WATER-QUALITY DATA FOR SHALLOW WELLS IN THE WESTERN AND SOUTHERN TULARE BASIN SAN JOAQUIN VALLEY, CALIFORNIA MAY TO AUGUST 1989

U.S. GEOLOGICAL SURVEY
Open-File Report 92-655

Prepared in cooperation with the CALIFORNIA DEPARTMENT OF WATER RESOURCES and the
SAN JOAQUIN VALLEY DRAINAGE PROGRAM

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By Walter C. Swain *and* Lowell F.W. Duell, Jr.

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U.S. GEOLOGICAL SURVEY
DALLAS L. PECK, Director

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Conversion Factors

Multiply	By	To obtain
acre	0.4047	hectare
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer

Temperature is given in degree Celsius (°C), which can be converted to degree Fahrenheit (°F) by the following equation:

$$°F=1.8(°C)+32.$$

Water-Quality Information

Chemical concentrations are given in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams and micrograms per liter are units expressing the weight of the solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. Milligrams per liter is approximately equivalent to parts per million. Micrograms per liter is approximately equivalent to parts per billion.

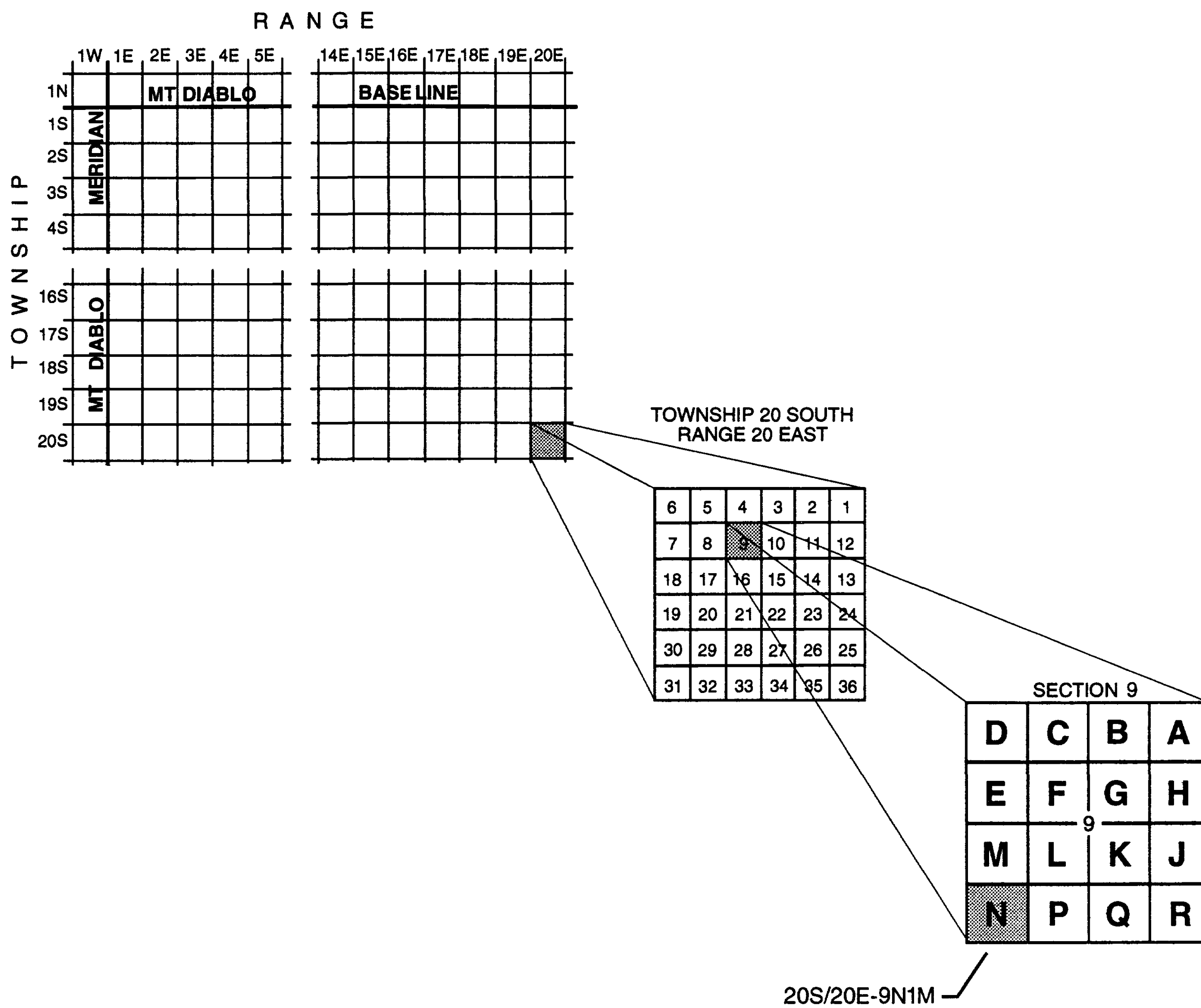
Tritium concentrations are expressed in picocuries per liter (pCi/L) which can be converted to tritium units (TU) by dividing by 3.2.

Vertical Datum

Sea Level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Well-Numbering System

Wells are identified and numbered according to their location in the rectangular system for the subdivision of public lands. Identification consists of the township number, north or south; the range number, east or west; and the section number. Each section is divided into sixteen 40-acre tracts lettered consecutively (except I and O), beginning with "A" in the northeast corner of the section and progressing in a sinusoidal manner to "R" in the southeast corner. Within the 40-acre tract, wells are sequentially numbered in the order they are inventoried. The final letter refers to the base line and meridian. In California, there are three base lines and meridians; Humboldt (H), Mount Diablo (M), and San Bernardino (S). All wells in the study area are referenced to the Mount Diablo base line and meridian (M) except two wells in the San Bernardino base line and meridian (S). Well numbers consist of 14 characters and follow the format 020S020E09N01M. In this report, well numbers are abbreviated and written 20S/20E-9N1M. Wells in the same township and range are referred to only by their section designation, 9N1M. The following diagram shows how the number for well 20S/20E-9N1M is derived.



WATER-QUALITY DATA FOR SHALLOW WELLS IN THE WESTERN AND SOUTHERN TULARE BASIN, SAN JOAQUIN VALLEY, CALIFORNIA, MAY TO AUGUST 1989

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Abstract

Water samples for chemical analyses were collected within 20 feet of land surface in the Tulare Basin in the southern San Joaquin Valley, California, where dissolved trace elements might contribute to potentially toxic conditions for waterfowl and other animals that use agricultural drainwater evaporation ponds. The samples were systematically collected from 117 shallow observation wells in the western and southern parts of the basin from May to August 1989 as part of a study being done by the U.S. Geological Survey, in cooperation with the California Department of Water Resources and the San Joaquin Valley Drainage Program. Analyses included tritium, the stable isotopes of hydrogen and oxygen (deuterium and oxygen-18), and nitrogen and phosphorus, in addition to major ions and selected trace elements. The results of these analyses are presented in this report.

Specific conductance ranged from 288 to 102,000 microsiemens per centimeter, with a median of 5,450 microsiemens per centimeter. Concentrations of dissolved solids, selected trace elements, and major ions typically varied by factors of 100 to 1,000, with median concentrations in the first quartile of their respective ranges. Sodium is the dominant cation in 89 of the 117 samples, and sulfate is the dominant anion in 68 of the 117 samples. Selenium, a trace element of primary interest in the study area, ranged from less than 1 to 1,000 micrograms per liter, with a median concentration of 1 microgram per liter.

INTRODUCTION

The presence of high selenium concentrations in shallow ground water and in agricultural drainwater in the western San Joaquin Valley, California, was identified as the most probable cause of high mortality and deformity rates of waterfowl in the Kesterson National Wildlife Refuge near Kesterson Reservoir (Deverel and others, 1984; Presser and Barnes, 1984; Ohlendorf and others, 1986). This has caused concern that selenium or other trace elements may be present in potentially toxic concentrations in shallow ground water areas of the Tulare Basin in the southern one-third of the San Joaquin Valley (fig. 1).

Previous studies of shallow ground-water quality and related issues in the Tulare Basin involved sampling of agricultural drain sumps (California Department of Water Resources, 1985, 1986) and drainwater evaporation pond inlets and basins (California Regional Water Quality Control Board, 1988). Fujii (1988) evaluated drainwater evaporation pond inlets and basin water quality and Schroeder and others (1988) evaluated drainwater related effects near Tulare Lake Bed. These reports identified areas with dissolved selenium concentrations as high as 919 μg/L (micrograms per liter), confirming that selenium is present in toxic concentrations associated with high mortality and deformity rates. The sampling represented a small part of the 886,000 acres mapped in the Tulare Basin with ground water within 20 ft of land surface (California Department of Water Resources, 1987).

Because of these water-quality concerns, the U.S. Geological Survey began a cooperative study of the shallow ground water in the Tulare Basin with the California Department of Water Resources and the San Joaquin Valley Drainage Program. The primary objective of this report is to characterize the quality of shallow ground water in the Tulare Basin. Water samples for chemical analyses were collected within 20 ft of land surface where dissolved trace elements might contribute to potentially toxic conditions for waterfowl and animals that use agricultural drainwater evaporation ponds. In addition to major ions and selected trace elements, the analyses included tritium, the stable isotopes of hydrogen and oxygen (deuterium and oxygen-18), and nitrogen and phosphorus.

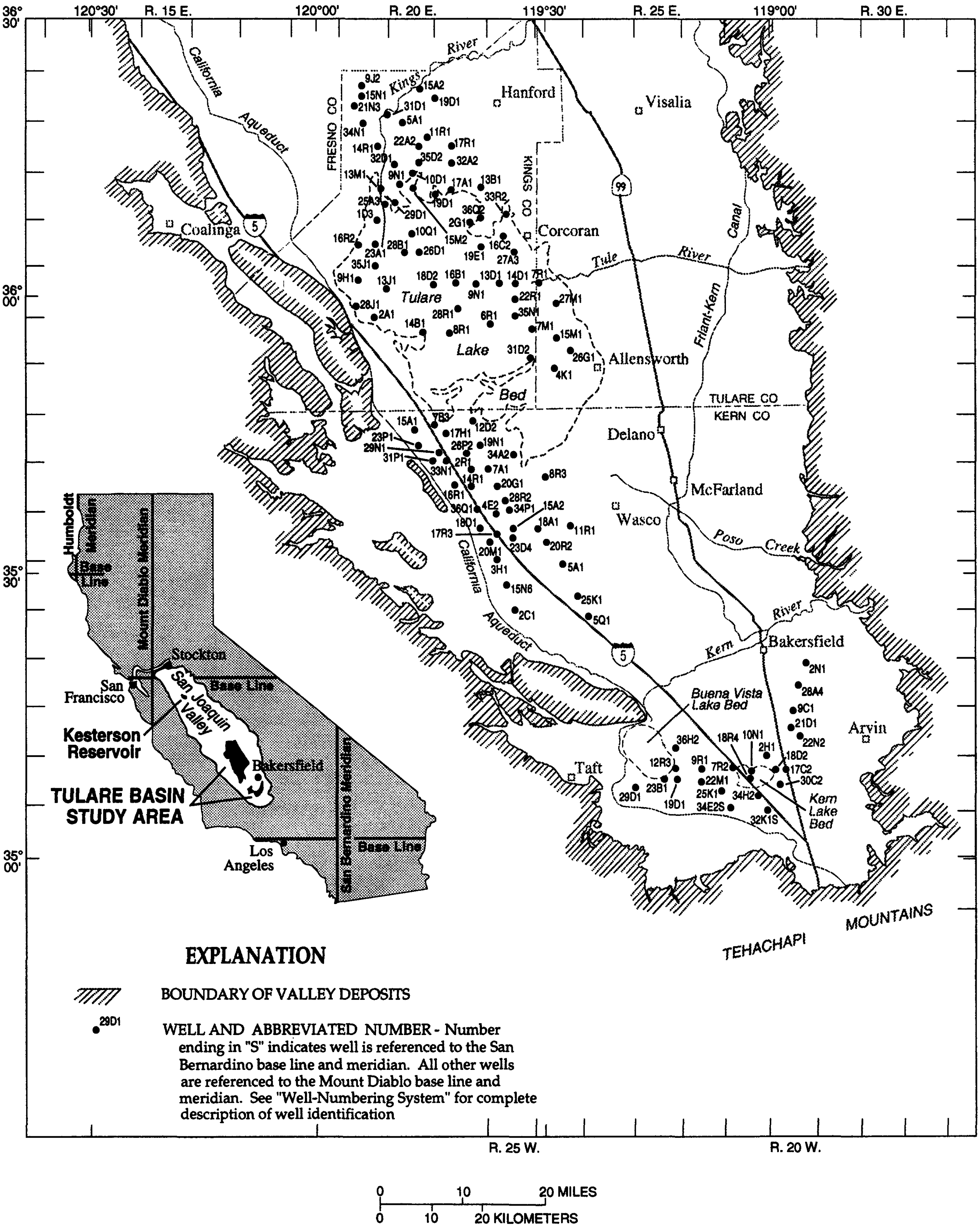


Figure 1. Location of study area and sampling sites.

The initial study area was defined as the 886,000-acre area in the Tulare Basin where ground water is within 20 ft of land surface (California Department of Water Resources, 1987). Existing observation wells were used where possible and additional wells were installed where necessary. Well density averaged about four per township, or one every 6,000 acres. Most existing and new wells were in a right-of-way along public and private roads.

METHODS

Water samples were collected using peristaltic pumps. Typically, wells were pumped until at least three well-casing volumes were withdrawn and the general chemical character of the water had stabilized, as indicated by relatively constant specific conductance and pH, prior to sampling. Standard field methods (U.S. Geological Survey, 1980) were used to collect samples for laboratory analyses.

Chemical analyses were done by or in cooperation with the U.S. Geological Survey National Water Quality Laboratory, Denver, Colorado, using standard methods (Fishman and Friedman, 1989). Hydrogen, oxygen, and tritium isotopic concentrations were determined in the Isotopic Fractionation Laboratory of the U.S. Geological Survey, Reston, Virginia.

