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

PART 5: WASHITA RIVER BASIN THROUGH 1979

U.S. GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS 82-29

Prepared in cooperation with the
OKLAHOMA WATER RESOURCES BOARD

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Jerry D. Stoner

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Room 621, Old Post Office Building
215 Dean A. McGee Avenue
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Water-quality data in the Washita River basin 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 water for irrigation. The possibility of boron phytotoxic effects is discussed.

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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. Mc Gee Avenue
Oklahoma City, Ok 73102
Telephone: 405-231-4256

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CONVERSION FACTORS

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

MULTIPLY INCH-POUND UNIT	BY	TO OBTAIN SI UNIT
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	Microsiemens per centimeter

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ABSTRACT

Water-quality data through 1979 in the Washita River basin within Oklahoma were examined for water type and suitability for public water supply and for irrigation use. Of 82 stations with available data, 32 stations or 39 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 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 suitability for use of the water for irrigation. Where data were available, the chance of phytotoxic effects by boron was discussed.

INTRODUCTION

Surface-water-quality data for Oklahoma have been collected and published on a regular basis since 1946. These data through 1975 represent 2,733 station-years of record from 527 stations (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 has recently 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 since 1946. 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 usable 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 (Stoner, 1982).

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 07328100 is shown in figure 1 as 328100. 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.

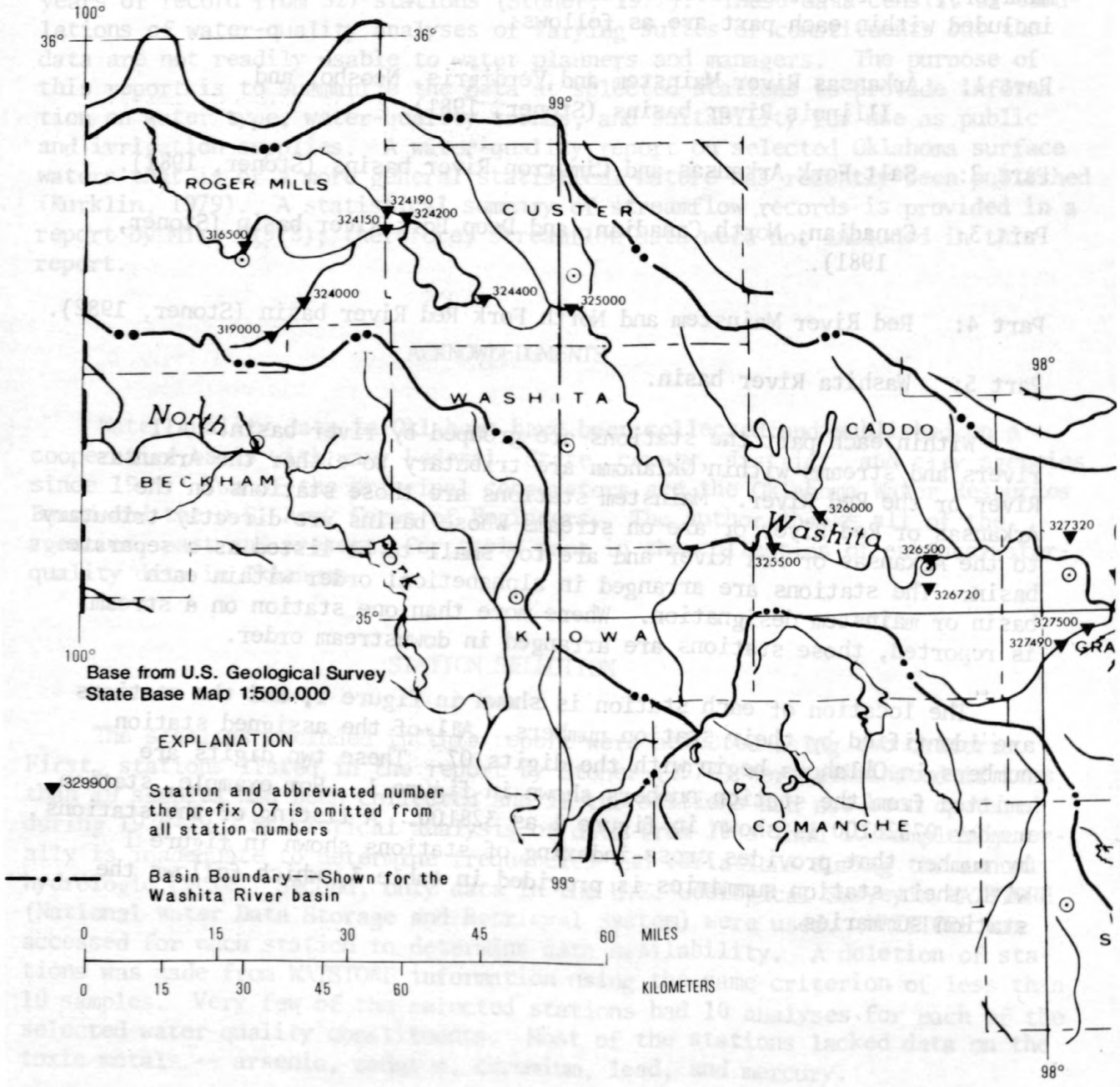
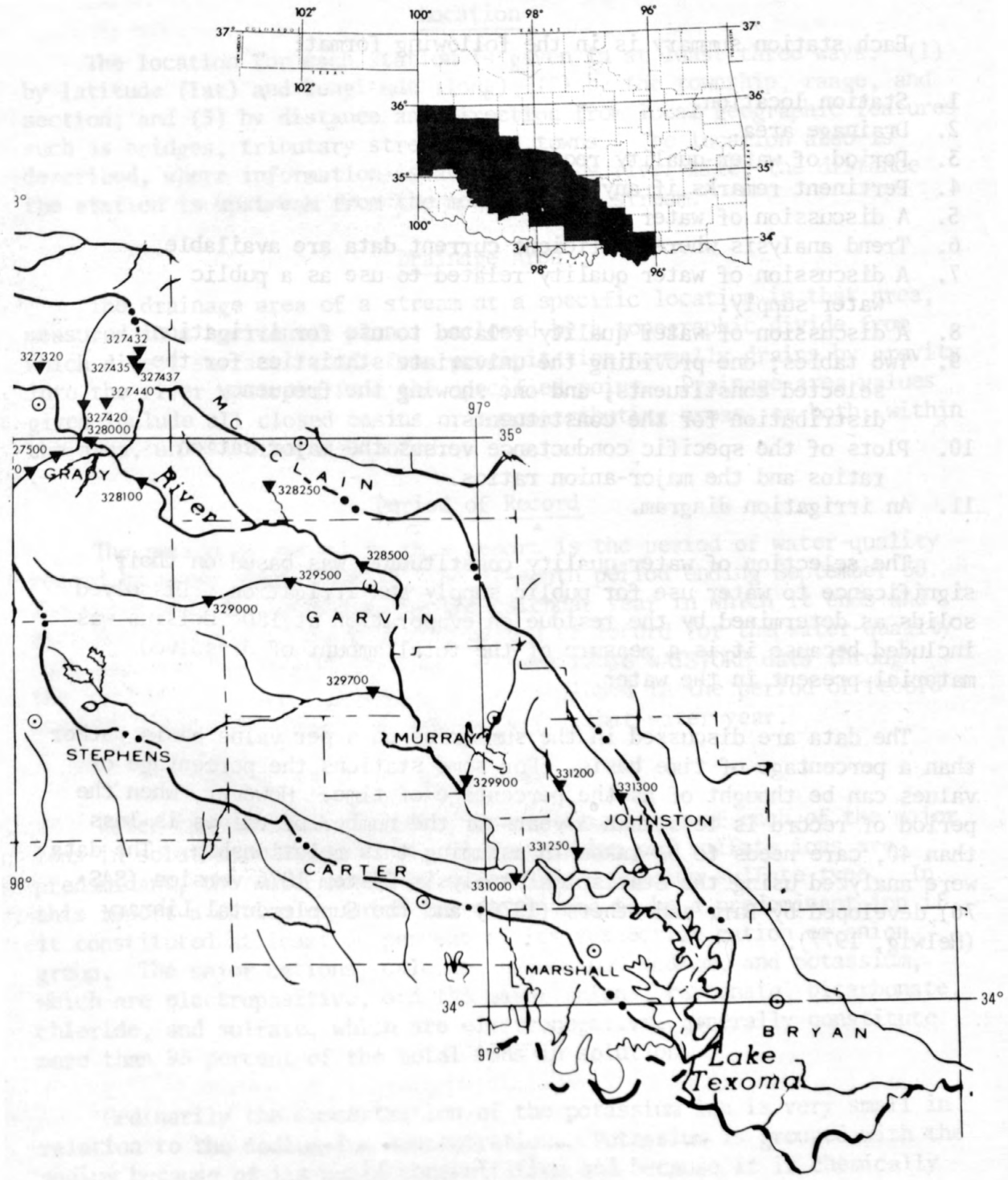


Figure 1.-Station location map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329700
STEPHENS
MURRAY
329900
331200
331300
JOHNSTON
331250
CARTER
331000
MARSHALL
BRYAN
Lake Texoma

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 (SAS-76) developed by Barr and others (1976) and the Supplemental Library (Helwig, 1977).

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 or noncontributing areas, or both, 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 1979 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 electronegative, 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 relationship 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 maximum 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.

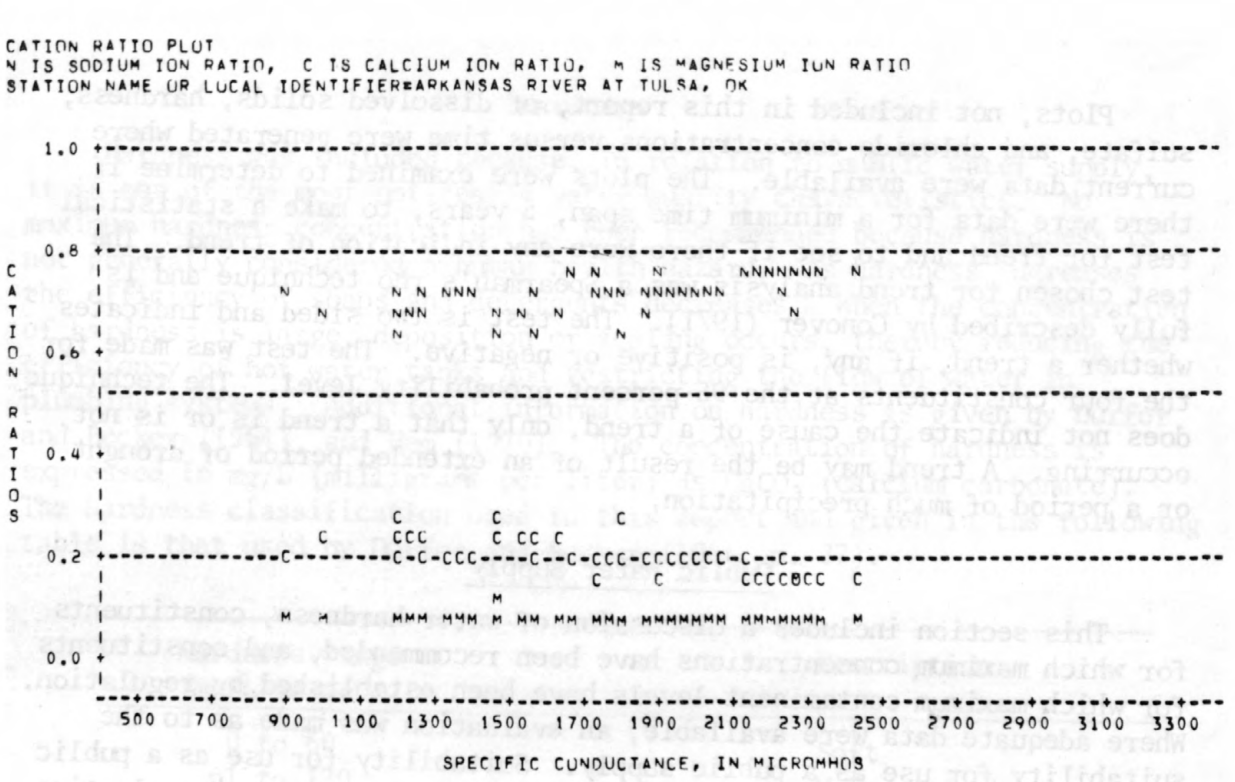

Figure 2 - Cation ratio plot for Arkansas River at Tulsa, Oklahoma.

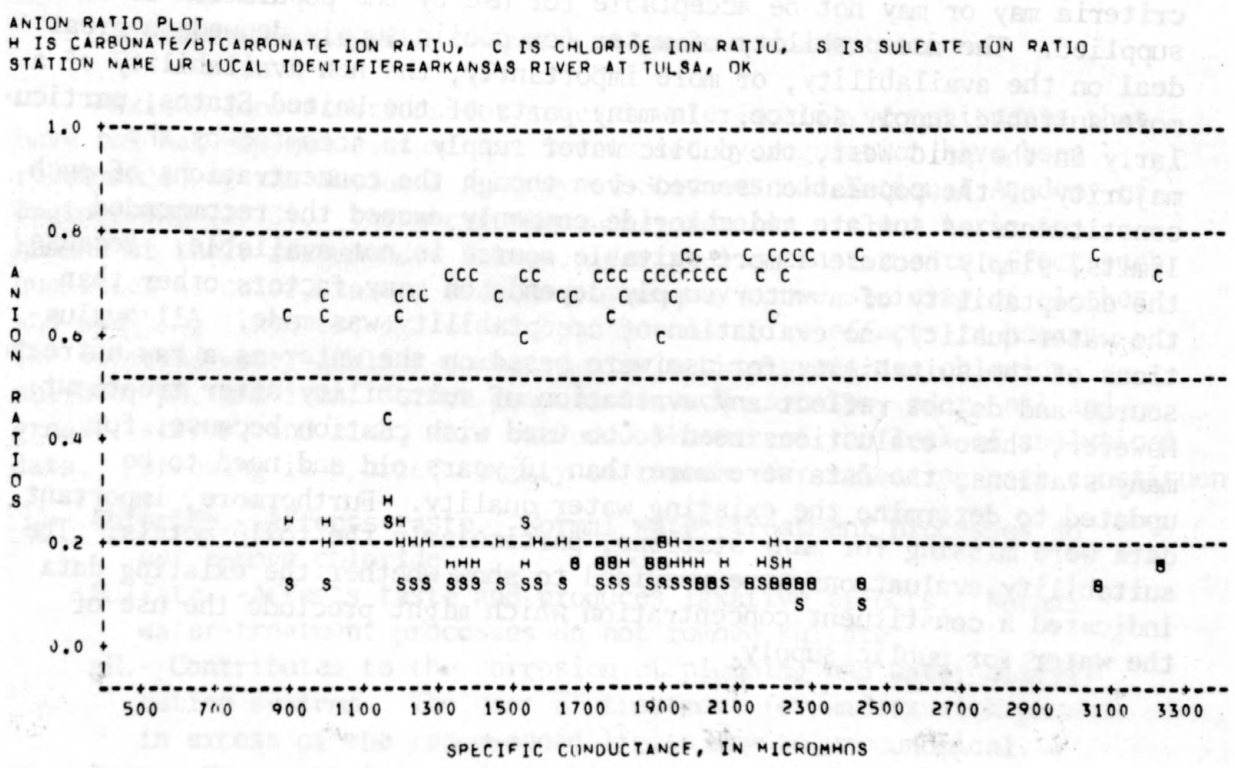

Figure 3 - Anion ratio plot for Arkansas River at Tulsa, Oklahoma.

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 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 mg/L (milligrams per liter) as $CaCO_3$ (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 (mg/L as $CaCO_3$)	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 fluoride 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 classification

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 degrees 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.

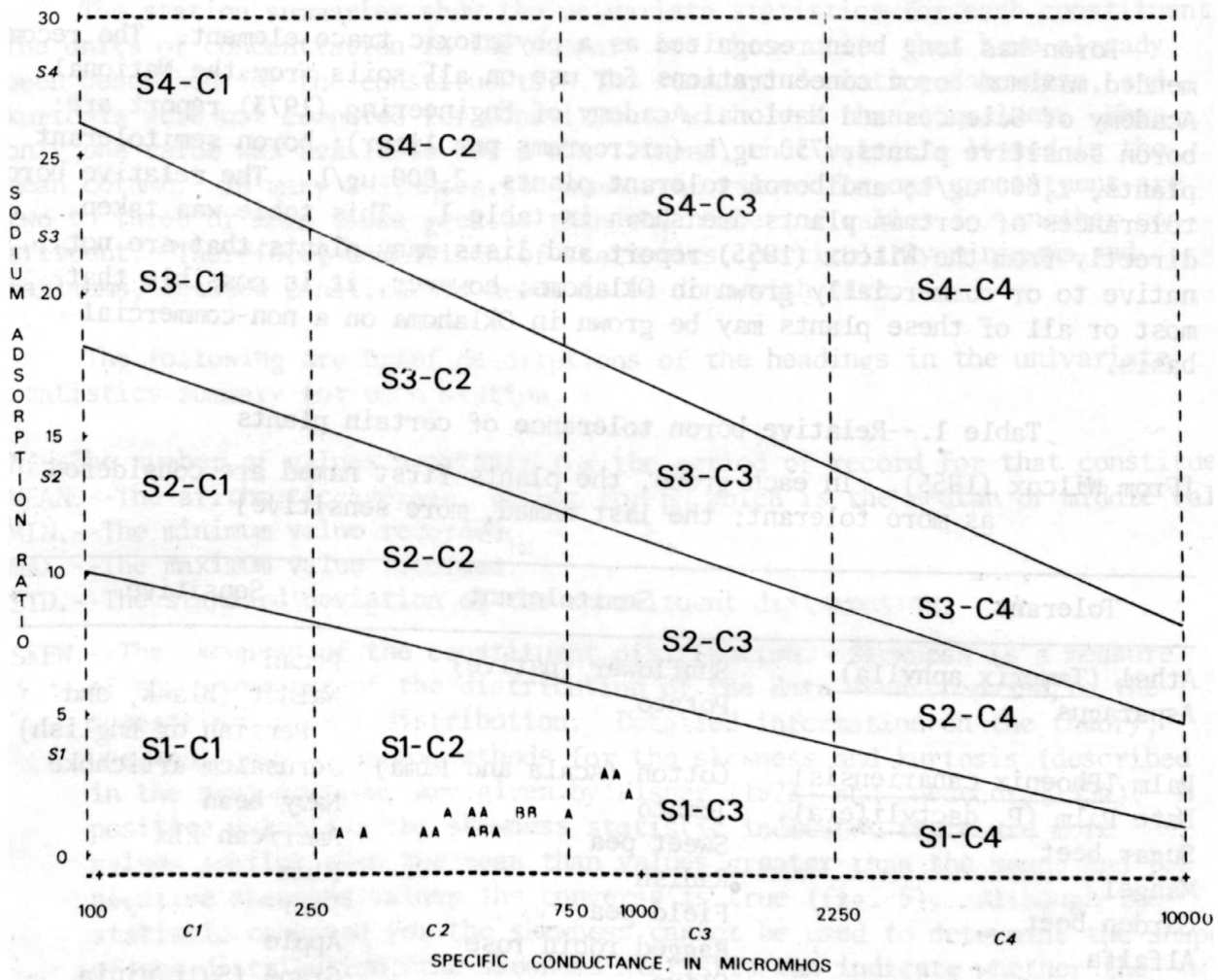

Figure 4 - Irrigation diagram for Bird Creek near Barnsdall, Oklahoma

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 (Tamerix aphylla)	Sunflower (native)	Pecan
Asparagus	Potato	Walnut (Black; and Persian or English)
Palm (Phoenix canariensis)	Cotton (Acala and Pima)	Jerusalem artichoke
Date Palm (P. dactylifera)	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 exceeds 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.

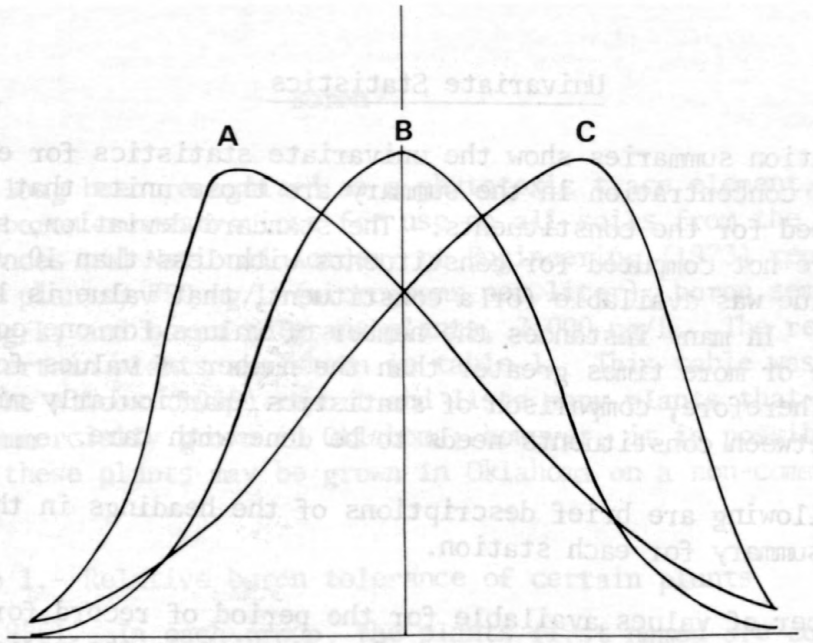

Figure 5 Skewness and the normal distribution. Curve A is positive skewness, curve B is normal distribution, and curve C is negative skewness.

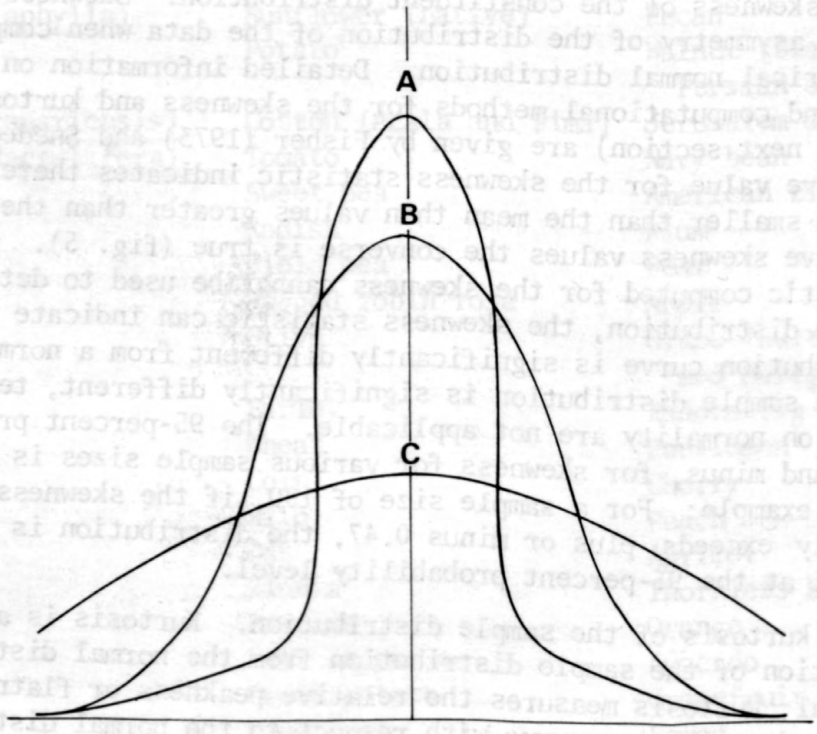

Figure 6 Kurtosis and the normal distribution. Curve A is positive kurtosis, curve B is normal distribution, and curve C is negative kurtosis.

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.

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_____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.

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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.

07326000 - Cobb Creek near Fort Cobb, Okla.

LOCATION.--Lat 35°08'37", long 98°26'33", in NE¼NE¼ sec. 27, T.8 N., R.12 W., Caddo County, at county road bridge, 0.3 mi upstream from Punjo Creek, 1.2 mi downstream from Fort Cobb Dam, 3.0 mi north of Fort Cobb, and at mile 5.8.

DRAINAGE AREA.--313 mi^2.

PERIOD OF RECORD.--1947 to 1948, 1950 to 1958, 1960 to 1963.

WATER TYPE.--When the specific conductance was greater than 450 umho, which accounted for 87 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance less than 450 umho the water was mixed cation carbonate/bicarbonate type. When the specific conductance was greater than 500 umho the water occasionally was a calcium sulfate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 291 mg/L and 90 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 sulfate concentration of 250 mg/L was exceeded by 4 percent of the sulfate values. No toxic metal data are available. Based on the data, this water probably is suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 83 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.

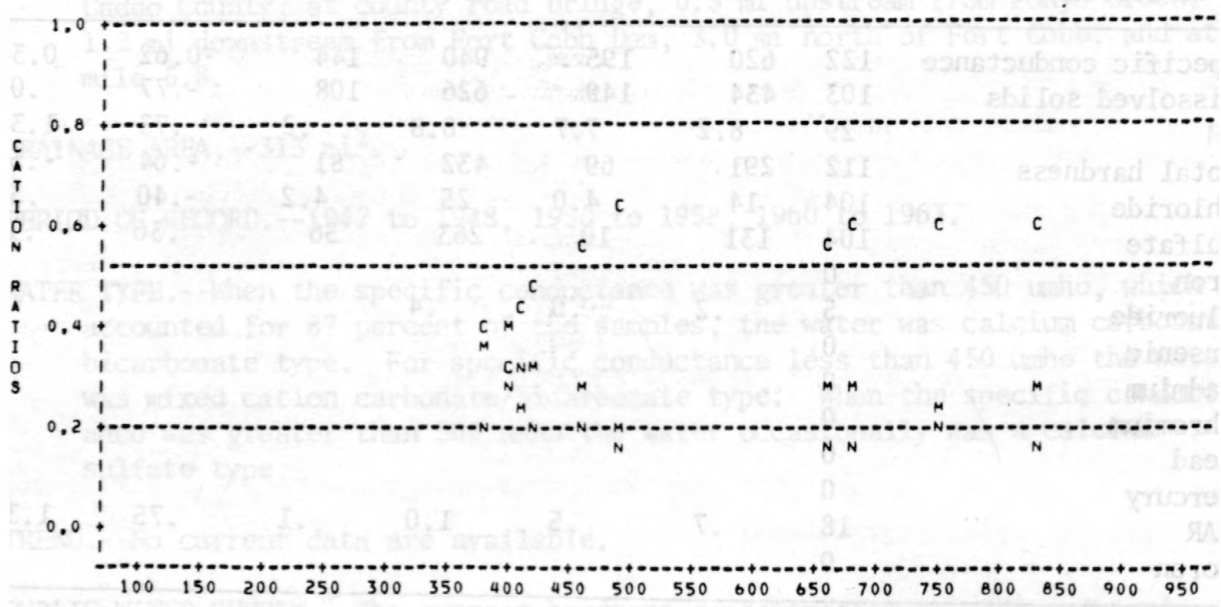
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	122	620	195	940	144	-0.62	0.34
Dissolved solids	103	434	149	626	108	-.77	.07
pH	29	8.2	7.7	8.8	.2	.73	1.38
Total hardness	112	291	69	432	81	-.64	-.54
Chloride	104	14	4.0	25	4.2	-.40	.33
Sulfate	104	131	10	263	56	.36	.16
Iron	0						
Fluoride	5	.2	.0	.4			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	18	.7	.5	1.0	.1	.75	1.33
Boron	0						

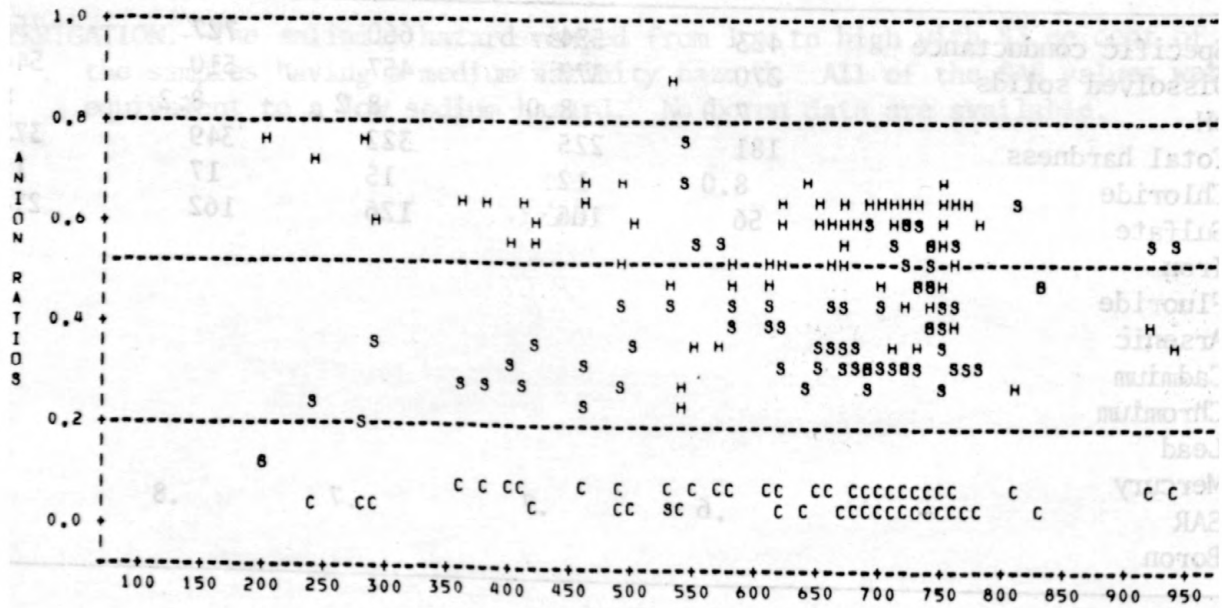
FREQUENCY DISTRIBUTION

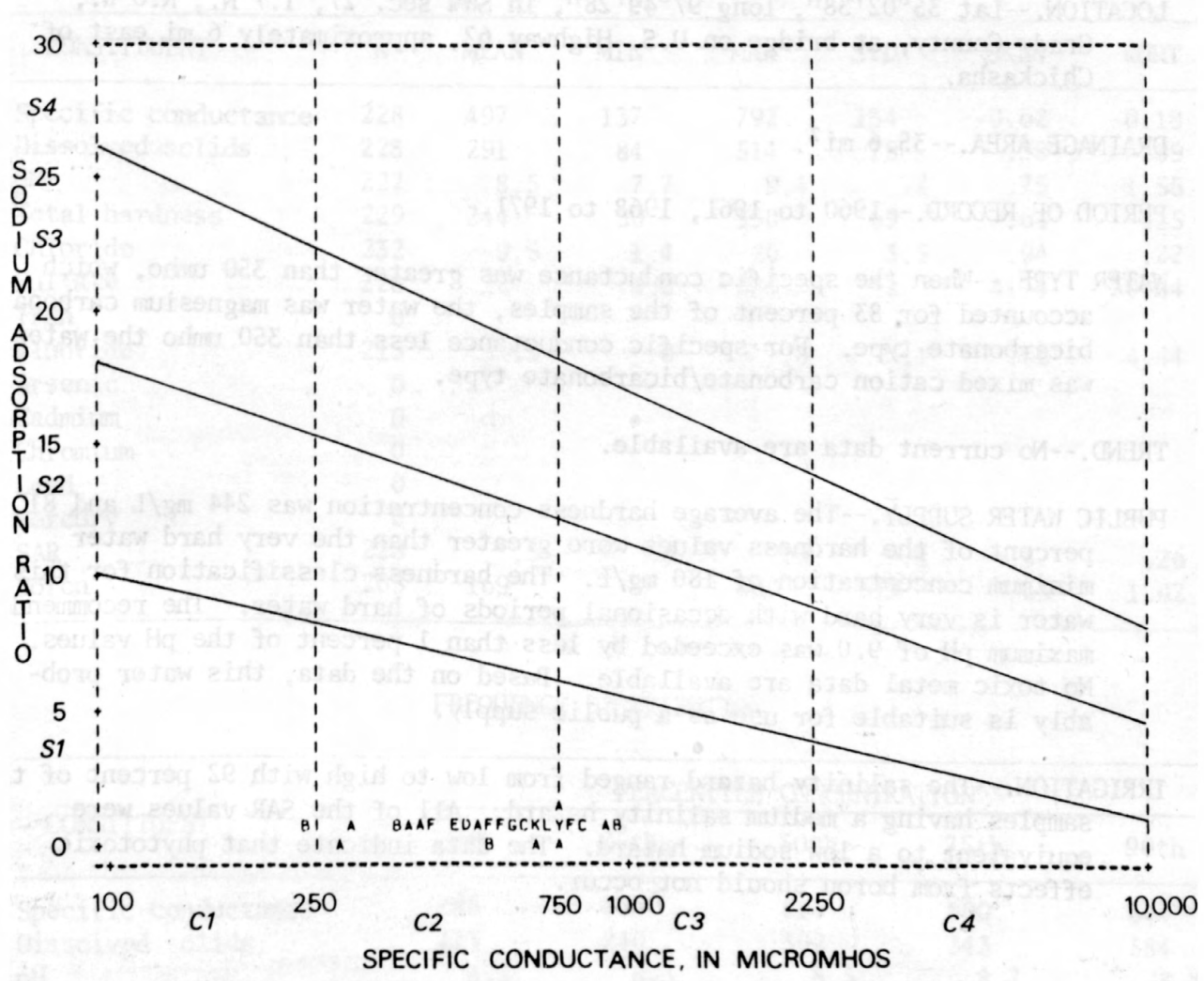
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	423	534	660	727	754
Dissolved solids	270	377	457	510	544
pH	7.9	8.0	8.2	8.2	8.4
Total hardness	181	225	322	349	373
Chloride	8.0	12	15	17	19
Sulfate	56	106	126	162	214
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.6	.7	.7	.8	1.0
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=COBB CREEK NR FORT COBB, 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=COBB CREEK NR FORT COBB, 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=COBB CREEK NR FORT COBB, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
B A BAAF EDAFFGCKLYFC AB
A B A A
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327440 - East Bitter Creek near Tabler, Okla.

LOCATION.--Lat 35°02'38", long 97°49'28", in SW¼ sec. 27, T.7 N., R.6 W., Grady County, at bridge on U.S. Highway 62, approximately 6 mi east of Chickasha.

DRAINAGE AREA.--35.6 mi^2.

PERIOD OF RECORD.--1960 to 1961, 1968 to 1971.

WATER TYPE.--When the specific conductance was greater than 350 umho, which accounted for 83 percent of the samples, the water was magnesium carbonate/bicarbonate type. For specific conductance less than 350 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 244 mg/L and 81 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 with occasional periods of hard water. The recommended maximum pH of 9.0 was exceeded by less than 1 percent of the pH values. No toxic metal data are available. Based on the data, this water probably is suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to high with 92 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.

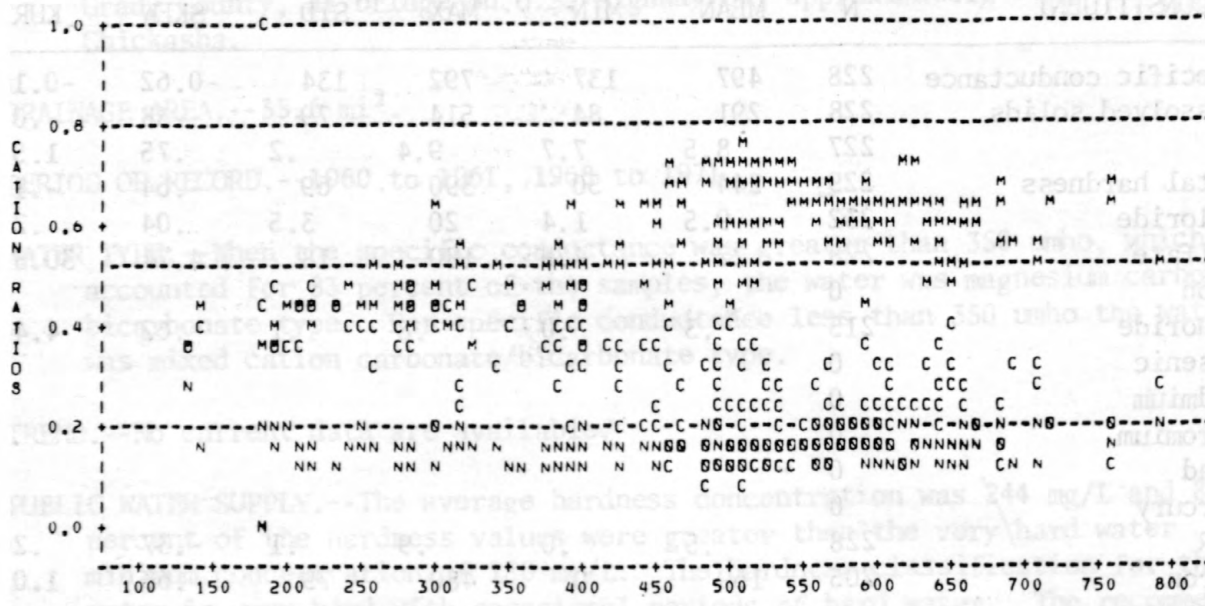
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	228	497	137	792	134	-0.62	-0.18
Dissolved solids	228	291	84	514	79	-.38	-.09
pH	227	8.5	7.7	9.4	.2	.75	1.55
Total hardness	229	244	50	390	69	-.64	-.15
Chloride	232	9.5	1.4	20	3.5	.04	.22
Sulfate	228	22	4.0	180	18	4.74	30.84
Iron	0						
Fluoride	215	.3	.0	.8	.1	.62	4.44
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	228	.5	.0	.9	.1	-.37	.26
Boron	205	169	0	480	79	.63	1.02

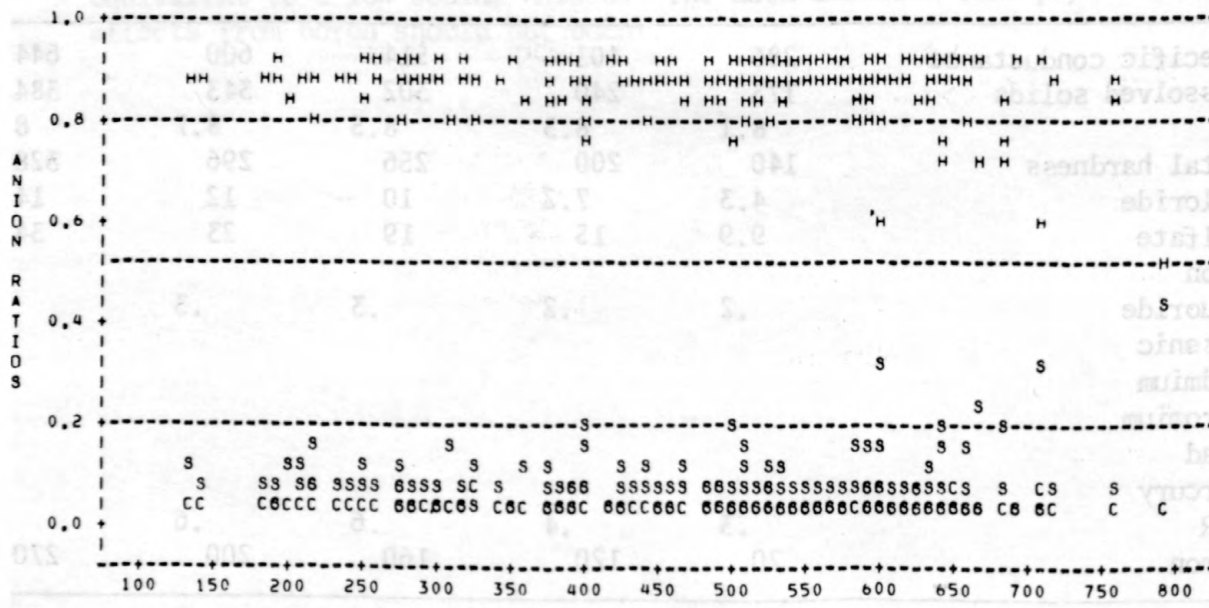
FREQUENCY DISTRIBUTION

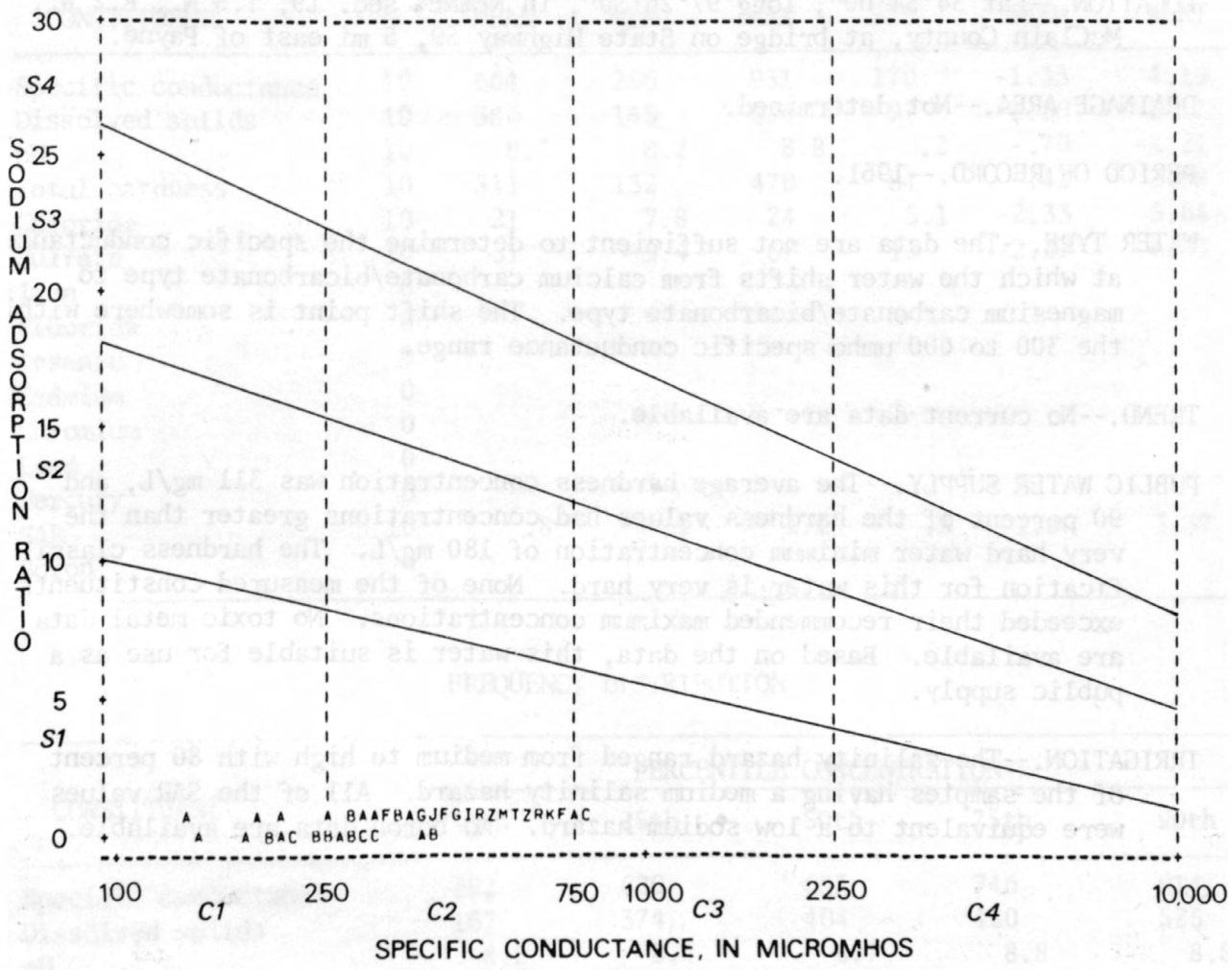
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	286	403	514	600	644
Dissolved solids	173	240	302	343	384
pH	8.1	8.3	8.5	8.7	8.8
Total hardness	140	200	256	296	328
Chloride	4.3	7.2	10	12	14
Sulfate	9.9	15	19	23	34
Iron					
Fluoride	.2	.2	.3	.3	.4
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.4	.6	.6	.7
Boron	70	120	160	200	270

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=EAST BITTER CREEK NR TABLER, 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 BITTER CREEK NR TABLER, 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 BITTER CREEK NR TABLER, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
A A A A BAAFBAGJFGIRZMTZRKFAC
A A BAC BBABCC AB
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07328250 - Finn Creek near Payne, Okla.

