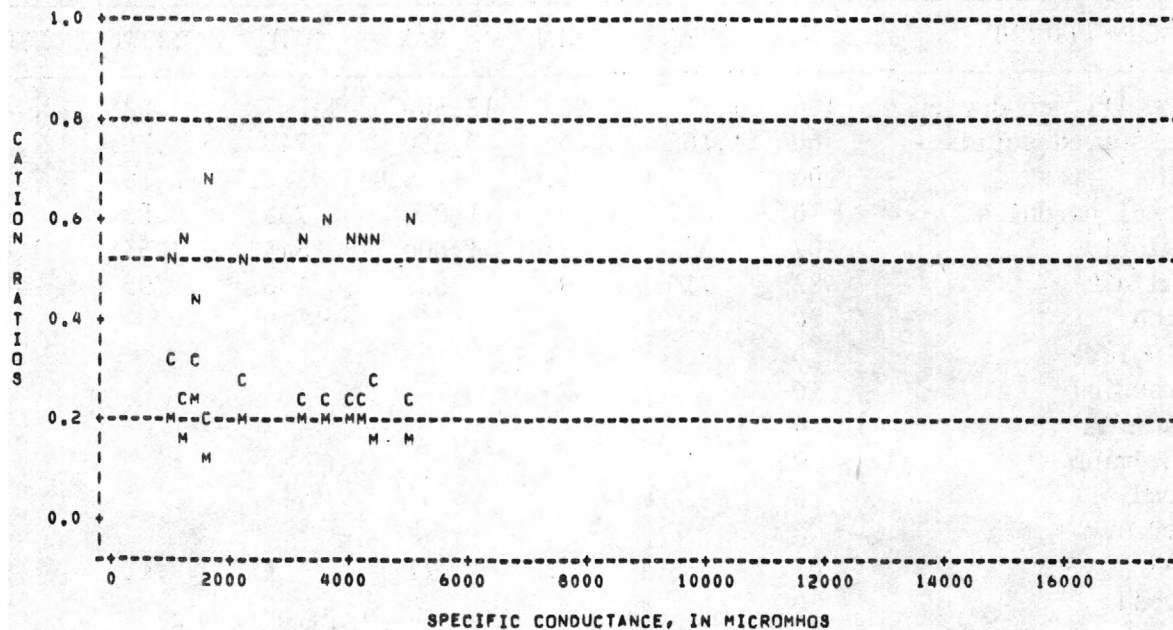
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	106	2,112	52	13,500	1,567	3.92	25.88
Dissolved solids	60	1,366	46	3,550	749	.70	.22
pH	100	7.6	4.6	8.8	.7	-2.18	7.29
Total hardness	76	459	20	1,030	236	.55	.03
Chloride	102	398	3.0	1,600	343	1.53	1.88
Sulfate	82	219	9.4	655	165	.92	-.02
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	67	5.1	.3	11	1.9	.11	.90
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	699	1,268	1,815	2,507	3,968
Dissolved solids	558	868	1,190	1,670	2,654
pH	7.0	7.4	7.6	7.9	8.3
Total hardness	140	304	445	585	886
Chloride	73	176	260	535	980
Sulfate	47	84	186	290	502
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	2.5	4.0	5.2	6.2	7.5
Boron					

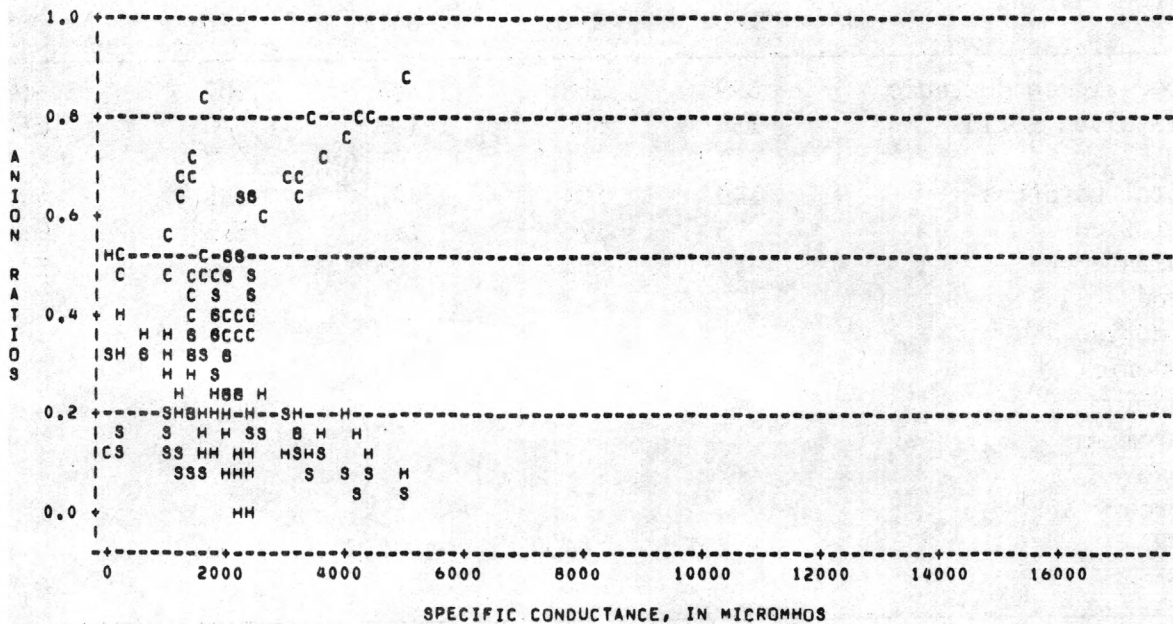
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER= COW CREEK AT MAURIKA, OK

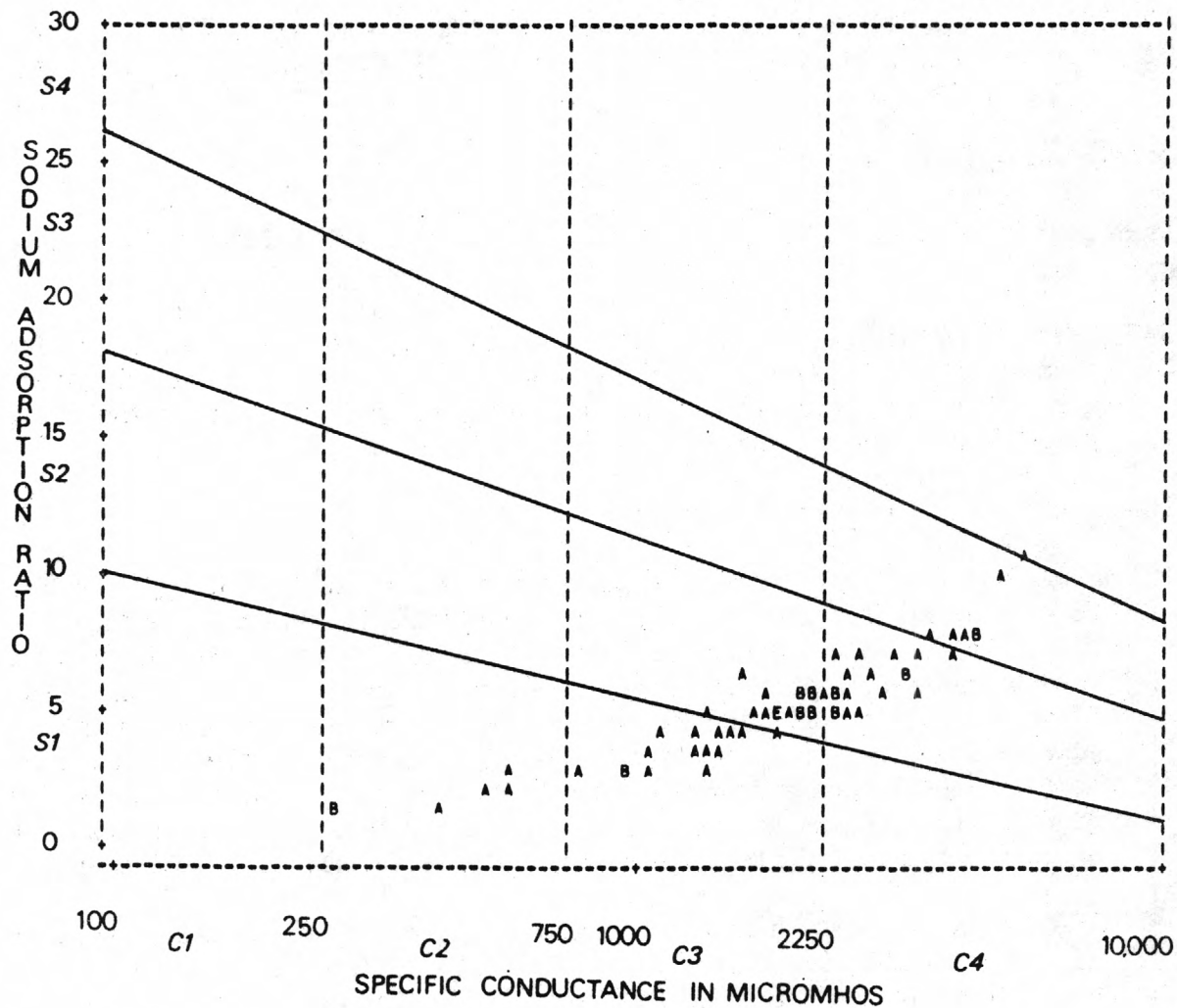


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER= COW CREEK AT MAURIKA, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=COW CREEK AT MAURIKA, OK



RED RIVER MAINSTEM

07311500 - Deep Red Run near Randlett, Okla.

LOCATION.--Lat 34°13'15", long 98°27'10", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 10, T.4 S., R.12 W., Cotton County, at bridge on U.S. Highway 277, 2.8 mi north of Randlett, and at mile 4.8.

DRAINAGE AREA.--617 mi².

PERIOD OF RECORD.--1948, 1950 to 1952, 1954 to 1956, 1958, 1960 to 1963, 1969 to 1971.

WATER TYPE.--For specific conductance less than 800 umho, which accounted for 32 percent of the samples, the water was calcium carbonate/bicarbonate type. When the specific conductance was greater than 800 umho the water was sodium chloride type.

TREND.--There are no current data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 335 mg/L and for 68 percent of the hardness values the concentration was greater than 180 mg/L. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 52 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 15 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum sulfate and chloride concentrations were exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 33 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with about 30 percent of the SAR values equivalent to a high or very high sodium hazard. None of the boron values exceeded the 750 ug/L recommended limit for boron sensitive plants.

UNIVARIATE STATISTICS

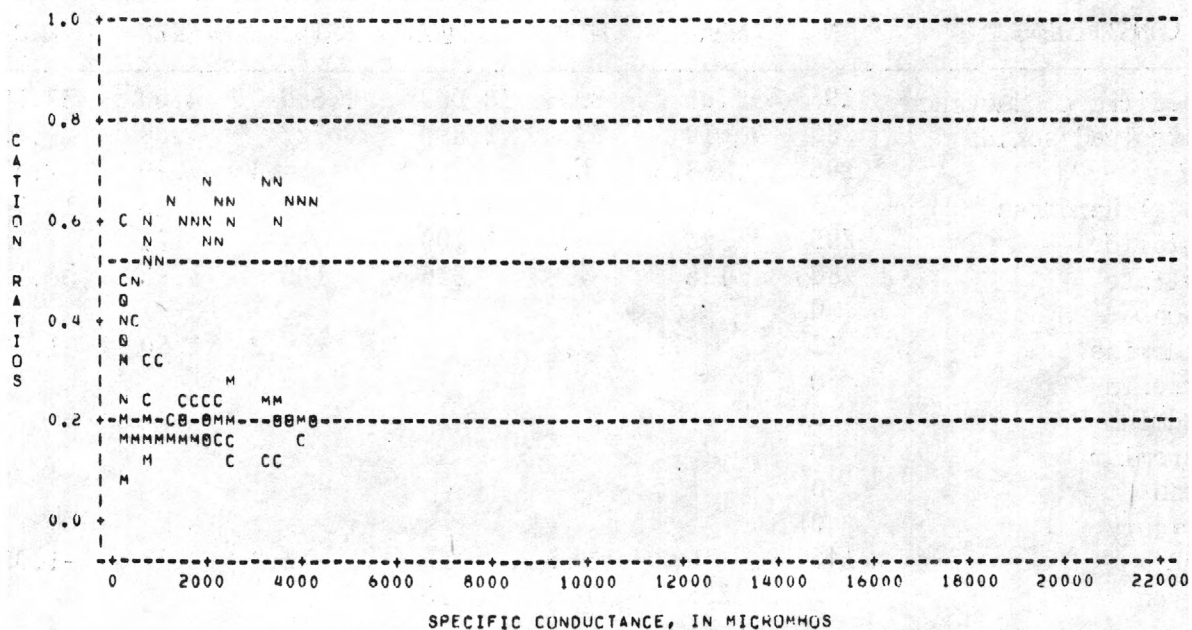
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	295	1,793	89	18,000	1,569	4.00	37.38
Dissolved solids	280	1,019	73	2,890	727	.68	-.66
pH	195	8.3	6.4	9.0	.4	-1.19	2.49
Total hardness	293	336	32	2,226	240	2.13	12.04
Chloride	295	373	2.6	1,200	317	.71	-.73
Sulfate	280	126	4.8	536	106	.99	.42
Iron	0						
Fluoride	12	.2	.1	.7	.2	1.50	1.70
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	146	6.2	.5	15	3.8	.27	-1.05
Boron	2	255	100	410			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	316	672	1,420	2,710	3,704
Dissolved solids	222	396	826	1,570	2,188
pH	7.8	8.0	8.3	8.5	8.7
Total hardness	97	150	290	467	662
Chloride	31	93	270	610	886
Sulfate	18	39	99	195	281
Iron					
Fluoride	.1	.1	.1	.3	.6
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.3	2.7	5.8	9.4	12
Boron					

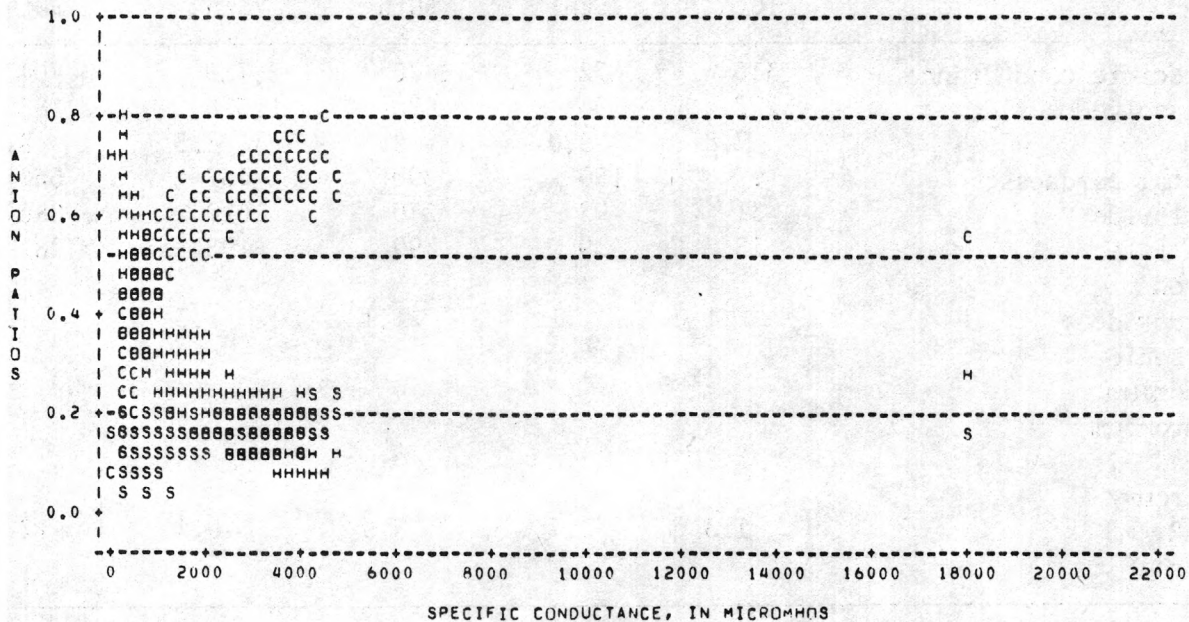
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=DEEP RED RUN NR RANOLETT, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=DEEP RED RUN NR RANOLETT, OK



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, R = 2 OBS, C = 3 OBS



RED RIVER MAINSTEM

07311000 - East Cache Creek near Walters, Okla.

LOCATION.--Lat 34°21'44", long 98°16'56", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 19, T.2 S., R.10 W., Cotton County, at bridge on State Highway 53, 1.8 mi east of Walters, 12.2 mi upstream from West Cache Creek, and at mile 19.7.

DRAINAGE AREA.--675 mi².

PERIOD OF RECORD.--1947 to 1948, 1951 to 1955, 1958 to 1963, 1970 to 1979.

WATER TYPE.--When the specific conductance was less than 900 umho, which accounted for 93 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance greater than 900 umho the water was sodium chloride type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos at the 95-percent probability level for dissolved solids, sulfate, and chloride also do not indicate any trends; however, the Spearman's rho for hardness indicates a positive trend.

PUBLIC WATER SUPPLY.--The average hardness concentration was 182 mg/L and for 50 percent of the hardness values the concentration was greater than 180 mg/L. The hardness classification for this water varies between hard and very hard. The recommended maximum pH of 9.0 was exceeded by 5 percent of the pH values, the recommended maximum chloride concentration of 250 mg/L was exceeded by less than 1 percent of the chloride values, and the recommended maximum sulfate concentration of 250 mg/L was exceeded by less than 1 percent of the sulfate values. The maximum fluoride contaminant level for the average annual maximum daily air temperature at this location was exceeded by about 50 percent of the fluoride values. No toxic metal data are available. Because the maximum contaminant level for fluoride was exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 75 percent of the samples having a low or medium salinity hazard. The sodium hazard ranged from low to very high with more than 99 percent of the SAR values equivalent to a low sodium hazard. Phytotoxic effects could occur in boron sensitive plants. Five percent of the boron values exceeded the recommended 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

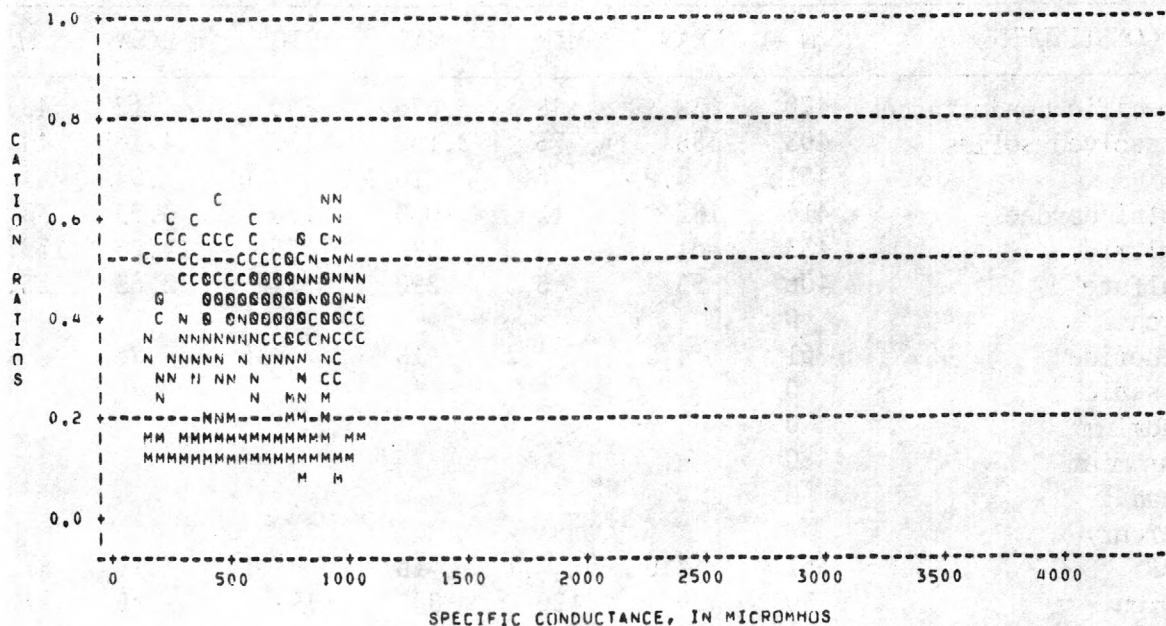
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	470	639	148	3,670	249	4.12	48.21
Dissolved solids	403	388	75	2,160	157	4.16	44.08
pH	451	7.9	6.4	10.3	.6	.94	1.77
Total hardness	414	182	12	960	70	3.73	38.36
Chloride	433	61	3.0	980	55	11.29	179.12
Sulfate	406	53	5.3	290	24	2.83	25.77
Iron	0						
Fluoride	61	4.8	.2	15	4.5	.86	-.39
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	361	2.0	.1	16	1.1	7.11	87.31
Boron	30	429	120	800	192	-.25	-1.08

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	334	497	672	750	853
Dissolved solids	206	291	408	454	520
pH	7.3	7.6	7.9	8.3	8.6
Total hardness	104	140	180	210	250
Chloride	20	38	62	72	88
Sulfate	25	42	54	64	73
Iron					
Fluoride	.5	.9	3.3	8.4	14
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.1	1.6	2.0	2.4	2.7
Boron	162	235	490	600	640

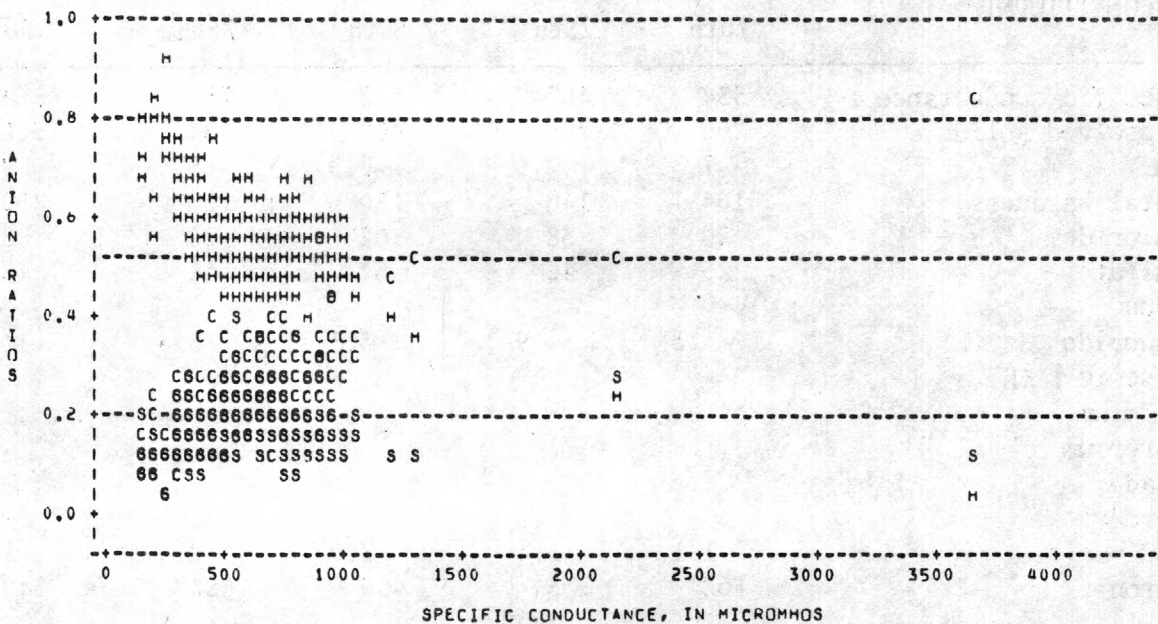
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=EAST CACHE CREEK NR WALTERS, OK

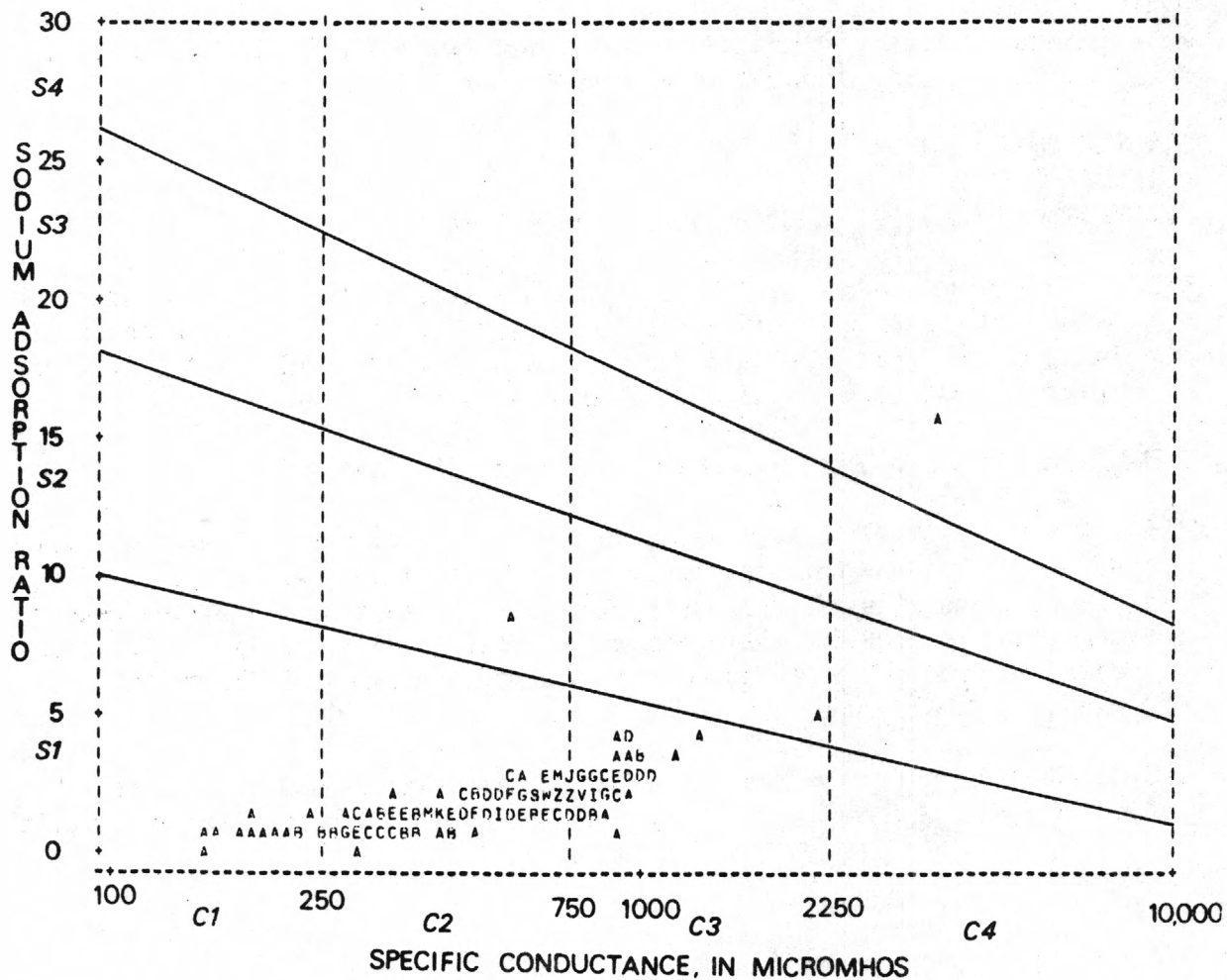


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=EAST CACHE CREEK NR WALTERS, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER= EAST CACHE CREEK NR WALTERS, OK



RED RIVER MAINSTEM

07337900 - Glover Creek near Glover, Okla.

LOCATION.--Lat 34°05'51", long 94°54'07", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 28, T.5 S., R.23 E.,
McCurtain County, at bridge on State Highways 3 and 7, 2.0 mi north of
Glover, 11.0 mi northwest of Broken Bow, and at mile 9.2.

DRAINAGE AREA.--315 mi².

PERIOD OF RECORD.--1949, 1953, 1962 to 1963, 1976 to 1979.

WATER TYPE.--When the specific conductance was greater than 40 umho, which
accounted for 80 percent of the samples, the water was calcium carbonate/
bicarbonate type. The data are not adequate to determine water type for
specific conductance less than 40 umho.

TREND.--The data are not sufficient to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 29 mg/L and for
89 percent of the hardness values the concentration was less than 60 mg/L.
The hardness classification for this water is soft. None of the measured
constituents exceeded their recommended maximum limits. No toxic metal
data are available. Based on the data, this water would be suitable for
use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR
values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

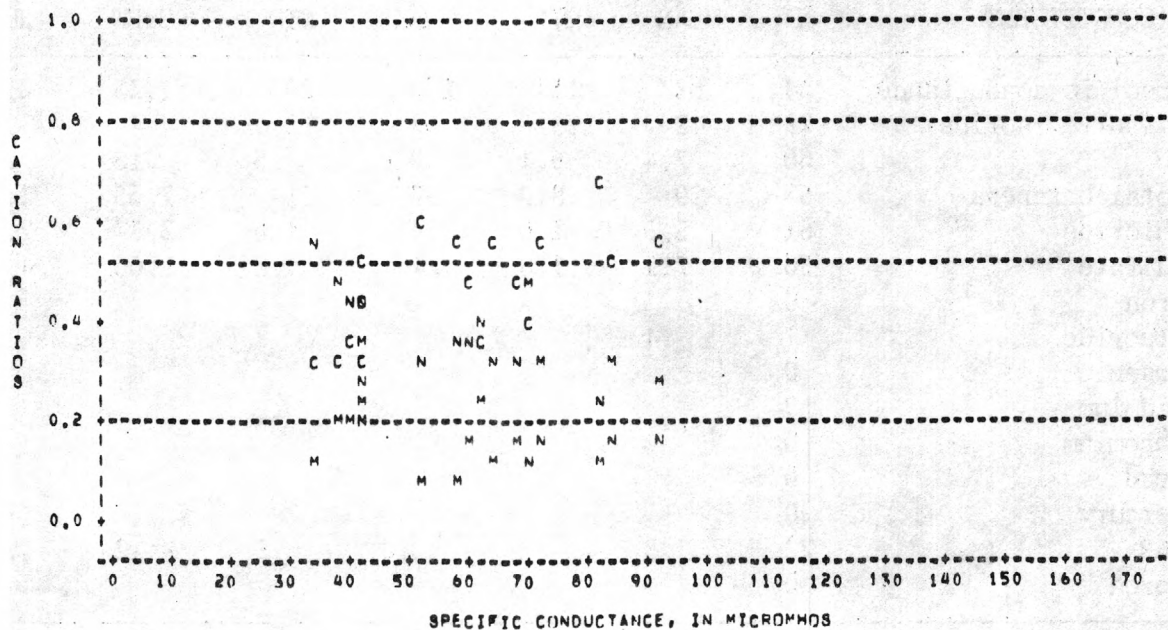
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	64	62	15	150	27	1.33	2.04
Dissolved solids	22	42	23	67	12	.48	-.48
pH	66	7.4	6.1	9.0	.5	.18	.16
Total hardness	53	29	8.0	97	21	1.65	2.32
Chloride	61	5.5	1.0	24	4.6	2.57	7.07
Sulfate	50	7.2	1.0	24	4.2	1.66	4.27
Iron	0						
Fluoride	1	.4					
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	22	.5	.2	.8	.2	-.12	-1.06
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	33	42	58	71	101
Dissolved solids	26	34	38	53	59
pH	6.7	7.1	7.4	7.8	8.1
Total hardness	10	14	20	37	63
Chloride	2.3	3.0	4.0	6.0	10
Sulfate	3.8	4.2	6.0	9.2	12
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.3	.5	.6	.7
Boron					

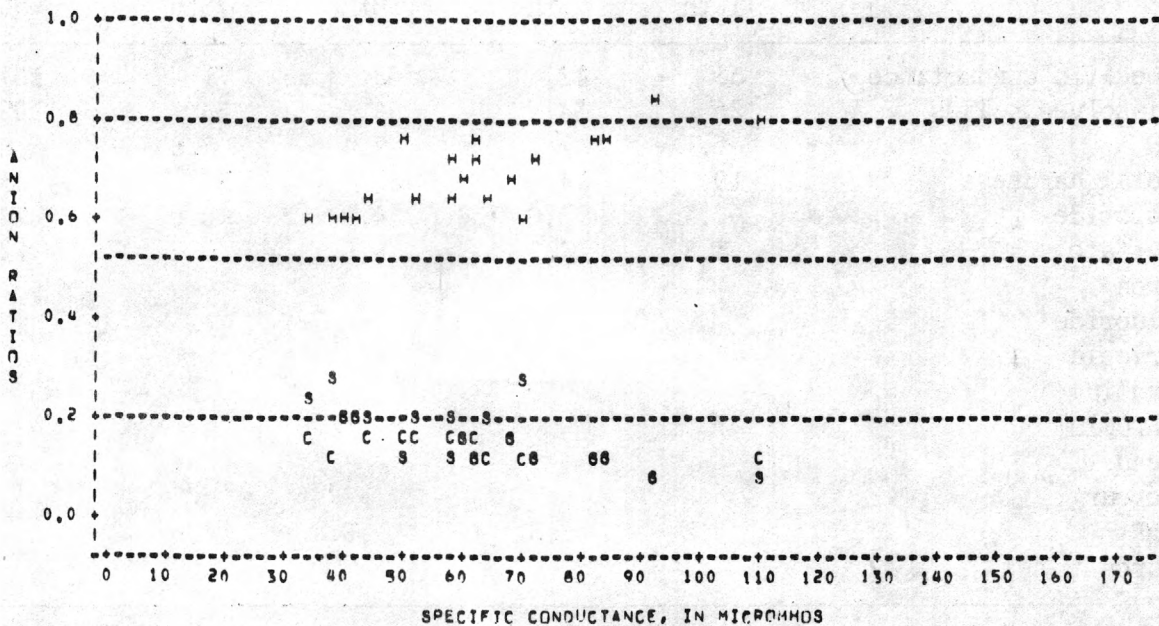
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=GLOVER CREEK NR GLOVER, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=GLOVER CREEK NR GLOVER, OK

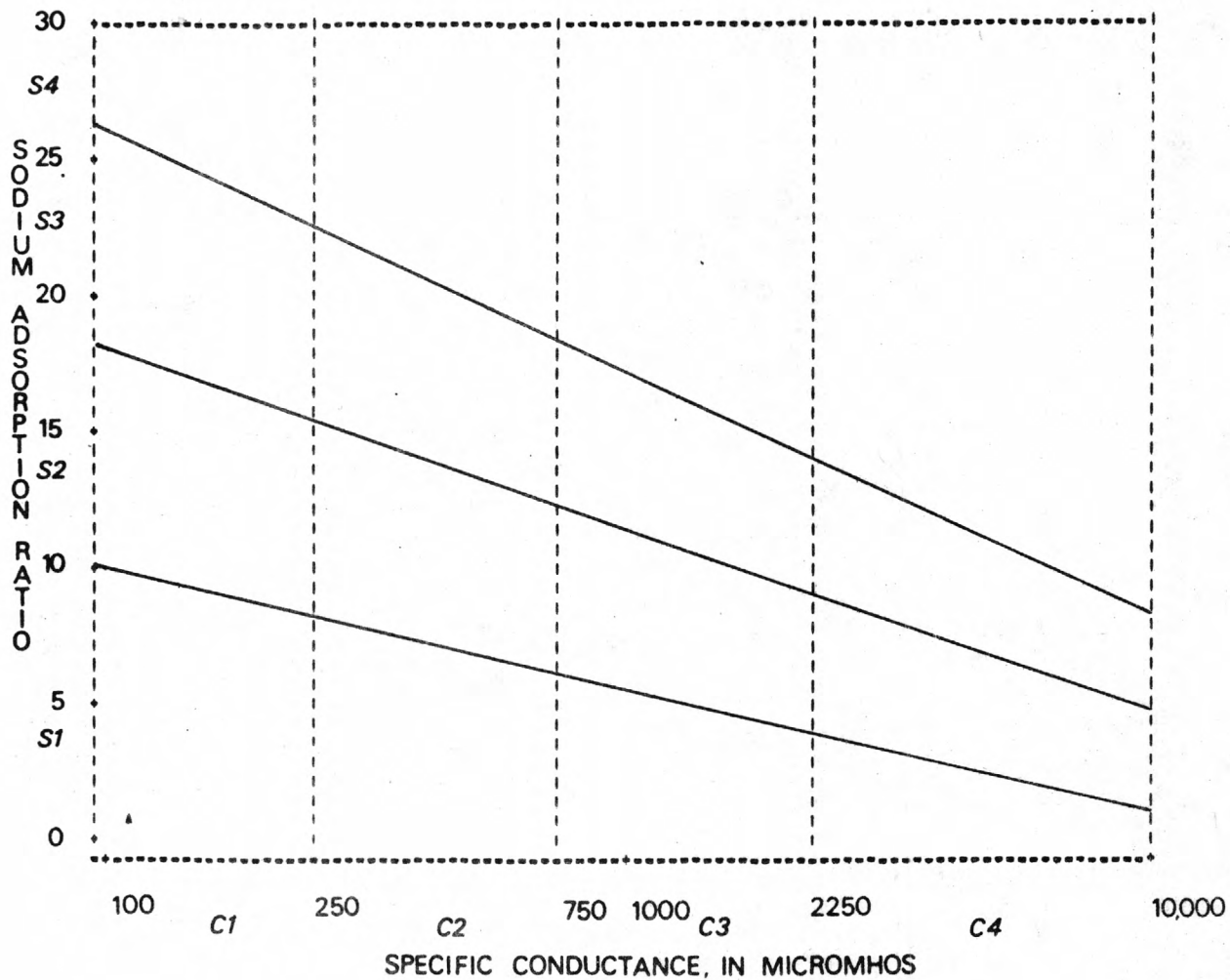


IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD

A = 1 DBS, B = 2 DBS, C = 3 DBS

STATION NAME OR LOCAL IDENTIFIER: GLOVER CREEK NR GLOVER, UK



RED RIVER MAINSTEM

07335700 - Kiamichi River near Big Cedar, Okla.

LOCATION.--Lat 34°38'18", long 94°36'45", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, T.2 N., R.26 E., Le Flore County, at bridge on State Highway 63, 0.2 mi upstream from Rattlesnake Creek, 1.1 mi upstream from Big Branch, 2.1 mi east of Big Cedar, and at mile 157.6.

DRAINAGE AREA.--40.1 mi².

PERIOD OF RECORD.--1966 to 1979.

WATER TYPE.--The water was sodium carbonate/bicarbonate type throughout the range of measured specific conductance.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time indicate the possibility of a trend of increasing concentration for hardness. The Spearman's rhos at the 95-percent probability level indicate positive trend for hardness and no trends for dissolved solids, sulfate, and chloride.

PUBLIC WATER SUPPLY.--The average hardness concentration was 7.2 mg/L and all of the hardness values had concentrations less than 60 mg/L. The hardness classification for this water is soft. None of the measured constituents exceeded their recommended maximum limits. The maximum contaminant levels for cadmium, chromium, and lead were not exceeded. Data are not available for arsenic and mercury. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects should not occur.

UNIVARIATE STATISTICS

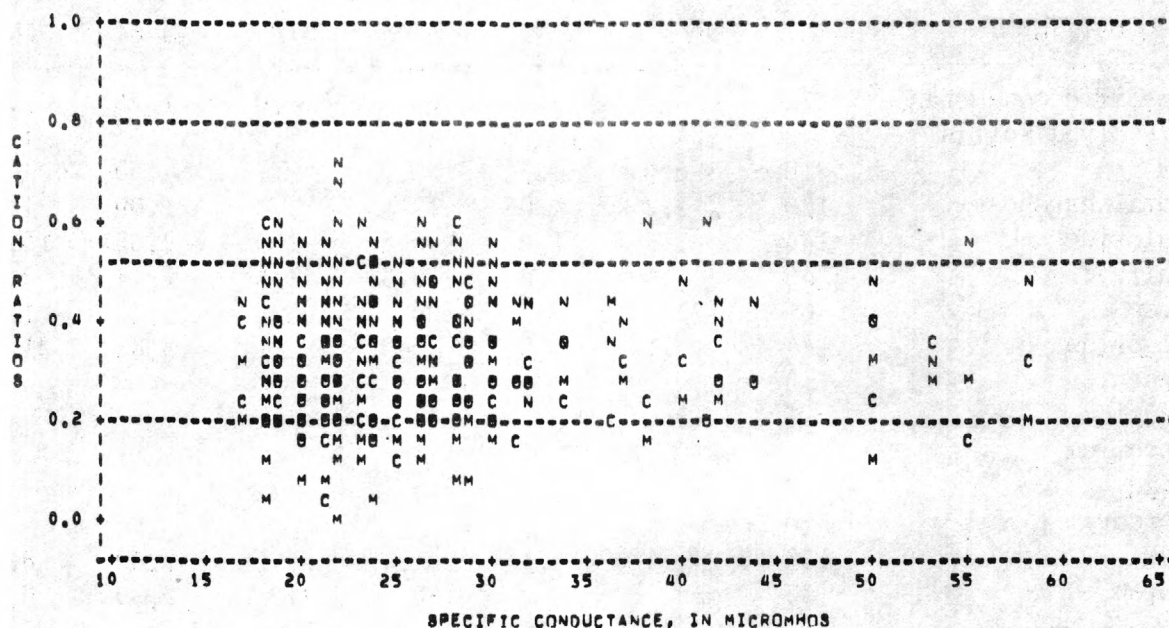
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	222	26	15	63	8.0	1.75	3.67
Dissolved solids	142	24	10	45	5.6	.65	1.17
pH	219	6.9	5.2	9.0	.7	.60	.84
Total hardness	139	7.2	1.0	17	2.8	1.09	1.35
Chloride	146	2.5	1.0	9.6	1.0	2.96	15.90
Sulfate	145	3.6	.8	9.3	1.5	1.14	2.02
Iron	61	77	0	300	66	1.20	1.63
Fluoride	144	.1	.0	.9	.1	3.82	21.15
Arsenic	0						
Cadmium	3	2	0	7			
Chromium	1	0					
Lead	7	1	0	10			
Mercury	0						
SAR	139	.4	.1	1.0	.1	2.09	6.21
Boron	92	29	0	160	24	2.29	9.78

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	19	21	24	29	38
Dissolved solids	18	20	23	27	31
pH	6.3	6.6	6.9	7.3	7.9
Total hardness	4.0	5.0	7.0	8.0	11
Chloride	1.6	1.9	2.2	3.0	3.4
Sulfate	2.0	2.6	3.4	4.2	5.9
Iron	0	35	70	105	178
Fluoride	.0	.0	.1	.1	.2
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.3	.4	.4	.5
Boron	0	14	30	40	50

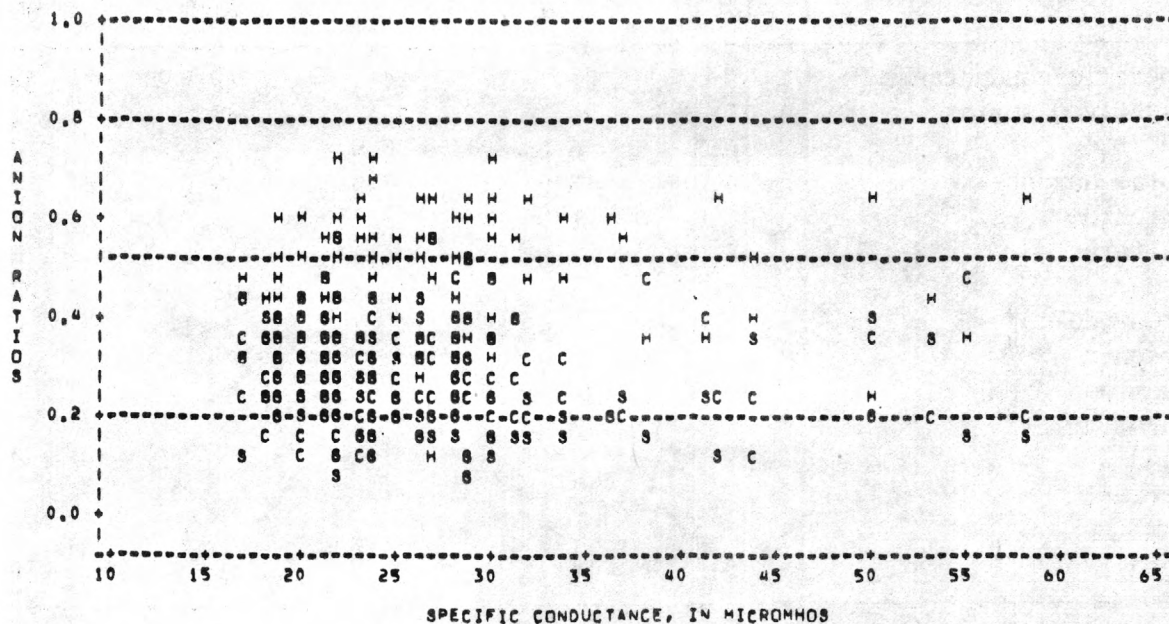
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR BIG CEDAR, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR BIG CEDAR, OK



No Irrigation Diagram.

RED RIVER MAINSTEM

07336200 - Kiamichi River near Antlers, Okla.

LOCATION.--Lat 34°14'55", long 95°36'18", in SW $\frac{1}{4}$ sec. 35, T.3 S., R.16 E., Pushmataha County, at bridge on U.S. Highway 271 and State Highway 2, 2.0 mi northeast of Antlers, 7.7 mi downstream from Tenmile Creek, 5.4 mi upstream from Cedar Creek, and at mile 59.6.

DRAINAGE AREA.--1,138 mi².

PERIOD OF RECORD.--1976 to 1979.

WATER TYPE.--The data are insufficient to determine the water type or the relation between water type and specific conductance.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 27 mg/L and for 92 percent of the hardness values the concentration was less than 60 mg/L. The hardness classification for this water is soft. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples. The only SAR value was equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

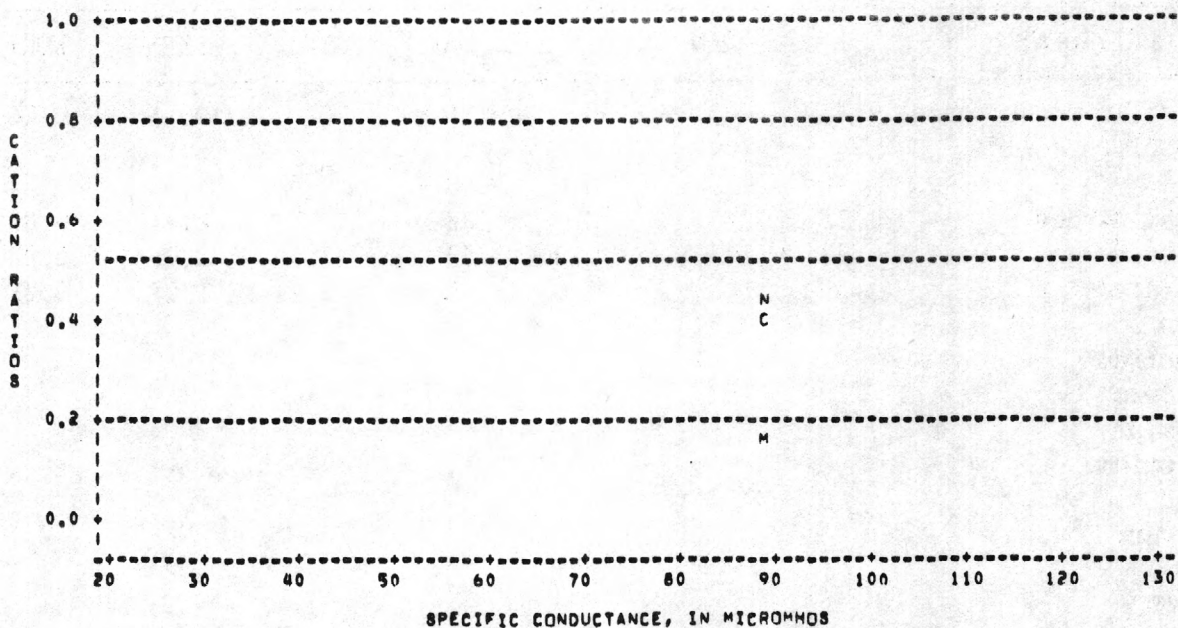
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	43	70	30	125	20	0.33	0.26
Dissolved solids	1	70					
pH	46	7.2	6.0	8.7	.6	.32	.27
Total hardness	33	27	12	88	17	2.41	6.02
Chloride	43	10	1.0	42	7.5	2.25	6.90
Sulfate	30	14	3.0	44	8.4	1.97	5.28
Iron	0						
Fluoride	1	.3					
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	1	.8					
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	43	58	70	85	94
Dissolved solids					
pH	6.6	6.9	7.2	7.6	8.1
Total hardness	14	18	21	28	48
Chloride	4.0	6.0	8.0	12	21
Sulfate	5.2	8.0	12	16	23
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR					
Boron					

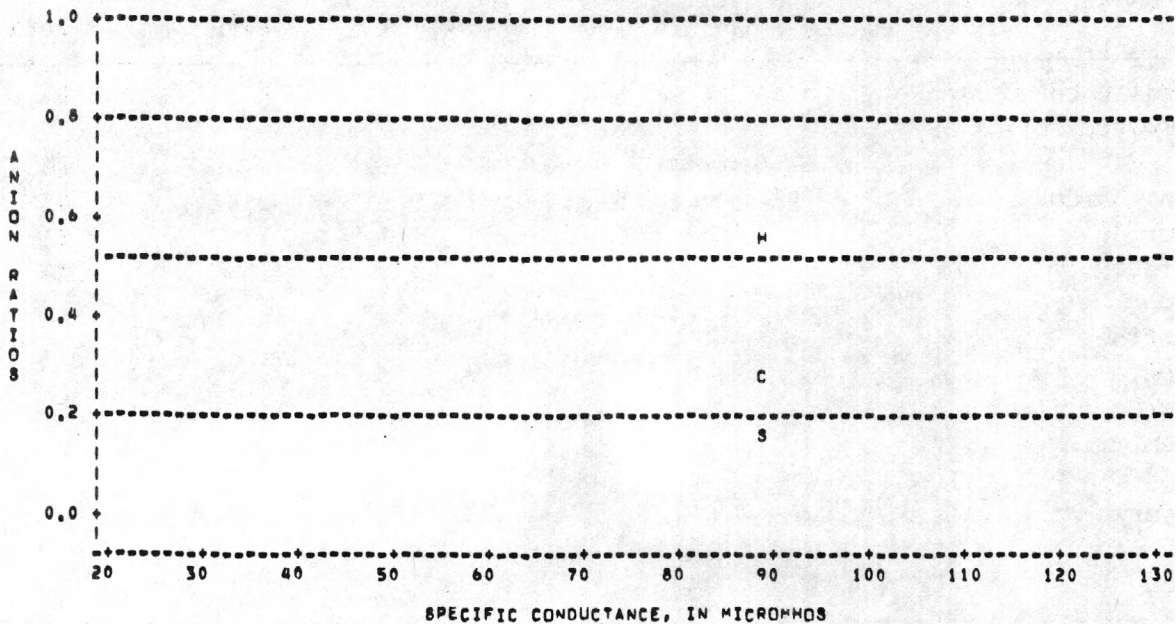
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR ANTLERS, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR ANTLERS, OK



No Irrigation Diagram.