For quality assurance purposes, analytical results were reviewed on receipt. Verification or duplicate analyses were requested if reported values were unexpectedly high or low. Ten of the 117 wells were randomly selected for duplicate sampling and laboratory analyses; values for duplicate samples were consistent. Three of the 117 wells sampled were resampled in January 1990 to verify high selenium concentrations; all initial concentrations were verified.

WATER-QUALITY DATA

In the study area, 55 existing shallow wells were identified as suitable for sampling and 62 additional wells were drilled for the study. A well was considered suitable if the well location was consistent with the desired distribution of wells in the study area; the well was constructed with plastic pipe with a cap at the bottom; and the yielding rate of the well allowed sampling within 3 hours. Locations suitable for wells were restricted by extensive flood-irrigation agricultural practices (the dominant land use), irrigation canals and reservoirs, drainwater ditches and drainwater evaporation ponds, and access to private property. As a result, most wells were on or adjacent to a right-of-way along public and private roads. The 886,000 acres identified with ground water within 20 ft of land surface (California Department of Water Resources, 1987) was reduced by about 88,000 acres in sparsely irrigated parts of Kern County and adjacent Tulare County where the water table was greater than 20 ft below land surface. Private lands in Kings County, immediately north of Kern County, and on the Buena Vista Lake Bed in Kern County that were completely inaccessible, further reduced the study area by about 102,000 acres, to an effective total area of 696,000 acres.

Water samples were collected from 117 shallow observation wells in the Tulare Basin (fig. 1) from May to August 1989. The wells had a median depth of 19 ft, with a range of 12.1 to 24.9 ft. Most wells were screened in the lower 10 ft and were completed in valley-fill sediments deposited in differing alluvial, fluvial, paludal, and lacustrine environments predominantly derived from sedimentary and igneous sources.

The well location and characteristics, and chemical analyses of 34 dissolved constituents for 117 wells in the Tulare Basin are given in tables 2 through 5 (at back of report). These properties included specific conductance (a measure of salinity), pH, major ions, dissolved solids (by summation), selected trace elements (including arsenic, boron, mercury, molybdenum, selenium, and uranium), nutrients, organic carbon, tritium, and stable isotopes. These dissolved constituent concentrations are summarized in table 1.

Dissolved constituent concentrations in the shallow ground water sampled are characterized by wide ranges, typically by a factor of 100 to 1,000 between the minimum and maximum concentrations. Sixteen of the 34 constituents reported have minimum concentrations less than the analytical limit of detection, which makes their actual minimum concentrations unknown. For all but two of the constituents (pH and silica), median concentrations are in the first quartile of the reported ranges. (The median represents the point in the range where 50 percent of the observations are greater than and 50 percent are less than the indicated value).

The distribution of values for salinity (measured as specific conductance), dissolved solids, and selected trace elements are shown in boxplots (fig. 2). The boxplots graphically represent the main features of selected data sets summarized in table 1. However, in order to make effective use of this technique, several modifications of the data set were necessary: (1) The three to five highest concentrations were replaced by the next highest concentration, allowing a 2- to 10-fold reduction in the range represented in the scale; (2) one value was randomly selected from each pair of duplicate samples and represented in the boxplots; and (3) less than (censored) values were incorporated at one-half the reported detection limit.

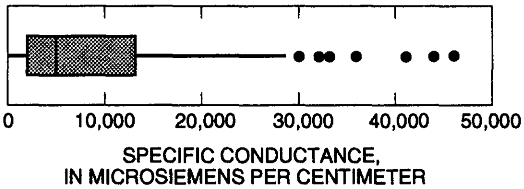
Trace-element concentrations reported also generally vary by a factor of 100 to 1,000, with the exceptions of barium, chromium, and mercury. Mercury has the smallest apparent range, less than 0.1 to 0.6 µg/L. Areal distributions of dissolved solids, arsenic, boron, molybdenum, selenium, and uranium are shown in figures 3-8.

Table 1. Summary of dissolved constituent concentrations from 117 shallow observation wells

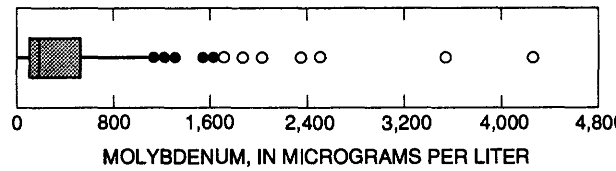
[µS/cm, microsiemen per centimeter at 25°C; mg/L, milligram per liter; µg/L, microgram per liter; pCi/L, picocurie per liter]

Constituent	Minimum	Median	Maximum
Specific conductance, lab (µS/cm)	288	5,450	102,000
pH, Field (standard units)	5.6	7.3	9.2
Calcium (mg/L)	3.1	250	1,000
Magnesium (mg/L)	.4	94	1,800
Sodium (mg/L)	22	790	30,000
Potassium (mg/L)	.1	3.6	100
Bicarbonate (mg/L)	68	436	2,365
Sulfate (mg/L)	16	2,200	34,000
Chloride (mg/L)	4.9	390	44,000
Fluoride (mg/L)	<.1	.8	11
Bromide (mg/L)	<.01	.9	110
Silica (mg/L)	1	33	83
Solids, sum of constituents, dissolved (mg/L)	176	4,440	91,900
Nitrogen, nitrite (mg/L)	<.01	.02	.98
Nitrogen, nitrite plus nitrate (mg/L)	<.1	4.4	185
Phosphorus (mg/L)	<.01	.1	9.2
Aluminum (µg/L)	<10	10	690
Arsenic (µg/L)	<1	9	2,600
Barium (µg/L)	9	50	300
Boron (µg/L)	70	2,800	73,000
Chromium (µg/L)	<1	2	[1]20
Iron (µg/L)	<3	40	210,000
Lithium (µg/L)	<4	80	1,700
Manganese (µg/L)	<1	170	67,000
Mercury (µg/L)	<.1	<.1	.6
Molybdenum (µg/L)	1	150	14,000
Nickel (µg/L)	<1	2	400
Selenium (µg/L)	<1	1	1,000
Uranium (µg/L)	1.1	37	5,400
Vanadium (µg/L)	<1	25	2,400
Carbon, organic, dissolved (mg/L)	.7	6.2	98
Tritium (pCi/L)	<5.7	30	140
Delta deuterium (per mil)	-96	-71.5	-38
Delta oxygen-18 (per mil)	-13.1	-9.05	-.1

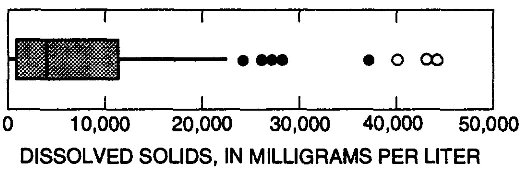
[1]Maximum dissolved chromium concentration may exceed 20 µg/L. One sample reported as less than 50 µg/L.



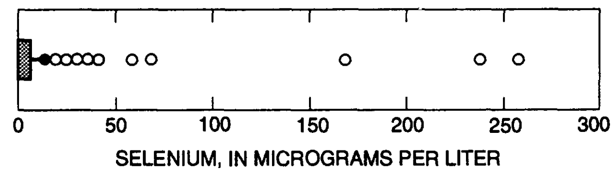
Three highest specific conductance values (57,100, 59,200, and 102,000 µS/cm) replaced with next highest value (45,800 µS/cm)



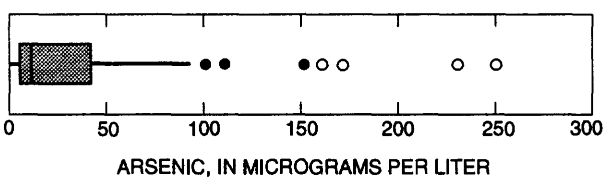
Three highest molybdenum concentration values (9,800, 12,000, and 14,000 µg/L) replaced with next highest value (4,200 µg/L)



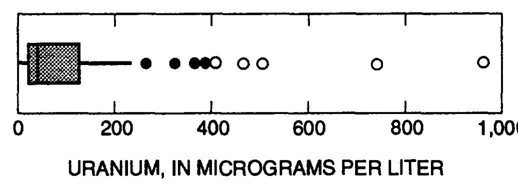
Three highest dissolved-solids concentration values (52,800, 63,600, and 91,900 mg/L) replaced with next highest value (44,400 mg/L)



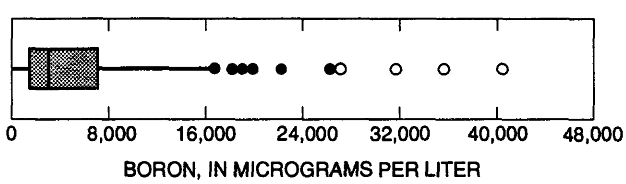
Three highest selenium concentration values (350, 520, and 1,000 µg/L) replaced with next highest value (260 µg/L)



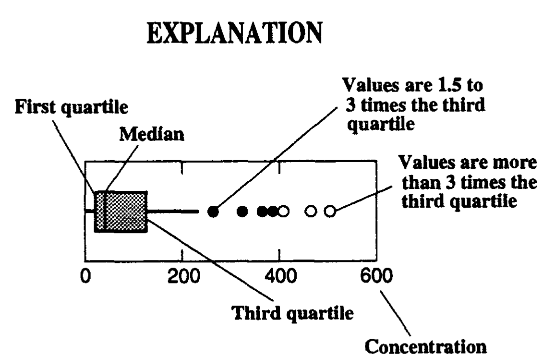
Three highest arsenic concentration values (480, 870, and 2,600 µg/L) replaced with next highest value (250 µg/L)

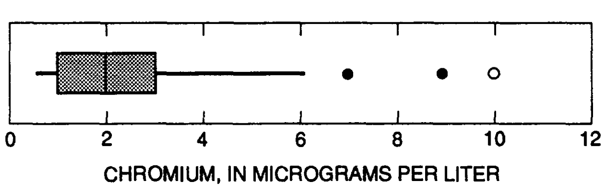


Four highest uranium concentration values (2,500, 3,000, 3,100, and 5,400 µg/L) replaced with next highest value (960 µg/L)



Five highest boron concentration values (61,000, 64,000, 68,000, 70,000, and 73,000 µg/L) replaced with next highest value (41,000 µg/L)





Three highest chromium concentration values (20, 20, and < 50 µg/L) replaced with next highest value (10 µg/L)

The three to five highest concentration values of each data set were replaced with the next highest value to improve scale. One value was randomly selected from each pair of duplicate samples and represented in the boxplots. Less than values were incorporated at one-half the reported detection limit

Figure 2. Distribution of selected constituent values for 117 shallow observation wells.

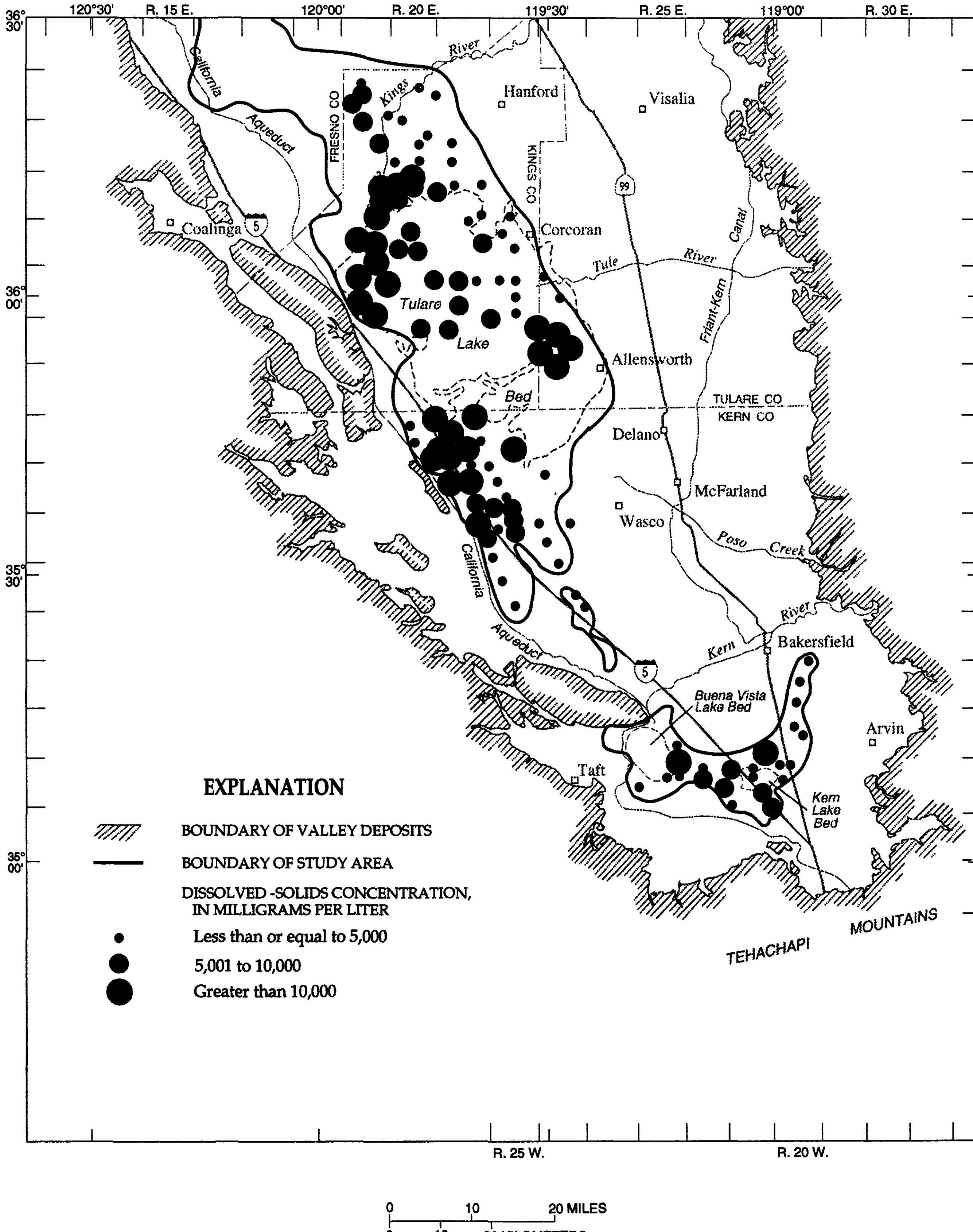


Figure 3. Areal distribution of dissolved solids in shallow ground water.

