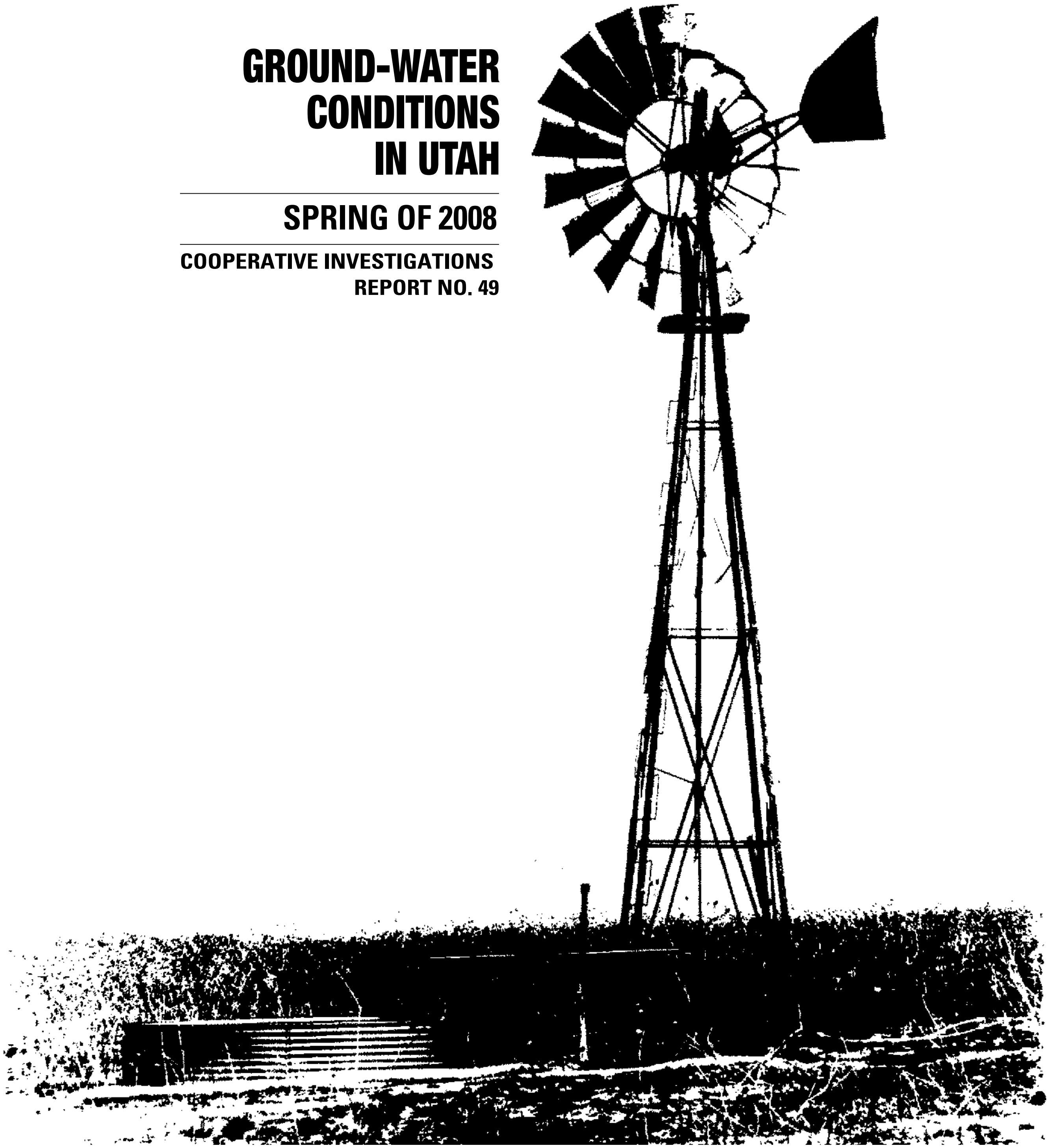
GROUND-WATER CONDITIONS IN UTAH

SPRING OF 2008

COOPERATIVE INVESTIGATIONS
REPORT NO. 49



UTAH DEPARTMENT OF NATURAL RESOURCES and
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

U.S. GEOLOGICAL SURVEY

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 2008

By
C.B. Burden and others
U.S. Geological Survey

Prepared by the U.S. Geological Survey
in cooperation with the Utah Department of Natural Resources,
Division of Water Resources and
Division of Water Rights; and
Utah Department of Environmental Quality, Division of Water Quality

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Contents

Illustrations

Tables

CONVERSION FACTORS, DATUMS, AND WATER-QUALITY UNITS

Multiply	By	To obtain
acre-foot	1,233	cubic meter
foot	0.3048	meter
gallon per minute	0.06308	liter per second
inch	25.4	millimeter
mile	1.609	kilometer
square mile	2.590	square kilometer

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 1929). Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Chemical concentration is reported only in metric units. Chemical concentration in water is reported in milligrams per liter (mg/L) or micrograms per liter (µg/L), which express the solute mass per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million.

DEFINITION OF TERMS

Acre-foot—The quantity of water required to cover 1 acre to a depth of 1 foot; equal to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Aquifer—A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield substantial amounts of water to wells and springs.

Artesian—Describes a well in which the water level stands above the top of the aquifer tapped by the well (confined). A flowing artesian well is one in which the water level is above the land surface.

Average annual withdrawal—Calculated averages from estimated withdrawals, rounded to the nearest thousand acre-feet.

Cumulative departure from average annual precipitation—A graph of the departure or difference between the average annual precipitation and the value of precipitation for each year, plotted cumulatively. A cumulative plot is generated by adding the departure from average precipitation for the current year to the sum of departure values for all previous years in the period of record. A positive departure, or greater-than-average precipitation, for a year results in a graph segment trending upward; a negative departure results in a graph segment trending downward. A generally downward-trending graph for a period of years represents a period of generally less-than-average precipitation, which commonly causes and corresponds with declining water levels in wells. Likewise, a generally upward-trending graph for a period of years represents a period of greater-than-average precipitation, which commonly causes and corresponds with rising water levels in wells. However, increases or decreases in withdrawals of ground water from wells also affect water levels and can change or eliminate the correlation between water levels in wells and the graph of cumulative departure from average precipitation.

Dissolved—Material in a representative water sample that passes through a 0.45–micrometer membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of “dissolved” constituents are made on subsamples of the filtrate.

Land-surface datum (lsd)—A datum plane that is approximately at land surface at each ground-water observation well.

Milligrams per liter—A unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water.

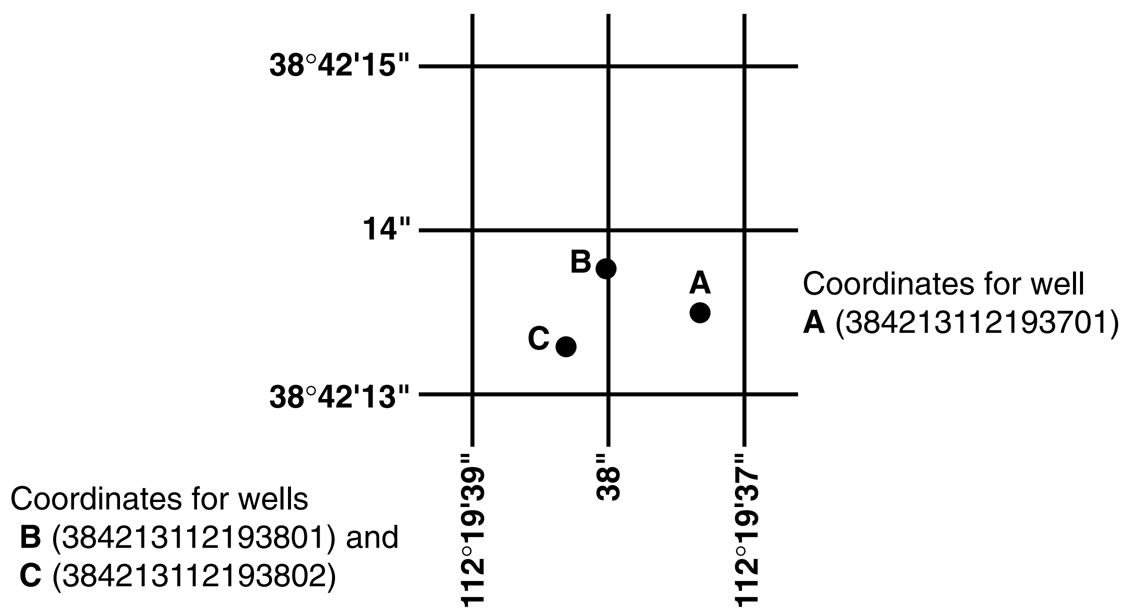
Precipitation—The total annual precipitation in inches, rounded to tenths of an inch. For selected locations, is computed from monthly total precipitation (rain, sleet, hail, snow, etc.). Data supplied by the National Oceanic and Atmospheric Administration (NOAA) and the Utah Climate Center. Data may be provisional and/or estimated when used to compute annual total and long-term average precipitation values.

Specific conductance—A measure of the ability of water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25 degrees Celsius. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids concentration of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant in water from one well or stream to another, and it may vary for the same source with changes in the composition of the water.

NUMBERING SYSTEM FOR WELLS AND SURFACE-WATER SITES

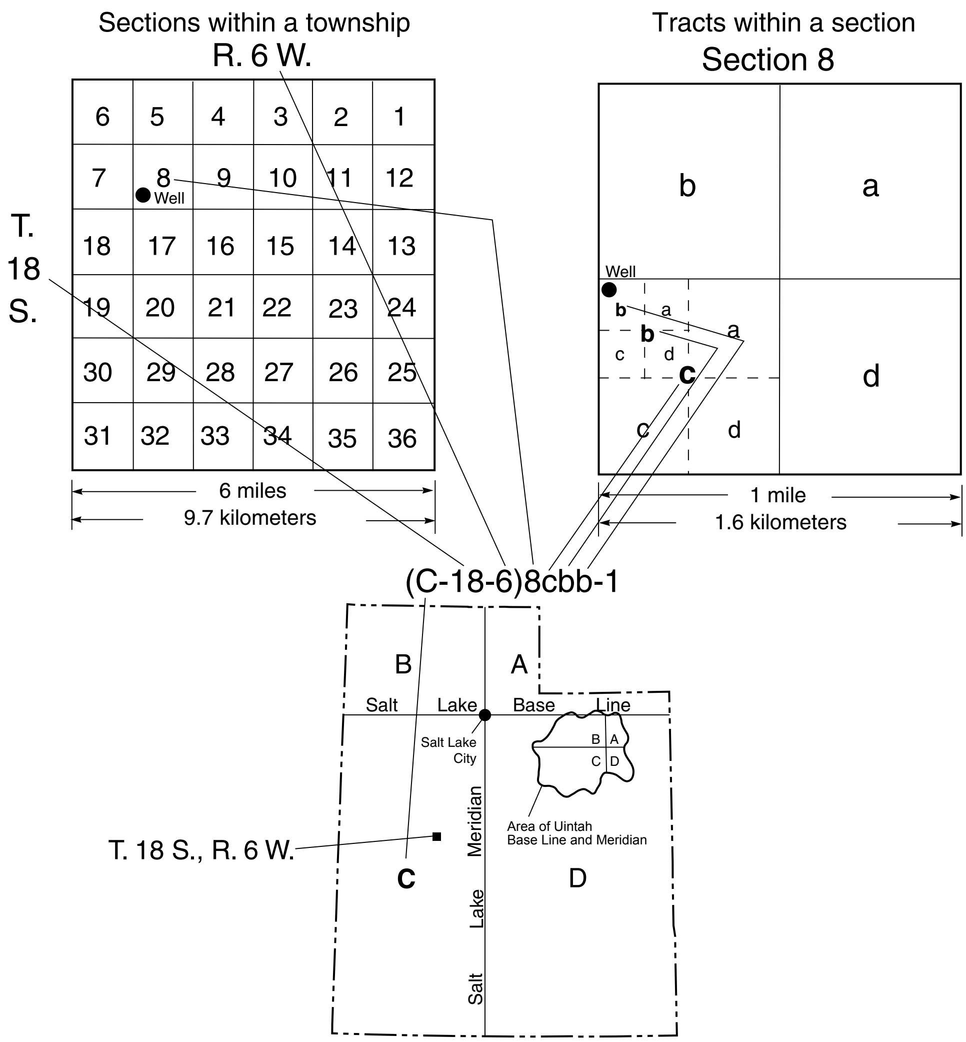
Wells by Latitude and Longitude

The U.S. Geological Survey well numbering system is based on the grid system of latitude and longitude. The system provides the geographic location of the well and a unique number for each site. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, and the next seven digits denote degrees, minutes, and seconds of longitude; the last two digits are a sequential number for wells within a 1-second grid. In the event that the latitude-longitude coordinates for a well are the same, a sequential number such as “01,” “02,” and so forth, would be assigned. Even though the site number is based on latitude and longitude, it may not reflect the accurate location of the site. When error corrections or new technology locate a site more accurately, latitude-longitude coordinates will change but the site number will not. In addition to the well number that is based on latitude and longitude for each well, another well number is assigned based on the U.S. Bureau of Land Management system of land subdivision.



Wells by Bureau of Land Management System of Land Subdivision

The well-numbering system used in Utah is based on the Bureau of Land Management system of land subdivision. The well-numbering system is familiar to most water users in Utah, and the well number shows the location of the well by quadrant, township, range, section, and position within the section. Well numbers for most of the State are derived from the Salt Lake Base Line and the Salt Lake Meridian. Well numbers for wells located inside the area of the Uintah Base Line and Meridian are designated in the same manner as those based on the Salt Lake Base Line and Meridian, with the addition of the "U" preceding the parentheses.



Surface-Water Sites— Downstream Order and Station Number

Since October 1, 1950, hydrologic-station records in U.S. Geological Survey reports have been listed in order of downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary entering between two main-stream stations is listed between those stations.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These station numbers are in the same downstream order used in this report. In assigning a station number, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list composed of both types of stations. Gaps are consecutive. The complete 8-digit (or 10-digit) number for each station such as 09004100, which appears just to the left of the station name, includes a 2-digit part number "09" plus the 6-digit (or 8-digit) downstream order number "004100." In areas of high station density, an additional two digits may be added to the station identification number to yield a 10-digit number. The stations are numbered in downstream order as described above between stations of consecutive 8-digit numbers.

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 2008

By C.B. Burden and others
U.S. Geological Survey

INTRODUCTION

This is the forty-fifth in a series of annual reports that describe ground-water conditions in Utah. Reports in this series, published cooperatively by the U.S. Geological Survey and the Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights, and the Utah Department of Environmental Quality, Division of Water Quality, provide data to enable interested parties to maintain awareness of changing ground-water conditions.

This report, like the others in the series, contains information on well construction, ground-water withdrawal from wells, water-level changes, precipitation, streamflow, and chemical quality of water. Information on well construction included in this report refers only to wells constructed for new appropriations of ground water. Supplementary data are included in reports of this series only for those years or areas which are important to a discussion of changing ground-water conditions and for which applicable data are available.

This report includes individual discussions of selected significant areas of ground-water development in the State for calendar year 2007. Most of the reported data were collected by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights, and the Utah Department of Environmental Quality, Division of Water Quality. This report is available online at *http://www.waterrights.utah.gov/techinfo/* and *http://ut.water.usgs.gov/publications/GW2008.pdf*.

For comparison purposes in this report, discussions were included regarding Utah State maximum contaminant levels (MCLs) and secondary drinking-water standards of routinely measurable substances present in water supplies. These can be found at: *http://www.rules.utah.gov/publicat/code/r309/r309-200.htm#T5*. The U.S. Environmental Protection Agency (EPA) drinking-water standards can be found at *http://www.epa.gov/safewater/mcl.html#mcls*.

The following reports deal with ground water in the State and were published by the U.S. Geological Survey or by cooperating agencies from May 2007 through April 2008:

Ground-water conditions in Utah, spring of 2007: Utah Division of Water Resources Cooperative Investigations Report No. 48, by C.B. Burden and others.

Evaluation of the ground-water flow model for northern Utah Valley, Utah, updated to conditions through 2002: U.S. Geological Survey Scientific Investigations Report 2006-5064, by Susan A. Thiros. Published online at http://pubs.usgs.gov/sir/2006/5064/.

Net-infiltration map of the Navajo Sandstone outcrop area in western Washington County, Utah: U.S. Geological Survey Scientific Investigations Map 2988, by Victor M. Heilweil and Tim S. McKinney. Published online at http://pubs.usgs.gov/sim/2988/.

Application of Geographic Information System methods to identify areas yielding water that will be replaced by water from the Colorado River in the Vidal and Chemehuevi areas, California, and the Mohave Mesa area, Arizona: U.S. Geological Survey Scientific Investigations Report 2007-5284, by Lawrence E. Spangler, Cory E. Angeroth, and Sarah J. Walton. Published online at http://pubs.usgs.gov/sir/2007/5284/.

Geospatial database of ground-water altitude and depth-to-ground-water data for Utah, 1971–2000: U.S. Geological Survey Data Series 302, by Susan G. Buto and Brent E. Jorgensen. Published online at http://pubs.usgs.gov/ds/302/.

UTAH'S GROUND-WATER RESERVOIR

Small amounts of ground water can be obtained from wells throughout most of Utah, but large amounts that are of suitable chemical quality for irrigation, public supply, or industrial use generally can be obtained only in specific areas. The areas of ground-water development discussed in this report are shown in figure 1 and listed in table 1. Relatively few wells outside of these areas yield large amounts of ground water of suitable chemical quality for the uses listed above, although some basins in western Utah and many areas in eastern Utah have not been explored sufficiently to determine their potential for ground-water development.

Most wells in Utah yield water from unconsolidated deposits. These deposits may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these materials. The largest yields are obtained from coarse materials that are sorted into deposits of uniform grain size. Most wells that yield water from unconsolidated deposits are in large intermountain basins that have been partly filled with rock material eroded from adjacent mountains.

A small percentage of wells in Utah yield water from consolidated rock. Consolidated rocks that have the highest yield are lava flows, such as basalt, which contain interconnected vesicular openings, fractures, or permeable weathered zones at the tops of flows; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains open fractures. Most wells that penetrate consolidated rock are in the eastern and southern parts of the State in areas where water cannot be obtained readily from unconsolidated deposits.

SUMMARY OF CONDITIONS

The total estimated withdrawal of water from wells in Utah during 2007 was about 997,000 acre-feet (table 2), which is about 143,000 acre-feet more than the revised total for 2006 and 149,000 acre-feet more than the 1997–2006 average annual withdrawal (table 3). The increase in withdrawal mostly resulted from increased irrigation and public supply use. The total estimated withdrawal for irrigation was about 538,000 acre-feet, which is 72,000 acre-feet more than the value for 2006. Withdrawal for public supply was about 316,000 acre-feet, which is about 74,000 acre-feet more than the value for 2006. Withdrawal for industrial use decreased about 1,000 acre-feet to about 79,000 acre-feet. Withdrawal for domestic and stock use was about 64,000 acre-feet, which is the same as in 2006.

Ground-water withdrawal increased from 2006 to 2007 in all 16 areas of ground-water development discussed in this report (table 2). Withdrawal in Utah and Goshen Valleys increased about 26,000 acre-feet, the largest increase of any of the ground-water development areas shown in figure 1. The 2007 withdrawal was more than the average annual withdrawal for 1997–2006 in 15 of the 16 areas (tables 2 and 3).

The amount of water withdrawn from wells is related to demand and availability of water from other sources, which, in turn, are partly related to local climatic conditions. Precipitation during calendar year 2007 at 24 of 28 weather stations included in this report (National Oceanic and Atmospheric Administration, 2007), was less than the long-term average. The greatest decrease in precipitation from average was 9.2 inches at Silver Lake Brighton. The greatest increase in precipitation from average was 1.4 inches at Fillmore.

About 770 water-level measurements were made during February and March 2008 in wells for areas included in this report. Water-level data included in the hydrographs in this report are from measurements made during the spring months, generally February-March, but may include water-level measurements made in April and May. Many of the wells in this report have additional water-level measurements made throughout the year which are not included in this report. All water-level data are available online at *http://waterdata.usgs.gov/ut/nwis/gwlevels*. Water-quality data are available online at *http://waterdata.usgs.gov/ut/nwis/qw.*

In 2007, 558 wells were constructed for new appropriations of ground water, as determined by the Utah Division of Water Rights (table 2), which is 9 more wells than the total reported for 2006. In 2007, 17 large-diameter wells (12 inches or more) were constructed for new appropriations of ground water (table 2), which is five more wells than the total reported for 2006. These are principally for withdrawal of water for public supply, irrigation, and industrial use.

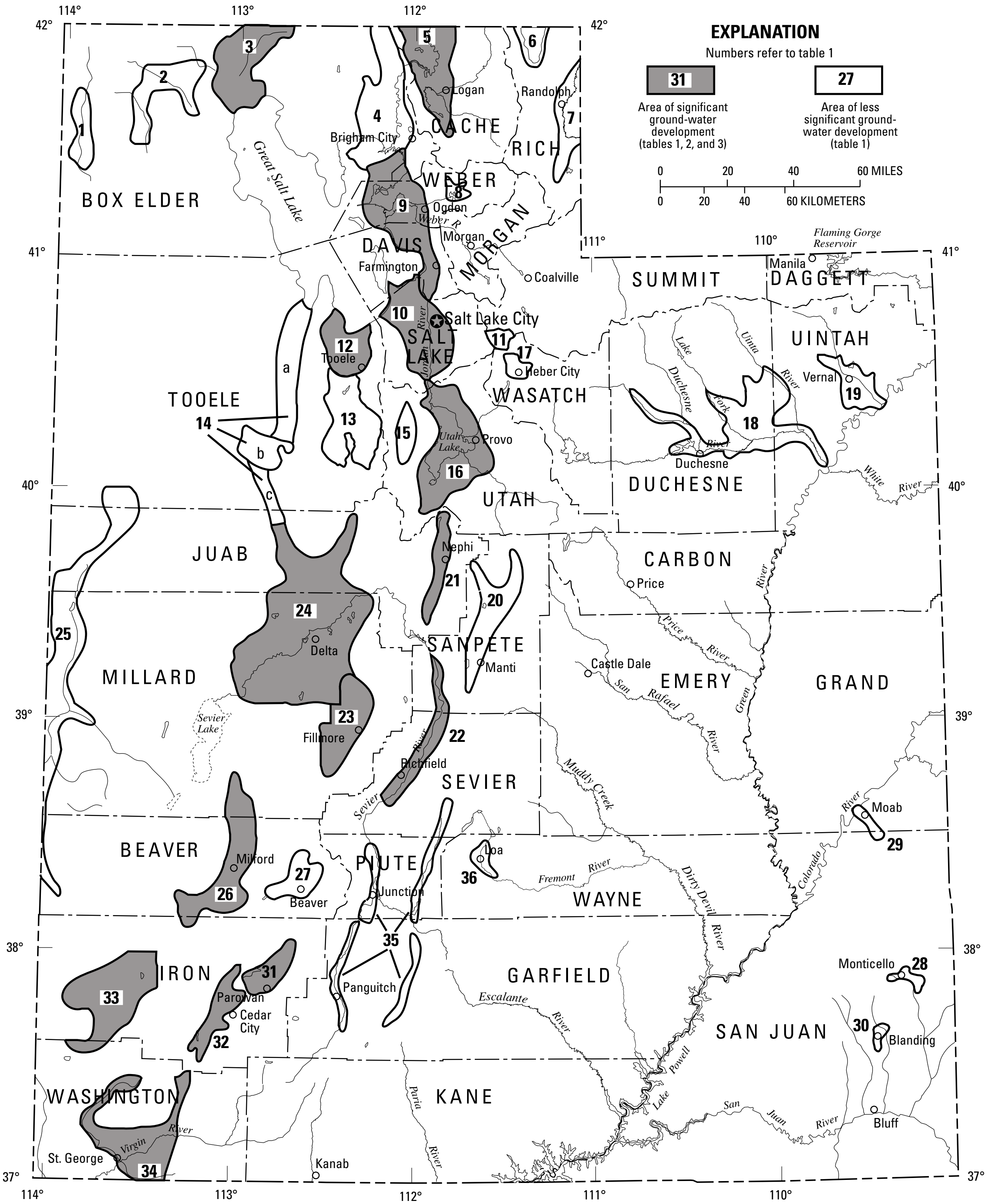


Figure 1. Areas of ground-water development in Utah specifically referred to in this report.

Table 1. Areas of ground-water development in Utah specifically referred to in this report.

[Do., ditto]

Number in figure 1	Area	Principal types of water-bearing rock
1	Grouse Creek Valley	Unconsolidated
2	Park Valley	Do.
3	Curlew Valley	Unconsolidated and consolidated
4	Malad-lower Bear River Valley	Unconsolidated
5	Cache Valley	Do.
6	Bear Lake Valley	Do.
7	Upper Bear River Valley	Do.
8	Ogden Valley	Do.
9	East Shore area	Do.
10	Salt Lake Valley	Do.
11	Park City area	Unconsolidated and consolidated
12	Tooele Valley	Do.
13	Rush Valley	Do.
14a	Skull Valley	Unconsolidated
14b	Dugway area	Do.
14c	Old River Bed	Do.
15	Cedar Valley, Utah County	Do.
16	Utah and Goshen Valleys	Do.
17	Heber Valley	Do.
18	Duchesne River area	Unconsolidated and consolidated
19	Vernal area	Do.
20	Sanpete Valley	Do.
21	Juab Valley	Unconsolidated
22	Central Sevier Valley	Do.
23	Pahvant Valley	Unconsolidated and consolidated
24	Sevier Desert	Unconsolidated
25	Snake Valley	Do.
26	Milford area	Do.
27	Beaver Valley	Do.
28	Monticello area	Consolidated
29	Spanish Valley	Unconsolidated and consolidated
30	Blanding area	Consolidated
31	Parowan Valley	Unconsolidated and consolidated
32	Cedar Valley, Iron County	Unconsolidated
33	Beryl-Enterprise area	Do.
34	Central Virgin River area	Unconsolidated and consolidated
35	Upper Sevier Valleys	Unconsolidated
36	Upper Fremont River Valley	Unconsolidated and consolidated

Table 2. Number of wells constructed and estimated withdrawal of water from wells in Utah.

Area	Number in figure 1	Number of wells[1] constructed in 2007		Estimated withdrawal from wells (acre-feet)					
				2007					2006 total[2] (rounded)
		Total	Diameter of 12 inches or more	Irrigation	Industrial[1]	Public supply[1]	Domestic and stock	Total (rounded)	
Curlew Valley	3	2	0	37,800	0	200	100	38,000	31,000
Cache Valley	5	24	1	16,000	6,000	12,100	2,000	36,000	31,000
East Shore area	9	8	1	7,800	3,800	35,000	5,000	52,000	46,000
Salt Lake Valley	10	11	4	1,100	[3]22,600	105,000	22,000	151,000	131,000
Tooele Valley	12	18	0	[4,5]10,200	1,500	10,000	1,100	23,000	18,000
Utah and Goshen Valleys	16	31	0	34,900	7,800	65,100	17,700	126,000	100,000
Juab Valley	21	8	0	25,000	120	[6]840	400	26,000	21,000
Sevier Desert	24	7	0	27,100	3,900	1,500	1,200	34,000	20,000
Central Sevier Valley	22	29	0	15,300	80	2,900	1,000	19,000	16,000
Pahvant Valley	23	5	0	87,600	0	1,100	320	89,000	86,000
Cedar Valley, Iron County	32	19	1	30,000	100	7,600	2,100	40,000	35,000
Parowan Valley	31	6	0	[7]32,800	100	350	330	34,000	33,000
Escalante Valley									
Milford area	26	5	1	40,600	[8]7,900	750	140	49,000	45,000
Beryl-Enterprise area	33	21	0	88,200	[9]3,000	450	640	92,000	79,000
Central Virgin River area	34	10	5	6,900	200	23,100	2,400	33,000	32,000
Other areas[10,11]		354	4	76,600	21,500	49,600	7,300	155,000	130,000
Total (rounded)		558	17	538,000	79,000	316,000	64,000	997,000	854,000

[1] Data provided by Utah Department of Natural Resources, Division of Water Rights.

[2] From Burden and others (2007, table 2).

[3] Includes some use for air conditioning, about 2,800 acre-feet. About 95 percent was injected back into the aquifer.

[4] Includes some domestic and stock use.

[5] Includes some flowing well discharge.

[6] Previously included some springs.

[7] Includes some stock use.

[8] Includes 5,420 acre-feet for geothermal power generation. About 99 percent was injected back into the aquifer.

[9] Includes 2,810 acre-feet for heating greenhouses. About 95 percent was injected back into the aquifer.

[10] Withdrawal totals are estimated minimum. See “Other Areas” section of this report for withdrawal estimates.

[11] Includes withdrawals for upper Sevier Valley and upper Fremont River Valley that were included with central Sevier Valley in reports prior to number 31 of this series.

Table 3. Total annual withdrawal of water from wells in significant areas of ground-water development in Utah, 1997–2006.

Area	Number in figure 1	Thousands of acre-feet[1] (rounded)										1997–2006 average (rounded)
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Curlew Valley	3	36	29	29	41	36	[2]38	42	38	29	31	35
Cache Valley	5	25	26	24	30	32	33	27	27	29	31	28
East Shore area	9	62	56	61	60	57	49	49	46	41	46	53
Salt Lake Valley	10	123	122	126	145	151	[2]140	130	125	110	131	130
Tooele Valley	12	25	[2]19	21	24	21	21	22	21	[2]18	[2]18	21
Utah and Goshen Valleys	16	[2]84	[2]77	[2]103	[2]120	[2]111	[2]111	[2]108	[2]105	[2]87	100	101
Juab Valley	21	15	12	14	27	29	29	27	26	14	21	21
Sevier Desert	24	17	12	12	15	19	36	28	41	24	20	22
Central Sevier Valley	22	20	20	20	13	12	11	15	15	17	16	16
Pahvant Valley	23	67	66	76	80	80	89	86	85	80	86	80
Cedar Valley, Iron County	32	34	36	32	[2]35	32	42	39	40	30	35	36
Parowan Valley	31	25	28	[2]26	30	[2]33	39	31	37	27	33	31
Escalante Valley												
Milford area	26	52	41	41	49	42	52	50	44	40	45	46
Beryl-Enterprise area	33	81	74	79	84	81	99	92	98	68	79	84
Central Virgin River area	34	18	20	[2]18	[2]26	27	27	28	26	29	32	25
Other areas		107	99	106	[2]135	114	131	128	129	111	130	119
Total (rounded)		[2]791	[2]737	[2]788	[2]914	[2]877	[2]947	[2]902	[2]903	[2]754	[2]854	848

[1] From previous reports of this series.

[2] Revised.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CURLEW VALLEY

By David V. Allen

The Curlew Valley drainage basin extends across the Utah-Idaho State line between latitudes 41°40' and 42°30' north and longitudes 112°30' and 113°20' west, and covers about 1,200 square miles (fig. 2). The valley is bounded on the west, north, and east by mountains that range in altitude from about 6,500 to nearly 10,000 feet and is open to the south, where water draining from the valley enters Great Salt Lake.

The Utah part of Curlew Valley (Utah subbasin) covers about 550 square miles in Box Elder County. It is an arid to semiarid, largely uninhabited area, with a community center at Snowville. Average annual precipitation in the Utah subbasin is less than 8 inches on the valley floor and reaches a maximum that exceeds 35 inches on one of the highest mountain peaks.

The principal source of water in Curlew Valley is ground water. The ground-water reservoir is primarily composed of confined aquifers in alluvial and lacustrine deposits and volcanic rocks. These formations yield several hundred to several thousand gallons of water per minute to individual large-diameter irrigation wells west of Snowville and near Kelton.

Total estimated withdrawal of water from wells in Curlew Valley in 2007 was about 38,000 acre-feet, which is 7,000 acre-feet more than the value for 2006 and 3,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3).

The location of wells in Curlew Valley in which the water level was measured during March 2008 is shown in figure 2. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 3.

Water levels in Curlew Valley generally declined from March 2007 to March 2008. Since about 1980, water levels have generally declined, probably the result of continued large withdrawals for irrigation.

Precipitation at Grouse Creek in 2007 was about 6.1 inches, which is about 4.7 inches less than in 2006 and about 5.1 inches less than the average annual precipitation for 1959–2007.

Physical properties and results of chemical analyses for water from five wells in Curlew Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved solids in water samples from four wells ((B-12-11)4bcc-1, (B-12-11)6aab-1, (B-14-9)4ccc-1, and (B-14-9)7bbb-1) and the dissolved-chloride concentration in water samples from three wells ((B-12-11)4bcc-1, (B-14-9)4ccc-1, and (B-14-9)7bbb-1) exceeded the secondary drinking-water standards for these constituents (500 mg/L and 250 mg/L, respectively). The dissolved-solids concentration in water from well (B-12-11)4bcc-1 also exceeded the MCL for this constituent (2,000 mg/L).

The concentration of dissolved solids in water from well (B-12-11)4bcc-1, north of Kelton, and well (B-14-9)5bbb-1, 10 miles west of Snowville, from 1972–2007 and 1971–2006, respectively, is shown in figure 3. The dissolved-solids concentration in water from well (B-12-11)4bcc-1 has generally increased since 1972. The sample collected in June 2007 had a dissolved-solids concentration of 2,930 mg/L, which is about 2.5 times greater than the concentration in the water sample collected in March 1972 (1,160 mg/L). Dissolved-solids concentrations in water from well (B-14-9)5bbb-1 have gradually increased since 1971. This irrigation well was not sampled in 2007 because it was not pumping at the time of sampling.

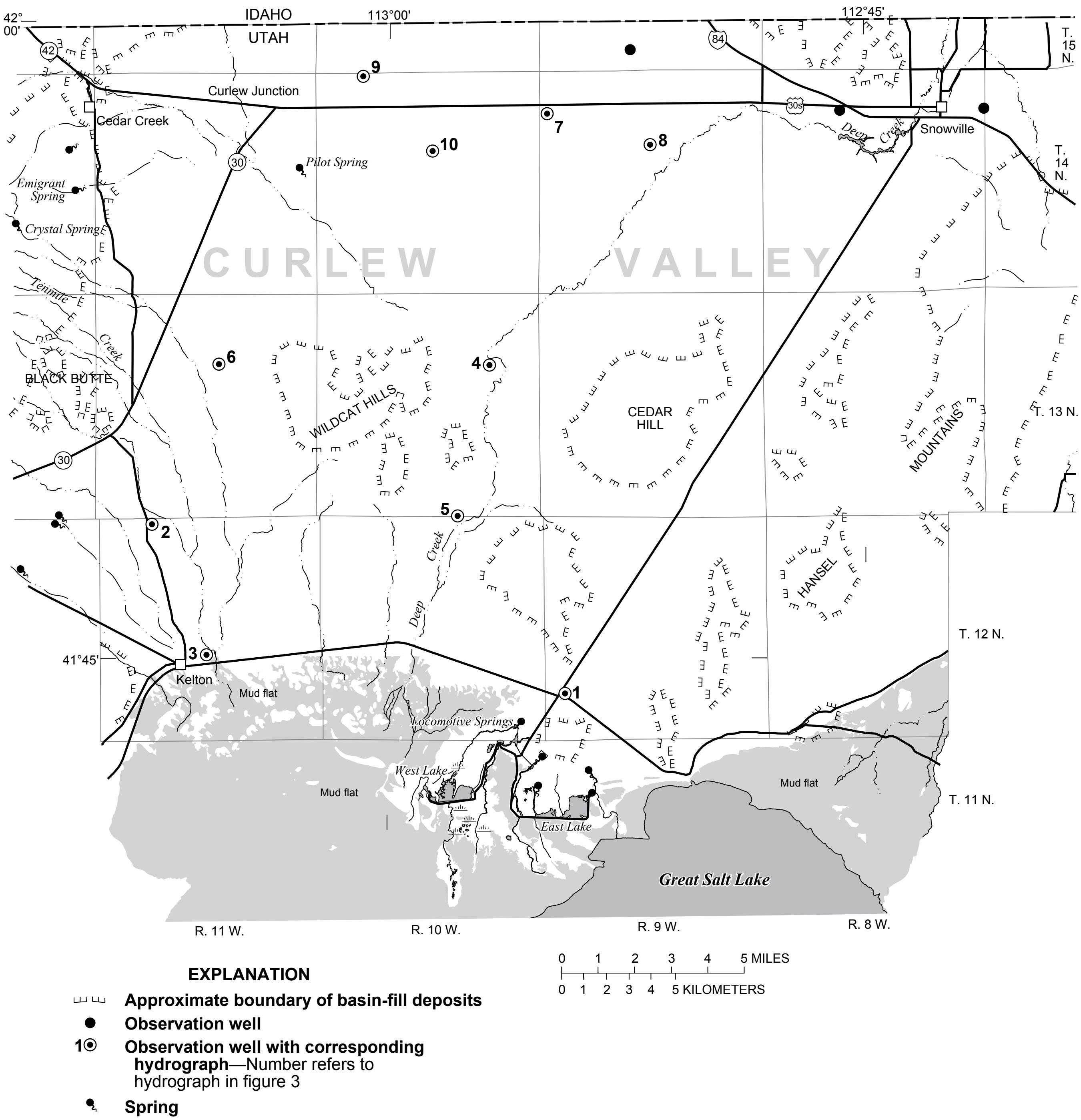


Figure 2. Location of wells in Curlew Valley in which the water level was measured during March 2008.

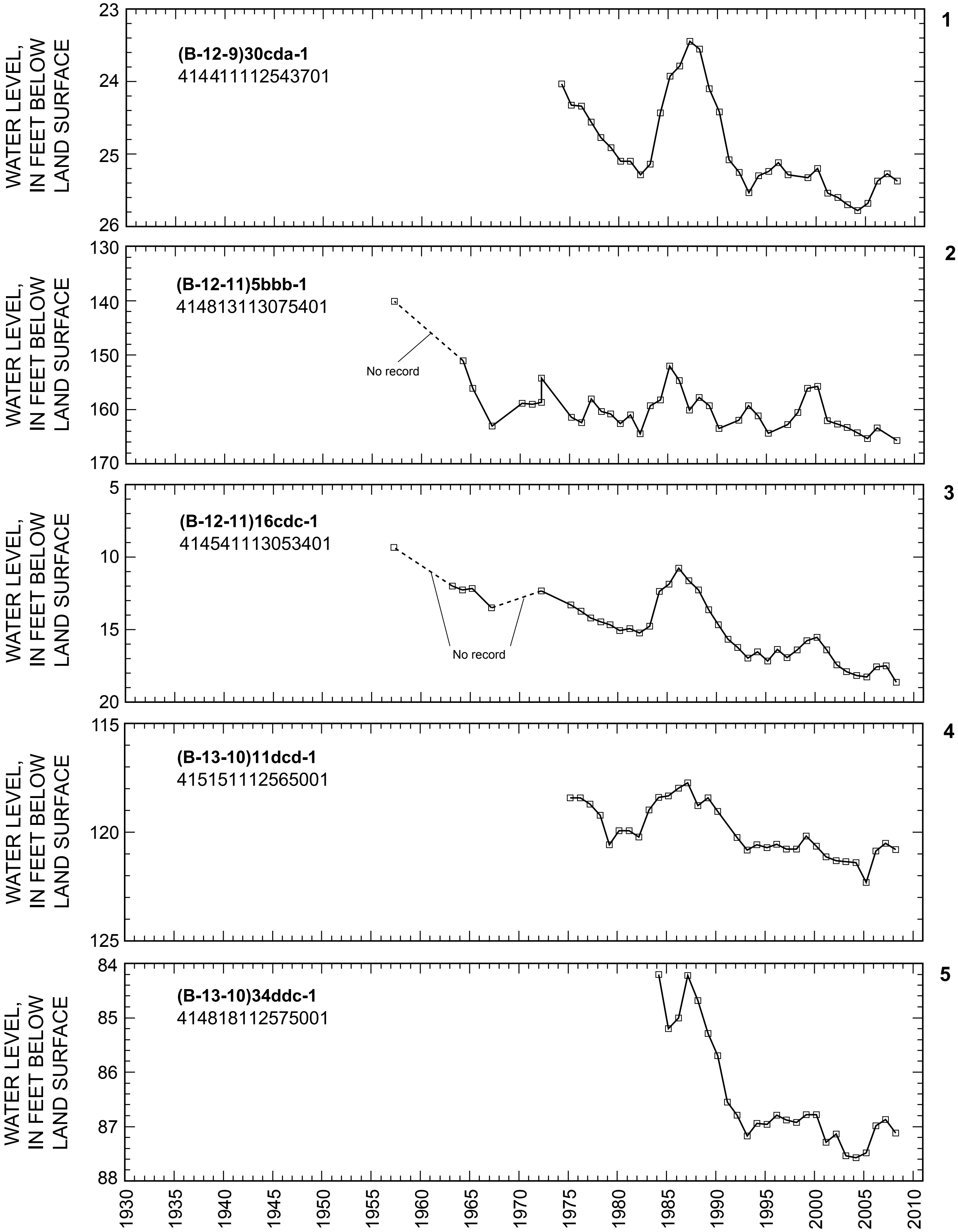


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

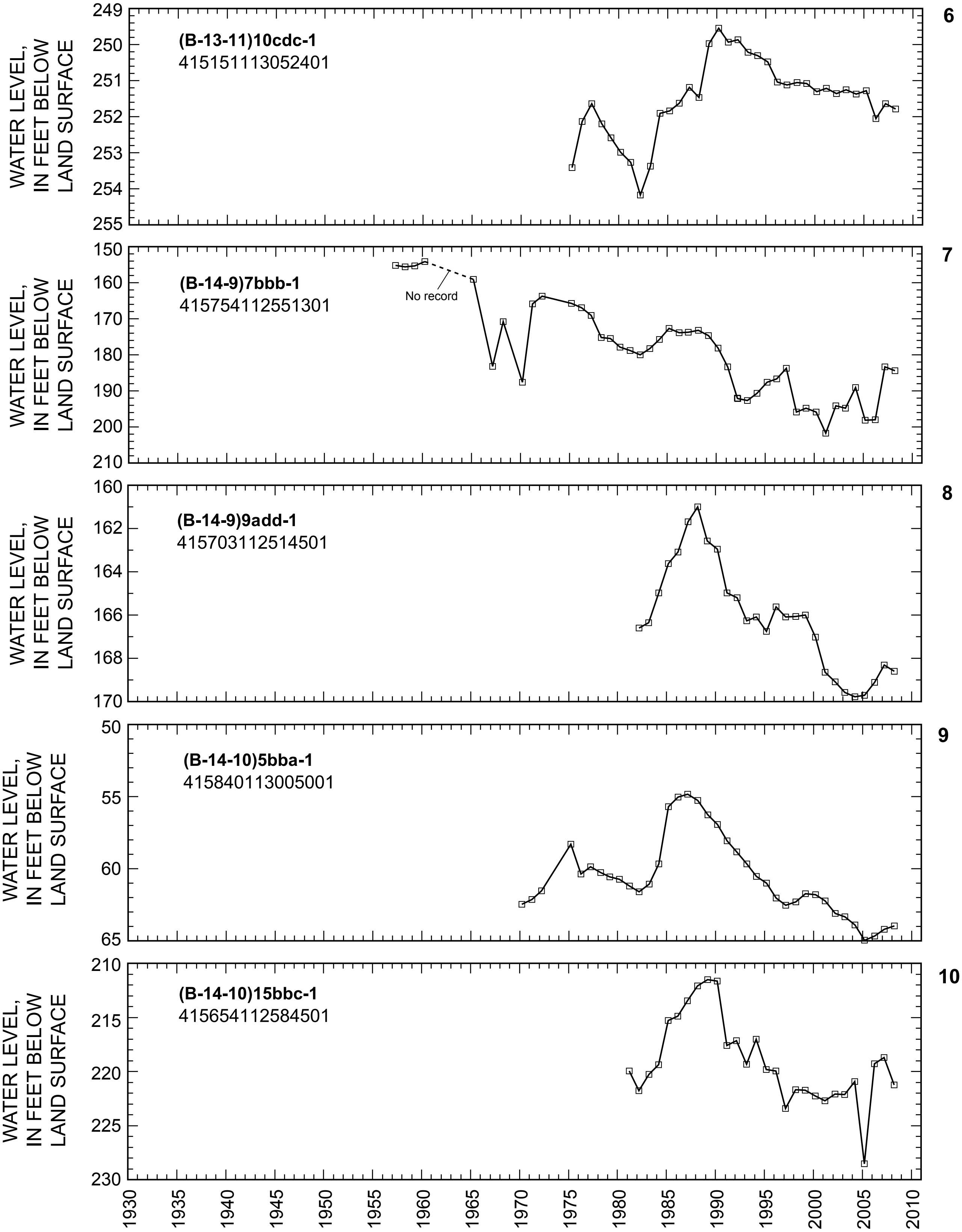


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

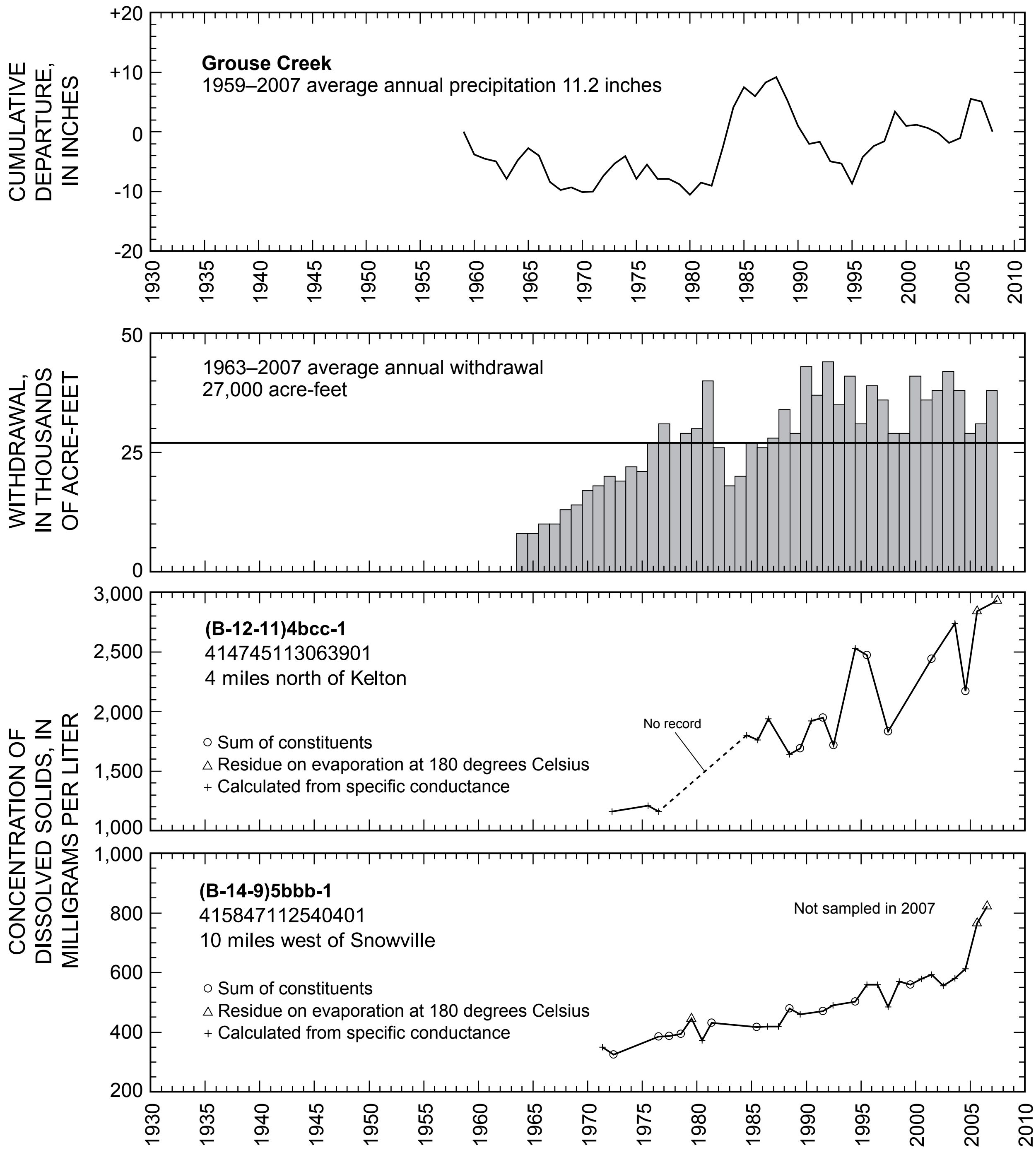


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Grouse Creek, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

CACHE VALLEY

By M.R. Danner

Cache Valley covers about 450 square miles in Cache County (fig. 4). Ground water occurs in unconsolidated deposits in the valley, under both water-table and artesian conditions. Recharge to the ground-water system occurs principally at the margins of the valley, and ground water moves toward the center of the valley and west toward Cache Junction.

Total estimated withdrawal of water from wells in Cache Valley in 2007 was about 36,000 acre-feet, which is 5,000 acre-feet more than in 2006 and 8,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for irrigation was 16,000 acre-feet, which is 2,700 acre-feet more than in 2006. Withdrawal for public supply was 12,100 acre-feet, 3,500 acre-feet less than in 2006.

The location of wells in Cache Valley in which the water level was measured during March 2008 is shown in figure 4. The relation of the water level in selected observation wells to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1 is shown in figure 5.

Water levels throughout the valley generally declined from March 2007 to March 2008. Water levels fluctuated between 1935 and 1983; since 1985, water levels have fluctuated depending on the amount and timing of precipitation and recharge from snowmelt runoff.

Total discharge of the Logan River (combined flow from the Logan River above State Dam, near Logan, and Logan, Hyde Park, and Smithfield Canal at Head, near Logan) during 2007 was about 126,300 acre-feet, which is 114,100 acre-feet less than the revised 2006 total of 240,400 acre-feet and 53,700 acre-feet less than the 1941–2007 average annual discharge.

Precipitation at Logan, Utah State University, was about 14.2 inches in 2007. This is about 7.4 inches less than for 2006 and about 4.0 inches less than the average annual precipitation for 1930–2007.

Physical properties and results of chemical analyses for water from two wells in Cache Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved manganese in water from well (A-13-1)29bcd-1 exceeded the secondary standard for this constituent (0.05 mg/L). Analytical results did not exceed secondary standards or MCLs for major ions and nutrients.

The concentration of dissolved solids in water from well (A-13-1)29bcd-1, located 1.5 miles west of Smithfield, from 1970 to 2007, is shown in figure 5. Concentrations range from 223 to 269 mg/L, with a median value of 258 mg/L. There is little variability in the data, which is consistent with the relatively small range (46 mg/L) and standard deviation (10.8 mg/L) associated with the data.

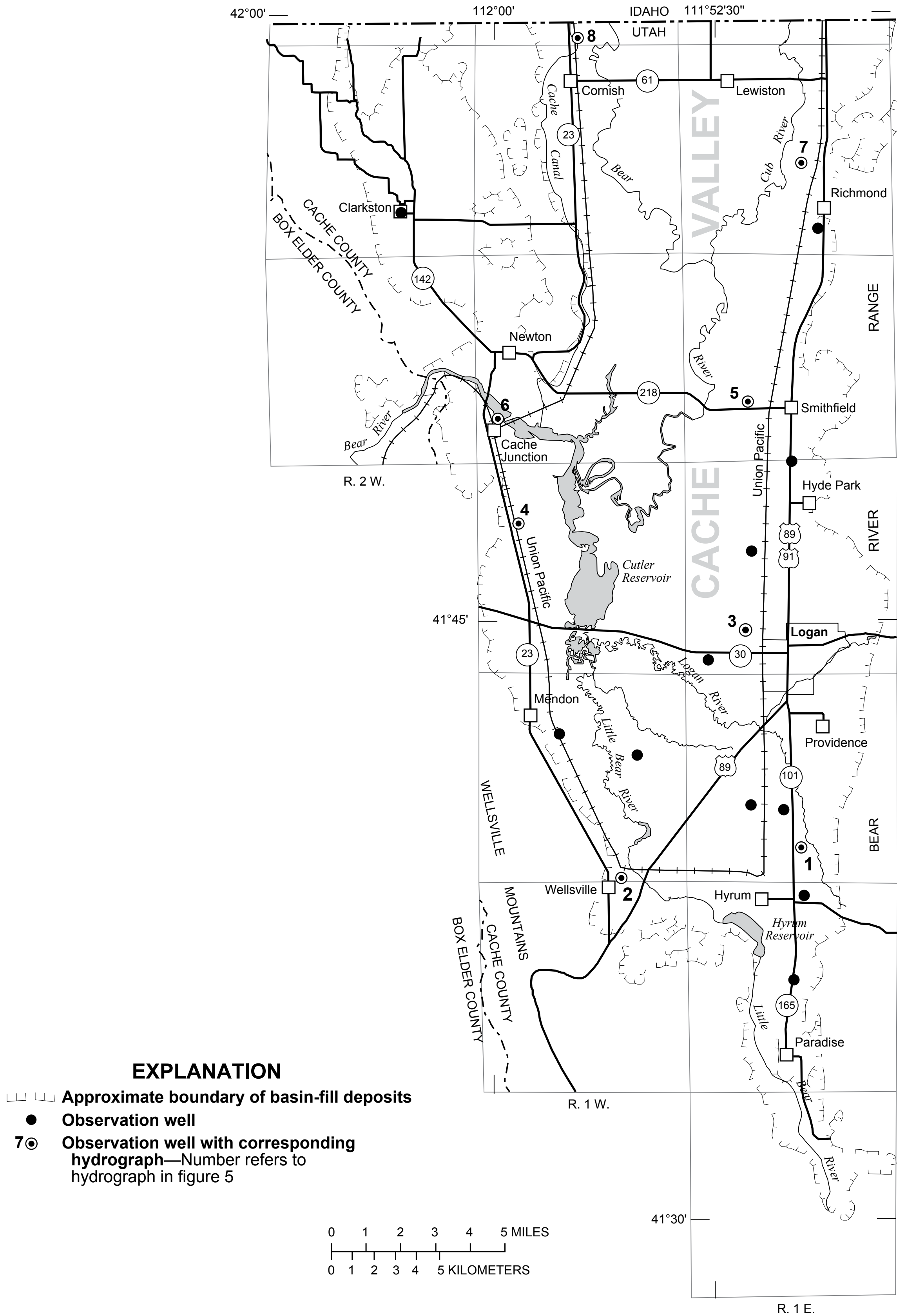


Figure 4. Location of wells in Cache Valley in which the water level was measured during March 2008.