RED RIVER MAINSTEM

07336500 - Kiamichi River near Belzoni, Okla.

LOCATION.--Lat 34°12'02", long 95°29'03", in SE¼ sec. 14, T.4 S., R.17 E., Pushmataha County, at bridge on State Highway 7, 1.8 mi northwest of Belzoni, and at mile 47.7.

DRAINAGE AREA.--1,423 mi².

PERIOD OF RECORD.--1948 to 1954, 1962 to 1963.

WATER TYPE.--When the specific conductance was less than 120 umho, which accounted for 95 percent of the samples, the water was a mixed cation carbonate/bicarbonate type. For specific conductance greater than 120 umho the water was mixed type.

TREND.--There are no current data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 19 mg/L and all of the hardness values had a concentration of less than 60 mg/L. The hardness classification for this water is soft. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects should not occur.

UNIVARIATE STATISTICS

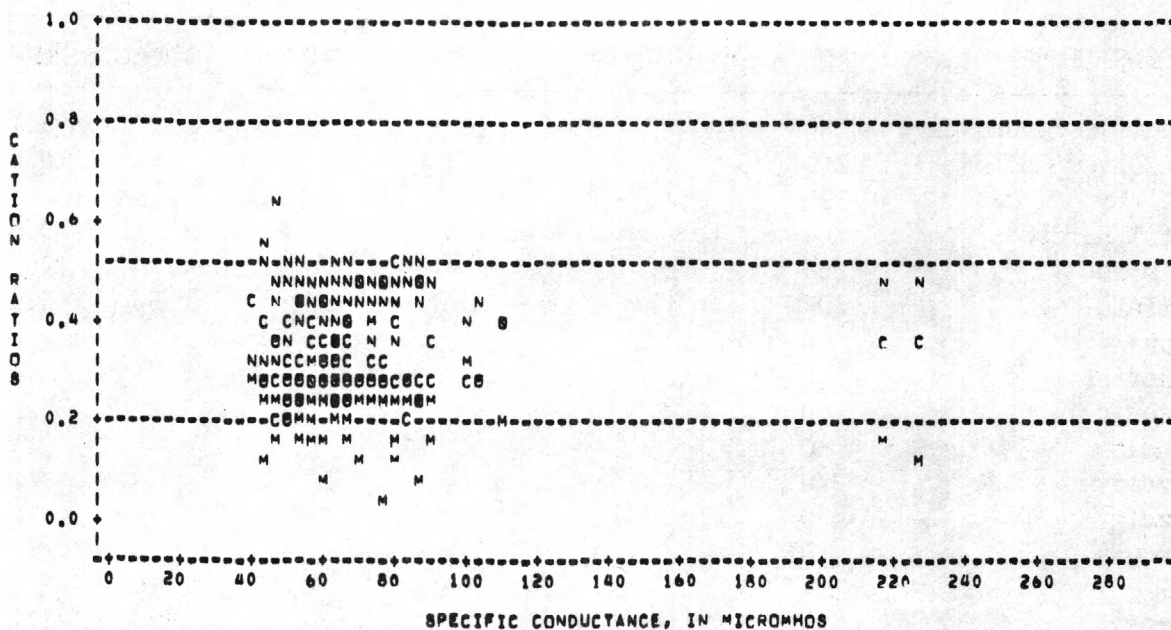
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	204	66	39	228	32	2.97	5.13
Dissolved solids	204	63	25	145	17	2.46	10.22
pH	123	7.1	6.0	8.2	.4	.09	.14
Total hardness	204	19	11	50	6.8	2.81	9.47
Chloride	204	6.9	2.5	41	6.5	4.16	17.53
Sulfate	204	6.1	2.8	14	2.0	1.50	3.13
Iron	0						
Fluoride	66	.2	.0	1.0	.2	2.21	7.25
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	114	.7	.2	1.4	.2	1.16	1.78
Boron	28	221	0	740	176	.99	1.23

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	44	51	59	71	123
Dissolved solids	48	54	62	68	90
pH	6.6	6.8	7.1	7.3	7.6
Total hardness	14	15	18	21	30
Chloride	3.5	4.2	5.5	6.6	15
Sulfate	4.0	4.7	5.8	7.0	9.8
Iron					
Fluoride	.0	.0	.1	.3	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.6	.6	.7	1.3
Boron	0	70	185	302	623

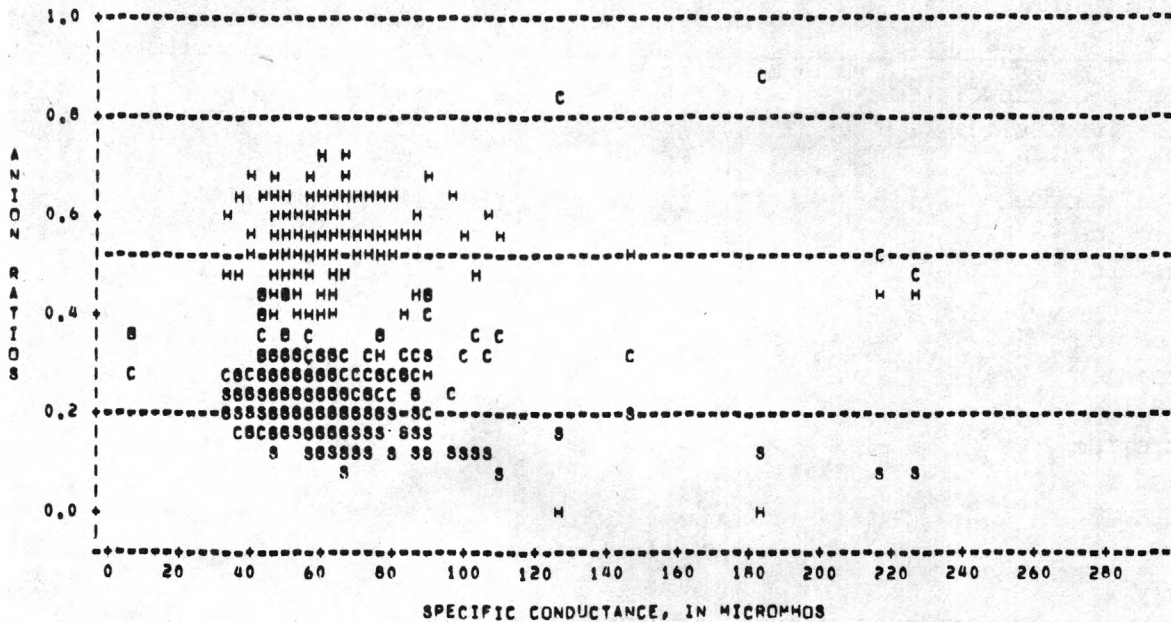
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR BELZONI, OK



ANION RATIO PLOT

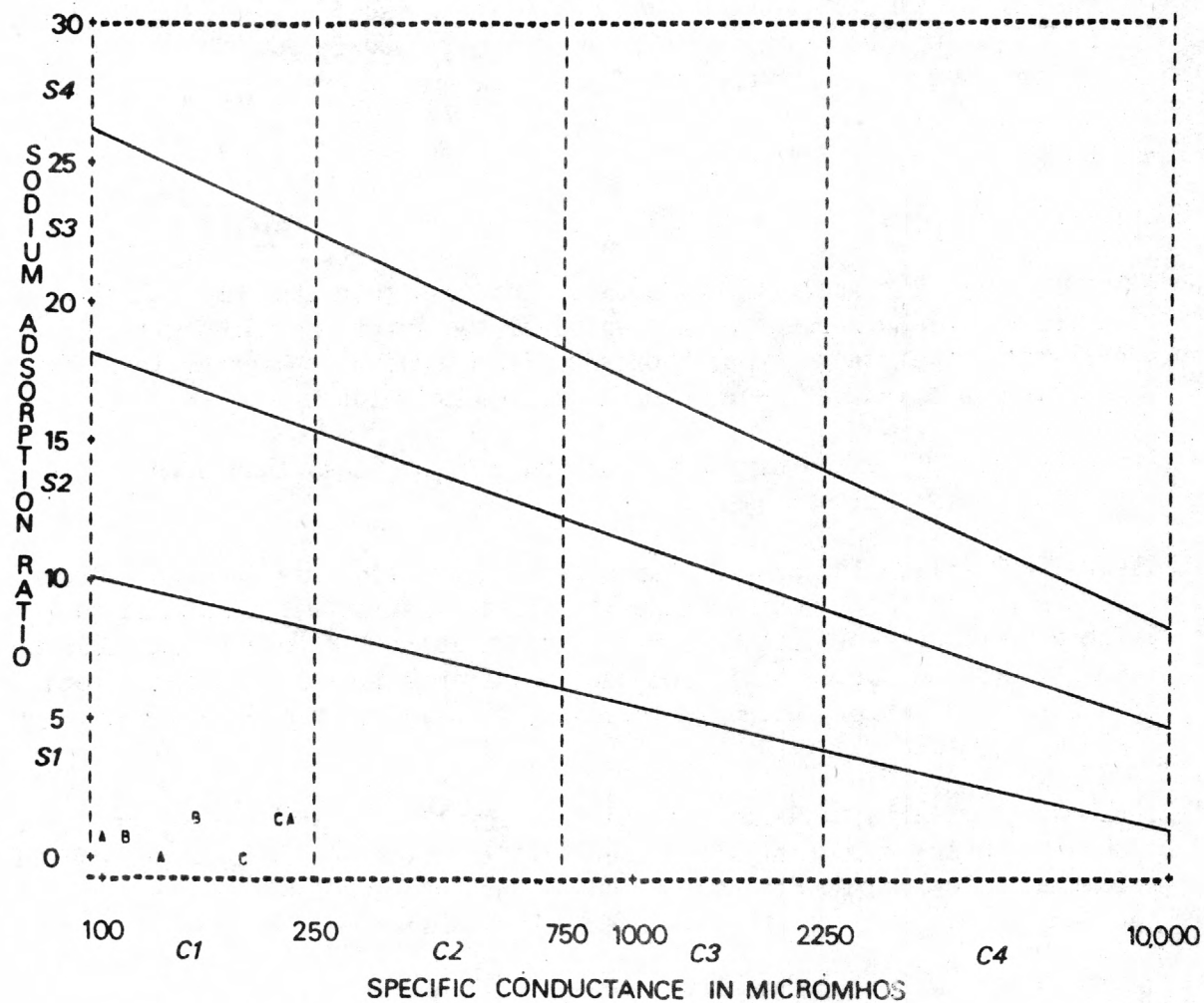
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR BELZONI, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=KIAMICHI RIVER NR BELZONI, OK



RED RIVER MAINSTEM

07336700 - Kiamichi River near Sawyer, Okla.

LOCATION.--Lat 34°00'30", long 95°23'00", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 25, T.6 S., R.18 E., Choctaw County, at bridge on U.S. Highway 71, 900 ft downstream from Hugo Dam, and 0.5 mi southwest of Sawyer.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1962, 1978 to 1979.

WATER TYPE.--When the specific conductance was less than 200 umho, which accounted for 89 percent of the samples, the water was mixed cation carbonate/bicarbonate type. For specific conductance greater than 200 umho the data indicate the water is sodium chloride type.

TREND.--The current period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 30 mg/L and for 94 percent of the hardness values the concentration was less than 60 mg/L. The hardness classification for this water is soft. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 90 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

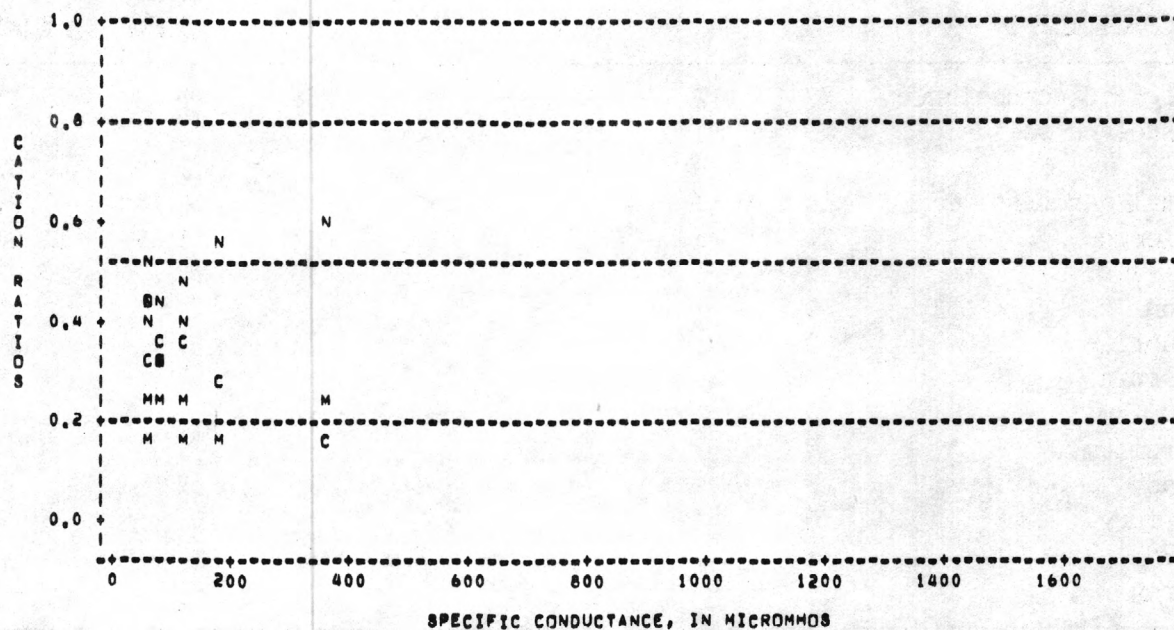
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	27	147	30	1,400	258	4.77	23.71
Dissolved solids	9	83	42	218			
pH	32	7.2	6.2	8.3	.5	.19	.07
Total hardness	18	30	14	64	12	1.18	1.98
Chloride	26	16	1.0	130	27	3.59	13.60
Sulfate	26	12	4.8	59	10	4.00	17.95
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	9	1.0	.5	2.6			
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	50	60	86	114	215
Dissolved solids					
pH	6.7	6.8	7.2	7.6	8.0
Total hardness	15	22	28	37	49
Chloride	2.7	4.9	7.5	12	45
Sulfate	6.1	6.8	8.5	12	20
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR					
Boron					

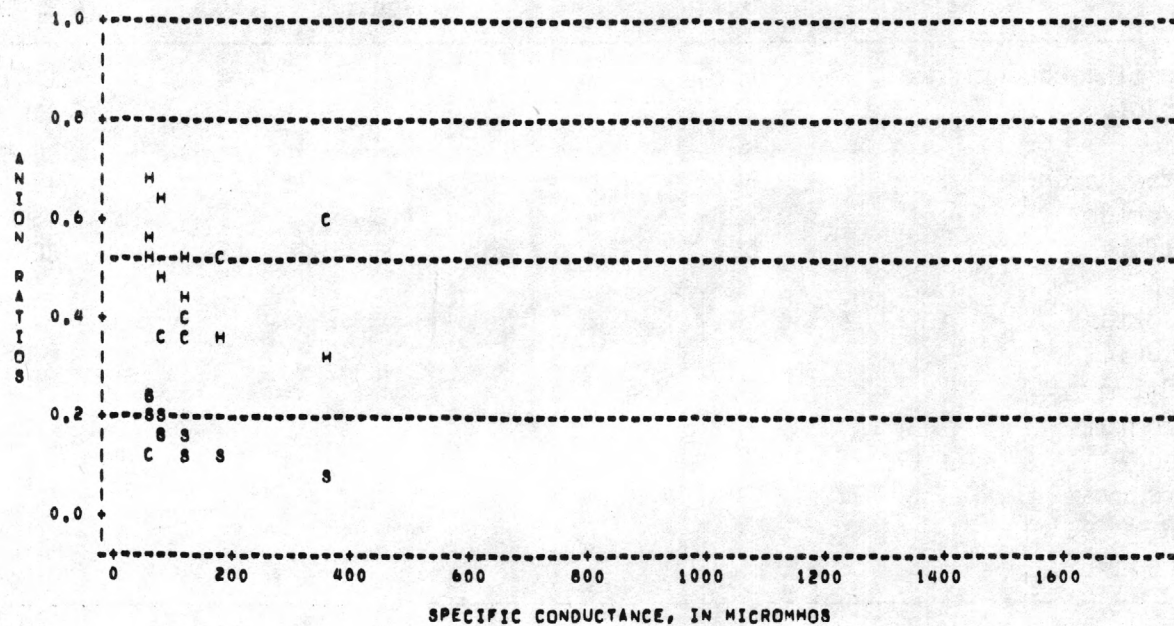
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER KIAMICHI RIVER NR SAWYER, OK



ANION RATIO PLOT

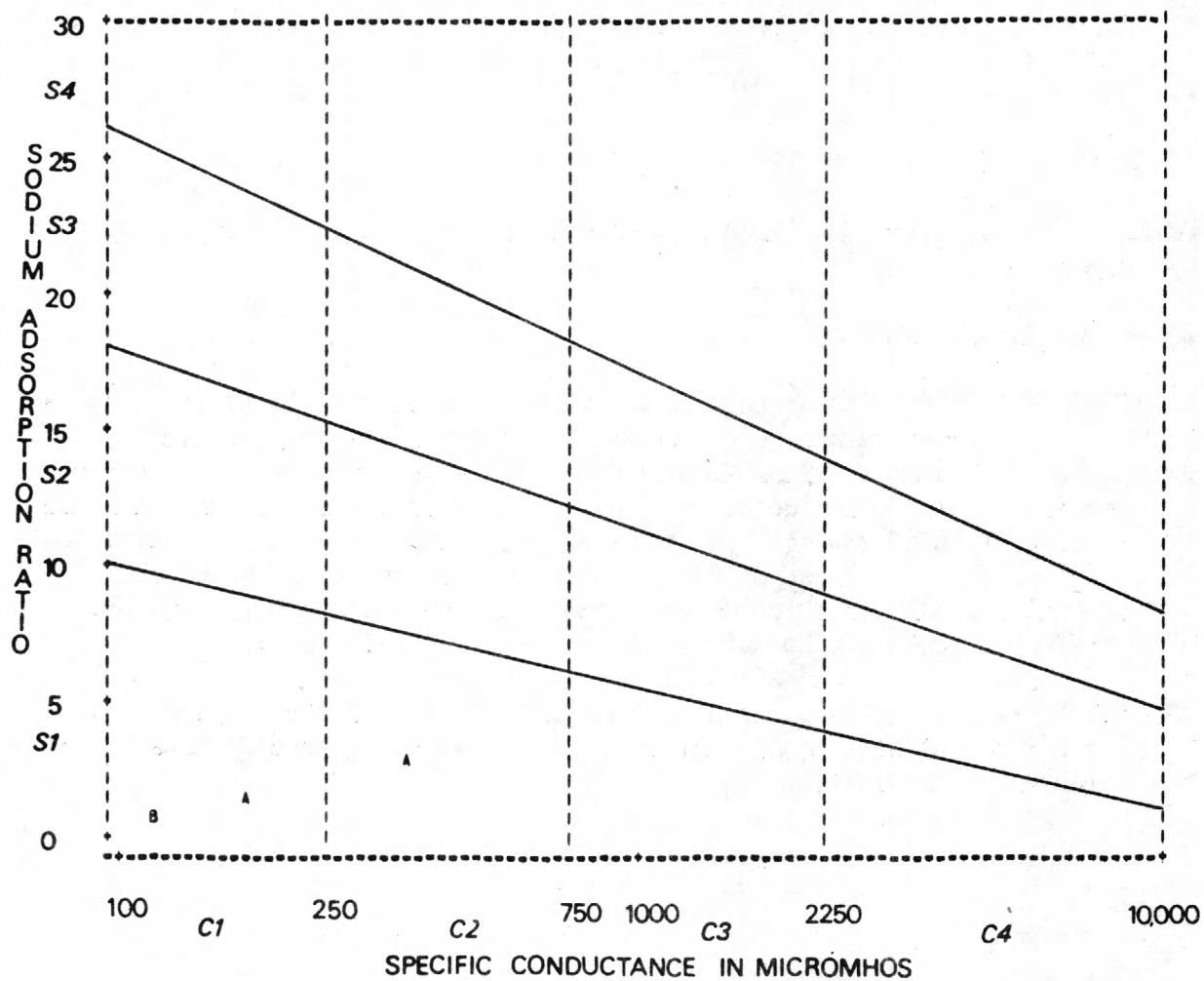
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER KIAMICHI RIVER NR SAWYER, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 DBS, B = 2 DBS, C = 3 DBS

STATION NAME OR LOCAL IDENTIFIER KIAMICHI RIVER NR SAWYER, OK



RED RIVER MAINSTEM

07299710 - Lebos Creek near Eldorado, Okla.

LOCATION.--Lat 34°28'45", long 99°40'40", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 11, T.1 S., R.24 W., Jackson County, at bridge on State Highway 5, 1.5 mi northwest of Eldorado.

DRAINAGE AREA.--280 mi².

PERIOD OF RECORD.--1952 to 1955, 1958, 1962 to 1963.

WATER TYPE.--The water was mixed type throughout the range of measured specific conductance.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 2,261 mg/L and all of the hardness values were greater than the very hard class limit of 180 mg/L. The hardness classification for this water is very hard. All of the sulfate and chloride concentrations exceeded the recommended maximum concentration of 250 mg/L for these two constituents. No toxic metal data are available. Because of the magnitude and frequency by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was very high for all of the samples. All of the SAR values were equivalent to a high or very high sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

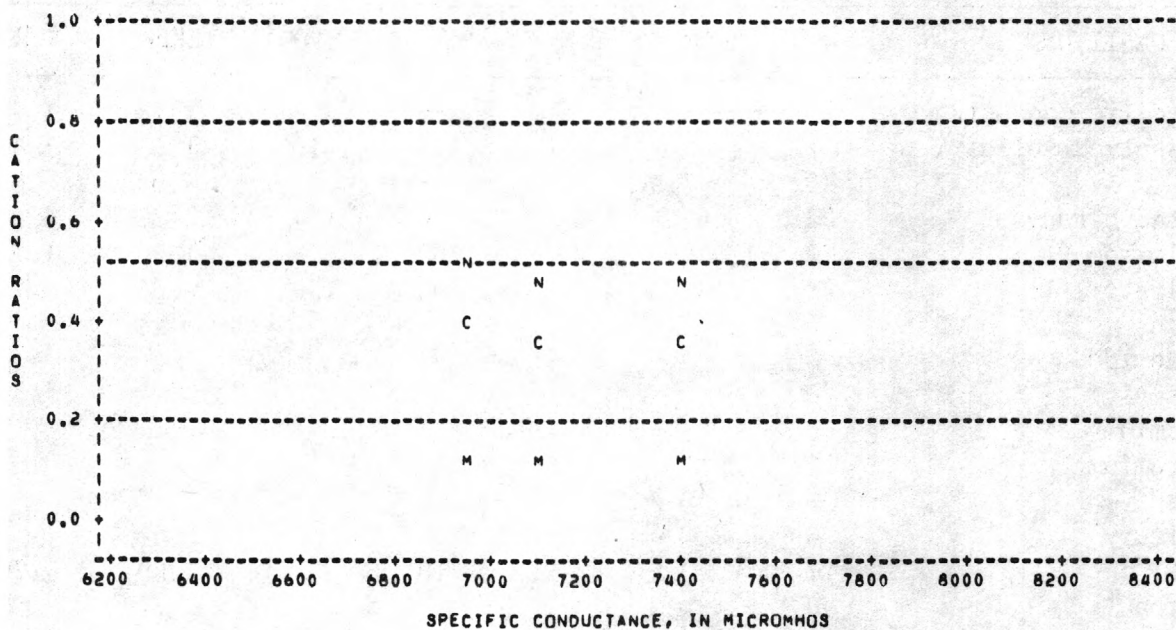
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	22	7,588	6,220	8,280	478	-1.18	1.77
Dissolved solids	22	5,948	4,640	6,440	416	-1.63	3.46
pH	22	7.9	7.4	8.1	.2	-.68	.02
Total hardness	22	2,261	1,650	2,450	174	-2.23	6.68
Chloride	22	1,585	1,200	1,750	139	-1.20	1.34
Sulfate	22	2,067	1,700	2,300	139	-.65	.73
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	22	9.5	8.3	10	.4	-.80	.76
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	6,959	7,283	7,680	7,925	8,090
Dissolved solids	5,400	5,693	6,070	6,213	6,388
pH	7.5	7.7	7.9	8.0	8.1
Total hardness	2,065	2,175	2,310	2,360	2,428
Chloride	1,371	1,495	1,600	1,700	1,720
Sulfate	1,906	1,995	2,065	2,185	2,217
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	9.0	9.1	9.5	9.9	10
Boron					

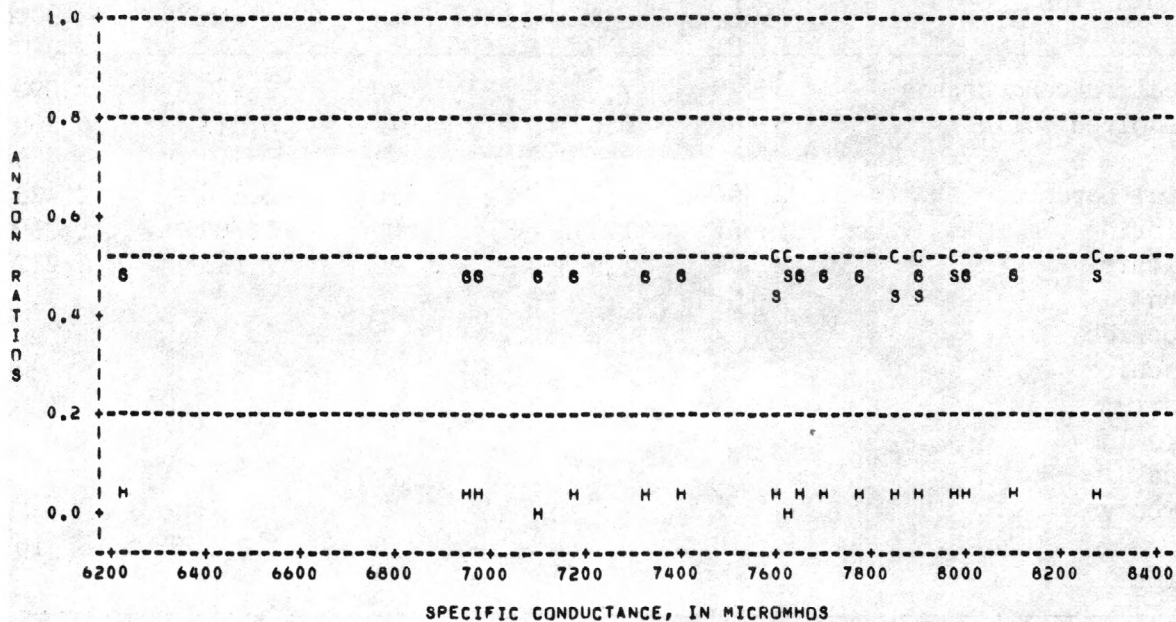
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LEBOS CREEK NR ELDORADO, OK



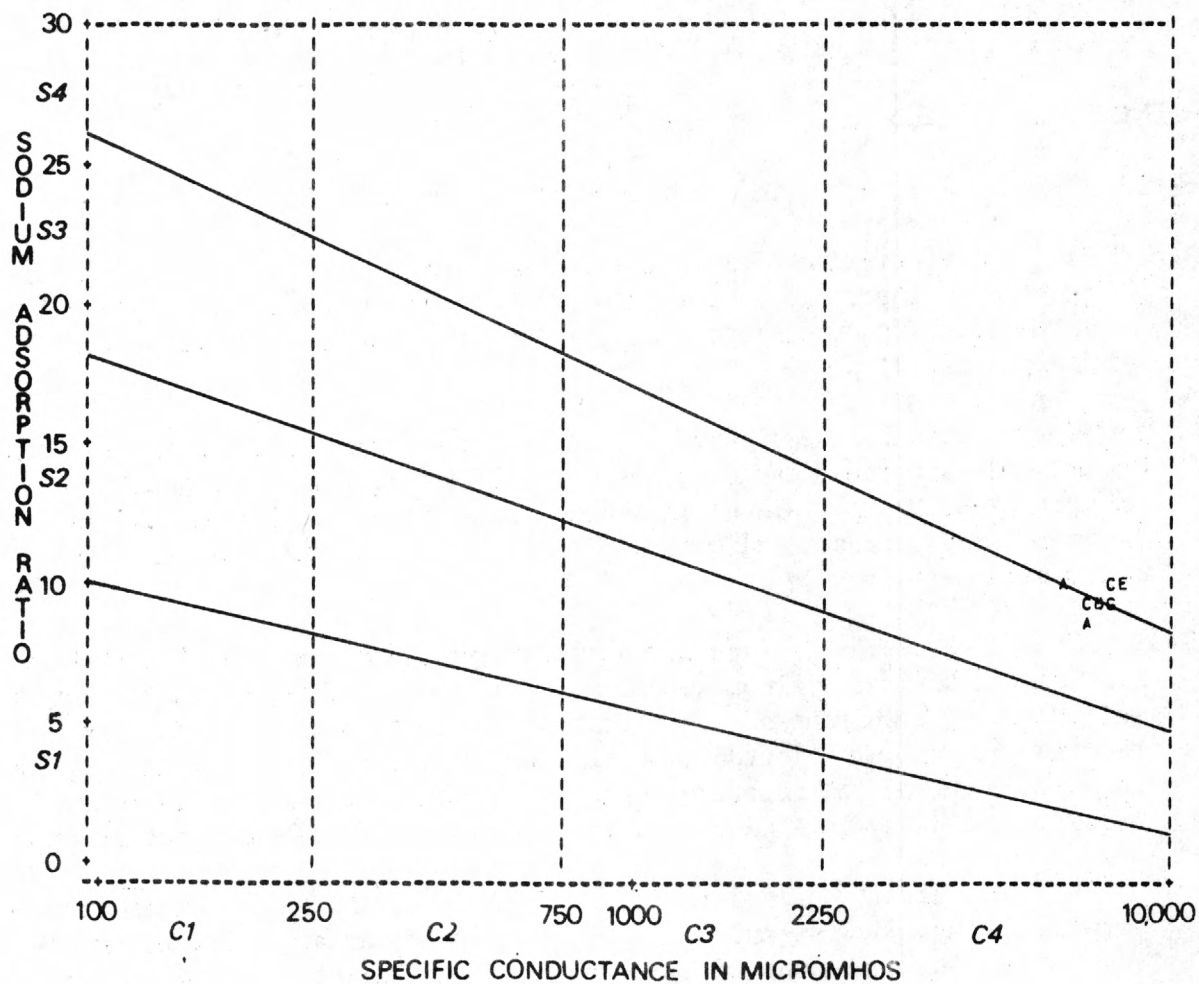
ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LEBOS CREEK NR ELDORADO, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=LEBUS CREEK NR ELDORADO, OK



RED RIVER MAINSTEM

07338500 - Little River below Lukfata Creek, near Idabel, Okla.

LOCATION.--Lat 33°56'28", long 94°45'30", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 14, T.7 S., R.24 E.,
McCurtain County, at bridge on U.S. Highway 70 just downstream from
Lukfata Creek, 5.0 mi northeast of Idabel, and at mile 103.4.

DRAINAGE AREA.--1,226 mi².

PERIOD OF RECORD.--1948 to 1954, 1961 to 1963, 1969 to 1973, 1976 to 1979.

WATER TYPE.--For specific conductance less than 175 umho, which accounted for
77 percent of the samples, the water was sodium carbonate/bicarbonate type.
When the specific conductance was greater than 175 umho the water was
sodium chloride type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time
do not indicate the presence of any trend. The Spearman's rhos at the
95-percent probability level indicate a positive trend for sulfate and
no trends for hardness and chloride. No current dissolved solids data
are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 28 mg/L and 96 per-
cent of the hardness values were less than the 60 mg/L upper limit for the
soft class. The hardness classification for this water is soft. The
recommended maximum chloride concentration of 250 mg/L was exceeded by less
than 1 percent of the chloride values. There are no toxic metal data.
Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 86 percent of the
samples having a low salinity hazard. The sodium hazard ranged from low
to medium with 98 percent of the SAR values equivalent to a low sodium
hazard. The data indicate that boron phytotoxic effects should not occur.

UNIVARIATE STATISTICS

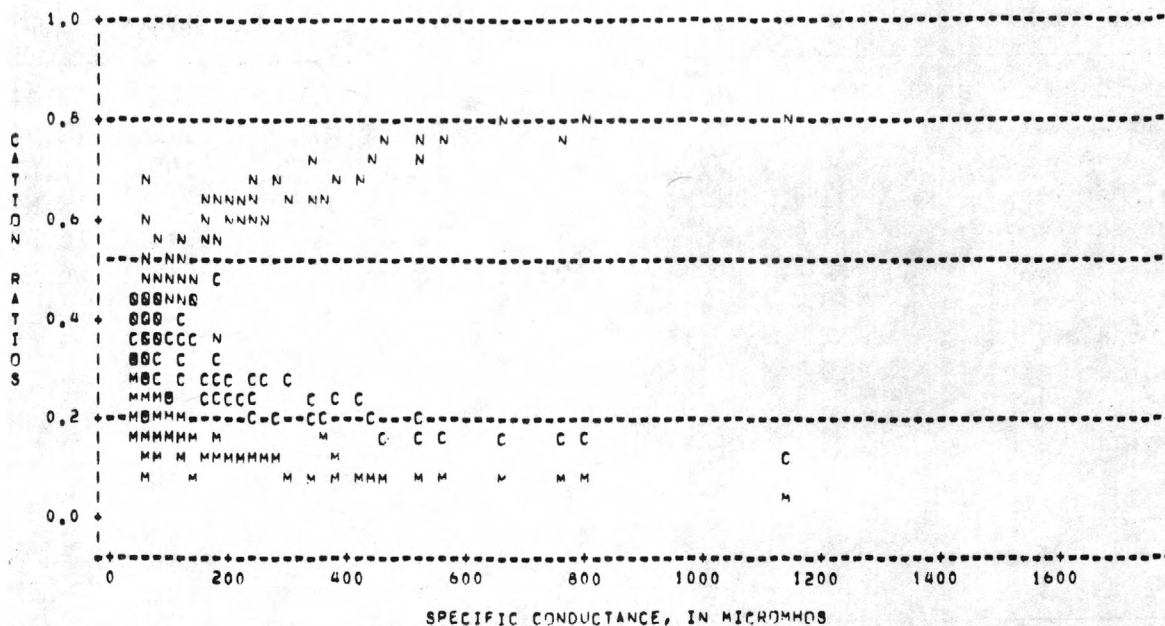
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	394	135	20	1,140	133	3.05	13.44
Dissolved solids	301	90	21	602	72	3.11	12.94
pH	306	7.2	5.2	8.5	.5	-.03	.68
Total hardness	341	28	9.0	98	15	1.49	2.64
Chloride	351	25	1.8	302	36	3.48	16.59
Sulfate	336	6.4	1.0	93	6.8	8.85	96.52
Iron	0						
Fluoride	57	.1	.0	.8	.2	2.63	8.72
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	176	1.3	.1	8.4	1.3	2.54	7.79
Boron	18	184	0	390	103	.12	-.23

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	43	57	86	165	294
Dissolved solids	45	52	63	100	179
pH	6.6	6.9	7.2	7.5	7.8
Total hardness	14	18	24	35	49
Chloride	3.5	5.4	10	28	62
Sulfate	3.3	4.0	5.0	7.0	9.7
Iron					
Fluoride	.0	.0	.1	.1	.3
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.5	.8	1.5	2.9
Boron	27	120	175	270	336

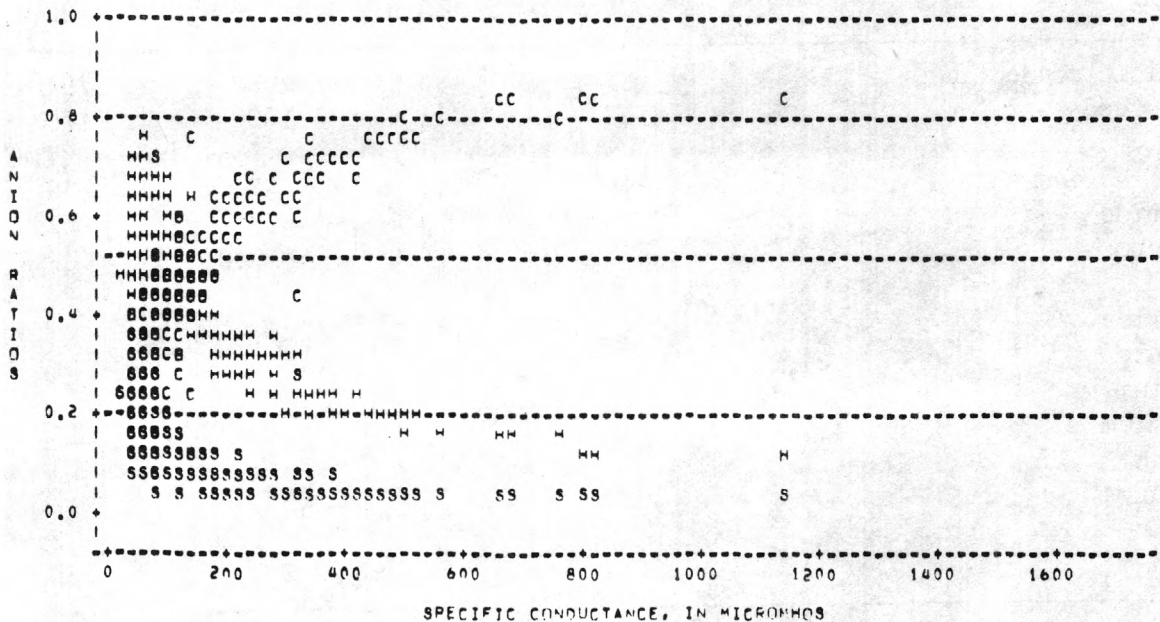
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER BLW LUKFATA CREEK, NR IDABEL, OK



ANION RATIO PLOT

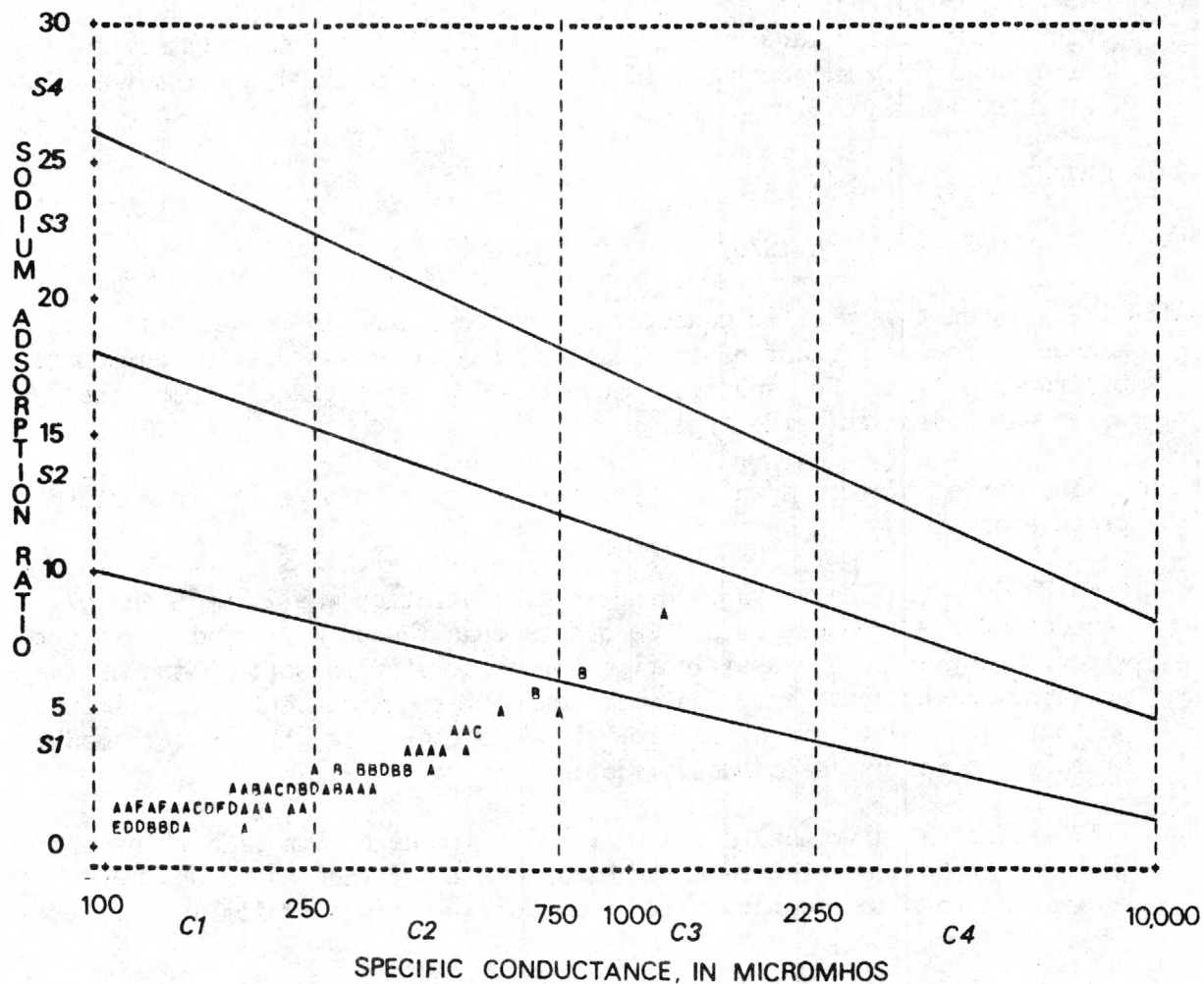
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER BLW LUKFATA CREEK, NR IDABEL, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER BLW LUKFATA CREEK, NR IDABEL, OK



RED RIVER MAINSTEM

07340000 - Little River near Horatio, Ark.

LOCATION.--Lat 33°55'10", long 94°23'15", in NE¼ sec. 10, T.10 S., R.32 W., Sevier County, at bridge on State Highway 41, 0.9 mi downstream from Rolling Fork, 2.0 mi southwest of Horatio, 28.5 mi upstream from Cossatot River, and at mile 72.0

DRAINAGE AREA.--2,674 mi².

PERIOD OF RECORD.--1978 to 1979.

WATER TYPE.--When the specific conductance was less than 100 umho, which accounted for 72 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance greater than 100 umho the water was sodium chloride type.

TREND.--The period of record was insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 23 mg/L and 97 percent of the hardness values were less than the 60 mg/L limit for soft water. The hardness classification for this water is soft. None of the measured constituents exceeded recommended maximum concentration limits. No toxic metal data are available. Based on the data, this water should be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 91 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

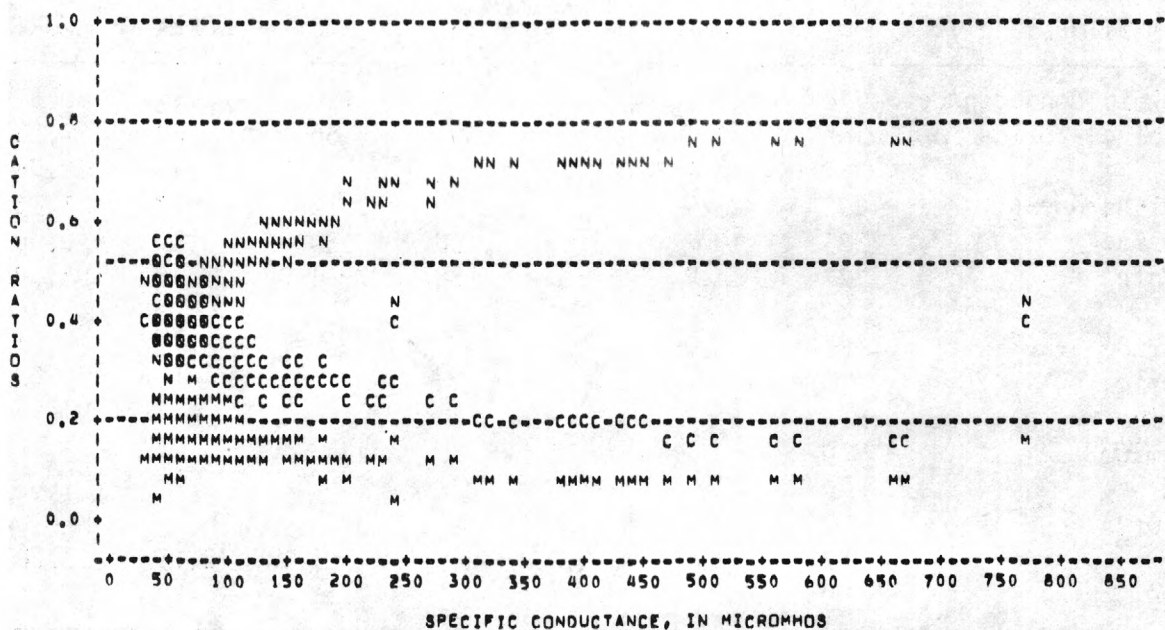
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	372	111	24	767	116	2.97	9.57
Dissolved solids	265	85	27	399	66	2.67	7.63
pH	372	6.9	5.8	8.1	.3	.13	.78
Total hardness	292	23	5.0	70	12	1.77	3.16
Chloride	353	19	.5	180	30	3.16	10.66
Sulfate	327	4.7	.8	58	4.0	8.10	96.50
Iron	0						
Fluoride	105	.2	.0	.4	.1	.72	-.04
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	252	1.1	.2	5.2	1.1	2.09	3.78
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	42	52	72	106	228
Dissolved solids	43	50	61	86	178
pH	6.5	6.6	6.9	7.1	7.3
Total hardness	13	15	19	26	39
Chloride	3.3	4.8	8.5	17	47
Sulfate	2.0	3.0	4.0	5.4	7.0
Iron					
Fluoride	.0	.1	.1	.2	.3
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.4	.7	1.2	3.1
Boron					

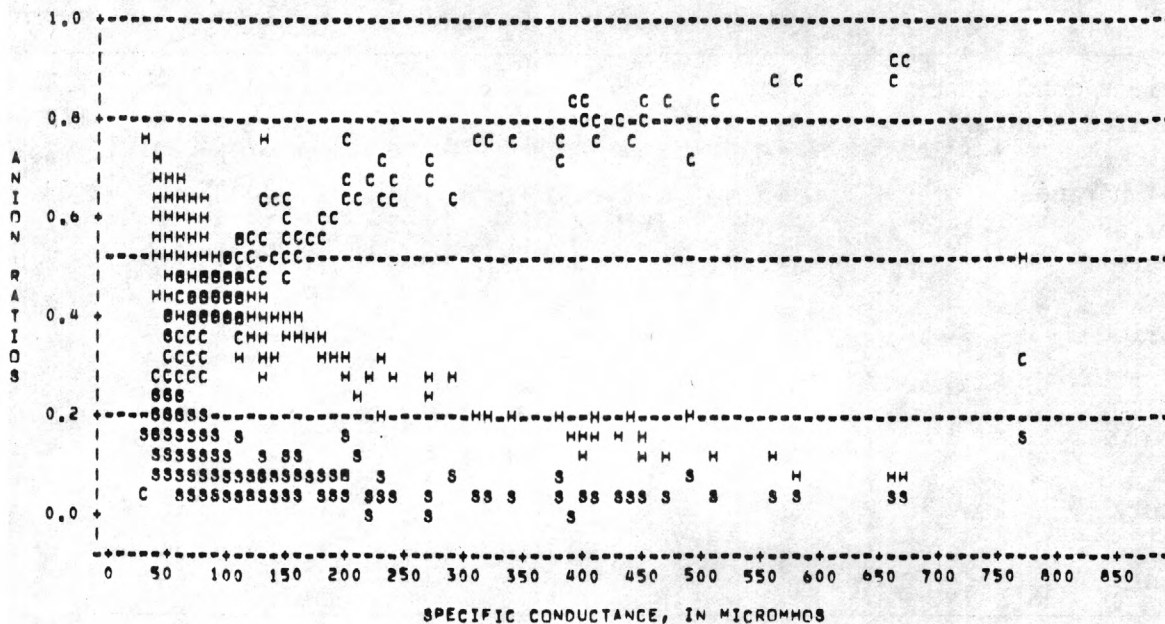
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER NEAR HORATIO, ARK.



ANION RATIO PLOT

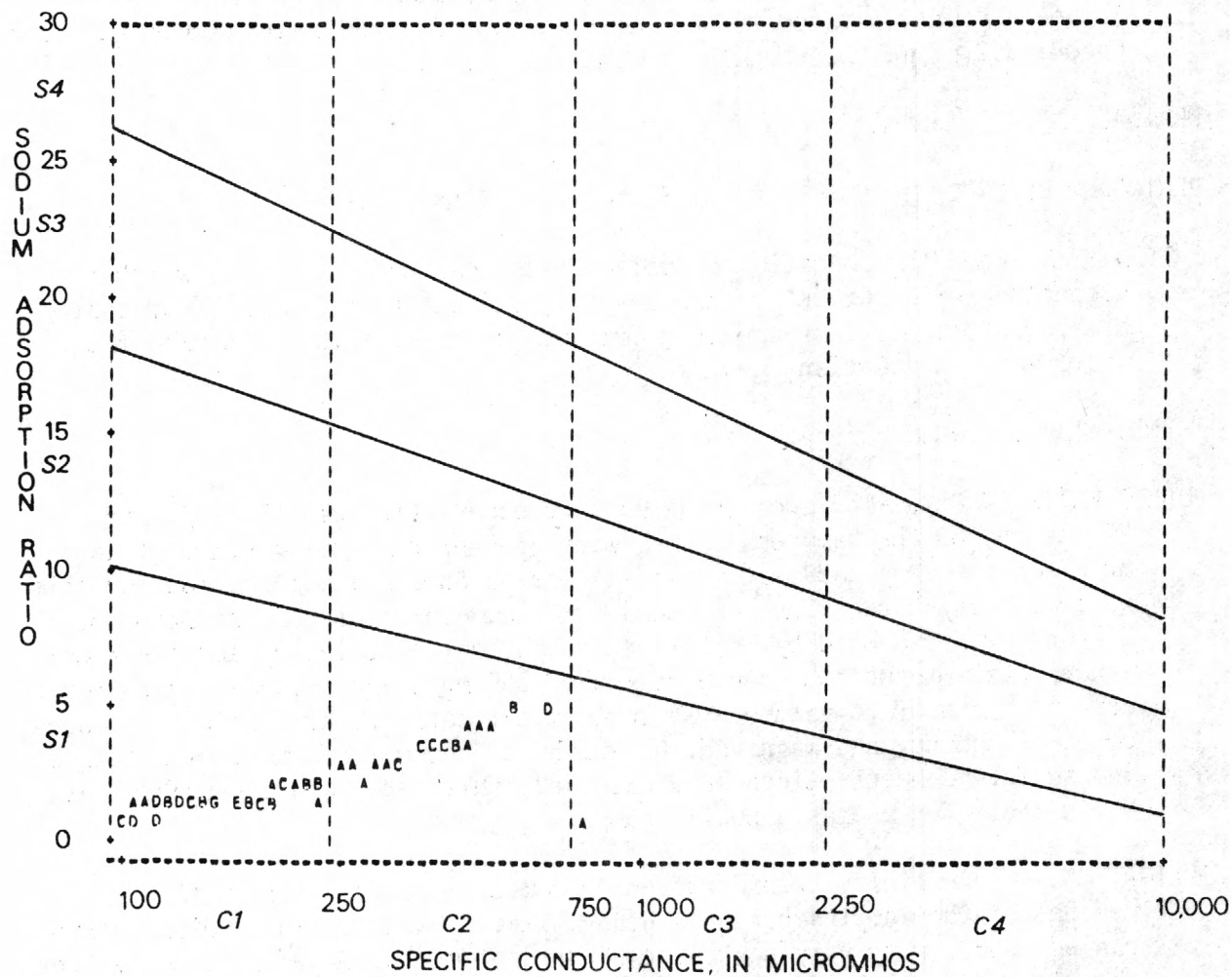
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER NEAR HORATIO, ARK.



