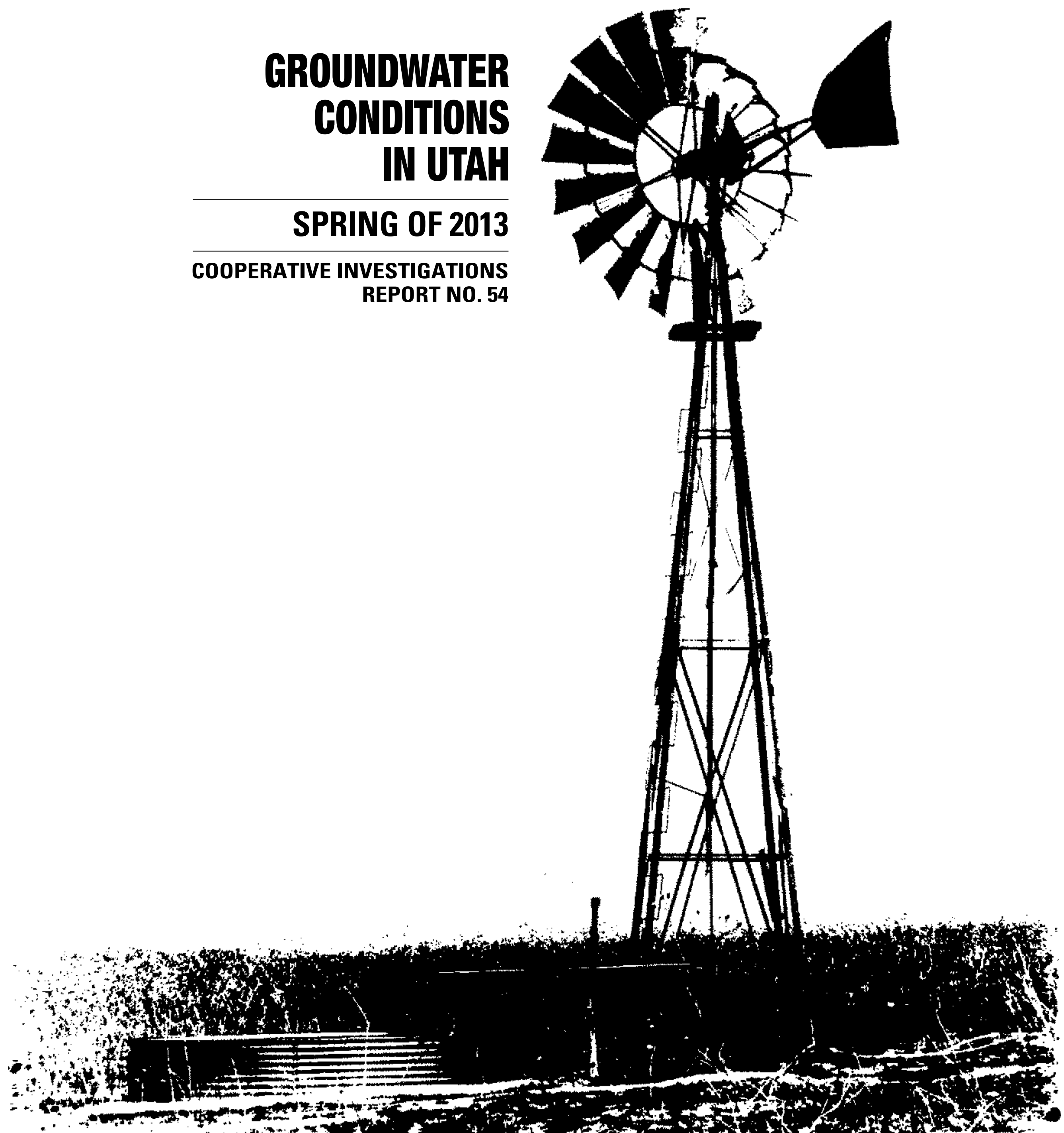
GROUNDWATER CONDITIONS IN UTAH

SPRING OF 2013

COOPERATIVE INVESTIGATIONS REPORT NO. 54



UTAH DEPARTMENT OF NATURAL RESOURCES and
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

U.S. GEOLOGICAL SURVEY

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 2013

By
Carole 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 Rights, and
Utah Department of Environmental Quality, Division of Water Quality

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Conversion Factors, Datums, and Water-Quality Units

Multiply	By	To obtain
acre-foot	1,233	cubic meter
foot	0.3048	meter
gallon per minute	0.06301	liter per second
inch	2.54	centimeter
mile	1.609	kilometer
square mile	2.59	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.

Specific conductance is 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 in 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.

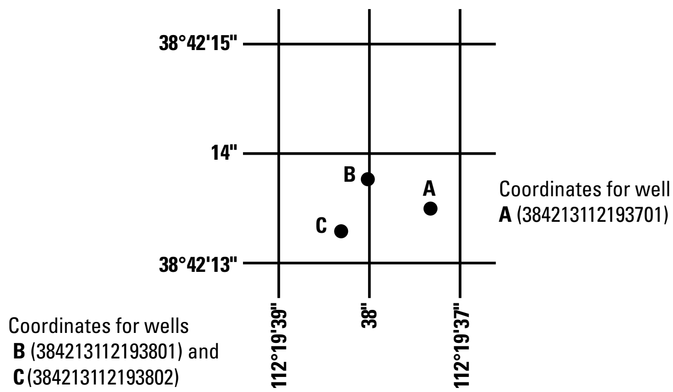
Definition of Terms

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

Numbering System for Wells and Surface-Water Sites

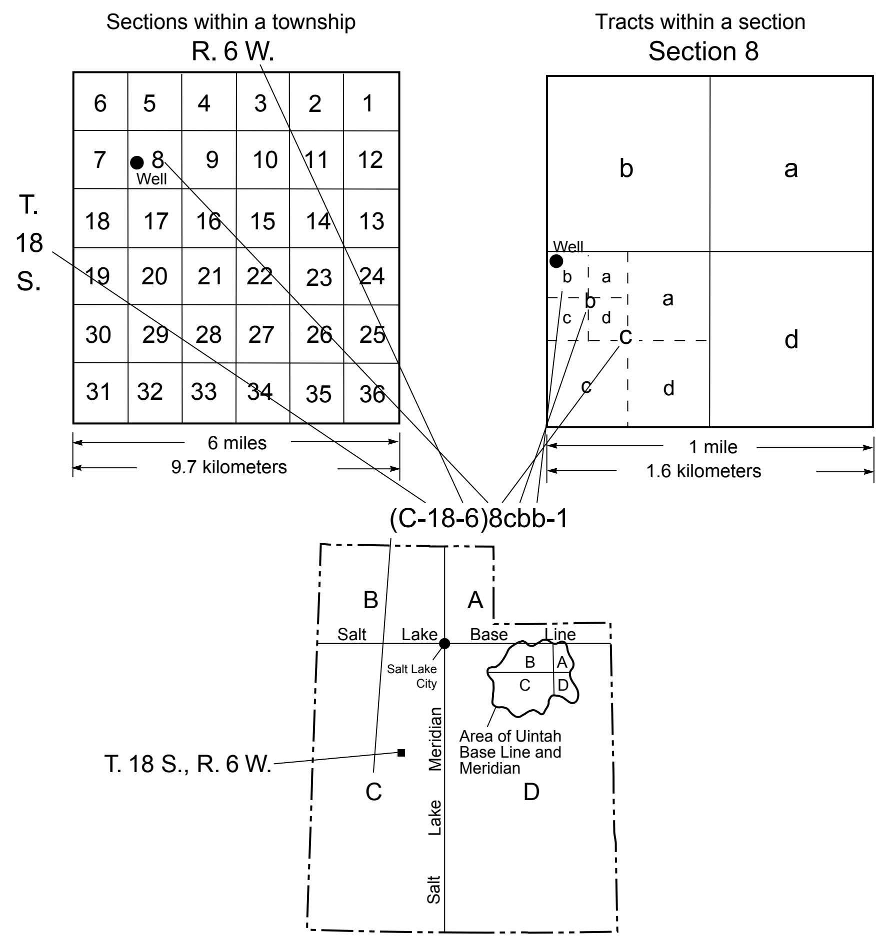
Wells by Latitude and Longitude

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 the Cadastral System of Land Subdivision

The well-numbering system used in Utah is based on the Cadastral 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 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. Well numbers for wells located in half ranges will have an additional “R” 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.

x

Groundwater Conditions in Utah, Spring of 2013

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

Introduction

This is the fiftieth in a series of annual reports that describe groundwater 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 Rights, and the Utah Department of Environmental Quality, Division of Water Quality, provide data to enable interested parties to maintain awareness of changing groundwater conditions.

This report, like the others in the series, contains information on well construction, groundwater withdrawals 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 groundwater. Supplementary data are included in reports of this series only for those years or areas that are important to a discussion of changing groundwater conditions and for which applicable data are available.

This report includes individual discussions of selected significant areas of groundwater development in the State for calendar year 2012. 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 Rights, and the Utah Department of Environmental Quality, Division of Water Quality. This report is also available online at *http://www.waterrights.utah.gov/techinfo/* and *http://ut.water.usgs.gov/publications/GW2013.pdf*. Groundwater conditions in Utah for calendar year 2011 are reported in Burden and others (2012) and available online at *http://ut.water.usgs.gov/publications/GW2012.pdf*.

Utah's Groundwater Reservoir

Small amounts of groundwater 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 groundwater development discussed in this report are shown on figure 1 and in table 1. Relatively few wells outside of these areas yield large amounts of groundwater 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 groundwater development.

Most wells in Utah yield water from unconsolidated basin-fill 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-grained 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 materials eroded from adjacent mountains.

A small percentage of wells in Utah yield water from consolidated-rock (bedrock) aquifers. Consolidated rocks that have the highest yield are basalt, which contains interconnected vesicular openings, fractures, or permeable weathered zones at the tops of lava 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 2012 was about 1,060,000 acre-feet (table 2), which is about 215,000 acre-feet more than the revised total for 2011 and 145,000 acre-feet more than the 2002–2011 average annual withdrawal (table 3). The increase in withdrawal resulted mostly from increased irrigation and public-supply use. The total estimated withdrawal for irrigation was about 574,000 acre-feet, which is about 116,000 acre-feet more than the revised total for 2011. Withdrawal for public-supply use was about 309,000 acre-feet, which is 84,000 acre-feet more than in 2011. Withdrawal for industrial use was about 113,000 acre-feet, which is 15,000 acre-feet more than the value for 2011. Withdrawal for domestic and stock use was about 64,000 acre-feet, which is the same as in 2011.

From 2011 to 2012, groundwater withdrawal increased in 15 of the 16 areas of groundwater development discussed in this report (table 2). Withdrawal in Salt Lake Valley increased about 41,000 acre-feet, the largest increase in any of the groundwater development areas shown on figure 1. Withdrawal in the central Sevier Valley decreased about 3,000 acre-feet, the only decrease in any of the areas. The 2012 total withdrawal was more than the average annual withdrawal for 2002–2011 in 13 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 2012 at 22 of 27 weather stations included in this report (Western Region Climate Center, 2012), was less than the long-term average. The greatest decrease in precipitation from average was 6.7 inches at Pineview Dam. The greatest increase in precipitation from average was 1.8 inches at Cedar City Federal Aviation Administration Airport.

During February and March 2013, about 640 water-level measurements were made in wells for areas included in this report. Most water-level data included in the hydrographs in this report are from measurements made during February and March, but may include some 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://nwis.waterdata.usgs.gov/ut/nwis/gwlevels*.

In 2012, 310 wells were constructed for new appropriations of groundwater, as determined by the Utah Division of Water Rights (table 2); this is 45 more wells than the total reported for 2011. In 2012, 22 large-diameter wells (12 inches or more) were constructed for new appropriations of groundwater (table 2), which is 1 more than the total reported for 2011. These new wells are used principally for withdrawal of water for public supply, irrigation, and industrial purposes.

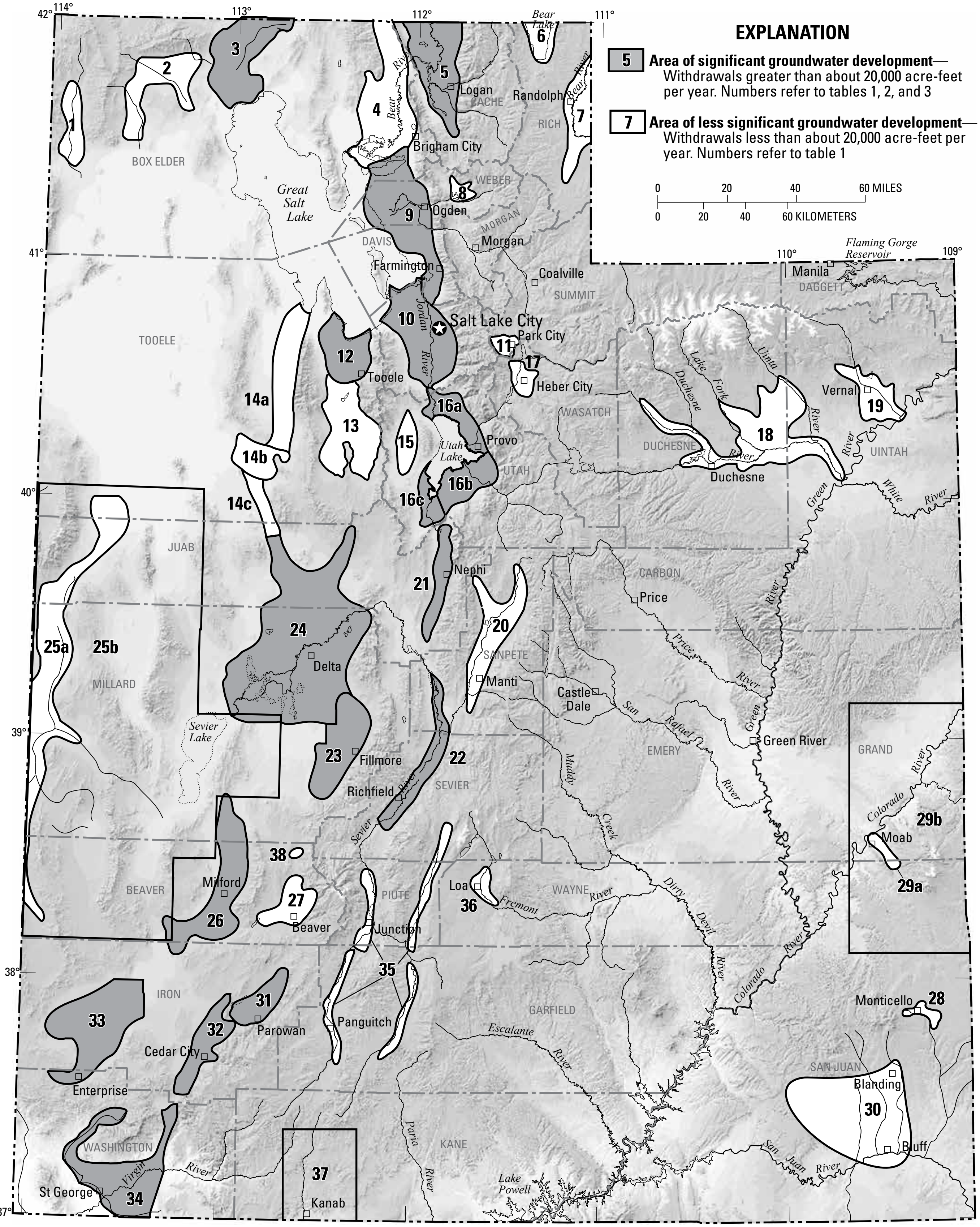


Figure 1. Areas of groundwater development in Utah specifically referred to in this report.

Table 1. Areas of groundwater development in Utah specifically referred to in this report.

[Do., ditto]

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

Table 2. Number of wells constructed and estimated withdrawal of water from wells in Utah, 2012.

Area	Number in figure 1	Number of wells[1] constructed in 2012		Estimated withdrawal from wells, in acre-feet (rounded)					
				2012					2011 total[2, 6]
		Total	Diameter of 12 inches or more	Irrigation	Industrial[1]	Public supply[1]	Domestic and stock	Total	
Curlew Valley	3	2	1	41,400	0	200	100	42,000	32,000
Cache Valley	5	32	0	17,300	5,600	13,600	2,000	38,000	30,000
East Shore area	9	4	2	7,000	3,800	30,600	5,000	46,000	37,000
Salt Lake Valley	10	5	3	600	[3]37,000	107,400	22,000	167,000	126,000
Tooele Valley	12	10	0	[4,5]14,200	800	13,500	1,200	30,000	21,000
Utah and Goshen Valleys	16	17	1	35,300	11,200	58,900	16,700	122,000	[6]90,000
Northern Utah Valley[7]	16a	2	0	(4,600)	(7,400)	(43,600)	(8,100)	(63,700)	([6]45,400)
Southern Utah Valley[7]	16b	15	1	(9,400)	(3,800)	(15,200)	(8,500)	(36,900)	(28,100)
Goshen Valley[7]	16c	0	0	(21,300)	(0)	(100)	(100)	(21,500)	(16,900)
Juab Valley	21	4	1	26,900	90	[8]450	400	28,000	15,000
Sevier Desert	24	6	0	17,000	3,800	1,600	1,200	24,000	20,000
Central Sevier Valley	22	19	1	23,200	8	2,800	1,500	28,000	31,000
Pahvant Valley	23	4	0	113,300	0	880	320	114,000	89,000
Cedar Valley, Iron County	32	2	1	29,700	100	7,500	2,400	40,000	34,000
Parowan Valley	31	4	0	[9]36,900	200	300	350	38,000	32,000
Escalante Valley									
Milford area	26	6	4	44,700	[10]21,400	700	140	67,000	53,000
Beryl-Enterprise area	33	10	4	86,500	[11]3,800	550	650	91,000	84,000
Central Virgin River area	34	6	0	7,100	640	18,400	2,400	29,000	28,000
Other areas[12, 13]		179	4	72,800	24,600	51,600	7,500	156,000	123,000
Total		310	22	574,000	113,000	309,000	64,000	1,060,000	[6]845,000

[1] Data provided by Utah Department of Natural Resources, Division of Water Rights.
[2] From Burden and others (2012, table 2).
[3] Includes some use for air conditioning, about 2,700 acre-feet. About 94 percent was injected back into the aquifer.
[4] Includes some domestic and stock use.
[5] Includes some flowing well discharge.
[6] Revised.
[7] Numbers for Northern Utah Valley, Southern Utah Valley, and Goshen Valley, presented within parentheses, are a subtotal of withdrawal.
[8] Previously included some springs.
[9] Includes some stock use.
[10] Includes 18,900 acre-feet for geothermal power generation. About 99 percent was injected back into the aquifer.
[11] Includes 2,810 acre-feet for heating greenhouses. About 95 percent was injected back into the aquifer.
[12] Withdrawal totals are estimated minimum. See "Other Areas" section of this report for withdrawal estimates for other areas (table 4).
[13] 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 groundwater development in Utah, 2002–2011.

Area	Number in figure 1	Thousands of acre-feet[1] (rounded)											
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2002–2011 average (rounded)	2012
Curlew Valley	3	[2]38	42	38	29	31	38	44	34	39	32	37	42
Cache Valley	5	33	27	27	29	31	36	34	31	33	30	31	38
East Shore area	9	49	49	46	41	46	52	54	46	43	37	46	46
Salt Lake Valley	10	[2]140	130	125	110	131	151	135	137	140	126	133	167
Tooele Valley	12	21	22	21	[2]18	[2]21	[2]27	[2]28	25	24	21	23	30
Utah and Goshen Valleys	16	[2]111	[2]108	[2]105	[2]87	[2]99	126	[2]120	[2]105	[2]106	[2]90	105	122
Northern Utah Valley[3]	16a	([2]64)	([2]68)	([2]66)	([2]46)	(58)	(72)	([2]67)	([2]60)	([2]58)	([2]45)	(60)	(64)
Southern Utah Valley[3]	16b	(36)	(33)	(30)	(31)	(29)	(38)	(34)	(30)	(31)	(28)	(32)	(37)
Goshen Valley[3]	16c	(11)	(7)	(9)	(10)	(12)	(16)	(19)	(15)	(17)	(17)	(13)	(21)
Juab Valley	21	29	27	26	14	21	26	26	21	22	15	23	28
Sevier Desert	24	36	28	41	24	20	34	44	48	46	20	34	24
Central Sevier Valley	22	11	15	15	17	16	19	24	27	26	31	20	28
Pahvant Valley	23	89	86	85	80	86	89	94	104	106	89	91	114
Cedar Valley, Iron County	32	42	39	40	30	35	40	40	38	38	34	38	40
Parowan Valley	31	39	31	37	27	33	34	38	37	34	32	34	38
Escalante Valley													
Milford area	26	52	50	44	40	45	49	51	56	62	53	50	67
Beryl-Enterprise area	33	99	92	98	68	79	92	93	93	90	84	89	91
Central Virgin River area	34	27	28	26	29	32	33	29	33	29	28	29	29
Other areas		131	128	129	111	130	155	144	130	134	123	132	156
Total (rounded)		[2]947	[2]902	[2]903	[2]754	[2]856	[2]1,001	[2]998	[2]965	[2]972	[2]845	915	1,060

[1] From previous reports in this series.
[2] Revised.
[3] Numbers for Northern Utah Valley, Southern Utah Valley, and Goshen Valley, presented within parentheses, are a subtotal of withdrawal.

Major Areas of Groundwater Development

Curlew Valley

By Adam S. Birkin

The Curlew Valley drainage basin extends across the Utah-Idaho state line and includes the communities of Cedar Creek, Kelton, and Snowville (fig. 2). The valley is bounded on the west and east by the Raft River and Hansel Mountains, which range in altitude from about 6,500 to nearly 10,000 feet. The valley is open to the south, where water draining from it 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 is substantially more in the surrounding mountains.

The principal source of water in Curlew Valley is groundwater. The groundwater reservoir is primarily composed of confined aquifers in alluvial and lacustrine basin-fill 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 2012 was about 42,000 acre-feet, which is 10,000 acre-feet more than the value for 2011 and 5,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3).

The location of wells in Curlew Valley in which the water level was measured during March 2013 is shown in figure 2. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Oakley, Idaho (replaces Grouse Creek, which has been discontinued), to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 3.

Precipitation at Oakley, Idaho in 2012 was about 11.1 inches, which is 2.2 inches less than in 2011 and 0.1 inch more than the average annual precipitation for 1930–2012.

Water levels in Curlew Valley generally rose or declined less than about 1 foot from March 2012 to March 2013, except for three wells with declines of up to about 9.4 feet. These large declines were observed in two wells west of Snowville and one well north of Kelton, and were probably the result of large localized withdrawals.

The concentration of dissolved solids in water samples collected from well (B-12-11)8abb-1, 3 miles north of Kelton, and well (B-14-9)5bbb-1, 10 miles west of Snowville, from 1972–2011 and 1971–2012, respectively, is shown in figure 3. The dissolved-solids concentration in water from well (B-14-9)5bbb-1 increased slightly from September 2011 to July 2012. Well (B-12-11)8abb-1 was not sampled in 2012. Dissolved-solids concentrations in water from both wells have generally increased since the early 1970s.

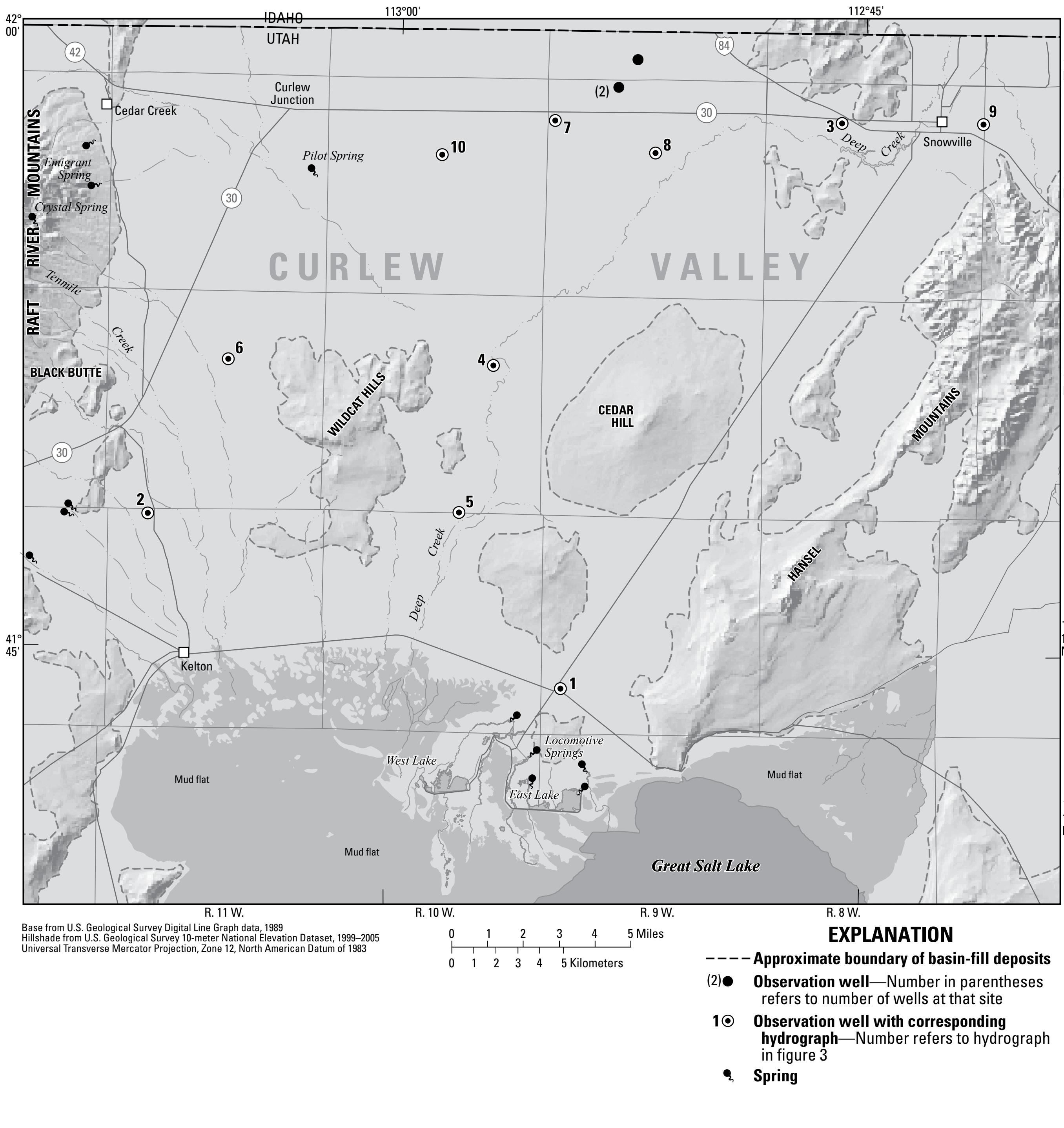


Figure 2. Location of wells in Curlew Valley in which the water level was measured during March 2013.

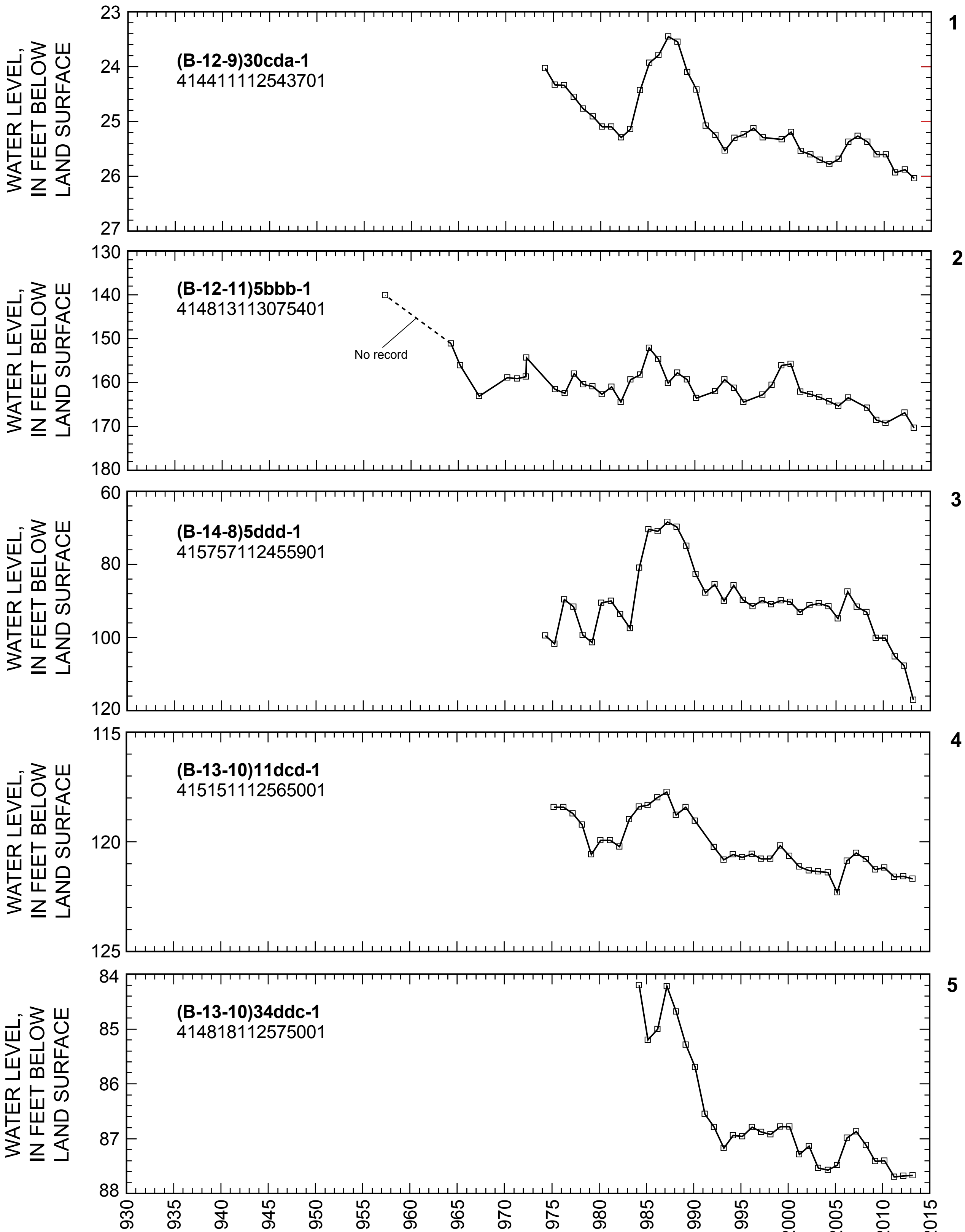


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

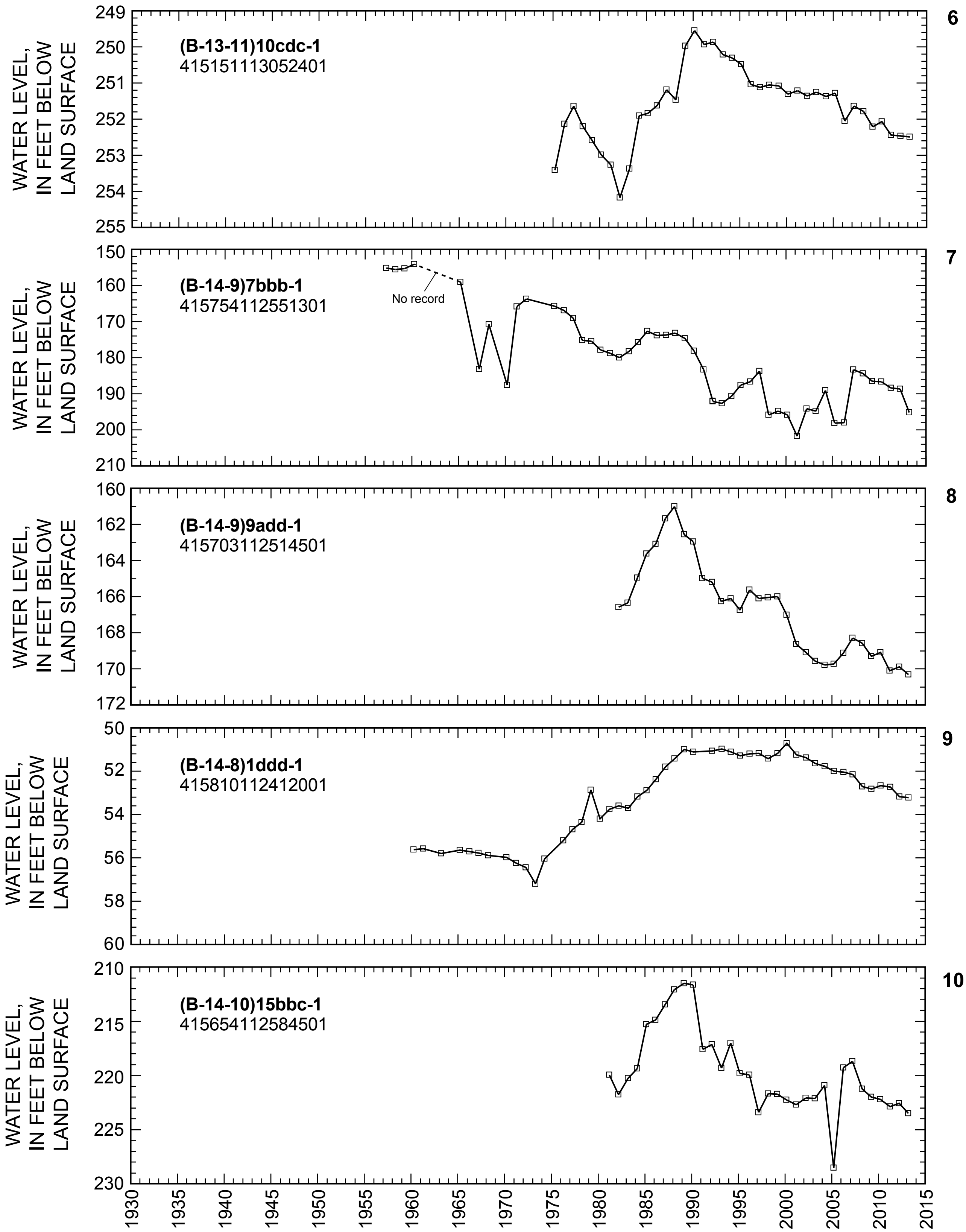


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

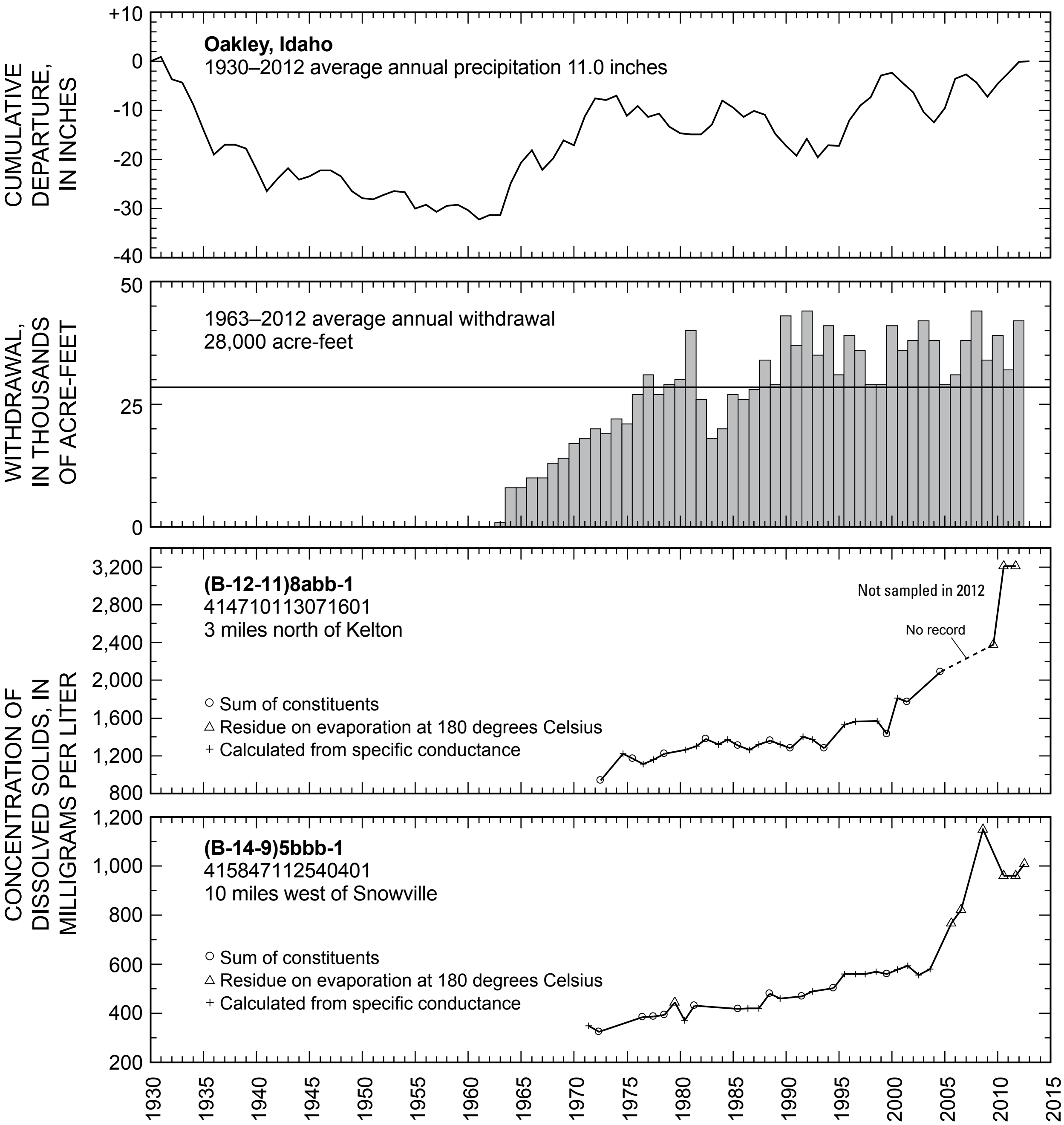


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

Cache Valley

By V. Noah Derrick

Cache Valley covers about 450 square miles in Cache County where it is bounded on the east by the Bear River Range and on the southwest by the Wellsville Mountains (fig. 4). Groundwater occurs in unconsolidated basin-fill deposits in the valley, under both water-table and artesian conditions. Recharge to the groundwater system occurs principally along the margins of the valley, and groundwater moves toward the center of the valley and west toward Cache Junction.

Total estimated withdrawal of water from wells in Cache Valley in 2012 was about 38,000 acre-feet, which is 8,000 acre-feet more than in 2011 and 7,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal for irrigation was 17,300 acre-feet, of which an estimated 12,000 acre-feet was from flowing wells. Irrigation withdrawals were about 3,900 acre-feet more than in 2011. Withdrawal for public supply was 13,600 acre-feet, 5,300 acre-feet more than in 2011.

The location of wells in Cache Valley in which the water level was measured during March 2013 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.

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 2012 was about 140,000 acre-feet, which is 184,000 acre-feet less than the 2011 total of 324,000 acre-feet and 41,000 acre-feet less than the 1941–2012 average annual discharge. Precipitation at Logan, Utah State University, was about 15.7 inches in 2012. This is about 7.8 inches less than for 2011 and about 2.6 inches less than the average annual precipitation for 1930–2012.

Water levels throughout the valley generally declined from March 2012 to March 2013. Declines are probably the result of increased withdrawals for irrigation and public-supply use, and less-than-average precipitation. Water levels have fluctuated over the entire period of record, as far back as 1935 in many cases, depending on the amount and timing of precipitation and recharge to the unconsolidated deposits from snowmelt runoff.

The concentration of dissolved solids in water samples collected during 1970 to 2012 from well (A-13-1)29bcd-1, located 1.5 miles west of Smithfield, is shown in figure 5. The concentration has ranged from 223 to 278 mg/L, with a median value of 258 mg/L. The water sample collected in August 2012 had a dissolved-solids concentration of 265 mg/L, slightly greater than the median value.

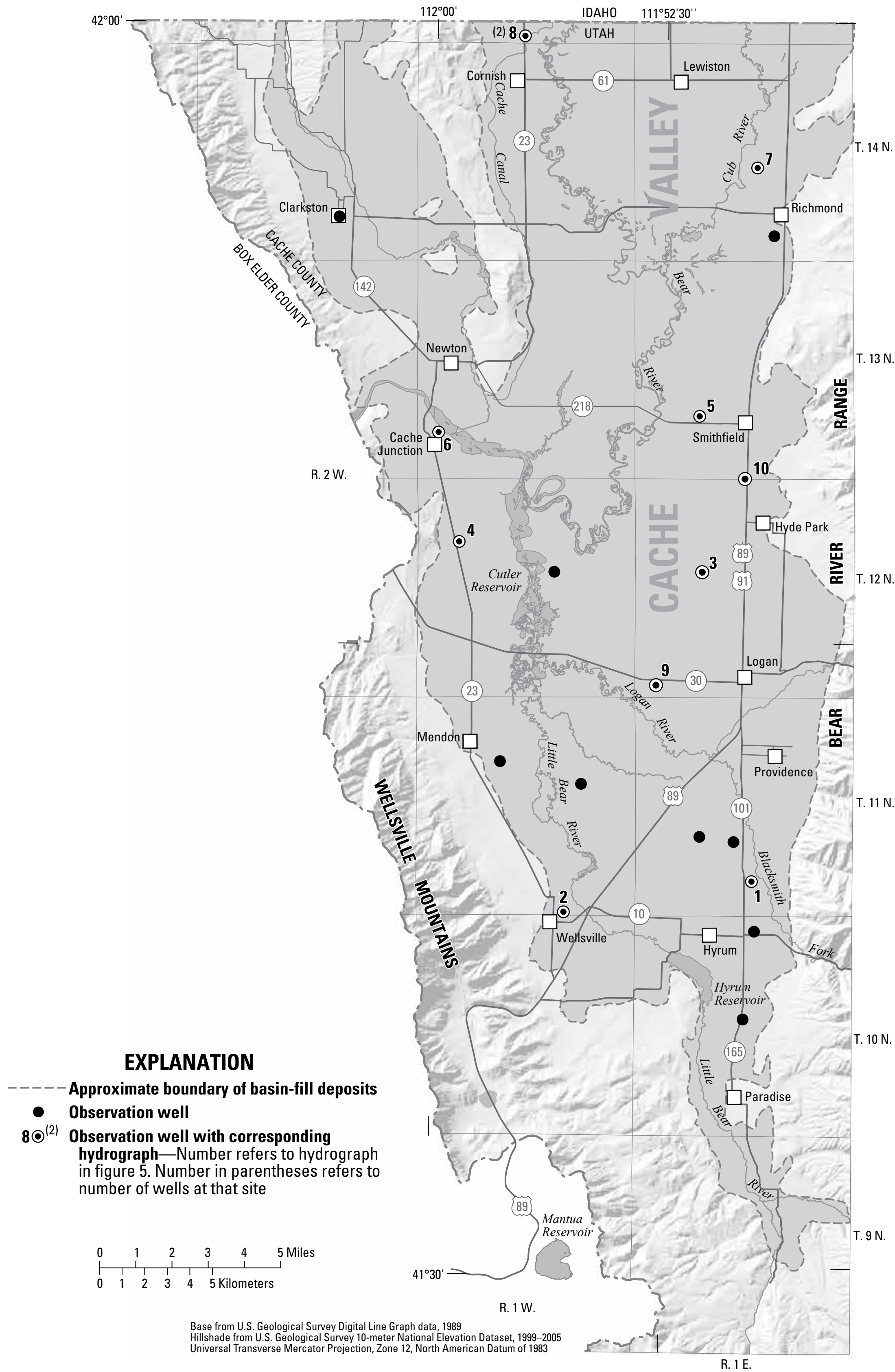


Figure 4. Location of wells in Cache Valley in which the water level was measured during March 2013.

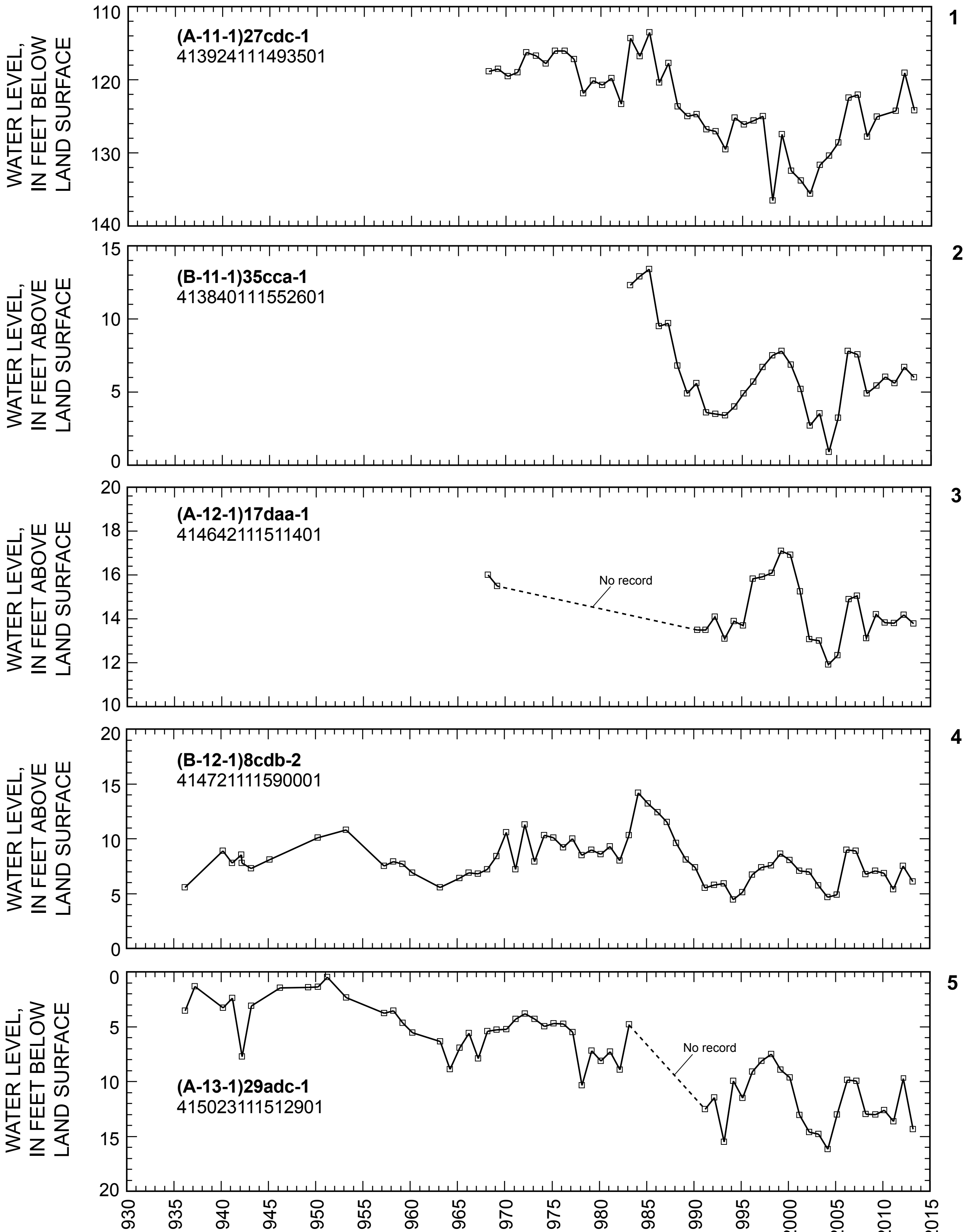


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from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

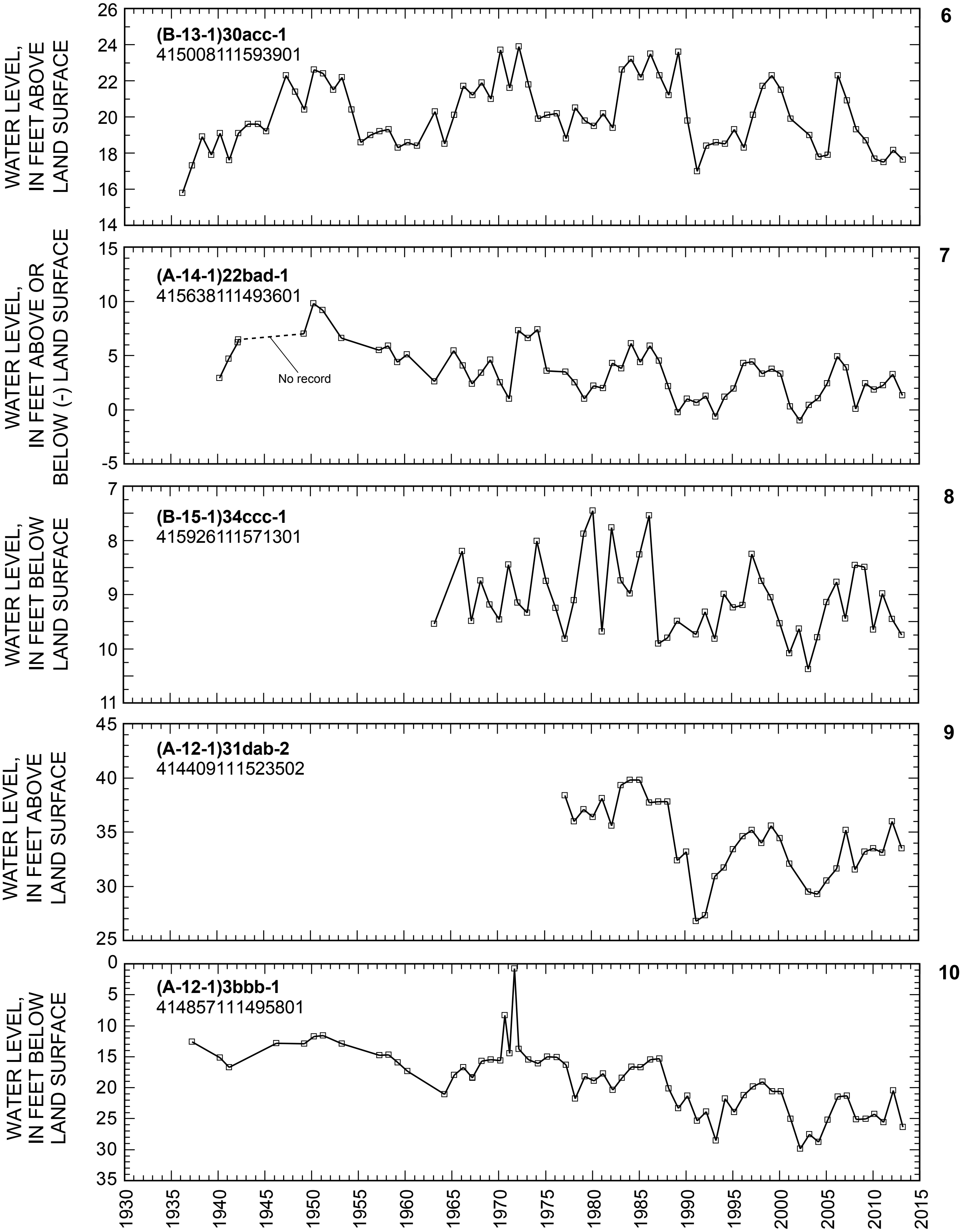


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from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

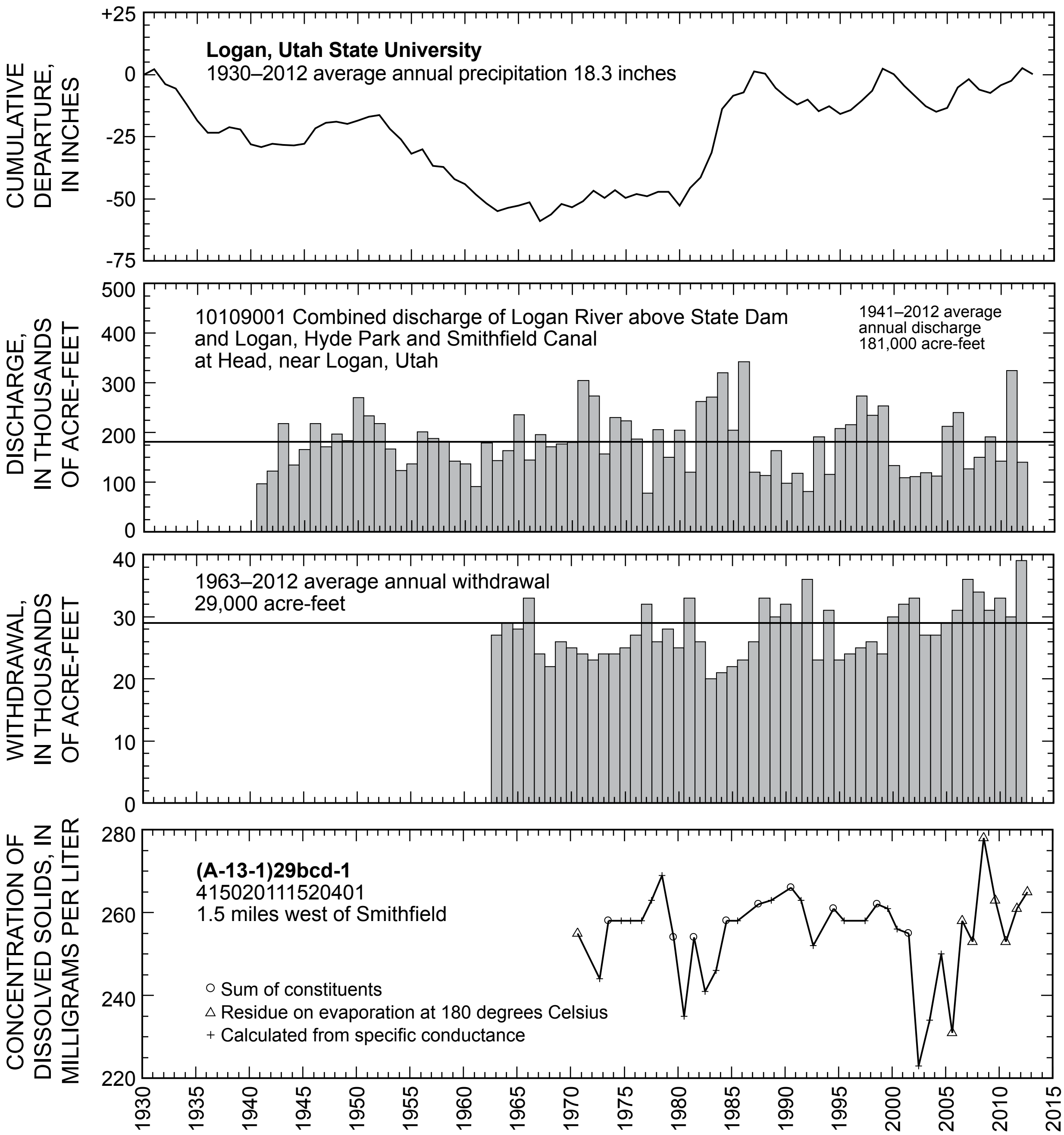


Figure 5. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from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

East Shore Area

By Martel J. 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). Groundwater occurs in unconsolidated basin-fill 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 contact between the Wasatch Range and 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 2012 was about 46,000 acre-feet, which is 9,000 acre-feet more than was reported for 2011 and the same as the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal for public supply was 30,600 acre-feet in 2012, about 9,600 acre-feet more than in 2011. Withdrawal for irrigation was about 7,000 acre-feet, which is 200 acre-feet less than was reported for 2011. Withdrawal for industrial use was about 3,800 acre-feet, which was the same as in 2011.

