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# Impact of Oil & Gas Production on Salinity in Major Fresh Water Aquifers

# IMPACT OF OIL AND GAS PRODUCTION ON SALINITY IN MAJOR FRESH WATER AQUIFERS

(ARKANSAS, LOUISIANA, NEW MEXICO, OKLAHOMA)

FOR

INTERSTATE OIL COMPACT COMMISSION

July, 1978

Prepared by
Louis R. Reeder And Associates
4815 South Sheridan
Tulsa, Oklahoma 74145

# IMPACT OF OIL AND GAS PRODUCTION ON SALINITY IN MAJOR FRESH WATER AQUIFERS

**INTERSTATE OIL COMPACT COMMISSION**

HEADQUARTERS OFFICE: 900 N. E. 23RD STREET • P. O. BOX 53127 • OKLAHOMA CITY, OKLAHOMA 73105

TELEPHONE: (405) 525-3556

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ROBERT F. BENNETT
Chairman
Governor of Kansas

W. TIMOTHY DOWD
Executive Director

# INTRODUCTION

For the past several years a controversy has existed between the oil and gas producing states, on the one hand, and the Environmental Protection Agency, on the other, as to whether oil and gas operations were causing contamination of fresh water aquifers. The states and the Interstate Oil Compact Commission have maintained that state regulatory standards protect underground drinking water sources. In May, 1978 the National Drinking Water Advisory Council, a statutory arm of EPA, entered the controversy. The Council, through its chairman, challenged the EPA and the states to produce a study which would prove either one contention or the other. At the Council's suggestion, the IOCC responded with two studies covering the five major producing states in EPA's Region VI.

These two studies by independent consultants have been combined into one publication. Each consultant found that there was no evidence of oil and gas operations causing any increase in the salinity of fresh water aquifers.

W. Timothy Dowd

MEMBER STATES: ALABAMA - ALASKA - ARIZONA - ARKANSAS - CALIFORNIA - COLORADO - FLORIDA - ILLINOIS - INDIANA - KANSAS - KENTUCKY
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W. Timothy Dowd

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Data furnished by the personnel of various agencies of Arkansas, Louisiana, New Mexico and Oklahoma was essential to the completion of this report. The assistance and contributions of the following persons are acknowledged:

Mr. Ralph A. Dumas, Director of Production and Conservation, Arkansas Oil and Gas Commission

Mr. Arnold C. Chauviere, Assistant Commissioner, Department of Natural Resources, Office of Conservation, State of Louisiana

Mr. R. L. Stamets, Technical Support Chief, State of New Mexico Energy and Minerals Department, Oil Conservation Division

Mr. Sam F. Shakely, Manager, Pollution Abatement, Oklahoma Corporation Commission

Thanks go to the Herndon Map Company of Oklahoma City, Oklahoma for granting permission to use and reproduce their base maps and information for Oklahoma.

Conversations with Raphael G. Kazmann, of Baton Rouge, Louisiana, aided greatly in clarifying the hydrologic relationships of some of the aquifers in Louisiana. This was of considerable help in preparing portions of this report and his contribution is appreciated.

FIGURE I

INTERSTATE OIL COMPACT COMMISSION

EPA REGION VI SHOWING THE AREA OF INVESTIGATION OF THIS REPORT

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

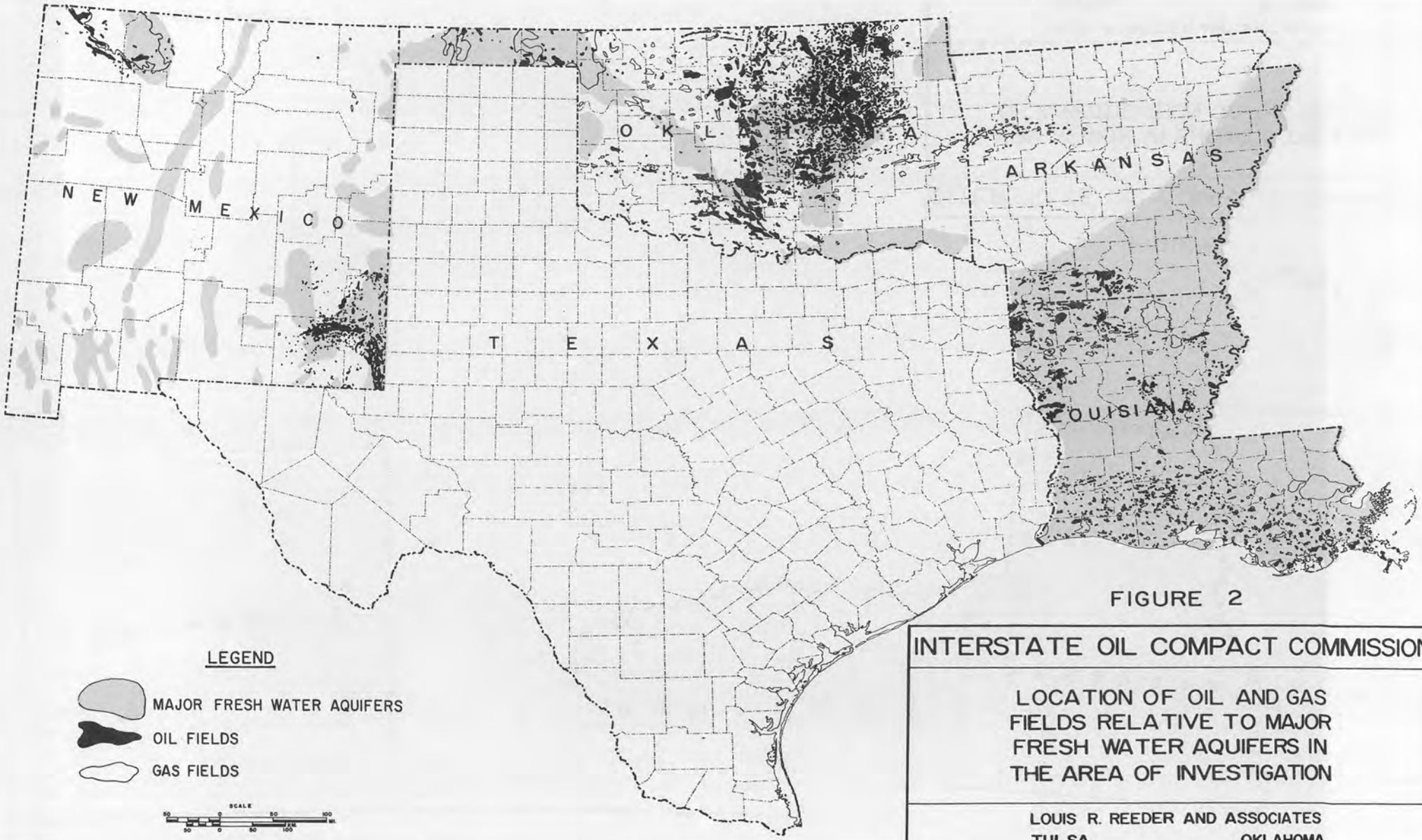



FIGURE 2

INTERSTATE OIL COMPACT COMMISSION

LOCATION OF OIL AND GAS FIELDS RELATIVE TO MAJOR FRESH WATER AQUIFERS IN THE AREA OF INVESTIGATION

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

## EXECUTIVE SUMMARY

The examination and interpretation of the chloride analyses available for this investigation indicated that no pollution can be attributed to oil and gas field salt water injection operations in the areas monitored by those analyses sources. This, however, does not preclude the possibility of isolated localized instances of contamination nor the existance of restricted areas of contamination which occurred prior to the enforcement of strict operating regulations. It may be concluded from the number of monitor analyses and the geographic distribution of the monitors that contamination of major fresh water aquifers by salt water injection located in areas of oil and gas field operations will be rare. In the areas of investigation, there appears to be more contamination coming from the natural water within the aquifers or aquifer systems than from outside sources.

### Arkansas

Analyses from 96 municipal and 4 industrial water wells located at 23 sites in six counties of southwestern Arkansas were studied.

The monitored aquifers in southwestern Arkansas are a continuation of those bearing the same name in Louisiana and are part of the same aquifer system, although slightly less complex hydrogeologically, than the system to the south and east in Louisiana.

Pollution resulting from salt water injection and disposal was not identified in the monitor analyses in areas which have been operational since 1920.

### Louisiana

Analyses from over 200 USGS monitor wells located in 22 parishes throughout Louisiana were studied.

The aquifers monitored are part of the hydrogeologically complex Mississippi Embayment, and are in areas of oil and gas production which

have been actively injecting salt water for disposal or pressure maintenance since shortly after oil was discovered in Louisiana in 1902.

The monitor analyses showed no identifiable pollution related to oil or gas field injection operations.

## New Mexico

Analyses from 70 municipal water wells located at 22 sites in six groundwater basins were studied.

The aquifers monitored are relatively simple hydrogeologically and are in areas of oil and gas production which have been developing since New Mexico began commercial production in 1923.

The monitor analyses showed no pollution related to oil or gas field injection operations.

## Oklahoma

Analyses from the wells of 75 municipal water systems located in 24 counties and withdrawing water from 6 major aquifers were examined.

The aquifers monitored are relatively simple hydrogeologically and all have been exposed to salt water injection for pressure maintenance, secondary recovery or disposal for varying periods of time since oil was discovered in 1897.

The monitor analyses showed no pollution attributable to oil and gas field injection operations.

This investigation was requested by the Interstate Oil Compact Commission. Its purpose is to establish the impact of oil and gas production on the salinity in major fresh water aquifers in Arkansas, Louisiana,

New Mexico, and Oklahoma; all located in EPA Region VI. Combined with Texas these states produce approximately 80 percent of the oil and 90 percent of the salt water in the United States.

Available data was to be used. No original testing or onsite visits were made to collect data for this report.

The term "milligrams per litre" (mg/l) which replaces the unit "parts per million" (ppm) is used throughout this report. The two units are equivalent at the dissolved-solid concentrations of less than about 7,000 milligrams per litre.

Detailed sections on specific areas and analyses follow this section.

## ARKANSAS

### Northwestern Arkansas Gas District

The gas fields are most numerous in the vicinity of Ft. Smith on the Arkansas River, a short distance east of the Oklahoma state line. The district extends eastward down the Arkansas River Valley across Crawford, Sebastian, Franklin, northern Logan, Johnson and Pope Counties and into central Conway County.

Inasmuch as the major portion of the fresh water supplies for the communities in this area are from surface impoundment, and the area has no major fresh water aquifers, this area is not considered in this investigation.

### Southern Arkansas Oil District

Most of the oil fields of Arkansas lie in the southern tier of counties extending from Miller on the Texas line across Layayette, Columbia, and Union Counties and into Ashley County. The district extends far enough north to include southern Nevada, Ouachita, and Calhoun Counties in the second tier north of the Louisiana border. Those counties of particular interest to this investigation include all those mentioned above except Ashley and Nevada.

The discovery of the El Dorado field in 1920 closely followed by the giant Smackover field in 1922 established Arkansas as an oil and gas producing state. Exploration, drilling, and producing operations continued to develop until large portions of the counties mentioned contained operating oil fields. Most of these fields are now operating under some type of secondary recovery, usually water flooding, and almost all of them have at least one injection well that is being used for salt water disposal. Almost all of the producing wells and the salt water disposal wells have been drilled through the major aquifers in the area.

## Southern Arkansas Aquifers

Although Arkansas has a large total water supply and relatively few water problems, limitations on groundwater availability or use are imposed by the chemical quality in nearly all parts of the state. Groundwater throughout Arkansas is subject to some mineralization; however, it is generally low and total dissolved solids, averaging about 271 mg/l and rarely exceeding 1,000 mg/l. The water is also very low in chloride concentration.

Nearly all of the Gulf Coastal Plain, roughly the southeastern half of Arkansas is underlain by one or more aquifers that will yield fairly large amounts of good quality water (Figure 2 and Figure 3). The principal fresh water aquifer underlying the six oil producing counties of interest in this investigation is the Sparta Sand. East of a north-south line through western Columbia and Ouachita Counties, younger aquifers are also used. West of the same north-south line, older and deeper aquifers are used as a source of fresh water.

Because the recharge area of the older underlying aquifers has a higher altitude than the younger overlying aquifers, the piezometric surface of the underlying aquifers is greater than that of the overlying aquifers. Under conditions when withdrawals from the overlying aquifers are unusually great and pressure sinks are created around the pumping wells, leakage can occur from the underlying aquifers into the overlying aquifers. This condition does not create serious problems unless the water in the underlying aquifer is brackish or salty, then there is an increase in chlorides in the overlying aquifer in the area where the leakage is taking place.

Analyses of municipal water supply wells and oil field data were furnished by Mr. Ralph A. Dumas, Director of Production and Conservation, Arkansas Oil and Gas Commission. Analyses of chloride concentrations for municipal water wells producing in areas of active salt water injection and compiled by the Arkansas State Health Department were received for 21 communities and 2 industrial sites. Maps are attached showing the location of each city for which data was received and the proximity to oil and gas operations. Accompanying each map for the area shown are basic data sheets

and graphs of the chloride analyses from the water wells supplying water to the municipal systems. The precise location of each well could not be plotted to the scale of the maps so the bounding limits of the water well field are shown as heavy circles carrying the town name on the map. A review of the analyses by county follows:

Calhoun

Hampton, the only area sampled in Calhoun County averages less than 20 mg/l chloride for five wells. There is no indication of any oil field pollution in the area sampled.

Ouachita

Municipal wells for the towns of Louann, Stephens, and Camden were sampled in Ouachita County. The average chloride concentration for the wells of these three towns is under 20 mg/l for the data processed. One anomalous reading in Camden for the Burton well in 1978 indicates 330 mg/l. This probably represents salt water encroachment within the aquifer or leakage from a lower aquifer with higher salinity.

Miller

One municipal well at Garland City and one municipal well at Texarkana was sampled in this county. The Miller well averaged about 45 mg/l chloride and the Texarkana well showed 11 mg/l from one analysis. No pollution from oil field operations is indicated in either analysis.

