DISSOLVED-SELENIUM DATA FOR WELLS IN THE WESTERN SAN JOAQUIN VALLEY, CALIFORNIA, FEBRUARY TO JULY 1985

By J.M. Neil

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CONVERSION FACTORS

For this report, the inch-pound system of units was used. For those readers who may prefer metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply	By	To obtain
acres	4,047	square meters
ft (feet)	0.3048	meters
mi (miles)	1.609	kilometers

Selenium concentrations are given in micrograms per liter (µg/L). One thousand micrograms per liter is equivalent to 1 milligram per liter. Micrograms per liter is equivalent of "parts per billion."

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ABSTRACT

Water samples were collected for selenium analysis from 63 wells in western San Joaquin Valley, California, during February to July 1985. Results of the data collection indicate that dissolved-selenium concentrations ranged from less than 1 to 120 micrograms per liter; more than 50 percent of the wells sampled had concentrations of less than 1 microgram per liter. Four additional samples collected from public-supply wells in the western valley had concentrations ranging from less than 1 to 2 micrograms per liter. All samples from five public-supply wells east of the study area had concentrations less than 1 microgram per liter. The U.S. Environmental Protection Agency's drinking-water standard of 10 micrograms per liter for selenium was slightly exceeded in 2 of 39 domestic wells (11 and 13 micrograms per liter) and substantially exceeded in 2 of 11 irrigation and agricultural wells (55 and 120 micrograms per liter).