The location of wells in the East Shore area in which the water level was measured during March 2013 is shown in figure 6. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Pineview Dam, 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.

Precipitation at Pineview Dam in 2012 was about 23.9 inches, which is about 6.7 inches less than the average annual precipitation for 1949–2012 and about 13.8 inches less than in 2011.

Water levels declined from March 2012 to March 2013 in most of the wells measured in the East Shore area. Declines are probably due to increased withdrawal for public-supply use and less-than-average precipitation. Water levels have generally declined since the mid-1980s in wells south of Kaysville in the East Shore area and have generally declined since the mid-1950s in wells north of Kaysville.

The concentration of dissolved solids in water samples collected from well (B-4-2)27aba-1, 2.3 miles south-southeast of Syracuse, from 1969 to 2012, is shown in figure 7. The median concentration during this period was 399 mg/L. From 1969 to 1993, dissolved-solids concentration in water samples ranged from 287 to 633 mg/L. Dissolved-solids concentration in water samples collected from 1995 to 2012 were much less variable, ranging from 362 to 399 mg/L. The dissolved-solids concentration in the water sample collected in June 2012 (367 mg/L) was similar to the median concentration.

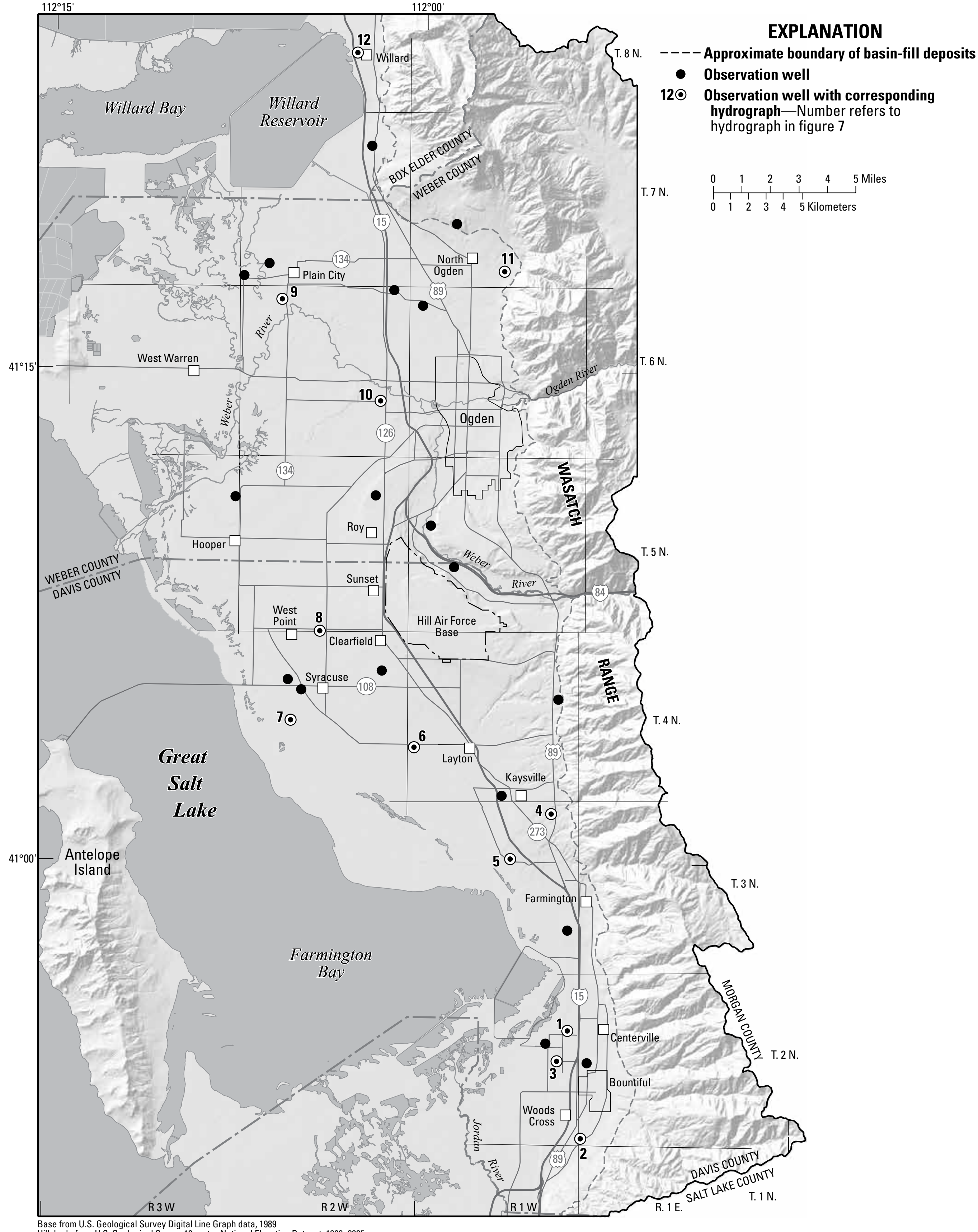


Figure 6. Location of wells in the East Shore area in which the water level was measured during March 2013.

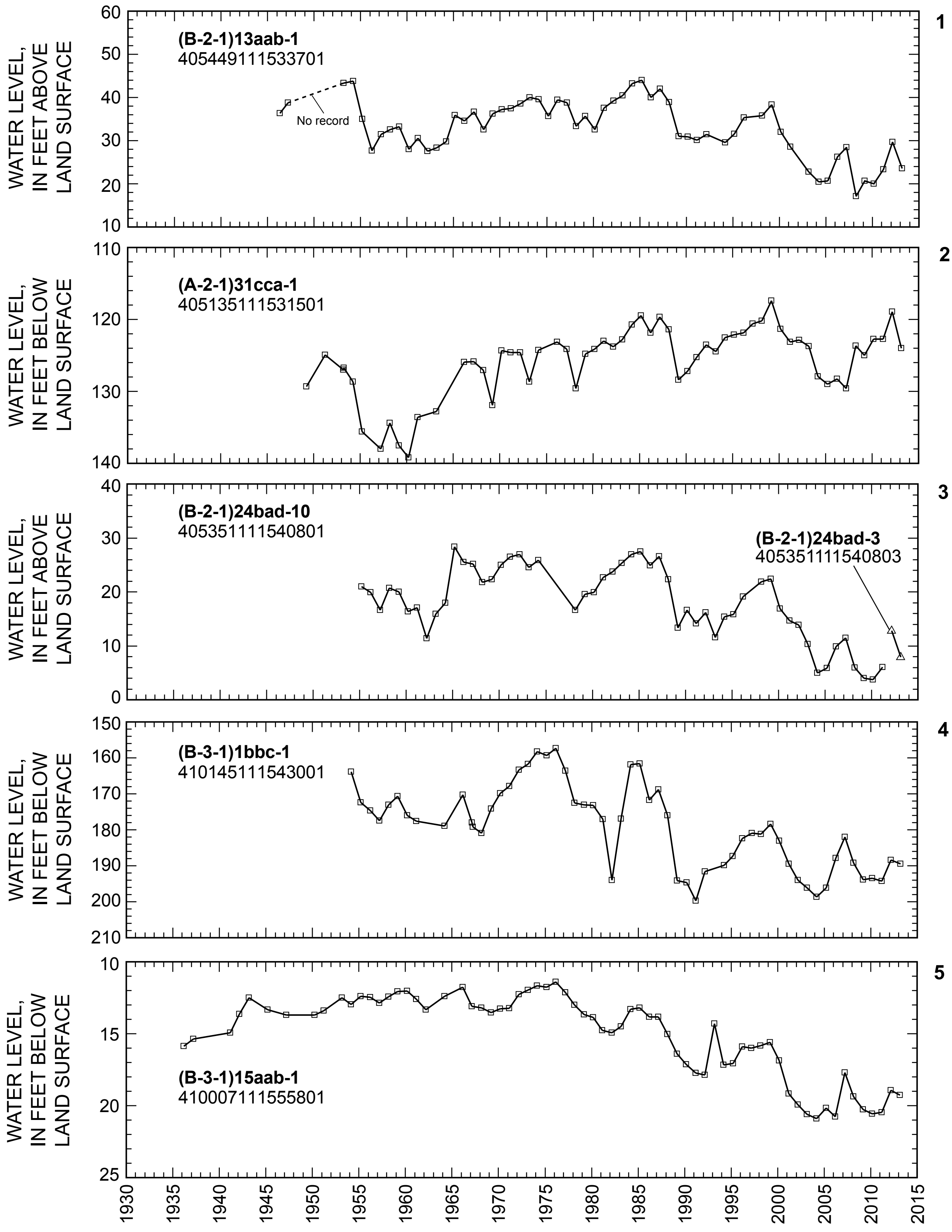


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.

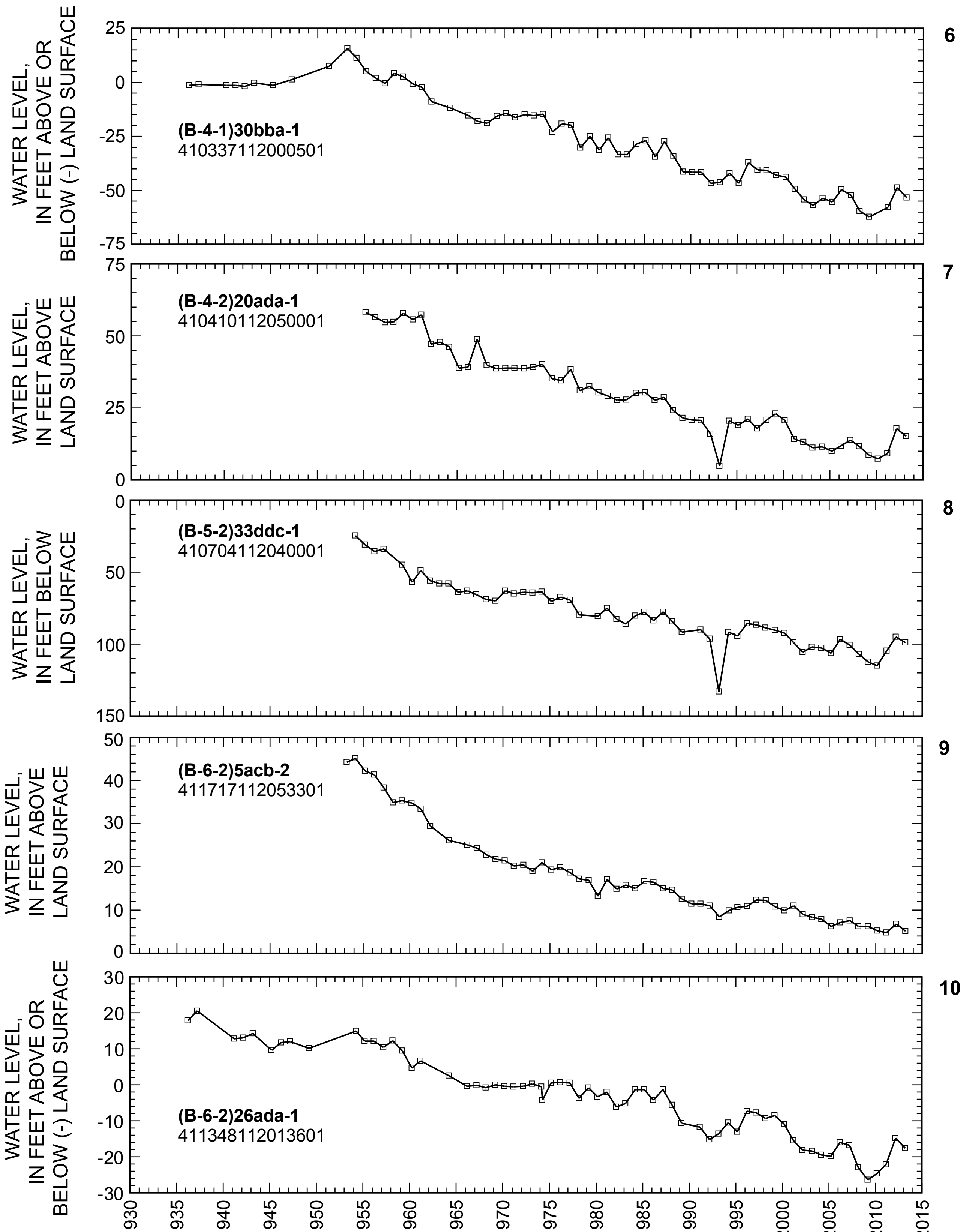


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.—Continued

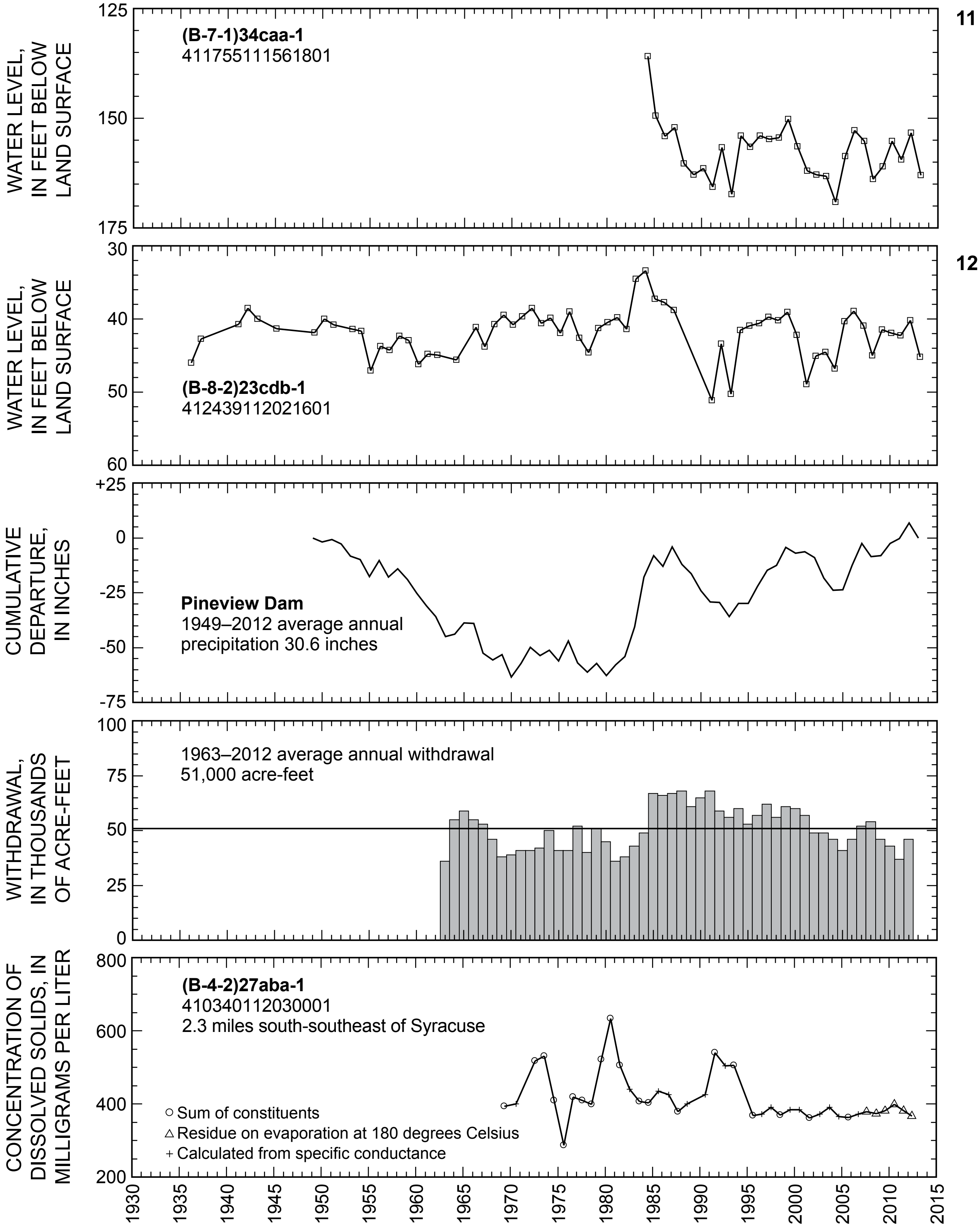


Figure 7. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.—Continued

Salt Lake Valley

By Christopher M. Holt

Salt Lake Valley covers about 400 square miles between the Wasatch Range and the Oquirrh and Traverse Mountains in Salt Lake County (fig. 8). Groundwater 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, groundwater 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, groundwater moves westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface water and groundwater from the valley.

Total estimated withdrawal of water from wells in Salt Lake Valley in 2012 was about 167,000 acre-feet, which is 41,000 acre-feet more than in 2011 and 34,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal for public supply was about 107,400 acre-feet, which is 31,300 acre-feet more than the total for 2011. Withdrawal for industrial use was about 37,000 acre-feet, which is 9,600 acre-feet more than the total for 2011.

The location of wells in Salt Lake Valley in which the water level was measured during February 2013 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 the Salt Lake City Weather Service Office (International Airport) are shown in figure 9. Precipitation at Salt Lake City during 2012 was about 12.8 inches, about 6.3 inches less than in 2011 and about 2.5 inches less than the average annual precipitation for 1931–2012.

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 36.7 inches in 2012, which is about 8.0 inches less than in 2011 and about 5.7 inches less than the average annual precipitation for 1931–2012.

Water levels declined from February 2012 to February 2013 in most of the wells measured in Salt Lake Valley. Declines are probably the result of increased withdrawal for public supply and industrial use, and less-than-average precipitation. 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.

The concentrations of dissolved solids and dissolved chloride (from 1931–2012 and 1935–2012, respectively), in water samples collected from well (D-1-1)7abd-6, a flowing well at 800 South 500 East in Salt Lake City, are shown in figure 10. The concentration of dissolved solids has ranged from 554 to 879 mg/L with a median value of 695 mg/L. The concentration of dissolved solids generally increased from 576 mg/L in December 1931 to 879 mg/L in July 2009. The dissolved-solids concentration in July 2012 (874 mg/L) increased 43 mg/L from July 2011. The dissolved chloride concentration generally increased from 52 mg/L in July 1935 to 194 mg/L in July 2012, with a median value of 120 mg/L. The dissolved chloride concentration increased only slightly (9 mg/L) from August 2011 to July 2012.

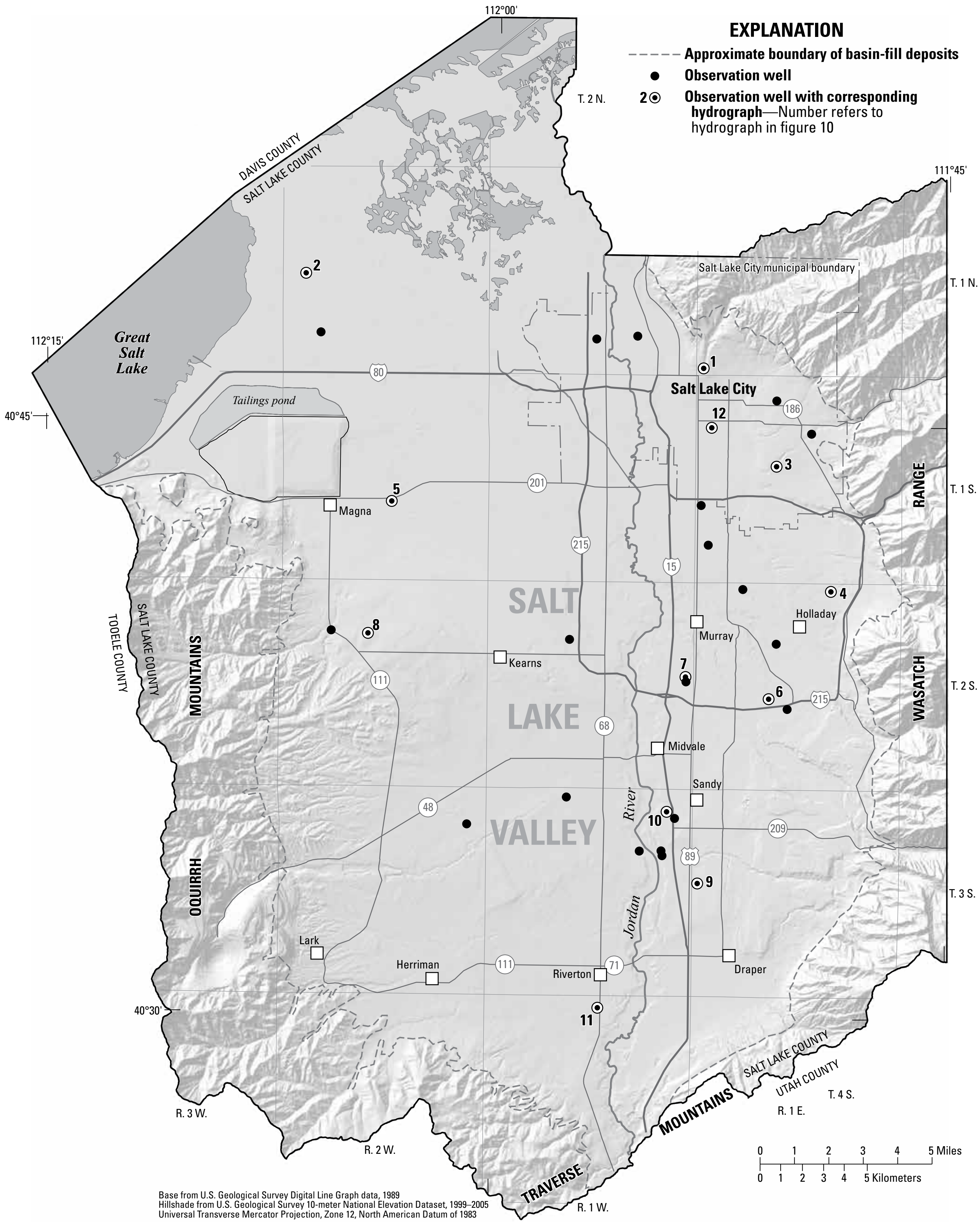


Figure 8. Location of wells in Salt Lake Valley in which the water level was measured during February 2013.

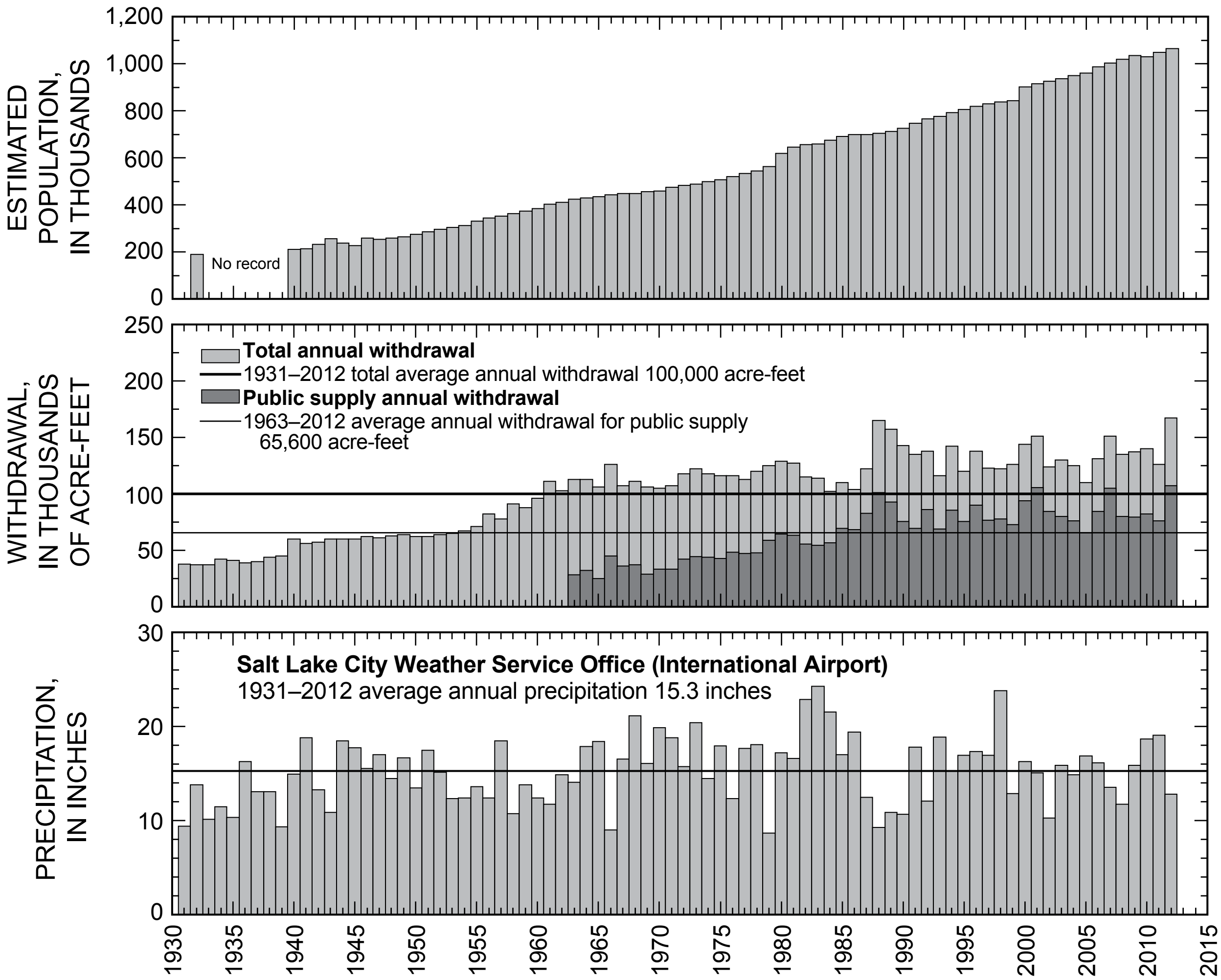


Figure 9. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (International Airport).

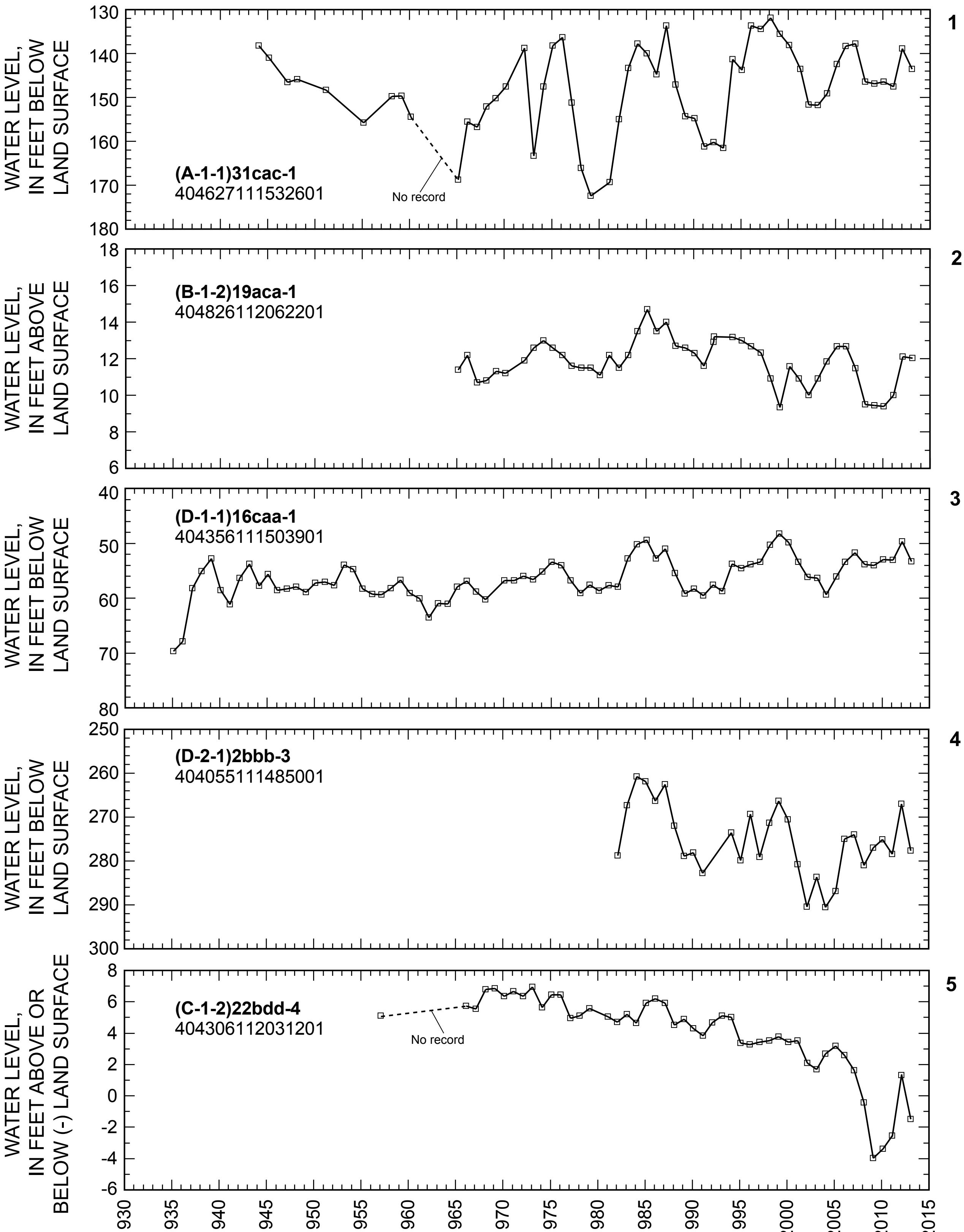


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from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

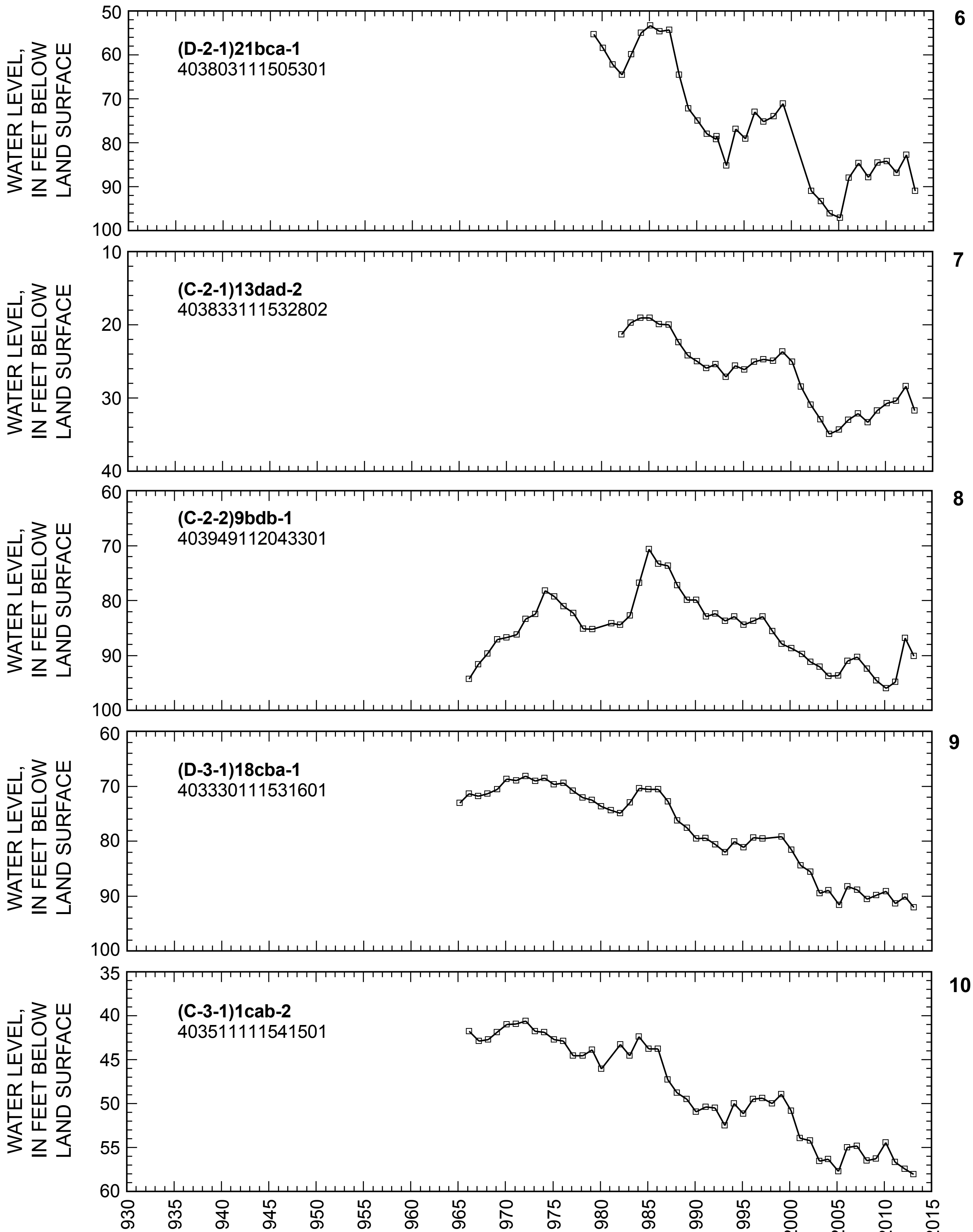


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from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

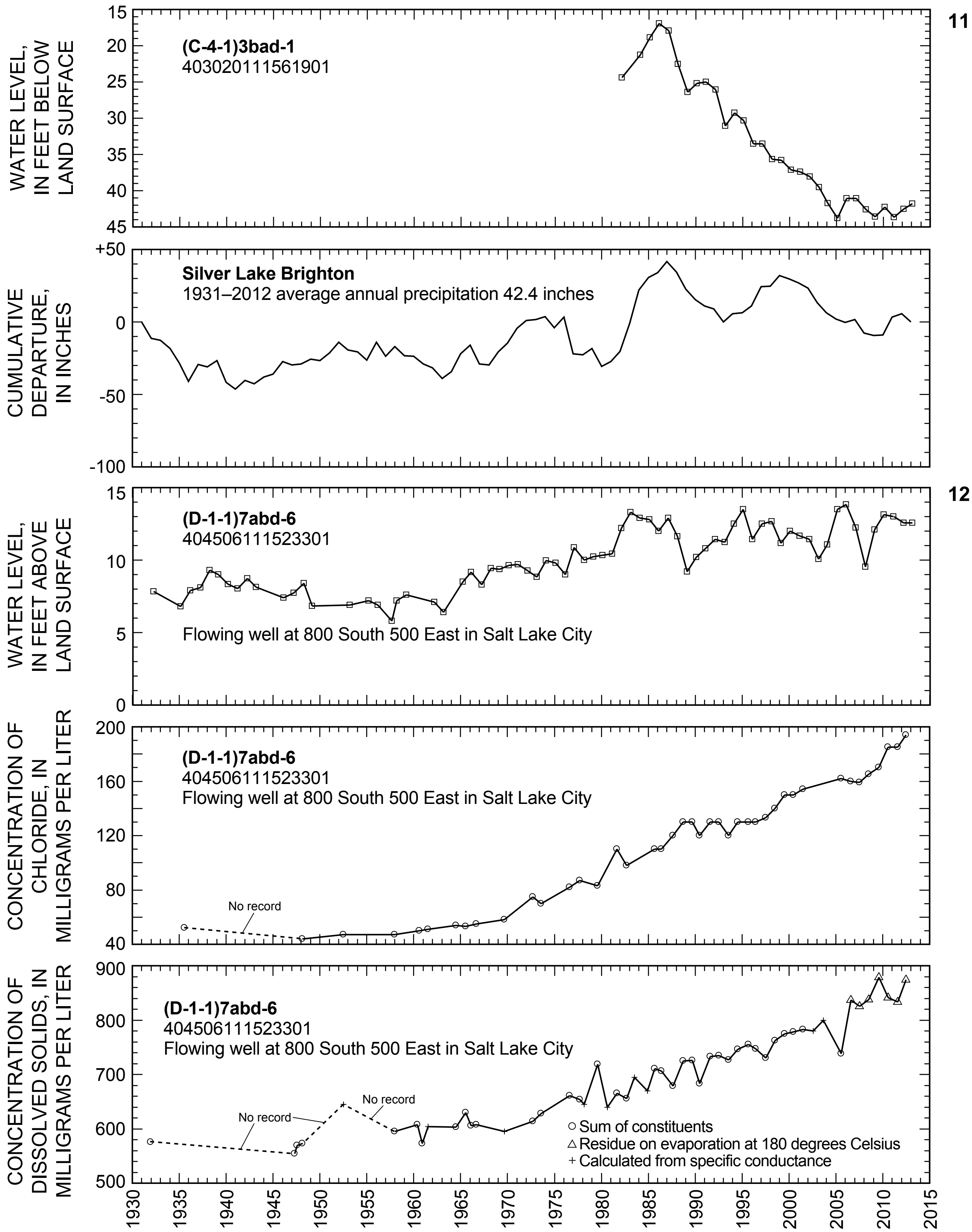


Figure 10. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from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

Tooele Valley

By Paul Downhour

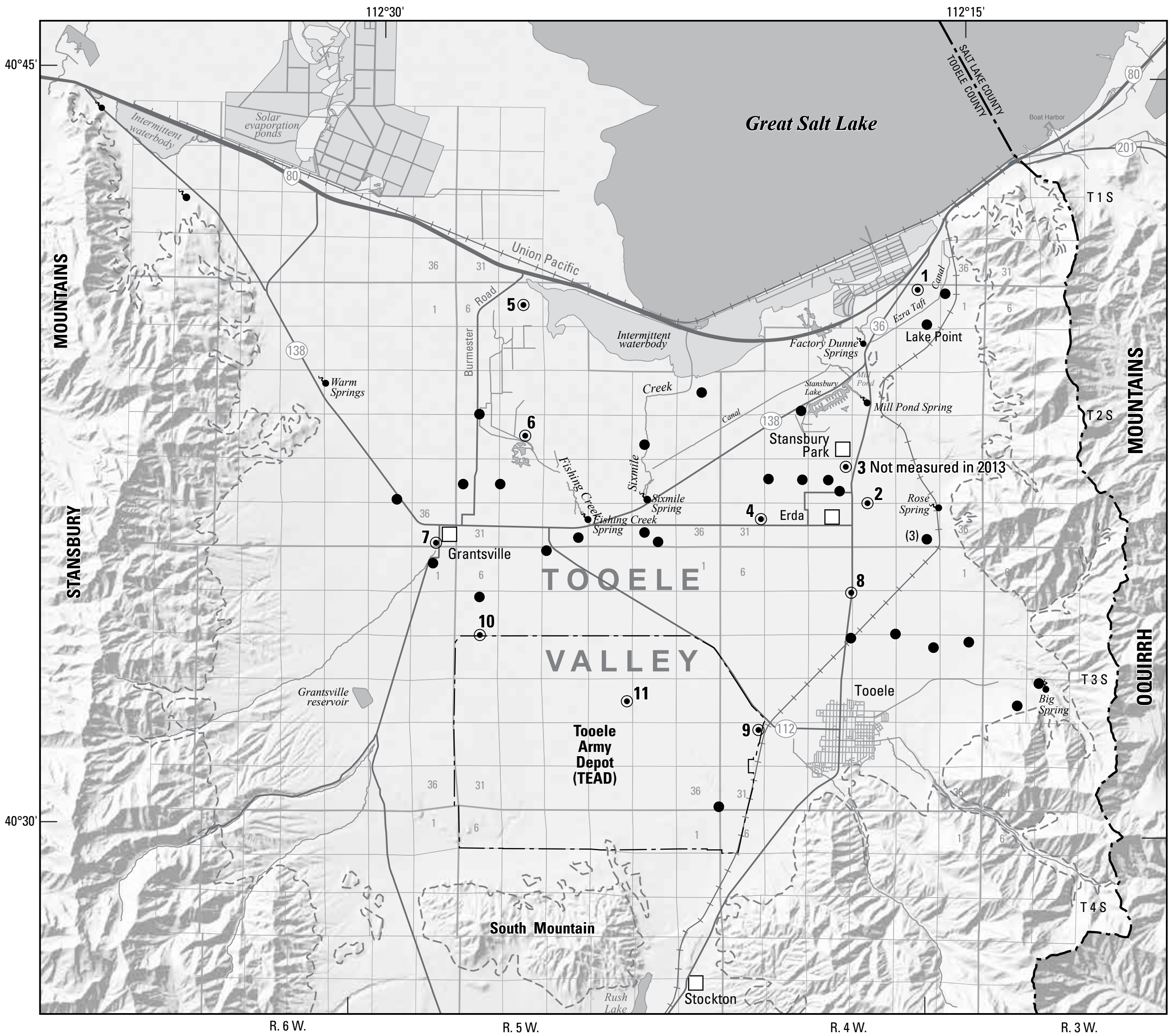
Tooele Valley lies between the Stansbury and Oquirrh Mountains and extends south from Great Salt Lake to South Mountain. The total area of the valley is about 250 square miles within Tooele County (fig. 11). Groundwater occurs in the bedrock and unconsolidated basin-fill deposits in Tooele Valley under 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 2012 was about 30,000 acre-feet, which is about 9,000 acre-feet more than the total for 2011 and 7,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal for irrigation was about 14,200 acre-feet, which is 3,100 acre-feet more than the total for 2011. Withdrawal for public supply was about 13,500 acre-feet, which is 6,100 acre-feet more than in 2011. Withdrawal for industrial use was about 800 acre-feet, which is 300 acre-feet less than in 2011.

The location of wells in Tooele Valley in which the water level was measured during March 2013 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-2-4)33bdd-1 is shown in figure 12. Precipitation at Tooele during 2012 was about 15.0 inches, which is about 4.9 inches less than in 2011 and about 2.9 inches less than the average annual precipitation for 1936–2012.

Water levels declined from March 2012 to March 2013 in most of the wells measured in Tooele Valley. The largest decline, about 3.2 feet, was observed in a well about 4 miles west of Stansbury Park. Declines are probably the result of increased withdrawals for irrigation and public-supply use, and less-than-average precipitation.

The concentration of dissolved solids in water samples collected from well (C-2-4)33bdd-1, located at Erda, from 1977 to 2012, is shown in figure 12. The concentration has ranged from 456 to 616 mg/L with a median value of 509 mg/L. The maximum concentration was measured in the water sample collected during July 2012. The dissolved-solids concentration has generally increased since 1977.



Base from U.S. Geological Survey Digital Line Graph data, 1989
Hillshade from U.S. Geological Survey 10-meter National Elevation Dataset, 1999–2005
Universal Transverse Mercator Projection, Zone 12, North American Datum of 1983

0 1 2 3 4 5 Miles
0 1 2 3 4 5 Kilometers

EXPLANATION

- – – – **Approximate boundary of basin-fill deposits**
- (3)● **Observation well**—Number in parentheses refers to number of wells at that site
- 9⦿ **Observation well with corresponding hydrograph**—Number refers to hydrograph in figure 12

Figure 11. Location of wells in Tooele Valley in which the water level was measured during March 2013.