LOCATION.--Lat 34°54'00", long 97°26'30", in NE¼NE¼ sec. 19, T.5 N., R.2 W., McClain County, at bridge on State Highway 59, 5 mi east of Payne.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1961.

WATER TYPE.--The data are not sufficient to determine the specific conductance at which the water shifts from calcium carbonate/bicarbonate type to magnesium carbonate/bicarbonate type. The shift point is somewhere within the 300 to 600 umho specific conductance range.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 311 mg/L, and 90 percent of the hardness values had concentrations greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. None of the measured constituents exceeded their recommended maximum concentrations. No toxic metal data are available. Based on the data, this water is suitable for use as a public supply.

IRRIGATION.--The salinity hazard ranged from medium to high with 80 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.

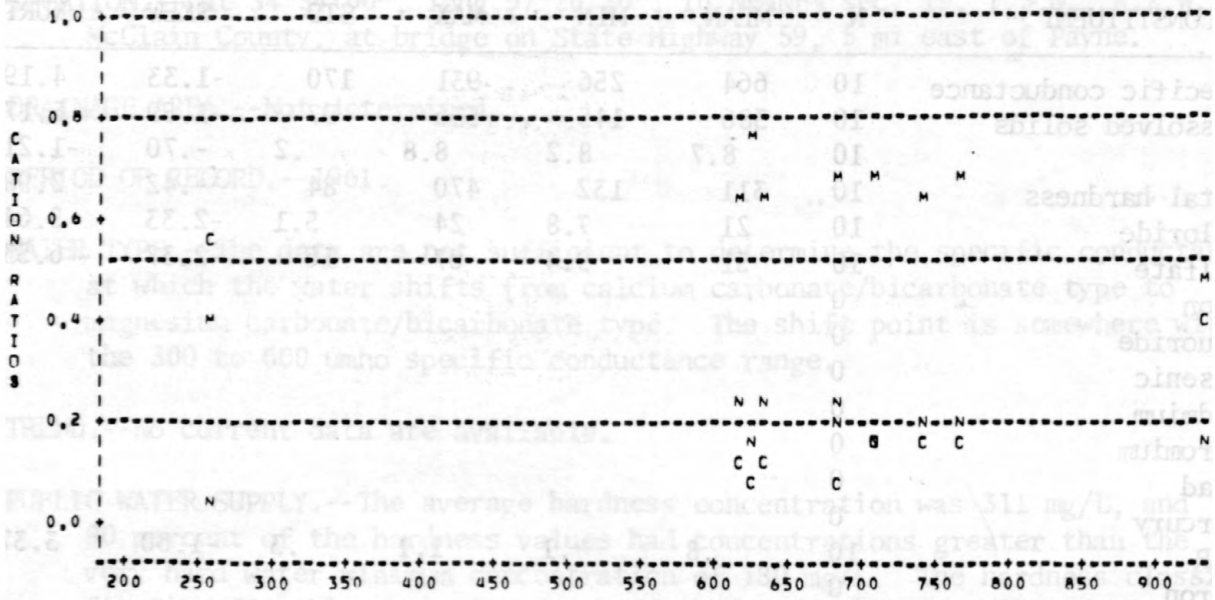
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	10	664	256	931	170	-1.33	4.19
Dissolved solids	10	386	145	536	97	-1.59	5.17
pH	10	8.7	8.2	8.8	.2	-.70	-1.21
Total hardness	10	311	132	470	84	-.42	2.98
Chloride	10	21	7.8	24	5.1	-2.33	5.64
Sulfate	10	51	9.4	67	16	-2.37	6.53
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	10	.8	.1	1.1	.3	-1.60	3.37
Boron	0						

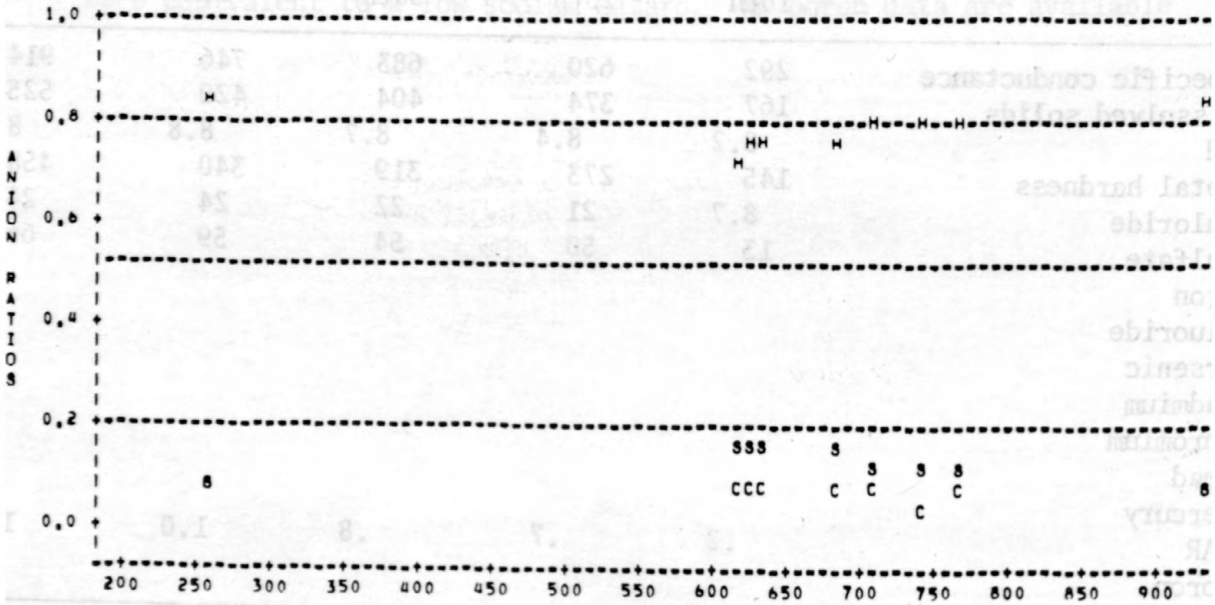
FREQUENCY DISTRIBUTION

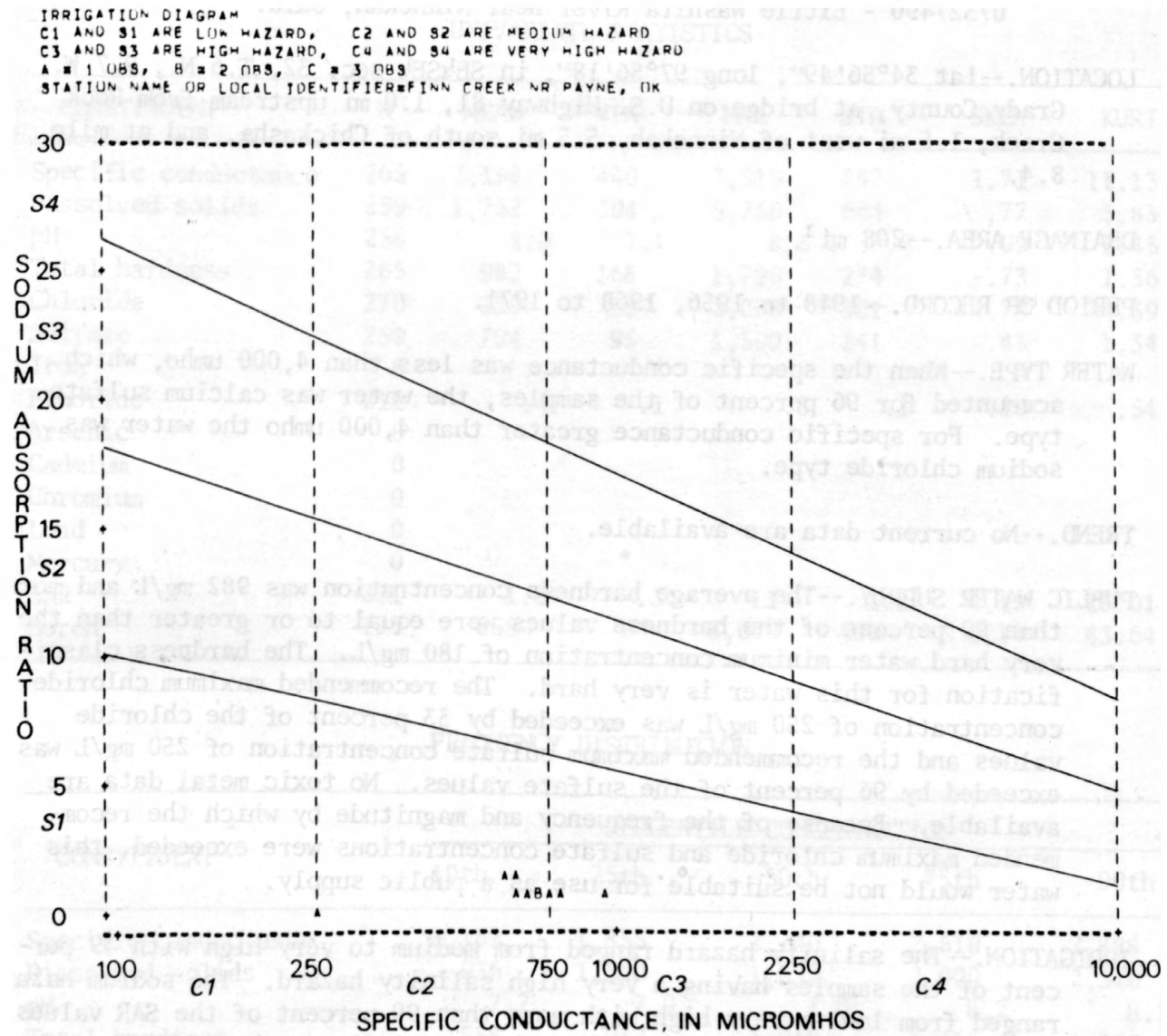
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	292	620	683	746	914
Dissolved solids	167	374	404	420	525
pH	8.2	8.4	8.7	8.8	8.8
Total hardness	145	273	319	340	458
Chloride	8.7	21	22	24	24
Sulfate	13	50	54	59	66
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.7	.8	1.0	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=FINN CREEK NR PAYNE, 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=FINN CREEK NR PAYNE, 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=FINN CREEK NR PAYNE, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
AA
AABAA
A
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327490 - Little Washita River near Ninnekah, Okla.

LOCATION.--Lat 34°56'49", long 97°56'18", in SE¼SE¼ sec. 32, T.6 N., R.7 W., Grady County, at bridge on U.S. Highway 81, 1.0 mi upstream from Rock Creek, 1.5 mi west of Ninnekah, 5.5 mi south of Chickasha, and at mile 8.4.

DRAINAGE AREA.--208 mi^2.

PERIOD OF RECORD.--1948 to 1956, 1968 to 1971.

WATER TYPE.--When the specific conductance was less than 4,000 umho, which accounted for 96 percent of the samples, the water was calcium sulfate type. For specific conductance greater than 4,000 umho the water was sodium chloride type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 982 mg/L and more than 99 percent of the hardness values were equal to or 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 33 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 96 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 49 percent of the samples having a very high 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. The data indicate that even boron tolerant plants could be affected by the high boron concentrations. The recommended maximum boron concentrations for sensitive and for semi-tolerant plants were each exceeded by 5 percent of the boron values and the recommended maximum concentration for boron tolerant plants was exceeded by 3 percent of the boron values.

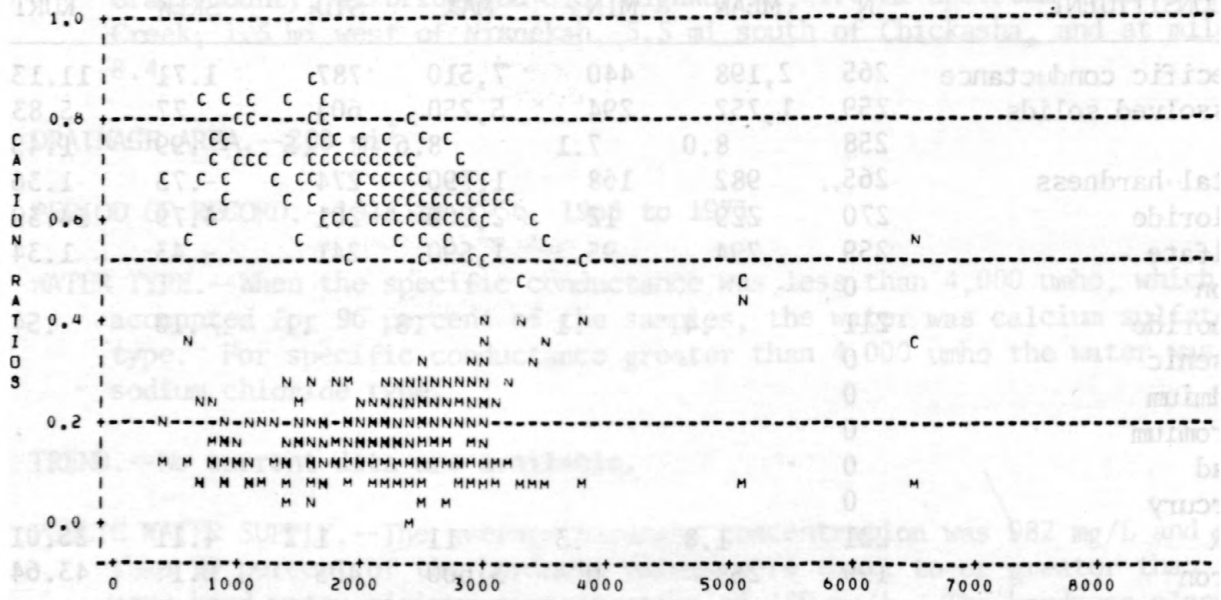
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	265	2,198	440	7,510	787	1.71	11.13
Dissolved solids	259	1,752	294	5,250	604	.77	5.83
pH	258	8.0	7.1	8.6	.5	.99	1.45
Total hardness	265	982	168	1,790	274	-.73	1.36
Chloride	270	229	12	2,000	201	4.79	34.39
Sulfate	259	794	95	1,590	241	-.43	1.34
Iron	0						
Fluoride	211	.4	.1	.8	.1	-.10	.54
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	221	1.8	.3	11	1.2	4.11	25.01
Boron	199	258	0	3,600	405	6.14	43.64

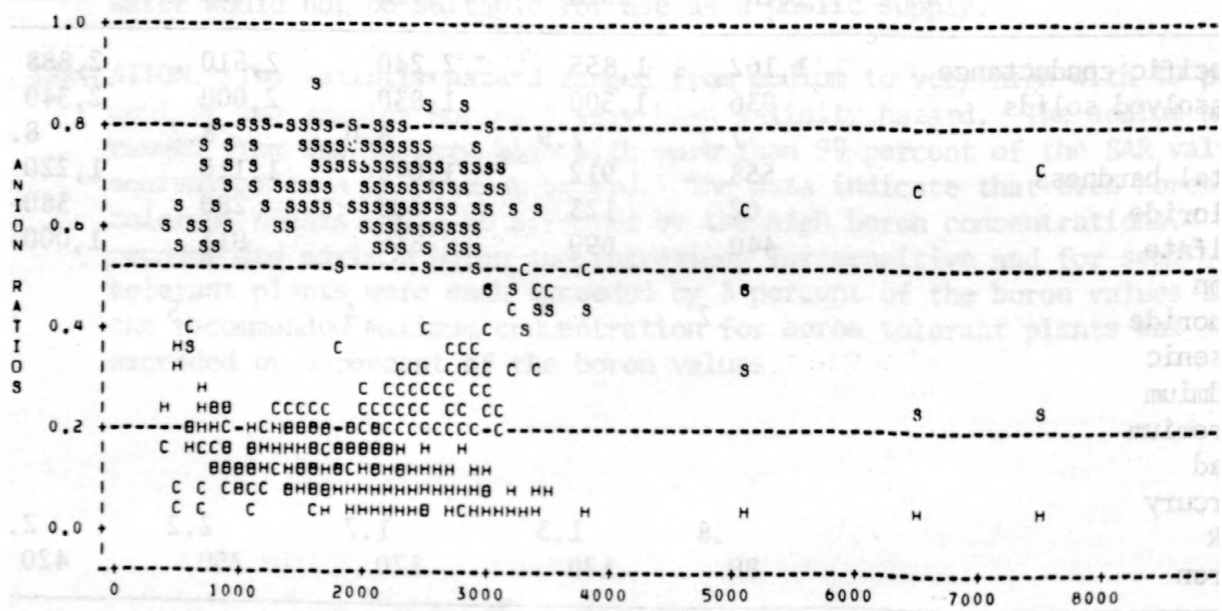
FREQUENCY DISTRIBUTION

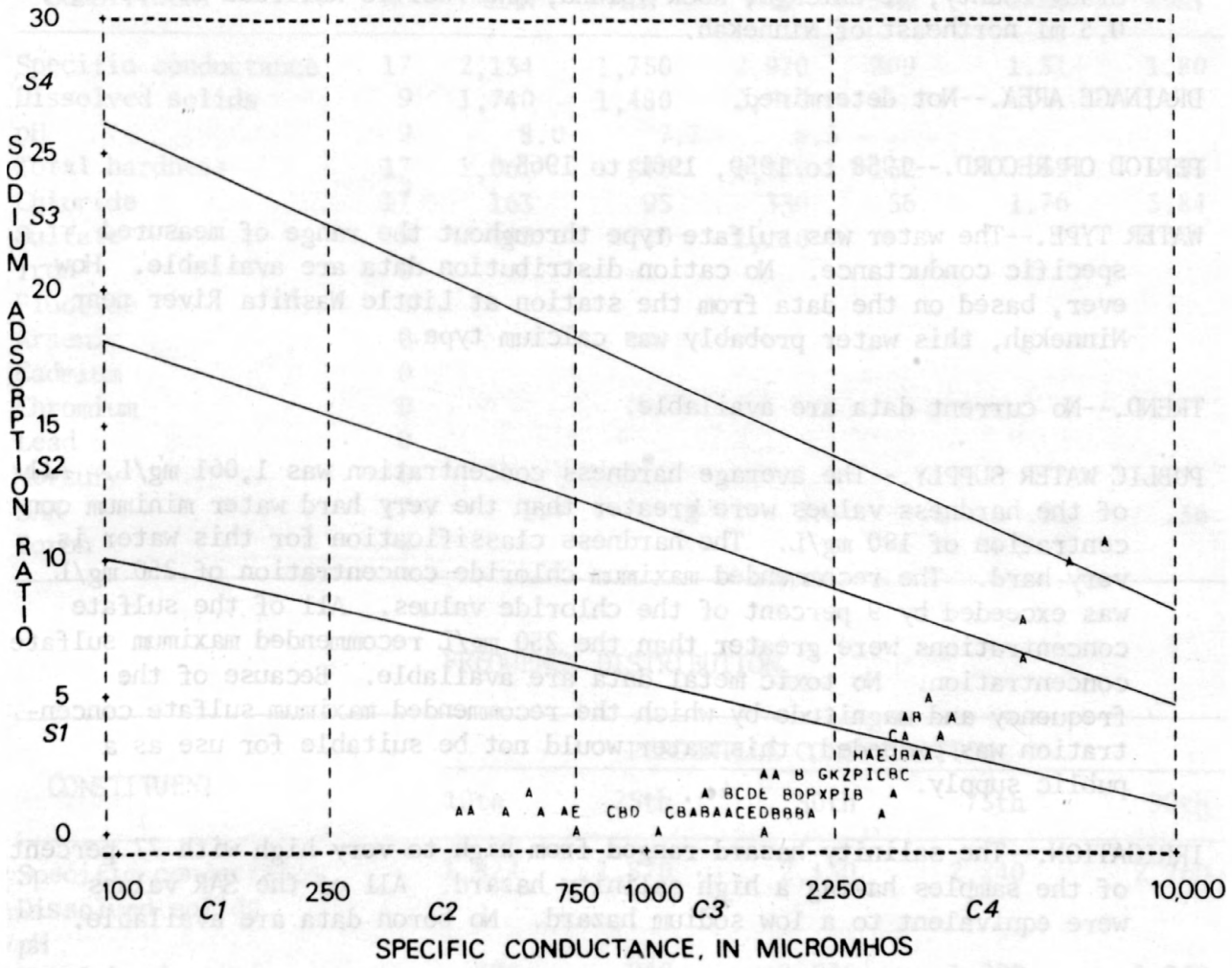
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,162	1,855	2,240	2,510	2,888
Dissolved solids	936	1,500	1,830	2,000	2,340
pH	7.7	7.9	8.0	8.2	8.3
Total hardness	558	912	1,040	1,115	1,220
Chloride	62	123	206	280	380
Sulfate	440	699	835	913	1,000
Iron					
Fluoride	.2	.3	.4	.5	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.8	1.3	1.7	2.2	2.7
Boron	80	120	170	250	420

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=LITTLE WASHITA RIVER NR NINNEKAH, 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 WASHITA RIVER NR NINNEKAH, 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 WASHITA RIVER NR NINNEKAH, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327500 - Little Washita River at Ninnekah, Okla.

LOCATION.--Lat 34°57'24", long 97°55'34", in NW¼NE¼ sec. 34, T.6 N., R.7 W., Grady County, at Chicago, Rock Island, and Pacific Railroad Co. bridge, 0.5 mi northeast of Ninnekah.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1958 to 1959, 1961 to 1963.

WATER TYPE.--The water was sulfate type throughout the range of measured specific conductance. No cation distribution data are available. However, based on the data from the station at Little Washita River near Ninnekah, this water probably was calcium type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,061 mg/L. 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 9 percent of the chloride values. All of the sulfate concentrations were greater than the 250 mg/L recommended maximum sulfate concentration. 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 high to very high with 77 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

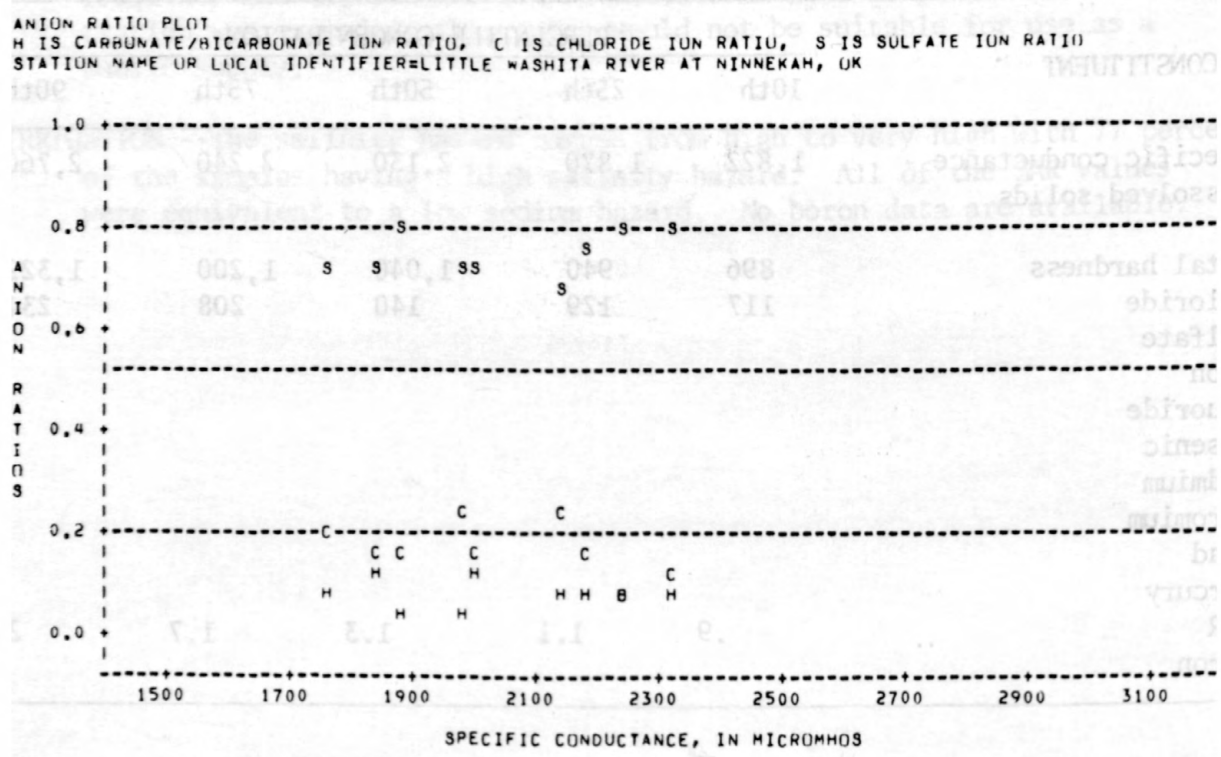
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	17	2,134	1,750	2,920	309	1.31	1.80
Dissolved solids	9	1,740	1,480	2,040			
pH	9	8.0	7.7	8.3			
Total hardness	17	1,061	840	1,330	152	.59	-.83
Chloride	17	163	95	330	56	1.76	3.84
Sulfate	9	889	710	1,110			
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	17	1.4	.8	2.4	.4	.91	.36
Boron	0						

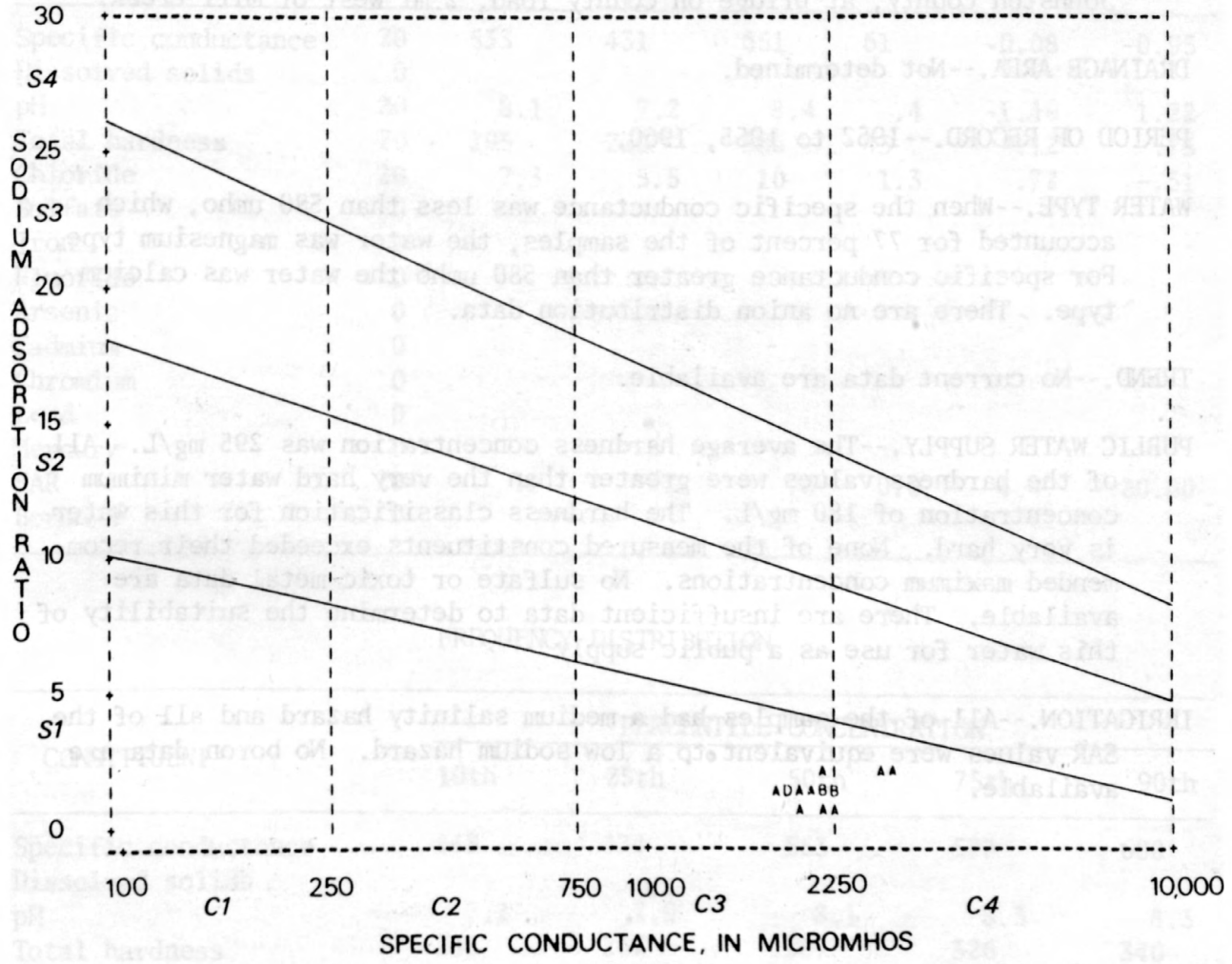
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,822	1,870	2,130	2,240	2,760
Dissolved solids					
pH					
Total hardness	896	940	1,040	1,200	1,322
Chloride	117	129	140	208	234
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.9	1.1	1.3	1.7	2.2
Boron					

No cation 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=LITTLE WASHITA RIVER AT NINNEKAH, OK



07331200 - Mill Creek near Mill Creek, Okla.

LOCATION.--Lat 34°24'18", long 96°51'47", in NW¼ sec. 11, T.2 S., R.4 E., Johnston County, at bridge on county road, 2 mi west of Mill Creek.

DRAINAGE AREA.--Not determined.

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

WATER TYPE.--When the specific conductance was less than 580 umho, which accounted for 77 percent of the samples, the water was magnesium type. For specific conductance greater than 580 umho the water was calcium type. There are no anion distribution data.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 295 mg/L. 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. None of the measured constituents exceeded their recommended maximum concentrations. No sulfate or toxic metal data are available. There are insufficient data to determine the suitability of this water for use as a public supply.

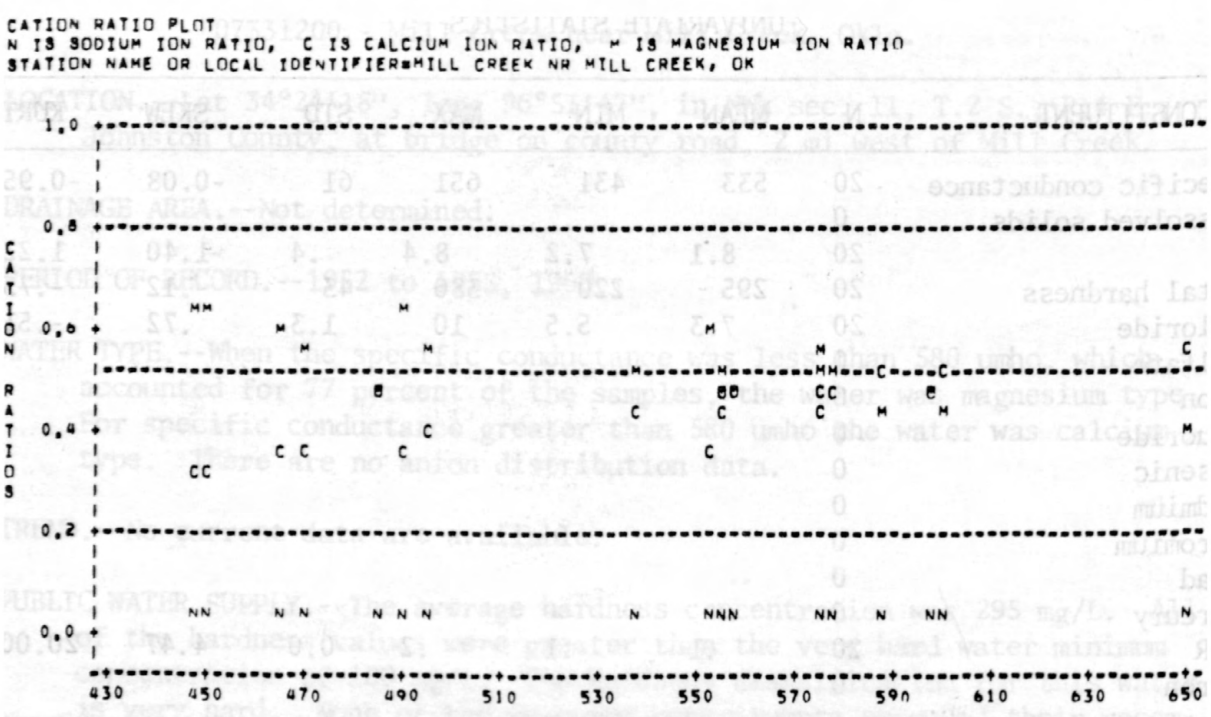
IRRIGATION.--All of the samples had a medium salinity hazard and all of the SAR values were equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

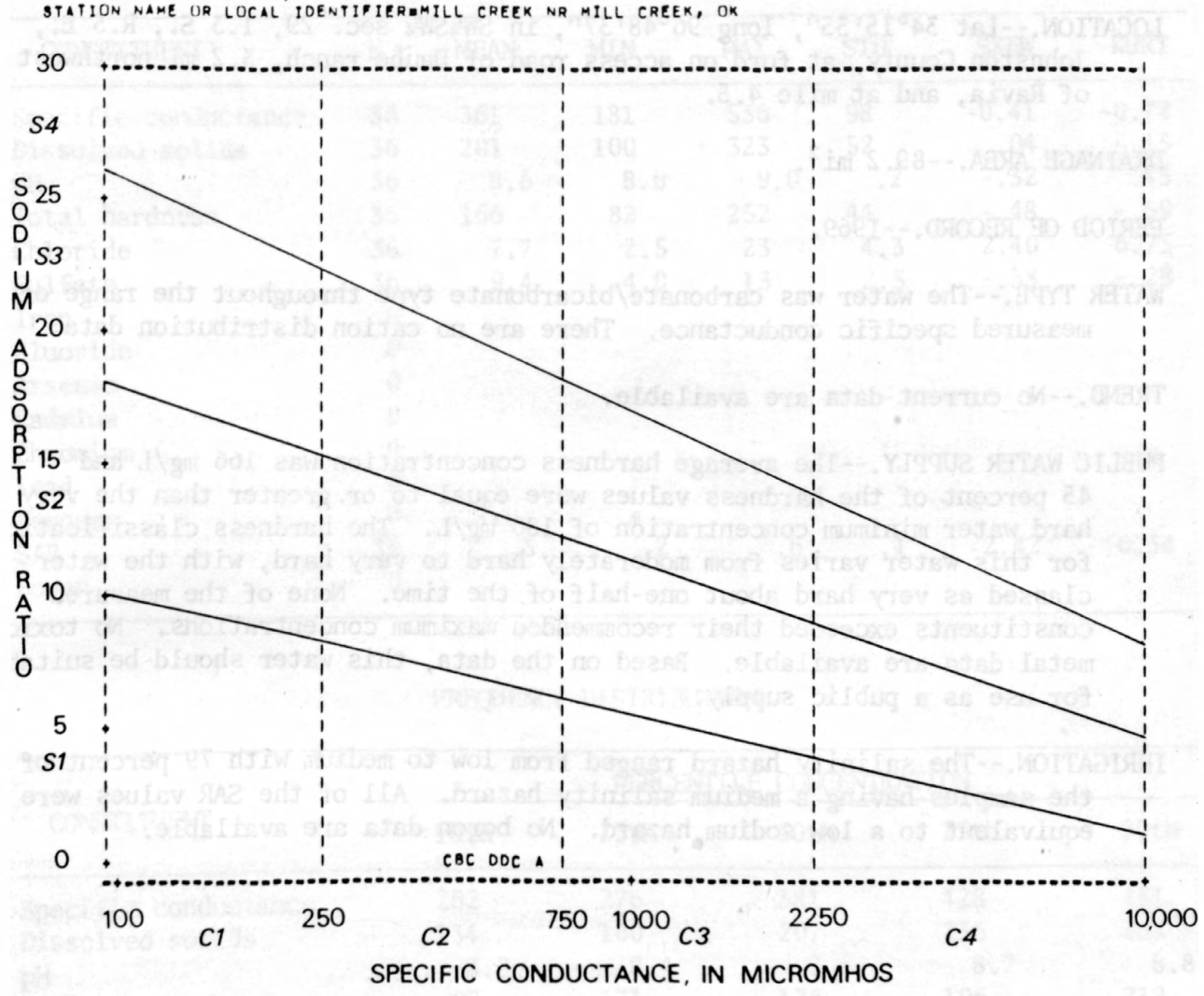
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	20	533	431	651	61	-0.08	-0.95
Dissolved solids	0						
pH	20	8.1	7.2	8.4	.4	-1.40	1.22
Total hardness	20	295	220	380	43	-.12	-.73
Chloride	20	7.3	5.5	10	1.3	.72	-.51
Sulfate	0						
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	20	.1	.1	.2	0.0	4.47	20.00
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	448	474	553	577	600
Dissolved solids					
pH	7.2	7.9	8.1	8.3	8.3
Total hardness	236	257	307	326	340
Chloride	5.8	6.5	7.0	8.6	9.4
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.1	.1	.1	.1	.1
Boron					



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=MILL CREEK NR MILL CREEK, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
CBC DDC A
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07331250 - Mill Creek near Ravia, Okla.

LOCATION.--Lat 34°15'35", long 96°48'37", in SW¼SW¼ sec. 29, T.3 S., R.5 E., Johnston County, at ford on access road of Daube ranch, 3.2 mi northwest of Ravia, and at mile 4.5.

DRAINAGE AREA.--89.2 mi^2.

PERIOD OF RECORD.--1969.

WATER TYPE.--The water was carbonate/bicarbonate type throughout the range of measured specific conductance. There are no cation distribution data.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 166 mg/L and 45 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water varies from moderately hard to very hard, with the water classed as very hard about one-half of the time. None of the measured constituents exceeded their recommended maximum concentrations. 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 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.