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INTRODUCTION

The presence of high selenium concentrations in shallow ground water in parts of the western San Joaquin Valley (Deverel and others, 1984) has caused concern that selenium or other substances may be present at potentially harmful concentrations in the confined and unconfined aquifers of the western valley. To address this concern, the U.S. Geological Survey, in cooperation with the U.S. Bureau of Reclamation, began a comprehensive water-quality study of the two aquifers in January 1985. Objectives of the comprehensive study are to (1) assess the areal distribution of trace elements and pesticides in the confined and unconfined regional aquifers; (2) evaluate the geochemical controls on the chemistry of ground water in the aquifers and the hydrologic and geologic factors that affect the quality of the water in different areas; (3) evaluate ground-water quality of western San Joaquin Valley; and (4) assess the degree of change that may have occurred in the chemical characteristics of ground water.

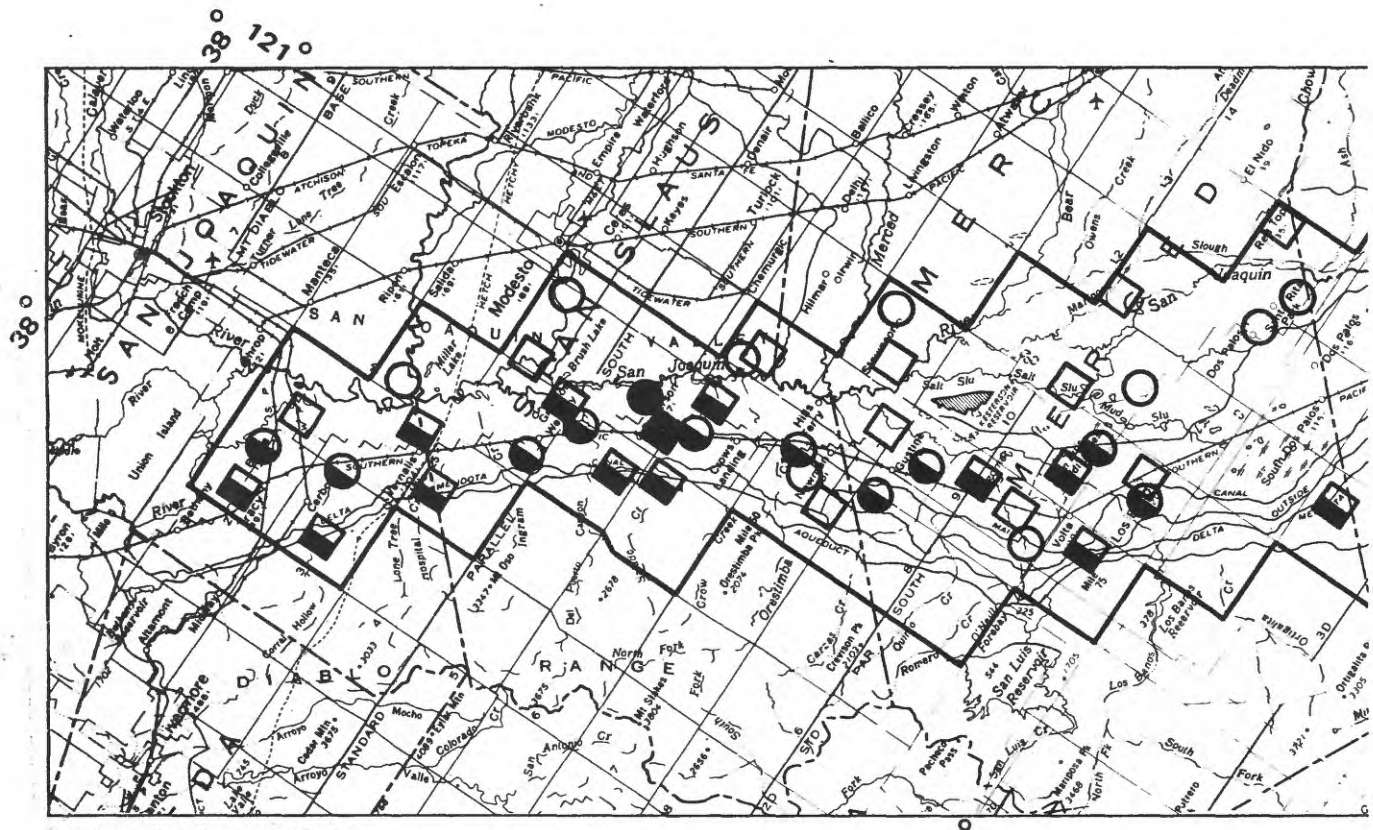
This report was prepared to provide a timely release of selenium-concentration data that were collected February to June 1985 as part of the comprehensive assessment of ground water in the western San Joaquin Valley. Detailed evaluation of these data and data collected on numerous other properties and constituents is in progress and interpretive reports will be released as they are completed.