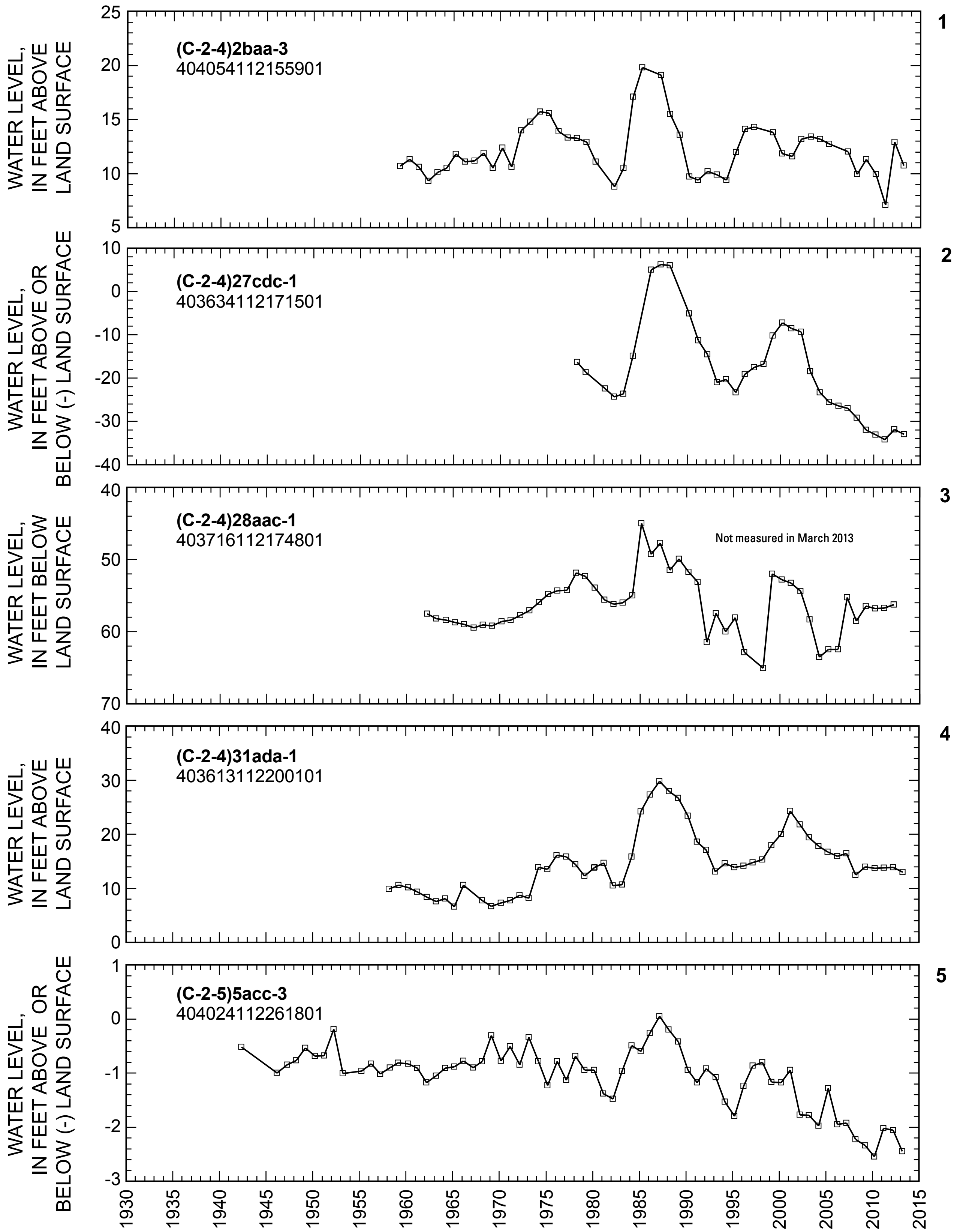


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.

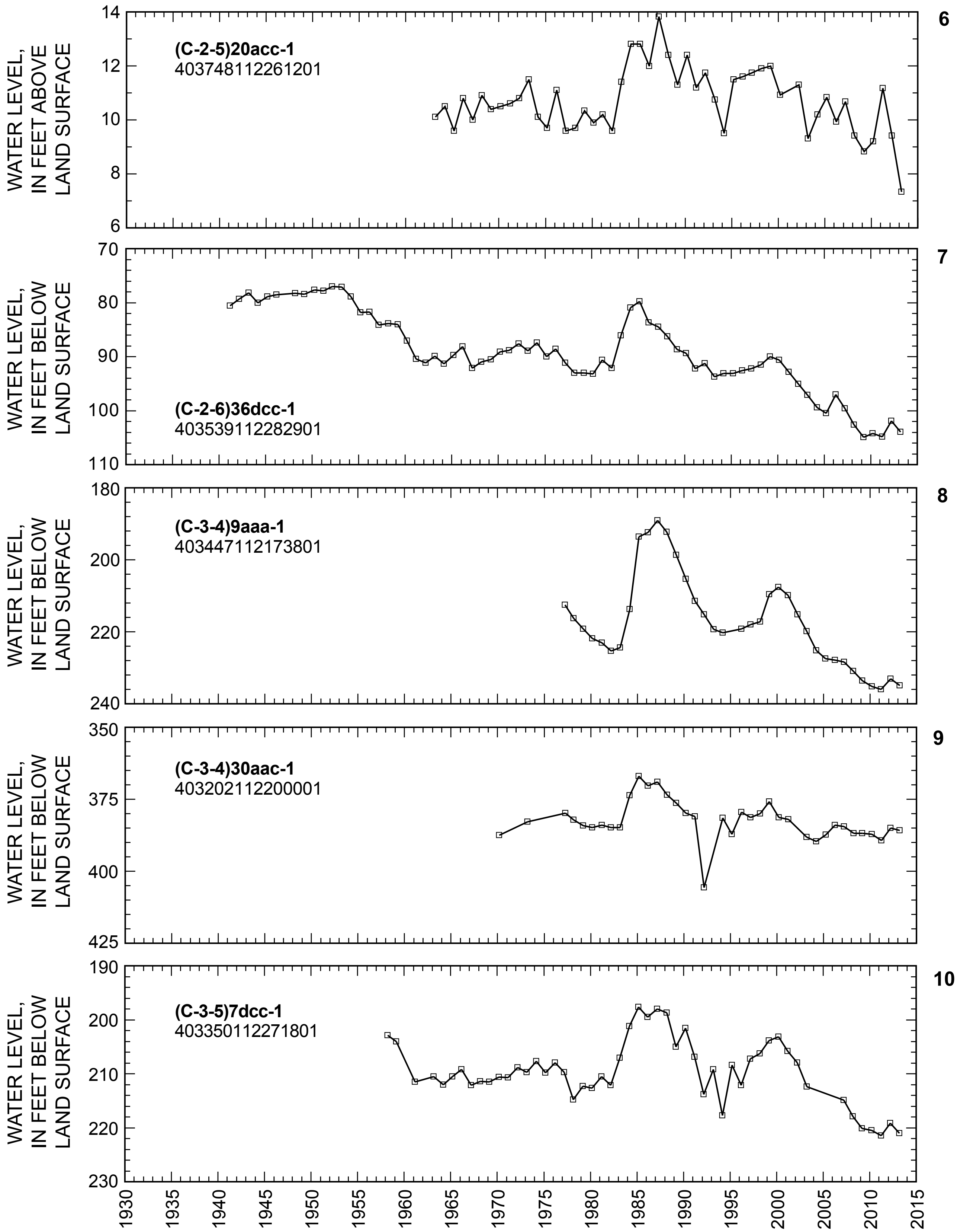


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.—Continued

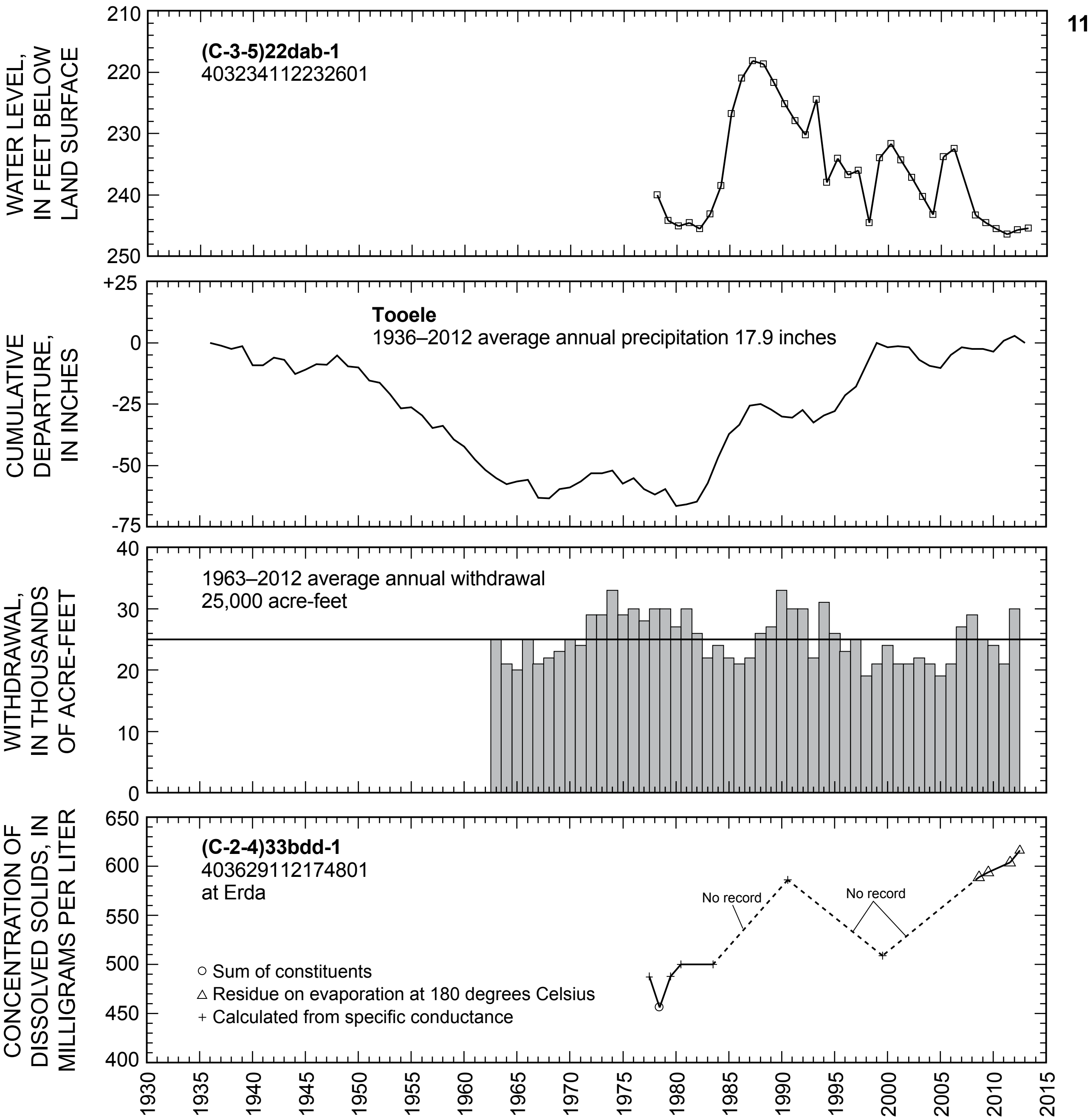


Figure 12. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.—Continued

Utah and Goshen Valleys

By Lincoln Smith

Utah Valley is bounded by the Wasatch Range, West Mountain, and the northern extension of Long Ridge. The Valley is divided into two groundwater basins, northern and southern, which are separated by Provo Bay in northern Utah Valley (fig. 13). Goshen Valley is bounded by West Mountain, Long Ridge, the Lake Mountains, and the East Tintic Mountains (fig. 13). Groundwater in Utah and Goshen Valleys occurs in unconsolidated basin-fill deposits under both water-table and artesian conditions, but most wells discharge from artesian aquifers. The principal groundwater recharge area for the basin-fill deposits is in the eastern part of the valley, along the base of the Wasatch Range.

Total estimated withdrawal of water from wells in Utah and Goshen Valleys in 2012 was about 122,000 acre-feet, which is 32,000 acre-feet more than the revised value for 2011, and 17,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal in northern Utah Valley was about 63,700 acre-feet, which is 18,300 acre-feet more than the revised value for 2011. Withdrawal in southern Utah Valley was about 36,900 acre-feet, which is 8,800 acre-feet more than in 2011. Withdrawal in Goshen Valley was about 21,500 acre-feet, which is 4,600 acre-feet more than in 2011. The increase in total pumpage from all three valleys was mainly due to increased withdrawals for public-supply use.

The location of wells in Utah and Goshen Valleys in which the water level was measured during March 2013 is shown in figure 13. Water levels declined from March 2012 to March 2013 in most of the wells measured in Utah and Goshen Valleys. Declines are probably due to increased pumpage because of less-than-average precipitation and decreased availability of surface water. Water levels in Utah and Goshen Valleys 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. During this period, water levels in some wells were the lowest on record, with 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 Power House, 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 2012 was about 159,800 acre-feet, which is 10,600 acre-feet less than the 1933–2012 annual average and 127,700 acre-feet less than in 2011. Precipitation at Silver Lake Brighton in 2012 was about 36.7 inches, which is about 5.7 inches less than the long-term average (1931–2012) and about 8.0 inches less than in 2011. Precipitation at Spanish Fork Power House in 2012 was about 16.2 inches, which is about 3.1 inches less than the long-term average (1930–2012) and about 8.8 inches less than in 2011.

The concentration of dissolved solids in water samples collected from wells (C-9-1)28ccb-1, located 4 miles north of Elberta, (D-7-2)4cbb-2, located 2 miles west of Provo at the mouth of the Provo River, and (D-9-1)36bbc-1, located 1 mile north of Santaquin, is shown in figure 14. The concentration of dissolved solids in water from well (C-9-1)28ccb-1 has ranged from 498 to 1,550 mg/L with a median value of 716 mg/L. The concentration of dissolved solids in the July 2012 sample (1,550 mg/L), is the maximum value measured in water from this well. The dissolved-solids concentration in water from well (D-7-2)4cbb-2 has ranged from 278 to 539 mg/L with a median value of 321 mg/L. Water collected from this well in July 2012 had a dissolved-solids concentration of 328 mg/L, near the median value. The dissolved-solids concentration in water from well (D-9-1)36bbc-1 has ranged from 153 to 311 mg/L with a median value of 286 mg/L. The concentration of dissolved solids in the July 2012 sample (311 mg/L), is the maximum value measured in water from this well.

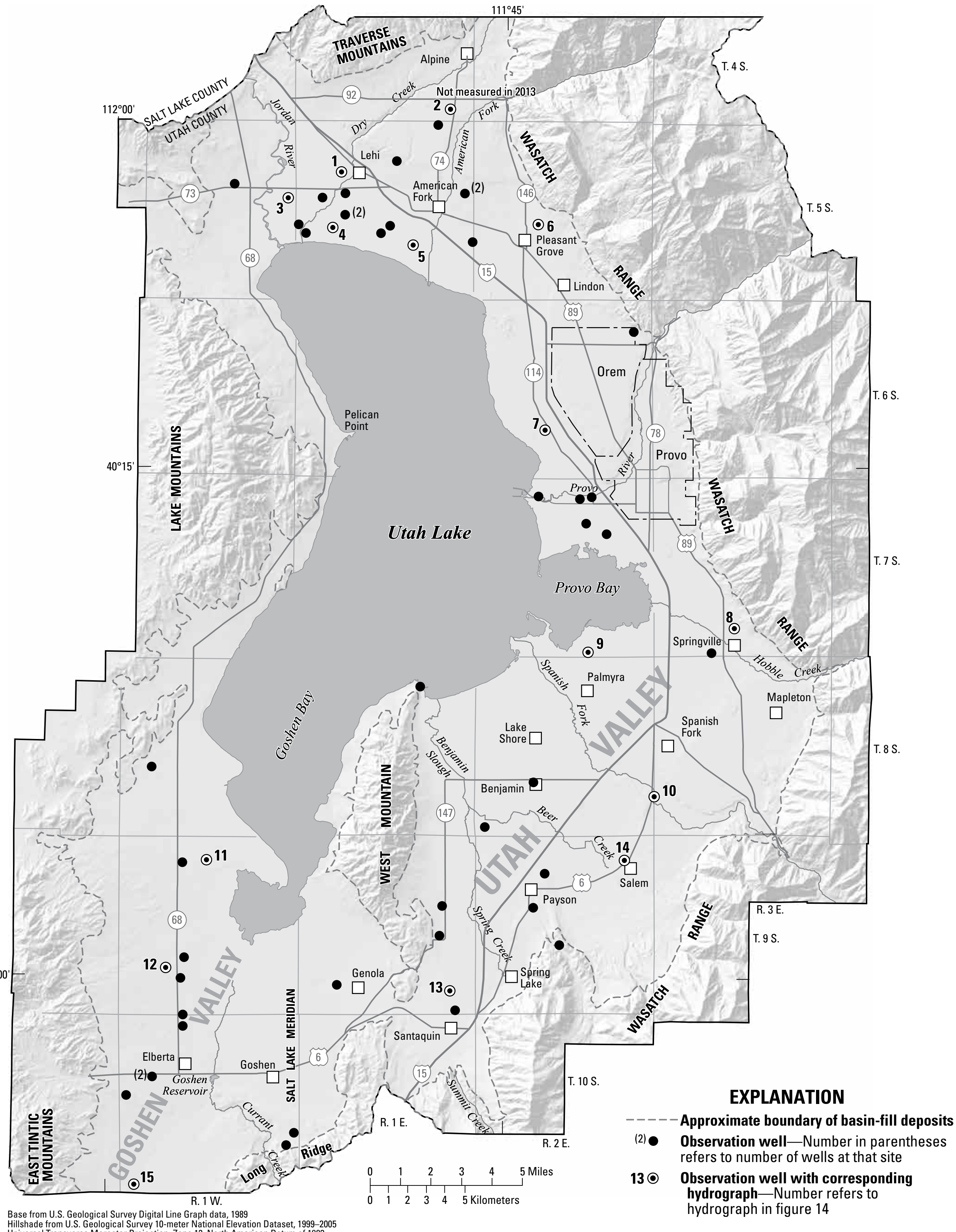


Figure 13. Location of wells in Utah and Goshen Valleys in which the water level was measured during March 2013.

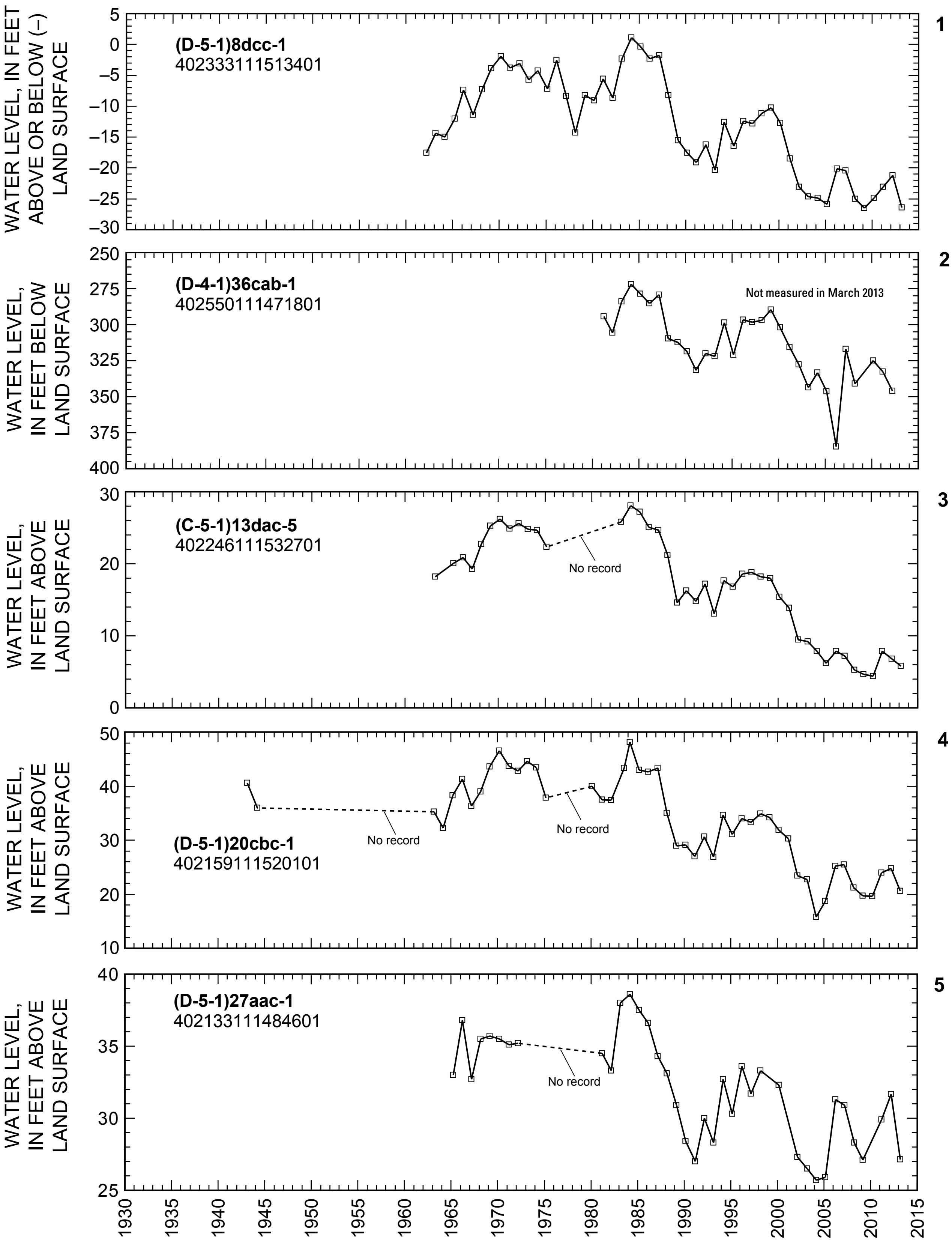


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish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

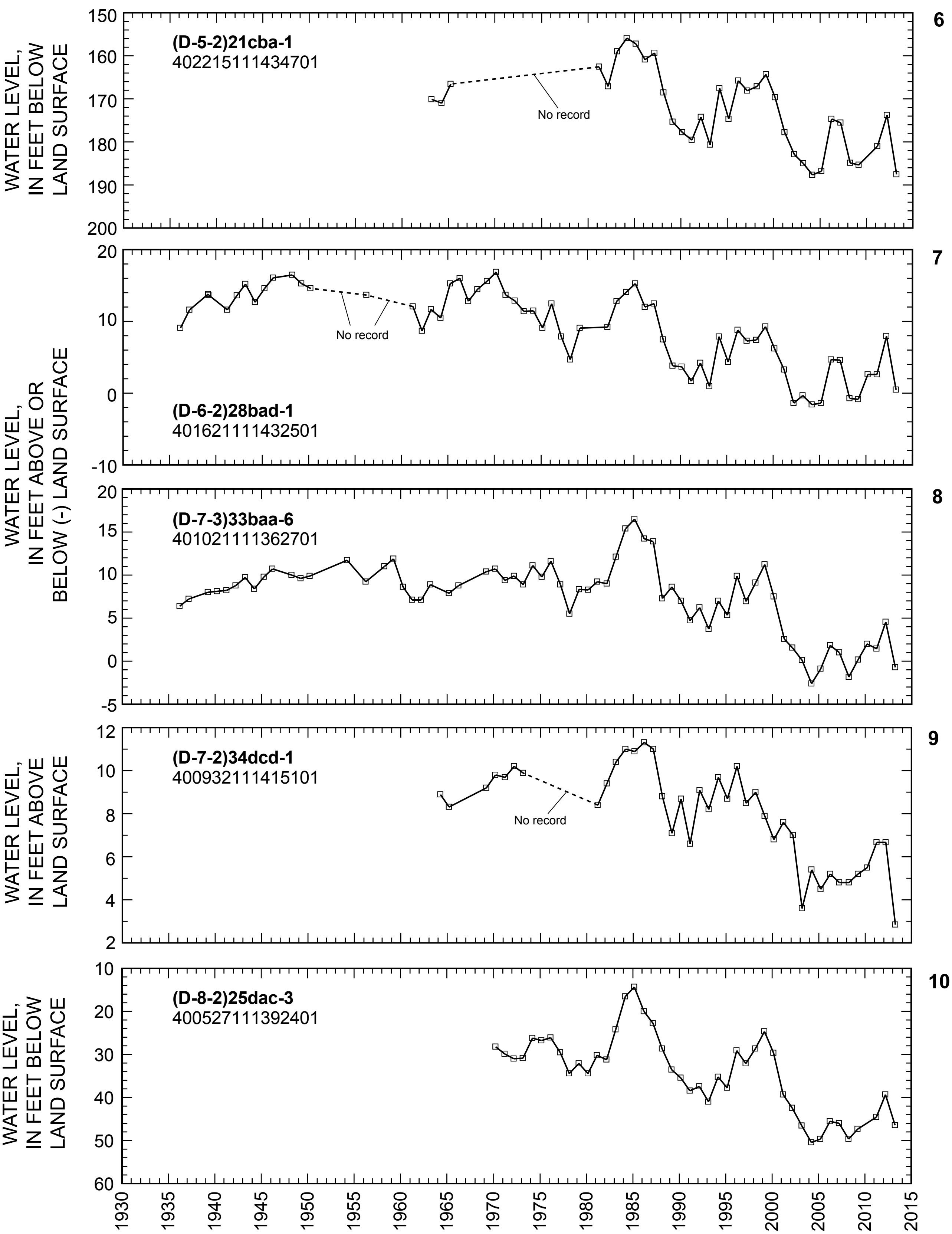


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish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

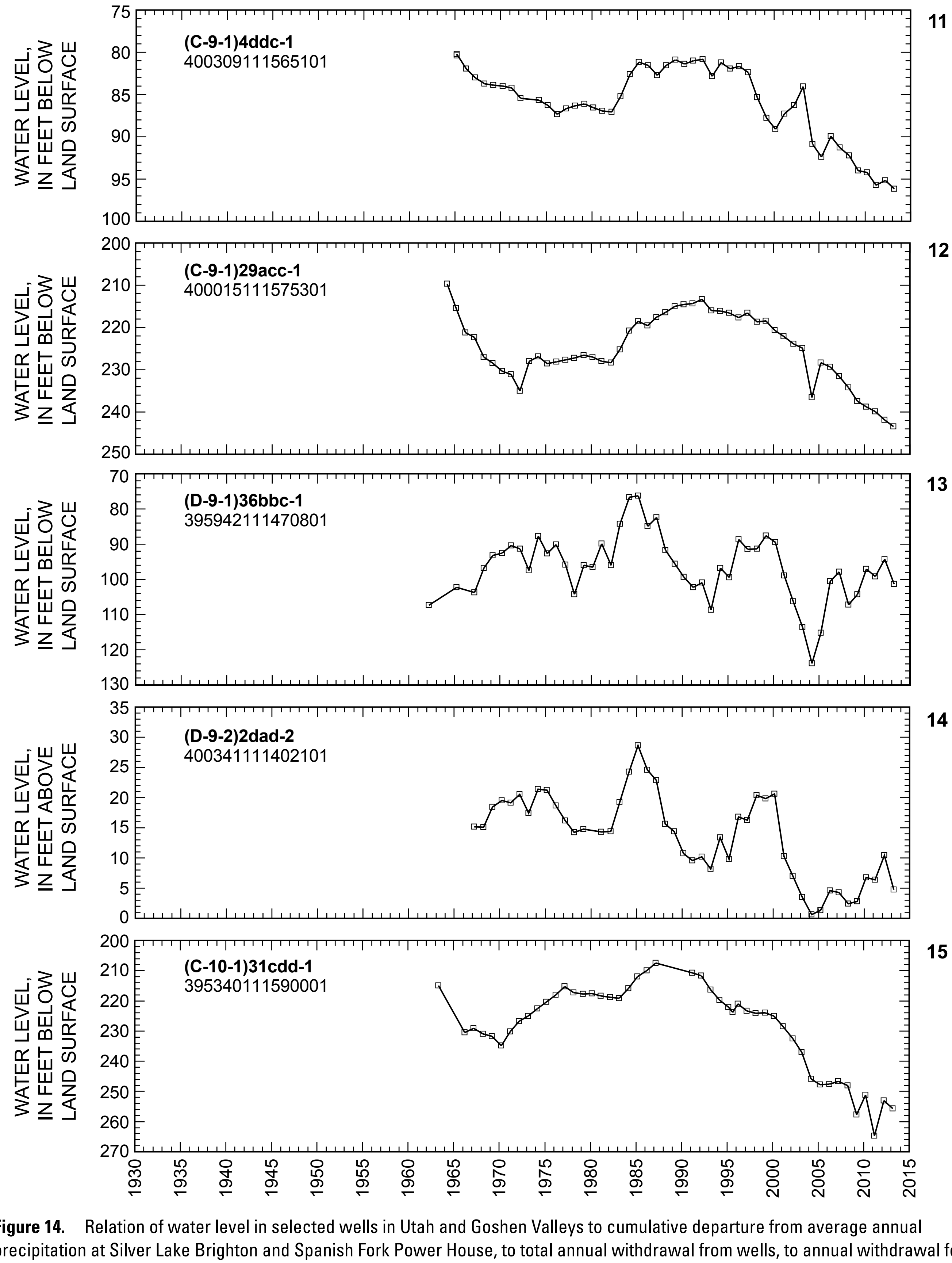


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish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

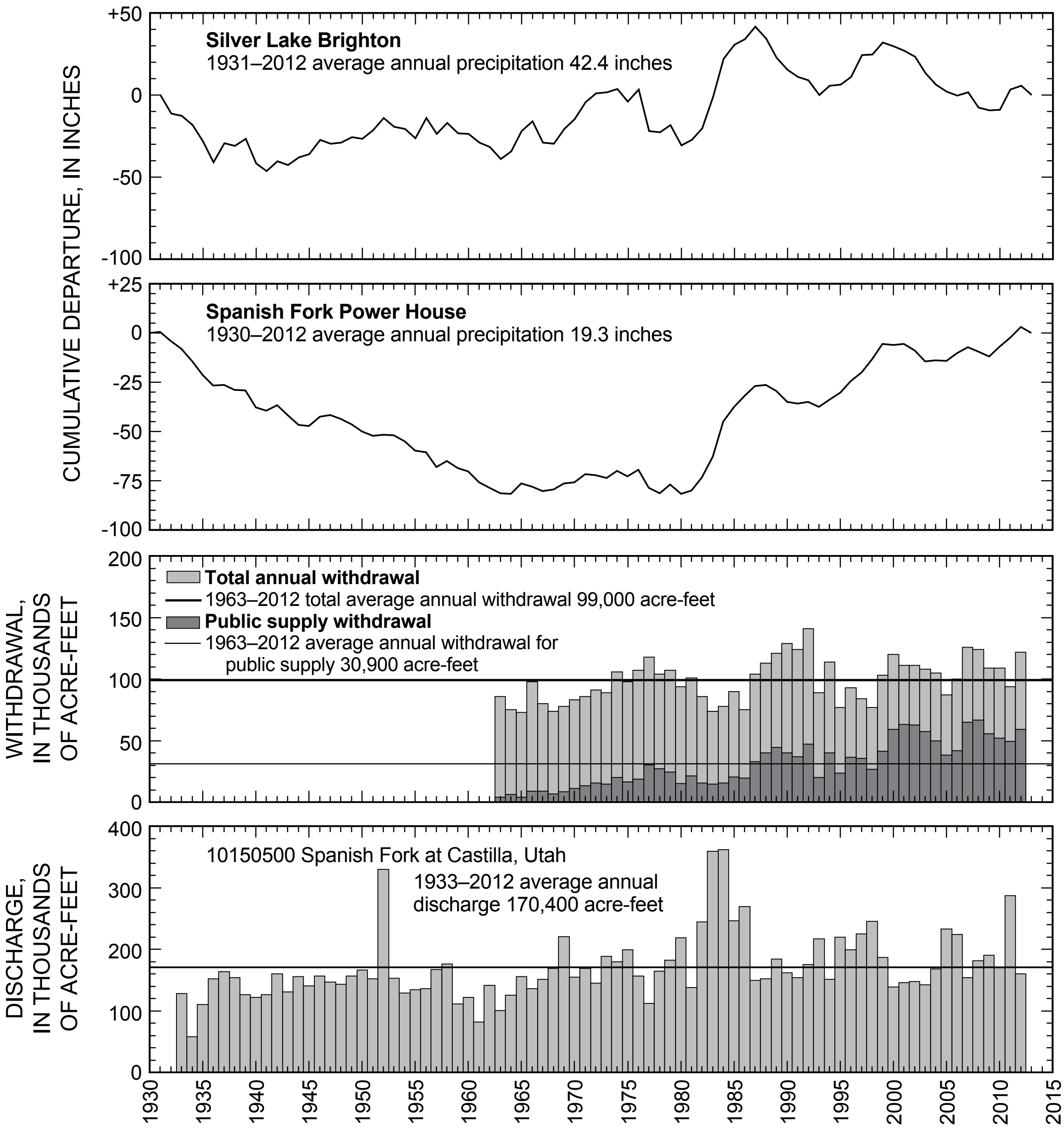


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish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

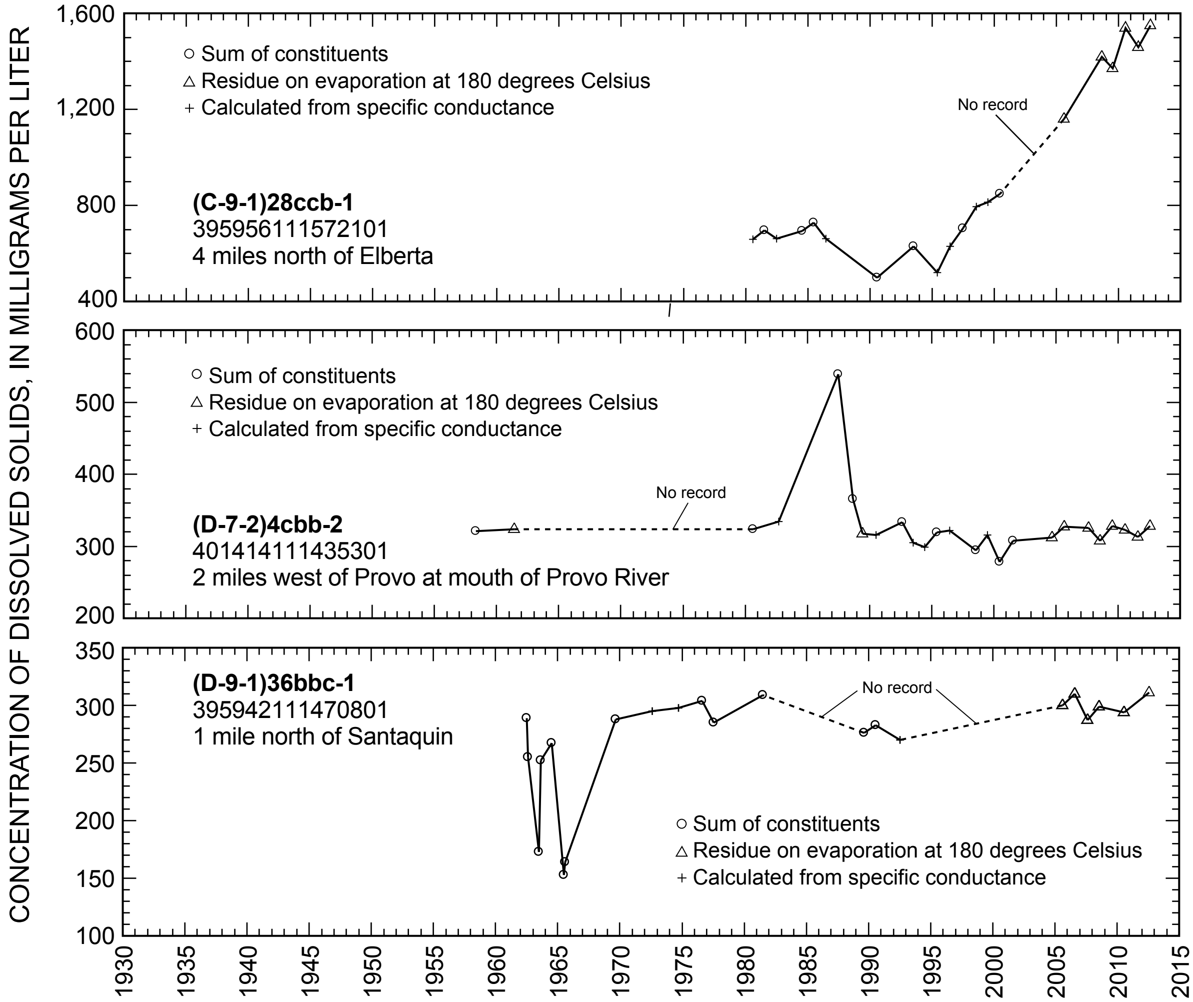


Figure 14. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish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

Juab Valley

By Robert J. Eacret

Juab Valley, in central Utah, is about 30 miles long and about 4 miles wide. It is bounded on the east side by the Wasatch Range and the San Pitch Mountains, and on the west side by the West Hills and Long Ridge (fig. 15). Groundwater drains from the valley in two directions—in northern Juab Valley it drains north via Currant Creek into Utah Lake, and in southern Juab Valley it drains south via Chicken Creek into the Sevier River. The northern and southern parts of Juab Valley are separated topographically and hydrologically by Levan Ridge, a gentle rise near the midpoint of the valley floor.

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

Total estimated withdrawal of water from wells in Juab Valley in 2012 was about 28,000 acre-feet, which is 13,000 acre-feet more than the amount reported for 2011 and 5,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3).

The location of wells in Juab Valley in which the water level was measured during March 2013 is shown in figure 15. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Nephi and to annual withdrawal from wells, is shown in figure 16. Precipitation at Nephi during 2012 was about 10.6 inches, which is about 3.7 inches less than the average annual precipitation for 1935–2012, and about 1.8 inches less than in 2011.

Water levels declined in all of the wells measured in Juab Valley from March 2012 to March 2013 (fig. 16). Declines are probably the result of increased withdrawal for irrigation and less-than-average precipitation. Water levels generally rose from 1978 to their highest level in 1985–87. This rise corresponds to a period of greater-than-average precipitation during 1978–86. Water levels generally declined from the late 1980s to 2012, although there was a substantial rise from 1993 to 1999.

The concentration of dissolved solids in water from well (C-14-1)26dbd-1, located 2 miles west of Levan, is shown in figure 16 (this well replaces (C-12-1)24baa-1). The dissolved-solids concentration in two water samples, collected in August 2011 and August 2012, were 772 and 811 mg/L, respectively.

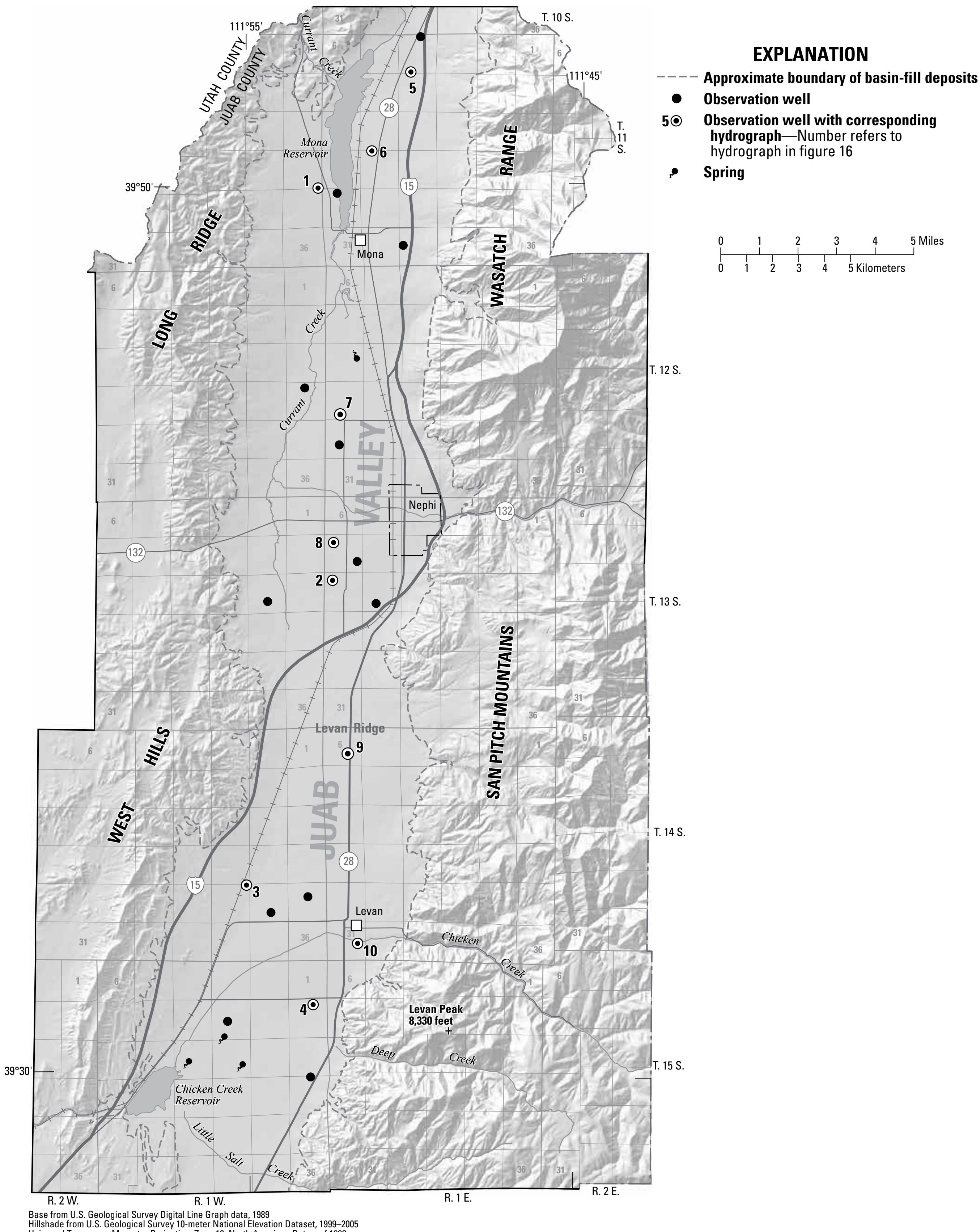


Figure 15. Location of wells in Juab Valley in which the water level was measured during March 2013.

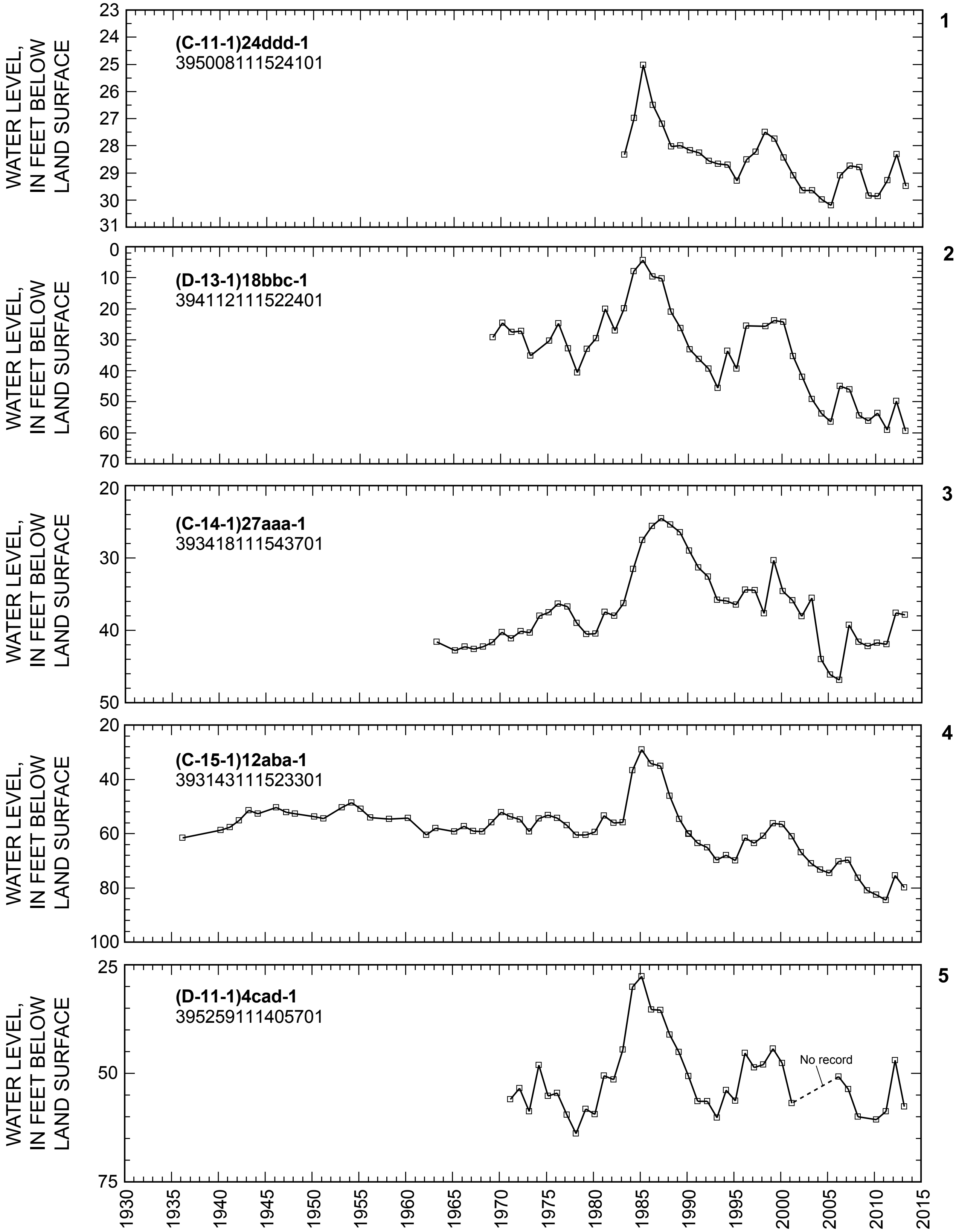


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.

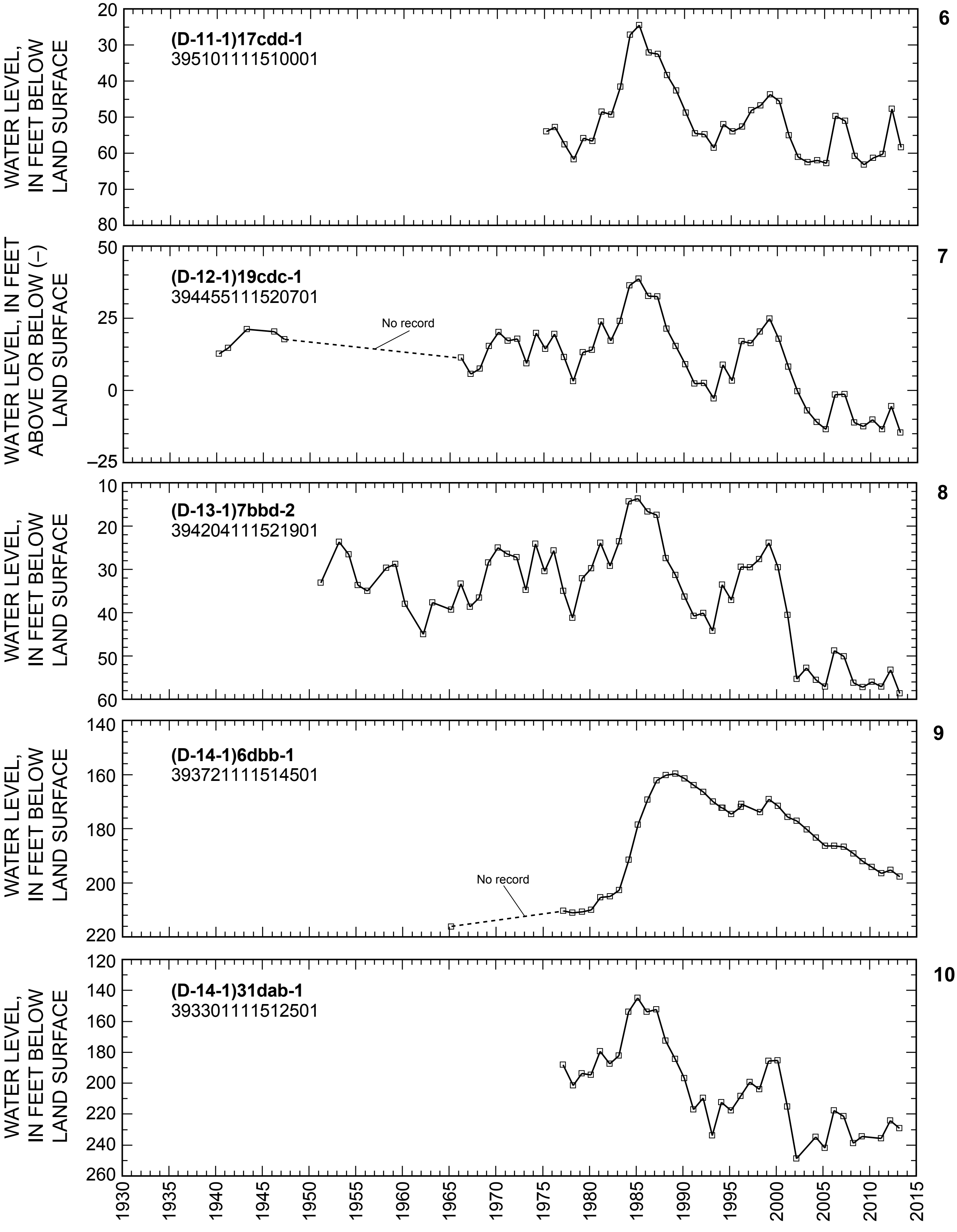


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.—Continued

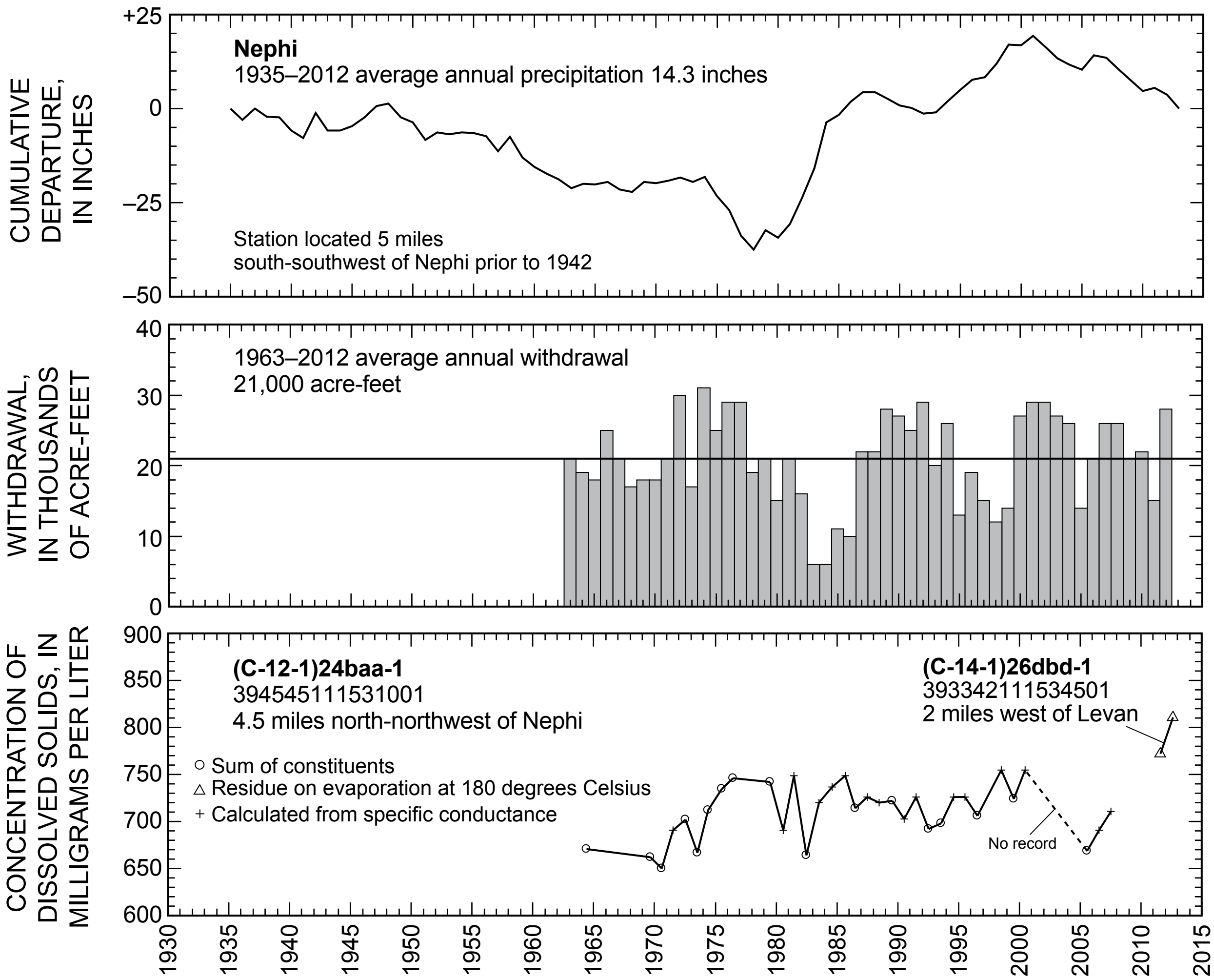


Figure 16. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Neph, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.—Continued

Sevier Desert

By Travis L. Gibson

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). It principally includes the broad, gently sloping areas that radiate from the Canyon Mountains to the east, the Drum Mountains to the west, and several non-continuous mountains to the north. Groundwater occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the groundwater 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 aquifers.