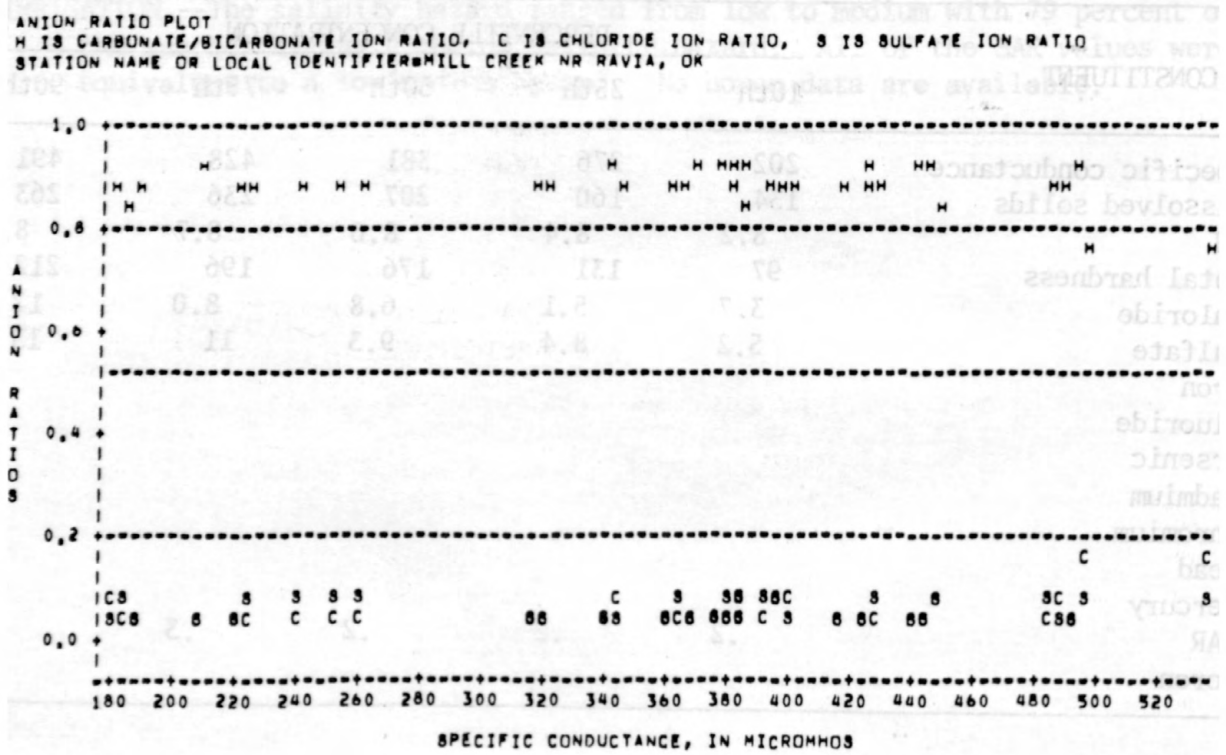
UNIVARIATE STATISTICS

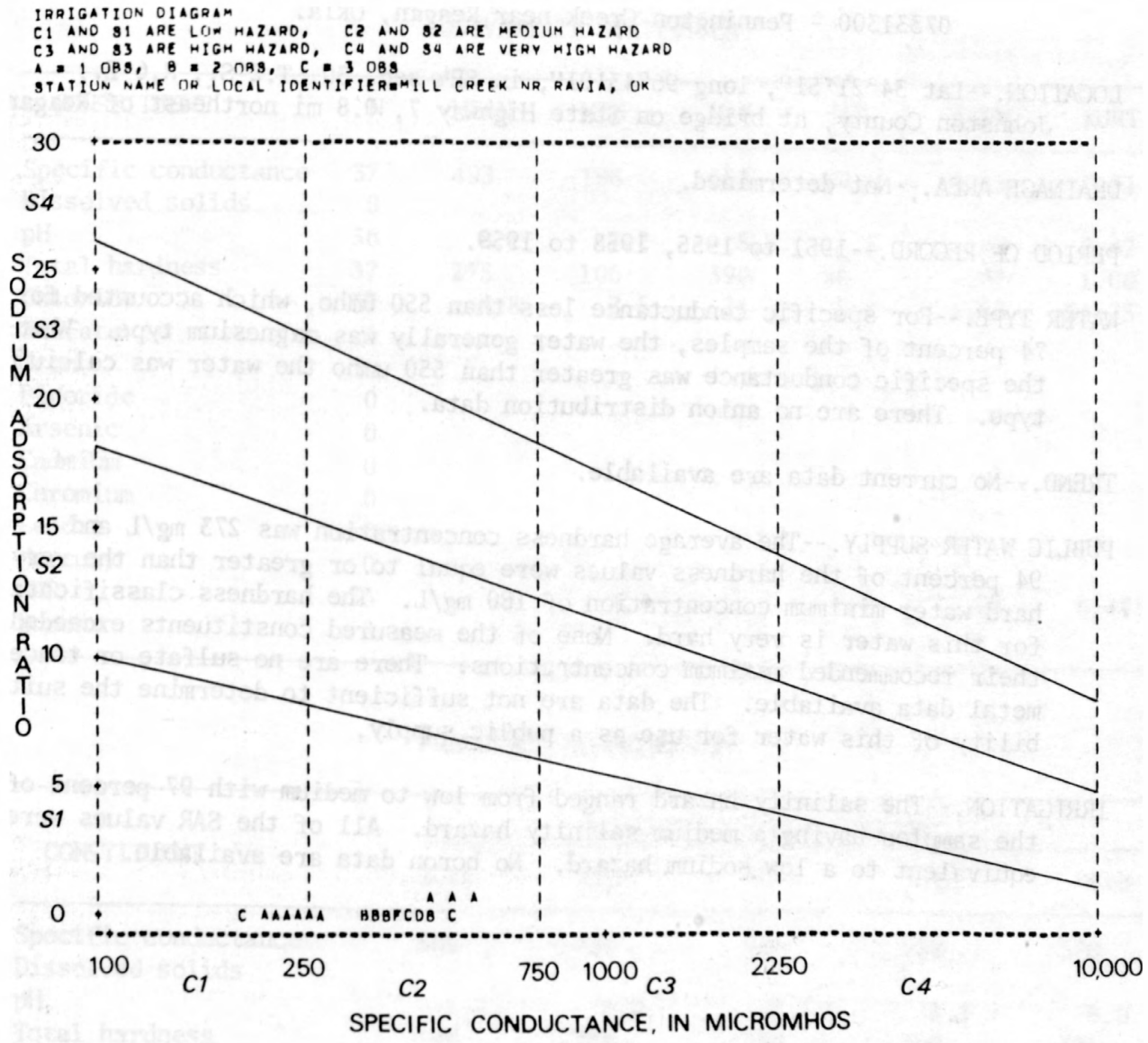
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	36	361	181	536	98	-0.41	-0.72
Dissolved solids	36	201	100	323	52	.04	-.15
pH	36	8.6	8.0	9.0	.2	-.32	.43
Total hardness	36	166	82	252	44	-.48	-.59
Chloride	36	7.7	2.5	23	4.3	2.40	6.75
Sulfate	36	9.4	4.0	13	2.5	-.38	-.28
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	36	.3	.2	.6	.1	2.42	6.34
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	202	276	381	428	491
Dissolved solids	134	160	207	236	263
pH	8.2	8.4	8.6	8.7	8.8
Total hardness	97	131	176	196	212
Chloride	3.7	5.1	6.8	8.0	12
Sulfate	5.2	8.4	9.3	11	13
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.2	.2	.3	.3
Boron					

No cation 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=MILL CREEK NR RAVIA, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
C1
C2
C3
C4
100
250
750
1000
2250
10,000
SPECIFIC CONDUCTANCE, IN MICROMHOS

07331300 - Pennington Creek near Reagan, Okla.

LOCATION.--Lat 34°21'51", long 96°43'01", in SE¼ sec. 30, T.2 S., R.6 E., Johnston County, at bridge on State Highway 7, 0.8 mi northeast of Reagan.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1951 to 1955, 1958 to 1959.

WATER TYPE.--For specific conductance less than 550 umho, which accounted for 74 percent of the samples, the water generally was magnesium type. When the specific conductance was greater than 550 umho the water was calcium type. There are no anion distribution data.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 273 mg/L and 94 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. None of the measured constituents exceeded their recommended maximum concentrations. There are no sulfate or trace metal data available. The data are not sufficient to determine the suitability of this water for use as a public supply.

IRRIGATION.--The salinity hazard ranged from low to medium with 97 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.

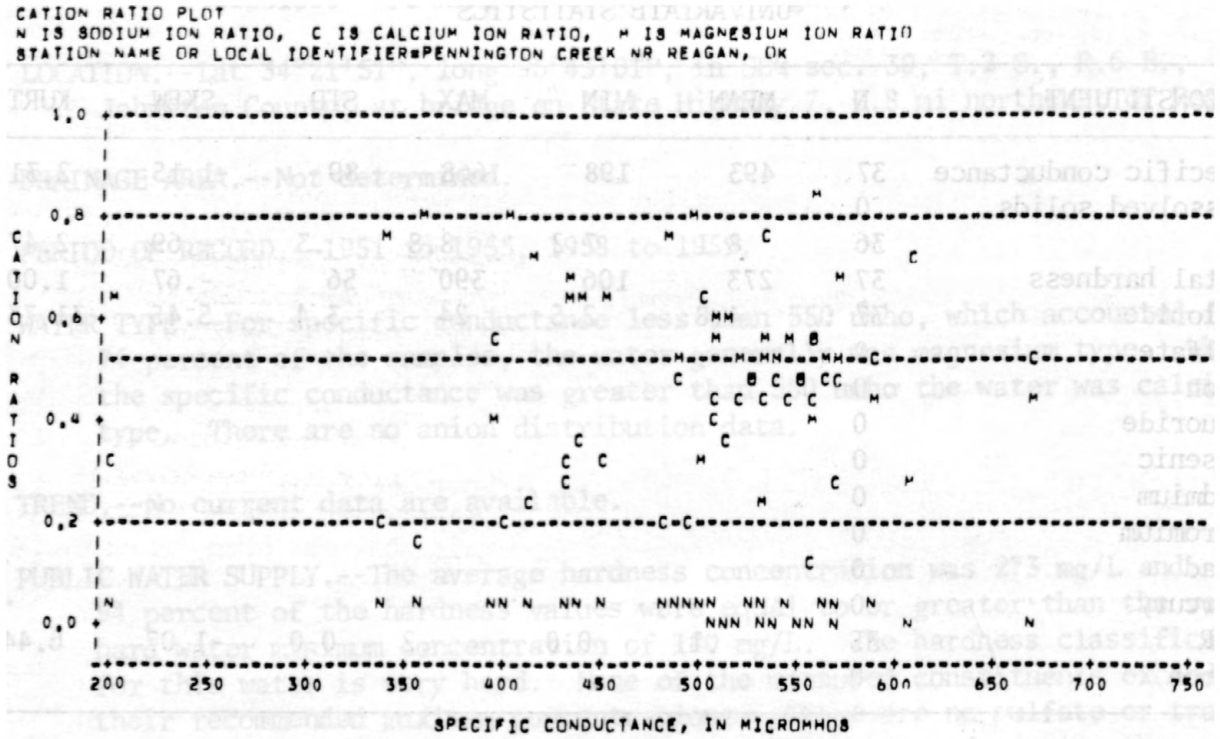
07331300 - Pennington Creek near Reagan, Okla.

UNIVARIATE STATISTICS

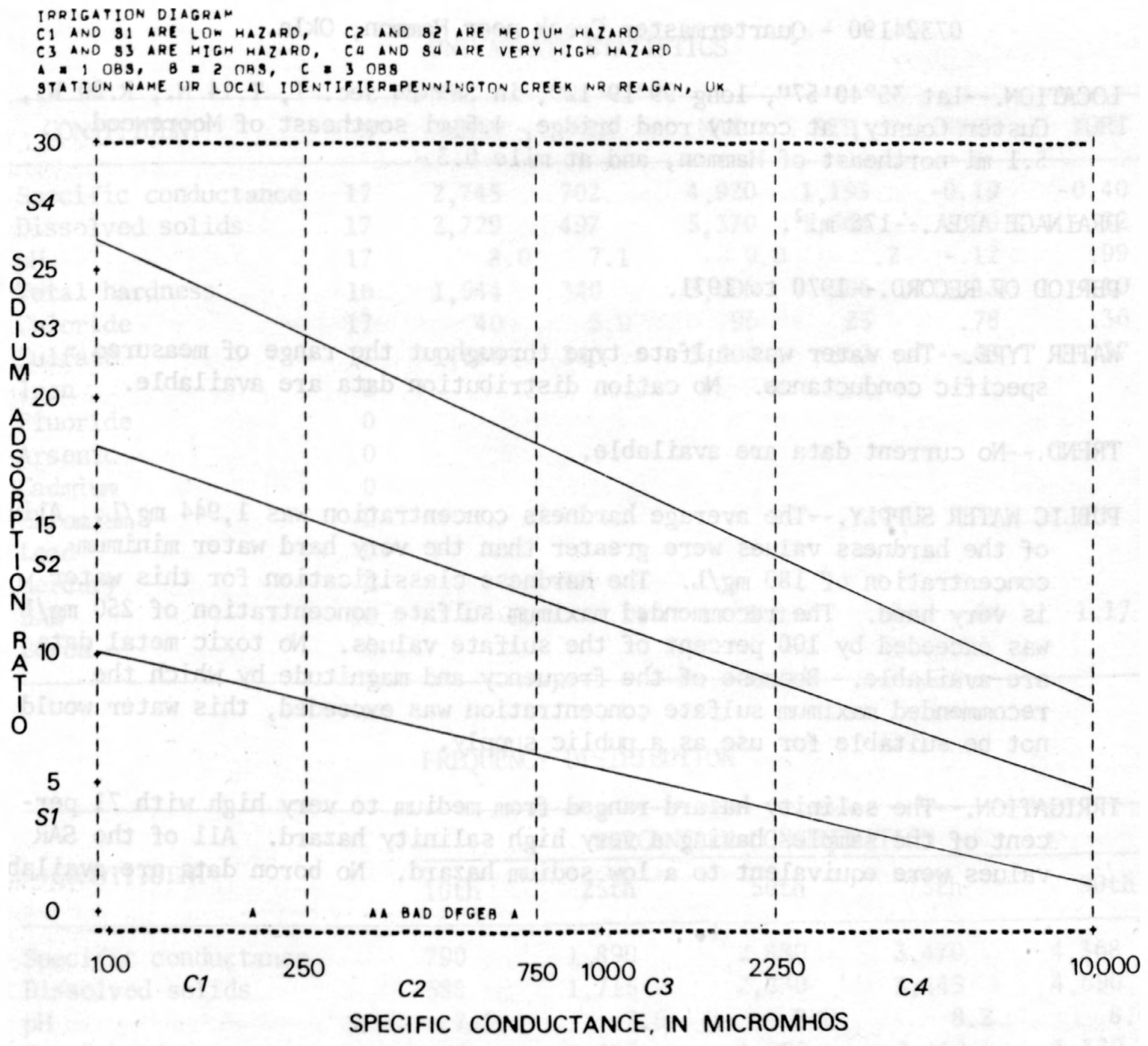
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	37	493	198	668	89	-1.15	2.31
Dissolved solids	0						
pH	36	8.1	7.2	8.8	.3	-.69	2.47
Total hardness	37	273	106	390	56	-.67	1.00
Chloride	37	4.8	2.5	24	3.4	5.45	31.73
Sulfate	0						
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	35	.1	0.0	.2	0.0	-1.07	6.44
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	360	434	516	552	570
Dissolved solids					
pH	7.9	8.0	8.1	8.3	8.6
Total hardness	198	233	290	309	331
Chloride	3.0	3.8	4.2	4.8	6.0
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.1	.1	.1	.1	.1
Boron					



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=PENNINGTON CREEK NR REAGAN, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
A
AA BAD DFGEB A
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07324190 - Quartermaster Creek near Hammon, Okla.

LOCATION.--Lat 35°40'57", long 99°19'12", in SW¼NE¼ sec. 7, T.14 N., R.20 W., Custer County, at county road bridge, 4.5 mi southeast of Moorewood, 5.1 mi northeast of Hammon, and at mile 0.3.

DRAINAGE AREA.--175 mi^2.

PERIOD OF RECORD.--1970 to 1971.

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

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 1,944 mg/L. 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 sulfate concentration of 250 mg/L was exceeded by 100 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 71 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

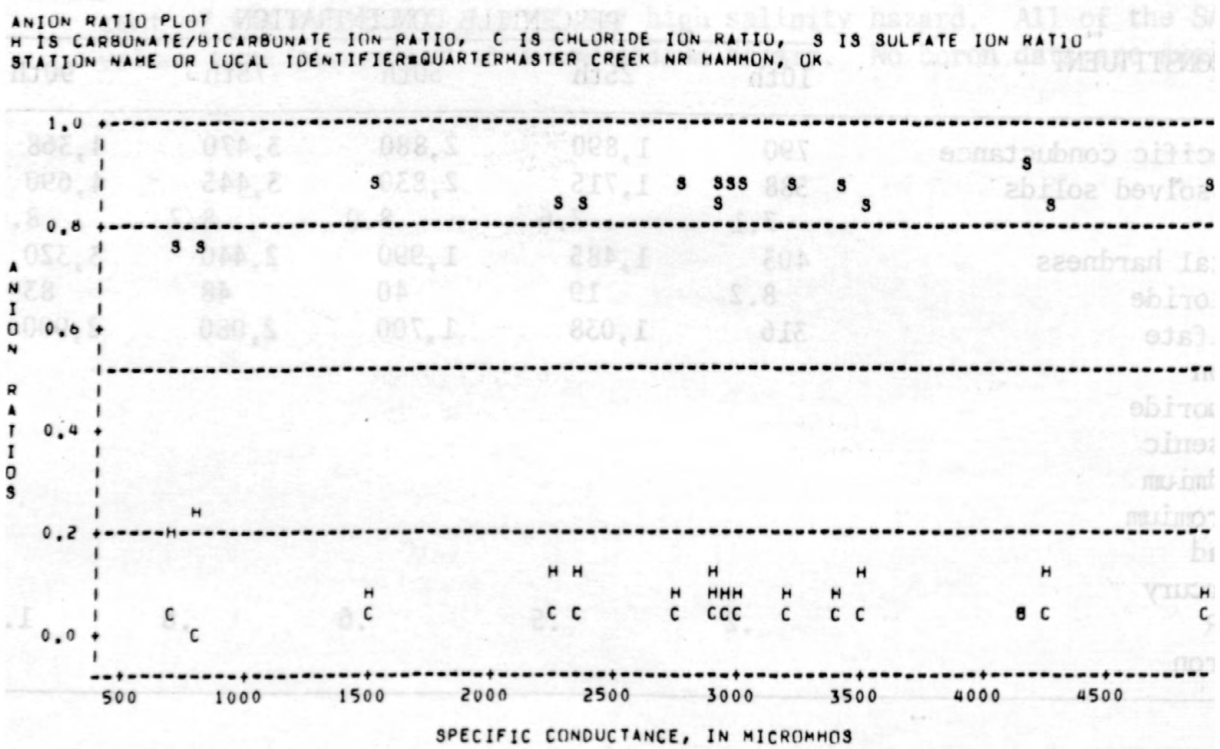
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	17	2,745	702	4,920	1,193	-0.19	-0.40
Dissolved solids	17	2,729	497	5,370	1,364	.00	-.32
pH	17	8.0	7.1	9.0	.2	-.12	.99
Total hardness	16	1,944	340	3,600	906	-.13	-.10
Chloride	17	40	5.0	96	25	.78	.36
Sulfate	17	1,660	260	3,300	862	.03	-.37
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	16	.6	.1	1.1	.2	.04	1.17
Boron	0						

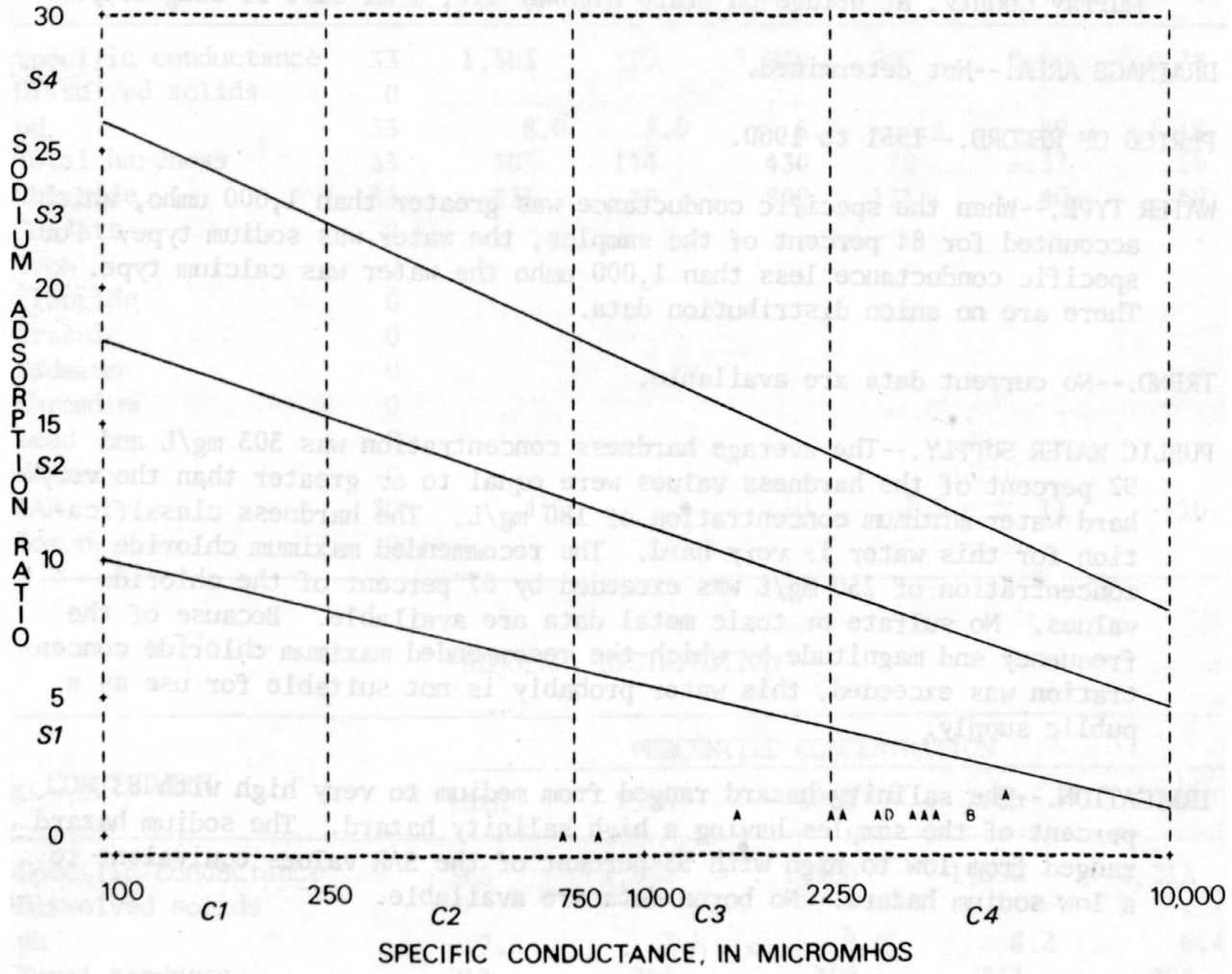
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	790	1,890	2,880	3,470	4,368
Dissolved solids	588	1,715	2,830	3,445	4,690
pH	7.1	7.6	8.0	8.2	8.6
Total hardness	403	1,485	1,990	2,440	3,320
Chloride	8.2	19	40	48	83
Sulfate	316	1,038	1,700	2,080	2,900
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.2	.5	.6	.8	1.0
Boron					

No cation 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=QUARTERMASTER CREEK NR HAMMON, OK



07329900 - Rock Creek at Dougherty, Okla.

LOCATION.--Lat 34°23'50", long 97°02'10", in NW¼SW¼ sec. 7, T.2 S., R.3 E., Murray County, at bridge on State Highway 110, 1 mi east of Dougherty.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--1951 to 1960.

WATER TYPE.--When the specific conductance was greater than 1,000 umho, which accounted for 84 percent of the samples, the water was sodium type. For specific conductance less than 1,000 umho the water was calcium type. There are no anion distribution data.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 303 mg/L and 92 percent of the hardness values were equal to or 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 67 percent of the chloride values. No sulfate or 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.

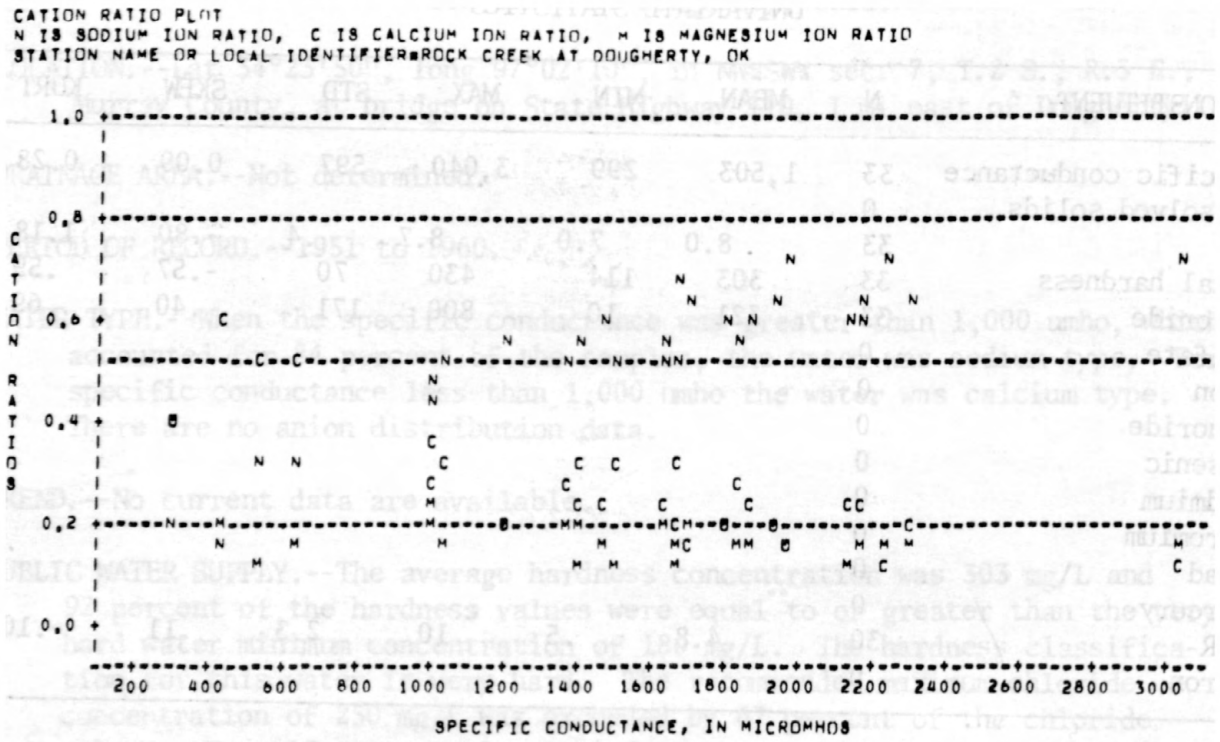
IRRIGATION.--The salinity hazard ranged from medium to very high with 83 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to high with 53 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

UNIVARIATE STATISTICS

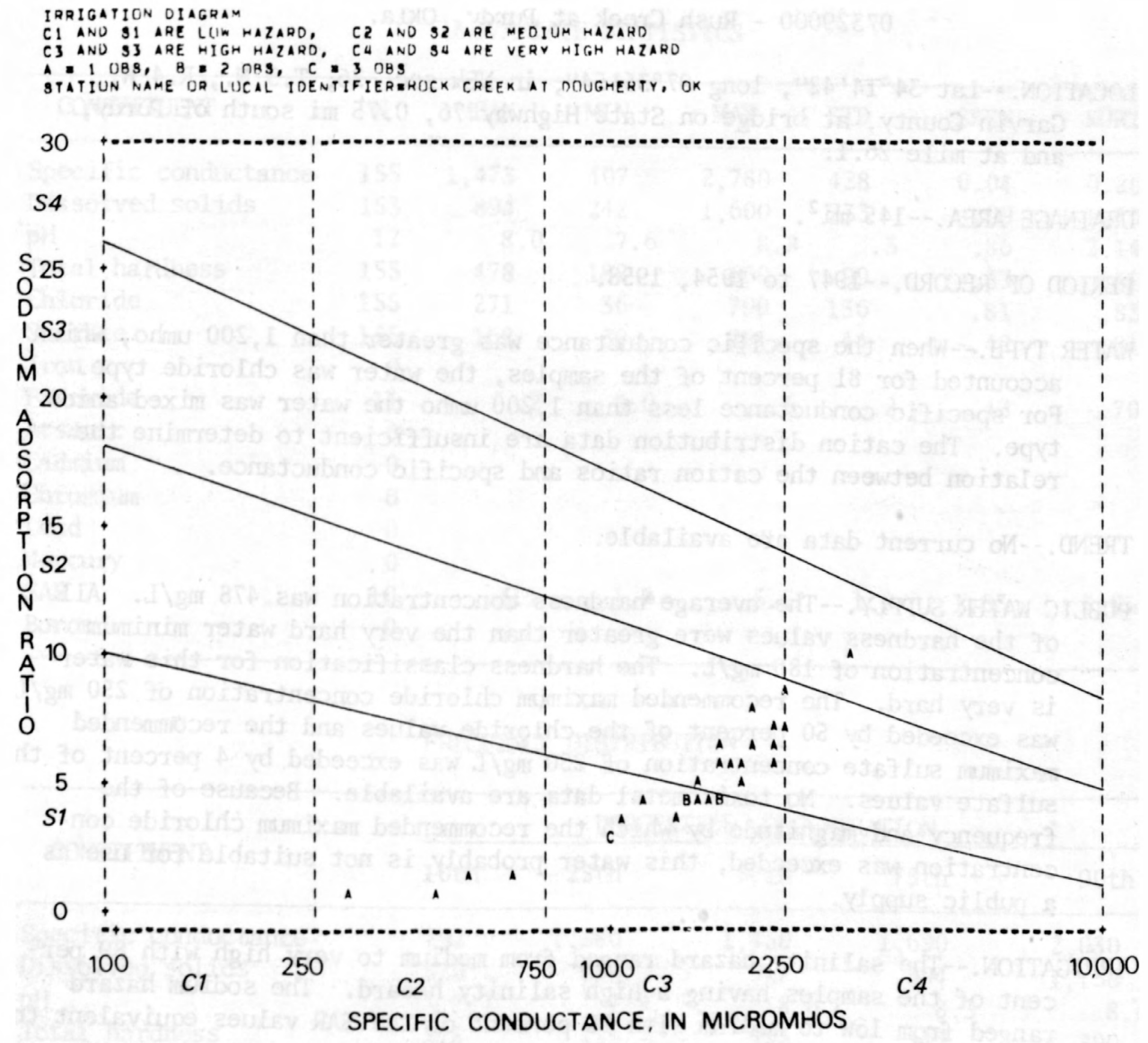
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	33	1,503	299	3,040	597	0.09	0.28
Dissolved solids	0						
pH	33	8.0	7.0	8.7	.4	-.80	1.18
Total hardness	33	303	114	430	70	-.57	.59
Chloride	33	321	10	800	171	.40	.69
Sulfate	0						
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	30	4.8	.5	10	2.3	.11	-.10
Boron	0						

FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	568	1,065	1,500	1,890	2,212
Dissolved solids					
pH	7.5	7.8	8.0	8.2	8.4
Total hardness	213	264	302	351	396
Chloride	70	205	310	435	535
Sulfate					
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.2	3.2	4.5	6.2	8.1
Boron					



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=ROCK CREEK AT DOUGHERTY, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07329000 - Rush Creek at Purdy, Okla.

LOCATION.--Lat 34°14'42", long 97°35'54", in NE¼ sec. 26, T.3 N., R.4 W., Garvin County, at bridge on State Highway 76, 0.75 mi south of Purdy, and at mile 26.1.

DRAINAGE AREA.--145 mi^2.

PERIOD OF RECORD.--1947 to 1954, 1958.

WATER TYPE.--When the specific conductance was greater than 1,200 umho, which accounted for 81 percent of the samples, the water was chloride type. For specific conductance less than 1,200 umho the water was mixed anion type. The cation distribution data are insufficient to determine the relation between the cation ratios and specific conductance.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 478 mg/L. 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 50 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 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 89 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. No boron data are available.

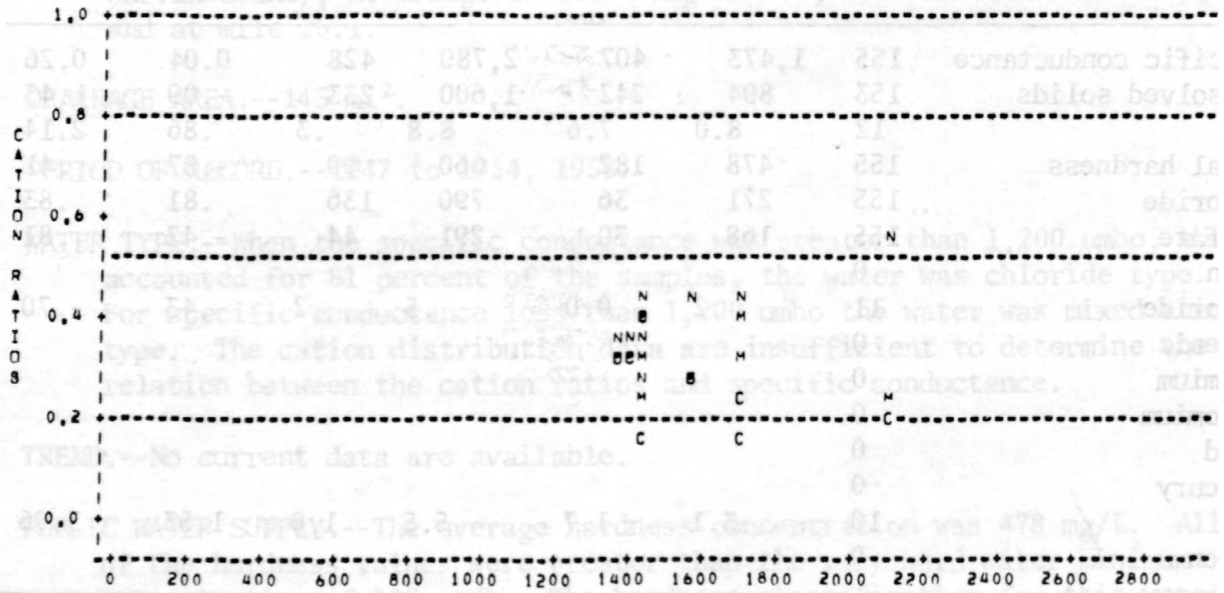
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	155	1,473	407	2,780	428	0.04	0.26
Dissolved solids	153	894	242	1,600	233	-.09	1.43
pH	12	8.0	7.6	8.8	.3	.86	2.14
Total hardness	155	478	182	660	99	-.87	.41
Chloride	155	271	36	790	136	.81	.83
Sulfate	155	168	30	291	44	-.42	.81
Iron	0						
Fluoride	11	.2	0.0	.5	.2	-.43	-.70
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	10	3.1	1.7	5.5	1.0	1.53	3.96
Boron	0						

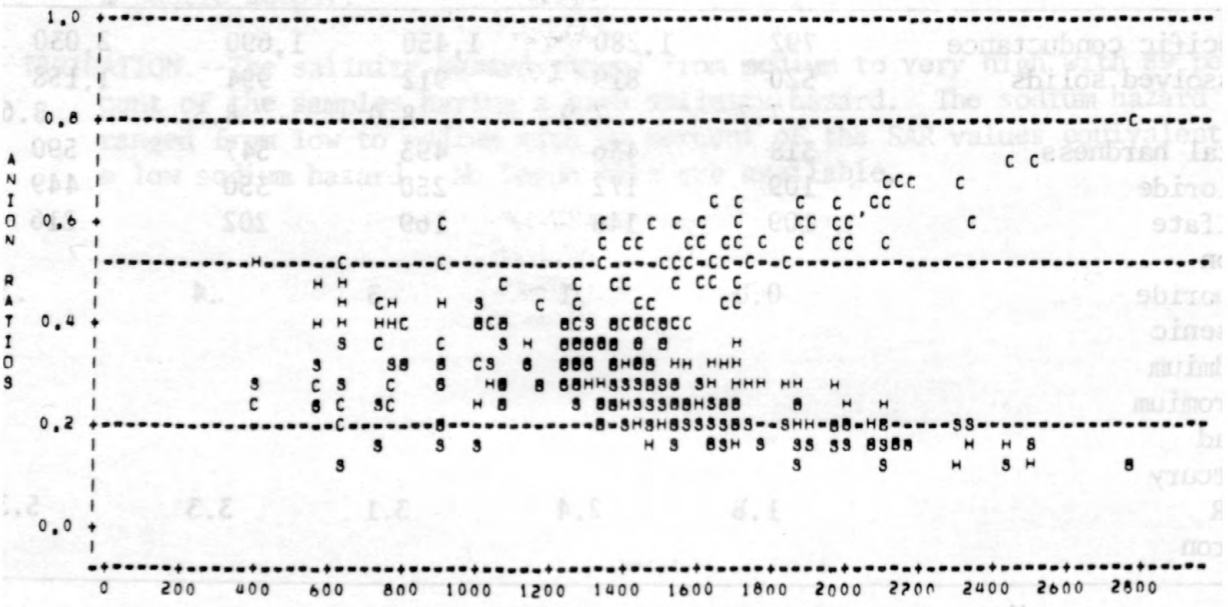
FREQUENCY DISTRIBUTION

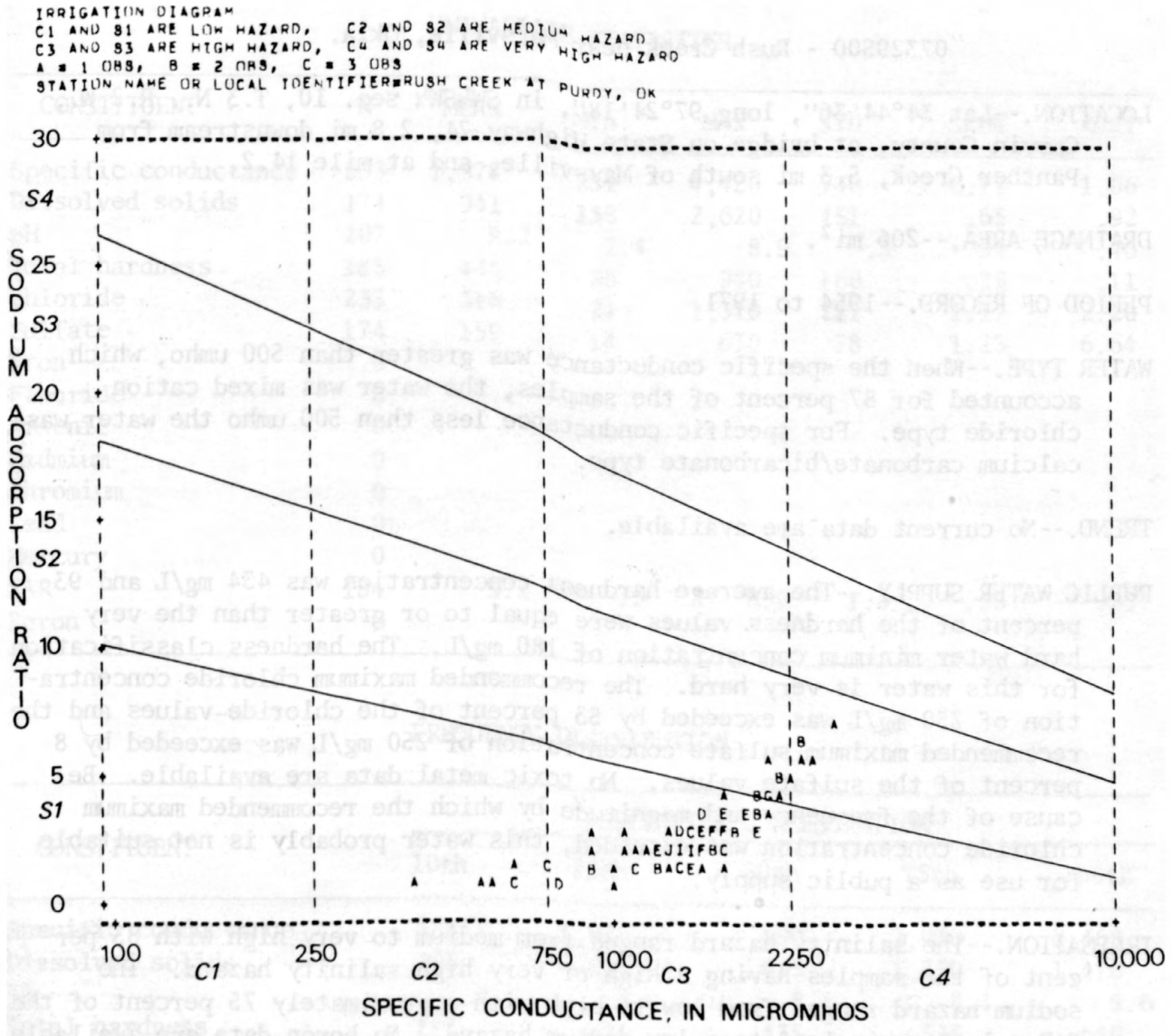
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	792	1,280	1,450	1,690	2,030
Dissolved solids	520	819	912	994	1,158
pH	7.7	7.9	8.0	8.3	8.6
Total hardness	318	436	493	547	590
Chloride	109	172	250	350	449
Sulfate	109	148	169	202	216
Iron					
Fluoride	0.0	.1	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.8	2.4	3.1	3.3	5.3
Boron					

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



ANION RATIO PLOT
M IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RUSH CREEK AT PURDY, 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=RUSH CREEK AT PURDY, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07329500 - Rush Creek near Maysville, Okla.

LOCATION.--Lat 34°44'36", long 97°24'18", in SW¼SW¼ sec. 10, T.3 N., R.2 W., Garvin County, at bridge on State Highway 74, 2.8 mi downstream from Panther Creek, 5.3 mi south of Maysville, and at mile 14.2.

DRAINAGE AREA.--206 mi^2.

PERIOD OF RECORD.--1954 to 1971.

