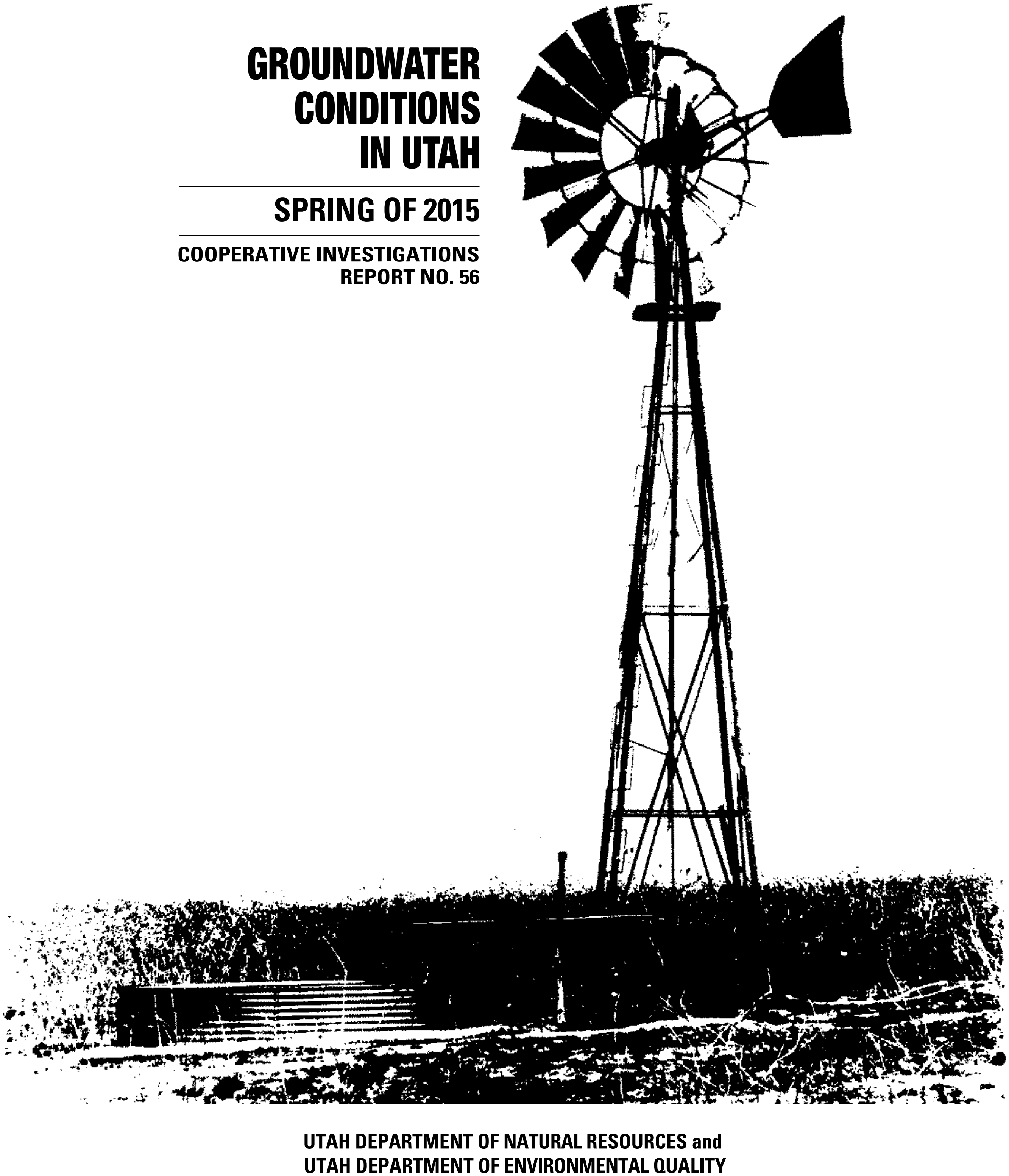
GROUNDWATER CONDITIONS IN UTAH

SPRING OF 2015

COOPERATIVE INVESTIGATIONS
REPORT NO. 56



UTAH DEPARTMENT OF NATURAL RESOURCES and
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

U.S. GEOLOGICAL SURVEY

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 2015

By
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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.

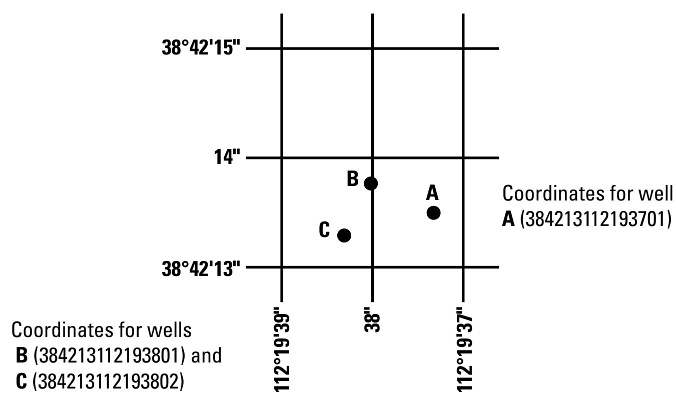
Definition of Terms

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 are 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