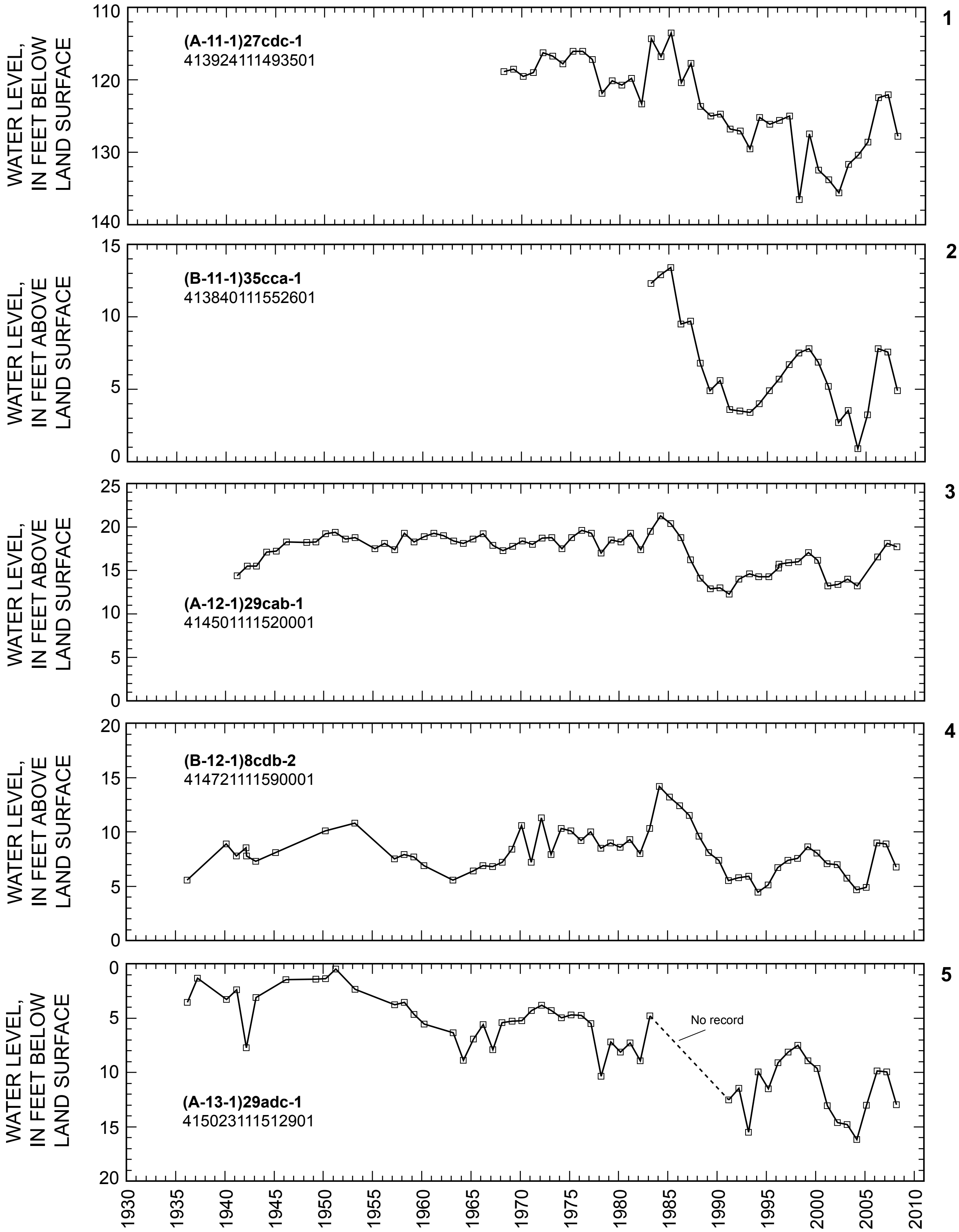


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.

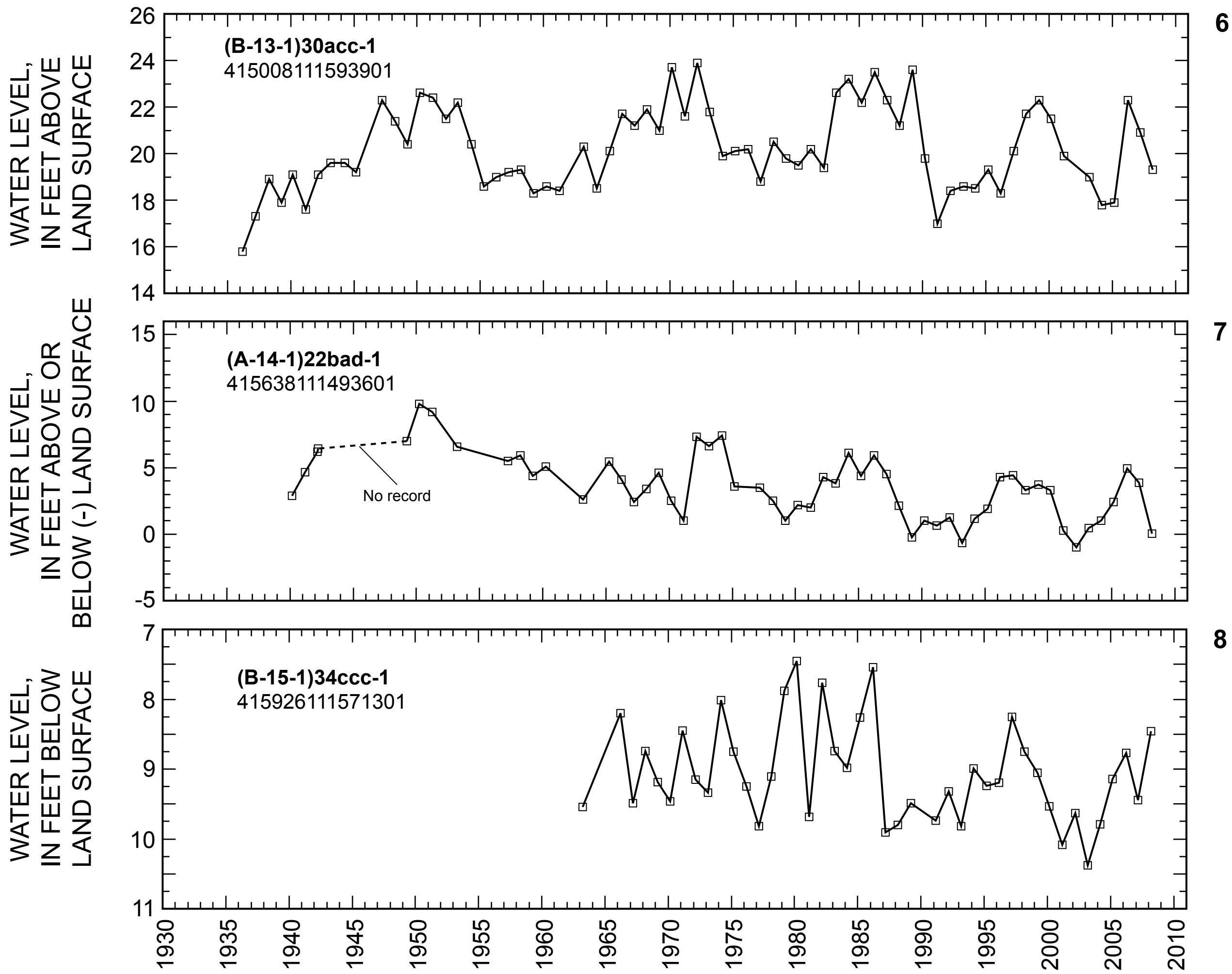


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1—Continued.

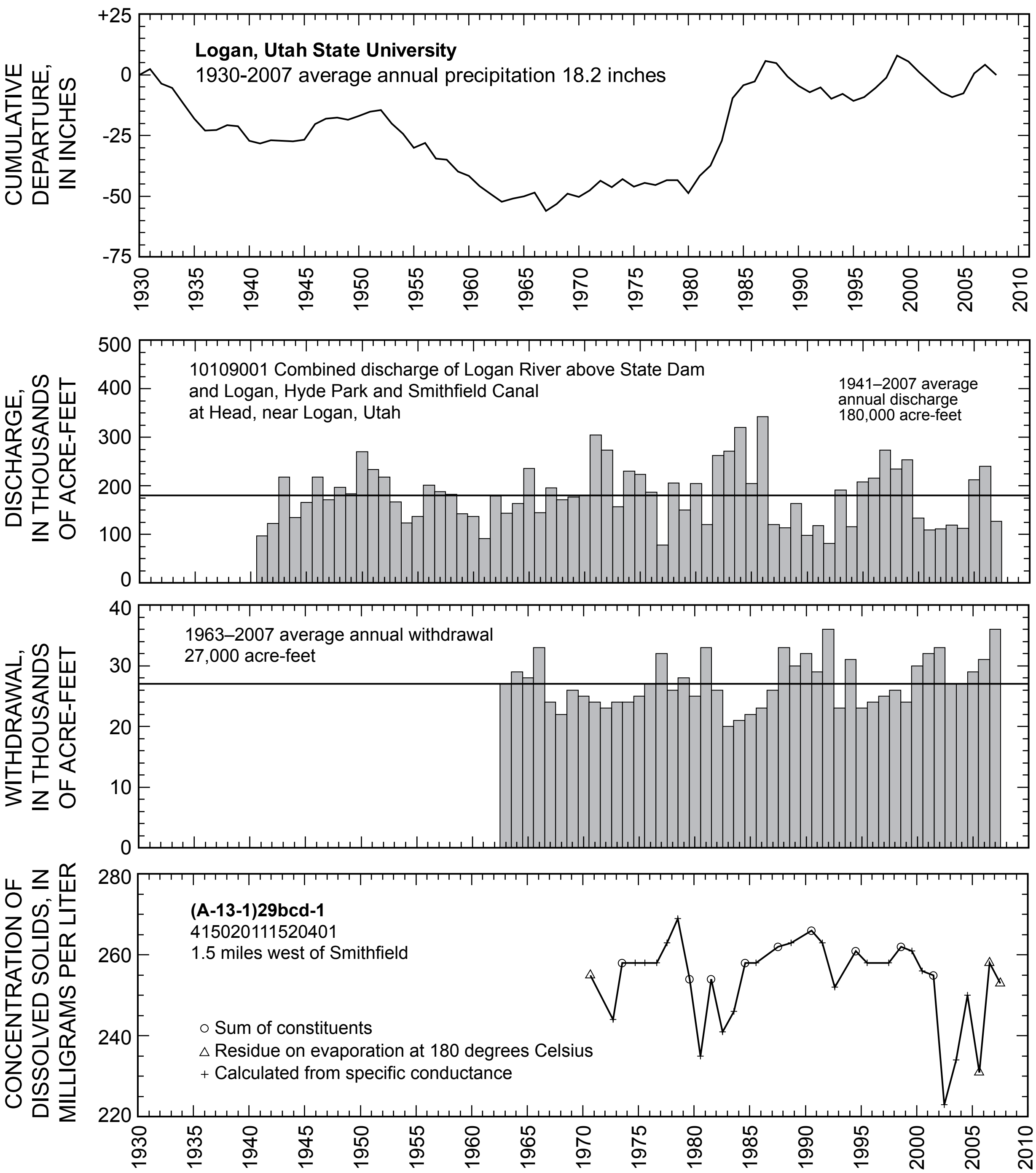


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1—Continued.

EAST SHORE AREA

By Martel Fisher

The East Shore area is in north-central Utah between the Wasatch Range and Great Salt Lake within Davis, Weber, and Box Elder Counties (fig. 6). Ground water occurs in unconsolidated deposits under both water-table and artesian conditions, but most of the water withdrawn by wells is from the artesian aquifers. Water enters the artesian aquifers along the eastern edge of the basin-fill deposits and generally moves westward toward Great Salt Lake.

Total estimated withdrawal of water from wells in the East Shore area in 2007 was about 52,000 acre-feet, which is 6,000 acre-feet more than was reported for 2006 and 1,000 acre-feet less than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for public supply was about 10,500 acre-feet more than in 2006. Withdrawal for irrigation was about 4,800 acre-feet less than in 2006.

The location of wells in the East Shore area in which the water level was measured during March 2008 is shown in figure 6. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1 is shown in figure 7.

Water levels declined from March 2007 to March 2008 in most of the wells measured in the East Shore area. Declines probably resulted from less recharge due to less-than-average precipitation and continued large withdrawals for public supply (table 2). Water levels have generally declined in most of the East Shore area from the mid-1950s to 2008.

Precipitation at Ogden Pioneer Powerhouse in 2007 was about 17.8 inches, which is about 3.5 inches less than the average annual precipitation for 1930–2007 and about 4.3 inches less than in 2006.

Physical properties and results of chemical analyses for water from seven wells in the East Shore area are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved iron in water from well (B-4-2)27aba-1 (Davis County) and the concentration of dissolved manganese in water from wells (B-5-2)6cdd-2 and (B-6-3)15cbc-1 (both Weber County) exceeded the secondary standards for these constituents (0.3 mg/L and 0.05 mg/L, respectively). The dissolved-arsenic concentration in water from wells ((B-4-2)27aba-1 (Davis County), and (B-6-3)15cbc-1 (Weber County)) exceeded the MCL for this constituent (10 μg/L). The dissolved-orthophosphate concentration (0.618 mg/L) in water from well (B-4-2)27aba-1 was the maximum concentration in water samples collected for this study.

The concentration of dissolved solids in water collected from well (B-4-2)27aba-1, 2.3 miles south-southeast of Syracuse, from 1969 to 2007, is shown in figure 7. Concentrations range from 287 to 633 mg/L, with a median value of 400 mg/L. From 1969 to 1993, dissolved-solids concentrations in water samples varied by as much as 346 mg/L; however, recent samples collected from 1995 to 2007 vary by less than 30 mg/L.

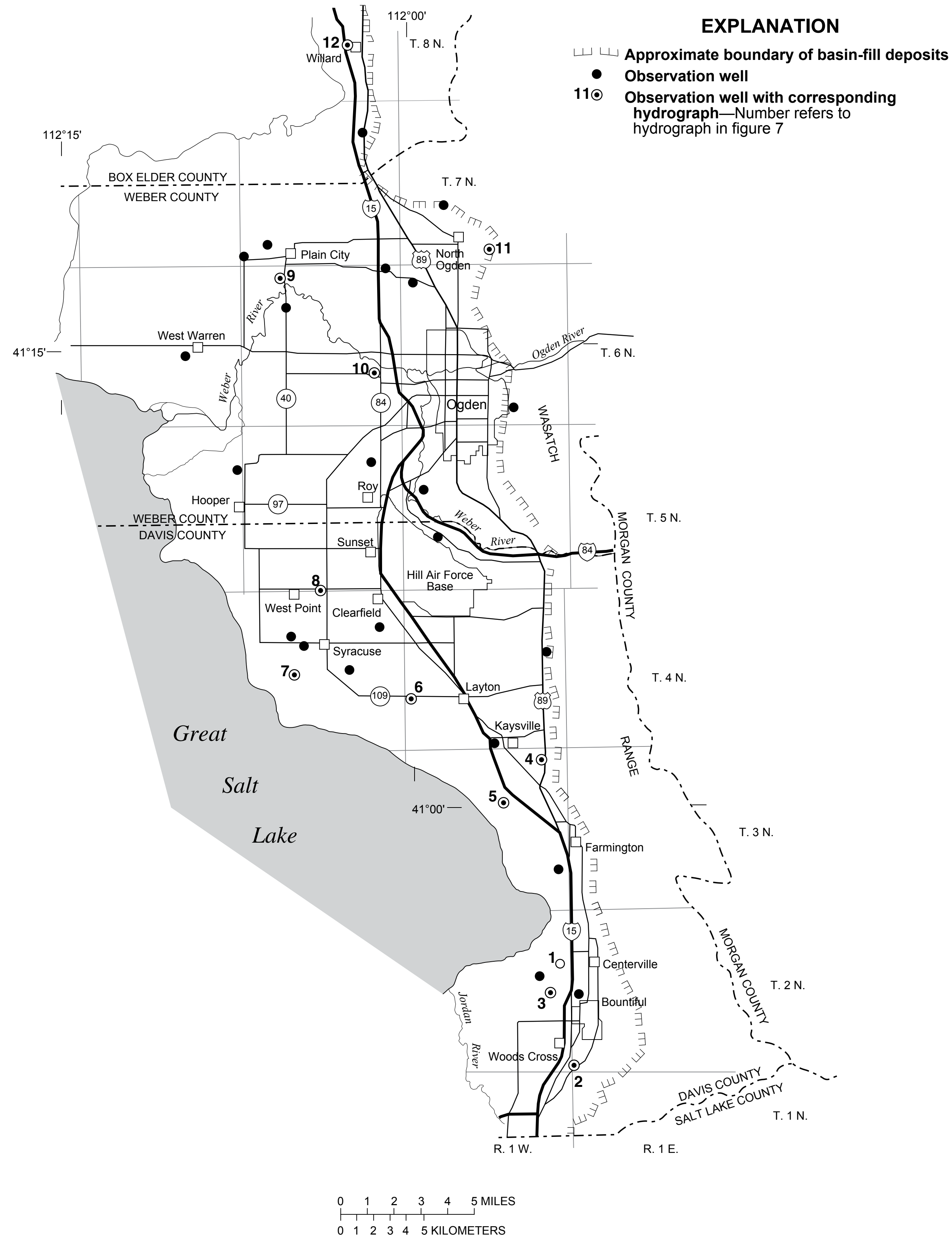


Figure 6. Location of wells in the East Shore area in which the water level was measured during March 2008.

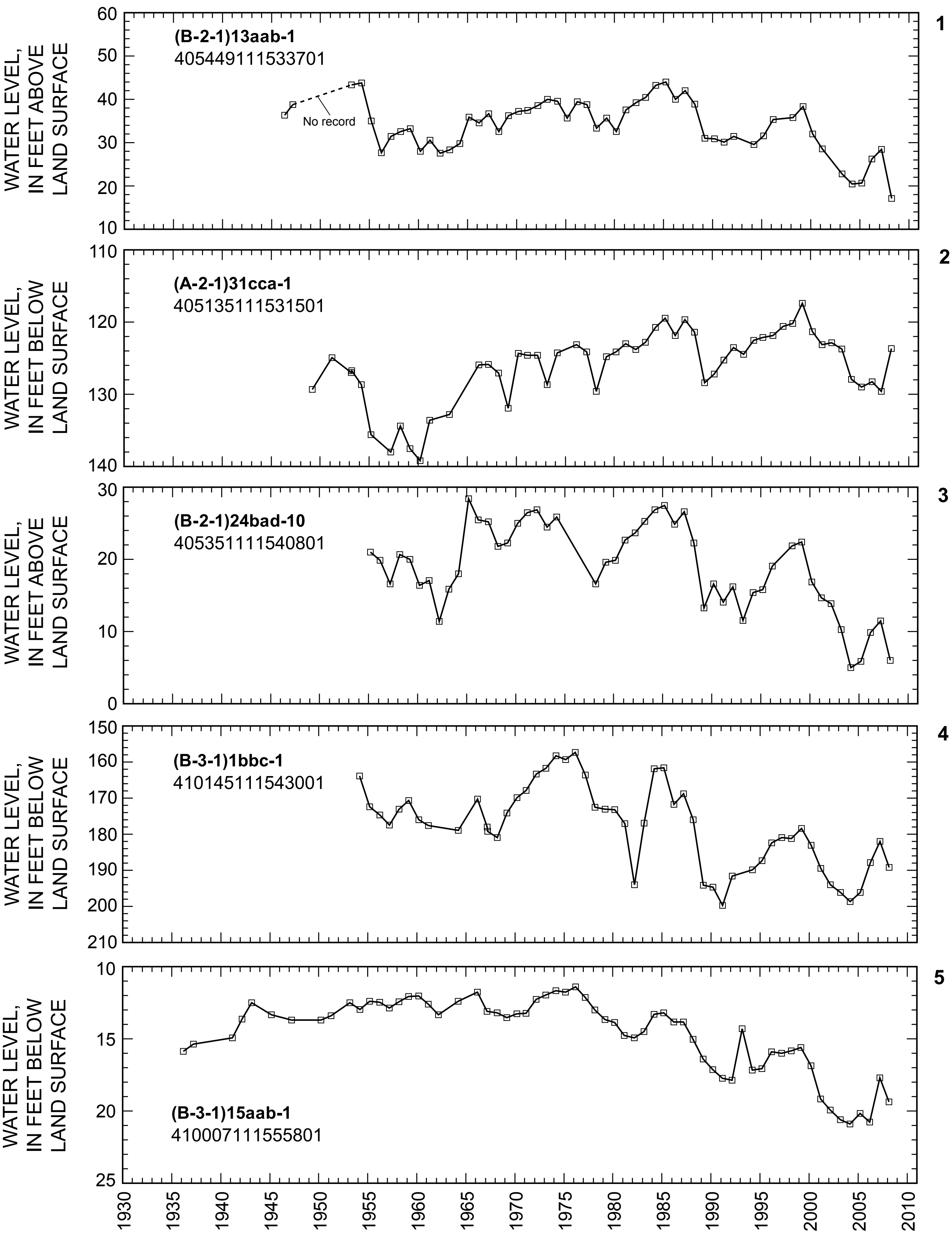


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.

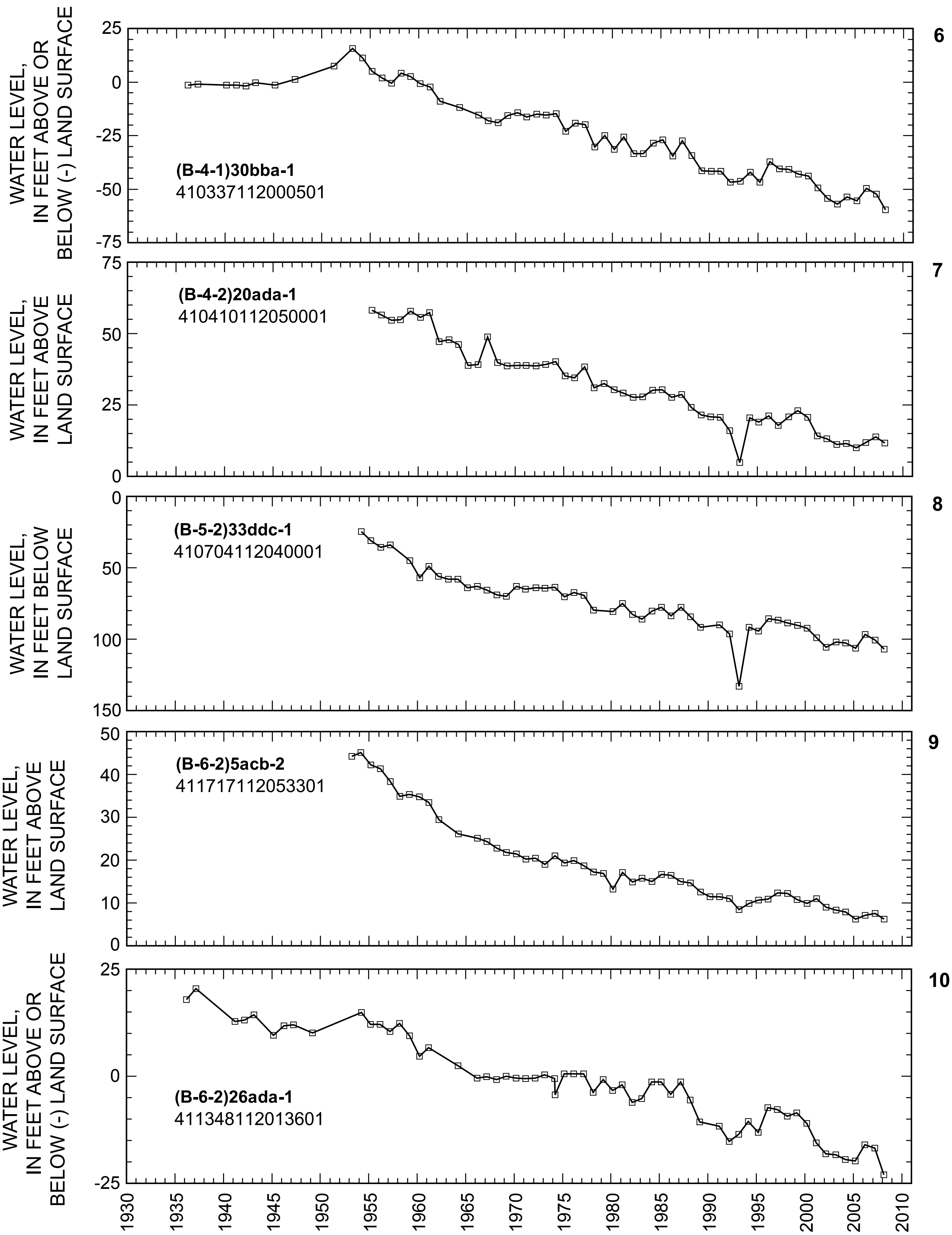


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

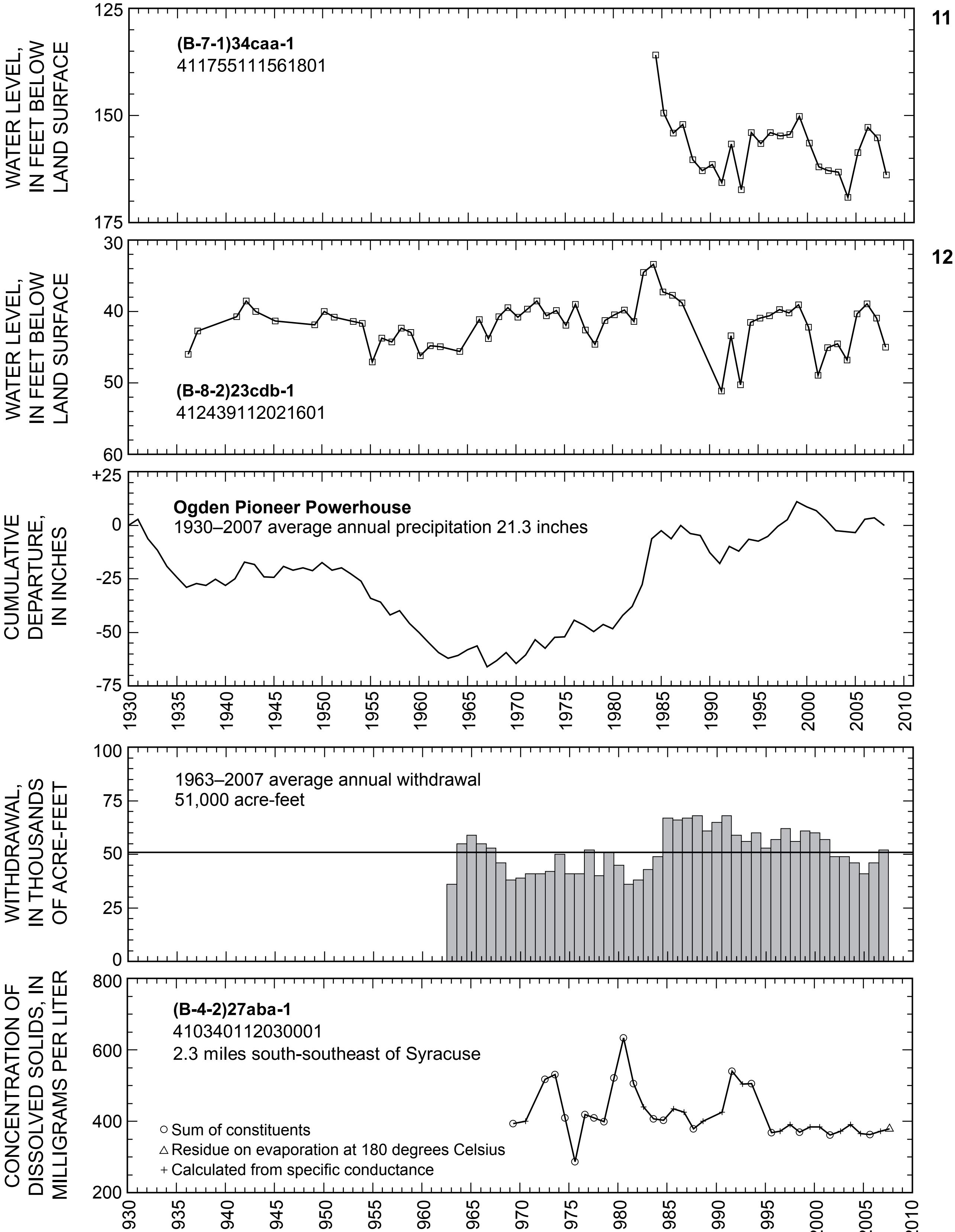


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Ogden Pioneer Powerhouse, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1—Continued.

SALT LAKE VALLEY

By M.L. Freeman

Salt Lake Valley covers about 400 square miles in the lowlands of Salt Lake County (fig. 8). Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions. Recharge to the aquifers occurs mainly along the area where the mountains border the valley. In the southwestern part of the valley, ground water moves from the base of the Oquirrh Mountains eastward toward the Jordan River. In the northwestern part of the valley, the direction of movement is mostly toward Great Salt Lake. In the eastern half of the valley, ground water moves westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface and ground water from the valley.

Total estimated withdrawal of water from wells in Salt Lake Valley in 2007 was about 151,000 acre-feet, which is 20,000 acre-feet more than in 2006 and 21,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for public supply was about 105,000 acre-feet, which is 20,800 acre-feet more than the total for 2006. Withdrawal for industrial use was about 22,600 acre-feet, which is 600 acre-feet less than the total for 2006.

The location of wells in Salt Lake Valley in which the water level was measured during February 2008 is shown in figure 8. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (WSO) (International Airport) are shown in figure 9. Precipitation at Salt Lake City WSO during 2007 was about 13.6 inches, about 2.5 inches less than 2006 and about 1.6 inches less than the average annual precipitation for 1931–2007.

The relation of the water level in selected observation wells completed in the principal aquifer to cumulative departure from average annual precipitation at Silver Lake Brighton, and the relation of the water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well are shown in figure 10. Precipitation at Silver Lake Brighton was about 33.1 inches in 2007, which is about 11.1 inches less than in 2006 and about 9.2 inches less than the average annual precipitation for 1931–2007.

Water levels declined from February 2007 to February 2008 in most of the wells measured in Salt Lake Valley. The water level in most of the observation wells was highest during 1985–87, which corresponds to a period of much-greater-than-average precipitation. Levels have generally declined since 1987, although substantial rises occurred in the northeastern part of the valley from 1994 to 1999.

Physical properties and results of chemical analyses for water from two wells in Salt Lake Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from both wells ((C-3-1)32adc-1 and (D-1-1)7abd-6) exceeded the secondary standard for this constituent (500 mg/L).

The concentration of dissolved solids in water from well (D-1-1)7abd-6, a flowing well at 800 South 500 East in Salt Lake City, from 1931 to 2007, is shown in figure 10. Concentrations range from 554 to 837 mg/L, with a median value of 679 mg/L. The concentration of dissolved solids increased from 576 mg/L in December 1931 to 825 mg/L in July 2007.

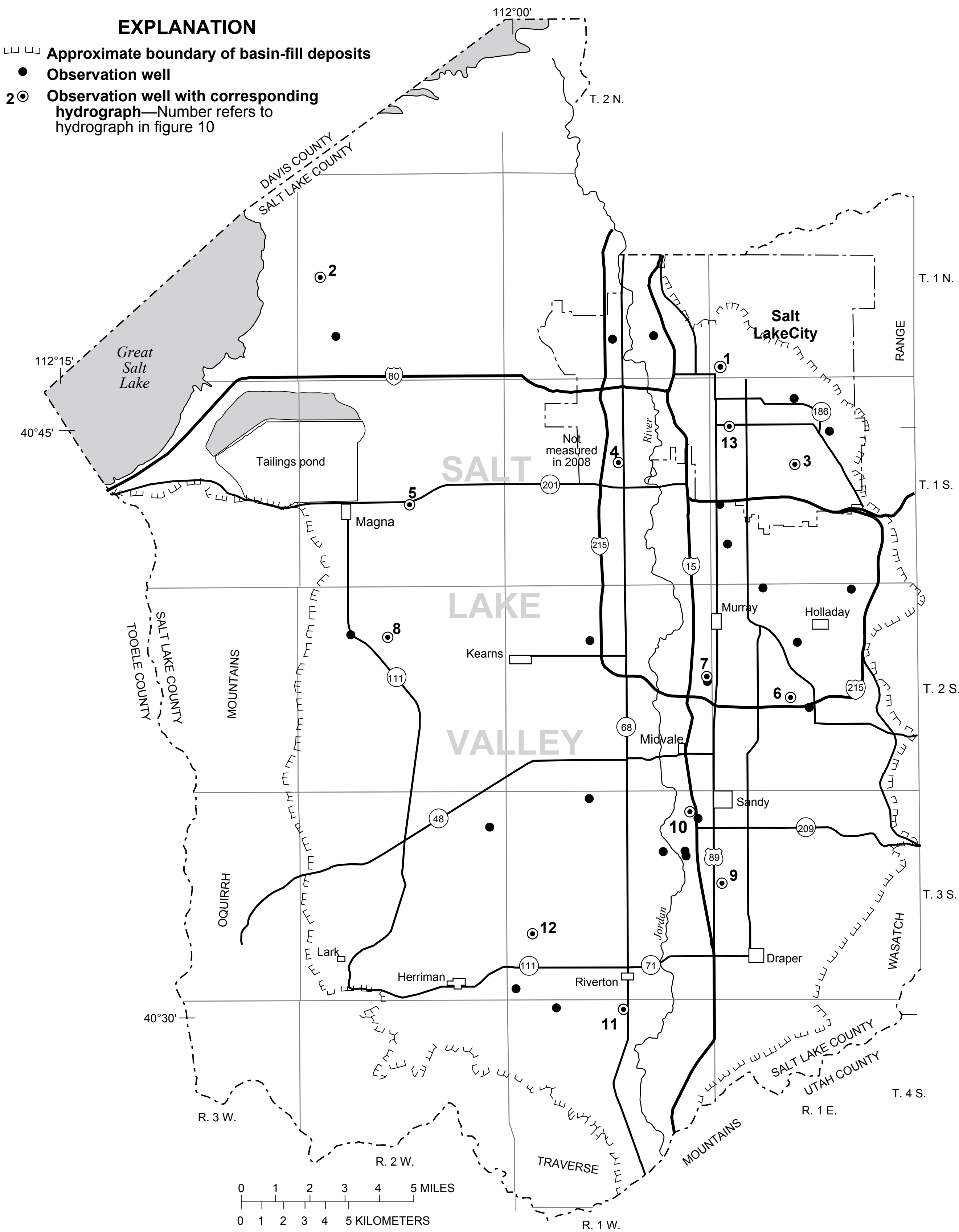


Figure 8. Location of wells in Salt Lake Valley in which the water level was measured during February 2008.

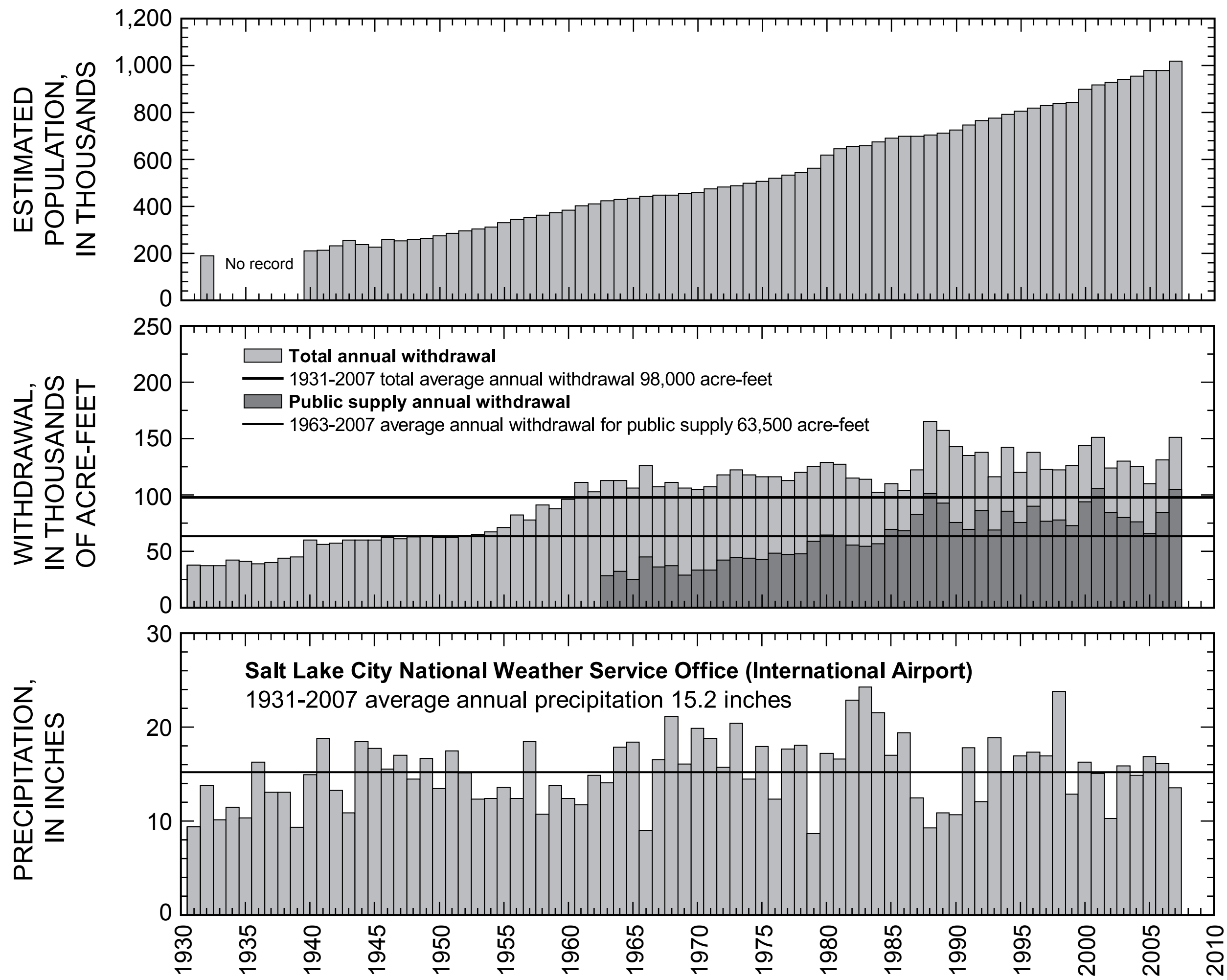


Figure 9. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (International Airport).

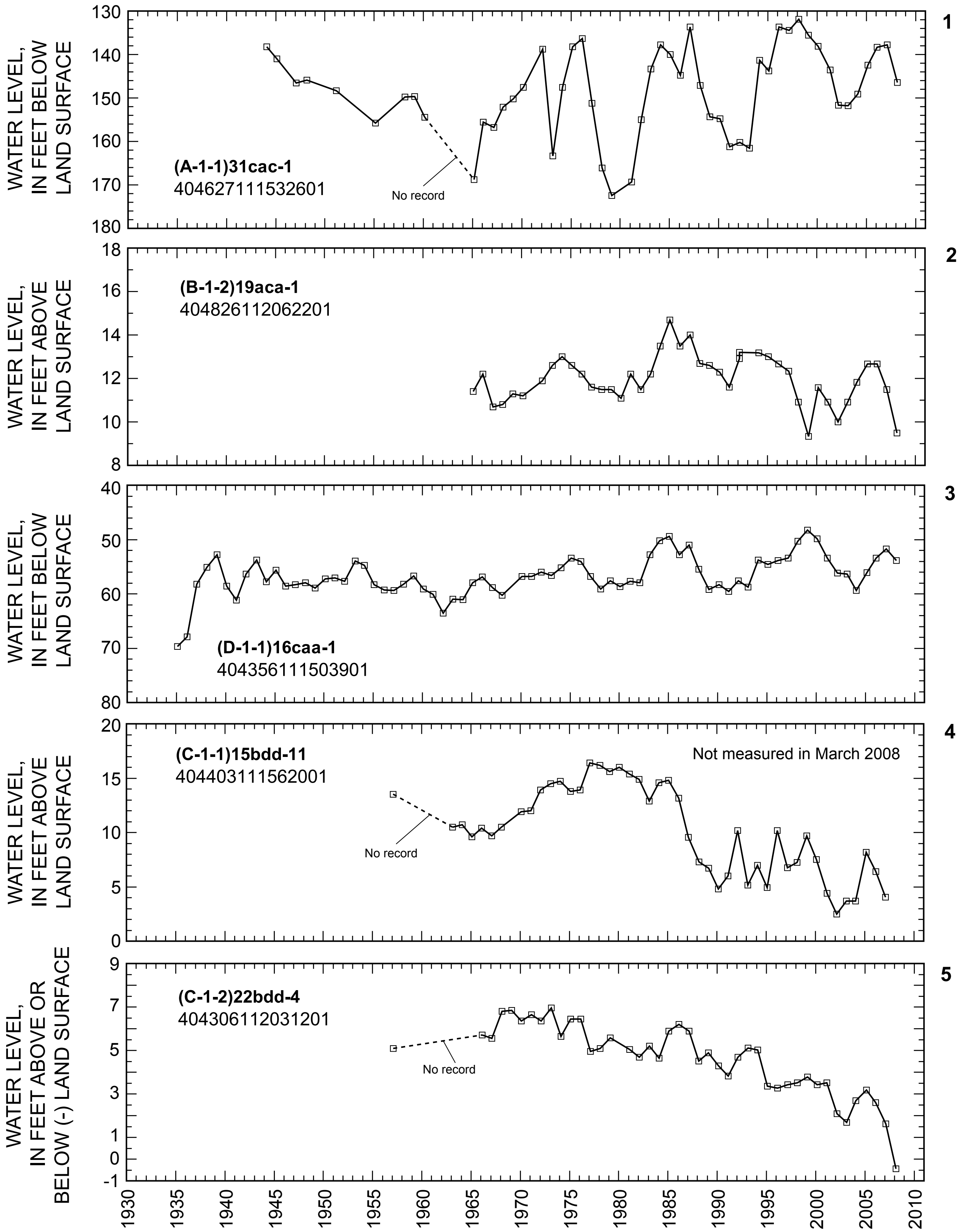


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.

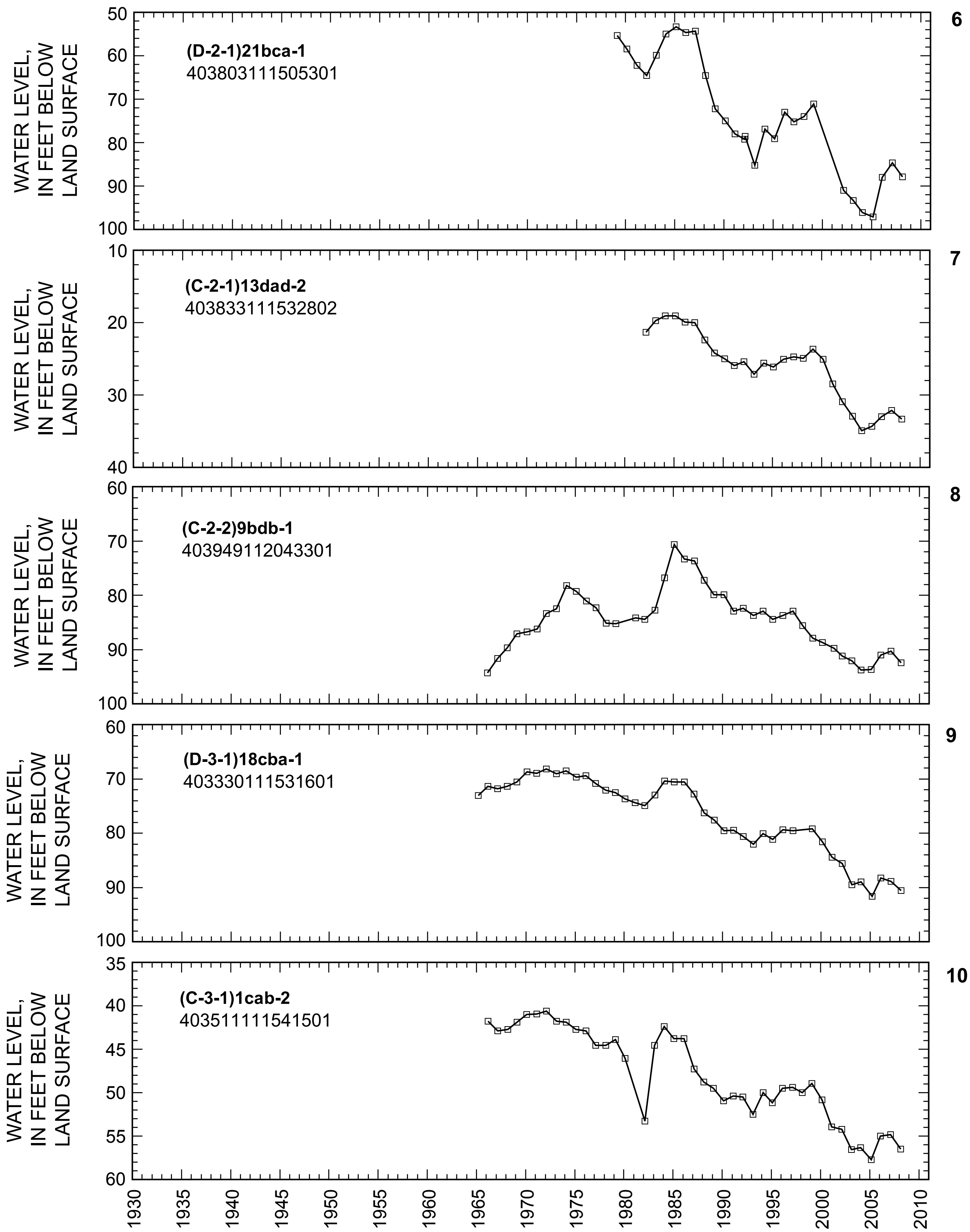


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

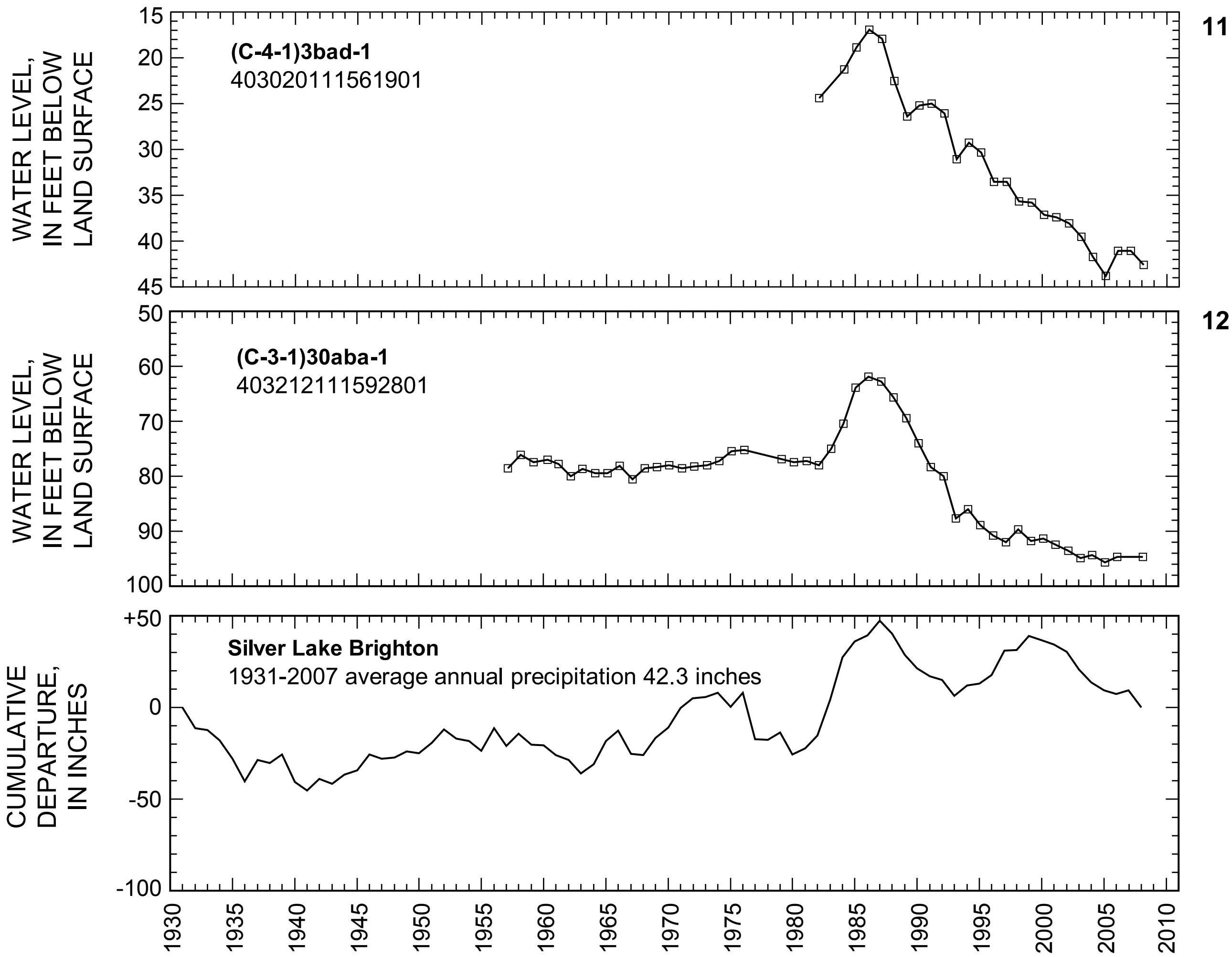


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

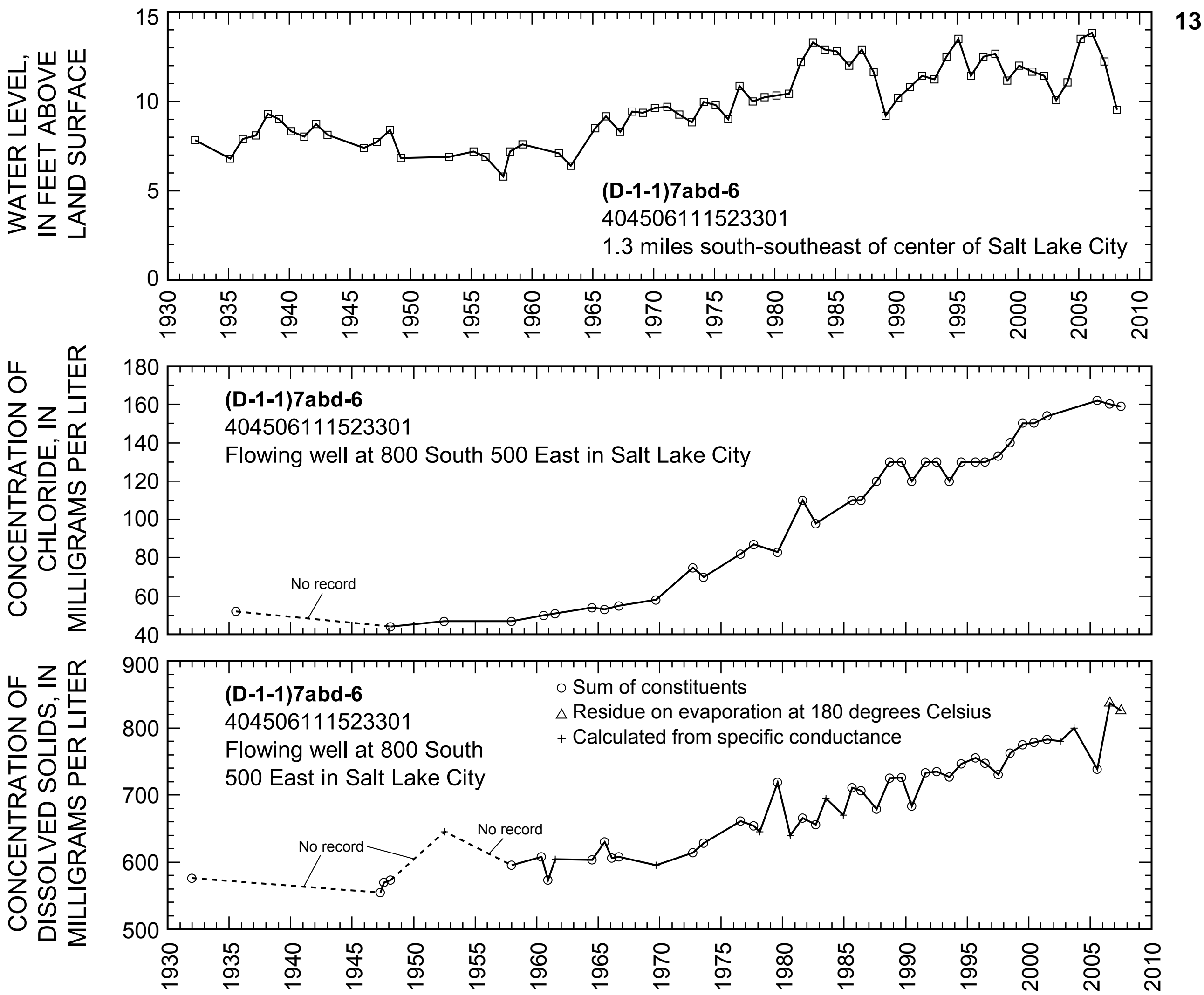


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well—Continued.

TOOELE VALLEY

By Paul Downhour

Tooele Valley is between the Stansbury and Oquirrh Mountains and extends south from Great Salt Lake to South Mountain. The total area of the valley is about 250 square miles within Tooele County (fig. 11). Ground water occurs in the bedrock and unconsolidated deposits in Tooele Valley under both water-table and artesian conditions, but most of the water withdrawn by wells is from artesian aquifers in the unconsolidated deposits.

Total estimated withdrawal of water from wells in Tooele Valley in 2007 was about 23,000 acre-feet, which is about 5,000 acre-feet more than the revised total for 2006 and 2,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for irrigation was about 10,200 acre-feet, which is 1,300 acre-feet more than revised total for 2006. Withdrawal for public supply was about 10,000 acre-feet, which is 3,300 acre-feet more than in 2006. Withdrawal for industry was about 1,500 acre-feet, which is the same as in 2006.

One component of the total withdrawal of water from wells is an estimate of the amount of water that naturally discharges from flowing wells. Flowing well discharge is reported as part of the withdrawal for irrigation and is estimated by scaling a base amount of discharge. The base amount of flowing well discharge was re-evaluated in 2005 and erroneously reported as 5,200 acre-feet in Burden and others (2007, p. 32). The correct base amount is 4,500 acre-feet. That amount was used to determine 2007 flowing well discharge and the revised values reported in table 3 for 2005 and 2006.