DESCRIPTION OF DATA

Water samples were collected for selenium analysis from 63 wells completed in the unconfined and confined aquifers during February to July 1985. These aquifers underlie the entire western San Joaquin Valley and are separated by a confining layer (E Clay) that ranges in thickness from 40 to 140 feet (Hotchkiss and Balding, 1971). Wells completed in the unconfined aquifer range from about 50 to 500 feet in depth; wells completed in the confined aquifer range from about 200 to 1,400 feet in depth. In addition, samples were collected during September 1985 from nine public-supply wells, five of which were outside the study area to the east.

In the 79 townships of the study area, 28 suitable wells in 27 townships were sampled in the unconfined aquifer and 35 suitable wells in 35 townships were sampled in the confined aquifer. Most wells completed in the confined and unconfined aquifers were in the northern part of the study area (fig. 1). A well was considered suitable if construction data identified (1) which of the two aquifers the well was withdrawing water from, and (2) whether an operational pump was installed.

Well and selenium data are given for each well in table 1 for the unconfined aquifer, table 2 for the confined aquifer, and table 3 for the nine public-supply wells. Selenium data for all wells are summarized in table 4. The areal distribution of concentrations in wells listed in tables 1 and 2 are shown in figure 1.

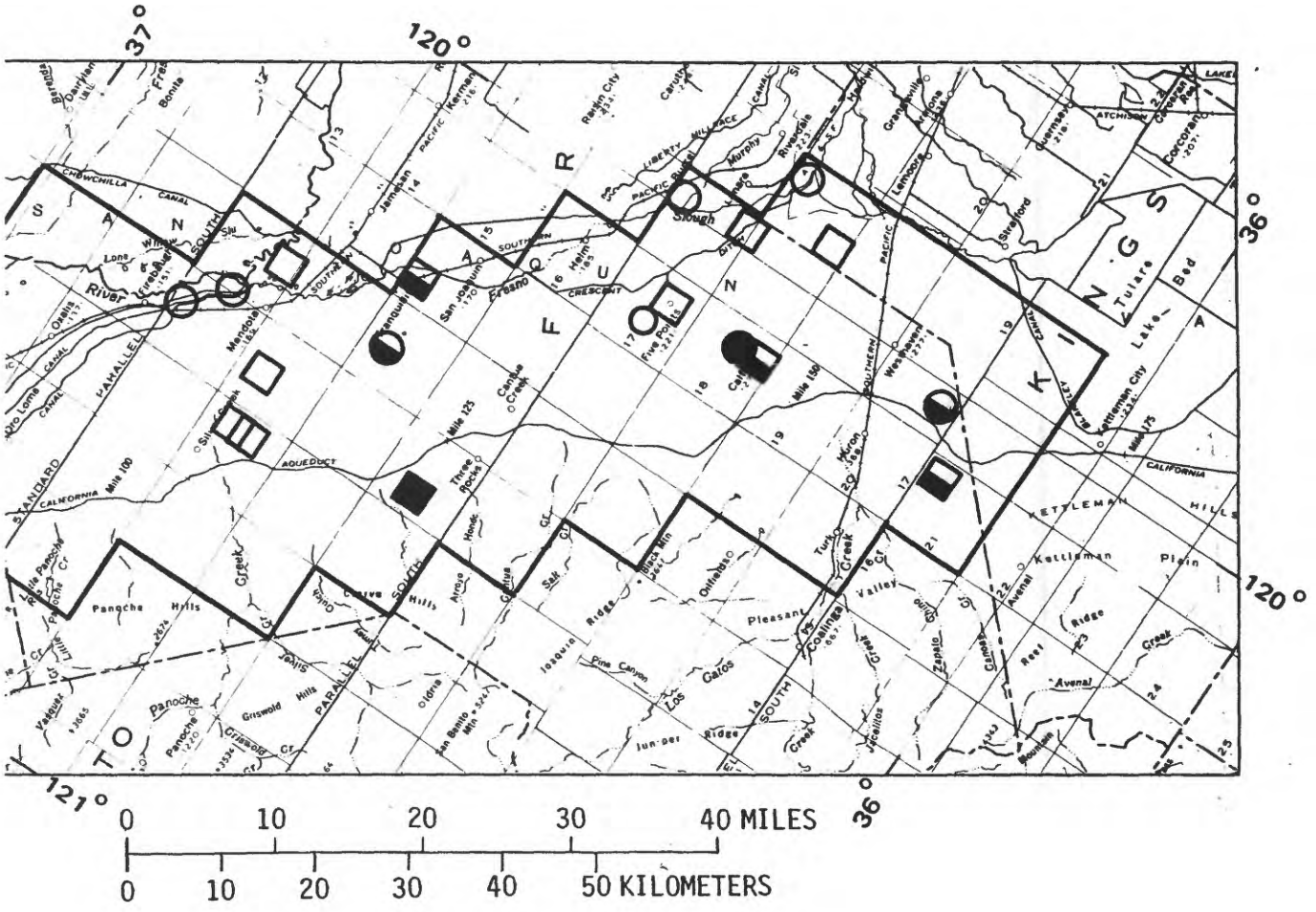


EXPLANATION

WELL-Symbol indicates range of selenium concentration, in micrograms per liter. Wells completed in the confined aquifer are shown as squares. Wells completed in the unconfined aquifer are shown as circles.