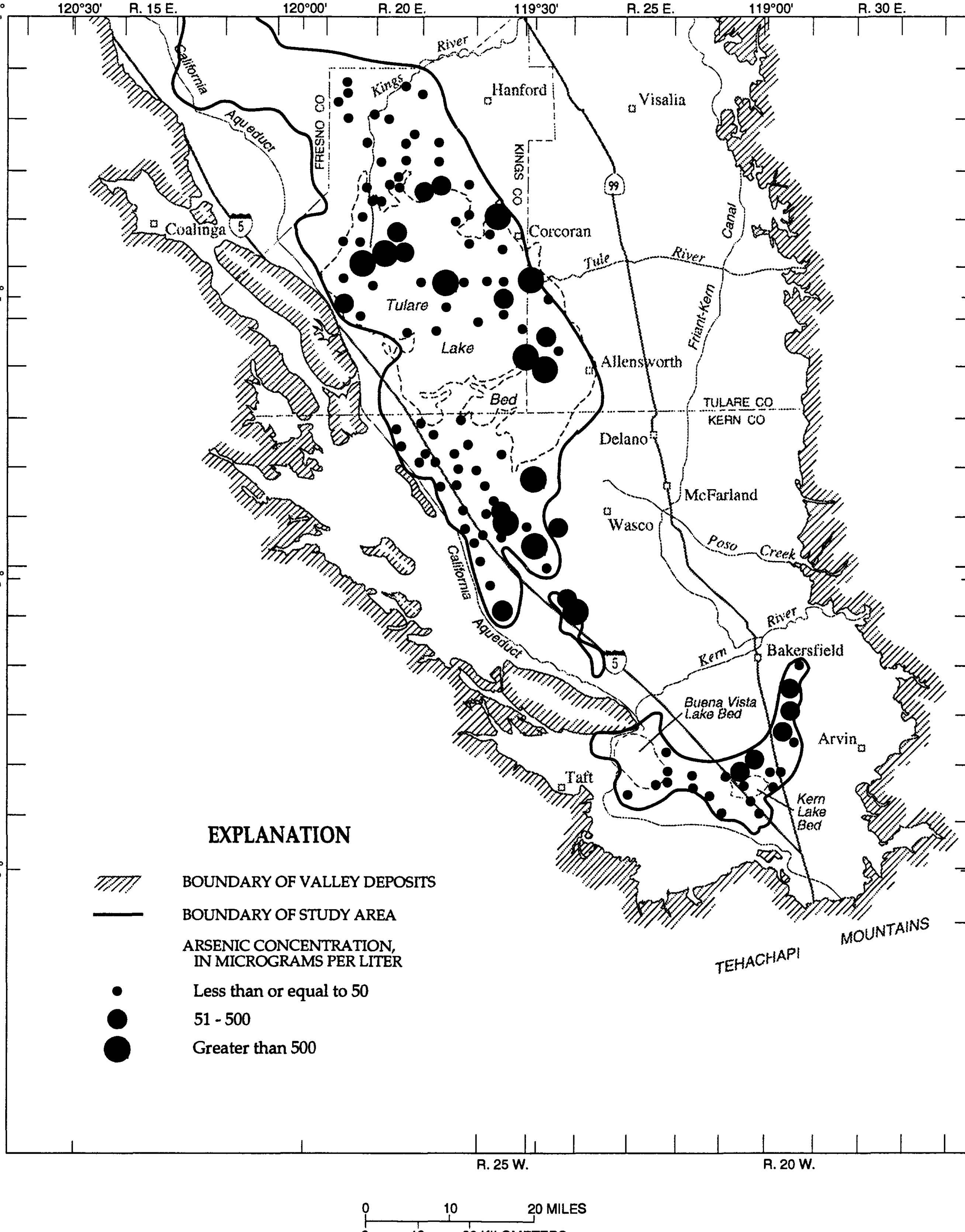


Figure 4. Areal distribution of arsenic in shallow ground water.

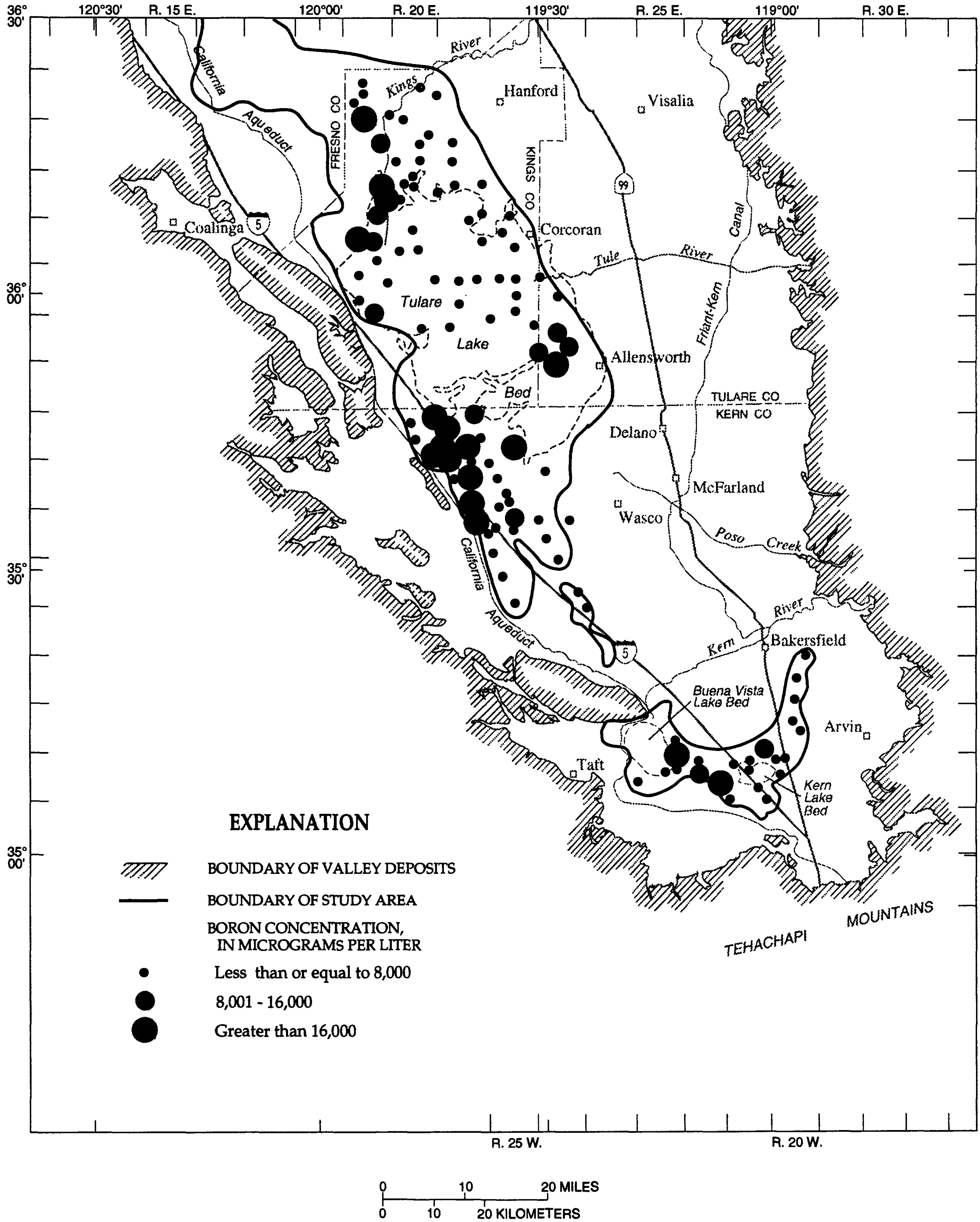


Figure 5. Areal distribution of boron in shallow ground water.

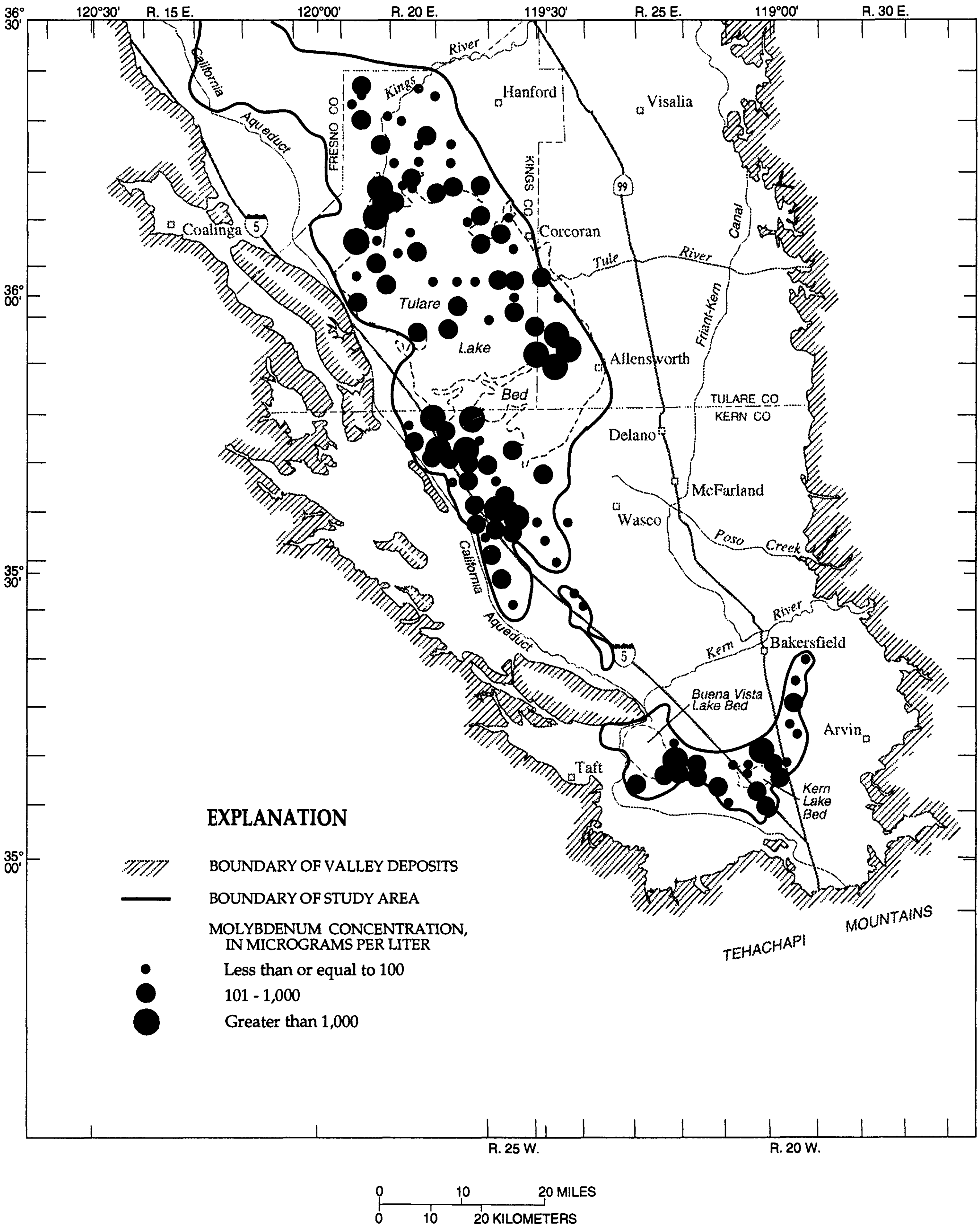


Figure 6. Areal distribution of molybdenum in shallow ground water.

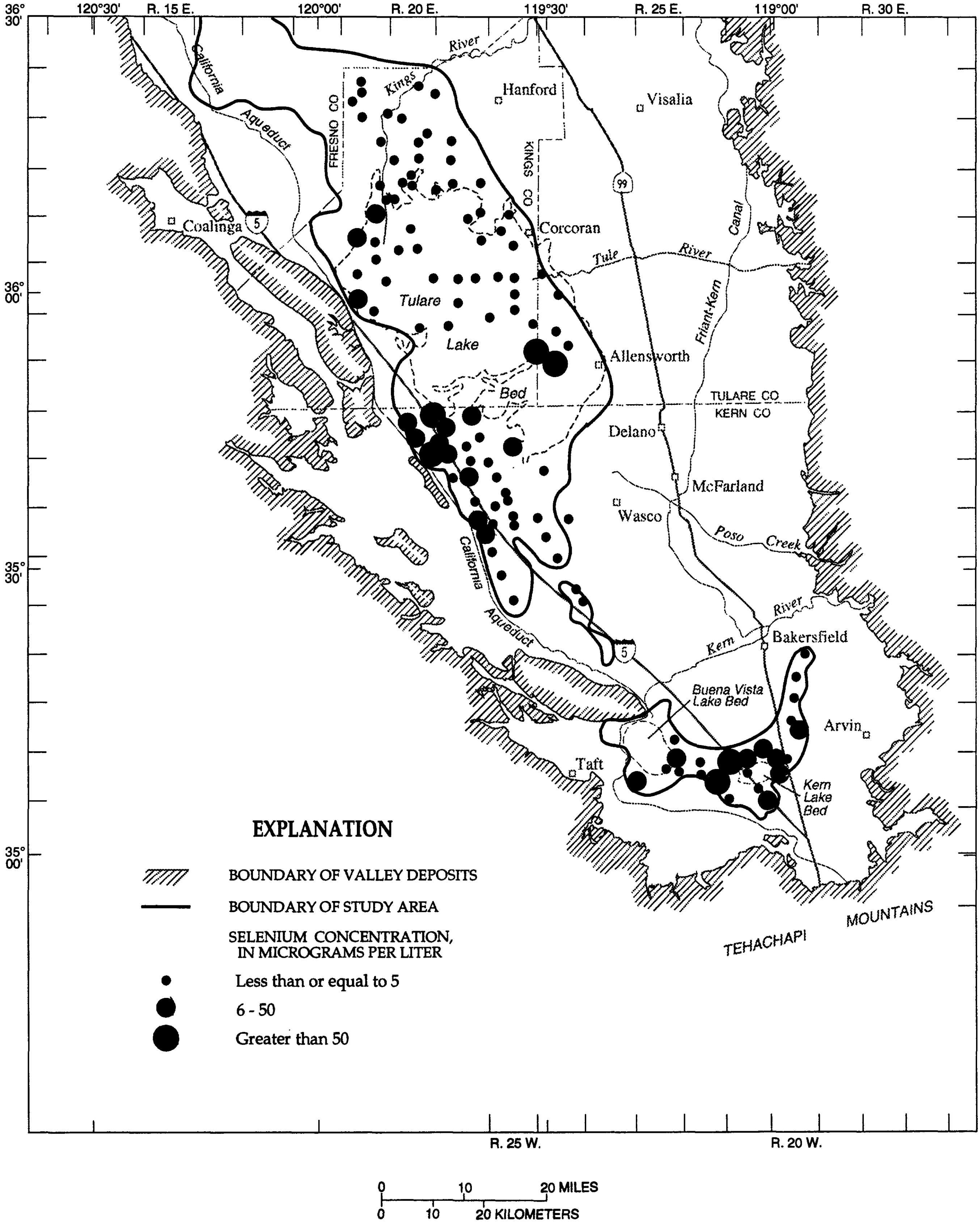


Figure 7. Areal distribution of selenium in shallow ground water.