The location of wells in Tooele Valley in which the water level was measured during March 2008 is shown in figure 11. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-6)23cbb-1 is shown in figure 12. Precipitation at Tooele during 2007 was about 17.3 inches, which is about 3.7 inches less than in 2006 and about 0.5 inch less than the average annual precipitation for 1936–2007.

Water levels declined in most of the wells measured in Tooele Valley from March 2007 to March 2008. Declines probably are the result of less-than-average precipitation and increased withdrawals.

Physical properties and results of chemical analyses for water from five wells in Tooele Valley are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The dissolved-solids concentration in water from all five wells ((C-2-4)28aac-1, (C-2-4)31add-6, (C-2-5)34cbc-1, (C-2-6)23cbb-1, and (C-3-6)1bdb-1) exceeded the secondary standard for this constituent (500 mg/L). The concentration of dissolved chloride in water from two wells ((C-2-5)34cbc-1 and (C-2-6)23cbb-1) exceeded the secondary standard for this constituent (250 mg/L).

The concentration of dissolved solids in water from well (C-2-6)23cbb-1, located 3 miles northwest of Grantsville, from 1961 to 2007, is shown in figure 12. Concentrations range from 553 to 830 mg/L, with a median value of 698 mg/L. Dissolved-solids concentrations in water samples collected in 2005 and 2007 were significantly greater than in the sample collected in 2001.

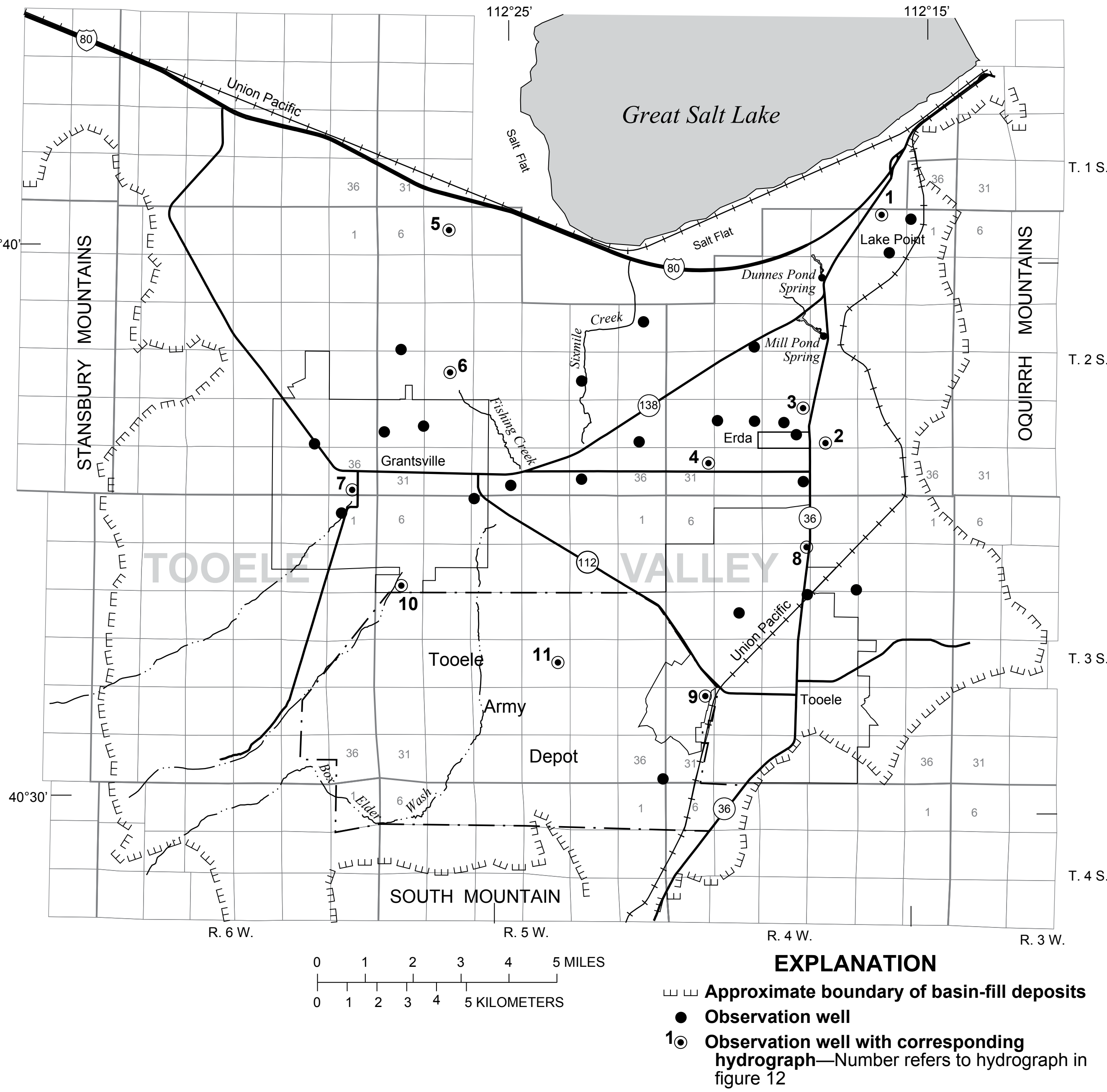


Figure 11. Location of wells in Tooele Valley in which the water level was measured during March 2008.

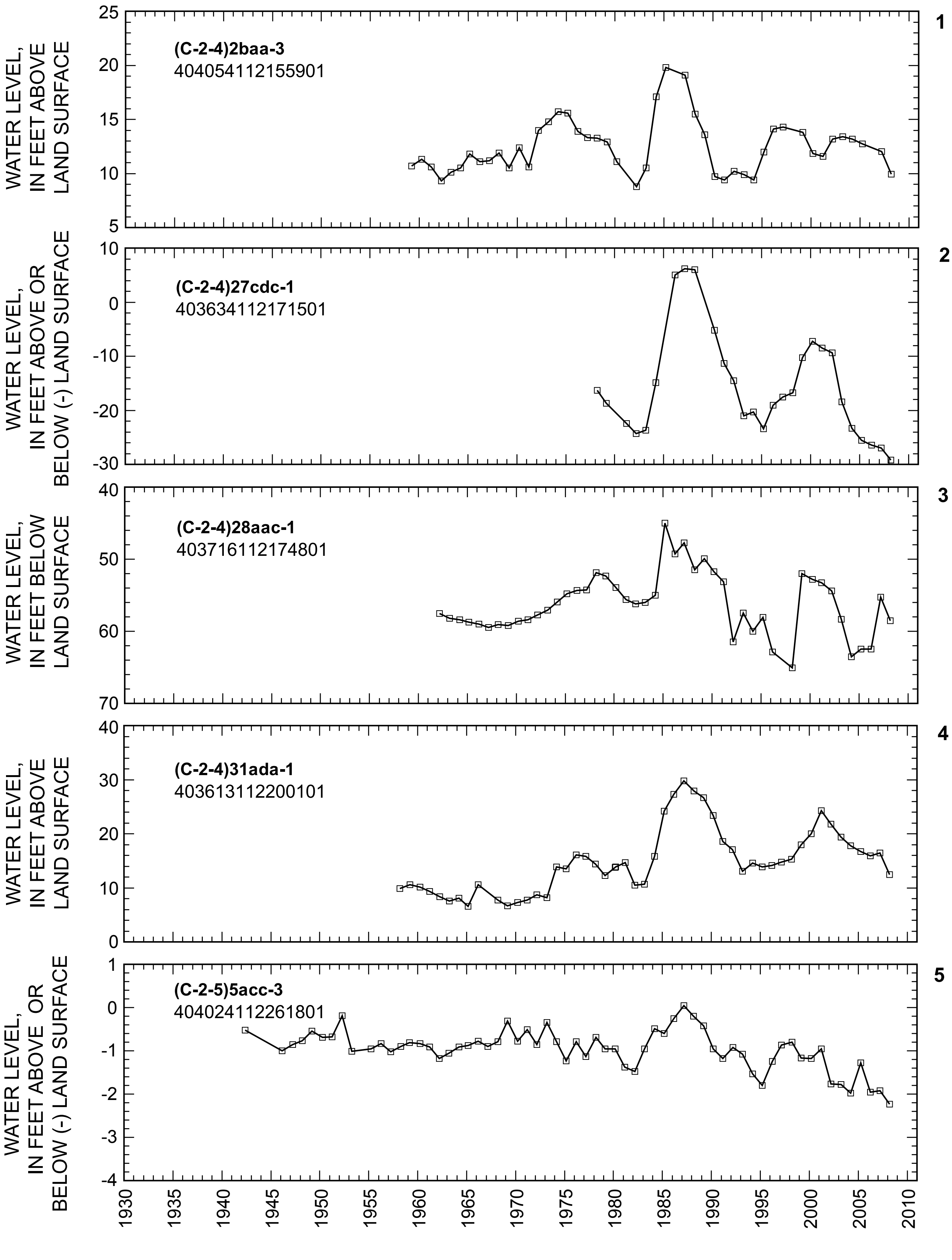


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-6)23cbb-1.

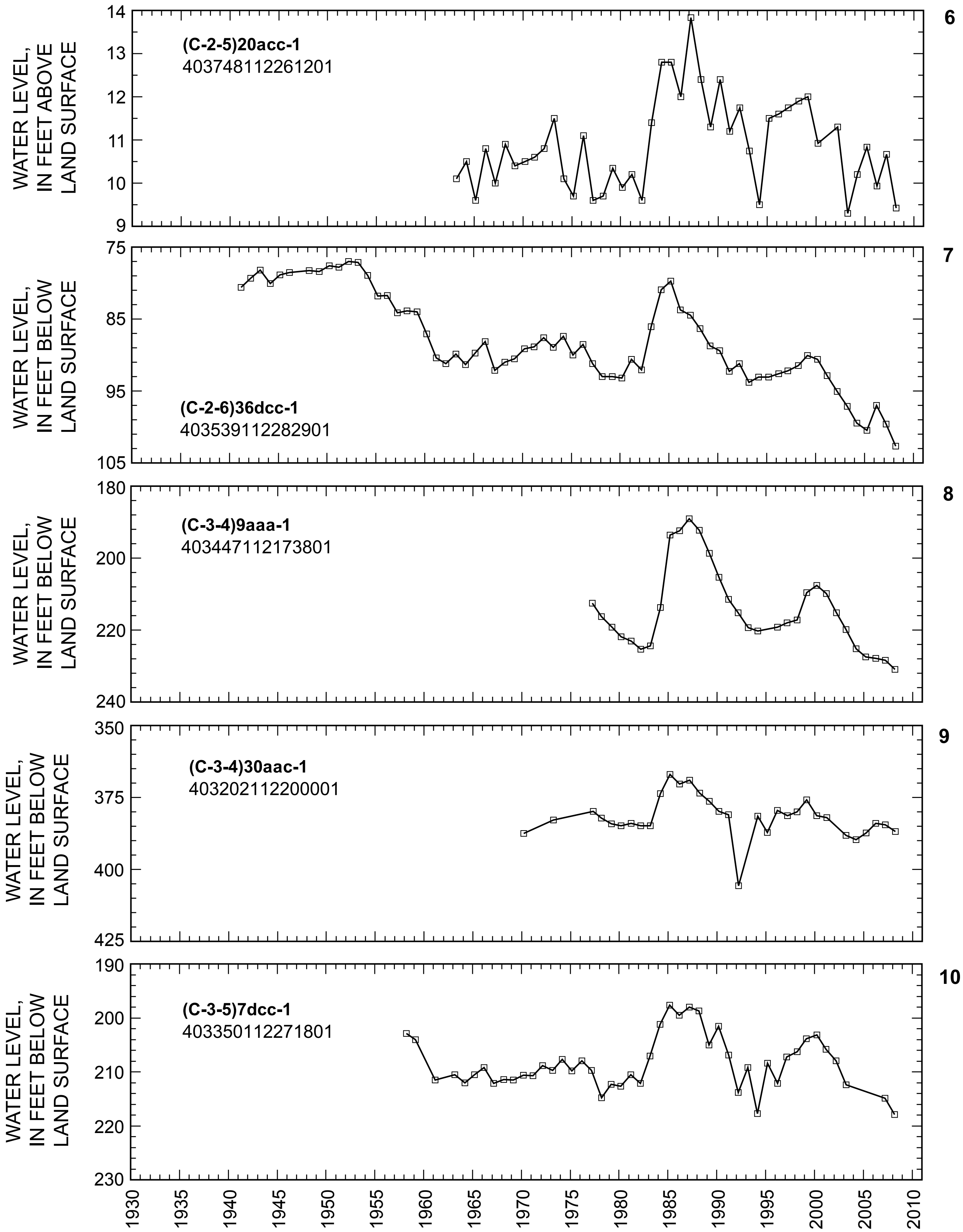


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-6)23cbb-1—Continued.

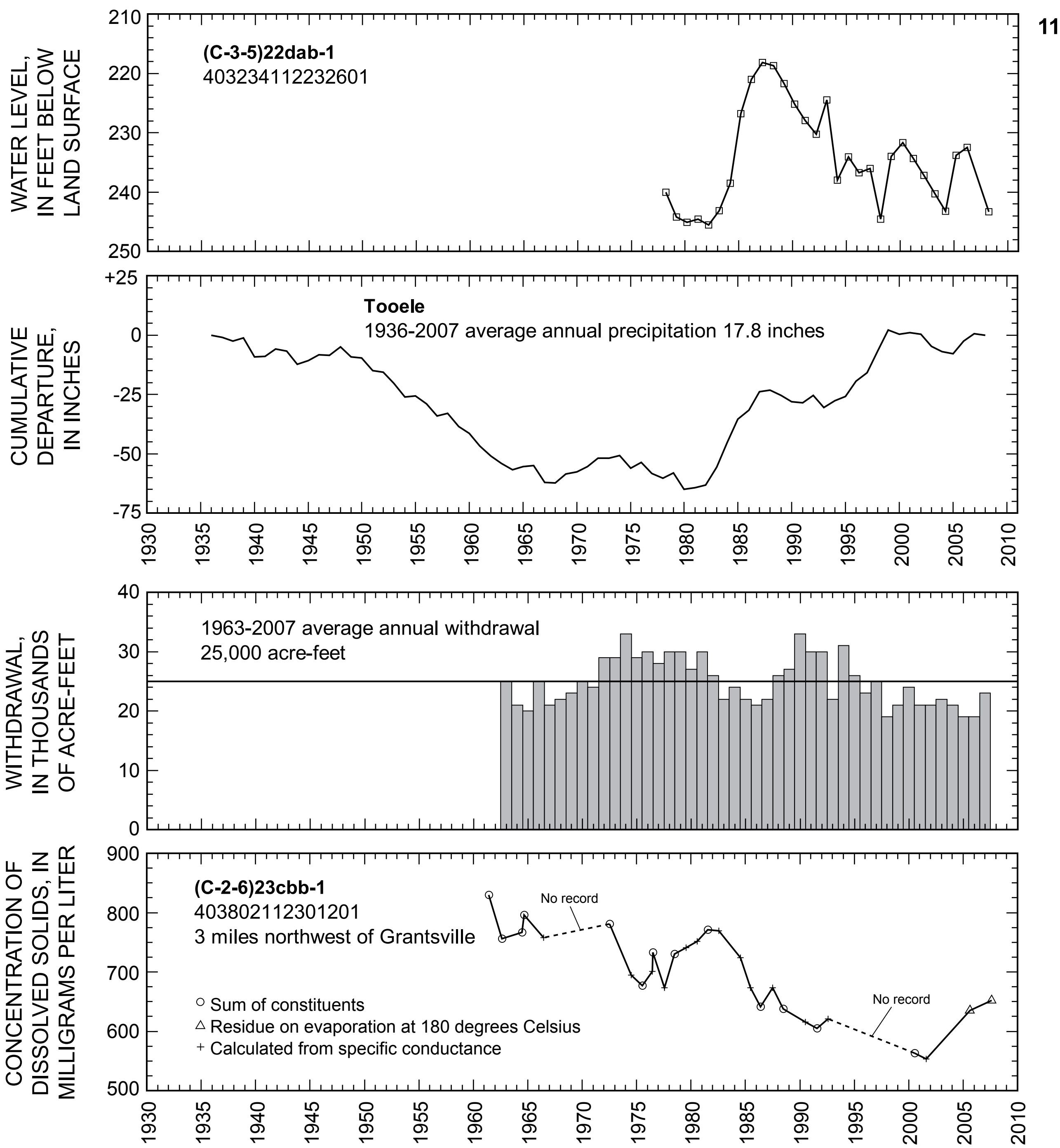


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-6)23cbb-1—Continued.

UTAH AND GOSHEN VALLEYS

By C.D. Wilkowske

Utah Valley, in Utah County, is divided into two ground-water basins, northern and southern, which are separated by Provo Bay in northern Utah Valley (fig.13). Ground water occurs in unconsolidated basin-fill deposits in the valley. The principal ground-water recharge area for the basin-fill deposits is in the eastern part of the valley, along the base of the Wasatch Range.

Southern Utah Valley is bounded by the Wasatch Range, West Mountain, and the northern extension of Long Ridge. Goshen Valley is south of the latitude of Provo and is bounded by West Mountain, Long Ridge, the Lake Mountains, and the East Tintic Mountains (fig. 13). Ground water in Utah and Goshen Valleys occurs in the alluvium under both water-table and artesian conditions, but most wells discharge from artesian aquifers.

Total estimated withdrawal of water from wells in Utah and Goshen Valleys in 2007 was about 126,000 acre-feet, which is 26,000 acre-feet more than in 2006, and 25,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal in southern Utah Valley was about 37,800 acre-feet, which is 8,400 acre-feet more than in 2006. Withdrawal in Goshen Valley was about 15,600 acre-feet, which is 3,400 acre-feet more than in 2006. Withdrawal in northern Utah Valley was about 72,100 acre-feet, which is 14,000 acre-feet more than in 2006. The overall increase in withdrawals resulted from increased withdrawal for public supply, particularly in northern Utah Valley.

The location of wells in Utah and Goshen Valleys in which the water level was measured during March 2008 is shown in figure 13. Water levels generally declined slightly in most of the wells measured in Utah and Goshen Valleys from March 2007 to March 2008. Water levels in Goshen Valley and in the northern and southern parts of Utah Valley generally rose in the early 1980s. The rise corresponds to a period of greater-than-average precipitation and recharge from surface water. Water levels generally declined from 1985 to 1993 in Utah Valley and generally rose from 1993 to 1998. This rise is the result of greater-than-average precipitation during this period. Water levels generally declined throughout Utah Valley from March 1999 to March 2005. Water levels in some wells reached their lowest level for their period of record, many dating back to 1935. From March 2005 to March 2007, most water levels in Utah and Goshen Valleys rose as a result of average to greater-than-average precipitation in 2005 and 2006 following 6 years of less-than-average precipitation.

The relation of the water level in selected observation wells to cumulative departure from average precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells, is shown in figure 14. Discharge of Spanish Fork at Castilla in 2007 was about 153,400 acre-feet, which is 15,200 acre-feet more than the 1933–2007 annual average. Precipitation at Silver Lake Brighton in 2007 was about 33.1 inches, which is about 9.2 inches less than the long-term average and about 11.1 inches less than in 2006. Precipitation at Spanish Fork Powerhouse in 2007 was about 17.0 inches, which is about 2.2 inches less than the long-term average and about 5.4 inches less than in 2006.

Physical properties and results of chemical analyses for water from ten wells in Utah Valley (includes northern and southern Utah Valleys) and Goshen Valley are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. For Goshen Valley, the dissolved-solids concentration in water from three wells ((C-9-1)3ddb-1, (C-10-1)4cbb-1, and (C-10-1)31cdd-1) and the dissolved-chloride concentration in water from two wells ((C-9-1)3ddb-1 and (C-10-1)4cbb-1) exceeded the secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The concentration of dissolved solids in water from well (C-10-1)4cbb-1 also exceeded the MCL for this constituent (2,000 mg/L). The concentration of dissolved nitrite plus nitrate in water from well (C-10-1)31cdd-1 (11.8 mg/L) exceeded the MCL for this constituent (10 mg/L). Finally, the concentration of dissolved iron and manganese in water from well (D-7-2)4cbb-2, in northern Utah Valley, exceeded secondary standards for these constituents (0.3 mg/L and 0.05 mg/L, respectively).

The concentration of dissolved solids in water collected from wells (C-10-1)4cbb-1, located 1.5 miles north of Elberta, and (D-7-2)4cbb-2, located 2 miles west of Provo at the mouth of Provo River, since 1962 and 1958, respectively, is shown in figure 14. Concentrations in water from well (C-10-1)4cbb-1 range from 603 to 2,140 mg/L, with a median value of 896 mg/L. The maximum value for dissolved solids, 2,140 mg/L, is associated with the sample collected in August 2007 and is nearly 50 percent greater than the previous maximum value of the sample collected in June 1986. The dissolved-solids concentrations in water from well (D-7-2)4cbb-2 range from 278 to 539 mg/L, with a median value of 320 mg/L. With the exception of the relatively high dissolved-solids concentration in a sample collected in 1987, concentrations have varied little.

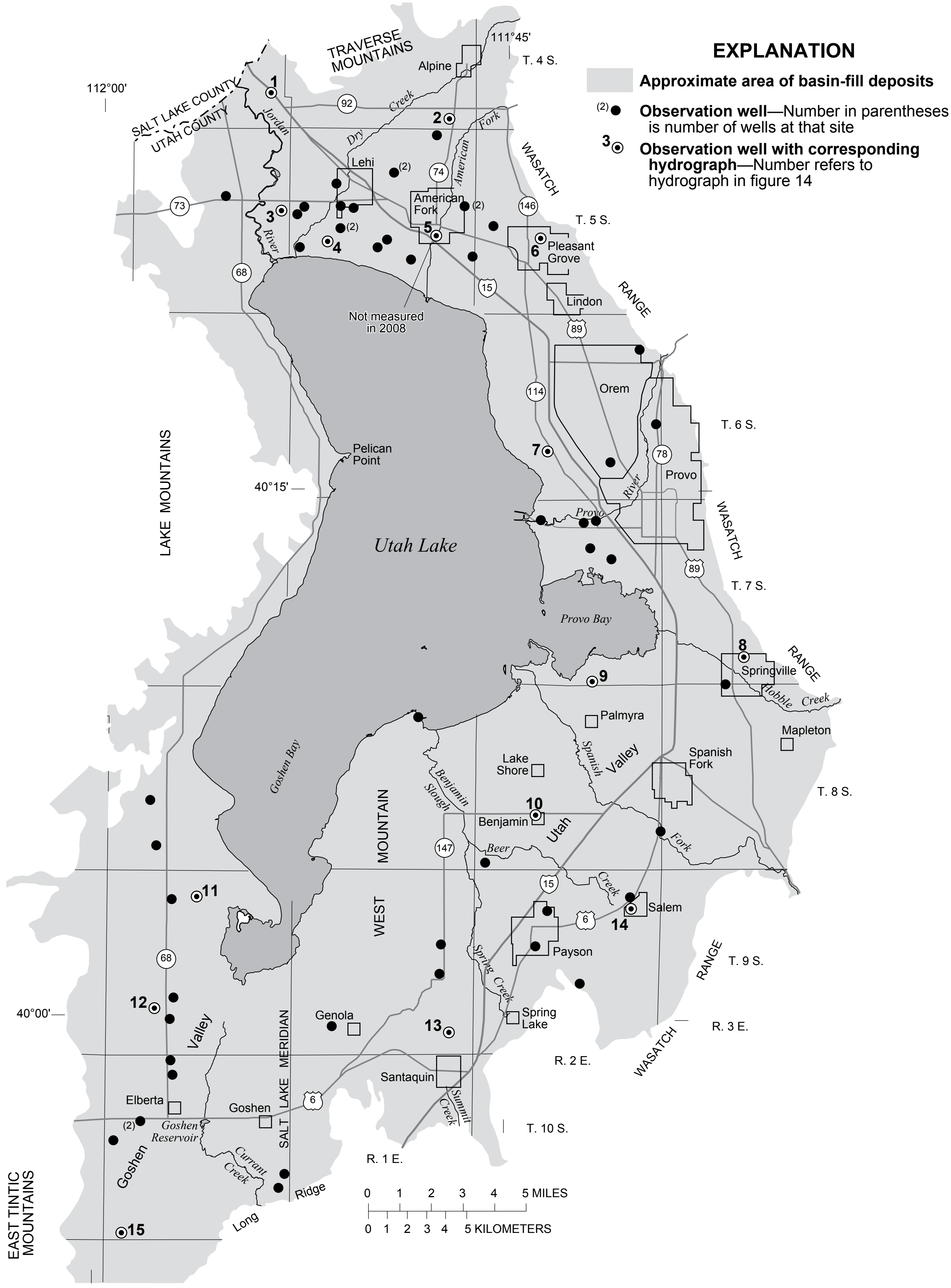


Figure 13. Location of wells in Utah and Goshen Valleys in which the water level was measured during March 2008.

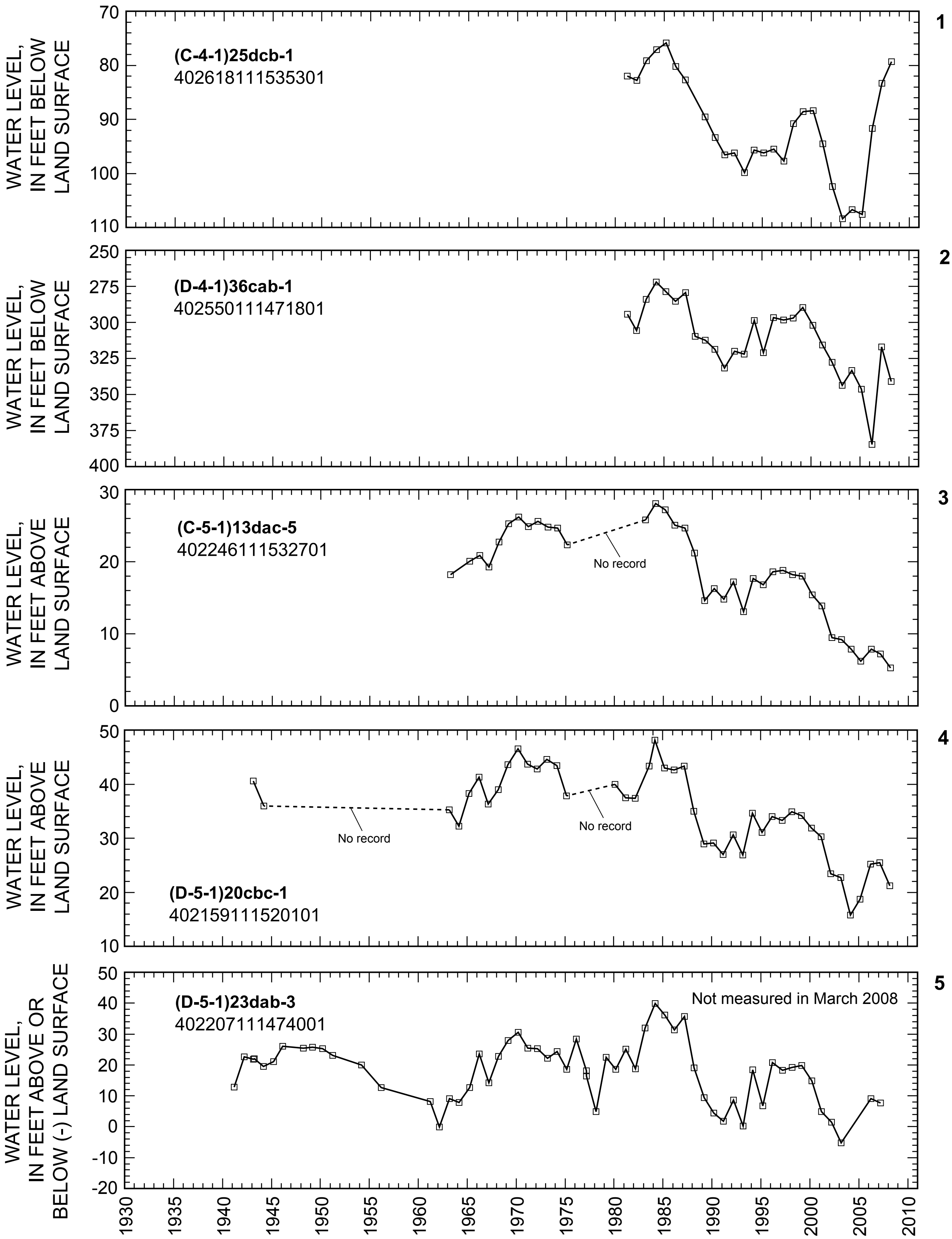


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells.

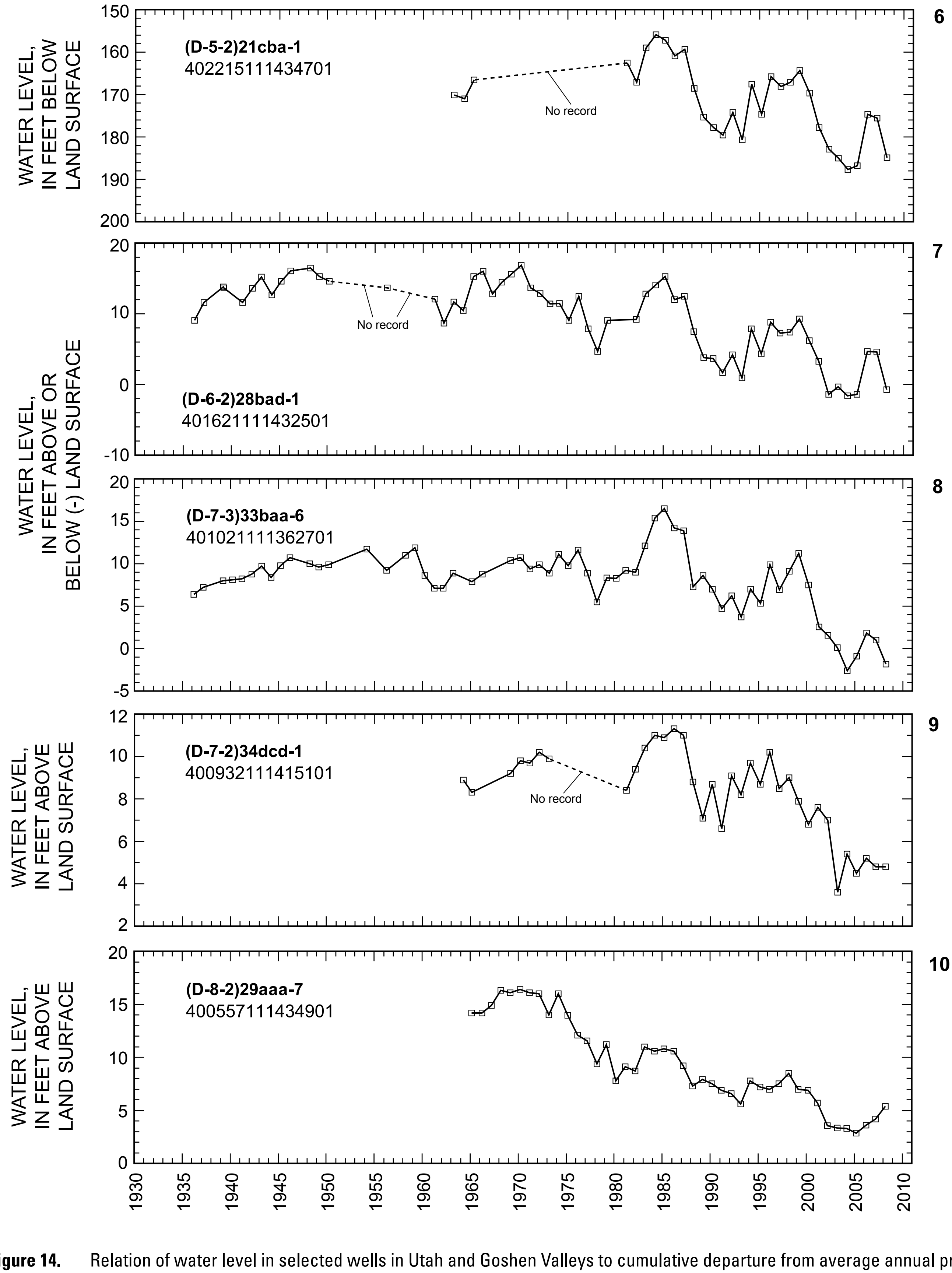


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

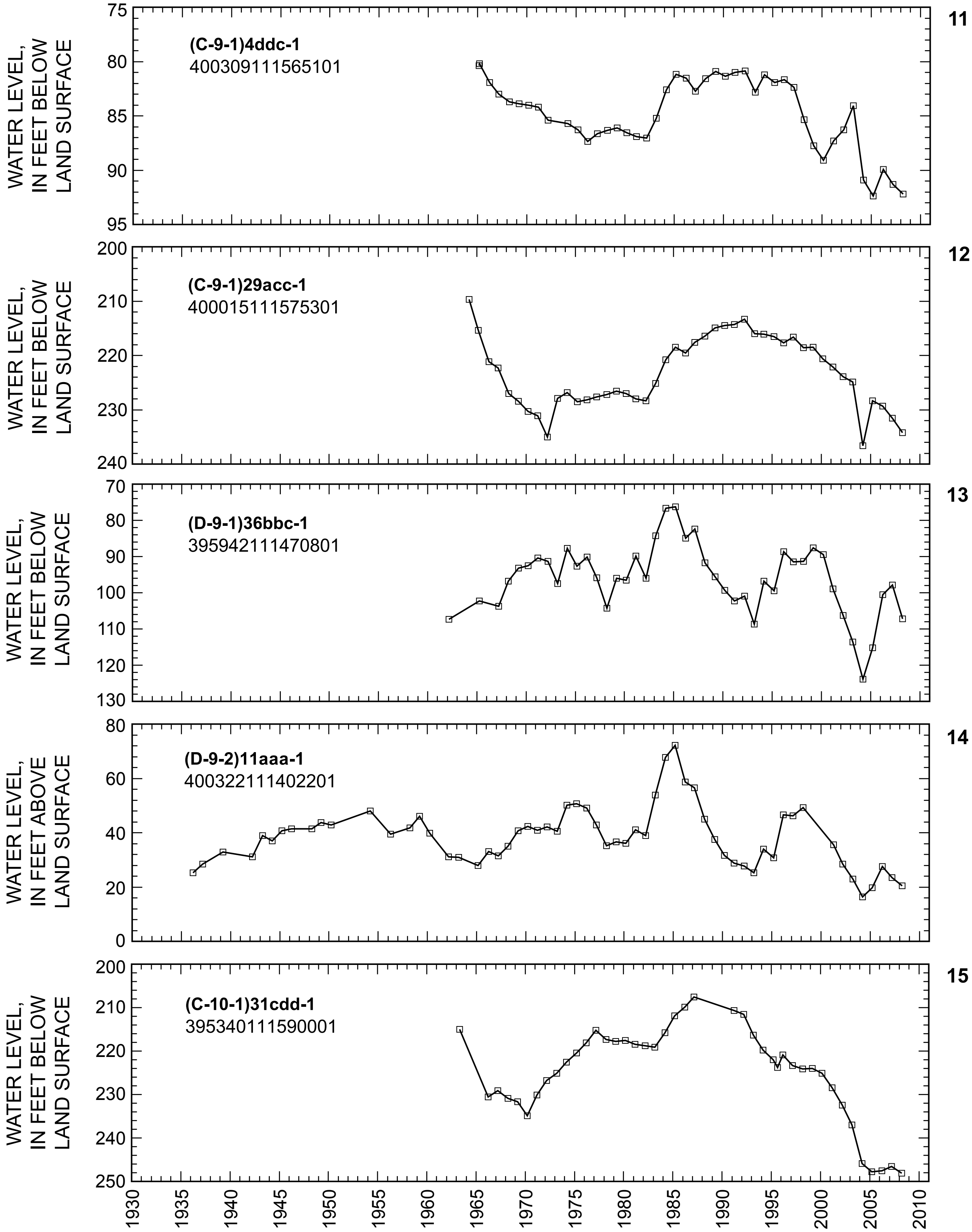


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

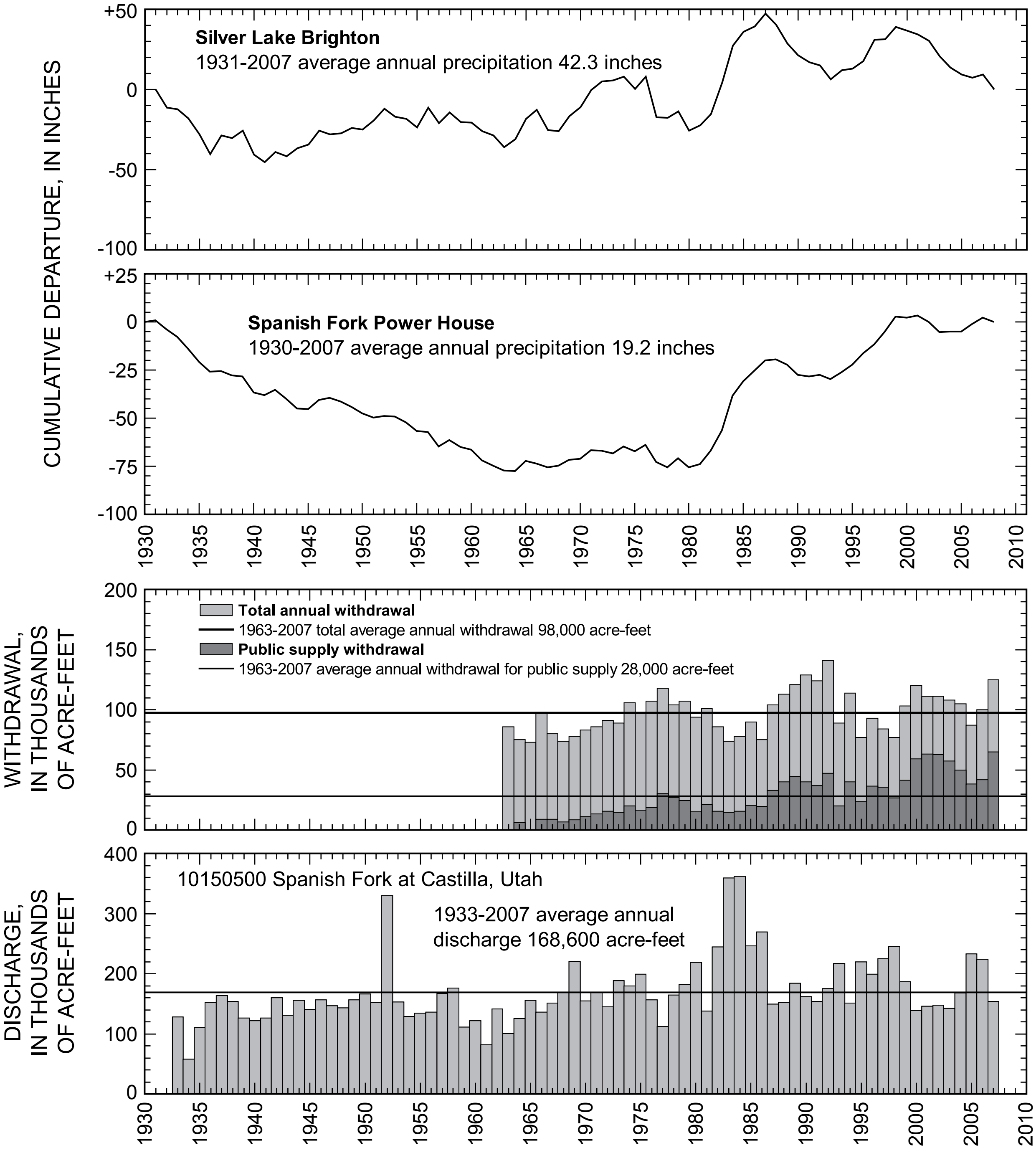


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

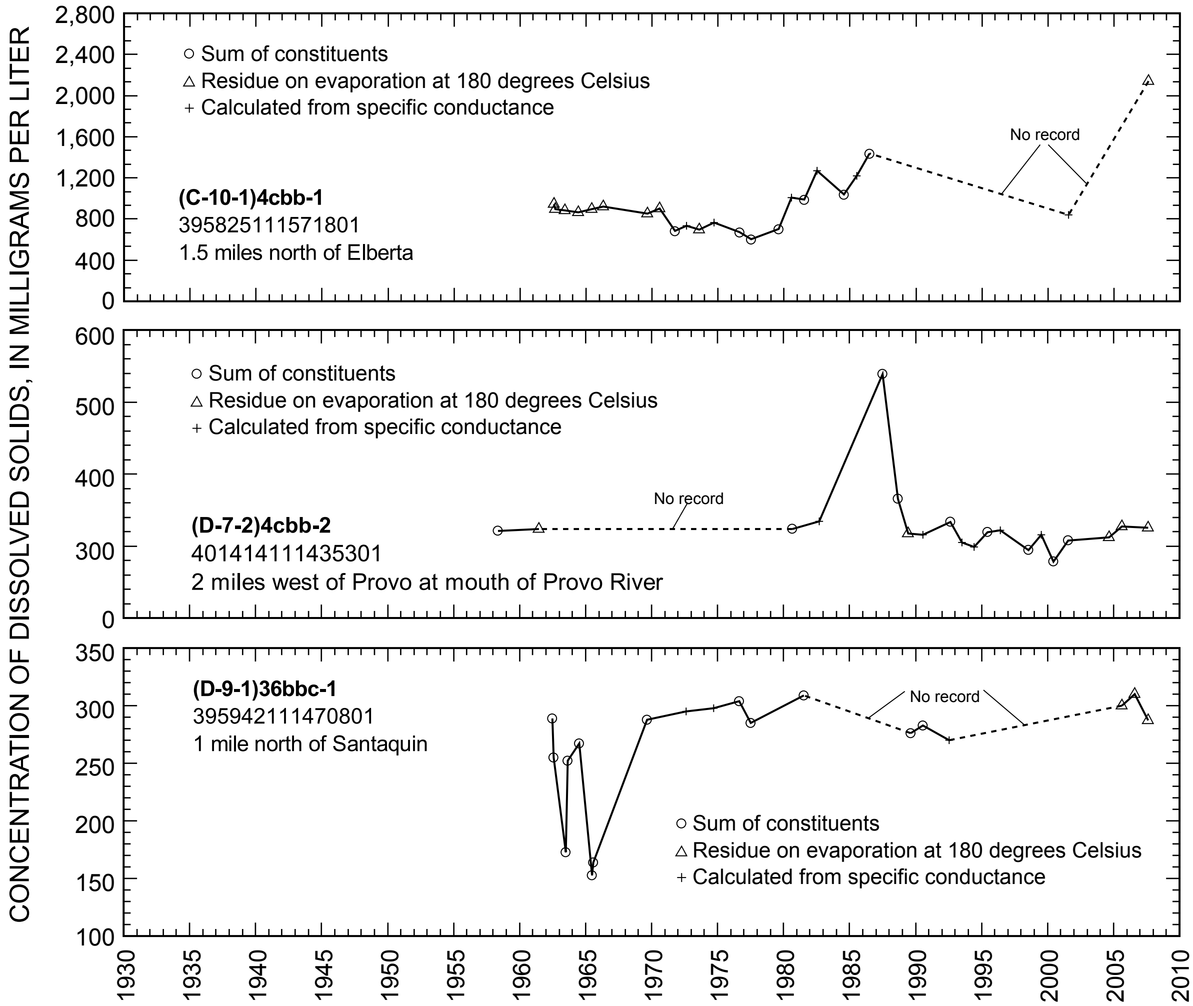


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Powerhouse, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, and to concentration of dissolved solids in water from three wells—Continued.

JUAB VALLEY

By R.J. Eacret

Juab Valley, which is about 30 miles long and averages about 4 miles wide, is in central Utah in Juab County, along the west side of the Wasatch Range and the San Pitch Mountains (fig. 15). Ground water drains from the valley near both its northern and southern ends—in northern Juab Valley via Currant Creek into Utah Lake, and in southern Juab Valley via Chicken Creek into the Sevier River. The northern and southern parts of Juab Valley are separated topographically by Levan Ridge, a gentle rise near the midpoint of the valley floor.

Ground water in Juab Valley occurs in the unconsolidated basin-fill deposits. Most of the recharge to the ground-water reservoir occurs on the eastern side of the valley along the Wasatch Range and the San Pitch Mountains. Ground water moves to the lower part of the valley and to eventual discharge points at the northern and southern ends of the valley. The ground-water divide between the northern and southern parts of Juab Valley is near Levan Ridge. Ground water occurs in the basin-fill deposits under both water-table and artesian conditions; artesian conditions are prevalent in the lower part of the valley.

Total estimated withdrawal of water from wells in Juab Valley in 2007 was about 26,000 acre-feet, which is 5,000 acre-feet more than the amount reported for 2006 and 5,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3).

The location of wells in Juab Valley in which the water level was measured during March 2008 is shown in figure 15. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-12-1)24baa-1 is shown in figure 16.

Water levels declined in most of the wells measured in Juab Valley from March 2007 to March 2008. Water levels generally rose from 1978 to their highest level in 1985. This rise corresponds to a period of greater-than-average precipitation during 1978–86. Water levels generally declined from 1986 to 2005, although there was a substantial rise from 1993 to 1999.

Precipitation at Nephi during 2007 was about 11.2 inches, which is about 3.2 inches less than the average annual precipitation for 1935–2007, and about 2.5 inches less than in 2006.

Physical properties and results of chemical analyses for water from four wells in Juab Valley are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The dissolved-solids concentration in water from all four wells ((C-12-1)24baa-1, (C-14-1)26dca-1, (C-15-1)1baa-1, and (D-13-1)4cca-1) exceeded the secondary drinking-water standard for this constituent (500 mg/L). The concentration of dissolved sulfate in water from two wells ((C-14-1)26dca-1 and (C-15-1)1baa-1) also exceeded the secondary drinking-water standard for this constituent (250 mg/L). Finally, the dissolved-chloride concentration in water from well (D-13-1)4cca-1 exceeded the secondary drinking-water standard for this constituent (250 mg/L).

The concentration of dissolved solids in water from well (C-12-1)24baa-1, located 4.5 miles north-northwest of Nephi, from 1964 to 2007, is shown in figure 16. Concentrations range from 650 to 755 mg/L, with a median value of 714 mg/L. Concentrations have varied little during the period of record.

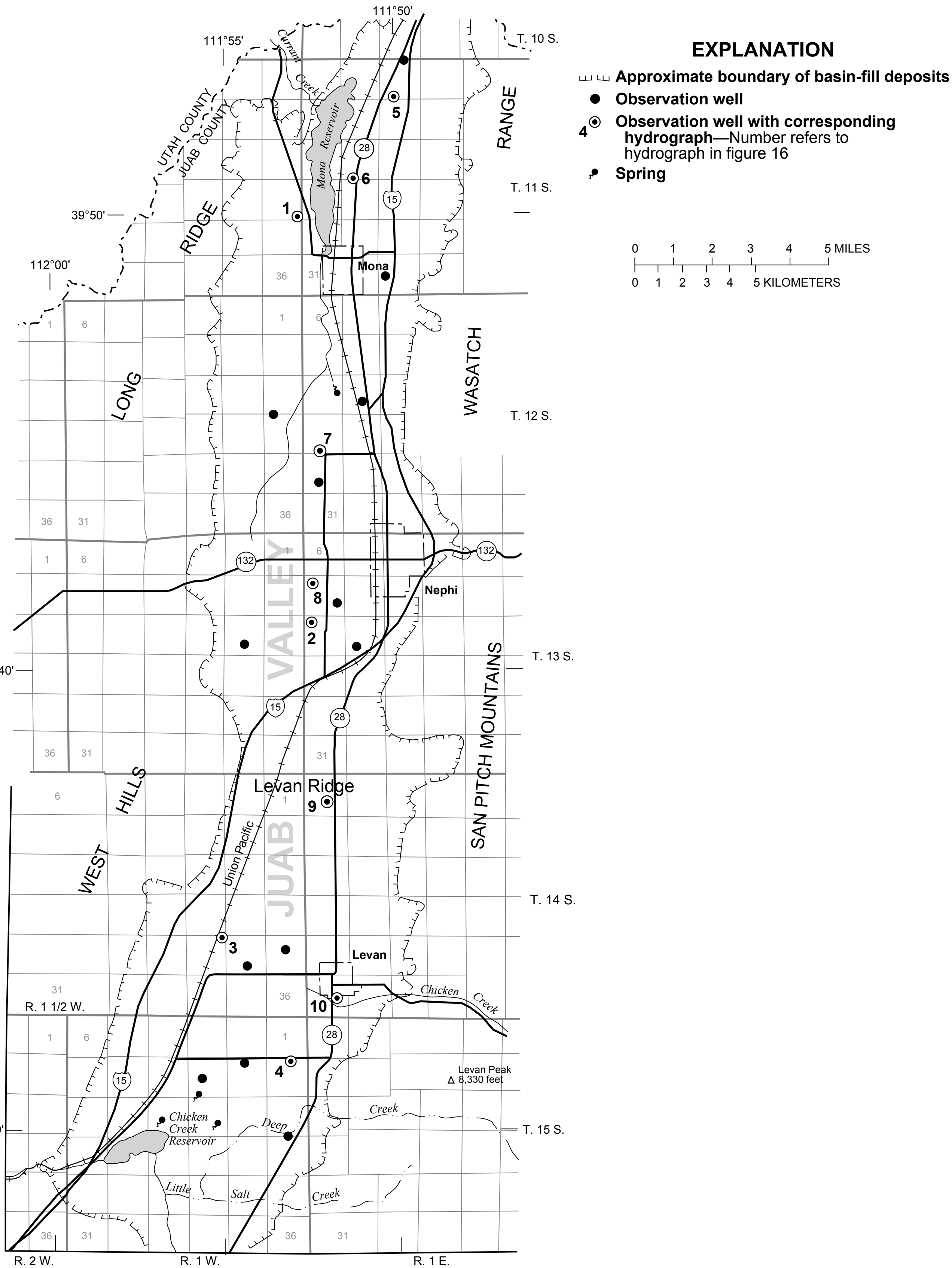


Figure 15. Location of wells in Juab Valley in which the water level was measured during March 2008.

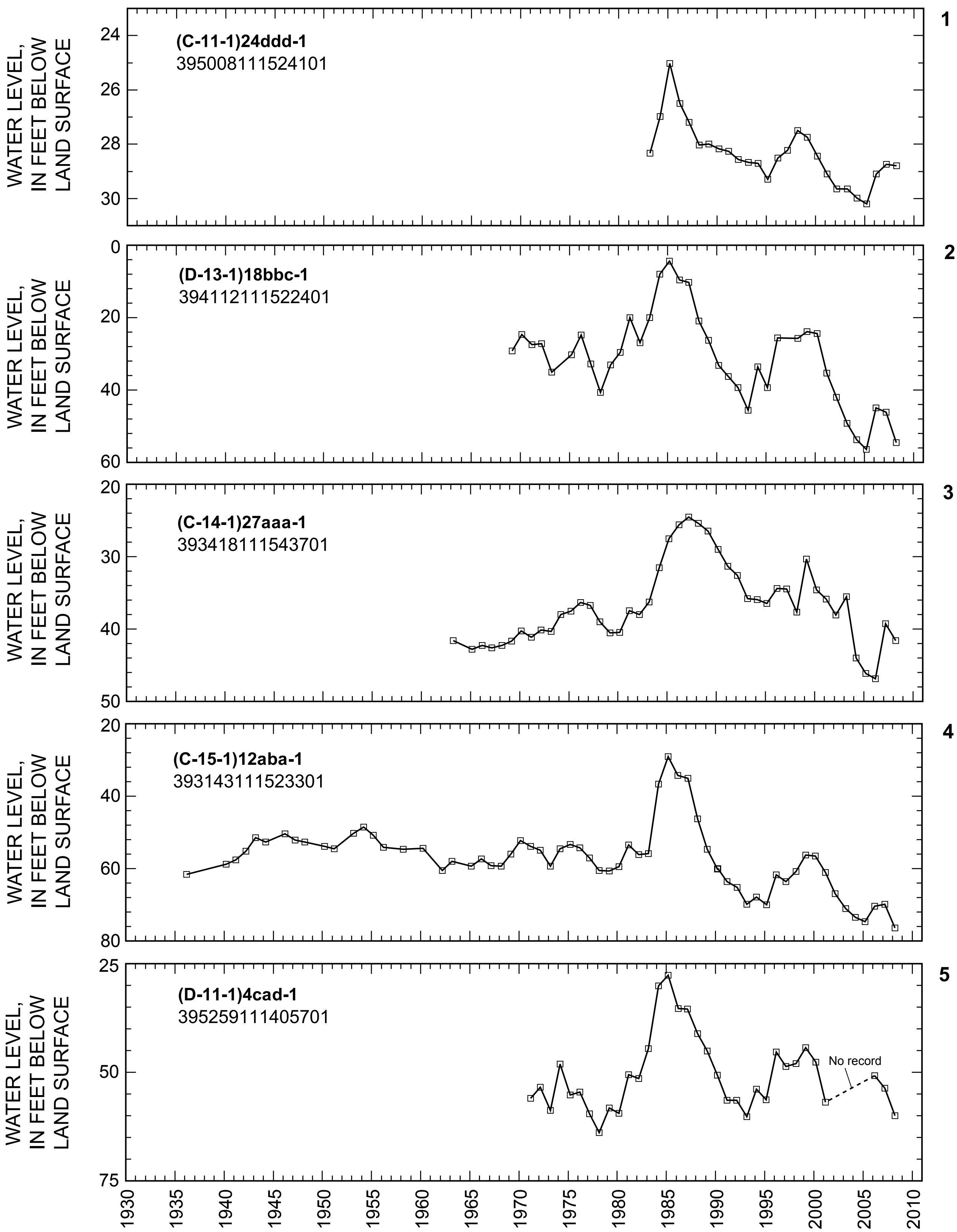


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-12-1)24baa-1.