Lafayette

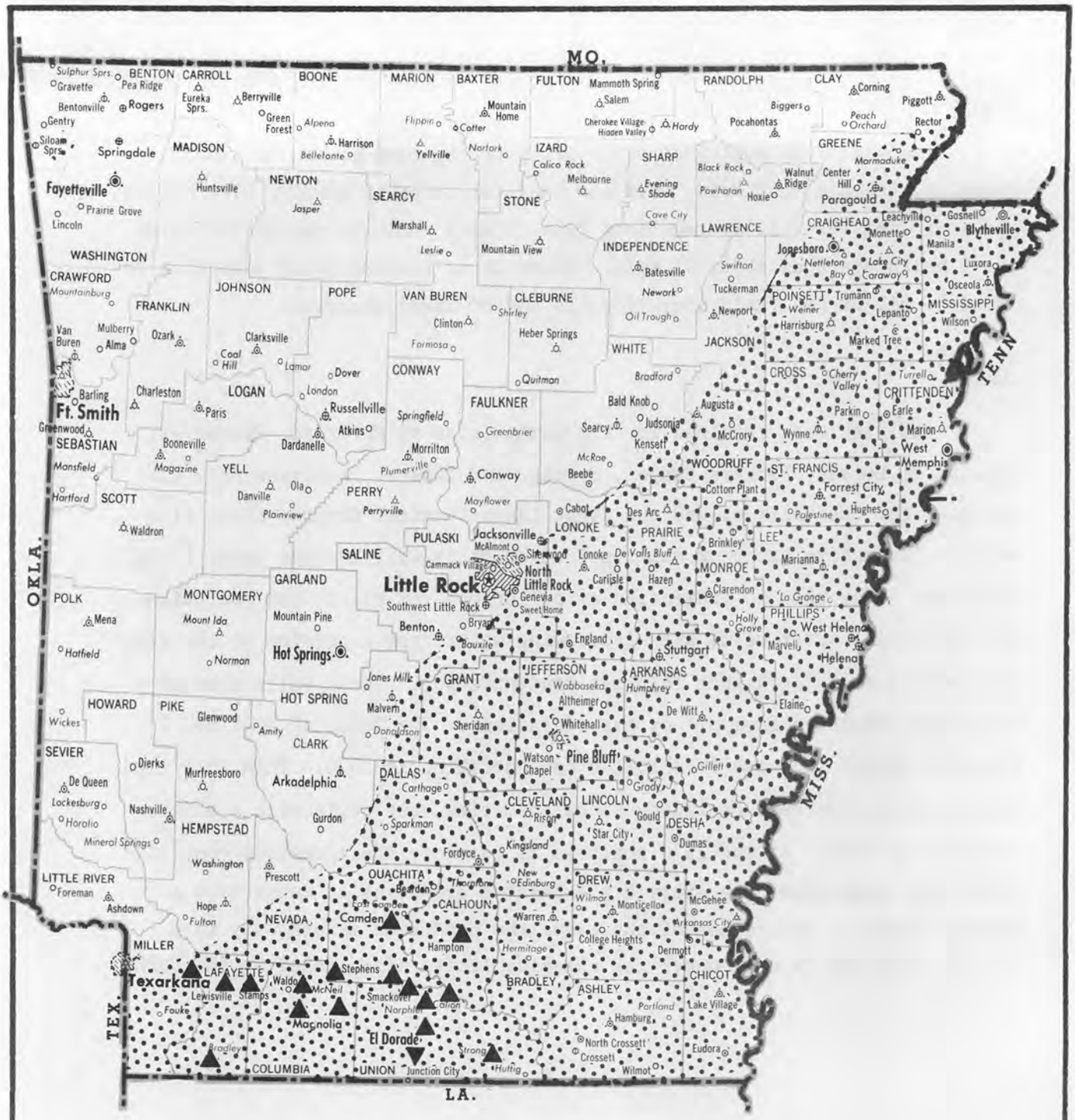
Analyses from municipal water wells in the towns of Buckner, Lewisville, Stamps, and Bradley were interpreted for this county. The aquifer water from the Buckner, Lewisville, and Stamps wells will average under 10 mg/l chloride. The analyses for the Bradley wells show 143 and 144 mg/l chloride for 1972 and 1977 respectively. These concentrations do not indicate oil field pollution, but will probably be found to be representative of the aquifer water in the area of the wells or possibly the aquifer water mixed with leakage from an underlying aquifer.

Columbia

Analyses from municipal water wells in the communities of McNeil, Magnolia, Village, and Waldo were examined for Columbia County. The entire group of analyses will average less than 10 mg/l chloride except for Waldo No. 3 which averages about 45 mg/l. There is no indication of pollution related to oil or gas field operations in any of these analyses.

Union

Analyses were examined for the communities of Norphlet, Smackover, Calion, El Dorado, Parkers Chapel, Strong, and Lawson. Analyses were also examined for the Velsicol and the Great Lakes Chemical Company plant site wells. The entire group of municipal water wells will average under 50 mg/l chloride. They show no indication of pollution from oil or gas operations. The industrial water wells are withdrawing water from a portion of the reservoir with a slightly higher chloride concentration. These wells show no pollution resulting from oil or gas operations. The Velsicol Well No. 2 showed a sudden increase in chloride concentration in 1970. This increased concentration has been declining since that time, but registered a slight increase in 1977. If the 1970 analysis is correct, the anomalous condition could have been caused by extremely excessive drawdowns or water from a foreign source. Regardless of the cause the condition exists only in a limited area and is well under the chloride limits established by the USPHS.




LEGEND

▲ Municipal Well Chloride Analyses

▼ Industrial Well Chloride Analyses

⁘ Major Fresh Water Aquifers

Figure 3

INTERSTATE OIL COMPACT COMMISSION

LOCATION OF CHLORIDE ANALYSES FOR ARKANSAS

LOUIS R. REEDER AND ASSOCIATES

TULSA, OKLAHOMA

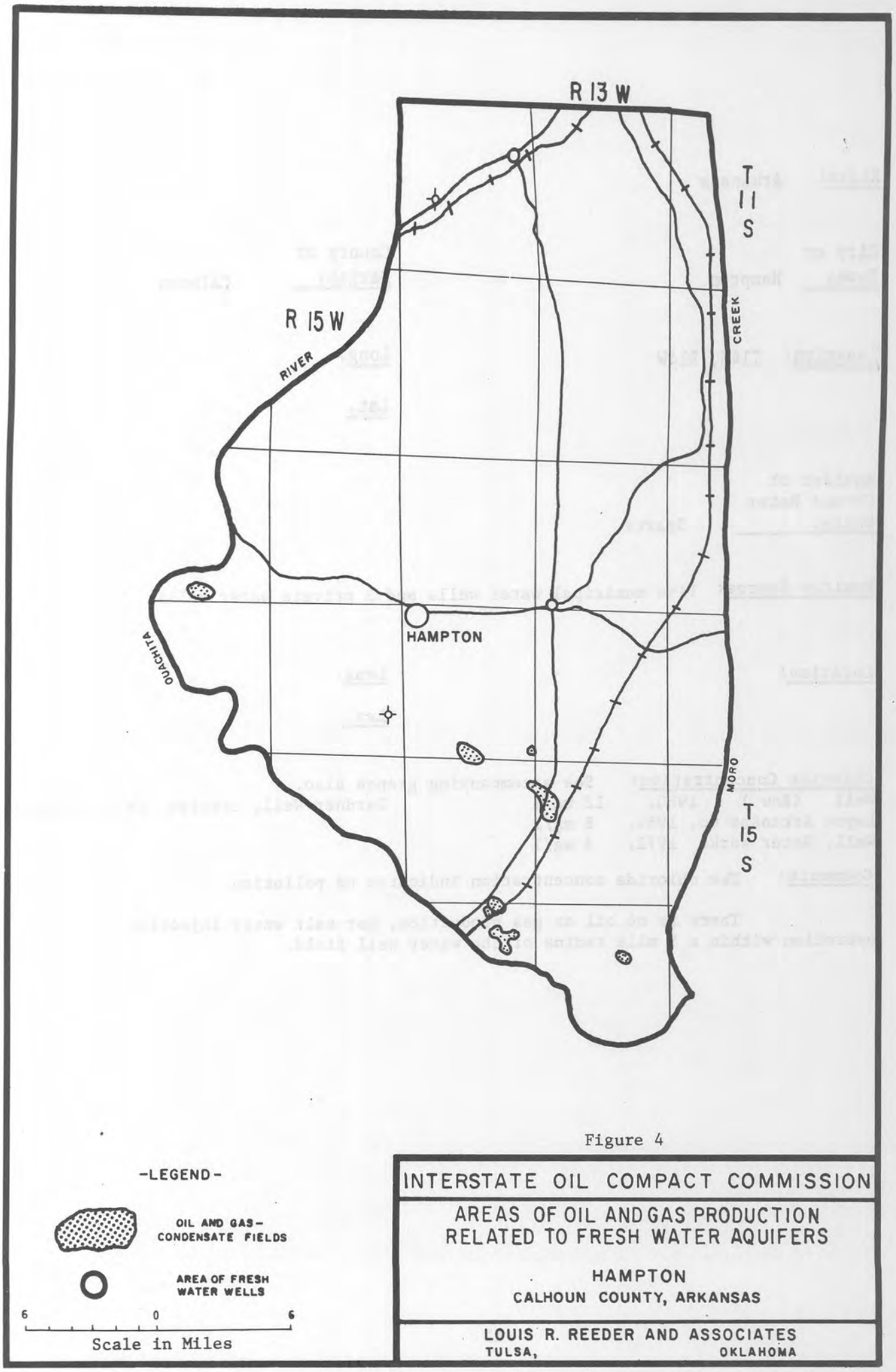



Figure 4

INTERSTATE OIL COMPACT COMMISSION

AREAS OF OIL AND GAS PRODUCTION RELATED TO FRESH WATER AQUIFERS

HAMPTON
CALHOUN COUNTY, ARKANSAS

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

State: Arkansas

City or Town: Hampton

County or Parish: Calhoun

Location: T14S, R14W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Five municipal water wells and 2 private water wells.

Location:

Long.

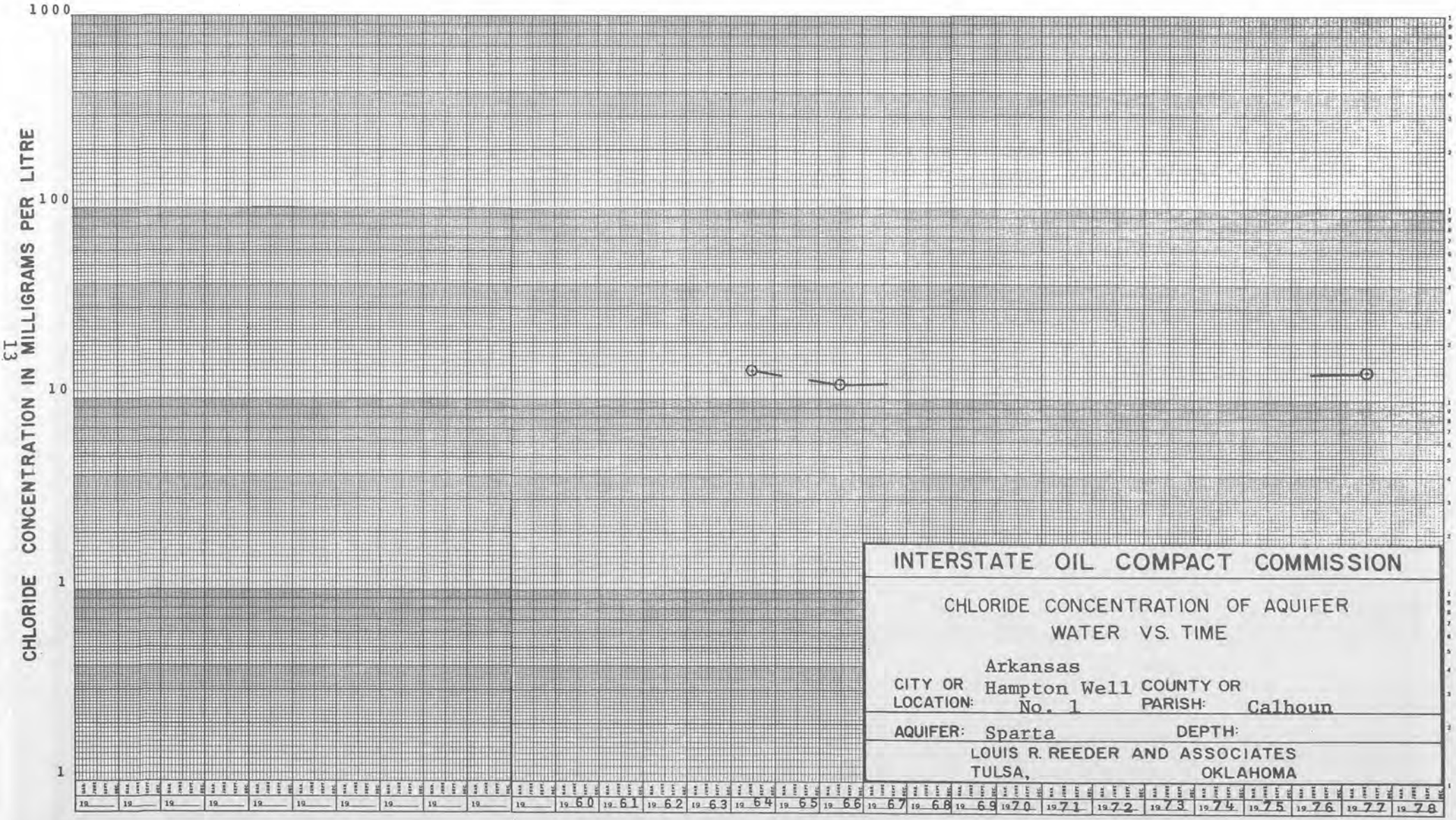
Lat.

Chloride Concentration: See accompanying graphs also.

| | | | |
|---|---|---|---|
| Well (Raw ) | 1960, | 12 mg/l | Gardner Well, treated 1977, 12 mg/l |
| Layne Arkansas Co. | 1964, | 8 mg/l | |
| Well, Water works | 1972, | 3 mg/l | |

Comments: The chloride concentration indicates no pollution.