Total estimated withdrawal of water from wells in the Sevier Desert in 2012 was about 24,000 acre-feet, which is 4,000 acre-feet more than in 2011 and about 10,000 acre-feet less than the 2002-2011 average annual withdrawal (tables 2 and 3). The increase in withdrawals from 2011 to 2012 was mainly due to increased pumpage for irrigation, which coincides with decreased withdrawal of surface water from the Sevier River.

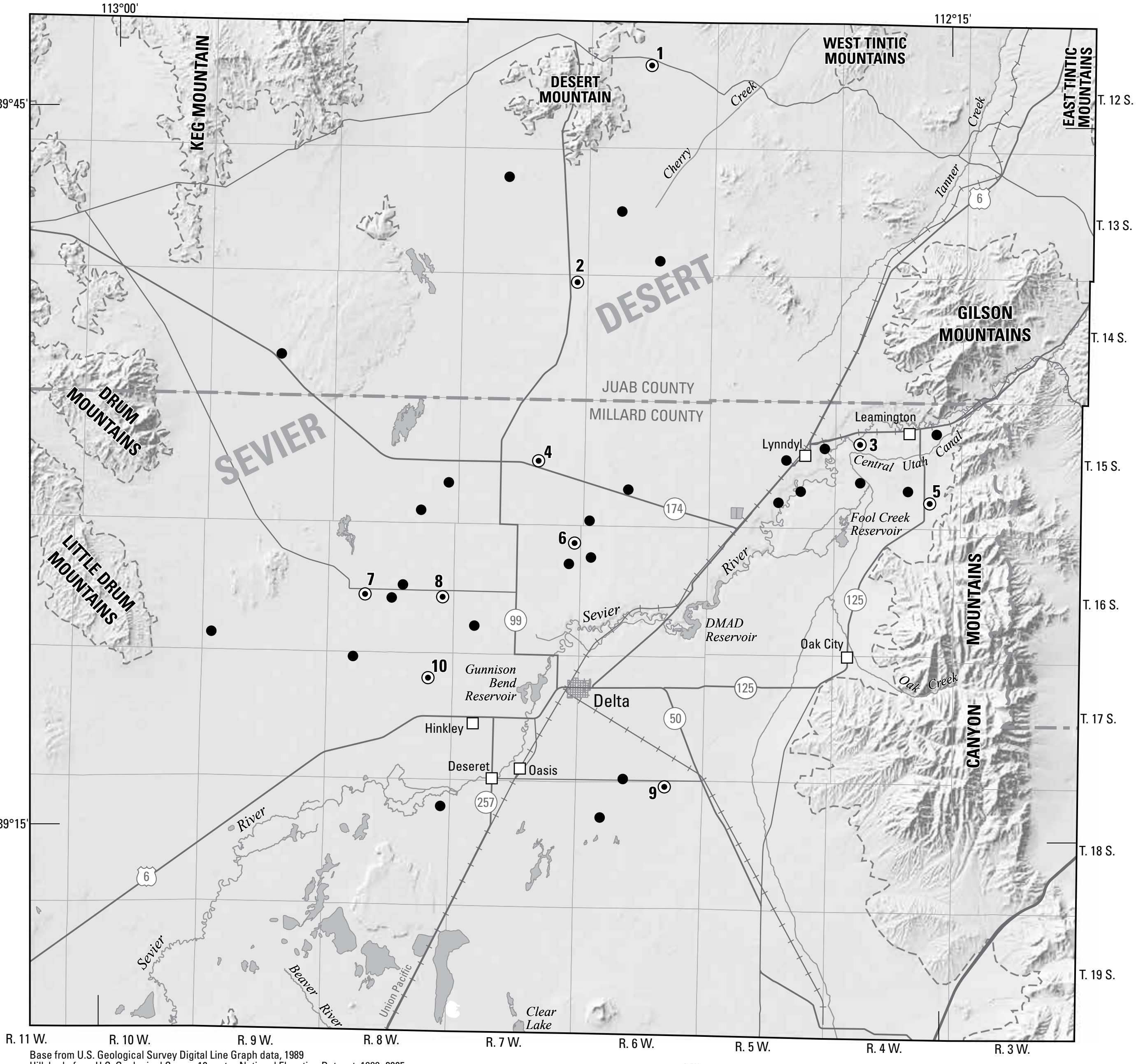
The location of wells in the Sevier Desert in which the water level was measured during March 2013 is shown in figures 17 and 18. The relation of the water level in selected observation wells to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation 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.

Discharge of the Sevier River near Juab in 2012 was 261,900 acre-feet, 125,000 acre-feet less than in 2011 and 80,500 acre-feet more than the long-term average (1935–2012). Precipitation at Oak City was about 11.2 inches in 2012, about 1.8 inches less than the 1930–2012 average annual precipitation and about 5.4 inches less than in 2011.

Most water levels in the shallow artesian aquifer rose or declined less than 1 foot from March 2012 to March 2013. These minor changes were probably due to fluctuations in localized pumping. The water level in most wells in the deep artesian aquifer rose from March 2012 to March 2013 in spite of increased groundwater withdrawals, less-than-average precipitation, and decreased discharge of the Sevier River during this period. The rise in water levels may be the result of persistent recharge of the deep artesian aquifer from the greater-than-average precipitation that occurred during the winter of 2010-2011 and less-than-average groundwater withdrawals in 2011. Some water levels declined in the deep artesian aquifer from March 2012 to March 2013. This may have been due to localized groundwater withdrawals for irrigation.

Periods when the water level in the shallow and deep aquifers generally rose (including 1980–89, 1995–99, 2006–07, and since 2010) correspond to greater-than-average precipitation, less-than-average groundwater withdrawals, and greater than average discharge of the Sevier River. Periods when the water level in the shallow and deep aquifers generally declined (including 1988–94, 2001–05, and 2008–10) correspond to less-than-average precipitation, greater-than-average groundwater withdrawals, and less-than-average discharge of the Sevier River.

The concentration of dissolved solids in water samples collected from well (C-15-4)8cba-1, located 2.5 miles east of Lynndyl, from 1958 to 2011, is shown in figure 19. The concentration has ranged from 1,490 to 2,340 mg/L, with a median value of 2,030 mg/L. This well was not sampled in 2012.



Base from U.S. Geological Survey Digital Line Graph data, 1989
Hillshade from U.S. Geological Survey 10-meter National Elevation Dataset, 1999–2005
Universal Transverse Mercator Projection, Zone 12, North American Datum of 1983

0 2 4 6 8 10 Miles
0 2 4 6 8 10 Kilometers

EXPLANATION

– – – – **Approximate boundary of basin-fill deposits**

● **Observation well**

9⊙ **Observation well with corresponding hydrograph**—Number refers to hydrograph in figure 19

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 2013.

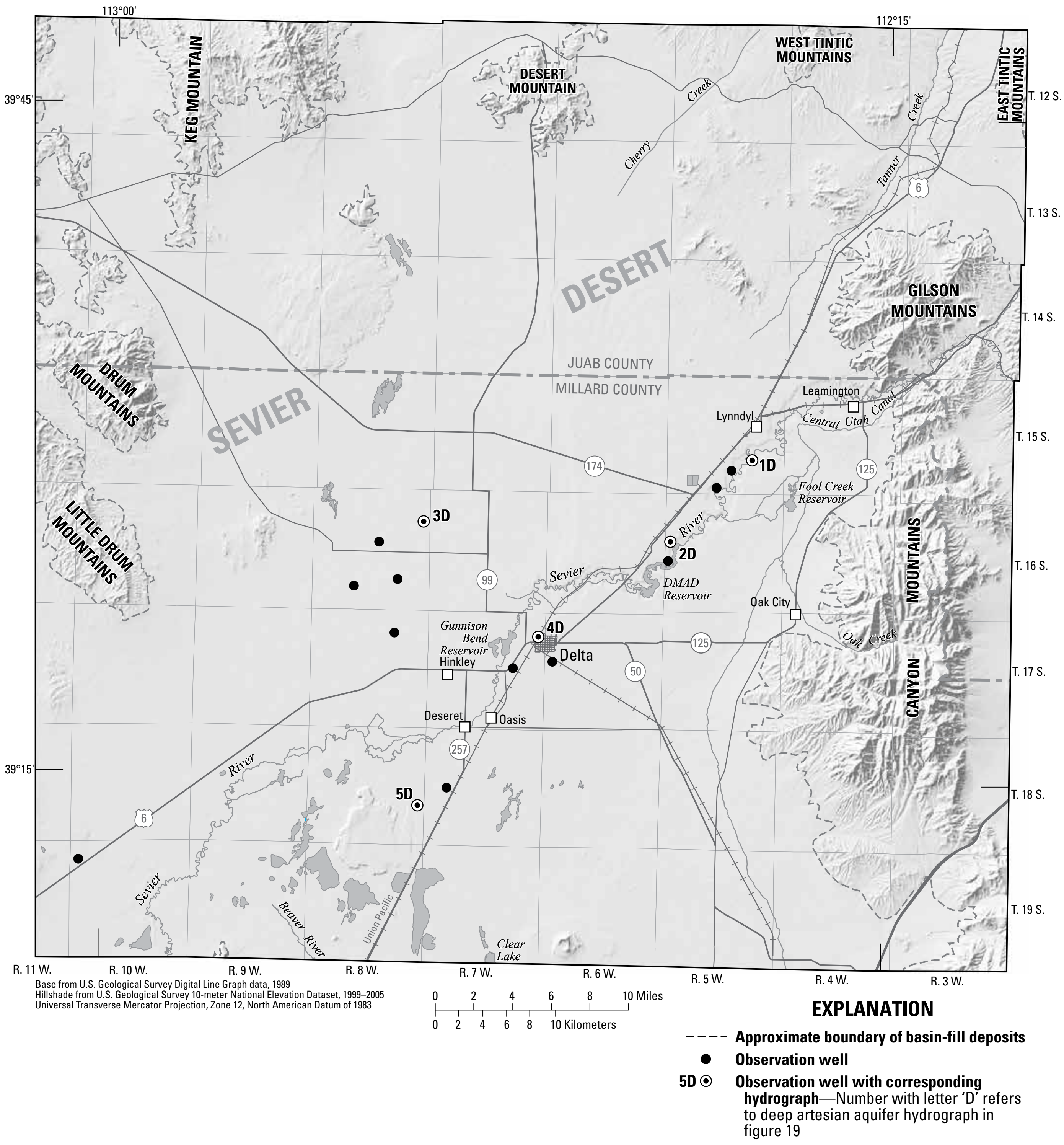


Figure 18. Location of wells in the deep artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2013.

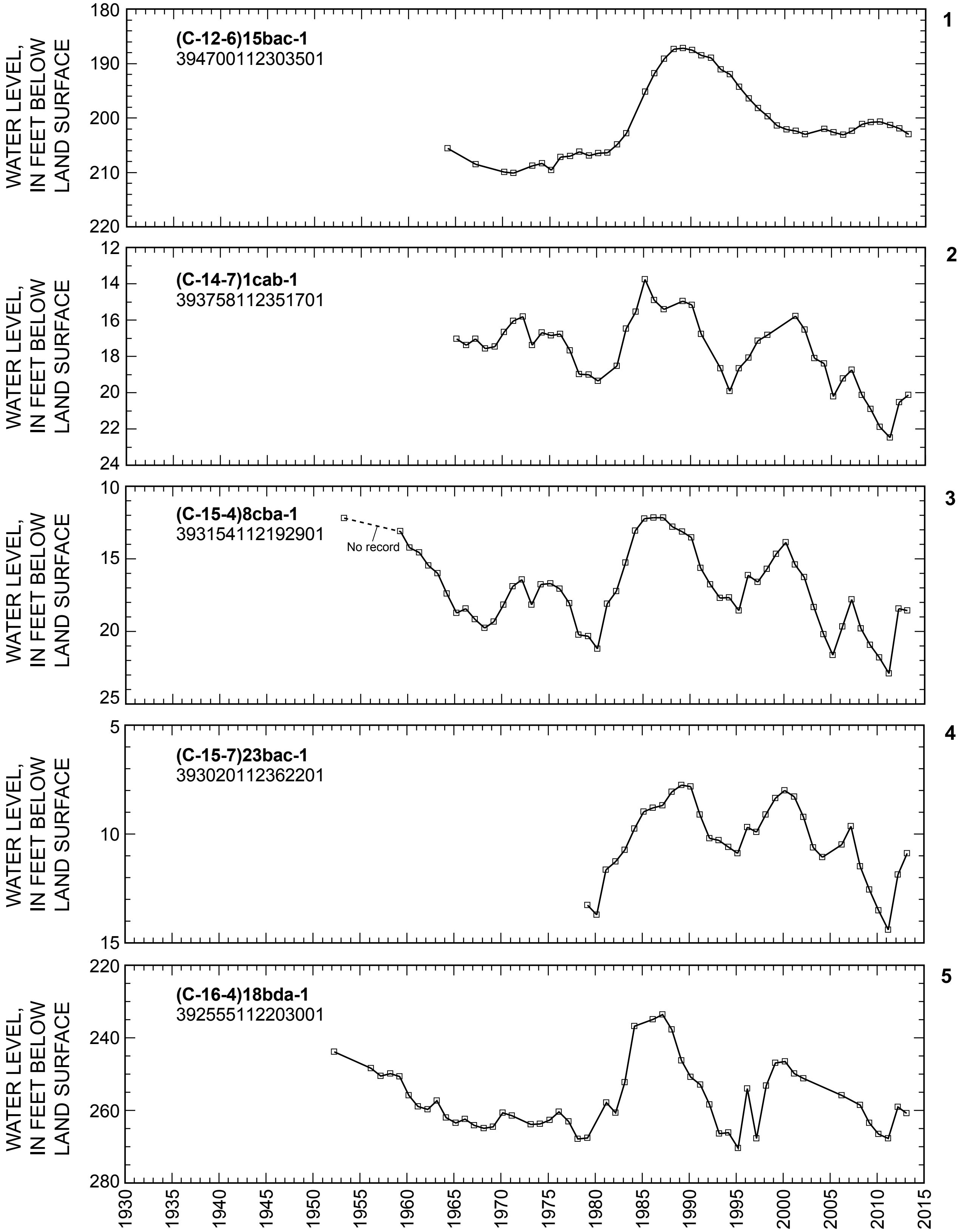


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.

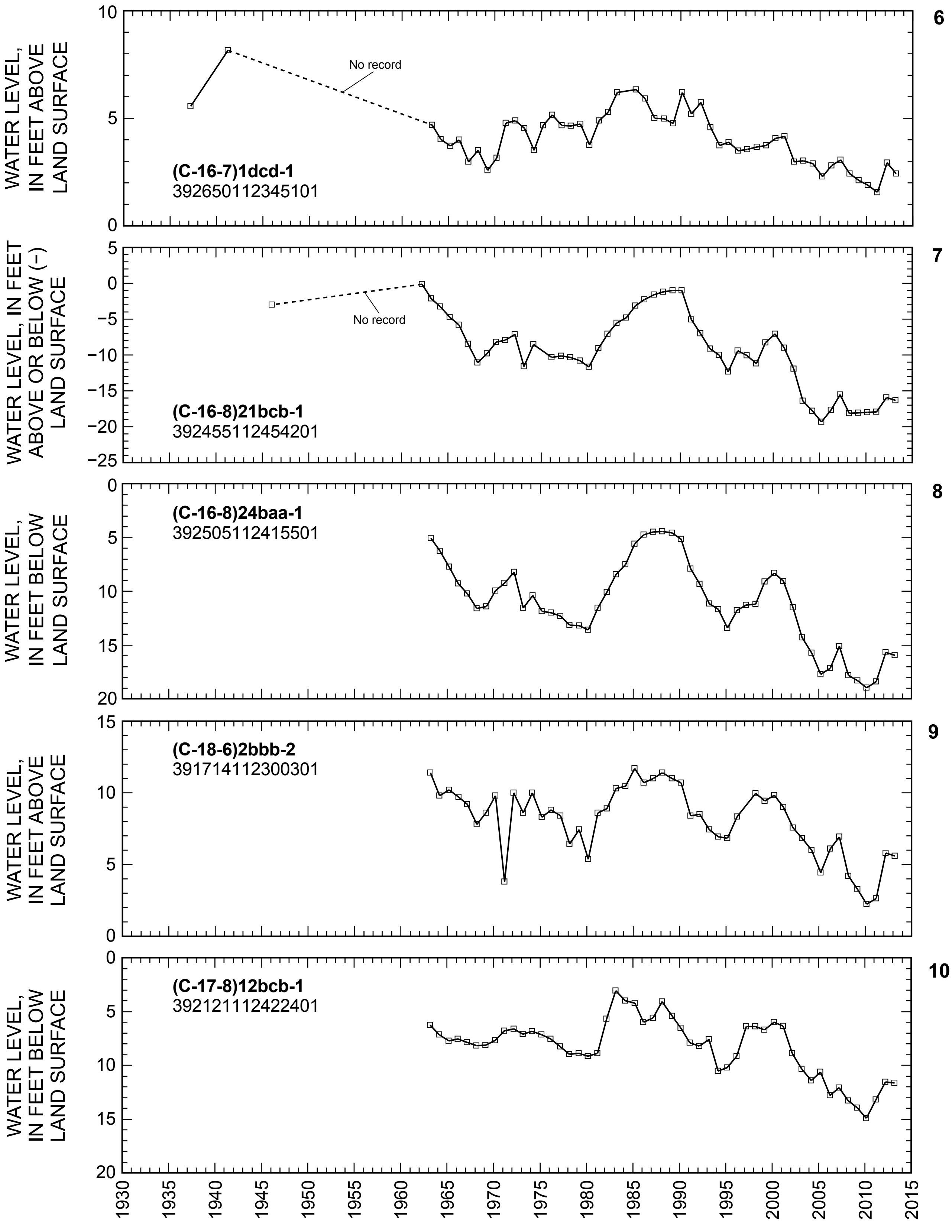


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

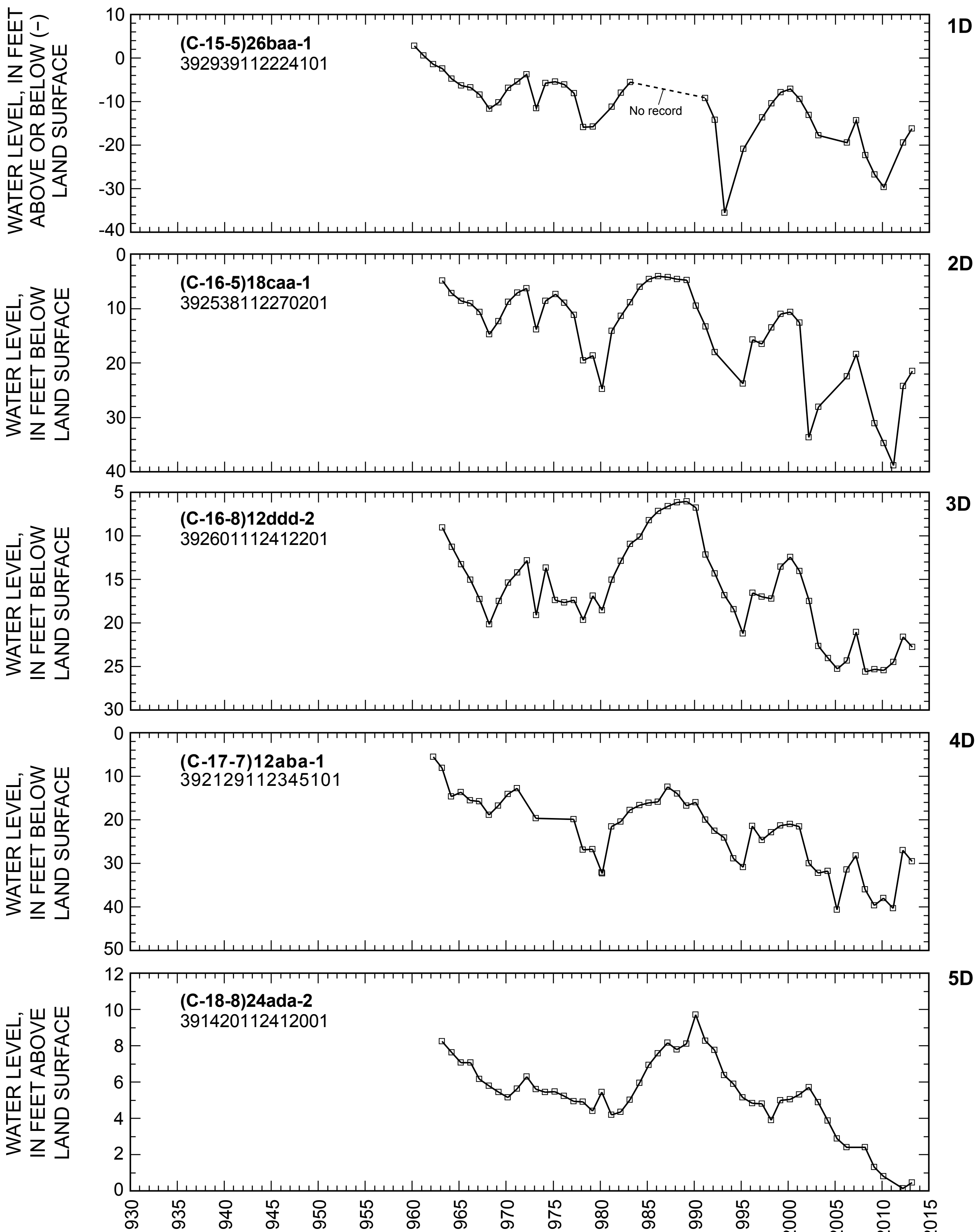


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

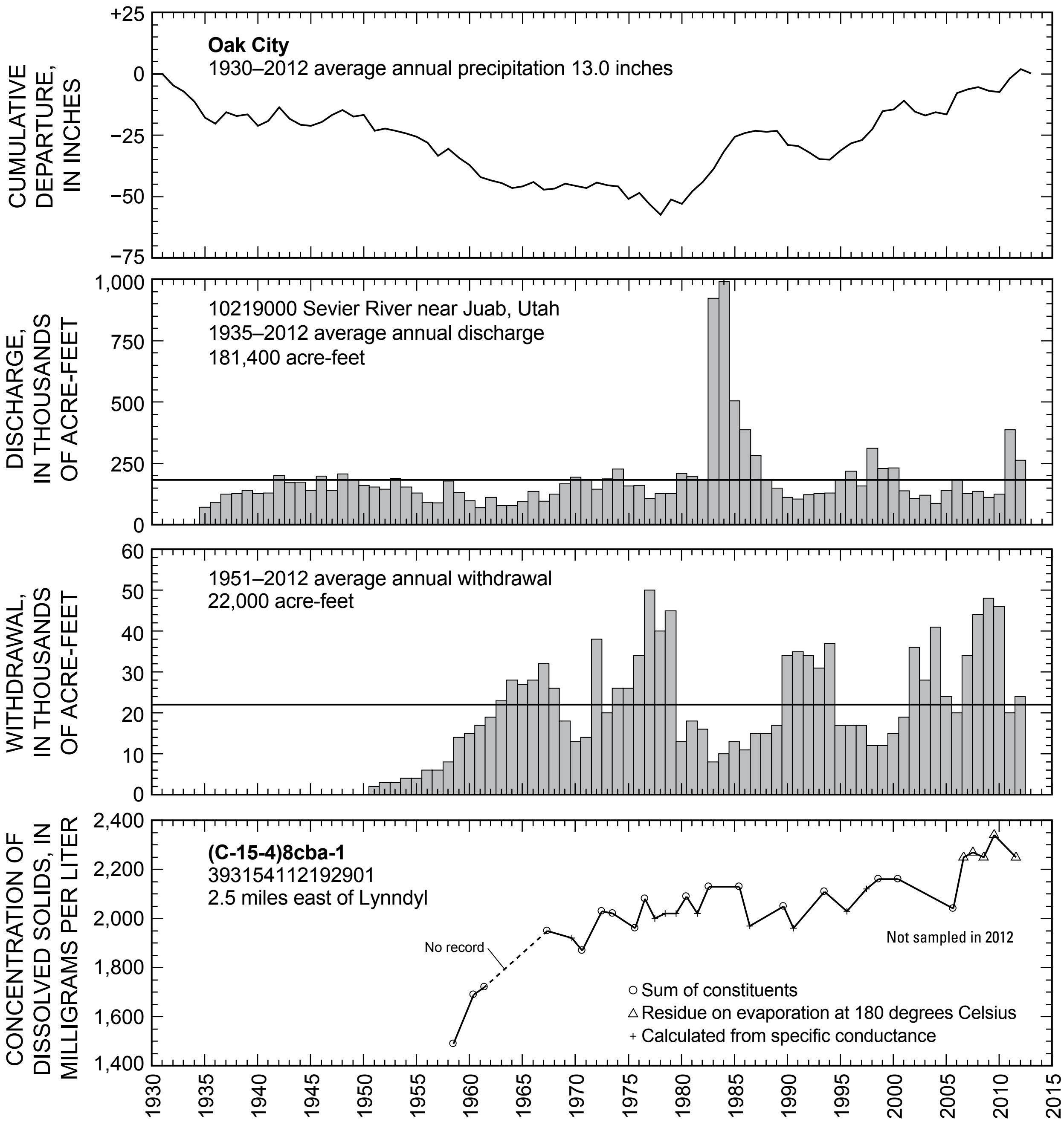


Figure 19. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

Central Sevier Valley

By Bradley 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. Groundwater occurs in unconsolidated basin-fill deposits under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in central Sevier Valley in 2012 was about 28,000 acre-feet, which is 3,000 acre-feet less than reported for 2011 and 8,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3).

The location of 25 wells in central Sevier Valley in which the water level was measured during March 2013 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.

Discharge of the Sevier River at Hatch in 2012 was about 65,500 acre-feet, which is about 15,300 acre-feet less than the 1940–2012 average annual discharge. Precipitation at Richfield Radio KVSC was about 7.7 inches in 2012, which is about 0.4 inch less than the 1950–2012 average annual precipitation and about 3.1 inches less than in 2011.

Water levels in central Sevier Valley generally declined from March 2012 to March 2013. 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 to the basin-fill aquifer from snowmelt runoff.

The concentration of dissolved solids in water samples collected from well (C-23-2)15dcb-4, located 0.1 mile south of Sevier River in Venice, from 1955 to 2012, is shown in figure 21. The concentration has ranged from 307 to 630 mg/L, with a median value of 414 mg/L. There were substantial increases and decreases in dissolved-solids concentration during the mid- to late 1960s and 1980s. Dissolved-solids concentrations in samples collected from 1990 through 2012 show little variability and are generally near the median value for all sample concentrations.

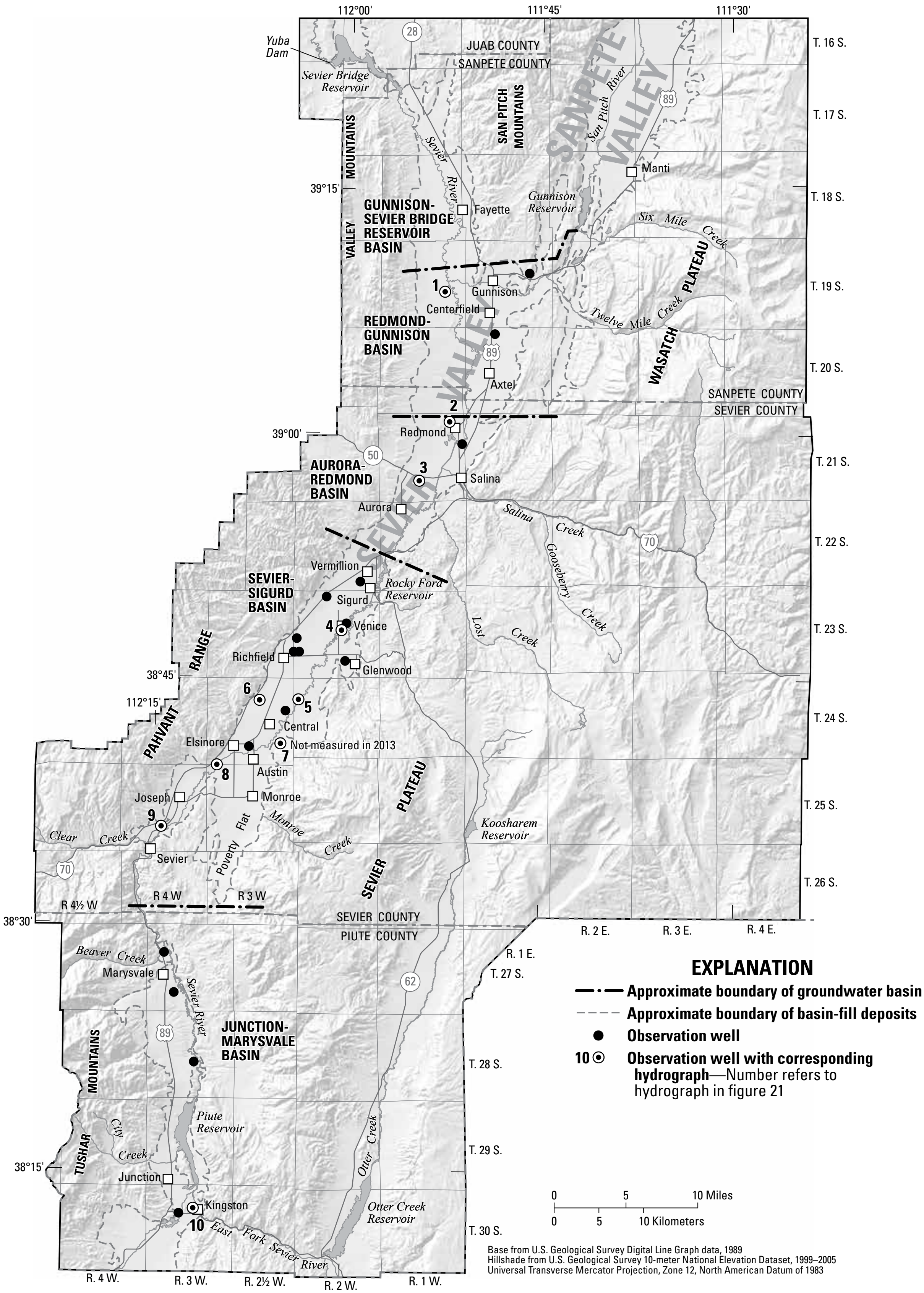


Figure 20. Location of wells in central Sevier Valley in which the water level was measured during March 2013.

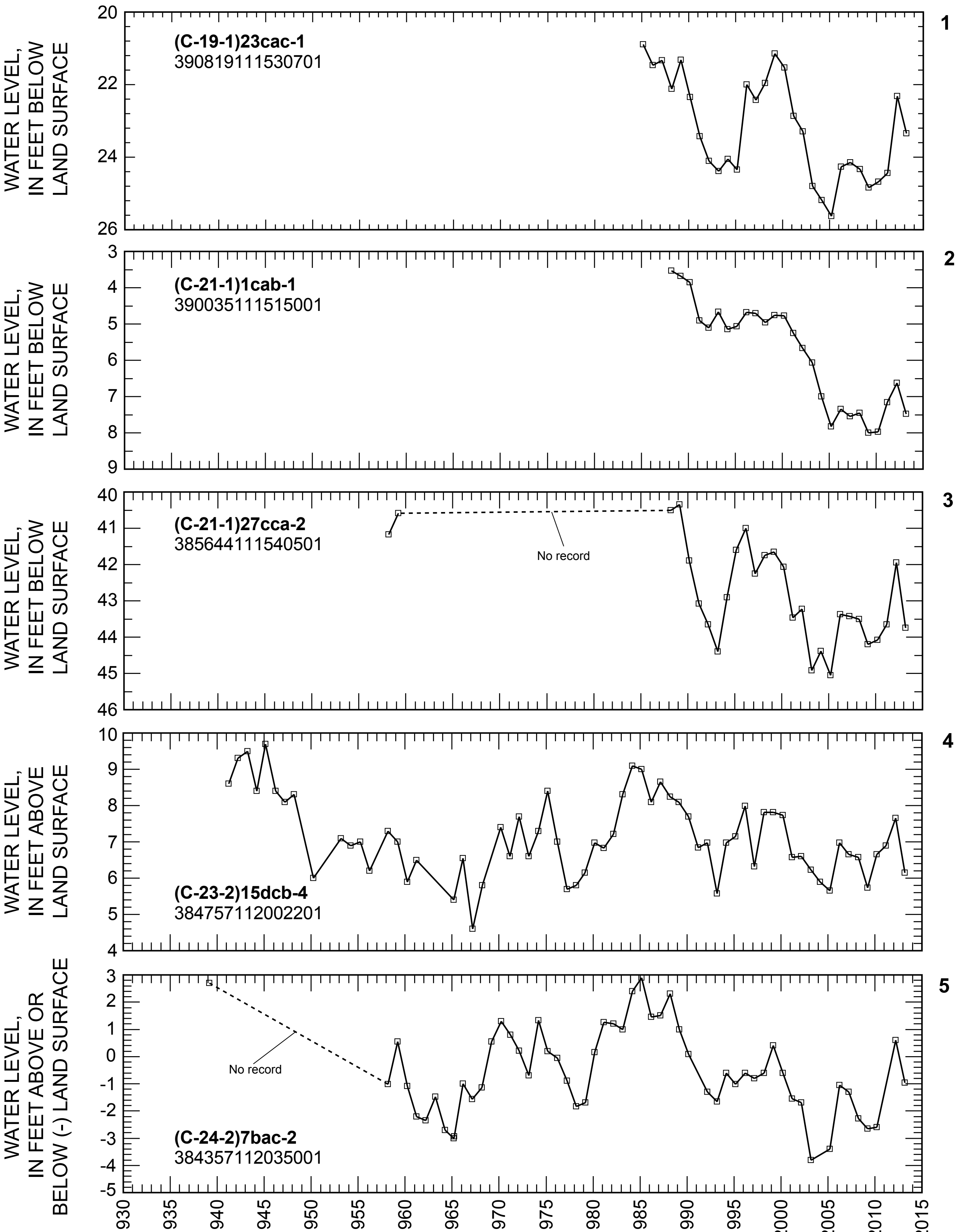


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.

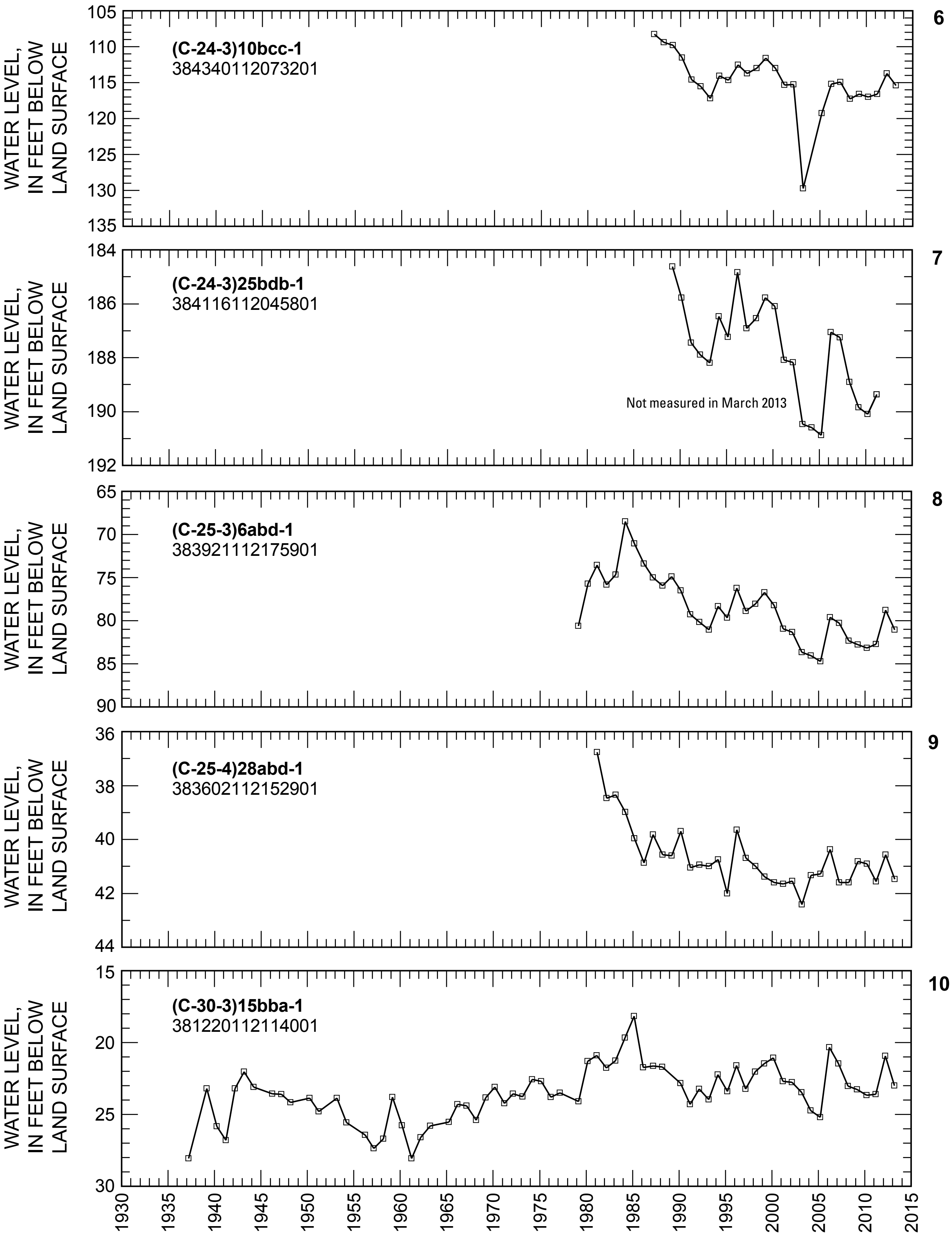


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.—Continued

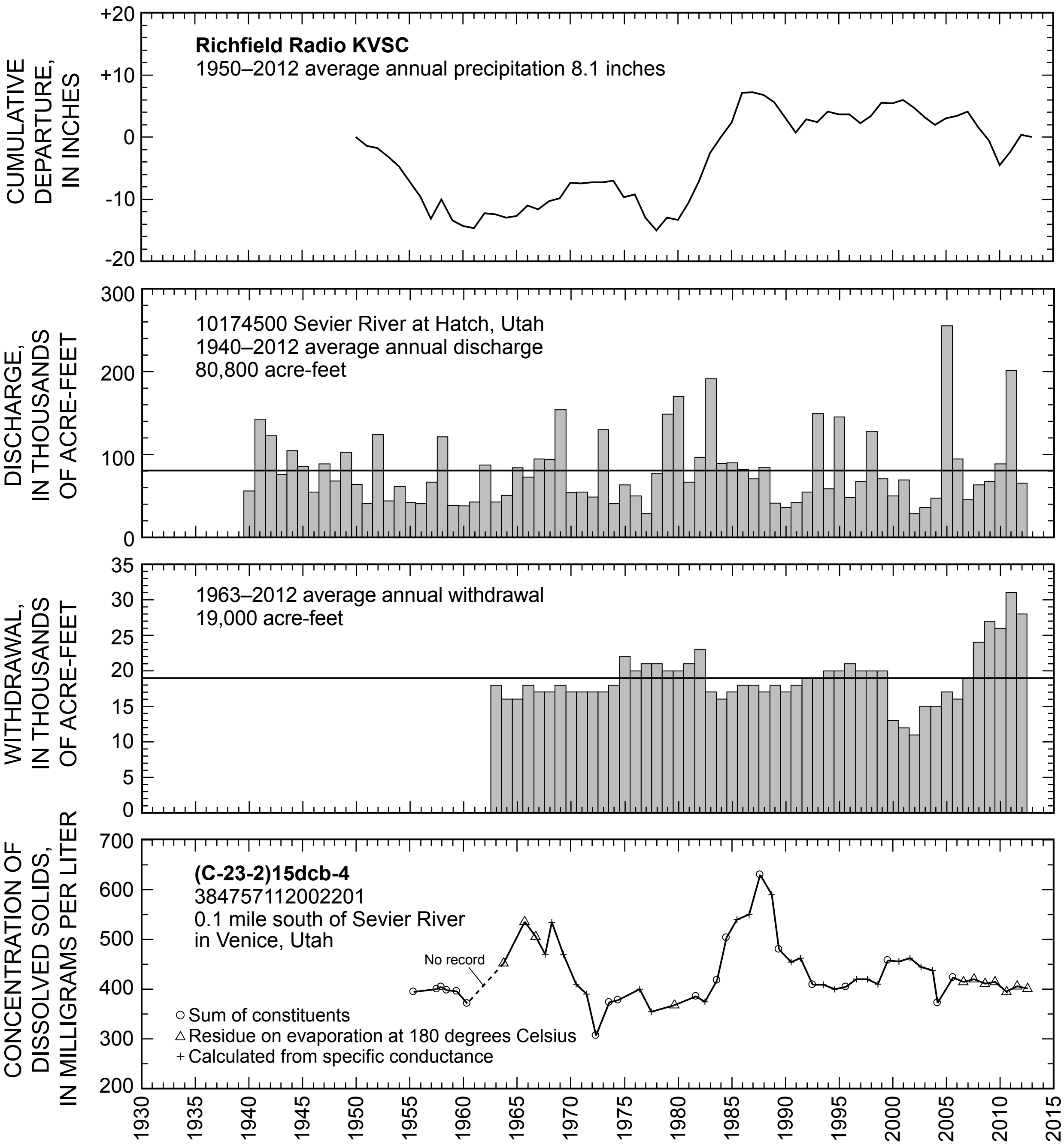


Figure 21. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at Richfield, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.—Continued

Pahvant Valley

By Nickolas R. Whittier

Pahvant Valley, in southeastern Millard County, extends from the vicinity of McCornick in the north to Kanosh in the south, and 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 is about 300 square miles. Groundwater drains west to the valley from the mountainous terrain to the east. Groundwater occurs in basin-fill deposits in the valley under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in Pahvant Valley in 2012 was about 114,000 acre-feet, which is about 25,000 acre-feet more than was reported in 2011 and 23,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). Withdrawal for irrigation in 2012 was about 113,300 acre-feet, which is 24,900 acre-feet more than was reported in 2011.

The location of wells in Pahvant Valley in which the water level was measured during March 2013 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.

Precipitation at Fillmore during 2012 was about 12.7 inches, which is about 2.6 inches less than the average annual precipitation for 1930–2012 and about 6.8 inches less than in 2011.

Water levels declined from March 2012 to March 2013 in most parts of Pahvant Valley; however, there were a few wells in the southwest part of the valley in which water levels rose slightly. Water-level declines of more than 6 feet were observed in several wells north of Flowell. These declines are probably the result of continued large localized 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 rose substantially from 1982 to 1985 as a result of greater-than-average precipitation and decreased withdrawals for irrigation. Water levels generally have declined throughout the valley since the mid-to-late 1980s.

The concentration of dissolved solids in water samples collected from wells (C-21-5)7cdd-2 and (C-21-5)7cdd-3, located in the Flowell area, from 1954 to 2012, and from well (C-23-6)8abd-1, located in the Kanosh area, from 1957 to 2010, 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 samples from these wells were combined to give an extended temporal record for this constituent. Dissolved-solids concentrations in water samples from wells in the Flowell area have ranged from 707 to 1,080 mg/L, with a median value of 879 mg/L. The concentration of dissolved solids in water samples from well (C-23-6)8abd-1 has ranged from 2,350 to 5,990 mg/L, with a median value of 4,465 mg/L.

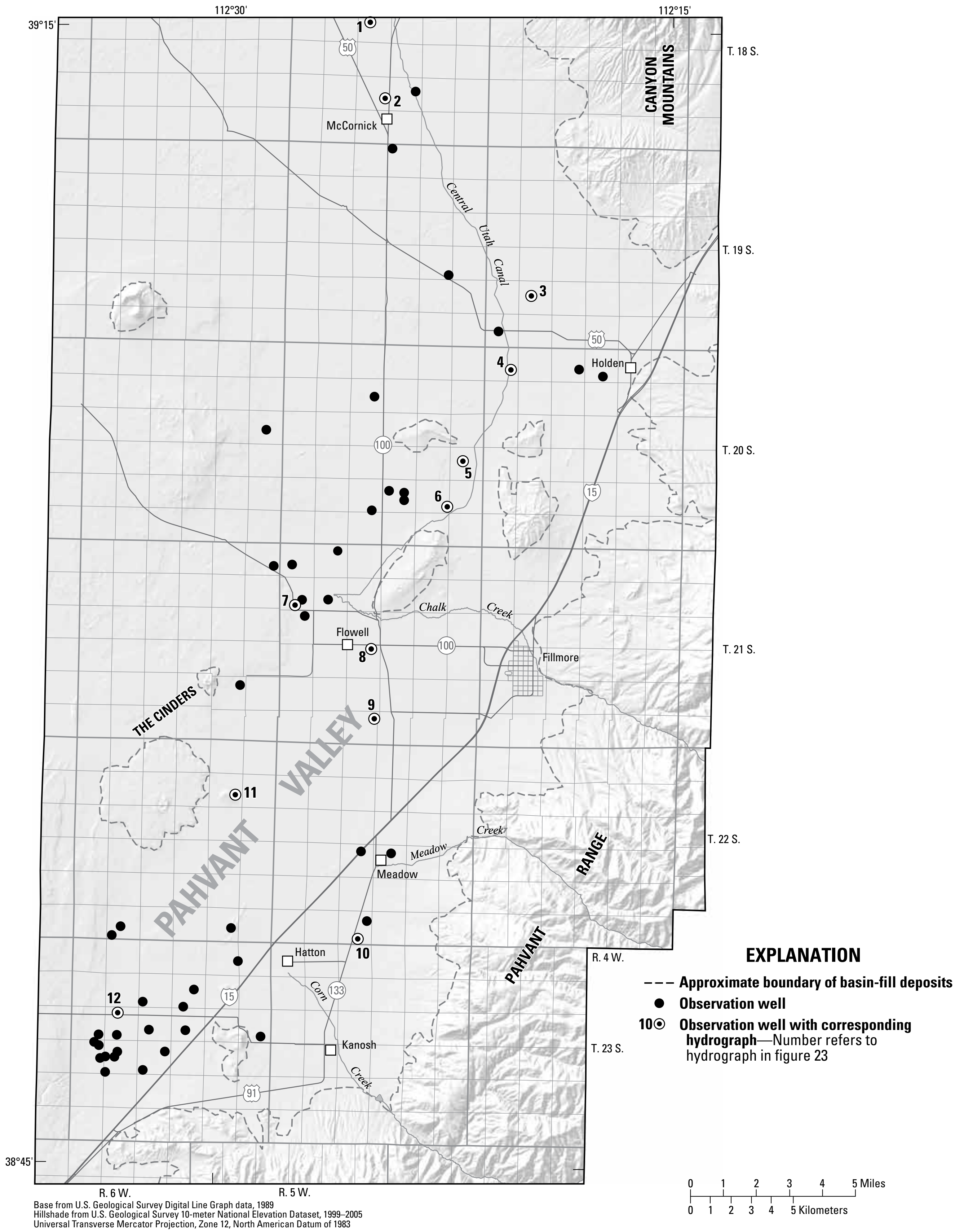


Figure 22. Location of wells in Pahvant Valley in which the water level was measured during March 2013.