- Not detected
- 1 to 10
- Greater than 10

FIGURE 1.— Areal distribution of selenium concentrations



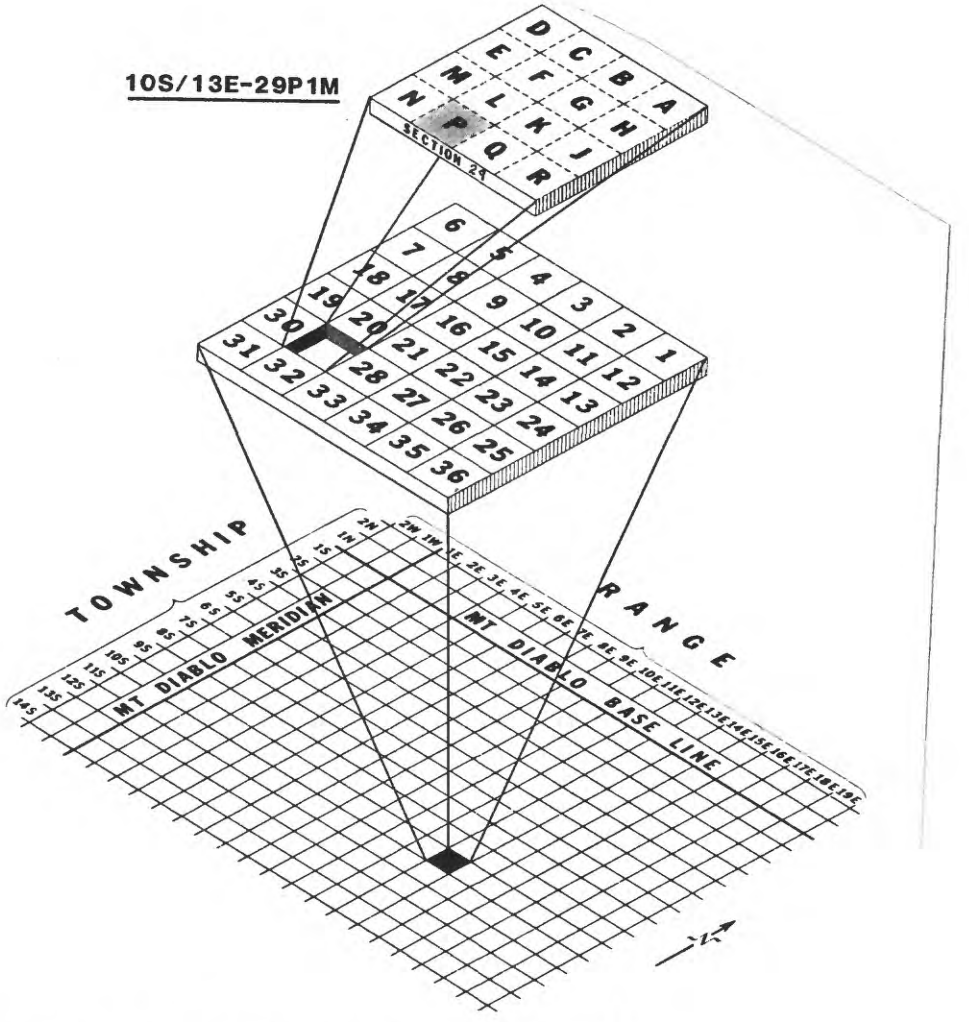
from wells completed in the confined and unconfined aquifers.

METHODS

For all the wells, samples were collected using the existing pump and piping system. Samples were collected after a period of pumping in which the general chemical character of the water, as measured in the field by specific conductance and pH, had stabilized. Standard field methods (U.S. Geological Survey, 1980) were then used to collect samples for laboratory analyses. The method used for analyzing dissolved selenium is described in Fishman and Bradford (1982).

WELL-NUMBERING SYSTEM

Wells are identified according to their location in the rectangular system for the subdivision of public lands. Their identification consists of the township number, north or south; the range number, east or west; and the section numbers. Each section is further 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 in a well identification number refers to the base line and meridian. All wells in the study area are referenced to the Mount Diablo base line and meridian (M). The illustration below shows how the well number 10S/13E-29P1M is derived.



RESULTS

Results of the data collection indicate that dissolved-selenium concentrations ranged from less than 1 to 120 µg/L; more than 50 percent of the wells sampled had concentrations of less than 1 µg/L. The highest concentration of 120 µg/L was in an agricultural well in the confined aquifer, and the second highest concentration of 55 µg/L was in an irrigation well in the unconfined aquifer.

The drinking-water standard of 10 µg/L (U.S. Environmental Protection Agency, 1977) for selenium was slightly exceeded in 2 of 39 domestic wells (11 and 13 µg/L) and substantially exceeded in 2 of 11 irrigation and general agricultural wells (55 and 120 µg/L). The 10-µg/L standard, however, may be revised to 45 µg/L (U.S. Environmental Protection Agency, 1985).

Samples from six public-supply wells in the west side of the valley (2 in table 2 and 4 in table 3) had concentrations ranging from less than 1 to 3 µg/L. All samples from five public-supply wells (table 3) east of the study area had selenium concentrations of less than 1 µg/L.

REFERENCES CITED

Deverel, S.J., Gilliom, R.J., Fujii, Roger, Izbicki, J.A., and Fields, J.C., 1984, Areal distribution of selenium and other inorganic constituents in shallow ground water of the San Luis Drain service area, San Joaquin Valley, California: A preliminary study: U.S. Geological Survey Water-Resources Investigations Report 84-4319, 67 p.

Fishman, M.J., and Bradford, W.L., 1982, A supplement to methods for the determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Open-File Report 82-272, 136 p.

Hotchkiss, W.R., and Balding, G.O., 1971, Geology, hydrology, and water quality of the Tracy-Dos Palos area, San Joaquin Valley, California: U.S. Geological Survey Open-File Report, 107 p.

U.S. Environmental Protection Agency, 1977, National interim primary drinking-water regulations: Environmental Protection Agency Office of Water Supply, EPA 570/9-76-003, 159 p.

_____ 1985, National primary drinking-water regulations, synthetic organic chemicals, inorganic chemicals and microorganisms: Federal Register, v. 50, no. 219, p. 46973-46975.