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=LITTLE RIVER NEAR MORATIO, ARK.



RED RIVER MAINSTEM

07313000 - Little Beaver Creek near Duncan, Okla.

LOCATION.--Lat 34°29'35", long 98°06'50", in NE¼ sec. 11, T.1 S., R.9 W., Stephens County, at county road bridge, 0.8 mi downstream from Stage Stand Creek, 8.2 mi west of Duncan, and at mile 11.9.

DRAINAGE AREA.--158 mi².

PERIOD OF RECORD.--1948 to 1949, 1951 to 1956, 1958 to 1963.

WATER TYPE.--When the specific conductance was less than 600 umho, which accounted for 8 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance greater than 600 umho the water was mixed cation chloride type.

TREND.--There are no current data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 534 mg/L and 96 percent of the hardness values were greater than the minimum of 180 mg/L for the very hard water class. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 36 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 50 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would probably not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 83 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to very high with 98 percent of the SAR values equivalent to a low sodium hazard. None of the boron values exceeded the 750 ug/L limit for boron-sensitive plants.

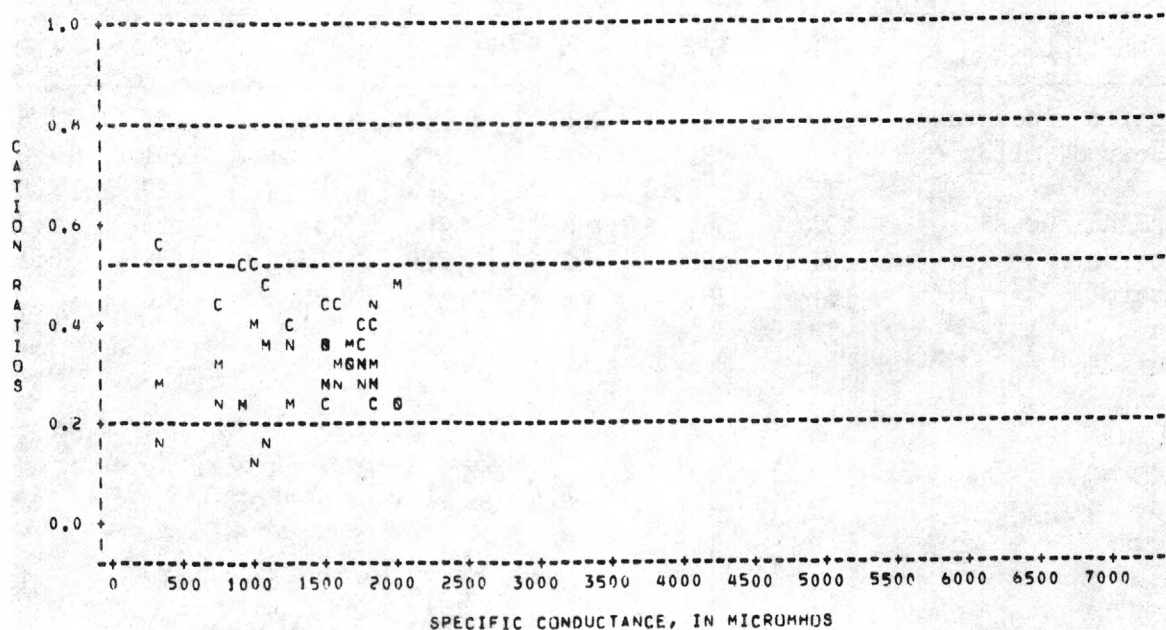
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	201	1,411	296	6,740	650	2.97	22.81
Dissolved solids	180	953	194	4,020	418	2.51	17.05
pH	85	8.0	7.0	8.7	.3	-.59	.80
Total hardness	192	534	108	1,400	181	.13	2.28
Chloride	201	209	12	2,280	203	5.98	56.13
Sulfate	181	235	23	396	80	-.60	-.26
Iron	0						
Fluoride	6	.4	.3	.5			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	31	1.8	.3	3.9	.8	.12	.12
Boron	4	175	140	230			

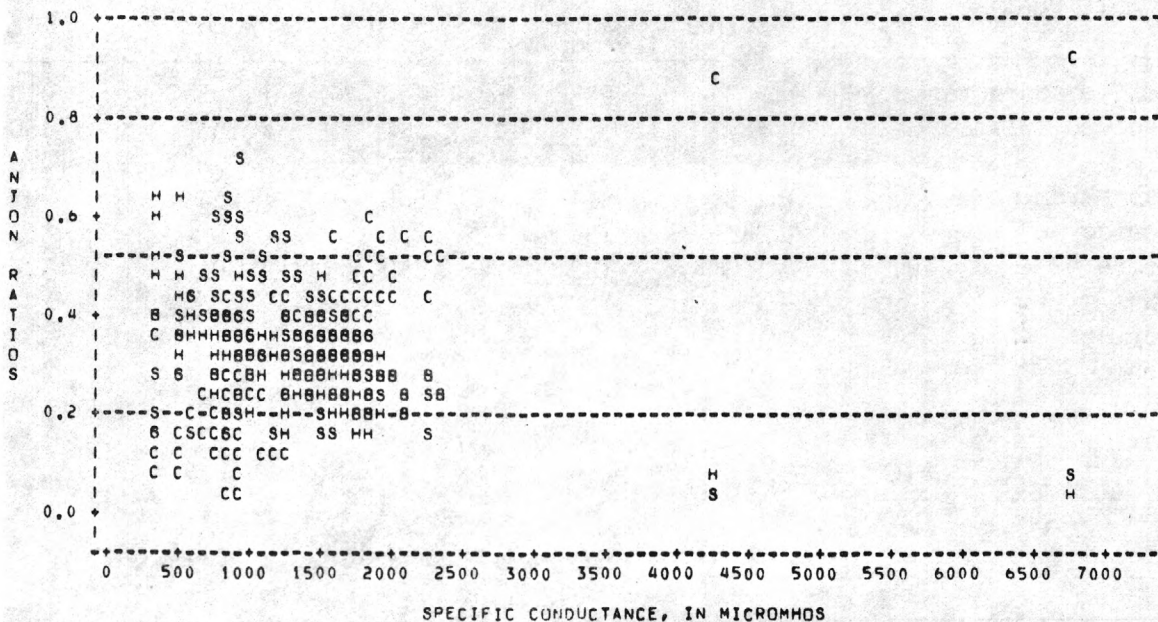
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	703	957	1,460	1,765	2,010
Dissolved solids	487	658	984	1,163	1,350
pH	7.6	7.9	8.0	8.2	8.5
Total hardness	278	414	565	664	705
Chloride	42	80	190	289	362
Sulfate	103	182	250	301	323
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.5	1.1	1.9	2.3	3.0
Boron					

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=LITTLE BEAVER CREEK NR DUNCAN, OK



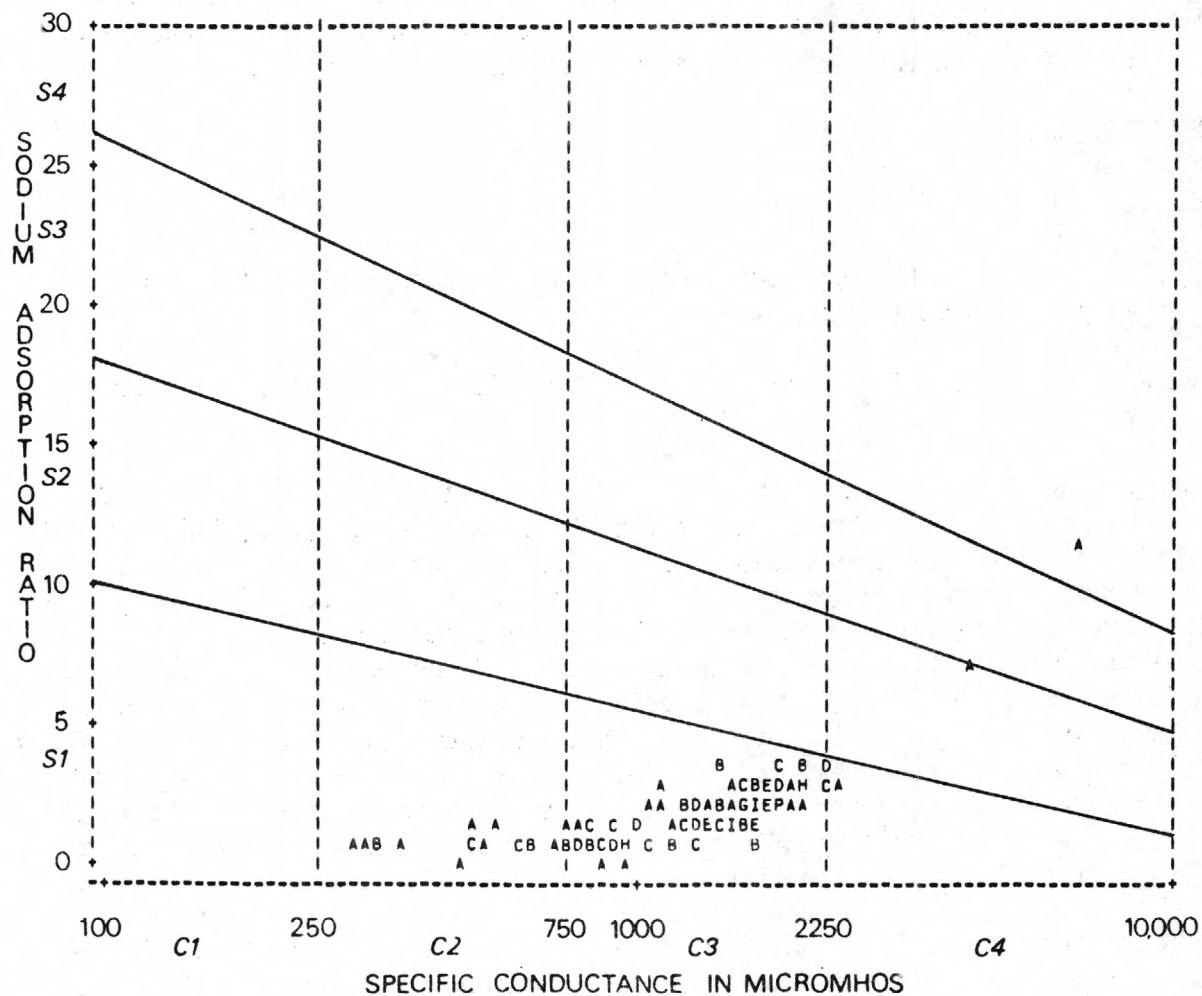
ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=LITTLE BEAVER CREEK NR DUNCAN, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=LITTLE BEAVER CREEK NR DUNCAN, OK



RED RIVER MAINSTEM

07333910 - McGee Creek near Farris, Okla.

LOCATION.--Lat 34°18'54", long 95°52'30", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T.3 S., R.14 E., Atoka County, 0.1 mi downstream from Crooked Creek, 1.1 mi downstream from Potapo Creek, 3.7 mi northwest of Farris, and at mile 3.5.

DRAINAGE AREA.--176 mi².

PERIOD OF RECORD.--1976 to 1979.

WATER TYPE.--The water was sodium mixed anion type throughout the range of measured specific conductance.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 32 mg/L and 95 percent of the hardness values were less than the 60 mg/L limit for soft water. The hardness classification for this water is soft. The recommended maximum iron concentration of 300 ug/L was exceeded by 67 percent of the iron values. The maximum chromium contaminant level of 50 ug/L was exceeded by 2 of 37 chromium values and the maximum mercury contaminant level of 2.0 ug/L was exceeded by 1 of 9 mercury values. Arsenic, cadmium, and lead did not exceed their maximum contaminant levels. Based on the data, this water may be suitable for use as a public water supply; however, the concentrations of chromium and mercury should be monitored. In addition, staining of clothes and plumbing fixtures could occur as a result of the high iron concentrations.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

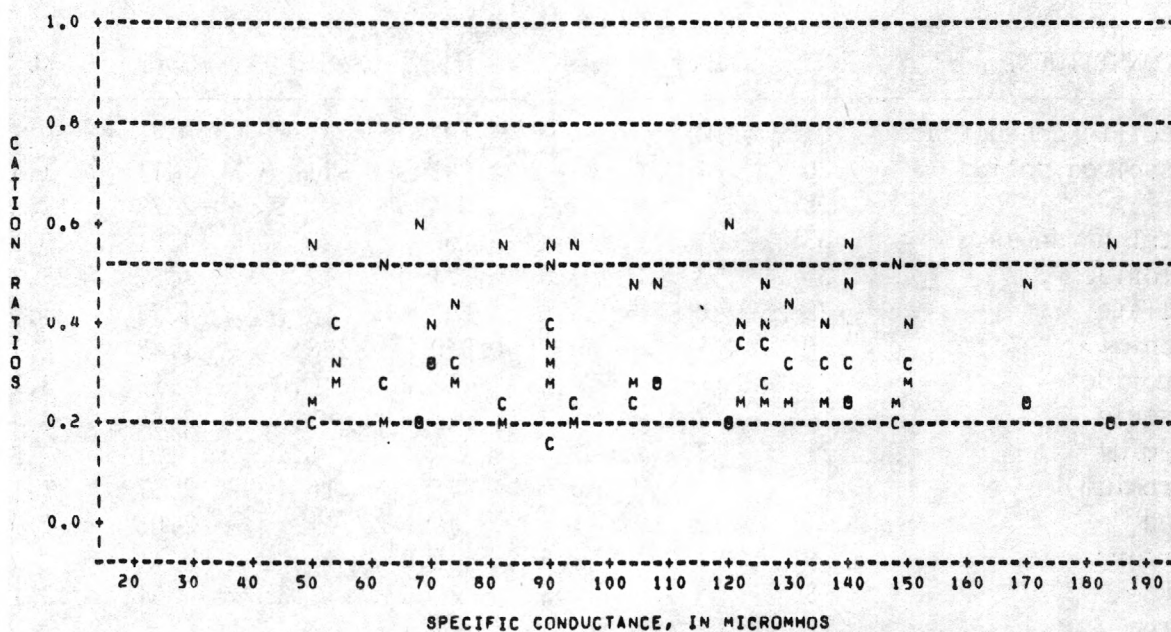
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	101	104	34	195	31	0.43	0.15
Dissolved solids	20	67	48	85	11	.11	-1.10
pH	96	7.2	3.1	8.5	.8	-2.72	12.94
Total hardness	53	32	14	160	20	4.81	29.53
Chloride	31	13	4.0	74	12	4.52	23.14
Sulfate	29	16	5.0	107	18	4.71	24.01
Iron	50	488	80	1,530	338	1.48	2.12
Fluoride	24	.1	.0	.2	.0	-.18	3.15
Arsenic	17	2	1	11	2.5	2.80	8.47
Cadmium	21	3	1	7	1.9	.91	-.30
Chromium	37	16	0	75	16	2.57	7.13
Lead	25	12	1	48	11	2.05	4.07
Mercury	9	1.8	.5	5.0			
SAR	28	.9	.2	1.9	.3	.54	2.18
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	68	82	100	122	147
Dissolved solids	54	58	64	77	83
pH	6.5	6.9	7.2	7.6	7.9
Total hardness	17	22	30	38	44
Chloride	5.7	7.4	10	16	18
Sulfate	6.6	8.8	13	16	22
Iron	172	245	400	687	954
Fluoride	.0	.1	.1	.1	.2
Arsenic	1	1	2	3	7
Cadmium	1	1	2	4	6
Chromium	6	8	10	20	36
Lead	2	5	8	14	33
Mercury					
SAR	.6	.7	.9	1.2	1.3
Boron					

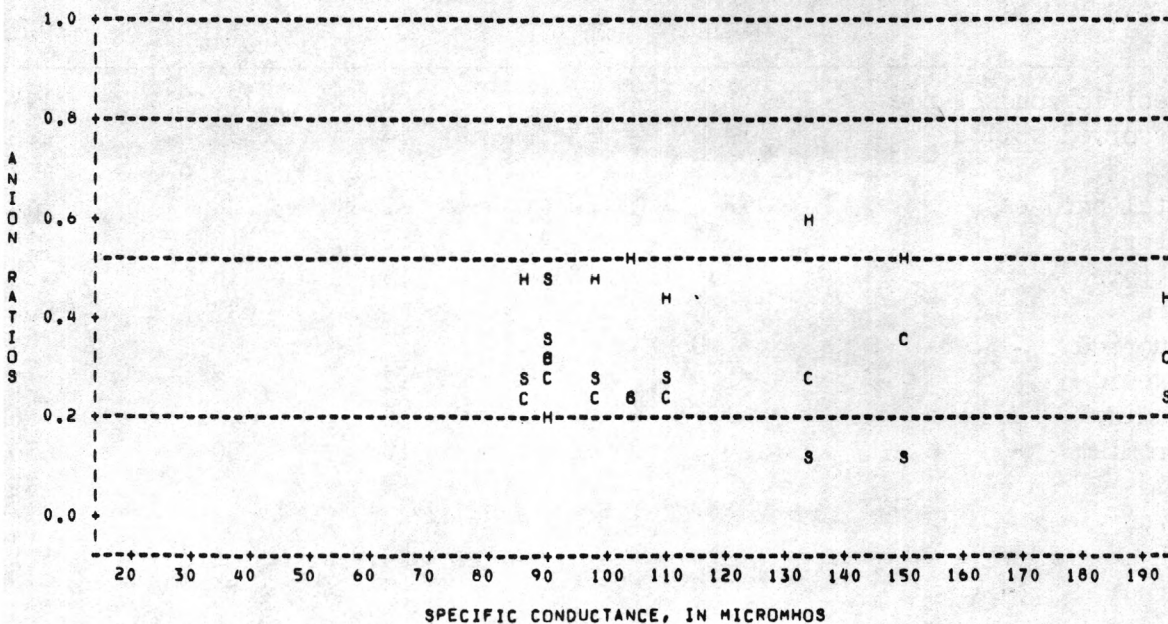
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=MC GEE CREEK NR FARRIS OK

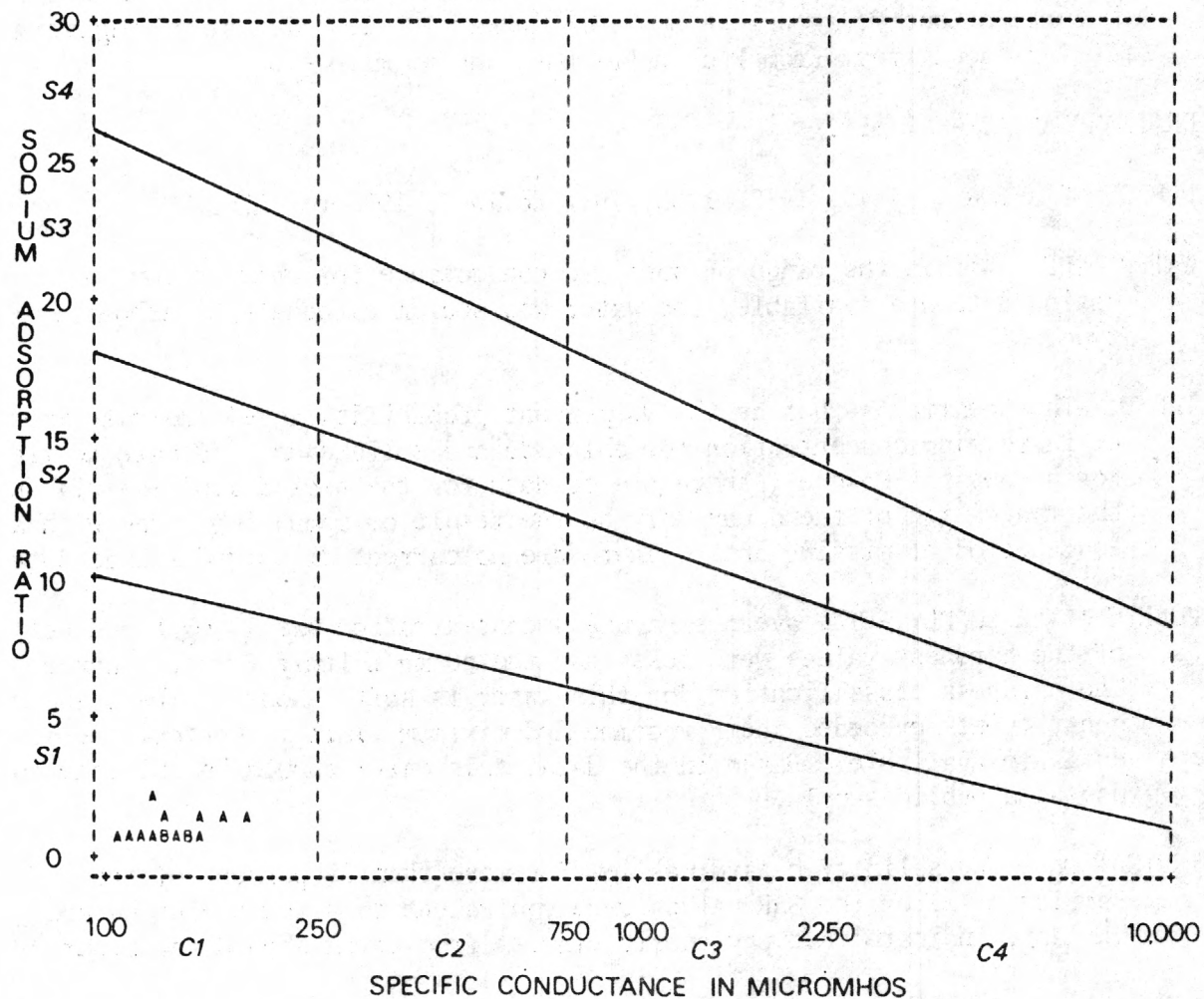


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=MC GEE CREEK NR FARRIS OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=MC GEE CREEK NR FARRIS OK



RED RIVER MAINSTEM

07339000 - Mountain Fork near Eagletown, Okla.

LOCATION.--Lat 34°02'30", long 94°37'15", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 7, T.6 S., R.26 E.,
McCurtain County, at bridge on U.S. Highway 70, 2.0 mi west of Eagletown,
10.7 mi downstream from Broken Bow Dam, and at mile 8.9.

DRAINAGE AREA.--787 mi².

PERIOD OF RECORD.--1948, 1953, 1955, 1961 to 1963, 1975 to 1979.

WATER TYPE.--Within the range of specific conductance for which anion and
cation data are available, the water was sodium carbonate/bicarbonate
type.

TREND.--The Spearman's rhos at the 95-percent probability level indicate trends
of increasing concentration for chloride and sulfate and indicate no trend
for hardness. However, there are no data for the period 1964 to 1974 and
the indication of trend may only be the result of computing trend with a
long period of missing data. There are no current dissolved solids data.

PUBLIC WATER SUPPLY.--The average hardness concentration was 14 mg/L and all
of the hardness values were less than the 60 mg/L limit for soft water.
The hardness classification for this water is soft. None of the measured
constituents exceeded their recommended maximum limits. No toxic metal
data are available. Based on the data, this water should be suitable for
use as a public supply.

IRRIGATION.--The salinity hazard was low for more than 99 percent of the
samples. All of the SAR values were equivalent to a low sodium hazard.
The data indicate that phytotoxic effects from boron should not occur.

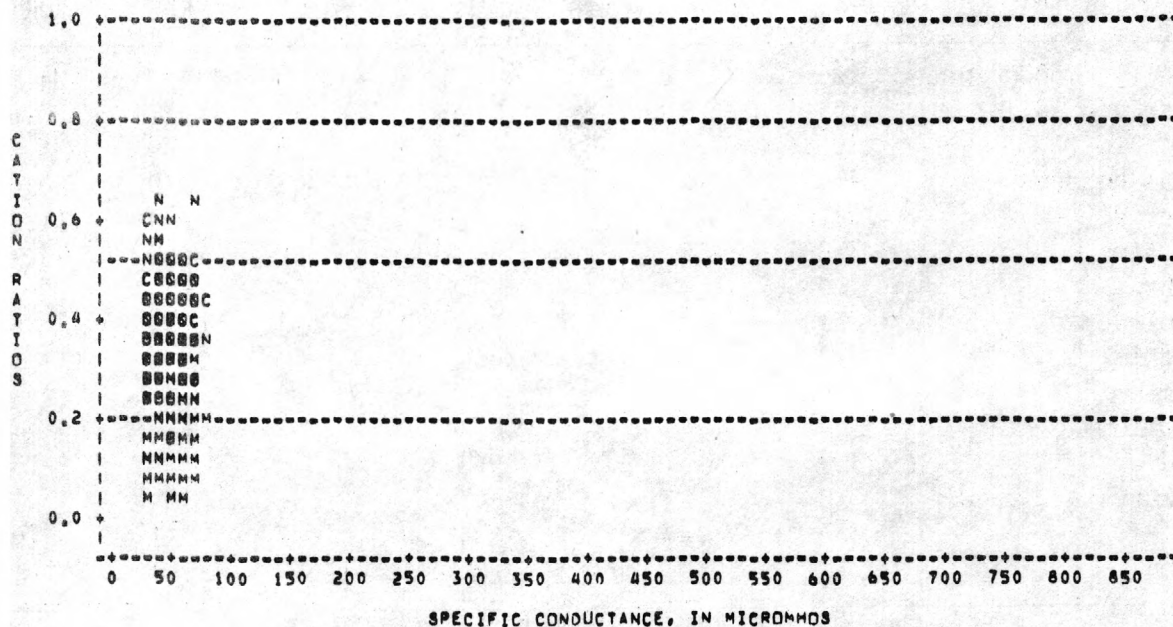
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	222	48	26	750	49	13.52	194.67
Dissolved solids	168	38	15	68	8.7	.11	.61
pH	205	7.3	6.1	8.3	.4	-.29	1.20
Total hardness	212	14	6.0	27	4.5	.79	.00
Chloride	221	3.7	.8	18	2.1	2.49	11.85
Sulfate	210	4.8	1.0	51	4.6	7.20	63.14
Iron	0						
Fluoride	33	.1	.0	.3	.1	1.30	.87
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	157	.5	.1	1.0	.2	.32	.00
Boron	14	250	60	490	152	.10	-1.44

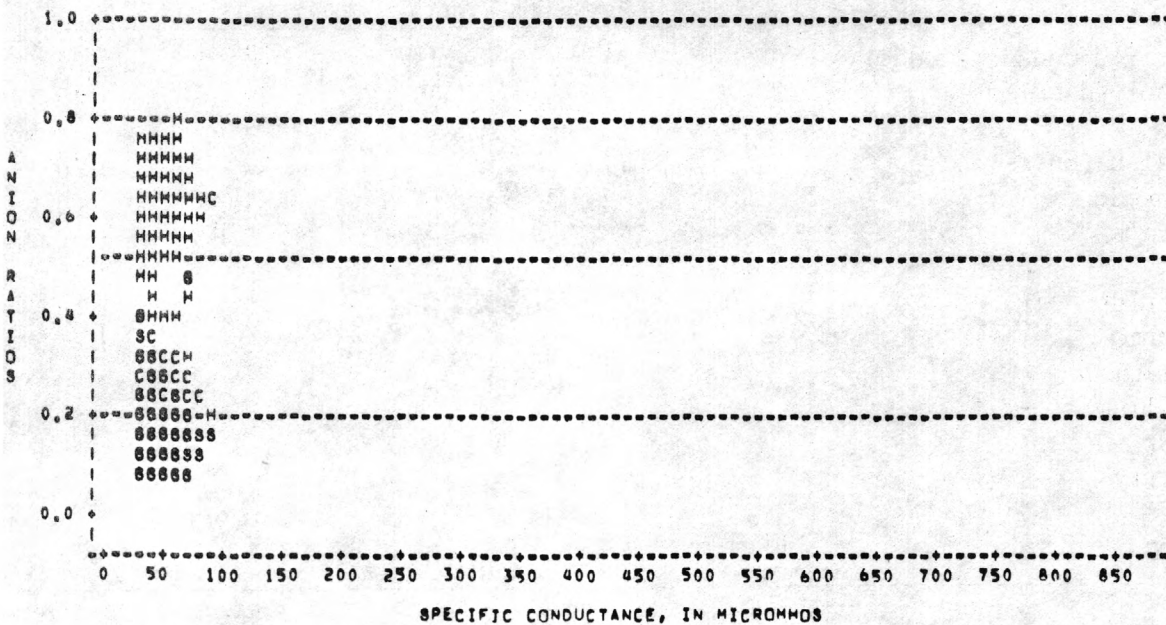
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	32	36	43	54	64
Dissolved solids	28	32	38	44	49
pH	6.8	7.0	7.3	7.5	7.6
Total hardness	9.3	11	13	17	20
Chloride	1.6	2.4	3.5	4.3	6.0
Sulfate	2.6	3.3	3.8	5.0	7.0
Iron					
Fluoride	.0	.0	.0	.1	.2
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.4	.5	.6	.7
Boron	65	88	280	378	475

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER MOUNTAIN FORK NR EAGLETOWN, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER MOUNTAIN FORK NR EAGLETOWN, OK



No Irrigation Diagram.

RED RIVER MAINSTEM

07339010 - Mountain Fork below Eagletown, Okla.

LOCATION.--Lat 34°00'00", long 94°36'00", in sec. 20, T.6 S., R.26 E.,
McCurtain County, at bridge on U.S. Highway 70 about 3 mi below gaging
station near Eagletown.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1961 to 1963.

WATER TYPE.--The water was a mixed cation carbonate/bicarbonate type through-
out the range of measured specific conductance.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 14 mg/L and all
of the hardness values were less than the 60 mg/L limit for soft water.
The hardness classification for this water is soft. None of the measured
constituents exceeded their recommended maximum limits. No toxic metal
data are available. Based on the data, this water should be suitable for
use as a public supply.

IRRIGATION.--The salinity hazard was low for all samples and all of the SAR
values were equivalent to a low sodium hazard. No boron data are available.

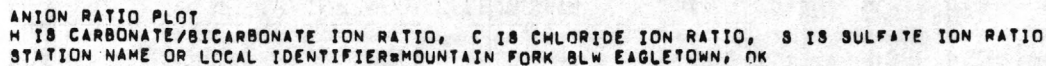
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	33	44	32	65	8.9	0.64	-0.43
Dissolved solids	30	33	21	50	8.9	.36	-1.04
pH	33	7.2	6.8	7.5	.2	-.30	-1.05
Total hardness	33	14	10	21	3.7	.39	-1.25
Chloride	34	2.6	1.1	4.6	.9	.87	-.03
Sulfate	34	4.0	1.0	7.9	1.5	.44	.22
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	33	.4	.1	.8	.2	-.10	.31
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	33	36	41	50	57
Dissolved solids	22	24	31	41	46
pH	6.9	7.0	7.2	7.4	7.4
Total hardness	10	12	14	18	20
Chloride	1.6	1.9	2.4	3.0	4.2
Sulfate	2.1	2.8	3.9	5.0	6.1
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.4	.4	.6	.6
Boron					

STATION NAME OR LOCAL IDENTIFIER=MOUNTAIN FORK BLW EAGLETOWN, OK



No Irrigation Diagram.

RED RIVER MAINSTEM

07315697 - Mud Creek near Grady, Okla.

LOCATION.--Lat 34°04'00", long 97°38'04", in NE¼ sec. 5, T.6 S., R.4 W., Jefferson County, at bridge on county road, 3.6 mi northeast of Grady.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1951 to 1952, 1969 to 1971.

WATER TYPE.--The data indicate that the water is essentially a sodium chloride type. There is some indication that for specific conductance less than 300 umho the water changes to carbonate/bicarbonate type. However, the data are not sufficient to determine definitely the relation between specific conductance and the anion and cation distributions.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 263 mg/L and 54 percent of the hardness values were greater than the 180 mg/L lower limit for very hard water. The hardness classification for this water varies between hard and very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 48 percent of the chloride values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride concentration was exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 50 percent of the samples having a high or very high salinity hazard. The sodium hazard ranged from low to medium with 70 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

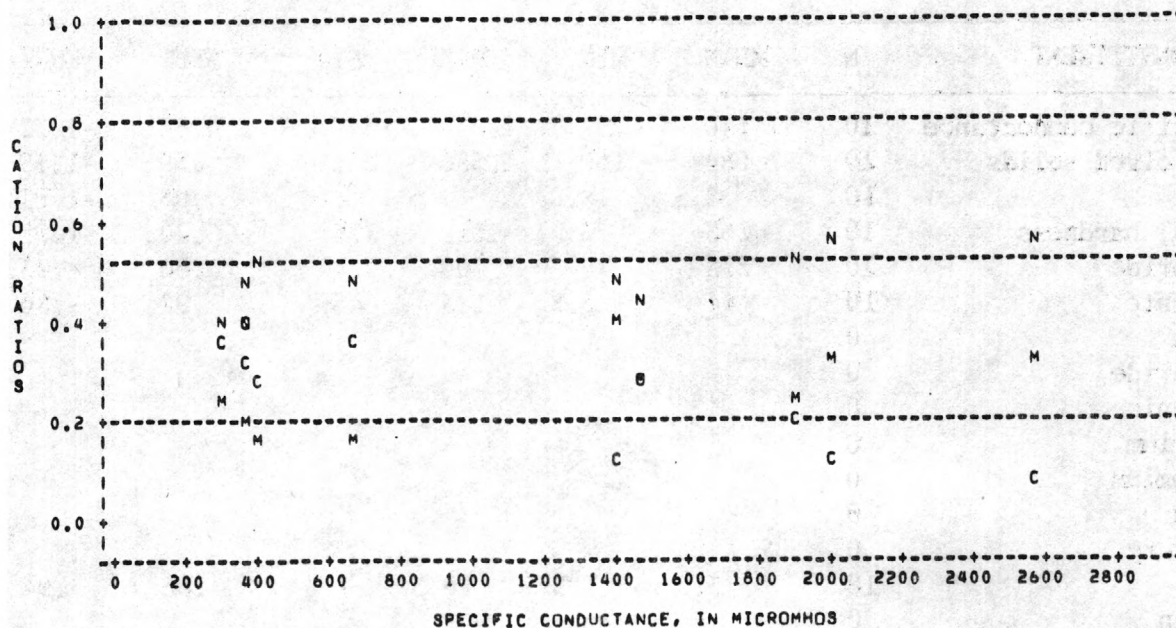
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	10	1,140	297	2,560	829	0.47	-1.32
Dissolved solids	10	684	160	1,580	522	.59	-1.19
pH	10	8.3	8.0	8.6	.2	.05	-1.01
Total hardness	10	263	72	530	175	.20	-1.91
Chloride	10	273	40	700	236	.66	-.93
Sulfate	10	44	5.8	123	45	.92	-.86
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	10	3.2	1.3	6.3	1.8	.66	-.94
Boron	0						

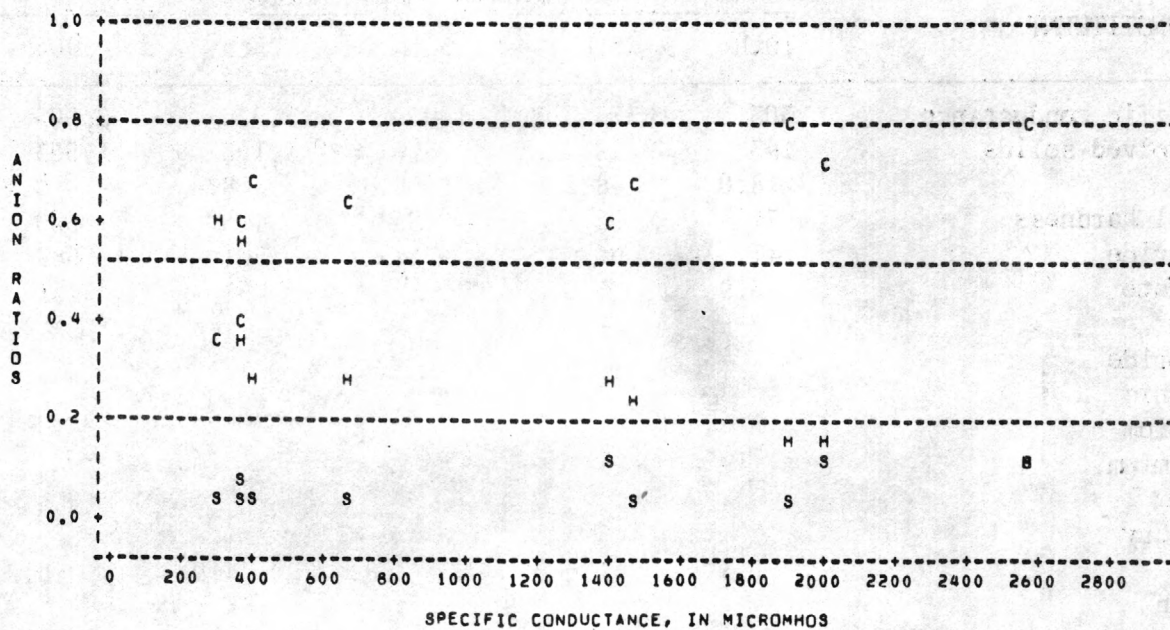
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	303	373	1,030	1,920	2,505
Dissolved solids	163	219	576	1,198	1,553
pH	8.0	8.2	8.3	8.5	8.6
Total hardness	74	92	253	415	520
Chloride	41	66	214	501	682
Sulfate	5.9	6.6	27	94	121
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.3	1.6	2.8	4.9	6.2
Boron					

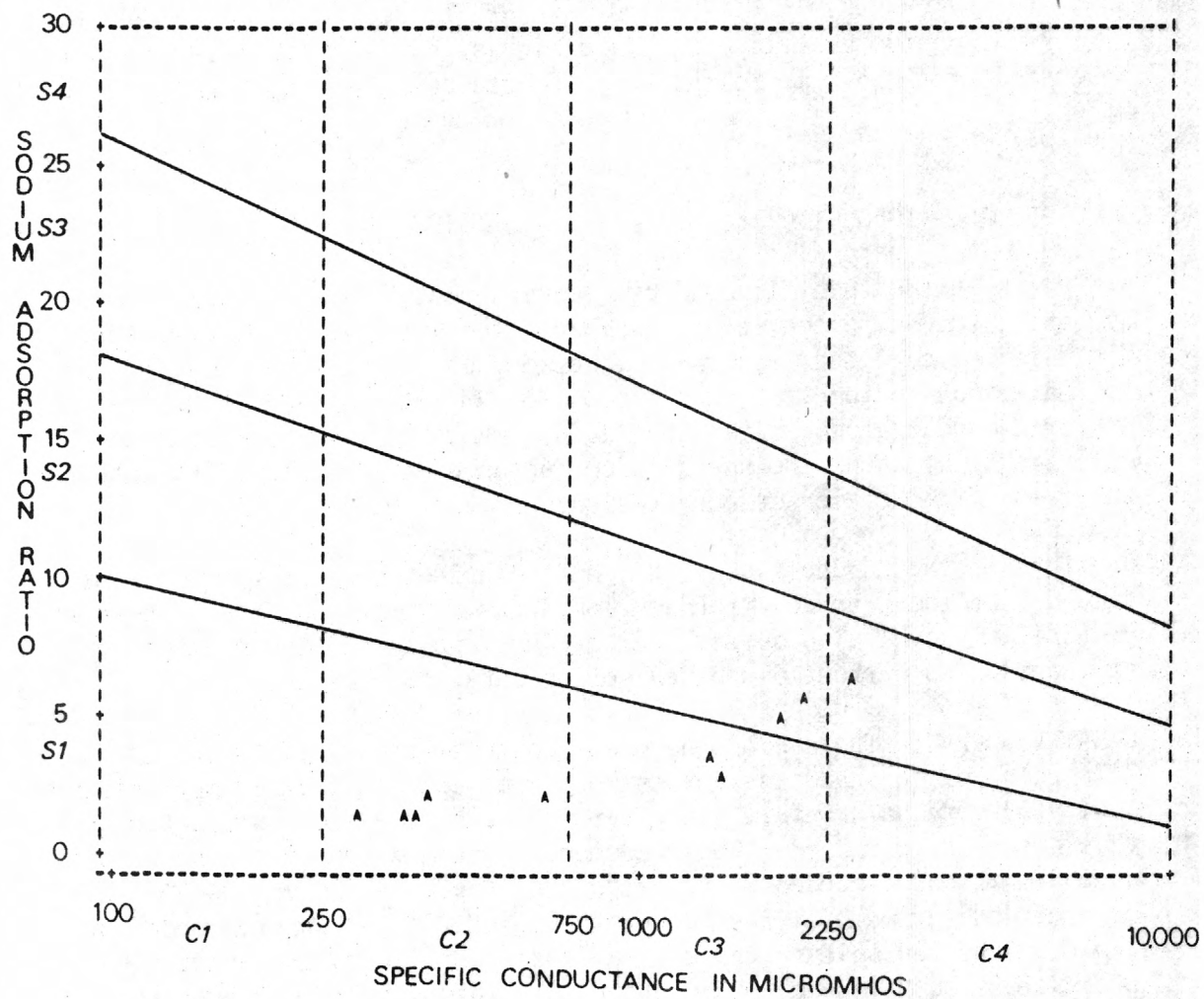
CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR GRADY, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR GRADY, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR GRADY, OK



RED RIVER MAINSTEM

07315700 - Mud Creek near Courtney, Okla.

LOCATION.--Lat 34°00'20", long 97°34'00", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 25, T.6 S., R.4 W., Jefferson County, at bridge on State Highway 89, 4.0 mi downstream from North Mud Creek, 6.0 mi northwest of Courtney, and at mile 11.5.

DRAINAGE AREA.--572 mi².

PERIOD OF RECORD.--1960, 1962 to 1963, 1975 to 1979.

WATER TYPE.--When the specific conductance was greater than 500 umho, which accounted for 81 percent of the samples, the water was chloride type. The data indicate that for specific conductance greater than 1,500 umho the water was sodium type; therefore, for 40 percent of the samples, specific conductance greater than 1,500 umho, the water was sodium chloride type. When the specific conductance was less than 500 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos at the 95-percent probability level also do not indicate any trends for these three constituents. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 379 mg/L and 74 percent of the hardness values were greater than the 180 mg/L minimum limit for very hard water. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 48 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 2 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride concentration was exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 64 percent of the samples having a high or very high salinity hazard. The sodium hazard ranged from low to very high with 83 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

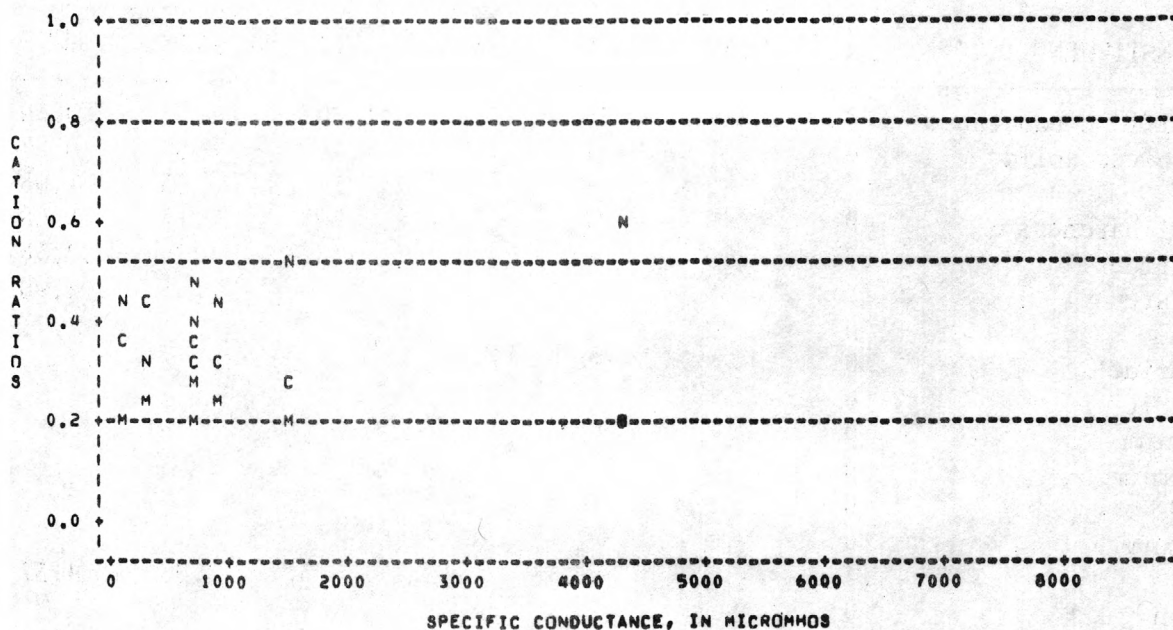
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	58	1,417	115	7,450	1,202	2.55	10.39
Dissolved solids	14	957	109	4,700	1,246	2.51	6.57
pH	47	7.9	6.3	8.7	.5	-.83	1.08
Total hardness	49	379	32	1,280	263	1.15	1.65
Chloride	57	300	4.5	2,450	372	3.96	20.36
Sulfate	35	56	6.1	270	50	2.53	8.90
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	14	3.5	.5	13	3.4	2.08	4.37
Boron	0						

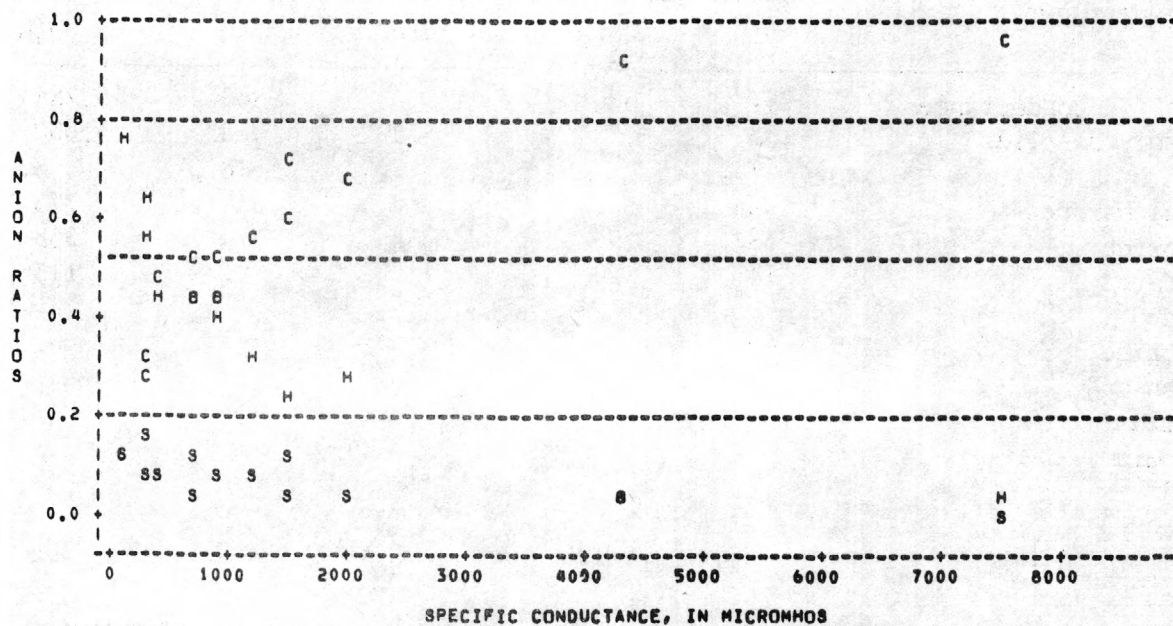
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	288	620	1,255	1,863	2,784
Dissolved solids	133	212	538	958	3,630
pH	7.2	7.6	7.9	8.2	8.4
Total hardness	93	172	340	513	775
Chloride	35	96	235	374	558
Sulfate	14	24	41	81	113
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.6	1.2	2.4	3.7	11
Boron					

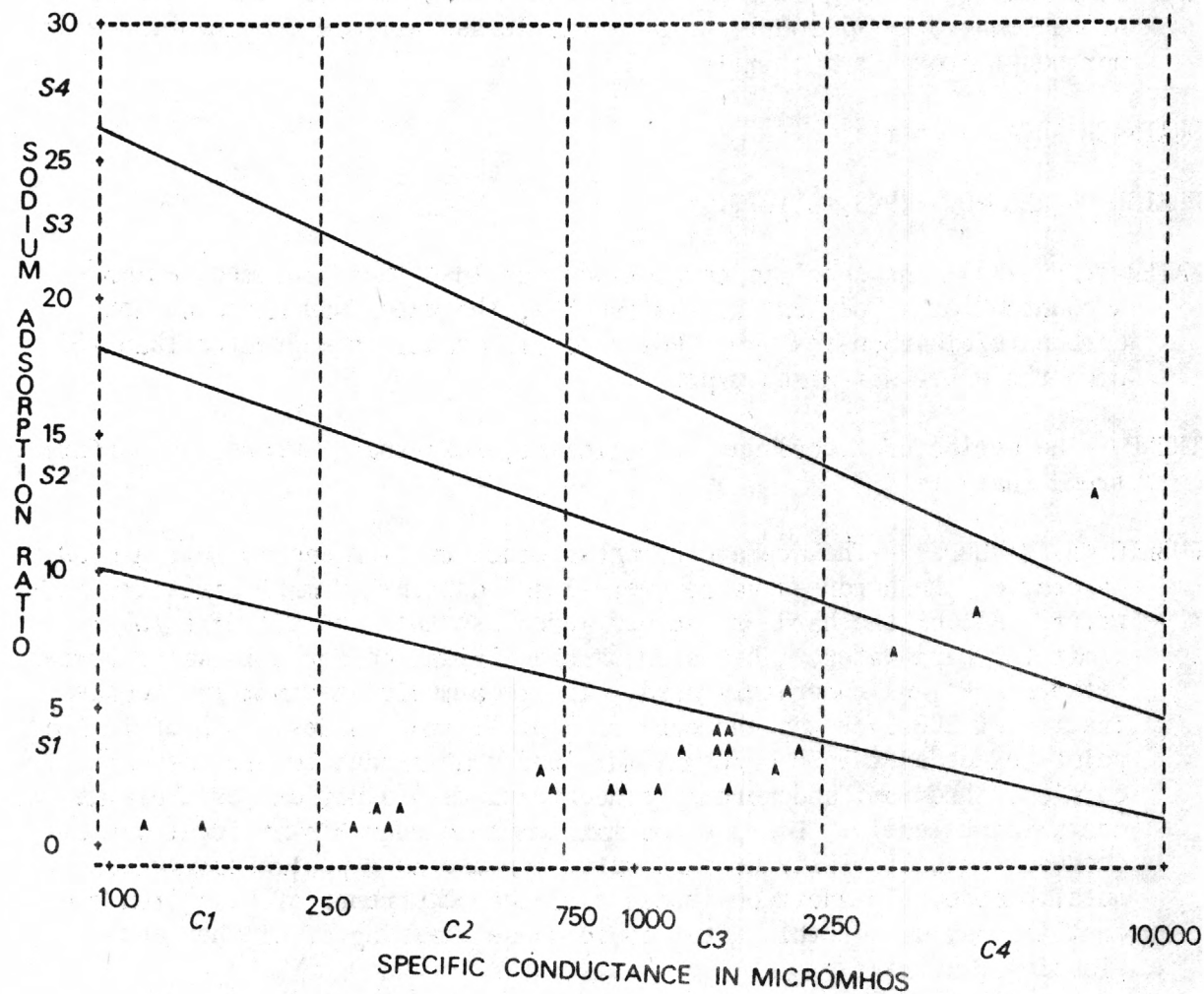
CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR COURTNEY, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR COURTNEY, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=MUD CREEK NR COURTNEY, OK



RED RIVER MAINSTEM

07332950 - Muddy Boggy Creek at Atoka, Okla.