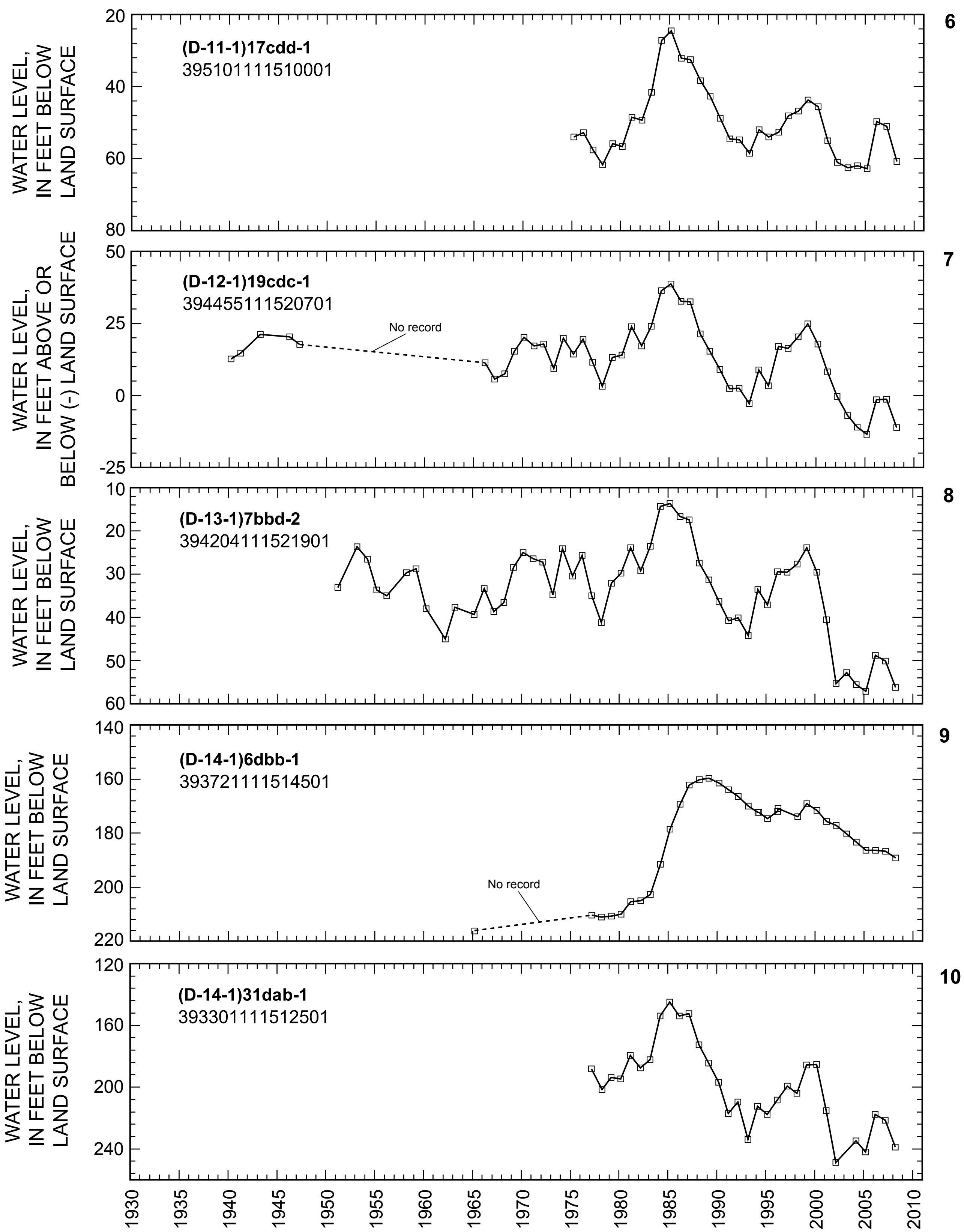


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-12-1)24baa-1—Continued.

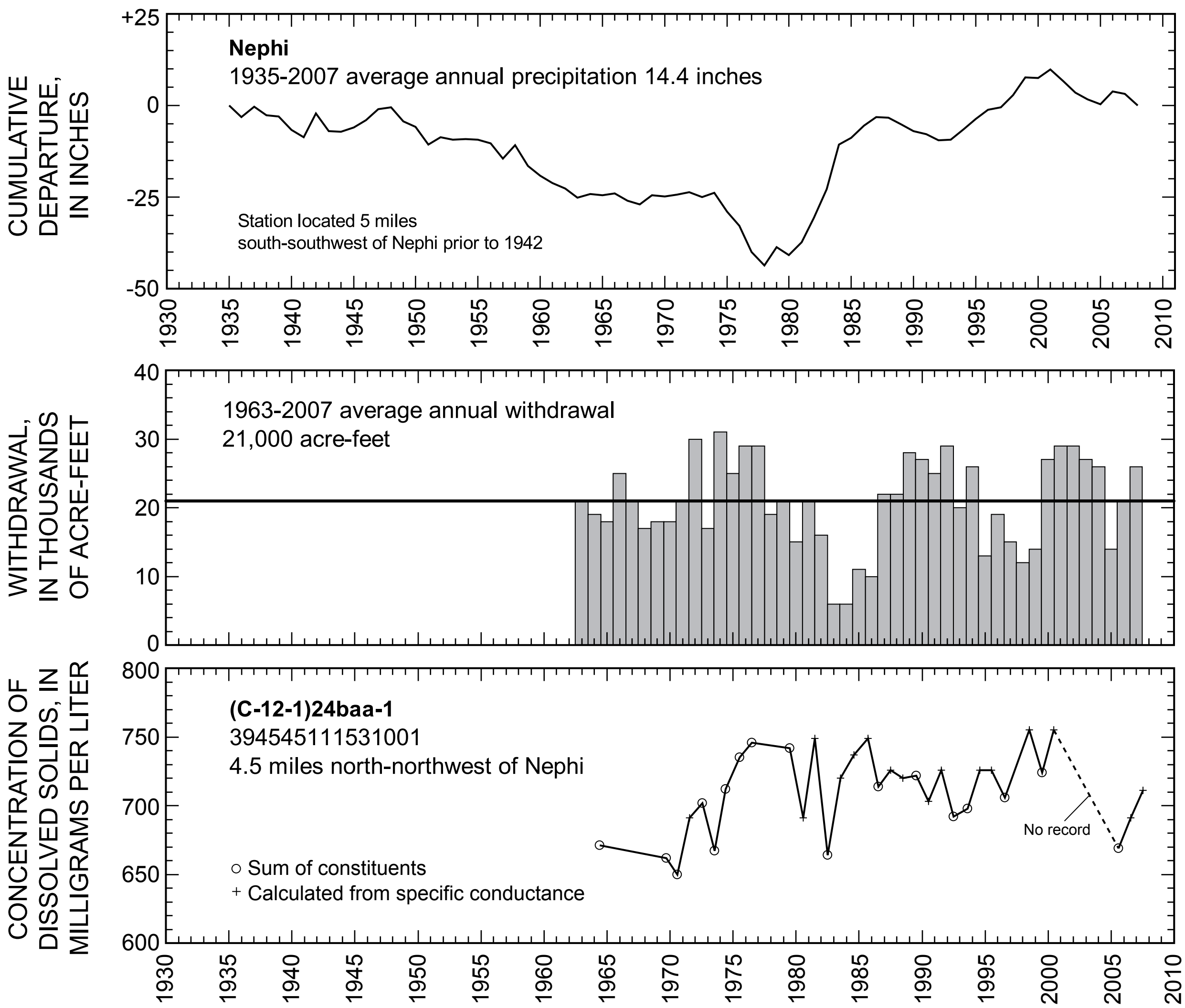


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-12-1)24baa-1—Continued.

SEVIER DESERT

By Michael Enright

The part of the Sevier Desert described here covers about 2,000 square miles in northern Millard and southern Juab Counties (figs. 17 and 18), and principally includes the broad, gently sloping areas that radiate from the mountain ranges located to the east, north, and west. Ground water occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the ground water is discharged from wells completed in either of two artesian aquifers—the shallow or deep artesian aquifer. The Sevier River enters the Sevier Desert from the east and is a source of recharge to the aquifer.

Total estimated withdrawal of water from wells in the Sevier Desert in 2007 was about 34,000 acre-feet, which is 14,000 acre-feet more than in 2006 and about 12,000 acre-feet more than the 1997–2006 average annual withdrawal (tables 2 and 3). The increase in withdrawals was mainly due to increased withdrawal for irrigation, probably because of decreased availability of surface water.

The location of wells in the Sevier Desert in which the water level was measured during March 2008 is shown in figures 17 and 18. The relation of the water level in selected observation wells to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1 is shown in figure 19.

Most water levels measured in March 2008 in both the shallow and deep artesian aquifers in the Sevier Desert were lower than in March 2007, probably due to less-than-average availability of surface water and greatly increased ground-water withdrawals. Water levels in both the shallow and deep aquifers generally rose from 1980 to 1987, which corresponds to a period of greater-than-average precipitation and less-than-average withdrawal. Water levels in both aquifers began declining during 1987–90 and continued to decline until 1995. Levels generally rose or remained stable from about 1995 to 1999. Rises during this period probably resulted from decreased ground-water withdrawals because of greater-than-average precipitation, and greater availability of surface water for irrigation. Water levels generally declined from March 2001 to March 2005, probably as a result of 4 years of less-than-average surface-water supplies and increased withdrawals from wells.

Discharge of the Sevier River near Juab in 2007 was 127,000 acre-feet, 58,300 acre-feet less than in 2006 and 52,800 acre-feet less than the long-term average (1935–2007). Precipitation at Oak City was about 14.0 inches in 2007, about 1.1 inches more than the 1930–2007 average annual precipitation and about 0.5 inch less than in 2006.

Physical properties and results of chemical analyses for water from five wells in the Sevier Desert are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The dissolved-solids concentration in water from four of the five wells sampled ((C-15-4)8cba-1, (C-15-4)26dcc-1, (C-15-5)2ddc-1, and (C-15-5)15dad-1) and the dissolved-sulfate concentration in the water from two wells ((C-15-4)8cba-1 and (C-15-5)2ddc-1) exceeded the secondary drinking-water standards for these constituents (500 mg/L and 250 mg/L, respectively). The concentration of dissolved chloride and manganese in water from two wells ((C-15-4)8cba-1 and (C-15-5)2ddc-1) exceeded the secondary drinking-water standards for these constituents (250 mg/L and 0.05 mg/L, respectively). The dissolved-solids concentration in water from well (C-15-4)8cba-1 also exceeded the MCL for this constituent (2,000 mg/L). In addition, the dissolved nitrite plus nitrate concentration in water from well (C-15-4)26dcc-1 (10.9 mg/L) exceeded the MCL for the combined concentration of these constituents (10 mg/L).

The concentration of dissolved solids in water collected from well (C-15-4)8cba-1, located 2.5 miles east of Lynndyl, from 1958 to 2007, is shown in figure 19. The concentration of dissolved solids has increased from 1,490 mg/L in 1958 to 2,270 mg/L in 2007, with a median value of 2,025 mg/L.

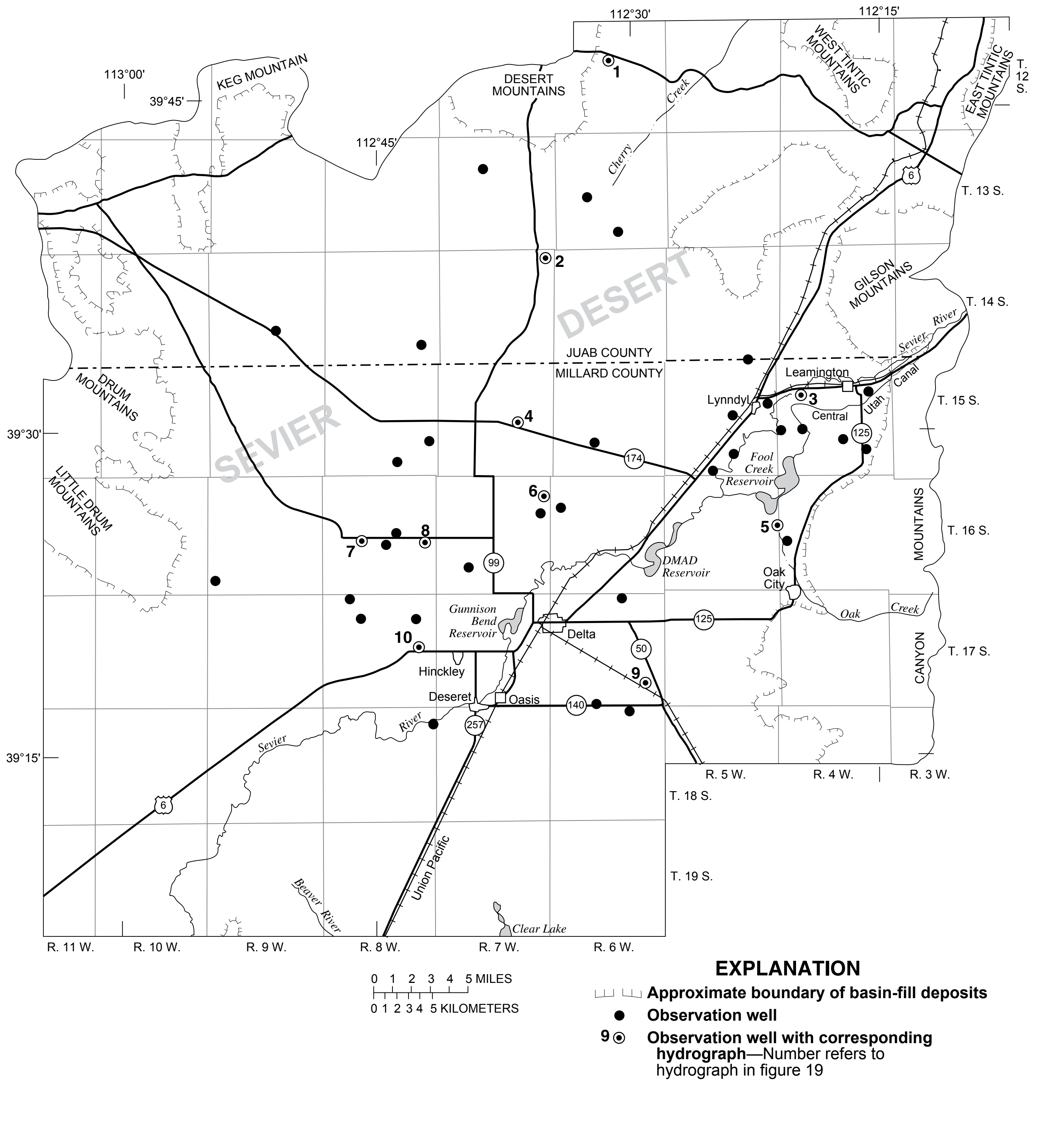
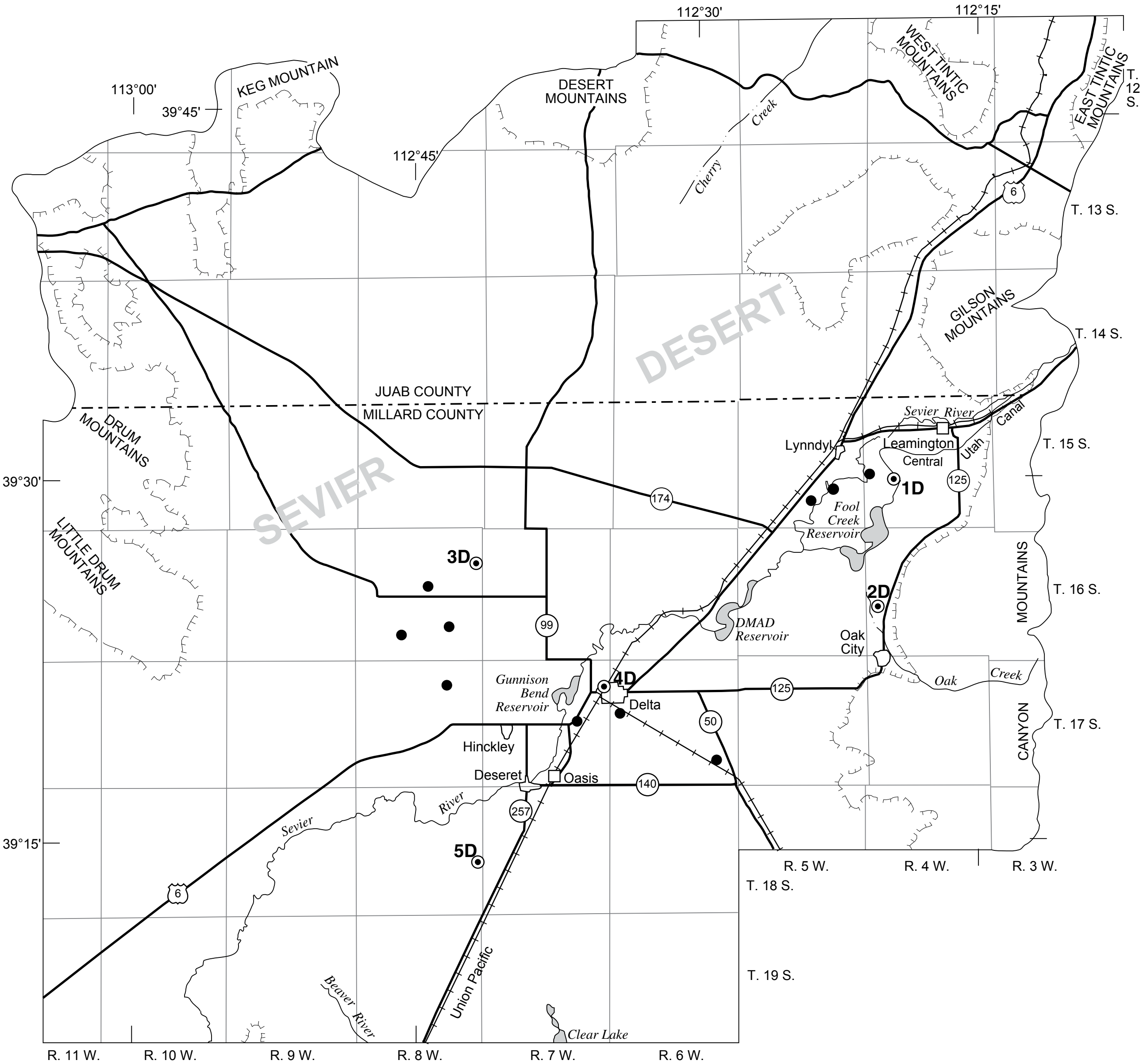


Figure 17. Location of wells in the shallow artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2008.



0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

EXPLANATION

Approximate boundary of basin-fill deposits

● **Observation well**

5D⊙ **Observation well with corresponding hydrograph**—Number with letter D refers to deep artesian aquifer hydrograph in figure 19

Figure 18. Location of wells in the deep artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2008.

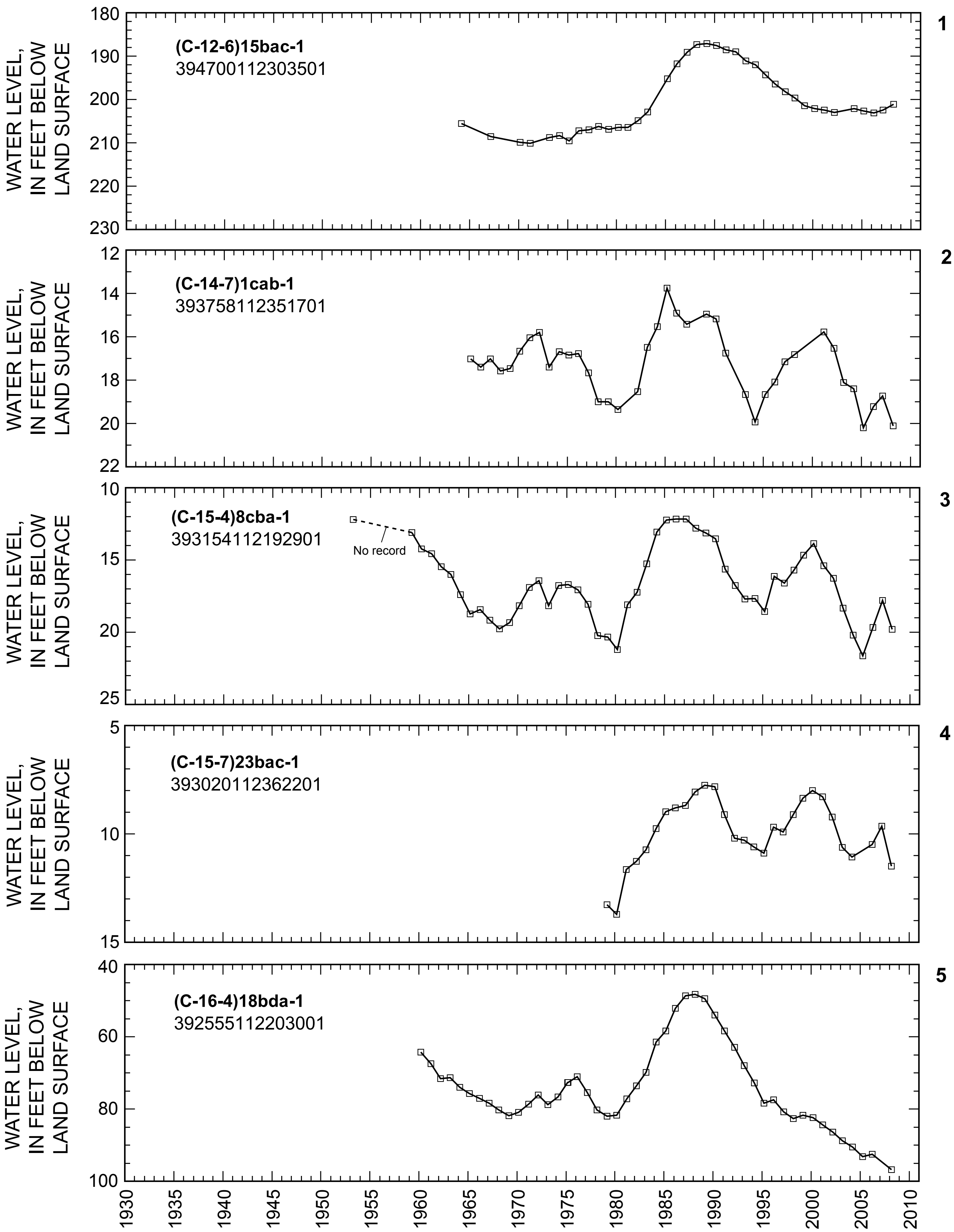


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.

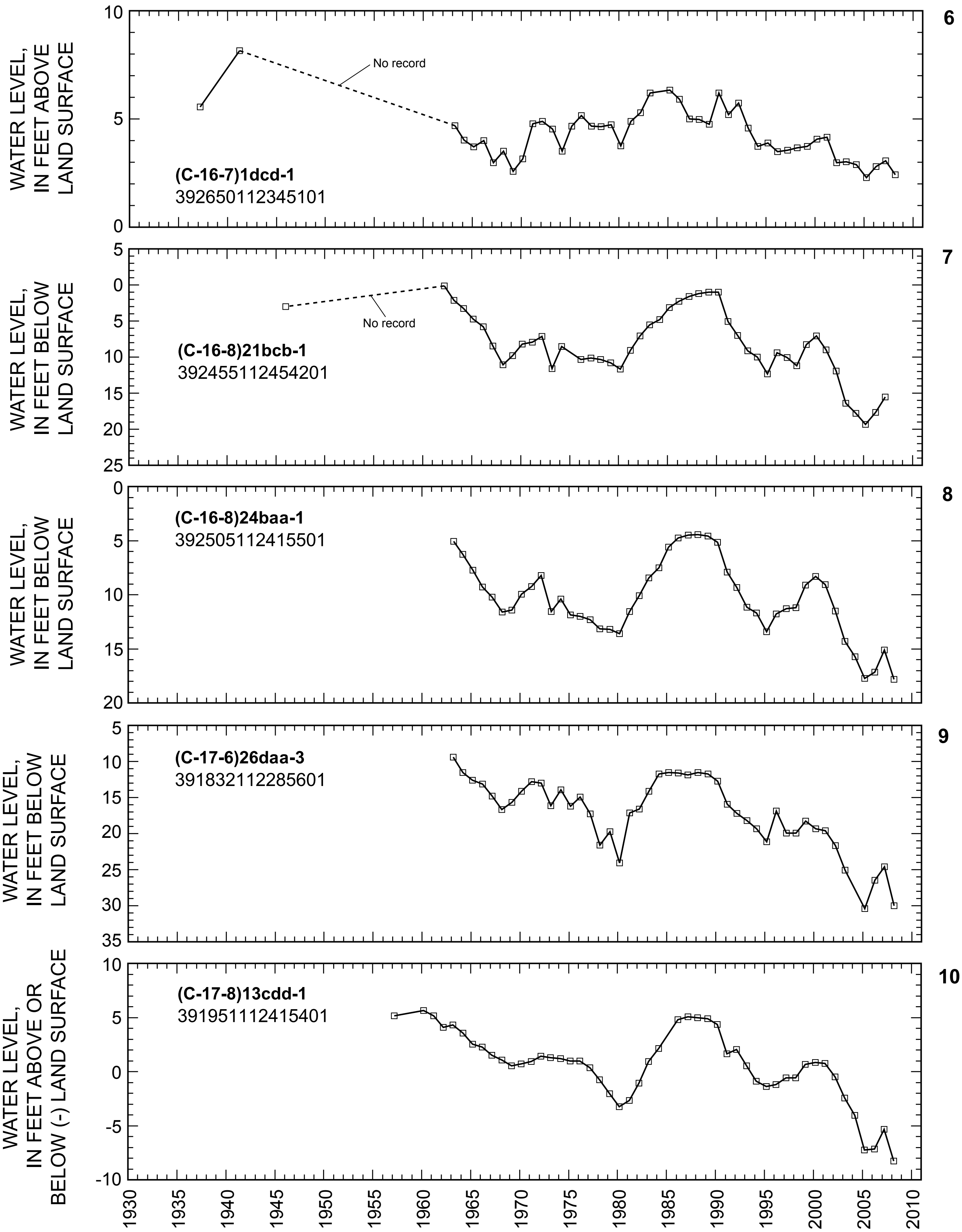


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1—Continued.

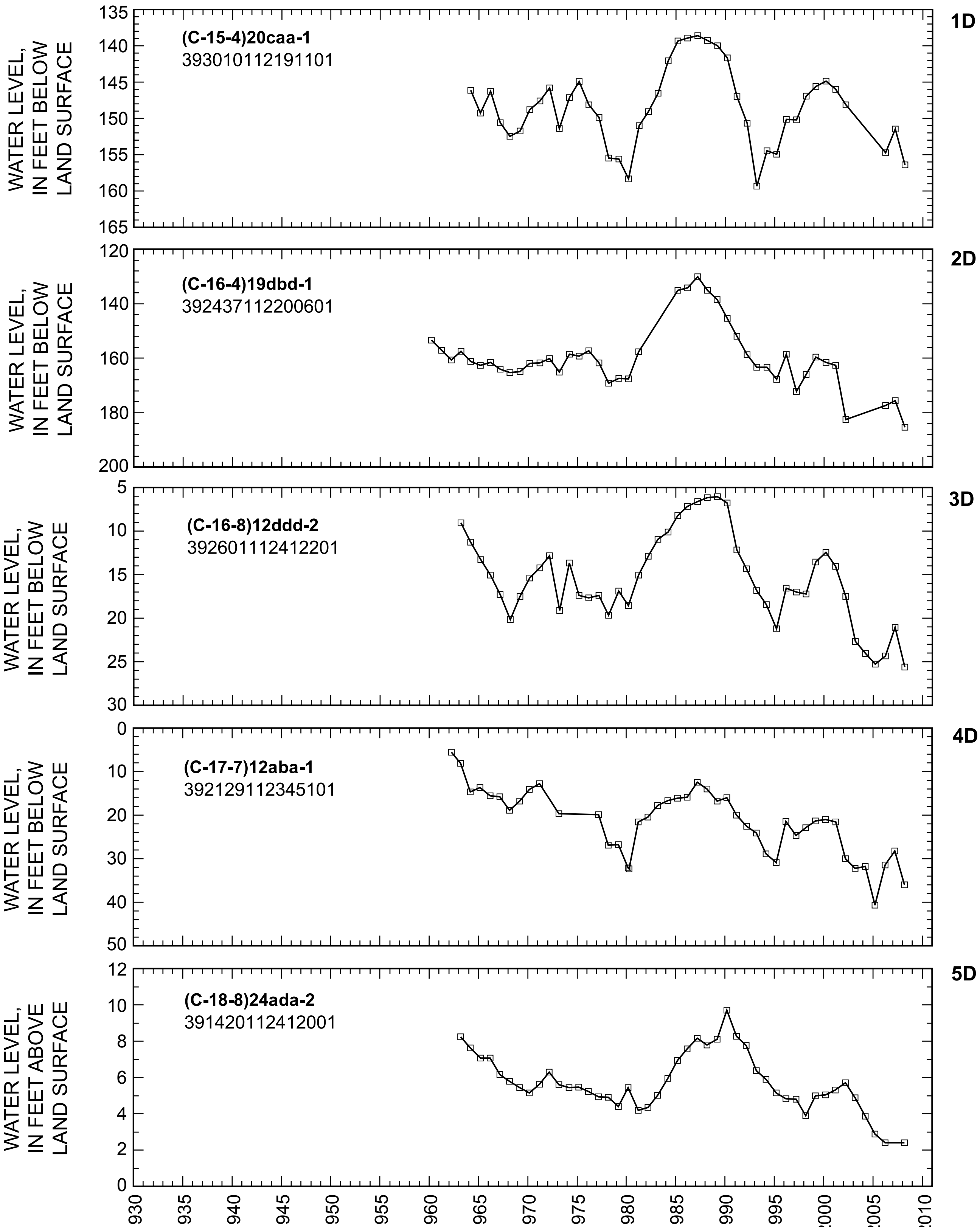


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1—Continued.

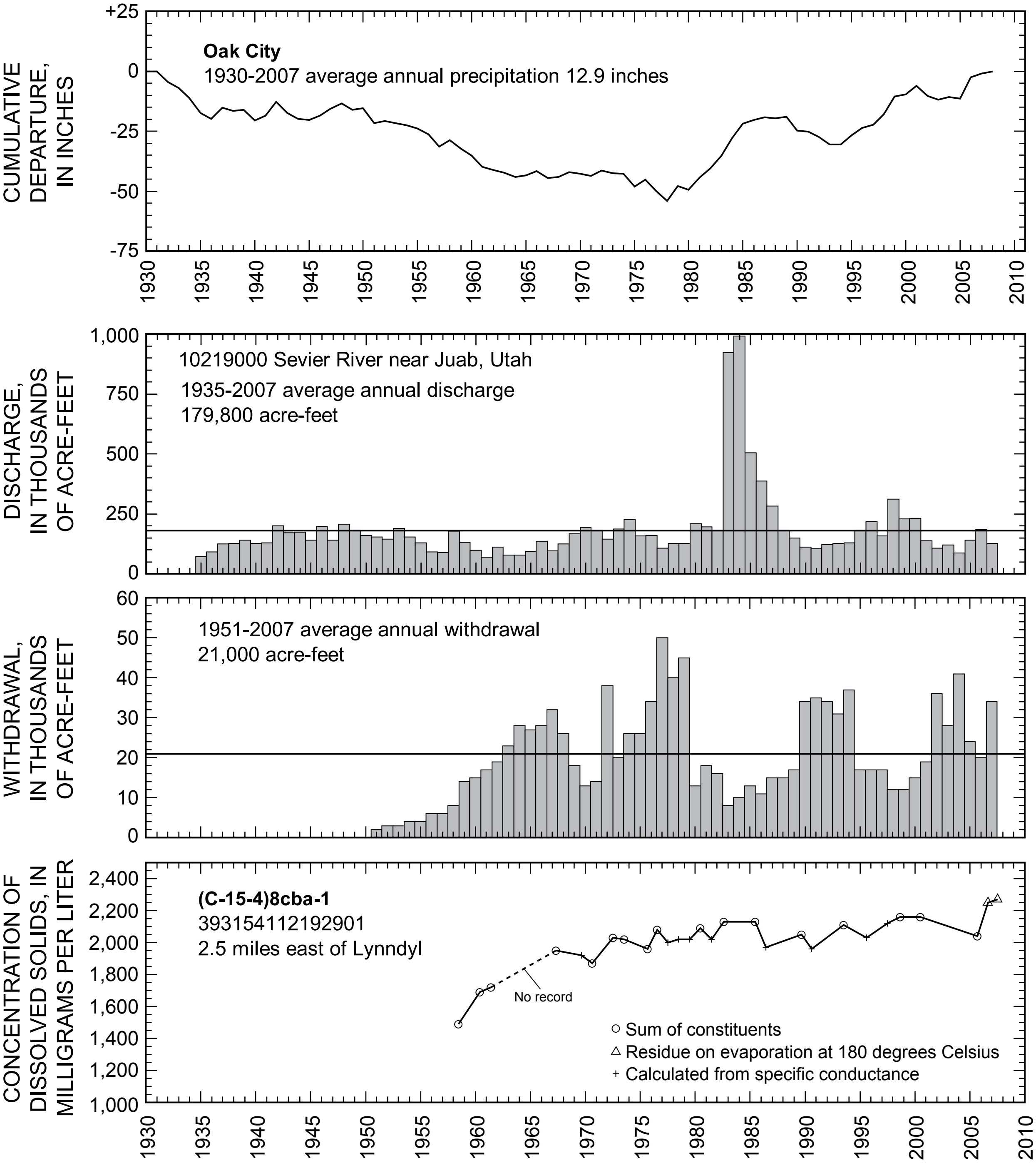


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1—Continued.

CENTRAL SEVIER VALLEY

By B.A. Slaugh

Central Sevier Valley, located in northern Piute, Sevier, and southern Sanpete Counties, in south-central Utah, is surrounded by the Sevier and Wasatch Plateaus to the east and the Tushar Mountains, Valley Mountains, and Pahvant Range to the west (fig. 20). Altitude ranges from 5,100 feet on the valley floor at the north end of the valley near Gunnison to more than 12,000 feet in the Tushar Mountains.

Total estimated withdrawal of water from wells in the central Sevier Valley in 2007 was about 19,000 acre-feet, which is 3,000 acre-feet more than reported for 2006 and 3,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3).

The location of 25 wells in central Sevier Valley in which the water level was measured during March 2008 is shown in figure 20. The relation of the water level in selected observation wells to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4 is shown in figure 21.

Water levels generally declined from March 2007 to March 2008 in central Sevier Valley. Hydrographs for selected wells show that March water levels generally rose from about 1978 to 1985 and declined from 1985 to about 1993. Since 1993, water levels have fluctuated depending upon the amount and timing of precipitation and recharge from snowmelt runoff.

Discharge of the Sevier River at Hatch in 2007 was about 45,200 acre-feet. This is about 210,000 acre-feet less than the record high 255,200 acre-feet reported for 2005 (revised value) and about 34,400 acre-feet less than the 1940–2007 average annual discharge.

Precipitation at Richfield was about 5.6 inches in 2007, which is about 2.5 inches less than the 1950–2007 average annual precipitation and about 3.1 inches less than in 2006.

Physical properties and results of chemical analyses for water from three wells in central Sevier Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved solids, sulfate, and chloride in water from well (C-19-1)23cac-1 exceeded the secondary standards for these constituents (500 mg/L, 250 mg/L, and 250 mg/L, respectively). The dissolved-iron concentration in water from well (C-23-2)30baa-2 (4.7 mg/L) exceeded the secondary standard for this constituent (0.3 mg/L) and was the maximum dissolved-iron concentration determined during this study.

The concentration of dissolved solids in water collected from well (C-23-2)15dcb-4, located 0.1 mile south of Sevier River in Venice, from 1955 to 2007, is shown in figure 21. Concentrations range from 307 to 630 mg/L, with a median value of 418 mg/L. Relative to the median value, there were modest (less than 225 mg/L) increases in dissolved-solids concentrations during the mid- to late- 1960s and 1980s. Samples collected from 1990 through 2007 show little variation and are in close agreement with the median value.

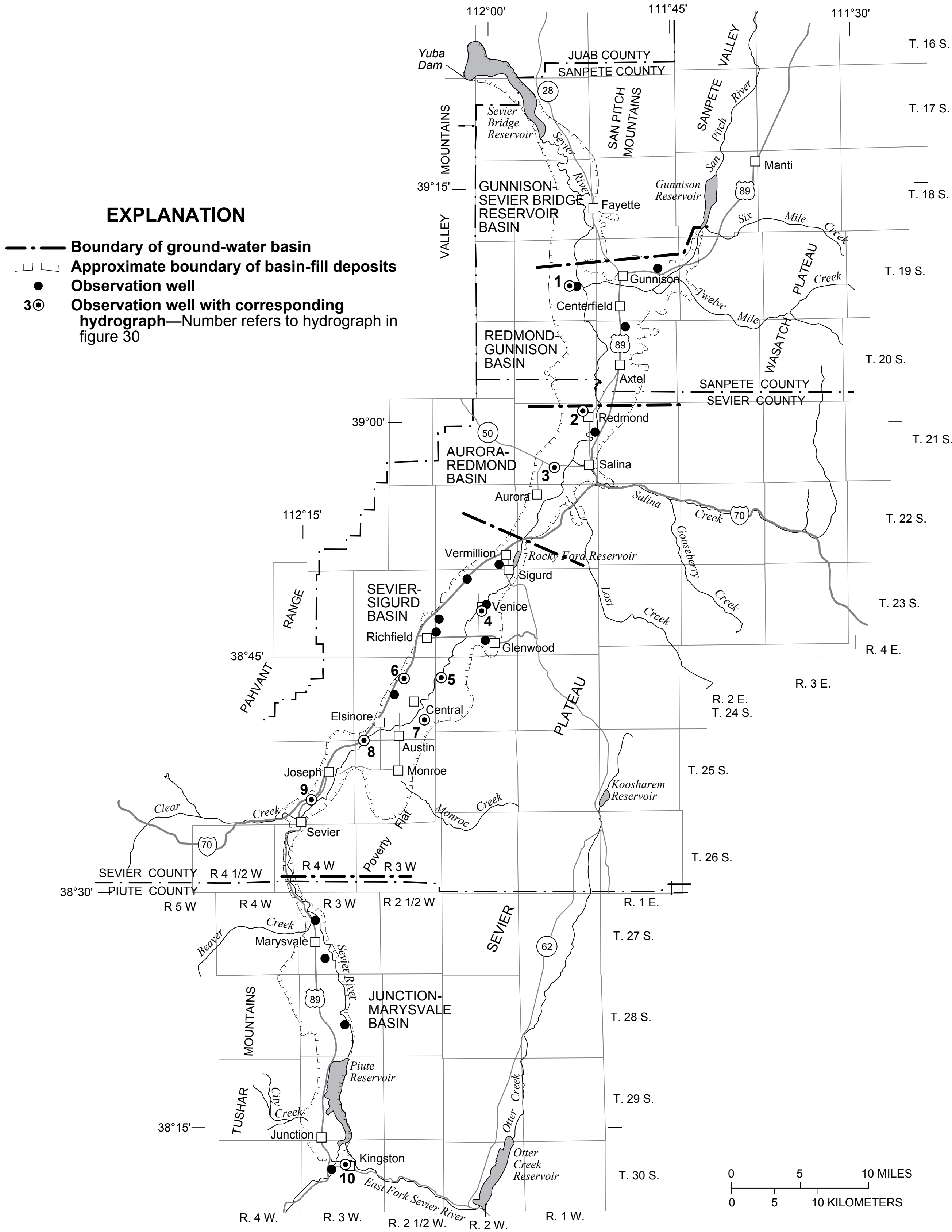


Figure 20. Location of wells in central Sevier Valley in which the water level was measured during March 2008.

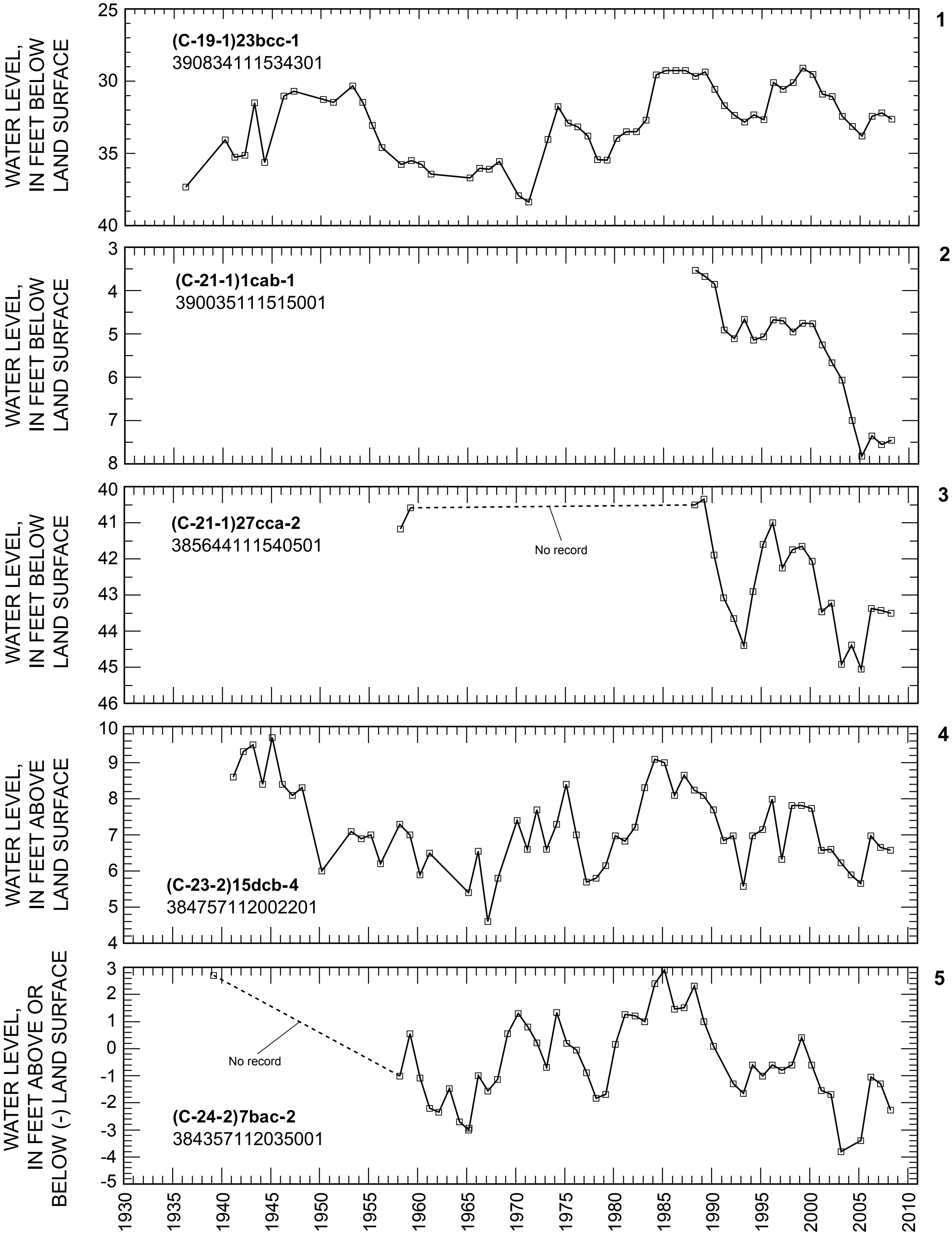


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.

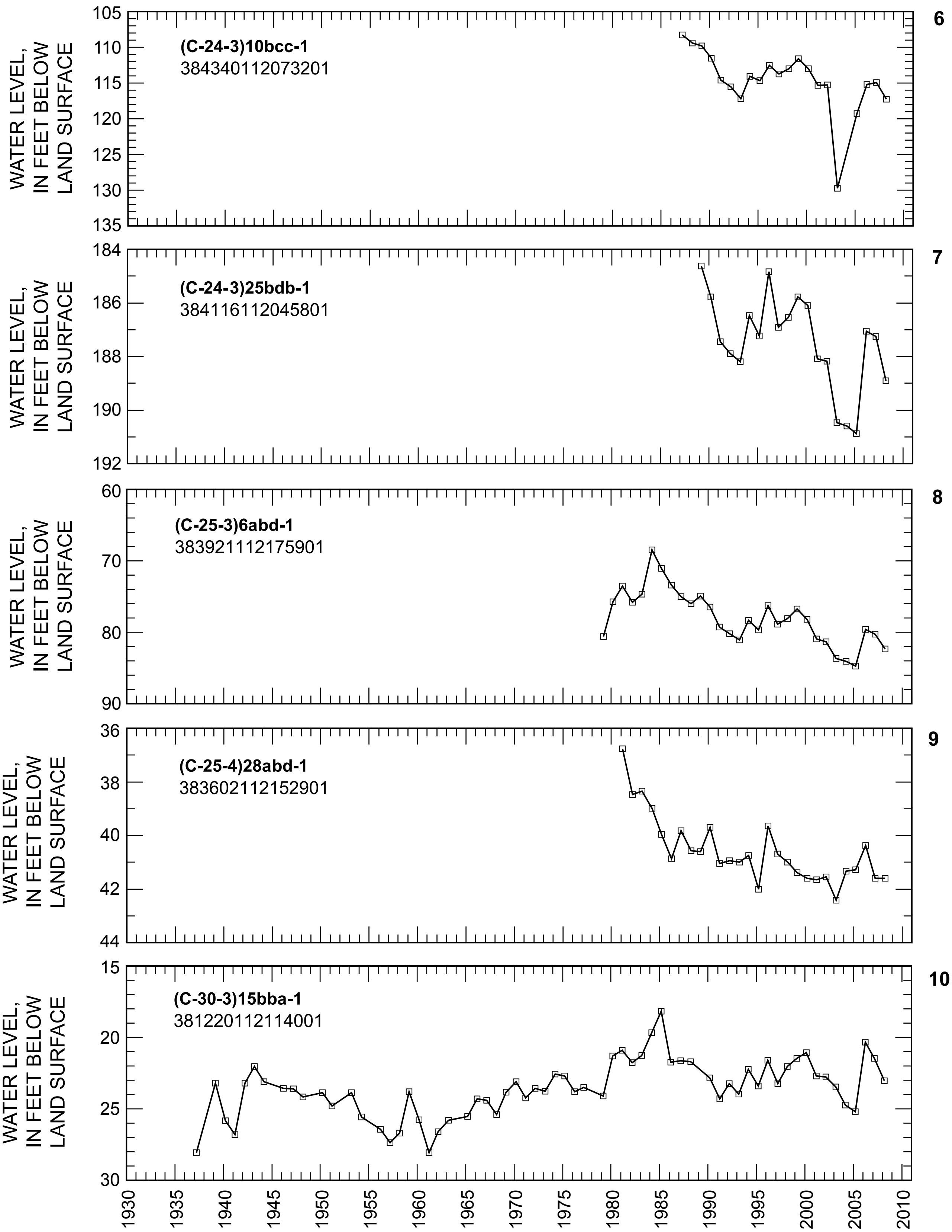


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

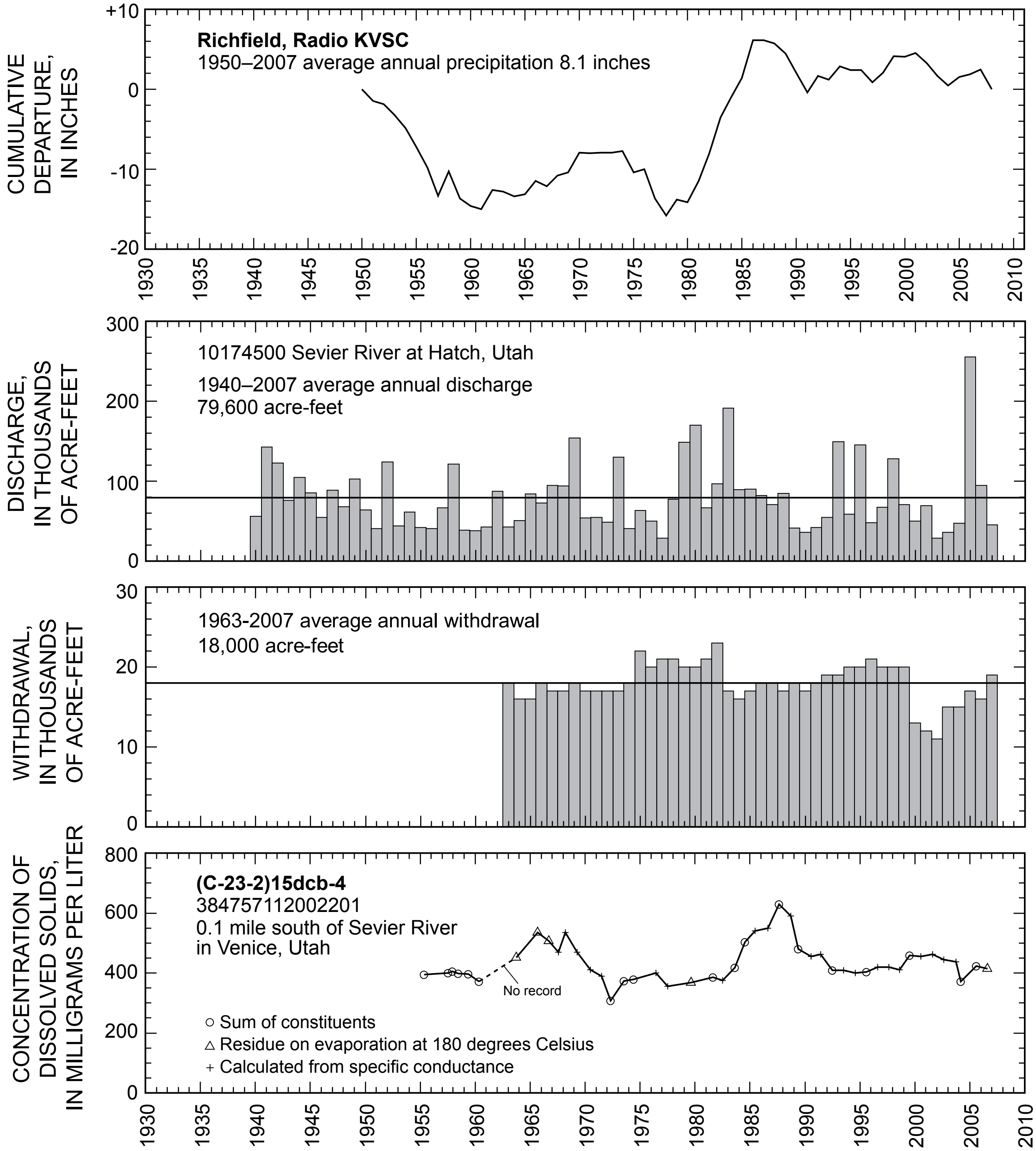


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4—Continued.

PAHVANT VALLEY

By R.L. Swenson

Pahvant Valley, in southeastern Millard County, extends from the vicinity of McCornick on the north to Kanosh on the south, from the Pahvant Range and Canyon Mountains on the east and northeast to a low basalt ridge known as The Cinders on the west (fig. 22). The area of the valley covers about 300 square miles, and ground water drains west to the valley from the mountainous terrain to the east.

Total estimated withdrawal of water from wells in Pahvant Valley in 2007 was about 89,000 acre-feet, which is about 3,000 acre-feet more than was reported in 2006 and 9,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for irrigation in 2007 was about 87,600 acre-feet, which is 3,300 acre-feet more than was reported in 2006.

The location of wells in Pahvant Valley in which water levels were measured during March 2008 is shown in figure 22. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 23.

Water levels declined in most of the wells measured in Pahvant Valley from March 2007 to March 2008. The declines probably are a result of continued large withdrawals for irrigation. Water levels generally declined from the early 1950s until 1982 as a result of generally less-than-average precipitation and increased withdrawals. Water levels generally rose from 1982 to 1985, and were generally higher than in the early 1950s. The 1982–85 rises were the result of greater-than-average precipitation and decreased withdrawals for irrigation. Levels generally have declined since 1985.

Precipitation at Fillmore during 2007 was about 16.6 inches, which is about 1.4 inches more than the average annual precipitation for 1930–2007 and about 0.4 inch less than in 2006.

Physical properties and results of chemical analyses for water from nine wells in Pahvant Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from all nine wells and the dissolved sulfate in water from six wells ((C-20-4)6dbd-1, (C-21-5)29cbc-1, (C-21-5)30dbc-3, (C-21-6)1ddb-1, (C-23- 6)15bda-1, and (C-23-6)28bbb-2) exceeded the secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The dissolved-chloride concentration in water from four wells ((C-21- 5)29cbc-1, (C-21-6)1ddb-1, (C-23-6)15bda-1, and (C-23-6)28bbb-2) exceeded the secondary drinking-water standard for this constituent (250 mg/L). The concentration of dissolved solids and nitrite plus nitrate in water from well (C-23-6)28bbb-2 also exceeded the MCLs for these constituents (2,000 mg/L and 10 mg/L, respectively). Finally, dissolved magnesium, dissolved bromide, and total hardness concentrations in water from well (C-23-6)28bbb-2 (281 mg/L, 2.62 mg/L, and 2,100 mg/L, respectively) were the maximum values determined during this study.

The concentration of dissolved solids in water from wells (C-21-5)7cdd-2 and (C-21-5)7cdd-3, located in the Flowell area, from 1957 to 2007, and from well (C-23-6)8abd-1, located in the Kanosh area, from 1957 to 1999, is shown in figure 23. Wells (C-21-5)7cdd-2 and (C-21-5)7cdd-3 are located near each other and are finished in the same aquifer. The dissolved-solids concentrations in water from these wells were combined to give an extended temporal record for this constituent. Dissolved-solids concentrations range from 707 to 1,080 mg/L, with a median value of 863 mg/L. Concentrations in water samples collected since 2003 have steadily increased. The concentration of dissolved solids in water from well (C-23-6)8abd-1 has increased from 2,350 mg/L in 1957 to 5,990 mg/L in 1976, with a median value of 4,190 mg/L. This well was not sampled from 2003–2007 because it was not pumping at the time of sampling.