U.S. Geological Survey, 1980, Ground water, chapter 2 of National Handbook of Recommended Methods for Water-Data Acquisition: U.S. Geological Survey, Office of Water-Data Coordination, p. 2-1 to 2-149.

TABLE 1.--Well and selenium data for selected wells completed in the unconfined aquifer

[Station No.: Unique number for each site based on the 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. State well No.: See Well-Numbering System in text. Altitude of land surface: Datum is sea level. Casing: Top and bottom of the open interval was measured from the top of the casing. Primary use of water: I, irrigation; D, dewatering; and H, domestic. <, actual value is less than the value shown]

Station No.	State well No.	Altitude of land surface (ft)	Casing		Primary use of water	Date of sample	Dissolved selenium (ug/L)
			Top of open interval (ft)	Bottom of open interval (ft)			
374528121221801	2S/5E-13P1M	15	68	80	H	3-28-85	4
374136121213601	3S/6E- 7E1M	76	18	47	I	3-11-85	2
374058121141501	3S/7E- 7Q1M	25	101	106	H	3-12-85	<1
373258121115901	4S/7E-33B1M	90	55	75	H	3-12-85	10
373616121025001	4S/8E-12E1M	60	91	106	H	5- 1-85	<1
373137121092701	5S/7E- 1M2M	91	90	120	H	5- 1-85	2
372927121044401	5S/8E-22C1M	50	62	72	H	4-30-85	13
372608121054401	6S/8E- 4P1M	105	88	108	H	5-16-85	4
372619120593001	6S/9E- 4M1M	60	71	81	D	5-15-85	<1
371912121025001	7S/8E-13N1M	108	36	46	H	3-26-85	<1
371953121013701	7S/9E-18D1M	95	110	120	H	3-26-85	2
372004120501301	7S/10E-11Q1M	88	47	65	H	5-14-85	<1
371613121015201	8S/8E- 1H1M	110	63	78	H	3-27-85	2
371433120595601	8S/9E-17B1M	105	56	76	H	3-27-85	1
370644120591601	9S/9E-33C1M	125	40	60	H	3-28-85	<1
370600120503501	9S/10E-35Q1M	95	120	140	H	4- 9-85	6
370557120453901	9S/11E-34N2M	95	90	110	H	4-10-85	<1
370259120511201	10S/10E-22H4M	123	open bottom at 75 ft		H	4-30-85	1
370248120380701	10S/12E-22J1M	105	120	160	H	4-29-85	<1
370145120341701	10S/13E-29P1M	115	115	130	H	4-30-85	<1
365000120253801	13S/14E- 3B1M	150	open bottom at 240 ft		H	5-15-85	<1
364747120223402	13S/15E-18Q2M	160	180	220	H	5-13-85	<1
363801120195901	15S/15E- 9R1M	168	100	200	I	3-26-85	3
362630120073901	17S/17E-16Q2M	218	270	480	I	5-16-85	<1
362907119584901	17S/18E- 2A2M	203	216	336	H	5-16-85	<1
362019120064201	18S/17E-27F2M	283	40	60	I	3-27-85	55
						5-15-85	54*
362317119522201	18S/19E- 2R1M	220	200	240	H	5-15-85	<1
360852120014601	20S/18E-33E3M	305	380	500	H	5-15-85	1

*Water-quality control sample.

TABLE 2.--Well and selenium data for wells completed in the confined aquifer

[Station No.: Unique number for each site based on the 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. State well No.: See Well-Numbering System in text. Altitude of land surface: Datum is sea level. Casing: Top and bottom of the open interval was measured from the top of the casing. Primary use of water: A, general agriculture; C, commercial; H, domestic; I, irrigation; N, industrial; P, public supply; U, unused. <, actual value is less than the value shown]