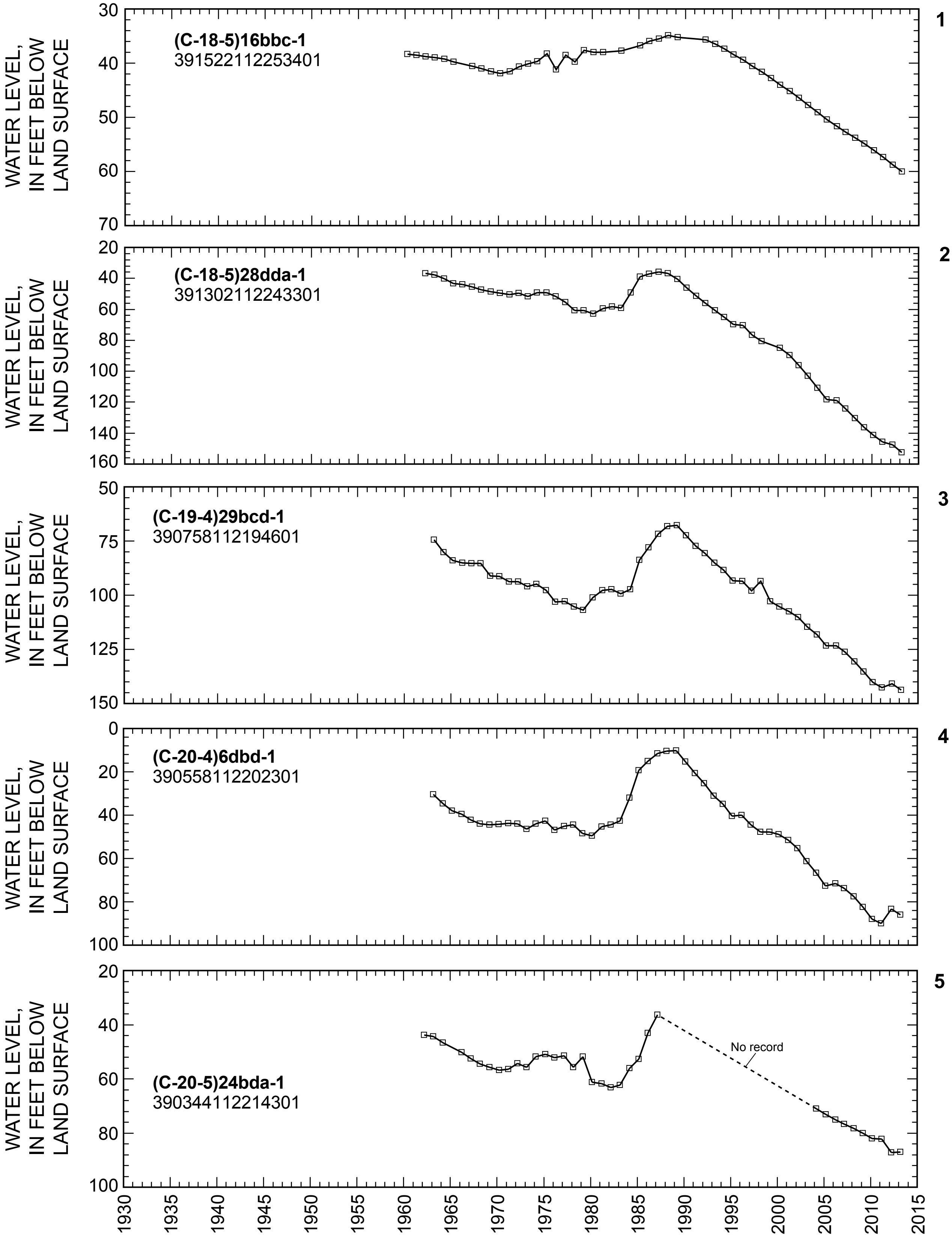


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

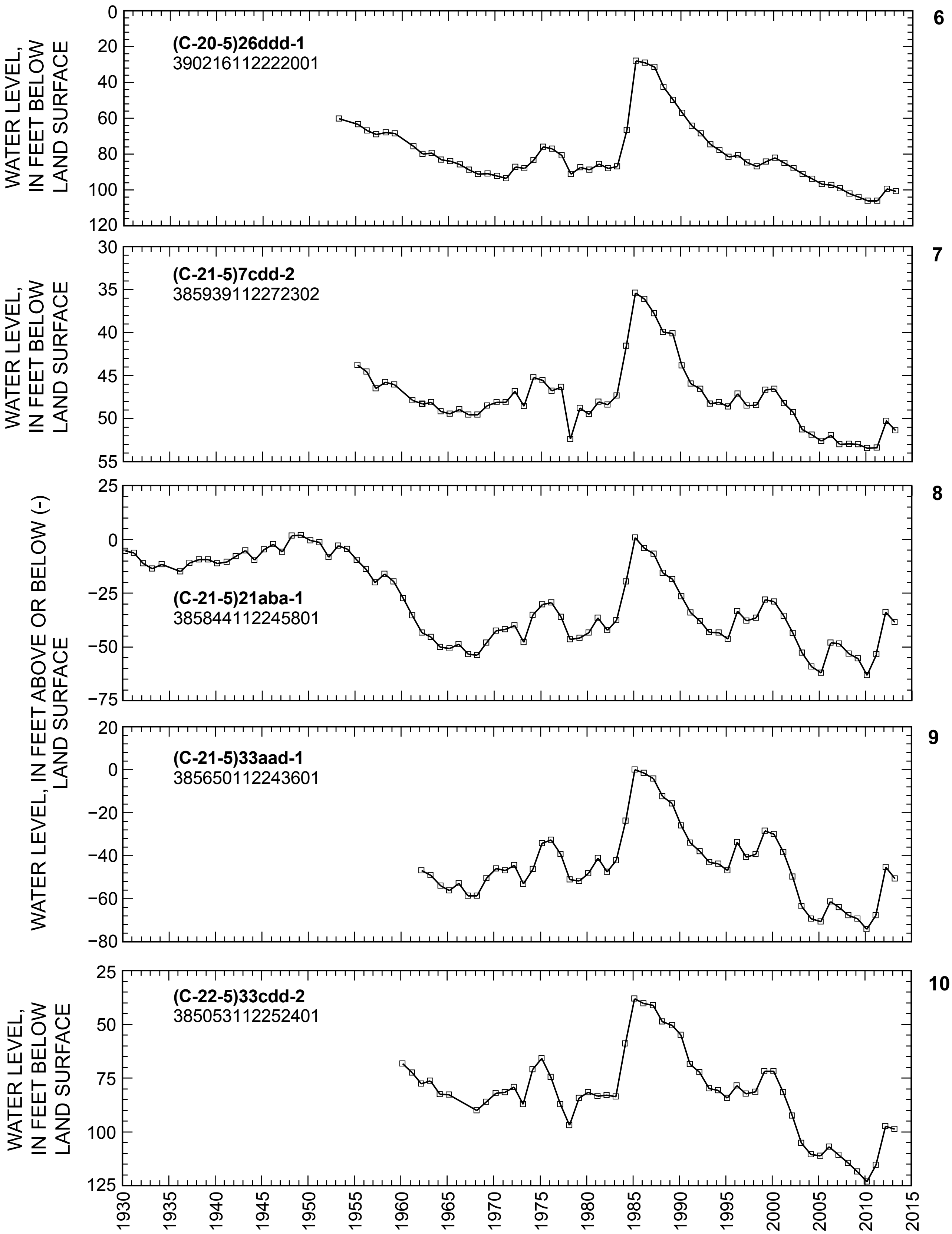


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

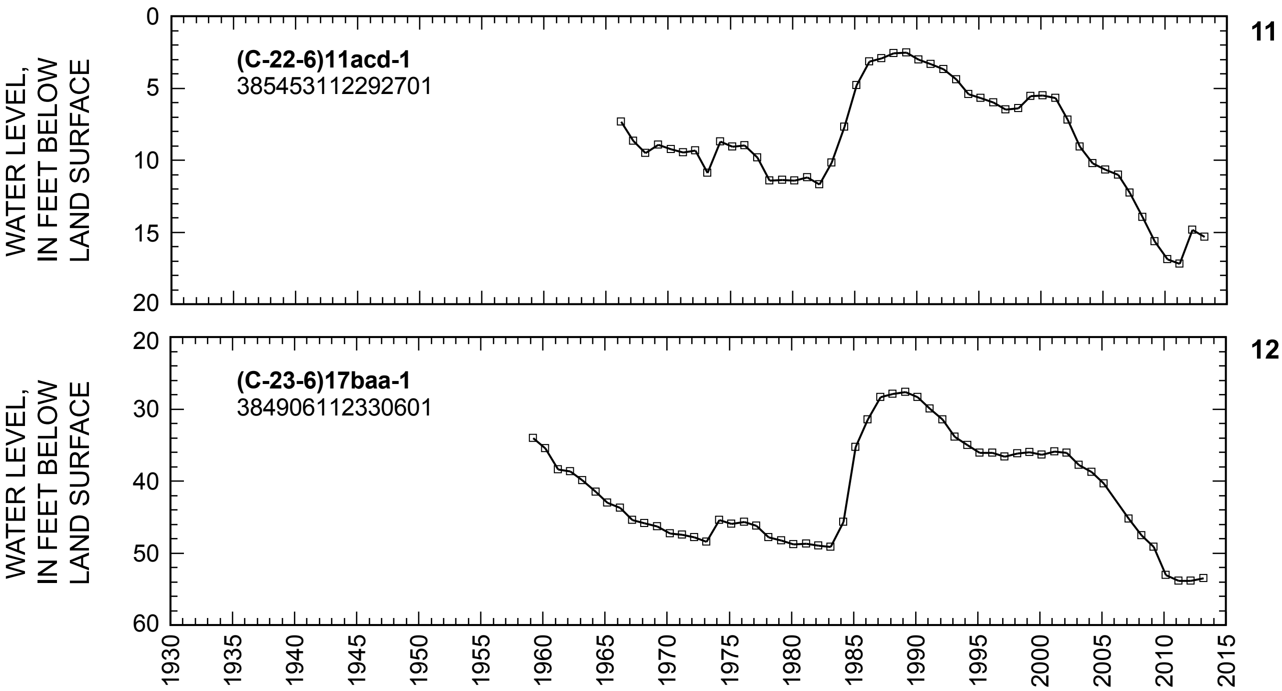


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

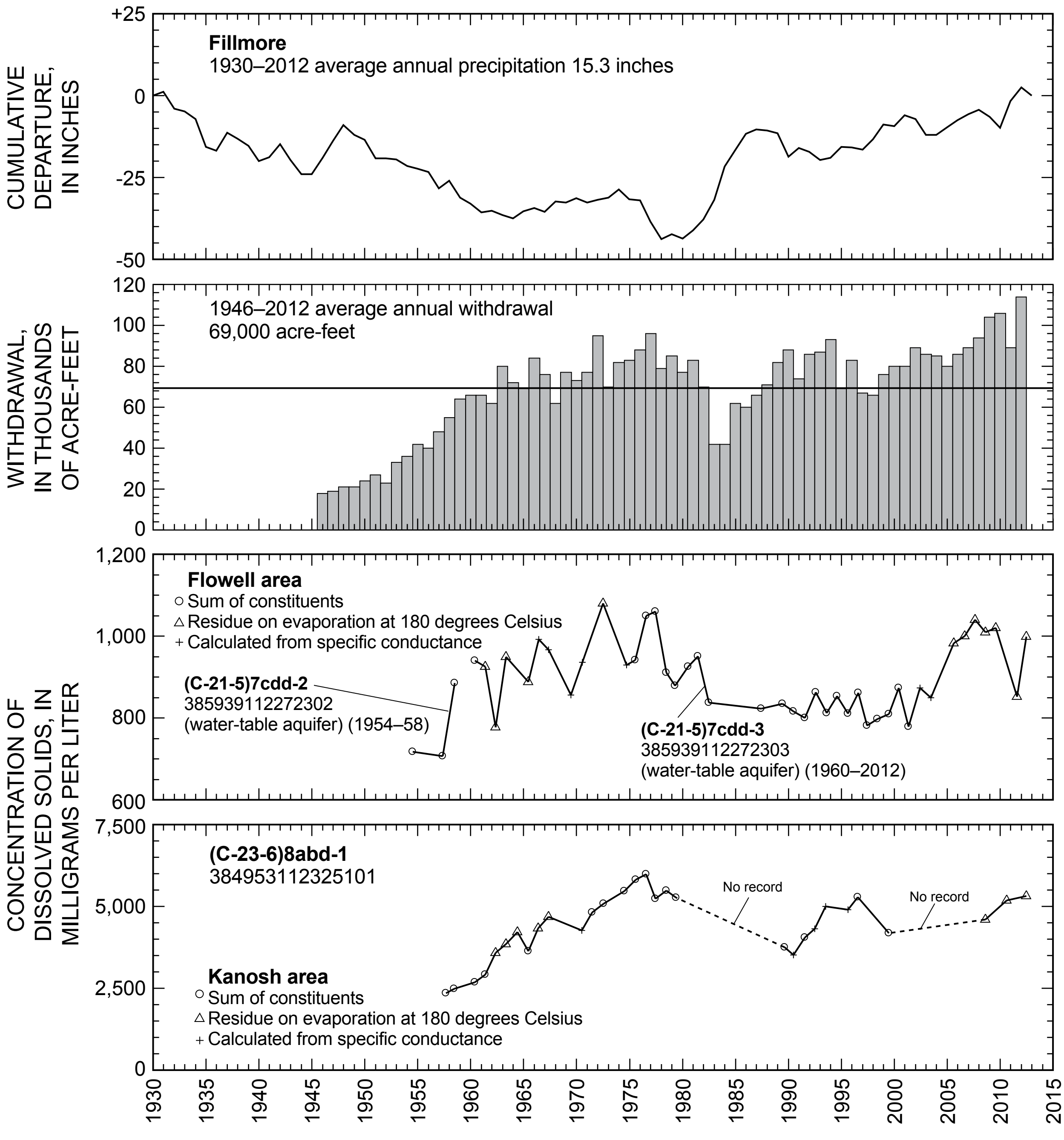


Figure 23. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

Cedar Valley, Iron County

By James H. Howells

Cedar Valley is in eastern Iron County, southwestern Utah. The valley covers about 220 square miles from the vicinity of Rush Lake in the north to the community of Kanarraville in the south and includes Cedar City on its eastern edge (fig. 24). Groundwater in Cedar Valley occurs in unconsolidated basin-fill deposits, mostly under water-table conditions. The principal source of recharge to the basin-fill aquifer is water from Coal Creek, some of which seeps directly from the stream channel into the groundwater system.

Total estimated withdrawal of water from wells in Cedar Valley in 2012 was about 40,000 acre-feet, which is 6,000 acre-feet more than in 2011 and 2,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3).

The location of wells in Cedar Valley in which the water level was measured during March 2013 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.

Precipitation at Cedar City Federal Aviation Administration Airport in 2012 was about 12.6 inches, which is about 2.6 inches less than in 2011 and about 1.8 inches more than the average annual precipitation for 1949–2012. Discharge of Coal Creek was about 18,800 acre-feet in 2012, which is 28,600 acre-feet less than in 2011, and 5,900 acre-feet less than the average annual discharge for 1936 and 1939–2012.

Groundwater levels declined from March 2012 to March 2013 in most parts of Cedar Valley. The largest declines, greater than 6 feet, were measured in four wells north and west of Cedar City. Water-level declines probably resulted from locally increased withdrawals and decreased recharge. Water-level rises were measured in one well west and three wells north of Cedar City. Water-level rises probably resulted from decreased localized withdrawals and increased recharge.

The concentration of dissolved solids in water samples collected from well (C-37-12)23acb-1, located 2.3 miles northeast of Kanarraville, from 1966 to 2012, and well (C-35-11)31dbd-1, located about 4 miles northwest of Cedar City, from 1977 to 2012, is shown in figure 25. The dissolved-solids concentration in water from well (C-37-12)23acb-1 has ranged from 347 to 1,050 mg/L, with a median value of 506 mg/L; the concentration of dissolved solids from 1966 to 2012 has generally increased. For well (C-35-11)31dbd-1, the concentration of dissolved solids in water samples has ranged from 364 to 1,020 mg/L, with a median value of 543 mg/L. From 1987 to 2012, the concentration has generally increased.

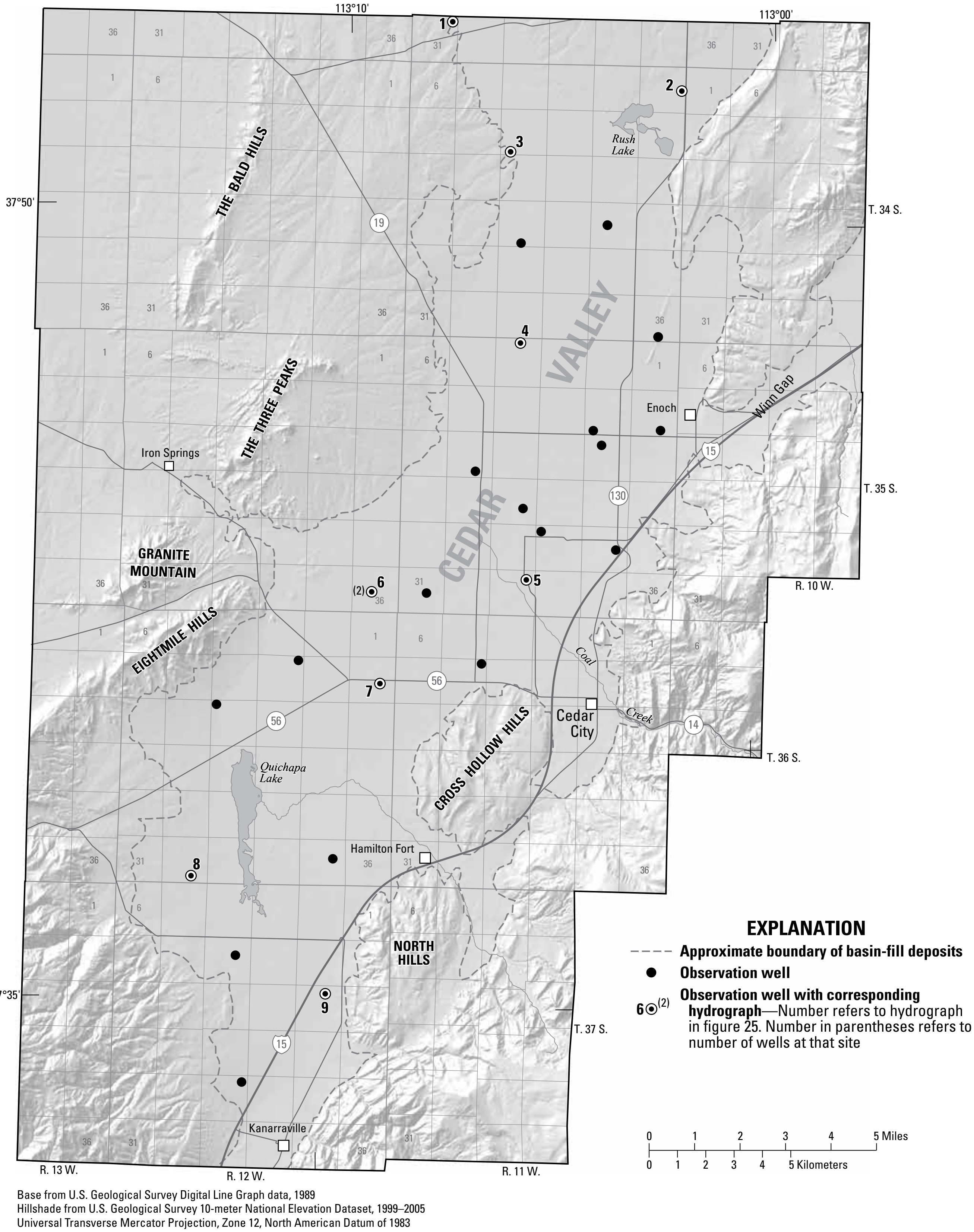


Figure 24. Location of wells in Cedar Valley, Iron County, in which the water level was measured during March 2013.

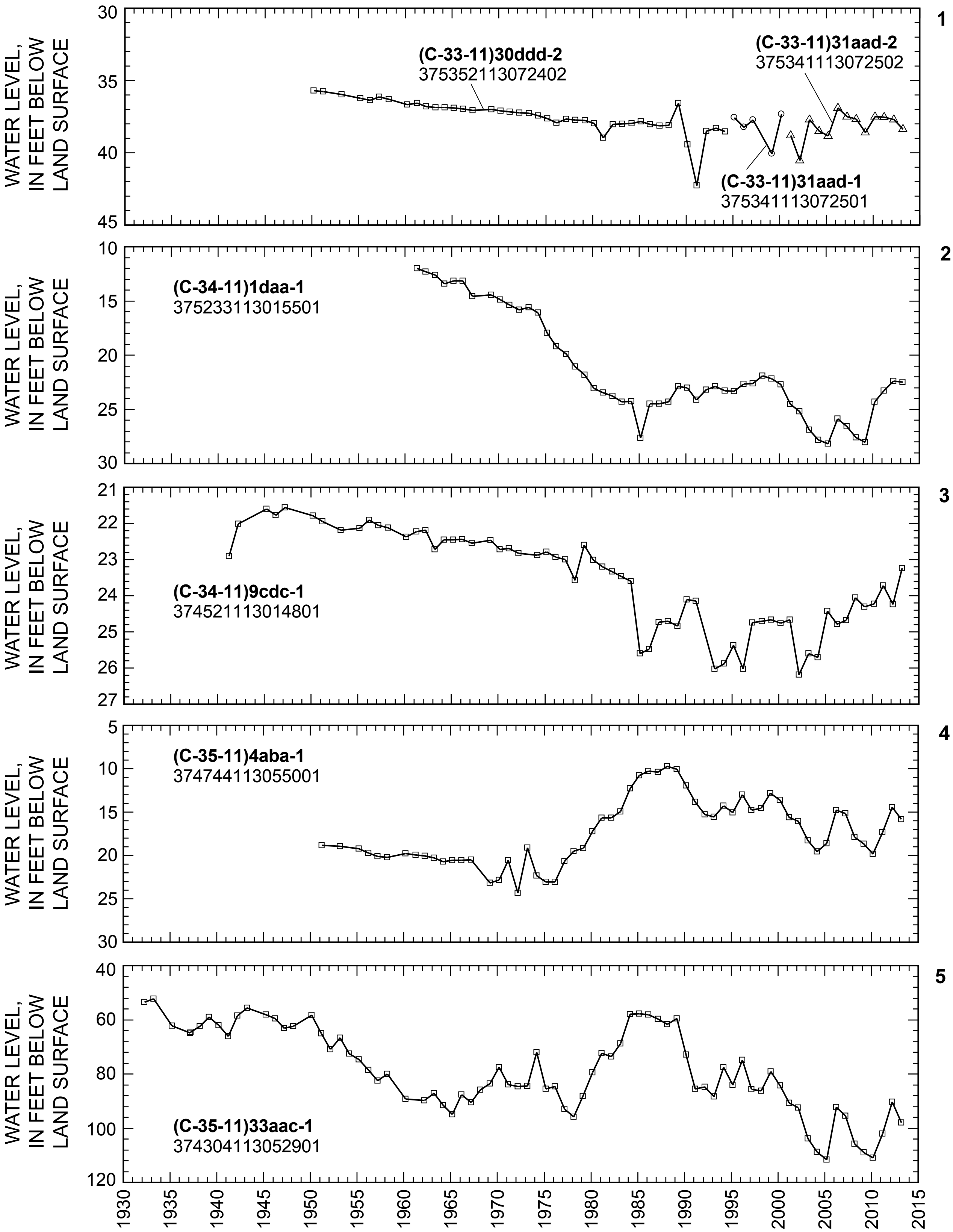


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration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

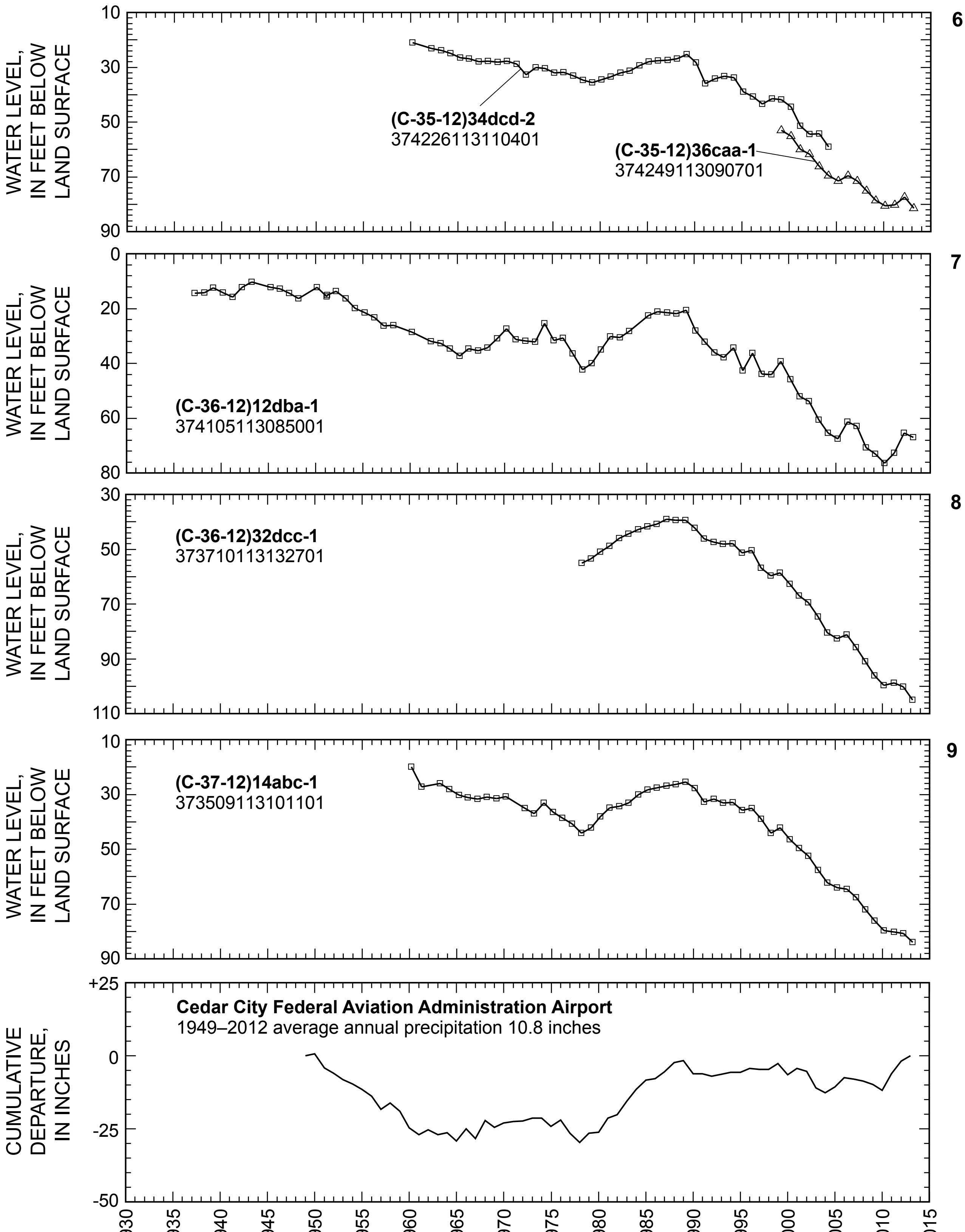


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration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

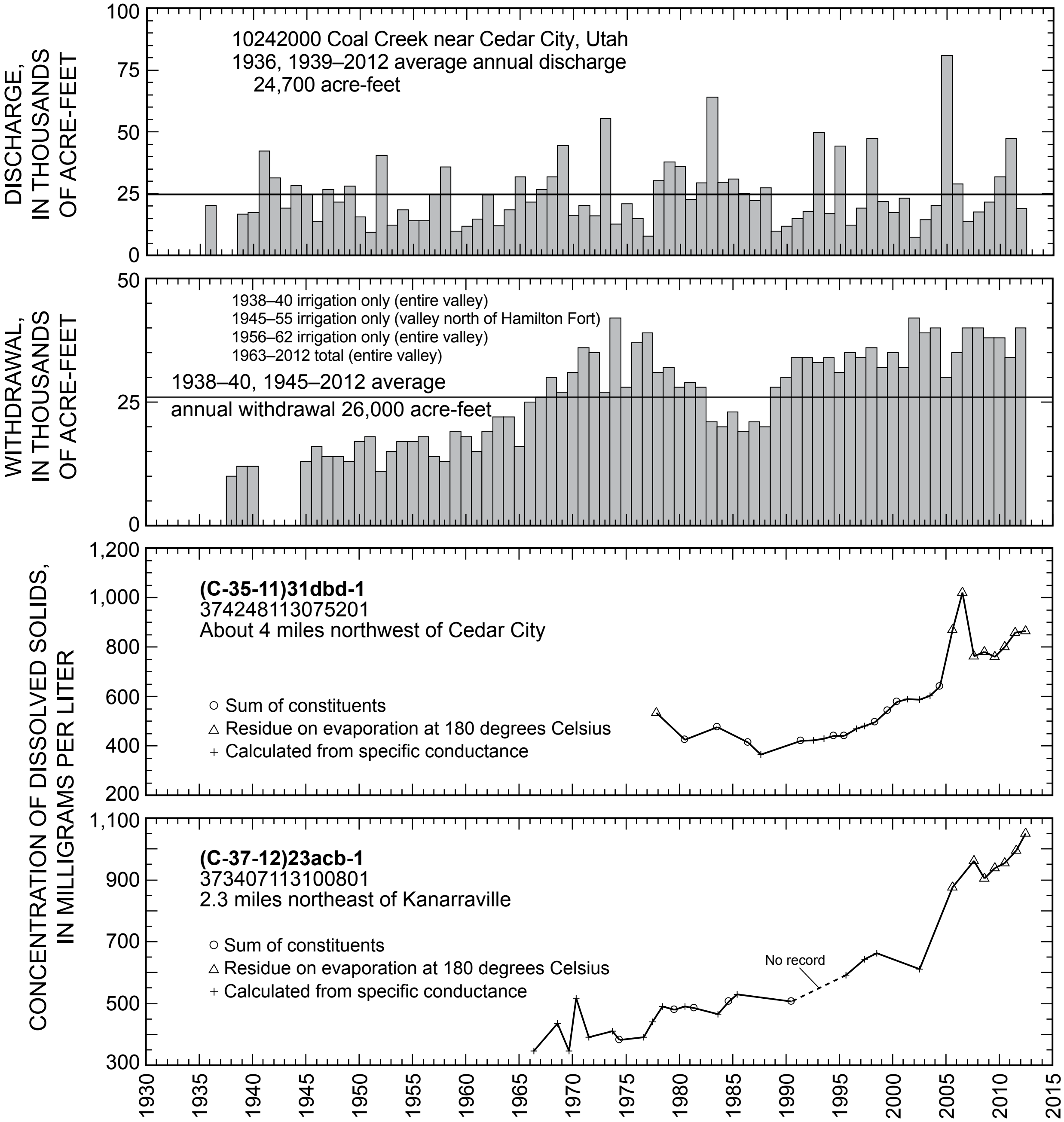


Figure 25. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, to annual withdrawal from wells, and to concentration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

Parowan Valley

By James H. Howells

Parowan Valley is in northern Iron County, southwestern Utah. The valley covers about 160 square miles west of the Hurricane Cliffs and includes the towns of Paragonah and Parowan (fig. 26). Groundwater occurs in unconsolidated basin-fill deposits under both water-table and artesian conditions.

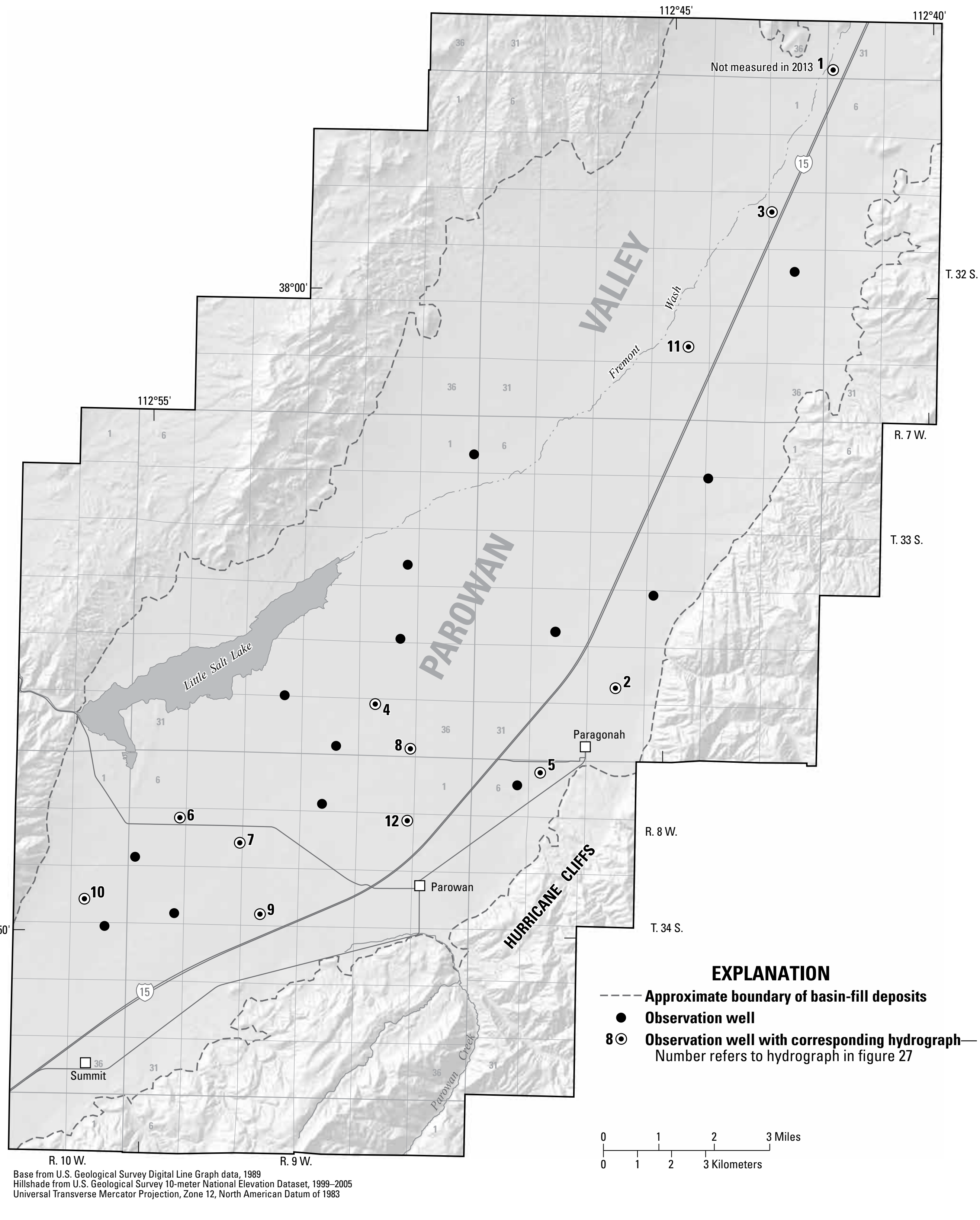
Total estimated withdrawal of water from wells in Parowan Valley in 2012 was about 38,000 acre-feet, which is about 6,000 acre-feet more than was reported for 2011 and 4,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). The increase is mainly due to increased withdrawals for irrigation.

The location of wells in Parowan Valley in which the water level was measured during March 2013 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.

Precipitation at Cedar City Federal Aviation Administration Airport in 2012 was about 12.6 inches, which is about 2.6 inches less than the value for 2011 and 1.8 inches more than the average annual precipitation for 1949–2012.

Water levels declined from March 2012 to March 2013 in all parts of Parowan Valley for which data are available. The largest decline, about 6.3 feet, was measured in a well northwest of Parowan. Water levels in Parowan Valley generally have declined since 1950. Some rises occurred during 1973–74, 1983–85, 1996–99, 2006, and 2012. Declines in water levels are probably the result of continued large local withdrawals for irrigation. Rises are probably the result of less withdrawal for irrigation and several years of greater-than-average precipitation.

The concentration of dissolved solids in water samples collected from well (C-33-8)31ccc-1, located 2 miles west of Paragonah, from 1961 to 2012, is shown in figure 27. The concentration has ranged from 257 to 885 mg/L, with a median value of 290 mg/L. The water sample collected in June 2012 had a dissolved-solids concentration of 290 mg/L. With the exception of relatively high dissolved-solids concentrations in water samples collected in 1970, 1973, and 1974, concentrations have varied little.



Base from U.S. Geological Survey Digital Line Graph data, 1989
Hillshade from U.S. Geological Survey 10-meter National Elevation Dataset, 1999–2005
Universal Transverse Mercator Projection, Zone 12, North American Datum of 1983

Figure 26. Location of wells in Parowan Valley in which the water level was measured during March 2013.

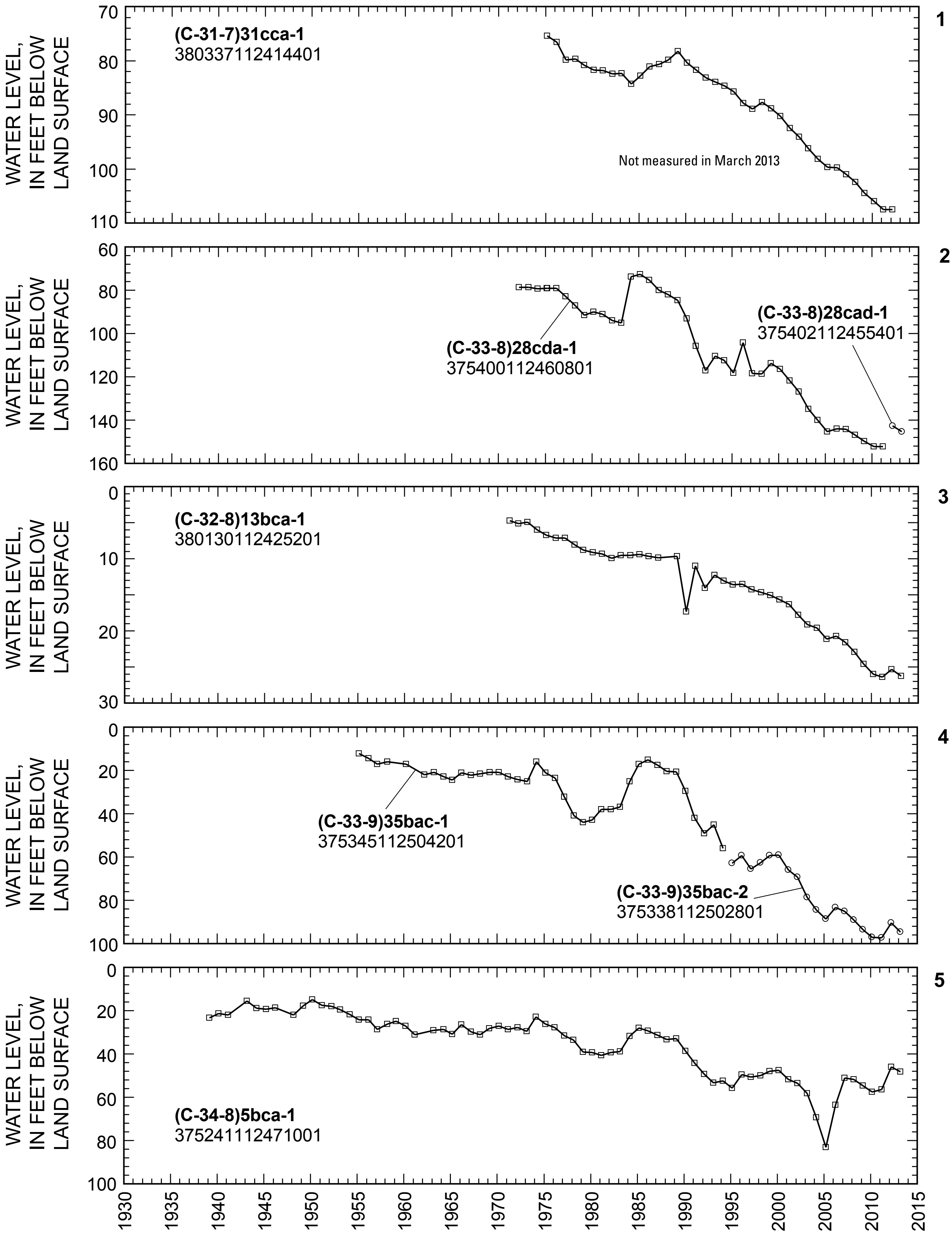


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.

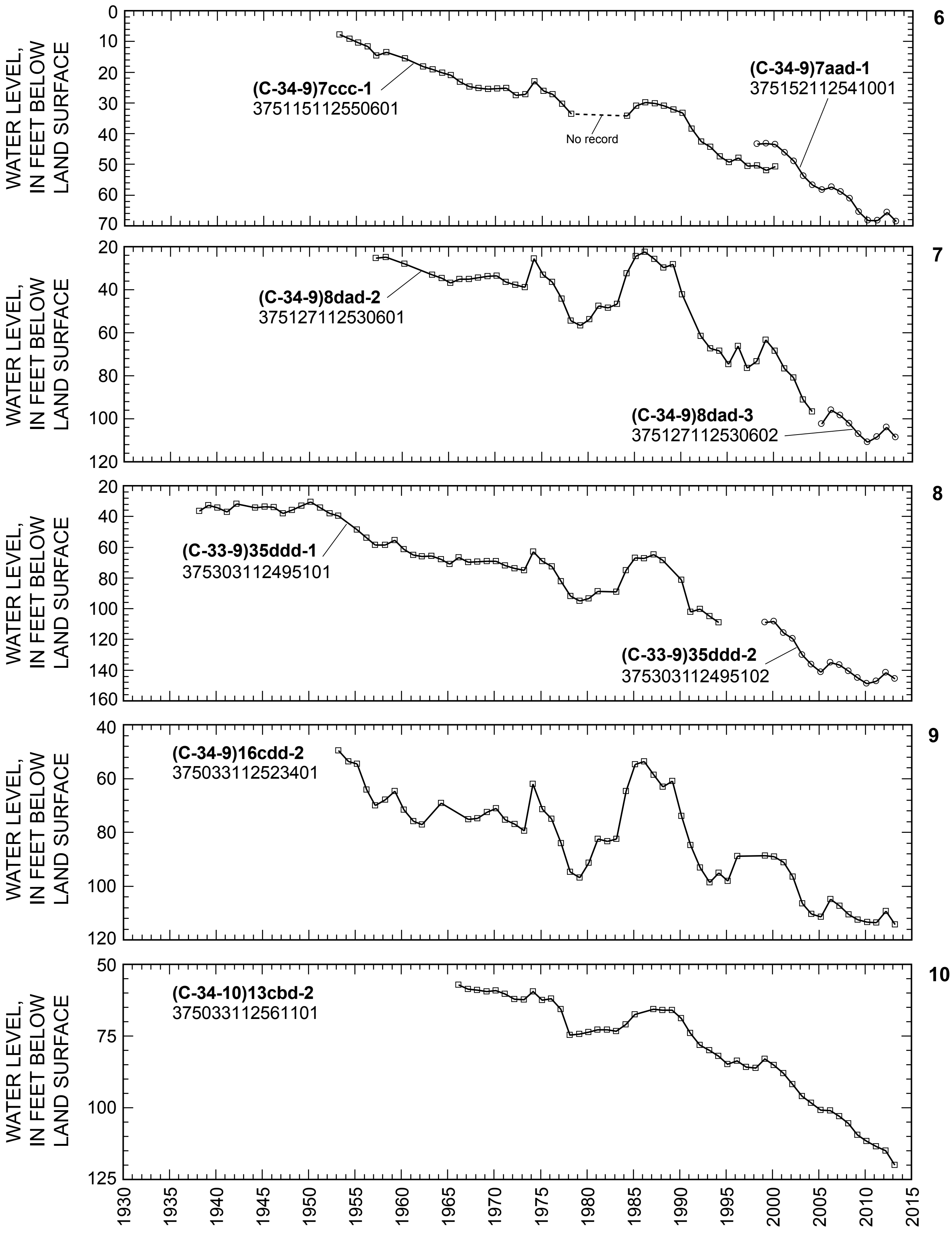


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.—Continued

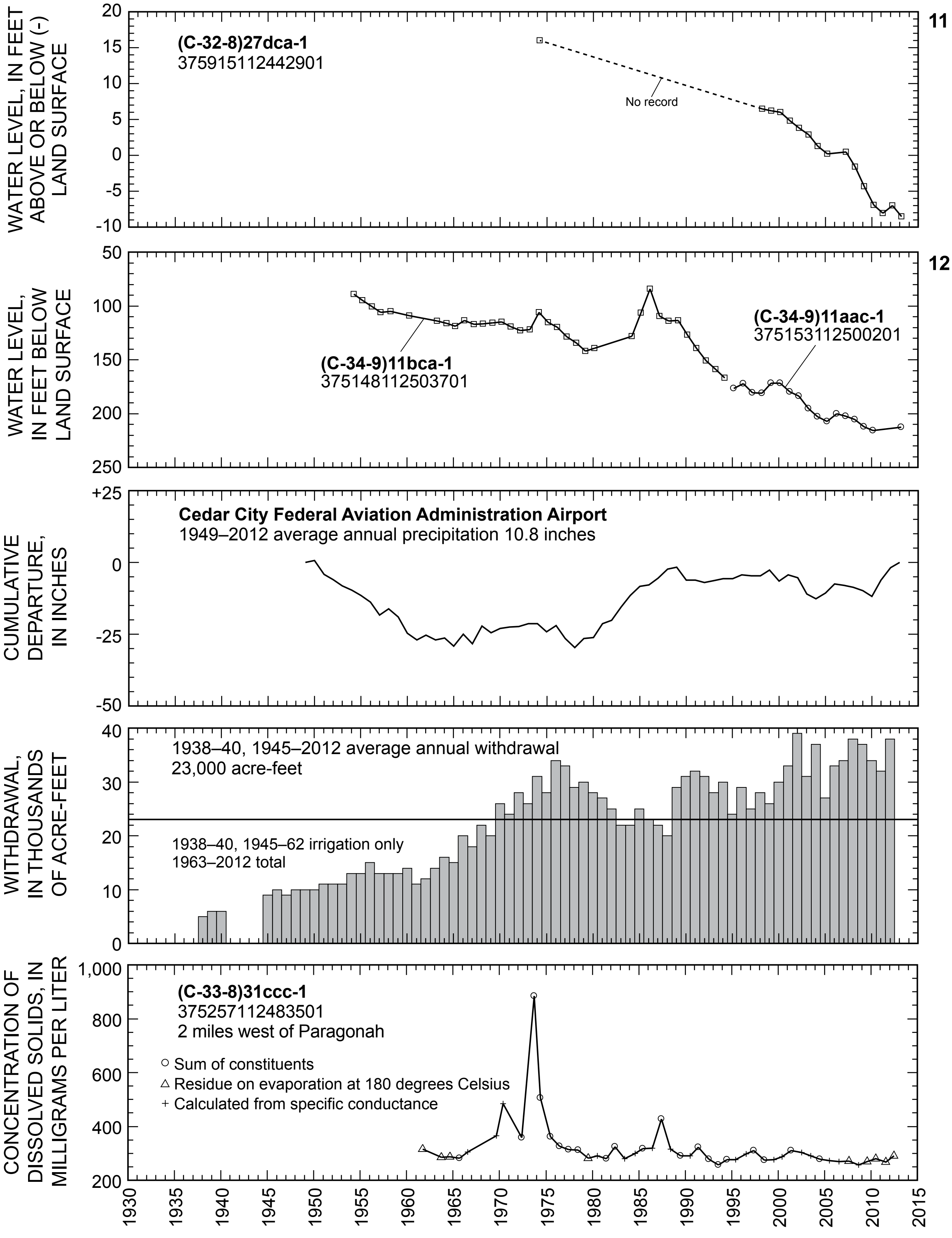


Figure 27. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.—Continued

Escalante Valley

Milford Area

By Bradley A. Slaugh

The Milford area is in southwestern Utah and includes that part of Escalante Valley lying entirely within Beaver County west of the Mineral Mountains, the southern part of Millard County, and a small area in the northern part of Iron County (fig. 28). Groundwater occurs in unconsolidated basin-fill deposits in the valley.

Total estimated withdrawal of water from wells in the Milford area of Escalante Valley in 2012 was about 67,000 acre-feet, which is 14,000 acre-feet more than was reported for 2011 and 17,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). This increase was most likely the result of increased pumpage for irrigation due to decreased availability of surface water and less-than-average precipitation.

The location of wells in the Milford area in which the water level was measured during March 2013 is shown in figure 28. The relation of the water level in selected observation wells 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)5cdd-2 is shown in figure 29.

Precipitation at Black Rock in 2012 was about 6.6 inches, about 7.1 inches less than in 2011 and about 2.4 inches less than the 1952–2012 average annual precipitation.

Water levels declined from March 2012 to March 2013 in most of the Milford area. The amount of water-level rise or decline depends largely on groundwater withdrawals, the amount and timing of precipitation, and recharge to the basin-fill aquifer from the Beaver River. Since the early 1950s, water levels generally have declined in the south-central Milford area in response to the long-term effects of groundwater withdrawals. Water-level rises during 1983–85 resulted from greater-than-average precipitation during 1982–85 and increased recharge to the basin-fill aquifer from record flow in the Beaver River during 1983–84.

The concentration of dissolved solids in water samples collected from well (C-29-10)5cdd-2, located 5 miles south of Milford, from 1969 to 2012, is shown in figure 29. The concentration has ranged from 477 to 909 mg/L with a median value of 572 mg/L. The dissolved-solids concentration in the June 2012 sample was 477 mg/L. With the exception of a relatively high dissolved-solids concentration in the water sample collected in 2001 (909 mg/L), concentrations have varied little.