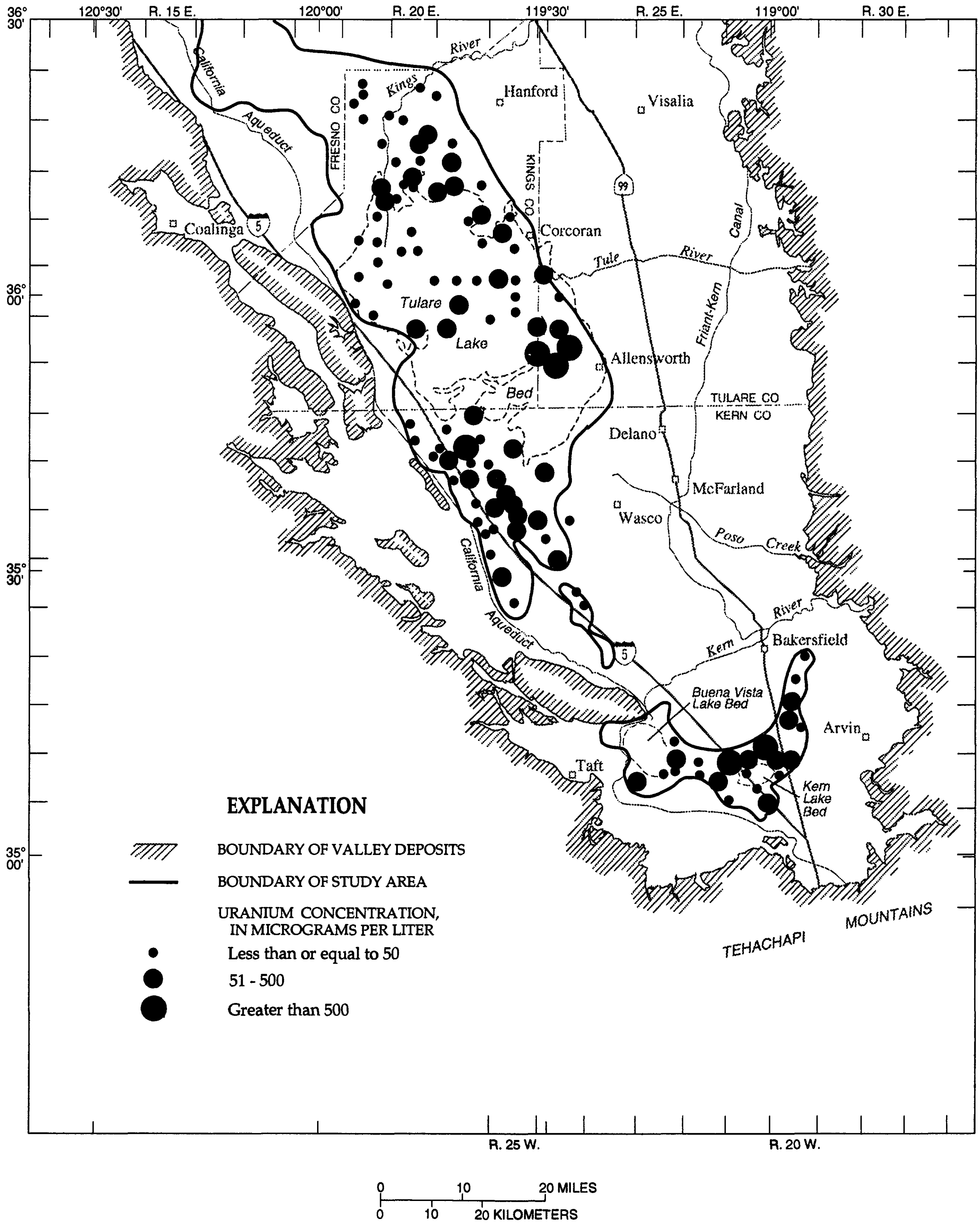


Figure 8. Areal distribution of uranium in shallow ground water.

RESULTS

The quality of shallow ground water in the Tulare Basin is characterized by a high degree of variability. Concentrations of dissolved solids range from 176 to 91,900 mg/L (milligrams per liter), with a median concentration of 4,440 mg/L. Salinity, expressed as specific conductance, ranges from 288 to 102,000 µS/cm (microsiemens per centimeter), with a median of 5,450 µS/cm. By comparison, drinking water typically is less than 750 µS/cm, irrigation water is less than 1,250 µS/cm, and seawater is about 50,000 µS/cm.

Sodium is the dominant (50 percent or greater) major cation in 89 of the 117 wells sampled, calcium is dominant in 8, and magnesium in 2. There is no dominant cation in 18 of the wells sampled. Sulfate is the dominant anion in 68 of the 117 wells sampled, bicarbonate is dominant in 18, and chloride in 11. There is no dominant anion in 20 of the wells sampled.

Selenium, a trace element of primary interest in this study, ranged from less than 1 to 1,000 µg/L, with a median concentration of 1 µg/L. In contrast, selenium concentrations in the San Luis Drain, which discharged into the Kesterson Reservoir until 1986, averaged about 300 µg/L. The U.S. Environmental Protection Agency water-quality criteria for long-term exposure in aquatic environments is 5 µg/L (U.S. Environmental Protection Agency, 1988), and the drinking water maximum contaminant level is 50 µg/L (U.S. Environmental Protection Agency, 1991).

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Table 2. Well location, characteristics, and field measurements of wells sampled

[State well No.: See Well-Numbering System on page V. Station No.: Unique number for each site based on latitude and longitude of the site. First six digits are latitude, next seven digits are longitude, and final two digits are a sequence number to uniquely identify each site. Water level and depth of well in feet below land surface. Altitude of land surface in feet above sea level. Temperature in degrees Celsius; barometric pressure in millimeters of mercury; --, no data]

State well No.	Station No.	Date	Time	Water level	Depth of well	Altitude of land surface	Temperature, air	Temperature, water	Barometric pressure
18S/19E- 9J2M	362236119541701	5-31-89	1230	7.77	16.40	209	29.0	21.0	760
15N1M	362131119541501	5-31-89	1140	3.87	13.50	211	26.0	19.5	760
21N3M	362035119552001	5-31-89	1620	5.00	13.30	218	34.5	22.0	755
34N1M	361850119541201	5-30-89	1930	7.38	14.90	215	27.5	20.0	755
18S/20E- 15A2M	362218119464901	5-31-89	1800	9.39	15.30	236	34.0	21.0	750
31D1M	361940119510001	5-31-89	1530	5.41	12.10	214	33.0	22.0	750
18S/21E- 19D1M	362125119443701	5-23-89	1630	9.10	14.10	235	27.0	20.0	760
19S/19E- 14R1M	361612119520701	5-30-89	1630	6.96	15.00	213	31.0	22.5	755
19S/20E- 5A1M	361848119485701	8-11-89	1515	6.24	20.40	218	33.5	23.5	755
		8-11-89	1615	6.24	20.40	218	33.5	23.5	755
11R1M	361703119454501	6-01-89	0915	7.90	12.90	223	26.0	19.5	760
22A2M	361609119464901	5-31-89	1850	7.70	14.80	222	31.0	23.0	755
32D1M	361415119500001	6-07-89	1730	5.15	16.52	208	30.5	22.0	750
35D2M	361424119464701	5-25-89	1100	7.83	17.72	215	22.0	20.5	760
19S/21E- 17R1M	361610119423001	5-26-89	1000	8.34	15.20	230	19.0	20.0	760
32A2M	361414119423001	5-24-89	1630	7.32	21.53	222	27.0	19.5	755
20S/19E- 13M1M	361122119520201	6-07-89	1400	5.13	21.15	204	31.0	21.5	750
25A3M	360955119510301	6-07-89	1130	7.39	20.50	198	27.0	21.0	750
20S/20E- 9N1M	361149119485501	6-01-89	1000	7.09	16.80	200	31.0	21.0	750
10D1M	361232119475001	6-07-89	1600	3.95	15.35	207	31.5	21.0	750
15M2M	361122119475001	5-25-89	1630	6.82	17.70	204	27.0	21.0	760
29D1M	361002119495901	5-25-89	1830	6.40	16.90	195	28.0	20.0	760
20S/21E- 13B1M	361148119383901	6-26-89	1600	5.26	19.72	214	31.0	21.5	755
17A1M	361140119422801	6-26-89	1400	7.65	19.80	212	32.5	22.0	755
19D1M	361054119443601	5-24-89	1100	6.89	17.20	206	22.5	19.5	760
36Q2M	360856119384001	6-08-89	1500	4.38	19.60	208	32.0	21.0	750
20S/22E- 33R2M	360820119350801	6-08-89	0930	11.14	16.20	211	24.0	20.0	750
21S/19E- 1D3M	360814119522801	6-07-89	0930	5.66	17.97	193	22.0	21.0	750
16R2M	360538119550601	6-06-89	1730	7.45	20.45	198	33.0	22.5	750
23A1M	360537119523801	6-06-89	1500	4.04	18.62	182	32.0	22.5	750
35J1M	360325119523801	6-06-89	1130	3.43	19.80	178	26.0	20.5	755
21S/20E- 10Q1M	360642119474801	6-27-89	0930	4.70	22.82	182	32.0	21.0	760
26D1M	360445119470201	6-27-89	1500	3.72	12.60	179	33.0	24.0	755
28B1M	360446119484401	6-27-89	1200	4.96	22.50	179	33.0	21.0	760
21S/21E- 2G1M	360752119401201	6-08-89	1200	7.70	19.60	200	28.0	21.0	750
21S/22E- 16C2M	360620119355301	6-26-89	1800	4.12	20.03	198	32.0	21.5	755
19E1M	360521119381401	6-08-89	1630	3.65	17.70	187	34.0	21.0	750
27A3M	360442119341701	6-09-89	0800	3.19	21.20	197	20.5	20.0	750
22S/19E- 9H1M	360148119544801	6-06-89	0900	5.99	19.34	182	21.0	19.5	755
13J1M	360048119510801	6-05-89	1600	8.22	20.60	180	30.0	21.5	755
28J1M	355858119550201	6-05-89	1830	5.13	20.05	187	33.0	19.5	755
22S/21E- 13D1M	360117119392701	6-28-89	1030	9.03	22.90	184	24.0	22.5	760
16B1M	360116119420301	6-28-89	0845	5.10	20.20	183	20.0	19.0	760

Table 2. Well location, characteristics, and field measurements of wells sampled--*Continued*