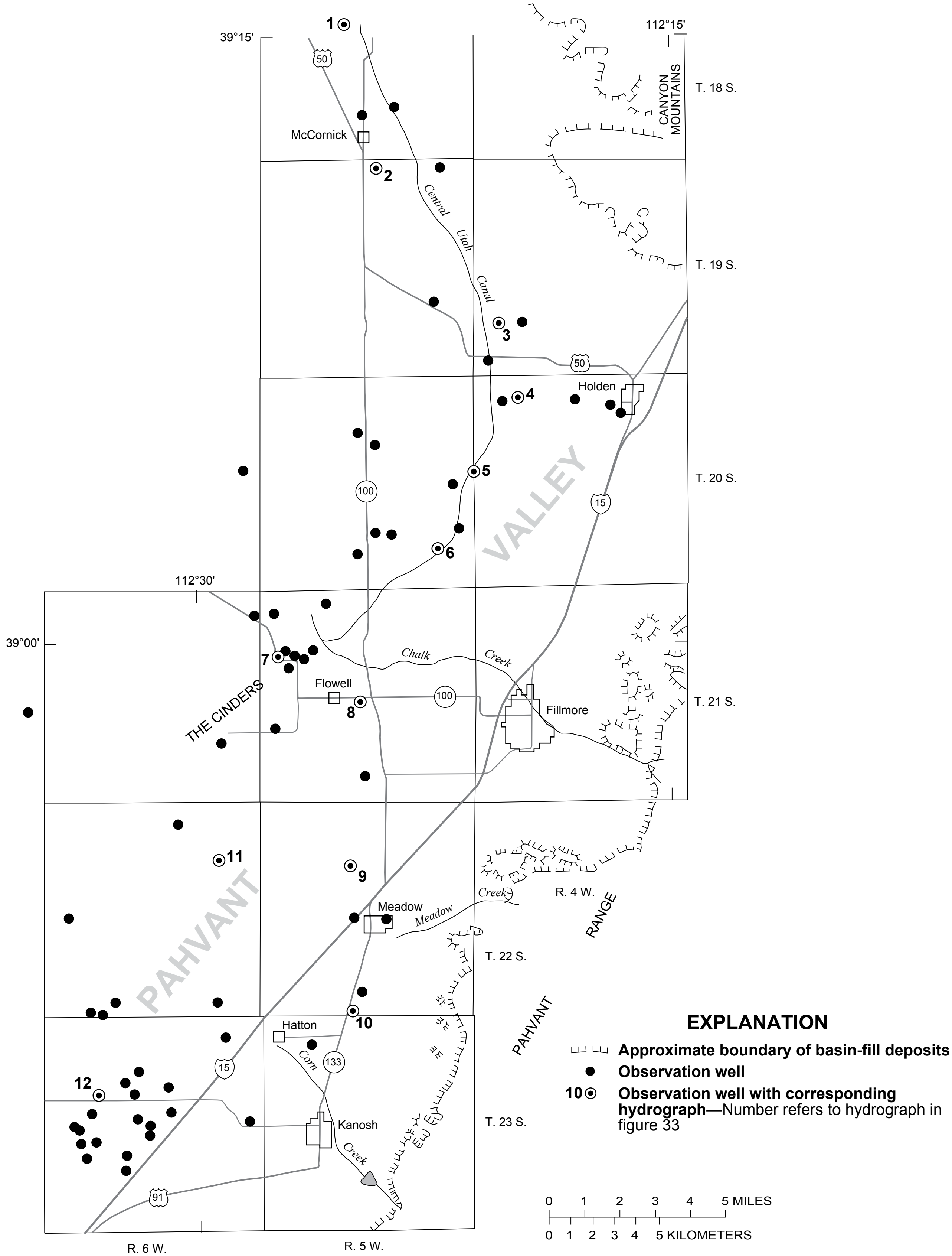


Figure 22. Location of wells in Pahvant Valley in which the water level was measured during March 2008.

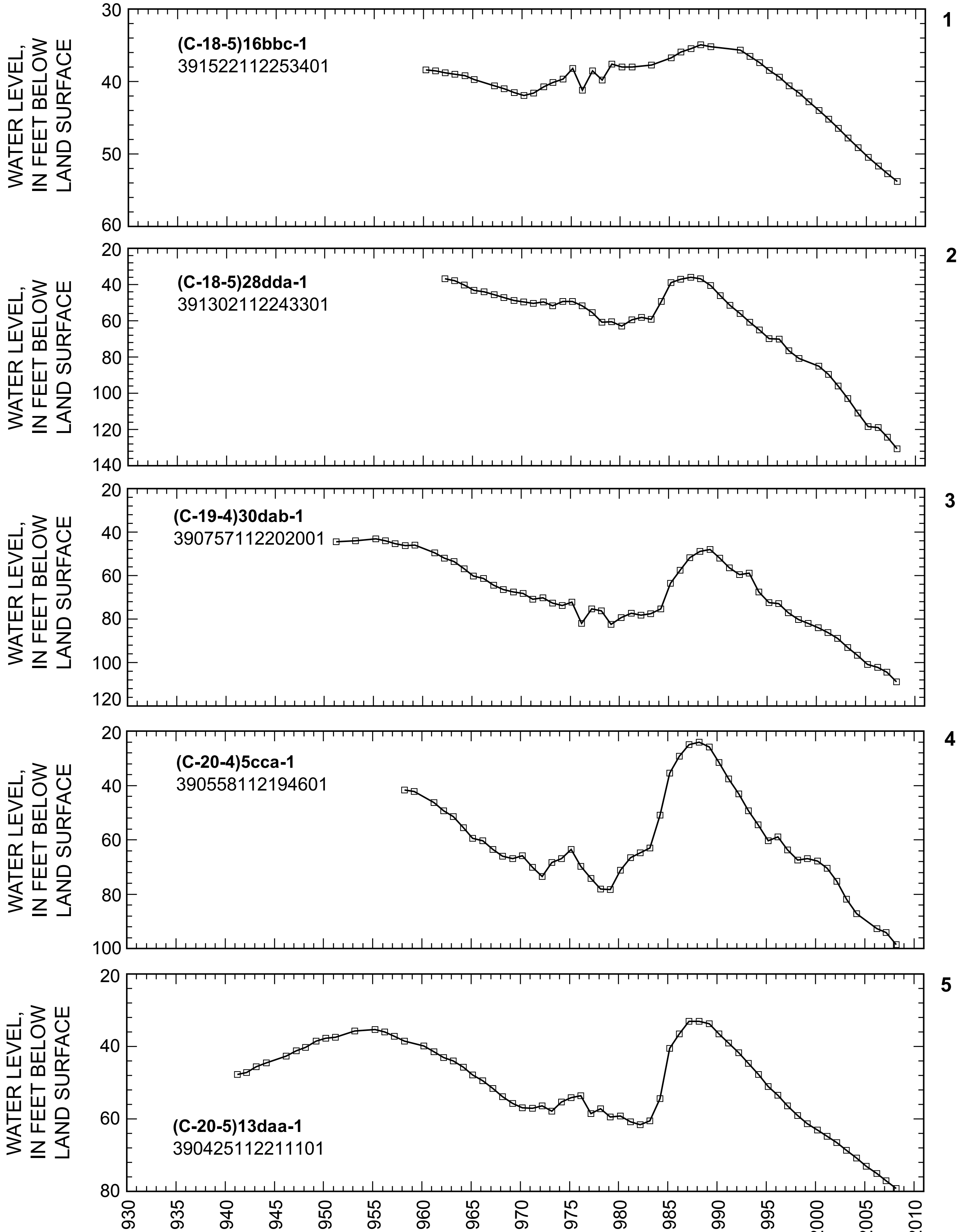


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

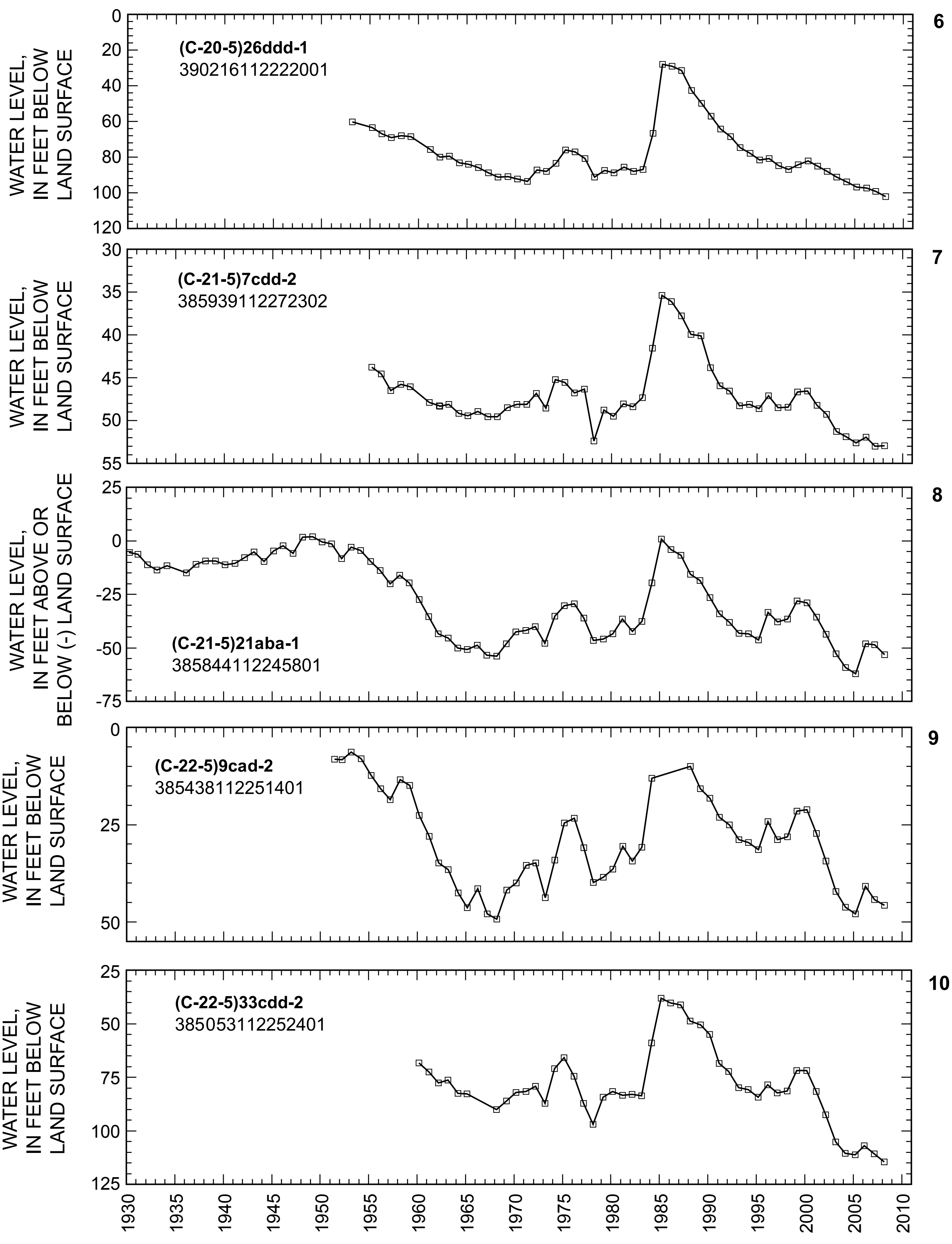


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells —Continued.

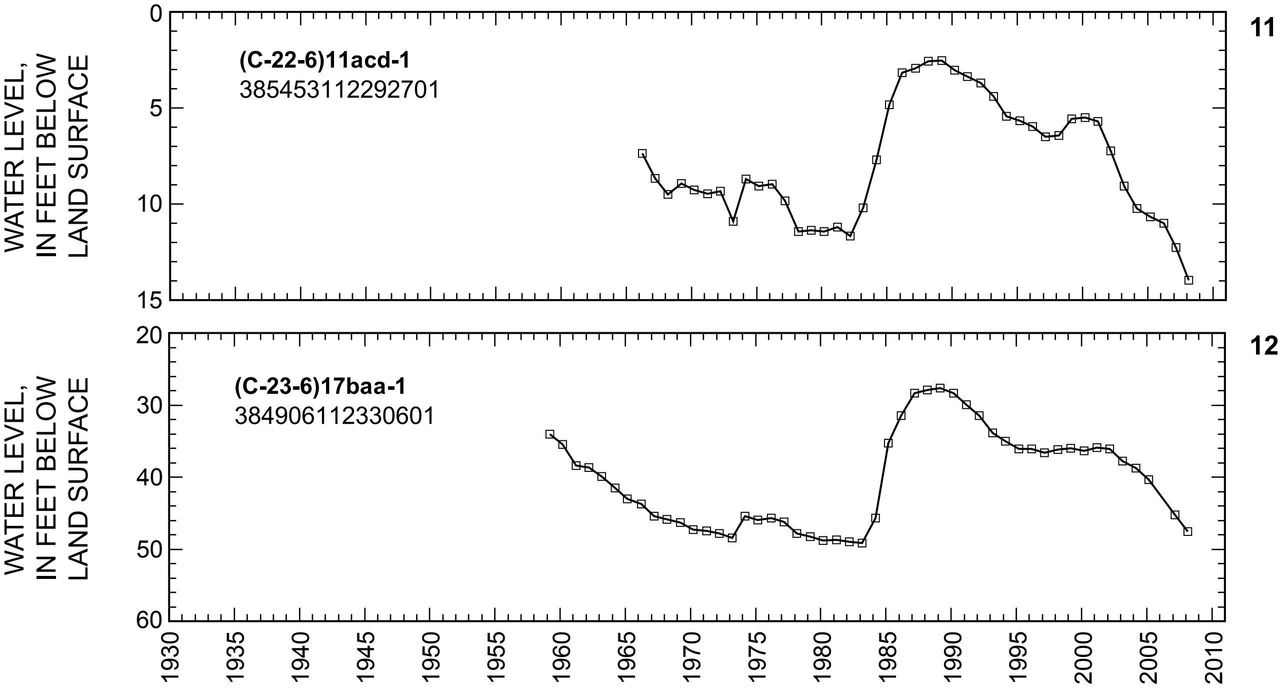


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

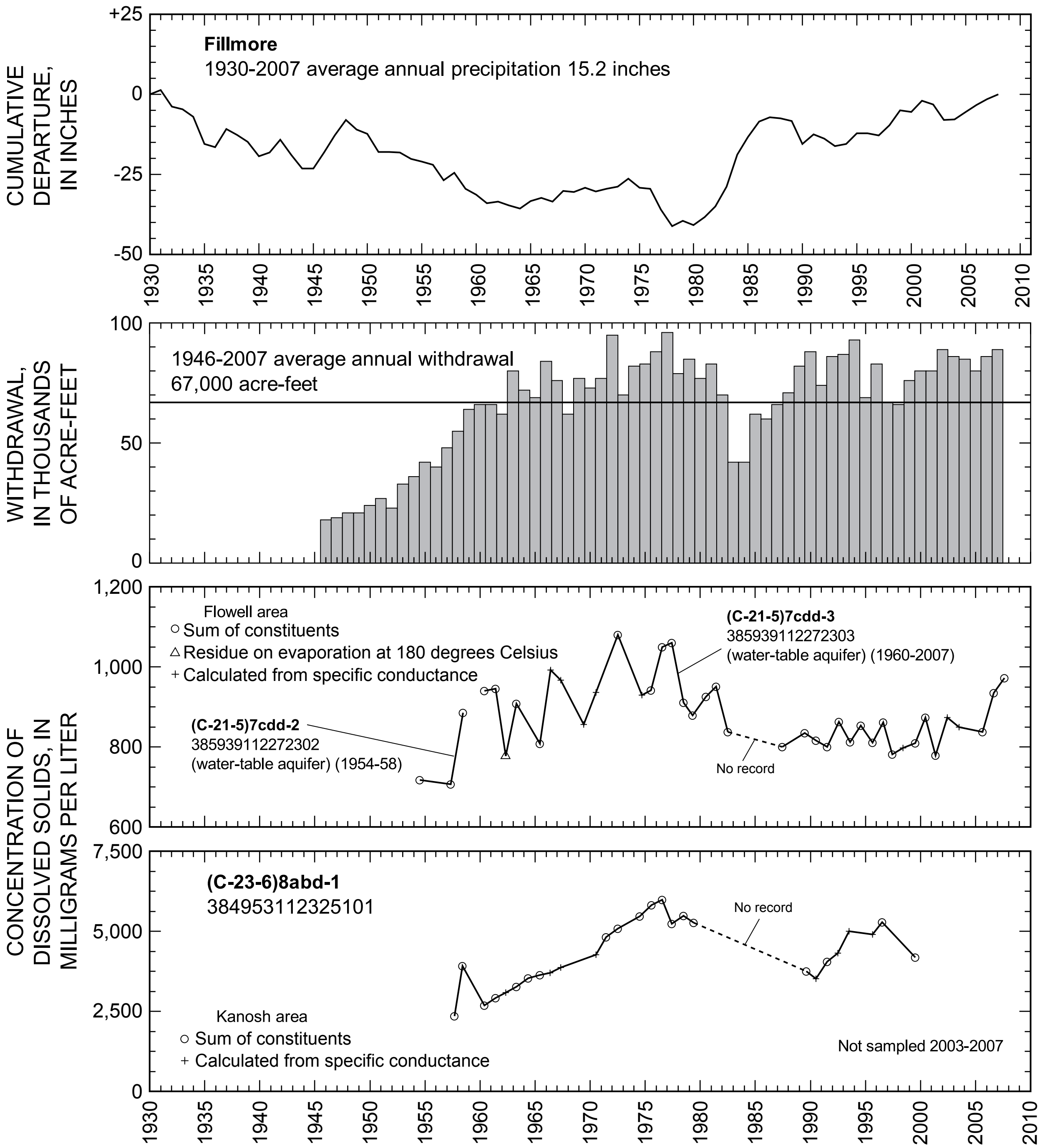


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

CEDAR VALLEY, IRON COUNTY

By J.H. Howells

Cedar Valley is in eastern Iron County, southwestern Utah. The valley covers about 170 square miles from about Townships 34 South to 37 South and Ranges 10 West to 12 West and includes Cedar City on its eastern edge (fig. 24). Ground water in Cedar Valley occurs in unconsolidated deposits, mostly under water-table conditions. The principal source of recharge to aquifers is water from Coal Creek, some of which seeps directly from the stream channel into the ground-water system after being diverted for irrigation.

Total estimated withdrawal of water from wells in Cedar Valley in 2007 was about 40,000 acre-feet, which is about 5,000 acre-feet more than in 2006 and 4,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). The increase was mainly due to increased withdrawals for irrigation.

The location of wells in Cedar Valley in which the water level was measured during March 2008 is shown in figure 24. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 25.

Ground-water levels generally declined from March 2007 to March 2008 in most parts of Cedar Valley. The largest declines, greater than 10 feet, were measured in three wells north of Cedar City. One water-level rise was measured in a well north and west of Enoch. Water-level declines probably resulted from continued localized large withdrawals for irrigation and municipal use. Water-level rises probably resulted from locally decreased withdrawals.

Precipitation at Cedar City Federal Aviation Administration Airport in 2007 was about 10.2 inches, which is about 0.2 inch less than in 2006 and about 0.5 inch less than the average annual precipitation for 1949–2007. Discharge of Coal Creek was about 13,700 acre-feet in 2007, which is 15,300 acre-feet less than in 2006, and 10,800 acre-feet less than the average annual discharge for 1936 and 1939–2007.

Physical properties and results of chemical analyses for water from five wells in Cedar Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from all five wells exceeded the secondary standard for this constituent (500 mg/L) and the concentration of dissolved sulfate in water from four of the five wells ((C-35-11)11ccc-1, (C-35-11)31dbd-1, (C-36-11)11bac-1, and (C-37-12)23acb-1) exceeded the secondary standard for this constituent (250 mg/L). In addition, the dissolved-sulfate and dissolved-solids concentrations in water from well (C-36-11)11bac-1 exceeded the MCLs for these constituents (1,000 mg/L and 2,000 mg/L, respectively). The dissolved nitrite plus nitrate concentration in water from well (C-35-11)11ccc-1 was at the MCL for this constituent (10 mg/L).

The concentration of dissolved solids in water from well (C-37-12)23acb-1, located 2.3 miles northeast of Kanarraville, from 1966 to 2007, and well (C-35-11)31dbd-1, located about 4 miles northwest of Cedar City, from 1977 to 2007, is shown in figure 25. The dissolved-solids concentration in water from well (C-37-12)23acb-1 has increased from 347 mg/L in 1966 to 961 mg/L in 2007, with a median value of 491 mg/L. For well (C-35-11)31dbd-1, the concentration of dissolved solids ranges from 364 to 1,020 mg/L, with a median value of 488 mg/L. From 1987 to 2006, concentrations in water from this well have increased.

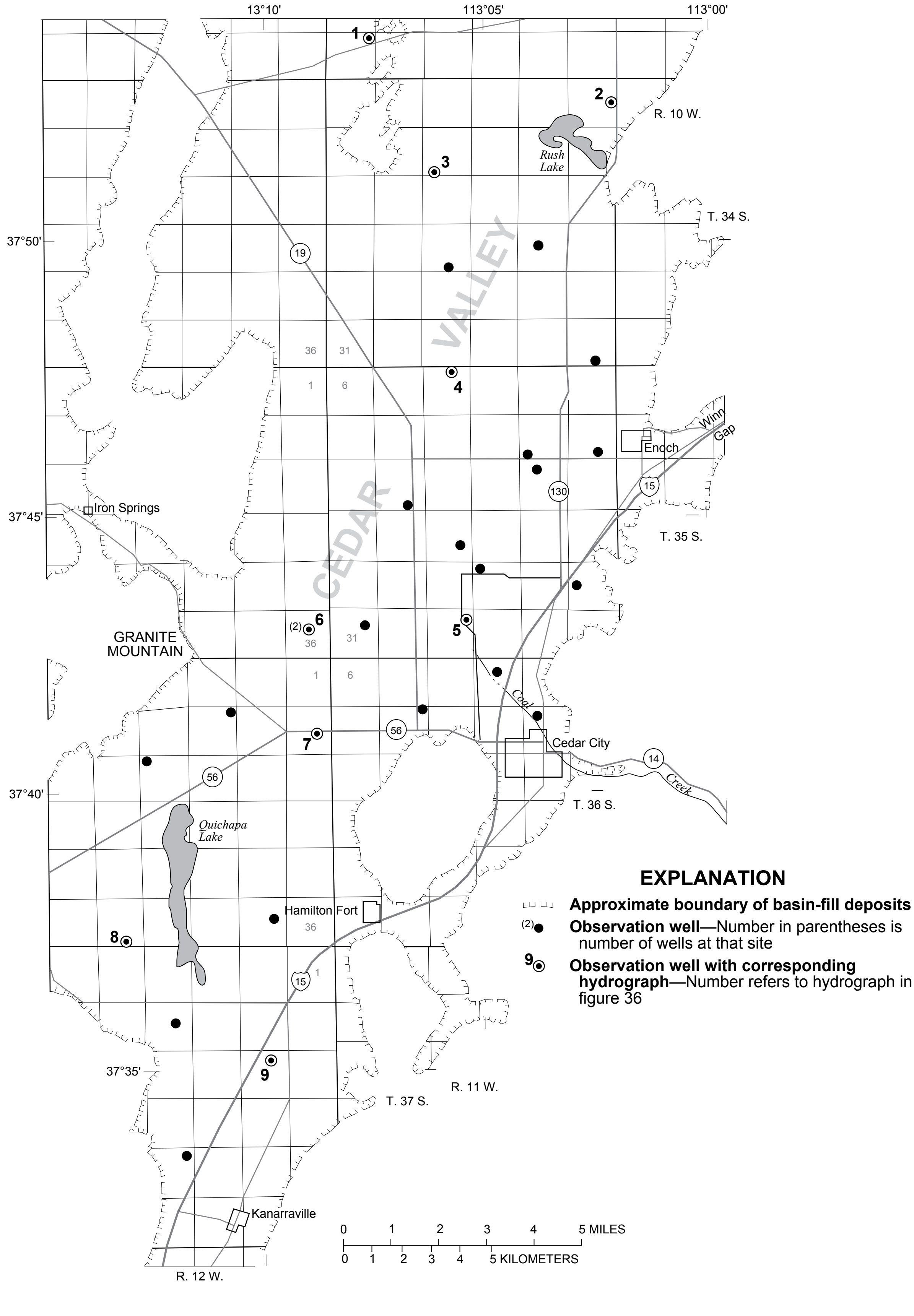


Figure 24. Location of wells in Cedar Valley, Iron County, in which the water level was measured during March 2008.

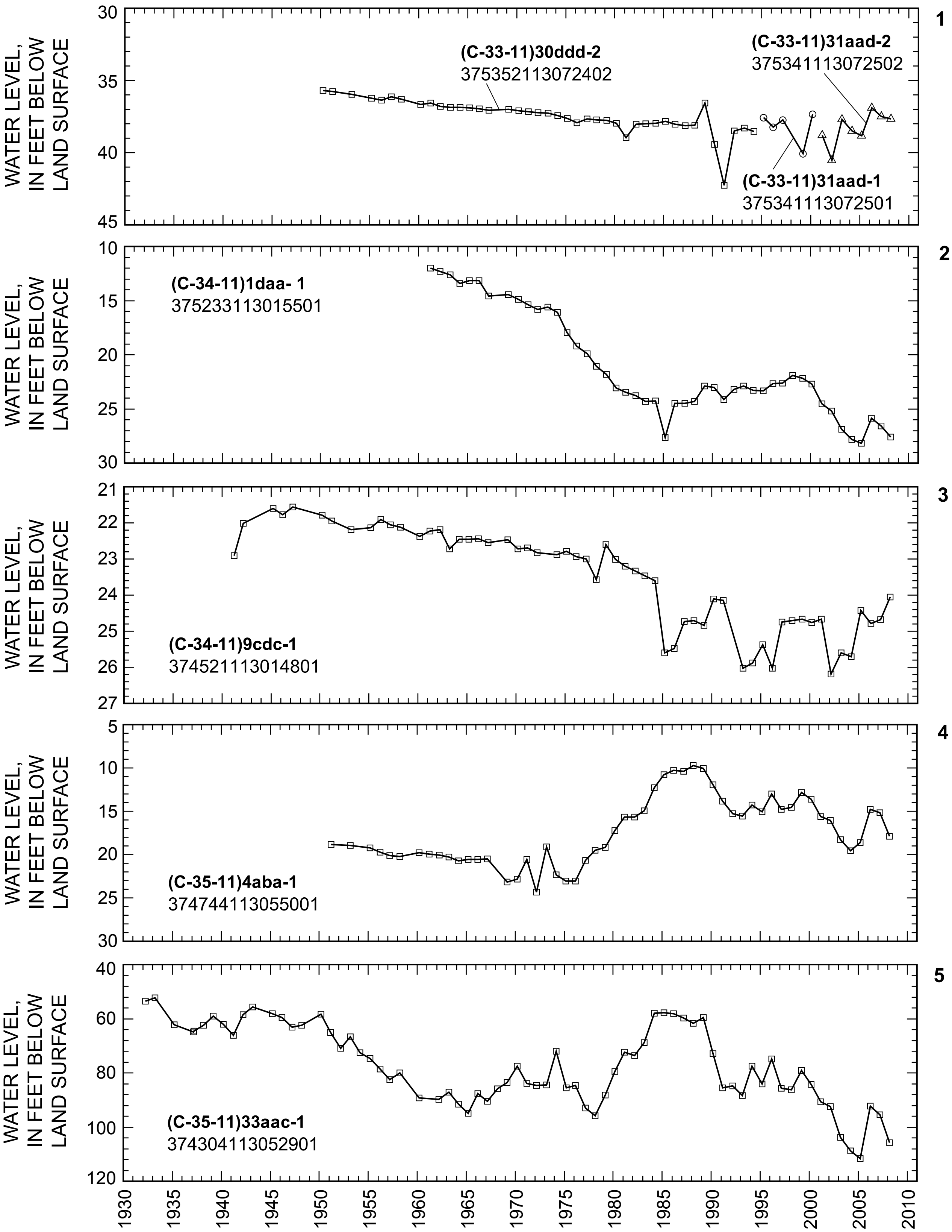


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

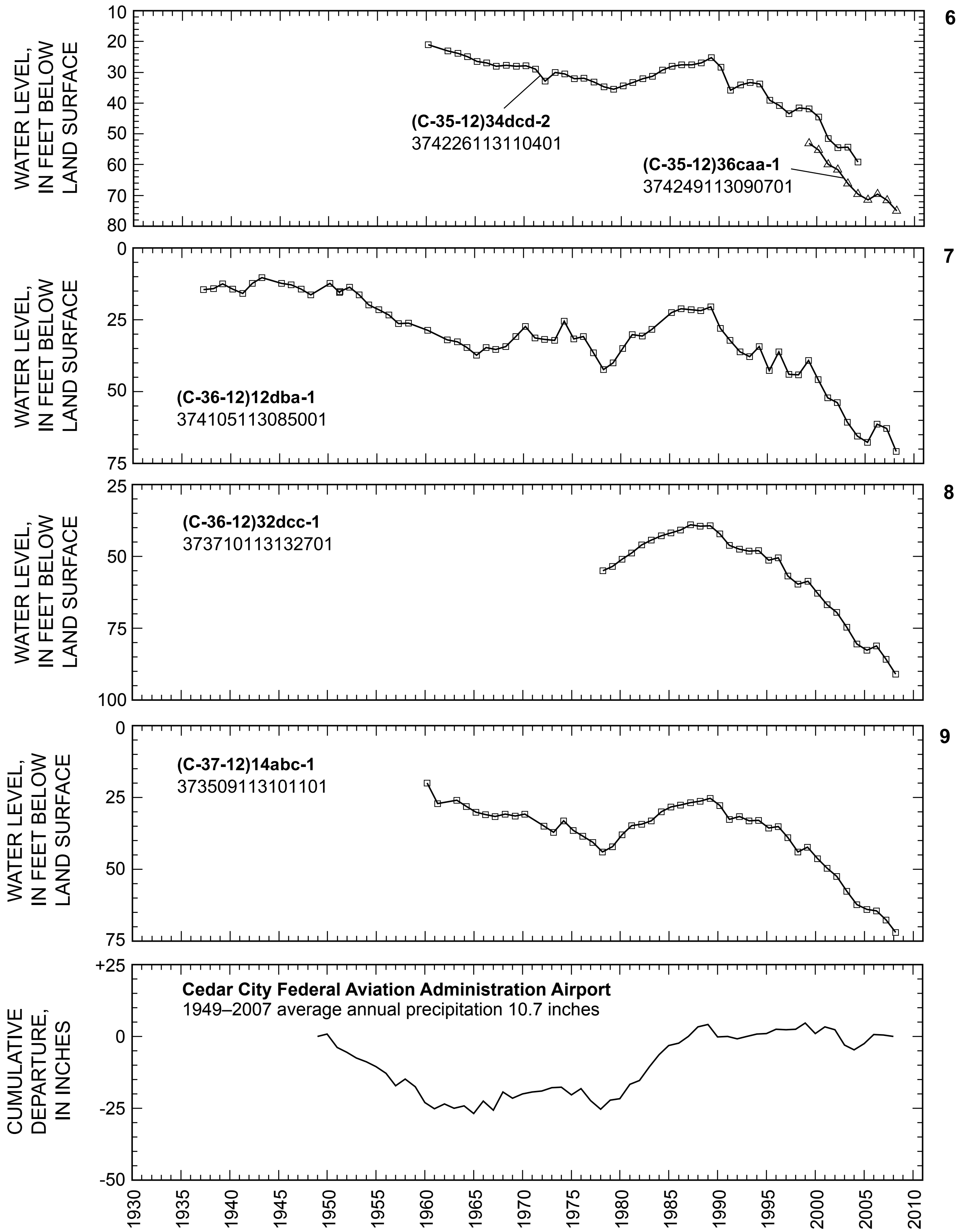


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

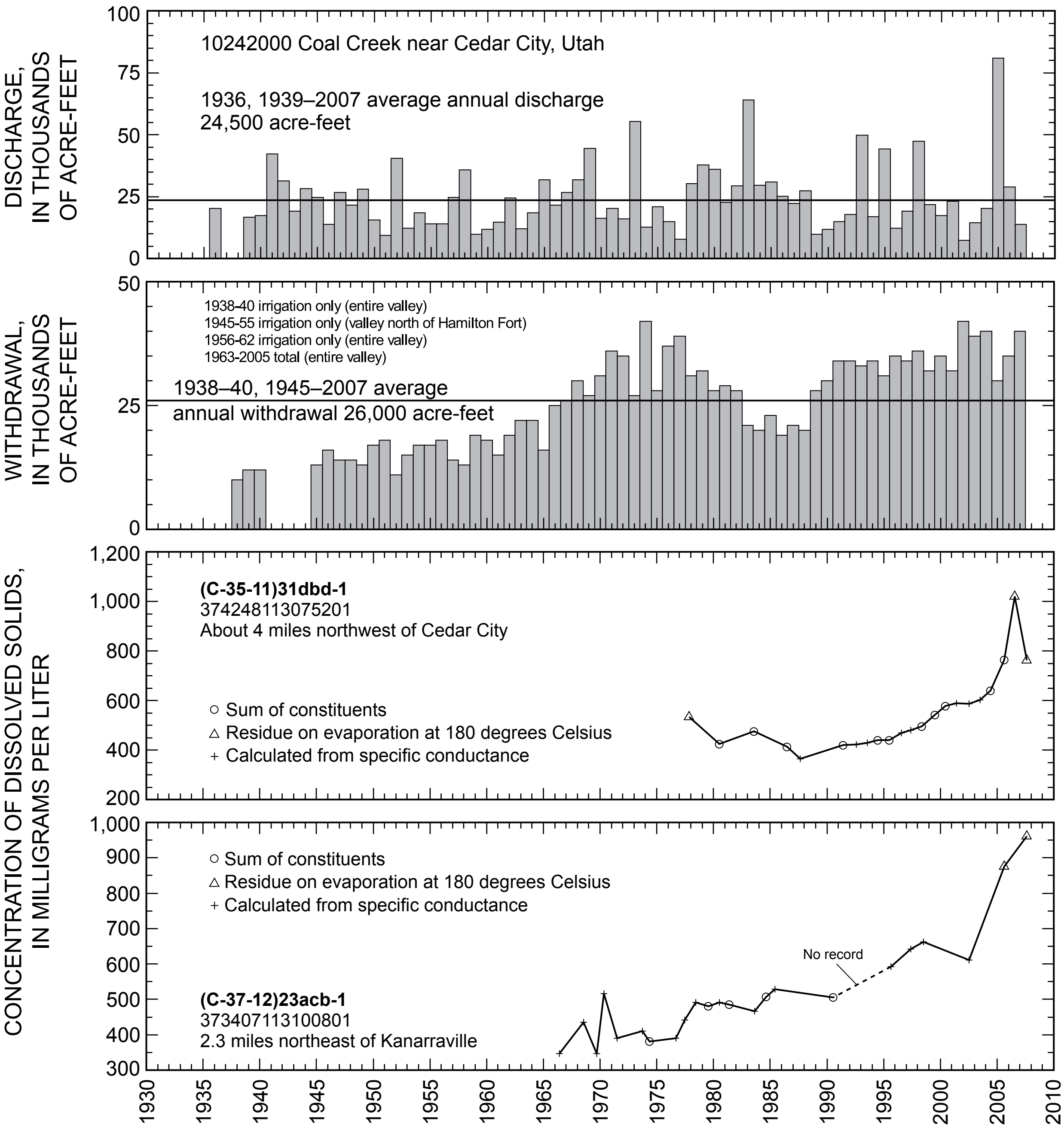


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells—Continued.

PAROWAN VALLEY

By J.H. Howells

Parowan Valley is in northern Iron County, southwestern Utah. The valley covers about 160 square miles between about Townships 32 South and 34 South and Ranges 7 West and 10 West and includes the towns of Paragonah and Parowan (fig. 26). Ground water occurs in unconsolidated deposits under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in Parowan Valley in 2007 was about 34,000 acre-feet, which is about 1,000 acre-feet more than was reported for 2006 and 3,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3).

The location of wells in Parowan Valley in which the water level was measured during March 2008 is shown in figure 26. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1 is shown in figure 27.

Water levels declined from March 2007 to March 2008 in most parts of Parowan Valley for which data are available. The largest declines, about 5 feet, were measured in a well north of Paragonah and in two wells north and west of Parowan. Water levels in Parowan Valley generally have declined since 1950. Some rises occurred during 1973–74, 1983–85, 1996–99, and 2006. Declines are probably the result of continued large withdrawals for irrigation. Rises are probably the result of greater-than-average precipitation and less withdrawal for irrigation.

Precipitation at Cedar City Federal Aviation Administration Airport in 2007 was about 10.2 inches, which is about 0.2 inch less than the value for 2006 and 0.5 inch less than the average annual precipitation for 1949–2007.

Physical properties and results of chemical analyses for water from two wells in Parowan Valley are listed in tables 4 and 5, and the location of the wells is shown in figure 39. Analytical results did not exceed secondary standards or MCLs for major ions, nutrients, and selected trace elements.

The concentration of dissolved solids in water from well (C-33-8)31ccc-1, located 2 miles west of Paragonah, from 1961 to 2007, is shown in figure 27. Concentrations range from 257 to 885 mg/L, with a median value of 297 mg/L. With the exception of relatively high dissolved-solids concentrations in water samples collected in 1970, 1973, and 1974, concentrations have varied little.

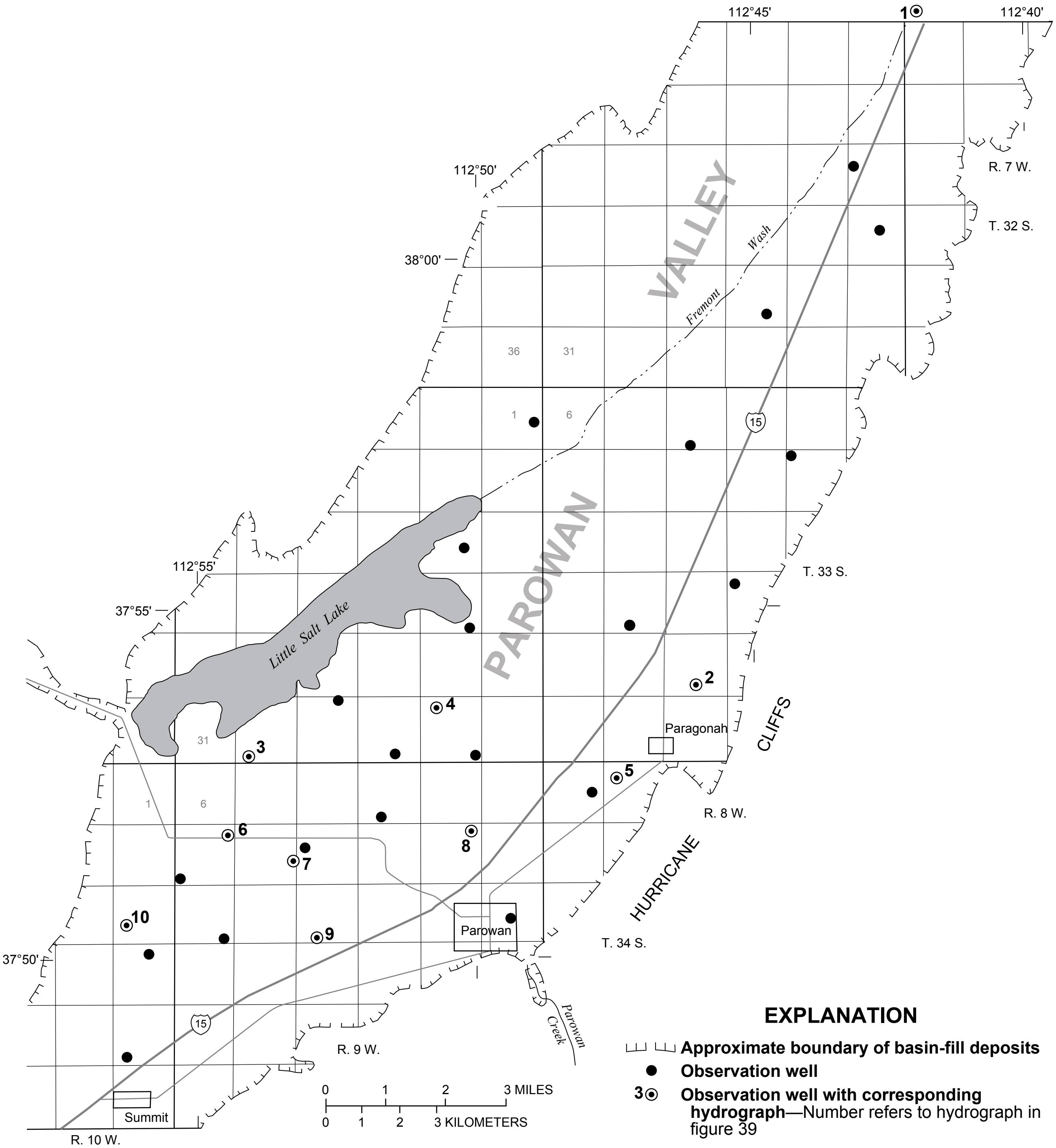


Figure 26. Location of wells in Parowan Valley in which the water level was measured during March 2008.

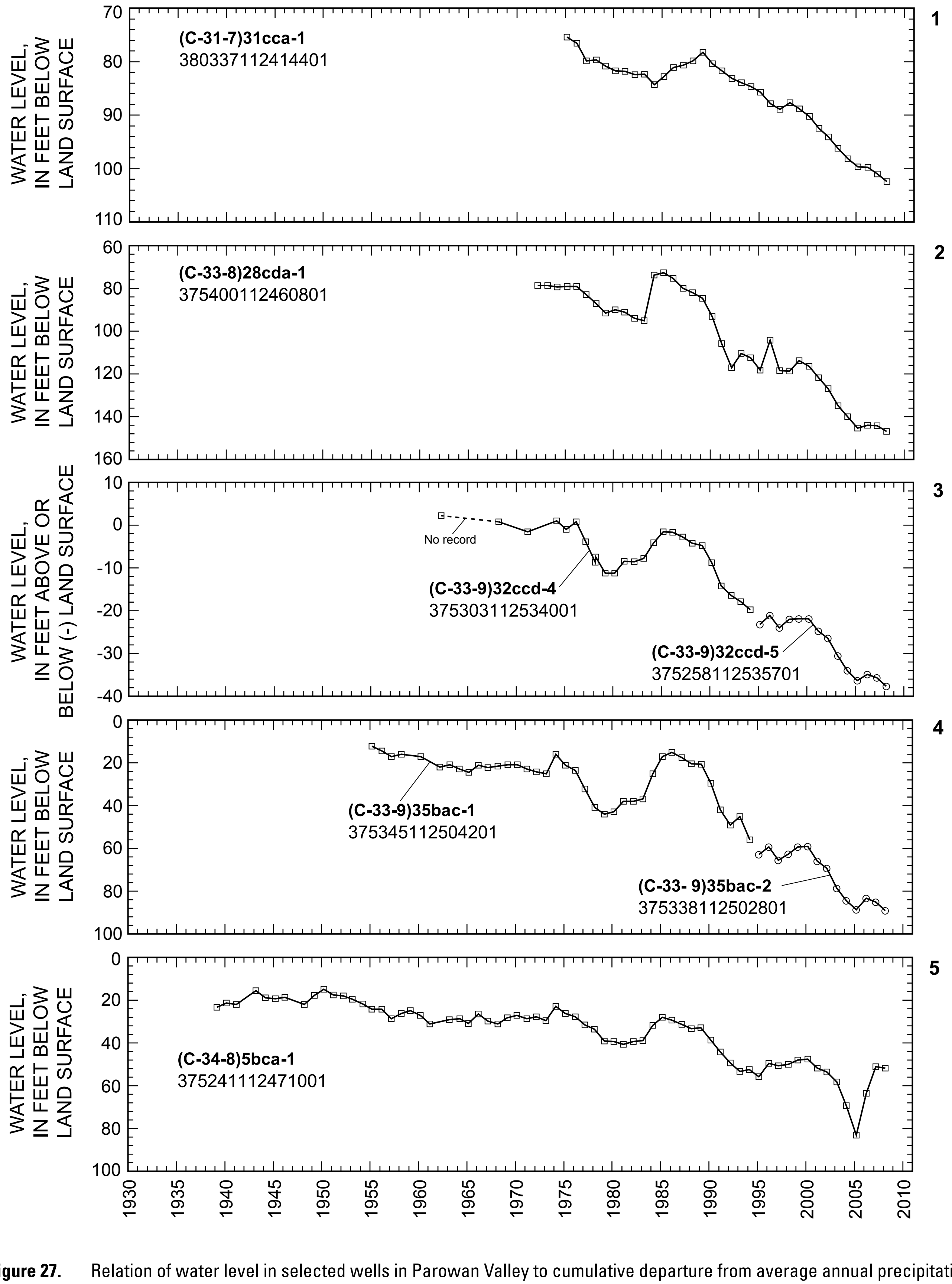


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.

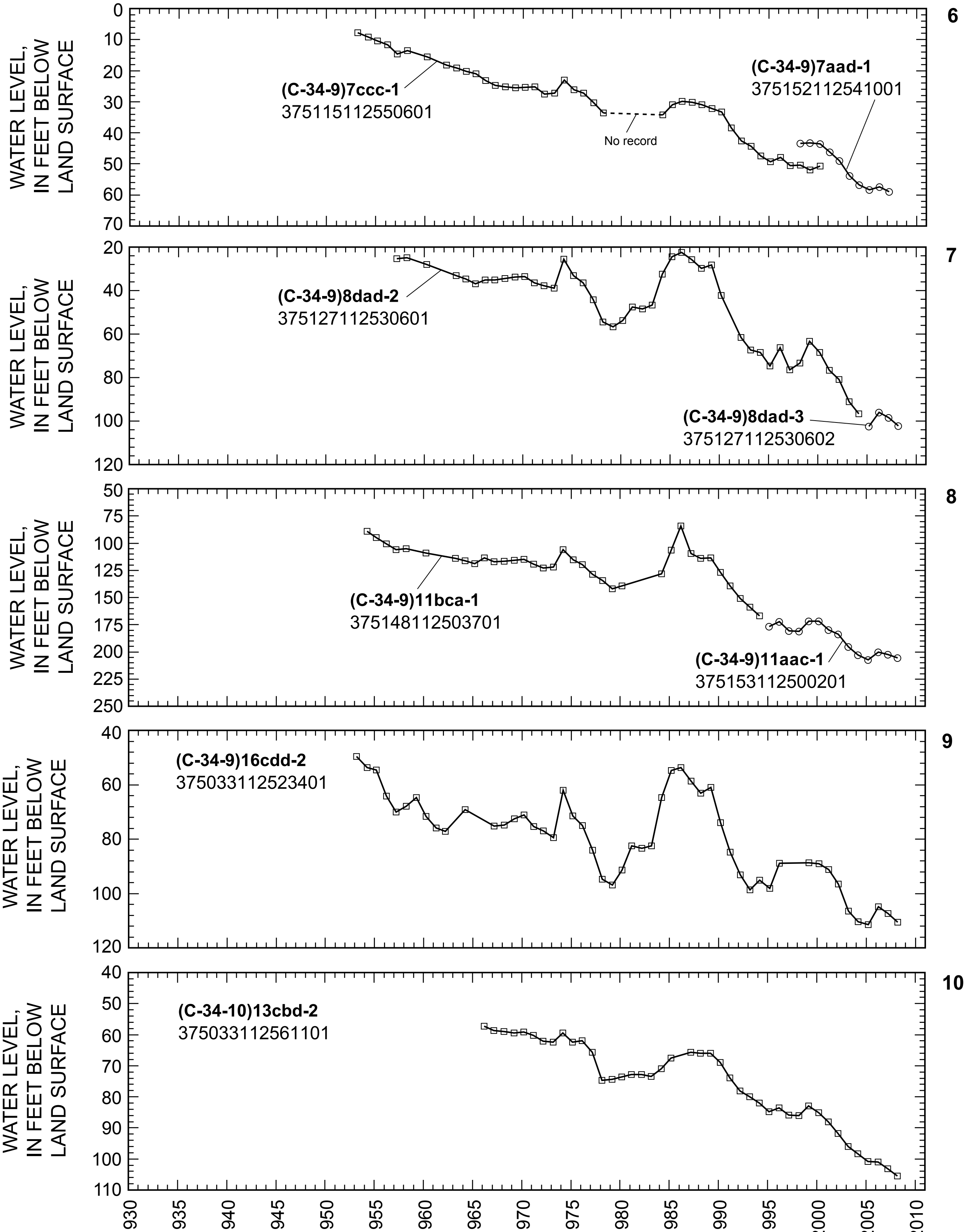


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

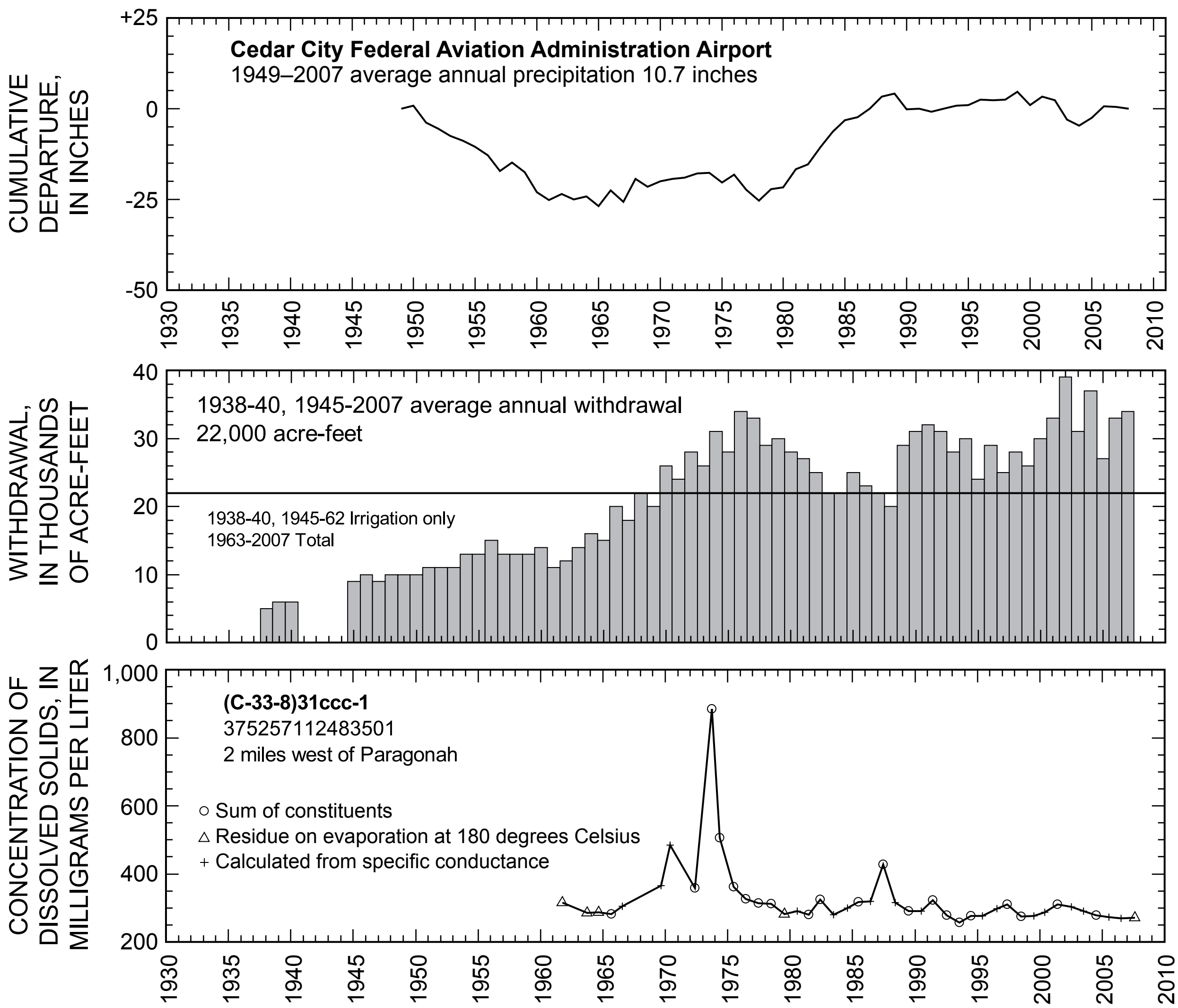


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1—Continued.

ESCALANTE VALLEY

Milford Area

By B.A. Slaugh

The Milford area is in southwestern Utah in parts of Millard, Beaver, and Iron Counties, between about Townships 24 South and 31 South and Ranges 9 West and 14 West (fig. 28).

Total estimated withdrawal of water from wells in the Milford area of Escalante Valley in 2007 was about 49,000 acre-feet, which is 4,000 acre-feet more than was reported for 2006 and 3,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). The increase in withdrawals was mostly the result of increased irrigation and decreased availability of surface water.

The location of 31 wells in the Milford area in which the water level was measured during March 2008 is shown in figure 28. The relation of the water level in selected observation wells to cumulative departure from the average annual precipitation at Black Rock, annual discharge of the Beaver River at Rocky Ford Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)18daa-1 is shown in figure 29.

Water levels generally declined slightly from March 2007 to March 2008 in the Milford area. The amount of water-level rise or decline depends largely on ground-water withdrawals, the amount and timing of precipitation, and discharge from the Beaver River. Since the early1950s water levels generally have declined in the south-central Milford area in response to the long-term effects of ground-water withdrawals. Water-level rises during 1983–85 resulted from greater-than-average precipitation during 1982–85 and increased recharge from record flow in the Beaver River during 1983–84.

Precipitation at Black Rock in 2007 was about 5.8 inches, about 5.0 inches less than in 2006 and about 3.1 inches less than the 1952–2007 average annual precipitation. The gaging station on the Beaver River at Rocky Ford Dam was discontinued in 2003. The Natural Resources Conservation Service reports in the "Utah Water Supply Outlook Report" that storage capacity of Minersville Reservoir in 2007 was 4,400 acre-feet less than in 2006 (Natural Resources Conservation Service, written commun., 2008).

Physical properties and results of chemical analyses for water from four wells in the Milford area are listed in tables 4 and 5, and the location of the wells is shown in figure 39. Dissolved-solids concentrations in water from three wells ((C-28-10)28ccc-1, (C-28-11)12dbc-2, and (C-29-10)5cdd-2) and the dissolved-sulfate concentration in water from one well ((C-28-10)28ccc-1) exceeded the secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The concentration of dissolved chloride in water from well (C-28-11)12dbc-2 also exceeded the secondary standard for this constituent (250 mg/L). The concentration of dissolved nitrite plus nitrate in water from well (C-28-11)12dbc-2 (40.3 mg/L) exceeded the MCL for this constituent (10 mg/L) and was the highest value determined during this study.

The concentration of dissolved solids in water from well (C-29-10)18daa-1, located 7 miles south of Milford, from 1959 to 2005, is shown in figure 29. This irrigation well was not sampled in 2006 and 2007 because it was not pumping at the time of sampling. Concentrations range from 202 to 613 mg/L, with a median value of 296 mg/L.