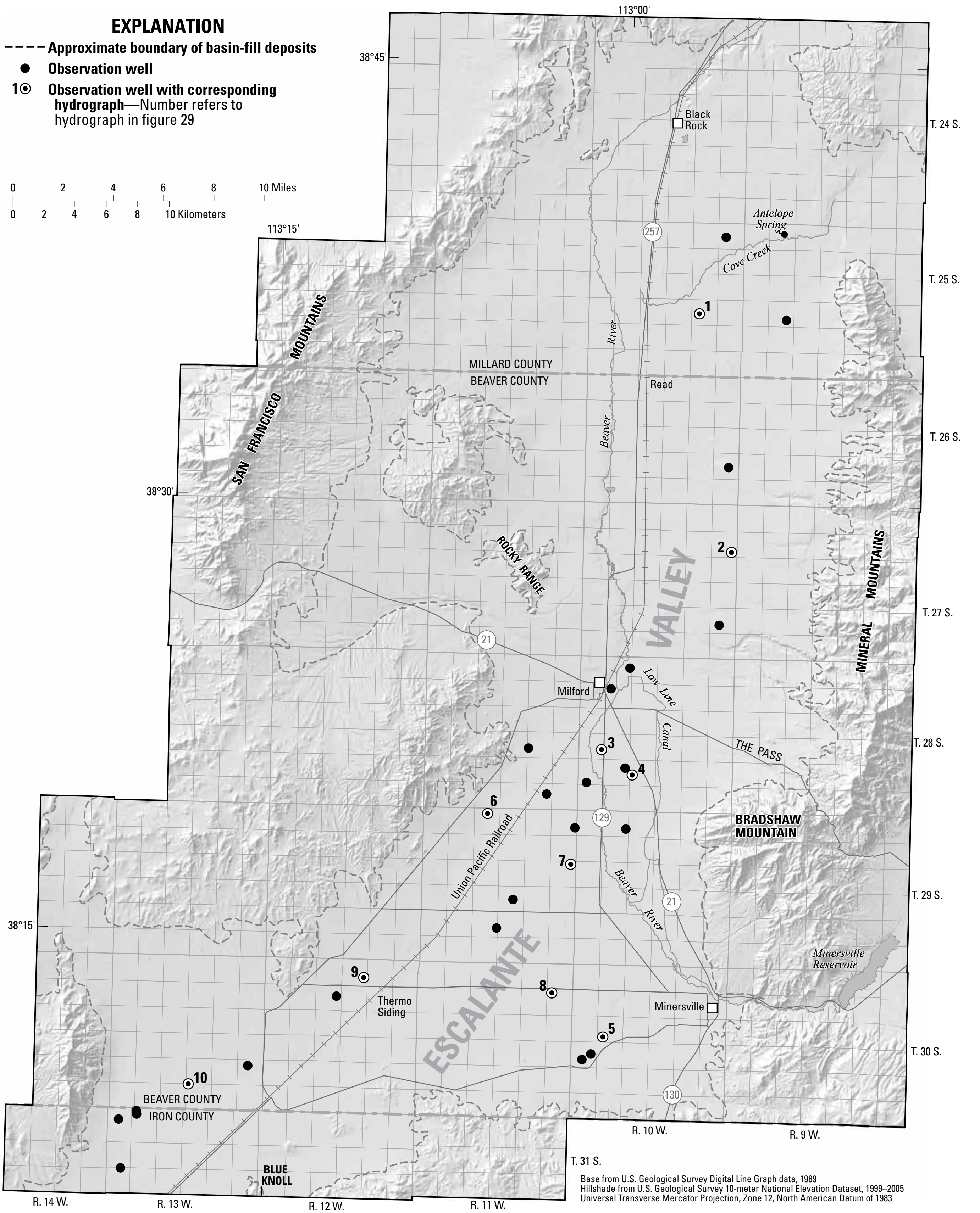


Figure 28. Location of wells in the Milford area in which the water level was measured during March 2013.

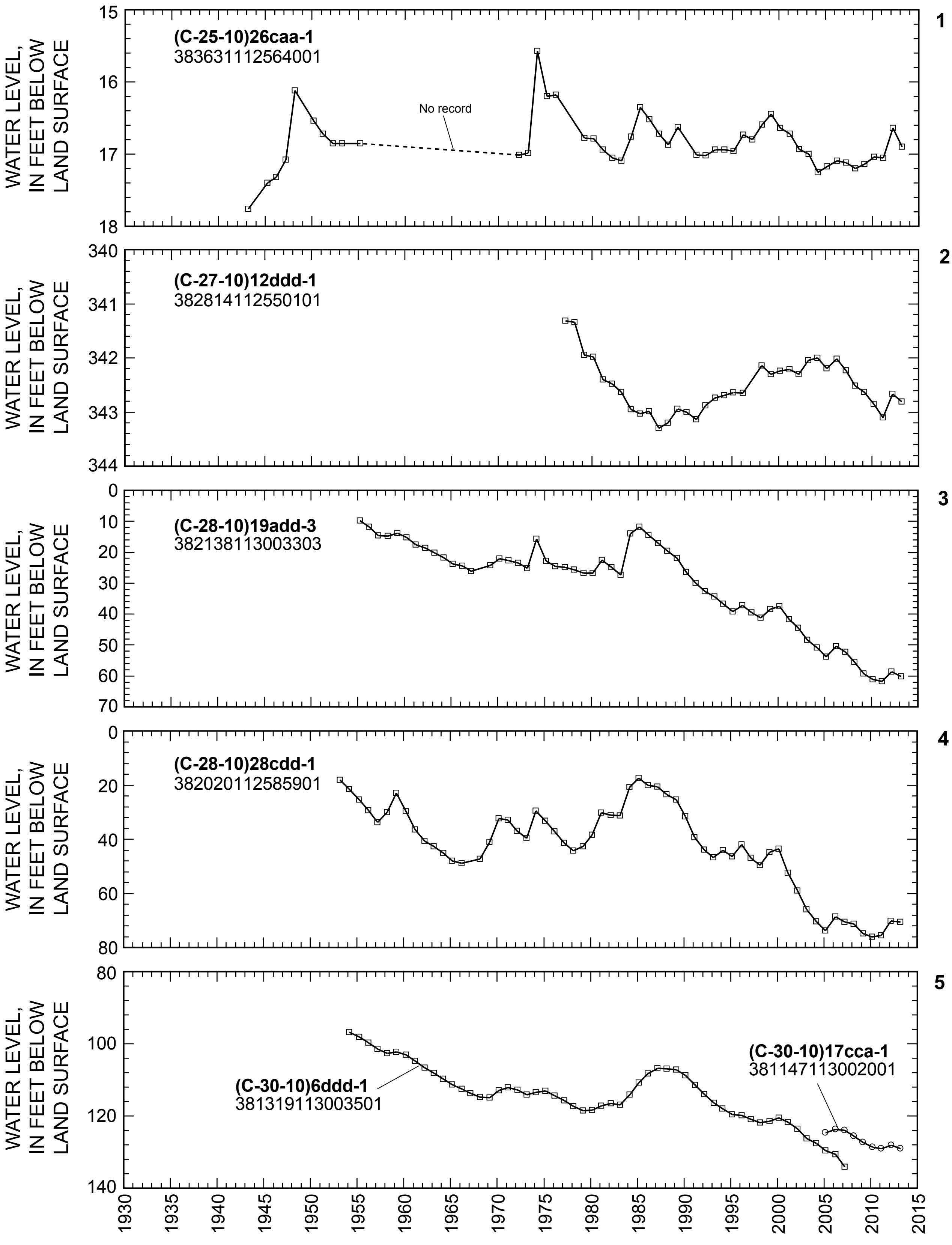


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.

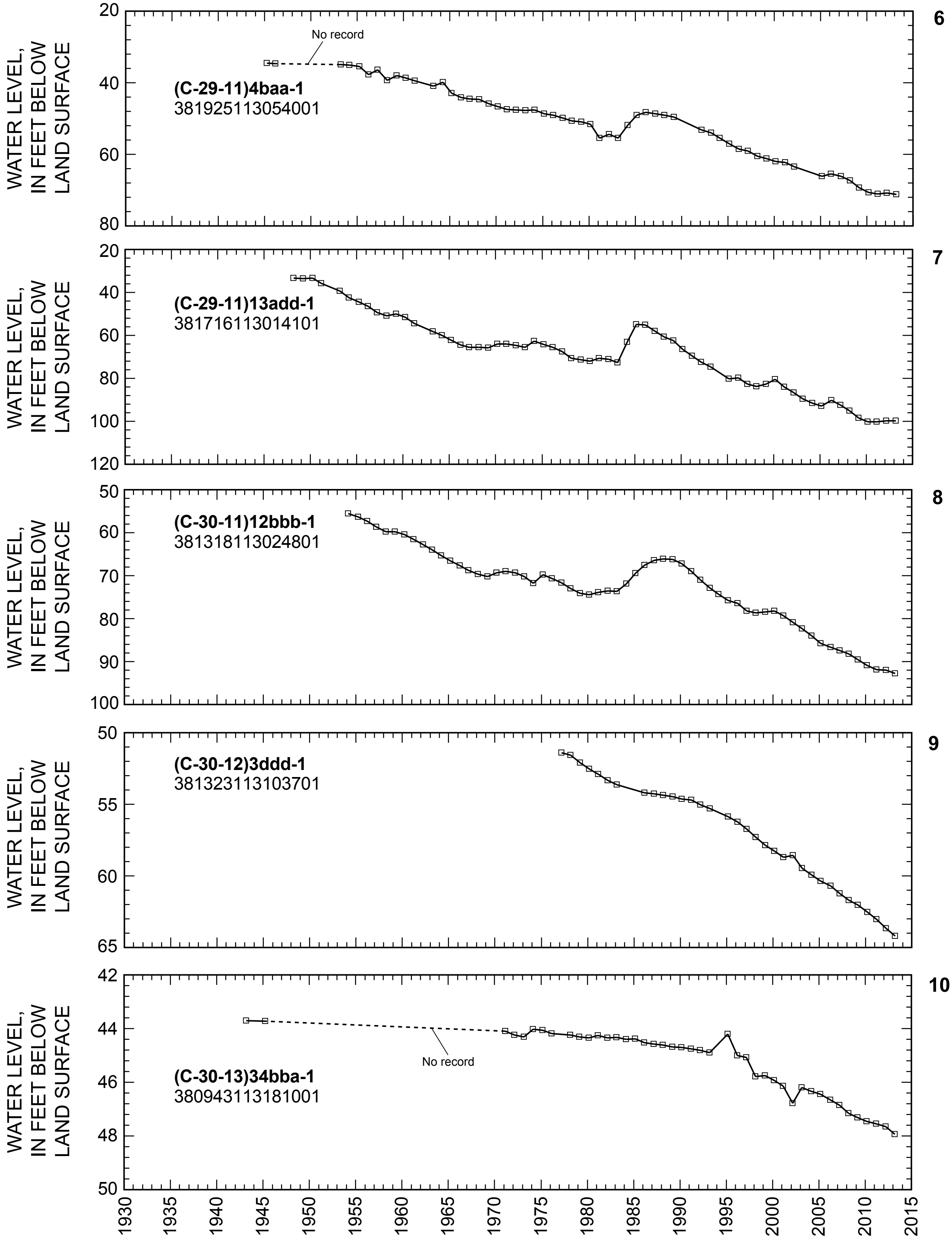


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.—Continued

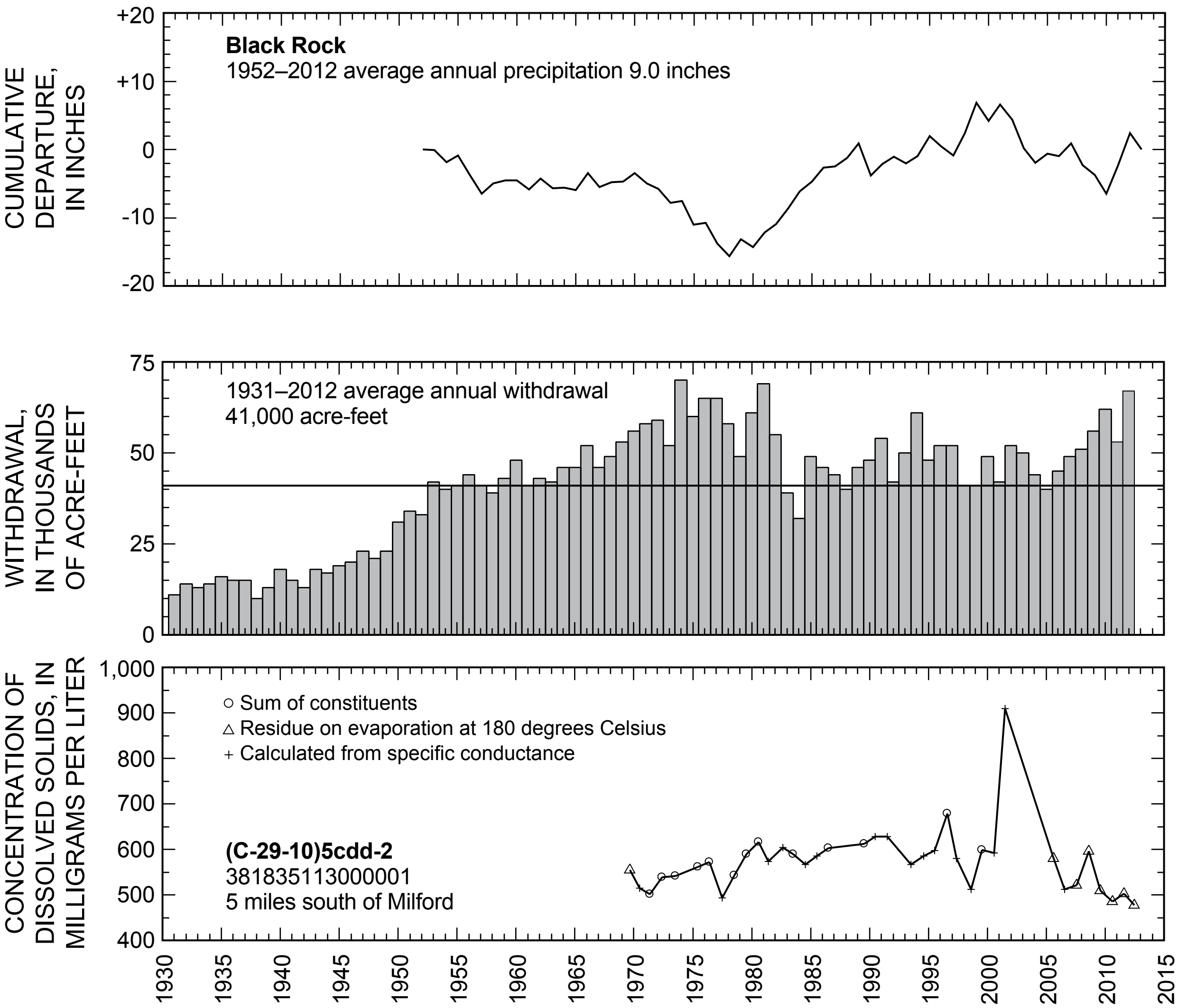


Figure 29. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.—Continued

Escalante Valley

Beryl-Enterprise Area

By Howard K. Christiansen

The Beryl-Enterprise area covers about 800 square miles at the southern end of Escalante Valley, southeast of the Wah Wah Mountains in Iron County, and a small area in Washington County in the vicinity of the community of Enterprise (fig. 30). Groundwater occurs in unconsolidated basin-fill deposits in the valley.

Total estimated withdrawal of water from wells in the Beryl-Enterprise area in 2012 was about 91,000 acre-feet, which is 7,000 acre-feet more than in 2011 and 2,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3).

The location of wells in the Beryl-Enterprise area in which the water level was measured during March 2013 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-3 is shown in figure 31.

Precipitation at Enterprise in 2012 was about 12.0 inches, which is about 2.1 inches less than the average annual precipitation for 1955–2012 and about 0.5 inch more than in 2011.

Water levels declined slightly from March 2012 to March 2013 in most of the wells measured in the Beryl-Enterprise area. Water levels throughout most of the area have declined steadily since 1950 and have shown little or no recovery during periods of greater-than-average precipitation. For example, water-level measurements in well (C-36-16)29daa-1, about 5 miles northeast of Enterprise (fig. 31), have shown a decline of nearly 133 feet from March 1946 to March 2013. Declines such as this one are a result of continued large withdrawals for irrigation beginning in about 1950.

The concentration of dissolved solids in one water sample collected from well (C-34-16)28dcc-3, located 6 miles south-southeast of Beryl, is shown in figure 31 (this well replaces well (C-34-16)28dcc-2). The concentration of dissolved solids in the water sample collected in June 2012 was 478 mg/L.

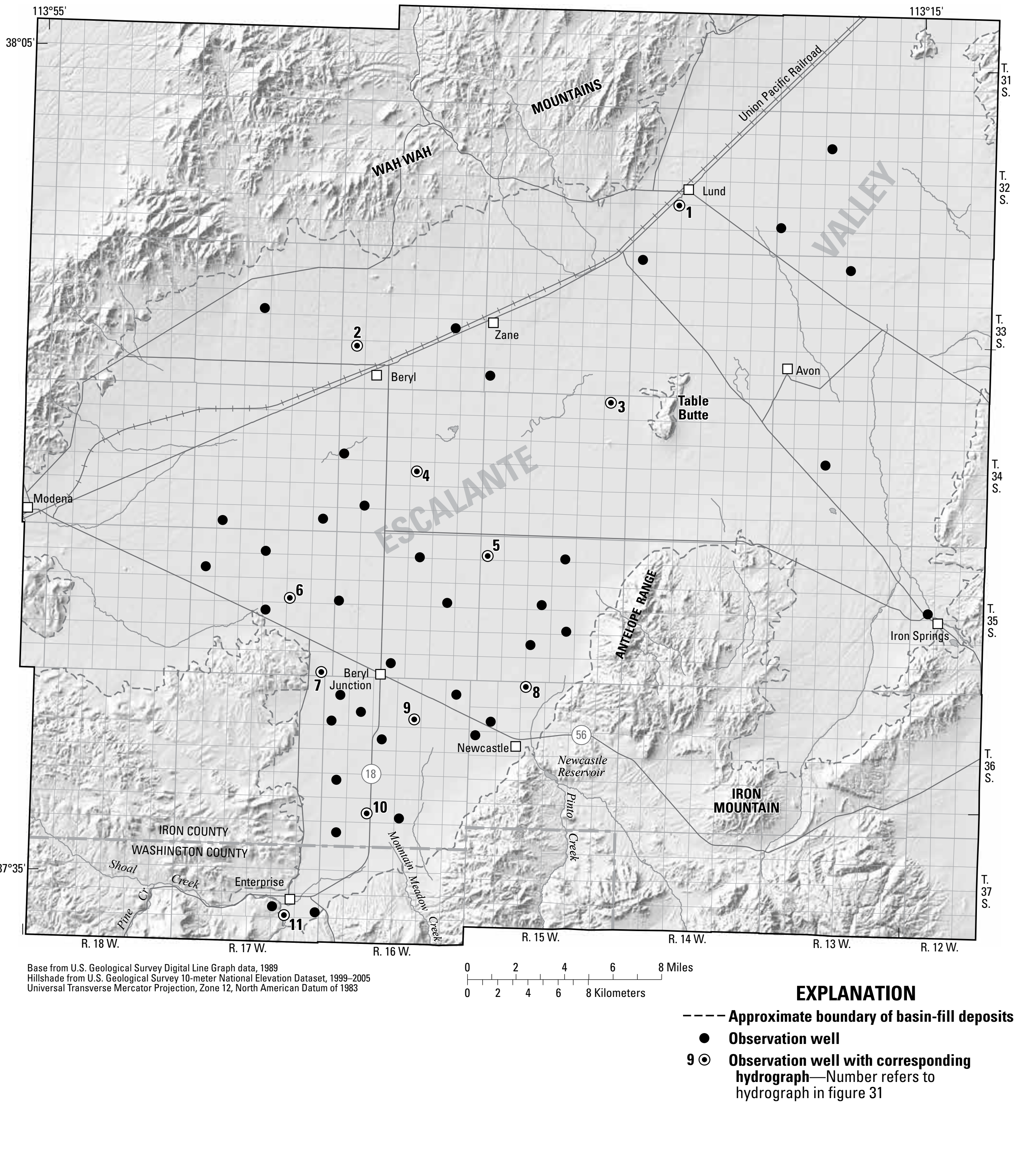


Figure 30. Location of wells in the Beryl-Enterprise area in which the water level was measured during March 2013.

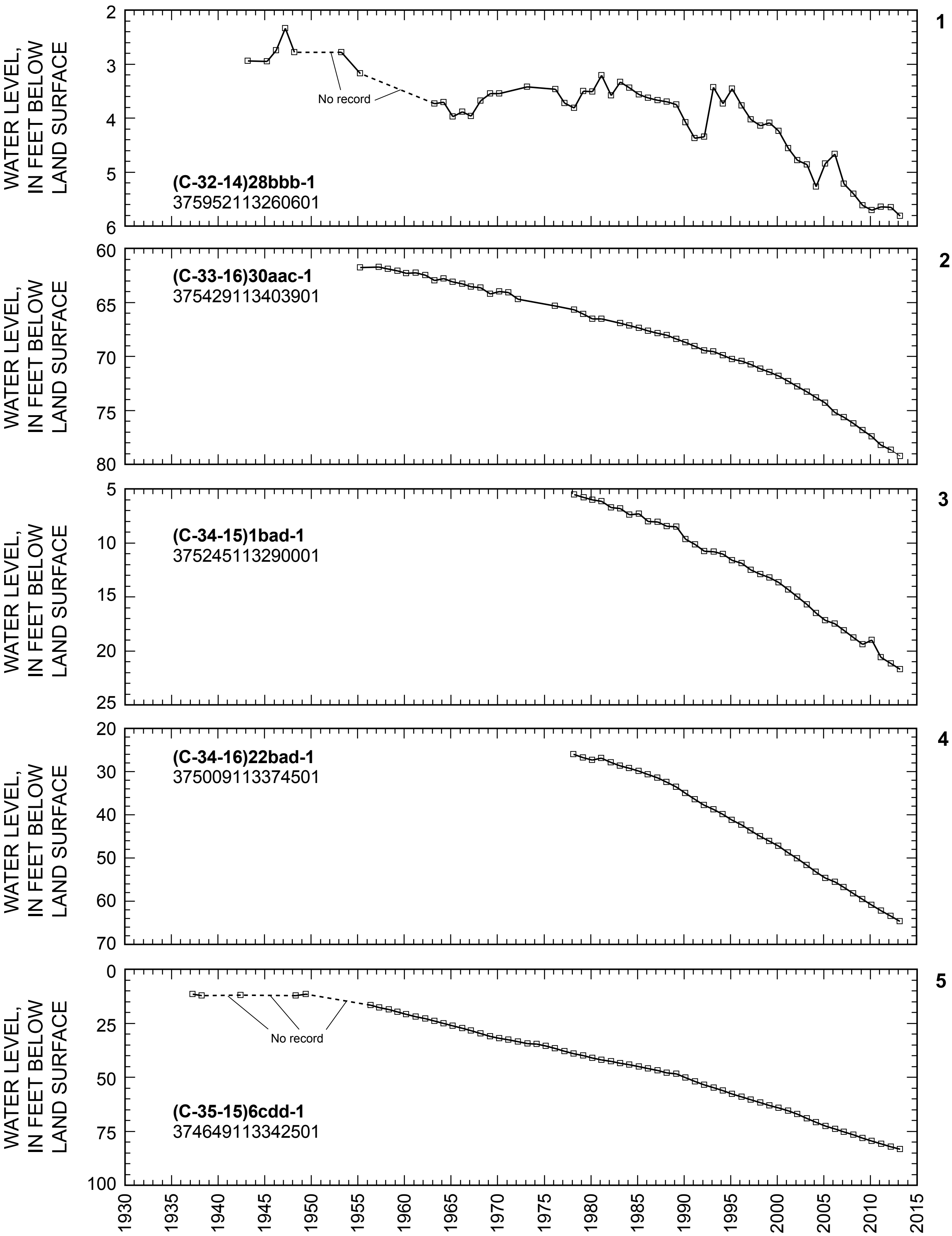


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.

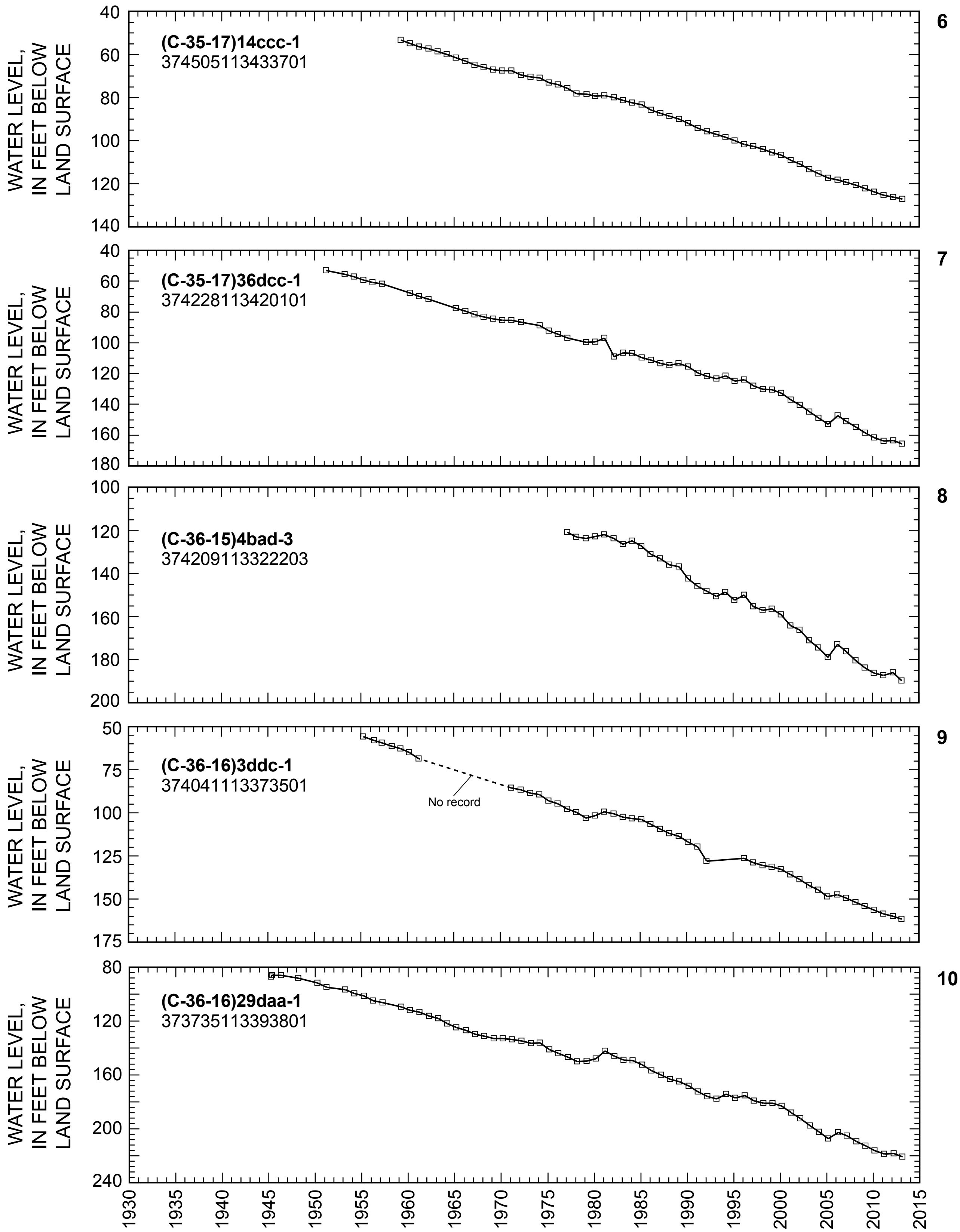


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.—Continued

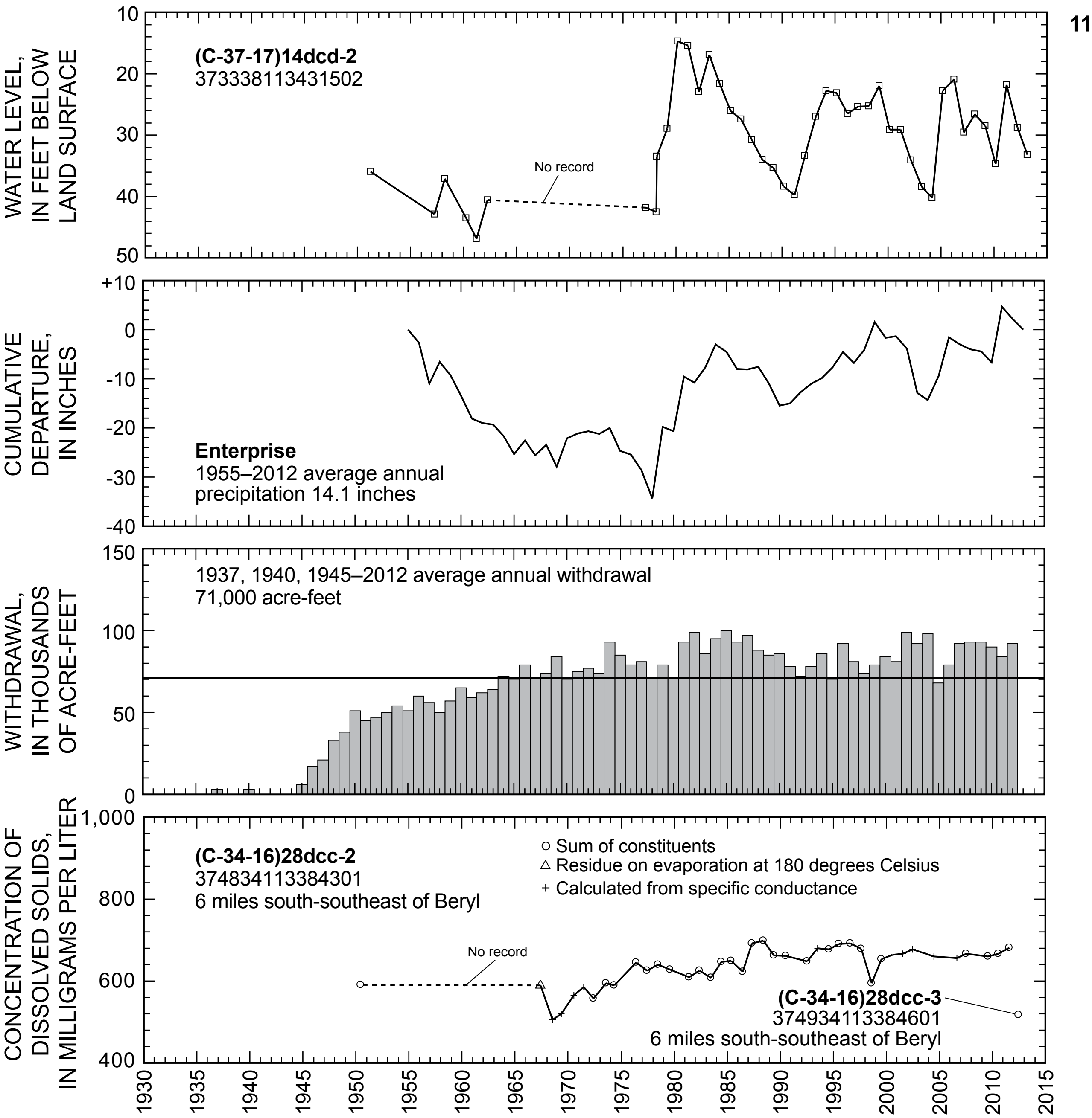


Figure 31. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.—Continued

Central Virgin River Area

By Howard K. Christiansen

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

Total estimated withdrawal of water from wells in the central Virgin River area in 2012 was about 29,000 acre-feet, which is about 1,000 acre-feet more than in 2011 and the same as the average annual withdrawal for 2002–2011 (tables 2 and 3), mainly due to a small increase in withdrawal for irrigation. Withdrawal for industrial use decreased slightly, and withdrawals for public supply and for domestic and stock use were about the same as in 2011.

The location of wells in the central Virgin River area in which the water level was measured during February 2013 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.

Discharge of the Virgin River at Virgin in 2012 was about 82,900 acre-feet, which is 151,200 acre-feet less than the value for 2011 and about 51,000 acre-feet less than the long-term average for 1931–70 and 1979–2012. Precipitation at St. George in 2012 was about 8.4 inches, which is about 0.2 inch more than the average annual precipitation for 1930–2012 and 6.0 inches more than in 2011.

Water levels from February 2012 to February 2013 generally declined in most of the central Virgin River area. The largest decline, about 7.9 feet, was observed in a well east of Bloomington in the Fort Pearce Wash area. Declines are probably the result of continued large withdrawals for public supply and irrigation use.

The concentration of dissolved solids in water samples collected from wells (C-41-17)8cbd-1 and (C-41-17)8cbd-2, located 1.5 miles south of Gunlock Reservoir, from 1966 to 2012, 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 samples from both wells were combined to give an extended temporal record for this constituent. The concentration has ranged from 255 to 313 mg/L with a median value of 290 mg/L. The dissolved-solids concentration in the water sample collected in July 2012 (292 mg/L) is very close to the median value.

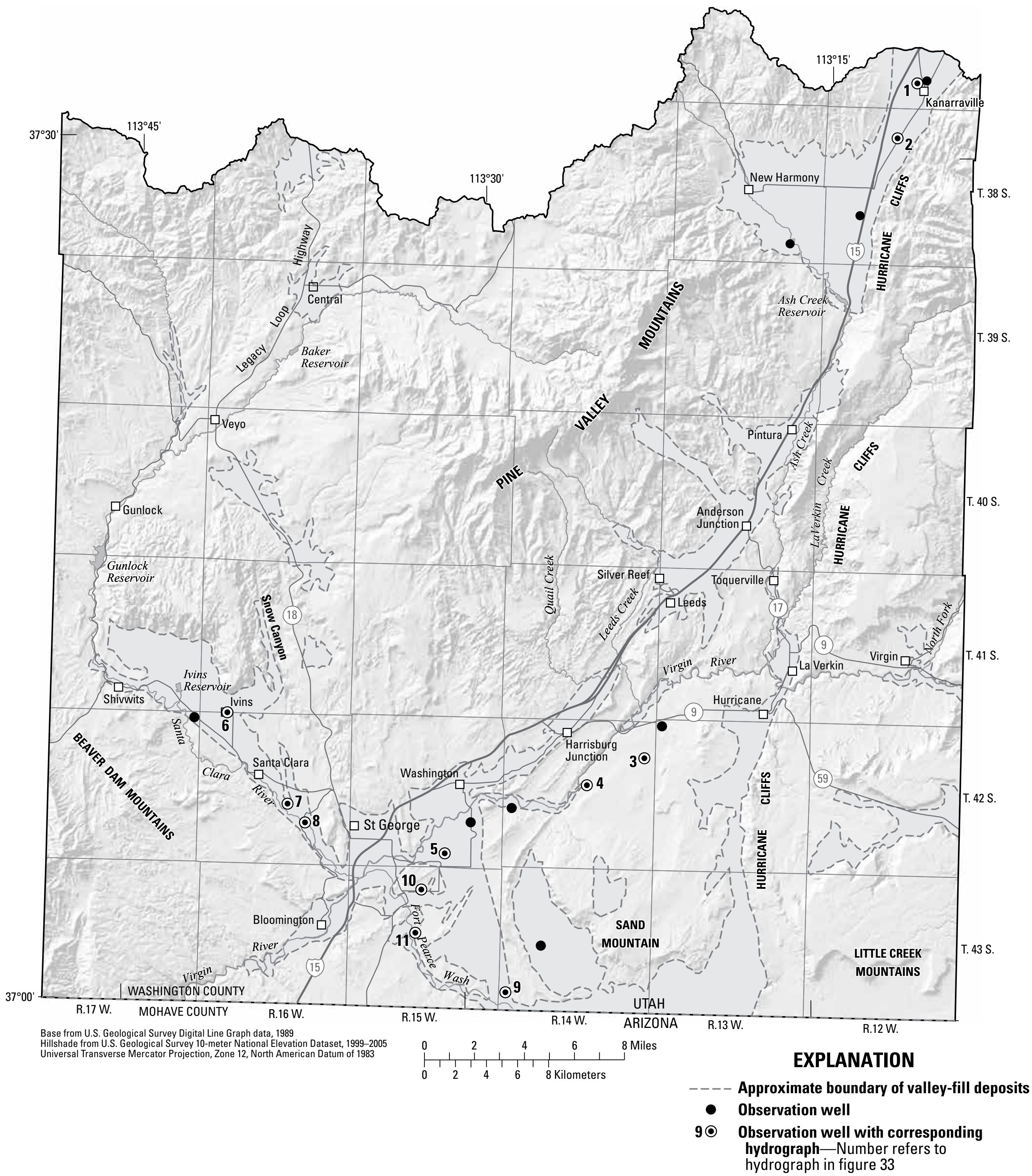


Figure 32. Location of wells in the central Virgin River area in which the water level was measured during February 2013.

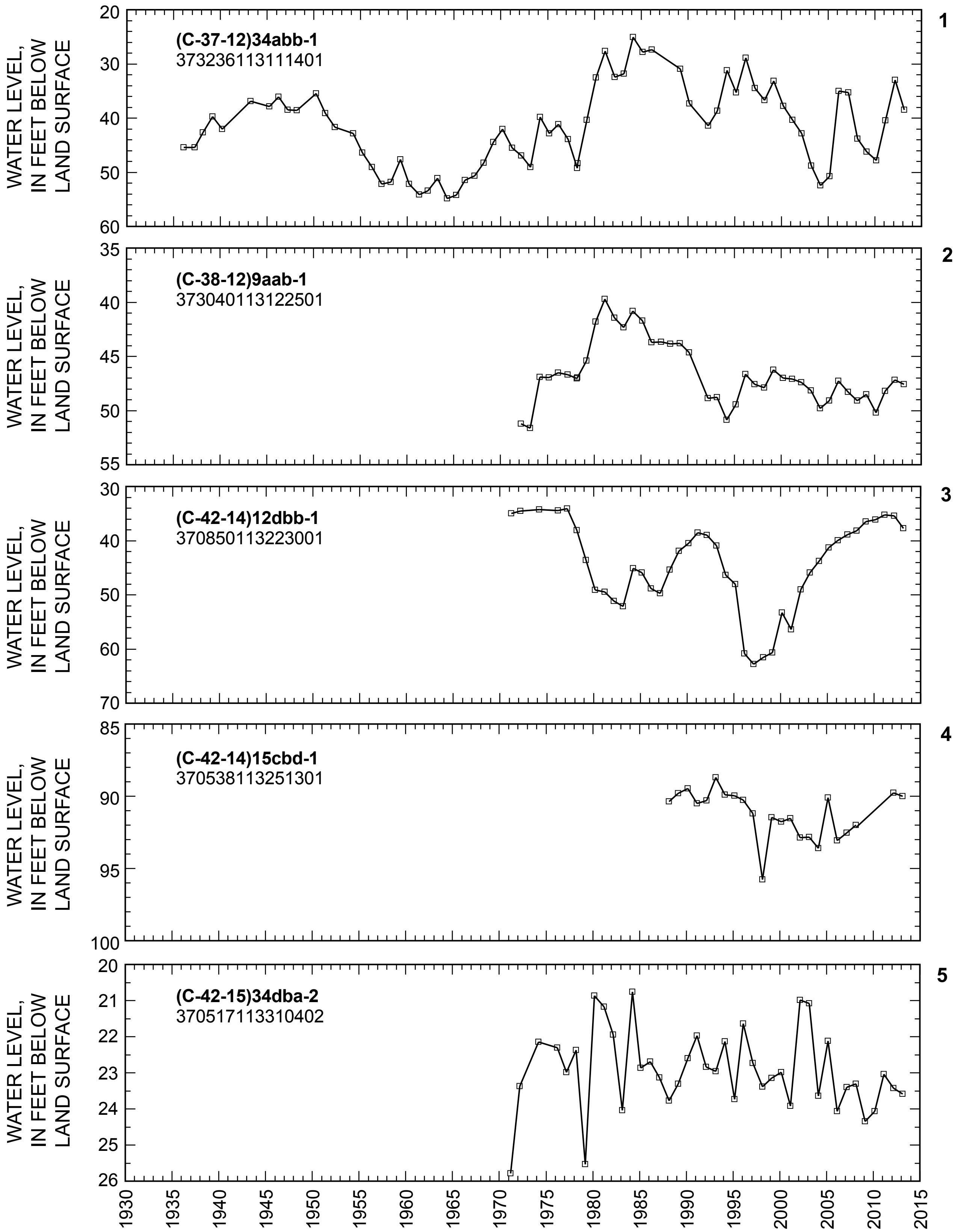


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well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

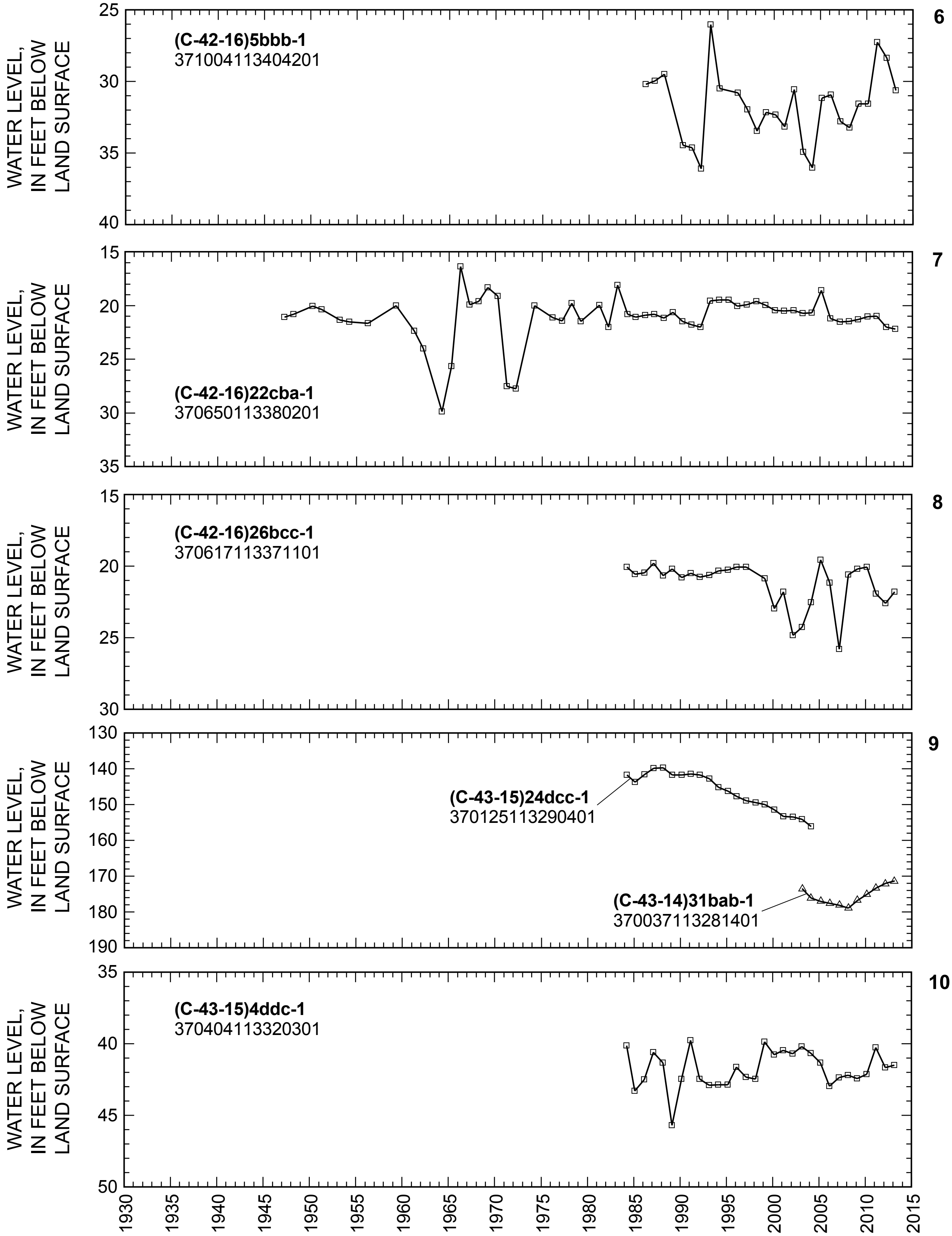


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well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

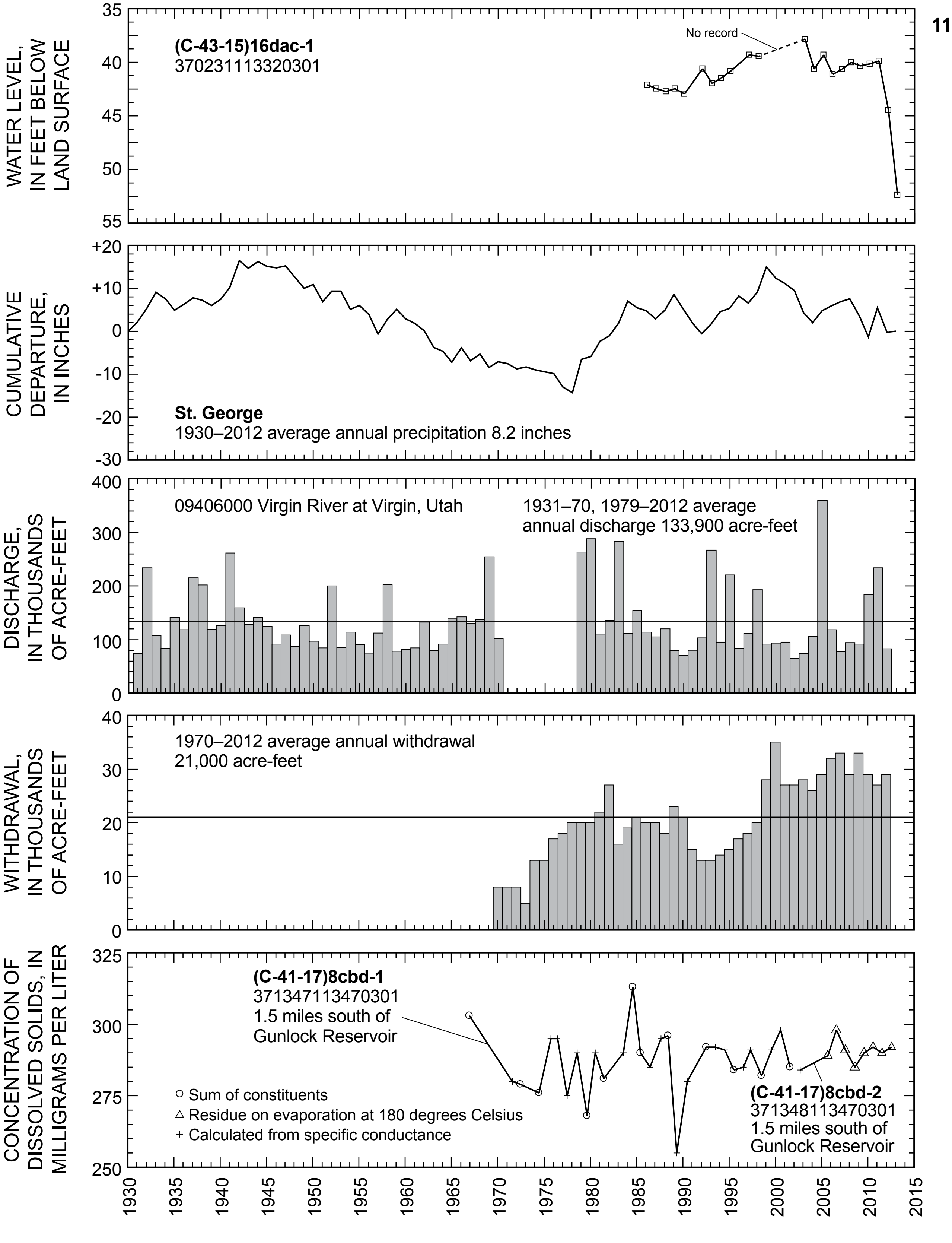


Figure 33. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, to cumulative departure from average annual precipitation at St. George, to annual withdrawal from wells, and to concentration of dissolved solids in water from well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

Other Areas

By Martel J. Fisher

Total estimated withdrawal of water from wells in other areas of Utah (table 4) in 2012 was about 156,000 acre-feet, which is 33,000 acre-feet more than the estimate for 2011 and 24,000 acre-feet more than the average annual withdrawal for 2002–2011 (tables 2 and 3). The largest increases were due to increased withdrawals for irrigation use. In most of the areas listed in table 4, withdrawals in 2012 were more than in 2011, except in Ogden Valley, where public-supply use decreased slightly, and in Grouse Creek Valley, where irrigation withdrawals decreased slightly.

The location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2013, is shown in figure 34. The relation of the water level in observation wells in Cedar Valley to cumulative departure from average annual precipitation at Provo BYU 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, then declined during the mid-to-late 1980s and early 1990s. Water levels in these wells have been relatively stable since 1995. Water levels declined in most of the wells from March 2012 to March 2013.

The location of wells in Sanpete Valley in which the water level was measured during March 2013 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 Valley 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 selected observation wells from March 2012 to March 2013.

The location of wells in Snake Valley and the West Desert in which the water level was measured during March 2013 is shown in figure 38. The relation of the water level in selected observation wells in the area to cumulative departure from average annual precipitation at Callao is shown in figure 39.

Water levels in many of the selected wells in Snake Valley and the West Desert declined, or rose only slightly, from March 2012 to March 2013. Water levels rose sharply in the early to mid-1980s as a result of greater-than-average precipitation, but have generally declined since the mid-1980s.