LOCATION.--Lat 34°23'23", long 96°07'12", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 11, T.2 S., R.11 E., Atoka County, at Missouri, Kansas, and Texas Railroad Company bridge in northeast Atoka, and at mile 80.1.

DRAINAGE AREA.--445 mi².

PERIOD OF RECORD.--1978 to 1979.

WATER TYPE.--When the specific conductance was less than 250 umho, which accounted for 48 percent of the samples, the water was mixed cation carbonate/bicarbonate type. For specific conductance greater than 250 umho the water was mixed type.

TREND.--The period of record was insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 72 mg/L and 39 percent of the hardness values were less than the 60 mg/L limit for soft water. All of the hardness values were less than the 121 mg/L lower limit for hard water. The hardness classification for this water varies between soft and moderately hard. The recommended maximum iron concentration of 300 ug/L was exceeded by 2 of 12 iron values. Two of 12 lead values exceeded the 50 ug/L maximum lead contaminant level. Arsenic, cadmium, chromium, and mercury concentrations did not exceed their maximum contaminant levels. Because the maximum lead contaminant level was exceeded, the suitability of this water for use as a public supply is questionable. In addition, because of the occurrence of high iron concentrations, use of this water could cause staining of clothes and plumbing fixtures.

IRRIGATION.--The salinity hazard ranged from low to medium with 54 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects should not occur.

UNIVARIATE STATISTICS

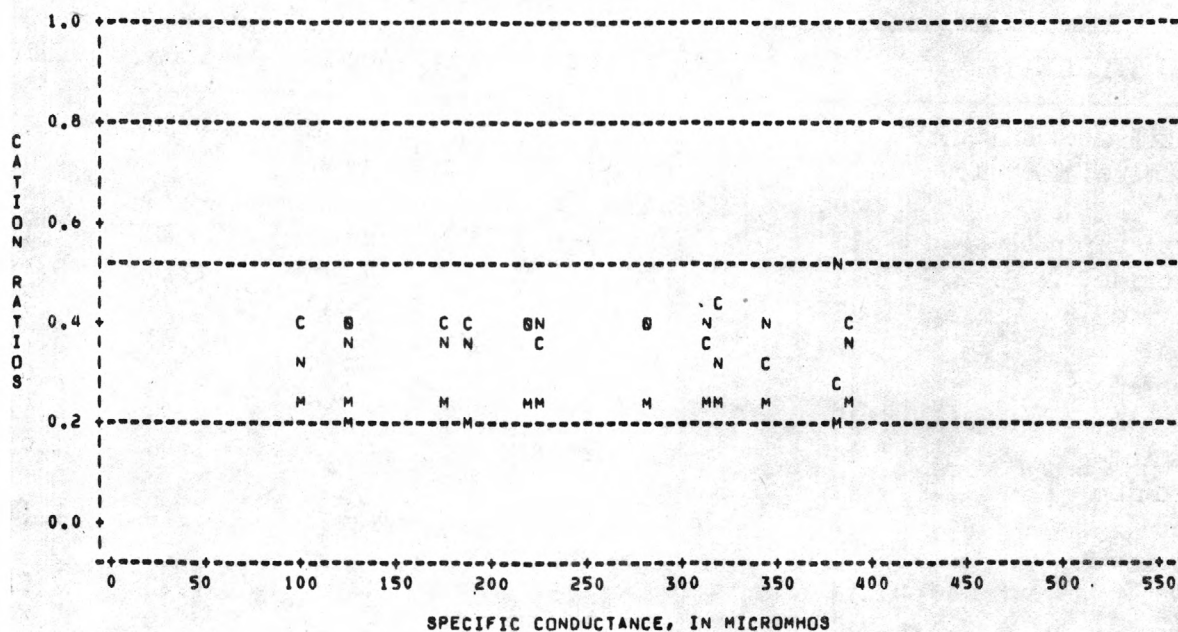
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	39	258	81	552	112	0.36	-0.22
Dissolved solids	12	172	81	340	80	.75	-.05
pH	40	7.2	6.4	7.6	.3	-.75	.98
Total hardness	13	72	34	120	28	.20	-1.11
Chloride	13	21	6.1	67	17	1.70	3.33
Sulfate	13	28	8.9	54	14	.29	-.40
Iron	12	208	30	650	179	1.62	2.73
Fluoride	12	.2	.1	.2	.1	-.81	-1.65
Arsenic	19	1	1	2	.4	2.04	2.41
Cadmium	14	4	2	9	2.4	1.58	1.63
Chromium	2	20	20	20			
Lead	12	30	5	82	23	1.19	1.14
Mercury	6	.4	.2	.7			
SAR	13	1.0	.5	1.9	.4	1.22	2.51
Boron	13	74	40	120	21	.49	.35

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	105	168	255	320	405
Dissolved solids	83	96	152	236	312
pH	6.8	7.0	7.2	7.3	7.5
Total hardness	36	46	68	94	116
Chloride	6.3	9.1	18	30	55
Sulfate	9.3	17	29	38	50
Iron	33	82	195	235	587
Fluoride	.1	.1	.2	.2	.2
Arsenic	1	1	1	1	2
Cadmium	2	2	3	4	9
Chromium					
Lead	6	14	25	43	75
Mercury					
SAR	.5	.7	1.0	1.2	1.7
Boron	44	60	80	90	108

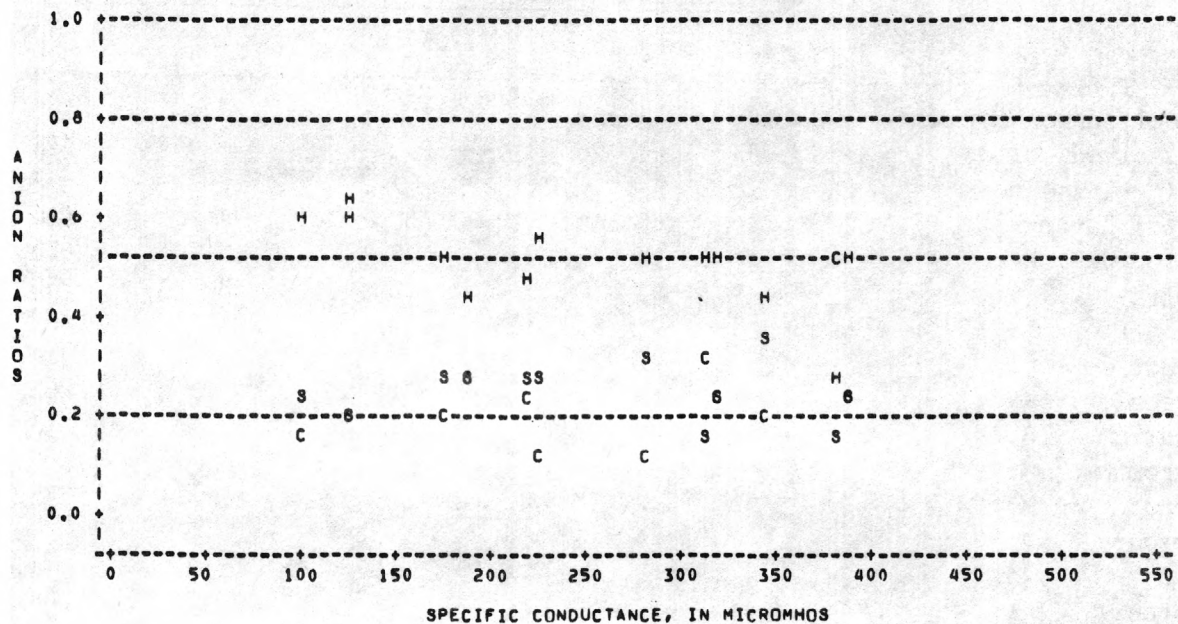
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=MUDDY BOGGY CREEK AT ATOKA OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=MUDDY BOGGY CREEK AT ATOKA OK

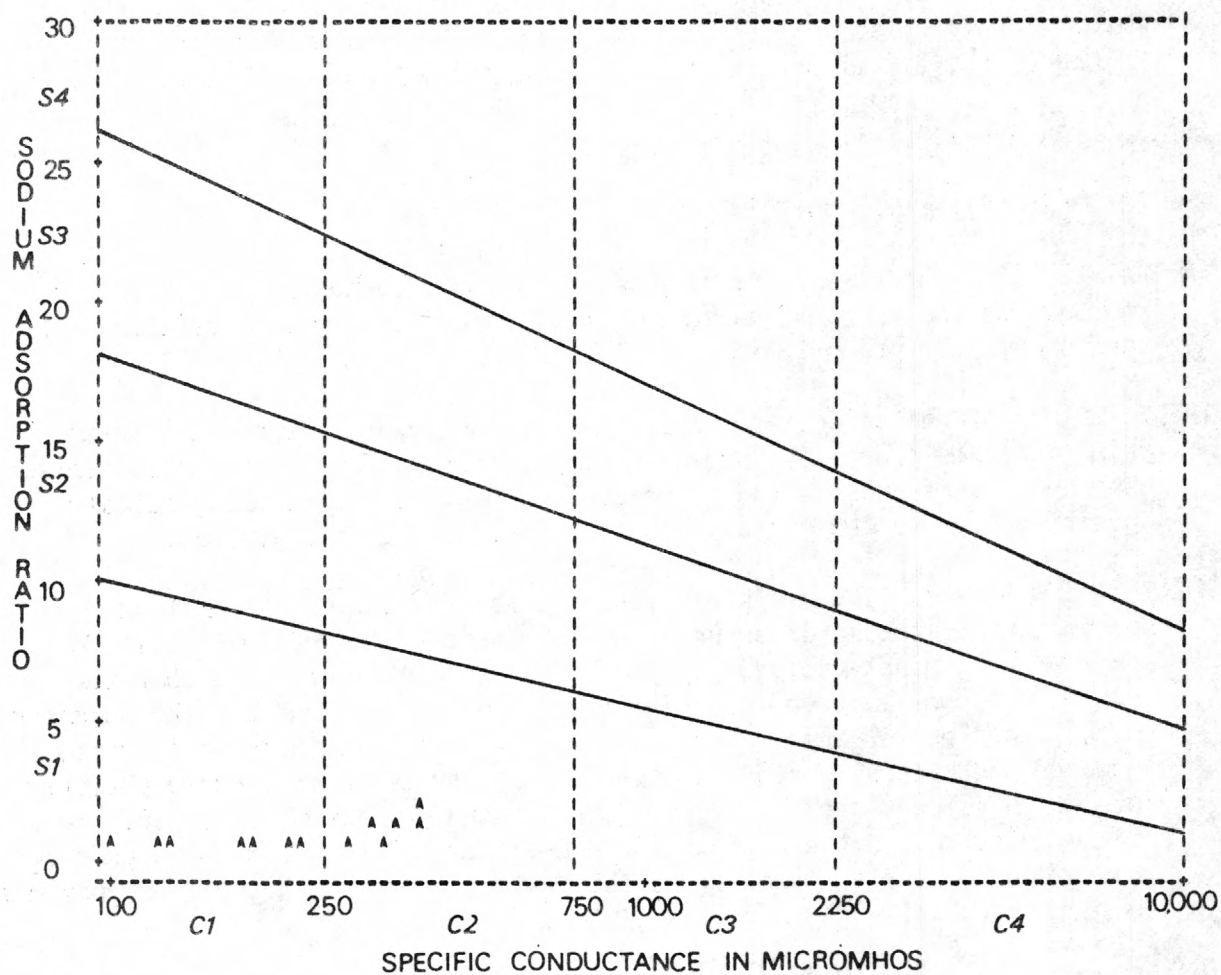


IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD

A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=MUDDY BOGGY CREEK AT ATOKA OK



RED RIVER MAINSTEM

07334000 - Muddy Boggy Creek near Farris, Okla.

LOCATION.--Lat 34°16'17", long 95°54'43", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 26, T.3 S., R.13 E., Atoka County, at bridge on State Highway 3, 1.3 mi downstream from McGee Creek, 2.8 mi northwest of Farris, and at mile 57.7.

DRAINAGE AREA.--1,087 mi².

PERIOD OF RECORD.--1973 to 1979.

WATER TYPE.--The water was generally mixed cation carbonate/bicarbonate type throughout the range of measured specific conductance. Occasionally the anion chloride predominated.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate trends of increasing concentration for these constituents. The Spearman's rhos at the 95-percent probability level also indicate positive trends. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 62 mg/L and 63 percent of the hardness values were less than the 60 mg/L limit for soft water. Ninety percent of the hardness values were less than the 120 mg/L upper limit for moderately hard water. In general, the hardness classification for this water varies between soft and moderately hard; however, occasional periods of very hard water do occur. Three percent of the pH values were less than the recommended minimum pH of 5.0. No toxic metal data are available. Because the minimum recommended pH value was exceeded, the suitability of this water for use as a public supply may be questionable.

IRRIGATION.--The salinity hazard ranged from low to high with 77 percent of the samples having a low salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

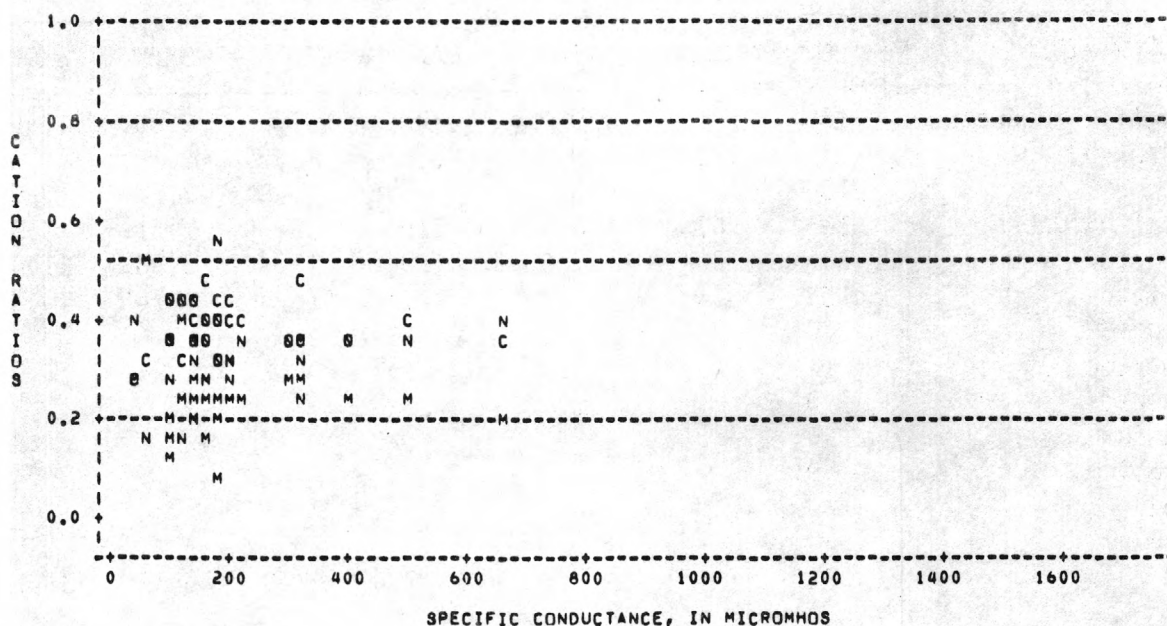
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	186	210	39	1,140	157	2.86	10.92
Dissolved solids	77	132	29	513	82	2.10	6.56
pH	130	7.4	3.2	8.6	.8	-2.77	10.95
Total hardness	163	62	8.0	219	39	1.81	3.30
Chloride	186	20	2.5	139	19	2.93	11.45
Sulfate	158	14	.0	161	16	4.70	40.20
Iron	0						
Fluoride	14	.2	.0	.7	.2	1.24	2.71
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	71	.9	.1	7.0	.9	5.35	35.12
Boron	0						

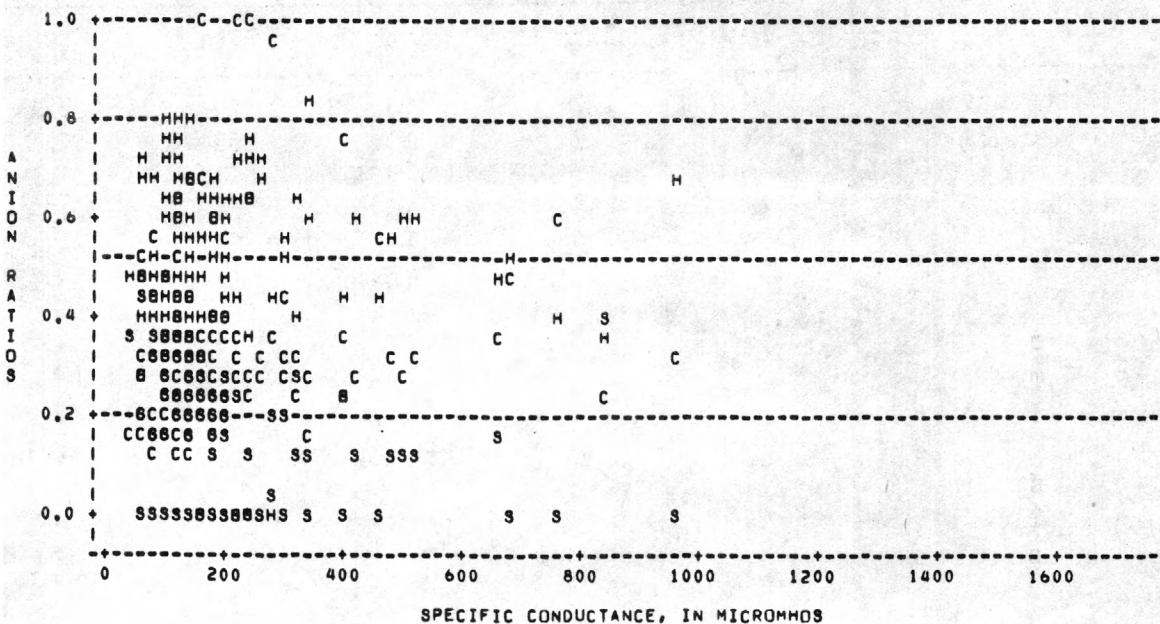
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	90	122	163	240	371
Dissolved solids	48	77	119	153	239
pH	6.4	7.0	7.4	7.7	7.9
Total hardness	28	36	50	74	123
Chloride	6.1	9.2	15	23	41
Sulfate	.0	.0	14	22	27
Iron					
Fluoride	.0	.1	.2	.3	.6
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.6	.7	.9	1.3
Boron					

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUDDY BOGGY CREEK NR FARRIS, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=MUDDY BOGGY CREEK NR FARRIS, OK



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

Figure 1 is a graph showing the relationship between Sodium Adsorption Ratio (SAR) and Specific Conductance (in micromhos) for various soil samples. The Y-axis is labeled "SODIUM ADSORPTION RATIO" and ranges from 0 to 30. The X-axis is labeled "SPECIFIC CONDUCTANCE IN MICROMHOS" and ranges from 100 to 10,000. Three downward-sloping lines are plotted, labeled S1, S2, and S4 from bottom to top. Data points are represented by letters (A, B, AA, ACA, AB, AAAA) plotted against the lines. Vertical dashed lines are drawn at specific conductance values of 250, 750, and 2250 micromhos. The graph is divided into four regions labeled C1, C2, C3, and C4.

RED RIVER MAINSTEM

07316000 - Red River near Gainesville, Tex.

LOCATION.--Lat 33°43'40", long 97°09'35", in SW $\frac{1}{4}$ sec. 36, T.9 S., R.1 E., Love County, Okla., at bridge on U.S. Highway 77, 0.2 mi downstream from Gulf, Colorado, and Santa Fe Railway Co. bridge, 5.0 mi downstream from Fish Creek, 7.0 mi north of Gainesville, and at mile 791.5.

DRAINAGE AREA.--30,782 mi², of which 5,936 mi² probably is noncontributing.

PERIOD OF RECORD.--1953 to 1963, 1967 to 1979.

WATER TYPE.--When the specific conductance was greater than 500 umho, which accounted for more than 99 percent of the samples, the water was sodium chloride type. For specific conductance less than 500 umho the water was calcium carbonate/bicarbonate type.

TREND.--Plots of the dissolved solids, hardness, chloride, and sulfate concentrations versus time do not clearly indicate any trends. The Spearman's rhos at the 95-percent probability level indicate no trends for dissolved solids, hardness, and sulfate and a trend of increasing concentration for chloride.

PUBLIC WATER SUPPLY.--The average hardness concentration was 640 mg/L and 97 percent of the hardness values were greater than the 180 mg/L minimum limit for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 84 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 71 percent of the sulfate values. Arsenic, cadmium, and lead concentrations did not exceed their maximum contaminant levels. No chromium or mercury data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 69 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with about 60 percent of the SAR values equivalent to a high or very high sodium hazard. The data indicate that phytotoxic effects could occur in boron sensitive plants. The 750 ug/L limit for boron sensitive plants was exceeded by 6 percent of the boron values.

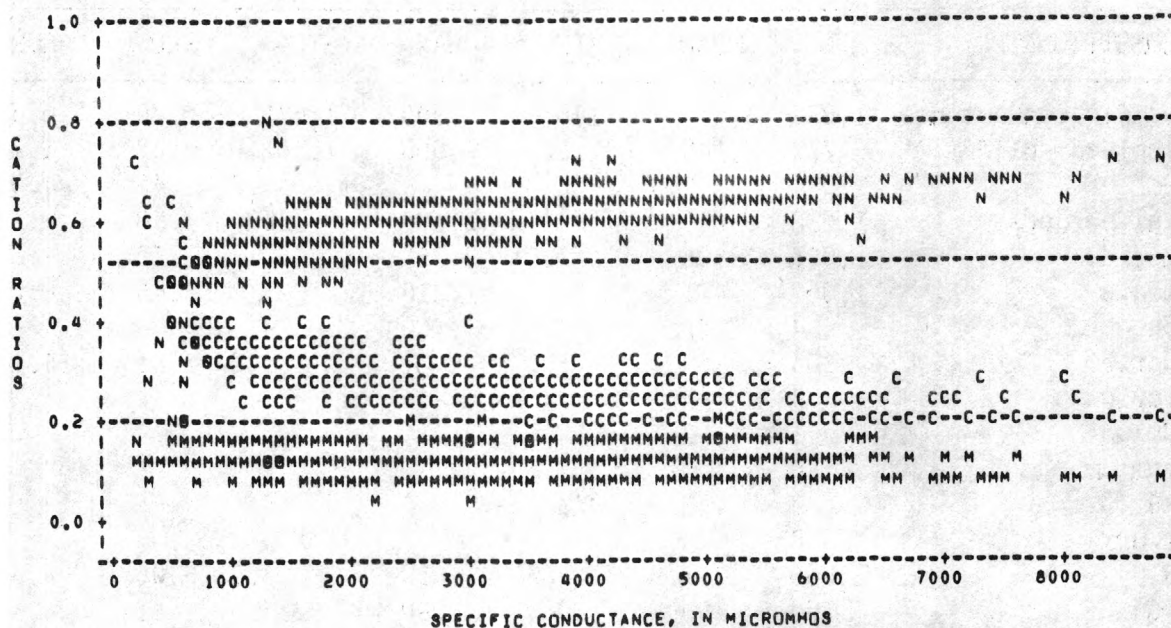
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	1,080	3,377	176	8,800	1,671	0.29	-0.60
Dissolved solids	772	2,143	115	9,000	1,102	.62	1.29
pH	1,074	7.9	6.8	8.8	.3	-.41	-.03
Total hardness	1,080	640	83	2,100	295	.30	-.35
Chloride	1,081	805	7.0	2,350	451	.37	-.52
Sulfate	1,067	411	14	1,210	227	.45	-.25
Iron	4	55	20	160			
Fluoride	203	.4	.0	1.5	.2	2.81	14.14
Arsenic	8	3	2	6			
Cadmium	1	2					
Chromium	0						
Lead	2	3	2	4			
Mercury	0						
SAR	1,055	7.9	.3	19	3.0	.06	-.31
Boron	166	398	0	980	214	.41	-.44

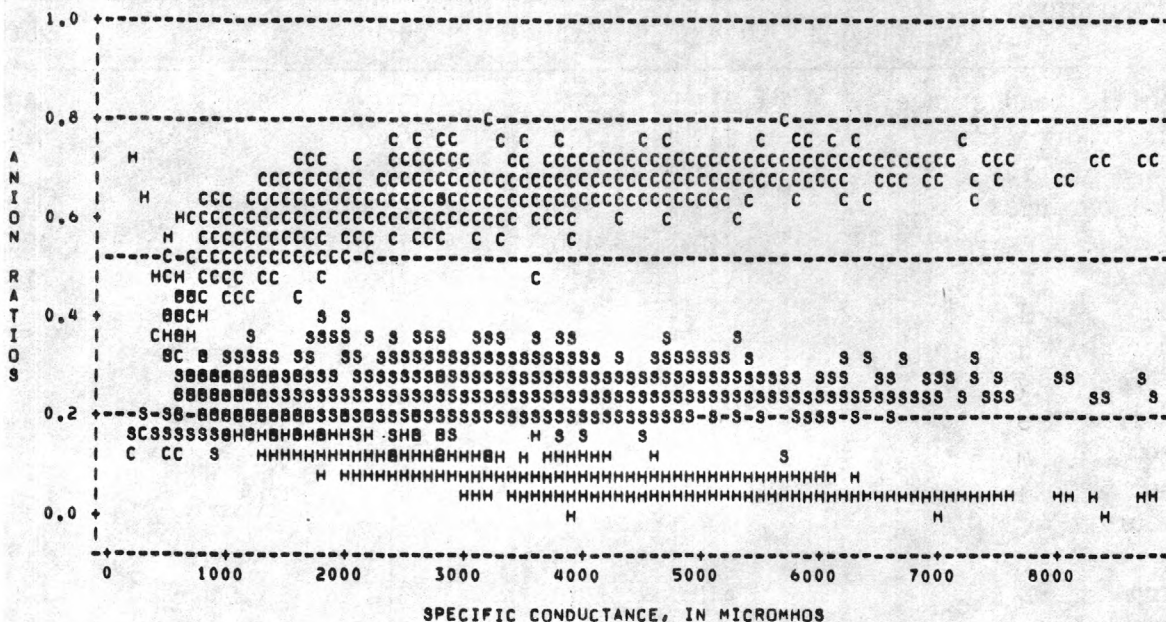
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,211	1,905	3,310	4,655	5,589
Dissolved solids	742	1,243	2,080	2,920	3,544
pH	7.5	7.7	7.9	8.2	8.3
Total hardness	252	389	638	870	1,020
Chloride	240	400	775	1,150	1,400
Sulfate	125	212	400	575	711
Iron					
Fluoride	.2	.3	.4	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	3.9	5.5	8.1	10	12
Boron	140	240	370	540	700

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=RED RIVER NR GAINESVILLE, TX



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=RED RIVER NR GAINESVILLE, TX



RED RIVER MAINSTEM

07331600 - Red River at Denison Dam, near Denison, Tex.

LOCATION.--Lat 33°49'08", long 96°33'47", Grayson County, 1,800 ft downstream from Denison Dam powerhouse, 0.4 mi upstream from Shawnee Creek (spillway flow return), 4.5 mi north of Denison, and at mile 725.5.

DRAINAGE AREA.--39,720 mi², of which 5,936 mi² probably is noncontributing.

PERIOD OF RECORD.--1960 to 1979.

WATER TYPE.--The water was sodium chloride type throughout the range of measured specific conductance.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate the possibility of negative trends for sulfate and chloride. The Spearman's rhos for the constituents at the 95-percent probability level indicate no trend for hardness and negative trends for sulfate and chloride. Data are not available for dissolved solids prior to 1974 and the concentration-time plots indicate that the positive trend indicated for dissolved solids by the Spearman's rho is a function of the short period of record.

PUBLIC WATER SUPPLY.--The average hardness concentration was 363 mg/L and all of the hardness values were greater than the very hard water minimum limit of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 92 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 44 percent of the sulfate values. Arsenic, cadmium, lead, and mercury concentrations did not exceed their maximum contaminant levels. No chromium data are available. Because of the frequency by which the recommended maximum chloride and sulfate concentrations were exceeded, the suitability of this water for use as a public supply is questionable.

IRRIGATION.--The salinity hazard ranged from high to very high with more than 99 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with 78 percent of the SAR values equivalent to a medium sodium hazard. None of the boron values exceeded the 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

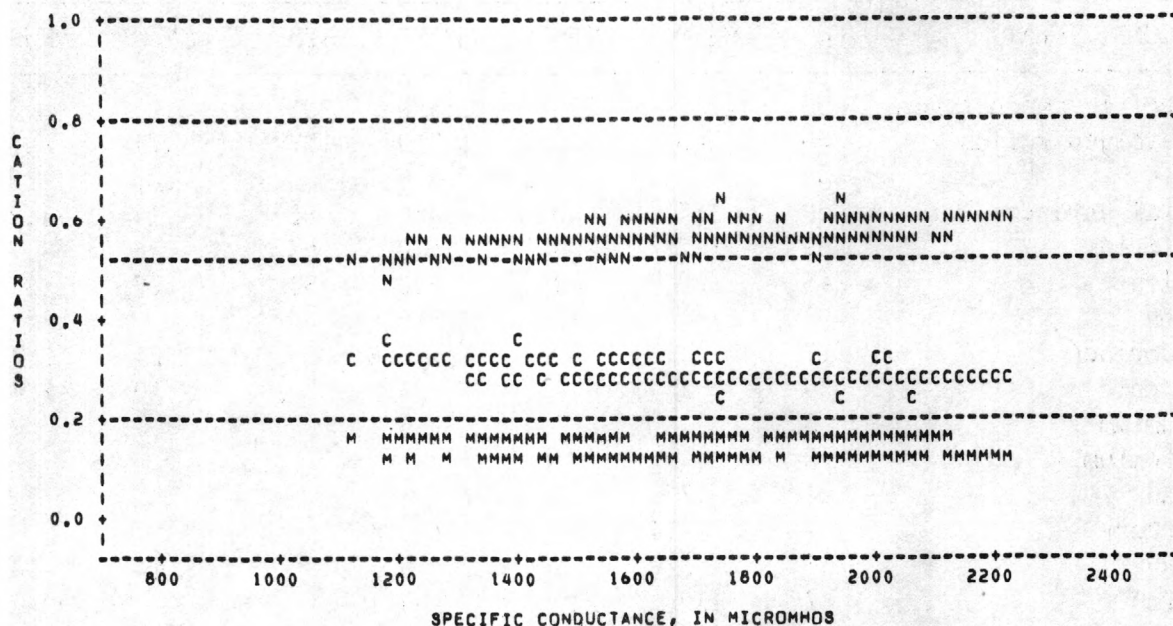
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	262	1,732	925	2,400	291	-0.25	-0.85
Dissolved solids	56	1,065	630	1,310	197	-.71	-.94
pH	259	7.6	6.2	8.7	.4	.05	.22
Total hardness	260	363	260	460	52	-.14	-1.27
Chloride	259	347	200	470	65	-.26	-.79
Sulfate	245	229	88	320	54	-.27	-1.14
Iron	8	44	20	110			
Fluoride	217	.3	.1	.8	.1	1.21	5.12
Arsenic	20	2	1	3	.8	-.30	-1.40
Cadmium	3	4	2	5			
Chromium	0						
Lead	4	2	2	3			
Mercury	2	.4	.2	.6			
SAR	237	5.0	3.3	6.6	.7	-.44	-.46
Boron	7	139	120	160			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,340	1,517	1,720	2,000	2,070
Dissolved solids	754	870	1,145	1,228	1,266
pH	7.1	7.3	7.6	7.9	8.1
Total hardness	290	313	368	410	430
Chloride	260	300	350	400	430
Sulfate	159	180	242	272	297
Iron					
Fluoride	.2	.3	.3	.4	.4
Arsenic	1	1	2	3	3
Cadmium					
Chromium					
Lead					
Mercury					
SAR	4.1	4.6	5.1	5.6	5.8
Boron					

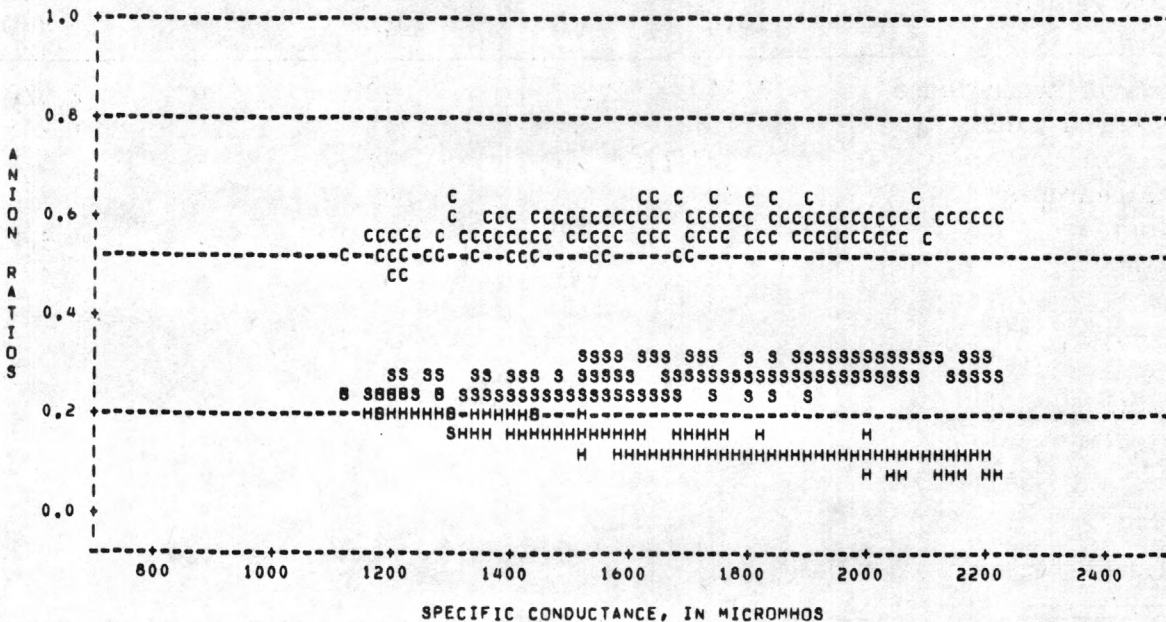
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT DENISON DAM NR DENISON, TX



ANION RATIO PLOT

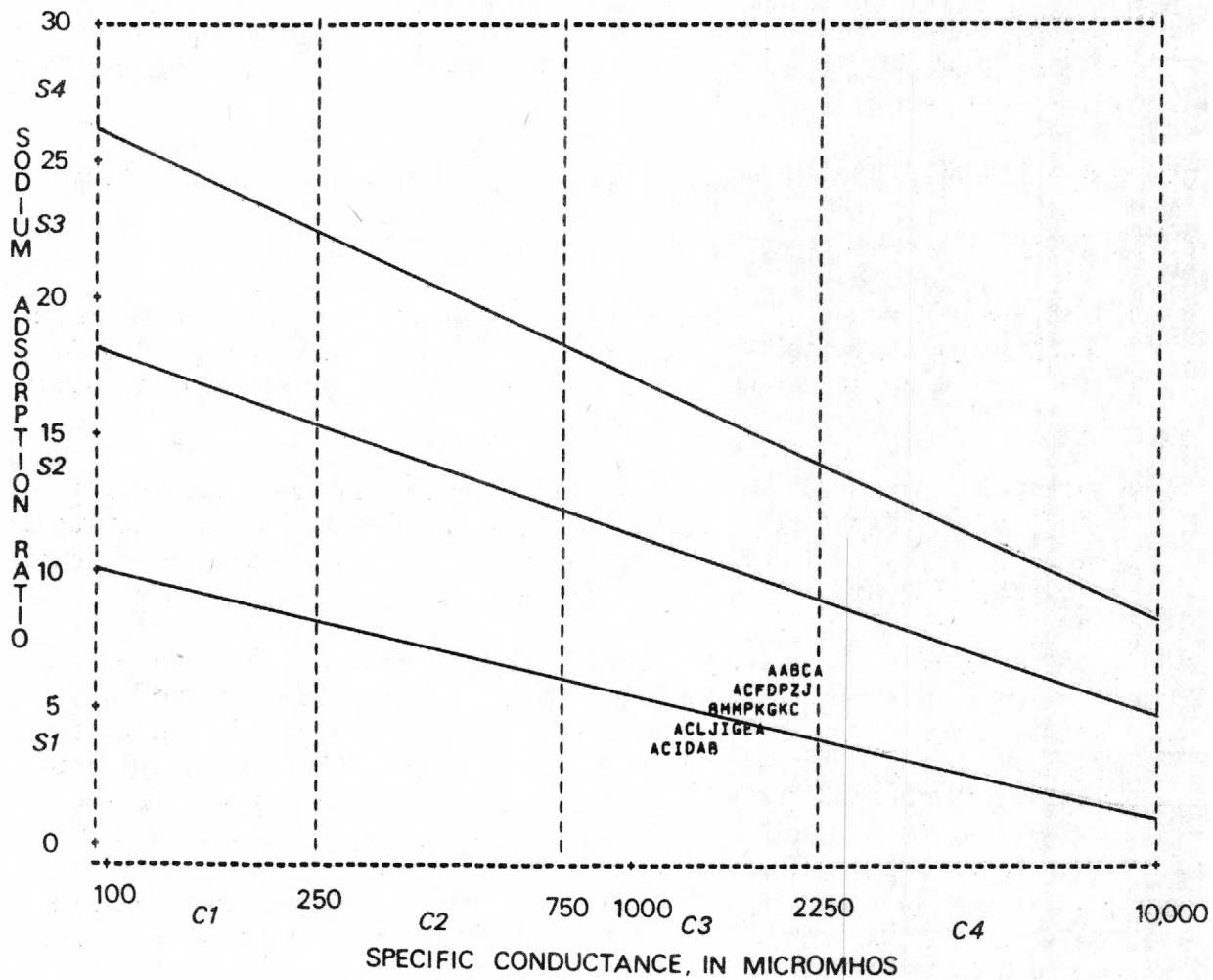
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT DENISON DAM NR DENISON, TX



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT DENISON DAM NR DENISON, TX



RED RIVER MAINSTEM

07335500 - Red River at Arthur City, Tex.

LOCATION.--Lat 33°52'32", long 95°30'08", in NW $\frac{1}{4}$ sec. 11, T.8 S., R.17 E., Choctaw County, Okla., at bridge on U.S. Highway 271 at Arthur City, 10.6 mi downstream from Muddy Boggy River, 26.0 mi upstream from Kiamichi River, and at mile 633.1.

DRAINAGE AREA.--44,531 mi², of which 5,936 mi² probably is noncontributing.

PERIOD OF RECORD.--1960 to 1963, 1976 to 1979.

WATER TYPE.--When the specific conductance was greater than 1,400 umho, which accounted for 38 percent of the samples, the water was sodium chloride type. For specific conductance less than 1,400 umho the water was mixed type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos for these constituents at the 95-percent probability level also do not indicate any trends. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 304 mg/L and 85 percent of the hardness values were greater than the very hard water minimum limit of 180 mg/L. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 52 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 20 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride concentration was exceeded, this water may not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 78 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with 84 percent of the SAR values equivalent to a low sodium hazard. None of the boron concentrations exceeded the 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

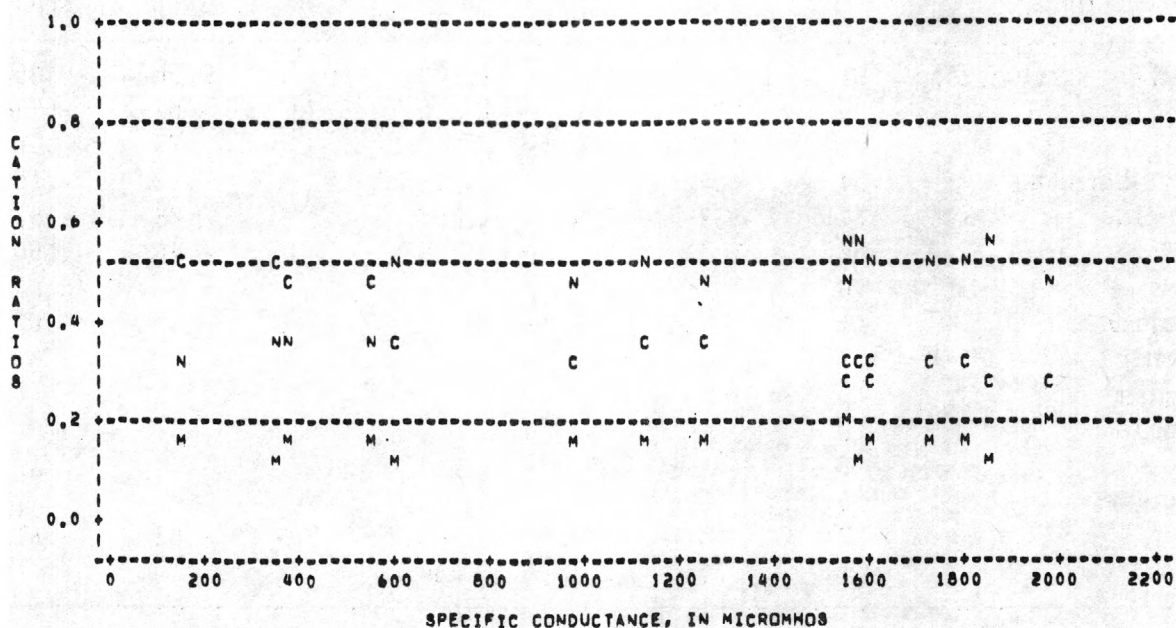
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	91	1,192	162	2,100	493	-0.26	-0.85
Dissolved solids	29	775	111	1,220	315	-.62	-.71
pH	91	8.0	6.6	8.8	.4	-.75	1.06
Total hardness	64	304	58	548	102	-.32	-.16
Chloride	74	238	15	494	113	-.28	-.87
Sulfate	62	173	10	289	77	-.40	-.90
Iron	0						
Fluoride	11	.4	.2	.5	.1	.53	-1.02
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	32	3.6	.7	5.2	1.3	-.83	-.51
Boron	7	226	130	430			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	452	910	1,260	1,580	1,800
Dissolved solids	253	587	902	1,015	1,130
pH	7.4	7.7	8.0	8.2	8.4
Total hardness	154	232	317	380	411
Chloride	63	150	260	319	370
Sulfate	57	123	190	237	265
Iron					
Fluoride	.2	.3	.3	.5	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.3	2.6	4.2	4.6	4.8
Boron					

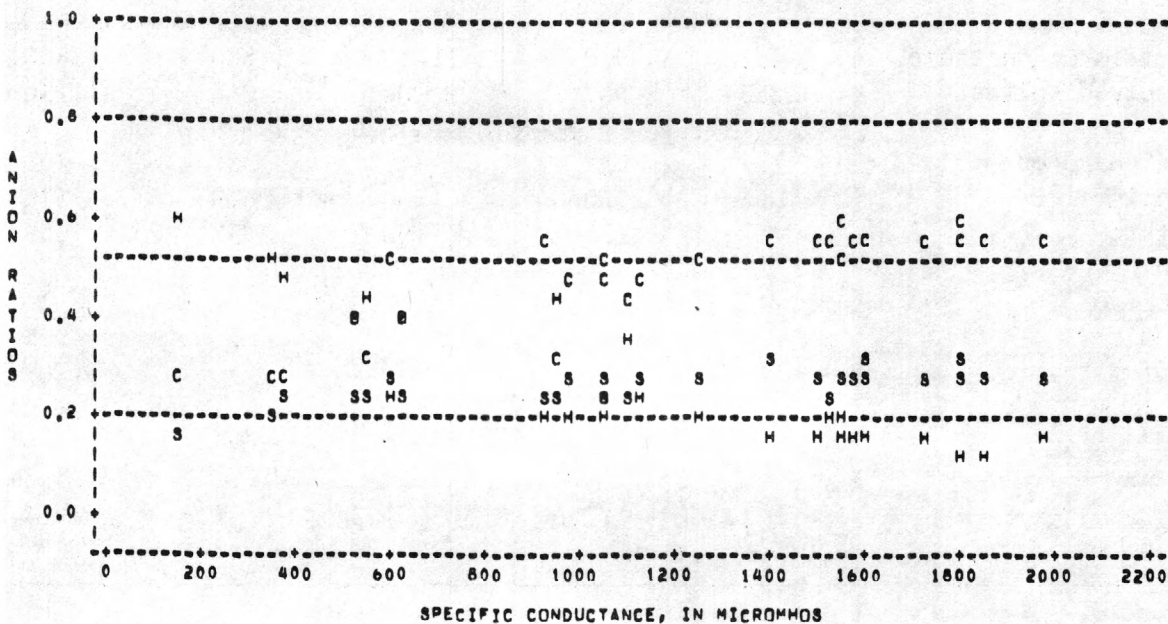
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT ARTHUR CITY, TX



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT ARTHUR CITY, TX



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

Figure 1 is a graph showing the relationship between Sodium Adsorption Ratio (SAR) and Specific Conductance (in micromhos). The Y-axis represents SAR, ranging from 0 to 30. The X-axis represents Specific Conductance, ranging from 100 to 10,000 micromhos. Three lines, labeled S1, S2, and S4, represent different SAR thresholds. S1 is the lowest line, S2 is in the middle, and S4 is the highest. Data points are plotted as triangles, mostly clustered between 1000 and 2250 micromhos and SAR values between 1 and 5. The graph is divided into four regions by vertical dashed lines at 250, 750, and 2250 micromhos, labeled C1, C2, C3, and C4.

RED RIVER MAINSTEM

07336850 - Red River near New Boston, Tex.

LOCATION.--Lat 33°34'05", long 94°24'20", Bowie County, at bridge on State Highway 8, 7 mi north of New Boston.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1961 to 1963.