State well No.		Station No.	Date	Time	Water level	Depth of well	Altitude of land surface	Temper-ature, air	Temper-ature, water	Baro-metric pres-sure
22S/21E-	18D2M	360115119445801	6-27-89	1730	7.35	20.20	183	32.0	24.0	755
	28R1M	355841119415001	6-28-89	1530	5.00	21.60	187	31.0	24.0	760
22S/22E-	9N1M	360118119362401	6-28-89	1215	2.50	22.80	187	28.0	22.5	760
			6-28-89	1315	2.25	22.80	187	28.0	22.5	760
	14D1M	360115119341501	6-09-89	1000	2.85	20.55	191	24.0	21.0	750
	22R1M	355938119341601	6-19-89	1430	3.49	19.70	191	33.0	21.0	750
	35N1M	355752119341401	6-19-89	1630	6.39	19.80	192	32.5	22.0	750
22S/23E-	7R1M	360124119310401	6-27-89	0930	6.19	17.88	201	26.0	21.0	755
	27M1M	355905119285201	6-27-89	1500	6.15	20.61	198	35.0	22.0	755
23S/19E-	2A1M	355743119524201	6-05-89	1400	3.43	22.00	187	27.5	21.0	755
23S/20E-	14B1M	355602119463301	6-28-89	1800	7.46	22.40	192	31.0	23.0	760
23S/21E-	8R1M	355604119430201	6-28-89	0930	4.65	19.85	188	24.0	22.0	760
23S/22E-	6R1M	355657119374001	6-19-89	1830	6.88	20.40	189	35.0	21.0	750
23S/23E-	7M1M	355622119320901	6-27-89	1630	3.98	22.05	193	33.0	21.0	755
			6-27-89	1730	3.98	22.05	193	33.0	21.0	755
	15M1M	355530119285201	6-27-89	1130	7.60	20.70	199	29.0	21.0	755
			6-27-89	1230	7.60	20.70	199	29.0	21.0	755
	26G1M	355404119271401	6-28-89	1200	6.94	20.35	209	24.5	20.0	760
	31D2M	355317119320301	6-27-89	1830	7.10	21.90	198	33.0	21.0	755
24S/23E-	4K1M	355210119291201	6-28-89	1400	6.47	18.20	209	28.0	20.5	760
25S/20E-	15A1M	354536119474401	7-12-89	1630	2.80	23.70	260	35.5	25.0	760
	23P1M	354355119471501	6-21-89	1900	4.10	15.40	285	32.0	24.0	750
25S/21E-	7B3M	354633119450403	5-09-89	1815	8.85	23.10	217	--	16.0	--
	12D2M	354631119400001	7-07-89	1015	6.49	18.51	210	29.0	24.0	755
	17H1M	354513119433001	6-21-89	1330	8.15	17.10	220	32.0	25.0	755
	26P2M	354304119405101	6-21-89	1015	6.34	18.40	221	--	20.0	755
	29N1M	354305119442901	6-21-89	1715	3.49	15.00	232	--	23.0	755
	31P1M	354211119451501	6-21-89	1330	6.53	16.68	254	34.0	22.0	750
	33N1M	354212119432501	6-21-89	1030	6.01	18.80	224	29.0	21.0	755
25S/22E-	19N1M	354358119390501	7-12-89	1900	5.62	20.00	218	35.0	21.0	760
	34A2M	354255119344601	6-20-89	1830	14.70	18.00	221	32.0	24.0	755
26S/21E-	2R1M	354120119401701	6-21-89	0830	13.12	17.50	234	26.5	21.0	755
	14R1M	353935119401701	6-29-89	1130	3.53	17.80	237	26.0	22.5	760
	16R1M	353935119423301	7-11-89	1300	16.14	23.50	286	33.0	26.0	755
	36Q1M	353703119392801	6-20-89	0930	11.11	19.00	245	30.0	23.5	755
26S/22E-	7A1M	354127119380901	7-12-89	1600	10.12	19.69	224	35.5	22.0	760
	20G1M	353925119371801	6-20-89	1100	7.45	14.40	229	28.0	23.0	750
			6-20-89	1200	7.45	14.40	229	28.0	23.0	750
	28R2M	353751119355001	6-20-89	1545	12.50	22.00	246	32.0	23.0	755
	34P1M	353659119352501	6-20-89	1300	6.00	17.90	249	30.0	23.0	755
26S/23E-	8R3M	354027119302901	6-20-89	1530	11.66	17.50	227	32.5	23.0	750
27S/22E-	4E2M	353635119365801	6-21-89	1600	3.18	14.30	238	35.0	21.5	750
	15A2M	353511119345301	7-11-89	1550	5.48	18.70	238	37.0	26.0	755

Table 2. Well location, characteristics, and field measurements of wells sampled--*Continued*

State well No.		Station No.	Date	Time	Water level	Depth of well	Altitude of land surface	Temper-ature, air	Temper-ature, water	Baro-metric pres-sure
27S/22E-	17R3M	353425119370401	6-22-89	1130	4.40	15.92	238	30.0	24.0	755
	18D1M	353512119390901	6-23-89	0830	14.12	18.00	257	24.0	22.5	750
	20M1M	353343119375601	7-12-89	1430	3.30	20.60	242	38.0	26.0	760
	23D4M	353410119344601	7-11-89	1830	5.81	20.80	238	36.0	23.5	755
27S/23E-	11R1M	353515119272001	6-26-89	1645	13.80	19.00	268	32.0	24.0	755
	18A1M	353500119313701	7-12-89	1200	6.61	20.50	277	32.0	22.5	760
	20R2M	353329119303401	6-29-89	0915	9.40	15.70	250	21.0	21.0	760
			6-29-89	1015	9.40	15.70	250	21.0	21.0	760
28S/22E-	5A1M	353142119370501	6-22-89	1000	4.73	12.60	243	28.0	22.0	755
	15N6M	352907119354501	7-12-89	1100	7.40	21.00	247	31.0	23.0	760
			7-12-89	1200	7.40	21.00	247	31.0	23.0	760
28S/23E-	3H1M	353119119282601	6-22-89	1700	11.80	19.00	250	40.0	21.0	750
	25K1M	352751119263401	6-22-89	1530	6.70	17.80	264	39.0	22.0	750
29S/22E-	2C1M	352629119345001	6-22-89	1130	6.02	13.40	253	35.5	22.0	750
29S/24E-	5Q1M	352541119250801	6-22-89	1400	3.95	15.50	280	38.0	23.0	750
30S/28E-	2N1M	352024118565501	7-18-89	0800	14.85	23.00	379	27.0	22.0	750
			7-18-89	0900	14.85	23.00	379	27.0	22.0	750
	28A4M	351745118575401	7-17-89	1330	9.05	23.20	361	33.0	22.0	755
31S/25E-	36H2M	351123119140601	6-29-89	1400	7.59	17.70	286	26.5	23.0	755
31S/28E-	9C1M	351507118584501	7-17-89	1600	12.95	24.00	335	35.0	23.0	755
			7-17-89	1530	12.95	24.00	335	35.0	23.0	755
	21D1M	351321118590201	6-28-89	1730	5.95	18.80	322	31.5	22.0	755
	22N2M	351233118575701	6-29-89	0830	9.88	17.10	317	21.0	21.0	755
32S/25E-	12R3M	350907119140501	6-29-89	1800	12.79	19.00	298	29.0	22.0	755
	23B1M	350812119153101	7-11-89	1530	7.53	18.40	310	34.5	23.0	755
			7-11-89	1600	7.53	18.40	310	34.5	23.0	755
	29D1M	350720119191601	7-11-89	1000	8.37	14.30	380	28.0	23.0	750
32S/26E-	9R1M	350912119105101	7-19-89	1330	6.35	21.00	298	35.0	22.0	755
	19D1M	350812119135801	7-11-89	1730	5.63	16.70	317	37.0	21.5	755
	22M1M	350747119104701	7-18-89	1800	16.11	22.40	334	38.0	22.0	755
	25K1M	350648119143101	7-18-89	1530	6.28	22.50	364	37.0	23.0	755
32S/27E-	2H1M	351025119021901	7-19-89	0830	11.45	22.00	293	30.0	22.0	755
	7R2M	350909119063201	7-19-89	1100	8.23	22.00	290	32.0	22.5	755
	10N1M	350905119041201	6-29-89	1030	10.78	18.50	282	26.0	22.5	760
	16R4M	350815119042501	6-29-89	1200	5.50	18.60	292	25.0	22.0	760
32S/27E-	34H2M	350618119032401	7-10-89	1800	5.30	17.40	301	38.0	23.5	750
32S/28E-	17C2M	350859118595201	7-17-89	1800	11.89	23.70	295	36.5	23.0	755
	18D2M	350904119010901	7-18-89	1030	3.47	20.00	281	31.5	22.5	755
	30C2M	350719119004101	7-18-89	1400	12.32	20.30	318	35.5	22.0	755
12N/20W-	32K1S	350446119021201	6-30-89	0900	11.68	24.90	362	25.0	22.0	755
12N/21W-	34E2S	350502119070201	7-10-89	1400	13.19	19.30	418	35.5	22.5	750

Table 3. Chemical analyses of major ions

[State well No.: See Well-Numbering System on page V. Results in milligrams per liter, unless otherwise noted; µS/cm,

State well No.		Date	Specific conductance, lab (µS/cm)	pH, field (standard units)	Calcium, dissolved	Magnesium, dissolved	Sodium, dissolved
18S/19E-	9J2M	5-31-89	4,400	7.1	87	95	840
	15N1M	5-31-89	6,140	7.0	610	360	620
	21N3M	5-31-89	2,010	7.6	300	40	130
	34N1M	5-30-89	8,120	7.8	510	140	1,500
18S/20E-	15A2M	5-31-89	607	6.4	57	20	42
	31D1M	5-31-89	2,000	7.1	150	51	210
18S/21E-	19D1M	5-23-89	1,600	6.7	91	36	210
19S/19E-	14R1M	5-30-89	6,620	7.8	67	51	1,400
19S/20E-	5A1M	8-11-89	288	7.2	28	7.9	22
		8-11-89	289	7.2	28	7.9	22
	11R1M	6-01-89	1,330	7.2	45	19	250
	22A2M	5-31-89	1,330	6.7	160	31	82
	32D1M	6-07-89	790	7.2	27	12	120
	35D2M	5-25-89	308	7.9	31	11	22
19S/21E-	17R1M	5-26-89	613	7.4	58	14	58
	32A2M	5-24-89	1,730	7.2	76	30	270
20S/19E-	13M1M	6-07-89	40,500	7.2	220	840	10,000
	25A3M	6-07-89	27,600	7.2	530	1,800	5,400
20S/20E-	9N1M	6-01-89	13,100	6.6	360	630	2,600
	10D1M	6-07-89	16,800	7.3	250	380	3,900
	15M2M	5-25-89	9,680	7.3	95	280	2,000
	29D1M	5-25-89	7,890	6.6	450	530	1,100
20S/21E-	13B1M	6-26-89	2,480	7.5	32	18	530
	17A1M	6-26-89	5,450	7.9	14	9.6	1,400
	19D1M	5-24-89	9,360	8.1	19	54	2,100
	36Q2M	6-08-89	4,930	7.1	180	100	820
20S/22E-	33R2M	6-08-89	3,200	9.2	3.1	1.1	790
21S/19E-	1D3M	6-07-89	15,500	7.4	360	720	3,600
	16R2M	6-06-89	59,200	7.4	440	1,400	18,000
	23A1M	6-06-89	18,700	6.1	480	1,300	3,300
	35J1M	6-06-89	18,000	6.0	440	1,700	2,600
21S/20E-	10Q1M	6-27-89	10,500	6.4	580	990	1,000
	26D1M	6-27-89	10,400	6.4	590	520	1,400
	28B1M	6-27-89	10,800	6.3	510	690	1,400
21S/21E-	2G1M	6-08-89	2,160	7.6	21	14	450
21S/22E-	16C2M	6-26-89	3,760	7.6	36	21	780
	19E1M	6-08-89	8,870	6.9	470	210	1,500
	27A3M	6-09-89	1,340	8.3	16	9.6	280
22S/19E-	9H1M	6-06-89	12,800	6.0	430	510	2,200
	13J1M	6-05-89	12,600	6.5	530	610	2,000
	28J1M	6-05-89	22,600	6.6	490	990	4,200
22S/21E-	13D1M	6-28-89	2,210	6.6	140	51	260
	16B1M	6-28-89	5,800	6.2	580	230	660
	18D2M	6-27-89	5,840	6.2	580	260	670
	28R1M	6-28-89	12,400	6.8	510	340	2,200
22S/22E-	9N1M	6-28-89	2,670	6.6	140	48	420
		6-28-89	2,670	6.6	140	48	410
	14D1M	6-09-89	1,500	7.2	44	13	290
	22R1M	6-19-89	3,680	7.2	140	65	580
	35N1M	6-19-89	4,210	6.3	260	94	650

microsiemen per centimeter; <, actual value less than value shown; --, not analyzed]

Potassium, dissolved	Bicarbonate (as HCO_3)	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Bromide, dissolved	Silica, dissolved	Solids, sum of constituents, dissolved
2.4	444	1,600	300	0.80	0.11	32	3,180
1.9	444	3,400	420	.50	.40	33	5,670
.90	137	790	140	.30	.44	22	1,520
2.6	400	4,400	310	.20	.49	40	7,230
1.6	115	140	24	.20	.06	31	409
.90	349	310	72	1.3	.27	38	1,450
1.6	248	330	120	.20	.68	31	1,070
1.3	300	2,900	390	1.0	.83	31	5,080
.80	110	29	7.2	.20	.01	25	176
.80	110	29	7.2	.20	.01	25	176
.80	607	170	21	.40	.03	25	851
.90	441	160	59	.20	.33	33	810
2.1	80	230	45	.70	.03	22	502
.50	167	16	4.9	.40	.01	33	203
.30	201	98	12	.40	.05	40	416
.70	580	180	110	.50	.26	42	1,130
21	495	20,000	5,900	.50	.94	23	37,300
17	861	12,000	5,300	.50	4.7	25	25,500
5.4	402	8,500	400	1.2	1.3	46	12,700
5.3	667	7,300	1,900	1.0	3.4	56	14,200
8.1	699	4,200	710	1.4	.78	51	7,710
3.5	355	4,700	310	.90	.65	51	7,440
1.1	804	320	150	1.7	.18	36	1,660
2.0	2,365	440	510	1.2	.39	25	3,570
2.6	1,305	2,300	1,300	1.2	2.1	45	6,490
2.2	587	1,200	700	.90	.05	48	3,380
.70	1,744	160	100	2.3	<.01	17	2,010
11	423	8,400	1,400	.70	2.6	26	14,800
89	668	34,000	9,200	.80	24	17	63,600
22	296	11,000	2,000	.30	5.2	38	18,000
25	637	12,000	1,200	.30	2.2	35	18,500
15	1,129	6,300	540	.20	1.2	22	10,000
18	839	4,500	1,200	.60	2.8	31	8,750
26	688	5,200	1,200	.70	3.4	25	9,460
1.5	724	260	180	2.3	.28	32	1,320
2.4	835	580	490	2.0	1.4	13	2,360
12	541	3,700	990	.40	2.4	34	7,200
.60	533	150	69	1.2	.33	23	850
23	234	6,700	1,000	.30	3.6	49	11,000
32	1,537	4,800	1,700	.20	3.8	49	10,500
65	627	8,700	4,200	.30	7.7	44	19,200
5.9	1,000	200	180	.20	.27	43	1,380
13	588	2,900	430	.80	1.2	53	5,220
20	451	3,400	280	.90	.58	39	5,550
5.5	795	5,100	1,400	1.0	3.3	22	9,990
4.3	449	920	120	1.0	.27	22	1,900
4.2	449	910	120	.90	.26	22	1,880
1.5	510	220	99	.80	.22	29	950
5.4	896	300	610	.80	2.1	38	2,190
7.3	315	2,100	140	.50	.24	35	3,450