The relation of the water level in wells in the remaining selected areas of Utah (table 4) to cumulative departure from average annual precipitation at sites in or near those areas is shown in figure 40. Water levels declined or rose only slightly in most of the selected observation wells from March 2012 to March 2013.

Table 4. Estimated withdrawal of water from wells in other areas of Utah, 2012.

Number in figure 1	Area	Estimated withdrawal from wells (acre-feet)					
		2012					2011 total (rounded)
		Irrigation	Industrial	Public supply	Domestic and stock	Total (rounded)	
1	Grouse Creek Valley	1,300	0	0	20	1,300	1,600
2	Park Valley area	2,400	0	0	10	2,400	1,500
4	Lower Bear River area	4,300	460	7,400	200	12,400	9,100
8	Ogden Valley	0	0	11,900	20	11,900	12,100
13	Rush Valley	4,600	300	260	30	5,200	4,700
14	Skull Valley, Dugway area, and Old River Bed	3,300	5,200	5,000	10	13,500	7,500
15	Cedar Valley, Utah County	3,000	0	4,300	40	7,300	6,200
20	Sanpete Valley	8,000	2,600	940	4,000	15,500	7,500
25a	Snake Valley	22,800	0	90	50	22,900	14,900
27	Beaver Valley	10,200	20	530	480	11,200	6,700
	Remainder of State	12,900	16,000	21,200	2,600	52,700	50,900
Total (rounded)		72,800	24,600	51,600	7,500	156,000	123,000

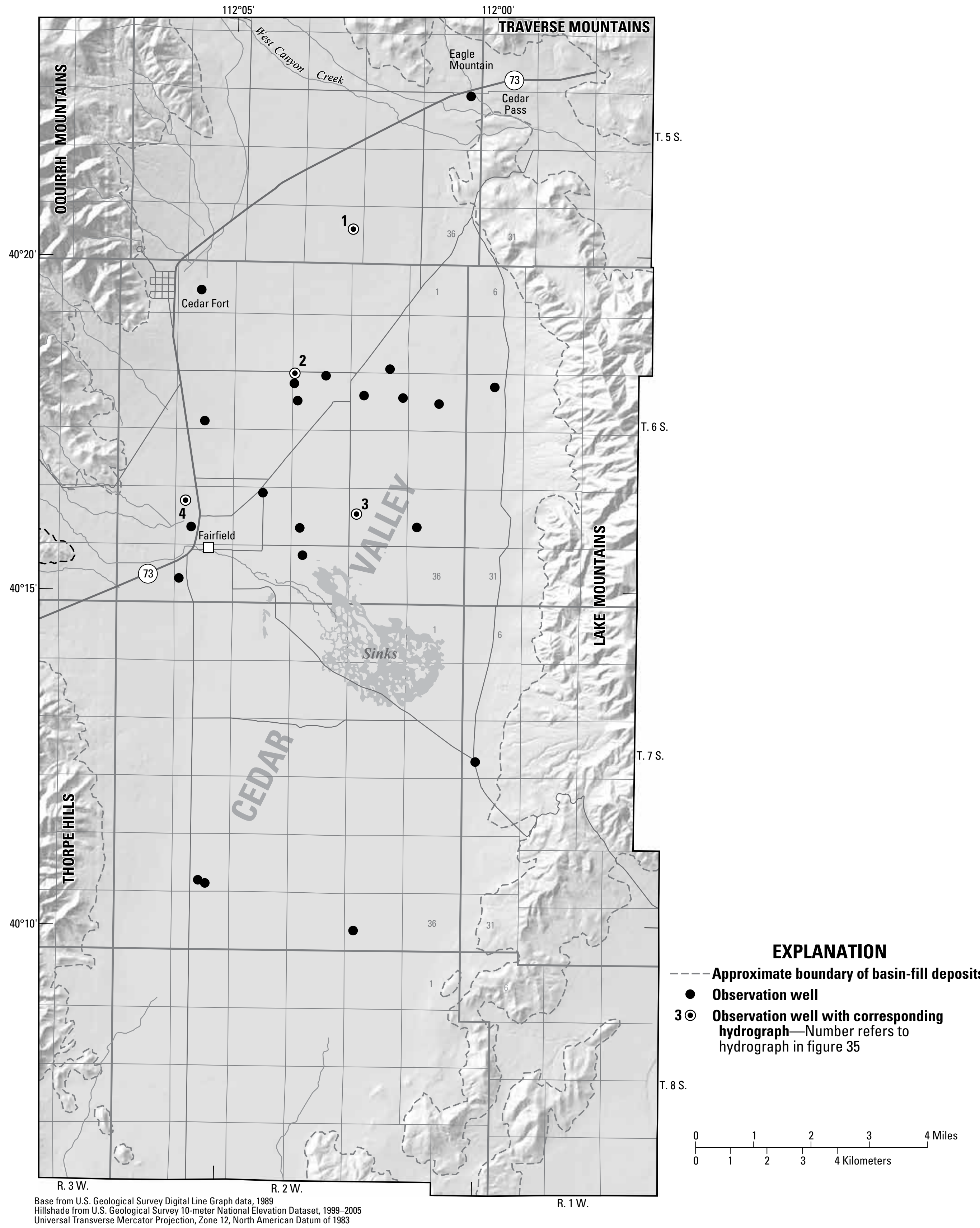


Figure 34. Location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2013.

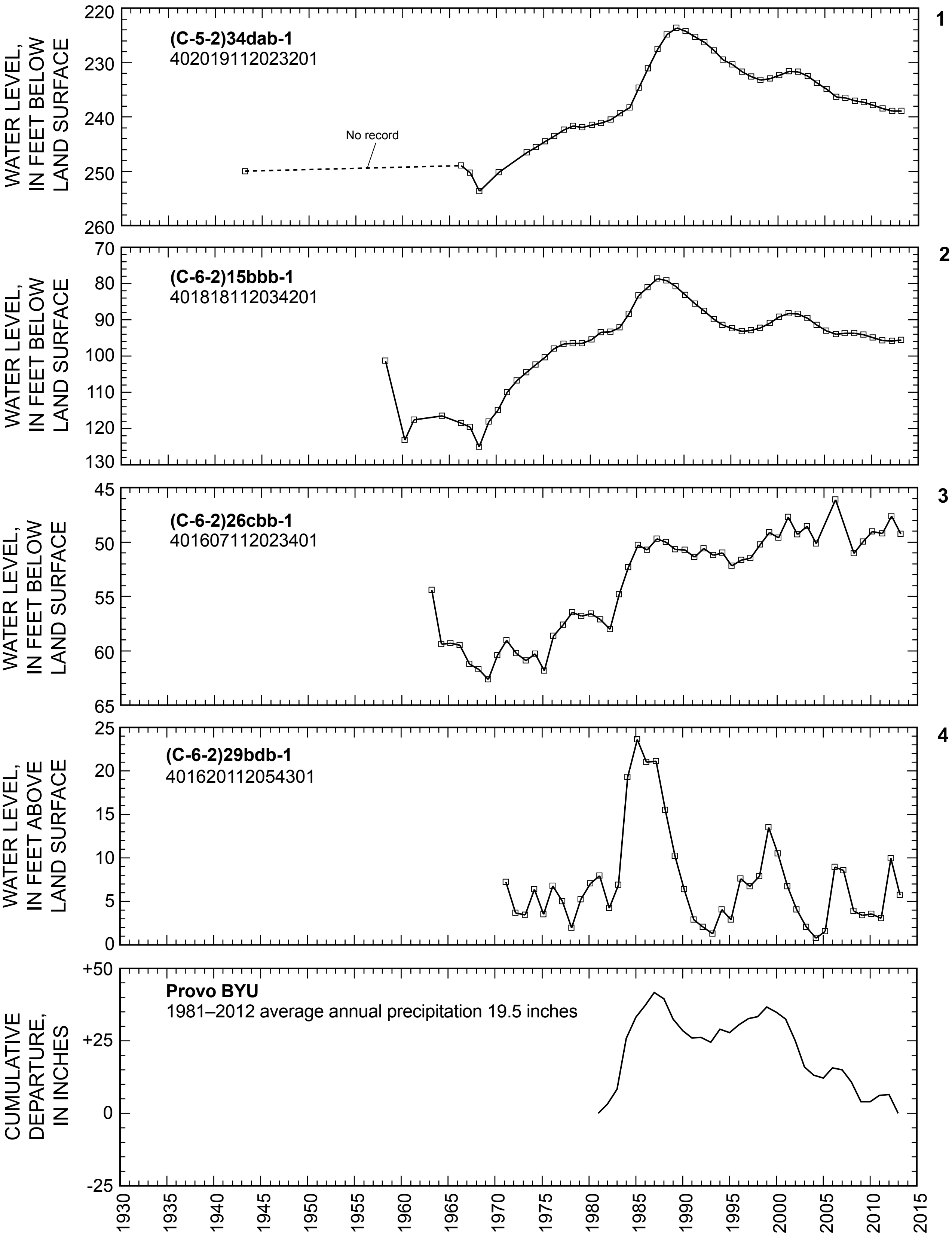


Figure 35. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Provo BYU.

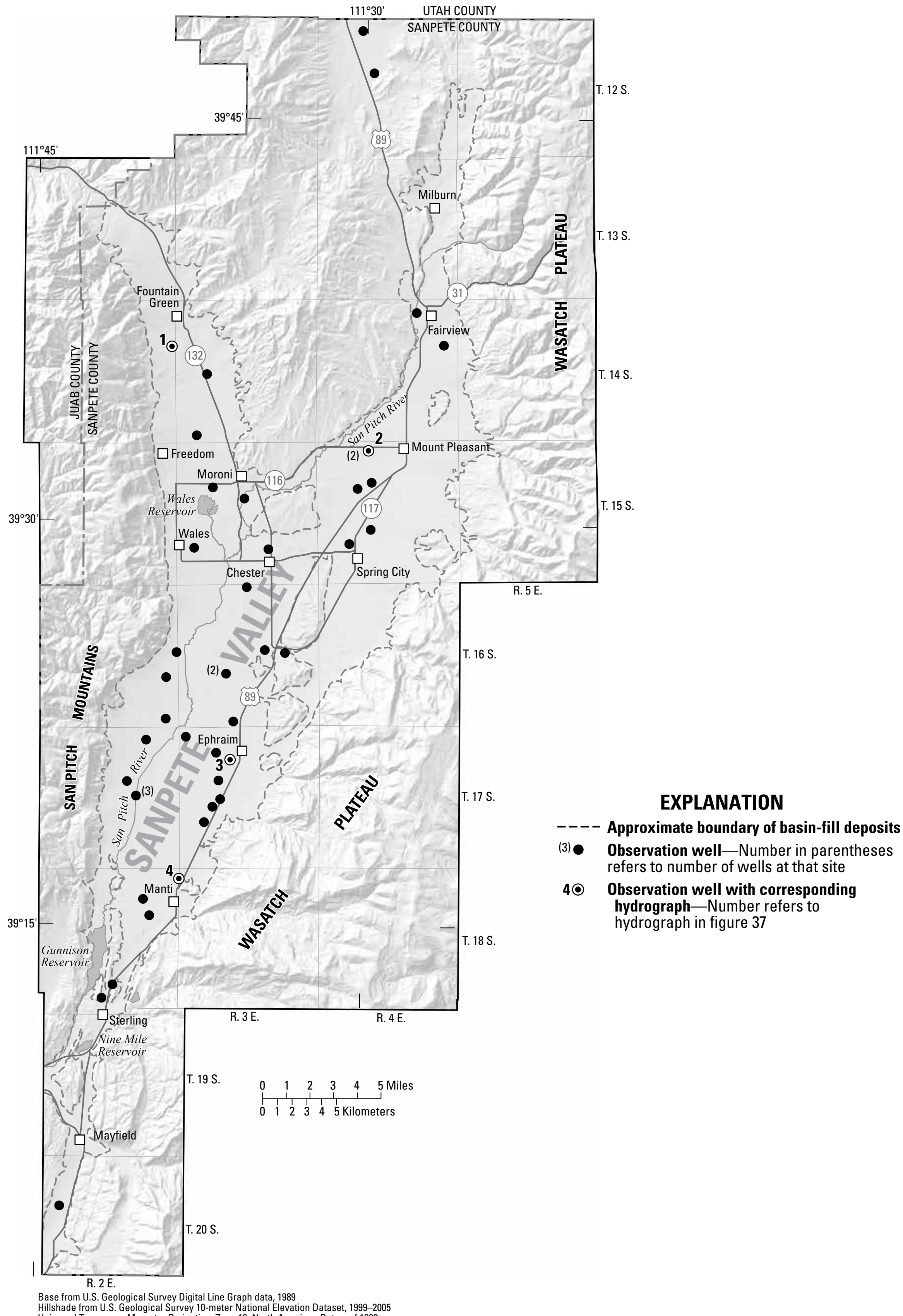


Figure 36. Location of wells in Sanpete Valley in which the water level was measured during March 2013.

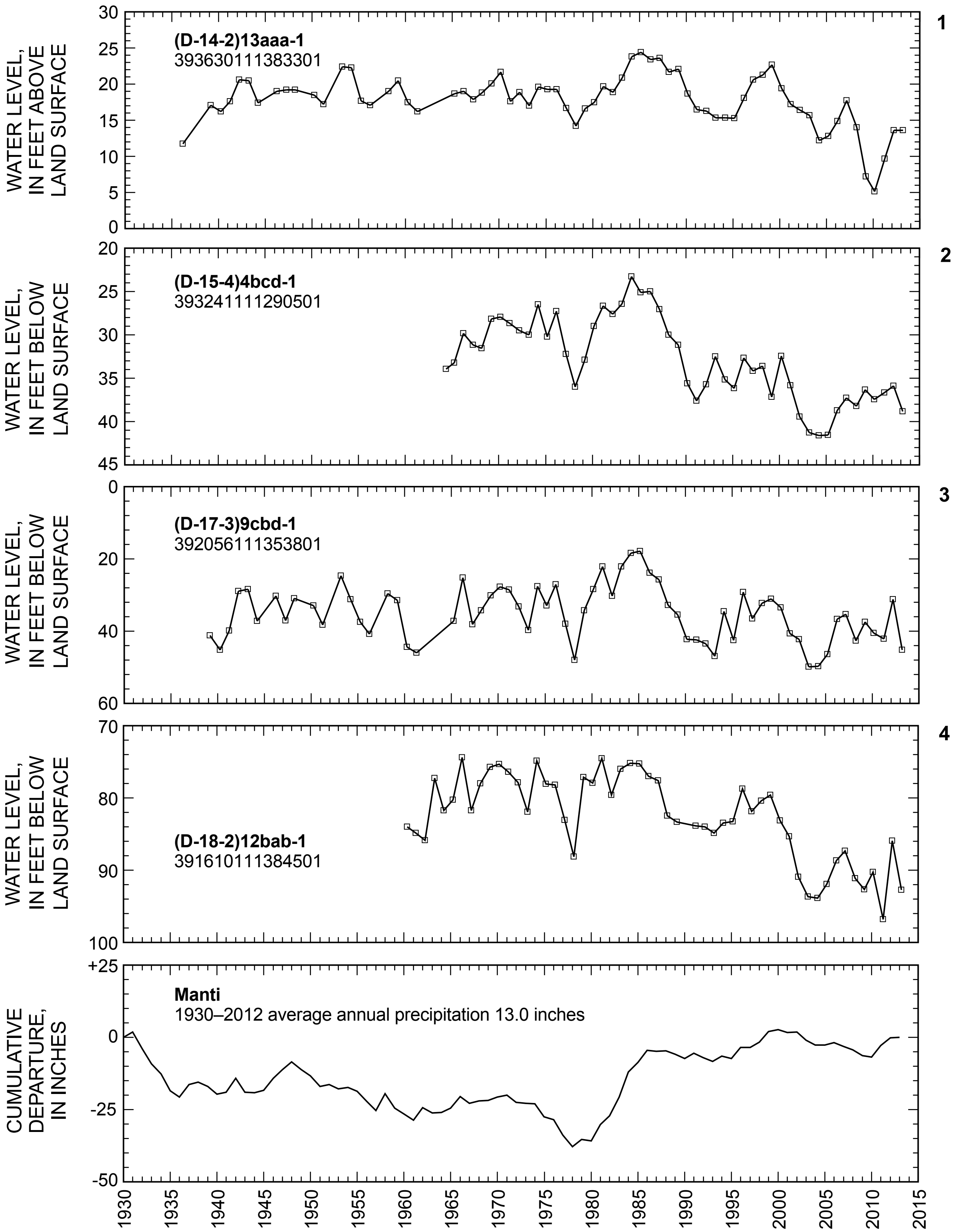


Figure 37. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti.

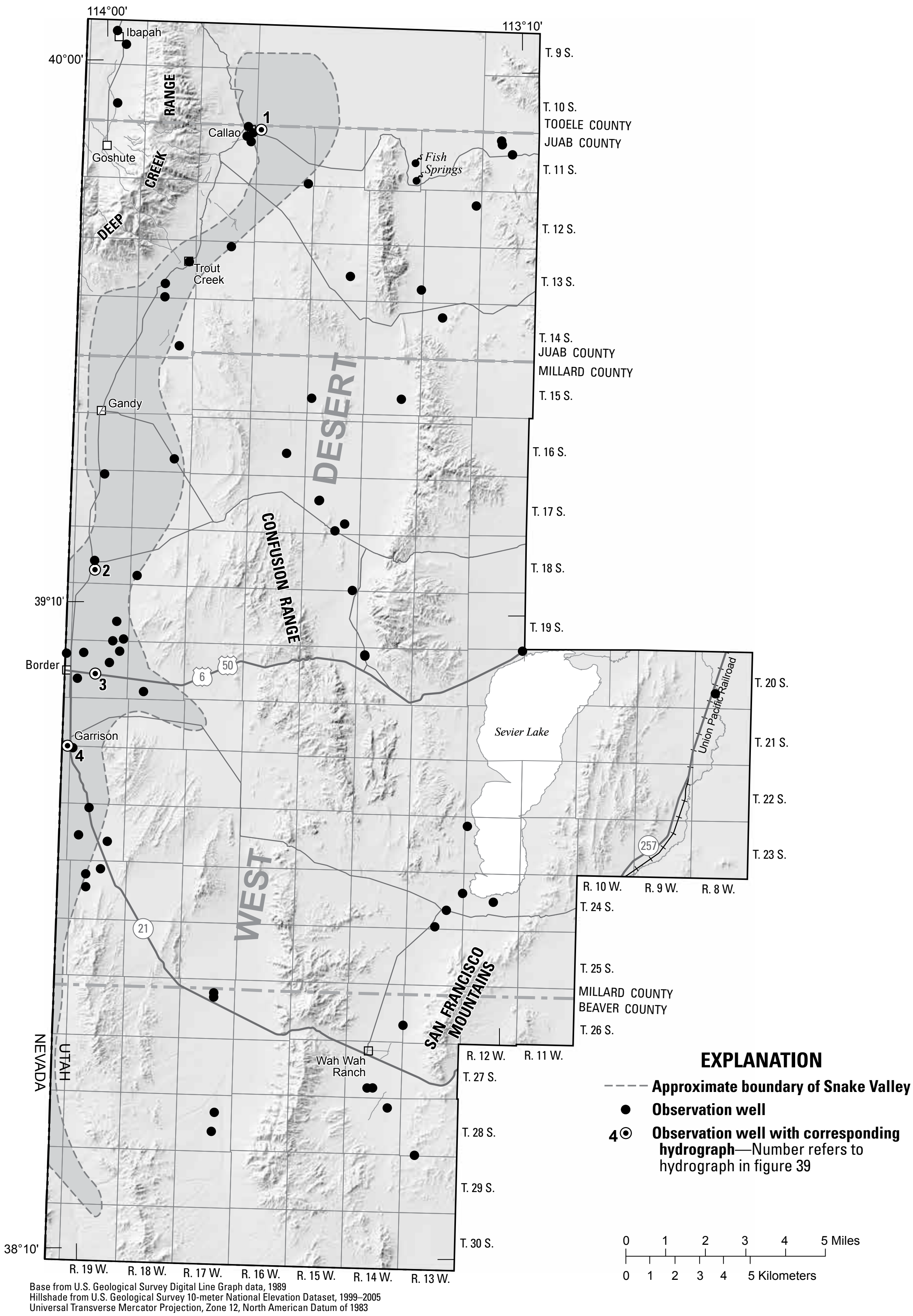


Figure 38. Location of wells in Snake Valley and the West Desert in which the water level was measured during March 2013.

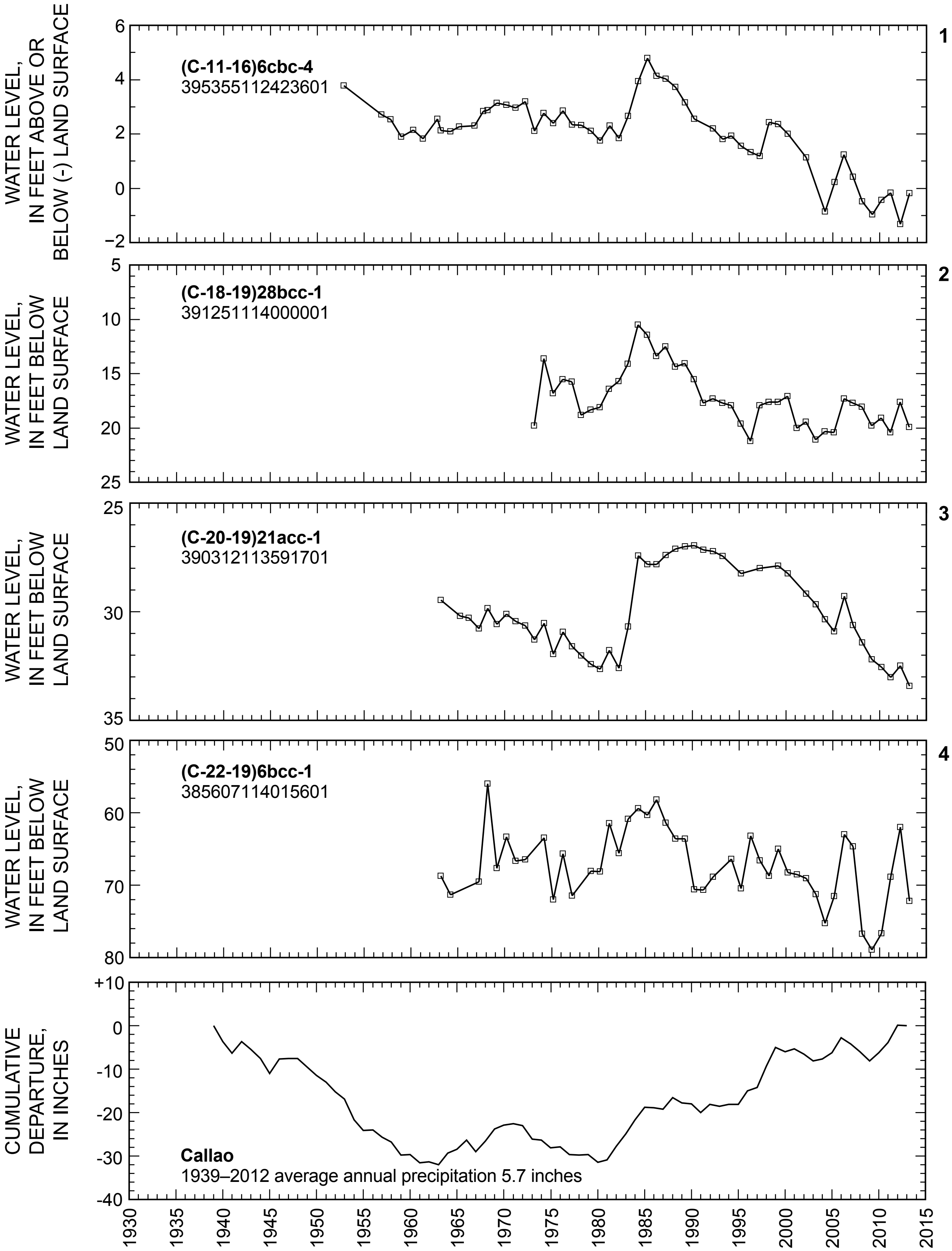


Figure 39. Relation of water level in selected wells in Snake Valley and the West Desert to cumulative departure from average annual precipitation at Callao.

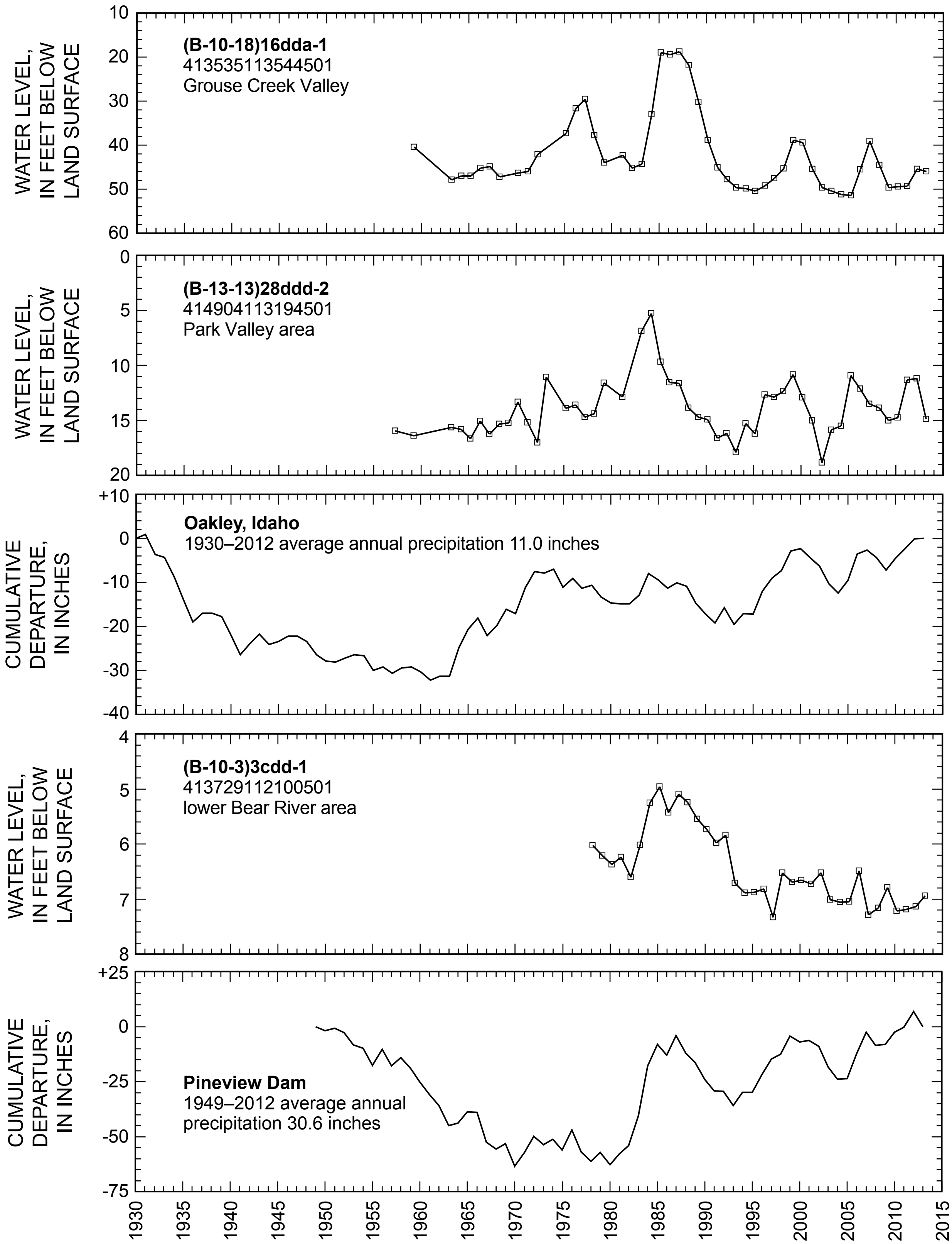


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.

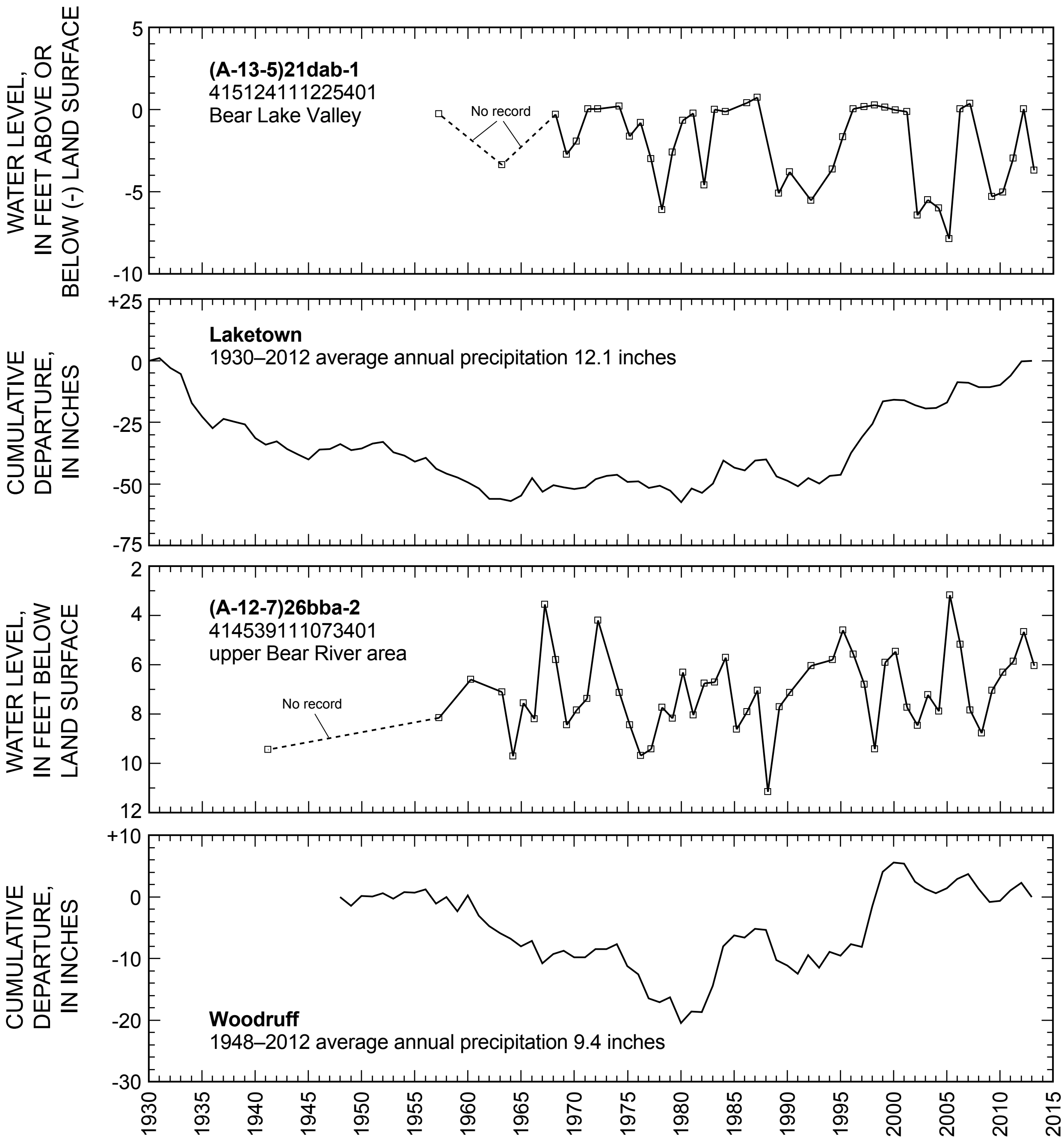


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

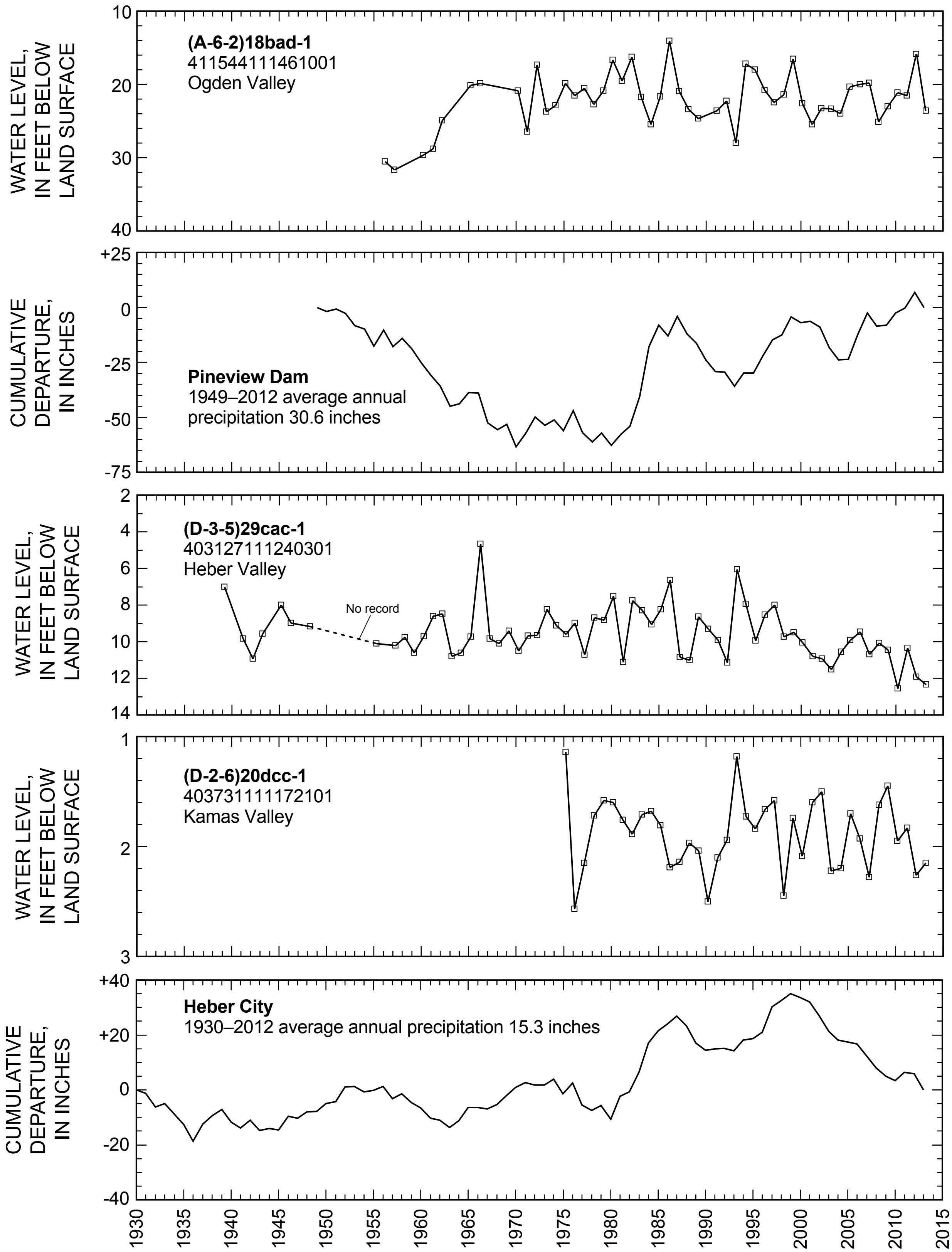


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

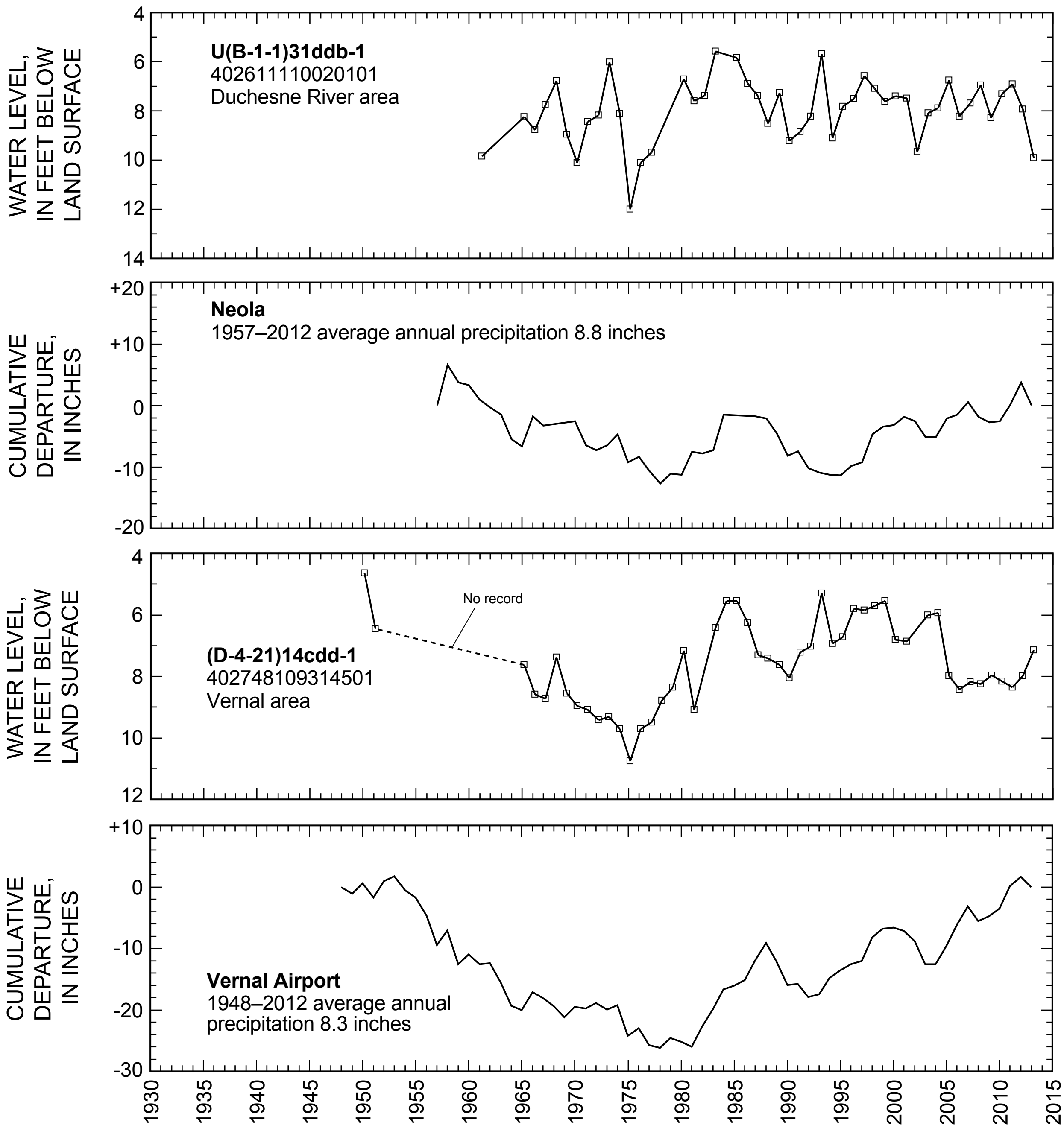


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

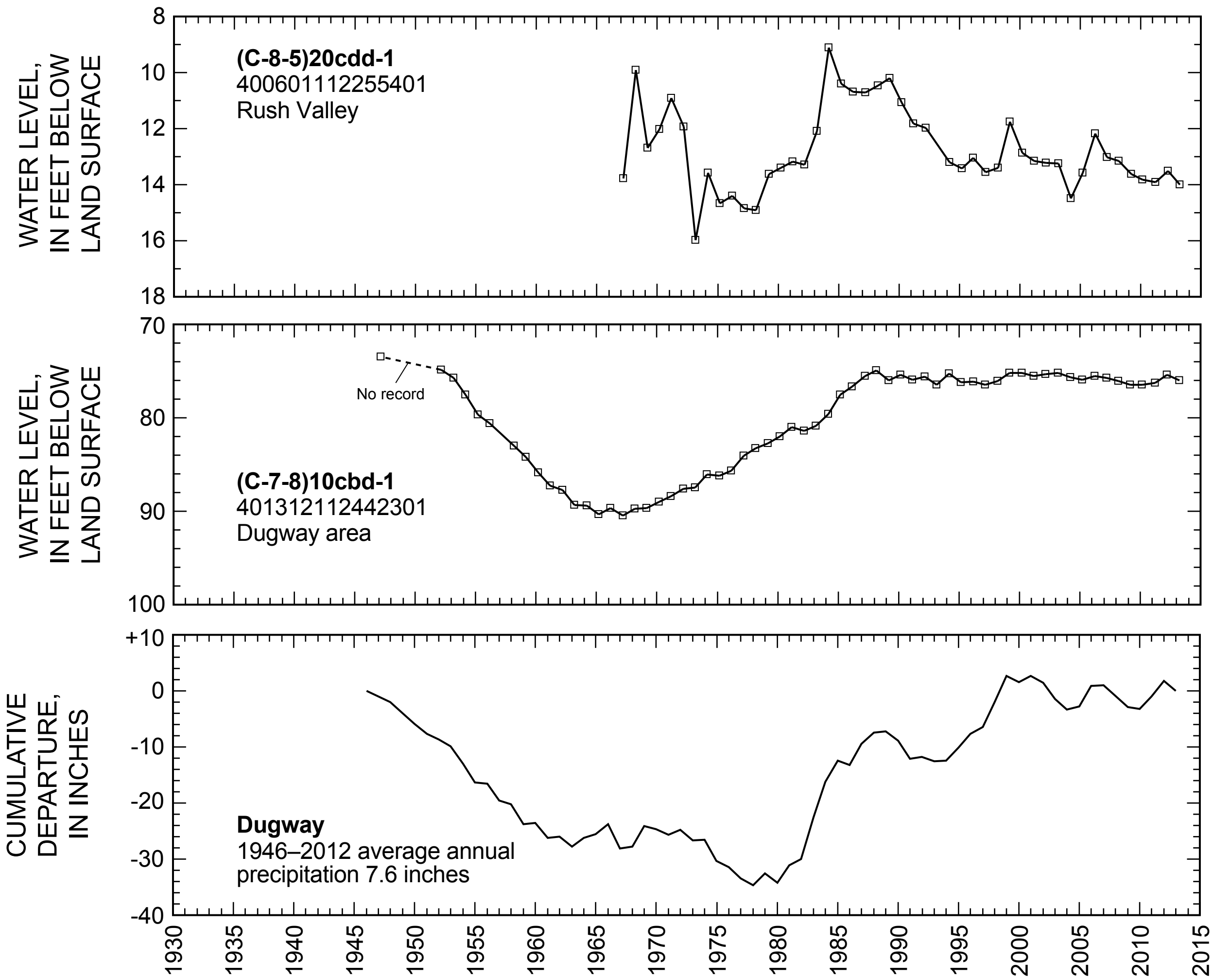


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

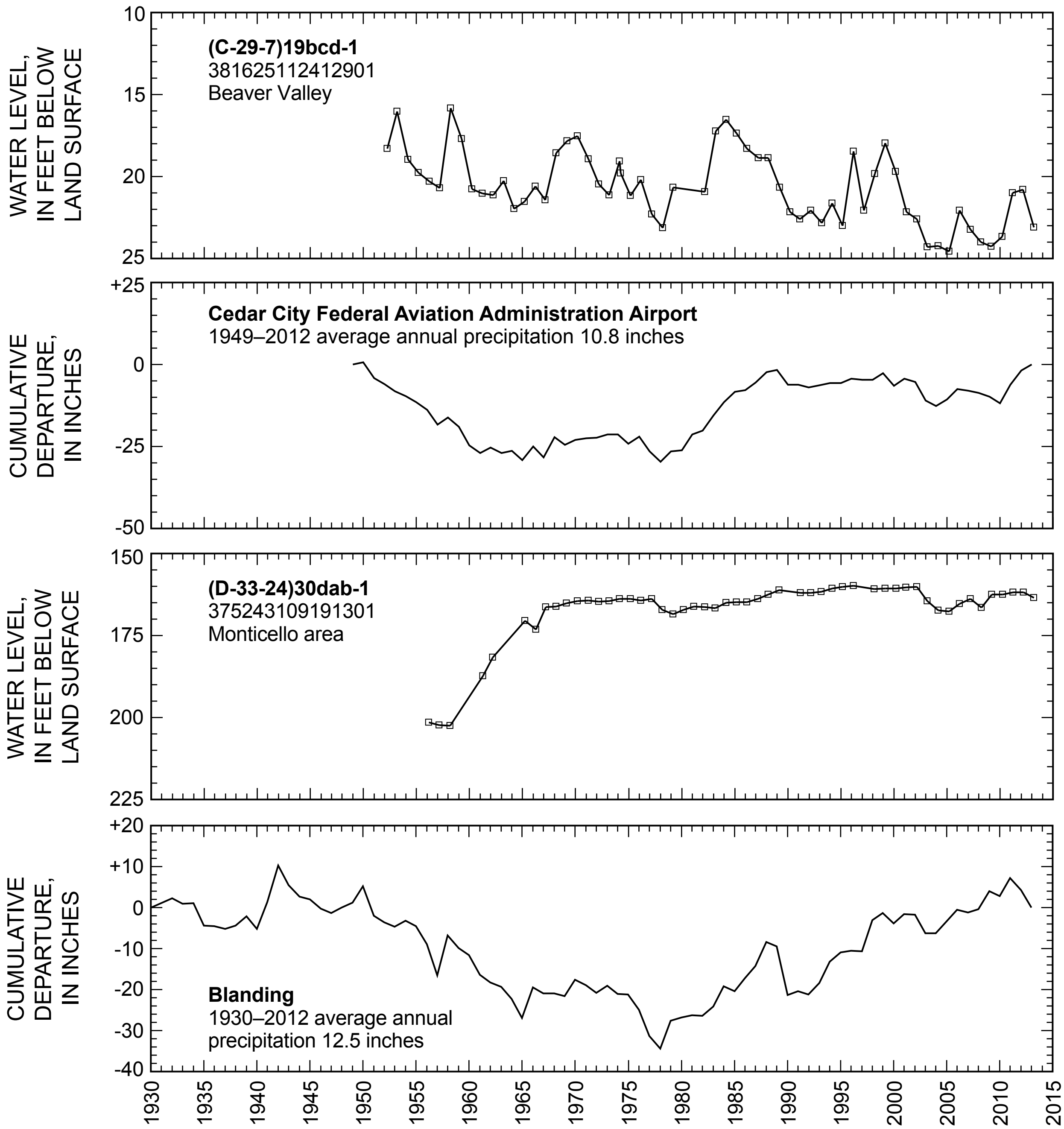


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

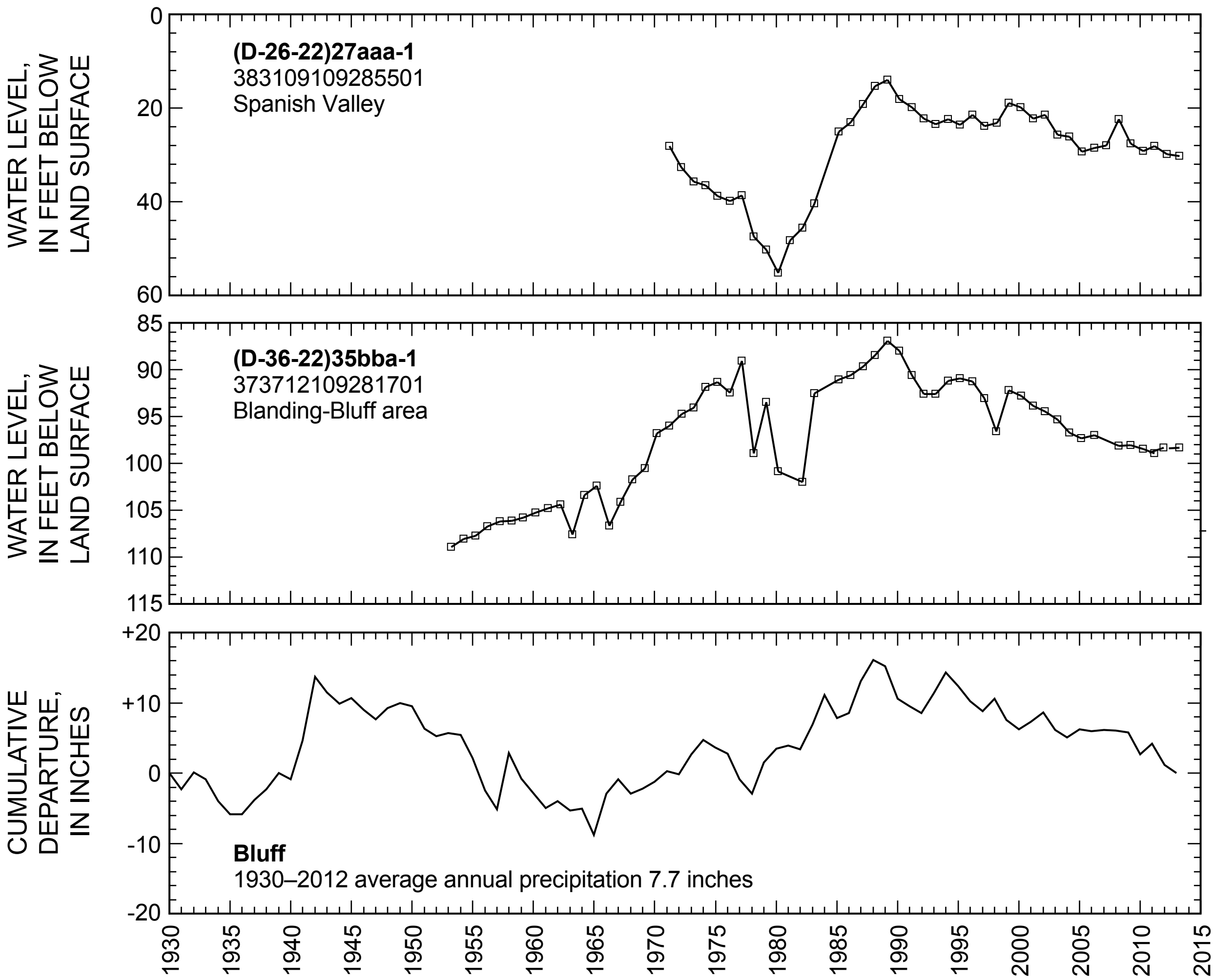


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

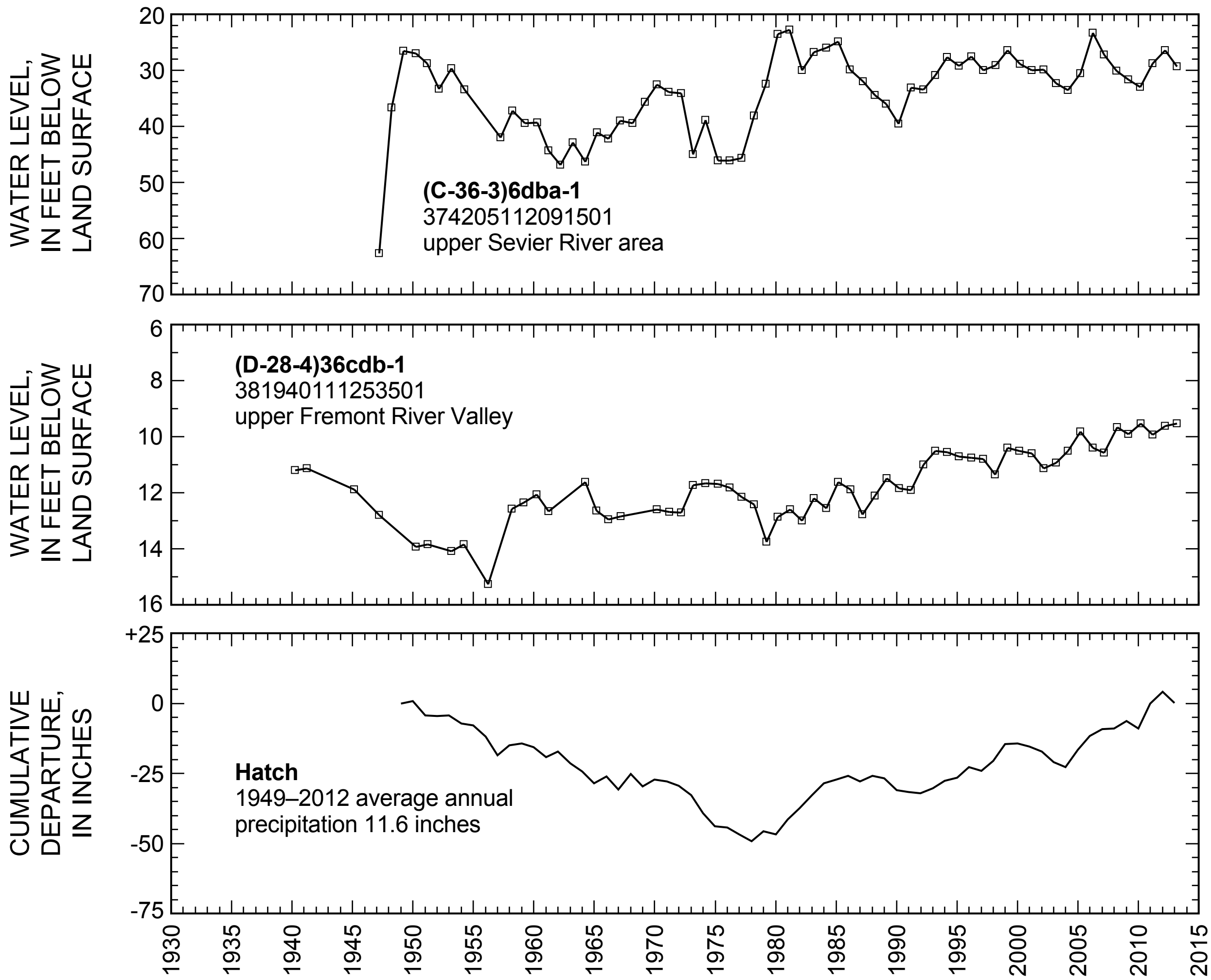


Figure 40. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

Quality of Water from Selected Wells in Utah, Summer of 2012

From June through September 2012, the U.S. Geological Survey (USGS) Utah Water Science Center, in cooperation with the Utah Department of Environmental Quality, Division of Water Quality, sampled water from 110 wells located in 21 counties (fig. 41). Samples were collected during this time period to limit seasonal variability in the data. The majority of water samples were collected from irrigation wells. Field parameters that were measured at the time the water samples were collected included pH, specific conductance, and water temperature. Chemical constituents that were analyzed in the water samples included major ions, dissolved solids, nutrients (nitrate plus nitrite and orthophosphate), and selected trace elements. The USGS National Water Quality Laboratory in Denver, Colorado, analyzed the water samples. Field parameter values and analytical results for major ions, dissolved solids, and nutrients are shown in table 5. Analytical results for trace elements are shown in table 6.