WATER TYPE.--The data indicate that for specific conductance greater than about 600 umho, which accounted for more than 75 percent of the samples, the water was sodium chloride type. For specific conductance less than 600 umho it appears that the water probably was calcium carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 267 mg/L and 73 percent of the hardness values were greater than the very hard class minimum limit of 180 mg/L. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 50 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 5 percent of the sulfate values. No toxic metal data are available. Because of the frequency by which the recommended maximum chloride concentration was exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to high with 73 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with 88 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

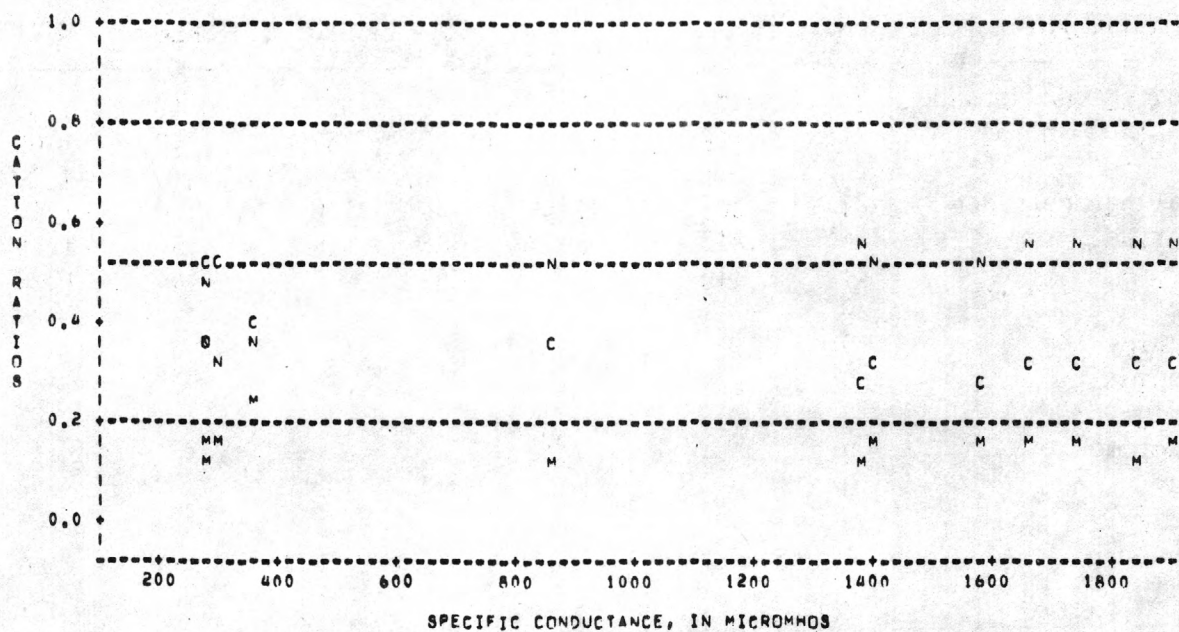
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	24	1,137	277	1,900	536	-0.49	-1.09
Dissolved solids	24	718	166	1,220	338	-.42	-1.09
pH	24	8.0	7.6	8.4	.2	.07	-1.02
Total hardness	24	267	84	420	110	-.54	-1.10
Chloride	24	212	25	385	118	-.36	-1.10
Sulfate	24	146	28	255	77	-.44	-1.26
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	24	3.4	1.0	5.1	1.3	-.69	-.86
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	288	679	1,330	1,570	1,780
Dissolved solids	196	421	818	995	1,145
pH	7.8	7.8	8.0	8.3	8.4
Total hardness	93	160	304	350	392
Chloride	29	126	250	312	364
Sulfate	30	58	166	205	233
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.0	2.4	3.9	4.5	4.7
Boron					

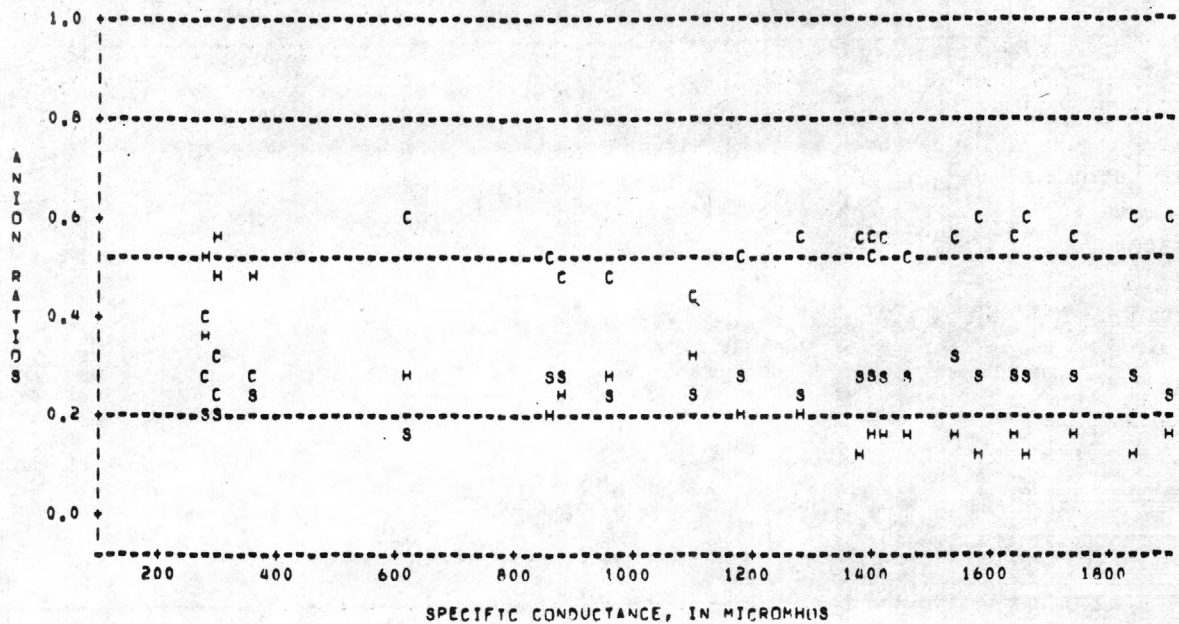
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER: RED RIVER NEAR NEW BOSTON, TEX



ANION RATIO PLOT

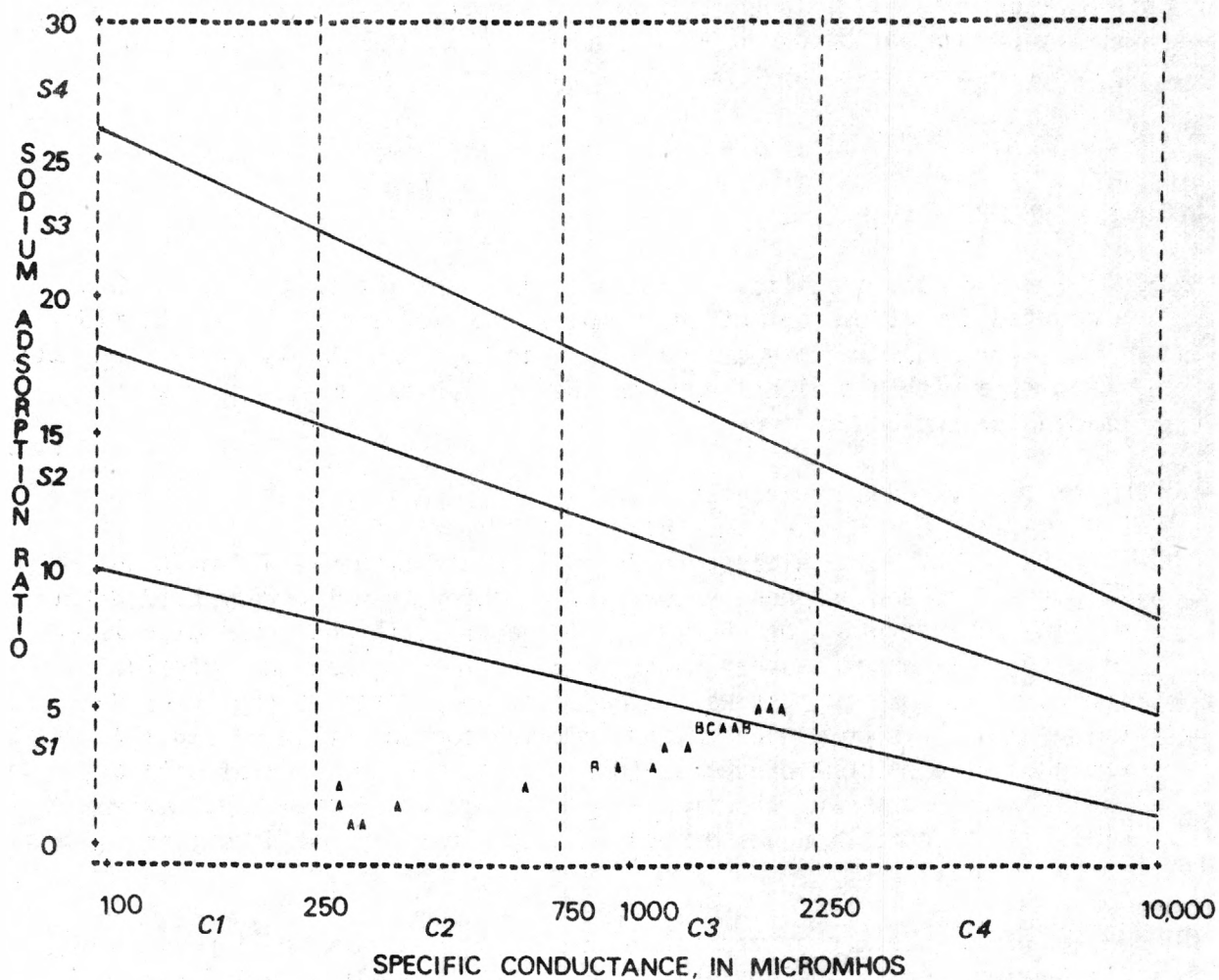
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER: RED RIVER NEAR NEW BOSTON, TEX



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=RED RIVER NEAR NEW RUSTON, TEX



RED RIVER MAINSTEM

07337000 - Red River at Index, Ark.

LOCATION.--Lat 33°33'07", long 94°02'28", in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 7, T.14 S., R.28 W., Miller County, at bridge on U.S. Highway 71 at Index, 2.2 mi south of Ogden, 20.6 mi upstream from Little River, and at mile 485.3.

DRAINAGE AREA.--48,030 mi², of which 5,936 mi² probably is noncontributing.

PERIOD OF RECORD.--1960 to 1963.

WATER TYPE.--When the specific conductance was greater than 600 umho, which accounted for 82 percent of the samples, the water was sodium chloride type. For specific conductance less than 600 umho the water was generally mixed type with occasional periods when the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 253 mg/L and 75 percent of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 30 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 4 percent of the sulfate values. No toxic metal data are available. Because of the frequency by which the recommended maximum chloride concentration was exceeded, this water may not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 71 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with 90 percent of the SAR values equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects should not occur.

UNIVARIATE STATISTICS

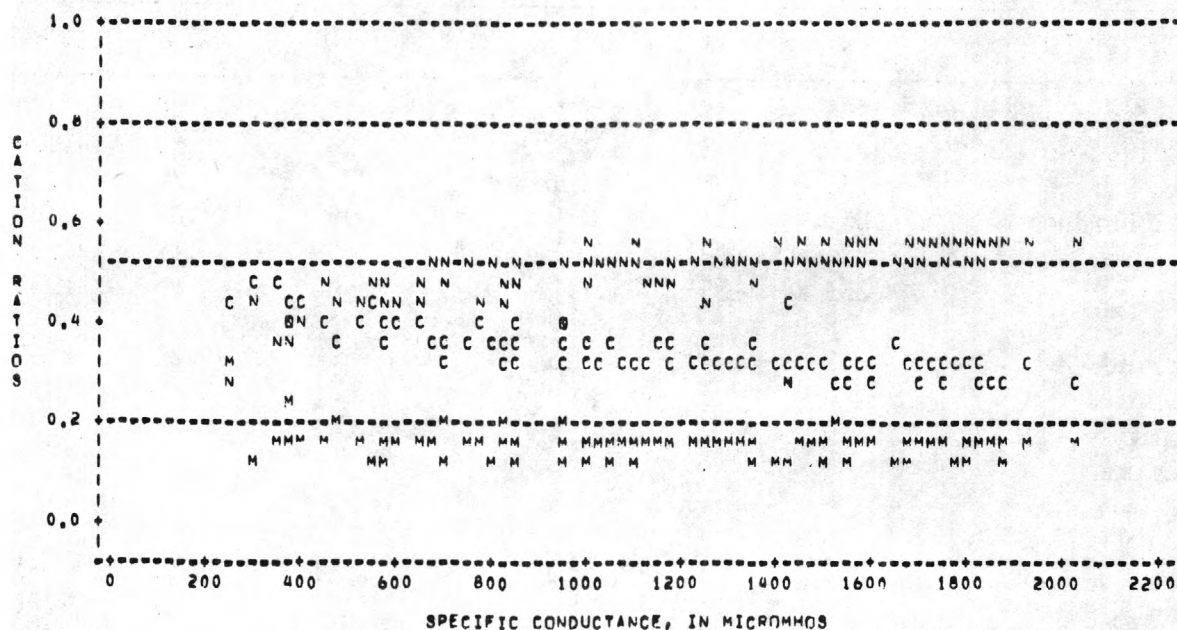
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	256	1,046	206	2,020	439	0.06	-0.90
Dissolved solids	229	653	157	1,260	281	.10	-1.06
pH	255	8.0	7.0	9.2	.3	-.20	1.36
Total hardness	232	253	86	445	92	.03	-1.05
Chloride	234	190	23	405	98	.19	-1.00
Sulfate	233	135	20	275	66	.16	-1.05
Iron	0						
Fluoride	33	.3	.1	.5	.1	.25	-.25
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	232	3.2	.1	5.3	1.2	-.22	-.81
Boron	32	274	60	560	129	.48	-.71

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	454	694	1,050	1,368	1,670
Dissolved solids	277	418	646	880	1,050
pH	7.7	7.9	8.0	8.2	8.4
Total hardness	124	180	251	330	380
Chloride	61	110	186	265	328
Sulfate	50	84	132	192	223
Iron					
Fluoride	.1	.2	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.5	2.3	3.2	4.1	4.6
Boron	112	185	240	400	460

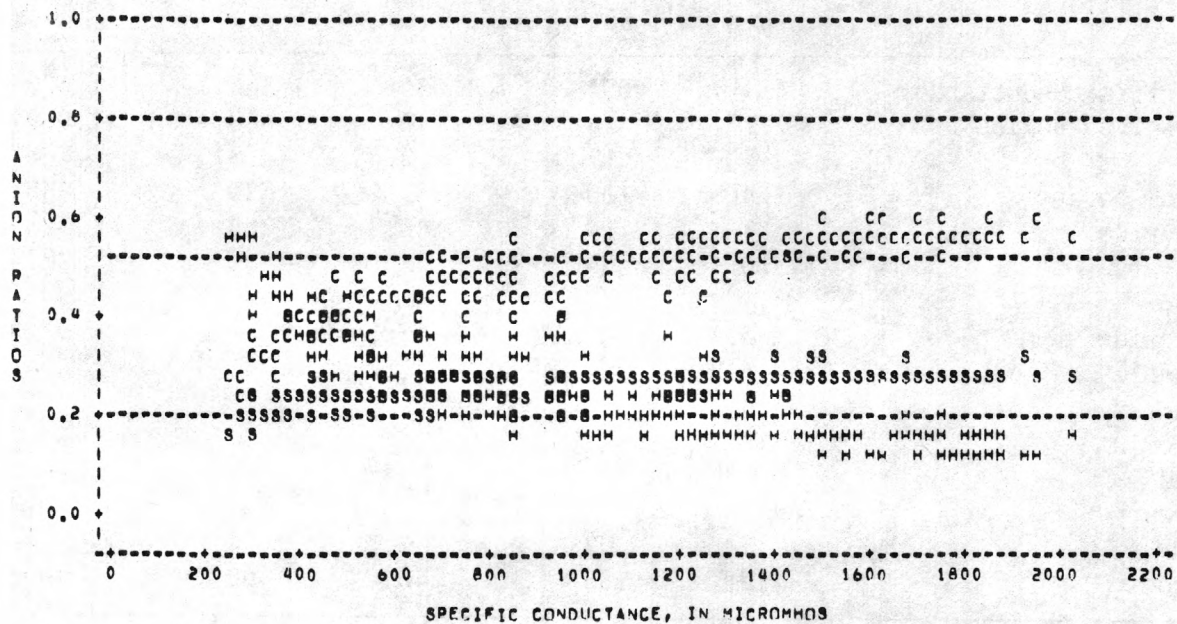
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT INDEX,ARK

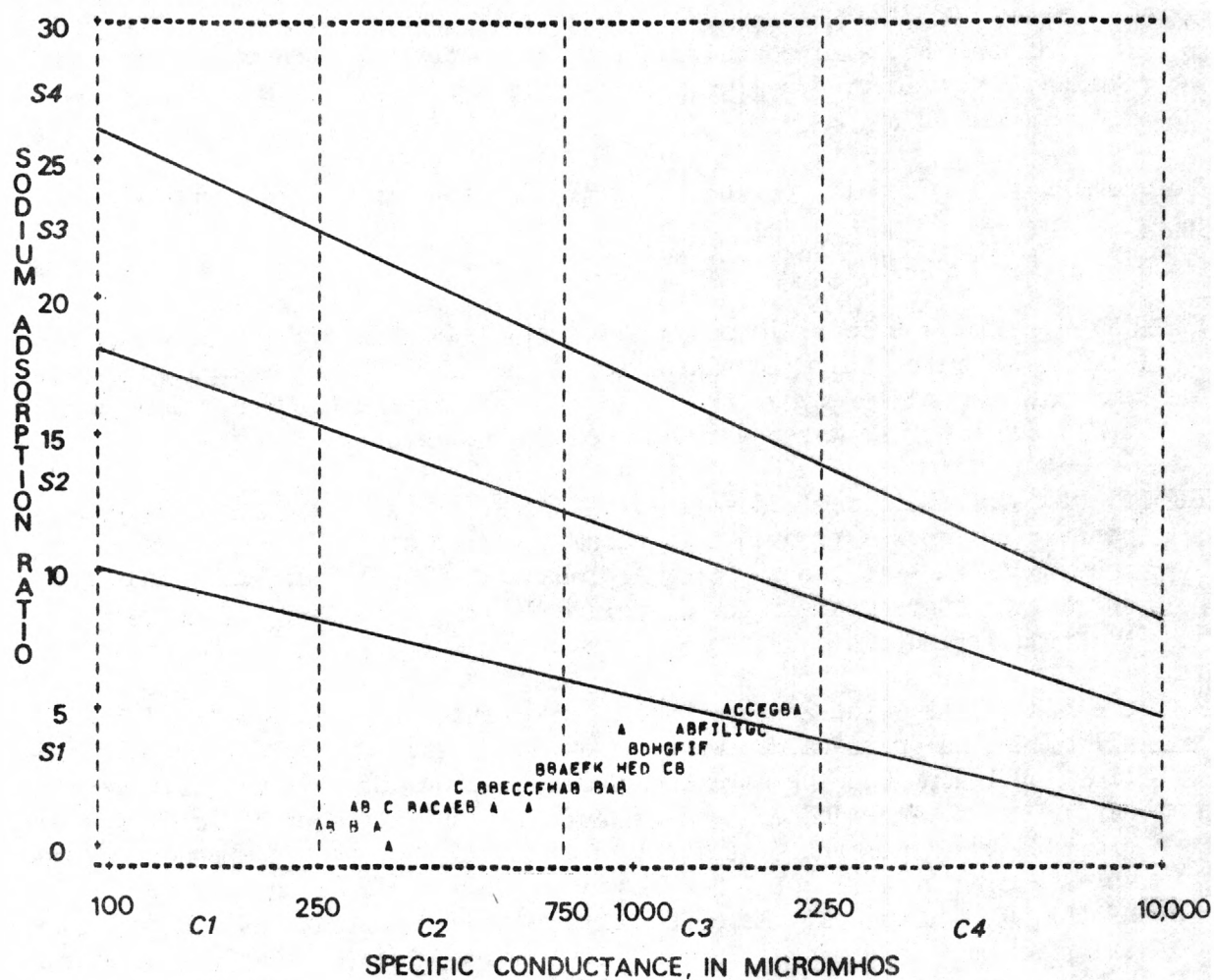


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT INDEX,ARK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 DBB, B = 2 DBB, C = 3 DBB
 STATION NAME OR LOCAL IDENTIFIER=RED RIVER AT INDEX,ARK



RED RIVER MAINSTEM

07300000 - Salt Fork Red River near Wellington, Tex.

LOCATION.--Lat 34°57'27", long 100°13'14", Collingsworth County, at bridge on U.S. Highway 83, 4 mi downstream from Fort Worth and Denver (Burlington) Railway Co. bridge, 4.5 mi south of Lutie, 7.2 mi north of Wellington, and at mile 86.8.

DRAINAGE AREA.--1,222 mi², of which 209 mi² probably is noncontributing.

PERIOD OF RECORD.--1960, 1967 to 1979.

WATER TYPE.--When the specific conductance was less than 1,500 umho or greater than 2,500 umho, which accounted for 81 percent of the samples, the water was calcium sulfate type. For specific conductance between 1,500 umho and 2,500 umho the water was mixed cation sulfate type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time do not indicate any trends. However, the Spearman's rhos at the 95-percent probability level indicate trends of increasing concentration for dissolved solids, hardness, and sulfate. No trend is indicated by the Spearman's rho for chloride.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,335 mg/L and all of the hardness values were greater than the very hard water minimum limit of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 51 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by more than 99 percent of the sulfate values. Arsenic and chromium concentrations did not exceed their maximum contaminant levels. No cadmium, lead, or mercury data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 79 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to medium with 98 percent of the SAR values equivalent to a low sodium hazard. None of the boron concentrations exceeded the 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

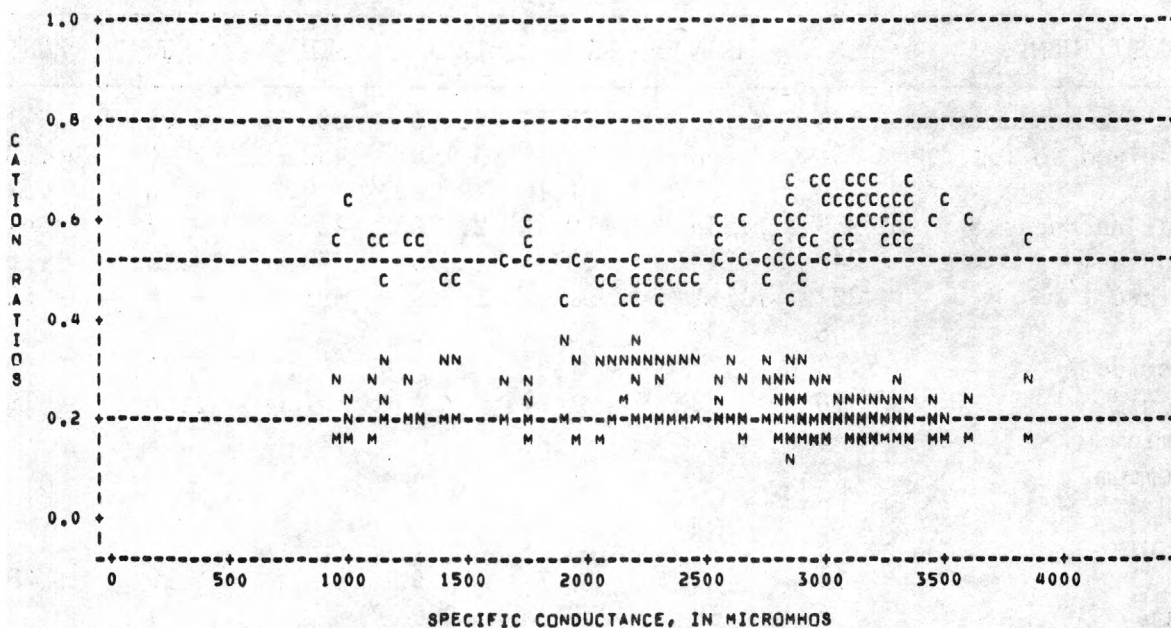
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	243	2,748	775	4,190	685	-1.02	0.51
Dissolved solids	36	2,608	717	3,190	482	-2.16	6.00
pH	226	7.8	7.1	8.7	0.2	.16	.37
Total hardness	239	1,335	320	2,116	425	-.72	-.61
Chloride	240	242	58	530	74	-.13	1.26
Sulfate	227	1,181	91	1,750	391	-.76	-.52
Iron	5	32	20	50			
Fluoride	112	.6	.0	.9	.1	-.84	3.90
Arsenic	10	2	1	4	1.0	1.96	4.19
Cadmium	0						
Chromium	2	5	2	8			
Lead	0						
Mercury	0						
SAR	214	2.2	.7	5.7	.6	1.19	5.43
Boron	6	238	230	260			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,610	2,420	2,990	3,200	3,360
Dissolved solids	1,899	2,448	2,740	2,898	3,033
pH	7.5	7.6	7.8	7.9	8.1
Total hardness	660	990	1,500	1,700	1,800
Chloride	136	200	252	294	315
Sulfate	560	881	1,300	1,500	1,600
Iron					
Fluoride	.5	.5	.6	.7	.7
Arsenic	1	1	1	2	4
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.4	1.7	2.2	2.5	2.8
Boron					

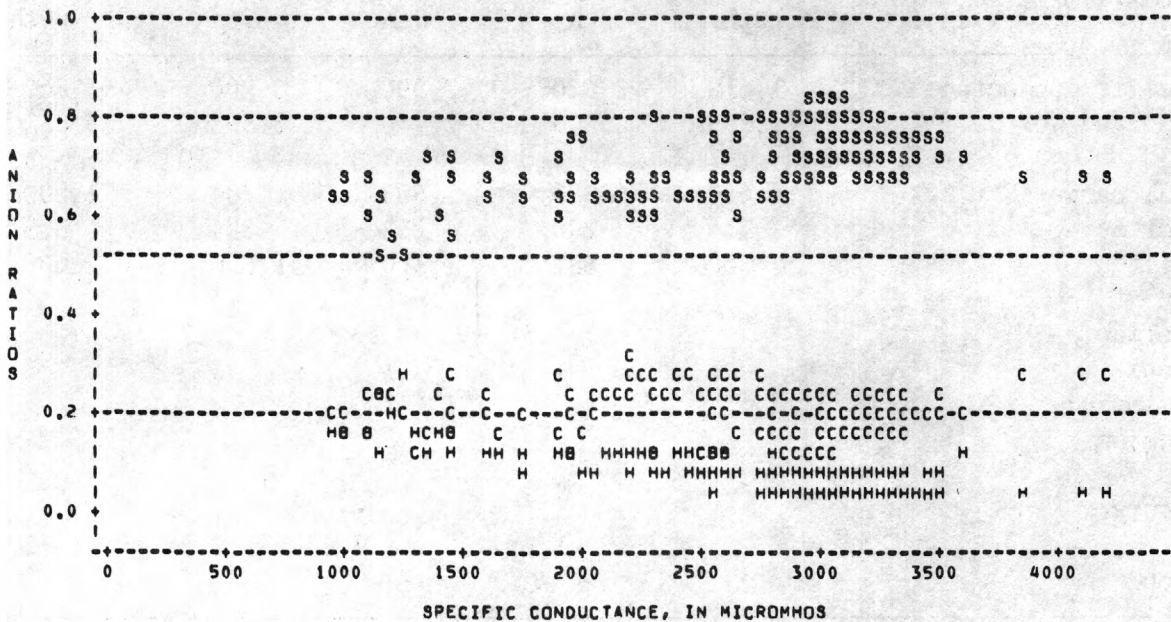
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR WELLINGTON, TX



ANION RATIO PLOT

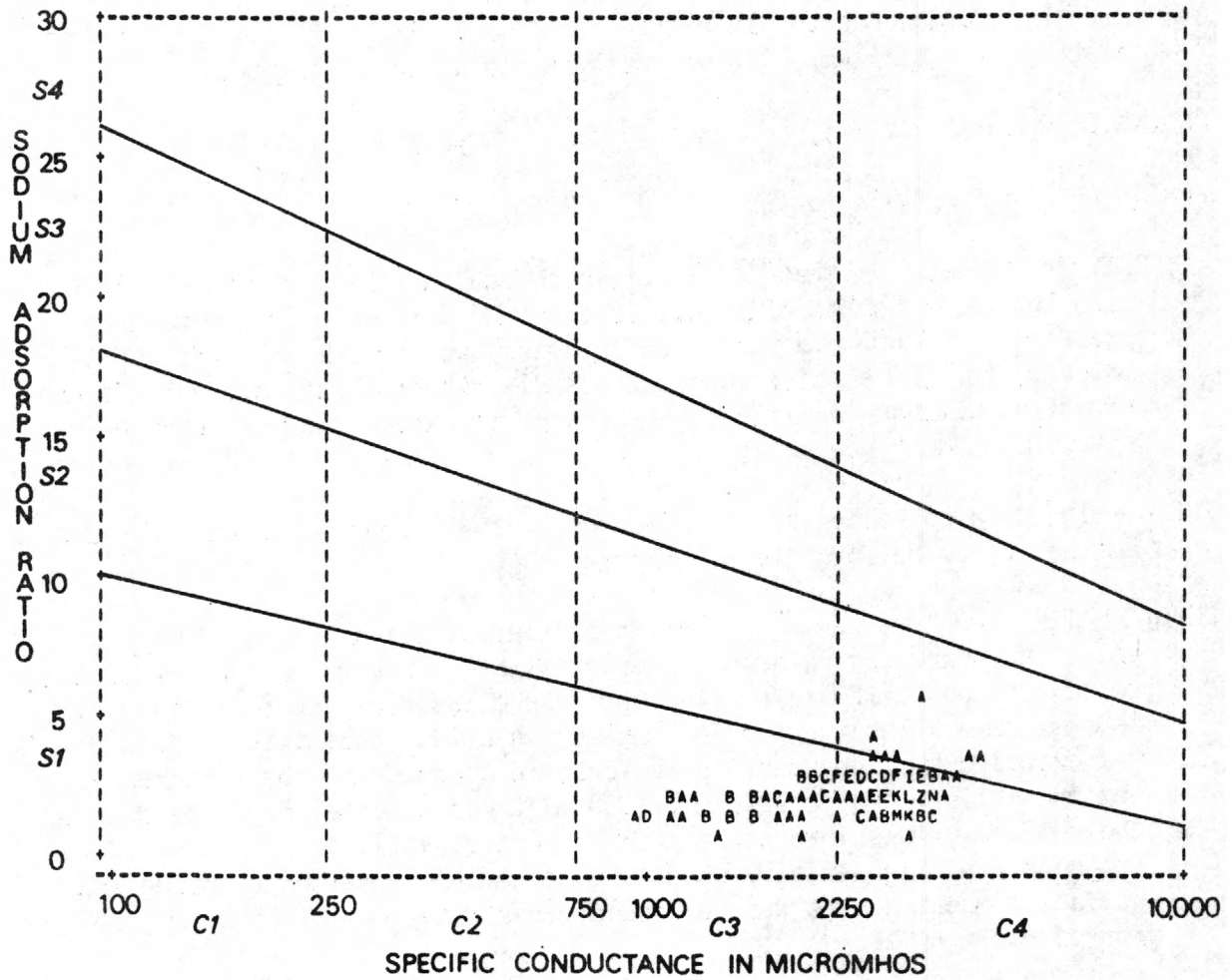
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR WELLINGTON, TX



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR WELLINGTON, TX



RED RIVER MAINSTEM

07300400 - Salt Fork Red River near Vinson, Okla.

LOCATION.--Lat 34°50'07", long 99°55'00", on west line of SW¹/₄ sec. 2, T.4 N., R.26 W., Harmon County, at bridge on State Highway 30, 1.1 mi northeast of Lake Hall spillway, 4.6 mi southwest of Vinson, and at mile 64.2.

DRAINAGE AREA.--1,421 mi², of which 209 mi² probably is noncontributing.

PERIOD OF RECORD.--1952 to 1954, 1960 to 1963, 1977.

WATER TYPE.--It appears that for specific conductance less than about 5,000 umho the water was calcium sulfate type and for specific conductance greater than 5,000 umho the water probably was sodium chloride type. However, the ion-specific conductance distribution data are not adequate to define with any confidence the change in water type with change in specific conductance.

TREND.--The data collected since 1960 are not sufficient, less than 5 years available, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,303 mg/L and all of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 27 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 99 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with more than 99 percent of the samples having a very high (specific conductance greater than 2,250 umho) salinity hazard. The sodium hazard ranged from low to very high with more than 90 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

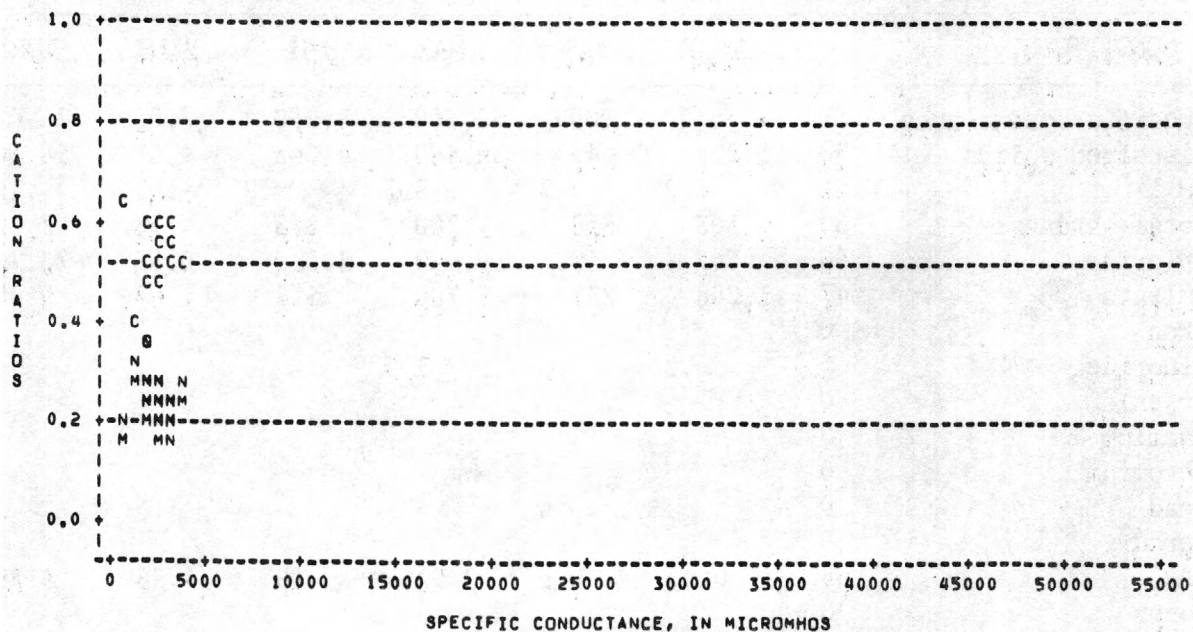
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	51	4,264	909	50,500	8,250	5.02	25.07
Dissolved solids	38	3,637	645	36,400	6,662	4.37	18.96
pH	51	7.8	7.2	8.3	.2	-.03	-.11
Total hardness	50	1,303	368	3,200	548	.98	2.72
Chloride	50	862	49	19,000	3,239	5.05	25.20
Sulfate	47	1,208	237	3,700	538	1.87	9.08
Iron	0						
Fluoride	6	.8	.6	1.0			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	38	6.5	1.1	97	19	4.38	18.78
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,710	2,270	2,800	3,100	3,680
Dissolved solids	1,349	1,815	2,150	2,665	3,020
pH	7.5	7.7	7.8	8.0	8.2
Total hardness	523	980	1,295	1,650	1,821
Chloride	138	192	220	254	292
Sulfate	584	940	1,210	1,510	1,604
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.8	2.0	2.3	2.5	3.1
Boron					

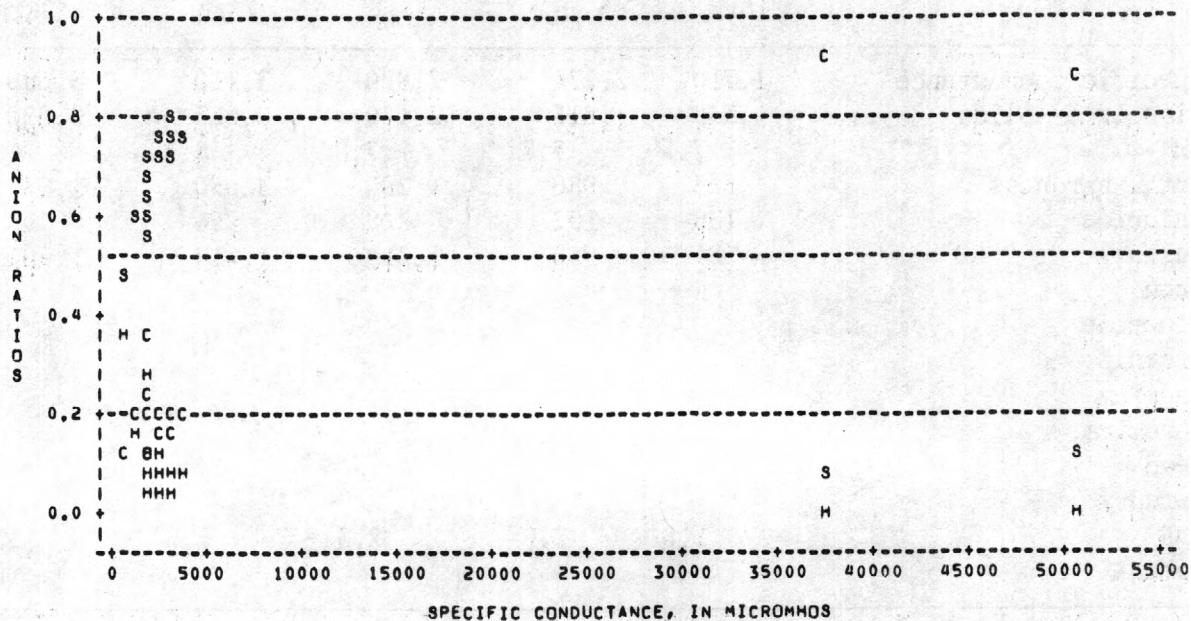
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR VINSON, OK



ANION RATIO PLOT

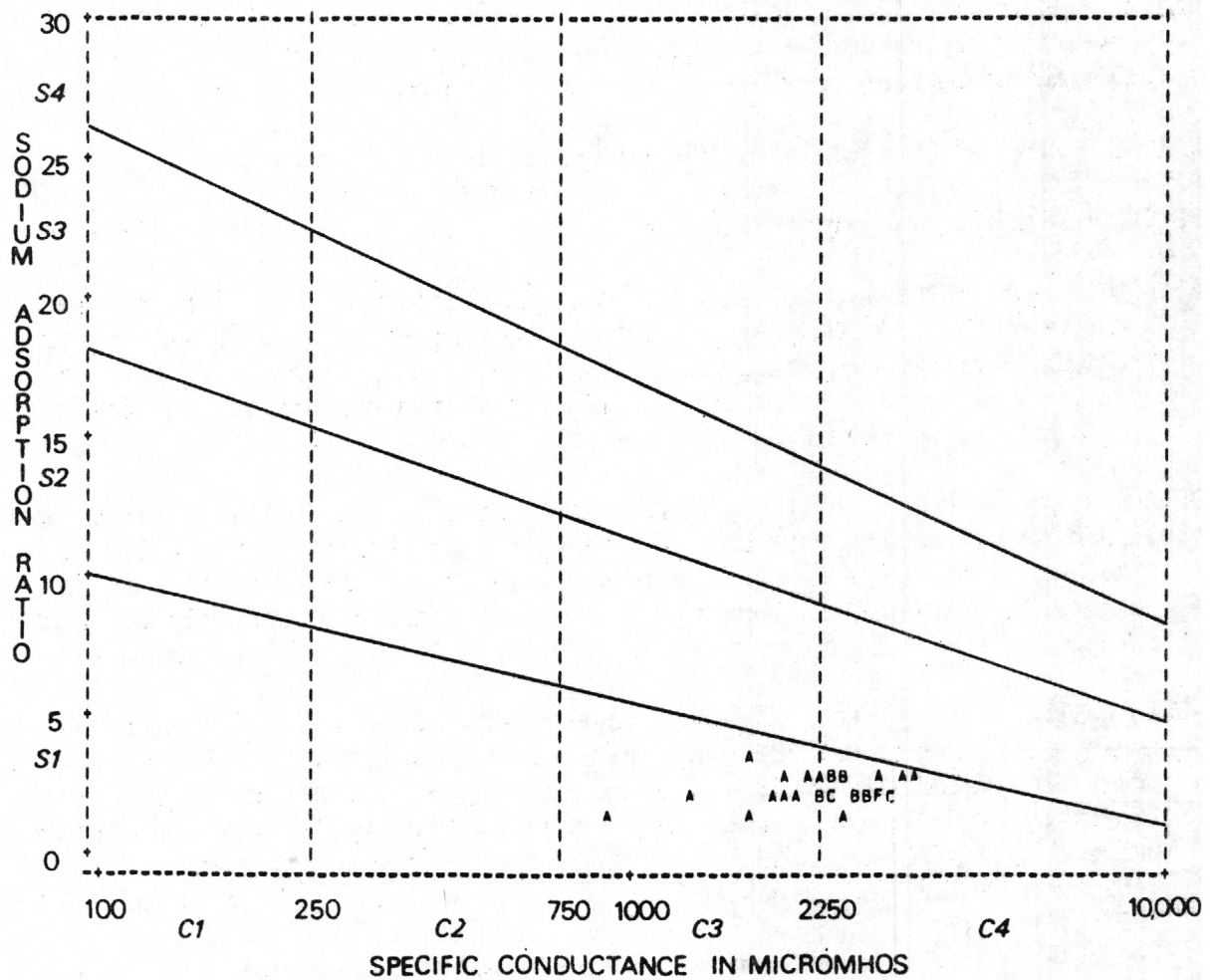
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR VINSON, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR VINSON, OK



RED RIVER MAINSTEM

07300500 - Salt Fork Red River at Mangum, Okla.

LOCATION.--Lat 34°51'32", long 99°30'28", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 34, T.5 N., R.22 W., Greer County, at bridge on State Highway 34, 0.5 mi south of Mangum, 13.0 mi downstream from Fish Creek, and at mile 35.5.

DRAINAGE AREA.--1,566 mi², of which 209 mi² probably is noncontributing.

PERIOD OF RECORD.--1947 to 1952, 1954 to 1956, 1960 to 1963, 1975 to 1979.

WATER TYPE.--When the specific conductance was greater than 1,000 umho, which accounted for more than 99 percent of the samples, the water was calcium sulfate type. For specific conductance less than 1,000 umho the water was chloride type. No cation-specific conductance distribution data are available for specific conductance less than 1,000 umho.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate trends of increasing concentration for hardness and chloride. The Spearman's rhos for the three constituents at the 95-percent probability level also indicate positive trend for hardness and chloride and no trend for sulfate. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,305 mg/L and more than 99 percent of the hardness values were greater than the minimum very hard water concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 21 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 97 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum sulfate concentration was exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 75 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to medium with 95 percent of the SAR values equivalent to a low sodium hazard. None of the boron values exceeded the 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

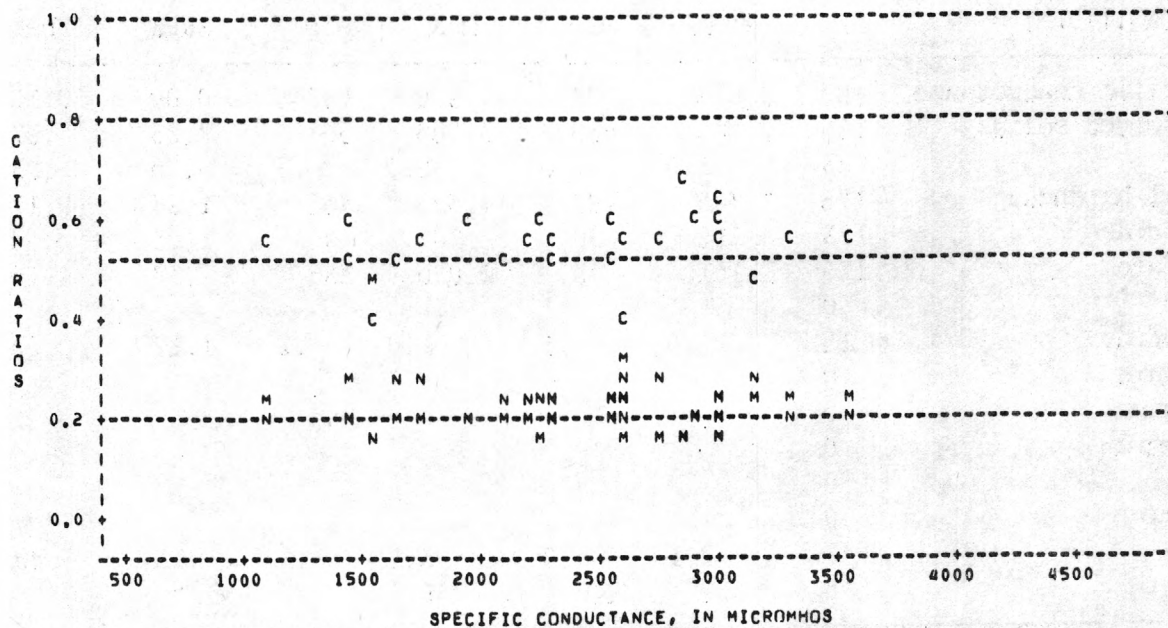
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	189	2,613	774	4,900	682	0.00	0.19
Dissolved solids	145	2,045	630	3,300	594	-.23	-.37
pH	83	8.0	7.0	9.0	.3	-.26	.93
Total hardness	175	1,305	97	4,325	465	1.28	9.17
Chloride	183	215	70	704	90	1.95	6.94
Sulfate	175	1,161	48	2,056	386	-.37	-.16
Iron	0						
Fluoride	15	.6	.5	1.0	.2	1.12	.76
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	42	2.1	.9	3.1	.5	-.13	.48
Boron	6	432	240	750			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,600	2,245	2,650	3,000	3,500
Dissolved solids	1,200	1,695	2,080	2,460	2,780
pH	7.5	7.8	8.0	8.2	8.4
Total hardness	700	1,020	1,330	1,600	1,781
Chloride	114	178	208	240	284
Sulfate	654	887	1,199	1,450	1,640
Iron					
Fluoride	.5	.5	.6	.7	.9
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.4	1.9	2.0	2.3	2.7
Boron					

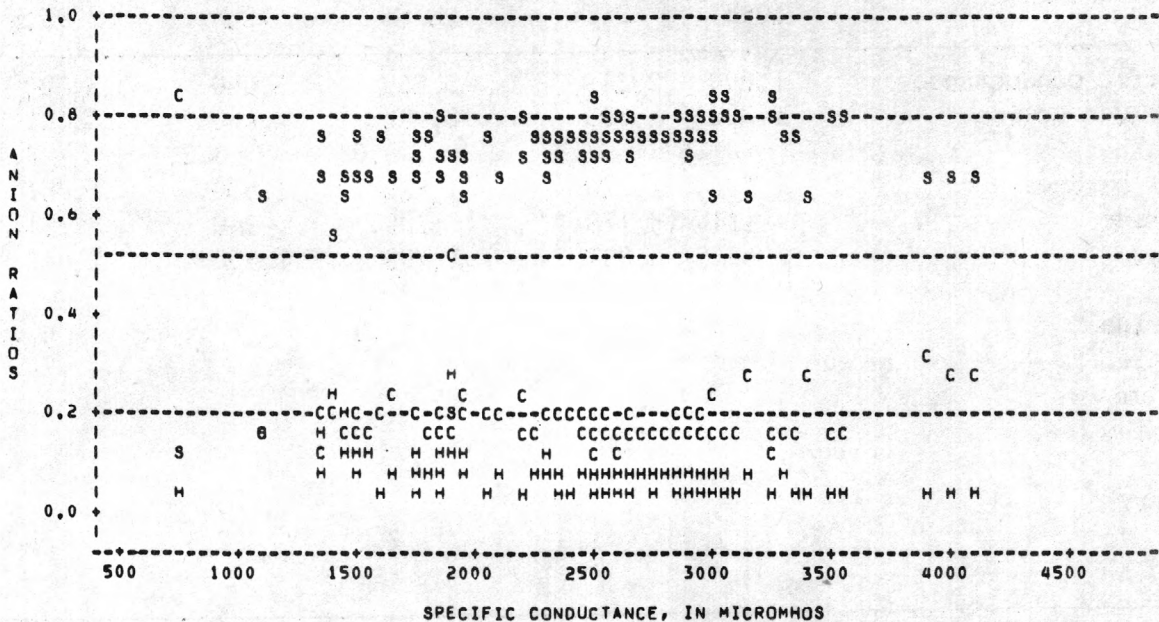
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER AT MANGUM, OK



ANION RATIO PLOT

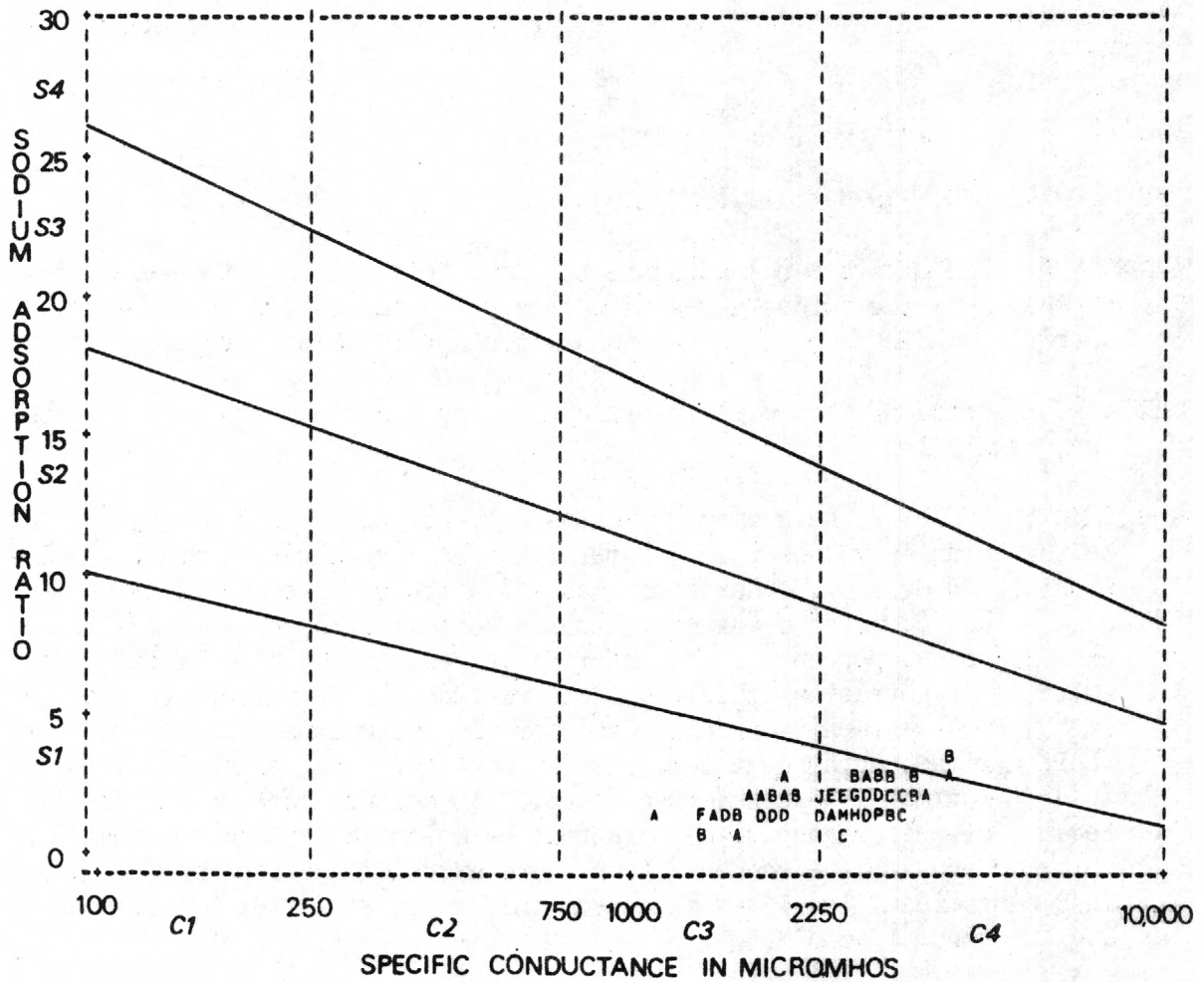
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER AT MANGUM, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER AT MANGUM, OK



RED RIVER MAINSTEM

07301110 - Salt Fork Red River near Elmer, Okla.

LOCATION.--Lat 34°28'44", long 99°22'55", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 15, T.1 S., R.21 W., Jackson County, at bridge on State Highway 5, 1.7 mi west of Elmer, and at mile 3.5.

DRAINAGE AREA.--1,878 mi².

PERIOD OF RECORD.--1978 to 1979.