There is no oil or gas production, nor salt water injection operation within a 5 mile radius of the water well field.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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19 64
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19 66
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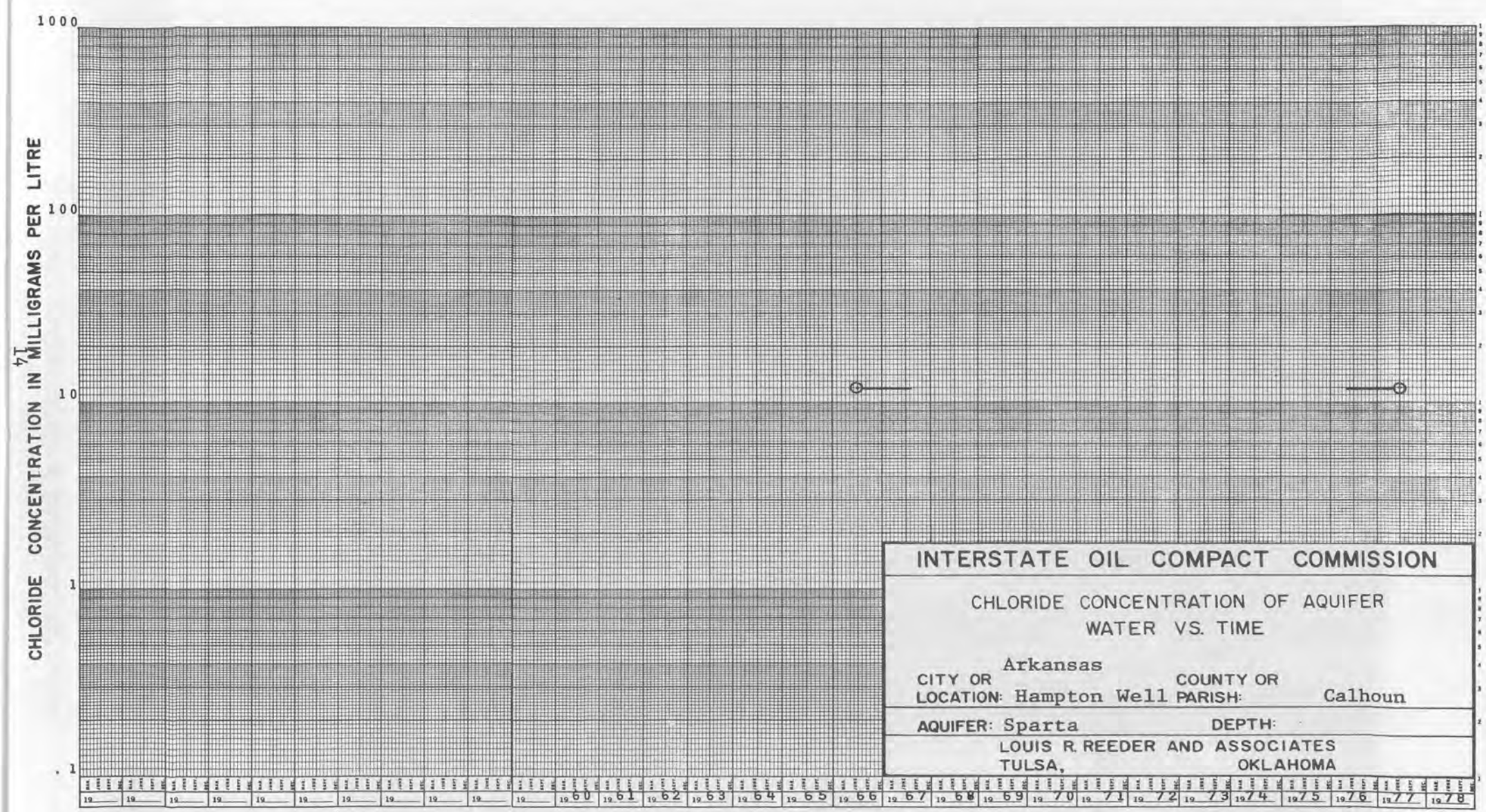
19 75
19 76
19 77
19 78
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Arkansas Hampton Well No. 1
COUNTY OR PARISH: Calhoun
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 5


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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.1
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
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1971
1972
1973
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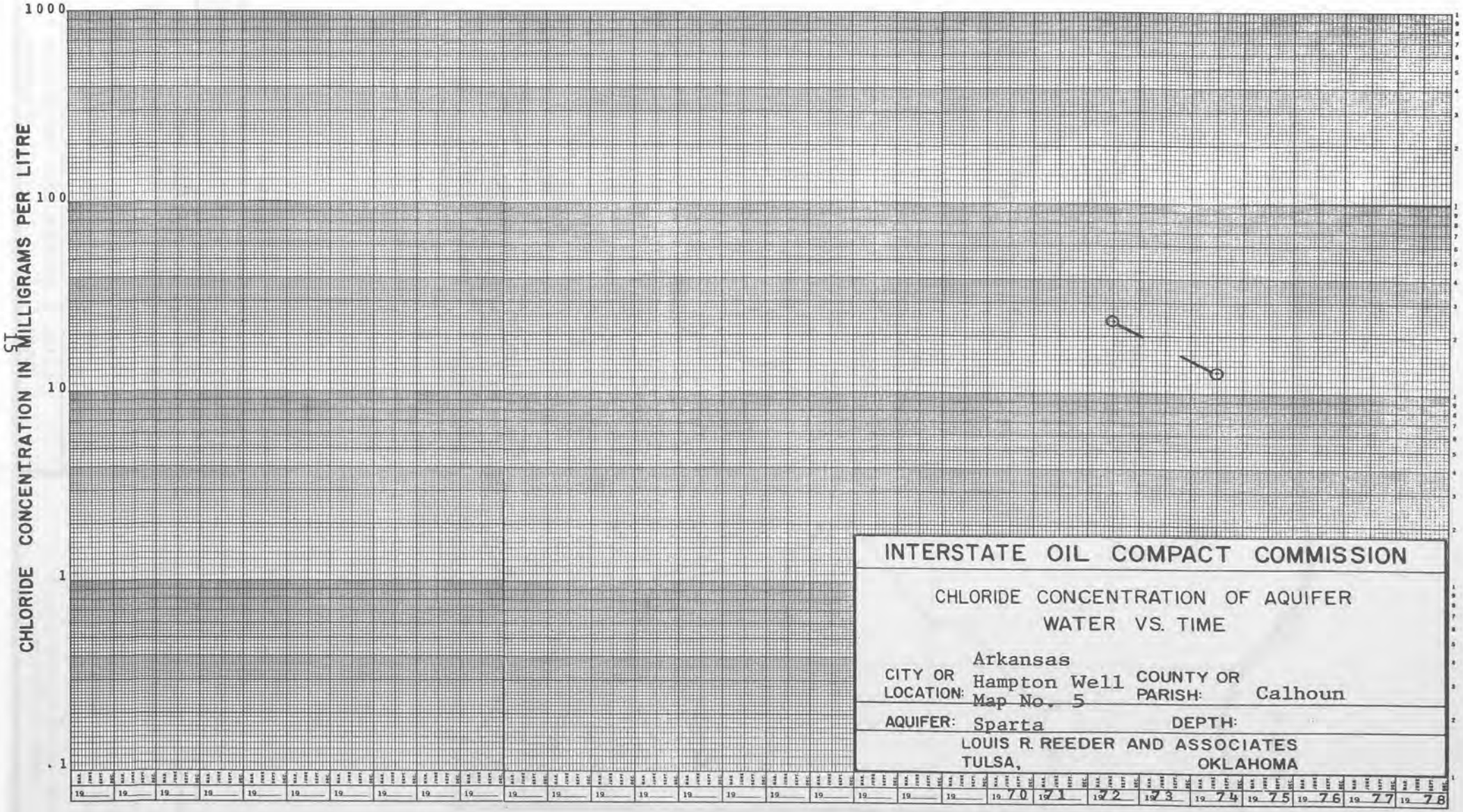
1977
1978
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Hampton Well Arkansas
COUNTY OR PARISH: Calhoun
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 6


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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19 76
19 77
19 78
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Arkansas Hampton Well Map No. 5
COUNTY OR PARISH: Calhoun
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 7

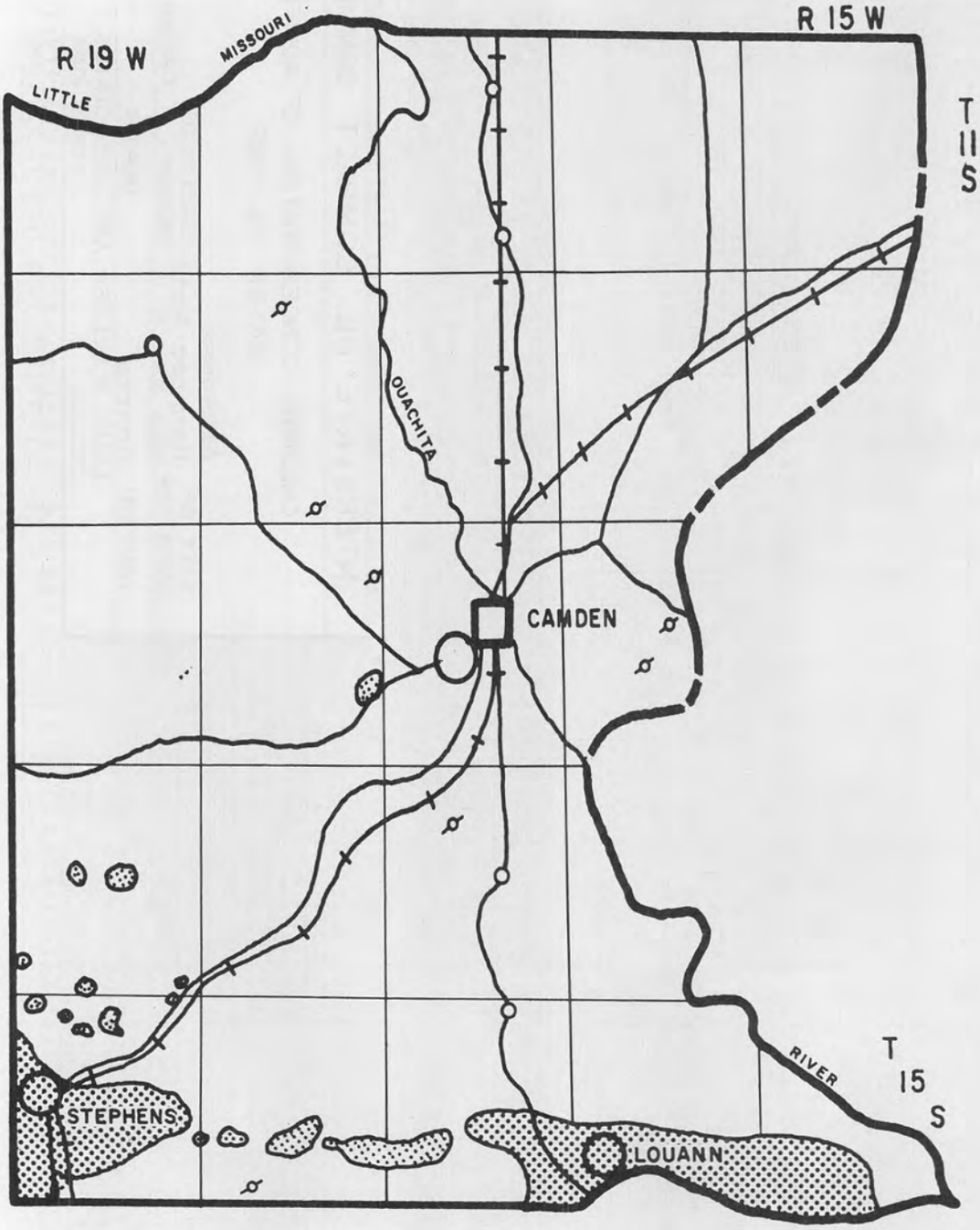



Figure 8

-LEGEND-

OIL AND GAS-
CONDENSATE FIELDS

AREA OF FRESH
WATER WELLS

6 0 6
Scale in Miles

INTERSTATE OIL COMPACT COMMISSION

AREAS OF OIL AND GAS PRODUCTION
RELATED TO FRESH WATER AQUIFERS

LOUANN, STEPHENS AND CAMDEN
OUACHITA COUNTY, ARKANSAS

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

State: Arkansas

City or Town: Louann

County or Parish: Ouachita

Location: T15S, R16W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Four municipal and 2 private water wells

Location: T15S, R16W

Long.

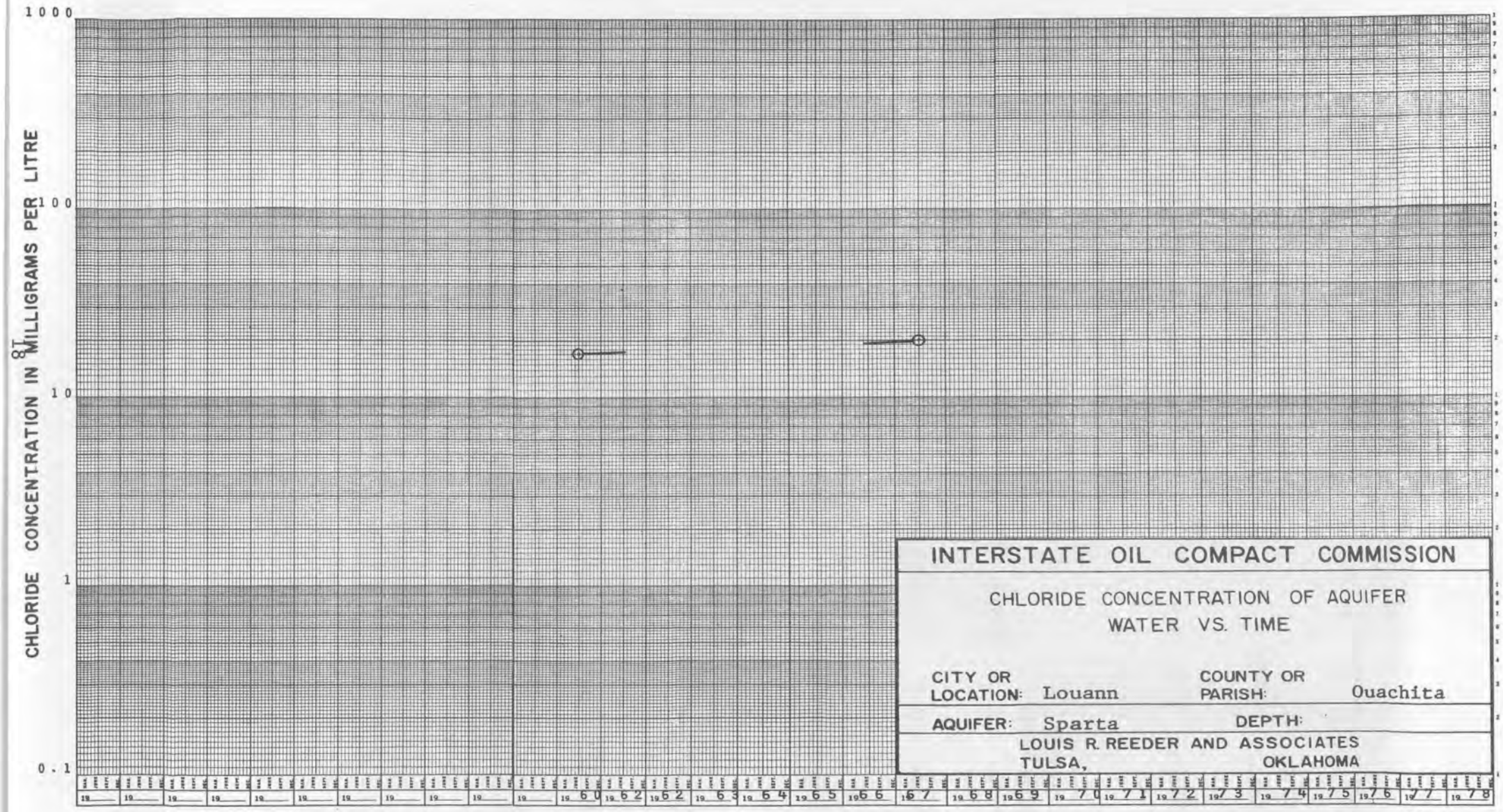
Lat.