Table 3. Chemical analyses of major ions--*Continued*

State well No.		Date	Specific conductance, lab (µS/cm)	pH, field (standard units)	Calcium, dissolved	Magnesium, dissolved	Sodium, dissolved
22S/23E-	7R1M	6-27-89	2,200	8.0	23	13	490
	27M1M	6-27-89	2,420	7.6	64	27	440
23S/19E-	2A1M	6-05-89	25,800	5.8	470	1,300	5,500
23S/20E-	14B1M	6-28-89	9,410	7.5	150	260	1,900
23S/21E-	8R1M	6-28-89	11,400	6.6	490	230	2,200
23S/22E-	6R1M	6-19-89	10,500	6.6	770	290	1,600
23S/23E-	7M1M	6-27-89	17,500	6.4	530	500	3,300
		6-27-89	17,600	6.4	530	510	3,400
	15M1M	6-27-89	56,900	6.8	600	1,500	15,000
		6-27-89	57,100	6.8	620	1,600	15,000
	26G1M	6-28-89	32,900	7.4	300	410	8,400
	31D2M	6-27-89	44,000	7.4	500	940	11,000
24S/23E-	4K1M	6-28-89	45,800	7.6	180	600	13,000
25S/20E-	15A1M	7-12-89	3,140	7.4	460	80	230
	23P1M	6-21-89	3,810	7.3	470	84	400
25S/21E-	7B3M	5-09-89	102,000	7.4	800	1,400	30,000
	12D2M	7-07-89	16,700	7.5	160	280	4,100
	17H1M	6-21-89	36,200	6.9	900	770	7,200
	26P2M	6-21-89	43,900	8.0	68	200	13,000
	29N1M	6-21-89	16,500	8.2	420	45	4,200
	31P1M	6-21-89	27,200	7.3	1,000	340	5,200
	33N1M	6-21-89	14,600	7.4	430	78	3,500
25S/22E-	19N1M	7-12-89	1,840	7.2	89	37	220
	34A2M	6-20-89	32,400	7.1	220	300	8,500
26S/21E-	2R1M	6-21-89	3,170	8.0	37	17	630
	14R1M	6-29-89	23,100	7.7	330	180	5,900
	16R1M	7-11-89	14,900	7.3	980	240	2,100
	36Q1M	6-20-89	7,110	7.2	390	99	1,300
26S/22E-	7A1M	7-12-89	1,140	6.0	65	16	150
	20G1M	6-20-89	1,240	6.3	71	16	160
		6-20-89	1,240	6.3	70	16	160
	28R2M	6-20-89	5,910	7.1	210	42	1,000
	34P1M	6-20-89	14,500	7.1	570	68	2,700
26S/23E-	8R3M	6-20-89	2,520	7.6	21	4.0	600
27S/22E-	4E2M	6-21-89	9,840	7.7	30	82	2,000
	15A2M	7-11-89	8,100	8.3	5.6	6.8	1,900
	17R3M	6-22-89	3,420	7.5	63	29	670
	18D1M	6-23-89	29,800	7.1	460	290	7,000
	20M1M	7-12-89	10,400	5.6	260	120	2,100
	23D4M	7-11-89	9,910	7.2	270	200	1,600
27S/23E-	11R1M	6-26-89	1,210	7.4	21	1.6	240
	18A1M	7-12-89	1,560	7.2	100	11	200
	20R2M	6-29-89	2,120	8.1	3.6	.50	440
		6-29-89	2,130	8.1	3.7	.40	440
28S/22E-	5A1M	6-22-89	2,170	6.4	140	12	300
	15N6M	7-12-89	5,210	7.1	310	85	670
		7-12-89	5,210	7.1	310	85	670
28S/23E-	3H1M	6-22-89	1,980	7.1	100	7.0	330
	25K1M	6-22-89	928	8.2	6.4	.51	190
29S/22E-	2C1M	6-22-89	3,320	8.0	22	8.9	630

Potassium, dissolved	Bicarbonate (as HCO_3)	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Bromide, dissolved	Silica, dissolved	Solids, sum of constituents, dissolved
1.4	1,132	130	58	5.2	0.03	21	1,400
1.2	436	610	120	.30	.24	67	1,710
35	243	13,000	3,700	.10	7.8	39	24,300
15	1,129	3,300	940	1.0	2.4	34	7,180
9.0	830	4,000	1,500	1.0	3.0	33	8,890
9.7	998	3,900	1,400	.40	2.0	53	8,530
9.8	585	6,100	3,100	.50	6.1	34	13,900
9.9	585	6,200	3,100	.50	5.9	34	14,100
10	945	18,000	14,000	.30	30	29	49,700
11	945	20,000	15,000	.20	32	32	52,800
31	1,293	13,000	5,100	.20	9.6	34	28,000
11	539	17,000	9,600	.50	21	30	39,500
82	1,537	19,000	8,700	.20	21	38	42,500
.70	107	1,900	67	.20	1.0	38	2,840
4.6	229	2,100	97	.30	.53	44	3,370
14	185	15,000	44,000	.10	110	16	91,900
1.7	849	7,200	1,600	2.9	2.3	31	13,900
9.3	349	5,500	11,000	.50	66	44	25,700
3.3	880	27,000	3,400	11	15	14	44,400
5.4	154	9,500	640	.20	1.1	32	15,100
1.4	160	4,000	8,200	1.1	57	40	19,000
1.6	295	6,700	1,500	1.2	3.0	21	12,400
1.4	189	310	310	.70	.92	33	1,100
1.9	805	12,000	6,300	2.2	36	32	27,400
1.4	354	740	340	.10	1.3	1	1,950
3.9	295	14,000	1,000	<.10	1.7	52	21,700
.90	151	2,400	3,700	<.10	13	36	10,400
2.2	234	4,200	59	1.9	--	22	6,210
5.9	167	250	130	.50	.35	37	737
3.2	117	190	210	1.2	.70	21	739
3.3	117	190	210	1.2	.69	21	739
.40	239	1,000	1,200	3.1	14	56	3,770
4.2	293	2,200	3,900	3.7	37	66	9,740
.80	676	560	130	1.4	.08	28	1,700
1.2	538	1,400	2,200	.80	9.9	27	6,230
.50	815	2,100	1,000	3.3	2.6	38	5,500
2.1	490	820	370	5.0	.75	28	2,240
6.7	379	5,800	8,400	2.3	32	56	22,300
2.5	68	4,100	1,200	.40	2.7	36	7,870
2.0	371	2,100	2,200	1.6	5.1	46	6,640
.50	254	130	150	1.1	.36	63	734
.50	273	160	180	.90	.47	38	985
.70	585	190	210	2.5	.50	52	1,250
.60	585	190	210	2.4	.50	52	1,250
5.8	180	410	350	.50	3.6	31	1,340
.90	449	560	1,100	1.0	5.1	38	3,010
.70	449	560	1,200	1.0	5.1	38	3,110
1.6	394	420	63	.50	.24	37	1,400
.10	161	90	140	2.0	.42	83	599
3.6	380	340	620	2.6	5.0	37	1,930

Table 3. Chemical analyses of major ions--*Continued*

State well No.		Date	Specific conductance, lab (µS/cm)	pH, field (standard units)	Calcium, dissolved	Magnesium, dissolved	Sodium, dissolved
29S/24E-	5Q1M	6-22-89	3,930	7.4	5.2	0.40	1,000
30S/28E-	2N1M	7-18-89	1,480	7.6	35	18	270
		7-18-89	1,470	7.6	35	18	270
	28A4M	7-17-89	1,070	7.7	40	17	160
31S/25E-	36H2M	6-29-89	2,660	7.2	600	6.0	53
31S/28E-	9C1M	7-17-89	3,040	7.7	40	32	620
		7-17-89	3,060	7.7	39	30	600
	21D1M	6-28-89	1,030	7.3	21	9.8	190
	22N2M	6-29-89	727	7.6	43	7.2	100
32S/25E-	12R3M	6-29-89	43,500	7.5	480	1,000	11,000
	23B1M	7-11-89	5,040	7.7	500	190	610
		7-11-89	5,050	7.7	520	180	580
	29D1M	7-11-89	4,860	7.0	720	160	190
32S/26E-	9R1M	7-19-89	3,350	7.6	550	97	250
	19D1M	7-11-89	4,290	7.9	520	240	370
	22M1M	7-18-89	8,660	7.7	480	180	1,700
	25K1M	7-18-89	16,100	8.0	270	420	3,600
32S/27E-	2H1M	7-19-89	15,400	7.8	130	85	3,800
	7R2M	7-19-89	5,930	6.8	660	260	550
	10N1M	6-29-89	1,310	7.1	140	42	94
	16R4M	6-29-89	3,740	6.9	540	130	270
	34H2M	7-10-89	11,000	7.4	380	320	2,100
32S/28E-	17C2M	7-17-89	3,590	7.6	260	46	450
	18D2M	7-18-89	5,190	7.4	440	140	700
	30C2M	7-18-89	4,790	7.6	410	260	460
12N/20W-	32K1S	6-30-89	6,590	7.6	450	160	960
12N/21W-	34E2S	7-10-89	1,410	7.3	220	12	55

Potassium, dissolved	Bicarbonate (as HCO_3)	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Bromide, dissolved	Silica, dissolved	Solids, sum of constituents, dissolved
0.10	1,029	710	310	2.5	1.5	45	2,700
3.0	507	160	110	.60	.17	54	1,010
3.0	507	160	100	.70	.17	55	999
4.2	279	89	90	.40	.13	48	702
2.8	216	1,500	80	2.2	.25	35	2,420
2.8	748	590	300	.60	.28	28	2,020
2.7	748	590	290	.60	.40	28	1,990
.90	485	58	51	2.5	.25	39	637
1.5	278	75	42	.50	.11	27	440
100	463	24,000	6,200	2.8	9.9	25	43,200
7.5	88	3,100	200	2.7	.28	22	4,680
7.0	88	3,100	170	2.7	.28	22	4,630
13	505	1,700	360	.60	.82	24	3,420
23	163	2,200	21	7.8	.11	13	3,260
21	99	2,600	140	5.5	.08	7.7	3,970
16	129	5,000	290	8.5	.50	14	7,780
27	159	9,200	1,000	6.3	.49	11	14,700
11	687	7,000	1,400	6.0	1.8	29	12,900
8.8	338	2,500	550	1.5	.83	29	5,140
1.2	444	330	21	.80	.08	62	938
26	220	2,100	67	.90	.11	48	3,370
3.8	251	6,000	550	1.8	3.1	31	9,480
23	159	940	660	1.5	1.0	16	2,490
12	227	2,600	350	5.5	.23	22	4,440
19	90	2,400	270	6.6	.88	17	4,260
17	118	3,600	230	2.1	1.5	53	5,750
4.3	227	340	120	.90	.24	28	972

Table 4. Chemical analyses of selected trace elements

[State well No.: See Well-Numbering System on page V. Results in micrograms per liter, unless otherwise noted; <,

State well No.		Date	Aluminum, dissolved	Arsenic, dissolved	Barium, dissolved	Boron, dissolved	Chromium, dissolved	Iron, dissolved
18S/19E-	9J2M	5-31-89	<10	3	<100	1,300	<1	1,400
	15N1M	5-31-89	<10	2	<100	1,500	3	20
	21N3M	5-31-89	<10	1	100	1,800	9	20
	34N1M	5-30-89	<10	13	<100	18,000	10	30
18S/20E-	15A2M	5-31-89	<10	<1	78	70	1	5
	31D1M	5-31-89	<10	2	49	900	3	11
18S/21E-	19D1M	5-23-89	<10	1	110	70	1	6
19S/19E-	14R1M	5-30-89	40	5	<100	9,800	4	30
19S/20E-	5A1M	8-11-89	<10	<1	15	100	<1	6
		8-11-89	<10	<1	15	120	<1	6
	11R1M	6-01-89	<10	2	99	500	<1	7
	22A2M	5-31-89	<10	3	26	130	1	4
	32D1M	6-07-89	20	3	17	390	<1	27
	35D2M	5-25-89	<10	12	32	70	1	6
19S/21E-	17R1M	5-26-89	<10	3	60	150	5	6
	32A2M	5-24-89	<10	3	69	510	2	8
20S/19E-	13M1M	6-07-89	<100	5	100	17,000	<5	190
	25A3M	6-07-89	20	4	100	20,000	<5	130
20S/20E-	9N1M	6-01-89	<20	8	<100	6,600	<2	8,100
	10D1M	6-07-89	20	14	100	3,800	<3	60
	15M2M	5-25-89	<10	10	<100	4,200	3	130
	29D1M	5-25-89	20	6	<100	3,500	2	40
20S/21E-	13B1M	6-26-89	<10	6	<100	1,600	2	<10
	17A1M	6-26-89	10	70	<100	6,200	<1	40
	19D1M	5-24-89	<10	54	<100	4,500	<1	20
	36Q2M	6-08-89	<10	18	100	950	<1	440
20S/22E-	33R2M	6-08-89	40	2,600	100	2,800	3	20
21S/19E-	1D3M	6-07-89	20	3	100	10,000	6	70
	16R2M	6-06-89	<100	3	100	27,000	<10	280
	23A1M	6-06-89	30	44	100	8,100	<3	15,000
	35J1M	6-06-89	20	110	100	5,700	<3	210,000
21S/20E-	10Q1M	6-27-89	<10	72	<100	3,400	<2	24,000
	26D1M	6-27-89	20	71	<100	3,200	<2	48,000
	28B1M	6-27-89	20	150	<100	3,200	3	52,000
21S/21E-	2G1M	6-08-89	10	3	100	1,200	<1	520
21S/22E-	16C2M	6-26-89	10	17	<100	1,900	<1	20
	19E1M	6-08-89	<10	20	100	2,300	<1	6,900
	27A3M	6-09-89	10	16	33	370	<1	11
22S/19E-	9H1M	6-06-89	20	3	100	6,500	3	1,500
	13J1M	6-05-89	<10	20	100	3,900	2	18,000
	28J1M	6-05-89	<50	56	100	7,300	<5	8,200
22S/21E-	13D1M	6-28-89	20	15	<100	660	2	4,200
	16B1M	6-28-89	<10	230	<100	2,100	<1	42,000
	18D2M	6-27-89	<10	40	<100	2,100	3	68,000
	28R1M	6-28-89	40	8	<100	7,400	3	60
22S/22E-	9N1M	6-28-89	10	8	<100	1,200	1	20
		6-28-89	<10	9	<100	1,300	<1	20
	14D1M	6-09-89	<10	21	47	860	<1	7

actual value is less than value shown; --, no data]