WATER TYPE.--The data are not adequate to accurately describe the relation between specific conductance and water type. It appears that for most specific conductances the water was mixed cation sulfate type.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,367 mg/L. All of the hardness values were greater than the very hard minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 86 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 94 percent of the sulfate values. Arsenic, cadmium, and chromium concentrations did not exceed their maximum contaminant levels. One out of 3 lead values exceeded the 50 ug/L maximum lead contaminant level. No mercury data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded and because the maximum lead contaminant level was exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 85 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to medium with 70 percent of the SAR values equivalent to a medium sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

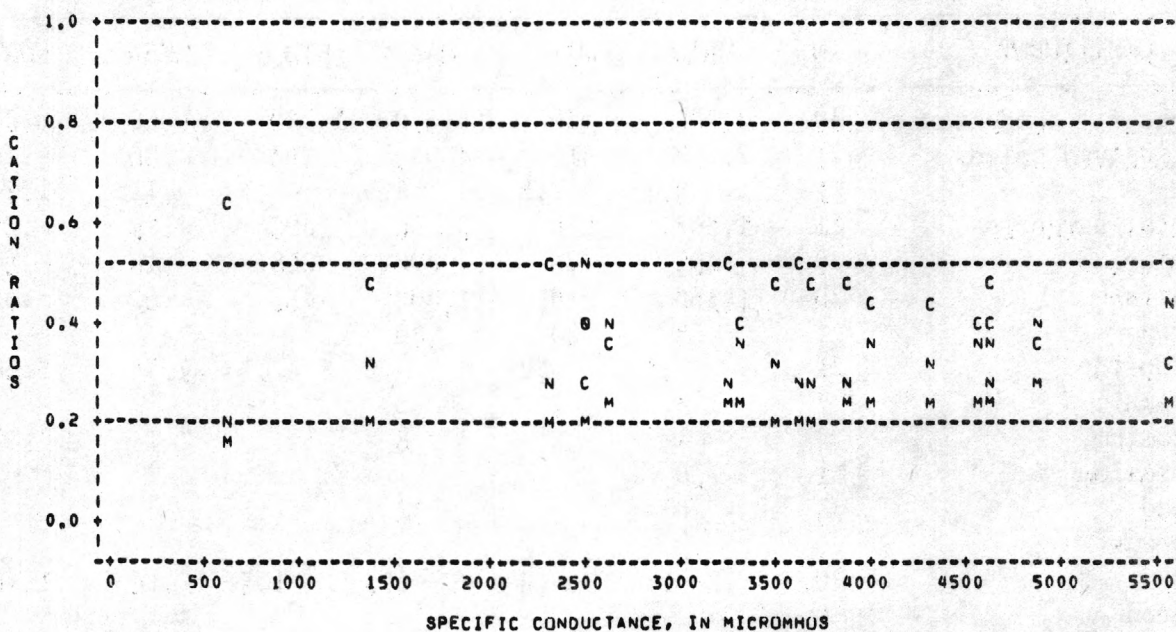
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	20	3,501	620	5,550	1,229	-0.68	0.28
Dissolved solids	21	2,697	419	4,050	993	-.86	-.15
pH	21	8.1	7.3	8.9	.3	.13	1.54
Total hardness	21	1,367	270	2,000	492	-.89	-.25
Chloride	20	492	26	890	218	-.18	-.14
Sulfate	20	1,156	210	1,800	455	-.63	-.65
Iron	4	38	20	80			
Fluoride	21	.5	.2	.6	.1	-1.54	3.68
Arsenic	7	3	2	6			
Cadmium	4	4	2	8			
Chromium	1	20					
Lead	3	26	2	72			
Mercury	0						
SAR	20	3.7	.7	6.5	1.3	-.16	1.10
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,463	2,525	3,660	4,520	4,834
Dissolved solids	1,038	1,745	2,910	3,485	3,628
pH	7.6	7.8	8.1	8.2	8.5
Total hardness	524	885	1,500	1,700	1,880
Chloride	151	370	465	640	796
Sulfate	420	740	1,300	1,475	1,690
Iron					
Fluoride	.4	.5	.5	.6	.6
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.9	3.2	3.8	4.4	5.7
Boron					

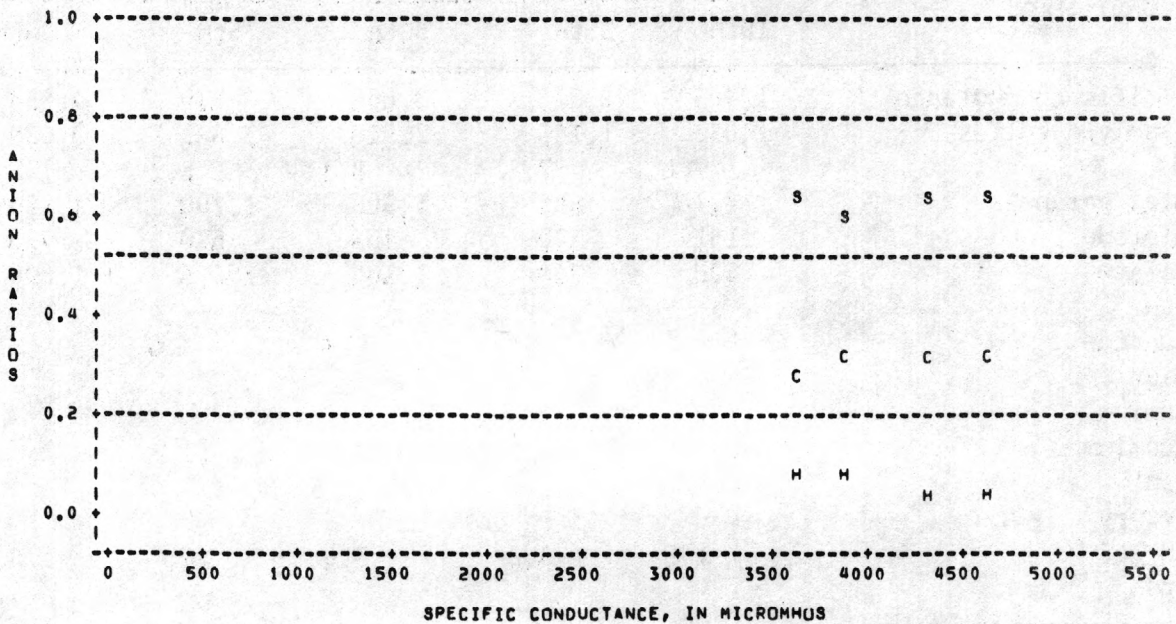
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR ELMER OK

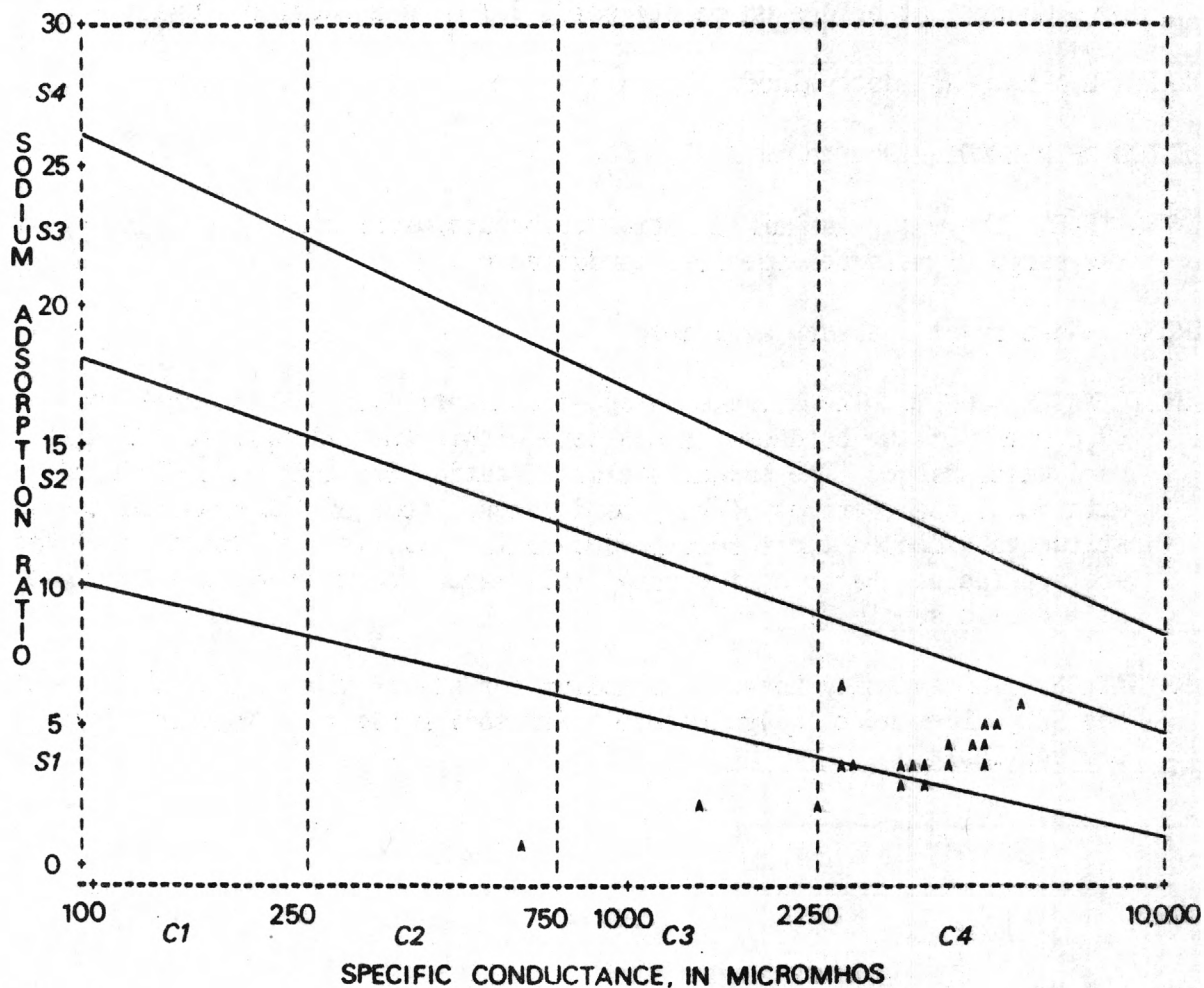


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR ELMER OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=SALT FORK RED RIVER NR ELMER OK



RED RIVER MAINSTEM

07315882 - Simon Creek near Oswalt, Okla.

LOCATION.--Lat 34°01'00", long 97°22'30", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 23, T.6 S., R.2 W., Love County, at bridge on county road, 2.1 mi southwest of Oswalt.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1960 to 1961.

WATER TYPE.--The water was mixed cation carbonate/bicarbonate type throughout the range of measured specific conductance.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 155 mg/L and 69 percent of the hardness values were within the 121 mg/L to 180 mg/L hard water range. The hardness classification for this water is hard with occasional periods of very hard water. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water would be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was medium for all of the samples and all of the SAR values were equivalent to a low sodium hazard. No boron data are available.

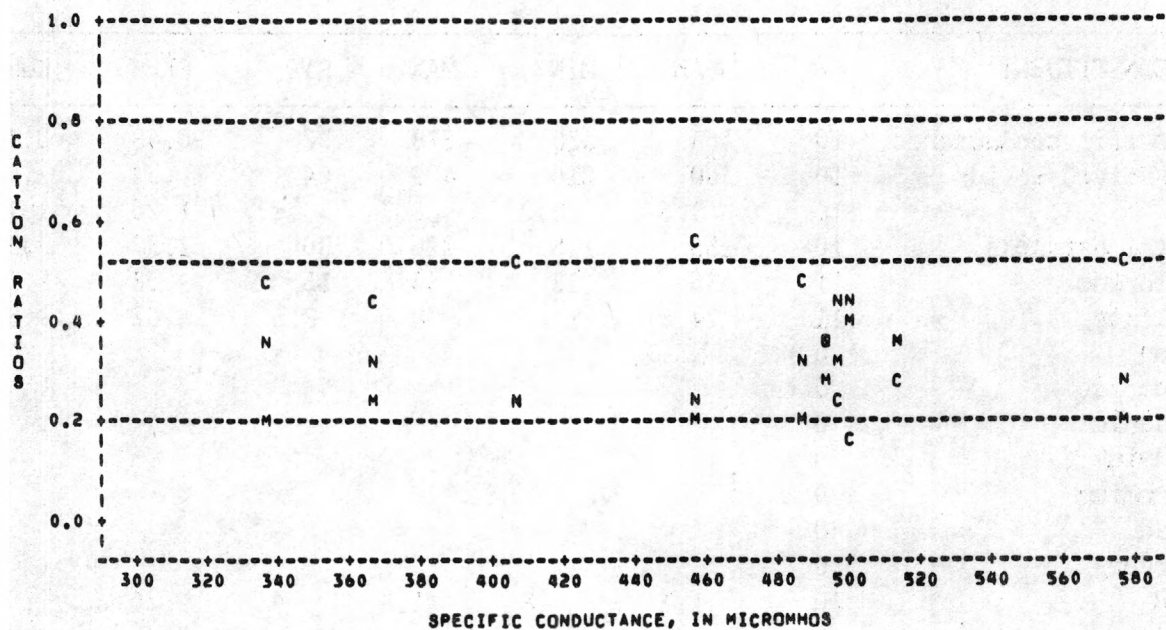
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	10	463	338	578	72	-0.48	-0.19
Dissolved solids	10	300	216	409	64	.34	-.95
pH	10	8.6	8.2	8.7	.2	-1.26	1.12
Total hardness	10	155	116	226	30	1.37	3.30
Chloride	11	36	12	54	15	-.58	-1.48
Sulfate	11	24	11	38	8.5	.02	-.84
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	10	1.3	.8	1.9	.4	.26	-.90
Boron	0						

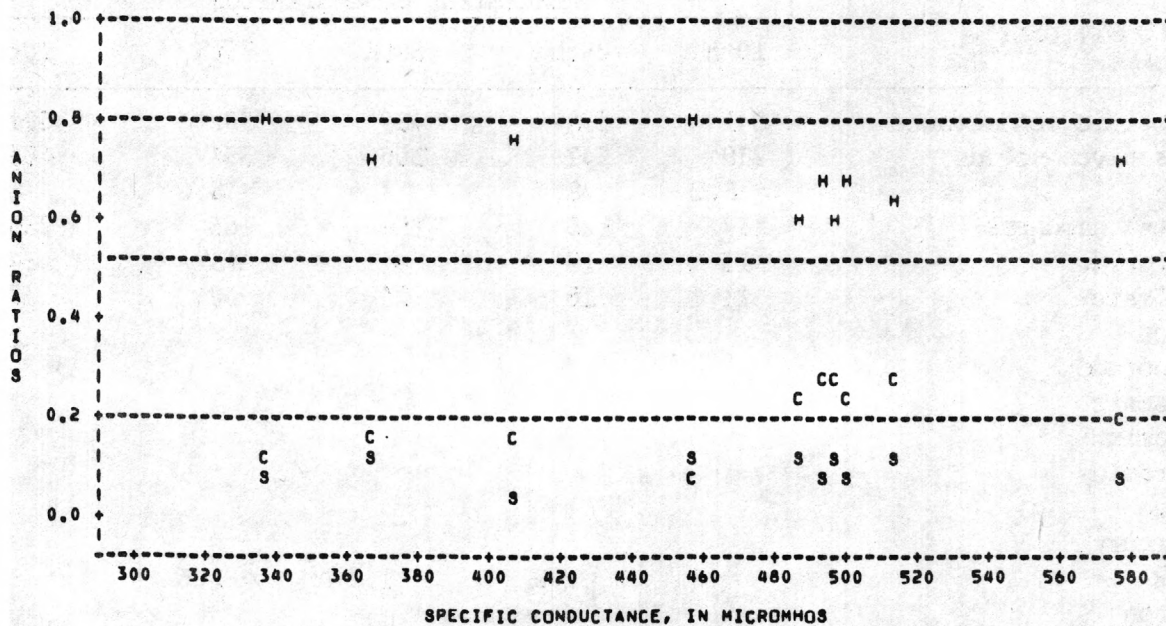
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	341	398	489	502	571
Dissolved solids	218	242	306	354	406
pH	8.2	8.4	8.6	8.6	8.7
Total hardness	117	139	150	165	220
Chloride	13	19	44	48	54
Sulfate	11	16	23	30	37
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.8	1.0	1.2	1.6	1.9
Boron					

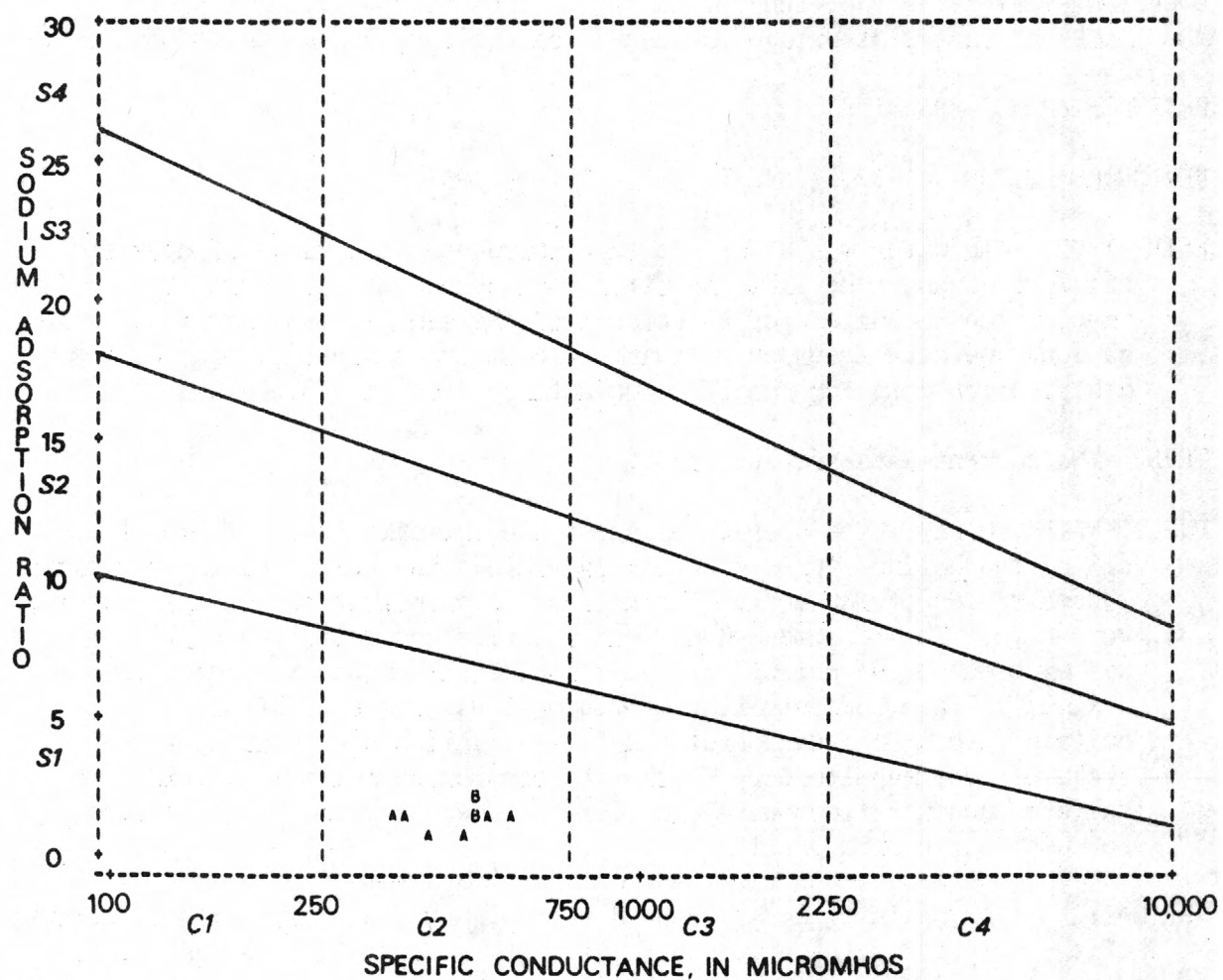
CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=SIMON CREEK NR OSWALT, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=SIMON CREEK NR OSWALT, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=SIMON CREEK NR OSWALT, OK



RED RIVER MAINSTEM

07301100 - Turkey Creek at Olustee, Okla.

LOCATION.--Lat 34°35'58", long 99°26'12", in NW¼ sec. 5, T.1 N., R.21 W., Jackson County, at bridge on county road bridge, 3.2 mi north of Olustee.

DRAINAGE AREA.--293 mi².

PERIOD OF RECORD.--1952, 1954 to 1957, 1961 to 1963.

WATER TYPE.--The water was a sulfate type throughout the range of measured specific conductance. For specific conductance greater than about 3,500 umho, which accounted for 85 percent of the samples, the water was mixed cation type with a tendency toward calcium type. There are no cation distribution data for specific conductance less than 3,500 umho.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,771 mg/L and all of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 93 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by all of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 92 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with 83 percent of the SAR values equivalent to a medium sodium hazard. No boron data are available.

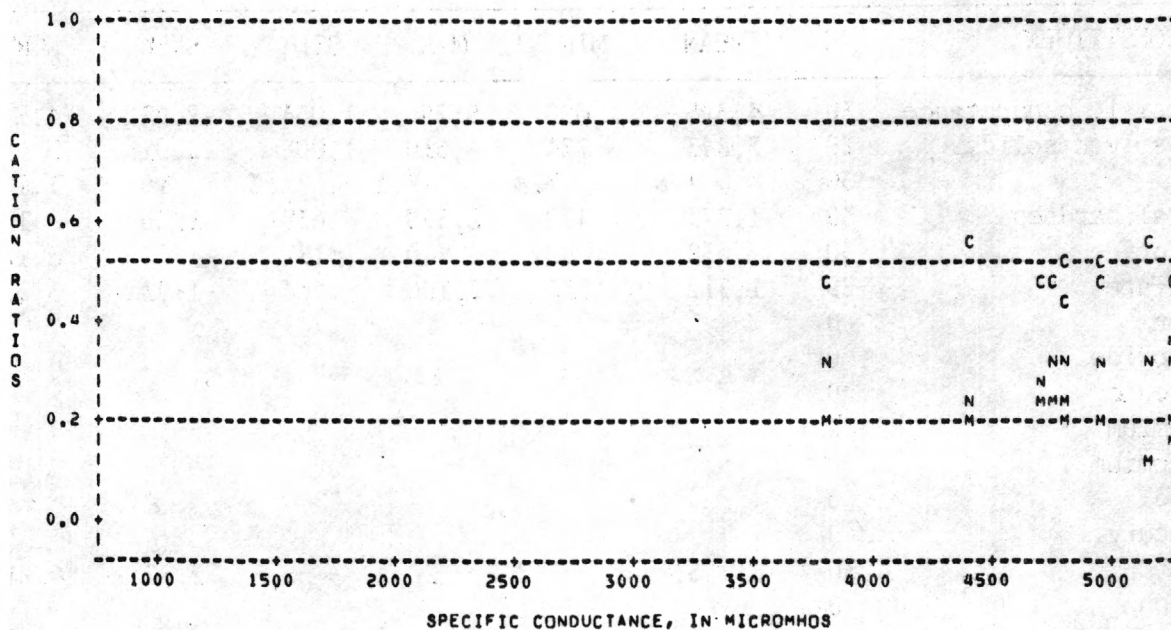
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	30	4,395	1,030	5,250	1,034	-2.08	4.27
Dissolved solids	29	3,843	724	4,610	1,008	-2.01	3.59
pH	30	7.8	7.4	8.1	.2	-.16	-1.10
Total hardness	30	1,771	420	2,350	638	-1.26	.11
Chloride	30	638	82	840	177	-1.73	3.17
Sulfate	29	1,712	315	2,100	464	-1.93	3.31
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	30	5.7	1.2	22	5.3	2.72	6.21
Boron	0						

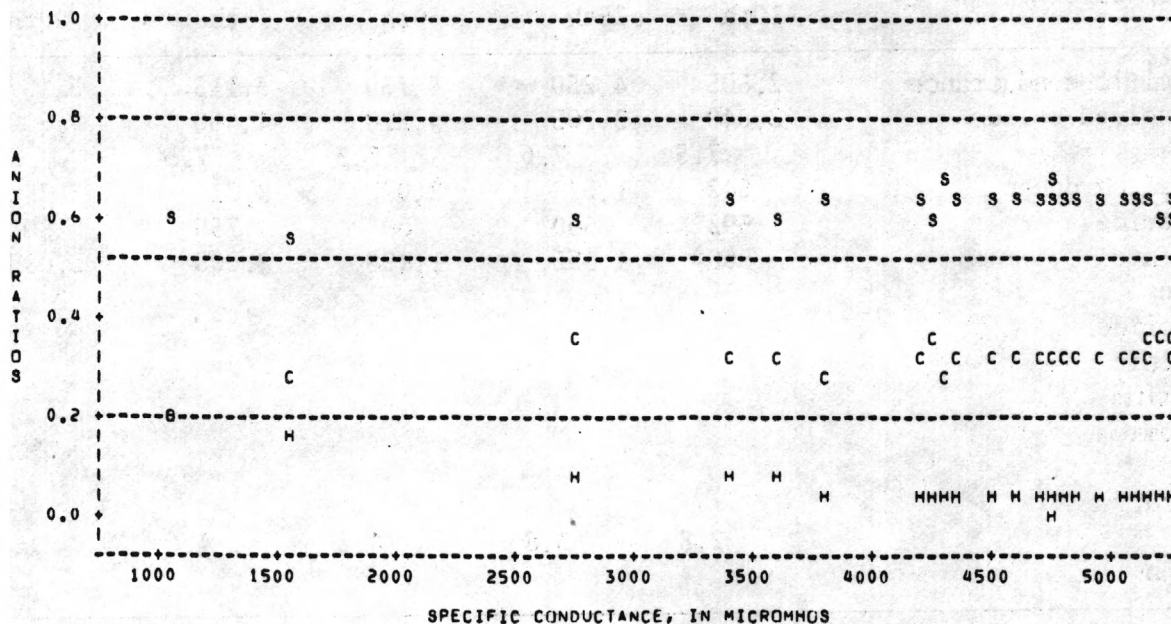
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	2,805	4,250	4,750	5,115	5,197
Dissolved solids	2,040	3,705	4,270	4,465	4,520
pH	7.5	7.6	7.8	7.9	8.0
Total hardness	542	1,578	2,070	2,210	2,280
Chloride	392	560	692	750	800
Sulfate	860	1,555	1,890	2,005	2,080
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	2.8	3.8	4.2	4.6	18
Boron					

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=TURKEY CREEK AT ULUSTEE, OK



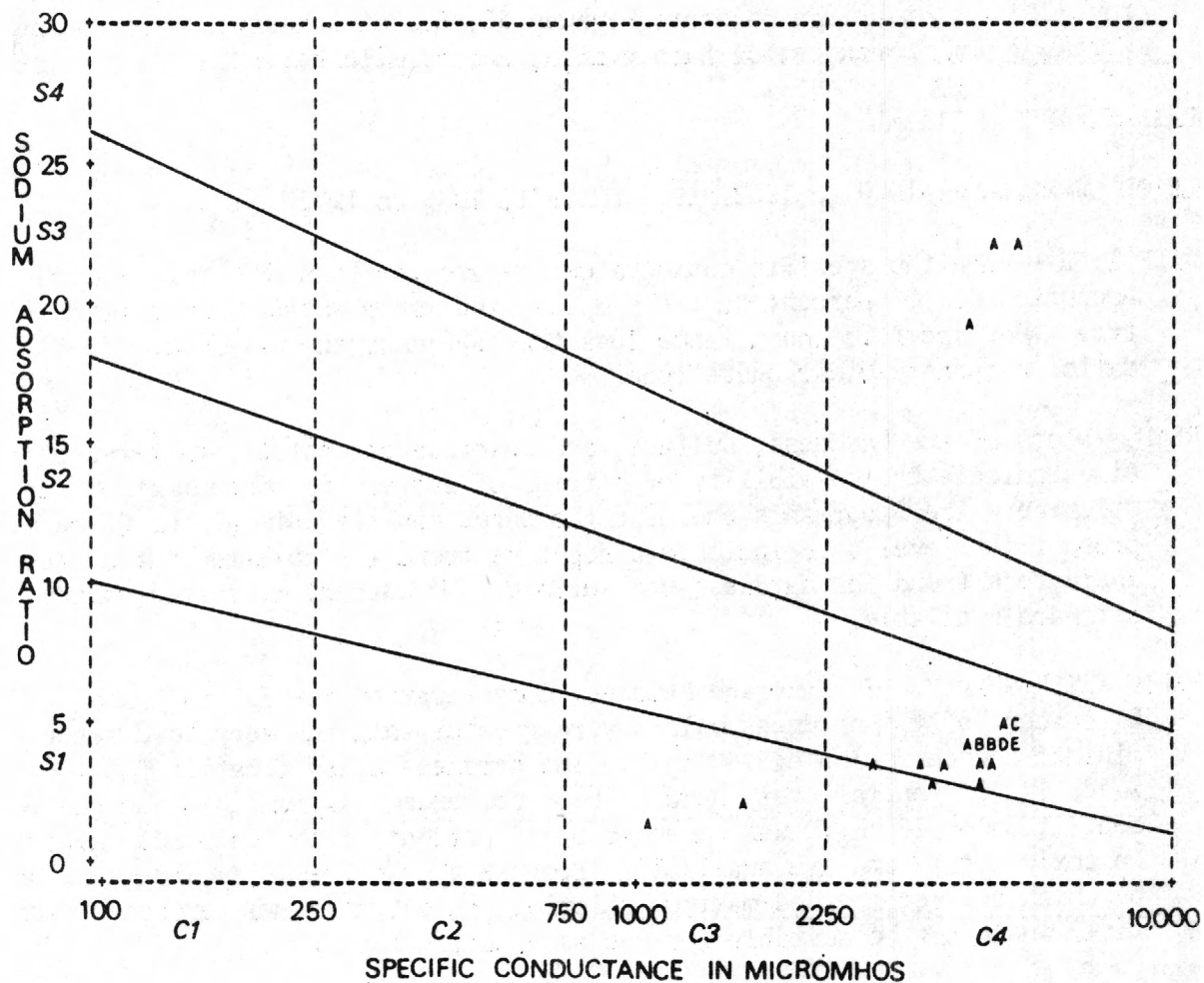
ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=TURKEY CREEK AT ULUSTEE, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER= TURKEY CREEK AT ULUSTEE, OK



RED RIVER MAINSTEM

07315900 - Walnut Bayou near Burneyville, Okla.

LOCATION.--Lat 33°56'30", long 97°18'20", in NW¼NE¼ sec. 21, T.7 S., R.1 W., Love County, at bridge on State Highway 32, 0.8 mi downstream from Simon Creek, 2.5 mi northwest of Burneyville, and at mile 6.5.

DRAINAGE AREA.--314 mi².

PERIOD OF RECORD.--1960 to 1962, 1969 to 1971, 1975 to 1979.

WATER TYPE.--When the specific conductance was greater than 300 umho, which accounted for 97 percent of the samples, the water was sodium chloride type. For specific conductance less than 300 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate the possibility of a trend of decreasing concentration for chloride. The Spearman's rhos for the three constituents at the 95-percent probability level also indicate a negative trend for chloride but do not indicate a trend for hardness and sulfate. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 391 mg/L and 84 percent of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is, in general, very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 58 percent of the chloride values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride concentration was exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 85 percent of the samples having a high or very high salinity hazard. The sodium hazard ranged from low to very high with 59 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

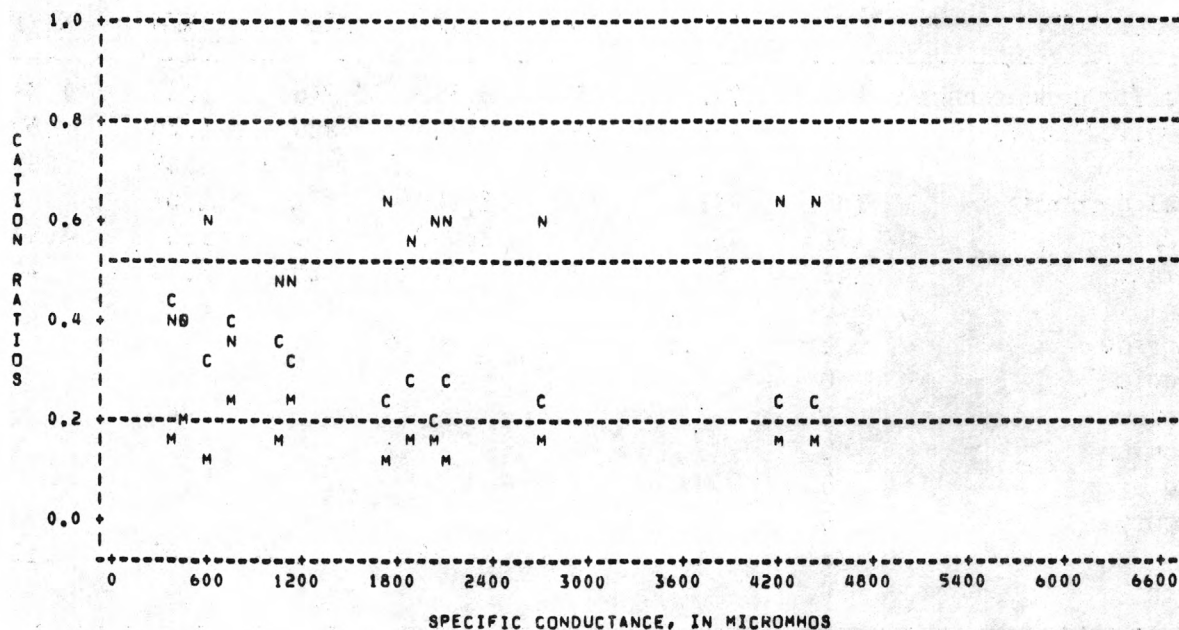
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	174	1,792	143	6,380	1,246	1.33	1.38
Dissolved solids	124	1,136	85	3,740	829	1.20	.66
pH	160	8.2	7.4	9.0	.3	-.39	.83
Total hardness	163	391	48	1,100	231	1.07	.60
Chloride	171	452	9.0	2,000	402	1.53	1.94
Sulfate	147	87	9.1	210	50	.48	-.44
Iron	0						
Fluoride	2	.6	.5	.6			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	128	4.7	.5	12	2.4	.69	.15
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	551	962	1,385	2,292	3,815
Dissolved solids	319	564	866	1,473	2,530
pH	7.8	8.1	8.2	8.4	8.5
Total hardness	141	244	320	480	776
Chloride	102	170	296	580	1,096
Sulfate	23	51	81	115	167
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.9	2.7	4.4	6.2	7.8
Boron					

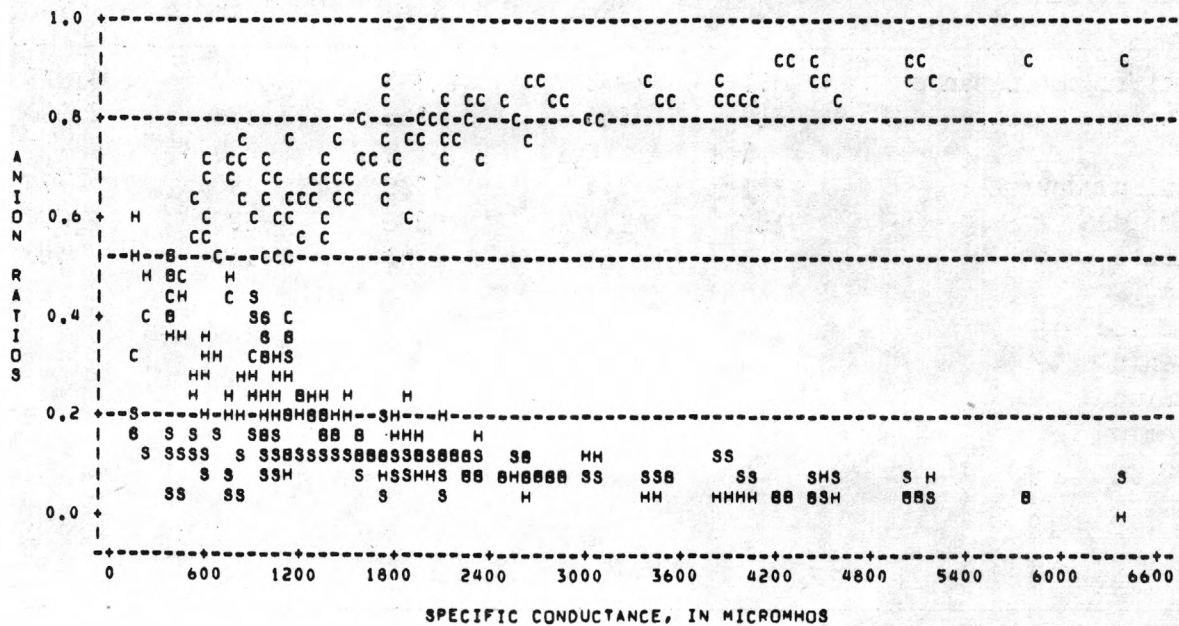
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WALNUT BAYOU NR BURNEYVILLE, OK



ANION RATIO PLOT

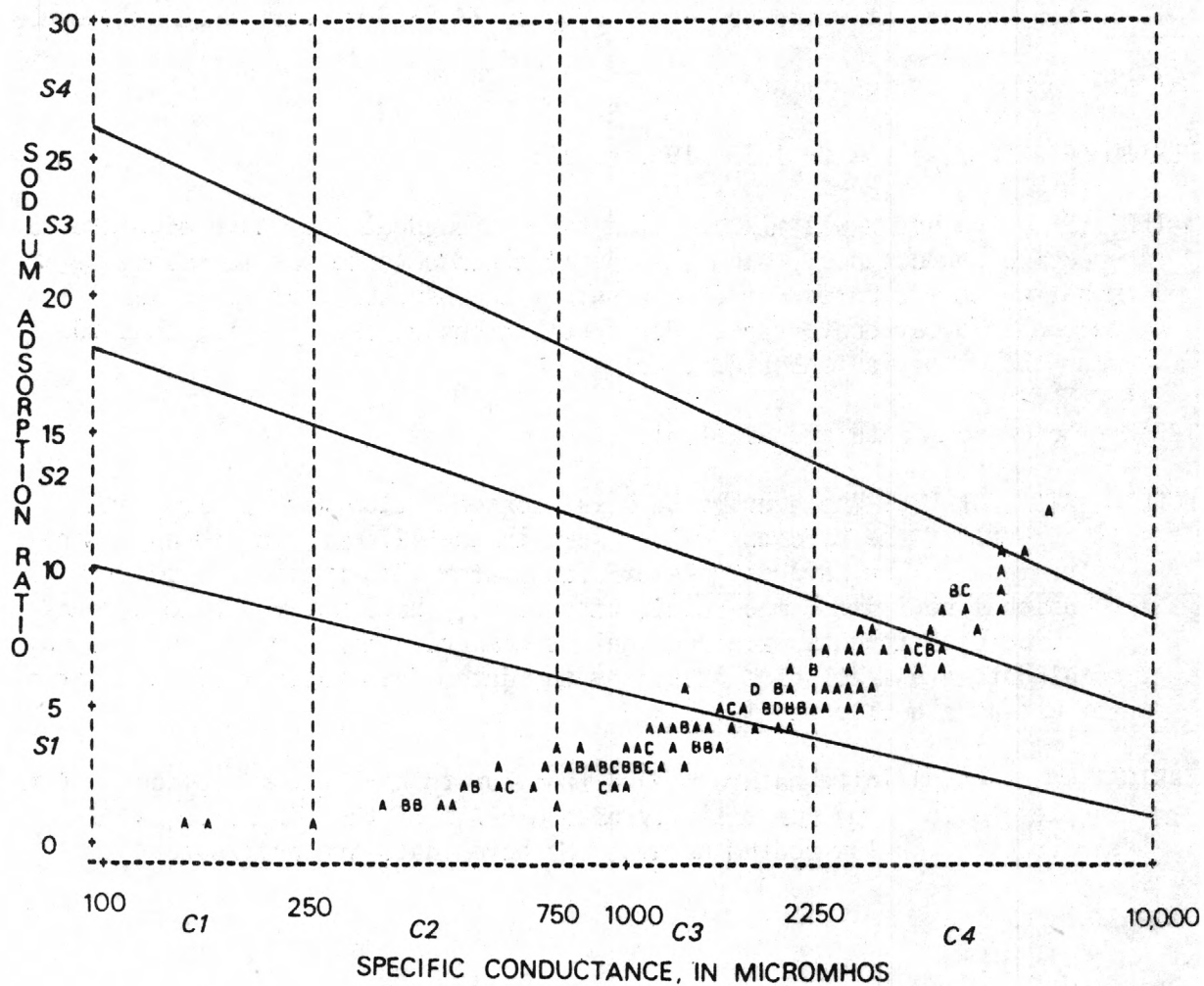
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WALNUT BAYOU NR BURNEYVILLE, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=WALNUT BAYOU NR BURNEYVILLE, OK



RED RIVER MAINSTEM

07311240 - West Cache Creek near Cookietown, Okla.

LOCATION.--Lat 34°16'30", long 98°23'15", in NW¼ sec. 30, T.3 S., R.11 W., Cotton County, at bridge on State Highway 5A, 3.5 mi east of Cookietown.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1952 to 1955, 1960 to 1963.

WATER TYPE.--The water was mixed cation type throughout the range of measured specific conductance. When the specific conductance was less than 600 umho, which accounted for 66 percent of the samples, the water was carbonate/bicarbonate type. For specific conductance greater than 600 umho the water was chloride type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 134 mg/L and 52 percent of the hardness values were in the 121 mg/L to 180 mg/L hard water range. The hardness classification for this water is hard with occasional periods of moderately hard or very hard water. None of the measured constituents exceeded their recommended maximum limits. No toxic metal data are available. Based on the data, this water would be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 75 percent of the samples having a medium salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

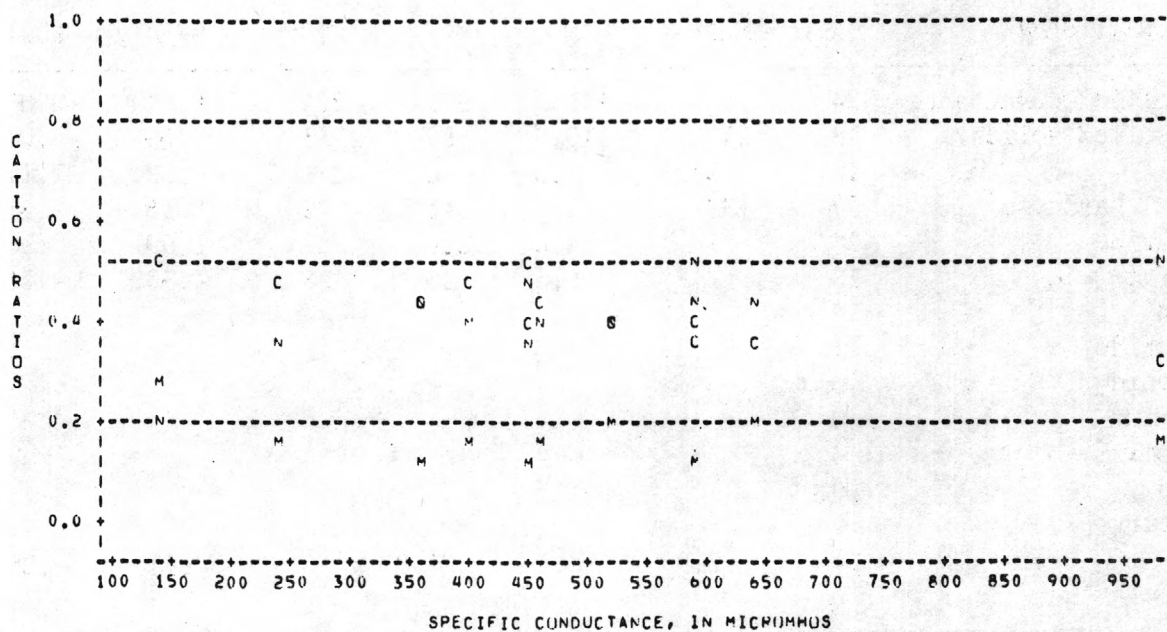
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	24	520	141	989	223	0.41	-0.03
Dissolved solids	18	313	110	589	133	.59	.04
pH	18	8.2	7.8	8.6	.2	-.32	-1.15
Total hardness	24	134	58	214	42	-.15	-.41
Chloride	24	77	4.8	220	59	1.09	.88
Sulfate	18	17	6.6	26	5.7	-.35	-.75
Iron	0						
Fluoride	1	.3					
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	24	2.0	.4	4.0	.9	.41	-.08
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	215	369	489	636	884
Dissolved solids	144	200	300	385	564
pH	7.9	8.0	8.2	8.5	8.5
Total hardness	67	101	142	159	195
Chloride	13	33	66	110	180
Sulfate	7.7	12	18	21	24
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.0	1.4	1.9	2.6	3.2
Boron					

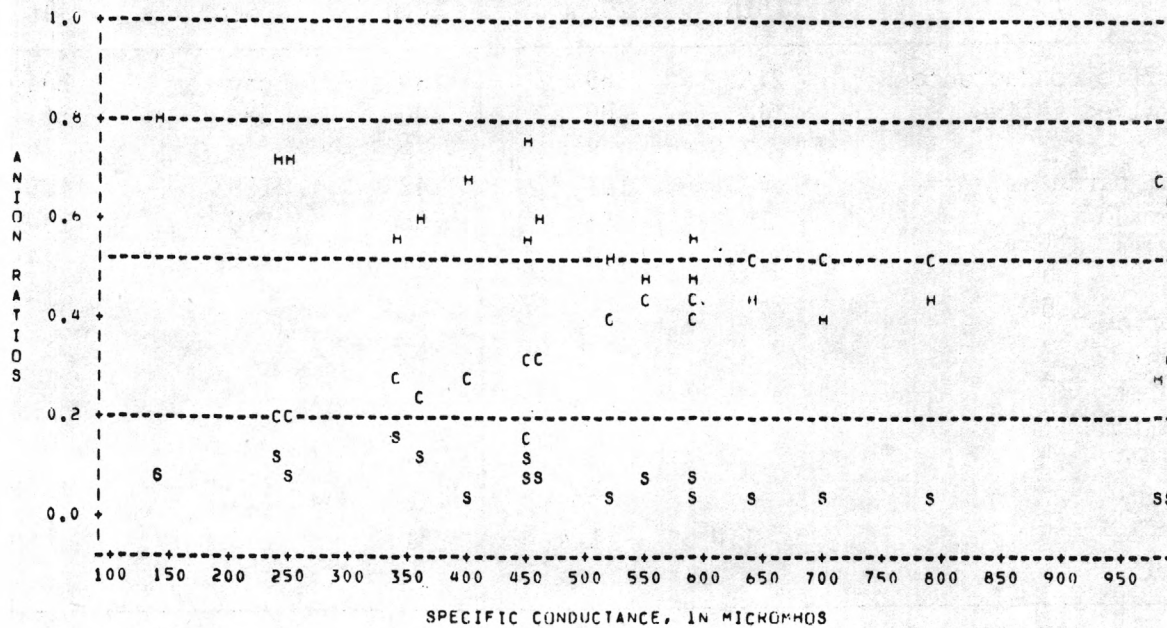
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WEST CACHE CREEK NR COOKIETOWN, UK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WEST CACHE CREEK NR COOKIETOWN, UK



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=WEST CACHE CREEK NR COOKIETOWN, OK



NORTH FORK RED RIVER BASIN

07304500 - Elk Creek near Hobart, Okla.

LOCATION.--Lat 34°54'51", long 99°06'49", in NE¹/₄NE¹/₄ sec. 17, T.5 N., R.18 W., Kiowa County, at bridge on county road, 7.0 mi downstream from Little Elk Creek, 7.5 mi south of Hobart, and at mile 10.9.

DRAINAGE AREA.--549 mi².

PERIOD OF RECORD.--1949 to 1952, 1954 to 1963, 1970 to 1979.

WATER TYPE.--When the specific conductance was greater than 600 umho, which accounted for 82 percent of the samples, the water was mixed cation sulfate type. For specific conductance less than 600 umho the water was calcium carbonate/bicarbonate type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time indicate the possibility of trends of increasing concentration for all four constituents. The Spearman's rhos at the 95-percent probability level also indicate positive trends.

PUBLIC WATER SUPPLY.--The average hardness concentration was 527 mg/L and 88 percent of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum pH of 9.0 was exceeded by 2 percent of the pH values, the recommended maximum chloride concentration of 250 mg/L was exceeded by less than 1 percent of the chloride values, and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 59 percent of the sulfate values. Arsenic, cadmium, chromium, and lead concentrations did not exceed their maximum contaminant levels. No mercury data are available. Because of the frequency and magnitude by which the recommended maximum sulfate concentration was exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to very high with 70 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to medium with more than 99 percent of the SAR values equivalent to a low sodium hazard. Phytotoxic effects in boron sensitive plants could occur. The recommended maximum boron concentration of 750 ug/L for boron sensitive plants was exceeded by 2 percent of the boron values.

UNIVARIATE STATISTICS

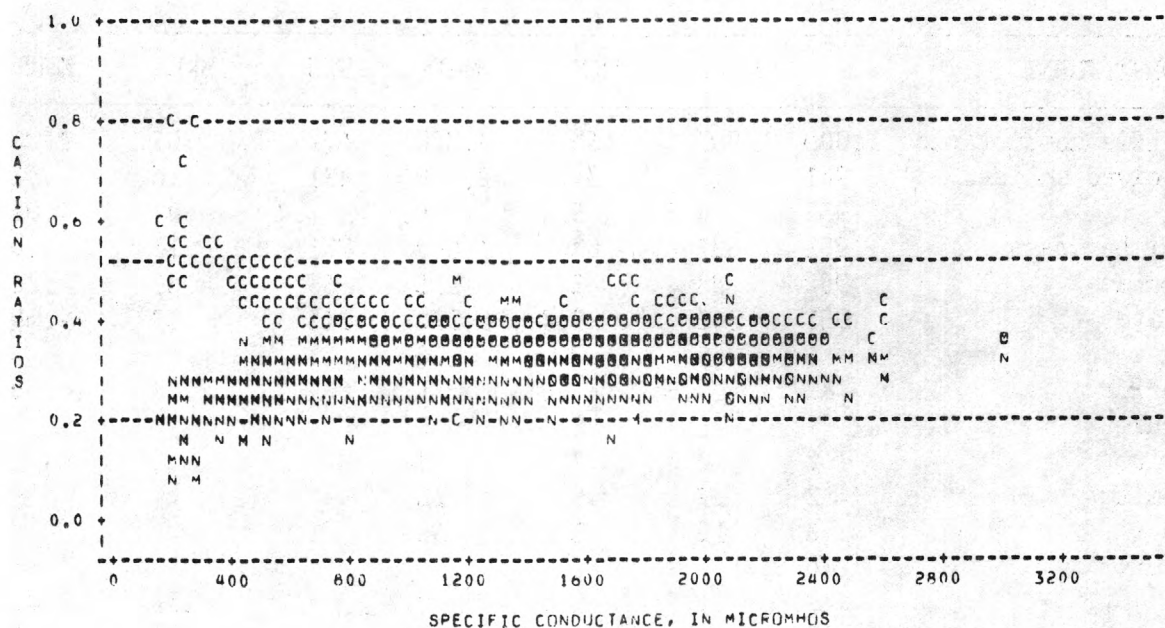
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	1,009	1,293	156	3,020	622	-0.03	-1.06
Dissolved solids	961	913	94	2,720	481	.16	-.82
pH	933	8.2	5.3	9.7	.4	-.81	4.09
Total hardness	953	527	62	1,640	271	.13	-.86
Chloride	962	88	2.4	335	53	.58	.22
Sulfate	951	340	7.4	1,270	215	.37	-.60
Iron	5	68	20	120			
Fluoride	82	.5	.0	1.8	.2	2.73	16.36
Arsenic	7	5	2	8			
Cadmium	2	2	2	3			
Chromium	2	12	5	20			
Lead	3	15	3	35			
Mercury	0						
SAR	819	1.7	.1	4.2	.7	.31	.46
Boron	109	344	0	780	164	.01	-.16

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	439	714	1,320	1,800	2,090
Dissolved solids	275	469	911	1,320	1,560
pH	7.7	8.0	8.2	8.4	8.6
Total hardness	167	276	535	757	880
Chloride	20	42	86	120	160
Sulfate	69	150	324	511	635
Iron					
Fluoride	.3	.3	.5	.5	.7
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.8	1.2	1.7	2.1	2.5
Boron	130	220	360	440	560

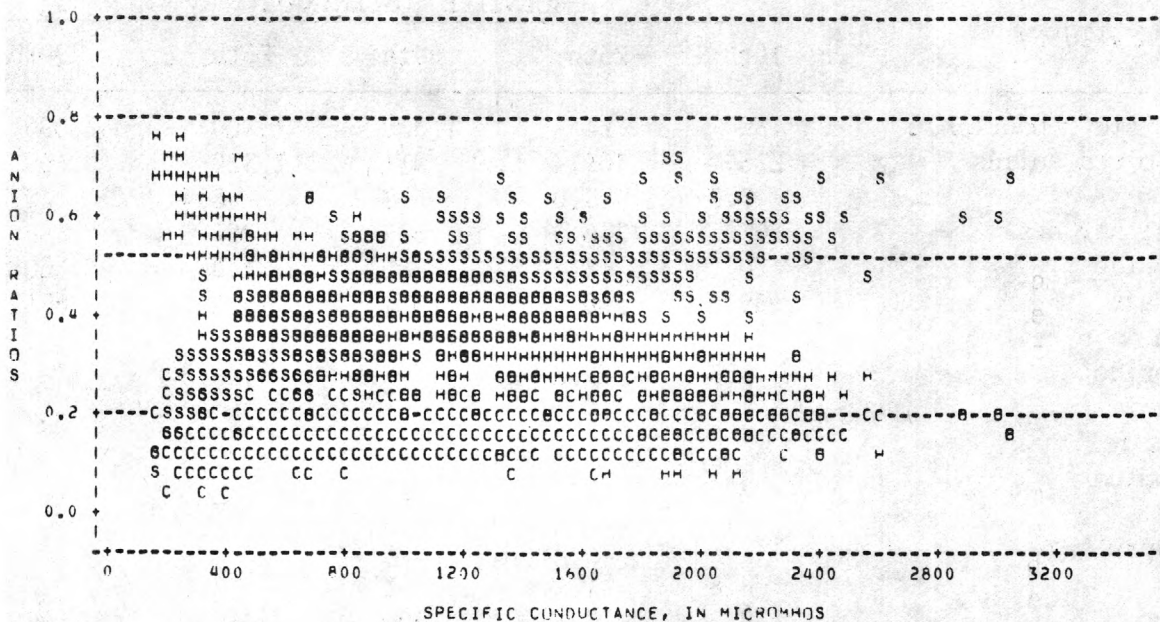
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELK CREEK NR HUBART, OK

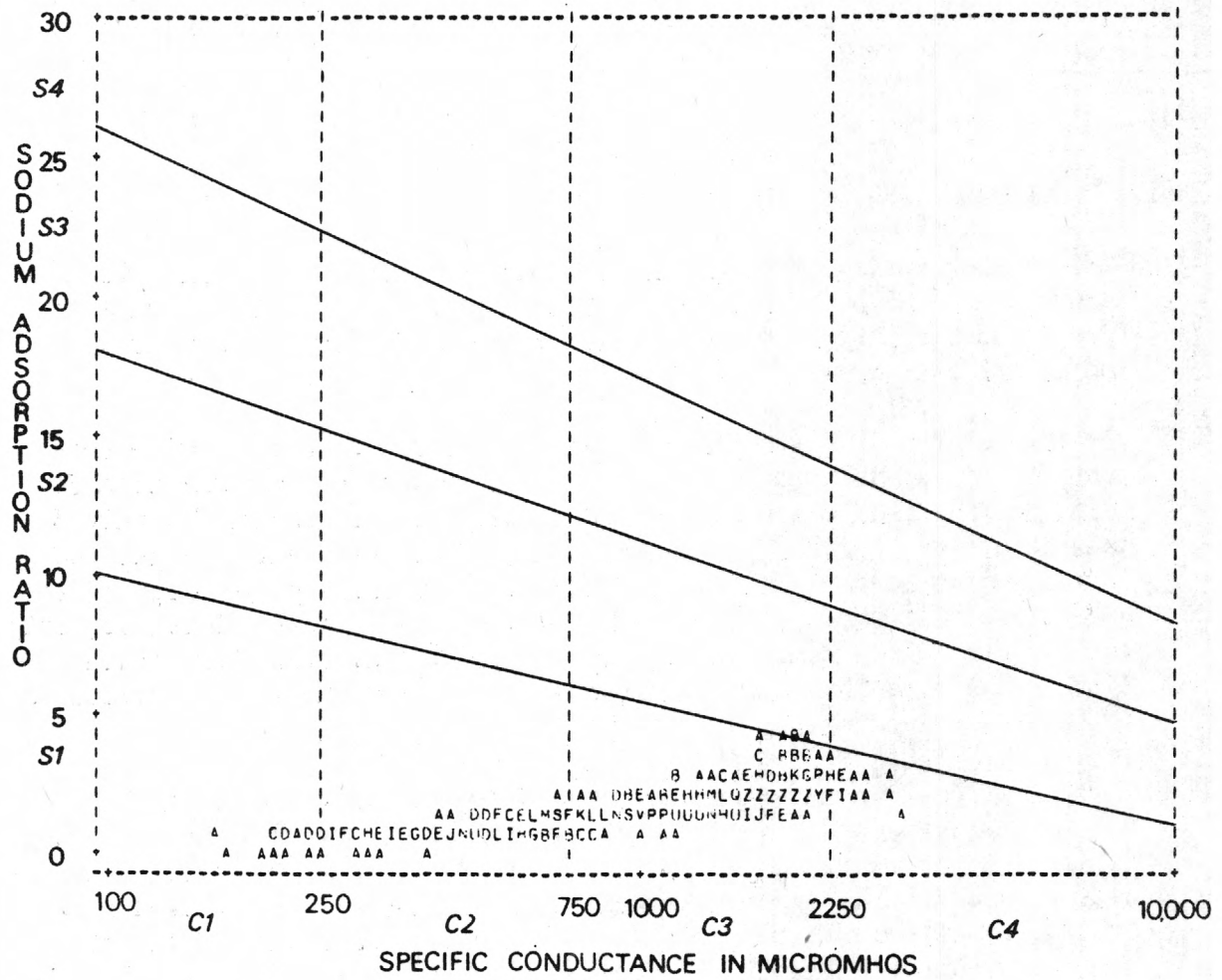


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELK CREEK NR HUBART, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=ELK CREEK NR MURART, OK



NORTH FORK RED RIVER BASIN

07303395 - Elm Fork North Fork Red River at Salton Crossing, Okla.