WATER TYPE.--When the specific conductance was greater than 500 umho, which accounted for 87 percent of the samples, the water was mixed cation chloride type. For specific conductance less than 500 umho the water was calcium carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 434 mg/L and 93 percent of the hardness values were equal to or 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 53 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 8 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 83 percent of the samples having a high or very high salinity hazard. The sodium hazard ranged from low to high with approximately 75 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

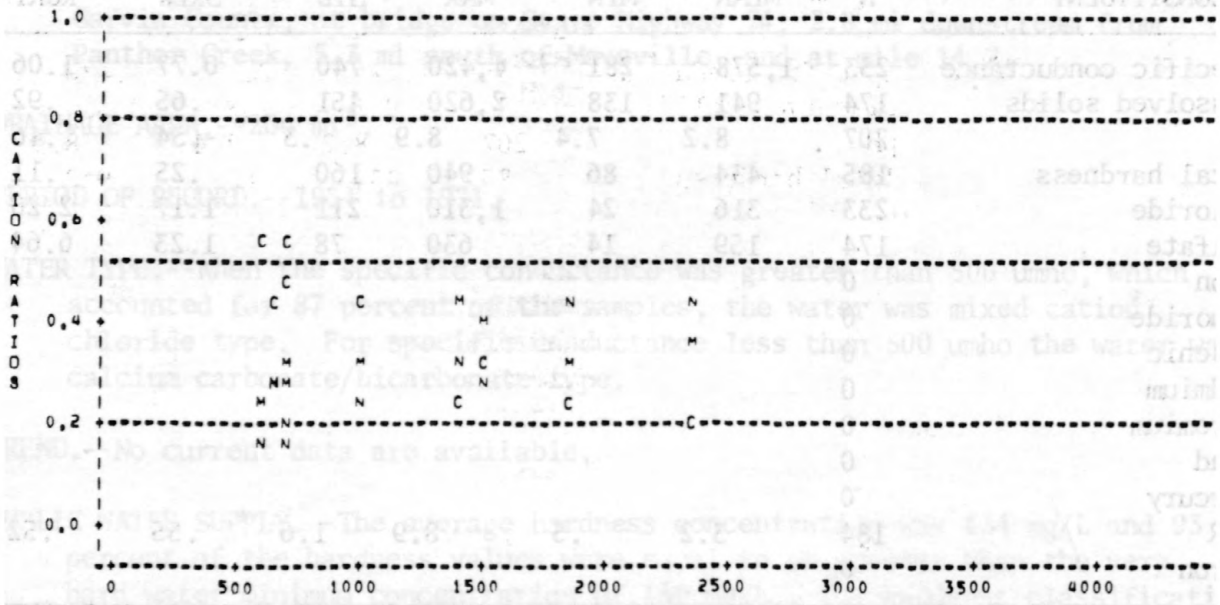
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	233	1,578	281	4,420	740	0.77	1.06
Dissolved solids	174	941	138	2,620	451	.65	.92
pH	207	8.2	7.4	8.9	.3	-.34	.46
Total hardness	185	434	86	940	160	.25	.11
Chloride	233	316	24	1,310	211	1.17	2.20
Sulfate	174	159	14	630	78	1.23	6.64
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	184	3.2	.5	8.9	1.6	.55	.52
Boron	0						

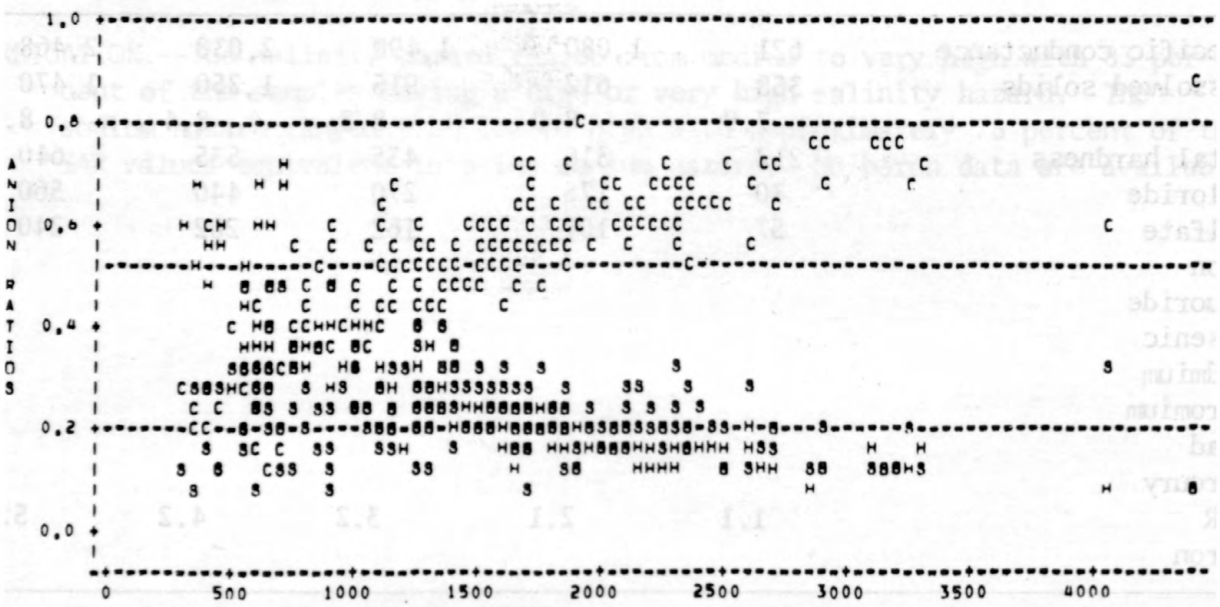
FREQUENCY DISTRIBUTION

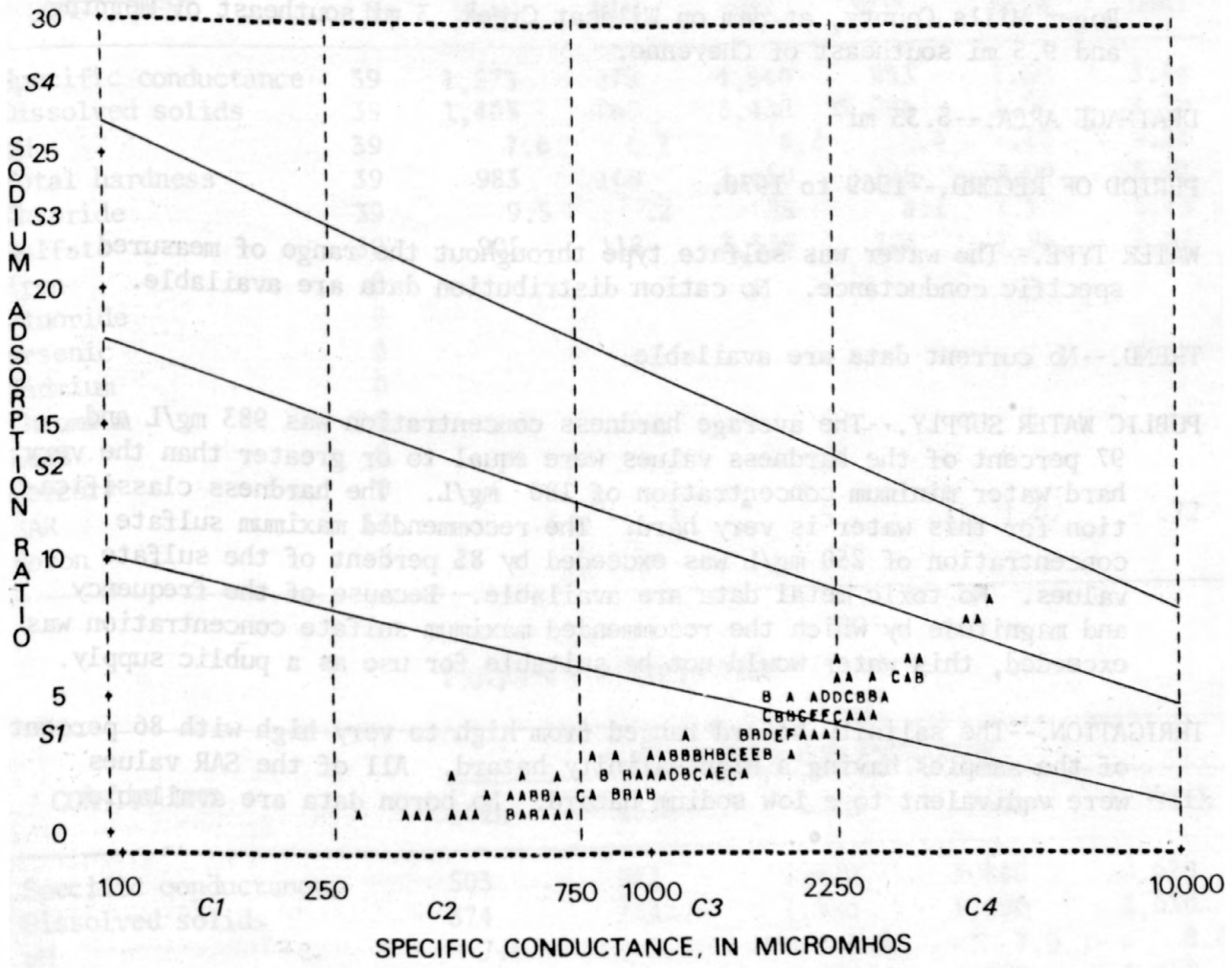
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	621	1,080	1,490	2,030	2,468
Dissolved solids	358	612	915	1,250	1,470
pH	7.9	8.0	8.2	8.4	8.6
Total hardness	212	316	435	535	640
Chloride	70	175	270	440	560
Sulfate	57	107	162	202	240
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.1	2.1	3.2	4.2	5.2
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=RUSH CREEK NR MAYSVILLE, 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=RUSH CREEK NR MAYSVILLE, 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=RUSH CREEK NR MAYSVILLE, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07324000 - Sandstone Creek Subwatershed 1 near Cheyenne, Okla.

LOCATION.--Lat 35°34'00", long 99°30'10", in NE¼NE¼ sec. 35, T.13 N., R.22 W., Roger Mills County, at dam on Wildcat Creek, 3 mi southeast of Herring, and 9.5 mi southeast of Cheyenne.

DRAINAGE AREA.--5.33 mi^2

PERIOD OF RECORD.--1969 to 1970.

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

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 983 mg/L and 97 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum sulfate concentration of 250 mg/L was exceeded by 85 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 high to very high with 86 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

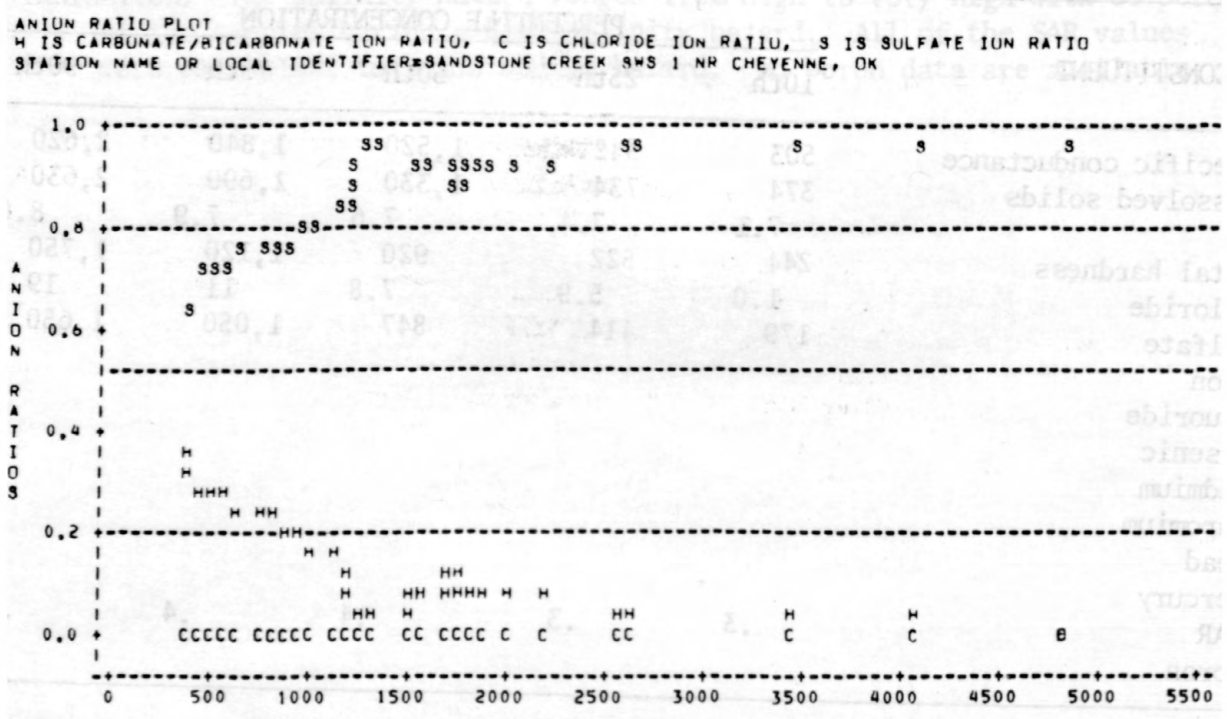
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	39	1,573	378	4,840	953	1.59	3.44
Dissolved solids	39	1,465	269	5,430	1,096	1.97	4.76
pH	39	7.6	6.7	8.2	.4	-.40	-.21
Total hardness	39	983	168	3,650	725	2.00	5.01
Chloride	39	9.5	.2	38	8.1	2.13	5.23
Sulfate	39	905	118	3,550	724	1.98	4.87
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	17	.4	.3	.6	.1	1.07	.72
Boron	0						

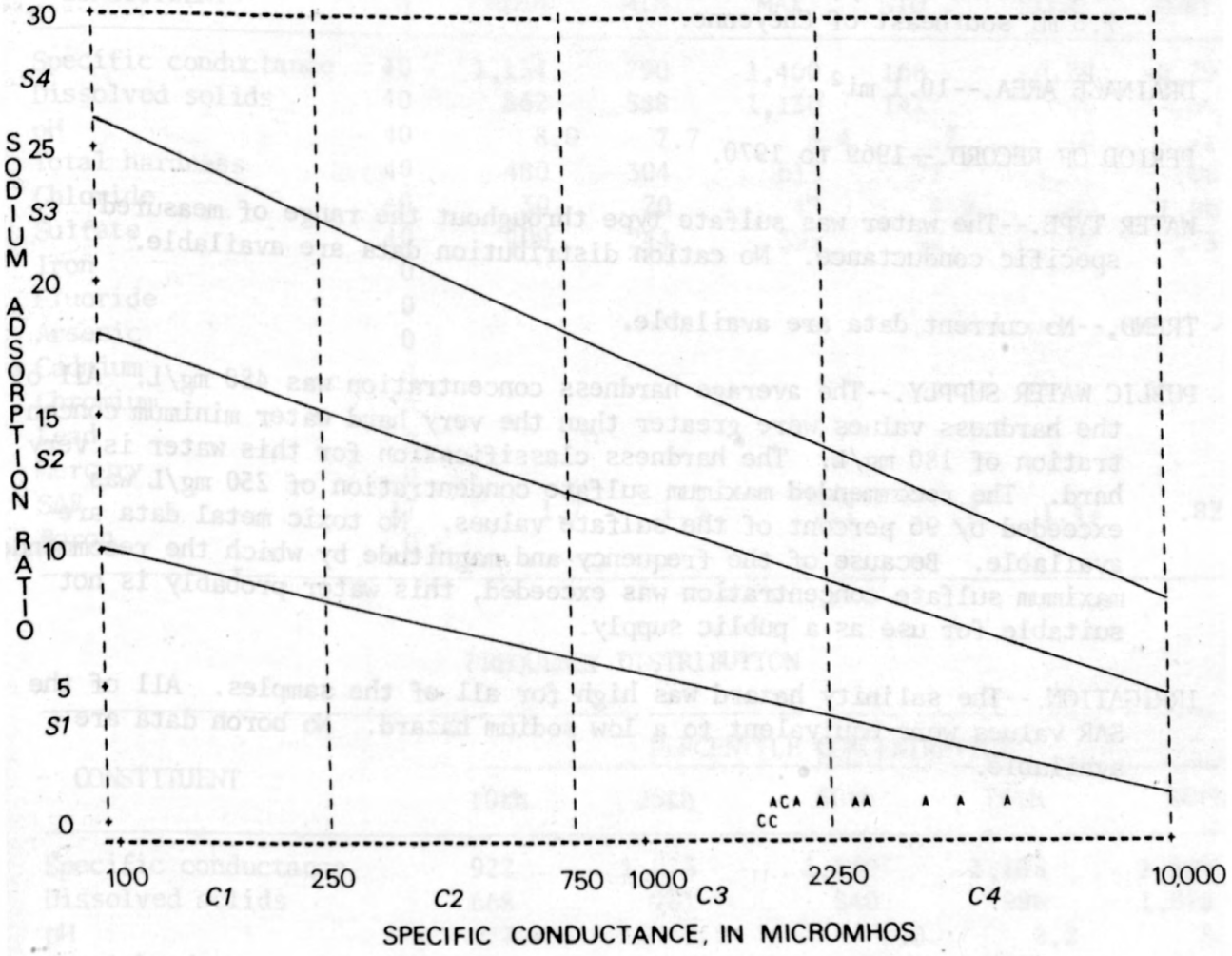
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	503	942	1,520	1,840	2,620
Dissolved solids	374	734	1,330	1,690	2,630
pH	7.1	7.4	7.6	7.9	8.0
Total hardness	244	522	920	1,120	1,750
Chloride	1.0	5.9	7.8	11	19
Sulfate	179	414	847	1,050	1,650
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.3	.4	.4	.6
Boron					

No cation 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=SANDSTONE CREEK SWS 1 NR CHEYENNE, OK



07319000 - Sandstone Creek Subwatershed 17 near Cheyenne, Okla.

LOCATION.--Lat 35°30'40", long 99°36'40", in NE¼NE¼ sec. 22, T.12 N., R.23 W., Roger Mills County, at dam on Currant Creek, 4 mi northeast of Berlin, and 7.5 mi southeast of Cheyenne.

DRAINAGE AREA.--10.1 mi^2.

PERIOD OF RECORD.--1969 to 1970.

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

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 480 mg/L. 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 sulfate concentration of 250 mg/L was exceeded by 96 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 probably is not suitable for use as a public supply.

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

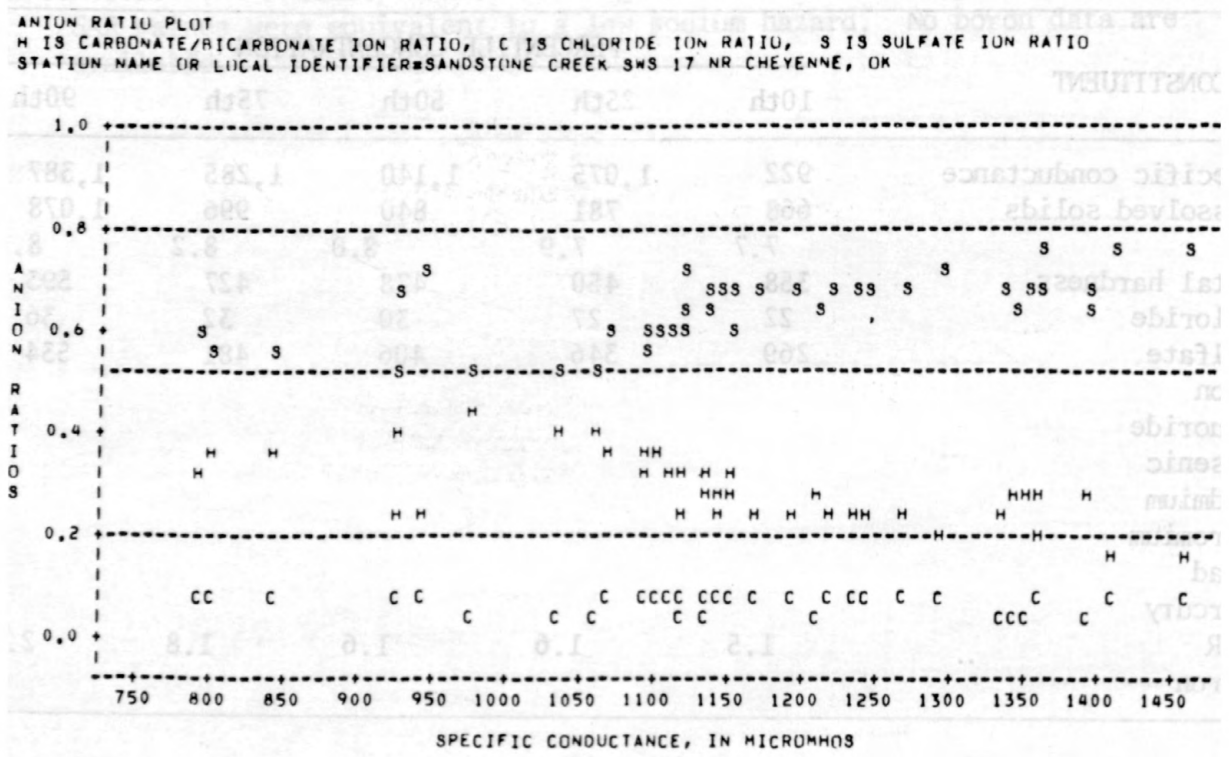
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	40	1,154	790	1,460	168	-0.29	-0.29
Dissolved solids	40	862	588	1,130	141	.06	-.60
pH	40	8.0	7.7	8.4	.2	.10	-.71
Total hardness	40	480	304	615	77	-.31	-.08
Chloride	40	30	20	43	4.9	.40	1.06
Sulfate	40	409	244	595	92	.02	-.73
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	17	1.7	1.5	2.1	.2	1.42	.82
Boron	0						

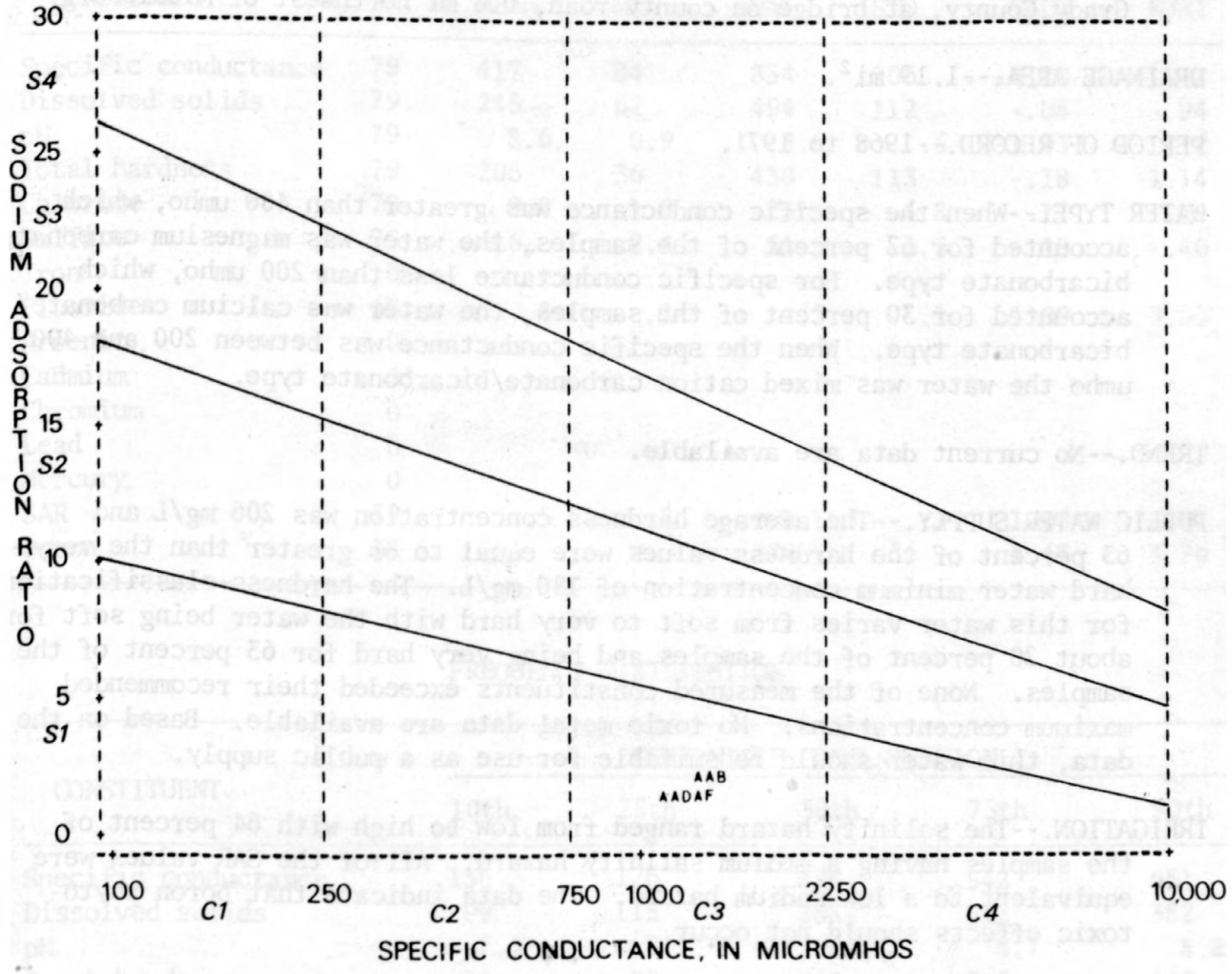
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	922	1,075	1,140	1,285	1,387
Dissolved solids	668	781	840	996	1,078
pH	7.7	7.9	8.0	8.2	8.2
Total hardness	358	450	478	427	593
Chloride	22	27	30	32	36
Sulfate	269	346	406	481	534
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.5	1.6	1.6	1.8	2.1
Boron					

No cation 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=SANDSTONE CREEK SWS 17 NR CHEYENNE, OK



07327432 - Spring Creek near Blanchard, Okla.

LOCATION.--Lat 35°06'50", long 97°44'34", in NE¼ sec. 5, T.7 N., R.5 W., Grady County, at bridge on county road, 0.8 mi northwest of Middleberg.

DRAINAGE AREA.--1.19 mi^2.

PERIOD OF RECORD.--1968 to 1971.

WATER TYPE.--When the specific conductance was greater than 400 umho, which accounted for 62 percent of the samples, the water was magnesium carbonate/bicarbonate type. For specific conductance less than 200 umho, which accounted for 30 percent of the samples, the water was calcium carbonate/bicarbonate type. When the specific conductance was between 200 and 400 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 206 mg/L and 63 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water varies from soft to very hard with the water being soft for about 20 percent of the samples and being very hard for 63 percent of the samples. None of the measured constituents exceeded their recommended maximum concentrations. 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 64 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 boron phytotoxic effects should not occur.

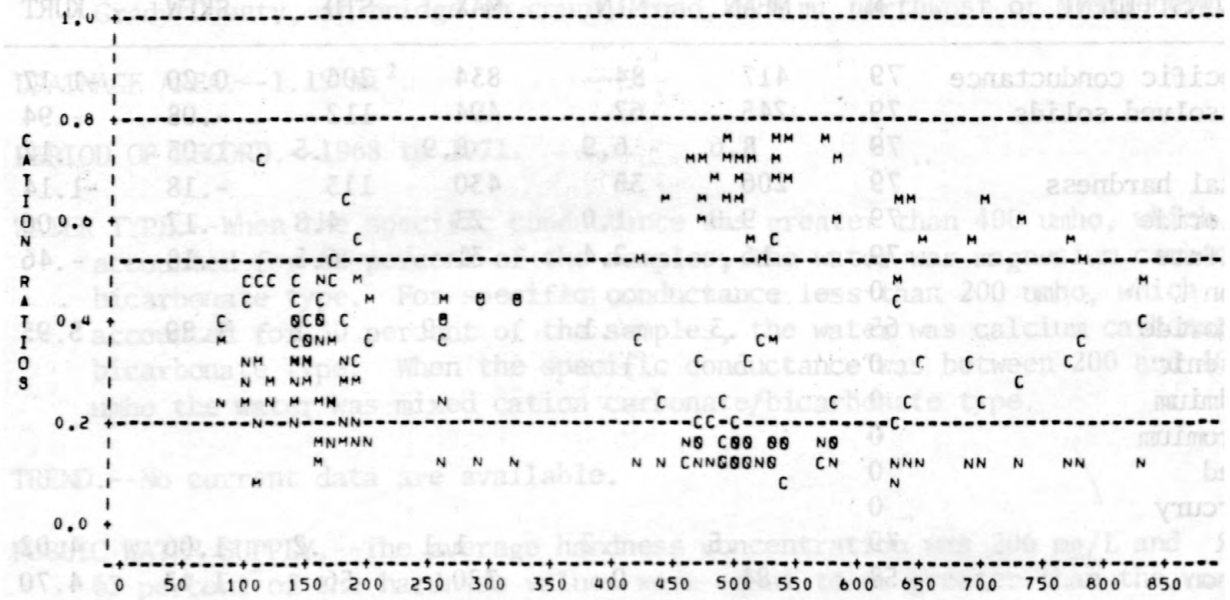
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	79	417	84	834	206	-0.20	-1.17
Dissolved solids	79	245	62	494	112	-.08	-.94
pH	79	8.6	6.9	8.9	.5	-1.03	.12
Total hardness	79	206	36	430	113	-.18	-1.14
Chloride	79	9.0	1.0	23	4.8	.17	-.06
Sulfate	79	16	2.4	31	6.5	-.18	-.46
Iron	0						
Fluoride	65	.3	.1	.9	.1	1.89	5.95
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	79	.5	.2	1.1	.2	1.06	4.02
Boron	58	84	0	320	56	1.43	4.70

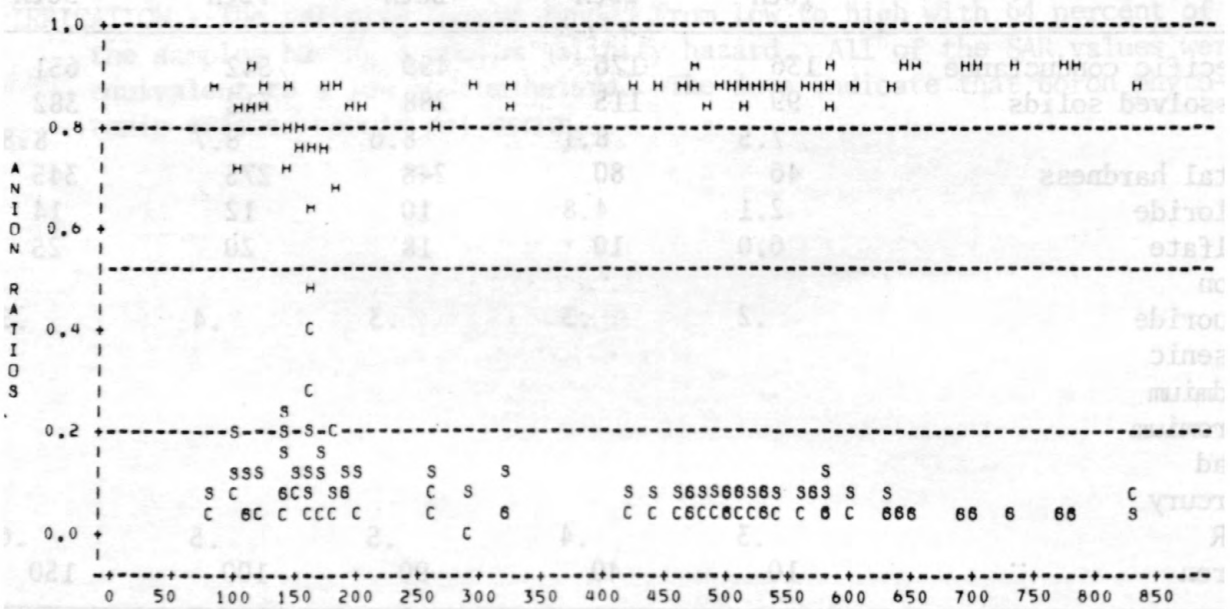
FREQUENCY DISTRIBUTION

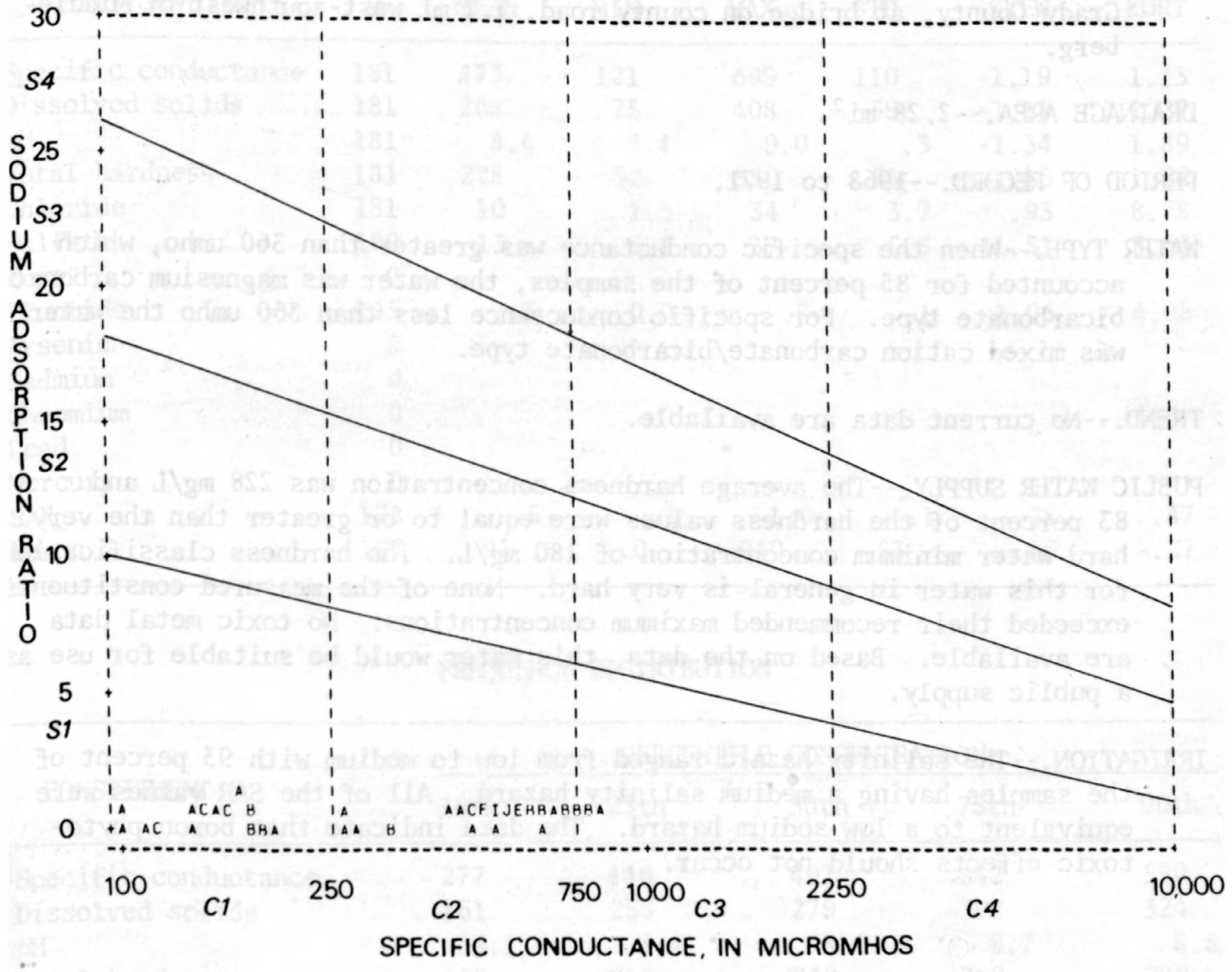
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	136	176	499	542	651
Dissolved solids	99	115	288	312	382
pH	7.5	8.1	8.6	8.7	8.8
Total hardness	46	80	248	275	345
Chloride	2.1	4.8	10	12	14
Sulfate	6.0	10	18	20	25
Iron					
Fluoride	.2	.3	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.4	.5	.5	.6
Boron	10	40	90	100	150

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SPRING CREEK NR BLANCHARD, 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=SPRING CREEK NR BLANCHARD, 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=SPRING CREEK NR BLANCHARD, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327435 - Spring Creek near Tabler, Okla.

LOCATION.--Lat 35°05'58", long 97°45'19", in center of sec. 5, T.7 N., R.5 W., Grady County, at bridge on county road, 1.2 mi west-southwest of Middleberg.

DRAINAGE AREA.--2.28 mi^2.

PERIOD OF RECORD.--1968 to 1971.

WATER TYPE.--When the specific conductance was greater than 360 umho, which accounted for 85 percent of the samples, the water was magnesium carbonate/bicarbonate type. For specific conductance less than 360 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 228 mg/L and 83 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water in general is very hard. None of the measured constituents exceeded their recommended maximum concentrations. 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 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 boron phytotoxic effects should not occur.

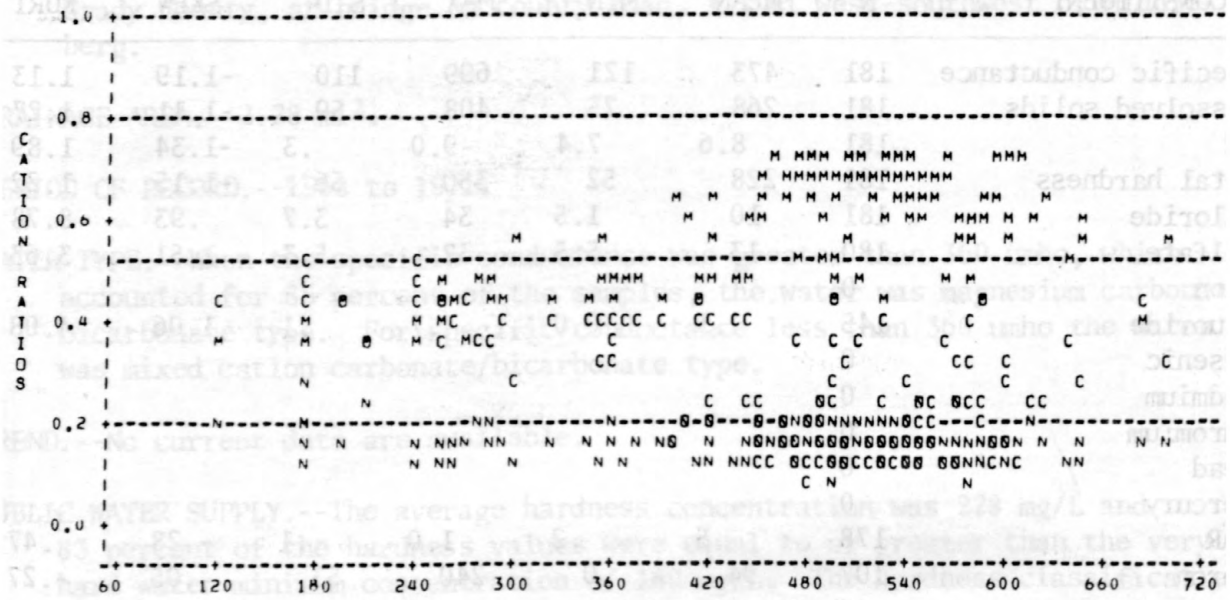
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	181	473	121	699	110	-1.19	1.13
Dissolved solids	181	268	75	408	59	-1.11	1.27
pH	181	8.6	7.4	9.0	.3	-1.34	1.89
Total hardness	181	228	52	350	56	-1.15	1.22
Chloride	181	10	1.5	34	3.7	.93	8.78
Sulfate	180	13	5.5	37	5.3	1.51	3.63
Iron	0						
Fluoride	145	.3	0.0	.7	.1	1.06	4.08
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	178	.5	.2	1.0	.1	-.28	.47
Boron	107	94	0	240	53	.05	-.27

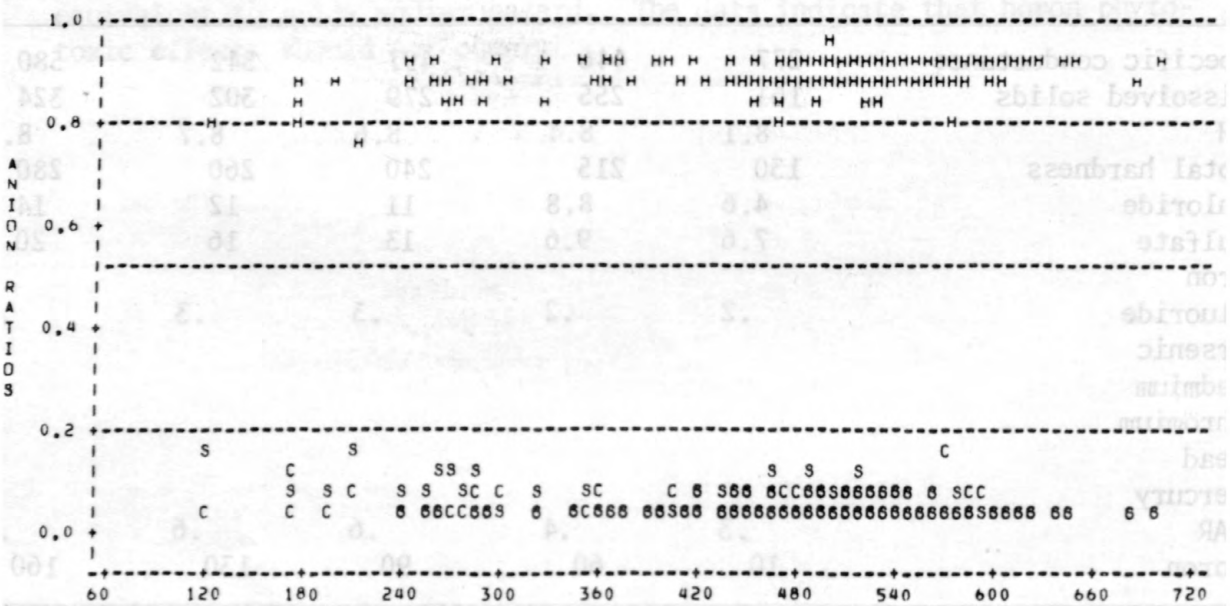
FREQUENCY DISTRIBUTION

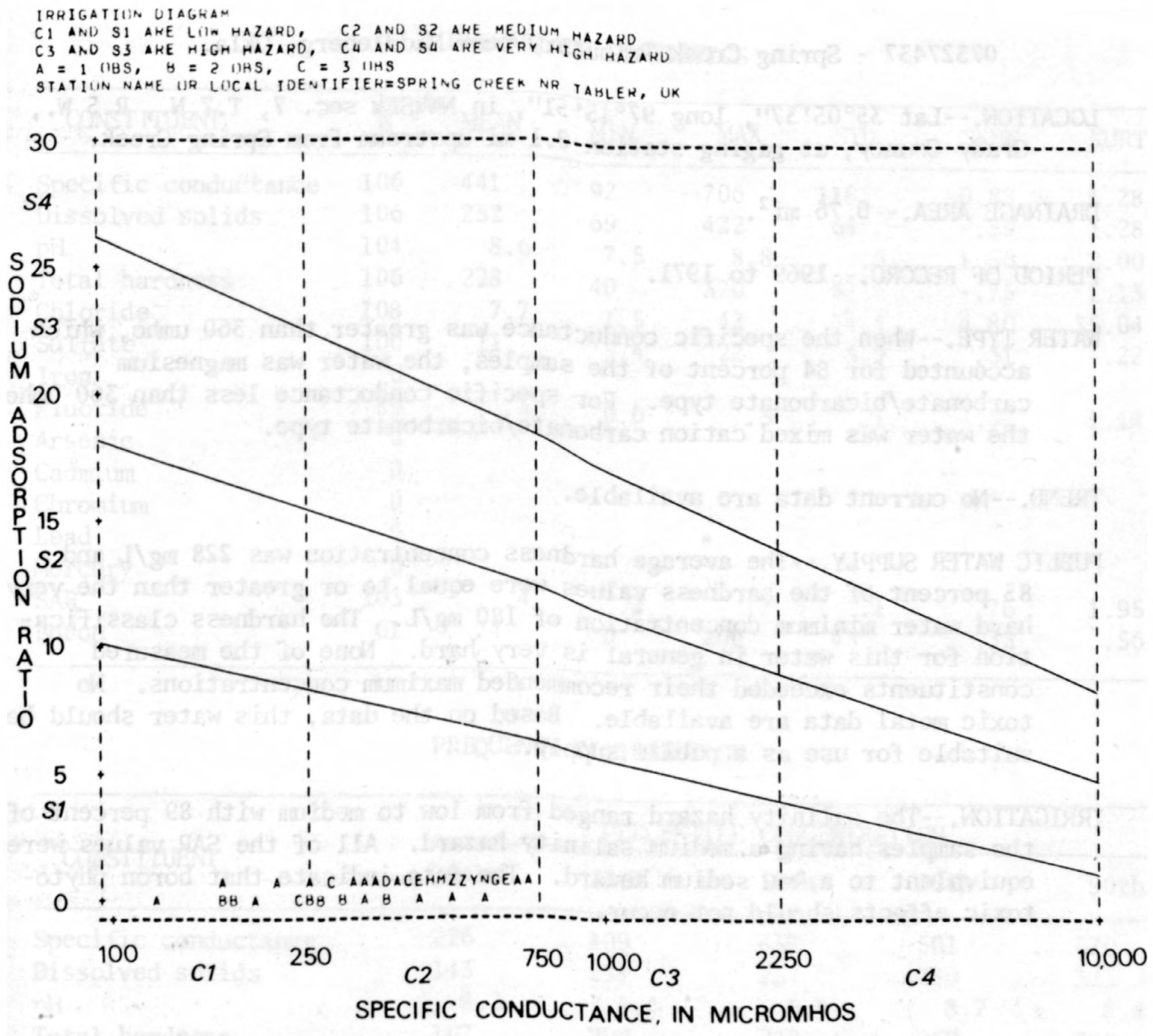
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	277	446	497	542	580
Dissolved solids	161	255	279	302	324
pH	8.1	8.4	8.6	8.7	8.8
Total hardness	130	215	240	260	280
Chloride	4.6	8.8	11	12	14
Sulfate	7.6	9.6	13	16	20
Iron					
Fluoride	.2	.2	.3	.3	.4
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.4	.6	.6	.7
Boron	10	60	90	130	160

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SPRING CREEK NR TABLER, 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=SPRING CREEK NR TABLER, 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=SPRING CREEK NR TABLER, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
A A A C AAADACEHMZZYNGEAA
A BB A CBB B A B A A A
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327437 - Spring Creek Tributary near Middleberg, Okla.