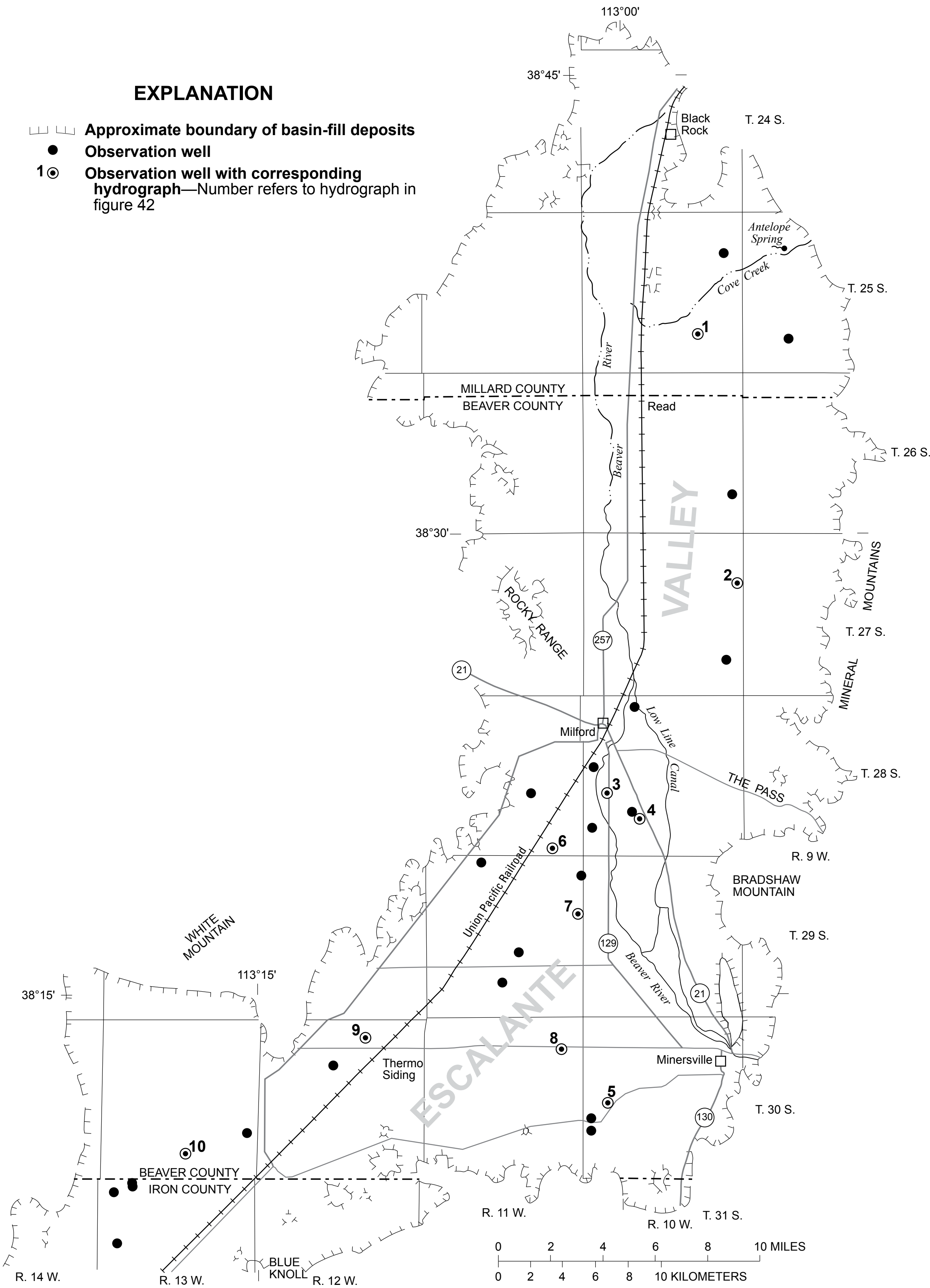


Figure 28. Location of wells in the Milford area in which the water level was measured during March 2008.

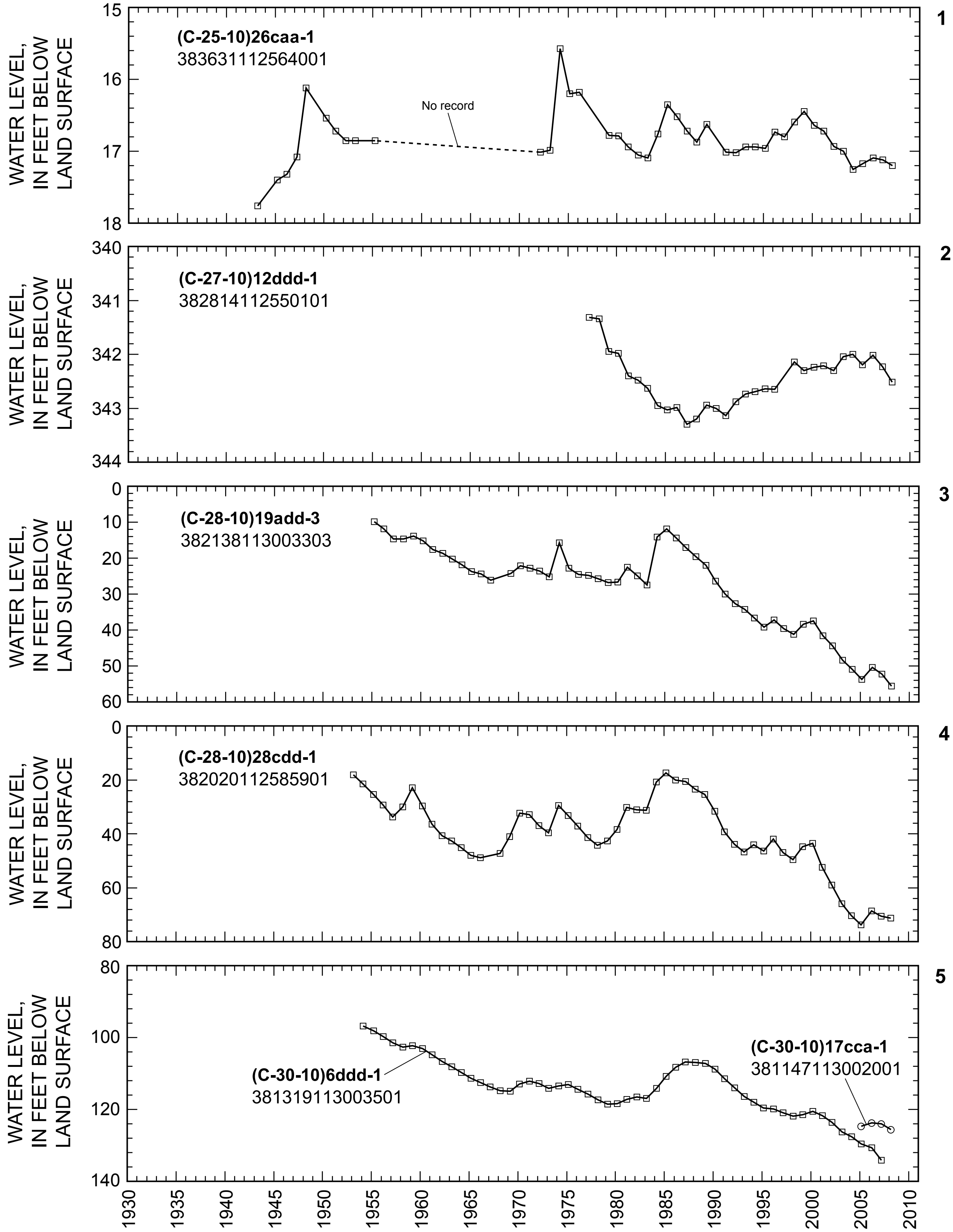


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)18daa-1.

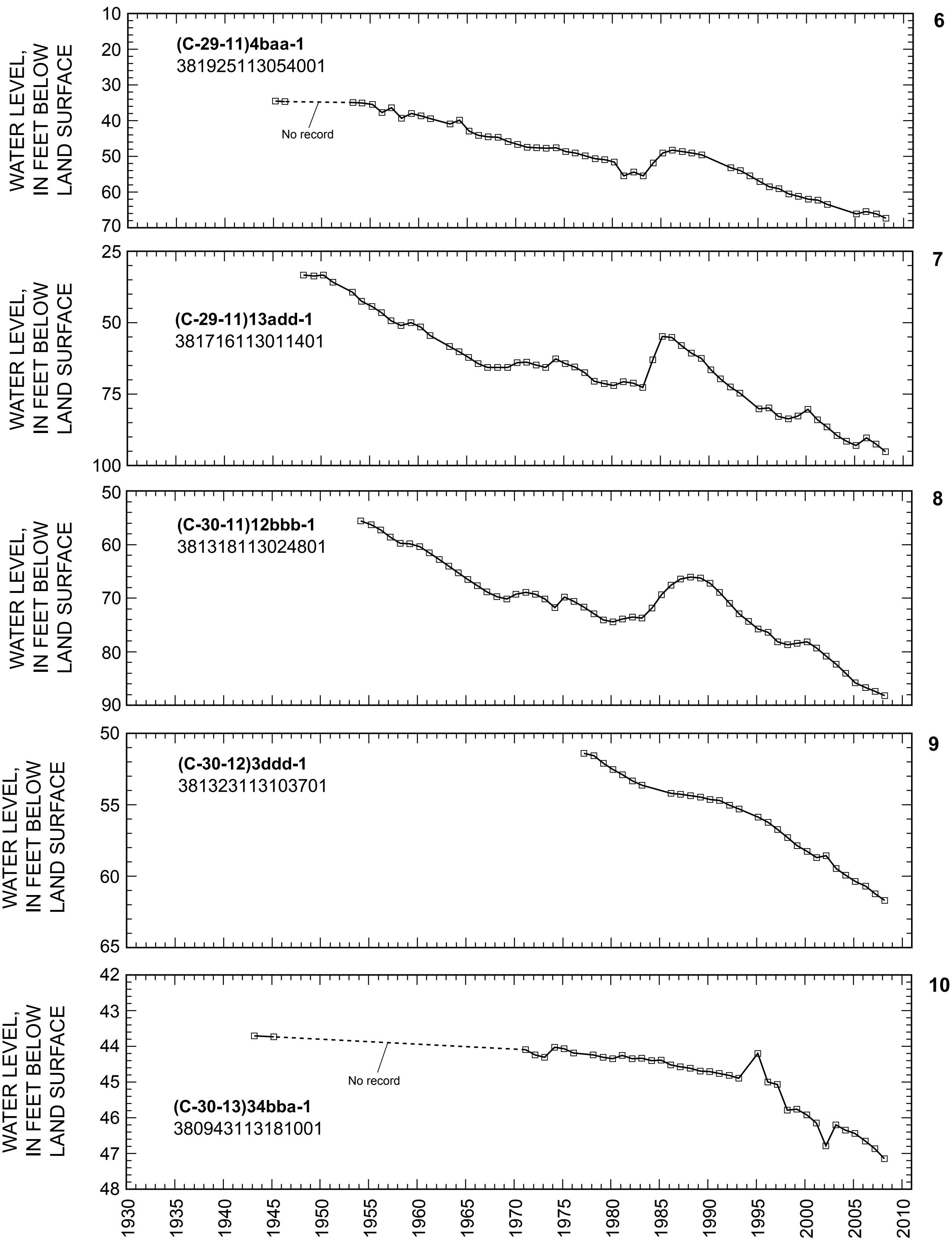


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)18daa-1—Continued.

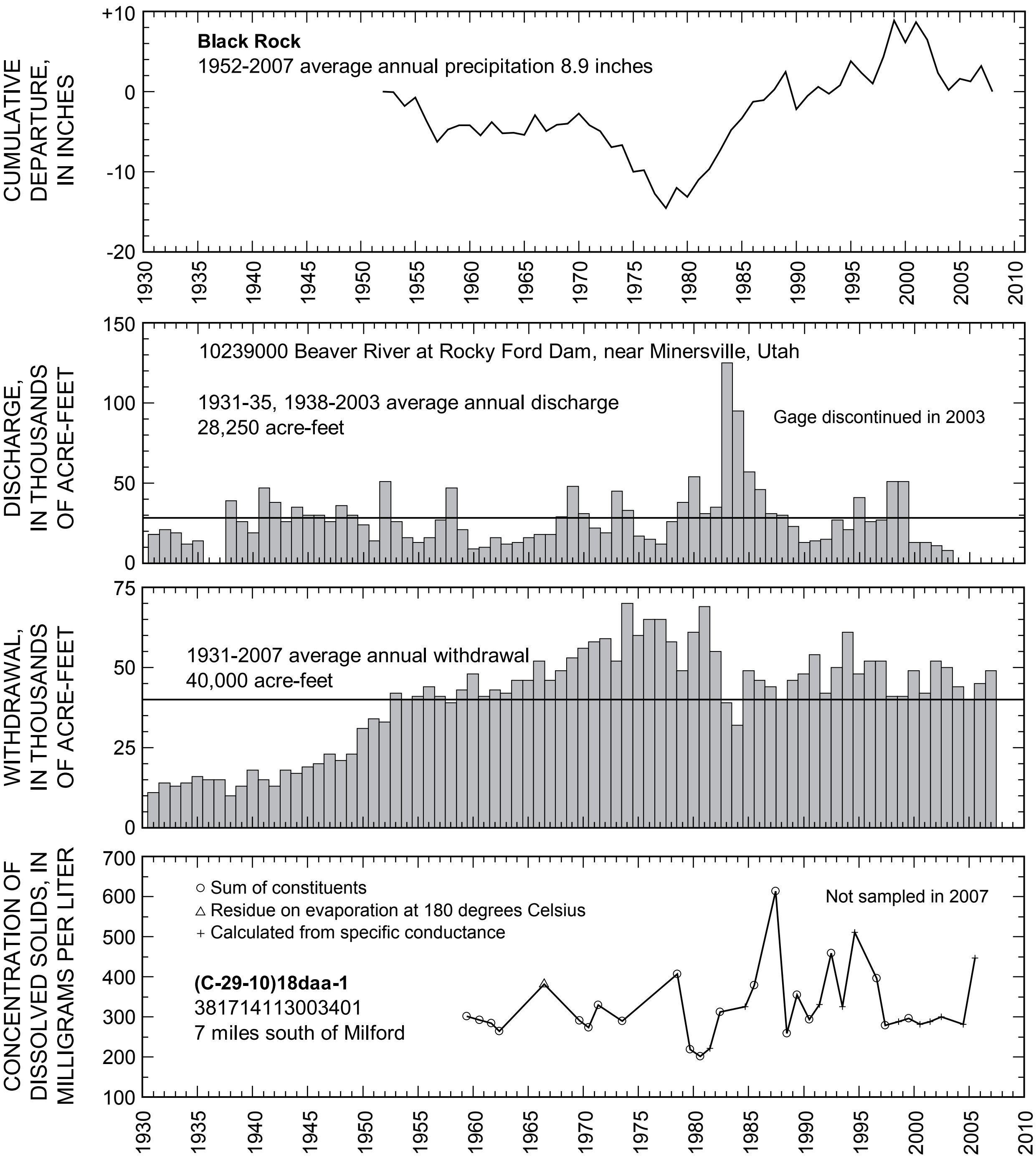


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)18daa-1—Continued.

ESCALANTE VALLEY

Beryl-Enterprise Area

By H.K. Christiansen

The Beryl-Enterprise area covers about 800 square miles at the southern end of Escalante Valley, in Iron and part of Washington County, between about Townships 31 South and 37 South and Ranges 12 West and 18 West (fig. 30).

Total estimated withdrawal of water from wells in the Beryl-Enterprise area in 2007 was about 92,000 acre-feet, which is 13,000 acre-feet more than in 2006 and 8,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). The increase was mostly the result of increased withdrawals for irrigation.

The location of wells in the Beryl-Enterprise area in which the water level was measured during March 2008 is shown in figure 30. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2 is shown in figure 31.

Water levels in the Beryl-Enterprise area declined from March 2007 to March 2008. Water levels have declined steadily since 1950 and show little or no recovery during periods of greater-than-average precipitation. The declines are a result of continued large withdrawals for irrigation since 1950. A decline of about 121 feet from March 1948 to March 2008 is shown in well (C-36-16)29daa-1 (fig. 31), about 5 miles northeast of Enterprise.

Precipitation at Enterprise in 2007 was about 13.0 inches, which is about 1.0 inch less than the average annual precipitation for 1960–2007 and about 0.3 inch more than in 2006.

Physical properties and results of chemical analyses for water from four wells in the Beryl-Enterprise area are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from two wells ((C-34-16)28dcc-2 and (C-36-15)4bad-3) exceeded the secondary standard for this constituent (500 mg/L). The dissolved-arsenic concentration (21.9 μg/L) in water from well (C-36-15)4bad-3 exceeded the MCL for this constituent (10 μg/L).

The concentration of dissolved solids in water from well (C-34-16)28dcc-2, located 6 miles south-southeast of Beryl, from 1950 to 2007, is shown in figure 31. Concentrations range from 460 to 761 mg/L, with a median value of 647 mg/L. From 1967 to 1976, dissolved-solids concentrations have increased.

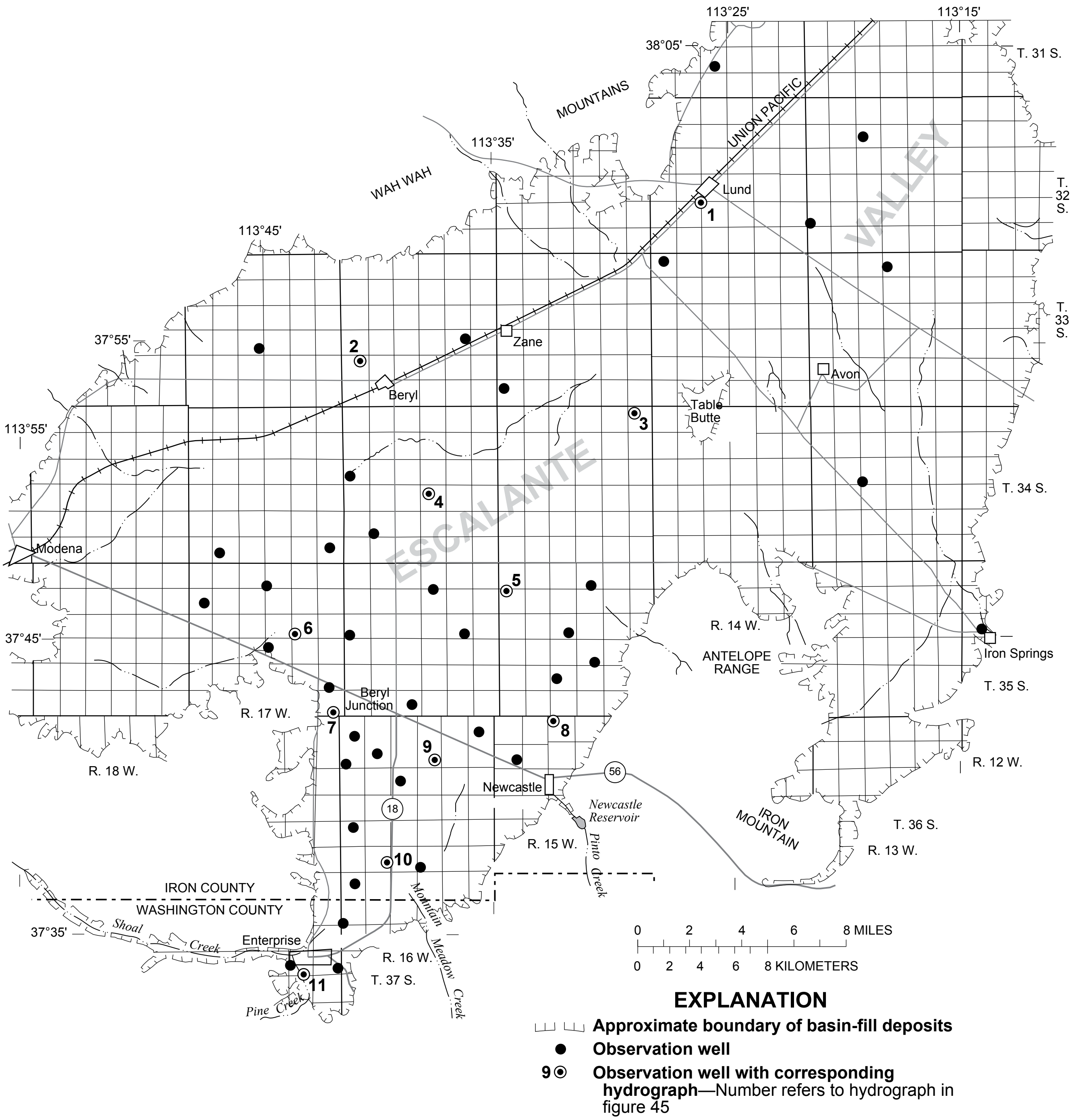


Figure 30. Location of wells in the Beryl-Enterprise area in which the water level was measured during March 2008.

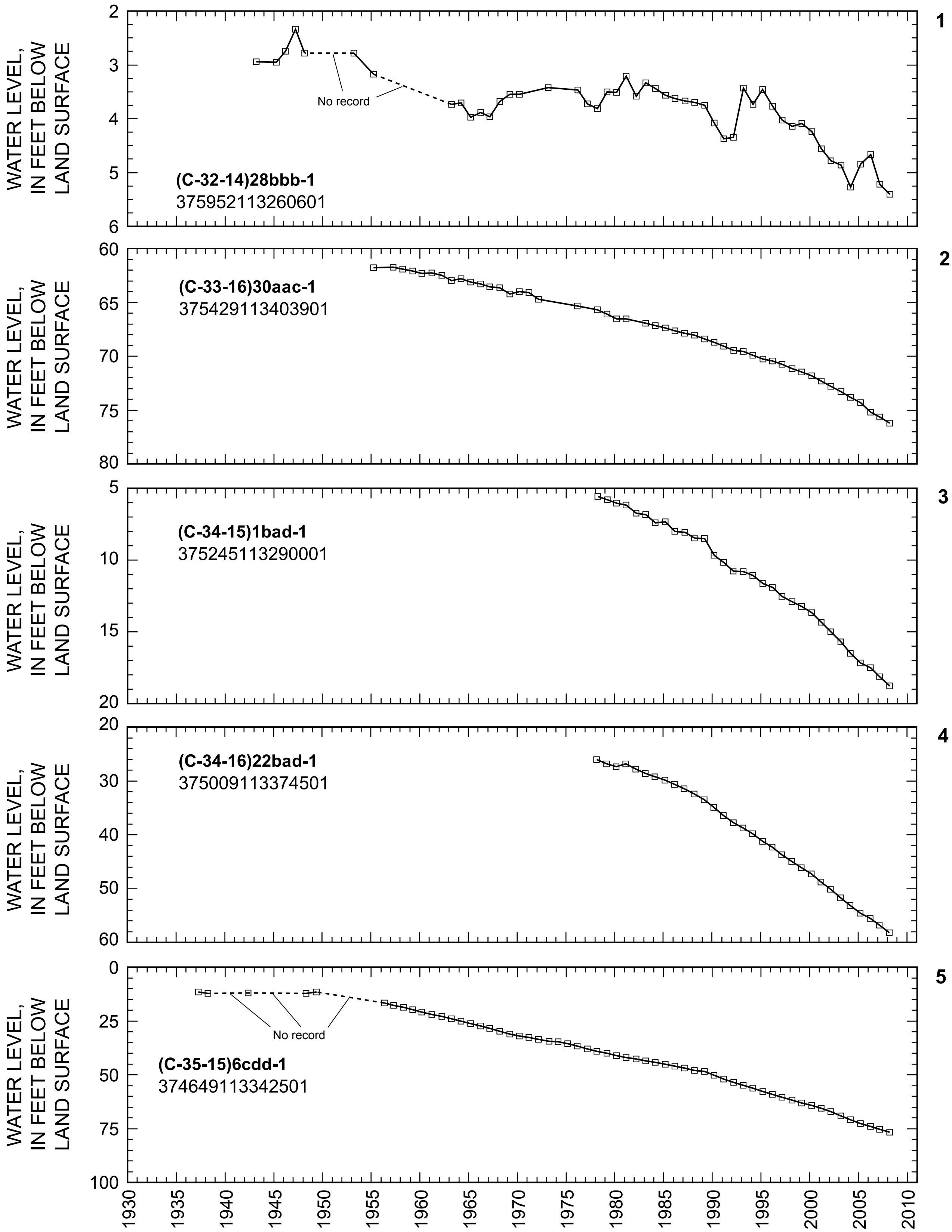


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2.

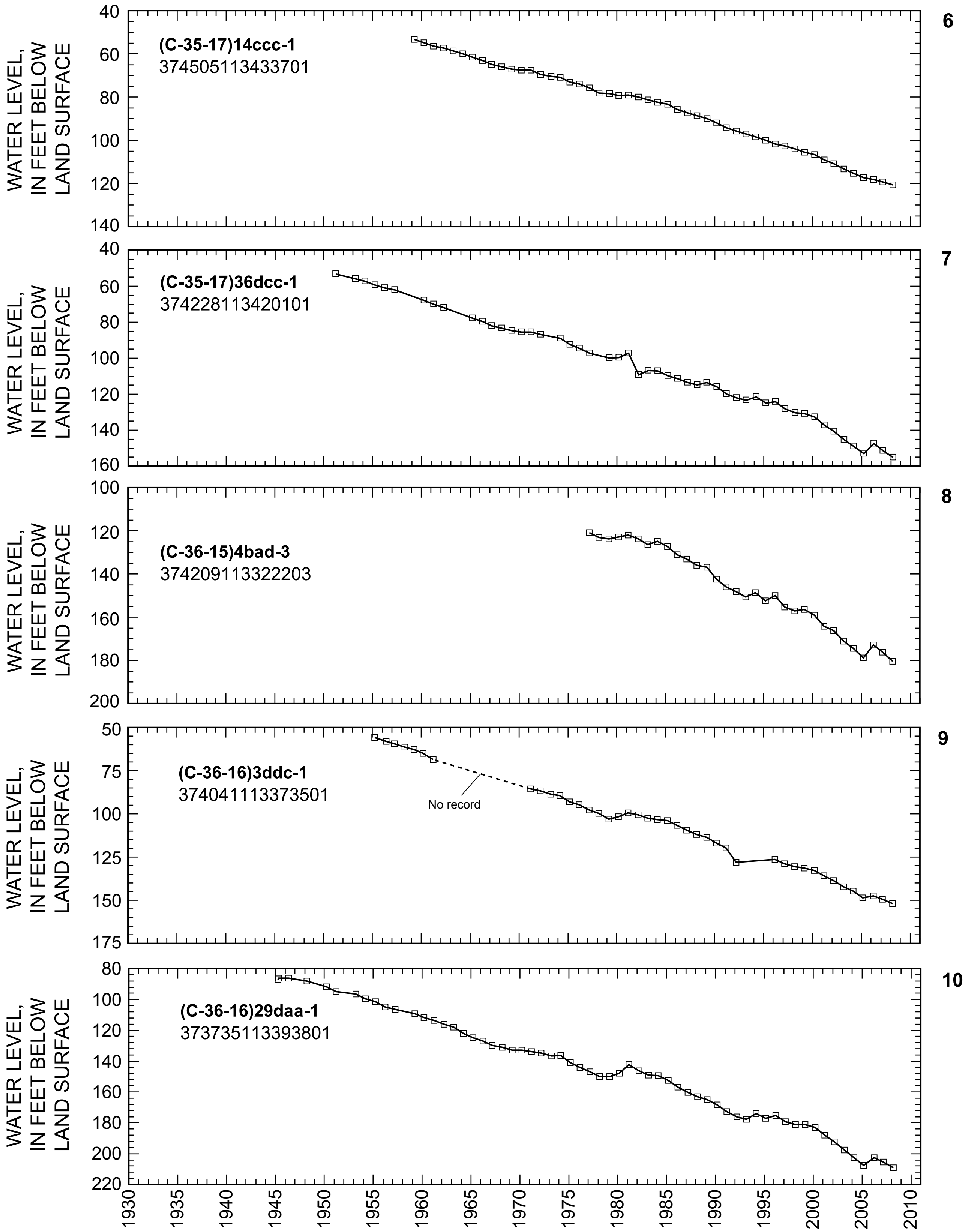


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2—Continued.

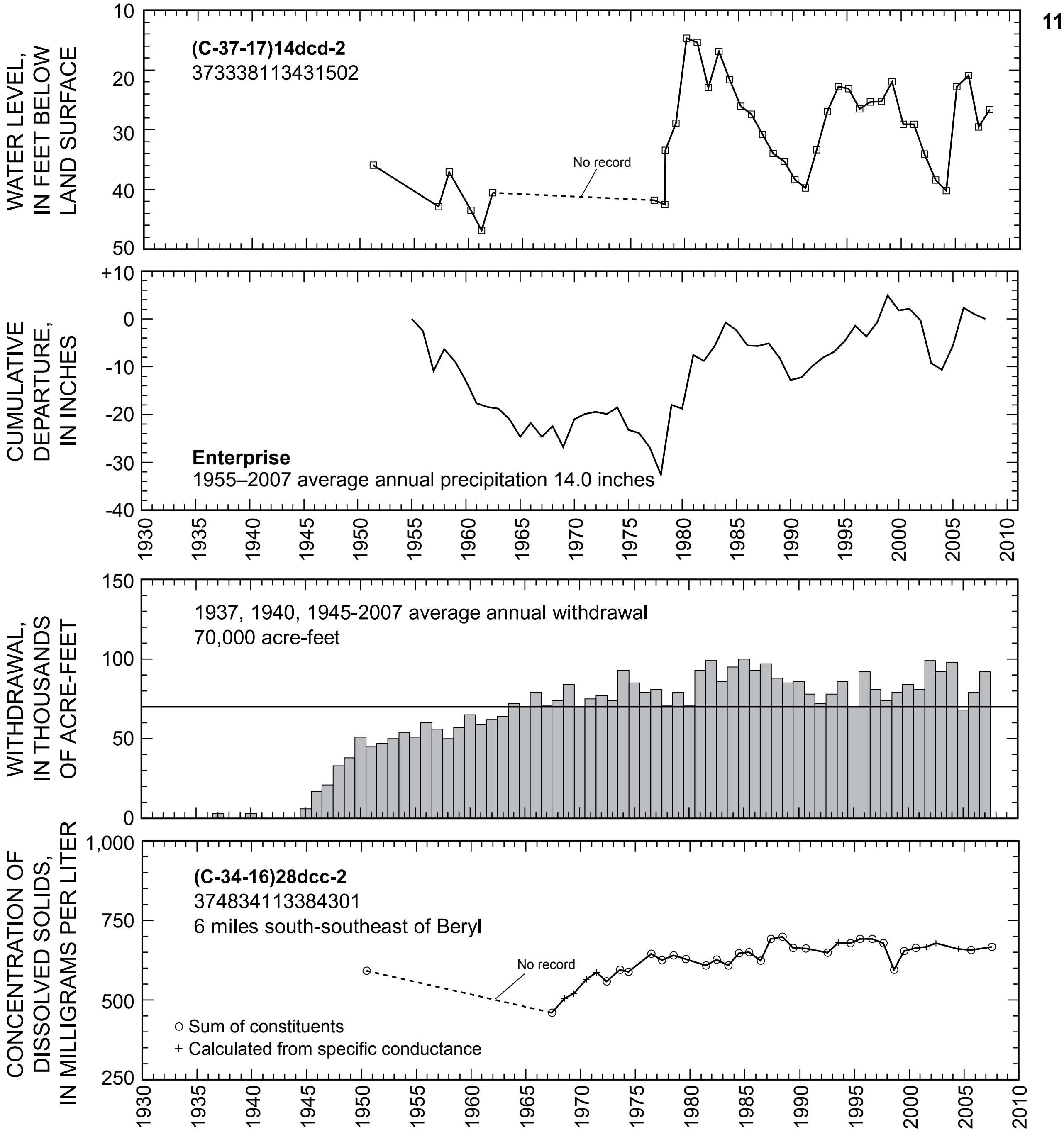


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-2 —Continued.

CENTRAL VIRGIN RIVER AREA

By H.K. Christiansen

The central Virgin River area is between the southern end of the Pine Valley Mountains and the Hurricane Cliffs to the east and the Beaver Dam Mountains to the southwest, in Washington County (fig. 32). Major ground-water development includes water from valley-fill aquifers that is used primarily for irrigation, and water from consolidated rock and valley fill that is used primarily for public supply. Most of the wells measured are near the Virgin and Santa Clara Rivers.

Total estimated withdrawal of water from wells in the central Virgin River area in 2007 was about 33,000 acre-feet, which is about 1,000 acre-feet more than in 2006 and 8,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). Withdrawal for irrigation increased by about 1,200 acre-feet from 2006 to 2007. Withdrawals for public supply and domestic and stock use were about the same as in 2006.

The location of wells in the central Virgin River area in which the water level was measured during February 2008 is shown in figure 32. The relation of the water level in selected observation wells to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2 is shown in figure 33.

Water levels from February 2007 to February 2008 in the central Virgin River area show little change in the Santa Clara River drainage, the Fort Pearce Wash area, and most of the Virgin River drainage.

Discharge of the Virgin River at Virgin in 2007 was about 77,400 acre-feet, which is 41,000 acre-feet less than the value of 118,400 acre-feet for 2006 and about 56,300 acre-feet less than the long-term average for 1931–70 and 1979–2007. Precipitation at St. George in 2007 was about 8.8 inches, which is about 0.6 inch more than the average annual precipitation for 1930–2007 and 0.4 inch less than in 2006.

Physical properties and results of chemical analyses for water from three wells in the central Virgin River area are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved solids and sulfate in water from two wells ((C-42-14)11aba-1 and (C-42-16)26bcc-1) exceeded secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The dissolved-solids and dissolved-sulfate concentrations in water from well (C-42-16)26bcc-1 also exceeded MCLs for these constituents (2,000 mg/L and 1,000 mg/L, respectively). The concentration of dissolved manganese in water from well (C-42-16)26bcc-1 also exceeded the secondary standard for this constituent (50 μg/L). The concentrations of several dissolved constituents including calcium (501 mg/L), sulfate (2,060 mg/L), manganese (1,090 μg/L), and uranium (65.4 μg/L), in water from well (C-42-16)26bcc-1 were the maximum concentrations determined during this study. Finally, the concentration of dissolved arsenic (31.1 μg/L) in water from well (C-41-17)8cbd-2 exceeded the MCL for this constituent (10 μg/L).

The concentration of dissolved solids in water from well (C-41-17)8cbd-1 and well (C-41-17)8cbd-2, located 1.5 miles south of Gunlock Reservoir, from 1966 to 2007, is shown in figure 33. These wells are located near each other and are finished in the same aquifer. The dissolved-solids concentrations in water from both wells were combined to give an extended temporal record for this constituent. Concentrations range from 255 to 313 mg/L, with a median value of 290 mg/L.

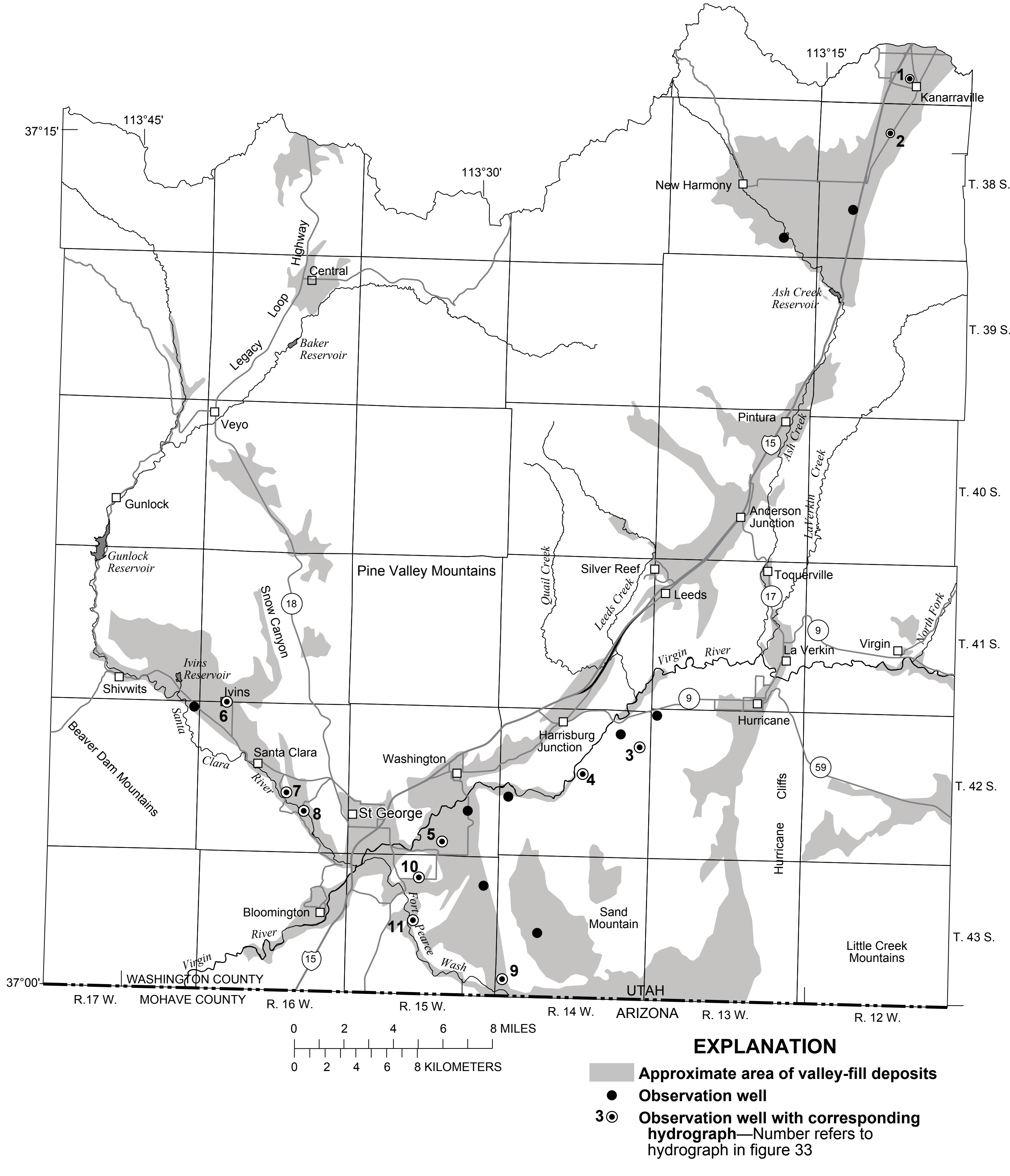


Figure 32. Location of wells in the central Virgin River area in which the water level was measured during February 2008.

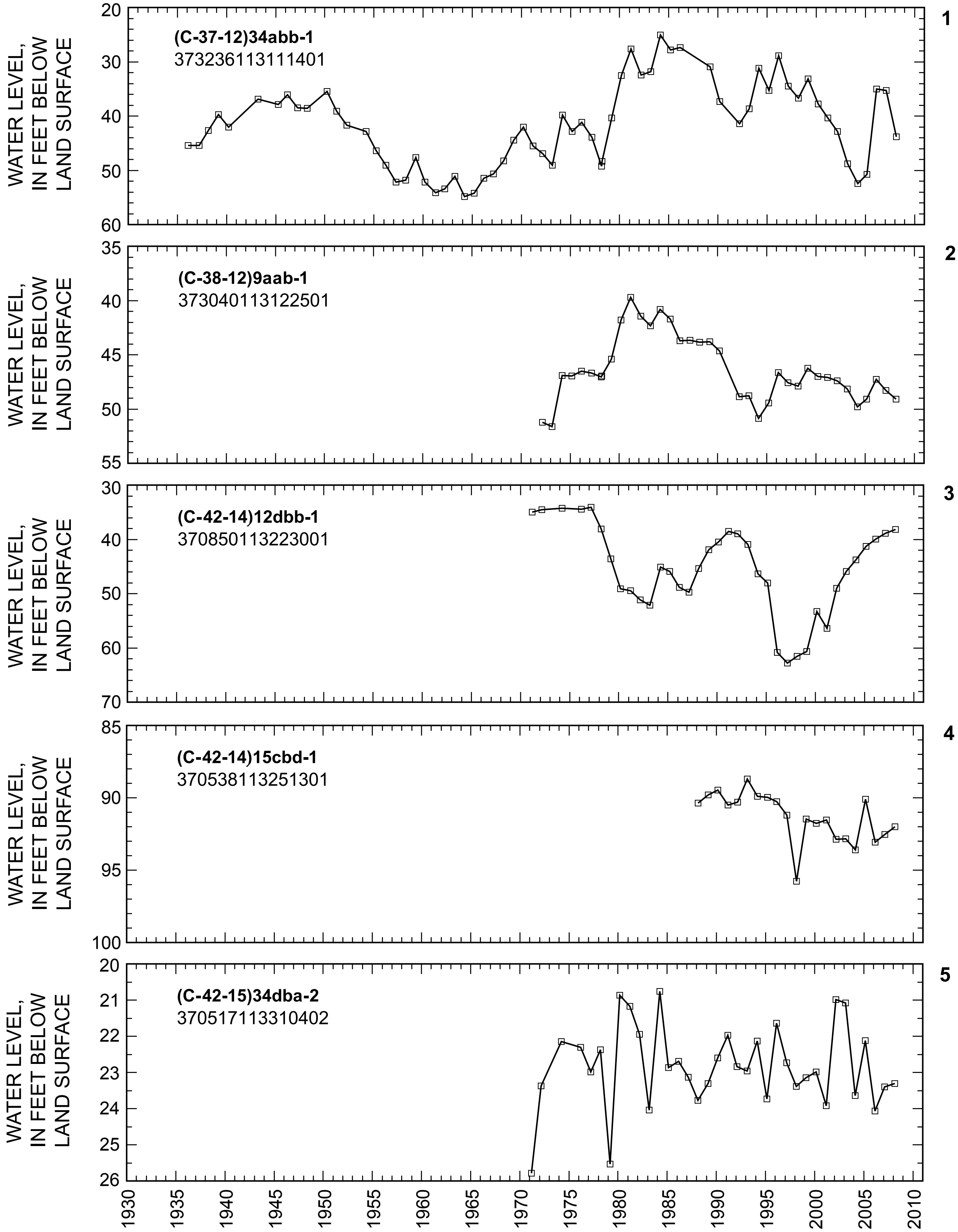


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2.

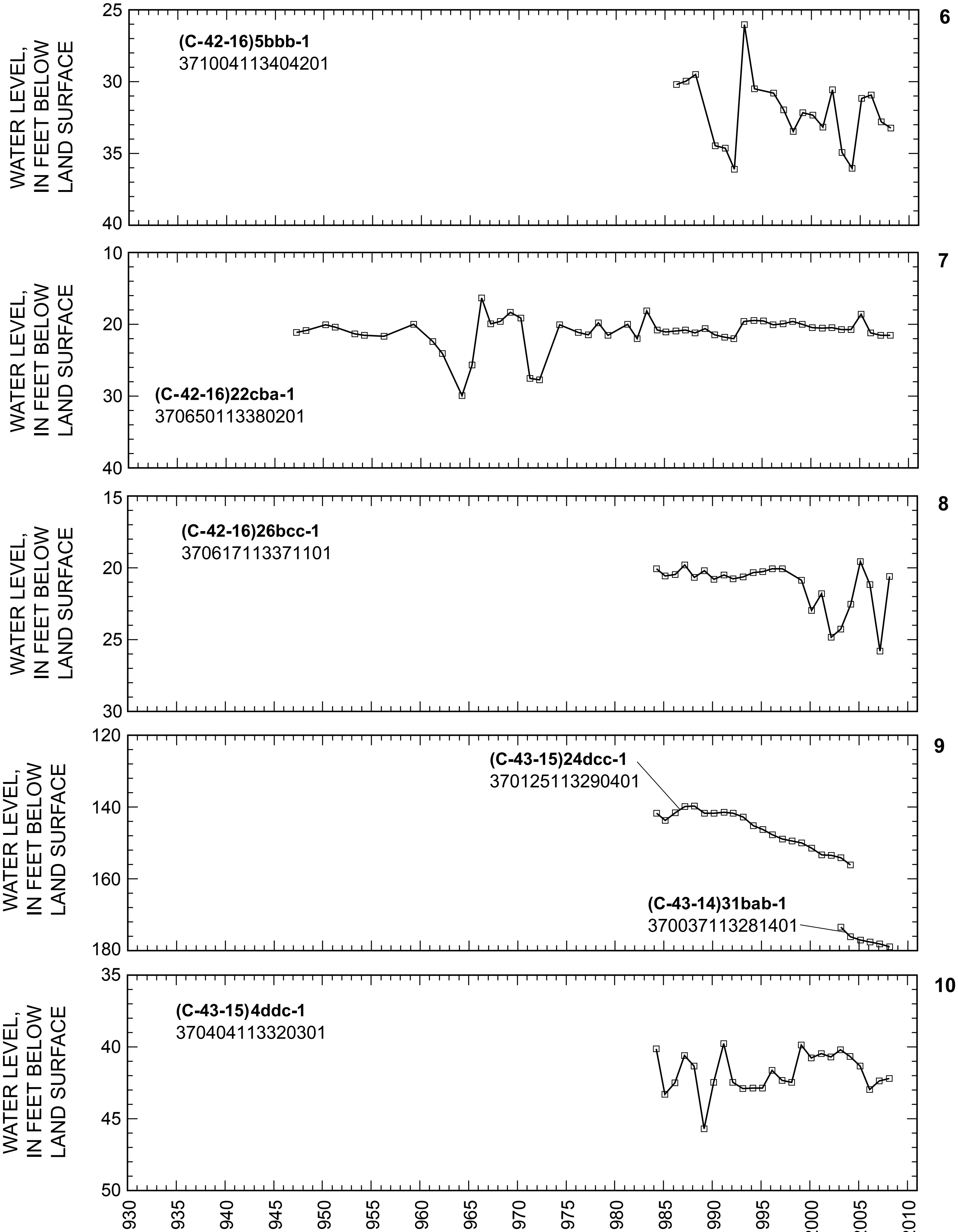


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2—Continued.

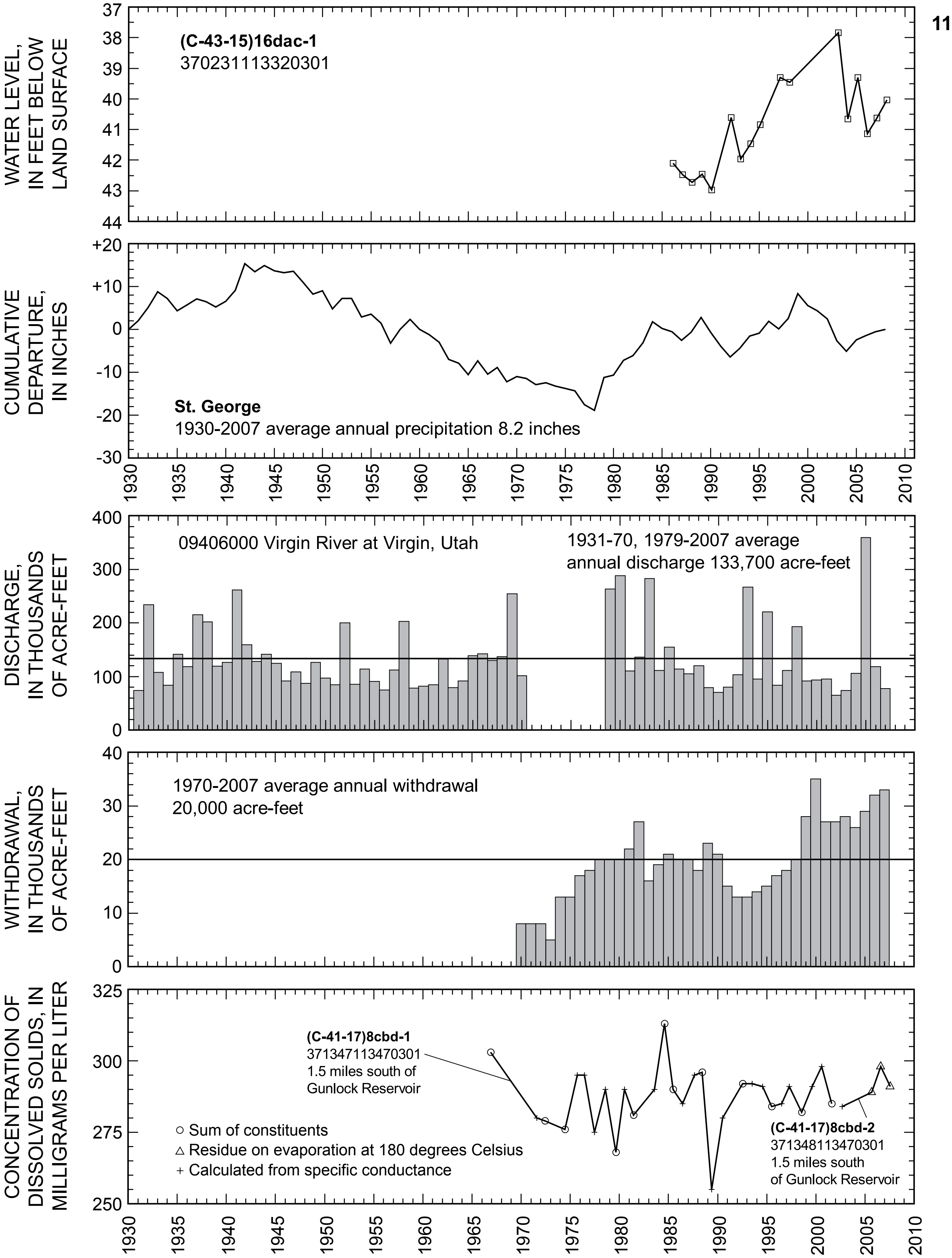


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2—Continued.

OTHER AREAS

By M.J. Fisher

Total estimated withdrawal of water from wells in the areas of Utah listed below in 2007 was about 155,000 acre-feet, which is 25,000 acre-feet more than the estimate for 2006 and 36,000 acre-feet more than the average annual withdrawal for 1997–2006 (tables 2 and 3). The largest increases were due to increased withdrawals for irrigation and public supply use. In most of the areas listed below, withdrawals in 2007 were more than in 2006, except in Park Valley, where withdrawals decreased slightly due to reduced irrigation.

The location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2008 is shown in figure 34. The relation of the water level in observation wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield is shown in figure 35.

Water levels in selected wells in Cedar Valley generally rose during the 1970s. Water levels rose sharply from the early to mid-1980s as a result of greater-than-average precipitation, but generally have declined since the mid-1980s. Water levels declined slightly in most of the wells from March 2007 to March 2008.

The location of wells in Sanpete Valley in which the water level was measured during March 2008 is shown in figure 36. The relation of the water level in selected observation wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti is shown in figure 37.

Water levels in many of the selected wells in Sanpete County rose from the late-1970s to the mid-1980s as a result of greater-than-average precipitation and have varied since the mid-1980s, but overall have declined. Water levels declined in most of the wells from March 2007 to March 2008.

The relation of the water level in wells in the remaining selected areas of Utah (see accompanying table) to cumulative departure from average annual precipitation at sites in or near those areas is shown in figure 38. Water levels rose or decreased only slightly in most of the selected observation wells from March 2007 to March 2008. The greatest rise observed was 5.55 feet in a well in Spanish Valley (fig. 1, table 1). The greatest decline observed was 12.08 feet in a well in Snake Valley.

Water Quality

Physical properties and results of chemical analyses for water from well (C-29-8)31add-1 in Beaver Valley, Beaver County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. The dissolved-solids concentration in water from this well exceeded the secondary drinking-water standard for this constituent (500 mg/L).

Physical properties and results of chemical analyses for water from well (B-13-6)1dbb-1 in Blue Creek Valley, Box Elder County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. The concentration of dissolved solids in water from this well exceeded the secondary drinking-water standard for this constituent (500 mg/L). Analytical results for the remaining constituents did not exceed MCLs or secondary standards for nutrients and selected trace elements.

Physical properties and results of chemical analyses for water from well (B-11-18)33ada-1 in Grouse Creek Valley, Box Elder County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. The dissolved-solids concentration in water from this well exceeded the secondary standard for this constituent (500 mg/L).

Physical properties and results of chemical analyses for water from two wells in the lower Bear River area, Box Elder County, are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids and

Number in figure 1	Area	Estimated withdrawal (acre-feet)					
		2007					2006 total (rounded)
		Irrigation	Industrial	Public supply	Domestic and stock	2007 total (rounded)	
1	Grouse Creek Valley	1,900	0	0	20	1,900	1,200
2	Park Valley	2,800	0	0	10	2,800	2,900
4	Malad-lower Bear River Valley	4,900	470	5,600	200	11,200	9,200
8	Ogden Valley	0	0	11,700	20	11,700	11,200
13	Rush Valley	5,900	250	340	30	6,500	6,100
14	Dugway area, Skull Valley, and Old River Bed	3,200	900	4,100	10	8,200	7,500
15	Cedar Valley, Utah County	4,300	0	5,400	40	9,700	5,900
20	Sanpete Valley	8,100	830	550	4,000	13,500	8,800
25	Snake Valley	19,700	0	70	50	19,800	15,500
27	Beaver Valley	12,600	20	730	460	13,800	10,100
	Remainder of State	13,200	19,000	21,100	2,500	55,800	51,200
Total (rounded)		76,600	21,500	49,600	7,300	155,000	130,000

dissolved-chloride concentrations in water from both wells ((B-12-4)27dbd-1 and (B-12-4)34cca-1) exceeded secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The dissolved-selenium concentration in water from well (B-12-4)27dbd-1 (230 µg/L) was the maximum value determined during this study.

Physical properties and results of chemical analyses for water from three wells in the Altamont-Bluebell area, Duchesne County, are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from two wells, U(C-1-1)33bcc-1 and U(C-2-1)7bbd-1, exceeded the secondary standard for this constituent (500 mg/L). Concentrations of dissolved sulfate, iron, and manganese in water from well U(C-1-1)33bcc-1 also exceeded the secondary standards for these constituents (250 mg/L, 0.3 mg/L, and 0.05 mg/L, respectively), and the concentration of dissolved fluoride in water from well U(C-2-1)7bbd-1 exceeded the secondary standard for this constituent (2.0 mg/L).

Physical properties and results of chemical analyses for water from four wells in the Starvation-Duchesne area, Duchesne County, are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The dissolved-solids concentration in water from well U(C-1-4)31bbb-1 exceeded the secondary standard for this constituent. The pH measured in water from well U(C-2-5)34abb-2 (9.0 standard units) exceeded the secondary standard for this parameter and was the maximum value measured during this study.

Physical properties and results of chemical analyses for water from two wells in the Kanab area, Kane County, are listed in tables 4 and 5, and the location of the wells is shown in figure 39. The concentration of dissolved sulfate and dissolved solids in water from well R(C-40-4)31bad-1 exceeded the secondary standards for these constituents (250 mg/L and 500 mg/L, respectively).