LOCATION.--Lat 35°01'15", long 99°56'58", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T.6 N., R.26 W., Harmon County, 0.1 mi upstream from ford at saltworks, 2.6 mi upstream from gage near Carl, 3.5 mi northeast of Carl, and at mile 56.6.

DRAINAGE AREA.--411 mi².

PERIOD OF RECORD.--1960 to 1961, 1973 to 1979.

WATER TYPE.--When the specific conductance was less than 7,500 umho, which accounted for 55 percent of the samples, the water was calcium sulfate type. For specific conductance greater than 7,500 umho the water was sodium chloride type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time indicate trends of increasing concentration for chloride and dissolved solids when the 1960 data are included. Only 3 data points were available for 1960 and no data were available for the period 1961 to 1972. This lack of data for the early period appears to have biased the indication of trend for the constituents; therefore, only the 1973 to 1979 period is used for this trend analysis. The concentration versus time plots and the Spearman's rhos for the 1973-79 period do not indicate any trends.

PUBLIC WATER SUPPLY.--The average hardness concentration was 2,029 mg/L and all of the hardness values were greater than the very hard water minimum limit. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 94 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by all of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 96 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with 48 percent of the SAR values equivalent to a very high sodium hazard. None of the boron concentrations exceeded the 750 ug/L recommended limit for boron sensitive plants.

UNIVARIATE STATISTICS

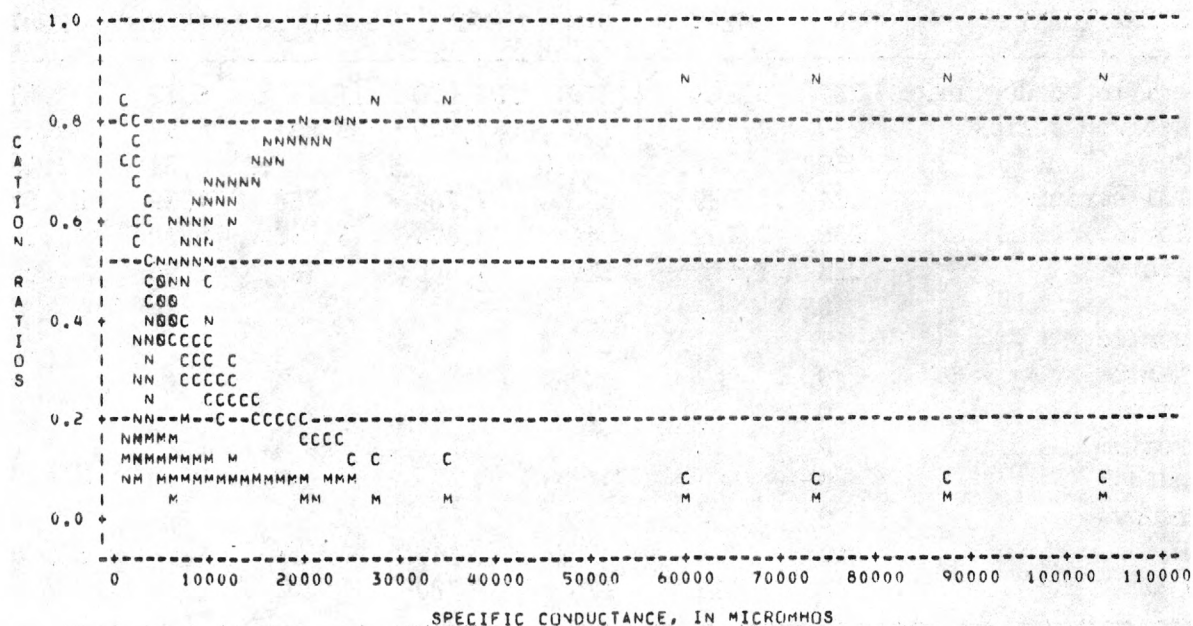
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	227	9,743	1,360	104,000	11,787	5.52	34.61
Dissolved solids	230	7,278	1,130	87,200	9,891	6.07	39.85
pH	230	7.8	7.0	8.9	.3	.31	2.46
Total hardness	224	2,029	630	7,700	758	4.39	26.57
Chloride	230	2,792	46	50,000	5,732	6.20	41.29
Sulfate	228	1,676	510	3,500	380	.95	5.03
Iron	0						
Fluoride	7	.6	.4	.7			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	216	14	.4	149	18	5.17	31.76
Boron	7	513	270	700			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	3,850	5,540	7,120	9,860	15,300
Dissolved solids	3,038	4,298	5,230	6,892	10,590
pH	7.4	7.6	7.8	7.9	8.0
Total hardness	1,450	1,800	1,900	2,200	2,500
Chloride	642	1,100	1,600	2,400	4,580
Sulfate	1,290	1,500	1,700	1,800	2,000
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	4.3	7.0	9.7	14	25
Boron					

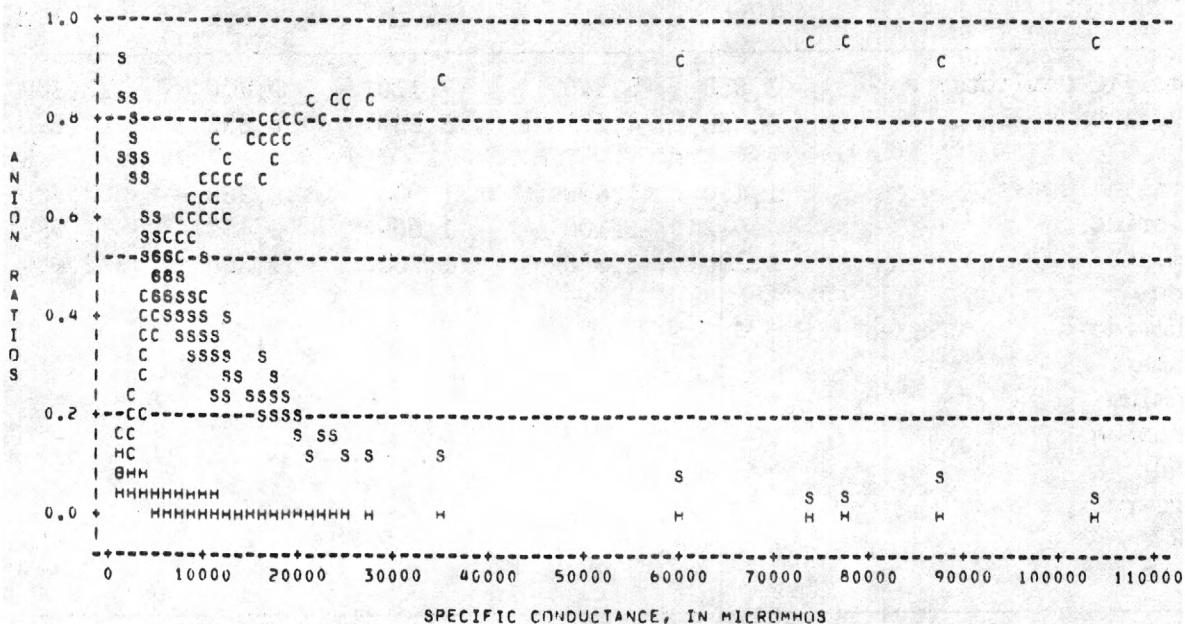
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK NORTH FORK RED R AT SALTON CROSSING, OK



ANION RATIO PLOT

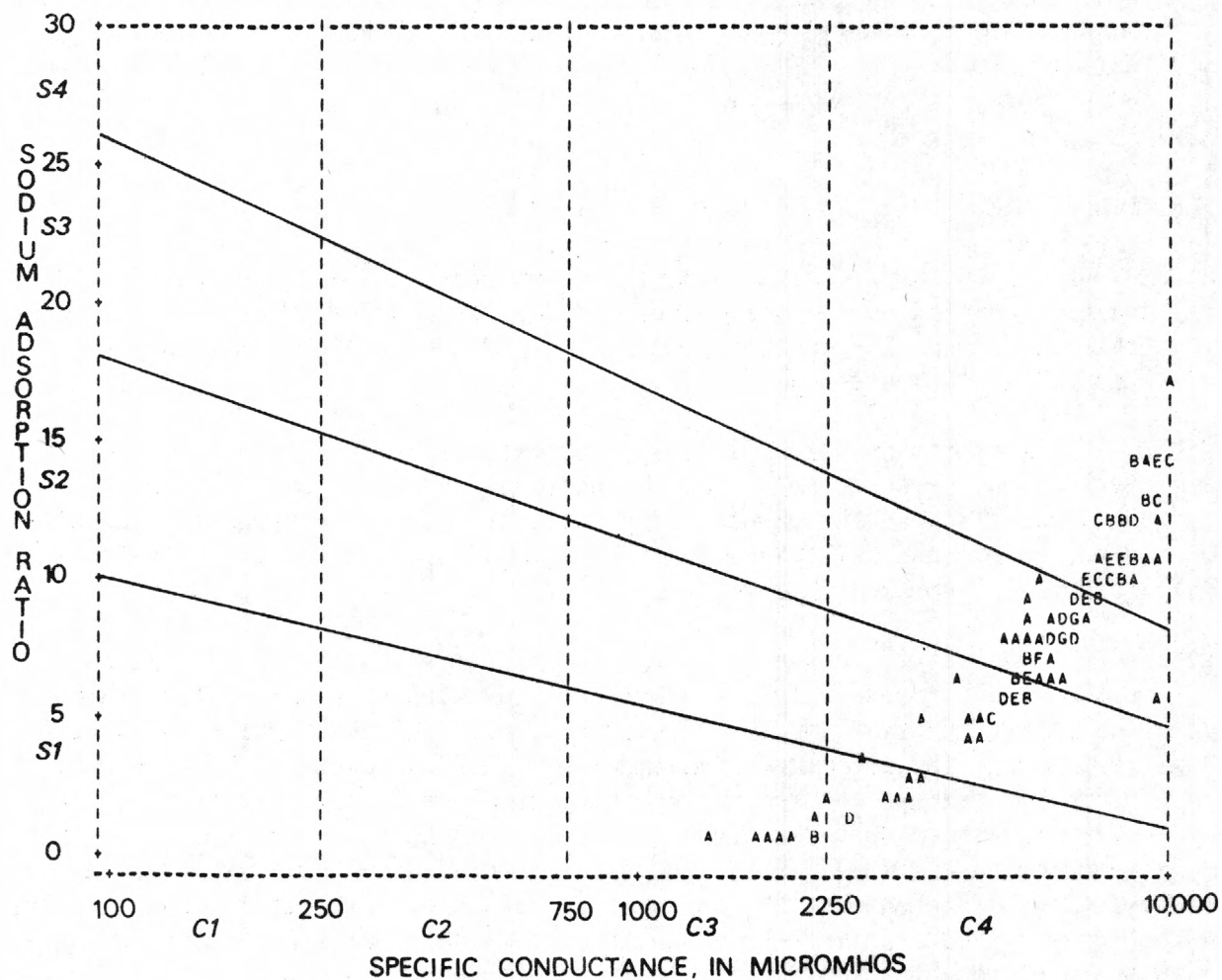
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK NORTH FORK RED R AT SALTON CROSSING, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, H = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=ELM FORK NORTH FORK RED R AT SALTON CROSSING, UK



NORTH FORK RED RIVER BASIN

07303400 - Elm Fork North Fork Red River near Carl, Okla.

LOCATION.--Lat 35°00'42", long 99°54'12", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 12, T.6 N., R.26 W., Harmon County, at bridge on State Highway 30, 4.0 mi northeast of Carl, and at mile 54.0.

DRAINAGE AREA.--416 mi².

PERIOD OF RECORD.--1960 to 1963, 1968 to 1979.

WATER TYPE.--When the specific conductance was greater than about 3,000 umho, which accounted for 99 percent of the samples, the water was sodium chloride type. For specific conductance less than 3,000 umho the water was calcium sulfate type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time do not indicate any trends. However, the Spearman's rho at the 95-percent probability level for hardness indicates a negative trend. The Spearman's rhos for dissolved solids, sulfate, and chloride do not indicate any trends.

PUBLIC WATER SUPPLY.--The average hardness concentration was 3,237 mg/L and all of the hardness values were greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum pH of 9.0 was exceeded by 1 percent of the pH values, the recommended maximum chloride concentration of 250 mg/L was exceeded by more than 99 percent of the chloride values, and the recommended maximum sulfate concentration of 250 mg/L was exceeded by all of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was very high for all samples. The sodium hazard ranged from low to very high with 97 percent of the SAR values equivalent to a very high sodium hazard. One of seven boron values was greater than 750 ug/L and it exceeded the 1,000 ug/L recommended limit for boron semi-tolerant plants.

UNIVARIATE STATISTICS

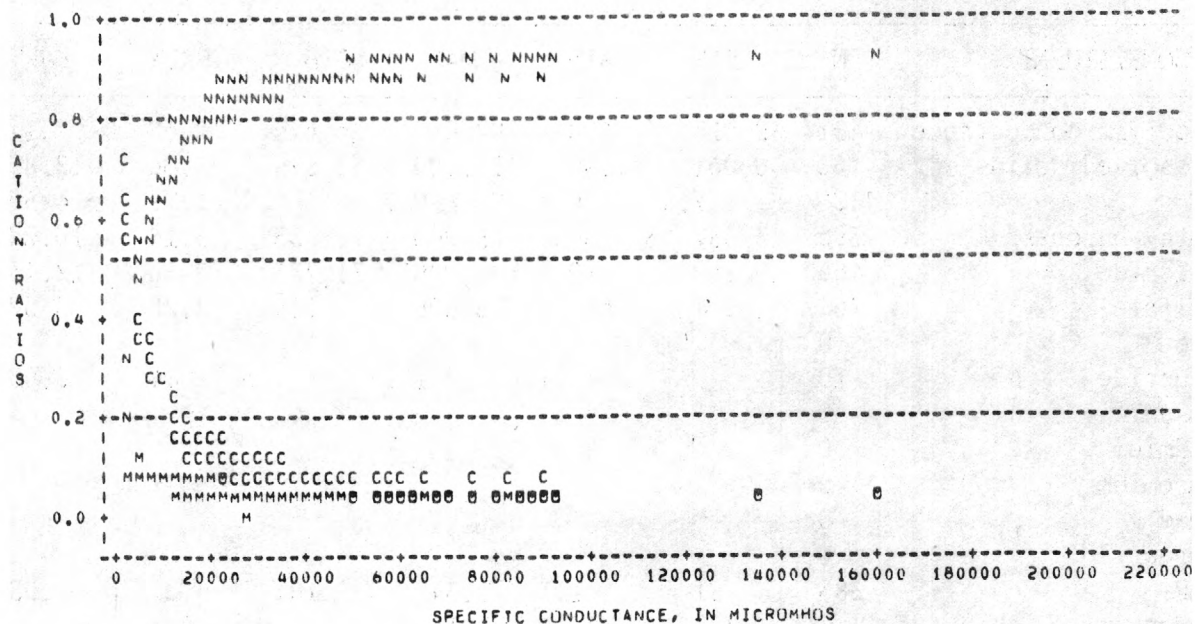
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	481	39,817	2,490	202,000	36,675	2.68	7.12
Dissolved solids	462	36,061	1,890	322,000	53,821	3.56	12.89
pH	425	7.8	6.6	10.7	.4	1.79	14.52
Total hardness	396	3,237	460	15,000	2,383	3.15	10.22
Chloride	466	19,819	220	188,000	31,773	3.50	12.43
Sulfate	464	1,974	660	5,800	649	2.20	6.52
Iron	0						
Fluoride	10	.5	.1	1.8	.5	2.44	6.68
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	383	81	1.3	1,340	101	6.27	63.98
Boron	7	727	360	1,100			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	14,420	19,600	26,400	41,050	77,260
Dissolved solids	10,009	13,300	18,900	30,650	65,170
pH	7.4	7.6	7.8	7.9	8.1
Total hardness	1,900	2,200	2,495	3,100	5,095
Chloride	4,435	6,275	9,600	16,000	38,000
Sulfate	1,500	1,652	1,800	2,035	2,800
Iron					
Fluoride	.1	.3	.4	.6	1.7
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	26	38	55	80	143
Boron					

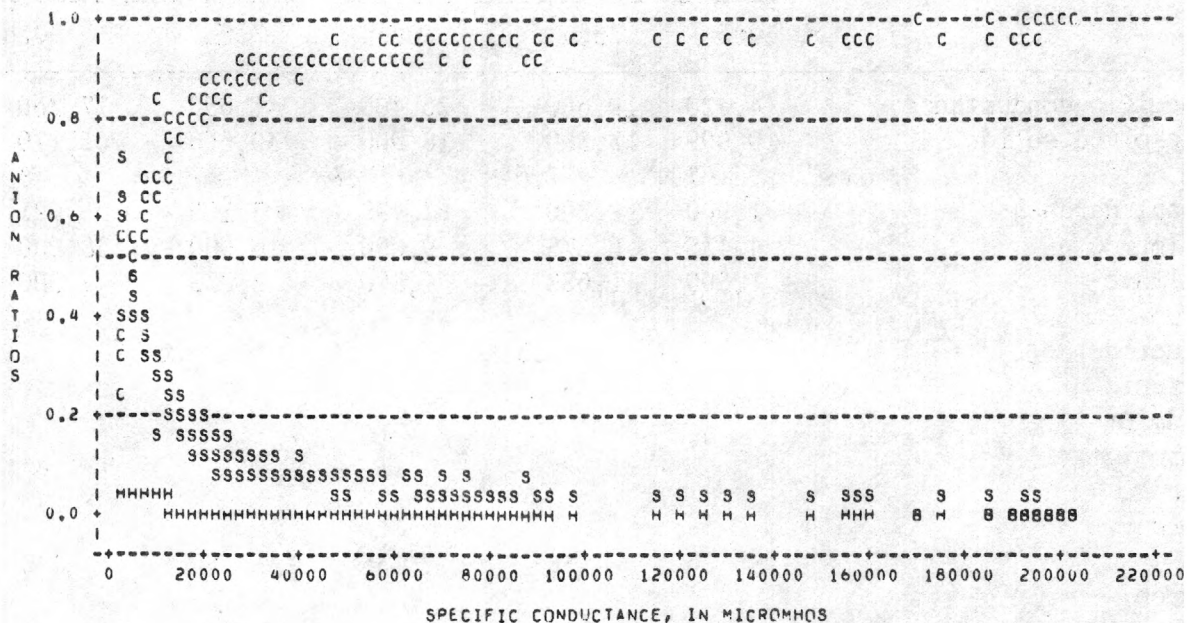
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NR CARL, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NR CARL, OK

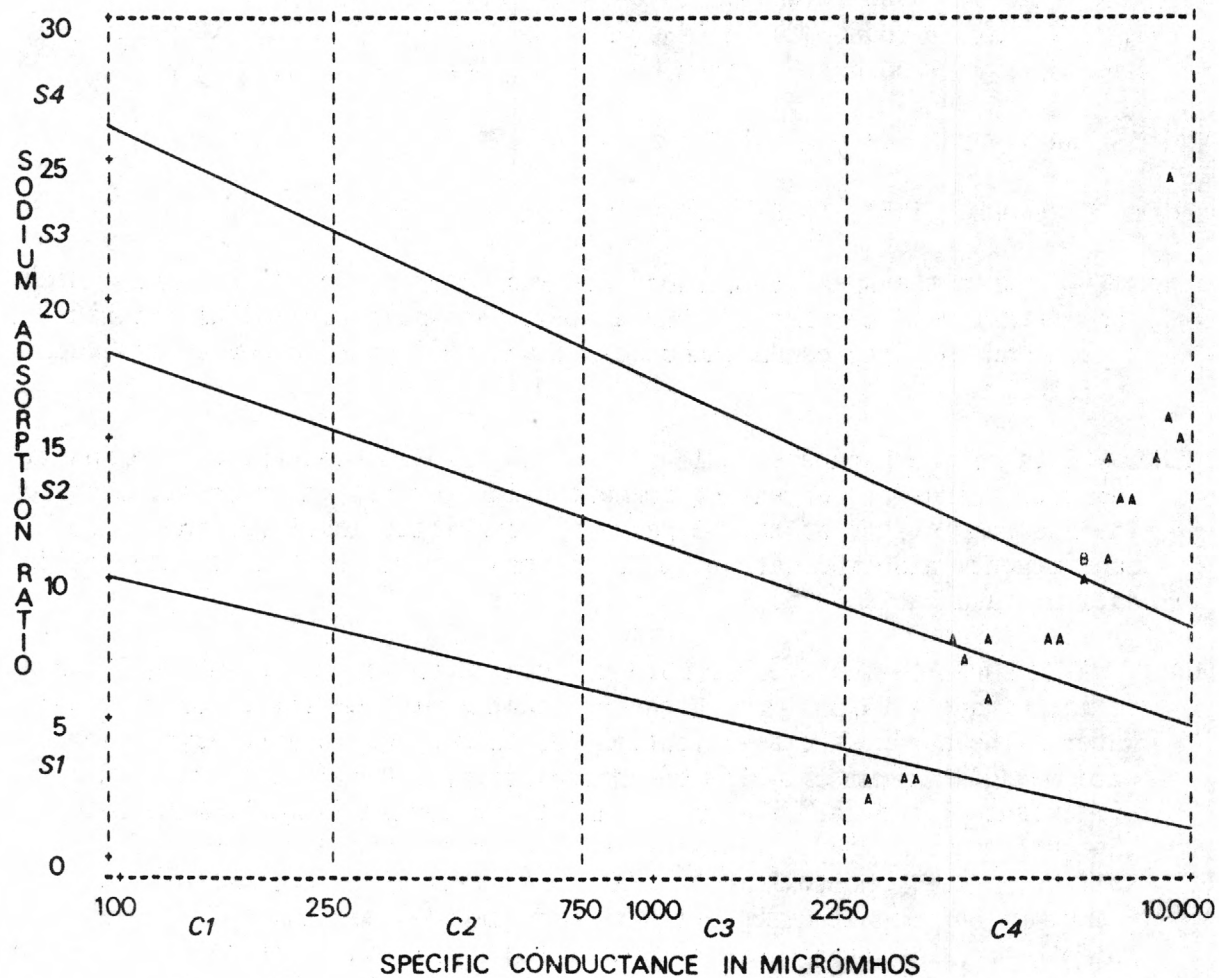


IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD

A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NW CARL, OK



NORTH FORK RED RIVER BASIN

07303500 - Elm Fork North Fork Red River near Mangum, Okla.

LOCATION.--Lat 34°55'36", long 99°30'00", on east line of sec. 10, T.5 N., R.22 W., Greer County, at bridge on U.S. Highway 283, 3.0 mi north of Mangum, 5.0 mi downstream from Haystack Creek, and at mile 17.8.

DRAINAGE AREA.--838 mi².

PERIOD OF RECORD.--1951, 1958, 1960, 1962 to 1963, 1968 to 1979.

WATER TYPE.--When the specific conductance was greater than 3,000 umho, which accounted for 97 percent of the samples, the water was sodium chloride type. For specific conductance less than 3,000 umho the water was calcium sulfate type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time indicate trends of decreasing concentration for all three constituents. The Spearman's rhos at the 95-percent probability level for the three constituents also indicate negative trends. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 2,316 mg/L and all of the hardness values were greater than the minimum limit for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 99 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by more than 99 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, the water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 98 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with 94 percent of the SAR values equivalent to a very high sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

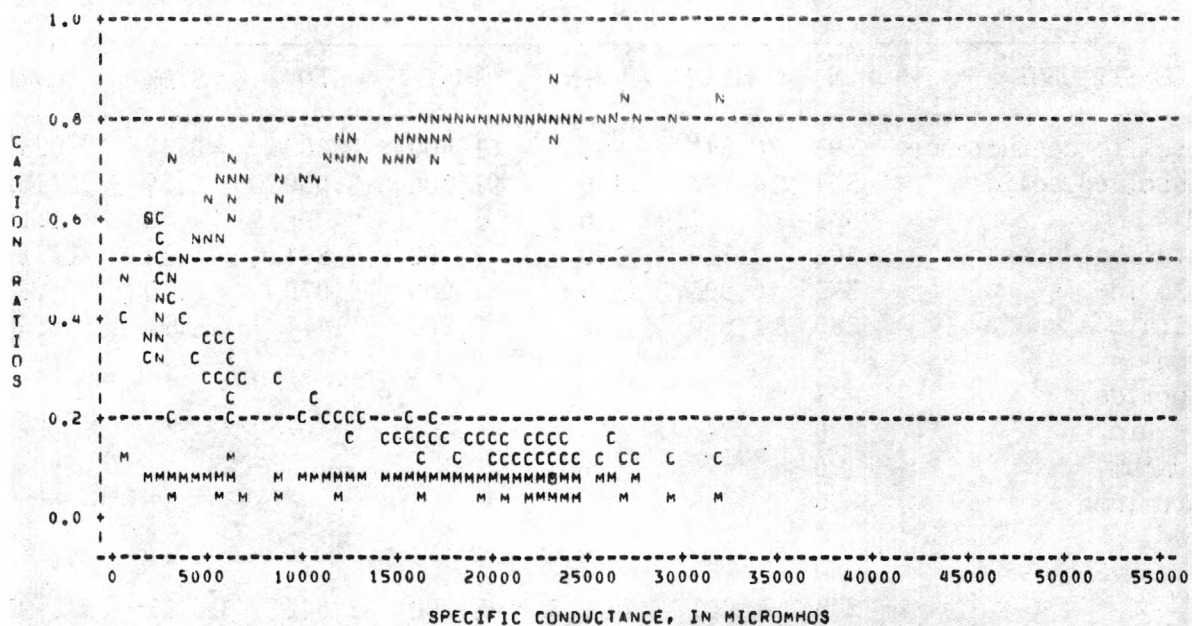
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	393	20,541	805	51,400	9,809	0.42	0.37
Dissolved solids	354	14,777	490	91,200	8,530	2.39	17.62
pH	332	7.9	6.9	8.9	.3	-.42	1.15
Total hardness	302	2,316	190	8,792	824	1.38	12.19
Chloride	373	6,903	120	21,000	4,079	.70	.54
Sulfate	380	1,650	82	2,900	444	-.96	1.56
Iron	0						
Fluoride	3	.5	.3	.9			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	273	201	1.5	43,700	2,642	16.52	272.97
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	7,328	14,850	20,100	25,950	31,960
Dissolved solids	4,595	9,975	13,950	18,700	24,350
pH	7.5	7.7	7.9	8.0	8.2
Total hardness	1,200	1,997	2,300	2,700	3,200
Chloride	1,620	4,110	6,500	9,125	12,000
Sulfate	993	1,500	1,700	1,900	2,100
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	14	28	41	52	66
Boron					

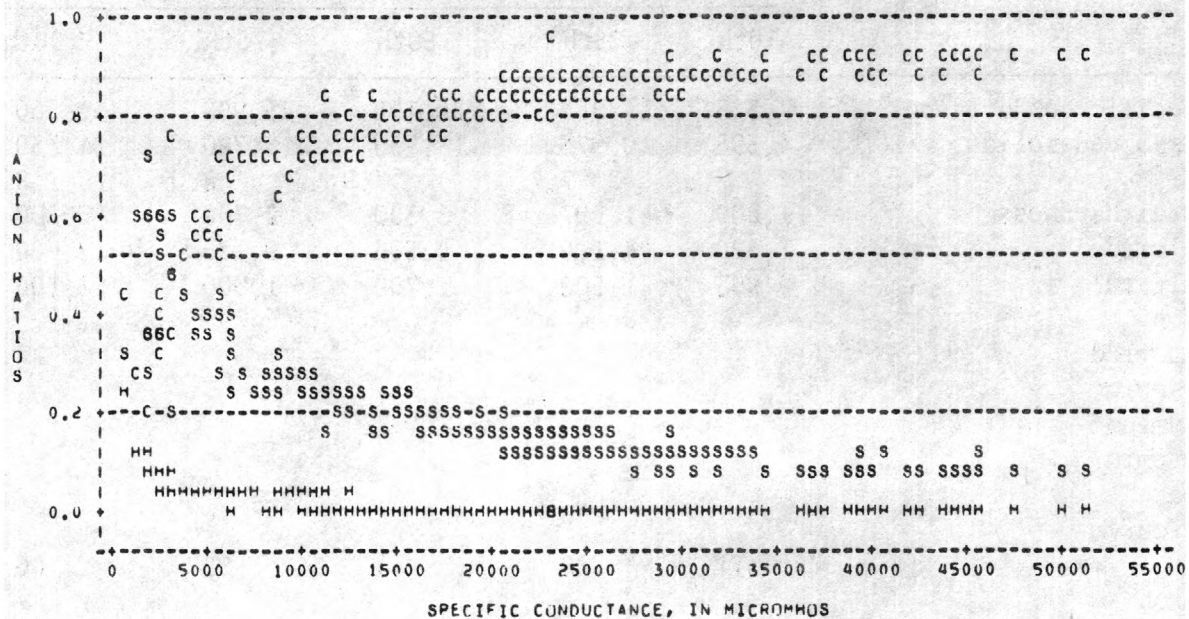
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NR MANGUM, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NR MANGUM, OK



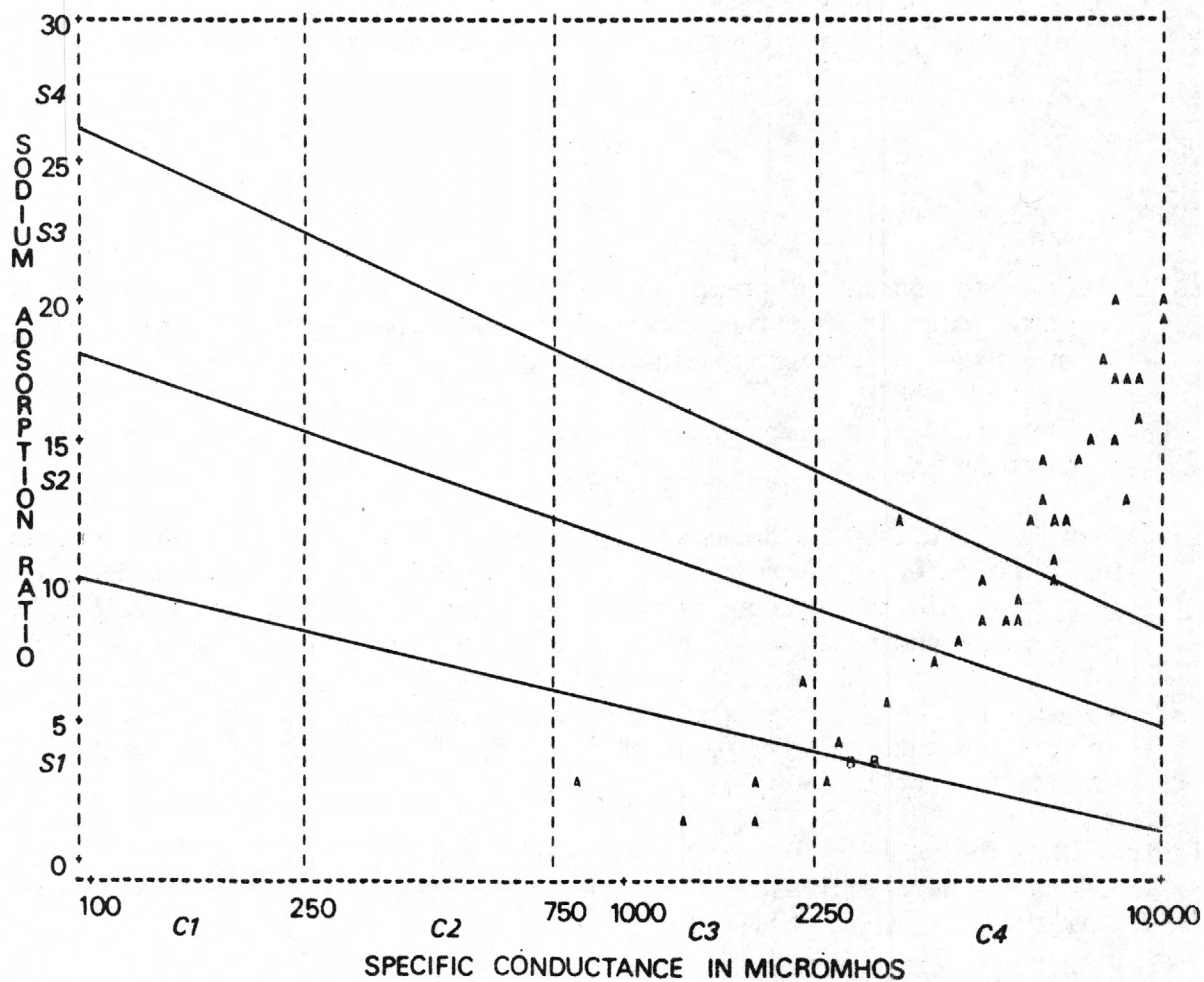
IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD

C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD

A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=ELM FORK OF NORTH FORK RED RIVER NR MANGUM, OK



NORTH FORK RED RIVER BASIN

07303402 - Fish Creek near Vinson, Okla.

LOCATION.--Lat 35°01'08", long 99°52'48", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 1, T.6 N., R.26 W., Harmon County, at bridge on county road, 7.0 mi north of Vinson, and at mile 0.3.

DRAINAGE AREA.--31.5 mi².

PERIOD OF RECORD.--1978 to 1979.

WATER TYPE.--The ion distribution versus specific conductance data are sparse. The data indicate that the water was mixed cation type. No anion distribution versus specific conductance data are available.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--Only two hardness values are available and they indicate that this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 92 percent of the chloride values and the recommended maximum sulfate concentration was exceeded by all of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard was very high for all samples and all of the SAR values were equivalent to a high sodium hazard. No boron data are available.

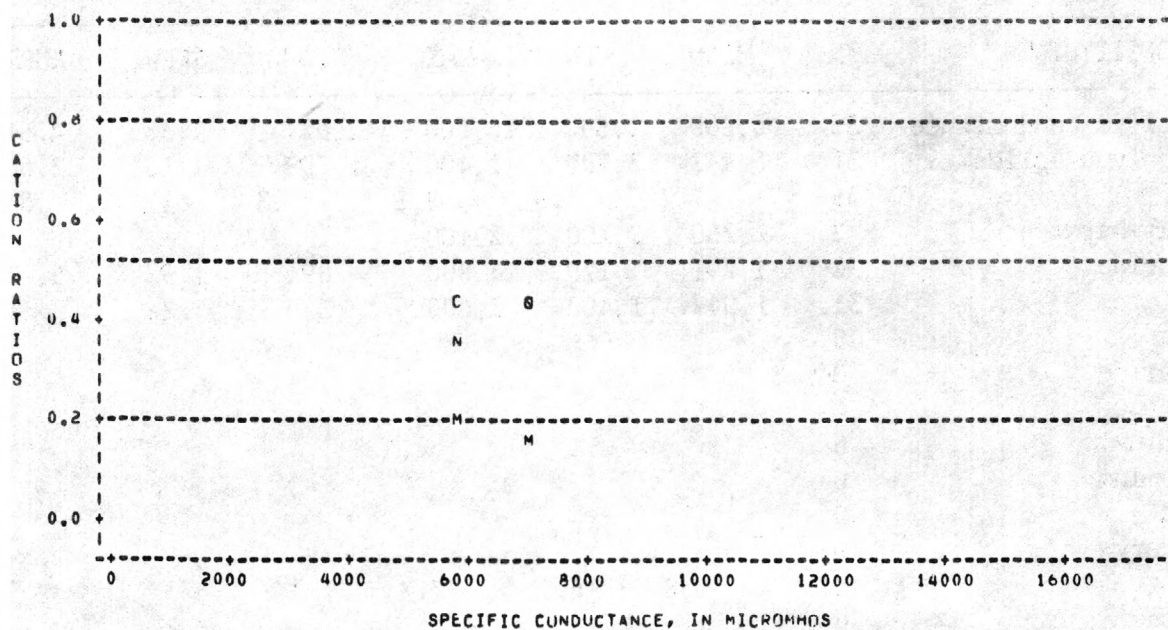
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	35	6,809	2,500	16,600	2,627	1.35	4.51
Dissolved solids	31	5,442	2,700	11,400	1,799	1.18	2.66
pH	35	7.7	7.0	8.5	.3	.11	.03
Total hardness	2	2,250	2,100	2,400			
Chloride	32	1,291	170	4,800	891	1.92	6.77
Sulfate	31	1,942	1,400	2,600	320	.22	-.51
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	2	6.8	6.3	7.2			
Boron	0						

FREQUENCY DISTRIBUTION

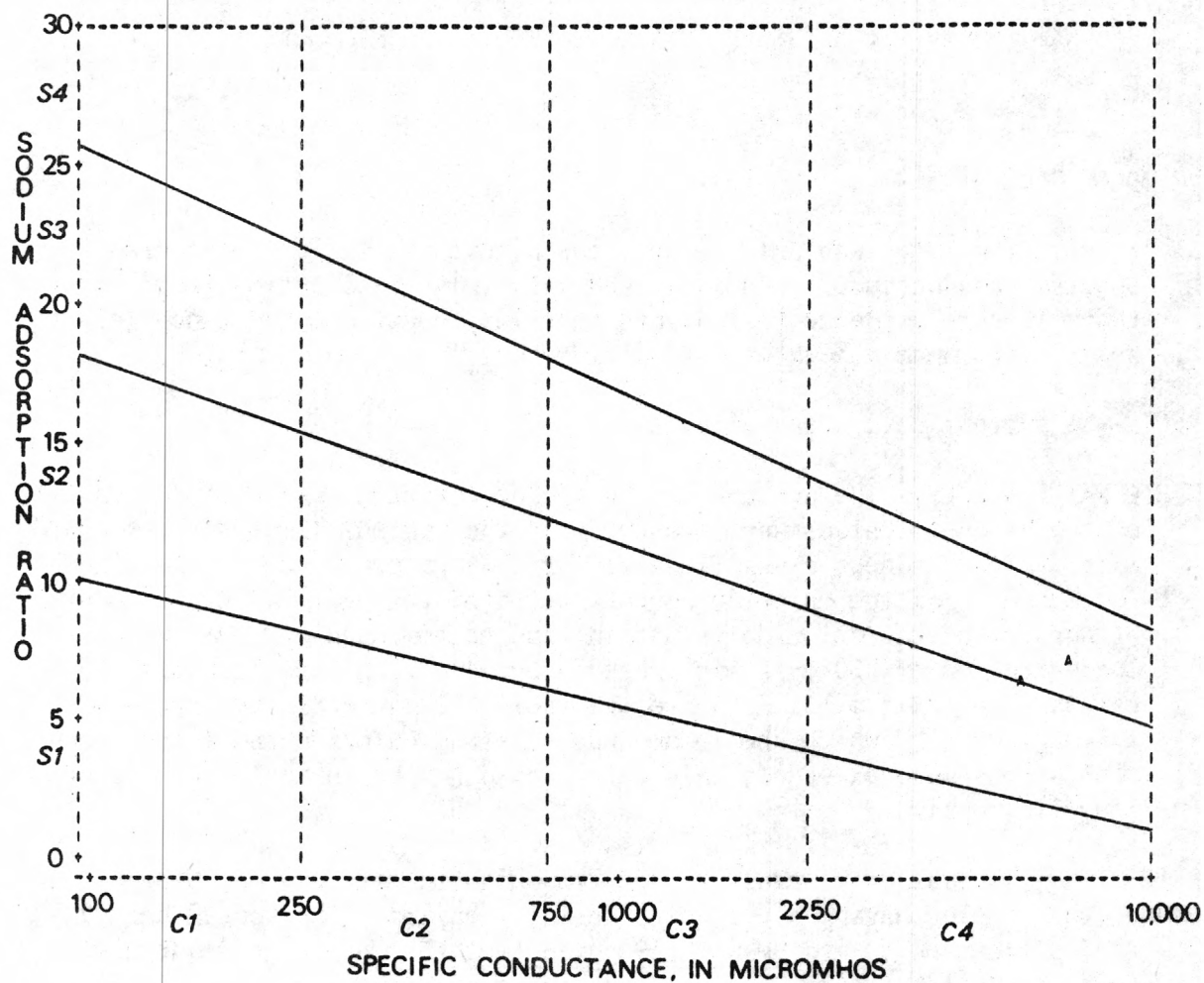
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	3,440	5,040	6,500	8,100	9,648
Dissolved solids	3,124	4,330	5,250	6,640	7,424
pH	7.3	7.5	7.7	7.9	8.1
Total hardness					
Chloride	272	780	1,200	1,700	2,200
Sulfate	1,440	1,700	1,900	2,200	2,400
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR					
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=FISH CREEK NR VINSON OK



No anion distribution data are available.

IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=FISH CREEK NR VINSON OK



NORTH FORK RED RIVER BASIN

07301450 - North Fork Red River near Erick, Okla.

LOCATION.--Lat 35°18'00", long 99°52'30", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 31, T.10 N., R.25 W., Beckham County, at bridge on State Highway 30, 6 mi north of Erick.

DRAINAGE AREA.--1,233 mi².

PERIOD OF RECORD.--1952, 1960 to 1963.

WATER TYPE.--The water was sulfate type throughout the range of measured specific conductance. Generally the water was mixed cation type; however, there is some evidence to indicate that for specific conductance less than about 1,500 umho the water was calcium type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 755 mg/L and all of the hardness values were greater than the minimum limit for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 61 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 94 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 52 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to medium with 69 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

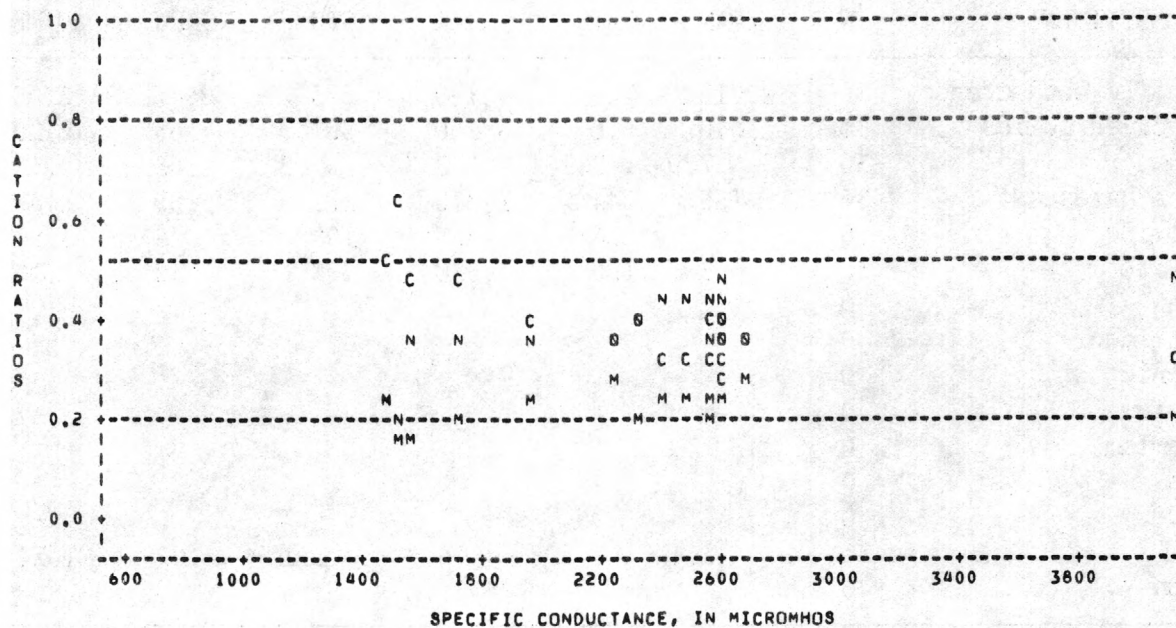
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	36	2,212	764	4,130	623	0.47	2.05
Dissolved solids	36	1,640	516	3,250	507	.63	2.20
pH	36	7.9	7.2	8.3	.2	-.63	.12
Total hardness	36	755	244	1,240	191	.09	1.37
Chloride	36	268	54	655	108	.78	3.84
Sulfate	36	668	190	1,330	228	.32	1.16
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	36	3.4	.7	6.7	1.1	.09	1.74
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,417	1,863	2,285	2,580	2,695
Dissolved solids	1,034	1,313	1,730	1,955	2,050
pH	7.5	7.7	7.9	8.1	8.2
Total hardness	542	653	745	854	986
Chloride	124	210	281	329	366
Sulfate	400	529	698	808	900
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.8	2.6	3.6	4.2	4.4
Boron					

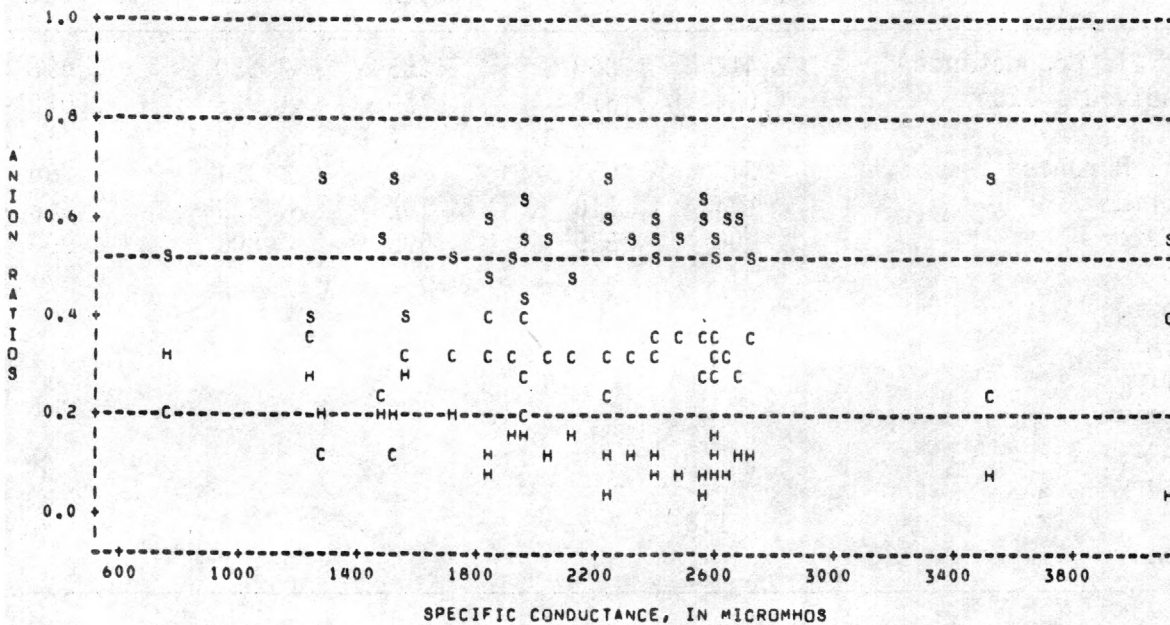
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR ERICK, OK



ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR ERICK, OK



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD

STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR ERICK, OK



NORTH FORK RED RIVER BASIN

07301500 - North Fork Red River near Carter, Okla.