The water samples were collected using protocols in the USGS 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 USGS National Water Information System (NWIS) database and are available online at *http://waterdata.usgs.gov/ut/nwis/qw*.

Water-quality field blanks were collected to determine if samples were being contaminated during equipment decontamination and/or sample collection and processing procedures. A field blank is an inorganic blank water sample that is prepared by the USGS National Water Quality Laboratory, carried in the field, and processed using the same methods and equipment as the environmental water samples. The field blank is subject to processing in the field, preservation, shipment, laboratory handling procedures, and analytical protocols. Eleven field blank water samples were processed during the 2012 sampling period. Analytical results for all constituents in the field blanks were less than the laboratory reporting limits.

Replicate water samples also were collected at two wells. A replicate sample is collected concurrent with an environmental sample and is used to assess the repeatability of the laboratory analytical results. Analytical results for the replicate water samples were in good agreement with the environmental samples, agreeing within 2 percent for all constituents.

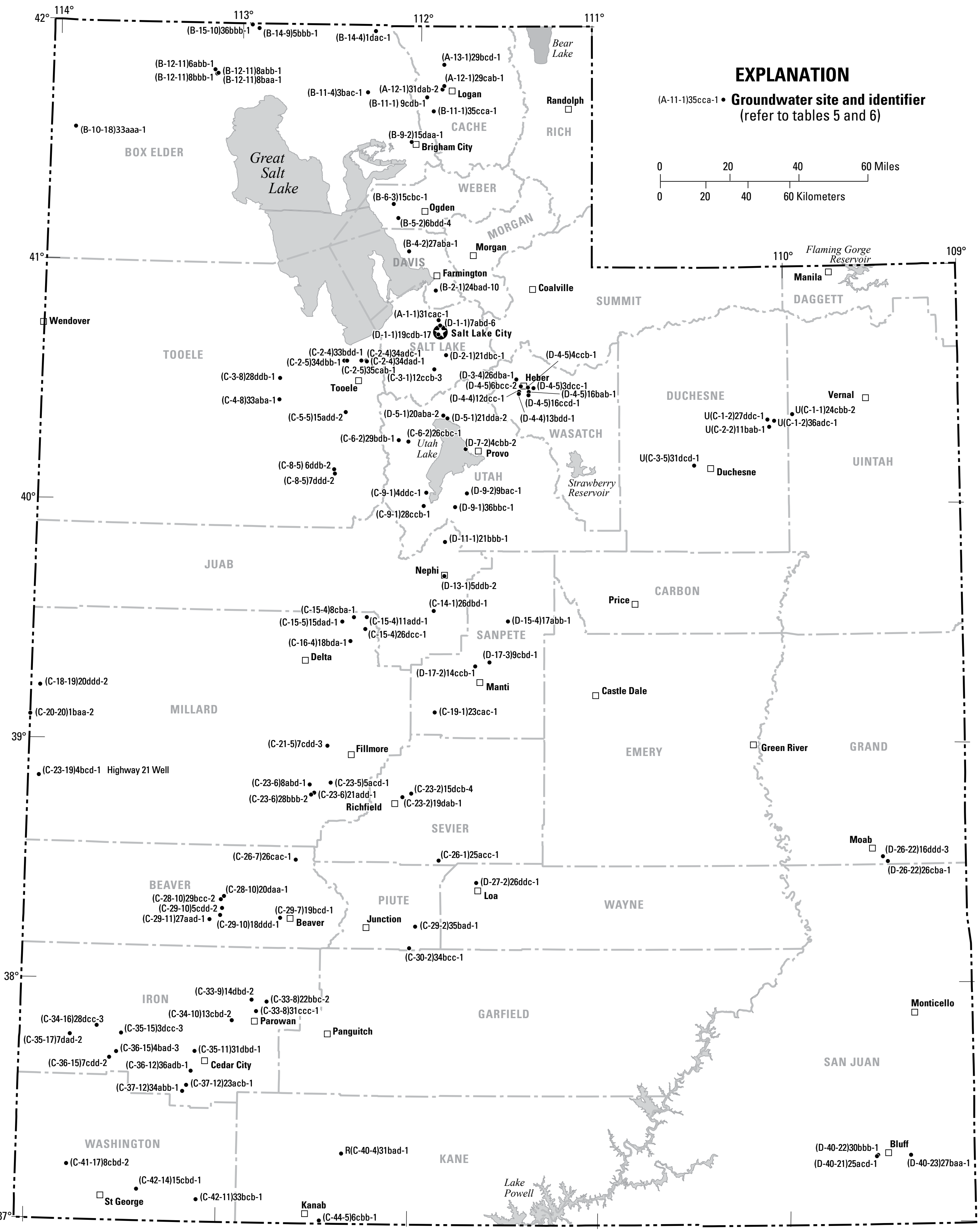


Figure 41. Location of groundwater sites sampled during the summer of 2012.

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2012.

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

Local identifier (refer to figure 41)	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Water 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-29-7)19bcd-1	381625112412901	6/25/2012	7.2	498	13.5	164	50.8	9.07
Cove Fort area								
(C-26-7)26cac-1	383101112365301	8/6/2012	7.9	634	14.8	270	82.3	15.7
Escalante Valley, Milford area								
(C-28-10)20daa-1	382135112592801	6/18/2012	7.0	2,110	19.5	902	188	105
(C-28-10)29bcc-2	381543113035501	6/18/2012	7.6	737	15.5	267	80	16.4
(C-29-10)5cdd-2	382046113002702	6/18/2012	7.1	790	21.4	310	72.8	31.2
(C-29-10)18ddd-1	381835113000001	6/18/2012	7.0	768	15.4	346	103	21.5
(C-29-11)27aad-1	381649113003401	6/18/2012	7.2	888	16.7	402	121	24.1
Box Elder County								
Curlew Valley								
(B-12-11)6abb-1	414813113082901	7/13/2012	7.5	751	14.9	271	80.1	17.3
(B-12-11)8bbb-1	414720113075201	7/13/2012	7.2	2,580	14.2	705	200	49.9
(B-12-11)8baa-1	414721113072601	7/13/2012	7.2	3,960	13.5	1,400	406	93.2
(B-14-9)5bbb-1	415847112540401	7/12/2012	7.0	1,400	17.3	513	151	33.1
(B-15-10)36bbb-1	415939112562201	7/12/2012	7.5	488	16.0	196	58.5	12.1
Lower Bear River area								
(B-11-4)3bac-1	414313112172501	8/31/2012	6.8	1,950	14.9	616	134	68.3
(B-14-4)1dac-1	415833112150701	8/31/2012	7.1	734	12.1	281	71.1	25
Cache County								
Cache Valley								
(B-11-1)9cdb-1	414209111574001	8/24/2012	6.8	915	13.0	352	94.5	28
(B-11-1)35cca-1	413840111552601	8/24/2012	7.0	693	12.0	227	56.6	20.8
(A-12-1)29cab-1	414501111520001	8/24/2012	7.2	488	20.9	224	54	21.6
(A-12-1)31dab-2	414409111523502	8/24/2012	7.4	402	16.3	213	50.3	21.3
(A-13-1)29bcd-1	415020111520401	8/24/2012	7.3	438	13.4	199	41.5	23.1
Davis County								
East Shore area								
(B-2-1)24bad-3	405351111540803	6/11/2012	7.8	452	15.7	94	27.6	6.17
(B-4-2)27aba-1	410340112030001	6/11/2012	8.1	599	13.7	46	11.6	4.09
(B-6-3)15cbc-1	411523112082101	6/11/2012	8.3	409	15.8	33	7.83	3.26
(B-9-2)15daa-1	413057112023901	6/12/2012	8.4	607	16.1	9	1.93	0.907
Duchesne County								
Duchesne River area								
U(C-1-1)24cbb-2	402252109571501	7/10/2012	6.8	736	14.5	398	86.6	44.2
U(C-1-2)27ddc-1	402135110051901	7/11/2012	7.3	329	12.5	181	51.1	12.9
U(C-1-2)36adc-1	402116110030801	7/11/2012	7.4	326	11.9	172	46.2	13.8
U(C-2-2)11bab-1	401946110044601	7/9/2012	7.4	334	15.1	169	43.2	14.8
Grand County								
Spanish Valley								
(D-26-22)16ddd-3	383201109295301	6/22/2012	7.4	1,280	16.0	613	158	52.9
(D-26-22)26cba-1	383043109282401	6/22/2012	7.5	906	15.8	418	110	34.4

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	Nitrate plus nitrite, dissolved, in mg/L as N	Orthophosphate, dissolved, in mg/L as P
Beaver County										
Beaver Valley										
6.33	29.6	162	0.06	20.5	0.88	40	33.3	297	1.35	0.034
Cove Fort area										
2.68	23.2	148	0.17	93.2	0.19	40.9	25.8	392	1.48	0.03
Escalante Valley, Milford area										
5.02	66.3	89	1.44	481	0.64	31.3	274	1,390	2.86	0.013
6.15	40.9	130	0.19	98.9	0.38	42.6	77.1	474	2.60	0.032
4.13	35.4	107	0.26	113	0.46	31.3	114	486	0.92	0.015
4.63	27.5	249	0.18	52.3	0.25	34.1	68.1	477	2.56	0.039
5.79	28.3	244	0.27	73.7	0.41	32.7	92.3	555	5.69	0.052
Box Elder County										
Curlew Valley										
2.84	39.8	128	0.13	121	0.15	16.3	28.3	470	0.49	0.01
7.34	251	173	0.48	658	0.09	22.1	291	1,770	3.77	0.013
10.3	218	110	0.81	1,180	0.06	21.2	64.8	2,980	2.57	0.01
13.5	51.2	114	0.28	357	0.17	54	24.3	1,010	1.98	0.026
8.22	17.4	142	0.05	55.2	0.19	58.2	18.4	339	0.80	0.026
Lower Bear River area										
5.9	192	302	0.25	246	0.17	25	349	1,320	7.58	0.015
2.27	47.1	211	0.11	98.6	0.12	16.4	29.5	436	1.58	0.021
Cache County										
Cache Valley										
8.3	47.7	387	0.11	76.3	0.61	48.9	0.19	529	<0.04	0.192
11	52.1	302	0.06	49.5	0.33	44.5	<0.09	402	<0.04	0.762
5.5	17.9	221	0.02	15.7	0.22	21.9	19.9	288	1.20	0.024
1.59	8.38	206	0.02	7.22	0.11	11.4	11.3	230	0.48	0.018
1.64	24.9	230	0.02	8.58	0.09	10.6	11.1	265	0.13	0.01
Davis County										
East Shore area										
0.81	60.1	167	0.04	28.7	0.23	16.2	22.7	269	1.48	0.047
5.51	112	262	0.06	41.1	0.36	28.5	0.21	367	<0.04	0.61
9.68	71.4	197	0.04	15.9	0.31	19.2	0.22	254	<0.04	0.253
1.73	139	310	0.02	13.8	0.62	14.8	1.2	387	<0.04	1.36
Duchesne County										
Duchesne River area										
1.14	18.1	348	0.11	5.77	1.5	56.4	62.3	502	0.18	0.019
3.36	4.24	146	0.02	0.54	0.54	8.46	36.7	214	<0.04	<0.004
3.9	3.79	135	0.02	0.69	0.87	7.49	41.3	199	<0.04	<0.004
3.32	11.2	140	0.02	1.25	0.6	9.31	47.5	220	<0.04	<0.004
Grand County										
Spanish Valley										
2.97	64.3	197	0.21	32.5	0.25	15.3	467	998	4.87	0.006
2.72	44.4	214	0.14	20.3	0.2	14.1	248	651	3.69	0.006

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Water temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
Iron County								
Cedar Valley								
(C-35-11)31dbd-1	374248113075201	6/26/2012	7.9	1,170	14.0	661	130	81.5
(C-36-12)36adb-1	373743113084201	8/6/2012	7.0	803	13.1	447	111	41
(C-37-12)23acb-1	373407113100801	6/26/2012	7.4	1,410	14.5	698	157	74.1
(C-37-12)34abb-1	373236113111401	6/26/2012	7.1	816	12.5	466	120	40.1
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-3	374934113384601	6/19/2012	7.1	790	18.0	288	87.2	17.2
(C-35-15)3dcc-3	374649113305801	6/19/2012	7.2	1,290	13.8	541	130	52.4
(C-35-17)7dad-2	374617113470601	6/19/2012	7.4	484	15.8	167	52.6	8.75
(C-36-15)4bad-3	374209113322203	6/19/2012	7.4	791	21.2	142	45.1	7.07
(C-36-15)7cdd-2	374040113343102	6/19/2012	7.4	929	24.4	200	52.3	16.9
Parowan Valley								
(C-33-8)22bbc-2	375523112451902	6/25/2012	7.9	495	16.6	64	15.4	6.32
(C-33-8)31ccc-1	375257112483501	6/25/2012	7.3	482	14.7	214	44.5	25
(C-33-9)14dbd-2	375548112500401	6/25/2012	7.9	725	16.2	207	34.3	29.6
(C-34-10)13cbd-2	375033112561101	6/25/2012	7.4	475	12.8	221	43.3	27.3
Juab County								
Juab Valley								
(C-14-1)26dbd-1	393342111534501	8/14/2012	7.4	1,170	13.7	534	114	60.4
(D-11-1)21bbb-1	395059111501901	8/14/2012	7.4	530	12.9	266	64.8	25.3
(D-13-1)5ddb-2	394225111502702	8/14/2012	7.2	1,510	12.6	475	129	37.2
Kane County								
Kanab area								
(C-44-5)6cbb-1	370050112274501	7/31/2012	7.0	2,100	15.1	712	178	65.1
R(C-40-4)31bad-1	371740112210601	7/31/2012	7.1	2,010	11.4	1,100	149	176
Millard County								
Pahvant Valley								
(C-21-5)7cdd-3	385939112272303	6/27/2012	7.1	1,500	12.1	546	120	59.8
(C-23-5)5acd-1	385026112261001	6/27/2012	7.4	580	15.0	265	71.2	21.2
(C-23-6)8abd-1	384953112325101	6/27/2012	7.0	7,670	14.9	2,170	542	198
(C-23-6)21add-1	384751112312201	6/27/2012	7.5	1,230	14.2	347	64.8	44.9
(C-23-6)28bbb-2	384722112322101	6/27/2012	7.6	6,590	13.4	2,320	415	312
Sevier Desert								
(C-15-4)11add-1	393158112152001	8/16/2012	7.1	1,770	14.5	518	122	51.5
(C-15-4)26dcc-1	392859112154601	8/14/2012	7.3	962	15.0	417	113	32.6
(C-15-5)15dad-1	393046112231301	8/16/2012	7.5	925	15.3	313	61.1	38.9
(C-16-4)18bda-1	392555112203001	8/16/2012	7.6	1,340	17.1	573	119	67
Snake Valley								
(C-18-19)20ddd-2	391324114000001	8/15/2012	7.9	339	21.9	121	29.6	11.5
(C-20-20)1baa-2	390604114025201	8/15/2012	7.6	433	15.1	184	46.1	16.8
(C-23-19)4bcd-1	385048113592901	8/15/2012	7.7	447	12.1	209	39.8	26.7

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	Nitrate plus nitrite, dissolved, in mg/L as N	Orthophosphate, dissolved, in mg/L as P
Iron County										
Cedar Valley										
2.44	12.4	132	0.07	14.7	0.2	19.4	467	865	2.51	0.009
1.87	15.1	300	0.04	7.03	0.11	18	146	527	1.51	0.009
2	53.5	144	0.67	133	0.07	16.6	435	1,050	2.08	0.018
1.99	16.1	318	0.06	8.69	0.17	16.9	131	540	1.01	0.012
Escalante Valley, Beryl-Enterprise area										
8.02	35.1	132	0.45	120	1.1	66.9	58.5	531	1.13	0.027
5.29	64.6	126	0.56	167	0.37	57.3	299	866	1.15	0.026
7.46	32.5	146	0.09	20.5	0.59	69.8	66	356	0.95	0.024
4.47	119	156	0.13	37.4	1.38	51.8	182	546	0.77	0.027
3.73	126	122	0.12	41.9	1.4	42.9	280	639	0.49	0.017
Parowan Valley										
1.44	80.5	121	0.08	69.8	0.46	22.9	18.2	294	0.31	0.024
2.59	23.3	202	0.07	22.2	0.18	27.3	21.1	290	1.60	0.027
2.61	61	111	0.21	142	0.38	20.7	31.9	396	0.10	0.023
4.55	16.2	200	0.07	17.5	0.24	40.5	24.6	330	1.74	0.025
Juab County										
Juab Valley										
3.11	65.1	247	0.05	58.9	0.18	19.1	298	811	1.86	0.02
0.91	12.3	209	0.05	20.5	0.09	9.19	38.1	310	1.68	0.006
3.58	141	347	0.10	215	0.13	23.4	114	898	5.45	0.029
Kane County										
Kanab area										
9.79	254	312	0.24	56.8	0.36	13.7	859	1,690	0.06	0.004
10.1	112	382	0.11	26.6	0.42	13.2	858	1,630	<0.04	0.005
Millard County										
Pahvant Valley										
4.85	115	311	0.28	171	0.15	24	241	999	5.25	0.022
1.88	25.1	249	0.05	26.9	0.16	18.7	26.2	350	1.06	0.035
75.4	851	322	2.34	1,930	0.86	34	1,210	5,310	1.91	0.067
4.93	116	185	0.35	189	0.4	24.7	141	742	5.43	0.019
11.9	512	177	2.85	1,770	0.22	27	788	4,690	36.30	0.019
Sevier Desert										
5.44	188	280	0.25	258	0.31	20.4	255	1,120	0.80	0.017
1.62	46.4	174	0.19	76.9	0.09	13.1	179	594	10.50	0.015
3.66	67.3	175	0.15	166	0.3	27.1	49.4	544	0.16	0.016
3.6	40.8	125	0.40	293	0.11	25.5	48.2	844	10.80	0.014
Snake Valley										
1.73	23.9	135	0.04	19.5	0.11	13.3	9.75	195	0.19	0.007
1.24	19.1	143	0.10	33.1	0.12	16.7	25.9	249	0.65	0.01
2.52	13.9	153	0.05	11.8	1.53	19.6	61	276	0.29	0.009

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Water temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
Salt Lake County								
Salt Lake Valley								
(A-1-1)31cac-1	404627111532601	7/2/2012	7.0	1,180	13.8	459	114	42
(C-3-1)12ccb-3	403409111542401	7/3/2012	7.4	2,390	19.2	573	143	52.1
(D-1-1)7abd-6	404506111523301	7/2/2012	7.0	1,360	14.5	605	147	57.8
(D-1-1)19cdb-17	404253111530901	7/3/2012	7.4	1,100	14.9	529	141	42.9
(D-2-1)21dbc-1	403742111503201	7/2/2012	7.9	334	13.6	150	39.8	12.3
San Juan County								
Blanding-Bluff area								
(D-40-21)25acd-1	371657109331901	8/23/2012	8.9	416	—	11	3.14	0.856
(D-40-22)30bbb-1	371716109325501	8/23/2012	8.9	796	19.6	5	1.26	0.427
(D-40-23)27baa-1	371621109211001	8/23/2012	7.5	3,110	19.4	102	24.6	9.75
Sanpete County								
Central Sevier Valley								
(C-19-1)23cac-1	390819111530701	8/6/2012	7.0	2,600	11.7	759	112	116
Sanpete Valley								
(D-15-4)17abb-1	393113111294501	8/28/2012	7.6 L	580	10.1	320	68.4	36.1
(D-17-2)14ccb-1	391955111401301	8/28/2012	7.7 L	890	13.1	399	61.2	59.7
(D-17-3)9cbd-1	392056111353801	8/28/2012	7.9 L	651	11.8	319	53.9	44.7
Sevier County								
Central Sevier Valley								
(C-23-2)15dcb-4	384757112002201	8/6/2012	7.3	664	12.9	319	64.7	38.4
(C-23-2)19dab-1	384702112031001	8/6/2012	7.2	649	13.3	327	62.6	41.4
(C-29-2)35bad-1	381440111584001	8/6/2012	7.2	471	14.4	211	58.5	15.7
Upper Sevier River area								
(C-26-1)25acc-1	383115111512501	8/6/2012	7.0	111	10.3	40	11.7	2.6
(C-30-2)34bcc-1	380915112003001	8/6/2012	7.5	299	13.5	116	36.3	6.2
Tooele County								
Rush Valley								
(C-5-5)15add-2	402310112231002	6/5/2012	7.0	542	11.8	263	57	29.2
(C-8-5)6ddb-2	400849112263902	6/5/2012	7.1	674	16.0	247	48.2	30.7
(C-8-5)7ddd-2	400745112263101	6/5/2012	7.2	541	16.4	204	37.5	26.7
Skull Valley								
(C-3-8)28ddb-1	403126112444501	7/19/2012	7.3	585	14.0	180	50.1	13.3
(C-4-8)33aba-1	402604112445501	7/19/2012	7.6	1,230	15.4	245	42.9	33.5
Tooele Valley								
(C-2-4)33bdd-1	403629112174801	7/18/2012	7.1	1,030	14.2	287	73.6	25
(C-2-4)34adc-1	403608112164201	7/19/2012	7.7 L	899	18.6	371	84.5	39
(C-2-4)34dad-1	403556112163001	7/18/2012	7.3	1,040	15.2	386	88.9	39.7
(C-2-5)34dbb-1	403602112235701	7/19/2012	7.4	2,110	28.3	315	75.7	30.7
(C-2-5)35cab-1	403602112230101	7/18/2012	7.3	3,890	21.0	419	103	39.1
Snake Valley—West Desert area								
(B-10-18)33aaa-1	413300113543001	7/12/2012	7.4	871	12.1	343	102	21.4
Uintah County								
Duchesne River area								
U(C-3-5)31dcd-1	401012110292101	7/9/2012	9.3	1,800	15.2	17	1.85	2.92

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	Nitrate plus nitrite, dissolved, in mg/L as N	Orthophosphate, dissolved, in mg/L as P
Salt Lake County										
Salt Lake Valley										
3.5	67.1	269	0.07	180	0.18	18	72.7	706	4.35	0.016
23.6	263	202	0.29	529	0.27	29.3	217	1,440	0.66	0.01
3.1	60.4	290	0.12	194	0.15	16.9	169	874	4.85	0.041
3.73	46.3	257	0.07	99.7	0.21	15.8	212	749	2.93	0.017
1.9	12	114	0.04	19.7	0.19	10.4	26.9	203	1.65	0.011
San Juan County										
Blanding-Bluff area										
1.26	95.2	171	0.02	1.89	0.08	10.1	43.1	272	<0.040	0.005
1.01	191	354	0.04	15.1	0.43	9.72	48.1	488	<0.040	0.008
13.2	501	765	1.06	449	1.28	10.7	189	1,900	<0.040	0.006
Sanpete County										
Central Sevier Valley										
3.3	332	600	<0.01	332	0.35	35	350	1,680	4.89	0.06
Sanpete Valley										
1.2	9.33	286	0.02	5.29	0.07	8.54	14.5	335	2.70	0.005
1.32	49.6	305	0.09	56	0.2	17.3	106	546	0.88	0.015
1.44	29.2	322	0.03	8.34	0.15	12.1	35.3	379	1.97	0.007
Sevier County										
Central Sevier Valley										
3.35	21	270	0.08	27.1	0.33	32.2	44.8	400	1.08	0.041
2.31	17.9	307	0.06	13.5	0.18	14	19.6	366	3.09	0.017
6.17	15.6	186	0.16	25.9	0.17	45	17.2	300	1.09	0.068
Upper Sevier River area										
1.95	7.04	48.9	0.02	3.76	0.24	43.6	1.41	94	0.33	0.062
4.45	18	136	0.04	8.55	0.24	36.6	6.24	204	0.77	0.152
Tooele County										
Rush Valley										
1.17	16	196	0.05	42.1	0.17	12.8	21.7	309	1.33	0.009
2.61	46.4	168	0.08	97	0.57	15	30.2	386	0.46	0.005
2.52	35.4	155	0.07	65	0.68	14.6	24.2	301	0.06	0.006
Skull Valley										
1.79	47.2	119	0.08	101	0.14	17.8	17.7	353	1.01	0.025
14	182	174	0.20	285	0.12	24.5	54.8	790	8.61	0.015
Tooele Valley										
2.15	109	218	0.13	137	0.12	12.1	111	616	1.80	0.046
1.48	61	235	0.08	51.3	0.07	13.2	173	588	3.12	0.022
1.76	76.3	227	0.13	106	0.06	14.4	165	640	3.33	0.023
5.13	297	183	0.33	546	0.2	20.7	35.9	1,170	0.48	0.009
9.68	644	197	0.69	1,160	0.46	24.2	88.3	2,230	1.47	0.018
Snake Valley—West Desert area										
8.21	45.4	173	0.21	115	0.29	50	63.3	565	0.53	0.04
Uintah County										
Duchesne River area										
1.14	426	540	0.07	170	1.39	14.7	156	1,150	<0.04	0.068

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	Station number	Date	pH, field, in standard units	Specific conductance, field, in µS/cm at 25°C	Water temperature, field, in °C	Hardness, water, in mg/L as $CaCO_3$	Calcium, dissolved, in mg/L	Magnesium, dissolved, in mg/L
Utah County								
Cedar Valley								
(C-6-2)26cbc-1	401600112023401	7/16/2012	7.4	956	11.2	421	67.7	61.1
(C-6-2)29bdb-1	401620112054301	7/16/2012	8.7	228	10.5	93	15.5	13.2
Goshen Valley								
(C-9-1)28ccb-1	395956111572101	7/24/2012	7.2	2,310	17.7	760	199	63.8
(D-9-2)9bac-1	400311111432001	7/23/2012	7.2	680	14.7	318	79.2	29.2
Northern Utah Valley								
(D-5-1)20aba-2	402234111511501	7/23/2012	7.3	499	11.3	248	56.2	26.1
(D-5-1)21dda-2	402154111495101	7/23/2012	7.6	382	11.5	204	47	21.1
Southern Utah Valley								
(C-9-1)4ddc-1	400309111565101	7/24/2012	7.5	1,390	17.0	345	89	29.9
(D-7-2)4cbb-2	401414111435301	7/23/2012	7.7	538	13.0	265	66.7	23.9
(D-9-1)36bbc-1	395942111470801	7/24/2012	7.5	527	10.7	280	71.5	24.7
Wasatch County								
Heber Valley								
(D-3-4)26dba-1	403146111272701	8/30/2012	7.1	752	13.0	367	112	21.6
(D-4-4)12dcc-1	402842111263101	8/30/2012	6.8	733	11.9	332	93.9	23.6
(D-4-4)13bdd-1	402810111263601	8/29/2012	7.6	475	21.5	239	56.2	24
(D-4-5)3dcc-1	402937111214901	8/29/2012	6.8	540	11.7	278	91.2	12.3
(D-4-5)4ccb-1	402946111233901	8/30/2012	6.7	414	12.5	211	67.3	10.4
(D-4-5)6bcc-2	403003111255801	8/29/2012	7.0	368	12.5	186	56	11.2
(D-4-5)16bab-1	402840111232201	8/29/2012	7.1	643 L	12.5	337	92.2	25.9
(D-4-5)16ccd-1	402750111232701	8/29/2012	7.1	604	11.9	278	71.2	24.4
Washington County								
Central Virgin River area								
(C-41-17)8cbd-2	371348113470301	7/30/2012	7.3	488	18.6	235	67.2	16.2
(C-42-11)33bcb-1	370535113062301	7/30/2012	6.9	1,190	17.6	684	160	69.2
(C-42-14)15cbd-1	370538113251301	7/30/2012	7.1	2,620	25.5	1,260	268	143
Wayne County								
Upper Fremont River Valley								
(D-27-2)26ddc-1	382544111392401	8/6/2012	7.3	240	10.7	95	26.6	6.92
Weber County								
East Shore area								
(B-5-2)6bdd-4	411153112064601	6/12/2012	7.9	431	16.5	145	35.4	13.8

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	Nitrate plus nitrite, dissolved, in mg/L as N	Orthophosphate, dissolved, in mg/L as P
Utah County										
Cedar Valley										
3.68	28	187	0.16	135	0.27	55	51.2	578	0.31	0.036
0.99	15	113	0.03	12.9	0.14	2.58	0.6	128	0.15	<0.004
Goshen Valley										
20.2	150	106	0.77	554	0.15	61	124	1,550	21.70	0.023
8.04	28.3	269	0.05	30.7	0.2	49.7	40.5	434	3.98	0.032
Northern Utah Valley										
1.59	14.5	202	0.02	13	0.13	11.8	45.4	302	2.39	0.007
0.99	7.24	160	0.02	6.36	0.18	11.2	42.9	230	0.69	0.008
Southern Utah Valley										
14.7	144	140	0.32	293	0.32	66.5	110	847	2.34	0.024
2.53	16.4	232	0.04	12.9	0.19	18.7	44.5	328	<0.04	0.024
1.51	7.72	228	0.04	22	0.19	15.9	20.1	311	2.41	0.01
Wasatch County										
Heber Valley										
6.06	23.1	261	—	26.9	0.44	19	83.6	458[1]	2.07	0.02[2]
1.47	27.9	249	—	60	0.09	21.9	38.3	434[1]	3.95	0.04[2]
1.82	10.3	208	—	20.5	0.25	12.5	17.8	270[1]	0.39	0.02[2]
3.41	8.58	197	—	38.7	0.07	37	7.71	350[1]	7.30	0.08[2]
2.56	5.58	170	—	15.2	0.09	40.3	14.8	277[1]	4.30	0.09[2]
2.08	8.66	161	—	10.3	0.06	29.4	18.1	238[1]	1.29	0.03[2]
1.66	16.1	290	—	23.6	0.13	29.5	20.1	398[1]	3.45	0.03[2]
1.16	26	219	—	40.1	0.11	17.2	21.6	359[1]	5.92	0.02[2]
Washington County										
Central Virgin River area										
2.16	15.2	202	0.07	14.9	0.28	18.5	35.5	299	0.33	0.012
2.25	48.4	230	0.53	62.2	0.2	12.3	416	910	<0.04	<0.004
9.6	163	170	0.51	285	0.27	21.3	943	2,090	10.30	0.01
Wayne County										
Upper Fremont River Valley										
2.74	14.2	105	0.03	6.64	0.24	41	11.6	170	0.27	0.023
Weber County										
East Shore area										
7.49	31.5	211	0.03	16.4	0.18	24.7	<0.09	246	<0.04	0.158

[1] Dissolved solids determined by sum of constituents.
[2] Phosphorus, dissolved, in mg/L as P.

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2012.

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

Local identifier (refer to figure 41)	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-29-7)19bcd-1	381625112412901	6/25/2012	5.6	<3.2	3.74	2.7	0.59	21
Cove Fort area								
(C-26-7)26cac-1	383101112365301	8/6/2012	2.5	31.9	0.25	0.354	1.6	3.85
Escalante Valley, Milford area								
(C-28-10)20daa-1	382135112592801	6/18/2012	3.1	17.3	<0.32	2.53	8.1	5.84
(C-28-10)29bcc-2	382046113002702	6/18/2012	7	11.2	0.23	2.27	4.7	13.2
(C-29-10) 5cdd-2	381835113000001	6/18/2012	2.5	5	0.26	0.578	0.64	28.7
(C-29-10)18ddd-1	381649113003401	6/18/2012	2.9	4.2	<0.16	1.77	0.81	58.3
(C-29-11)27aad-1	381543113035501	6/18/2012	3.7	<3.2	<0.16	1.53	0.89	12.4
Box Elder County								
Curlew Valley								
(B-12-11)6abb-1	414813113082901	7/13/2012	1.2	3.6	<0.16	0.957	0.97	1.98
(B-12-11)8baa-1	414721113072601	7/13/2012	0.45	18.1	<0.8	0.293	1.1	4.38
(B-12-11)8bbb-1	414720113075201	7/13/2012	0.92	6.7	<0.32	0.439	1	3.9
(B-14-9)5bbb-1	415847112540401	7/12/2012	1.9	3.7	<0.16	0.786	2	1.6
(B-15-10)36bbb-1	415939112562201	7/12/2012	2.5	<3.2	<0.16	0.819	1.1	1.74
Lower Bear River area								
(B-11-4)3bac-1	414313112172501	8/31/2012	0.95	4.1	<0.16	0.784	2.8	4.51
(B-14-4)1dac-1	415833112150701	8/31/2012	1.8	7.3	<0.16	0.434	1.8	0.904
Cache County								
Cache Valley								
(A-12-1)29cab-1	414501111520001	8/24/2012	1.4	<3.2	<0.16	0.682	0.2	0.634
(A-12-1)31dab-2	414409111523502	8/24/2012	1	<3.2	<0.16	0.47	0.33	0.711
(A-13-1)29bcd-1	415020111520401	8/24/2012	6.4	153	66.7	0.772	0.06	0.321
(B-11-1)9cdb-1	414209111574001	8/24/2012	13.1	1,770	283	0.15	0.09	<0.004
(B-11-1)35cca-1	413840111552601	8/24/2012	23.5	1,850	168	0.671	<0.03	0.004
Davis County								
East Shore area								
(B-2-1)24bad-3	405351111540803	6/11/2012	0.902	<3.2	<0.16	3.2	0.561	3.07
(B-4-2)27aba-1	410340112030001	6/11/2012	23.8	256	47.2	0.402	<0.03	0.006
(B-6-3)15cbc-1	411523112082101	6/11/2012	22.1	89.2	54.1	3.06	<0.03	0.004
(B-9-2)15daa-1	413057112023901	6/12/2012	0.11	249	11	0.534	<0.03	0.326
Duchesne County								
Duchesne River area								
U(C-1-1)24cbb-2	402252109571501	7/10/2012	9	23	16.7	2.06	0.89	6.29
U(C-1-2)27ddc-1	402135110051901	7/11/2012	0.69	783	13.1	0.449	<0.03	0.192
U(C-1-2)36adc-1	402116110030801	7/11/2012	0.57	528	23.9	0.517	<0.03	0.264
U(C-2-2)11bab-1	401946110044601	7/9/2012	0.11	234	9.41	0.415	<0.03	0.137
Grand County								
Spanish Valley								
(D-26-22)16ddd-3	383201109295301	6/22/2012	0.35	27.1	1.5	0.829	7.7	5.02
(D-26-22)26cba-1	383043109282401	6/22/2012	0.43	8.9	<0.16	0.807	3.5	4.09

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	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								
Cedar Valley								
(C-35-11)31dbd-1	374248113075201	6/26/2012	0.89	10.5	<0.16	0.525	1.6	3.01
(C-36-12)36adb-1	373743113084201	8/6/2012	0.9	<3.2	<0.16	0.338	1	2.41
(C-37-12)23acb-1	373407113100801	6/26/2012	0.68	3.7	<0.16	0.417	12.7	2.18
(C-37-12)34abb-1	373236113111401	6/26/2012	0.32	<3.2	<0.16	0.461	0.8	1.86
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-3	374934113384601	6/19/2012	18.5	5.4	0.18	1.72	1.8	3.12
(C-35-15)3dcc-3	374649113305801	6/19/2012	14.7	5.1	2.79	1.38	1.7	3.7
(C-35-17)7dad-2	374617113470601	6/19/2012	6.1	<3.2	<0.16	0.785	0.67	5.44
(C-36-15)4bad-3	374209113322203	6/19/2012	22.5	<3.2	<0.16	9.09	0.37	1.43
(C-36-15)7cdd-2	374040113343102	6/19/2012	26.1	4	<0.16	17.7	0.35	3.3
Parowan Valley								
(C-33-8)22bbc-2	375523112451902	6/25/2012	10.4	<3.2	8.28	1.36	0.12	0.569
(C-33-8)31ccc-1	375257112483501	6/25/2012	4.1	<3.2	<0.16	0.467	0.94	2.09
(C-33-9)14dbd-2	375548112500401	6/25/2012	9.8	5.4	1.06	1.97	0.23	1.46
(C-34-10)13cbd-2	375033112561101	6/25/2012	5.8	<3.2	<0.16	0.718	1.1	3.51
Juab County								
Juab Valley								
(C-14-1)26dbd-1	393342111534501	8/14/2012	1.2	4.5	<0.16	1.99	0.86	2.19
(D-11-1)21bbb-1	395059111501901	8/14/2012	0.22	<3.2	<0.16	0.538	5	1.19
(D-13-1)5ddb-2	394225111502702	8/14/2012	0.78	<3.2	<0.16	0.681	2.7	2.18
Kane County								
Kanab area								
(C-44-5)6cbb-1	370050112274501	7/31/2012	0.58	15.6	128	3.2	<0.03	0.533
R(C-40-4)31bad-1	371740112210601	7/31/2012	0.15	377	180	0.608	<0.03	5.26
Millard County								
Pahvant Valley								
(C-21-5)7cdd-3	385939112272303	6/27/2012	2.1	<3.2	<0.16	1.33	3	3.39
(C-23-5)5acd-1	385026112261001	6/27/2012	2.4	<3.2	<0.16	0.277	0.34	0.929
(C-23-6)8abd-1	384953112325101	6/27/2012	1.8	<12.8	<0.64	0.749	1.4	4.01
(C-23-6)21add-1	384751112312201	6/27/2012	6.3	<3.2	<0.16	1.39	2.5	2.87
(C-23-6)28bbb-2	384722112322101	6/27/2012	1.9	<12.8	<0.64	0.708	7.7	12.2
Sevier Desert								
(C-15-4)11add-1	393158112152001	8/16/2012	7	3.9	<0.16	1.24	1.4	4.53
(C-15-4)26dcc-1	392859112154601	8/14/2012	1.9	<3.2	<0.16	0.209	4.6	0.877
(C-15-5)15dad-1	393046112231301	8/16/2012	4.9	11.5	7.84	2.18	0.21	1.92
(C-16-4)18bda-1	392555112203001	8/16/2012	2.3	65	4.41	0.409	1.8	1.74
Snake Valley								
(C-18-19)20ddd-2	391324114000001	8/15/2012	0.87	<3.2	<0.16	0.463	0.36	1.44
(C-20-20)1baa-2	390604114025201	8/15/2012	1.4	<3.2	<0.16	0.607	0.67	1.39
(C-23-19)4bcd-1	385048113592901	8/15/2012	3.7	<3.2	<0.16	8.63	3.5	3.3

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	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
Salt Lake County								
Salt Lake Valley								
(A-1-1)31cac-1	404627111532601	7/2/2012	1.3	5.5	<0.16	1.47	1.5	2.05
(C-3-1)12ccb-3	403409111542401	7/3/2012	0.34	108	11.5	2.26	1.8	7.5
(D-1-1)7abd-6	404506111523301	7/2/2012	1.1	13.6	6.49	1.12	1.7	1.89
(D-1-1)19cdb-17	404253111530901	7/3/2012	0.6	4.7	0.24	0.484	1.7	1.23
(D-2-1)21dbc-1	403742111503201	7/2/2012	0.94	<3.2	<0.16	2.6	0.43	5.17
San Juan County								
Blanding-Bluff area								
(D-40-21)25acd-1	371657109331901	8/23/2012	9.4	<3.2	7.45	0.637	<0.03	0.033
(D-40-22)30bbb-1	371716109325501	8/23/2012	68.6	4.7	1.44	1.73	<0.03	0.395
(D-40-23)27baa-1	371621109211001	8/23/2012	22.6	519	16.7	2.89	0.09	1.52
Sanpete County								
Central Sevier Valley								
(C-19-1)23cac-1	390819111530701	8/6/2012	8.9	<6.4	<0.32	6.1	4.1	10.8
Sanpete Valley								
(D-15-4)17abb-1	393113111294501	8/28/2012	0.21	<3.2	<0.16	0.236	0.52	1.11
(D-17-2)14ccb-1	391955111401301	8/28/2012	1.2	<3.2	<0.16	0.692	6	2.42
(D-17-3)9cbd-1	392056111353801	8/28/2012	0.38	4.9	<0.16	1.07	1.1	2.19
Sevier County								
Central Sevier Valley								
(C-23-2)15dcb-4	384757112002201	8/6/2012	3.9	<3.2	<0.16	3.56	1.2	5.31
(C-23-2)19dab-1	384702112031001	8/6/2012	1.9	<3.2	<0.16	0.52	0.35	1.97
(C-29-2)35bad-1	381440111584001	8/6/2012	1.5	<3.2	0.19	0.521	0.31	6.21
Upper Sevier River area								
(C-26-1)25acc-1	383115111512501	8/6/2012	2.5	<3.2	<0.16	0.921	0.16	0.111
(C-30-2)34bcc-1	380915112003001	8/6/2012	2.2	5.4	0.81	0.695	0.29	1.08
Tooele County								
Rush Valley								
(C-5-5)15add-2	402310112231002	6/5/2012	1.7	<3.2	<0.16	0.778	1.6	1.93
(C-8-5)6ddb-2	400849112263902	6/5/2012	13.2	<3.2	<0.16	2.49	0.81	1.54
(C-8-5)7ddd-2	400745112263101	6/5/2012	19.8	<3.2	<0.16	2.96	0.09	1.87
Skull Valley								
(C-3-8)28ddb-1	403126112444501	7/19/2012	1	<3.2	<0.16	0.586	0.39	0.401
(C-4-8)33aba-1	402604112445501	7/19/2012	3.8	36.4	0.47	0.341	0.7	2.9
Snake Valley—West Desert area								
(B-10-18)33aaa-1	413300113543001	7/12/2012	6.7	12.4	0.16	4.48	3.2	8.06
Tooele Valley								
(C-2-4)33bdd-1	403629112174801	7/18/2012	1.4	3.3	<0.16	0.516	1.9	2.2
(C-2-4)34adc-1	403608112164201	7/19/2012	2	3.3	<0.16	0.305	12.6	1.97
(C-2-4)34dad-1	403556112163001	7/18/2012	2.7	4.6	<0.16	0.424	10.3	1.81
(C-2-5)34dbb-1	403602112235701	7/19/2012	1.4	29.4	5.36	1.53	0.83	2.06
(C-2-5)35cab-1	403602112230101	7/18/2012	4.4	47.8	0.98	3.82	2.2	2.02

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2012.—Continued

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

Local identifier (refer to figure 41)	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
Uintah County								
Duchesne River area								
U(C-3-5)31dcd-1	401012110292101	7/9/2012	0.14	<3.2	0.26	0.045	0.04	0.033
Utah County								
Cedar Valley								
(C-6-2)26cbc-1	401600112023401	7/16/2012	5.6	21.9	34.4	38.7	0.92	7.56
(C-6-2)29bdb-1	401620112054301	7/16/2012	1.6	43.6	24.5	0.56	0.18	0.169
Goshen Valley								
(C-9-1)28ccb-1	395956111572101	7/24/2012	3.7	7.9	<0.32	1.74	7.8	6.67
(D-9-2)9bac-1	400311111432001	7/23/2012	2.6	<3.2	<0.16	1.06	1.2	2.39
Northern Utah Valley								
(D-5-1)20aba-2	402234111511501	7/23/2012	0.59	<3.2	<0.16	1.09	1.5	7.41
(D-5-1)21dda-2	402154111495101	7/23/2012	0.82	<3.2	<0.16	1.99	1.5	1.83
Southern Utah Valley								
(C-9-1)4ddc-1	400309111565101	7/24/2012	11.7	<3.2	<0.16	2.03	2.2	5.29
(D-7-2)4cbb-2	401414111435301	7/23/2012	1.9	491	73.8	0.928	<0.03	0.019
(D-9-1)36bbc-1	395942111470801	7/24/2012	0.42	<3.2	<0.16	0.551	1.6	1.59
Wasatch County								
Heber Valley								
(D-3-4)26dba-1	403146111272701	8/30/2012	—	5.5	0.17	—	—	—
(D-4-4)12dcc-1	402842111263101	8/30/2012	—	<3.2	<0.16	—	—	—
(D-4-4)13bdd-1	402810111263601	8/29/2012	—	8.2	2.97	—	—	—
(D-4-5)3dcc-1	402937111214901	8/29/2012	—	3.6	<0.16	—	—	—
(D-4-5)4ccb-1	402946111233901	8/30/2012	—	15	1.4	—	—	—
(D-4-5)6bcc-2	403003111255801	8/29/2012	—	6.8	0.96	—	—	—
(D-4-5)16bab-1	402840111232201	8/29/2012	—	6	<0.16	—	—	—
(D-4-5)16ccd-1	402750111232701	8/29/2012	—	55	2.53	—	—	—
Washington County								
Central Virgin River area								
(C-41-17)8cbd-2	371348113470301	7/30/2012	23.9	34.7	10.3	5.14	0.7	1.58
(C-42-11)33bcb-1	370535113062301	7/30/2012	6.3	261	170	5.37	<0.03	8.94
(C-42-14)15cbd-1	370538113251301	7/30/2012	7.5	19.3	<0.32	3.17	12.7	11.9
Wayne County								
Upper Fremont River Valley								
(D-27-2)26ddc-1	382544111392401	8/6/2012	15	5	15.7	1.37	0.15	3.01
Weber County								
East Shore area								
(B-5-2)6bdd-4	411153112064601	6/12/2012	14.2	269	102	0.491	<0.03	<0.004

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