Chloride Concentration: See accompanying graph

| | | | |
|---|---|---|---|
| Not graphed: | Louann No. 2 | 1967, 11 mg/l | South 1972, 21 mg/l |
| | Louann No. 3 | 1968, 11 mg/l | Wetson Grocery 1975, 19 mg/l |
| | South Town | 1962, 9 mg/l | |

Comments: The chloride concentration indicates no pollution.

The Smackover Field, in which Louann is located, was discovered in 1922, and now has many water injection wells for secondary recovery and pressure maintenance as well as salt water disposal wells.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Louann
COUNTY OR PARISH: Ouachita
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 9

State: Arkansas

City or Town: Camden

County or Parish: Ouachita

Location: T13S, R17W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Five municipal wells and 3 private wells

Location: T13S, R17W

Long.

Lat.

Chloride Concentration:

| | | | | | |
|---|---|---|---|---|---|
| C. Rons Well | 1965, 13 mg/l | Well No 1 | 1975, 9 mg/l | Well No 6 | 1975, 7 mg/l |
| H. Inzek Well | 1965, 12 mg/l | Well No 3 | 1975, 6 mg/l | Davis Well | 1977, 19 mg/l |
| C Stover Well | 1965, 13 mg/l | Well No 4 | 1975, 8 mg/l | Burton Well | 1978, 330 mg/l |

Comments: The chloride concentration indicates no pollution from oil or gas field injection operations. Bragg Field, now abandoned, lies approximately 4 miles west of the water well field.

The anomalous chloride concentration shown in the analysis for the Burton probably is caused by a completion deeper in the aquifer which draws upon water with higher salinity than that encountered in the other wells.

State: Arkansas

City or Town: Stephens

County or Parish: Ouachita

Location: T15S, R19W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Three municipal water wells

Location: T15S, R19W

Long.

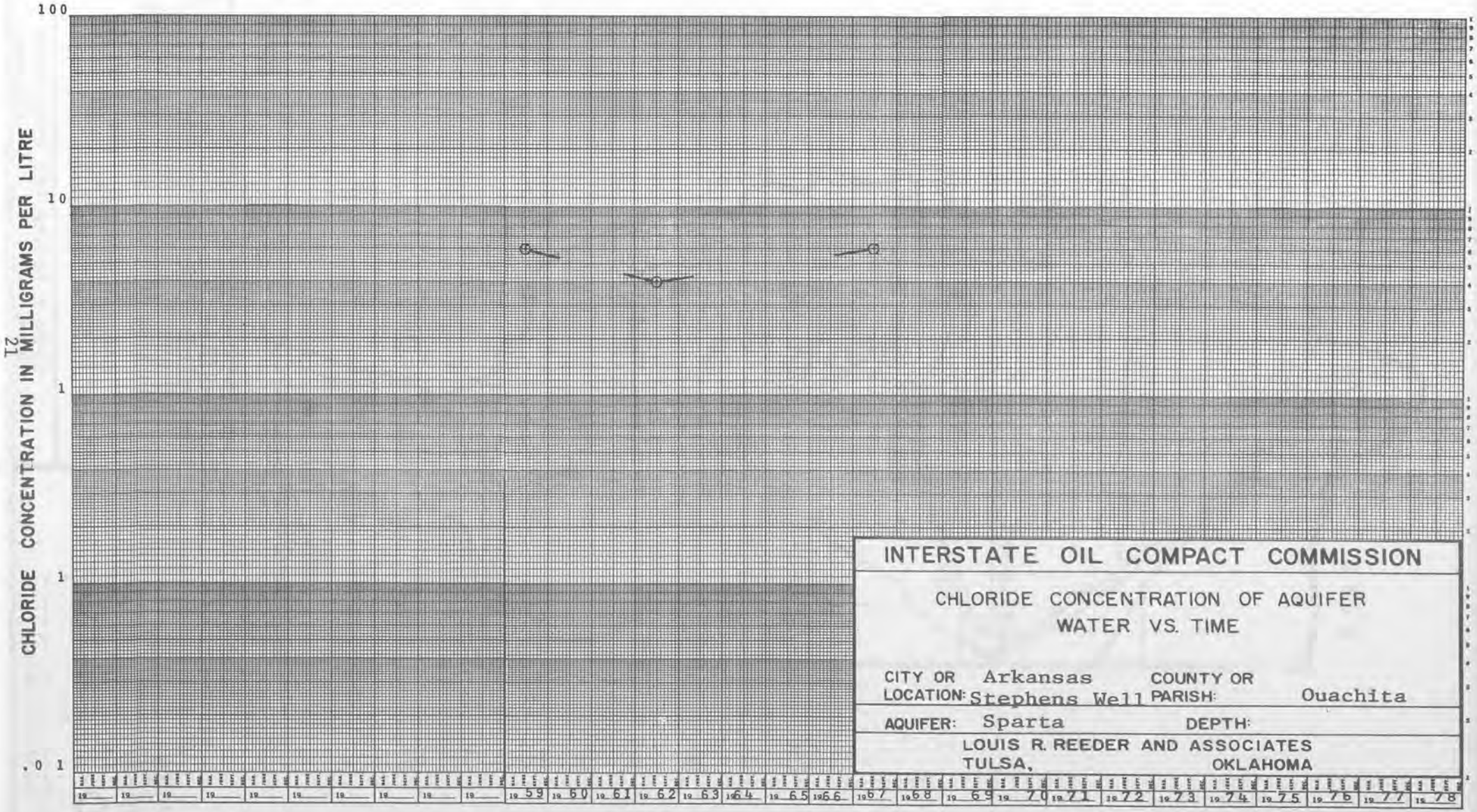
Lat.

Chloride Concentration: See accompanying graph also.

| | |
|---|---|
| Well No. 3 (Raw) | 1966, 5 mg/l |
| Well North | 1970, 6 mg/l |
| Well Highway 79 | 1972, 11 mg/l |

Comments: The chloride concentration indicates no pollution.

The water well field lies within the Wesson Oil Field which has numerous injection wells for secondary recovery and pressure maintenance as well as many salt water disposal wells.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Arkansas Stephens Well
COUNTY OR PARISH: Ouachita
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 10

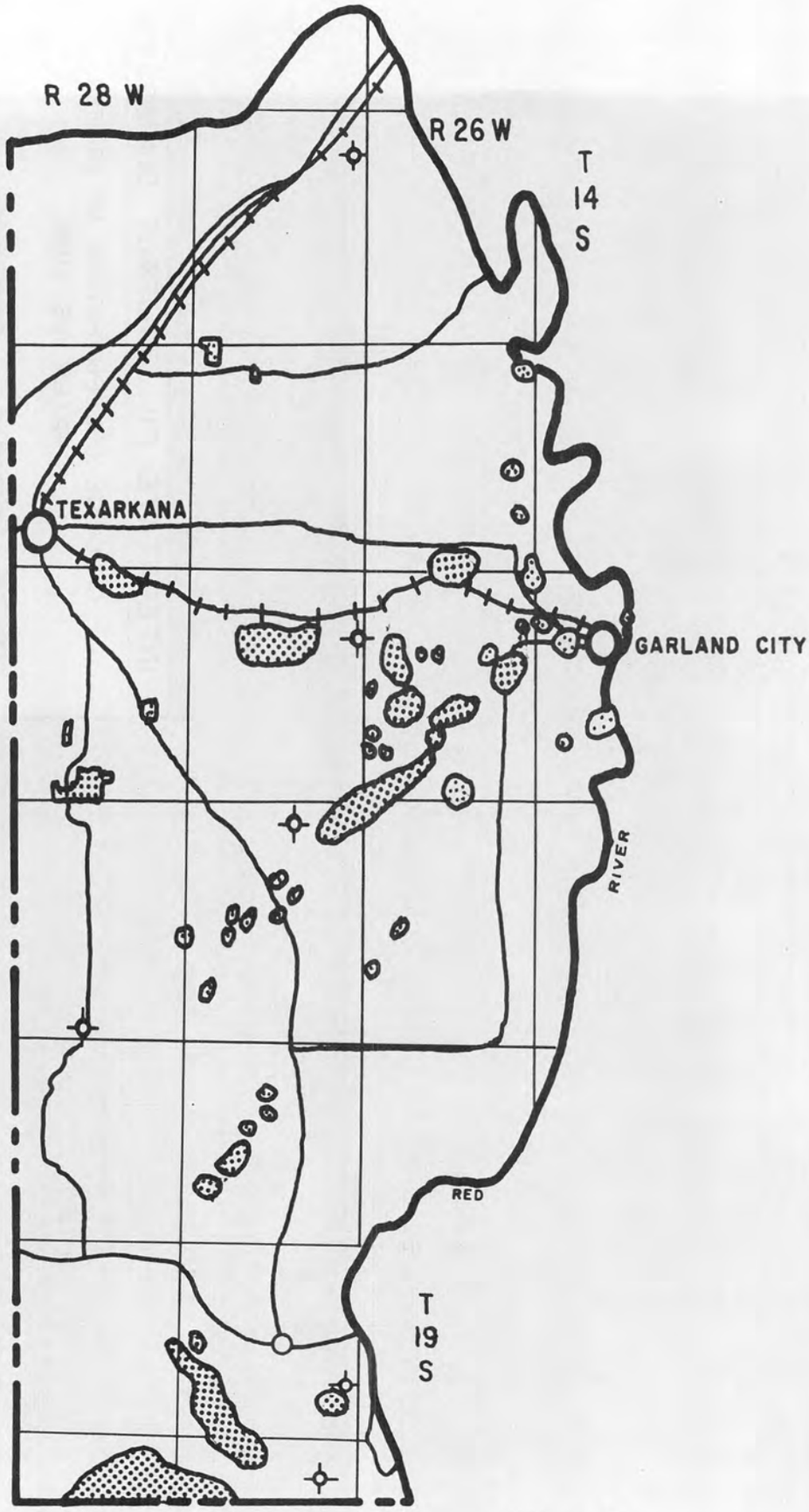



Figure 11

-LEGEND-

OIL AND GAS-
CONDENSATE FIELDS

AREA OF FRESH
WATER WELLS

6 0 6

Scale in Miles

INTERSTATE OIL COMPACT COMMISSION

AREAS OF OIL AND GAS PRODUCTION
RELATED TO FRESH WATER AQUIFERS

GARLAND CITY AND TEXARKANA
MILLER COUNTY, ARKANSAS

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

State: Arkansas

City or Town: Garland City

County or Parish: Miller

Location: T16S, R25W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: One municipal water well

Location: T16S, R25W

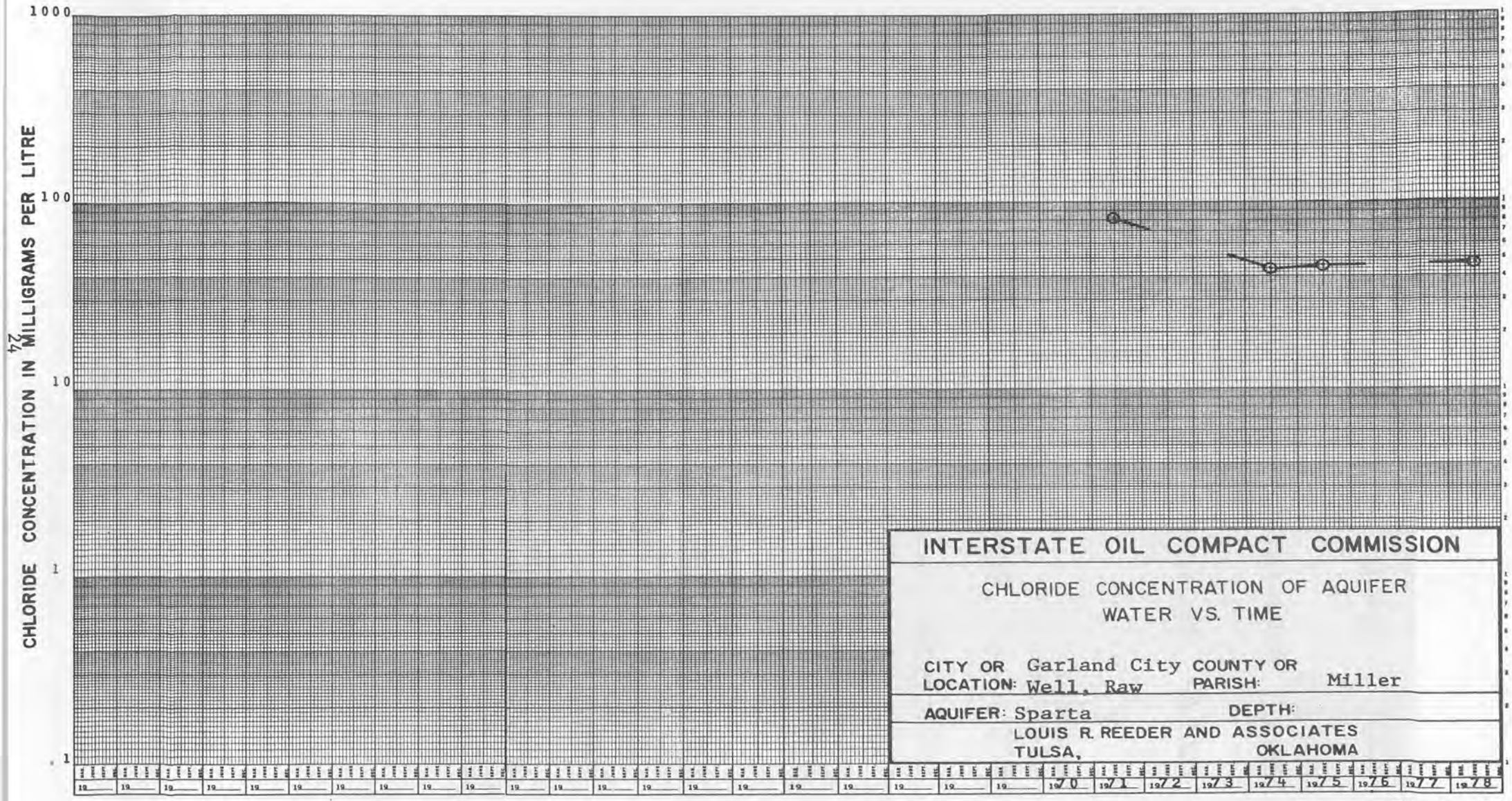
Long.

Lat.

Chloride Concentration: See accompanying graph

Comments: The chloride concentration indicates no pollution.

Garland City is surrounded by several producing fields; the New Garland City Field being less than one mile distant. All the oil fields are injecting salt water for secondary recovery or disposal purposes.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Garland City Well, Raw
COUNTY OR PARISH: Miller
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 12

State: Arkansas

City or Town: Texarkana

County or Parish: Miller

Location: T15S, R28W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: One municipal water well

Location: T15S, R28W

Long.