LOCATION.--Lat 35°05'37", long 97°45'51", in NW¼SE¼ sec. 7, T.7.N., R.5 W., Grady County, at gaging station 0.1 mi upstream from Spring Creek.

DRAINAGE AREA.--0.76 mi^2.

PERIOD OF RECORD.--1969 to 1971.

WATER TYPE.--When the specific conductance was greater than 360 umho, which accounted for 84 percent of the samples, the water was magnesium carbonate/bicarbonate type. For specific conductance less than 360 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 228 mg/L and 85 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water in general is very hard. None of the measured constituents exceeded their recommended maximum concentrations. 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 89 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 boron phytotoxic effects should not occur.

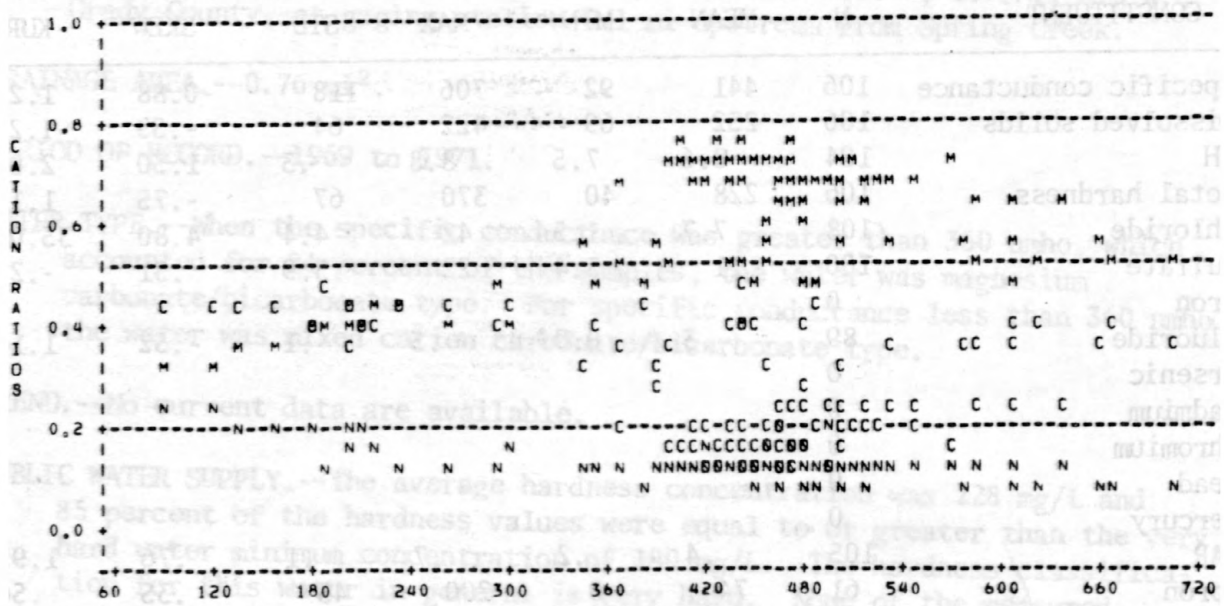
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	106	441	92	706	118	-0.88	1.28
Dissolved solids	106	252	69	422	64	-.59	1.28
pH	104	8.6	7.5	8.8	.3	1.50	2.00
Total hardness	106	228	40	370	67	-.75	1.13
Chloride	108	7.7	1.5	42	4.4	4.80	35.04
Sulfate	100	11	3.4	22	3.9	.31	-.22
Iron	0						
Fluoride	89	.3	0.0	.5	.1	-.52	1.14
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	105	.4	.2	.7	.1	.76	1.95
Boron	61	74	0	200	43	.35	.56

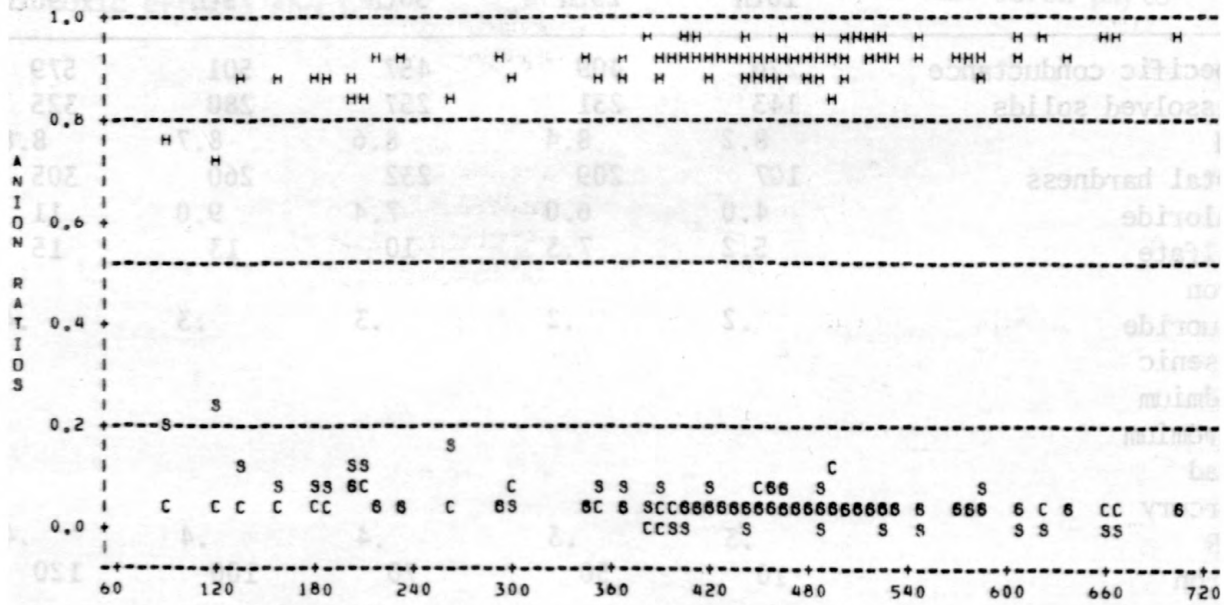
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	226	409	457	501	579
Dissolved solids	143	231	257	280	325
pH	8.2	8.4	8.6	8.7	8.8
Total hardness	107	209	232	260	305
Chloride	4.0	6.0	7.4	9.0	11
Sulfate	5.2	7.3	10	13	15
Iron					
Fluoride	.2	.2	.3	.3	.4
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.3	.4	.4	.4
Boron	10	50	70	100	120

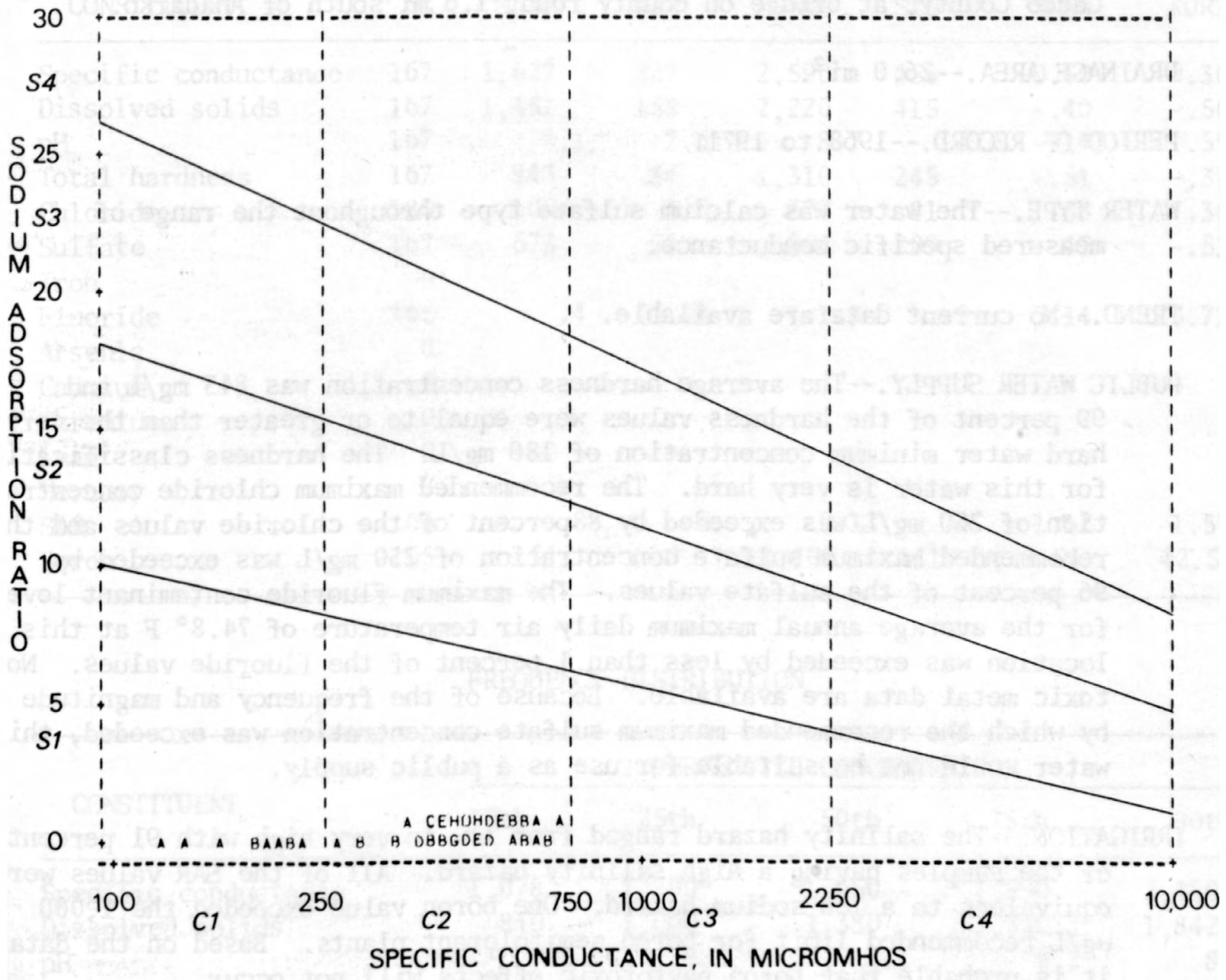
CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=SPRING CREEK TRIB NR MIDDLEBERG, OK



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



07326720 - Tonkawa Creek near Anadarko, Okla.

LOCATION.--Lat 35°03'00", long 98°15'00", in NW¼ sec. 34, T.7 N., R.10 W., Caddo County, at bridge on county road, 1.6 mi south of Anadarko.

DRAINAGE AREA.--26.0 mi^2.

PERIOD OF RECORD.--1968 to 1971.

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

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 843 mg/L and 99 percent of the hardness values were equal to or 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 8 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 96 percent of the sulfate values. The maximum fluoride contaminant level for the average annual maximum daily air temperature of 74.8° F at this location was exceeded by less than 1 percent of the fluoride 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 low to very high with 91 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. One boron value exceeded the 1,000 ug/L recommended limit for boron semitolerant plants. Based on the data, it is probable that boron phytotoxic effects will not occur.

UNIVARIATE STATISTICS

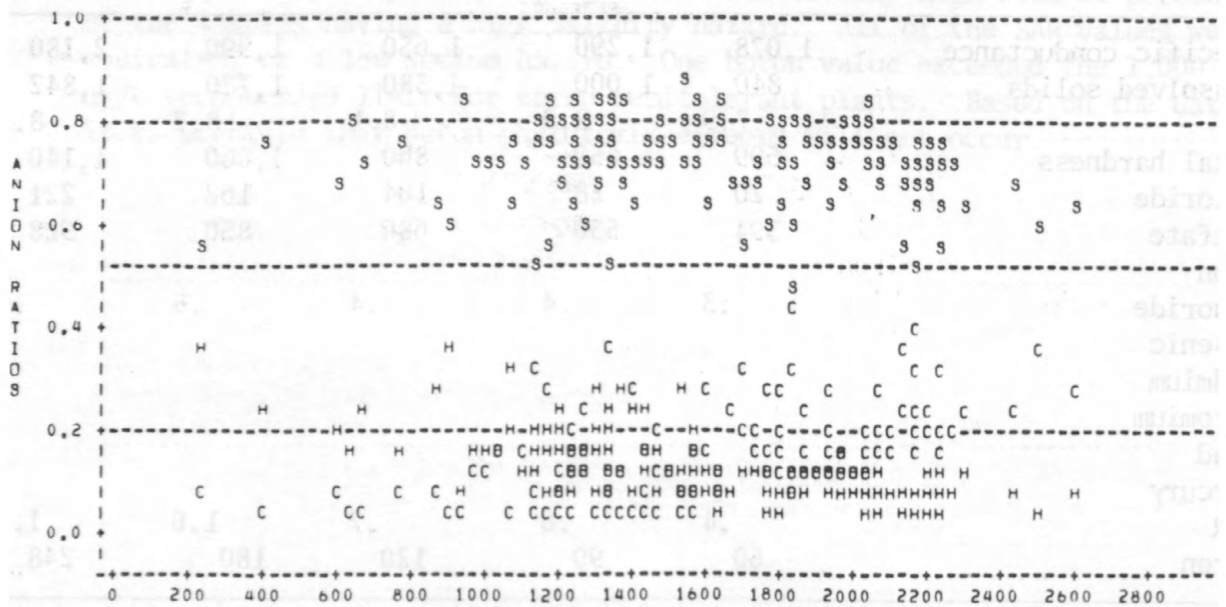
CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	167	1,627	227	2,590	453	-0.40	-0.30
Dissolved solids	167	1,351	158	2,220	415	-.40	-.56
pH	167	8.1	7.6	8.7	.2	-.14	.59
Total hardness	167	843	84	1,310	245	-.51	-.37
Chloride	180	109	4.0	372	81	.83	.36
Sulfate	167	673	55	994	209	-.47	-.51
Iron	0						
Fluoride	165	.4	.1	1.8	.2	3.14	23.71
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	166	.8	.2	2.1	.4	1.12	1.57
Boron	155	154	0	1,400	141	5.54	42.51

FREQUENCY DISTRIBUTION

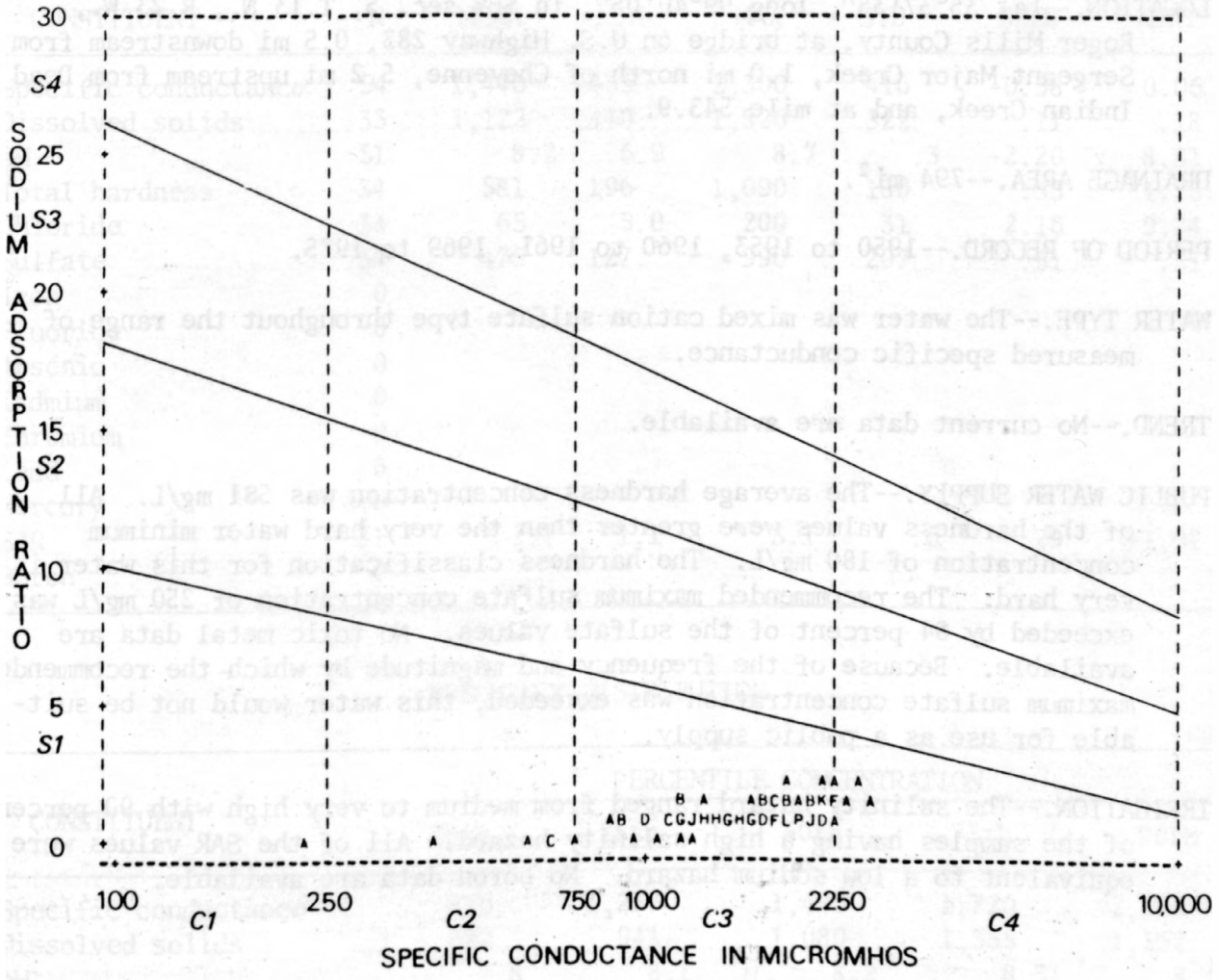
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	1,078	1,290	1,650	1,990	2,180
Dissolved solids	840	1,000	1,380	1,720	1,842
pH	7.9	8.0	8.1	8.2	8.3
Total hardness	509	650	860	1,060	1,140
Chloride	20	28	104	162	221
Sulfate	394	530	680	850	928
Iron					
Fluoride	.3	.4	.4	.5	.6
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.6	.7	1.0	1.3
Boron	60	90	120	180	248

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



07316500 - Washita River near Cheyenne, Okla.

LOCATION.--Lat 35°37'35", long 99°40'05", in SE¼ sec. 5, T.13 N., R.23 W., Roger Mills County, at bridge on U.S. Highway 283, 0.5 mi downstream from Sergeant Major Creek, 1.0 mi north of Cheyenne, 5.2 mi upstream from Dead Indian Creek, and at mile 543.9.

DRAINAGE AREA.--794 mi^2.

PERIOD OF RECORD.--1950 to 1953, 1960 to 1961, 1969 to 1975.

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

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 581 mg/L. 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 sulfate concentration of 250 mg/L was exceeded by 84 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 90 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

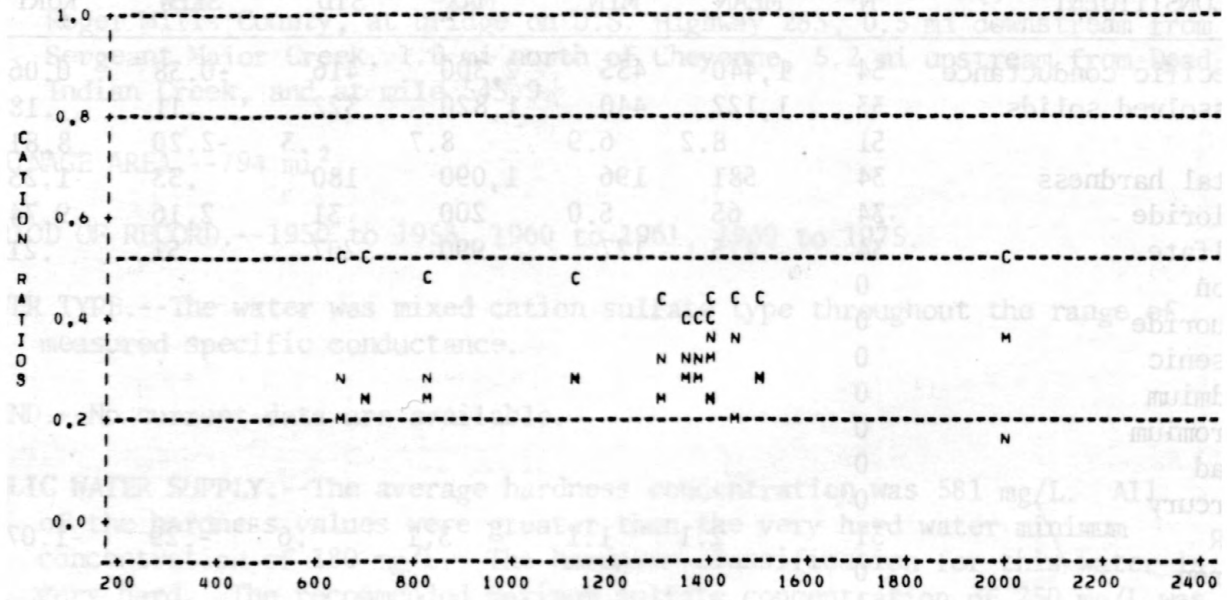
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	54	1,440	435	2,300	416	-0.38	0.06
Dissolved solids	33	1,122	440	1,820	322	.11	.18
pH	51	8.2	6.9	8.7	.3	-2.20	8.81
Total hardness	34	581	196	1,090	180	.33	1.23
Chloride	34	65	5.0	200	31	2.16	9.74
Sulfate	34	475	127	990	207	.51	.21
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	31	2.1	1.1	3.1	.6	-.29	-1.07
Boron	0						

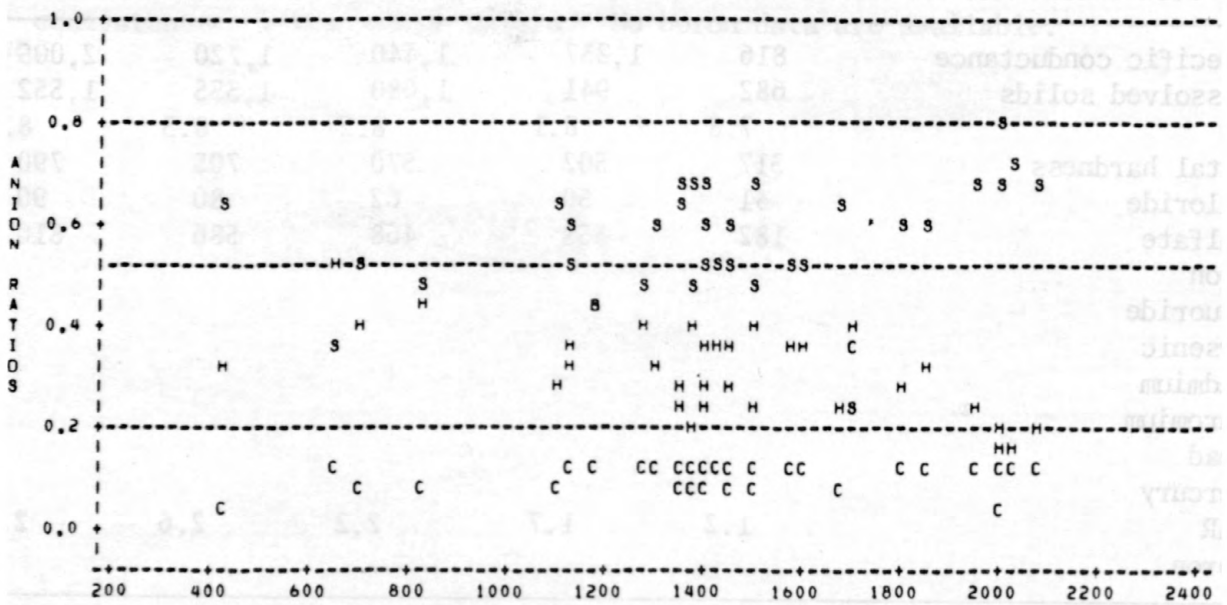
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	816	1,237	1,440	1,720	2,005
Dissolved solids	682	941	1,080	1,355	1,552
pH	7.8	8.1	8.2	8.3	8.4
Total hardness	317	502	570	705	790
Chloride	31	50	62	80	90
Sulfate	182	358	468	586	810
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.2	1.7	2.2	2.6	2.8
Boron					

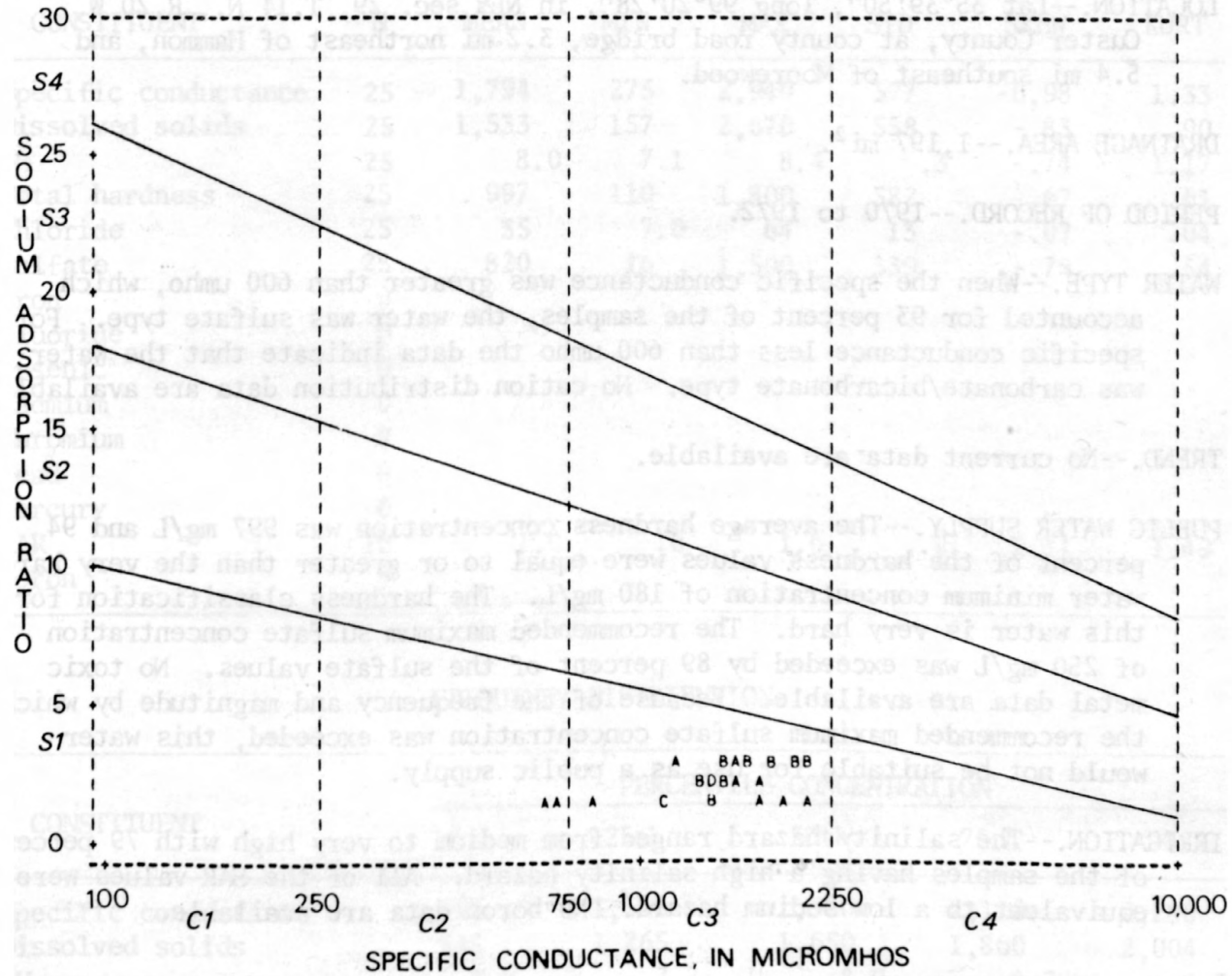
CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR CHEYENNE, OK



ANION RATIO PLOT
H IS CARBONATE/BICARBONATE ION RATIO, C IS CHLORIDE ION RATIO, S IS SULFATE ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR CHEYENNE, 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=WASHITA RIVER NR CHEYENNE, OK



07324150 - Washita River near Moorewood, Okla.

LOCATION.--Lat 35°39'50", long 99°20'28", in NE¼ sec. 29, T.14 N., R.20 W., Custer County, at county road bridge, 3.2 mi northeast of Hammon, and 5.4 mi southeast of Moorewood.

DRAINAGE AREA.--1,197 mi^2.

PERIOD OF RECORD.--1970 to 1972.

WATER TYPE.--When the specific conductance was greater than 600 umho, which accounted for 93 percent of the samples, the water was sulfate type. For specific conductance less than 600 umho the data indicate that the water was carbonate/bicarbonate type. No cation distribution data are available.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 997 mg/L and 94 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum sulfate concentration of 250 mg/L was exceeded by 89 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 79 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

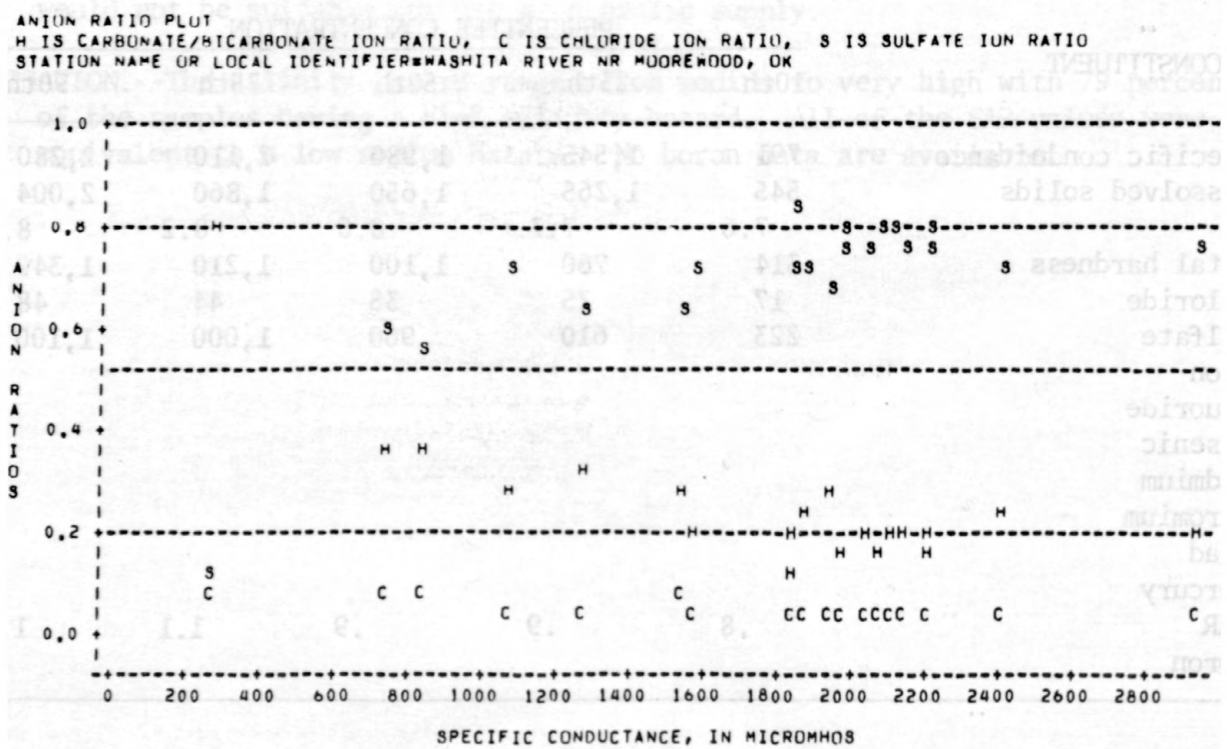
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	25	1,794	275	2,940	577	-0.98	1.33
Dissolved solids	25	1,533	157	2,670	558	-.83	.90
pH	25	8.0	7.1	8.4	.3	-.74	1.17
Total hardness	25	997	110	1,800	382	-.67	.61
Chloride	25	35	7.0	64	13	-.07	.04
Sulfate	25	820	16	1,500	339	-.78	.54
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	19	1.0	.6	1.6	.2	1.14	1.49
Boron	0						

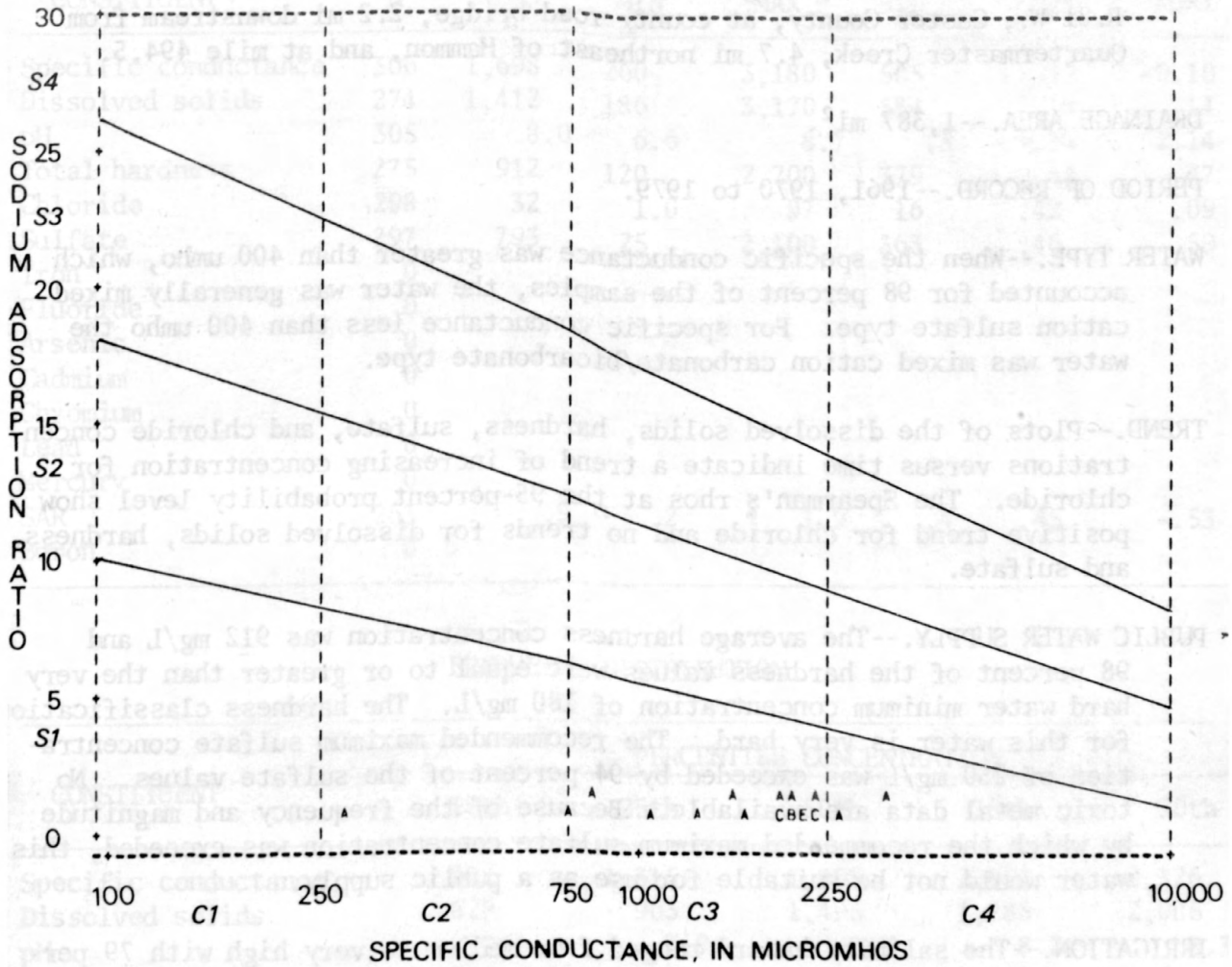
FREQUENCY DISTRIBUTION

CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	791	1,545	1,980	2,110	2,280
Dissolved solids	545	1,265	1,650	1,860	2,004
pH	7.6	7.7	8.0	8.2	8.3
Total hardness	314	760	1,100	1,210	1,340
Chloride	17	25	35	44	48
Sulfate	223	610	960	1,000	1,100
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.8	.9	.9	1.1	1.4
Boron					

No cation 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=WASHITA RIVER NR MOOREWOOD, OK



07324200 - Washita River near Hammon, Okla.

LOCATION.--Lat 35°39'23", long 99°18'21", on west line of sec. 26, T.14 N., R.21 W., Custer County, at county road bridge, 2.2 mi downstream from Quartermaster Creek, 4.7 mi northeast of Hammon, and at mile 494.5.

DRAINAGE AREA.--1,387 mi^2.

PERIOD OF RECORD.--1961, 1970 to 1979.

WATER TYPE.--When the specific conductance was greater than 400 umho, which accounted for 98 percent of the samples, the water was generally mixed cation sulfate type. For specific conductance less than 400 umho the water was mixed cation carbonate/bicarbonate type.