Lithium, dissolved	Manganese, dissolved	Mercury, dissolved	Molybdenum, dissolved	Nickel, dissolved	Selenium, dissolved	Uranium, dissolved	Vanadium, dissolved
20	1,700	<0.1	170	<1	<1	2.8	8
110	690	.1	12	6	<1	17	12
40	<10	<.1	30	2	<1	3.3	1
40	40	<.1	220	<1	<1	100	70
5	650	<.1	1	4	<1	2.7	<1
29	10	<.1	7	7	3	22	12
6	3	.1	18	2	1	42	<1
50	50	.1	480	<1	<1	16	31
6	70	.2	8	1	<1	7.0	3
5	70	.2	9	2	<1	7.4	3
<4	540	<.1	360	3	<1	320	13
11	12	<.1	6	1	4	57	14
4	11	<.1	37	6	<1	1.1	10
<4	160	<.1	4	2	<1	6.9	24
5	15	<.1	7	2	<1	18	22
9	270	<.1	100	7	1	390	17
170	2,000	<.1	1,100	30	3	16	160
260	1,100	<.1	1,600	16	3	160	150
60	3,100	<.1	84	14	<1	3.2	40
50	1,600	<.1	820	6	1	99	69
20	640	<.1	36	2	<1	13	29
220	2,200	<.1	120	73	2	17	14
10	30	<.1	260	2	1	--	26
<10	140	<.1	380	4	<1	150	87
10	80	.1	130	11	2	120	180
30	1,200	<.1	200	1	<1	63	43
<10	<10	<.1	72	1	<1	33	850
180	160	<.1	1,300	64	34	38	29
160	280	<.1	4,200	30	39	37	310
290	6,900	<.1	17	400	<1	1.3	29
400	32,000	<.1	170	400	<1	5.2	18
280	11,000	<.1	25	48	<1	3.7	<5
230	19,000	<.1	110	36	<1	21	<25
270	14,000	<.1	80	40	<1	1.9	<10
<10	250	<.1	86	2	<1	13	16
<10	200	<.1	600	1	4	450	53
30	4,300	<.1	370	1	<1	11	35
<4	73	<.1	86	<1	<1	47	18
280	3,300	<.1	22	200	1	2.8	23
320	16,000	<.1	310	34	2	31	31
500	6,300	<.1	480	200	39	31	100
40	1,800	<.1	21	1	<1	9.2	2
120	20,000	<.1	47	15	<1	1.9	<5
140	8,000	<.1	64	7	<1	5.5	2
170	7,900	<.1	410	5	2	260	<25
40	1,300	<.1	220	3	<1	140	5
40	1,300	<.1	210	4	<1	110	5
15	540	<.1	180	6	<1	26	25

Table 4. Chemical analyses of selected trace elements--*Continued*

State well No.		Date	Aluminum, dissolved	Arsenic, dissolved	Barium, dissolved	Boron, dissolved	Chromium, dissolved	Iron, dissolved
22S/22E	22R1M	6-19-89	10	90	100	1,200	<1	110
	35N1M	6-19-89	20	15	<100	1,800	<1	770
22S/23E-	7R1M	6-27-89	10	170	<100	2,100	3	<10
	27M1M	6-27-89	<10	9	<100	1,600	2	10
23S/19E-	2A1M	6-05-89	<50	4	100	14,000	<5	120
23S/20E-	14B1M	6-28-89	10	10	<100	4,900	5	40
23S/21E-	8R1M	6-28-89	30	14	<100	6,000	<2	3,800
23S/22E-	6R1M	6-19-89	20	24	<100	2,500	<2	3,400
23S/23E-	7M1M	6-27-89	<10	17	100	4,400	<2	3,000
		6-27-89	20	16	<100	4,100	<2	3,100
	15M1M	6-27-89	<100	110	<100	10,000	<10	2,000
		6-27-89	<100	65	<100	11,000	<10	2,000
	26G1M	6-28-89	<40	19	<100	16,000	<4	130
	31D2M	6-27-89	90	160	<100	14,000	<5	230
24S/23E-	4K1M	6-28-89	<50	230	<100	19,000	<5	220
25S/20E-	15A1M	7-12-89	<10	1	200	2,100	3	30
	23P1M	6-21-89	<10	1	<100	2,800	6	20
25S/21E-	7B3M	5-09-89	<200	5	200	61,000	<50	780
	12D2M	7-07-89	20	20	100	13,000	3	50
	17H1M	6-21-89	30	6	<100	36,000	<4	180
	26P2M	6-21-89	80	12	<100	70,000	<5	170
	29N1M	6-21-89	10	4	<100	68,000	5	60
	31P1M	6-21-89	60	3	<100	32,000	<5	130
	33N1M	6-21-89	20	3	<100	22,000	<2	60
25S/22E-	19N1M	7-12-89	<10	5	38	800	<1	4
	34A2M	6-20-89	<40	8	<100	26,000	<4	130
26S/21E-	2R1M	6-21-89	20	7	<100	2,500	<1	120
	14R1M	6-29-89	30	2	<100	64,000	7	100
	16R1M	7-11-89	<10	2	200	6,900	7	50
	36Q1M	6-20-89	<10	1	100	19,000	2	30
26S/22E-	7A1M	7-12-89	20	9	52	630	<1	1,400
	20G1M	6-20-89	30	19	39	580	<1	5,200
		6-20-89	30	22	38	580	<1	5,100
	28R2M	6-20-89	<10	29	<100	2,800	4	20
	34P1M	6-20-89	10	77	100	6,900	5	60
26S/23E-	8R3M	6-20-89	50	110	<100	740	3	50
27S/22E-	4E2M	6-21-89	<10	14	<100	6,100	<1	20
	15A2M	7-11-89	20	870	100	12,000	2	30
	17R3M	6-22-89	<10	4	<100	2,200	<1	10
	18D1M	6-23-89	<40	6	100	41,000	6	130
	20M1M	7-12-89	120	2	100	2,300	3	850
	23D4M	7-11-89	<10	41	200	3,600	2	40
27S/23E-	11R1M	6-26-89	<10	87	31	380	1	8
	18A1M	7-12-89	10	15	48	640	1	<3
	20R2M	6-29-89	50	480	<100	1,400	9	20
		6-29-89	50	490	<100	1,400	9	20
28S/22E-	5A1M	6-22-89	<10	20	<100	1,600	<1	10
	15N6M	7-12-89	<10	18	300	2,800	3	20
		7-12-89	20	17	300	3,000	2	30

Lithium, dissolved	Manganese, dissolved	Mercury, dissolved	Molybdenum, dissolved	Nickel, dissolved	Selenium, dissolved	Uranium, dissolved	Vanadium, dissolved
40	2,900	<0.1	62	2	<1	43	30
90	3,400	--	320	21	<1	30	8
20	<10	<.1	160	2	<1	62	180
70	20	<.1	20	<1	<1	4.3	7
370	67,000	<.1	56	300	1	2.3	80
120	520	<.1	680	1	<1	500	29
100	7,200	<.1	360	5	<1	350	<25
90	9,600	<.1	17	7	<1	7.4	55
170	18,000	<.1	190	20	2	130	<50
170	19,000	<.1	180	20	1	110	<50
130	9,600	<.1	2,000	12	<1	99	--
140	10,000	<.1	2,000	16	<1	100	<250
140	290	<.1	3,500	<2	<10	3,100	170
270	170	<.1	9,800	8	[1]1,000	3,000	<100
280	520	<.1	14,000	<2	[1]350	5,400	400
120	10	<.1	100	<1	8	15	7
200	10	<.1	120	<1	13	50	5
210	240	<.1	1,700	<1	170	--	1,000
280	50	<.1	1,500	<1	32	380	50
1,700	330	<.1	200	24	21	15	--
160	50	<.1	12,000	<2	<10	960	240
100	20	.1	1,600	2	20	8.5	58
320	40	.6	440	<2	520	34	120
140	20	<.1	1,000	<2	15	62	55
65	1,100	<.1	27	4	<1	6.4	4
230	40	.1	640	<2	14	260	<100
60	270	<.1	1,000	3	<1	15	32
240	30	<.1	1,000	2	17	150	<10
300	20	<.1	56	<1	<10	47	34
260	710	<.1	330	12	<1	36	3
69	140	<.1	14	4	<1	2.1	<1
17	420	<.1	300	10	<1	86	13
18	410	<.1	330	13	<1	90	12
50	10	<.1	220	1	<1	150	8
120	20	.2	3	1	<1	390	15
30	20	<.1	180	2	2	73	300
130	<10	.1	1,200	2	3	160	980
70	10	<.1	2,300	<1	<1	320	330
80	120	<.1	700	<1	<1	26	3
500	40	<.1	720	<2	27	23	55
200	1,500	<.1	17	33	10	27	11
290	360	<.1	420	2	2	140	33
10	280	<.1	21	<1	<1	15	280
31	5	<.1	28	1	3	51	22
10	<10	<.1	40	3	2	35	2,400
10	<10	<.1	38	3	4	35	2,400
50	180	<.1	120	9	<1	22	15
200	1,300	<.1	160	3	<1	110	29
200	1,200	<.1	160	2	<1	110	29

Footnote at end of table.

Table 4. Chemical analyses of selected trace elements--*Continued*

State well No.		Date	Aluminum, dissolved	Arsenic, dissolved	Barium, dissolved	Boron, dissolved	Chromium, dissolved	Iron, dissolved
28S/23E-	3H1M	6-22-89	20	3	66	350	20	4
	25K1M	6-22-89	20	57	9	250	1	16
29S/22E-	2C1M	6-22-89	<10	60	<100	3,700	<1	20
29S/24E-	5Q1M	6-22-89	690	250	<100	2,600	7	460
30S/28E-	2N1M	7-18-89	30	46	48	1,200	2	26
		7-18-89	40	44	48	1,200	2	25
	28A4M	7-17-89	20	78	56	630	<1	4
31S/25E-	36H2M	6-29-89	<10	1	<100	340	4	40
31S/28E-	9C1M	7-17-89	10	120	100	1,200	<1	10
		7-17-89	<10	100	200	1,200	<1	20
	21D1M	6-28-89	10	82	32	710	1	8
	22N2M	6-29-89	20	10	59	650	3	4
32S/25E-	12R3M	6-29-89	50	1	<100	73,000	20	220
	23B1M	7-11-89	<10	1	100	2,100	3	30
		7-11-89	<10	1	100	2,100	3	20
	29D1M	7-11-89	<10	1	100	1,600	6	40
32S/26E-	9R1M	7-19-89	<10	<2	100	2,200	4	30
	19D1M	7-11-89	<10	1	100	7,400	4	20
	22M1M	7-18-89	20	1	100	13,000	10	40
	25K1M	7-18-89	50	1	200	19,000	5	60
32S/27E-	2H1M	7-19-89	120	71	200	13,000	1	90
	7R2M	7-19-89	<10	2	100	2,800	3	40
	10N1M	6-29-89	20	68	32	830	1	6
	16R4M	6-29-89	20	4	<100	1,400	2	30
	34H2M	7-10-89	70	12	200	5,100	3	80
32S/28E-	17C2M	7-17-89	10	2	200	520	2	20
	18D2M	7-18-89	10	6	200	3,600	2	40
	30C2M	7-18-89	20	1	200	5,500	3	30
12N/20W-	32K1S	6-30-89	<10	2	<100	3,900	10	40
12N/21W-	34E2S	7-10-89	10	1	62	320	3	<3

Lithium, dissolved	Manganese, dissolved	Mercury, dissolved	Molybdenum, dissolved	Nickel, dissolved	Selenium, dissolved	Uranium, dissolved	Vanadium, dissolved
34	<1	<0.1	50	<1	4	55	5
7	<1	<.1	11	1	<1	7.5	640
340	<10	<.1	50	<1	<1	21	73
30	<10	<.1	100	2	2	40	1,200
30	3	<.1	38	1	<1	44	36
30	3	<.1	37	1	<1	47	37
16	130	<.1	6	1	<1	18	41
80	40	<.1	68	1	<1	18	1
20	280	<.1	120	<1	5	92	39
20	280	<.1	110	<1	5	120	38
16	2	<.1	60	<1	1	74	65
7	3	<.1	34	<1	6	22	6
210	50	.2	1,800	<2	58	62	<100
40	30	<.1	150	<1	<1	24	3
40	30	<.1	120	<1	<1	25	6
190	200	<.1	110	5	72	210	10
70	<10	<.1	230	<1	2	15	<1
50	10	<.1	300	<1	3	43	3
90	10	<.1	330	<1	5	42	15
120	40	<.1	120	1	260	74	43
80	320	<.1	2,500	<1	25	2,500	94
210	370	<.1	86	10	[1]240	730	17
100	4	<.1	16	1	13	79	27
230	700	<.1	100	21	1	44	3
90	330	<.1	490	4	<1	42	20
60	90	<.1	64	<1	5	66	11
60	440	<.1	820	2	7	400	27
70	30	<.1	350	<1	13	35	13
110	10	<.1	320	2	60	110	<2
51	<1	<.1	66	2	1	12	1

[1]Wells 23S/23E-31D2M, 24S/23E-4K1M, and 32S/27E-7R2M were resampled on January 5, 1990, to evaluate the reputed selenium concentrations of 1,000, 350, and 240 micrograms per liter, respectively. Selenium concentrations in the January 5, 1990, samples were 1,166, 405, and 251 micrograms per liter, respectively. These analyses were done in the U.S. Geological Survey laboratory in Sacramento, California, using procedures described in Makita and Fujii (1992).