Lat.

Chloride Concentration:
TEXARKANA WELL, treated 1974, 11 mg/l

Comments: The chloride concentration indicated no pollution.

The abandoned Texarkana Field lies within 3 miles of the water well area; other fields are beyond a 5 mile radius.

The major source of water for Texarcana is surface impoundment.

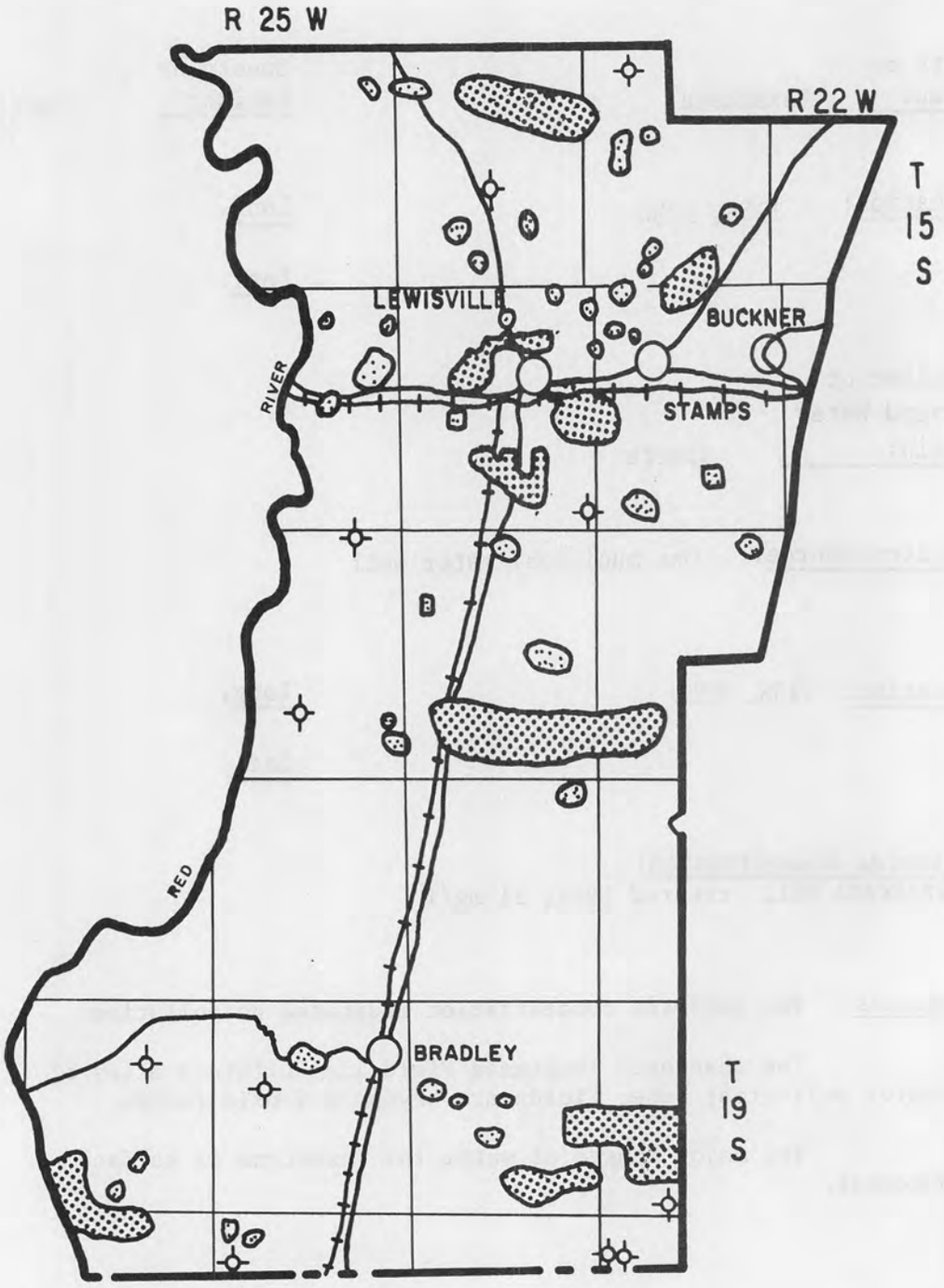



Figure 13

-LEGEND-

OIL AND GAS-CONDENSATE FIELDS

AREA OF FRESH WATER WELLS

Scale in Miles

INTERSTATE OIL COMPACT COMMISSION

AREAS OF OIL AND GAS PRODUCTION RELATED TO FRESH WATER AQUIFERS

BUCKNER, STAMPS, LEWISVILLE AND BRADLEY
LAYFETTE COUNTY, ARKANSAS

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

State: Arkansas

City or Town: Buckner

County or Parish: Lafayette

Location: T16S, R23W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Four municipal water wells

Location: T16S, R23W

Long.

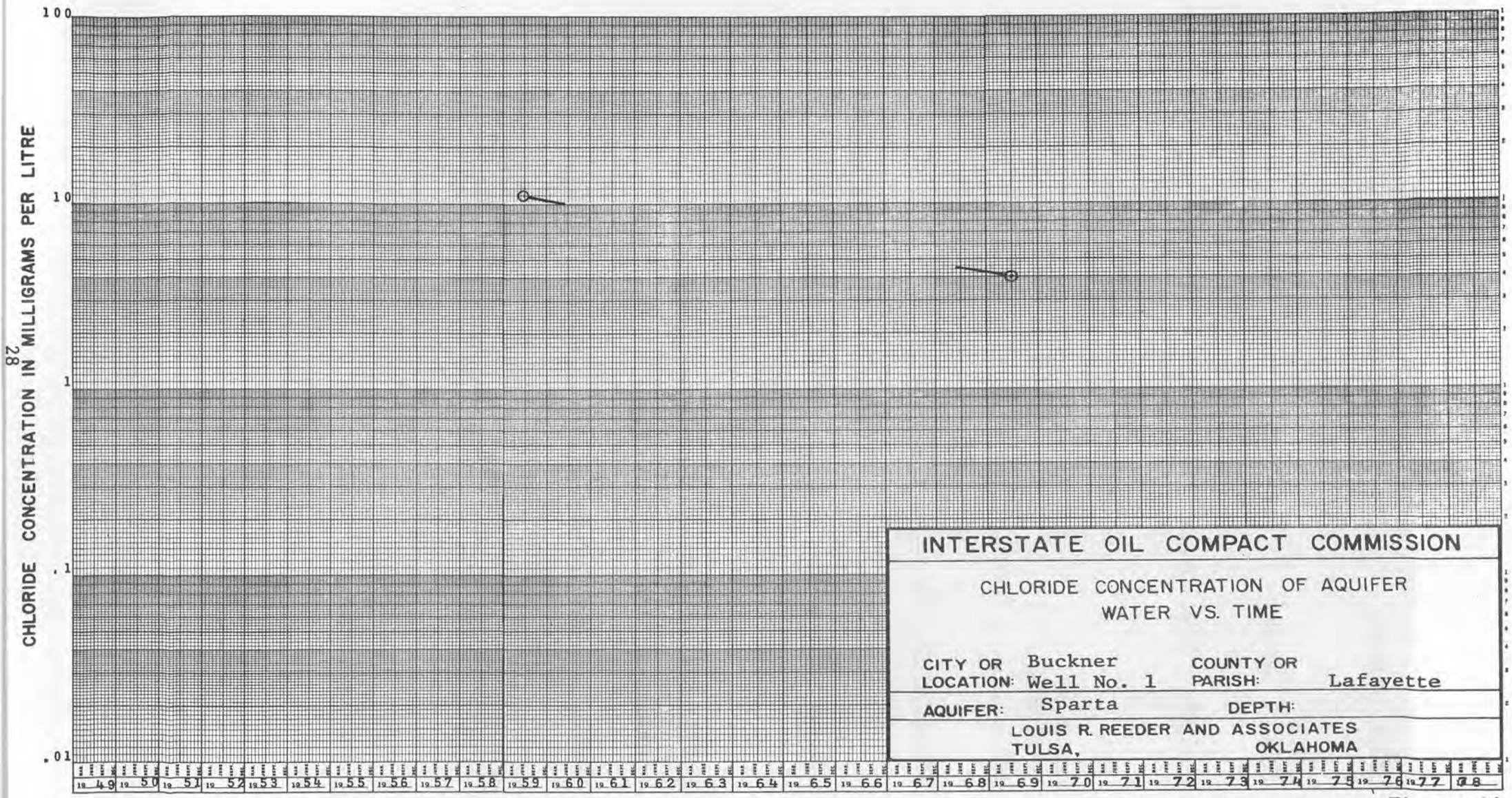
Lat.

Chloride Concentration: See accompanying graphs also

| | |
|---|---|
| Waymont League Well | 1969, 3 mg/l |
| Perkinson Well | 1975, 8 mg/l |

Comments: The chloride concentration indicates no pollution.

These wells are located in the western portion of Buckner Field. Other producing fields lie within a three mile radius of the water well field, and most of them, including Buckner, are injecting salt water for disposal.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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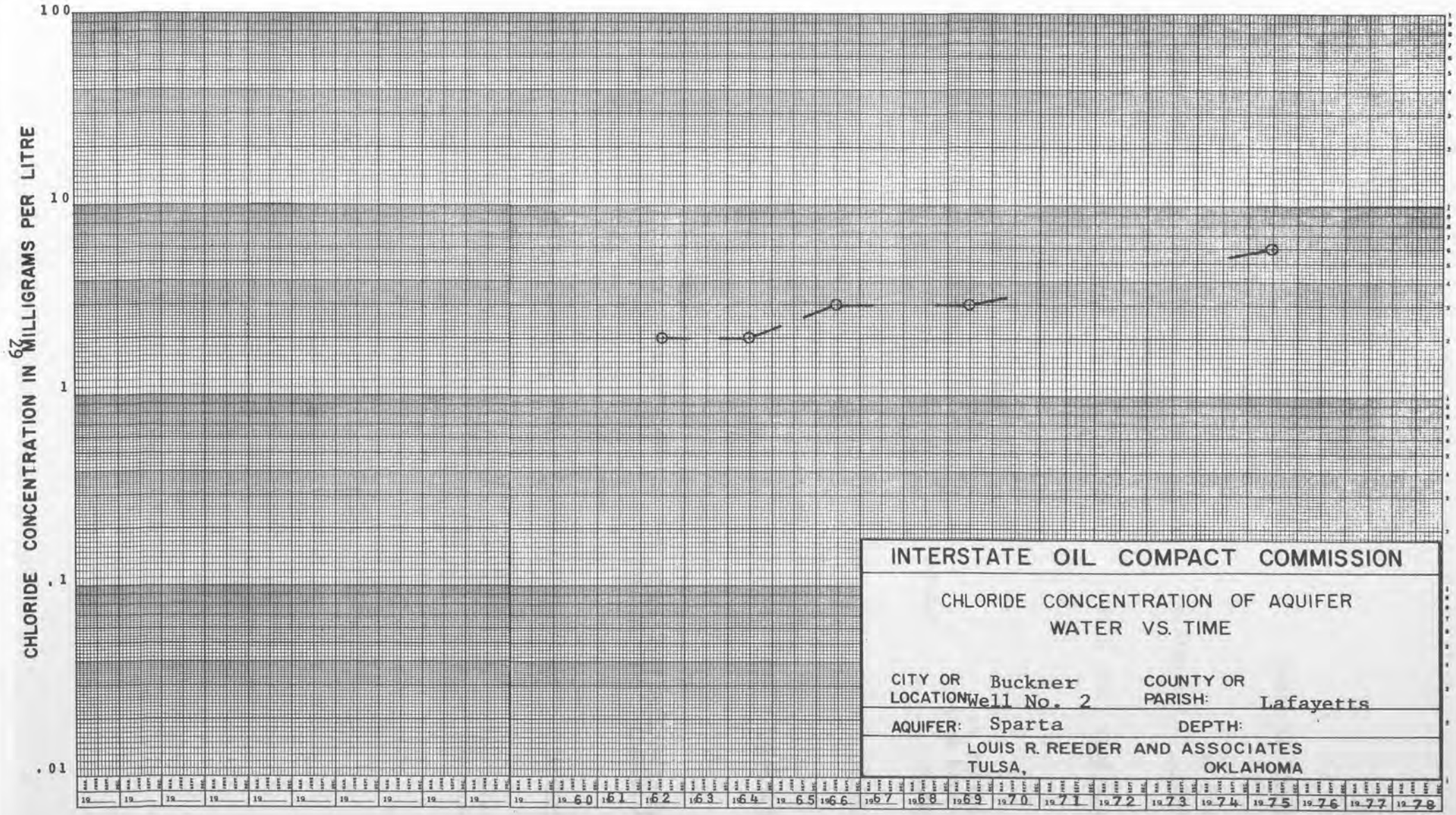
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Buckner Well No. 1
COUNTY OR PARISH: Lafayette
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 14


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION Buckner Well No. 2
COUNTY OR PARISH: Lafayetts
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 15

State: Arkansas

City or Town: Lewisville

County or Parish: Lafayette

Location: T16S, R24W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Three municipal water wells

Location: T16S, R24W

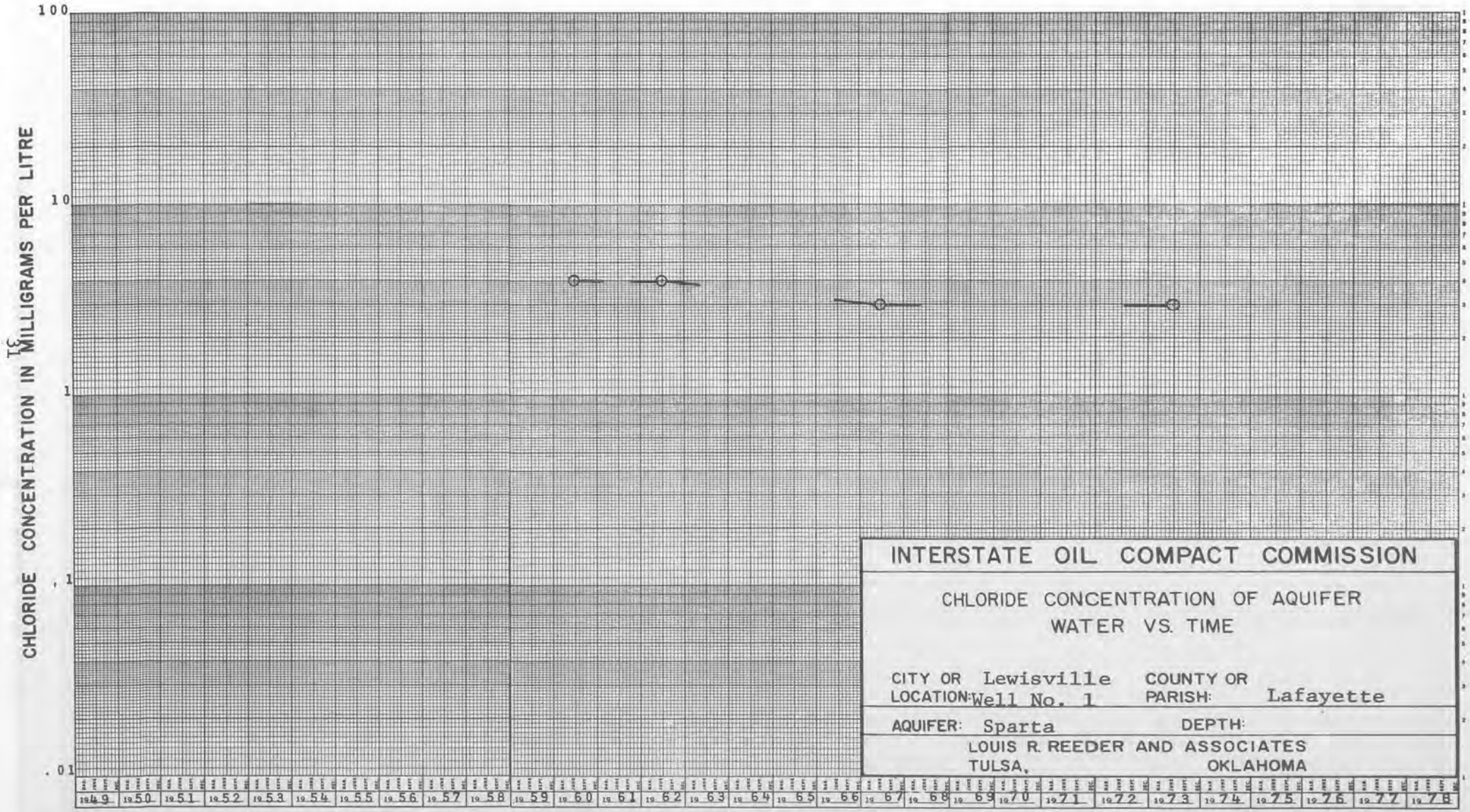
Long.