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

PUBLIC WATER SUPPLY.--The average hardness concentration was 912 mg/L and 98 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. 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 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 79 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

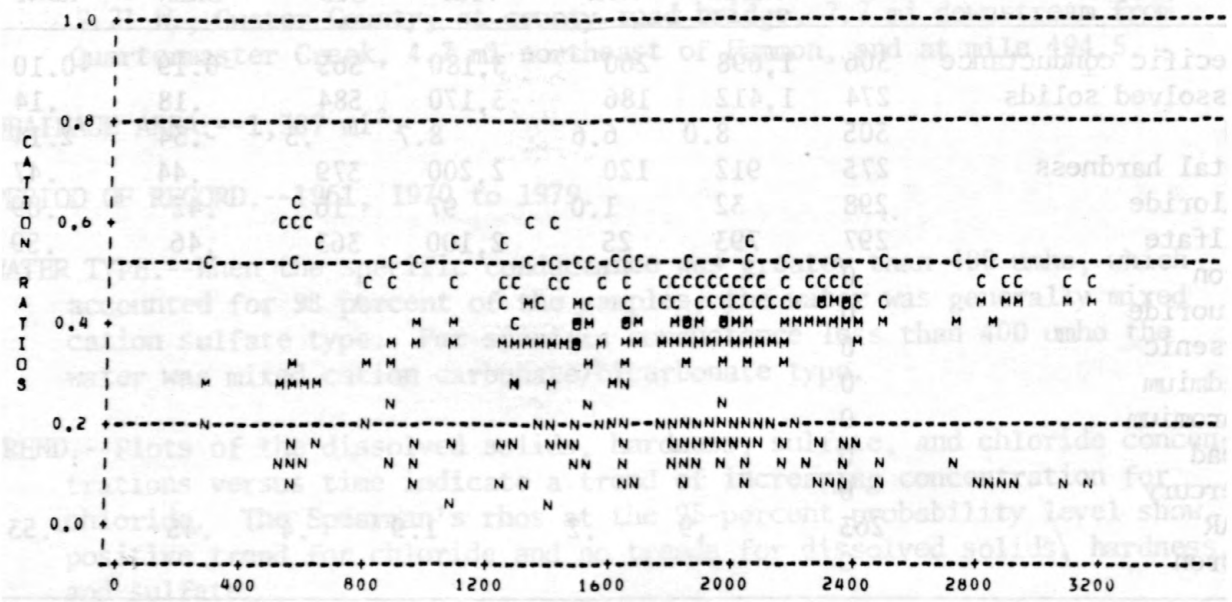
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	306	1,698	260	3,180	565	-0.19	-0.10
Dissolved solids	274	1,412	186	3,170	584	.18	.14
pH	305	8.0	6.6	8.7	.3	-.34	2.14
Total hardness	275	912	120	2,200	379	.44	.47
Chloride	298	32	1.0	97	16	.42	.09
Sulfate	297	793	25	2,100	363	.46	.59
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	263	.9	.2	1.9	.4	.45	-.53
Boron	0						

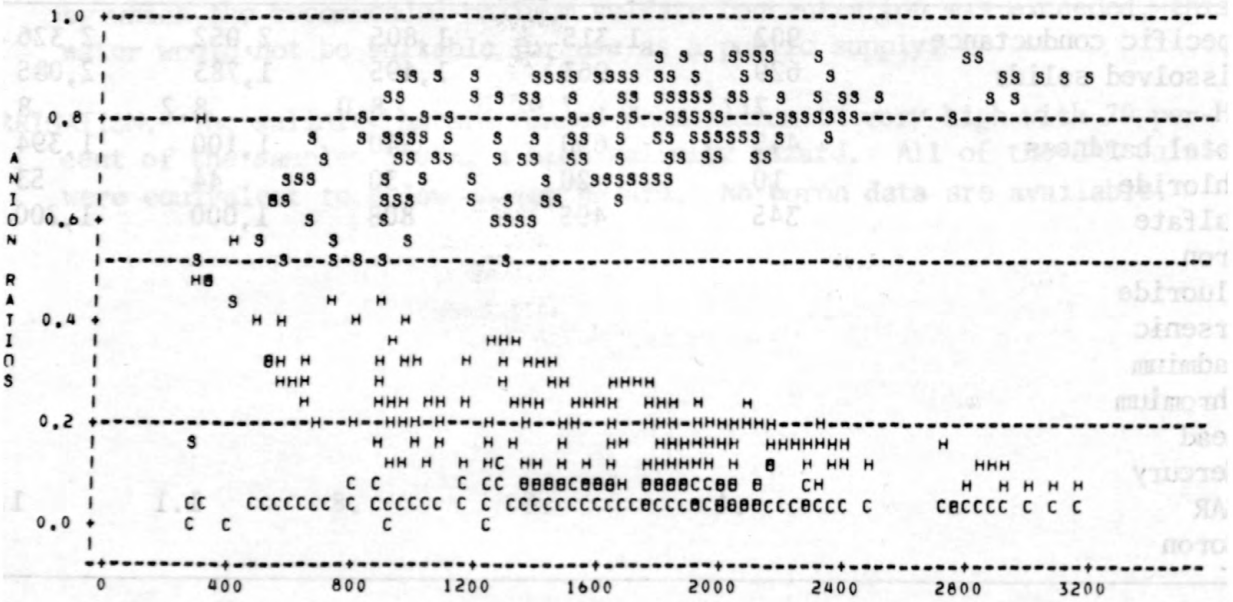
FREQUENCY DISTRIBUTION

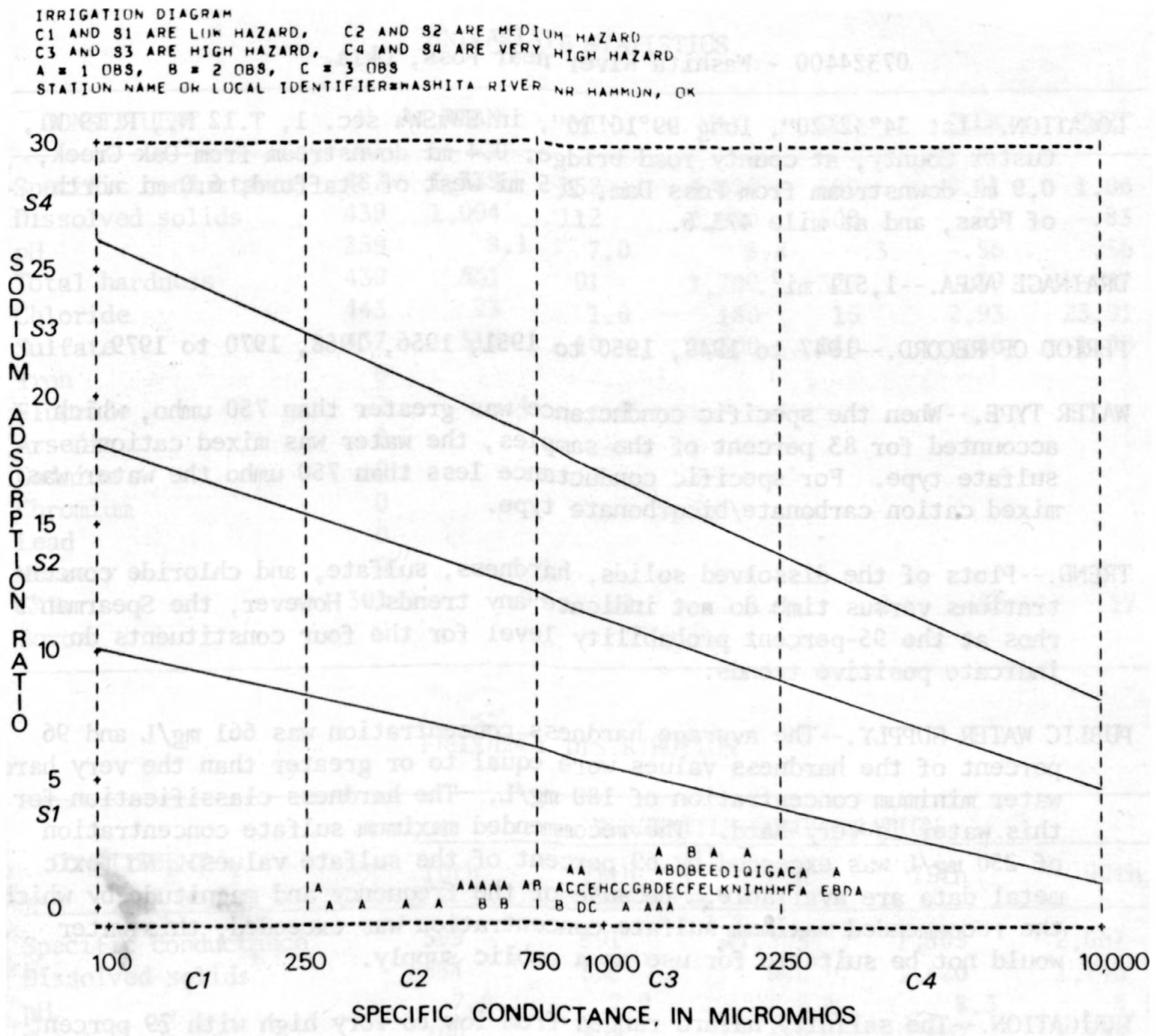
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	902	1,315	1,805	2,052	2,326
Dissolved solids	629	963	1,495	1,783	2,085
pH	7.7	7.9	8.0	8.2	8.3
Total hardness	445	630	940	1,100	1,394
Chloride	10	20	30	44	53
Sulfate	345	495	808	1,000	1,200
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.6	.8	1.1	1.4
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR HAMMON, 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=WASHITA RIVER NR HAMMON, 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=WASHITA RIVER NR HAMMON, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07324400 - Washita River near Foss, Okla.

LOCATION.--Lat 34°32'20", long 99°10'10", in SW¼SW¼ sec. 1, T.12 N., R.19 W., Custer County, at county road bridge, 0.4 mi downstream from Oak Creek, 0.9 mi downstream from Foss Dam, 2.5 mi west of Stafford, 6.0 mi north of Foss, and at mile 473.5.

DRAINAGE AREA.--1,511 mi^2.

PERIOD OF RECORD.--1947 to 1948, 1950 to 1951, 1956, 1958, 1970 to 1979.

WATER TYPE.--When the specific conductance was greater than 750 umho, which accounted for 83 percent of the samples, the water was mixed cation sulfate type. For specific conductance less than 750 umho the water was mixed cation carbonate/bicarbonate 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 for the four constituents do indicate positive trends.

PUBLIC WATER SUPPLY.--The average hardness concentration was 661 mg/L and 96 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum sulfate concentration of 250 mg/L was exceeded by 69 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 low to very high with 79 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

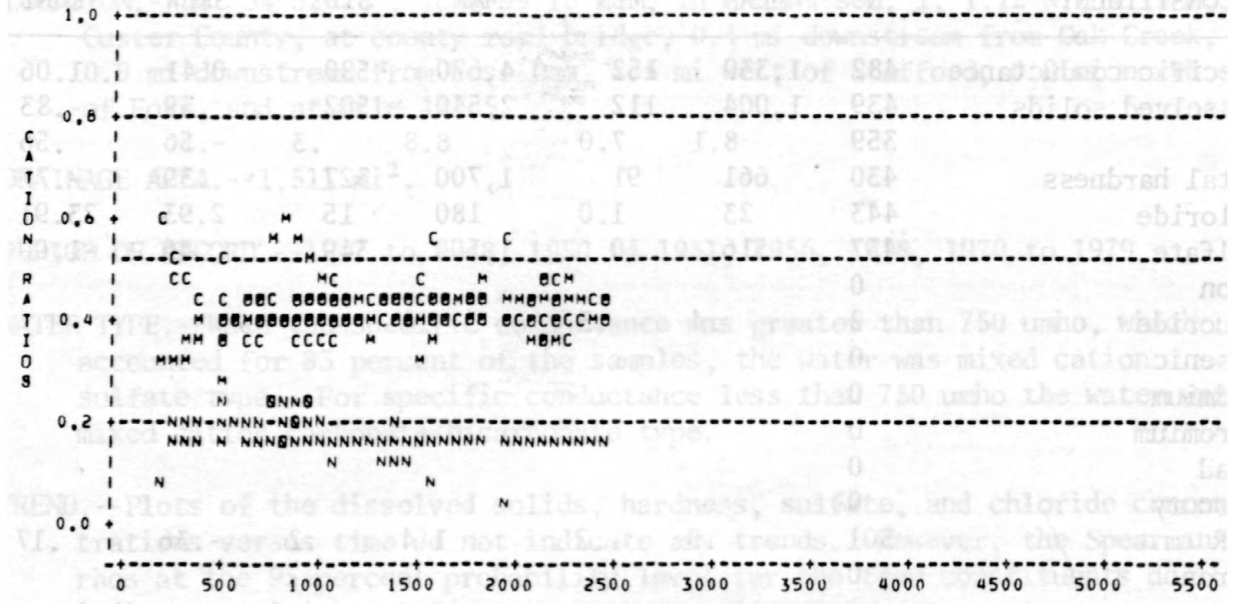
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	482	1,339	152	4,670	580	0.41	1.06
Dissolved solids	439	1,004	112	2,540	502	.39	-.83
pH	359	8.1	7.0	8.8	.3	-.56	.56
Total hardness	430	661	91	1,700	327	.39	-.77
Chloride	443	23	1.0	180	15	2.93	23.91
Sulfate	437	516	10	1,500	349	.46	-1.00
Iron	0						
Fluoride	2	.4	.3	.4			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	301	.9	.2	1.4	.2	-.36	.17
Boron	0						

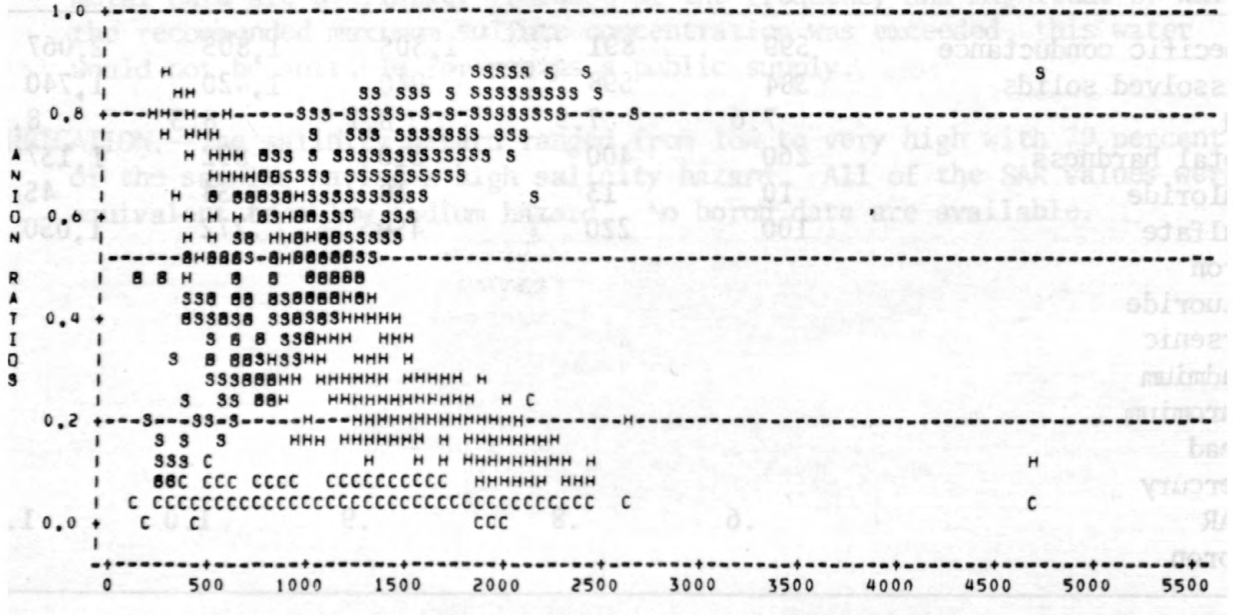
FREQUENCY DISTRIBUTION

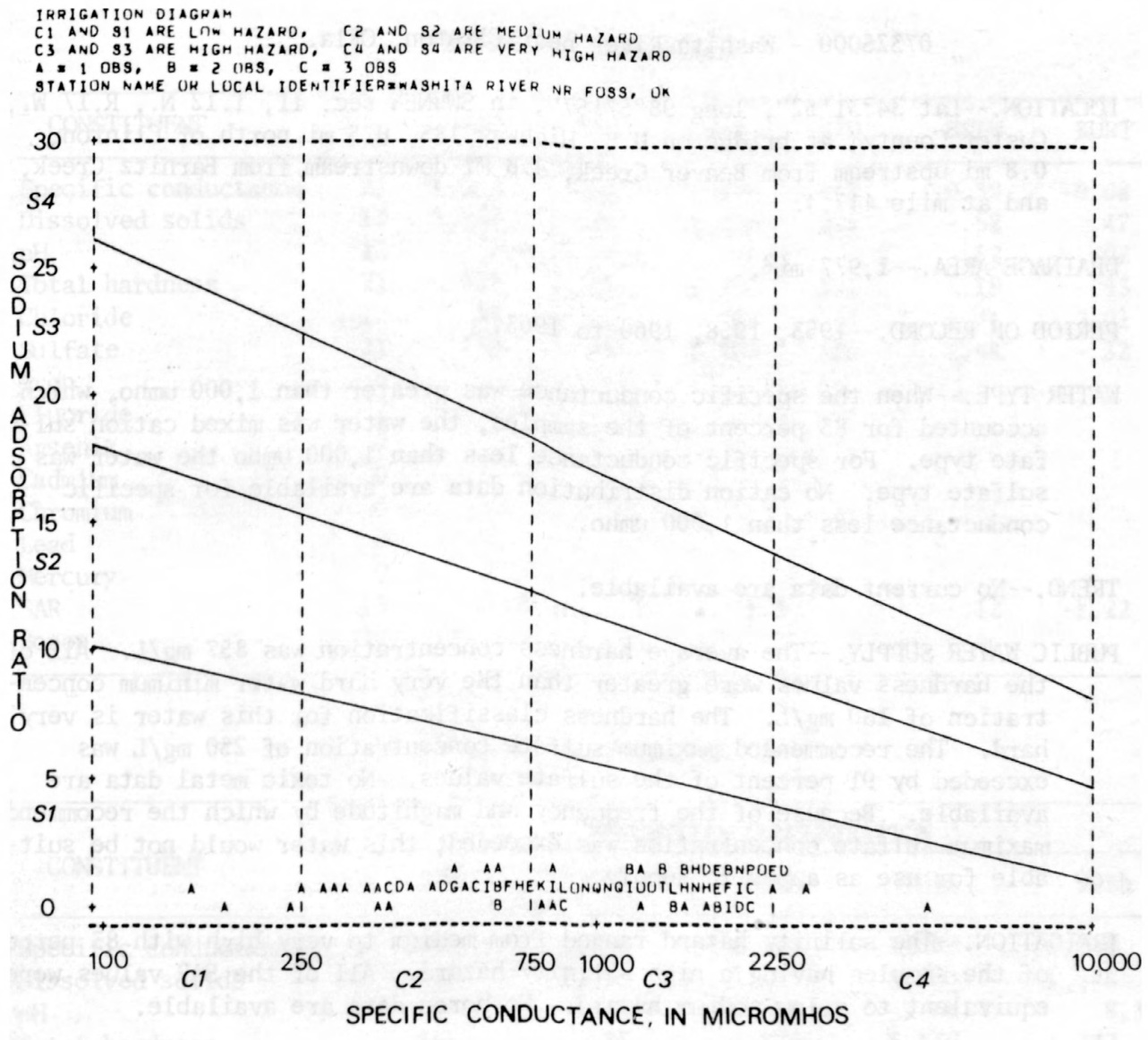
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	599	891	1,305	1,805	2,067
Dissolved solids	384	598	940	1,420	1,740
pH	7.6	7.9	8.1	8.3	8.5
Total hardness	260	400	610	892	1,137
Chloride	10	13	18	34	45
Sulfate	100	220	450	772	1,050
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.6	.8	.9	1.0	1.2
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR FOSS, 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=WASHITA RIVER NR FOSS, 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=WASHITA RIVER NR FOSS, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07325000 - Washita River near Clinton, Okla.

LOCATION.--Lat 34°31'52", long 98°57'57", in SW¼NE¼ sec. 11, T.12 N., R.17 W., Custer County, at bridge on U.S. Highway 183, 0.5 mi north of Clinton, 0.8 mi upstream from Beaver Creek, 4.8 mi downstream from Barnitz Creek, and at mile 447.4.

DRAINAGE AREA.--1,977 mi^2.

PERIOD OF RECORD.--1953, 1958, 1960 to 1963.

WATER TYPE.--When the specific conductance was greater than 1,000 umho, which accounted for 83 percent of the samples, the water was mixed cation sulfate type. For specific conductance less than 1,000 umho the water was sulfate type. No cation distribution data are available for specific conductance less than 1,000 umho.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 857 mg/L. 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 sulfate concentration of 250 mg/L was exceeded by 91 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 83 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

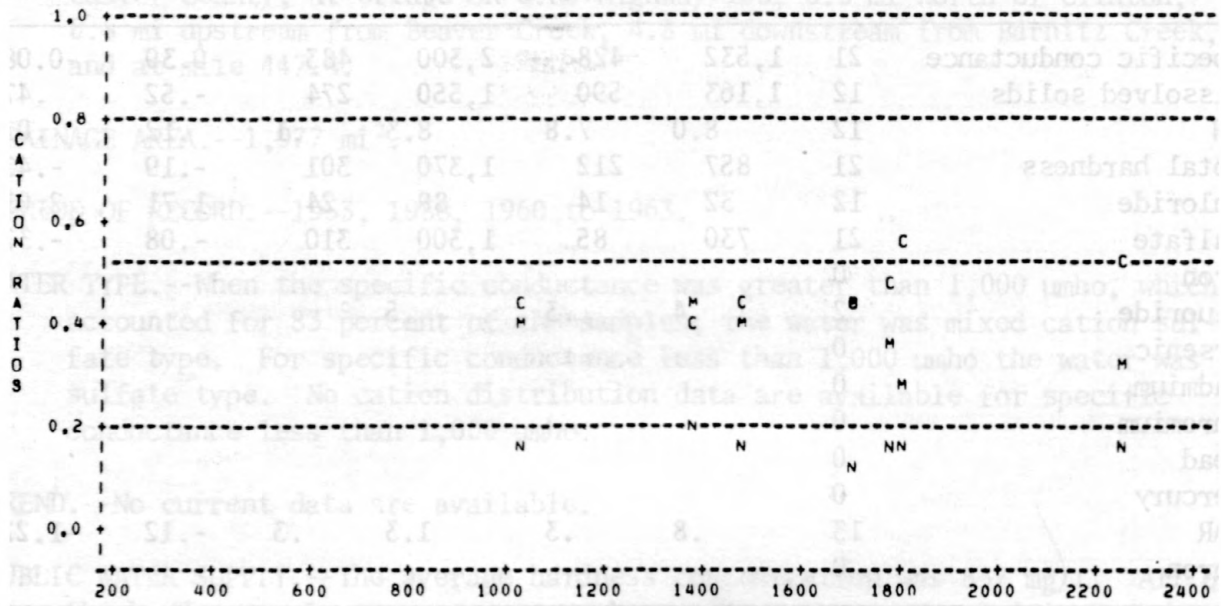
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	21	1,532	428	2,300	483	-0.39	-0.08
Dissolved solids	12	1,163	590	1,550	274	-.52	.47
pH	12	8.0	7.8	8.3	.1	.12	.02
Total hardness	21	857	212	1,370	301	-.19	-.43
Chloride	12	32	14	88	24	1.71	2.01
Sulfate	21	730	85	1,300	310	-.08	-.32
Iron	0						
Fluoride	2	.4	.3	.5			
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	13	.8	.3	1.3	.3	-.12	-1.22
Boron	0						

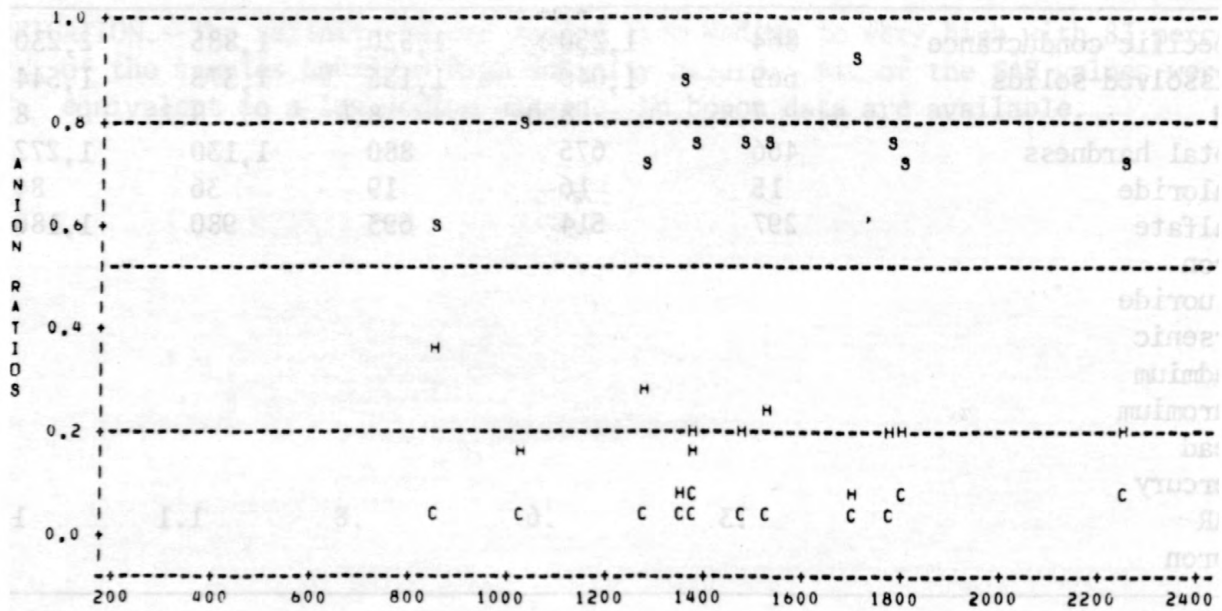
FREQUENCY DISTRIBUTION

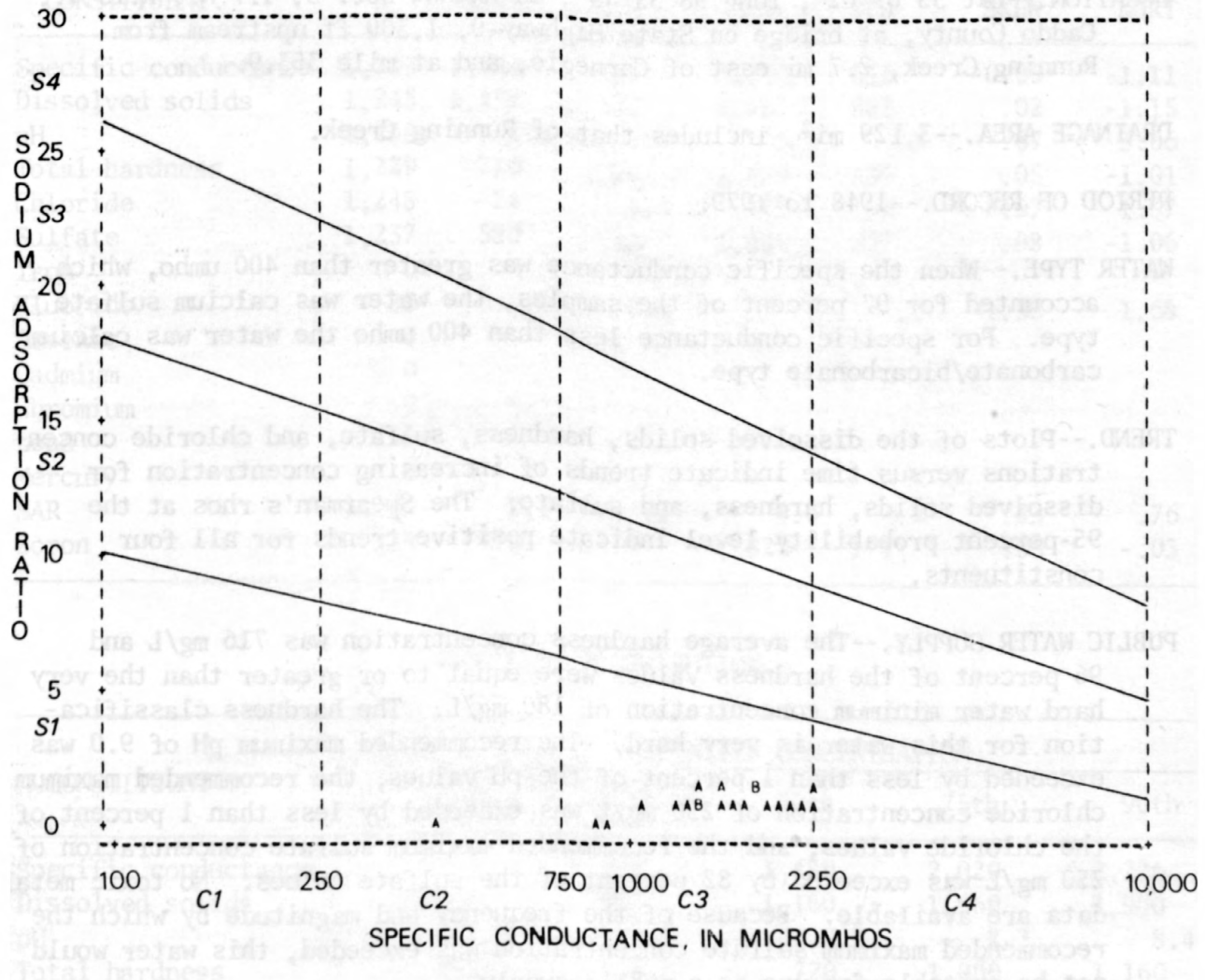
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	864	1,250	1,520	1,885	2,230
Dissolved solids	669	1,040	1,155	1,373	1,544
pH	7.8	8.0	8.0	8.2	8.3
Total hardness	466	675	880	1,130	1,272
Chloride	15	16	19	36	84
Sulfate	297	514	693	980	1,180
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.6	.8	1.1	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=WASHITA RIVER NR CLINTON, 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=WASHITA RIVER NR CLINTON, 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=WASHITA RIVER NR CLINTON, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07325500 - Washita River at Carnegie, Okla.

LOCATION.--Lat 35°07'02", long 98°33'49", in NW¼NW¼ sec. 3, T.7 N., R.13 W., Caddo County, at bridge on State Highway 9, 1,300 ft upstream from Running Creek, 2.7 mi east of Carnegie, and at mile 353.9.

DRAINAGE AREA.--3,129 mi^2, includes that of Running Creek.

PERIOD OF RECORD.--1948 to 1979.

WATER TYPE.--When the specific conductance was greater than 400 umho, which accounted for 97 percent of the samples, the water was calcium sulfate type. For specific conductance less than 400 umho the water was calcium carbonate/bicarbonate type.

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

PUBLIC WATER SUPPLY.--The average hardness concentration was 716 mg/L and 96 percent of the hardness values were equal to or 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 less than 1 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 82 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 low to very high with 82 percent of the samples having a high or very 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. The boron data indicate that phytotoxic effects could occur in sensitive plants. The 750 ug/L limit for boron sensitive plants was exceeded by 4 percent of the boron values.

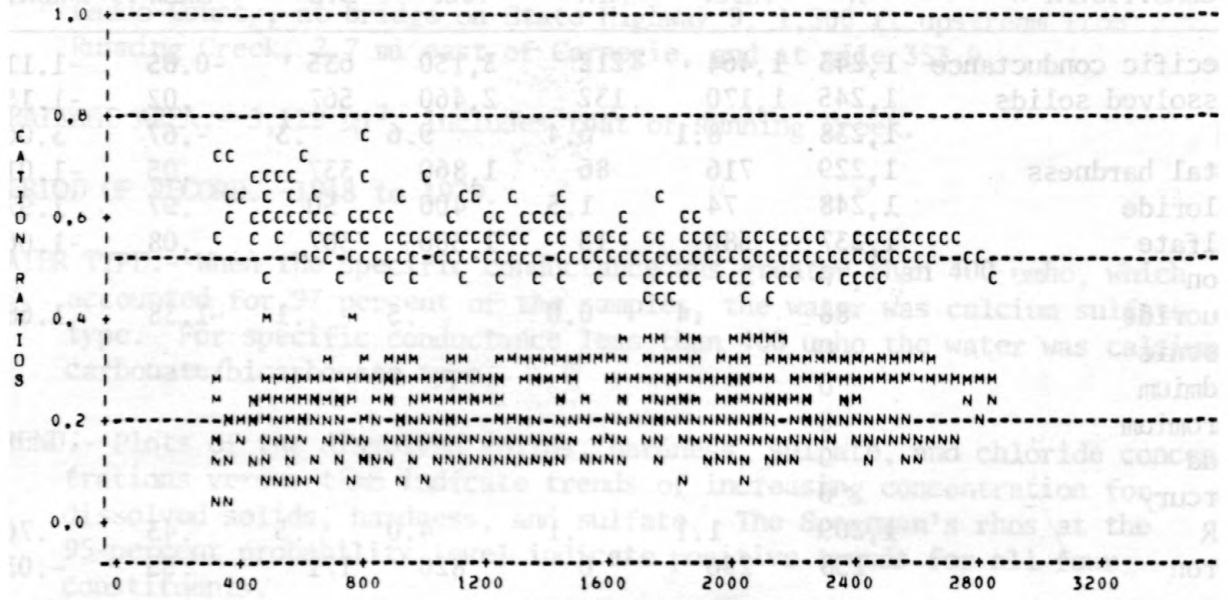
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	1,243	1,464	212	3,150	635	-0.05	-1.11
Dissolved solids	1,245	1,170	132	2,460	567	.02	-1.15
pH	1,238	8.1	6.4	9.6	.3	-.67	3.06
Total hardness	1,229	716	86	1,860	337	.05	-1.01
Chloride	1,248	74	1.5	400	50	.97	1.97
Sulfate	1,237	580	15	1,300	307	.08	-1.06
Iron	0						
Fluoride	88	.4	0.0	.5	.1	-1.38	1.68
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	1,209	1.1	.1	4.0	.5	.43	.76
Boron	138	296	0	820	171	.55	-.03

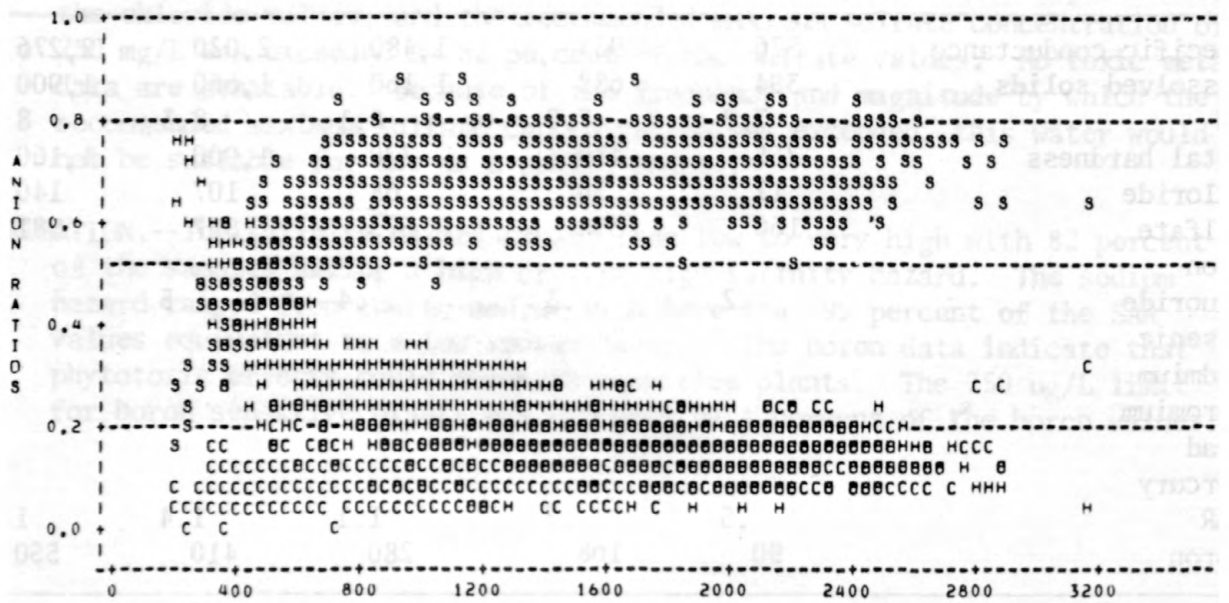
FREQUENCY DISTRIBUTION

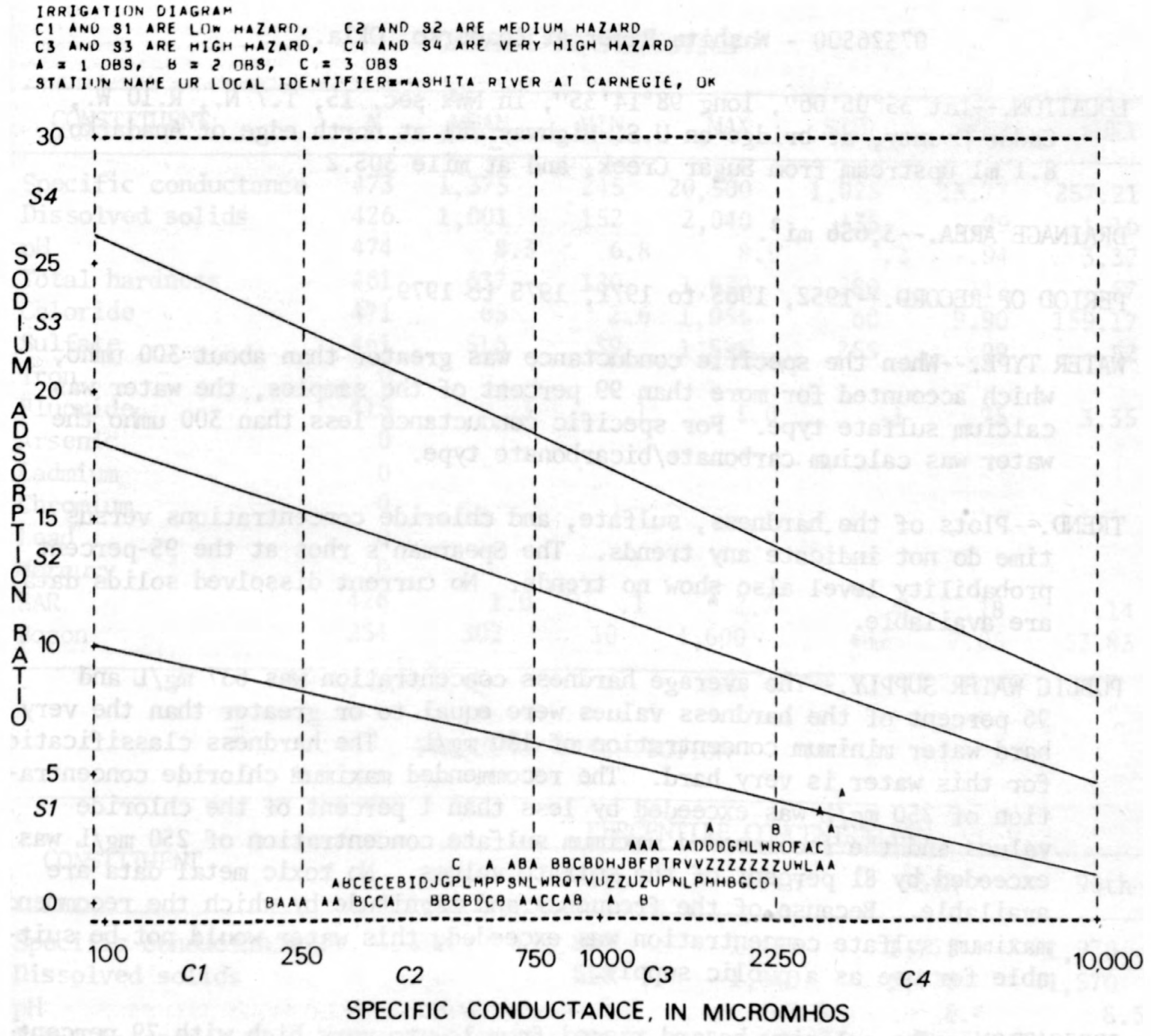
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	576	924	1,480	2,020	2,276
Dissolved solids	394	682	1,160	1,660	1,900
pH	7.7	7.9	8.1	8.3	8.4
Total hardness	255	430	720	1,000	1,160
Chloride	17	30	68	107	140
Sulfate	160	318	575	837	981
Iron					
Fluoride	.2	.3	.4	.5	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.5	.7	1.1	1.4	1.7
Boron	90	168	280	410	550

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER AT CARNEGIE, 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=WASHITA RIVER AT CARNEGIE, 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=WASHITA RIVER AT CARNEGIE, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07326500 - Washita River at Anadarko, Okla.

LOCATION.--Lat 35°05'06", long 98°14'35", in NW¼ sec. 15, T.7 N., R.10 W., Caddo County, at bridge on U.S. Highway 281 at north edge of Anadarko, 8.1 mi upstream from Sugar Creek, and at mile 305.2

DRAINAGE AREA.--3,656 mi^2.

PERIOD OF RECORD.--1952, 1965 to 1971, 1975 to 1979.

WATER TYPE.--When the specific conductance was greater than about 300 umho, which accounted for more than 99 percent of the samples, the water was calcium sulfate type. For specific conductance less than 300 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 also show no trends. No current dissolved solids data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 637 mg/L and 96 percent of the hardness values were equal to or 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 less than 1 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 81 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 low to very high with 79 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects could occur even in tolerant plants. The recommended limit of 750 ug/L for boron sensitive plants was exceeded by 5 percent of the boron values, the recommended limit of 1,000 ug/L for boron semitolerant plants was exceeded by 4 percent of the boron values, and the recommended limit of 2,000 ug/L for boron tolerant plants was exceeded by 3 percent of the boron values.