LOCATION.--Lat 35°10'05", long 99°30'25", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 15, T.8 N., R.22 W., Beckham County, at bridge on State Highway 34, 3.0 mi south of Carter, 18.8 mi downstream from Timber Creek, and at mile 110.5.

DRAINAGE AREA.--2,337 mi², of which 399 mi² probably is noncontributing.

PERIOD OF RECORD.--1949 to 1951, 1958 to 1963, 1968 to 1979.

WATER TYPE.--When the specific conductance was greater than 600 umho, which accounted for 98 percent of the samples, the water was mixed cation sulfate type. For specific conductance less than 600 umho the water was calcium carbonate/bicarbonate type.

TREND.--Plots of the hardness, sulfate, and chloride concentrations versus time do not indicate any trends. The Spearman's rhos at the 95-percent probability level indicate positive trends for hardness and chloride and no trend for sulfate. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 839 mg/L and 98 percent of the hardness values were greater than the minimum limit for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 80 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 95 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 72 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to medium with about 50 percent of the SAR values equivalent to a medium sodium hazard. None of the boron values exceeded the recommended 750 ug/L limit for boron sensitive plants.

UNIVARIATE STATISTICS

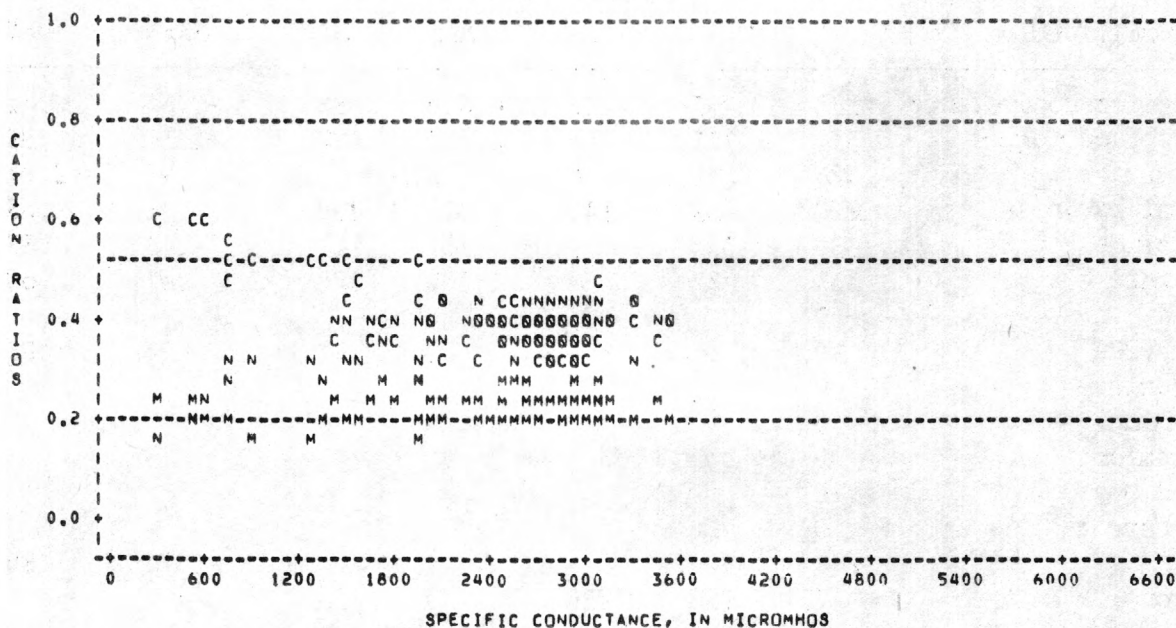
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	383	2,483	315	6,000	688	-0.54	2.41
Dissolved solids	311	1,781	206	2,590	497	-1.13	.99
pH	324	8.0	6.4	8.9	.3	-.95	2.81
Total hardness	277	839	140	1,317	239	-.82	.63
Chloride	339	334	7.0	757	117	-.48	.87
Sulfate	333	727	38	1,300	228	-.67	.66
Iron	0						
Fluoride	10	.6	.4	1.0	.2	.94	-.03
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	248	3.5	.1	4.8	.9	-1.40	1.86
Boron	7	386	230	530			

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,504	2,180	2,610	2,930	3,130
Dissolved solids	1,060	1,570	1,910	2,130	2,260
pH	7.6	7.8	8.0	8.2	8.3
Total hardness	490	740	886	1,000	1,100
Chloride	170	280	350	415	460
Sulfate	400	610	770	860	964
Iron					
Fluoride	.4	.5	.6	.8	1.0
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	2.1	3.2	3.8	4.2	4.5
Boron					

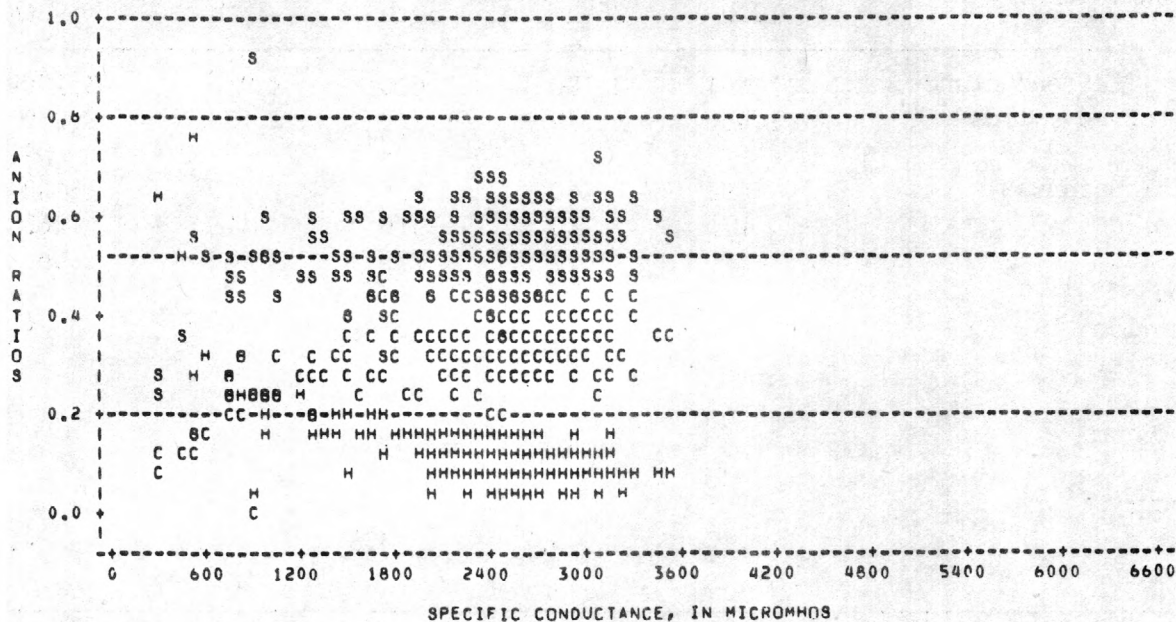
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR CARTER, OK

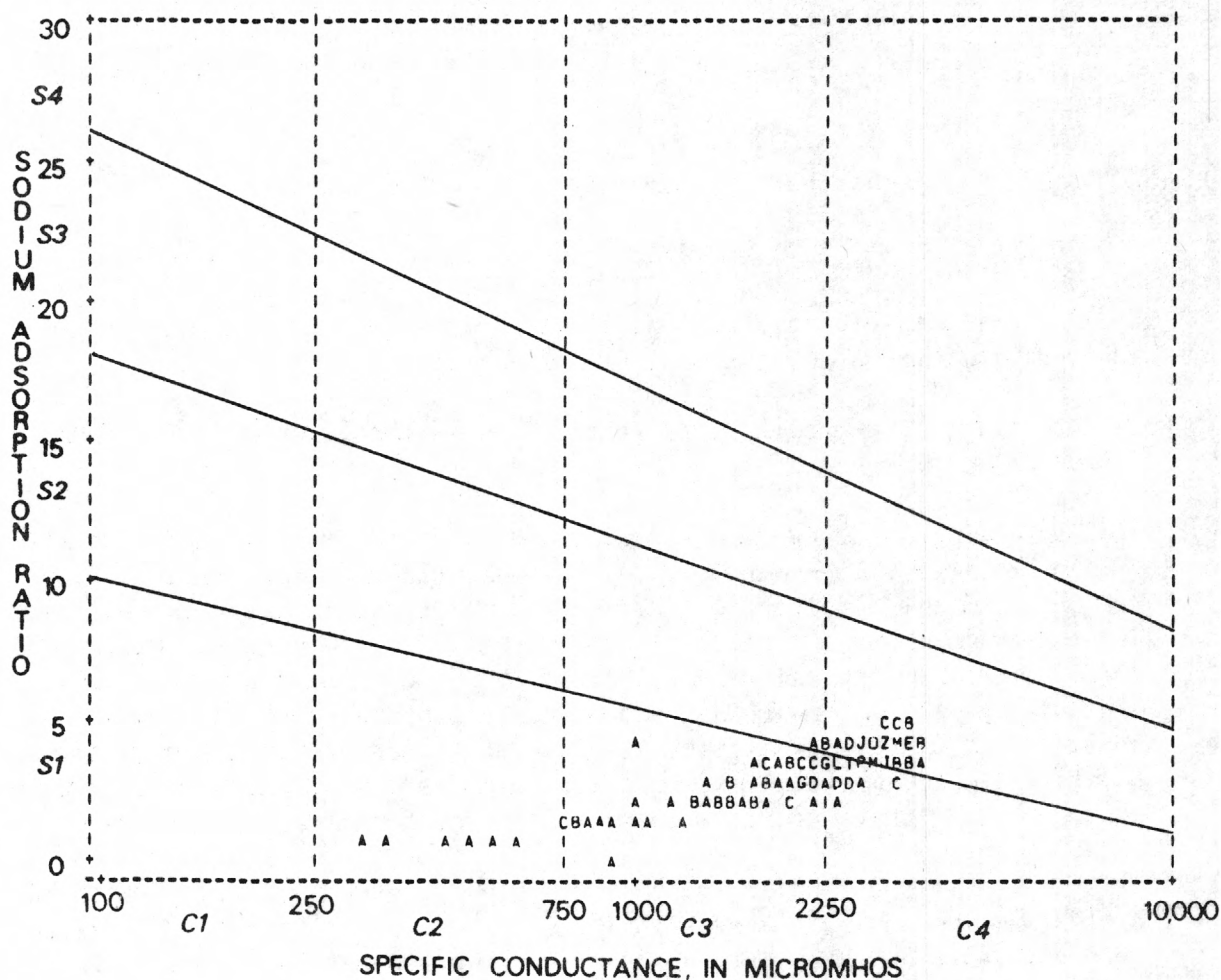


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR CARTER, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NH CARTER, UK



NORTH FORK RED RIVER BASIN

07303000 - North Fork Red River below Lake Altus Dam, near Lugert, Okla.

LOCATION.--Lat 34°53'26", long 99°18'22", in SW¼ sec. 22, T.5 N., R.20 W., Greer County, at bridge on State Highway 44A, 3,500 ft downstream from Altus Dam, 1.9 mi upstream from Elm Fork, 2.0 mi west of Lugert, and at mile 72.8.

DRAINAGE AREA.--2,515 mi², of which 399 mi² is noncontributing.

PERIOD OF RECORD.--1963, 1978 to 1979.

WATER TYPE.--The data are insufficient to determine the relation between the ionic distributions and the specific conductance.

TREND.--The period of record is insufficient, less than 5 years, to perform trend analysis.

PUBLIC WATER SUPPLY.--The average hardness concentration was 898 mg/L and all of the hardness values were greater than the minimum concentration for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 77 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by all of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from high to very high with 55 percent of the samples having a very high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	39	4,380	1,290	18,000	5,071	2.04	2.42
Dissolved solids	4	1,300	1,200	1,420			
pH	39	8.1	6.9	8.4	.3	-2.42	8.44
Total hardness	28	898	200	1,964	498	1.36	.67
Chloride	35	903	196	5,329	1,486	2.20	3.20
Sulfate	24	609	405	808	123	-.13	-1.18
Iron	0						
Fluoride	1	.6					
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	4	2.8	2.6	2.9			
Boron	0						

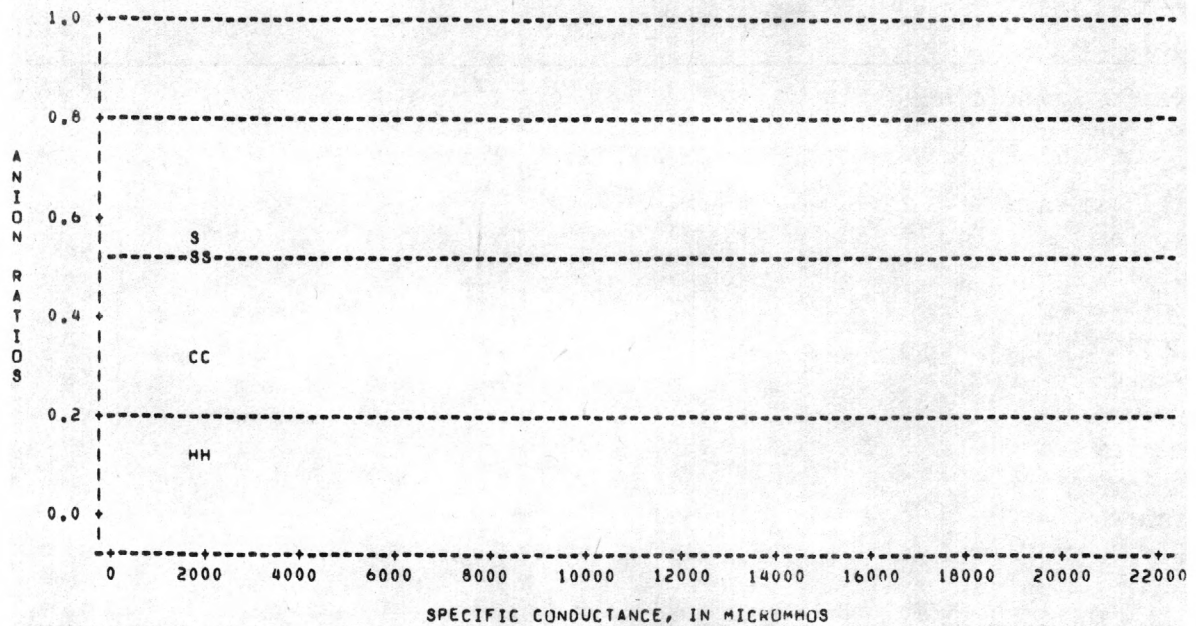
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,820	2,050	2,350	2,800	16,000
Dissolved solids					
pH	7.9	8.0	8.1	8.3	8.4
Total hardness	469	630	733	911	1,904
Chloride	217	257	313	437	4,146
Sulfate	430	504	624	711	779
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR					
Boron					

No cation distribution data are available.

ANION RATIO PLOT

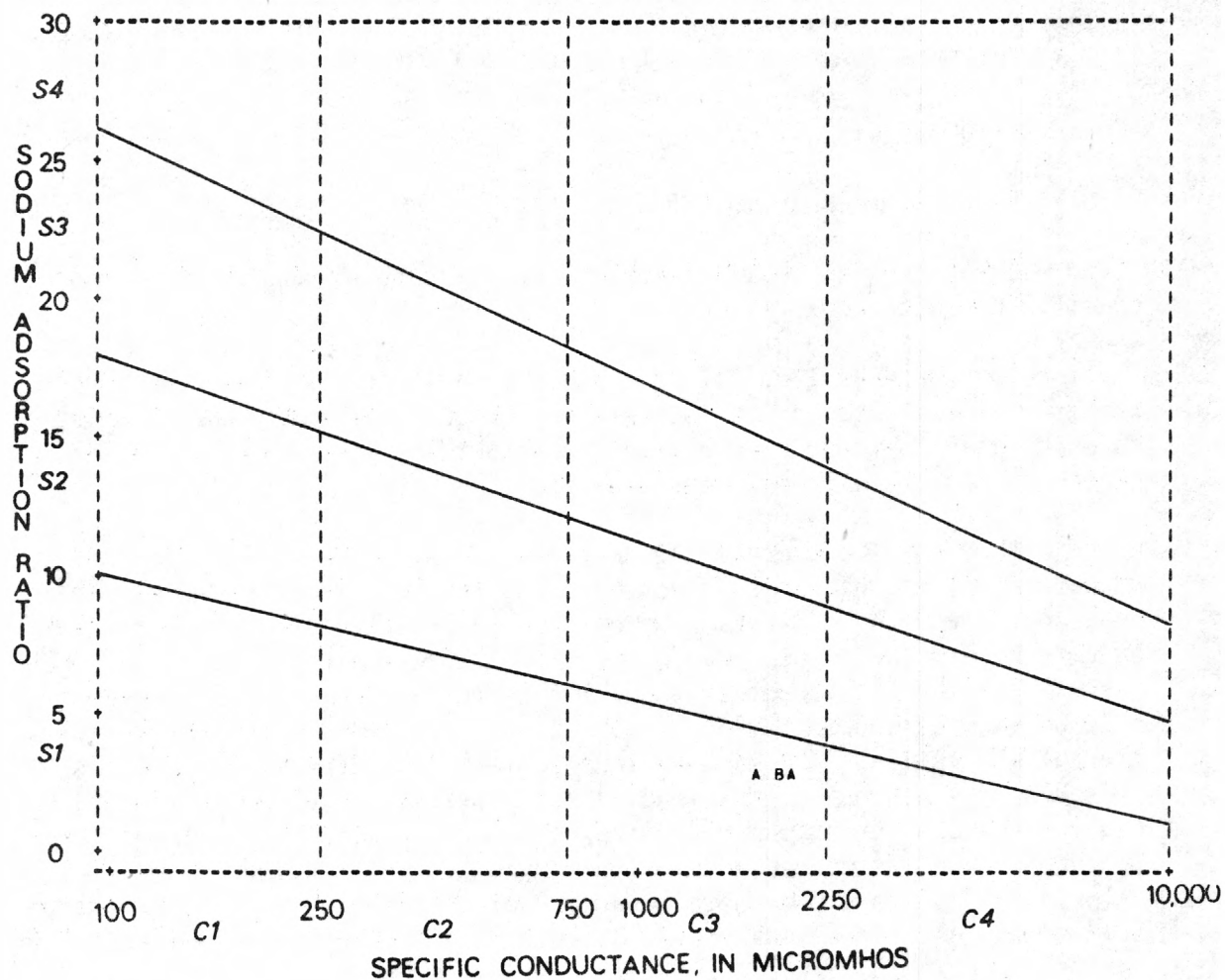
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER BLW ALTUS DAM NR LUGERT, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER BLW ALTUS, DAM NR LUGERT, OK



NORTH FORK RED RIVER BASIN

07305000 - North Fork Red River near Headrick, Okla.

LOCATION.--Lat 34°38'04", long 99°05'47", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 21, T.2 N., R.18 W., Tillman County, at bridge on U.S. Highway 62, 2.5 mi east of Headrick, 12.9 mi upstream from Otter Creek, and at mile 33.0.

DRAINAGE AREA.--4,244 mi², of which 399 mi² probably is noncontributing.

PERIOD OF RECORD.--1951 to 1952, 1954 to 1963, 1968 to 1979.

WATER TYPE.--The water was sodium chloride type throughout the range of measured specific conductance.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time do not indicate any trends. However, the Spearman's rhos at the 95-percent probability level indicate trends of increasing concentration for all four constituents.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,059 mg/L and 99 percent of the hardness values were greater than the minimum concentration for very hard water. The hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 95 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 95 percent of the sulfate values. The maximum lead contaminant level of 50 ug/L was exceeded by 7 percent of the lead values. Arsenic, cadmium, chromium, and mercury concentrations did not exceed their maximum contaminant levels. Because of the frequency and magnitude by which the recommended maximum chloride and sulfate concentrations were exceeded and because the maximum lead contaminant level was exceeded, this water would not be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 90 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to very high with 70 percent of the SAR values equivalent to a very high sodium hazard. The data indicate that boron phytotoxic effects could occur in boron sensitive and semitolerant plants. The recommended maximum boron concentration of 750 ug/L for boron sensitive plants was exceeded by 10 percent of the boron values and the recommended maximum boron concentration of 1,000 ug/L for boron semitolerant plants was exceeded by 5 percent of the boron values.

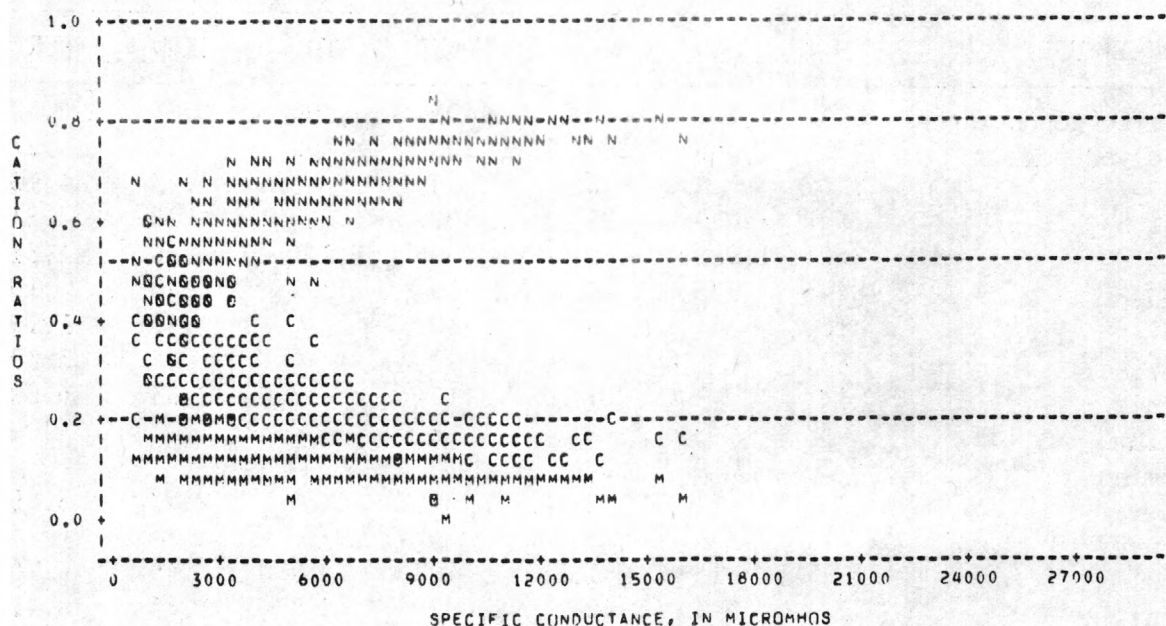
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	884	7,152	340	23,400	3,696	0.50	0.42
Dissolved solids	855	4,660	208	17,100	2,409	.60	.97
pH	821	8.0	6.7	8.9	.3	-.63	1.15
Total hardness	790	1,059	98	2,800	369	-.10	.54
Chloride	860	1,952	40	8,000	1,241	.89	1.31
Sulfate	844	825	24	2,000	292	-.46	.19
Iron	16	44	20	130	34	1.45	1.19
Fluoride	88	.4	.1	.7	.1	-.02	1.39
Arsenic	19	3	1	10	2.0	2.33	6.90
Cadmium	5	5	2	8			
Chromium	3	20	20	20			
Lead	14	14	2	64	20	2.02	3.05
Mercury	2	.4	.2	.6			
SAR	771	15	1.5	40	8.0	.45	-.16
Boron	172	473	60	2,000	268	1.66	6.41

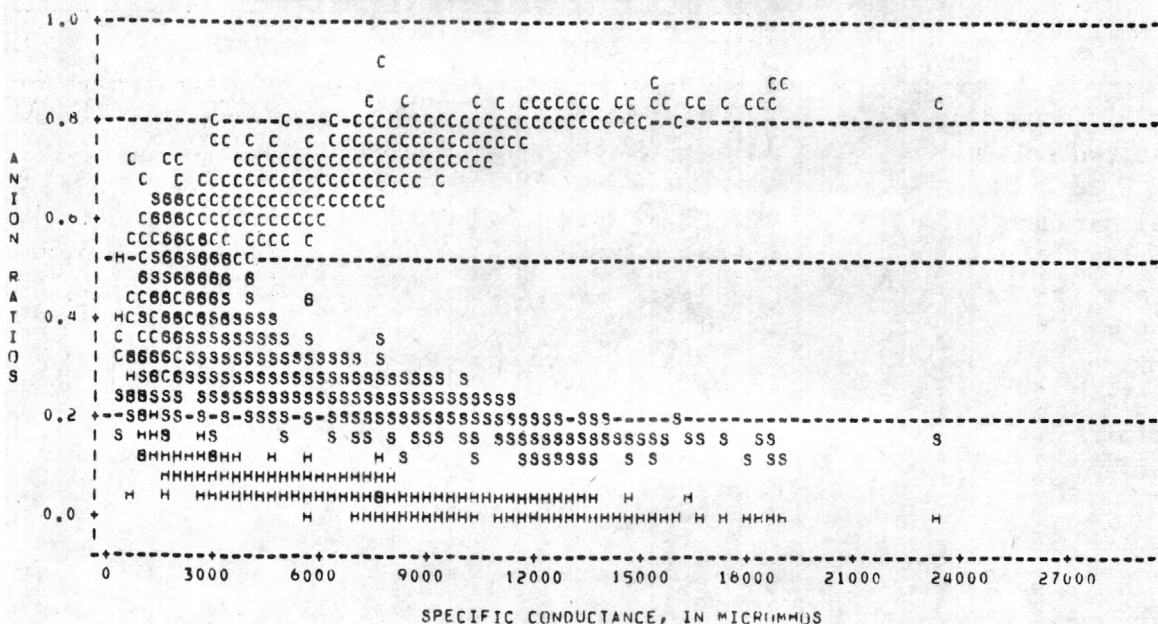
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	2,200	4,325	7,185	9,358	11,700
Dissolved solids	1,492	2,860	4,690	6,040	7,650
pH	7.6	7.8	8.0	8.2	8.3
Total hardness	541	820	1,100	1,300	1,440
Chloride	420	979	1,900	2,600	3,500
Sulfate	390	652	880	1,000	1,160
Iron	20	20	30	72	109
Fluoride	.3	.3	.4	.4	.5
Arsenic	1	2	3	4	6
Cadmium					
Chromium					
Lead	2	3	4	15	60
Mercury					
SAR	5.0	9.2	15	20	26
Boron	143	300	455	570	737

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR HEADRICK, OK



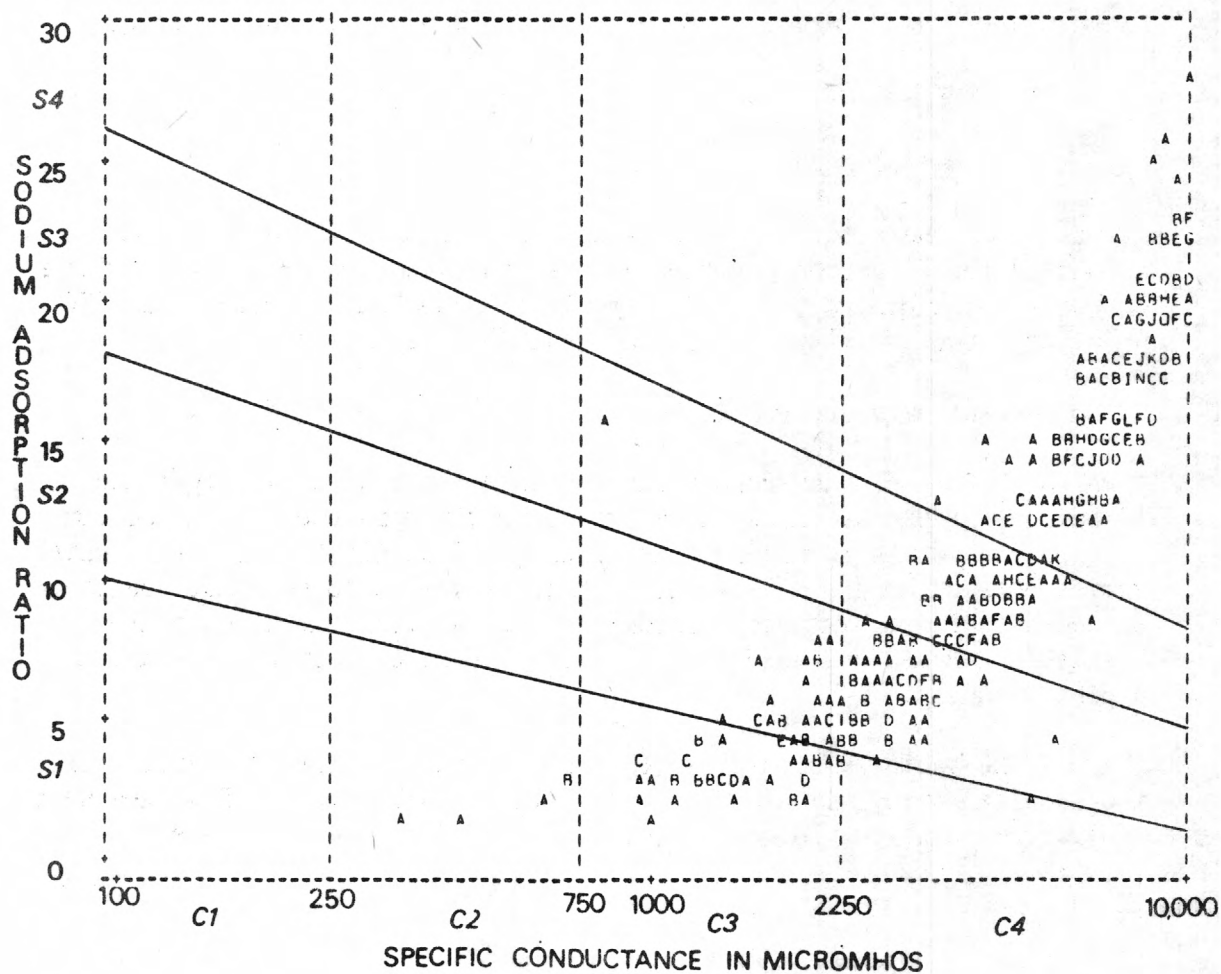
ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR HEADRICK, OK



IRRIGATION DIAGRAM

C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
A = 1 OBS, B = 2 OBS, C = 3 OBS

STATION NAME OR LOCAL IDENTIFIER=NORTH FORK RED RIVER NR HEADRICK, OK



NORTH FORK RED RIVER BASIN

07307010 - Otter Creek near Snyder, Okla.

LOCATION.--Lat 34°39'00", long 99°00'00", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 9, T.2 N., R.17 W., Kiowa County, at bridge on U.S. Highway 62, 2.5 mi west of Snyder.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1951, 1960 to 1963.

WATER TYPE.--When the specific conductance was less than 630 umho, which accounted for 77 percent of the samples, the water generally was calcium carbonate/bicarbonate type. For specific conductance greater than 630 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 174 mg/L and 35 percent of the hardness values were greater than the minimum concentration for very hard water. The hardness classification for this water varies between hard and very hard. None of the measured constituents exceeded their recommended maximum limits. No trace metal data are available. Based on the data, this water would be suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 79 percent of the samples having a medium salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

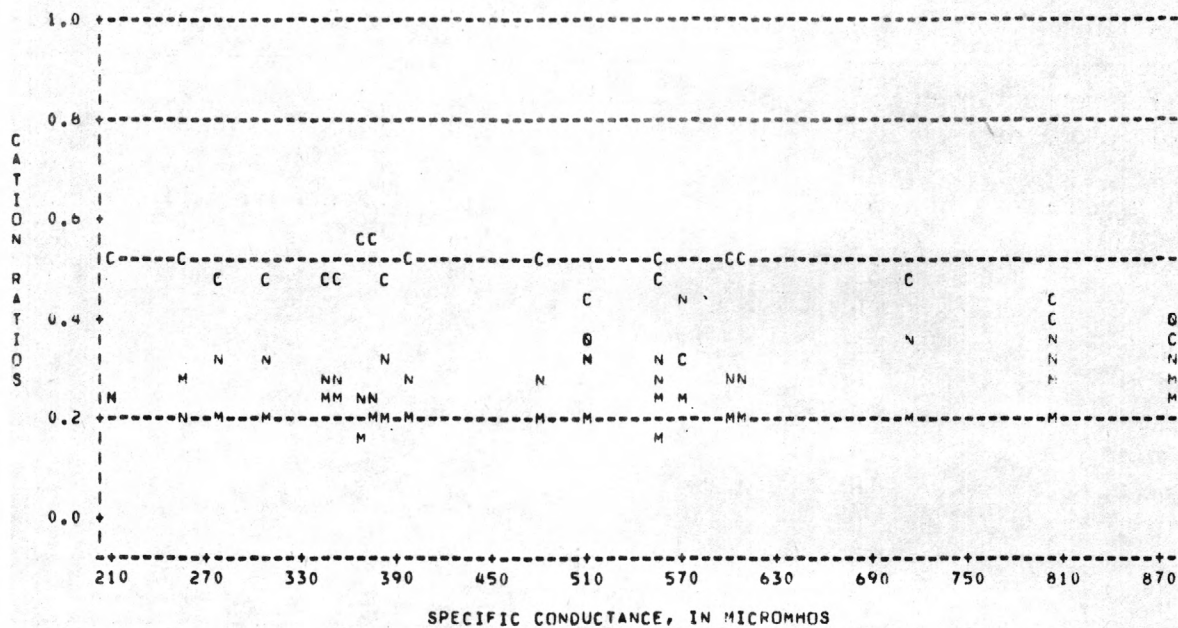
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	33	500	213	880	184	0.47	-0.49
Dissolved solids	33	293	123	530	105	.49	-.42
pH	33	8.0	6.9	8.6	.4	-.39	-.84
Total hardness	33	174	76	310	60	.50	-.27
Chloride	33	43	5.0	108	27	.92	.05
Sulfate	33	33	8.2	92	19	1.59	2.55
Iron	0						
Fluoride	2	.2	.2	.3			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	33	1.3	.6	3.1	.6	1.48	2.16
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	266	360	501	607	804
Dissolved solids	160	212	302	350	445
pH	7.4	7.4	8.0	8.3	8.4
Total hardness	99	131	168	210	269
Chloride	12	23	39	58	87
Sulfate	13	21	27	38	68
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.7	.9	1.2	1.6	2.2
Boron					

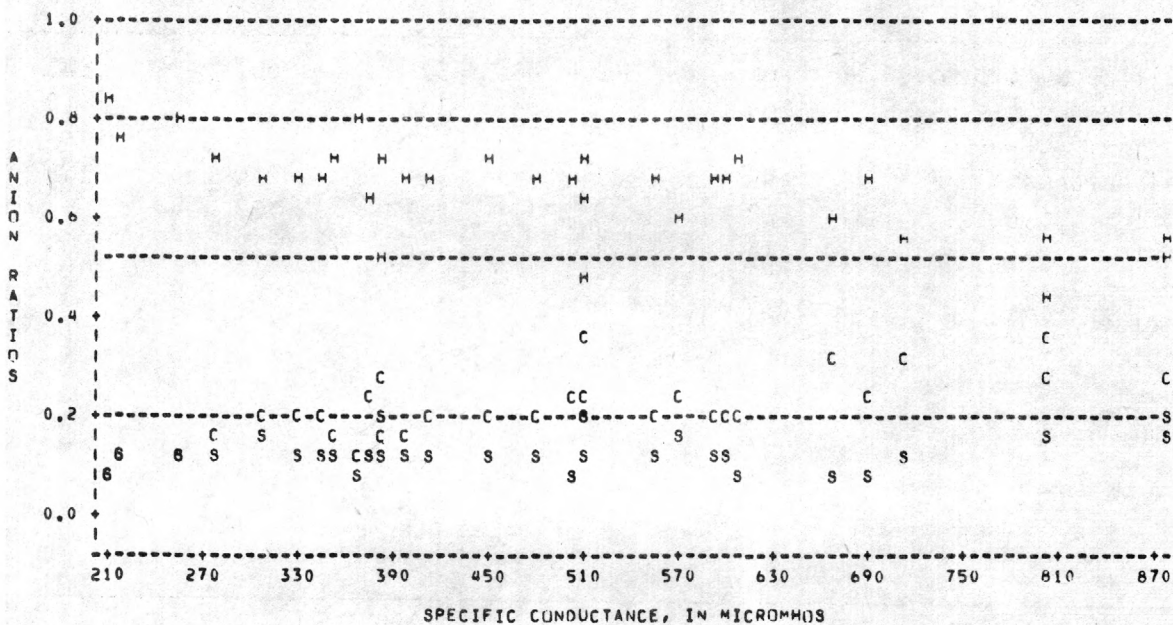
CATION RATIO PLOT

N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=OTTER CREEK NR SNYDER, OK

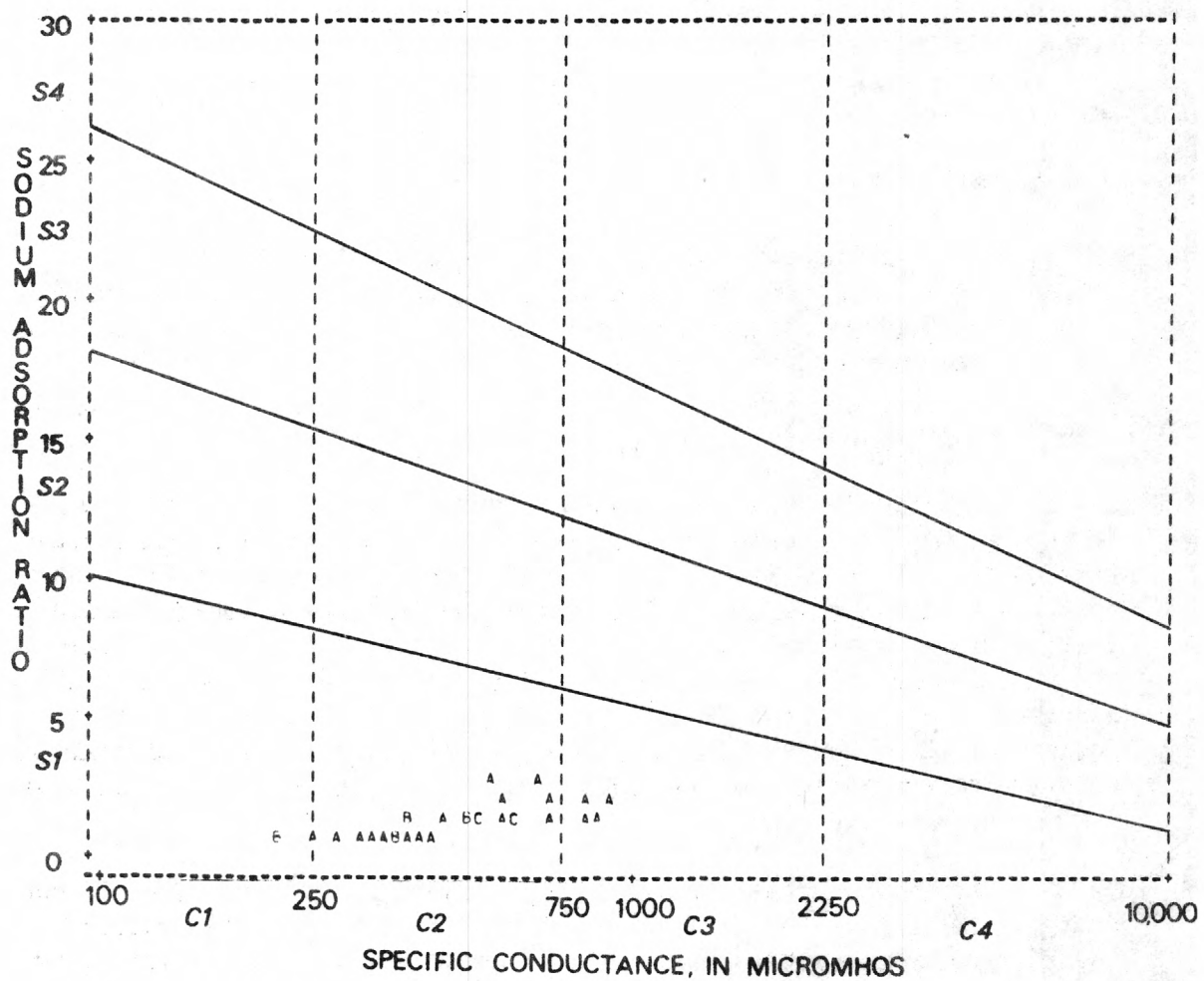


ANION RATIO PLOT

H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=OTTER CREEK NR SNYDER, OK



IRRIGATION DIAGRAM
 C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER BUTTER CREEK NR SNYDER, OK



NORTH FORK RED RIVER BASIN

07307020 - Otter Creek near Tipton, Okla.

LOCATION.--Lat 34°33'30", long 99°08'50", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T.1 N., R.19 W., Tillman County, at bridge on county road 4.5 mi north of Tipton.

DRAINAGE AREA.--266 mi².

PERIOD OF RECORD.--1960 to 1963.

WATER TYPE.--When the specific conductance was greater than 1,000 umho, which accounted for 76 percent of the samples, the water was sodium chloride type. For specific conductance less than 1,000 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 407 mg/L and 86 percent of the hardness values were greater than the minimum concentration for very hard water. In general, the hardness classification for this water is very hard. The recommended maximum chloride concentration of 250 mg/L was exceeded by 72 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 35 percent of the sulfate values. No toxic metal data are available. Because of the frequency and magnitude by which the recommended maximum chloride concentration was exceeded, this water probably is not suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to very high with 40 percent of the samples having a very high salinity hazard. The sodium hazard ranged from low to high with 61 percent of the SAR values equivalent to a medium sodium hazard. None of the boron values exceeded the 750 ug/L recommended maximum concentration for boron sensitive plants.

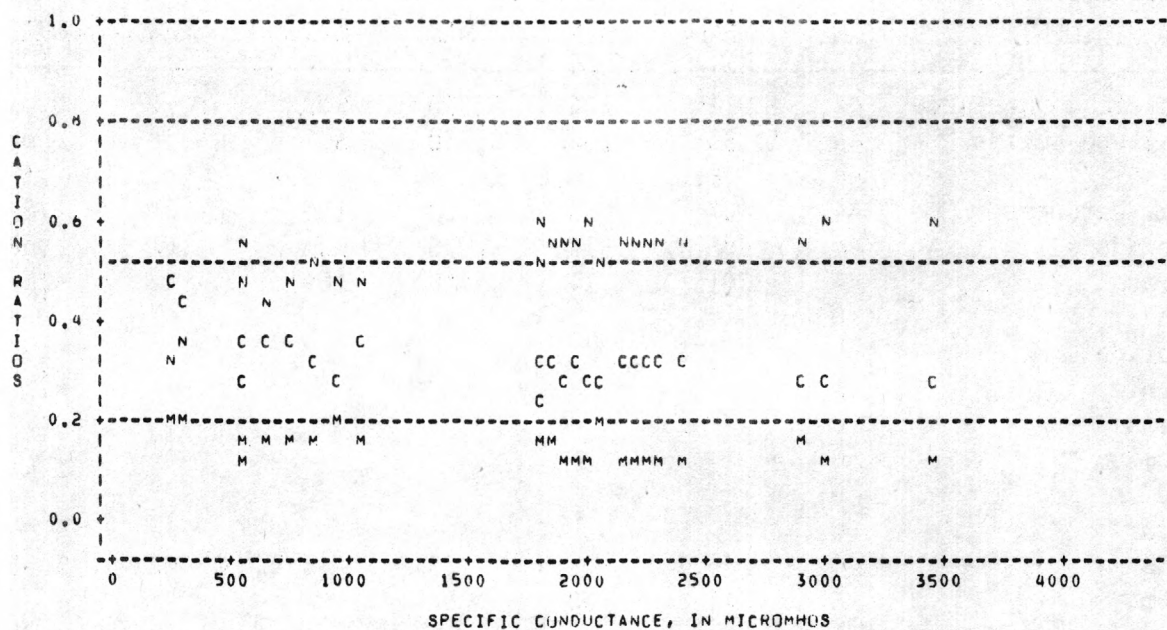
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	44	1,914	264	3,870	892	-0.22	-0.61
Dissolved solids	44	1,185	154	2,430	567	-.18	-.66
pH	44	8.0	6.8	8.7	.4	-.60	.13
Total hardness	44	407	88	760	176	-.26	-.81
Chloride	44	395	15	925	221	.06	-.38
Sulfate	44	201	14	440	104	-.05	-.51
Iron	0						
Fluoride	9	.5	.3	.8			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	44	5.2	.9	13	2.2	.62	2.35
Boron	5	244	160	300			

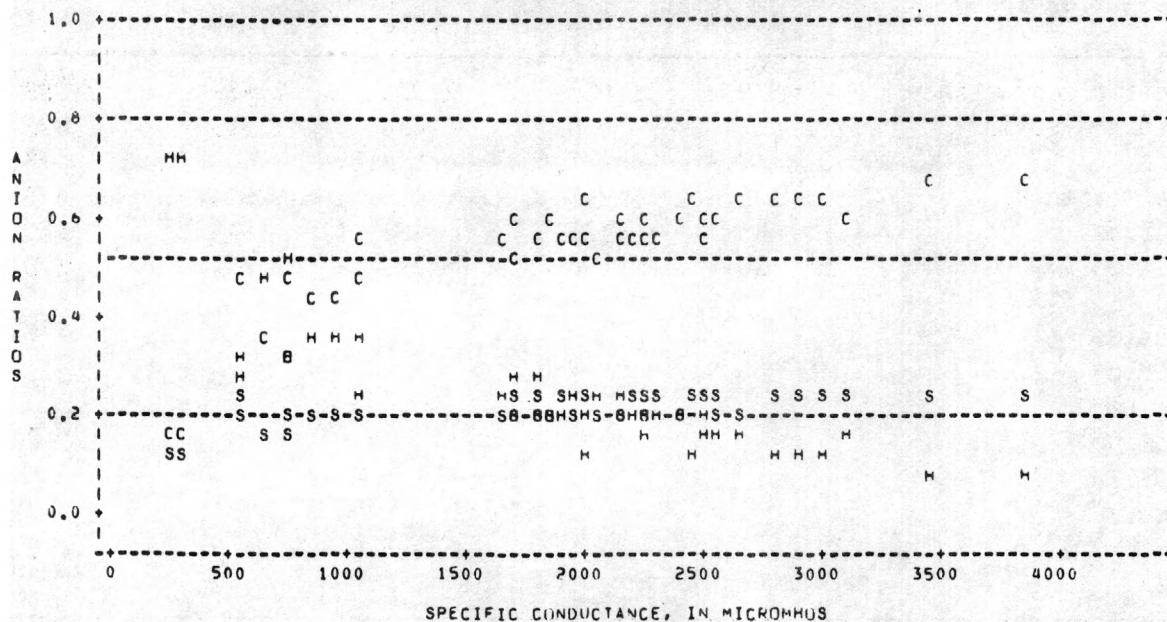
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	539	1,033	2,025	2,538	2,955
Dissolved solids	323	630	1,230	1,595	1,825
pH	7.2	7.6	8.0	8.2	8.4
Total hardness	123	243	425	534	625
Chloride	85	175	402	548	650
Sulfate	50	96	212	274	318
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	2.3	3.3	5.6	6.5	7.5
Boron					

CATION RATIO PLOT
 N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=OTTER CREEK NR TIPTON, OK



ANION RATIO PLOT
 H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
 STATION NAME OR LOCAL IDENTIFIER=OTTER CREEK NR TIPTON, OK



C1 AND S1 ARE LOW HAZARD, C2 AND S2 ARE MEDIUM HAZARD
 C3 AND S3 ARE HIGH HAZARD, C4 AND S4 ARE VERY HIGH HAZARD
 A = 1 OBS, B = 2 OBS, C = 3 OBS
 STATION NAME OR LOCAL IDENTIFIER=OTTER CREEK NR TIPTON, OK



Table 3.--List of stations in downstream order

Number	Station name	Page
07299710	Lebos Creek near Eldorado, Okla.-----	94
07300000	Salt Fork Red River near Wellington, Tex.-----	158
07300400	Salt Fork Red River near Vinson, Okla.-----	162
07300500	Salt Fork Red River at Mangum, Okla.-----	166
07301100	Turkey Creek at Olustee, Okla.-----	178
07301110	Salt Fork Red River near Elmer, Okla.-----	170
07301450	North Fork Red River near Erick, Okla.-----	210
07301500	North Fork Red River near Carter, Okla.-----	214
07303000	North Fork Red River below Lake Altus Dam, near Lugert, Okla.---	218
07303395	Elm Fork North Fork Red River at Salton Crossing, Okla.-----	194
07303400	Elm Fork North Fork Red River near Carl, Okla.-----	198
07303402	Fish Creek near Vinson, Okla.-----	206
07303500	Elm Fork North Fork Red River near Mangum, Okla.-----	202
07304500	Elk Creek near Hobart, Okla.-----	190
07305000	North Fork Red River near Headrick, Okla.-----	222
07307010	Otter Creek near Snyder, Okla.-----	226
07307020	Otter Creek near Tipton, Okla.-----	230
07311000	East Cache Creek near Walters, Okla.-----	70
07311200	Blue Beaver Creek near Cache, Okla.-----	38
07311240	West Cache Creek near Cookietown, Okla.-----	186
07311500	Deep Red Run near Randlett, Okla.-----	66
07313000	Little Beaver Creek near Duncan, Okla.-----	106
07313500	Beaver Creek near Waurika, Okla.-----	22
07313600	Cow Creek at Waurika, Okla.-----	62
07315697	Mud Creek near Grady, Okla.-----	122
07315700	Mud Creek near Courtney, Okla.-----	126
07315882	Simon Creek near Oswalt, Okla.-----	174
07315900	Walnut Bayou near Burneyville, Okla.-----	182
07316000	Red River near Gainesville, Tex.-----	138
07331600	Red River at Denison Dam, near Denison, Tex.-----	142
07332350	Blue River at Connerville, Okla.-----	26
07332400	Blue River at Milburn, Okla.-----	30
07332500	Blue River near Blue, Okla.-----	34
07332800	Caney Boggy Creek near Ashland, Okla.-----	42
07332900	Coal Creek near Lehigh, Okla.-----	58
07332950	Muddy Boggy Creek at Atoka, Okla.-----	130
07333500	Chickasaw Creek near Stringtown, Okla.-----	46
07333910	McGee Creek near Farris, Okla.-----	110
07334000	Muddy Boggy Creek near Farris, Okla.-----	134
07334400	Clear Boggy Creek near Tupelo, Okla.-----	50
07335000	Clear Boggy Creek near Caney, Okla.-----	54
07335500	Red River at Arthur City, Tex.-----	146
07335700	Kiamichi River near Big Cedar, Okla.-----	78
07336200	Kiamichi River near Antlers, Okla.-----	82

Table 3.--List of stations in downstream order--Continued

Number	Station name	Page
07336500	Kiamichi River near Belzoni, Okla.-----	86
07336700	Kiamichi River near Sawyer, Okla.-----	90
07336850	Red River near New Boston, Tex.-----	150
07337000	Red River at Index, Ark.-----	154
07337900	Glover Creek near Glover, Okla.-----	74
07338500	Little River below Lukfata Creek, near Idabel, Okla.-----	98
07339000	Mountain Fork near Eagletown, Okla.-----	114
07339010	Mountain Fork below Eagletown, Okla.-----	118
07340000	Little River near Horatio, Ark.-----	102