Physical properties and results of chemical analyses for water from five wells in Snake Valley, Millard County, are listed in tables 4 and 5, and the location of the wells is shown in figure 39. Water from well (C-23-19)20bac-2 had a dissolved-solids concentration that exceeded the corresponding secondary standard (500 mg/L) and a dissolved-arsenic concentration (20.1 µg/L) that exceeded the corresponding MCL (10 µg/L). In addition, the concentration of dissolved molybdenum in water from this well (16.2 µg/L) was the maximum concentration determined during this study.

Physical properties and results of chemical analyses for water from well (D-40-23)27baa-1 in the Bluff area, San Juan County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. The dissolved-solids, -chloride, and -iron concentrations in water from this well exceeded the secondary standards for these constituents (500 mg/L, 250 mg/L, and 0.3 mg/L, respectively), and the concentration of dissolved arsenic (25.1 µg/L) exceeded the MCL (10 µg/L) for this constituent.

Physical properties and results of chemical analyses for water from four wells in Sanpete Valley, Sanpete County, are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. Analytical results for the water samples collected from these wells did not exceed secondary standards or MCLs for major ions, nutrients, and selected trace elements.

Physical properties and results of chemical analyses for water from well (C-26-1)23ddb-1 in the upper Sevier Valley, Sevier County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. Analytical results for the water sample collected from this well did not exceed secondary standards or MCLs for major ions, nutrients, and selected trace elements.

Physical properties and results of chemical analyses for water from two wells in Rush Valley, Tooele County, are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The concentration of dissolved solids and chloride in water from well (C-8-5)31ccd-5 exceeded secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The concentration of dissolved arsenic (14.8 µg/L) in water from well (C-8-5) 6ddb-1 exceeded the MCL for this constituent (10 µg/L).

Physical properties and results of chemical analyses for water from two wells in Skull Valley, Tooele County, are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The concentration of dissolved solids and chloride in water from both wells ((C-1-7)31daa-1 and (C-4-8)3bca-1) exceeded secondary standards for these constituents (500 mg/L and 250 mg/L, respectively). The concentration of dissolved solids and arsenic (14.6 µg/L) in water from well (C-1-7)31daa-1 also exceeded MCLs for these constituents (2,000 mg/L and 10 µg/L, respectively). Finally, the value for specific conductance (8,410 microsiemens per centimeter) and concentrations of dissolved potassium (61 mg/L), sodium (1,480 mg/L), chloride (2,520 mg/L), and dissolved solids (4,710 mg/L) in water from well (C-1-7)31daa-1 were the maximum values of these constituents determined during this study.

Physical properties and results of chemical analyses for water from well (C-6-2)29bdb-1 in Cedar Valley, Utah County, are listed in tables 4 and 5, and the location of the well is shown in figures 39 and 40. The pH measured in water from this well exceeded the secondary standard for this constituent (8.5 standard units).

Physical properties and results of chemical analyses for water from ten wells in Heber Valley, Wasatch County, are listed in tables 4 and 5, and the location of the wells is shown in figures 39 and 40. The concentration of dissolved sulfate in water from well (D-4-4)2bcd-1 and the concentration of dissolved iron in water from well (D-3-5)18cba-1 exceeded the secondary standards for these constituents (250 mg/L and 0.3 mg/L, respectively).

Physical properties and results of chemical analyses for water from well (D-27-3)19aaa-1 in upper Fremont Valley, Wayne County, are listed in tables 4 and 5, and the location of the well is shown in figure 39. The concentration of dissolved solids and sulfate in water from this well exceeded the secondary standards for these constituents (500 mg/L and 250 mg/L, respectively).

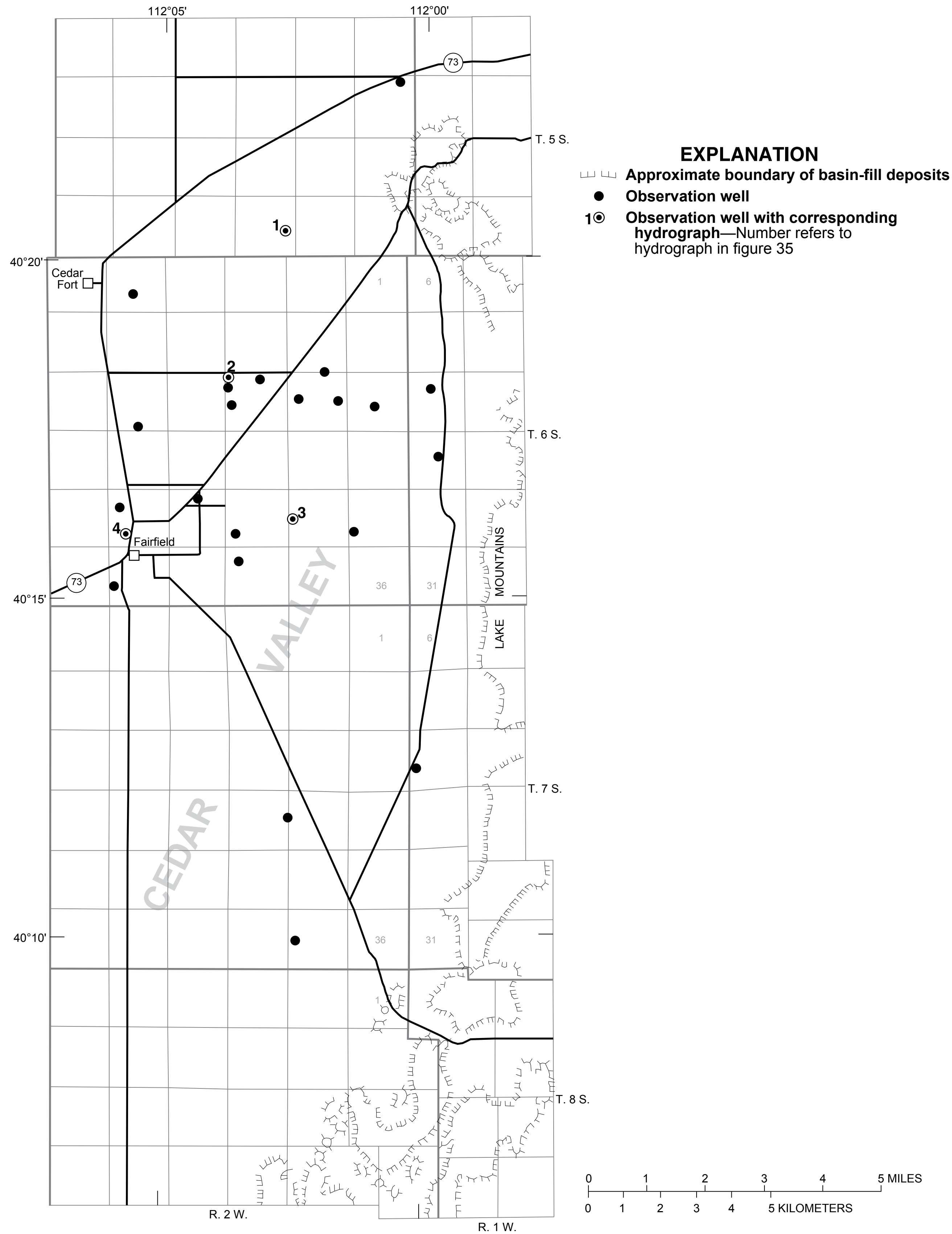


Figure 34. Location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2008.

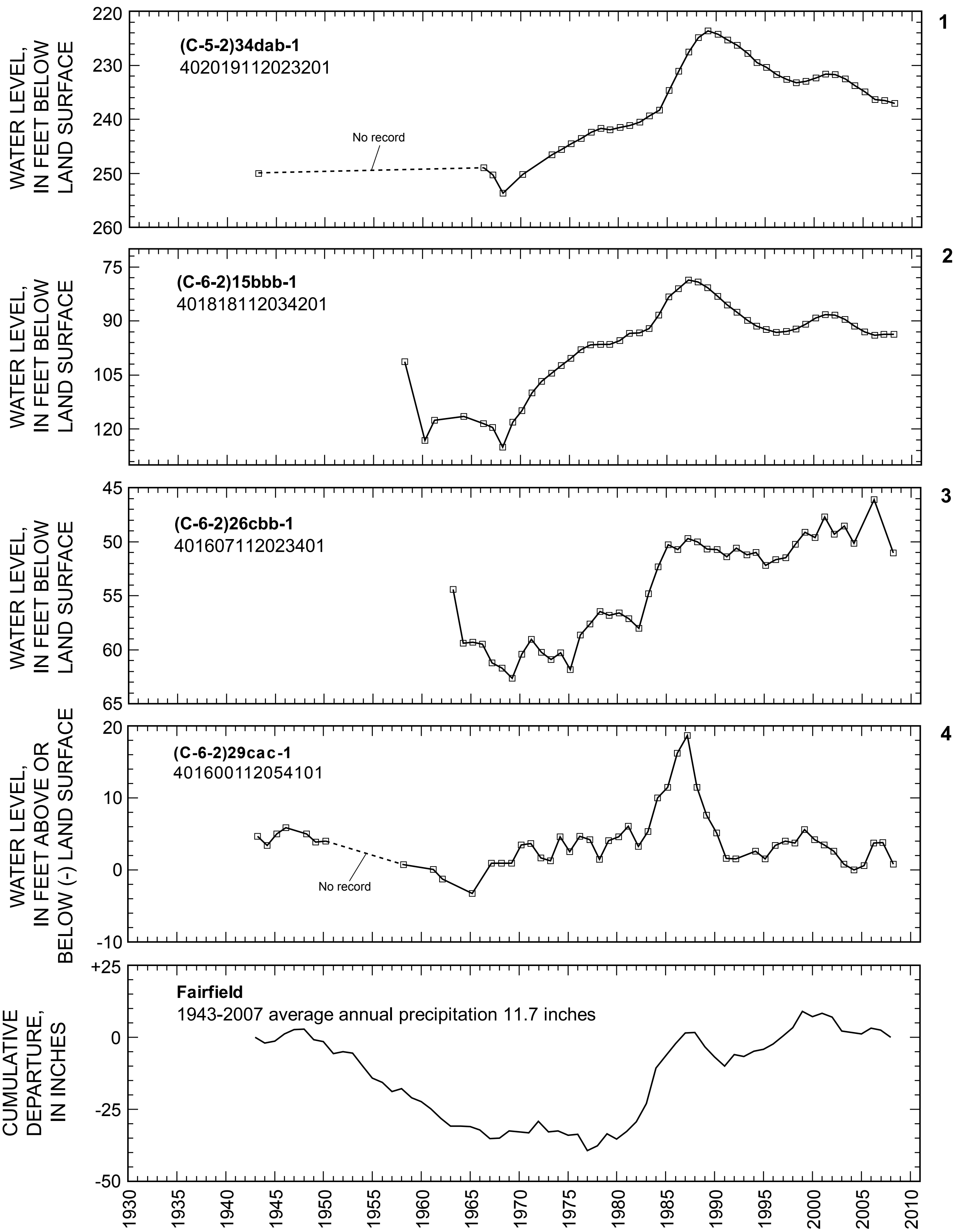


Figure 35. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Fairfield.

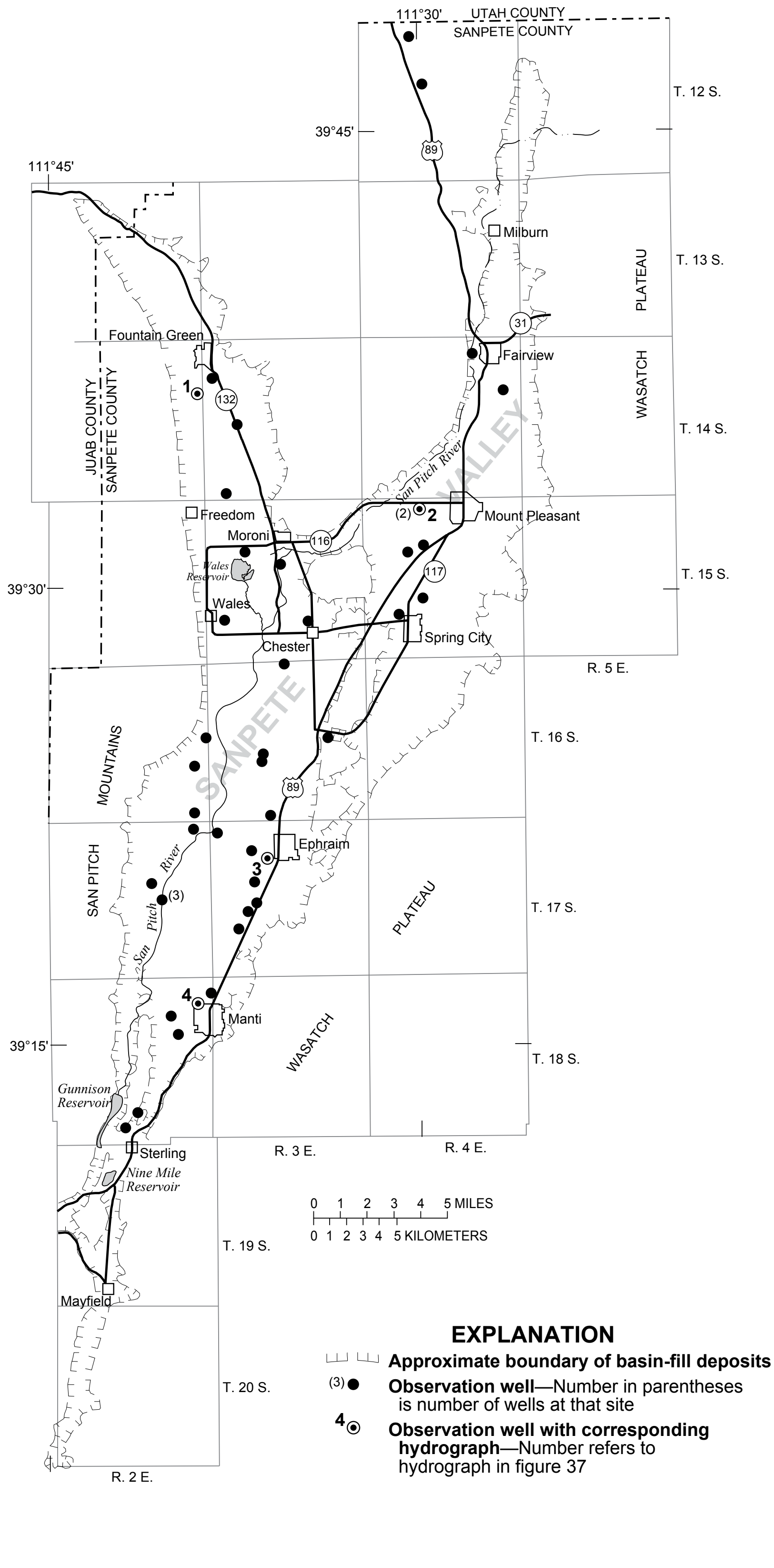


Figure 36. Location of wells in Sanpete Valley in which the water level was measured during March 2008.

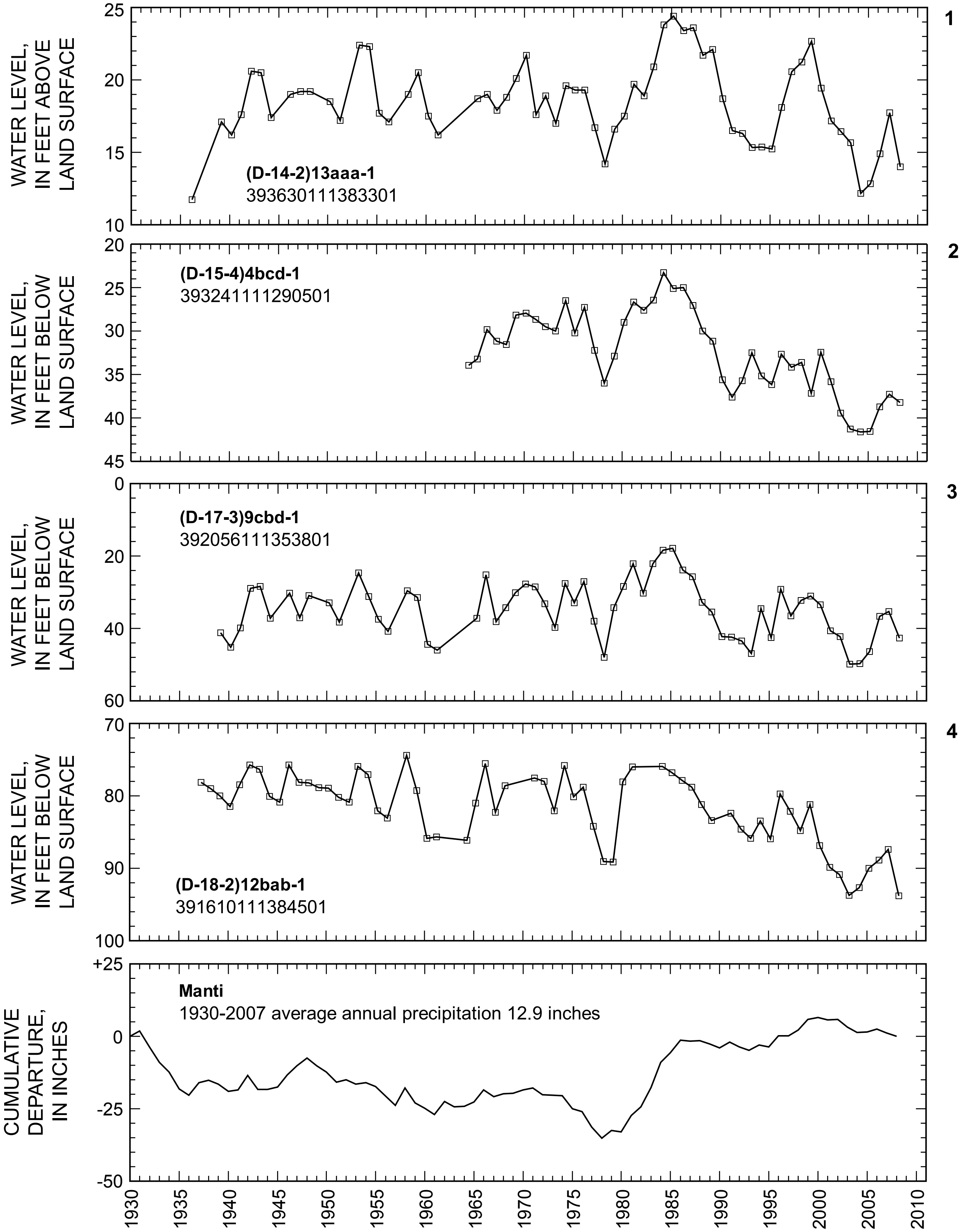


Figure 37. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti.

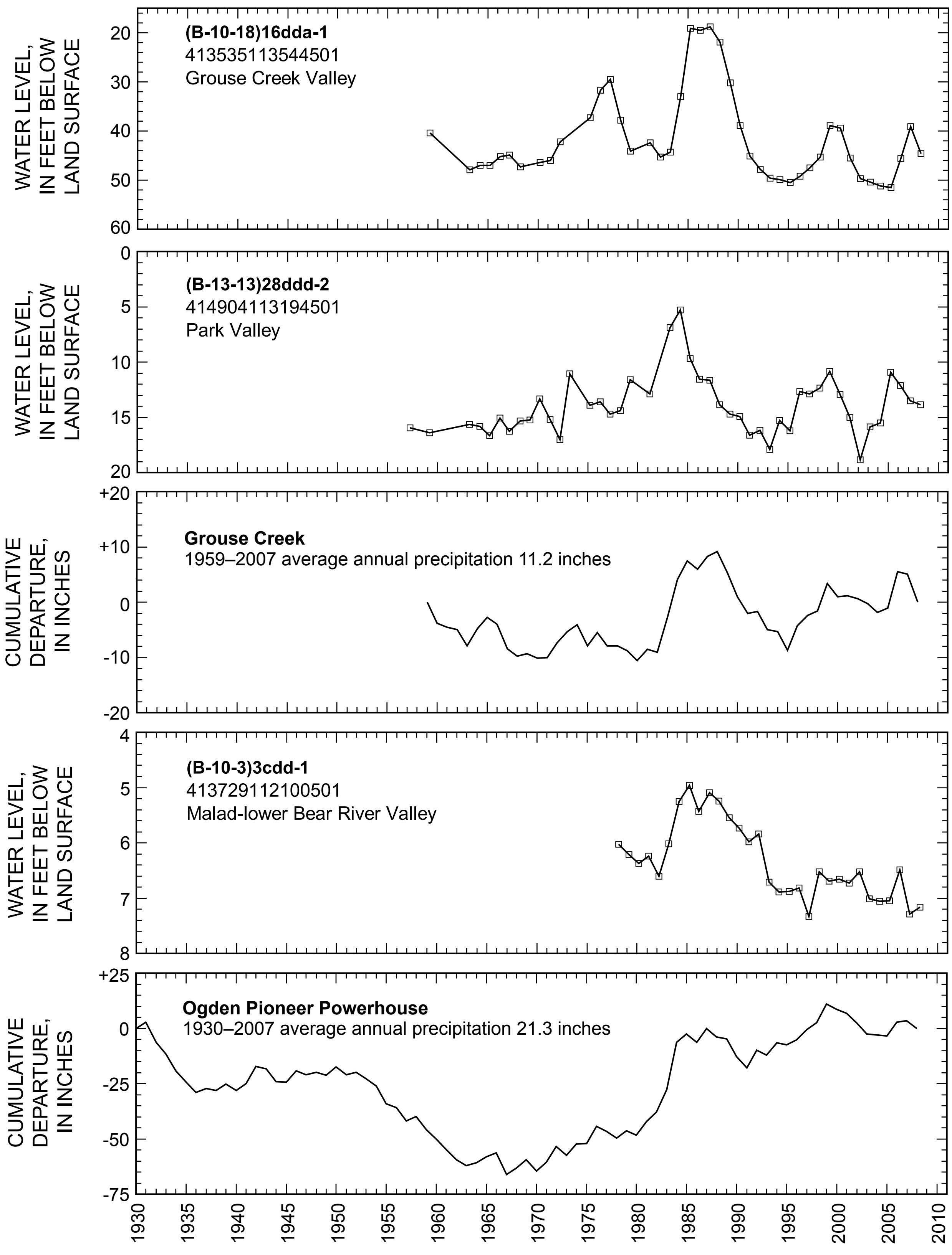


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.

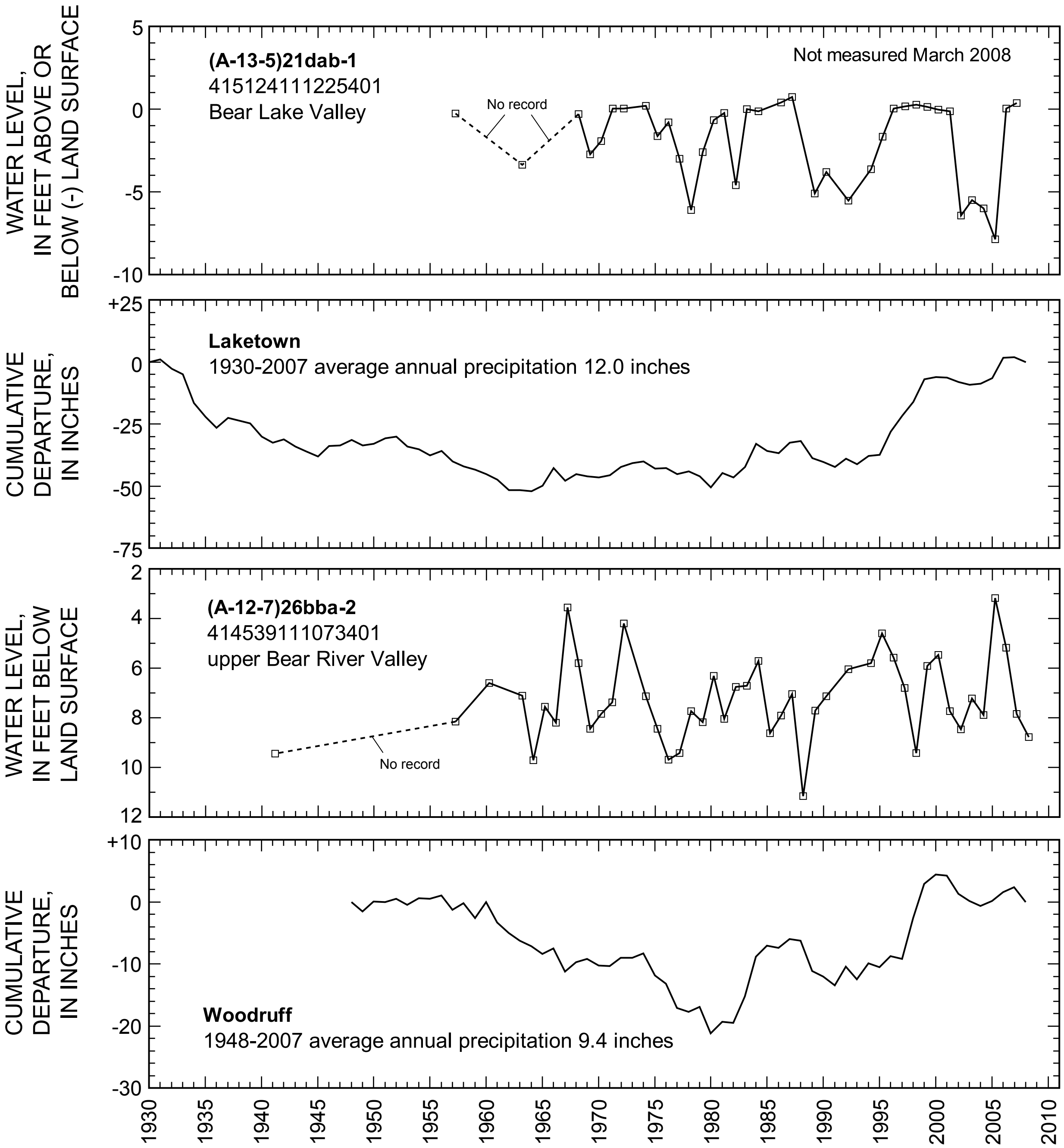


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

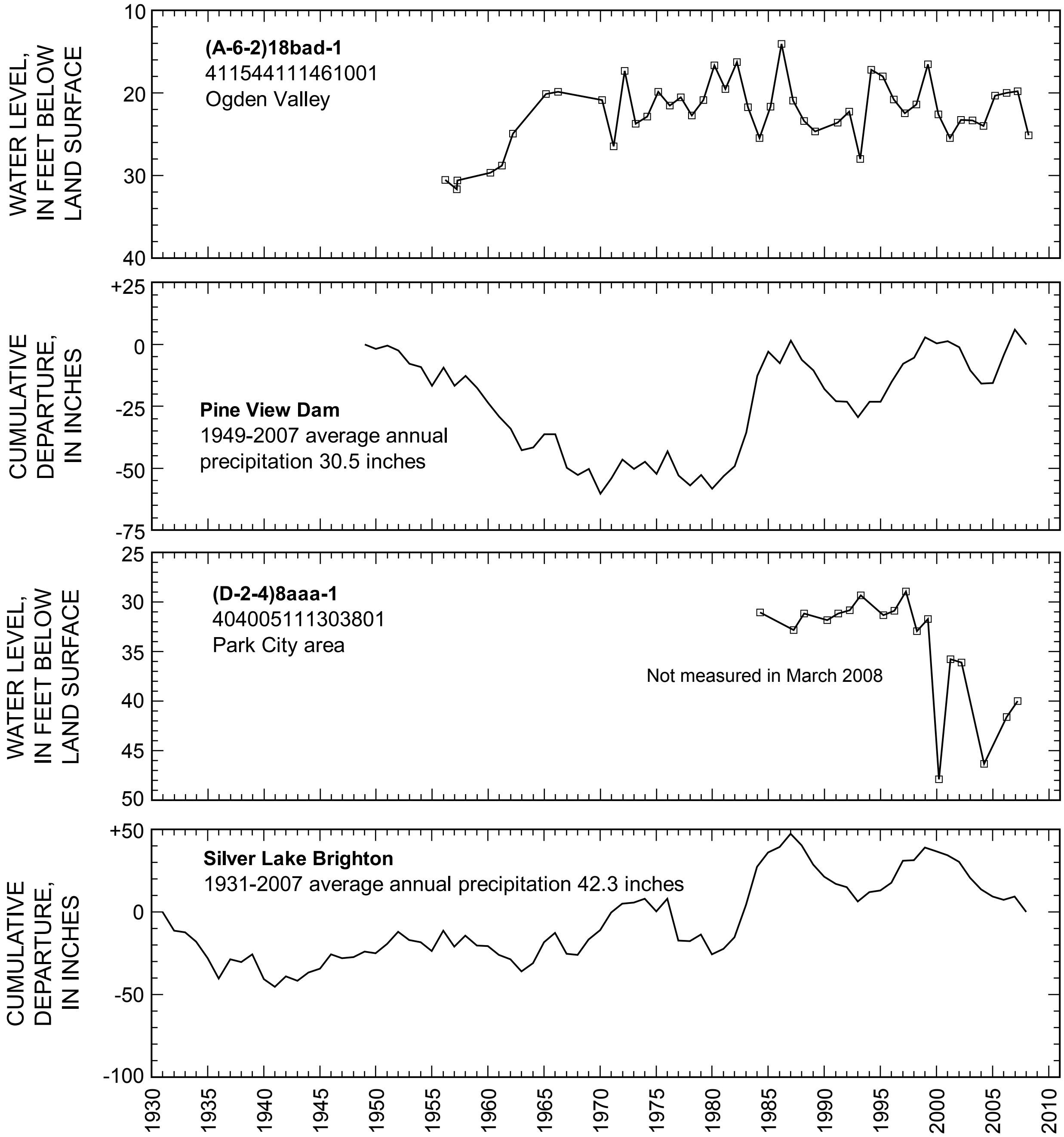


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

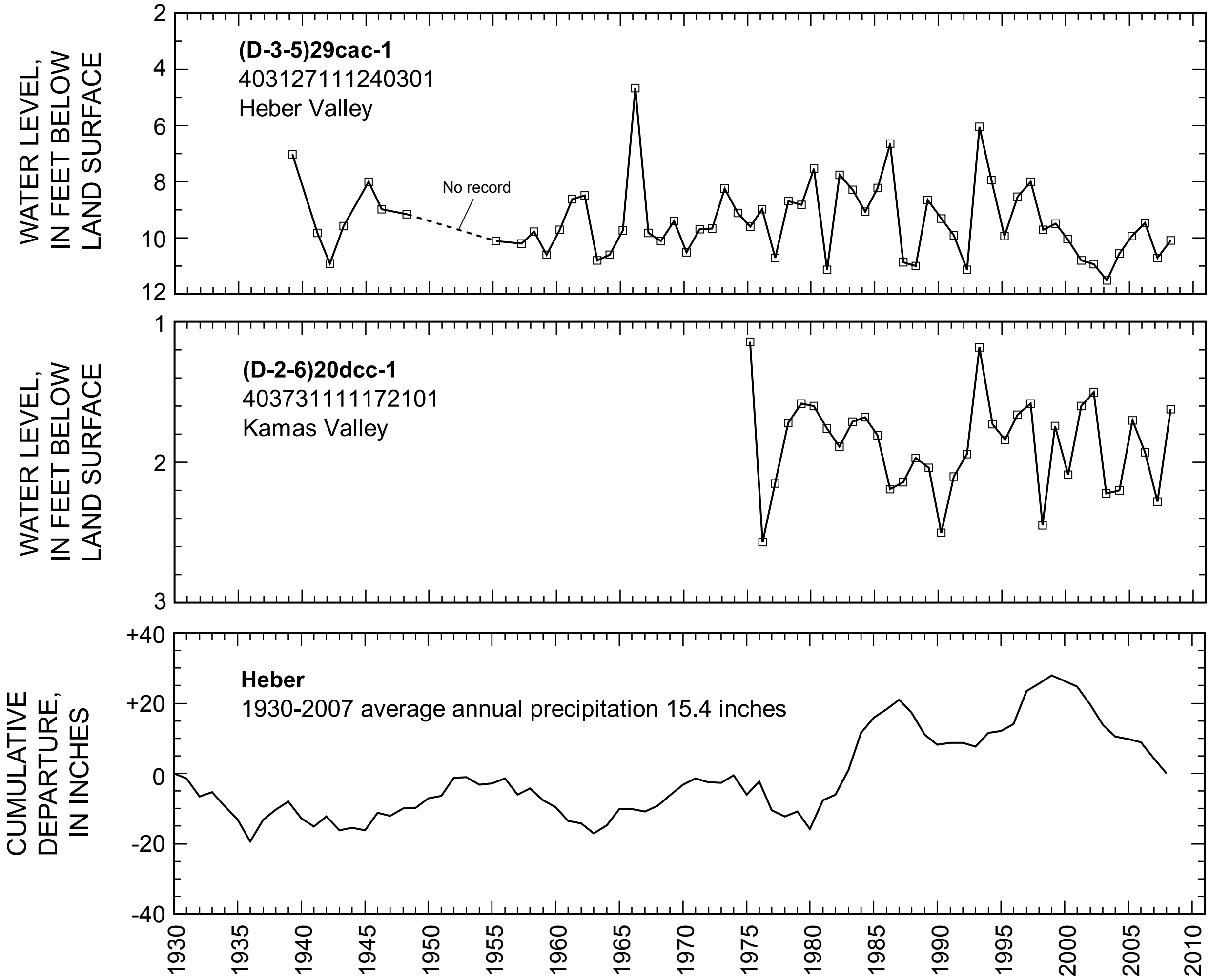


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

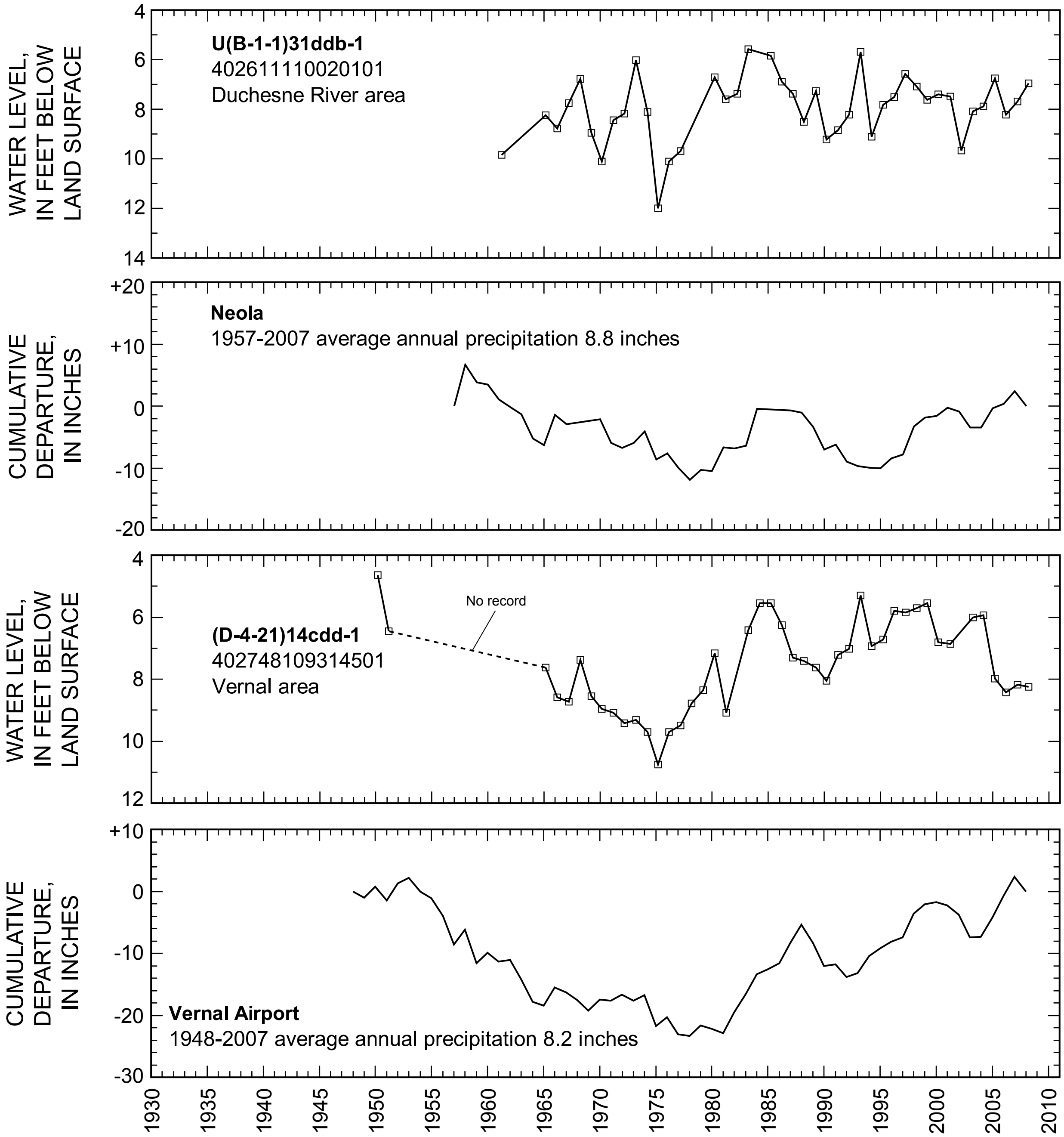


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

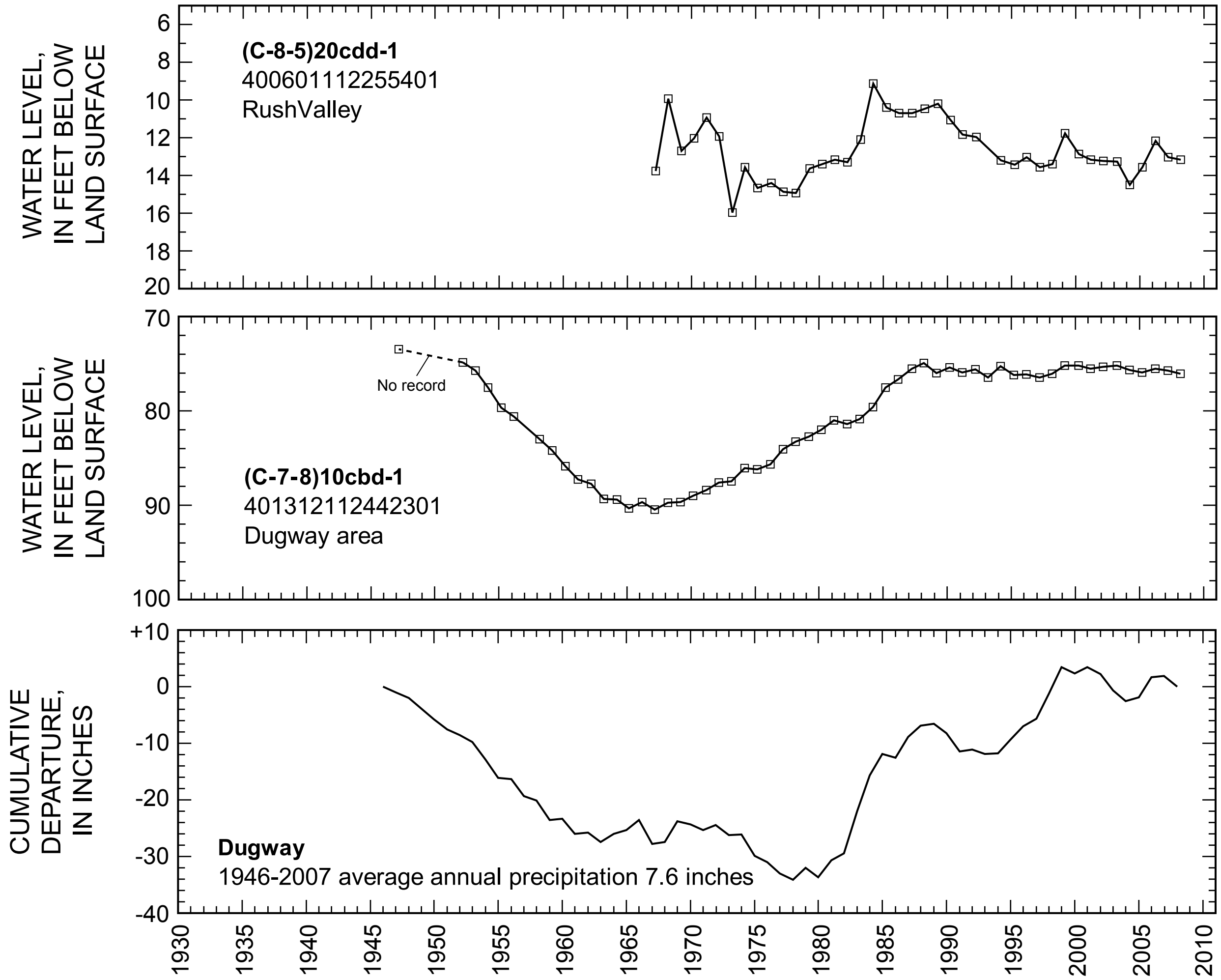


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

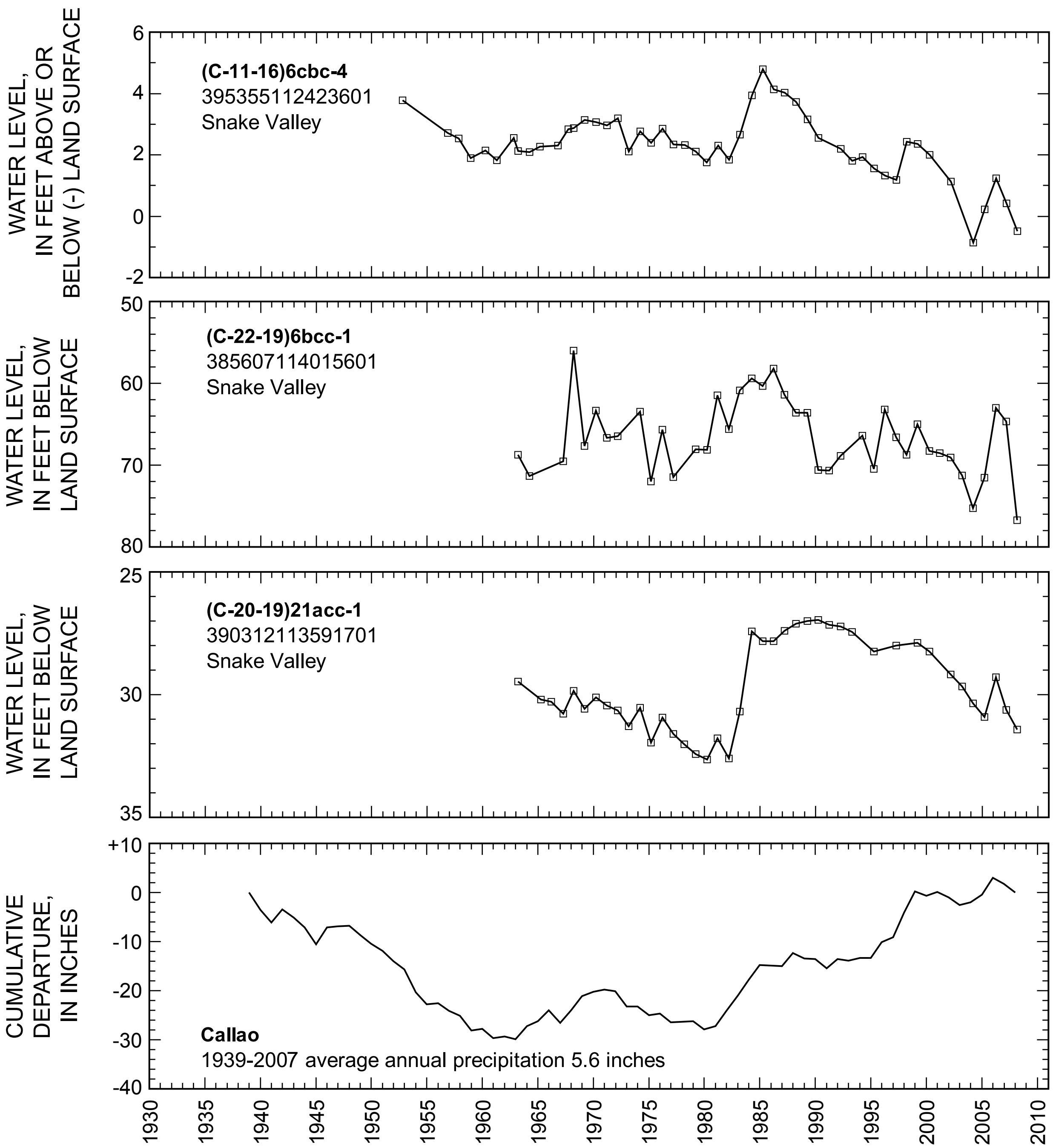


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

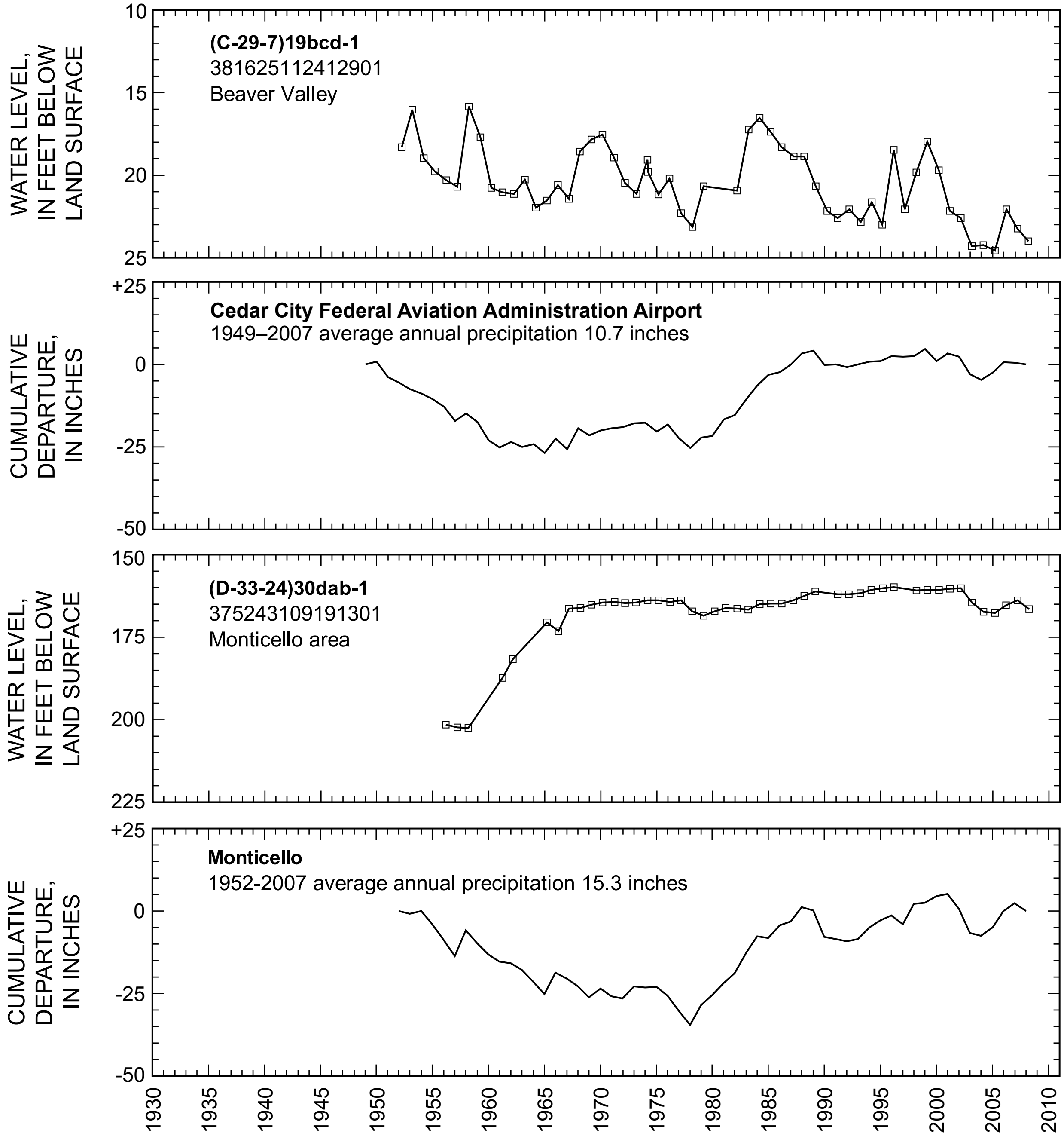


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

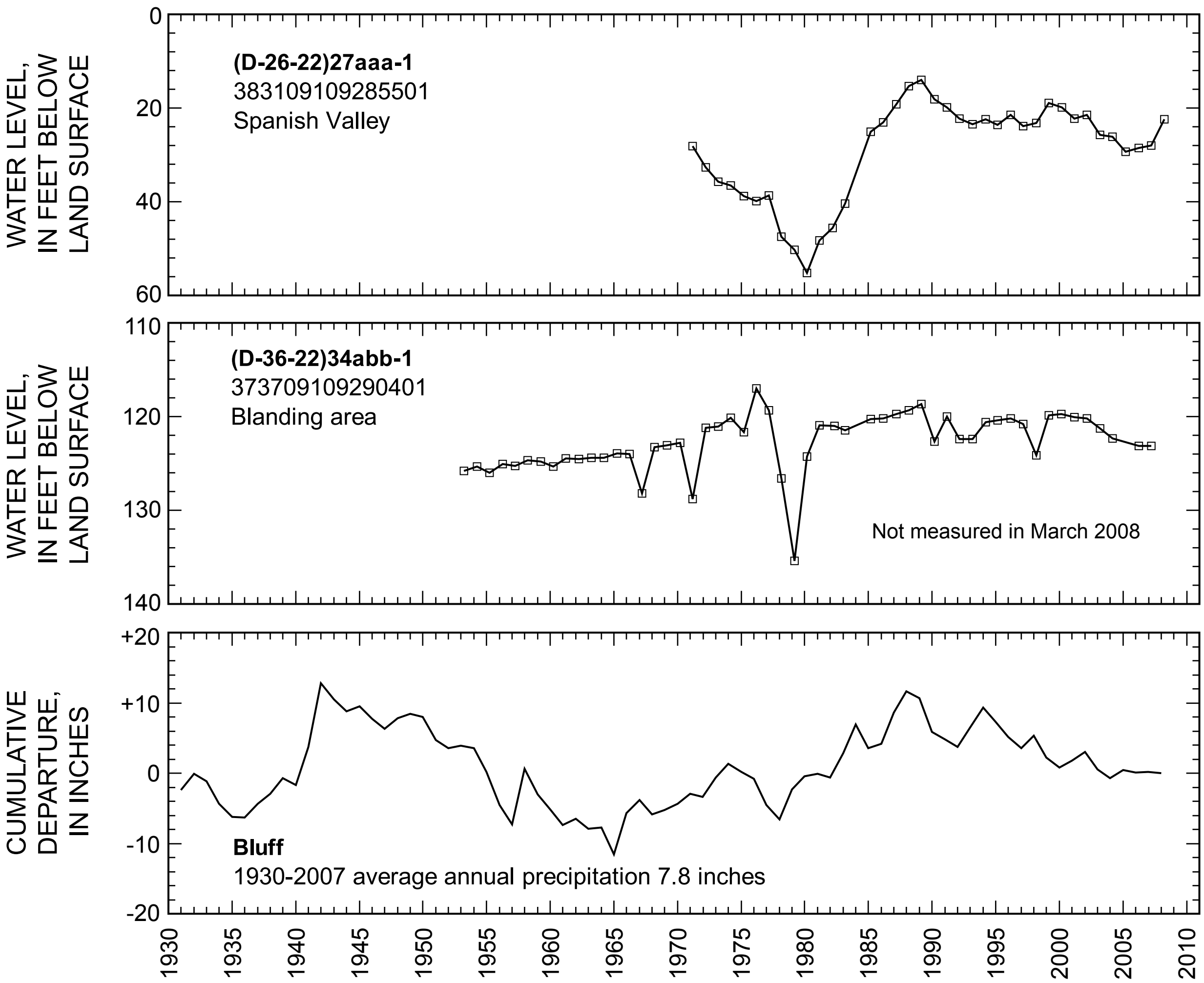


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

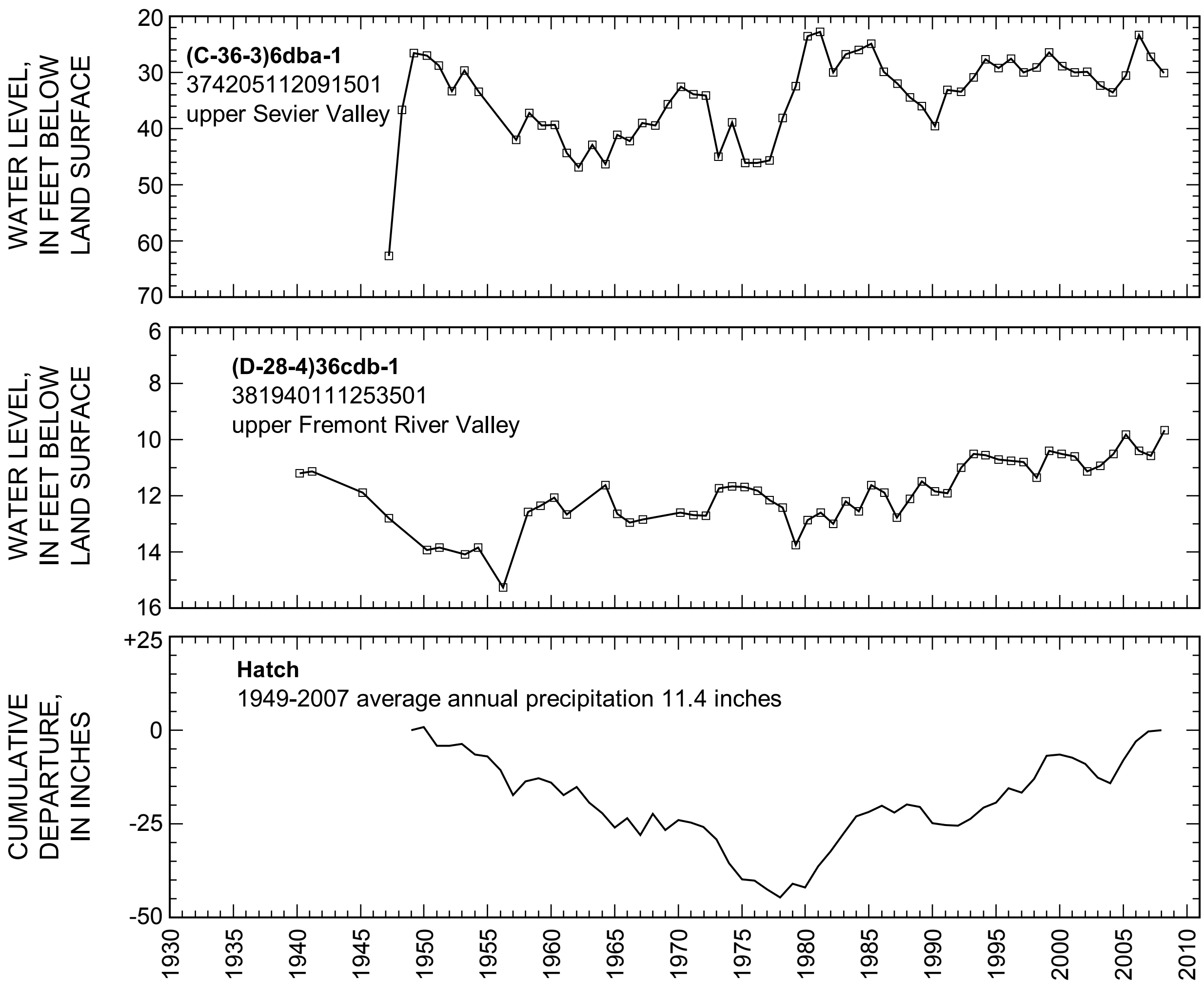


Figure 38. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas—Continued.