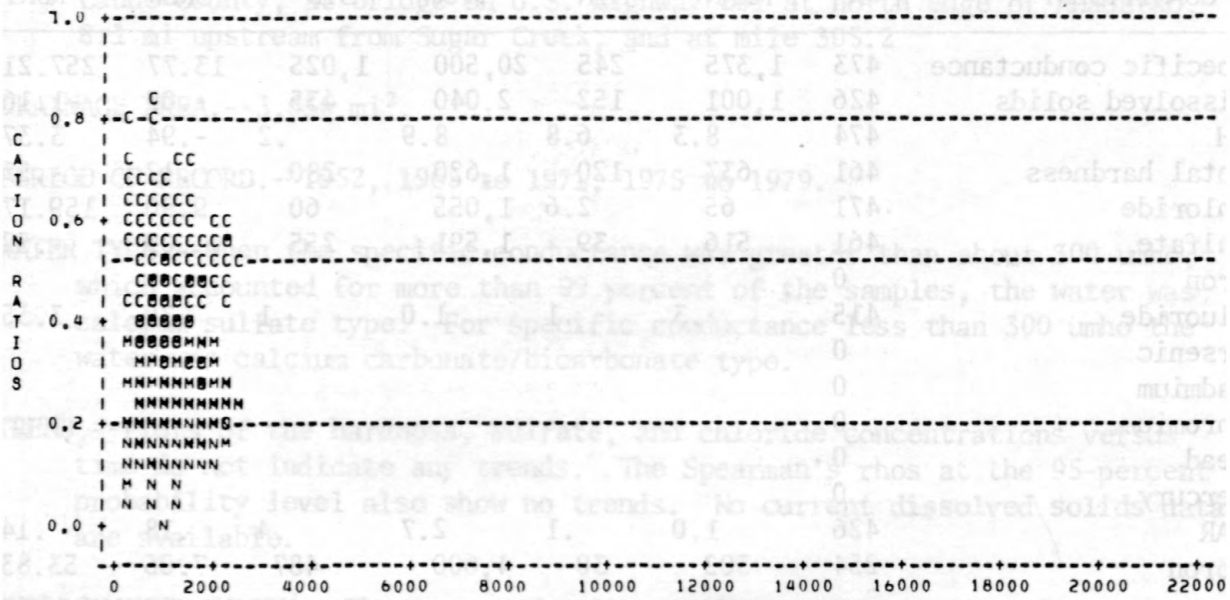
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	473	1,375	245	20,500	1,025	13.77	257.21
Dissolved solids	426	1,001	152	2,040	435	-.09	-1.16
pH	474	8.3	6.8	8.9	.2	-.94	3.37
Total hardness	461	637	120	1,620	280	.12	-.57
Chloride	471	65	2.6	1,055	60	9.90	159.17
Sulfate	461	516	39	1,591	255	.09	-.52
Iron	0						
Fluoride	415	.3	.1	1.0	.1	.75	3.35
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	426	1.0	.1	2.7	.4	.18	.14
Boron	254	302	30	4,600	487	7.05	53.83

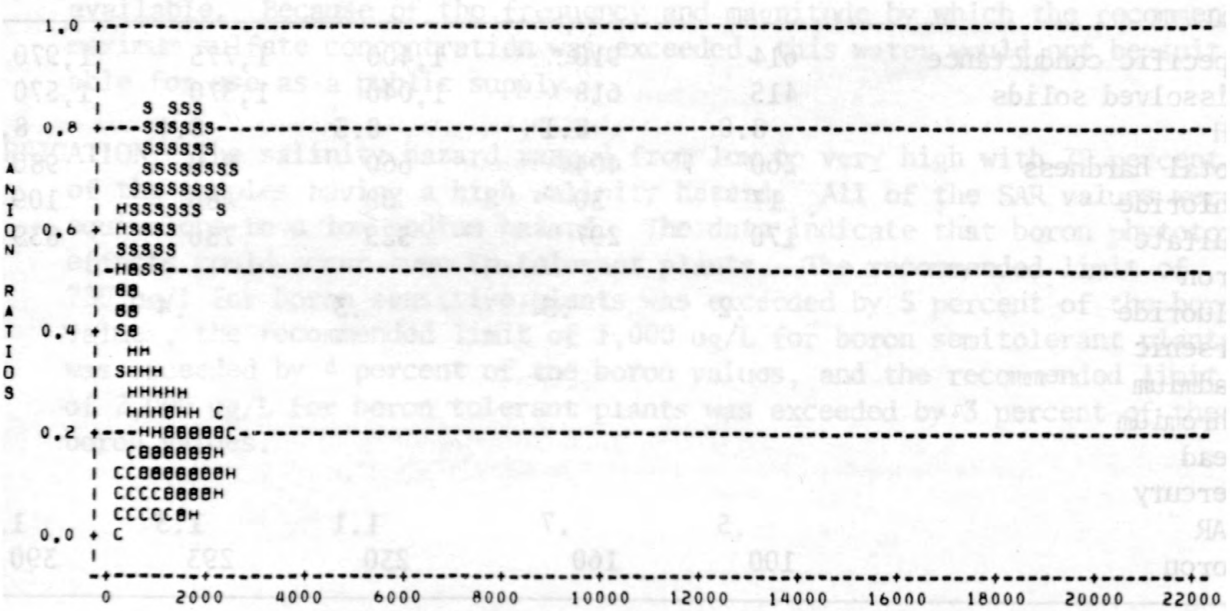
FREQUENCY DISTRIBUTION

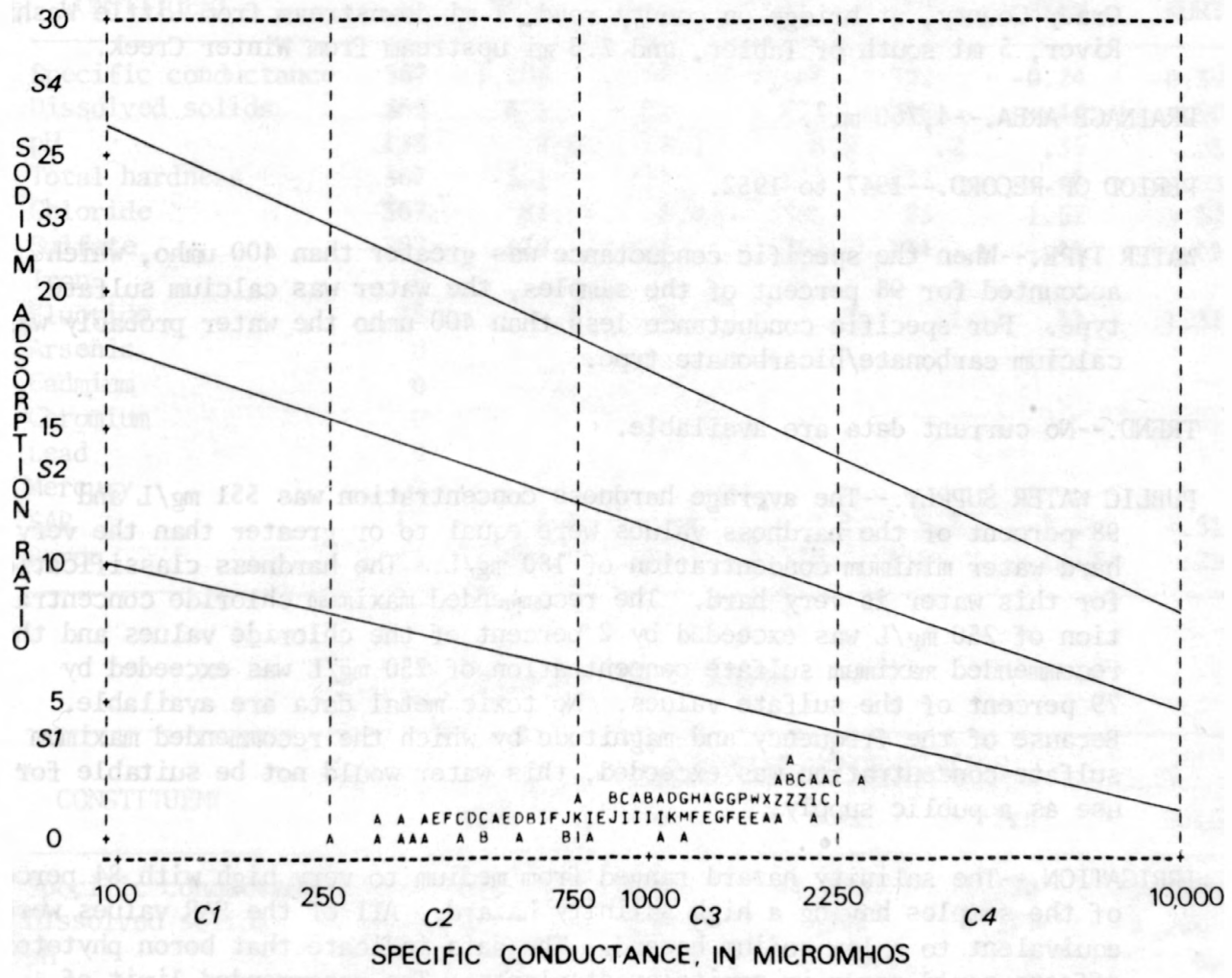
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	614	910	1,400	1,775	1,970
Dissolved solids	415	618	1,040	1,370	1,570
pH	8.0	8.1	8.3	8.4	8.5
Total hardness	260	404	660	850	980
Chloride	17	30	60	86	109
Sulfate	170	297	525	730	839
Iron					
Fluoride	.2	.3	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.5	.7	1.1	1.3	1.5
Boron	100	160	230	293	390

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER AT ANADARKO, 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=WASHITA RIVER AT ANADARKO, 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=WASHITA RIVER AT ANADARKO, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07328000 - Washita River near Tabler, Okla.

LOCATION.--Lat 34°58'18", long 97°52'21", in SW¼SW¼ sec. 21, T.6 N., R.6 W., Grady County, at bridge on county road, 1 mi downstream from Little Washita River, 5 mi south of Tabler, and 7.5 mi upstream from Winter Creek.

DRAINAGE AREA.--4,760 mi^2.

PERIOD OF RECORD.--1947 to 1952.

WATER TYPE.--When the specific conductance was greater than 400 umho, which accounted for 98 percent of the samples, the water was calcium sulfate type. For specific conductance less than 400 umho the water probably was calcium carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 551 mg/L and 98 percent of the hardness values were equal to or 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 2 percent of the chloride values and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 79 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 84 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects could occur in semitolerant plants. The recommended limit of 750 ug/L for boron sensitive plants was exceeded by 27 percent of the boron values and the recommended limit of 1,000 ug/L for boron semitolerant plants was exceeded by 20 percent of the boron values.

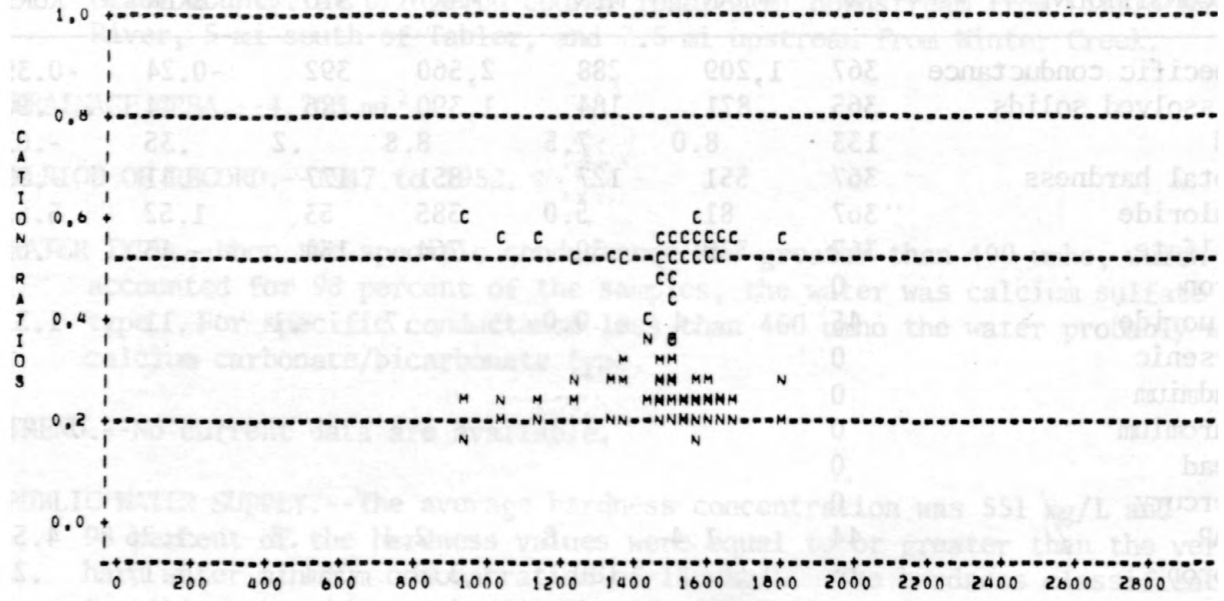
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	367	1,209	288	2,560	392	-0.24	-0.39
Dissolved solids	365	871	184	1,390	286	-.44	-.90
pH	133	8.0	7.5	8.8	.2	.35	-.03
Total hardness	367	551	127	851	177	-.41	-.93
Chloride	367	81	5.0	385	53	1.52	5.52
Sulfate	367	379	30	764	134	-.43	-.61
Iron	0						
Fluoride	45	.4	0.0	.7	.1	.11	1.31
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	44	1.4	.8	2.4	.3	1.26	4.51
Boron	13	562	180	1,370	381	1.17	.23

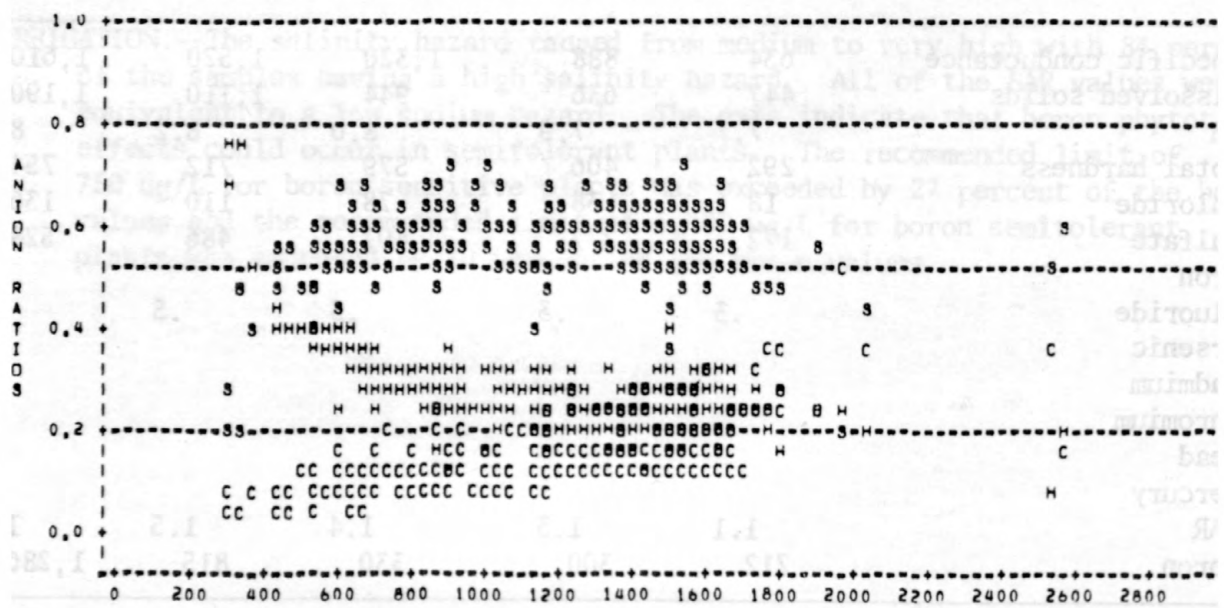
FREQUENCY DISTRIBUTION

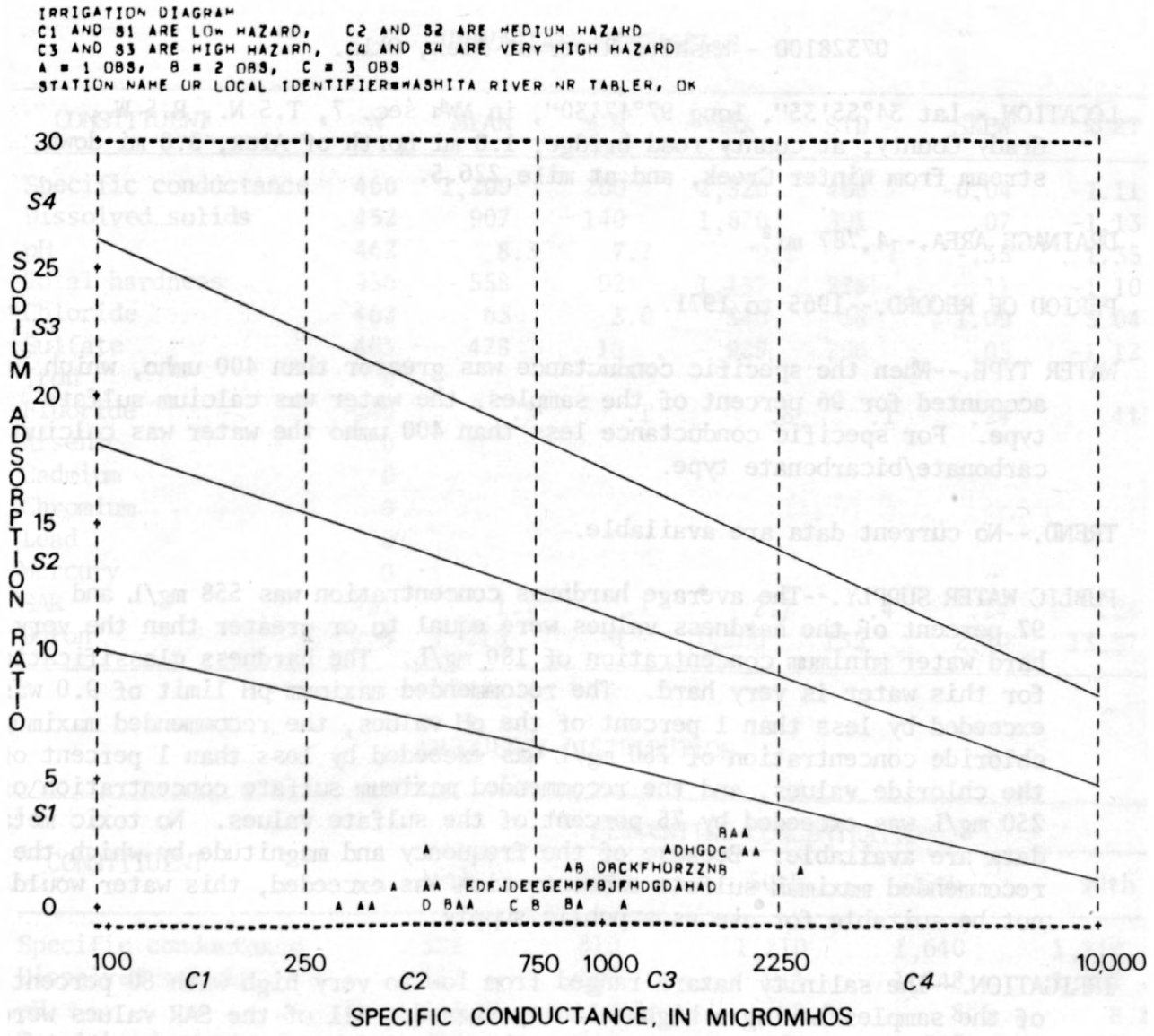
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	634	888	1,320	1,520	1,610
Dissolved solids	447	636	944	1,110	1,190
pH	7.7	7.9	8.0	8.2	8.4
Total hardness	292	406	579	712	754
Chloride	18	38	78	110	136
Sulfate	172	277	407	486	528
Iron					
Fluoride	.3	.3	.3	.5	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	1.1	1.3	1.4	1.5	1.8
Boron	212	300	330	815	1,286

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR TABLER, 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=WASHITA RIVER NR TABLER, 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=WASHITA RIVER NR TABLER, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07328100 - Washita River at Alex, Okla.

LOCATION.--Lat 34°55'35", long 97°47'30", in NW¼ sec. 7, T.5 N., R.5 W., Grady County, at county road bridge, 1.0 mi north of Alex, 3.8 mi downstream from Winter Creek, and at mile 226.5.

DRAINAGE AREA.--4,787 mi^2.

PERIOD OF RECORD.--1965 to 1971.

WATER TYPE.--When the specific conductance was greater than 400 umho, which accounted for 96 percent of the samples, the water was calcium sulfate type. For specific conductance less than 400 umho the water was calcium carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 558 mg/L and 97 percent of the hardness values were equal to or 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 limit of 9.0 was exceeded by less than 1 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 75 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 low to very high with 80 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects could occur in sensitive plants. The recommended limit of 750 ug/L for boron sensitive plants was exceeded by 2 percent of the boron values.

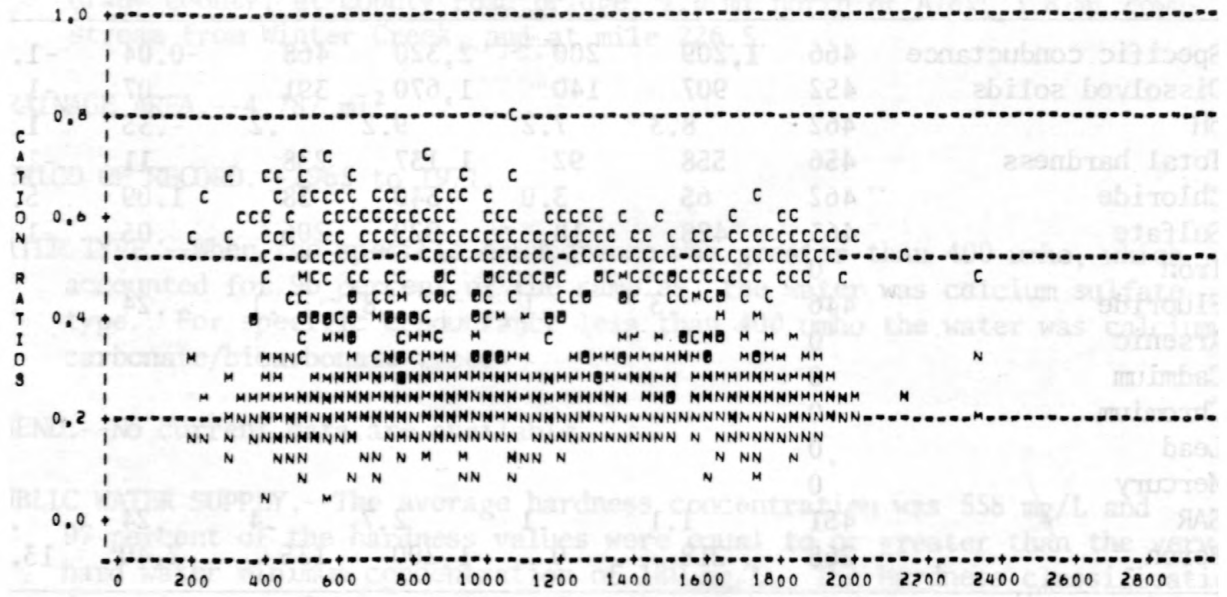
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	466	1,209	200	2,320	468	-0.04	-1.11
Dissolved solids	452	907	140	1,670	391	.07	-1.13
pH	462	8.3	7.2	9.2	.2	-.35	1.35
Total hardness	456	558	92	1,137	238	.11	-1.10
Chloride	462	65	3.0	340	38	1.09	5.04
Sulfate	463	428	18	929	206	.05	-1.12
Iron	0						
Fluoride	446	.3	.1	.8	.1	.24	.41
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	451	1.1	.1	2.7	.4	.24	.25
Boron	268	218	0	1,200	135	2.40	13.57

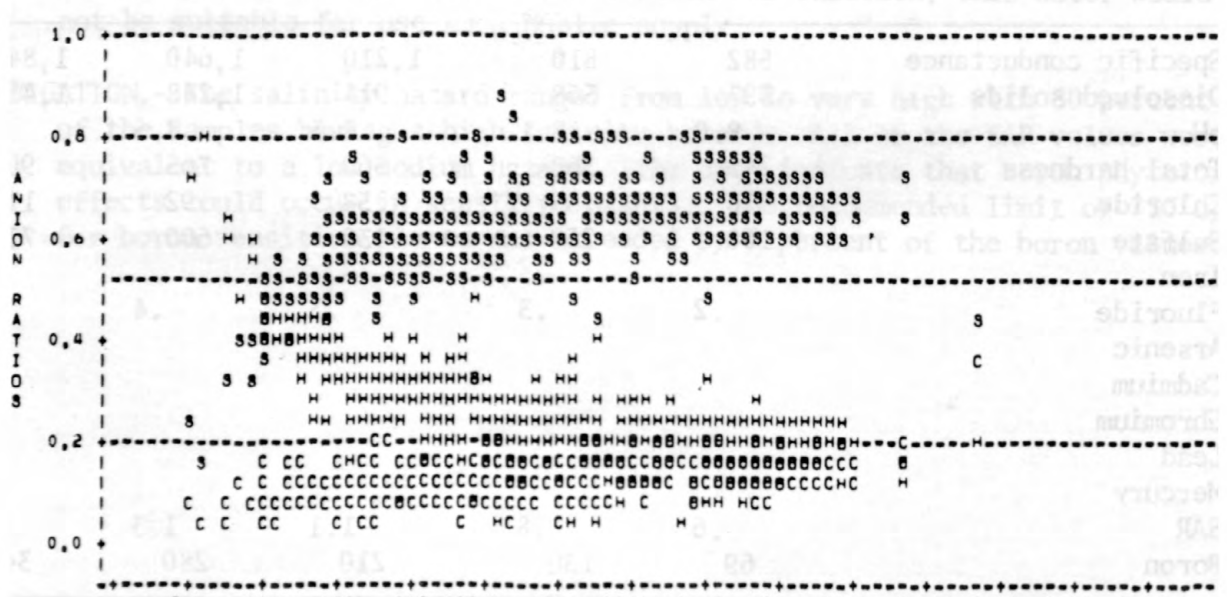
FREQUENCY DISTRIBUTION

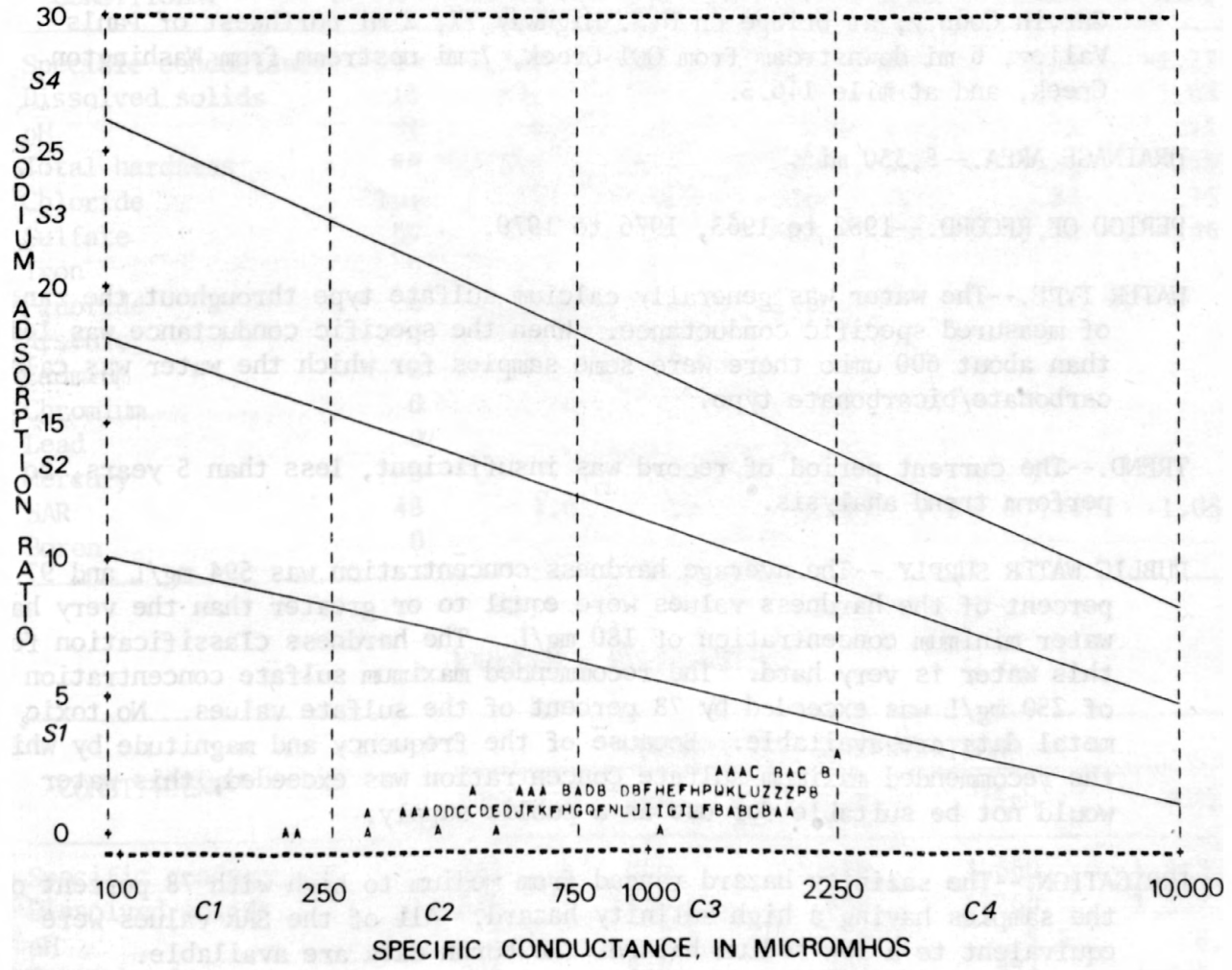
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	582	810	1,210	1,640	1,840
Dissolved solids	397	568	914	1,248	1,457
pH	8.0	8.1	8.3	8.5	8.5
Total hardness	249	360	560	765	900
Chloride	20	35	58	92	114
Sulfate	160	250	430	600	710
Iron					
Fluoride	.2	.3	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.6	.8	1.1	1.3	1.6
Boron	69	130	210	280	340

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER AT ALEX, 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=WASHITA RIVER AT ALEX, 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-WASHITA RIVER AT ALEX, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07328500 - Washita River near Pauls Valley, Okla.

LOCATION.--Lat 34°45'17", long 97°15'04", in SE¼ sec. 1, T.3 N., R.1 W., Garvin County, at bridge on U.S. Highway 77, 2 mi northwest of Pauls Valley, 6 mi downstream from Owl Creek, 7 mi upstream from Washington Creek, and at mile 146.5.

DRAINAGE AREA.--5,330 mi^2.

PERIOD OF RECORD.--1952 to 1963, 1976 to 1979.

WATER TYPE.--The water was generally calcium sulfate type throughout the range of measured specific conductance. When the specific conductance was less than about 600 umho there were some samples for which the water was calcium carbonate/bicarbonate type.

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

PUBLIC WATER SUPPLY.--The average hardness concentration was 594 mg/L and 97 percent of the hardness values were equal to or greater than the very hard water minimum concentration of 180 mg/L. The hardness classification for this water is very hard. The recommended maximum sulfate concentration of 250 mg/L was exceeded by 78 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 high with 78 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. No boron data are available.

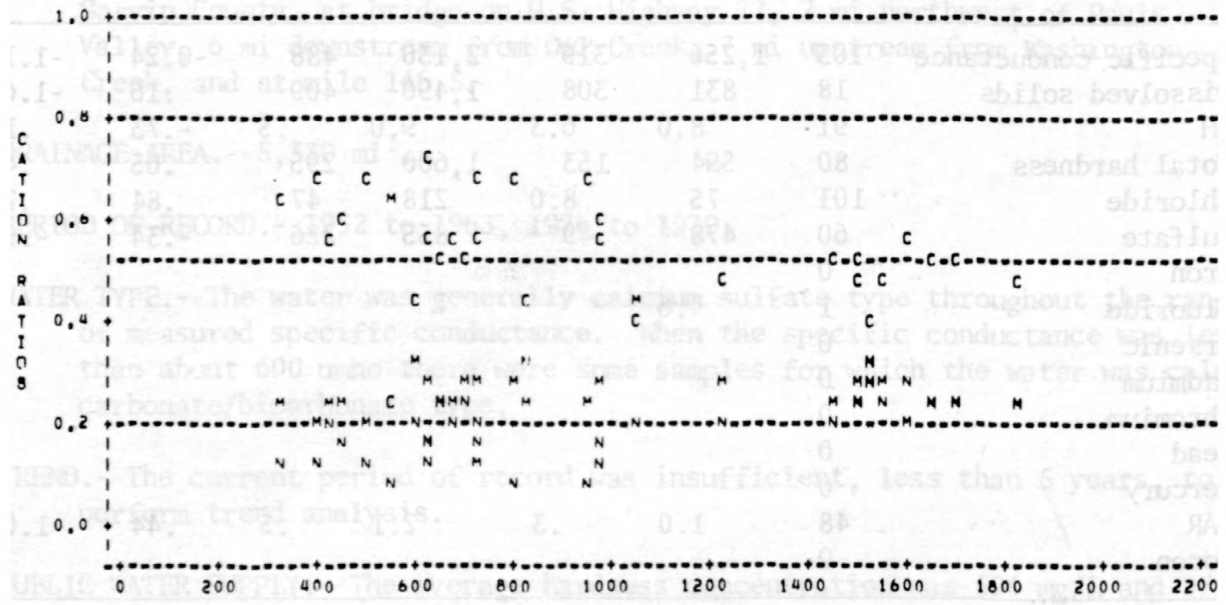
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	103	1,256	319	2,130	488	-0.24	-1.17
Dissolved solids	18	831	308	1,490	409	.16	-1.63
pH	91	8.0	6.3	9.0	.5	-.73	.11
Total hardness	80	594	153	1,600	295	.65	.48
Chloride	101	75	8.0	218	47	.84	.75
Sulfate	60	478	49	855	226	-.34	-.96
Iron	0						
Fluoride	1	.6					
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	48	1.0	.3	2.1	.5	.44	-1.05
Boron	0						

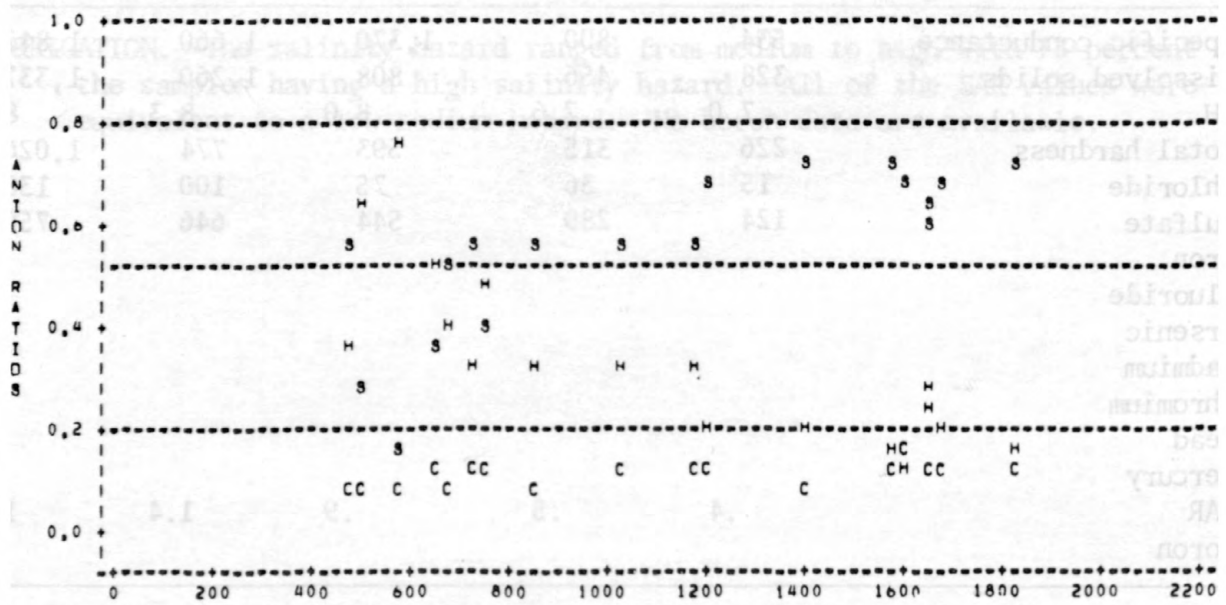
FREQUENCY DISTRIBUTION

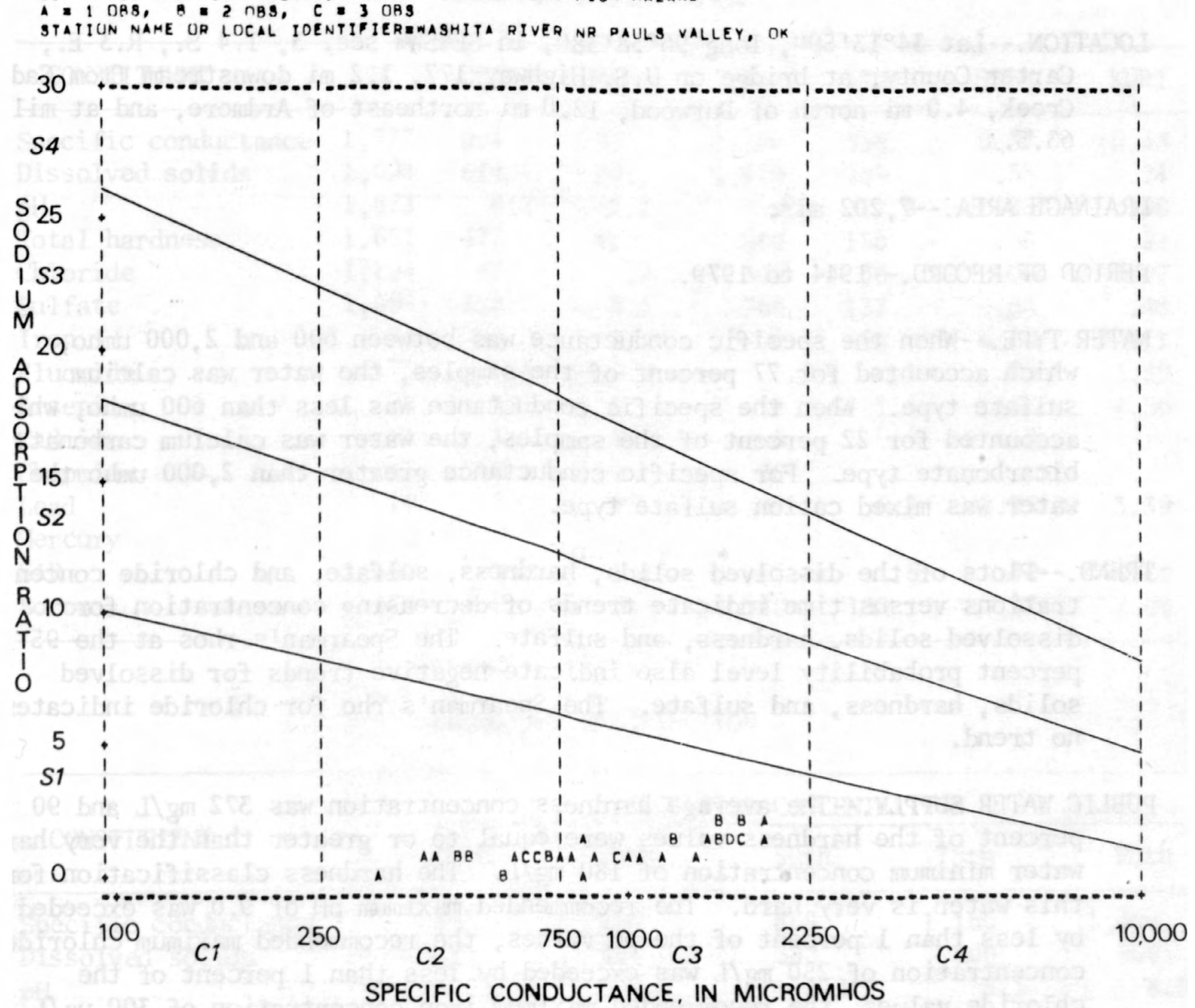
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	534	800	1,370	1,660	1,842
Dissolved solids	328	456	808	1,260	1,337
pH	7.0	7.6	8.0	8.3	8.4
Total hardness	226	315	593	774	1,026
Chloride	15	36	75	100	138
Sulfate	124	289	544	646	759
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.4	.5	.9	1.4	1.8
Boron					

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR PAULS VALLEY, 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=WASHITA RIVER NR PAULS VALLEY, 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=WASHITA RIVER NR PAULS VALLEY, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07331000 - Washita River near Durwood, Okla.

LOCATION.--Lat 34°13'59", long 96°58'38", in SE¼SW¼ sec. 3, T.4 S., R.3 E., Carter County, at bridge on U.S. Highway 177, 1.2 mi downstream from Caddo Creek, 4.0 mi north of Durwood, 12.0 mi northeast of Ardmore, and at mile 63.5.

DRAINAGE AREA.--7,202 mi^2.

PERIOD OF RECORD.--1944 to 1979.

WATER TYPE.--When the specific conductance was between 600 and 2,000 umho, which accounted for 77 percent of the samples, the water was calcium sulfate type. When the specific conductance was less than 600 umho, which accounted for 22 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance greater than 2,000 umho the water was mixed cation sulfate type.

TREND.--Plots of the dissolved solids, hardness, sulfate, and chloride concentrations versus time indicate trends of decreasing concentration for dissolved solids, hardness, and sulfate. The Spearman's rhos at the 95-percent probability level also indicate negative trends for dissolved solids, hardness, and sulfate. The Spearman's rho for chloride indicates no trend.

PUBLIC WATER SUPPLY.--The average hardness concentration was 372 mg/L and 90 percent of the hardness values were equal to or 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 less than 1 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, the recommended maximum iron concentration of 300 ug/L was exceeded by 6 percent of the iron values, and the recommended maximum sulfate concentration of 250 mg/L was exceeded by 36 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/or the magnitude by which the recommended maximum iron 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 high with 62 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that phytotoxic effects could occur in boron sensitive plants. The recommended limit of 750 ug/L for boron sensitive plants was exceeded by 3 percent of the boron values.