Lat.

Chloride Concentration: See accompanying graph also
Main Well 1958, 12 mg/1

Comments: The chloride concentration indicates no pollution.

The Lewisville water field is surrounded by three oil fields within a 1-4 mile radius all injecting salt water for secondary recovery and/or disposal.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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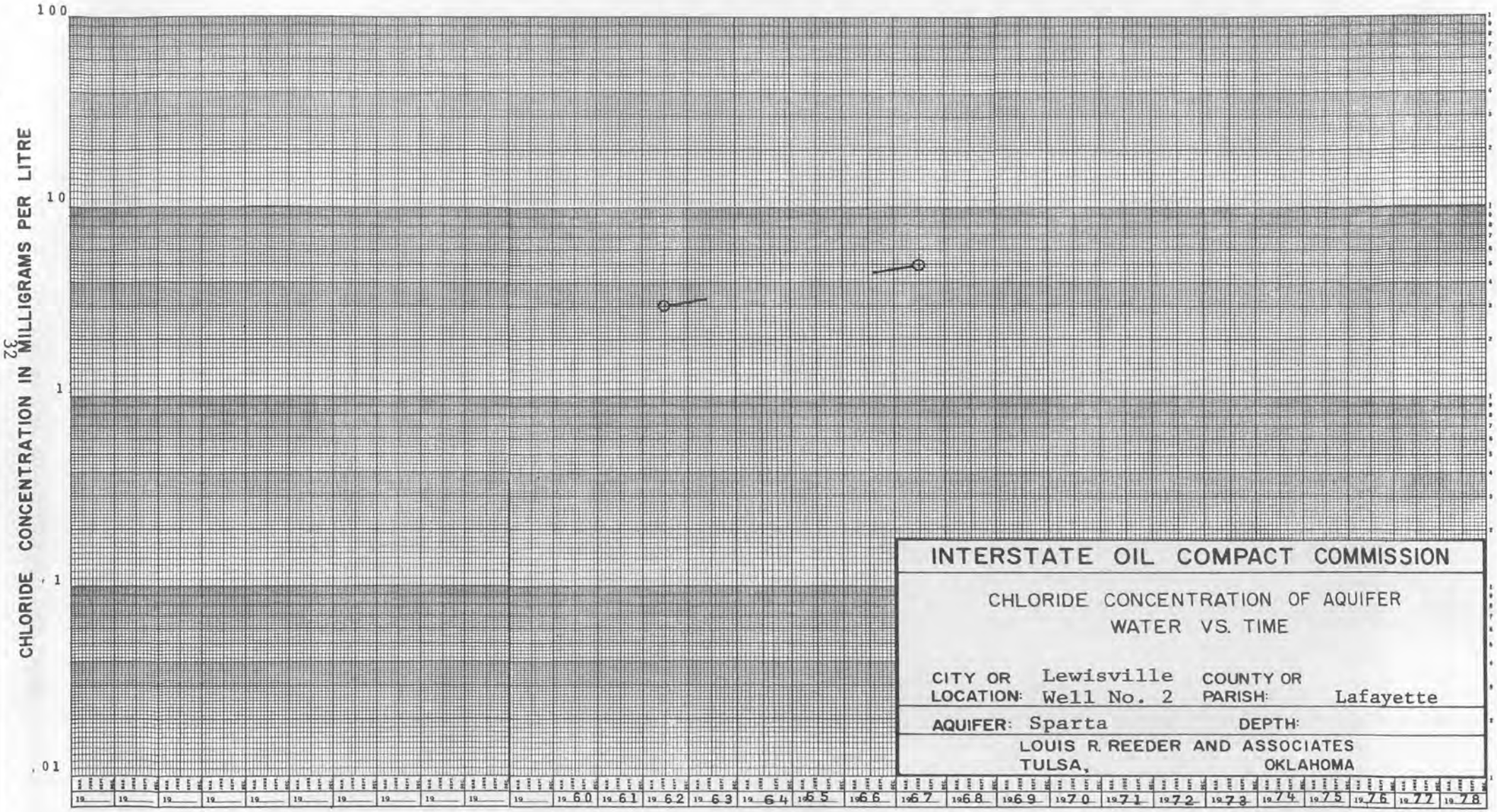
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Lewisville Well No. 1
COUNTY OR PARISH: Lafayette
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 16


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Lewisville Well No. 2
COUNTY OR PARISH: Lafayette
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 17

State: Arkansas

City or Town: Stamps

County or Parish: Lafayette

Location: T16S, R23W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Four municipal water wells

Location: T16S, R23W

Long.

Lat.

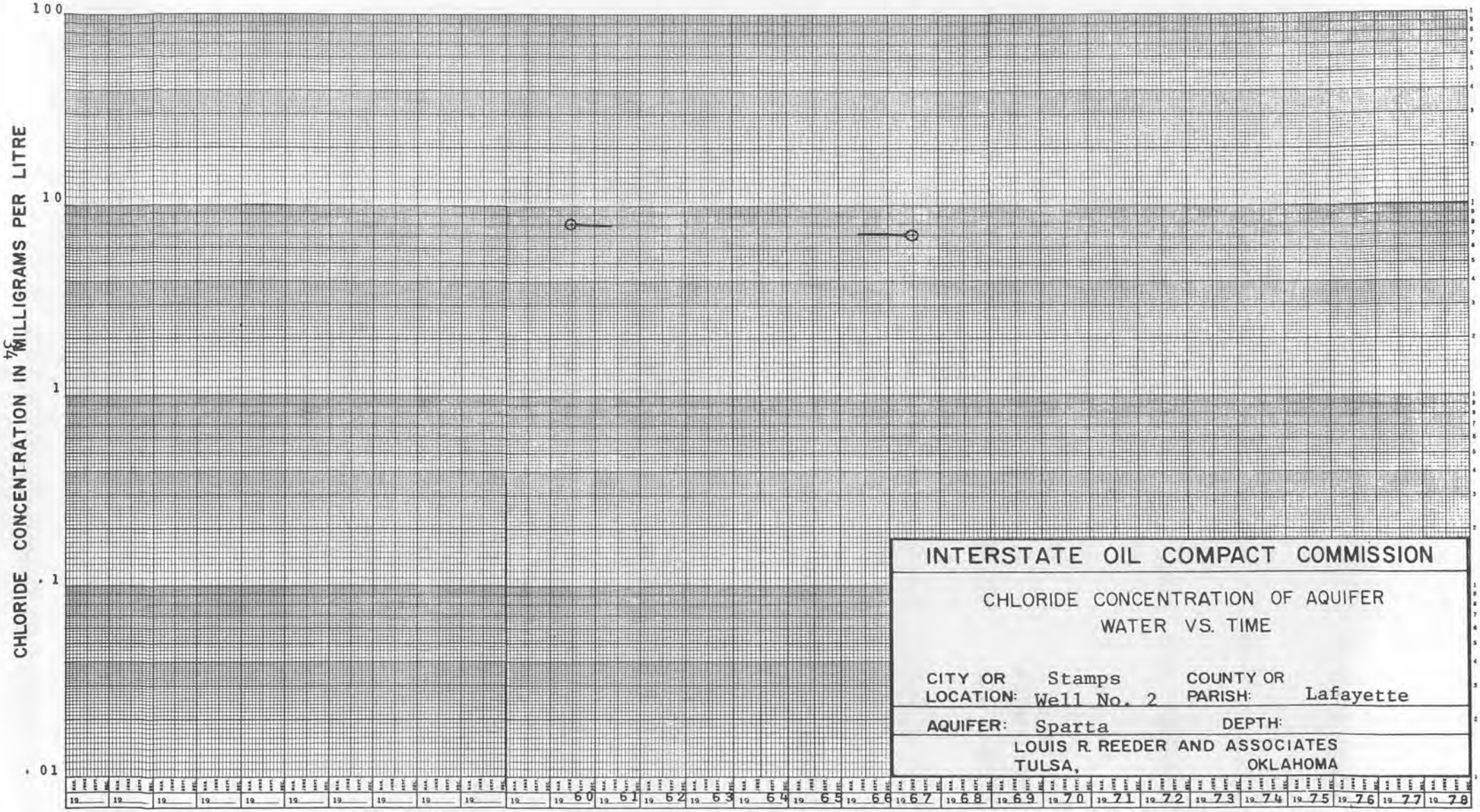
Chloride Concentration: See accompanying graph also

New Well 1958, 13mg/1

Well No. 4, 1975q 7 mg/1
Well, Raw, 1975, 4 mg/1

Comments: The chloride concentration indicates no pollution.

The Stamps water well field is surrounded by several small oil fields within a 1-2 mile radius; all are disposing of salt water injection.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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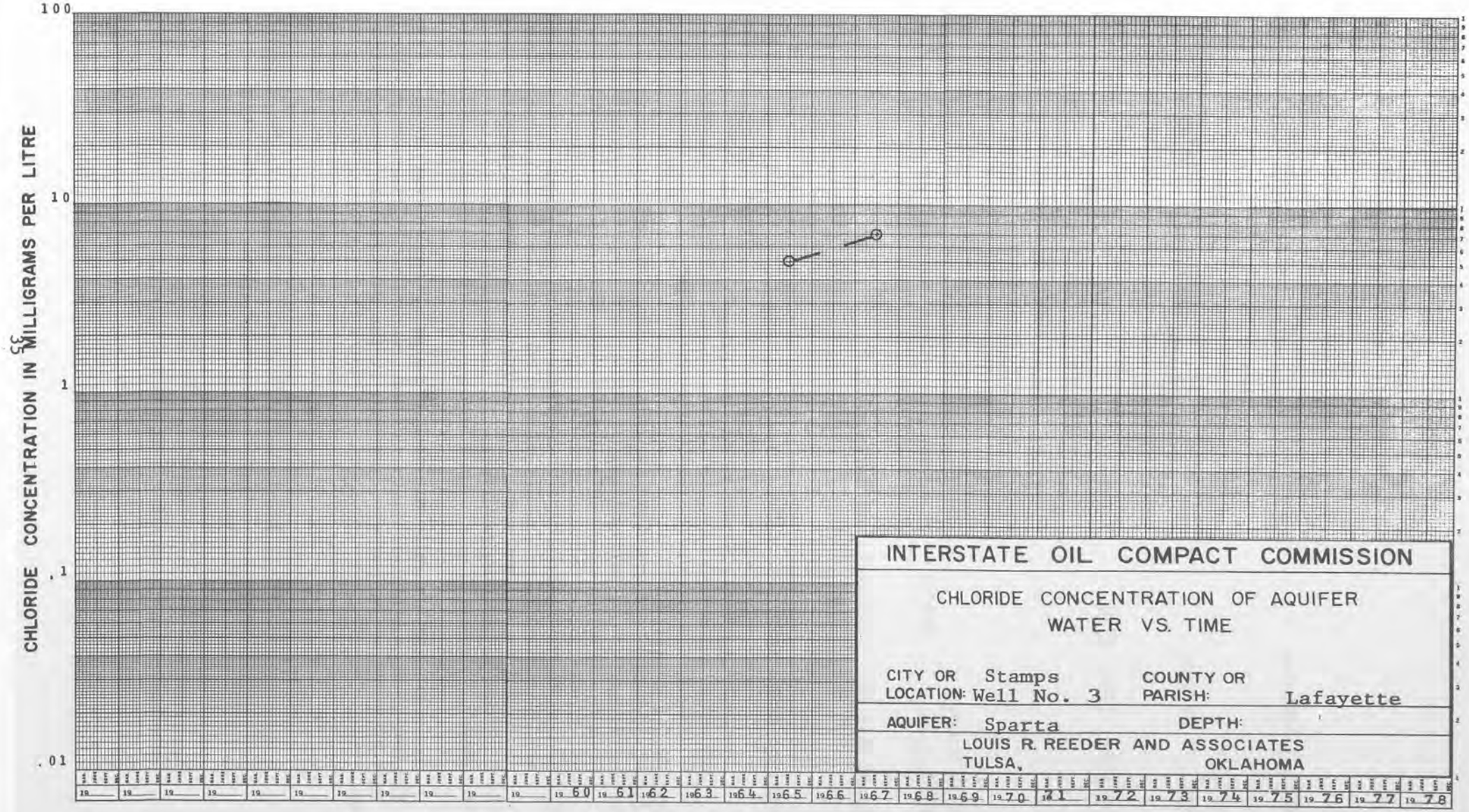
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Stamps Well No. 2
COUNTY OR PARISH: Lafayette
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 18


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Stamps Well No. 3
COUNTY OR PARISH: Lafayette
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 19

State: Arkansas

City or Town: Bradley

County or Parish: Lafayette

Location: T19S, R25W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Two municipal water wells

Location: T19S, R25W

Long.

Lat.