Table 5. Chemical analyses of nutrients, organic carbon, and stable isotopes

[State well No.: See Well-Numbering System on page V. Results in milligrams per liter, unless otherwise noted; <, actual value less than value shown; pCi/L, picocuries per liter; --, no data]

State well No.		Date	Nitrogen, nitrite, dissolved (as N)	Nitrogen, nitrite plus nitrate, dissolved (as N)	Phosphorus, dissolved (as P)	Carbon, organic, dissolved (as C)	Tritium (pCi/L)	Delta deuterium (per mil)	Delta oxygen-18 (per mil)
18S/19E-	9J2M	5-31-89	0.01	<0.10	0.02	3.5	55	-90.0	-11.40
	15N1M	5-31-89	.02	.50	.03	3.2	11	-87.0	-10.70
	21N3M	5-31-89	<.01	5.6	.07	2.1	31	-70.5	-8.75
	34N1M	5-30-89	.49	25	.26	5.1	31	-75.5	-9.35
18S/20E-	15A2M	5-31-89	.01	8.2	.05	1.6	64	-88.5	-12.25
	31D1M	5-31-89	.02	100	.06	7.3	31	-77.5	-9.95
18S/21E-	19D1M	5-23-89	<.01	29	.19	2.2	69	-89.0	-12.20
19S/19E-	14R1M	5-30-89	.08	19	.10	2.6	27	-69.0	-8.55
19S/20E-	5A1M	8-11-89	.02	.47	.04	1.2	43	-94.5	-13.00
		8-11-89	.02	.39	.04	1.1	40	-96.0	-13.10
	11R1M	6-01-89	.22	4.3	.59	7.3	--	-86.5	-11.50
	22A2M	5-31-89	<.01	15	.23	3.1	79	-88.5	-11.65
	32D1M	6-07-89	.02	.61	.36	2.5	34	-94.5	-11.65
	35D2M	5-25-89	<.01	.28	.28	1.8	28	-95.0	-13.05
19S/21E-	17R1M	5-26-89	<.01	8.2	.09	.9	73	-95.5	-13.00
	32A2M	5-24-89	.63	30	.29	5.4	47	-82.0	-11.80
20S/19E-	13M1M	6-07-89	.09	3.0	.48	8.6	24	-65.0	-7.10
	25A3M	6-07-89	.33	1.9	.74	17	25	-71.0	-8.15
20S/20E-	9N1M	6-01-89	.01	.80	.01	14	49	-87.0	-11.25
	10D1M	6-07-89	.82	5.7	.27	14	140	-88.5	-11.35
	15M2M	5-25-89	.22	3.9	2.3	15	24	-89.0	-11.25
	29D1M	5-25-89	.18	26	1.4	8.1	60	-84.0	-10.55
20S/21E-	13B1M	6-26-89	.03	39	.66	3.1	53	-83.0	-10.85
	17A1M	6-26-89	.02	<.10	9.2	22	<5.7	-93.0	-11.85
	19D1M	5-24-89	.37	18	2.4	16	84	-83.5	-10.90
	36Q2M	6-08-89	.24	8.0	.34	8.6	31	-80.0	-9.70
20S/22E-	33R2M	6-08-89	.03	17	.16	13	37	-81.5	-11.00
21S/19E-	1D3M	6-07-89	.22	23	.08	8.3	27	-68.0	-8.00
	16R2M	6-06-89	.21	20	.47	17	8.0	-55.5	-5.10
	23A1M	6-06-89	.02	<.10	.24	14	45	-59.0	-5.80
	35J1M	6-06-89	.03	.12	.01	31	14	-57.5	-4.65
21S/20E-	10Q1M	6-27-89	<.01	<.10	.08	13	<5.7	-60.5	-5.90
	26D1M	6-27-89	.01	.19	<.01	45	25	-66.5	-6.70
	28B1M	6-27-89	<.01	<.10	.06	39	27	-59.5	-6.75
21S/21E-	2G1M	6-08-89	<.01	.14	.06	10	15	-76.0	-9.65
21S/22E-	16C2M	6-26-89	.54	5.3	.75	7.0	83	-83.0	-10.85
	19E1M	6-08-89	<.01	<.10	.04	14	53	-75.0	-8.85
	27A3M	6-09-89	.05	7.5	.31	6.2	75	-83.5	-10.85
22S/19E-	9H1M	6-06-89	.08	1.3	.21	11	39	-63.0	-6.05
	13J1M	6-05-89	.03	.76	.08	39	13	-59.0	-4.90
	28J1M	6-05-89	.10	23	.03	21	34	-57.0	-5.40
22S/21E-	13D1M	6-28-89	<.01	<.10	.63	8.6	63	-68.0	-8.00

Table 5. Chemical analyses of nutrients, organic carbon, and stable isotopes--*Continued*

State well No.		Date	Nitrogen, nitrite, dissolved (as N)	Nitrogen, nitrite plus nitrate, dissolved (as N)	Phos-phorus, dissolved (as P)	Carbon, organic, dissolved (as C)	Tritium (pCi/L)	Delta deuterium (per mil)	Delta oxygen-18 (per mil)
22S/21E-	16B1M	6-28-89	<0.01	<0.10	<0.01	18	50	-73.0	-8.80
	18D2M	6-27-89	.02	<.10	.02	17	25	-71.5	-8.05
	28R1M	6-28-89	<.01	<.10	.95	20	17	-54.0	-4.45
22S/22E-	9N1M	6-28-89	<.01	<.10	.66	6.3	65	-68.0	-7.60
		6-28-89	<.01	<.10	.68	6.5	56	-69.0	-7.40
	14D1M	6-09-89	<.01	<.10	.86	5.2	32	-76.5	-8.85
	22RM1	6-19-89	<.01	<.10	1.3	10	100	-74.0	-9.05
	35N1M	6-19-89	.02	.46	.20	11	35	-74.5	-8.60
22S/23E-	7R1M	6-27-89	.29	23	1.5	4.6	110	-77.0	-10.25
	27M1M	6-27-89	.02	37	.06	3.3	20	-62.5	-7.60
23S/19E-	2A1M	6-05-89	<.01	<.10	.23	38	43	-55.5	-4.95
23S/20E-	14B1M	6-28-89	.06	3.4	.68	12	13	-57.5	-5.30
23S/21E-	8R1M	6-28-89	<.01	<.10	.34	20	13	-60.0	-5.55
23S/22E-	6R1M	6-19-89	.01	.58	.38	44	8.0	-49.5	-3.70
23S/23E-	7M1M	6-27-89	.01	.32	.06	33	<5.7	-47.5	-4.10
		6-27-89	<.01	.12	.11	34	<5.7	-48.0	-4.10
	15M1M	6-27-89	.02	.26	.34	69	<5.7	-41.5	-1.75
		6-27-89	.02	.13	.71	98	<5.7	-39.5	-1.75
	26G1M	6-28-89	.06	17	.46	39	9.0	-53.0	-5.60
	31D2M	6-27-89	.98	26	.38	75	<5.7	-40.0	-2.00
24S/23E-	4K1M	6-28-89	.26	27	1.7	69	7.0	-55.0	-4.60
25S/20E-	15A1M	7-12-89	.01	1.4	.03	1.5	36	-73.5	-9.55
	23P1M	6-21-89	<.01	17	.03	4.2	32	-76.0	-9.75
25S/21E-	7B3M	5-09-89	.14	95	[1].31	--	<5.7	-38.0	-0.10
	12D2M	7-07-89	.03	12	.28	6.6	29	-66.0	-6.65
	17H1M	6-21-89	.01	.30	.06	4.2	<5.7	-67.0	-7.65
	26P2M	6-21-89	<.01	36	.25	16	25	-59.5	-5.65
	29N1M	6-21-89	.20	15	.07	6.9	34	-62.5	-7.55
	31P1M	6-21-89	<.01	5.5	.01	1.0	--	-58.0	-4.75
	33N1M	6-21-89	<.01	3.0	.07	6.4	38	-62.0	-6.85
25S/22E-	19N1M	7-12-89	.01	<.10	.08	2.5	34	-71.5	-8.60
	34A2M	6-20-89	<.01	2.3	.15	9.2	45	-66.5	-7.85
26S/21E-	2R1M	6-21-89	.04	.33	.12	1.3	<5.7	-62.5	-5.35
	14R1M	6-29-89	<.01	14	.08	9.5	37	-60.0	-6.70
	16R1M	7-11-89	<.01	185	.06	14	44	-52.0	-3.60
	36Q1M	6-20-89	<.01	<.10	.02	17	15	-54.0	-6.45
26S/22E-	7A1M	7-12-89	<.01	<.10	.04	4.3	54	-79.0	-9.70
	20G1M	6-20-89	<.01	.49	<.01	3.3	26	-75.0	-9.20
		6-20-89	<.01	.50	<.01	3.4	20	-73.5	-9.15
	28R2M	6-20-89	<.01	29.	.02	2.4	15	-76.0	-9.70
	34P1M	6-20-89	<.01	9.4	.03	4.3	<5.7	-77.0	-9.75
26S/23E-	8R3M	6-20-89	.02	4.4	.17	3.9	10	-65.0	-8.55
27S/22E-	4E2M	6-21-89	<.01	46.	.30	1.9	20	-75.0	-9.10
	15A2M	7-11-89	.41	19.	1.5	8.0	44	-71.0	-8.40
	17R3M	6-22-89	.02	2.1	.17	1.5	16	-74.0	-9.45
	18D1M	6-23-89	<.01	.78	.02	1.8	<5.7	-69.0	-7.90

Footnote at end of table.

Table 5. Chemical analyses of nutrients, organic carbon, and stable isotopes--*Continued*

State well No.		Date	Nitrogen, nitrite, dissolved (as N)	Nitrogen, nitrite plus nitrate, dissolved (as N)	Phos-phorus, dissolved (as P)	Carbon, organic, dissolved (as C)	Tritium (pCi/L)	Delta deuterium (per mil)	Delta oxygen-18 (per mil)
27S/22E-	20M1M	7-12-89	0.46	2.2	0.01	5.0	47	-64.0	-8.05
	23D4M	7-11-89	.11	5.8	.10	4.8	84	-76.5	-9.75
27S/23E-	11R1M	6-26-89	<.01	<.10	.13	2.4	35	-76.5	-9.50
	18A1M	7-12-89	<.01	36	.04	2.9	34	-71.5	-9.10
	20R2M	6-29-89	<.01	13	.57	3.5	32	-72.0	-8.95
		6-29-89	<.01	13	.57	3.5	28	-72.0	-8.95
28S/22E-	5A1M	6-22-89	<.01	<.10	.24	2.6	68	-85.0	-10.95
	15N6M	7-12-89	<.01	3.4	.21	3.5	29	-80.0	-10.00
		7-12-89	<.01	3.4	.22	3.4	21	-79.0	-10.10
28S/23E-	3H1M	6-22-89	<.01	56	.03	2.2	<5.7	-65.5	-8.50
	25K1M	6-22-89	<.01	1.4	.12	.8	24	-73.5	-9.25
29S/22E-	2C1M	6-22-89	<.01	16	.05	2.6	32	-79.5	-10.05
29S/24E-	5Q1M	6-22-89	<.01	27	1.5	5.1	23	-73.5	-8.95
30S/28E-	2N1M	7-18-89	<.01	24	.05	2.4	28	-89.0	-11.85
		7-18-89	<.01	24	.05	2.3	32	-91.5	-11.90
	28A4M	7-17-89	.62	26	.39	3.7	40	-75.5	-10.25
31S/25E-	36H2M	6-29-89	.08	6.6	.04	1.1	23	-67.5	-8.45
31S/28E-	9C1M	7-17-89	.09	9.0	.19	2.4	38	-87.0	-11.40
		7-17-89	.09	9.0	.19	3.0	31	-89.5	-11.35
	21D1M	6-28-89	.02	4.9	.09	1.7	30	-89.5	-11.50
	22N2M	6-29-89	.01	.75	.06	.8	30	-92.5	-12.10
32S/25E-	12R3M	6-29-89	.02	15	.04	15	41	-64.0	-6.45
	23B1M	7-11-89	<.01	<.10	<.01	2.1	<5.7	-75.5	-10.00
		7-11-89	<.01	<.10	.01	2.6	<5.7	-76.5	-9.95
	29D1M	7-11-89	.36	1.2	.02	8.1	51	-70.5	-9.15
32S/26E-	9R1M	7-19-89	<.01	3.7	<.01	.7	<5.7	-79.0	-10.90
	19D1M	7-11-89	<.01	1.5	.01	2.7	22	-69.0	-8.45
	22M1M	7-18-89	.05	3.1	.02	3.8	26	-71.5	-9.55
	25K1M	7-18-89	.51	19	.02	6.2	29	-76.0	-9.55
32S/27E-	2H1M	7-19-89	.33	8.9	.11	5.5	17	-72.5	-9.70
	7R2M	7-19-89	.22	92	.02	7.2	30	-78.5	-10.20
	10N1M	6-29-89	.01	5.9	.19	1.1	23	--	--
	16R4M	6-29-89	.05	18	.07	7.6	<5.7	-70.0	-9.30
	34H2M	7-10-89	.02	.54	.10	6.5	<5.7	-70.5	-8.90
32S/28E-	17C2M	7-17-89	.15	2.2	.02	3.2	<5.7	-69.5	-9.95
	18D2M	7-18-89	.15	11	.05	9.8	15	-71.0	-9.70
	30C2M	7-18-89	.15	82	.01	4.2	22	-61.0	-7.60
12N/20W-	32K1S	6-30-89	.01	47	.02	2.6	15	-64.5	-8.70
12N/21W-	34E2S	7-10-89	<.01	18	.03	10	31	-71.0	-9.20

[1]Value shown is phosphorus, orthophosphate, dissolved.

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