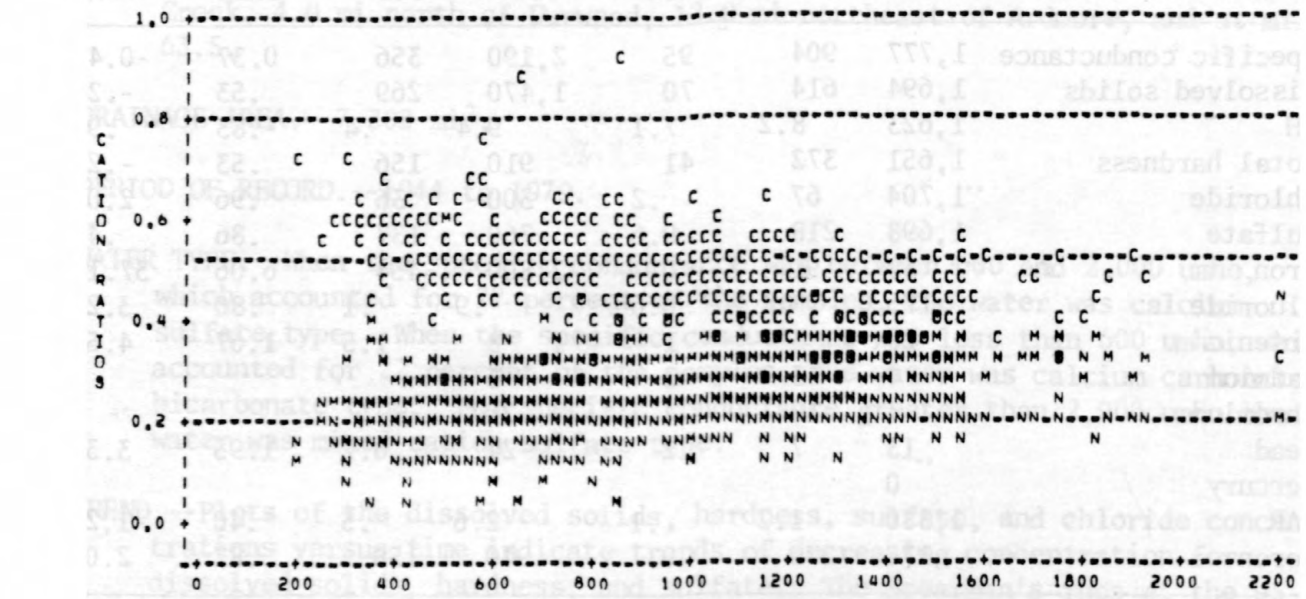
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	1,777	904	95	2,190	356	0.37	-0.43
Dissolved solids	1,694	614	70	1,470	269	.53	-.24
pH	1,623	8.2	7.1	9.4	.4	-.83	.98
Total hardness	1,651	372	41	910	156	.53	-.22
Chloride	1,704	67	.2	300	36	.96	2.07
Sulfate	1,698	218	9.6	760	137	.86	.48
Iron	38	91	0	2,800	454	6.06	37.11
Fluoride	175	.4	0.0	.9	.1	.80	3.29
Arsenic	20	3	1	8	1.5	1.67	4.56
Cadmium	4	3	2	5			
Chromium	3	10	4	20			
Lead	13	7	2	24	6.7	1.95	3.39
Mercury	0						
SAR	1,380	1.2	.1	2.6	.5	.40	-1.26
Boron	172	279	0	940	158	.87	2.09

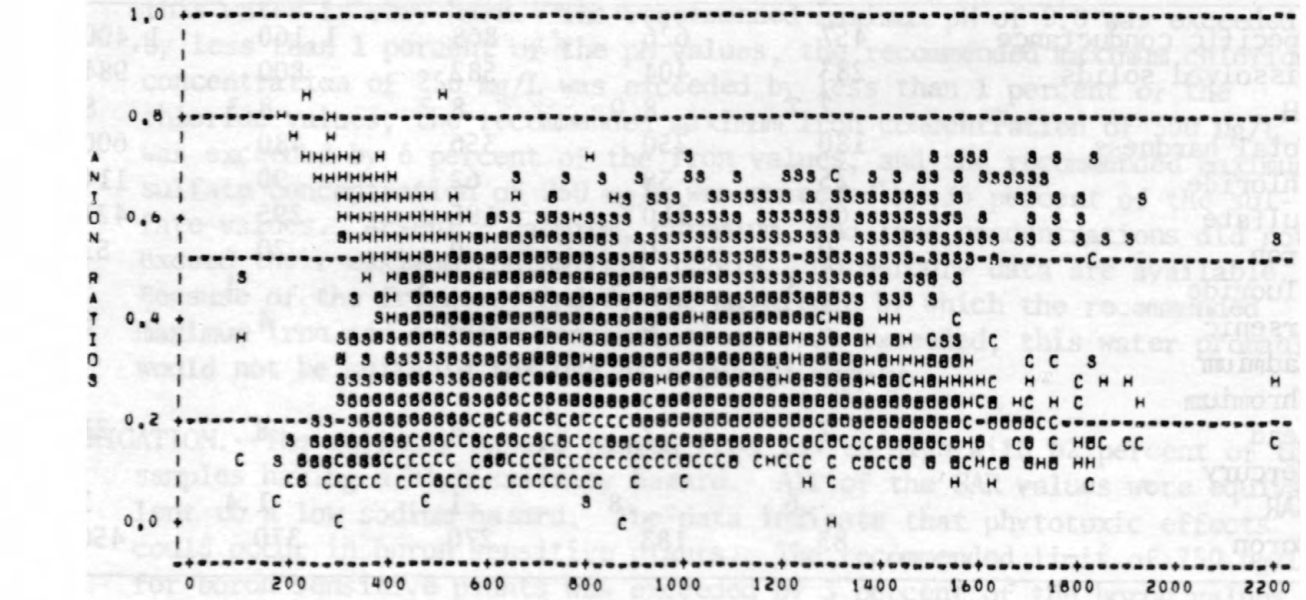
FREQUENCY DISTRIBUTION

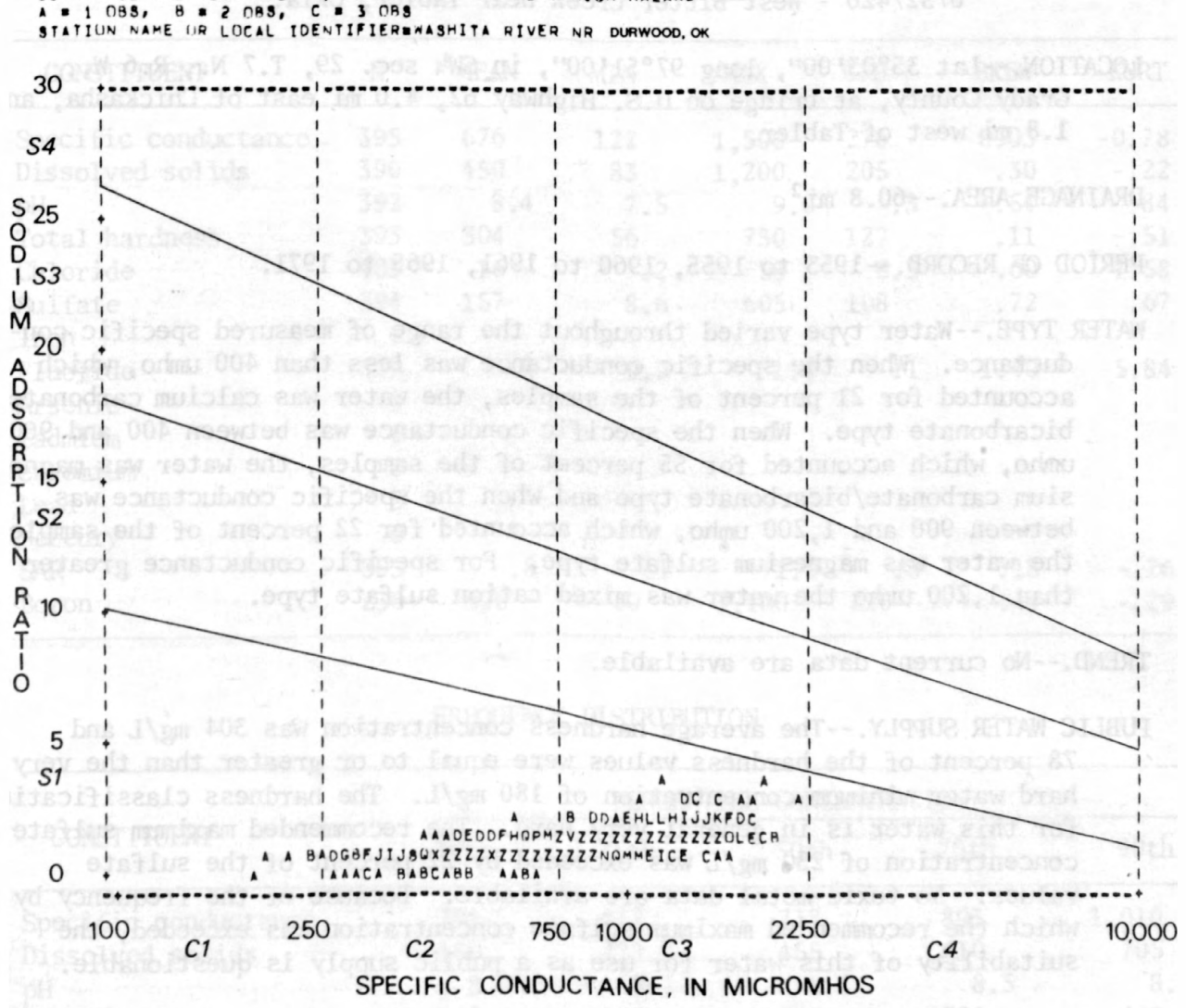
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	457	626	868	1,160	1,400
Dissolved solids	283	404	582	800	984
pH	7.7	8.0	8.2	8.3	8.5
Total hardness	180	250	356	480	600
Chloride	25	38	62	90	114
Sulfate	60	110	195	295	421
Iron	0	0	0	20	52
Fluoride	.3	.3	.3	.4	.5
Arsenic	2	2	3	4	5
Cadmium					
Chromium					
Lead	2	2	4	8	21
Mercury					
SAR	.6	.8	1.1	1.4	1.7
Boron	83	183	270	370	450

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WASHITA RIVER NR DURWOOD, 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=WASHITA RIVER NR DURWOOD, 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=WASHITA RIVER NR DURWOOD, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327420 - West Bitter Creek near Tabler, Okla.

LOCATION.--Lat 35°03'00", long 97°51'00", in SW¼ sec. 29, T.7 N., R.6 W., Grady County, at bridge on U.S. Highway 62, 4.0 mi east of Chickasha, and 1.8 mi west of Tabler.

DRAINAGE AREA.--60.8 mi^2.

PERIOD OF RECORD.--1953 to 1955, 1960 to 1961, 1965 to 1971.

WATER TYPE.--Water type varied throughout the range of measured specific conductance. When the specific conductance was less than 400 umho, which accounted for 21 percent of the samples, the water was calcium carbonate/bicarbonate type. When the specific conductance was between 400 and 900 umho, which accounted for 55 percent of the samples, the water was magnesium carbonate/bicarbonate type and when the specific conductance was between 900 and 1,200 umho, which accounted for 22 percent of the samples, the water was magnesium sulfate type. For specific conductance greater than 1,200 umho the water was mixed cation sulfate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 304 mg/L and 78 percent of the hardness values were equal to or 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 sulfate concentration of 250 mg/L was exceeded by 22 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 is questionable.

IRRIGATION.--The salinity hazard ranged from low to high with 46 percent of the samples having a high salinity hazard. All of the SAR values were equivalent to a low sodium hazard. The data indicate that boron phytotoxic effects could occur in sensitive and semitolerant plants. The recommended limit of 750 ug/L for boron sensitive plants was exceeded by 7 percent of the boron values and the recommended limit of 1,000 ug/L for boron semitolerant plants was exceeded by less than 1 percent of the boron values.

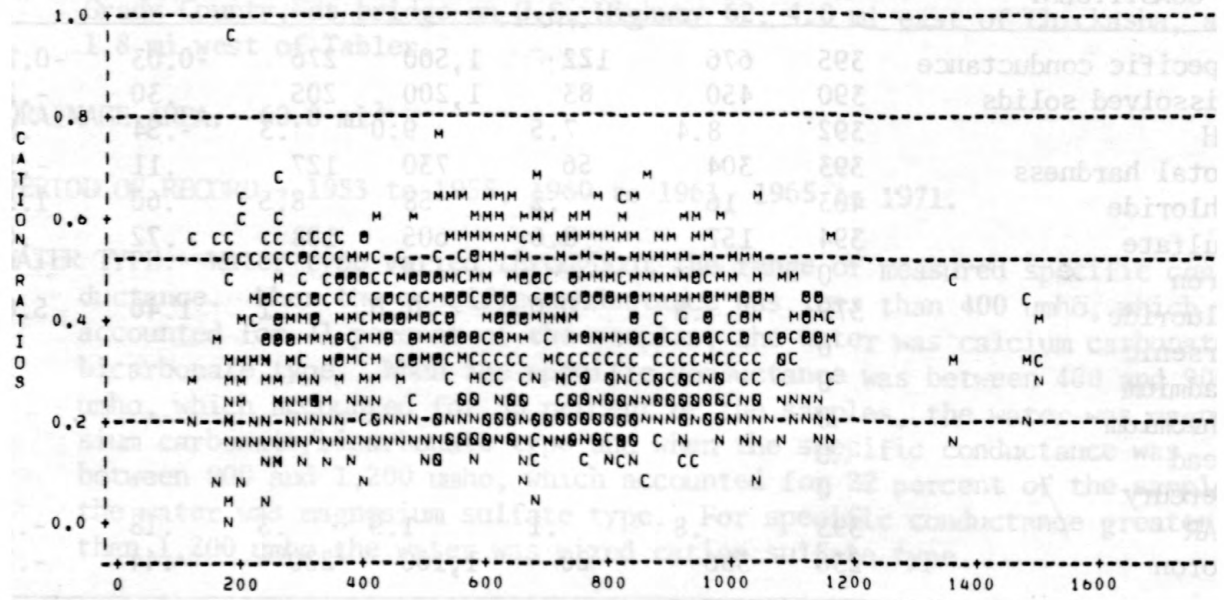
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	395	676	122	1,500	276	-0.03	-0.78
Dissolved solids	390	450	83	1,200	205	.30	-.22
pH	392	8.4	7.5	9.0	.3	-.54	.84
Total hardness	393	304	56	730	127	.11	-.51
Chloride	403	16	.2	58	8.5	.60	1.58
Sulfate	394	157	8.6	605	108	.72	.67
Iron	0						
Fluoride	379	.3	0.0	1.0	.1	1.40	5.84
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	393	.8	.1	1.9	.3	.18	-.26
Boron	236	396	20	1,100	220	.44	-.29

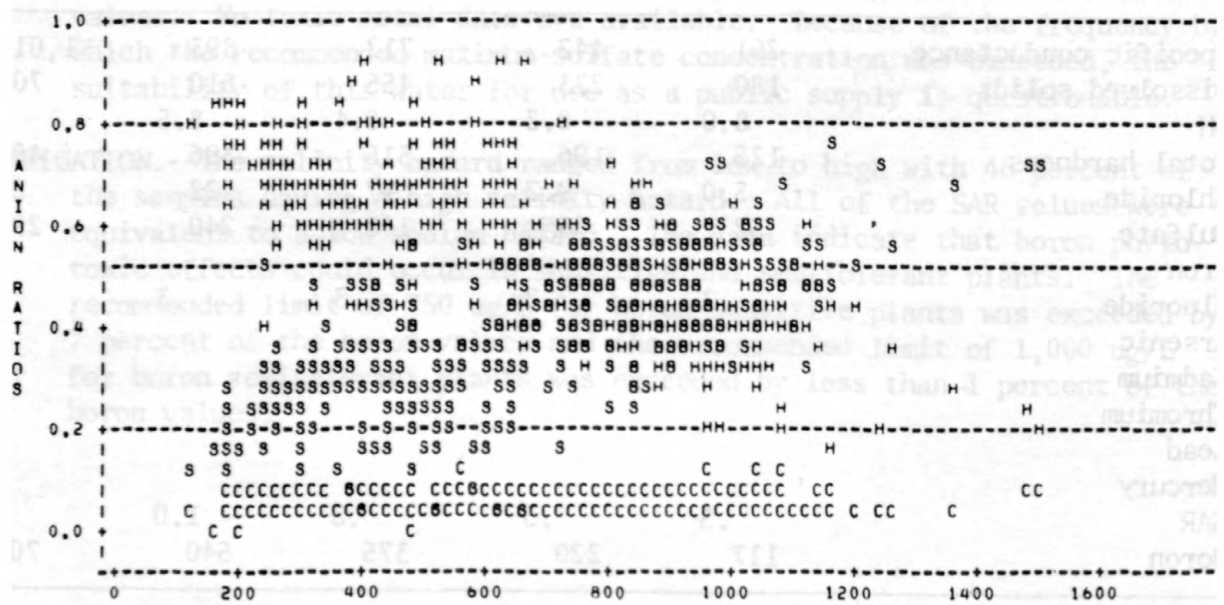
FREQUENCY DISTRIBUTION

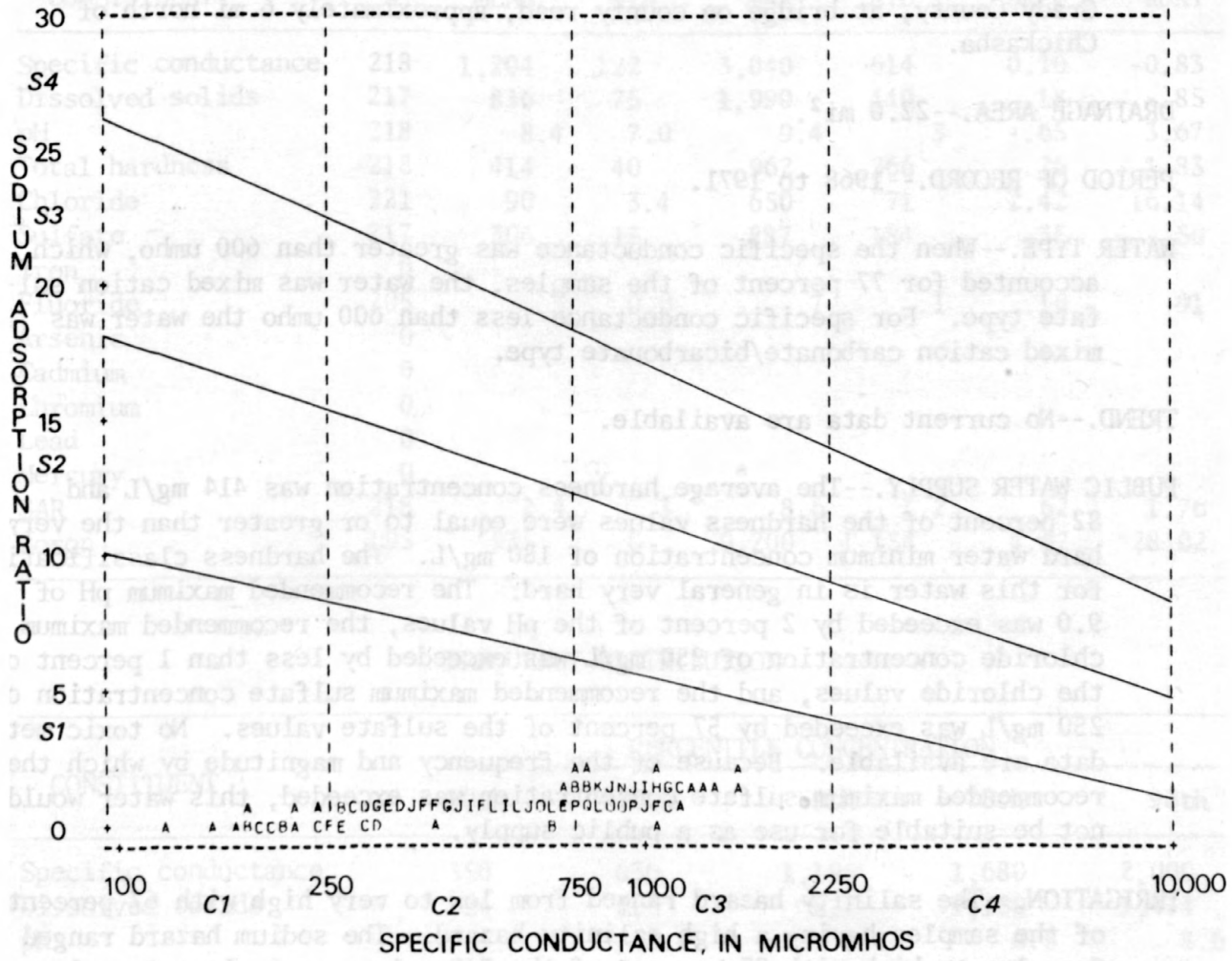
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	291	442	712	893	1,010
Dissolved solids	180	273	455	610	705
pH	8.0	8.2	8.4	8.5	8.6
Total hardness	125	196	315	396	458
Chloride	5.0	9.2	17	22	25
Sulfate	32	63	148	240	290
Iron					
Fluoride	.2	.2	.3	.3	.4
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.3	.5	.8	1.0	1.2
Boron	117	220	375	540	703

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WEST BITTER CREEK NR TABLER, 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=WEST BITTER CREEK NR TABLER, 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=WEST BITTER CREEK NR TABLER, OK
SODIUM ADSORPTION RATIO
30
25
20
15
10
5
0
S4
S3
S2
S1
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE, IN MICROMHOS

07327320 - West Salt Creek near Chickasha, Okla.

LOCATION.--Lat 35°09'00", long 97°57'00", in NW¼ sec. 28, T.8 N., R.7 W., Grady County, at bridge on county road, approximately 6 mi north of Chickasha.

DRAINAGE AREA.--22.0 mi^2.

PERIOD OF RECORD.--1968 to 1971.

WATER TYPE.--When the specific conductance was greater than 600 umho, which accounted for 77 percent of the samples, the water was mixed cation sulfate type. For specific conductance less than 600 umho the water was mixed cation carbonate/bicarbonate type.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 414 mg/L and 82 percent of the hardness values were equal to or 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 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 57 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 low to very high with 67 percent of the samples having a high salinity hazard. The sodium hazard ranged from low to high with 97 percent of the SAR values equivalent to a low sodium hazard. The boron data indicate that phytotoxic effects could occur even in boron tolerant plants. The recommended 750 ug/L limit for boron sensitive plants was exceeded by 43 percent of the boron values, the recommended 1,000 ug/L limit for boron semitolerant plants was exceeded by 29 percent of the boron values, and the recommended 2,000 ug/L limit for boron tolerant plants was exceeded by 8 percent of the boron values.

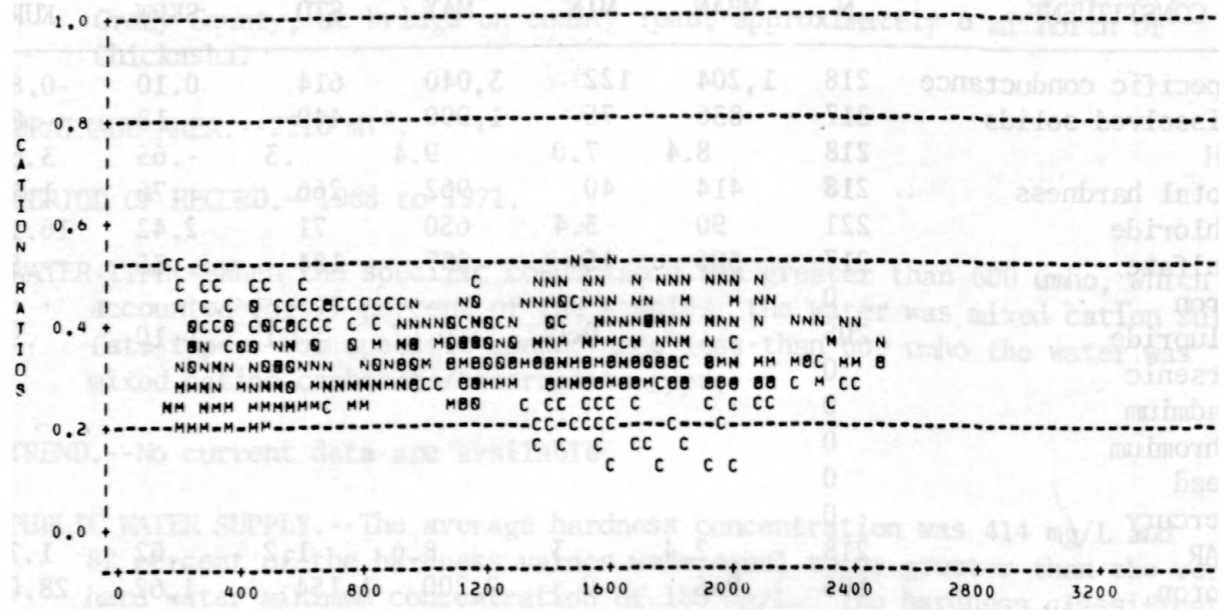
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	218	1,204	122	3,040	614	0.10	-0.83
Dissolved solids	217	836	75	1,990	449	.18	-.85
pH	218	8.4	7.0	9.4	.3	-.65	3.67
Total hardness	218	414	40	962	266	.76	1.83
Chloride	221	90	3.4	650	71	2.42	16.14
Sulfate	217	306	15	887	184	.35	-.50
Iron	0						
Fluoride	205	.3	0.0	.7	.1	.10	.91
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	218	2.4	.3	8.6	1.2	.62	1.76
Boron	195	935	0	9,200	1,154	4.62	28.02

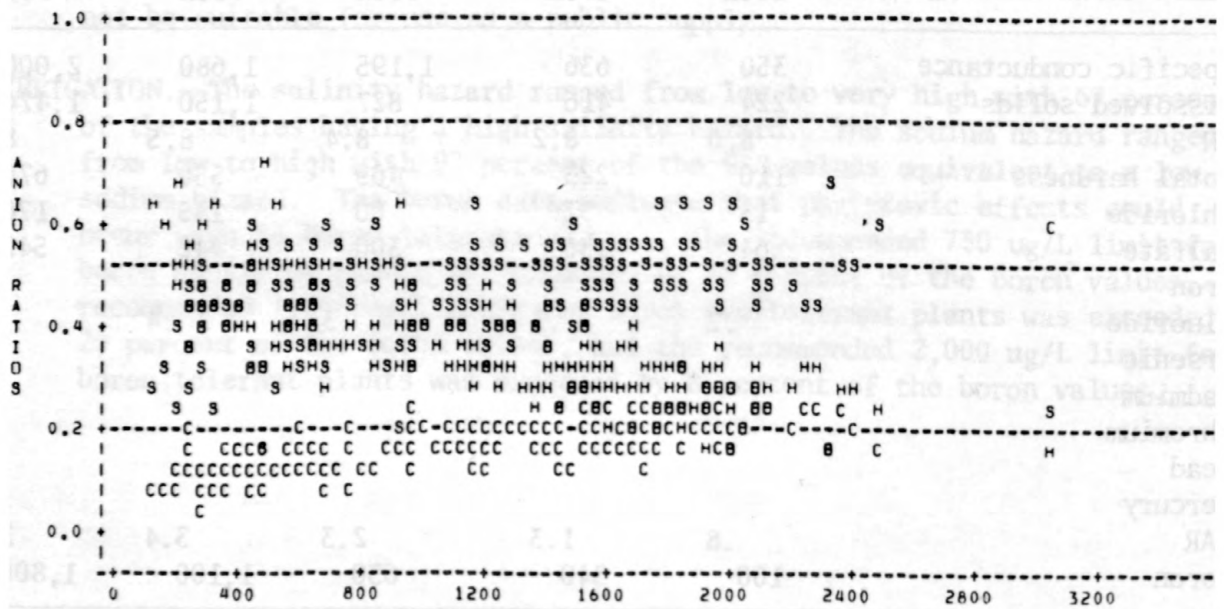
FREQUENCY DISTRIBUTION

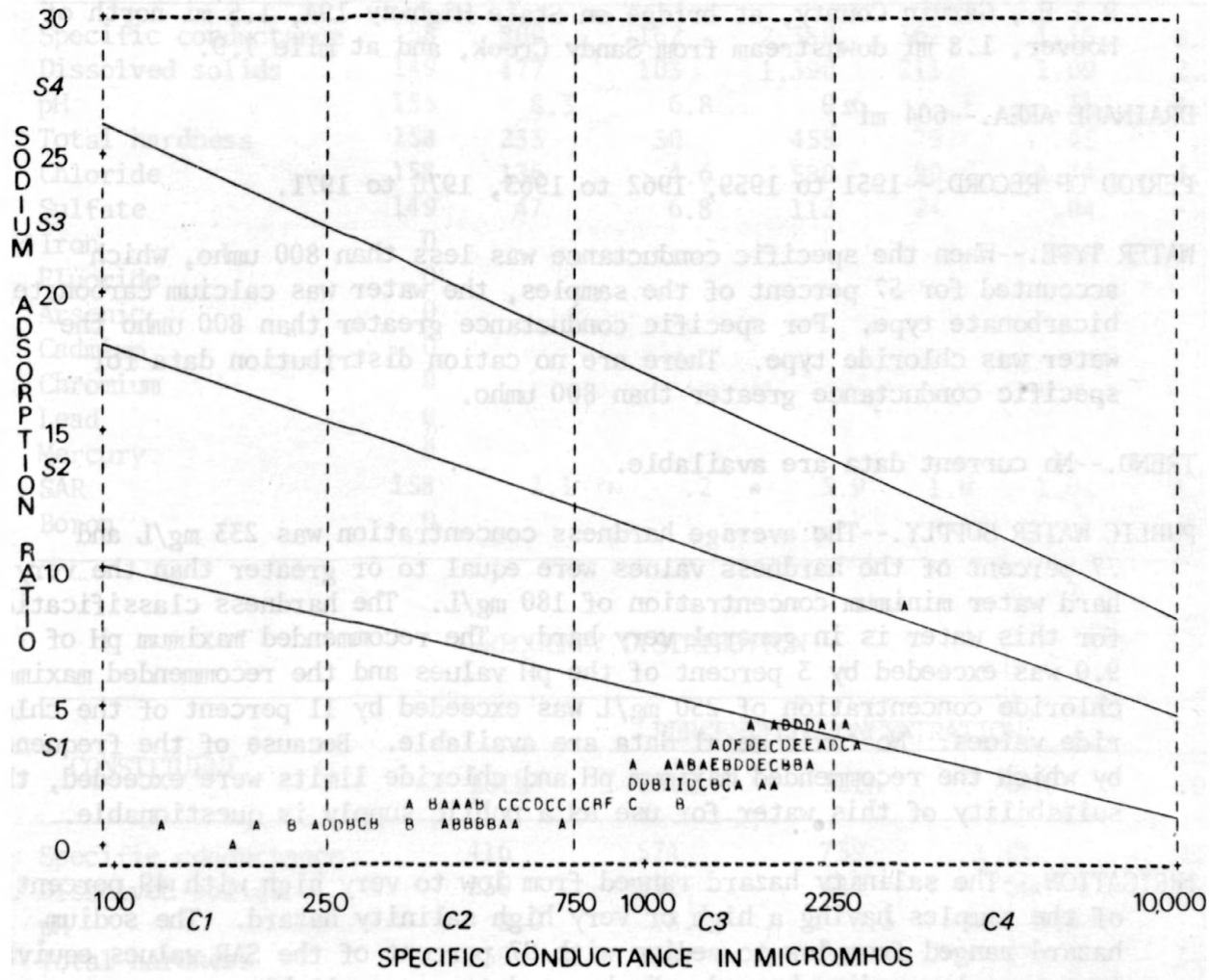
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	350	636	1,195	1,680	2,000
Dissolved solids	224	416	827	1,150	1,474
pH	8.0	8.2	8.4	8.5	8.6
Total hardness	110	223	409	550	670
Chloride	13	32	80	135	170
Sulfate	64	130	300	442	542
Iron					
Fluoride	.2	.3	.3	.4	.5
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.8	1.3	2.3	3.4	3.9
Boron	160	340	630	1,100	1,800

CATION RATIO PLOT
N IS SODIUM ION RATIO, C IS CALCIUM ION RATIO, M IS MAGNESIUM ION RATIO
STATION NAME OR LOCAL IDENTIFIER=WEST SALT CREEK NR CHICKASHA, 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=WEST SALT CREEK NR CHICKASHA, 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=WEST SALT CREEK NR CHICKASHA, OK
SODIUM ADSORPTION RATIO
30
S4
25
S3
20
15
S2
10
5
S1
0
100
250
750
1000
2250
10,000
C1
C2
C3
C4
SPECIFIC CONDUCTANCE IN MICROMHOS

07329700 - Wildhorse Creek near Hoover, Okla.

LOCATION.--Lat 34°32'29", long 97°14'49", on west line of SW¼ sec. 19, T.1 N., R.1 E., Garvin County, at bridge on State Highway 19A, 1.5 mi north of Hoover, 1.8 mi downstream from Sandy Creek, and at mile 7.9.

DRAINAGE AREA.--604 mi^2.

PERIOD OF RECORD.--1951 to 1959, 1962 to 1963, 1970 to 1971.

WATER TYPE.--When the specific conductance was less than 800 umho, which accounted for 57 percent of the samples, the water was calcium carbonate/bicarbonate type. For specific conductance greater than 800 umho the water was chloride type. There are no cation distribution data for specific conductance greater than 800 umho.

TREND.--No current data are available.

PUBLIC WATER SUPPLY.--The average hardness concentration was 233 mg/L and 77 percent of the hardness values were equal to or 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 pH of 9.0 was exceeded by 3 percent of the pH values and the recommended maximum chloride concentration of 250 mg/L was exceeded by 11 percent of the chloride values. No toxic metal data are available. Because of the frequency by which the recommended maximum pH and chloride limits were exceeded, the suitability of this water for use as a public supply is questionable.

IRRIGATION.--The salinity hazard ranged from low to very high with 49 percent of the samples having a high or very high salinity hazard. The sodium hazard ranged from low to medium with 97 percent of the SAR values equivalent to a low sodium hazard. No boron data are available.

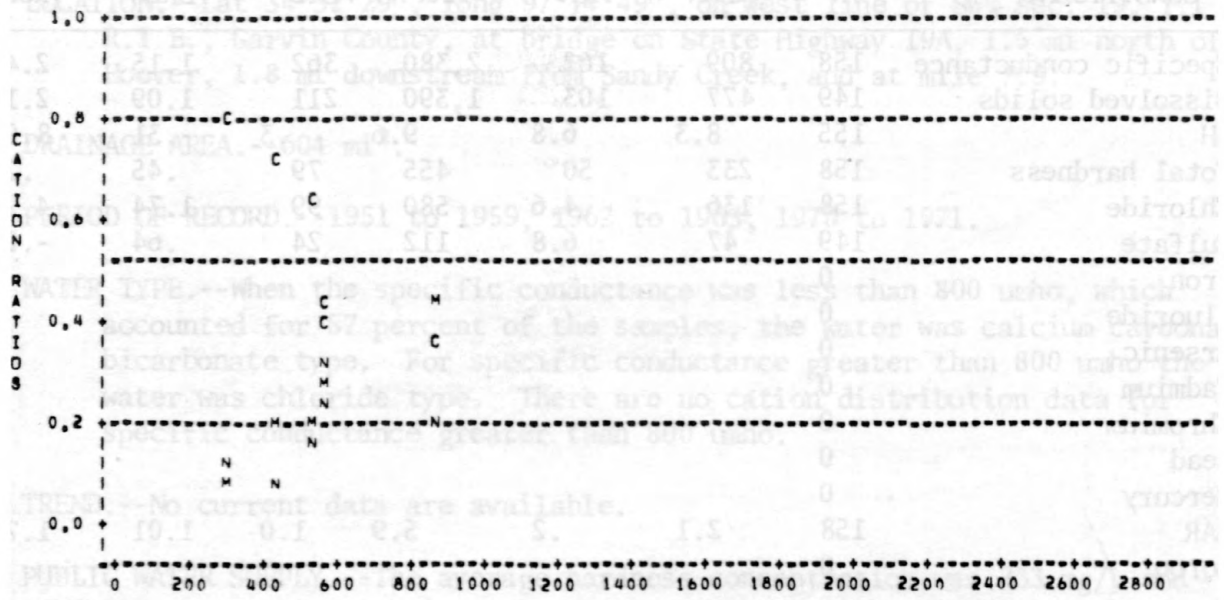
UNIVARIATE STATISTICS

CONSTITUENT	N	MEAN	MIN	MAX	STD	SKEW	KURT
Specific conductance	158	809	162	2,380	362	1.15	2.40
Dissolved solids	149	477	103	1,390	211	1.09	2.16
pH	155	8.3	6.8	9.6	.3	-.31	8.95
Total hardness	158	233	50	455	79	.45	.21
Chloride	158	136	4.6	580	99	1.74	4.25
Sulfate	149	47	6.8	112	24	.64	-.22
Iron	0						
Fluoride	0						
Arsenic	0						
Cadmium	0						
Chromium	0						
Lead	0						
Mercury	0						
SAR	158	2.1	.2	5.9	1.0	1.01	1.74
Boron	0						

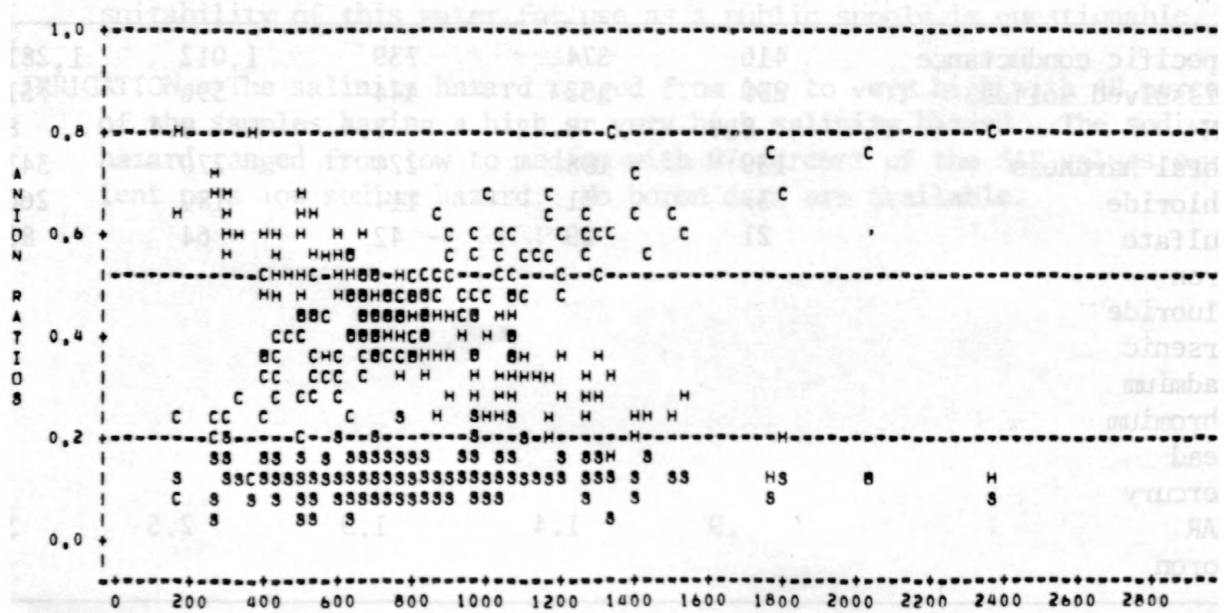
FREQUENCY DISTRIBUTION

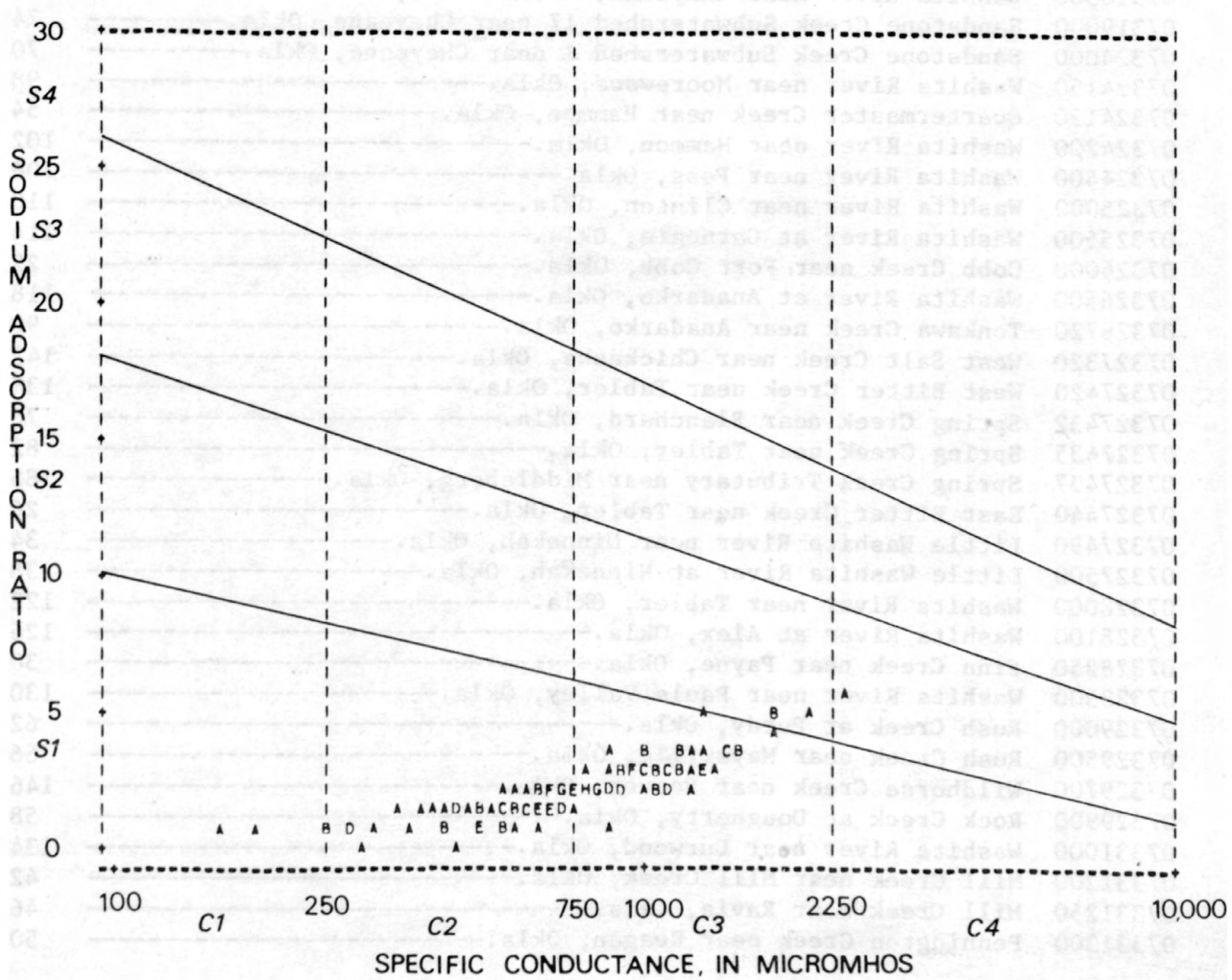
CONSTITUENT	PERCENTILE CONCENTRATION				
	10th	25th	50th	75th	90th
Specific conductance	416	574	739	1,012	1,281
Dissolved solids	239	352	444	596	751
pH	8.0	8.2	8.3	8.4	8.5
Total hardness	139	188	224	270	343
Chloride	37	71	114	180	260
Sulfate	21	29	42	64	82
Iron					
Fluoride					
Arsenic					
Cadmium					
Chromium					
Lead					
Mercury					
SAR	.9	1.4	1.9	2.5	3.3
Boron					

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





*U.S. GOVERNMENT PRINTING OFFICE:1983-671-047/342

Table 3.--List of stations in downstream order