Chloride Concentration:

Well No. 1, Raw, 1972, 143 mg/l
Well No. 2, Raw, 1977, 144 mg/l

Comments: The chloride concentration indicated no pollution.

There are abandoned and operating fields within 2 to 3 miles of Bradley. Salt water disposal is in progress about 3 miles away.

The Bradley wells are probably drawing from a portion of the Sparta with slightly higher chloride concentration than other areas or getting minor seepage upward from some of the more brackish cane river sands.

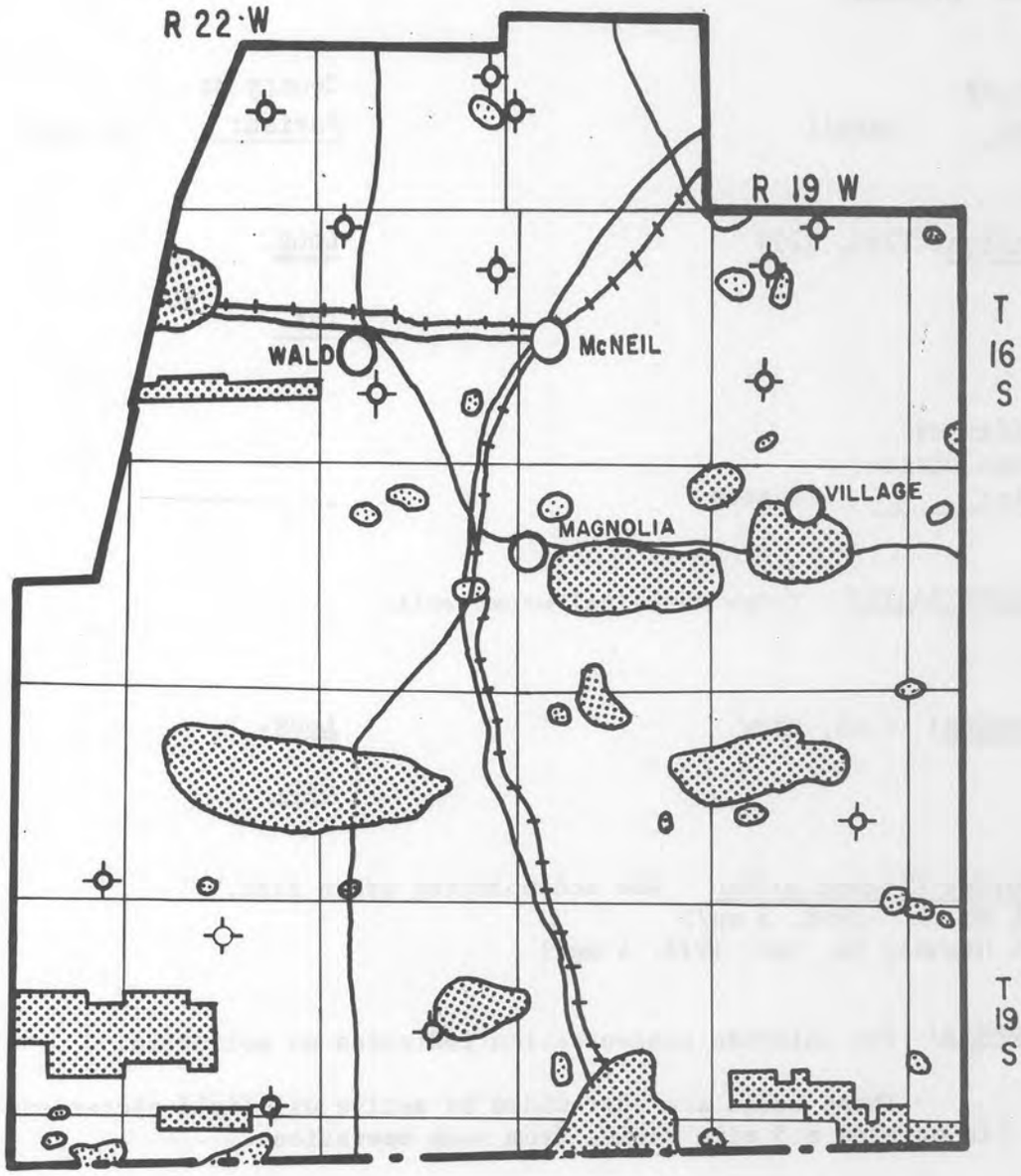



Figure 20

-LEGEND-

OIL AND GAS-CONDENSATE FIELDS

AREA OF FRESH WATER WELLS

6 0 6

Scale in Miles

INTERSTATE OIL COMPACT COMMISSION

AREAS OF OIL AND GAS PRODUCTION RELATED TO FRESH WATER AQUIFERS

WALD, McNEIL, VILLAGE AND MAGNOLIA
COLUMBIA COUNTY, ARKANSAS

LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

State: Arkansas

City or Town: McNeil

County or Parish: Columbia

Location: T16S, R20W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Three municipal water wells

Location: T16S, R20W

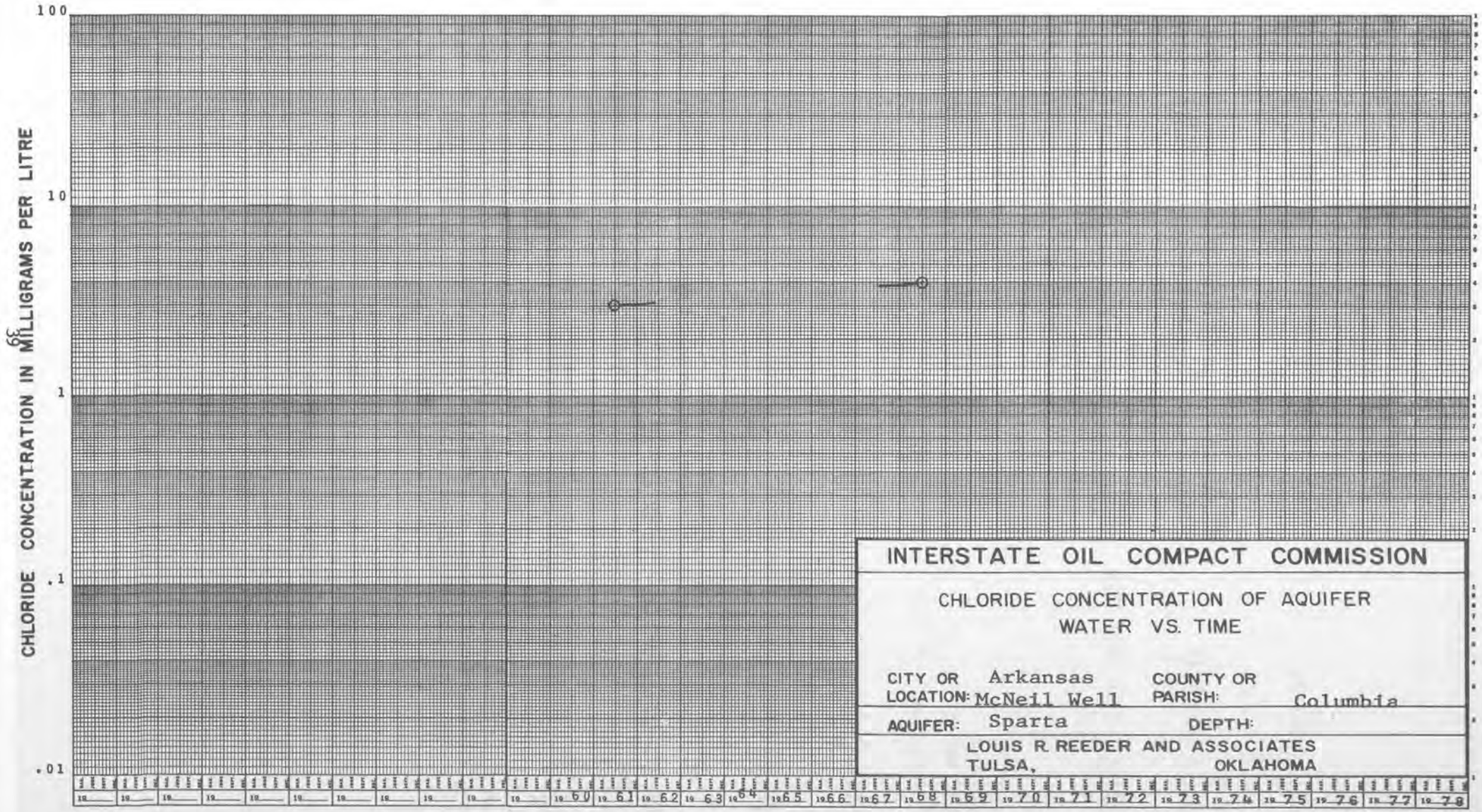
Long.

Lat.

Chloride Concentration: See accompanying graph also.
Well No. 2 1968, 5 mg/l
Well Highway 98, raw, 1975, 4 mg/l

Comments: The chloride concentration indicates no pollution.

These wells are surrounded by active oil field operations, but all lie outside a 5 mile radius from such operations.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Arkansas McNeil Well
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 21

State: Arkansas

City or Town: Magnolia

County or Parish: Columbia

Location: T17S, R20, 21W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: Nine municipal water wells

Location: T17S, R20W

Long.

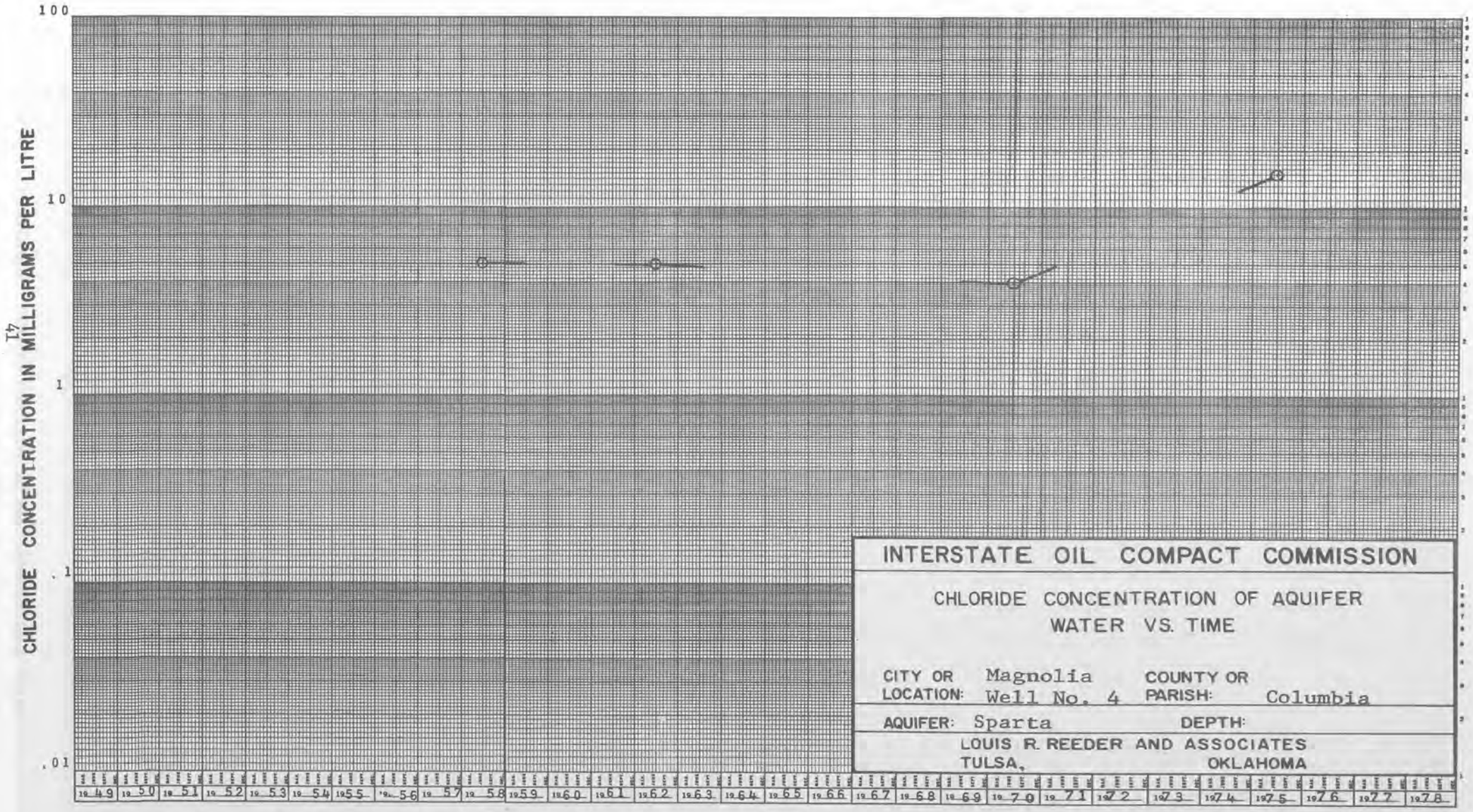
Lat.

Chloride Concentration: See accompanying graphs also.

Well No. 2 1959, 10 mg/l
Well No. 3 1959, 12 mg/l
Well So. State College, 1975, 4 mg/l

Comments: The chloride concentration indicates no pollution.

These wells are situated at the west edge of the Magnolia Field in which there is water and gas injection for secondary recovery and pressure maintenance as well as injection for salt water disposal.