QUALITY OF WATER FROM SELECTED WELLS IN UTAH, SUMMER OF 2007

From June through September 2007, the U.S. Geological Survey, Utah Water Science Center, in cooperation with the Utah Department of Environmental Quality, Division of Water Quality, sampled water from 110 wells located in 17 counties (figs. 39 and 40). Samples were collected during this time period to limit seasonal variability, if any, in the data. The majority of water samples were collected from irrigation wells. Field parameters that were measured at the time water samples were collected include pH, specific conductance, and water temperature. Chemical constituents that were analyzed in the water samples include major ions, dissolved solids, nutrients (nitrite plus nitrate, and orthophosphate), and selected trace elements. The U.S. Geological Survey National Water Quality Laboratory in Lakewood, Colorado, analyzed the water samples. Field parameter values and analytical results for all constituents except trace elements are listed in table 4. Analytical results for trace elements are listed in table 5.

The water samples were collected using protocols in the U.S. Geological Survey's National Field Manual for the Collection of Water Quality Data (U.S. Geological Survey, variously dated). Analytical methods used by the laboratory are described in Fishman and Friedman (1989). Water-quality data in this report are stored in the U.S. Geological Survey National Water Information System (NWIS) database and are available on the internet (http://waterdata.usgs.gov/ut/nwis/qw).

Analytical results associated with water samples collected from each area of ground-water development were compared to State of Utah maximum contaminant levels (MCLs) and secondary drinking-water standards of routinely measureable substances present in water supplies. The MCLs and secondary drinking-water standards can be accessed on the internet at http://www.rules.utah.gov/publicat/code/r309/r309-200.htm#T5. Maximum contaminant levels and secondary drinking-water standards were developed for public water systems and do not apply to the majority of wells sampled during this study. A comparison of MCLs and secondary drinking-water standards with results of analyses is included in the text associated with each area of ground-water development.

Water-quality field blanks were collected to determine if samples were being contaminated during equipment decontamination and/or sample collection procedures. A field blank is an inorganic blank water sample that is prepared by and obtained from the U.S. Geological Survey National Water Quality Laboratory and carried in the field. Each field blank water sample was processed using the same methods as the environmental water samples, including processing in the field, preservation, shipment, laboratory handling procedures, and analytical protocols. Replicate water samples also were collected at selected wells. A replicate sample is collected concurrent with an environmental sample and is used to assess the repeatability of the laboratory analytical results.

Eleven field blank water samples were processed during the 2007 sampling period. Only one constituent (dissolved solids) in one field blank sample was detected at a concentration greater than the reporting limit. The reporting limit for this constituent is 10 mg/L and the determined value was 15 mg/L. This is not significant because values for this constituent in water samples collected during this study ranged from 114 to 4,710 mg/L (see table 4), well above the value detected in the field blank. The analytical results for the replicate water samples were in good agreement with the environmental samples, confirming the repeatability of the laboratory analytical results.

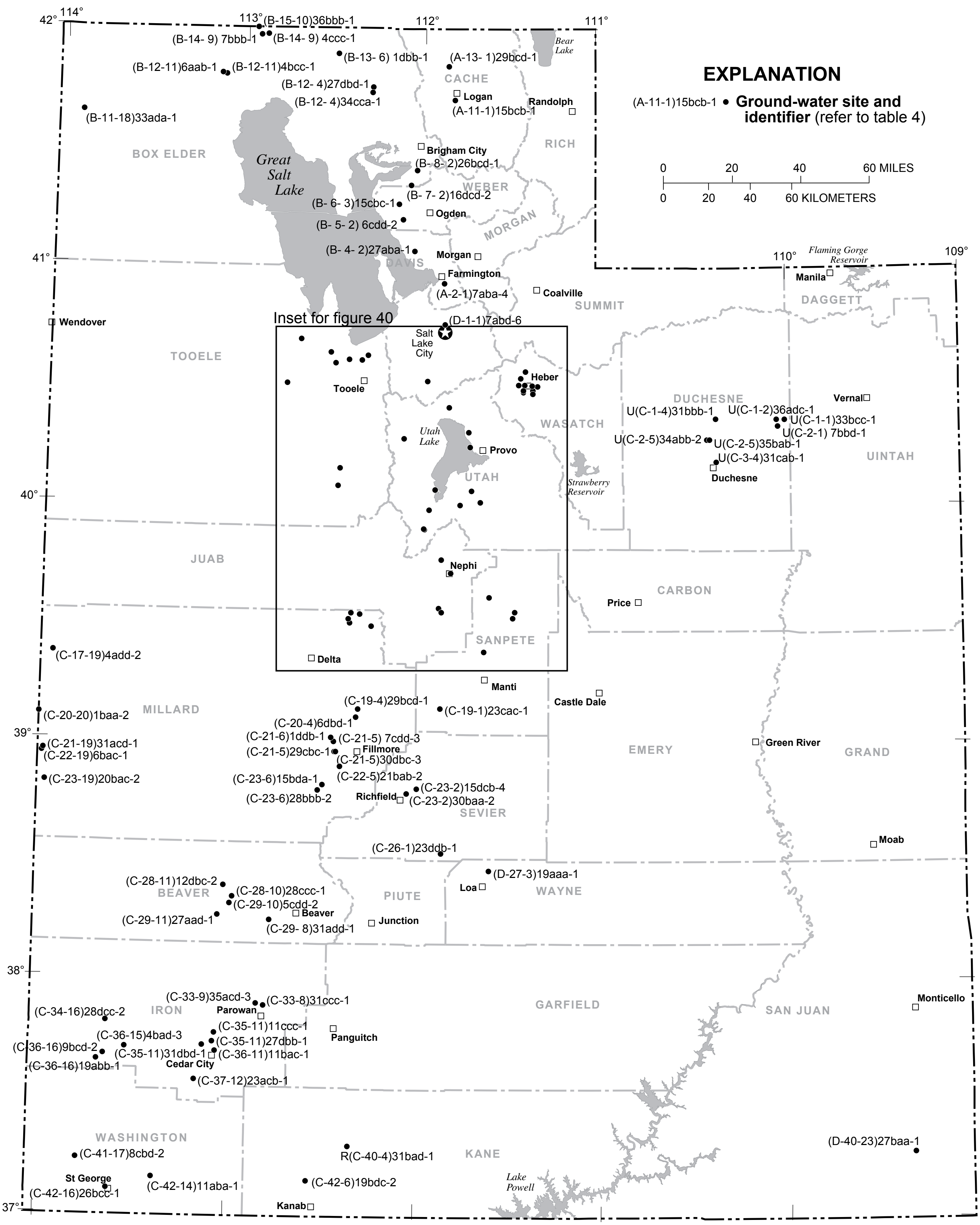


Figure 39. Location of ground-water sites sampled during the summer of 2007.

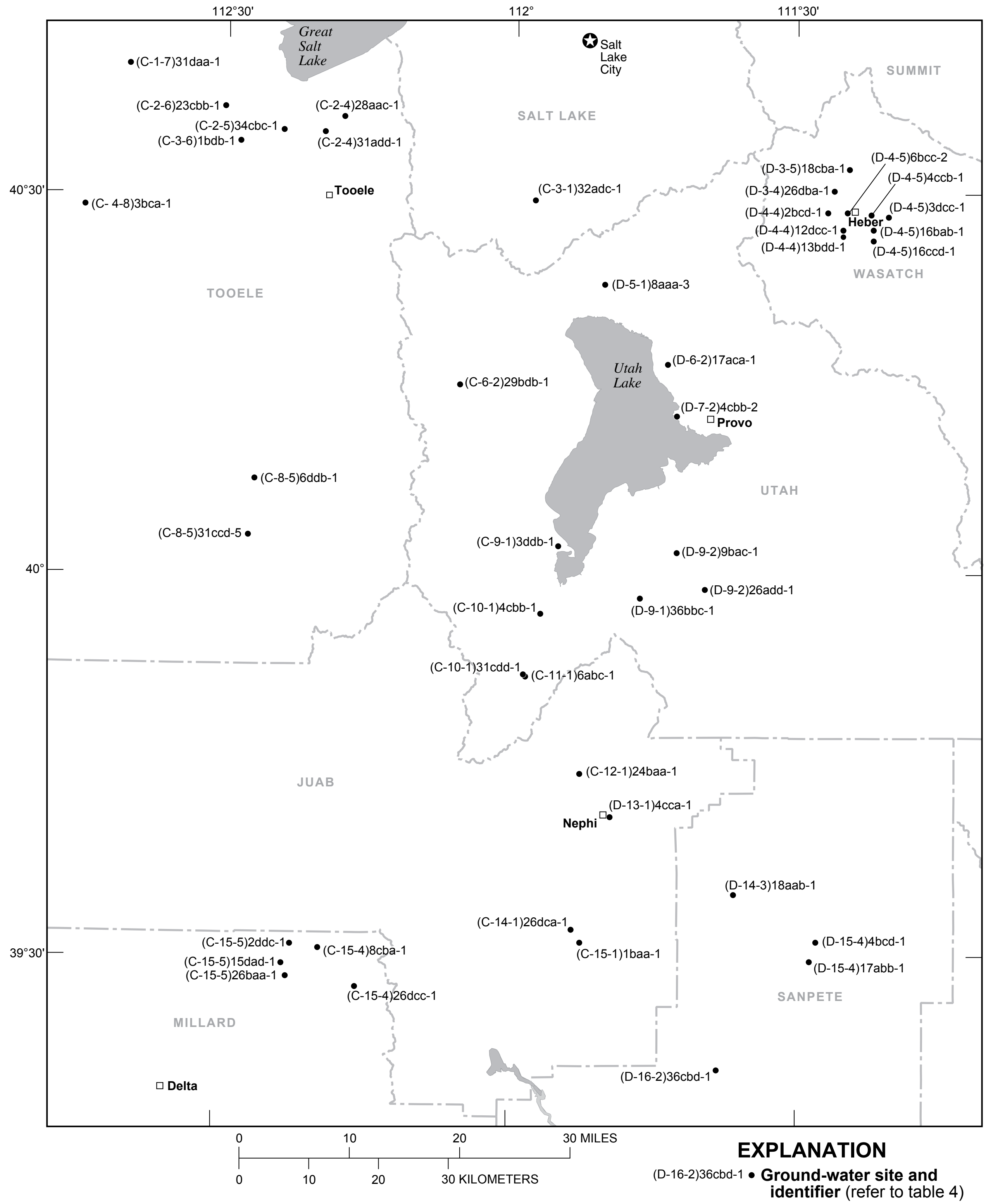


Figure 40. Location of ground-water sites sampled in inset from figure 39 during the summer of 2007.

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007.

[µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; ANC, acid neutralization capacity; <, less than; e, estimated; —, no data]

Local identifier	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
BEAVER COUNTY								
Beaver Valley								
(C-29-8)31add-1	381435112471401	8/20/2007	7.6	926	13.2	330	94.2	23.4
Escalante Valley, Milford area								
(C-28-10)28ccc-1	382019112591701	7/25/2007	7.8	1,340	15.9	520	108	61
(C-28-11)12dbc-2	382313113020901	7/25/2007	7.2	2,400	16.9	760	192	69.2
(C-29-10)5cdd-2	381835113000001	7/25/2007	7.5	870	13.9	390	118	24.4
(C-29-11)27aad-1	381543113035501	7/25/2007	7.6	745	15.3	260	78.7	15.9
BOX ELDER COUNTY								
Blue Creek Valley								
(B-13-6)1dbb-1	415320112290901	6/26/2007	7.6	731	19.0	260	74	19.4
Curlew Valley								
(B-12-11)4bcc-1	414745113063901	6/27/2007	7.1	4,700	19.7	820	177	92
(B-12-11)6aab-1	414808113080401	6/27/2007	—	858	15.7	320	93.8	19.9
(B-14-9)4ccc-1	415800112525301	6/26/2007	7.0	2,700	19.8	550	148	43.1
(B-14-9)7bbb-1	415754112551301	6/26/2007	7.6	1,330	19.5	480	133	35
(B-15-10)36bbb-1	415939112562201	6/26/2007	7.6	463	17.1	180	54.3	11.7
East Shore area								
(B-8-2)26bcd-1	412405112022501	8/30/2007	7.5	173	14.8	36	7.21	4.41
Grouse Creek Valley								
(B-11-18)33ada-1	413808113542501	6/26/2007	7.3	1,040	10.0	370	95.7	31.5
Lower Bear River area								
(B-12-4)27dbd-1	414454112173101	7/20/2007	7.3	2,680	15.2	840	184	92.2
(B-12-4)34cca-1	414339112173401	7/20/2007	7.3	2,080	16.2	580	128	62.9
CACHE COUNTY								
Cache Valley								
(A-11-1)15bcb-1	414143111495501	7/20/2007	7.7	561	11.1	280	64.5	29
(A-13-1)29bcd-1	415020111520401	7/20/2007	7.7	467	13.2	190	39.4	22.3
DAVIS COUNTY								
East Shore area								
(A-2-1)7aba-4	405535111525101	8/28/2007	7.6	225	17.7	51	10.6	5.83
(B-4-2)27aba-1	410340112030001	8/28/2007	8.0	595	16.7	44	11.1	3.92
DUCHESNE COUNTY								
Altamont-Bluebell area								
U(C-1-1)33bcc-1	402114110003301	9/13/2007	7.2	1,810	12.6	880	256	58.6
U(C-1-2)36adc-1	402116110030801	9/13/2007	7.3	340	12.8	170	45.1	13.2
U(C-2-1)7bbd-1	401940110023601	9/12/2007	7.7	1,140	14.9	52	13.7	4.3
Starvation-Duchesne area								
U(C-1-4)31bbb-1	402130110231301	9/12/2007	7.1	840	12.8	450	103	47
U(C-2-5)34abb-2	401613110260702	9/12/2007	9.0	640	12.1	19	2.65	2.9
U(C-2-5)35bab-1	401611110251502	9/13/2007	8.3	670	12.6	31	3.97	5.21
U(C-3-4)31cab-1	401030110225701	9/12/2007	7.3	580	14.9	300	84.2	20.8
IRON COUNTY								
Cedar Valley								
(C-35-11)11ccc-1	374550113040601	8/21/2007	7.4	943	13.9	440	86	55.9
(C-35-11)27dbb-1	374337113043701	8/20/2007	7.5	880	11.0	510	115	53.5
(C-35-11)31dbd-1	374248113075201	8/20/2007	—	953	15.1	540	107	67.1
(C-36-11)11bac-1	374122113034801	8/21/2007	8.3	1,710	14.3	1,300	287	147
(C-37-12)23acb-1	373407113100801	8/20/2007	8.2	1,160	13.2	620	138	67.3
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-2	374834113384301	7/11/2007	7.5	1,100	13.5	460	141	25.5
(C-36-15)4bad-3	374209113322203	7/11/2007	8.0	771	21.6	140	44.3	6.83
(C-36-16) 9bcd-2	374014113391101	7/11/2007	7.4	446	15.9	200	62	9.82
(C-36-16)19abb-1	373854113411501	8/8/2007	7.3	466	12.5	190	58.9	10.7
Parowan Valley								
(C-33-8)31ccc-1	375257112483501	8/20/2007	7.8	455	15.2	190	39.6	22.4
(C-33-9)35acd-3	375320112510003	8/20/2007	7.6	450	14.3	210	43.7	24.7

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007—Continued.

Potassium, dissolved, in mg/L	Sodium, dissolved, in mg/L	ANC, fixed end point, lab, in mg/L as $CaCO_3$	Bromide, dissolved, in mg/L	Chloride, dissolved, in mg/L	Fluoride, dissolved, in mg/L	Silica, dissolved, in mg/L	Sulfate, dissolved, in mg/L	Solids, dissolved, residue at 180°C, in mg/L	Nitrite plus nitrate, dissolved, in mg/L as N	Orthophos-phate, dissolved, in mg/L as P
BEAVER COUNTY										
Beaver Valley										
5.93	88.9	318	0.2	69.4	0.57	43.9	105	654	3.11	0.077
Escalante Valley, Milford area										
5.2	75.8	120	0.55	185	0.49	38.2	294	858	3.37	0.018
22.1	182	199	0.93	435	2.08	49.2	245	1,480	40.3	0.033
5.05	29.8	293	0.39	60.1	0.31	33.4	79.8	522	2.66	0.045
6.19	41.2	127	0.41	101	0.41	41.8	70.6	432	2.86	0.031
BOX ELDER COUNTY										
Blue Creek Valley										
10.6	34.6	128	0.13	145	0.31	58.7	18.1	506	2.5	0.021
Curlew Valley										
21.4	583	164	0.92	1,420	0.32	42.2	52.7	2,930	0.71	0.021
3.03	45.7	163	0.15	160	0.19	16.4	32	545	0.64	0.012
22.9	363	227	0.61	663	0.27	56.3	173	1,690	3.95	0.03
14.7	67.1	130	0.23	347	0.24	58	26.6	921	0.57	0.022
8.25	19.1	140	0.05	56	0.25	57.5	18.3	341	0.78	0.027
East Shore area										
3.79	26.5	76	e.02	6.81	0.11	14.2	9.35	114	0.64	0.144
Grouse Creek Valley										
9	77.8	349	0.2	92	0.39	43.6	72	617	0.36	0.068
Lower Bear River area										
4.28	183	169	0.81	643	0.21	23.7	171	1,690	5.43	0.017
4.6	166	183	0.38	460	0.25	19.7	135	1,280	2.77	0.013
CACHE COUNTY										
Cache Valley										
1.74	6.72	264	e.01	9.22	0.12	10.7	25.7	338	2.14	0.016
1.64	25.4	232	e.02	8.31	0.13	10.5	11	253	0.13	0.011
DAVIS COUNTY										
East Shore area										
1.14	29.2	84	e.01	14.2	<.10	13.3	13.9	136	<.06	0.058
5.21	121	261	0.06	42.1	0.39	30.6	e.10	379	<.06	0.618
DUCHESNE COUNTY										
Altamont-Bluebell area										
3.7	102	115	<.02	0.85	1.45	6.96	955	1,580	<.06	e.004
4.01	3.71	137	<.02	0.68	0.77	7.61	42.1	199	<.06	e.003
2.26	230	301	0.02	138	2.32	8.43	77.8	667	<.06	e.006
Starvation-Duchesne area										
1.35	21	442	0.1	18.4	0.84	31.3	20.7	523	1.49	0.056
0.28	146	321	e.01	2.3	0.33	9.6	27.9	390	<.06	0.096
0.73	149	306	e.01	8.59	0.35	11.2	55.4	422	<.06	0.047
1.44	13.4	262	0.02	7.15	0.22	8.99	53.1	342	0.13	0.007
IRON COUNTY										
Cedar Valley										
4.32	30.2	161	0.17	40.8	0.27	31.5	256	698	10.2	0.026
2.48	16	353	0.02	11	0.18	20.3	111	607	2.05	0.014
2.28	11.4	136	0.06	15.3	0.26	19.2	392	763	2.17	0.013
4.02	35.7	238	0.1	33.7	0.25	19.4	1,150	2,060	6.6	0.014
2	51.4	148	0.61	112	e.05	16.3	394	961	1.93	0.022
Escalante Valley, Beryl-Enterprise area										
8.53	38.9	124	0.84	212	0.61	60	98.2	761	1.67	0.025
4.37	116	159	0.14	38.7	1.56	54	161	532	0.92	0.026
3.58	15.6	152	0.16	39.2	0.28	39.1	12.4	314	1.47	0.053
4.5	18.2	169	0.15	32.4	0.32	35.1	17.4	288	2.31	0.051
Parowan Valley										
2.56	21.6	191	0.05	19.5	0.21	26.8	18.6	272	1.4	0.031
2.57	14.6	189	0.03	19	0.17	24.6	21.9	278	2.03	0.022

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007—Continued.

Local identifier	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
JUAB COUNTY								
Juab Valley								
(C-12-1)24baa-1	394545111531001	7/9/2007	7.1	1,190	15.9	350	84.1	33.6
(C-14-1)26dca-1	393335111534401	7/10/2007	7.0	1,370	16.9	620	125	75.2
(C-15-1)1baa-1	393236111525300	7/10/2007	6.9	1,210	13.2	590	148	53.4
(D-13-1)4cca-1	394225111495701	7/10/2007	7.0	1,730	12.0	480	130	38.3
KANE COUNTY								
Kanab area								
(C-42-6)19bdc-2	370843112340602	8/7/2007	8.0	250	15.0	120	22.4	15.6
R(C-40-4)31bad-1	371740112210601	8/7/2007	7.3	1,790	12.1	940	127	151
MILLARD COUNTY								
Pahvant Valley								
(C-19-4)29bcd-1	390758112194601	8/14/2007	7.4	930	14.0	370	82.7	40.9
(C-20-4)6dbd-1	390558112202301	8/20/2007	7.0	1,800	18.5	950	260	73.9
(C-21-5)7cdd-3	385939112272303	8/14/2007	7.2	1,540	12.0	510	111	56.3
(C-21-5)29cbc-1	385714112264701	8/15/2007	7.9	2,080	19.5	660	170	57.2
(C-21-5)30dbc-3	385715112271201	8/15/2007	7.1	1,530	18.5	480	119	44.8
(C-21-6)1ddb-1	390045112281201	8/15/2007	7.2	1,960	12.0	660	145	72.9
(C-22-5)21bab-2	385324112252301	8/20/2007	7.2	1,000	14.0	340	95.4	24.3
(C-23-6)15bda-1	384848112305101	8/20/2007	7.4	2,400	14.5	750	182	72.4
(C-23-6)28bbb-2	384722112322101	8/14/2007	7.1	6,230	13.5	2,100	363	281
Sevier Desert								
(C-15-4)8cba-1	393154112192901	7/10/2007	6.9	3,340	13.9	960	211	104
(C-15-4)26dcc-1	392859112154601	7/10/2007	7.4	938	15.6	400	110	31.8
(C-15-5)2ddc-1	393221112221801	7/10/2007	7.0	2,440	15.5	960	205	109
(C-15-5)15dad-1	393046112231301	7/10/2007	7.6	884	16.7	290	58.6	35
(C-15-5)26baa-1	392939112224101	7/10/2007	7.7	519	18.4	180	37.8	21.2
Snake Valley								
(C-17-19)4add-2	392141113585601	7/10/2007	7.6	480	14.0	160	39.6	15.8
(C-20-20)1baa-2	390604114025201	8/2/2007	8.1	424	15.2	180	44.5	15.8
(C-22-19)6bac-1	385615114013801	8/2/2007	7.6	543	11.4	250	64.6	22.1
(C-21-19)31acd-1	385650114010601	8/2/2007	7.5	681	12.2	310	88.1	22.4
(C-23-19)20bac-2	384900114003001	8/2/2007	7.6	927	13.3	310	46.4	47.4
SALT LAKE COUNTY								
Salt Lake Valley								
(C-3-1)32adc-1	403054111581601	7/10/2007	—	1,560	18.0	610	172	43.2
(D-1-1)7abd-6	404506111523301	7/10/2007	7.2	1,330	14.4	570	136	54.6
SAN JUAN COUNTY								
Bluff area								
(D-40-23)27baa-1	371621109211001	7/25/2007	7.4	3,100	19.5	99	24	9.61
SANPETE COUNTY								
Central Sevier Valley								
(C-19-1)23cac-1	390819111530701	7/30/2007	7.0	2,580	12.9	690	102	105
Sanpete Valley								
(D-14-3)18aab-1	393623111372401	8/8/2007	—	640	11.1	300	79.2	24.1
(D-15-4) 4bcd-1	393241111290501	8/8/2007	—	610	12.1	310	69.3	33.9
(D-15-4)17abb-1	393113111294501	8/8/2007	—	595	9.6	300	64	33.9
(D-16-2)36cbd-1	392238111390501	8/7/2007	—	791	14.5	290	44.5	44.6
SEVIER COUNTY								
Central Sevier Valley								
(C-23-2)15dcb-4	384757112002201	7/30/2007	7.3	690	13.2	320	64.7	37.7
(C-23-2)30baa-2	384641112034601	7/30/2007	7.4	845	21.3	390	80.9	46.5
Upper Sevier Valley								
(C-26-1)23ddb-1	383140111522001	7/30/2007	8.3	216	12.9	78	25.3	3.67

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007—Continued.

Potassium, dissolved, in mg/L	Sodium, dissolved, in mg/L	ANC, fixed end point, lab, in mg/L as $CaCO_3$	Bromide, dissolved, in mg/L	Chloride, dissolved, in mg/L	Fluoride, dissolved, in mg/L	Silica, dissolved, in mg/L	Sulfate, dissolved, in mg/L	Solids, dissolved, residue at 180°C, in mg/L	Nitrite plus nitrate, dissolved, in mg/L as N	Orthophosphate, dissolved, in mg/L as P
JUAB COUNTY										
Juab Valley										
4.14	107	235	0.13	188	0.23	27.4	78.9	711	4.92	0.06
4.58	80	225	0.05	65.6	0.33	21.8	448	1,020	0.93	0.011
2.07	46.1	268	0.05	56.3	0.23	12.9	318	897	2.31	0.01
3.73	172	311	0.06	293	0.24	21	130	1,030	4.05	0.025
KANE COUNTY										
Kanab area										
2.21	3.69	115	0.05	3.31	e.07	14.6	4.28	132	2.19	0.018
9.85	103	371	0.09	21.3	0.68	12.4	751	1,500	<.06	0.01
MILLARD COUNTY										
Pahvant Valley										
1.44	33.5	235	0.26	129	e.10	16.8	27.2	509	9.21	0.017
5.78	54.3	207	0.34	180	0.61	15.9	559	1,350	3.43	0.033
5.05	135	326	0.28	176	0.15	24.6	246	1,040	4.99	0.028
17.5	185	262	0.39	284	0.52	17.4	450	1,440	1.72	0.023
11.9	130	252	0.28	197	0.41	18.5	267	977	1.3	0.021
5.63	166	319	0.38	274	0.17	25.8	330	1,320	4.92	0.033
9.11	74.2	251	0.16	126	0.66	14.5	49.6	585	4.32	0.016
21	230	240	0.67	499	0.37	31.5	280	1,510	3.97	0.033
11.7	562	177	2.62	1,670	0.36	30.1	797	4,140	27.9	0.025
Sevier Desert										
7.98	351	401	0.56	615	0.24	26.8	541	2,270	0.68	0.022
1.65	42.6	170	0.21	79.7	0.14	13	162	588	10.9	0.015
7.04	111	175	0.44	541	0.28	26.7	298	1,500	<.06	0.017
3.61	66.3	182	0.14	142	0.42	28.7	54.6	508	0.08	0.019
2.09	32.2	140	0.07	52.1	0.15	24.6	44.8	311	0.76	0.014
Snake Valley										
1.47	34.8	175	0.09	34.6	0.2	14.1	15.2	271	1.99	0.011
1.27	19.2	142	0.1	35.8	0.16	16.5	25	256	0.64	0.011
1.28	15.1	251	0.06	16.6	0.13	15.7	13.5	325	2.46	0.01
1.77	21.7	294	0.07	20.9	0.19	18.3	35	409	3.34	0.013
4.31	104	343	0.17	86.9	1.09	47.9	76.7	642	1.23	0.042
SALT LAKE COUNTY										
Salt Lake Valley										
3.91	95	313	0.2	204	0.14	28.5	220	1,010	1.94	<.006
3.04	52.9	292	0.11	159	0.22	20.2	173	825	5.1	0.027
SAN JUAN COUNTY										
Bluff area										
13.3	674	754	1.11	455	1.36	10.7	191	1,850	<.06	0.013
SANPETE COUNTY										
Central Sevier Valley										
3.53	349	601	0.28	325	0.61	33.1	363	1,710	6.04	0.056
Sanpete Valley										
2.92	12.4	274	0.06	24.4	0.1	30.8	18	370	4.06	0.035
2.33	11.6	279	0.02	8.65	0.1	10.1	16.4	333	2.67	0.009
1.08	8.51	304	e.02	5.88	e.10	7.99	14.3	315	1.92	0.008
1.19	50.8	265	0.14	68.3	0.28	17.8	44	417	0.66	0.015
SEVIER COUNTY										
Central Sevier Valley										
3.15	20.8	274	0.08	30	0.42	32.7	47.5	420	0.85	0.039
1.88	32.7	419	0.07	13.6	0.21	9.45	29.6	477	<.06	e.004
Upper Sevier Valley										
2.79	9.46	83	0.05	12.3	0.27	41.5	4.7	162	0.42	0.018

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007—Continued.

Local identifier	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
TOOELE COUNTY								
Rush Valley								
(C-8-5)6ddb-1	400849112263901	7/26/2007	7.7	631	16.5	220	43.3	26.8
(C-8-5)31ccd-5	400418112271701	7/26/2007	7.1	1,360	12.0	500	156	28
Skull Valley								
(C-1-7)31daa-1	404113112395801	7/3/2007	7.7	8,410	17.5	520	99	66.9
(C-4-8)3bca-1	403006112442201	7/3/2007	7.1	1,490	13.5	510	156	29.4
Tooele Valley								
(C-2-4)28aac-1	403716112174801	8/15/2007	8.0	1,090	14.0	430	105	40.1
(C-2-4)31add-6	403606112195401	8/15/2007	7.5	1,100	15.6	320	81.8	28.3
(C-2-5)34cbc-1	403612112241001	8/15/2007	7.7	4,730	17.9	850	207	79.7
(C-2-6)23cbb-1	403802112301201	8/15/2007	7.9	970	18.6	220	50.6	22.7
(C-3-6)1bdb-1	403514112283701	8/15/2007	7.4	830	13.7	300	86.8	19.6
UTAH COUNTY								
Cedar Valley								
(C-6-2)29bdb-1	401620112054301	7/10/2007	8.6	287	10.3	120	24.1	14.2
Goshen Valley								
(C-9-1)3ddb-1	400325111552501	8/22/2007	7.6	1,330	14.3	260	66.1	23.3
(C-10-1)4cbb-1	395825111571801	8/22/2007	7.2	3,030	19.7	1,100	270	101
(C-10-1)31cdd-1	395340111590001	8/22/2007	7.4	907	19.3	370	93.2	33.2
(C-11-1)6abc-1	395326111585001	8/22/2007	7.0	667	20.3	250	70.2	18.6
Northern Utah Valley								
(D-5-1)8aaa-3	402420111505701	8/23/2007	8.1	425	14.1	170	39.9	16.5
(D-6-2)17aca-1	401801111442501	8/23/2007	7.3	542	14.5	250	61.8	22.2
(D-7-2)4cbb-2	401414111435301	8/23/2007	7.4	538	12.9	250	63.4	22.4
Southern Utah Valley								
(D-9-1)36bbc-1	395942111470801	8/22/2007	6.7	510	11.4	250	64.7	22
(D-9-2)9bac-1	400311111432001	8/22/2007	6.8	672	14.6	280	70.3	26.5
(D-9-2)26add-1	400023111402200	8/22/2007	6.9	608	12.1	300	75.1	27.3
WASATCH COUNTY								
Heber Valley								
(D-3-4)26dba-1	403146111272701	7/19/2007	7.4	740	14.2	340	100	21.9
(D-3-5)18cba-1	403325111254601	7/19/2007	7.2	324	11.1	140	42.6	9.14
(D-4-4)2bcd-1	403004111280301	7/19/2007	7.2	1,440	14.2	580	160	42.7
(D-4-4)12dcc-1	402842111263101	6/28/2007	7.0	510	13.6	240	67.5	17.4
(D-4-4)13bdd-1	402810111263601	6/28/2007	7.1	540	13.7	240	63.8	19.8
(D-4-5)3dcc-1	402937111214901	6/28/2007	6.8	465	12.7	220	71.6	9.71
(D-4-5)4ccb-1	402946111233901	6/28/2007	7.1	380	13.0	180	57.8	8.52
(D-4-5)6bcc-2	403003111255801	7/19/2007	7.3	377	14.0	180	54.6	10.8
(D-4-5)16bab-1	402840111232201	6/28/2007	7.1	540	12.7	260	72.4	19.7
(D-4-5)16ccd-1	402750111232701	6/28/2007	7.2	530	14.1	230	57.8	20.2
WASHINGTON COUNTY								
Central Virgin River area								
(C-41-17)8cbd-2	371348113470301	8/8/2007	7.3	479	18.5	220	64.3	15.4
(C-42-14)11aba-1	370913113230301	7/12/2007	7.3	1,470	22.5	750	174	77.2
(C-42-16)26bcc-1	370617113371101	7/12/2007	7.2	4,130	20.7	1,900	501	166
WAYNE COUNTY								
Upper Fremont Valley								
(D-27-3)19aaa-1	382717111365601	07-30-07	7.3	1,360	11.5	730	218	44.1
WEBER COUNTY								
East Shore area								
(B-5-2)6cdd-2	411130112064502	8/30/2007	7.9	530	15.5	140	33.5	14.3
(B-7-2)16dcd-2	412011112041401	8/30/2007	8.1	340	25.6	64	19.5	3.6
(B-6-3)15cbc-1	411523112082101	8/28/2007	8.3	396	15.8	33	7.87	3.16

Table 4. Physical properties and concentration of major ions in water samples collected from selected wells in Utah, summer of 2007—Continued.

Potassium, dissolved, in mg/L	Sodium, dissolved, in mg/L	ANC, fixed end point, lab, in mg/L as $CaCO_3$	Bromide, dissolved, in mg/L	Chloride, dissolved, in mg/L	Fluoride, dissolved, in mg/L	Silica, dissolved, in mg/L	Sulfate, dissolved, in mg/L	Solids, dissolved, residue at 180°C, in mg/L	Nitrite plus nitrate, dissolved, in mg/L as N	Orthophos-phate, dissolved, in mg/L as P
TOOELE COUNTY										
Rush Valley										
2.56	40.3	163	0.08	88.4	0.55	13.6	29.9	369	0.39	0.007
1.77	48.8	122	0.25	320	e.09	15.8	47.9	1,010	1.59	0.011
Skull Valley										
61	1,480	184	1.49	2,520	0.39	30	212	4,710	1.64	0.021
4.34	75.6	89	0.34	353	0.11	10.1	56.2	1,060	6.99	0.167
Tooele Valley										
2.19	77.3	216	0.19	122	e.08	14	196	744	3.1	0.027
2.62	131	188	0.22	242	0.16	15.4	50.3	701	4.63	0.021
11.7	646	169	1.04	1,440	0.41	21.8	168	2,990	4.33	0.021
20.5	120	126	0.17	255	0.38	52.1	28.9	652	0.86	0.036
1.72	41.8	160	0.13	152	e.05	20	30.4	572	2.04	0.035
UTAH COUNTY										
Cedar Valley										
1.11	15.4	135	e.02	11.4	0.18	5.49	2.71	142	<.06	e.003
Goshen Valley										
11.8	174	164	0.24	285	0.48	59.2	85.4	830	0.97	0.036
17.5	151	122	0.67	881	0.2	61.8	118	2,140	3.32	0.032
7.83	32.3	149	0.22	132	0.2	54	76.8	561	11.8	0.032
8.29	30.1	156	0.13	77	0.24	58.1	43.1	438	6.37	0.04
Northern Utah Valley										
2.01	16.1	128	0.04	41	0.23	19.4	17.8	234	0.74	0.018
4.38	15.4	206	0.03	18	0.2	20.2	53.5	329	0.95	0.036
2.77	16.6	229	0.03	12.4	0.24	18.5	46.3	325	<.06	0.018
Southern Utah Valley										
1.4	6.97	221	0.02	19.8	0.24	16.2	18.6	287	1.85	0.014
8.6	29.4	256	0.03	30.1	0.27	49.3	40.1	436	3.63	0.038
1.93	12.3	261	0.03	23	0.21	18.3	27	366	2.67	0.014
WASATCH COUNTY										
Heber Valley										
5.2	22	264	—	25.6	0.56	18.3	98.5	—	1.74	—
2.24	9.53	137	—	9.02	0.18	28.3	21.1	—	e.05	—
11.8	59.9	300	—	55.1	0.97	18.1	325	—	0.6	—
1.22	11.1	224	—	16.5	0.11	20.5	22.6	—	2.2	—
1.05	14.4	202	—	41.4	0.11	13.9	13.6	—	2.38	—
2.92	7.24	188	—	19.8	e.10	36.9	6.32	—	5.84	—
2.33	5.24	153	—	9.82	e.10	39.9	15	—	4.14	—
2.03	8.05	167	—	8.87	0.14	29.2	19.6	—	1.6	—
1.43	12.3	244	—	15	0.22	28.8	21.7	—	2.19	—
1.04	15.2	202	—	24.5	0.2	13.5	26.7	—	3.67	—
WASHINGTON COUNTY										
Central Virgin River area										
2.21	14.3	198	0.06	13.5	0.35	17.5	39.9	291	0.43	0.017
9.83	65.2	156	0.15	61.8	0.34	21.9	586	1,200	3.28	0.011
12.2	479	300	0.96	243	0.59	21.1	2,060	3,930	7.34	0.02
WAYNE COUNTY										
Upper Fremont Valley										
3.83	34.3	205	0.06	12.2	0.13	28.2	572	1,140	2.71	0.053
WEBER COUNTY										
East Shore area										
9.38	37.4	215	0.04	16.5	0.29	32.8	e.09	264	<.06	0.179
8.63	55.6	178	e.02	8.14	1.02	29.7	2.36	240	<.06	0.032
9.36	76	197	0.03	16.2	0.33	20.7	e.16	256	<.06	0.259

Table 5. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2007.

[µg/L, micrograms per liter; <, less than; e, estimated; —, no data]

Local identifier	Station number	Date	Arsenic, dissolved, in µg/L	Iron, dissolved, in µg/L	Manganese, dissolved, in µg/L	Molybdenum, dissolved, in µg/L	Selenium, dissolved, in µg/L	Uranium, dissolved, in µg/L
BEAVER COUNTY								
Beaver Valley								
(C-29-8)31add-1	381435112471401	8/20/2007	4.3	<6	0.5	2.5	0.99	22.1
Escalante Valley, Milford area								
(C-28-10)28ccc-1	382019112591701	7/25/2007	4.4	12	0.5	1.7	4.3	7.6
(C-28-11)12dbc-2	382313113020901	7/25/2007	6.2	<18	39.2	12.4	1.9	3.61
(C-29-10)5cdd-2	381835113000001	7/25/2007	2.4	<6	e.1	0.6	0.57	35.9
(C-29-11)27aad-1	381543113035501	7/25/2007	3.7	<6	e.1	1.5	0.74	12.8
BOX ELDER COUNTY								
Blue Creek Valley								
(B-13-6)1dbb-1	415320112290901	6/26/2007	4.5	8	0.5	0.7	1.4	1.74
Curlew Valley								
(B-12-11)4bcc-1	414745113063901	6/27/2007	3.2	250	1.5	1.7	2.2	2.18
(B-12-11)6aab-1	414808113080401	6/27/2007	1.2	e4	0.7	0.8	0.89	1.88
(B-14-9)4ccc-1	415800112525301	6/26/2007	3	<18	<.6	1	7.5	4.96
(B-14-9)7bbb-1	415754112551301	6/26/2007	1.8	<6	e.2	0.7	1.1	2.04
(B-15-10)36bbb-1	415939112562201	6/26/2007	2.5	<6	e.1	0.8	0.92	1.6
East Shore area								
(B-8-2)26bcd-1	412405112022501	8/30/2007	0.77	<6	0.7	0.8	0.3	0.16
Grouse Creek Valley								
(B-11-18)33ada-1	413808113542501	6/26/2007	7.7	6	0.2	5.9	3	18.5
Lower Bear River area								
(B-12-4)27dbd-1	414454112173101	7/20/2007	9.1	<18	e.3	6.8	230	17.8
(B-12-4)34cca-1	414339112173401	7/20/2007	e.70	e5	0.3	e1.0	7.2	1.3
CACHE COUNTY								
Cache Valley								
(A-11-1)15bcb-1	414143111495501	7/20/2007	0.63	<6	<.2	0.5	0.54	1.05
(A-13-1)29bcd-1	415020111520401	7/20/2007	8.2	169	60.9	0.8	<.24	0.3
DAVIS COUNTY								
East Shore area								
(A-2-1)7aba-4	405535111525101	8/28/2007	0.18	191	49.4	1.3	<.08	2.92
(B-4-2)27aba-1	410340112030001	8/28/2007	23.4	362	48.3	0.4	<.08	<.04
DUCHESNE COUNTY								
Altamont-Bluebell area								
U(C-1-1)33bcc-1	402114110003301	9/13/2007	2.3	694	59.4	5.8	<.08	1.33
U(C-1-2)36adc-1	402116110030801	9/13/2007	0.47	205	21.9	0.5	<.08	0.29
U(C-2-1)7bbd-1	401940110023601	9/12/2007	0.87	153	9.2	9.3	<.08	0.21
Starvation-Duchesne area								
U(C-1-4)31bbb-1	402130110231301	9/12/2007	3.2	<6	e.1	1.3	0.71	5.05
U(C-2-5)34abb-2	401613110260702	9/12/2007	0.75	15	4.2	0.6	<.08	0.36
U(C-2-5)35bab-1	401611110251502	9/13/2007	0.53	38	0.6	1	<.08	0.63
U(C-3-4)31cab-1	401030110225701	9/12/2007	0.52	12	0.3	0.6	0.26	1.11
IRON COUNTY								
Cedar Valley								
(C-35-11)11ccc-1	374550113040601	8/21/2007	2	<6	0.3	1.8	1.6	3.54
(C-35-11)27dbb-1	374337113043701	8/20/2007	0.57	<6	<.2	0.2	0.94	3.56
(C-35-11)31dbd-1	374248113075201	8/20/2007	0.98	<6	e.1	0.6	1.7	2.88
(C-36-11)11bac-1	374122113034801	8/21/2007	0.3	<18	<.6	0.2	3.8	7.08
(C-37-12)23acb-1	373407113100801	8/20/2007	0.65	<6	0.3	0.4	11	2.12

Table 5. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2007—Continued.

Local identifier	Station number	Date	Arsenic, dissolved, in µg/L	Iron, dissolved, in µg/L	Manganese, dissolved, in µg/L	Molybdenum, dissolved, in µg/L	Selenium, dissolved, in µg/L	Uranium, dissolved, in µg/L
IRON COUNTY—CONTINUED								
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-2	374834113384301	7/11/2007	8.6	<6	e.2	0.6	2.9	3.67
(C-36-15)4bad-3	374209113322203	7/11/2007	21.9	<6	e.2	9.4	0.36	1.39
(C-36-16)9bcd-2	374014113391101	7/11/2007	3.1	<6	e.1	0.5	0.82	2.56
(C-36-16)19abb-1	373854113411501	8/8/2007	1.9	<6	e.2	0.9	0.76	7.06
Parowan Valley								
(C-33-8)31ccc-1	375257112483501	8/20/2007	4	<6	<.2	0.5	0.6	1.9
(C-33-9)35acd-3	375320112510003	8/20/2007	2.4	<6	<.2	0.3	0.4	1.97
JUAB COUNTY								
Juab Valley								
(C-12-1)24baa-1	394545111531001	7/9/2007	1.3	<6	e.1	0.6	3.5	1.71
(C-14-1)26dca-1	393335111534401	7/10/2007	0.51	66	2.8	2.6	0.43	2.53
(C-15-1)1baa-1	393236111525300	7/10/2007	0.34	<6	e.1	0.4	1	1.01
(D-13-1)4cca-1	394225111495701	7/10/2007	0.58	<6	<.2	0.5	1.4	1.62
KANE COUNTY								
Kanab area								
(C-42-6)19bdc-2	370843112340602	8/7/2007	1.1	e4	e.1	<.1	0.39	0.41
R(C-40-4)31bad-1	371740112210601	8/7/2007	0.19	87	145	1.2	e.06	8.71
MILLARD COUNTY								
Pahvant Valley								
(C-19-4)29bcd-1	390758112194601	8/14/2007	1.8	7	0.2	0.1	1.3	0.91
(C-20-4)6dbd-1	390558112202301	8/20/2007	2.7	12	e.2	1	2.5	0.94
(C-21-5)7cdd-3	385939112272303	8/14/2007	2	<6	e.1	1.4	2.7	3.37
(C-21-5)29cbc-1	385714112264701	8/15/2007	0.88	21	0.8	0.1	0.48	1.36
(C-21-5)30dbc-3	385715112271201	8/15/2007	1.1	7	0.3	0.2	0.56	1.32
(C-21-6)1ddb-1	390045112281201	8/15/2007	5.2	<6	e.1	2.2	2.9	4.78
(C-22-5)21bab-2	385324112252301	8/20/2007	0.8	18	0.9	1.5	0.55	0.54
(C-23-6)15bda-1	384848112305101	8/20/2007	7.2	e11	<.6	1	3.7	4.54
(C-23-6)28bbb-2	384722112322101	8/14/2007	3	e23	<1.0	0.8	17.5	11.6
Sevier Desert								
(C-15-4)8cba-1	393154112192901	7/10/2007	2.9	148	396	2.5	0.18	5.42
(C-15-4)26dcc-1	392859112154601	7/10/2007	1.8	<6	<.2	0.2	4.2	0.76
(C-15-5)2ddc-1	393221112221801	7/10/2007	2.6	51	175	0.9	e.05	2.97
(C-15-5)15dad-1	393046112231301	7/10/2007	5.2	e4	11.4	2.6	0.12	1.65
(C-15-5)26baa-1	392939112224101	7/10/2007	3.9	e4	e.1	0.2	0.38	2.07
Snake Valley								
(C-17-19)4add-2	392141113585601	7/10/2007	2	<6	e.1	0.6	0.53	1.87
(C-20-20)1baa-2	390604114025201	8/2/2007	1.5	<6	0.2	0.6	0.59	1.27
(C-22-19)6bac-1	385615114013801	8/2/2007	0.99	e3	0.8	0.4	0.31	2.74
(C-21-19)31acd-1	385650114010601	8/2/2007	2.4	<6	e.2	0.5	0.6	4.84
(C-23-19)20bac-2	384900114003001	8/2/2007	20.1	e4	e.1	16.2	9.7	11
SALT LAKE COUNTY								
Salt Lake Valley								
(C-3-1)32adc-1	403054111581601	7/10/2007	2.8	e6	1.9	0.3	1.5	7.55
(D-1-1)7abd-6	404506111523301	7/10/2007	1.1	45	15.1	1.1	1.5	1.61
SAN JUAN COUNTY								
Bluff area								
(D-40-23)27baa-1	371621109211001	7/25/2007	25.1	749	17.6	2.9	e.08	1.5

Table 5. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2007—Continued.

Local identifier	Station number	Date	Arsenic, dissolved, in µg/L	Iron, dissolved, in µg/L	Manganese, dissolved, in µg/L	Molybdenum, dissolved, in µg/L	Selenium, dissolved, in µg/L	Uranium, dissolved, in µg/L
SANPETE COUNTY								
Central Sevier Valley								
(C-19-1)23cac-1	390819111530701	7/30/2007	9.7	e5	0.2	6.4	4.5	9.98
Sanpete Valley								
(D-14-3)18aab-1	393623111372401	8/8/2007	1.1	e3	<.2	0.2	1.4	1.78
(D-15-4)4bcd-1	393241111290501	8/8/2007	0.24	<6	<.2	0.2	0.61	0.85
(D-15-4)17abb-1	393113111294501	8/8/2007	0.19	<6	<.2	0.2	0.38	1.08
(D-16-2)36cbd-1	392238111390501	8/7/2007	6.7	155	23.4	1.7	0.49	0.8
SEVIER COUNTY								
Central Sevier Valley								
(C-23-2)15dcb-4	384757112002201	7/30/2007	4	e5	e.2	3.4	1.3	5.17
(C-23-2)30baa-2	384641112034601	7/30/2007	1.5	4,700	33.8	0.7	0.1	2.69
Upper Sevier Valley								
(C-26-1)23ddb-1	383140111522001	7/30/2007	3.9	<6	<.2	0.5	0.32	2.35
TOOELE COUNTY								
Rush Valley								
(C-8-5)6ddb-1	400849112263901	7/26/2007	14.8	<6	<.2	2.4	0.66	1.32
(C-8-5)31ccd-5	400418112271701	7/26/2007	1.3	9	0.8	0.2	1.4	1.31
Skull Valley								
(C-1-7)31daa-1	404113112395801	7/3/2007	14.6	63	2.2	5.3	2.6	7.76
(C-4-8)3bca-1	403006112442201	7/3/2007	0.82	e4	e.2	e.1	1.9	1.97
Tooele Valley								
(C-2-4)28aac-1	403716112174801	8/15/2007	1.9	<6	e.2	0.4	14.8	2.22
(C-2-4)31add-6	403606112195401	8/15/2007	1.1	<6	e.1	0.5	2.1	1.72
(C-2-5)34cbc-1	403612112241001	8/15/2007	3.6	e9	<.6	1.8	7.1	2.14
(C-2-6)23cbb-1	403802112301201	8/15/2007	4.4	e6	0.2	0.5	0.7	0.9
(C-3-6)1bdb-1	403514112283701	8/15/2007	0.35	<6	<.2	0.2	0.75	1.52
UTAH COUNTY								
Cedar Valley								
(C-6-2)29bdb-1	401620112054301	7/10/2007	0.18	55	33.9	2.2	<.08	0.06
Goshen Valley								
(C-9-1)3ddb-1	400325111552501	8/22/2007	8.2	e5	0.2	3.4	1.8	5.51
(C-10-1)4cbb-1	395825111571801	8/22/2007	6.9	<18	e.4	3.5	4.2	9.42
(C-10-1)31cdd-1	395340111590001	8/22/2007	3.5	<6	e.2	0.9	3.4	2.53
(C-11-1)6abc-1	395326111585001	8/22/2007	4.2	<6	0.3	1.2	1.8	2.04
Northern Utah Valley								
(D-5-1)8aaa-3	402420111505701	8/23/2007	2.4	<6	<.2	1.8	2.6	2.16
(D-6-2)17aca-1	401801111442501	8/23/2007	1.6	e4	1.4	1.7	1.2	1.71
(D-7-2)4cbb-2	401414111435301	8/23/2007	1.9	528	68.8	1	<.08	e.02
Southern Utah Valley								
(D-9-1)36bbc-1	395942111470801	8/22/2007	0.43	<6	e.1	0.6	1.4	1.51
(D-9-2)9bac-1	400311111432001	8/22/2007	2.5	<6	e.2	1.1	1	2.22
(D-9-2)26add-1	400023111402200	8/22/2007	0.46	<6	<.2	0.5	1.5	2.06
WASATCH COUNTY								
Heber Valley								
(D-3-4)26dba-1	403146111272701	7/19/2007	—	<6	0.2	—	—	—
(D-3-5)18cba-1	403325111254601	7/19/2007	—	674	43.9	—	—	—
(D-4-4)2bcd-1	403004111280301	7/19/2007	—	32	3.2	—	—	—
(D-4-4)12dcc-1	402842111263101	6/28/2007	—	<6	<.2	—	—	—
(D-4-4)13bdd-1	402810111263601	6/28/2007	—	8	1.3	—	—	—
(D-4-5)3dcc-1	402937111214901	6/28/2007	—	<6	0.3	—	—	—
(D-4-5)4ccb-1	402946111233901	6/28/2007	—	e3	1	—	—	—
(D-45)16bcc-2	403003111255801	7/19/2007	—	10	1.7	—	—	—
(D-4-5)16bab-1	402840111232201	6/28/2007	—	<6	0.2	—	—	—
(D-4-5)16ccd-1	402750111232701	6/28/2007	—	6	0.9	—	—	—

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WASHINGTON COUNTY								
Central Virgin River area								
(C-41-17)8cbd-2	371348113470301	8/8/2007	31.1	<6	e.2	6.7	0.38	1.64
(C-42-14)11aba-1	370913113230301	7/12/2007	4.5	22	0.7	2.2	2.6	5.52
(C-42-16)26bcc-1	370617113371101	7/12/2007	1.8	51	1,090	9.1	6	65.4
WAYNE COUNTY								
Upper Fremont Valley								
(D-27-3)19aaa-1	382717111365601	7/30/2007	1.2	e3	e.1	0.2	0.74	16.8
WEBER COUNTY								
East Shore area								
(B-5-2)6cdd-2	411130112064502	8/30/2007	10.6	222	116	0.4	<.08	<.04
(B-7-2)16dcd-2	412011112041401	8/30/2007	1.7	48	40.6	2.1	<.08	<.04
(B-6-3)15cbc-1	411523112082101	8/28/2007	21.4	88	55.4	3	<.08	<.04

REFERENCES CITED

Burden, C.B., and others, 2007, Ground-water conditions in Utah, spring of 2007: Utah Division of Water Resources Cooperative Investigations Report No. 48, 129 p.

Fishman, M.J., and Friedman, L.C., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

National Oceanic and Atmospheric Administration, 2007, Climatological data, Utah: Asheville, North Carolina, National Climatic Data Center, v. 109, no. 1-12 [variously paged].

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1–A9, available online at http://pubs.water.usgs.gov/twri9A. [Chapters were published from 1997–1999; updates and revisions are ongoing and can be viewed at http://water.usgs.gov/owq/FieldManual/mastererrata.html]

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