Station No.	State well No.	Altitude of land surface (ft)	Casing: Top of open interval (ft)	Casing: Bottom of open interval (ft)	Primary use of water	Date of sample	Dissolved selenium (ug/L)
374509121260001	2S/5E-21D1M	28	337*	1,130	P	3-27-85	3
374445121200001	2S/6E-20L2M	15	592	652	U	5-21-85	<1
373957121260101	3S/5E-20A2M	230	340	400	H	3-28-85	2
373820121163501	3S/6E-26Q1M	78	200	207	C	3-12-85	1
373557121191901	4S/6E- 9M1M	210	265	305	H	3-13-85	2
373224121085201	4S/7E-36Q3M	64	230	250	H	3-13-85	1
373548121075701	4S/8E- 7P1M	40	280	300	H	7-2-85	<1
372843121110401	5S/7E-27B1M	180	189	229	H	5-16-85	5
372722121063301	5S/8E-32K3M	97	255	275	H	4-30-85	11
372610121083101	6S/7E- 1R1M	195	205*	685	H	5-16-85	6
372608121041201	6S/8E- 3R2M	77	243	273	H	5-16-85	8
372603120584701	6S/9E- 9A2M	58	340	400	C	5-21-85	<1
371723121042901	7S/8E-27Q1M	155	147	247	H	5-13-85	<1
371631120574401	7S/9E-34Q1M	72	450	658	H	3-28-85	<1
371833120534701	7S/10E-20L2M	70	270	360	S	5-13-85	<1
371125120575701	8S/9E-34Q1M	87	410	470	H	3-27-85	4
370843120572301	9S/9E-14N2M	99	400	620	N	3-28-85	<1
370650120534101	9S/10E-32B1M	94	440	500	S	4-9-85	1
370936120484701	9S/11E- 7N4M	85	320	420	H	4-10-85	<1
371109120411401	9S/12E- 5D1M	100	240*	738	I	4-10-85	<1
370355120564901	10S/9E-14H2M	140	260	300	H	4-10-85	3
370322120501901	10S/10E-23A2M	115	93	250	N	4-11-85	<1
370515120332401	10S/13E- 1J1M	135	290	450	S	5-14-85	<1
365327120441301	12S/11E-14C1M	182	406	706	H	5-14-85	1
364523120185901	13S/15E-34J7M	162	140	220	N	3-26-85	<1
364313120302801	14S/13E-12P1M	272	700	1,400	I	2-28-85	<1
364258120301301	14S/13E-13G1M	273	700	1,350	I	2-28-85	<1
364313120265701	14S/14E- 9Q1M	230	612*	1,250	I	2-28-85	<1
363907120144401	15S/16E- 5J1M	162	663*	930	H	3-25-85	1
363153120272201	16S/14E-16N1M	495	904	1,900	A	3-26-85	120
						11-5-85	100**
362533120060603	17S/17E-26E3M	223	1,040	1,100	C	5-16-85	<1
362403119583501	17S/18E-35R2M	212	310	350	H	5-16-85	<1
362009120064201	18S/17E-27F1M	285	603*	1,700	I	3-27-85	1
361924119564801	18S/19E-31G1M	232	766	1,010	P	7-2-85	<1
360659120053101	21S/17E-12E2M	368	568	1,290	I	7-1-85	5

*Uppermost and lowermost depth of multiperforated well casing.
**Water-quality control sample.

TABLE 3.--Well and selenium data for selected public-supply wells

[Station No.: Unique number for each site based on the 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. State well No.: See Well-Numbering System in text. Casing: Top and bottom of the open interval was measured from the top of the casing. <, actual value is less than the value shown]

Station No.	State well No.	City	Aquifer	Casing: Top of open interval (ft)	Casing: Bottom of open interval (ft)	Date of sample	Dissolved selenium (ug/L)
			Study Area				
371512121002101	8S/9E- 8F1M	Gustine	Unconfined	120	200(?)	9-12-85	<1
37151212059470l	8S/9E- 8H3M	Gustine	Unconfined	130	250(?)	9-12-85	2
370308120510901	10S/10E-23E1M	Los Banos	Unconfined	164	310	9-11-85	<1
370308120510901	10S/10E-23E2M	Los Banos	Unknown	--	--	9-11-85	<1
			Outside of Study Area				
364841119480501	13S/20E- 9M1M	Fresno	Unknown	Open bottom at 172 ft		9-11-85	<1
364746119411801	13S/21E-16Q1M	Fresno	Unknown	144	256	9-11-85	<1
364339119414701	14S/21E- 9N1M	Fresno	Unknown	--	--	9-11-85	<1
363224119494801	16S/20E-18G1M	Caruthers	Unknown	--	--	9-10-85	<1
361923119392501	18S/21E-35H2M	Hanford	Unconfined	210	450	9-10-85	<1

TABLE 4.--Summary of dissolved selenium concentrations in wells

Type of well	Number of wells	Dissolved selenium (ug/L): Minimum	Median	Maximum
Wells completed in the unconfined aquifer (table 1)	28	<1	1	55
Wells completed in the confined aquifer (table 2)	35	<1	<1	120
Public-supply wells (table 3)	9	<1	<1	2