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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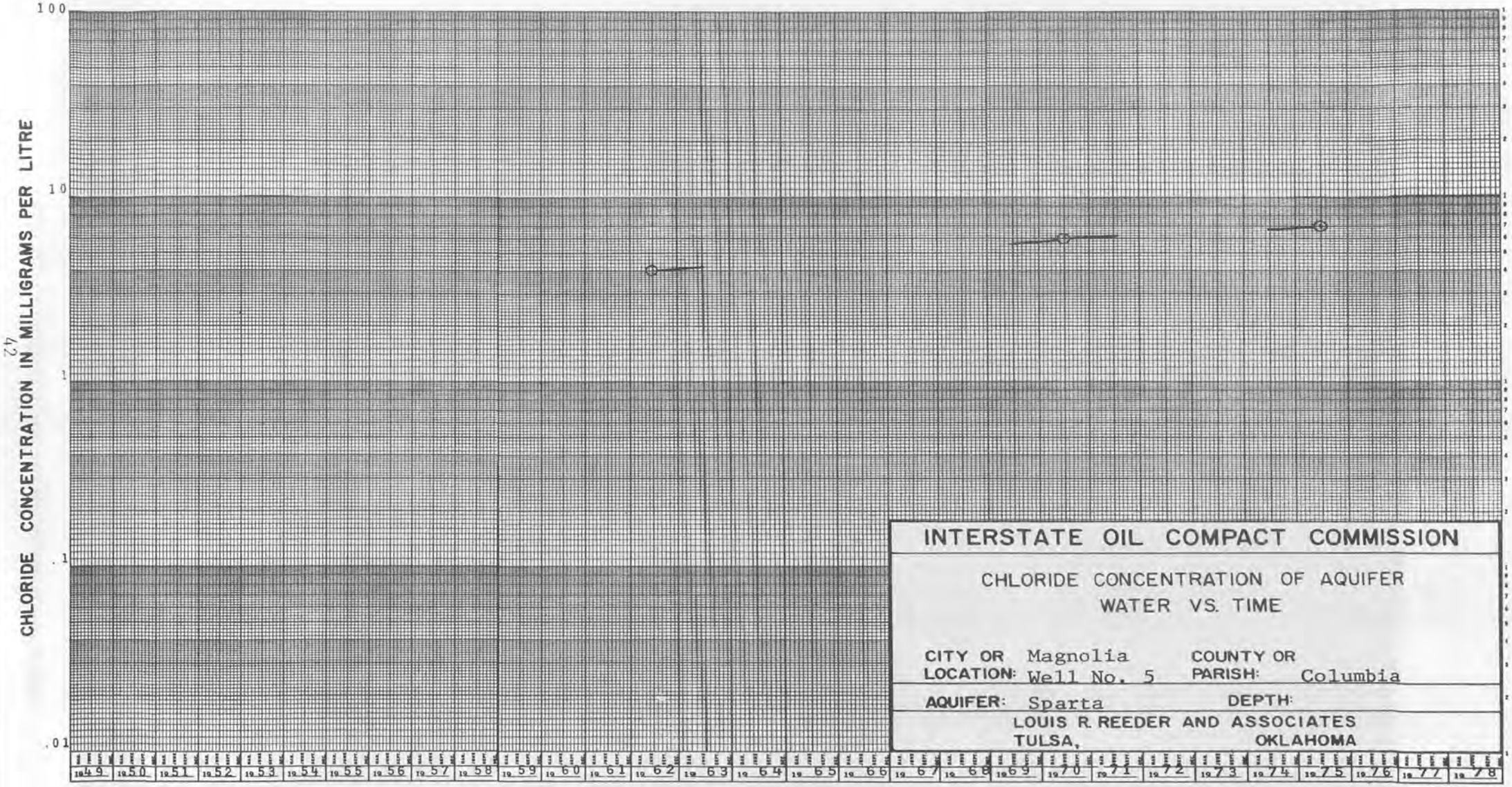
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Magnolia Well No. 4
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 22


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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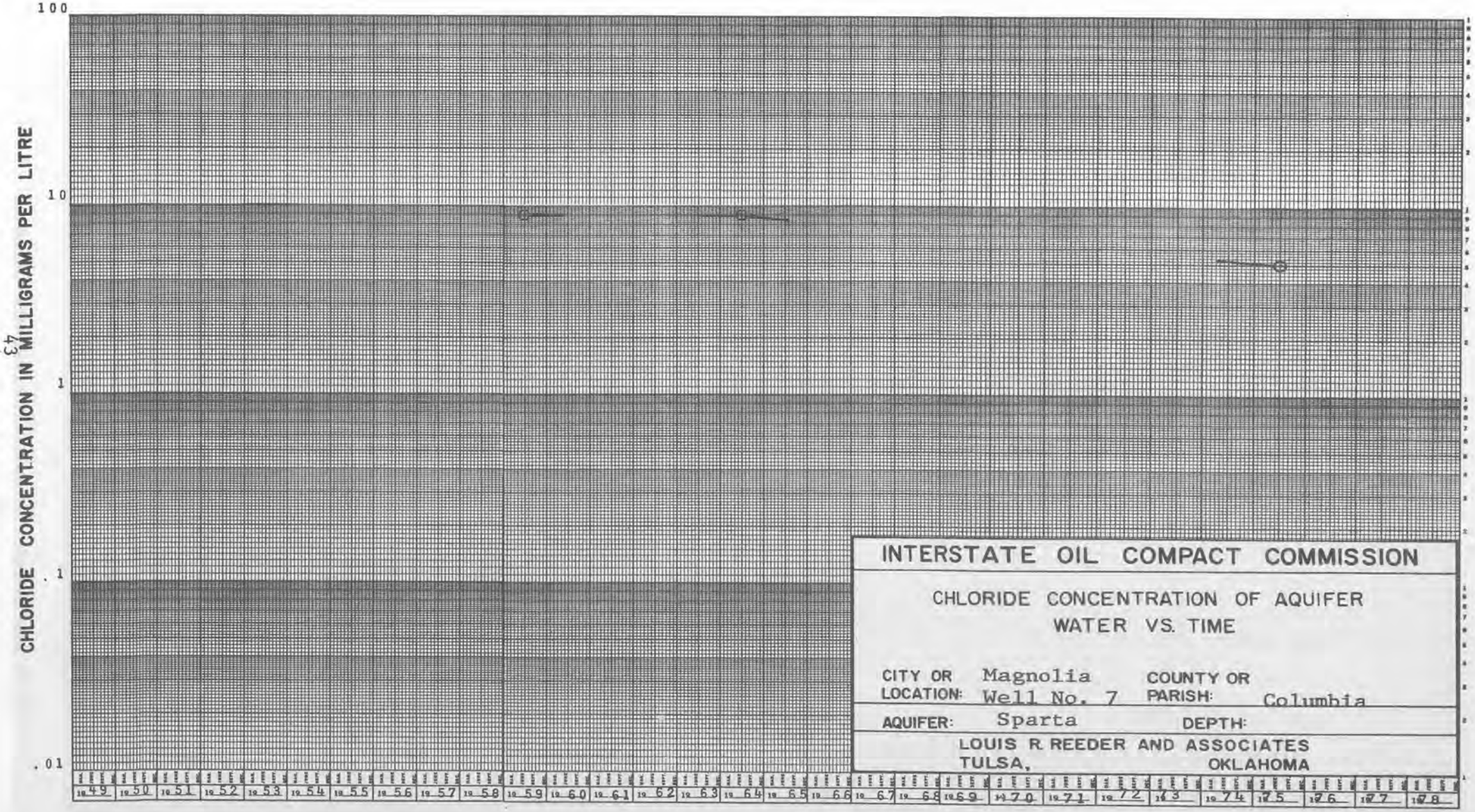
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Magnolia Well No. 5
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 23


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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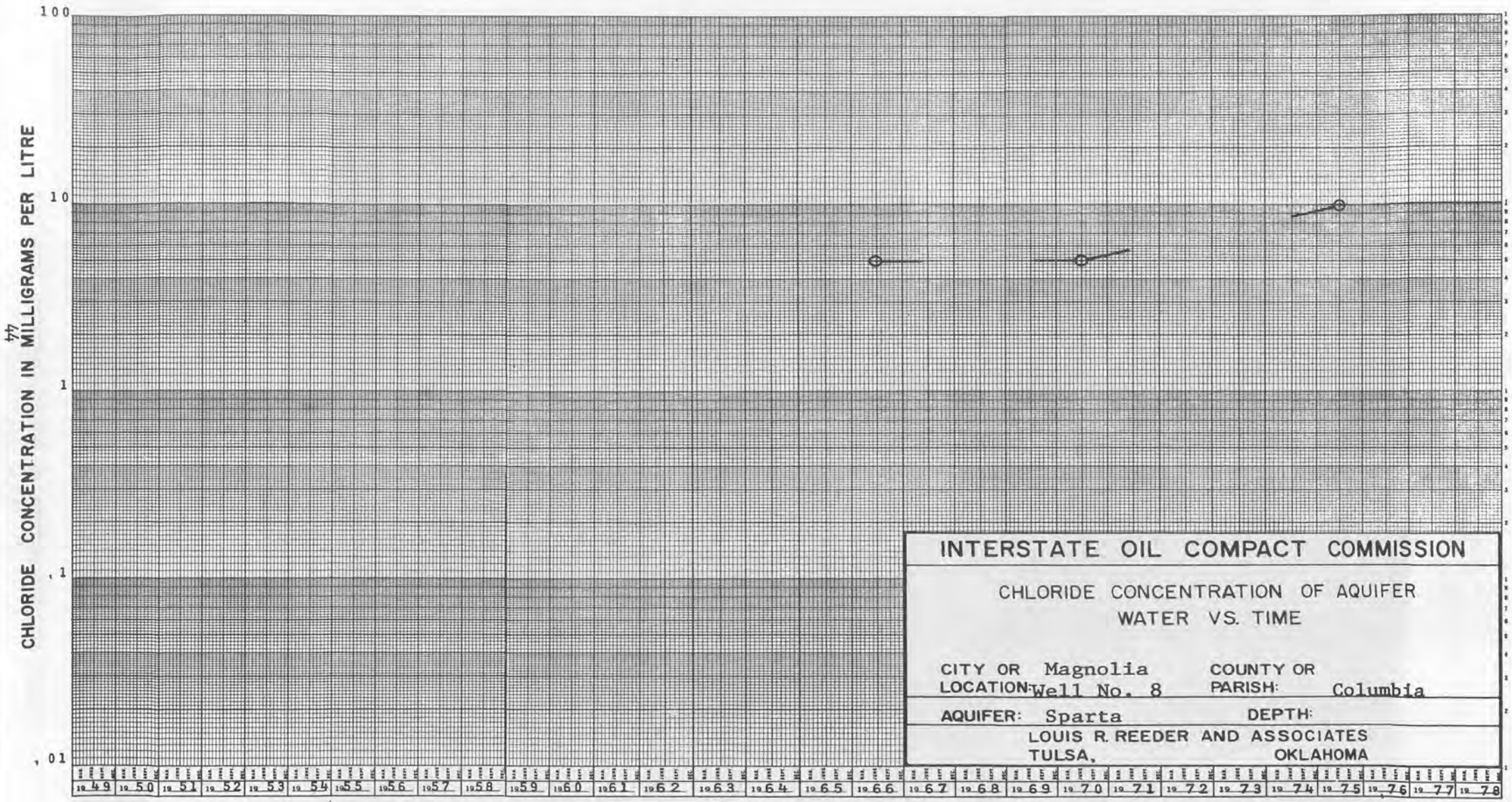
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Magnolia Well No. 7
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 24


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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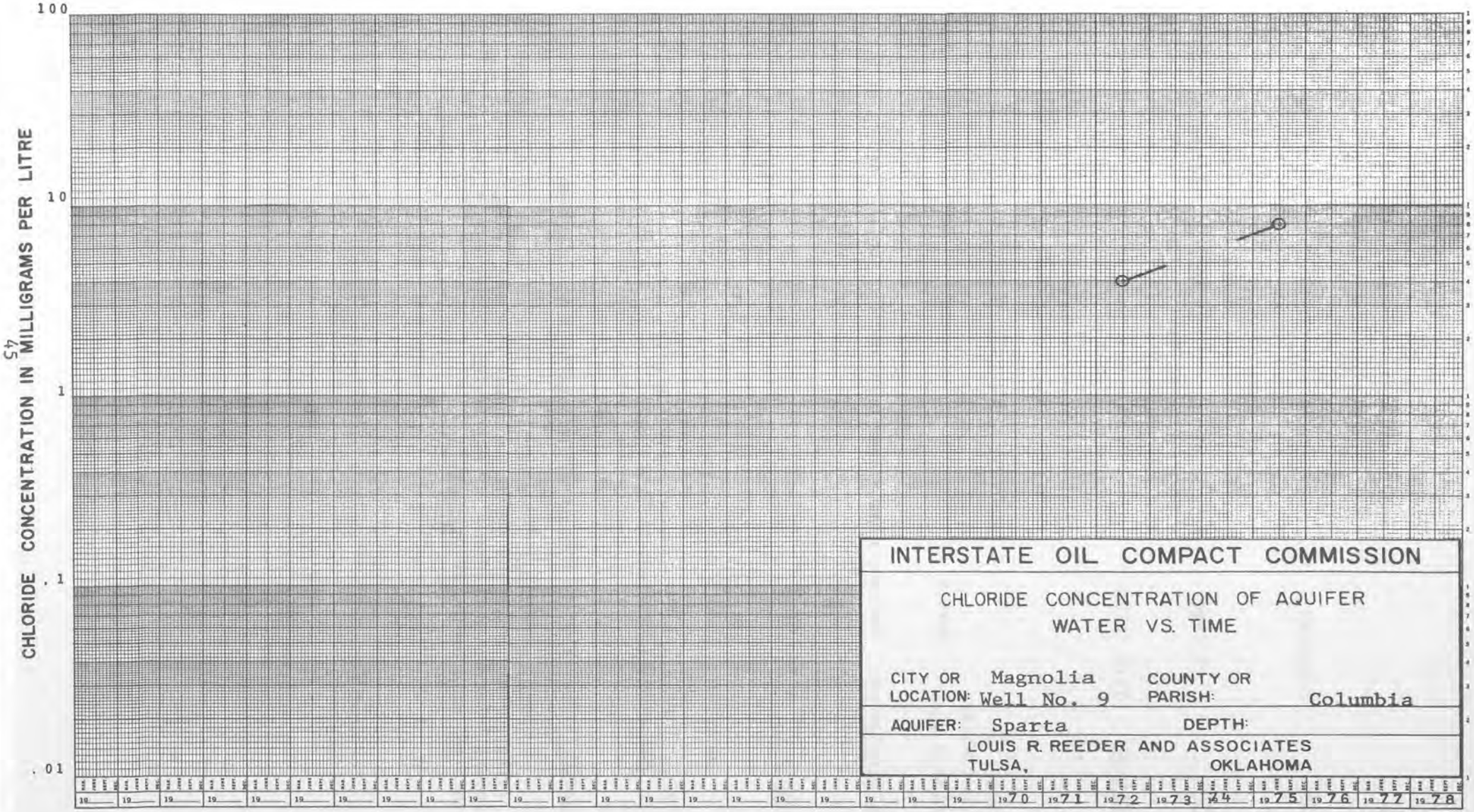
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Magnolia Well No. 8
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

**Figure 25**


CHLORIDE CONCENTRATION IN MILLIGRAMS PER LITRE
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1978
INTERSTATE OIL COMPACT COMMISSION
CHLORIDE CONCENTRATION OF AQUIFER WATER VS. TIME
CITY OR LOCATION: Magnolia Well No. 9
COUNTY OR PARISH: Columbia
AQUIFER: Sparta
DEPTH:
LOUIS R. REEDER AND ASSOCIATES
TULSA, OKLAHOMA

Figure 26

State: Arkansas

City or Town: Village

County or Parish: Columbia

Location: T17S, R19W

Long.

Lat.

Aquifer or Ground Water Basin: Sparta

Monitor Source: One municipal water well and one private water well.

Location: T17S, R19W

Long.

Lat.

Chloride Concentration: See accompanying graph also
Atl. Butane Well, treated, 1978, 19 mg/l

Comments: The chloride concentration indicates no pollution.

The two Village water wells are located in the north portion of Village Field which has active secondary recovery and salt water disposal injection operations. Other fields, active and abandoned, are within a 5 mile radius of Village.