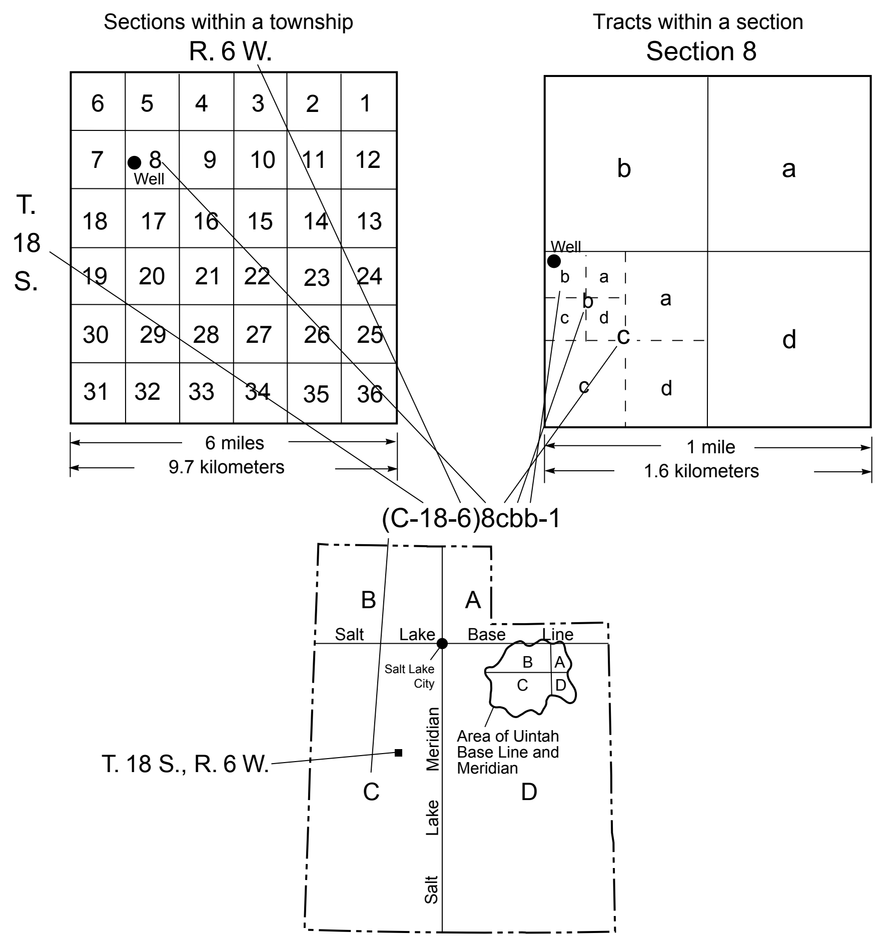
Wells by Latitude and Longitude

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 more than one 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 Cadastral 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 a "U" preceding the parentheses. Well numbers for wells located in half ranges will have an "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 mainstem. All stations on a tributary entering upstream from a mainstem station are listed before that station. A station on a tributary entering between two mainstem 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.

Groundwater Conditions in Utah, Spring of 2015

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

Introduction

This is the fifty-second 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 new wells constructed for withdrawal 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 2014. 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/GW2015.pdf*. Groundwater conditions in Utah for calendar year 2013 are reported in Burden and others (2014) and are available online at *http://ut.water.usgs.gov/publications/GW2014.pdf*.

The water-level change maps in this report show the difference between water levels measured in the same well at two distinct times: in the spring of 1985 and the spring of 2015. Throughout the state, many groundwater levels were near their peak in or around 1985 following a multiple-year period of above average precipitation in the early 1980s. Conversely, consecutive years of significant drought have contributed to low groundwater levels in 2015. For these reasons, the difference between 1985 and 2015 groundwater levels may not accurately portray long-term changes in an aquifer. An evaluation of water-level trends should also include consideration of the annual water-level measurement plots provided for each of the major areas of groundwater development in this report.

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 yields 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 may contain open fractures. Most wells that yield water from consolidated-rock aquifers 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 2014 was about 1,048,000 acre-feet (table 2), which is about 18,000 acre-feet more than the revised total for 2013 and 109,000 acre-feet more than the 2004–2013 average annual withdrawal (table 3). The increase in withdrawal resulted mostly from increased irrigation and industrial use. The total estimated withdrawal for irrigation was about 597,000 acre-feet, which is about 39,000 acre-feet more than the revised total for 2013 (Burden and others, 2014). Withdrawal for industrial use was about 129,000 acre-feet, which is 12,000 acre-feet more than in 2013. Withdrawal for public-supply use was about 268,000 acre-feet, which is 25,000 acre-feet less than the value for 2013. Withdrawal for domestic and stock use was about 55,000 acre-feet, which is 5,000 acre-feet less than the total for 2013.

From 2013 to 2014, groundwater withdrawals increased in 9 of the 16 areas of groundwater development discussed in this report (table 2). Withdrawal in Pahvant Valley increased about 15,000 acre-feet, the largest increase in any of the groundwater development areas shown on figure 1. Withdrawal in Cache Valley decreased about 11,000 acre-feet, the largest decrease in any of the areas. The 2014 total withdrawal was more than the average annual withdrawal for 2004–2013 in 12 of the 16 areas (table 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 2014 at 16 of 28 weather stations included in this report (Western Regional Climate Center, accessed July 1, 2015, at *http://www.wrcc.dri.edu*), was more than the long-term average. The greatest increase in precipitation from average was 6.8 inches at Laketown. The greatest decrease in precipitation from average was 3.4 inches at Blanding.

During February and March 2015, about 630 water-level measurements were made in wells for areas included in this report. Most water-level data included in the hydrographs for these wells are from measurements made during February and March, but may include some water-level measurements made in April and May. Many of the wells 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 2014, 348 new wells were constructed, as determined by the Utah Division of Water Rights (table 2); this is 7 more wells than the total reported for 2013 (Burden and others, 2014). In 2014, 32 large-diameter wells (12 inches or more) were constructed (table 2), which is 2 more than the total reported for 2013. These new wells are used principally for withdrawal of water for public supply, irrigation, and industrial purposes.

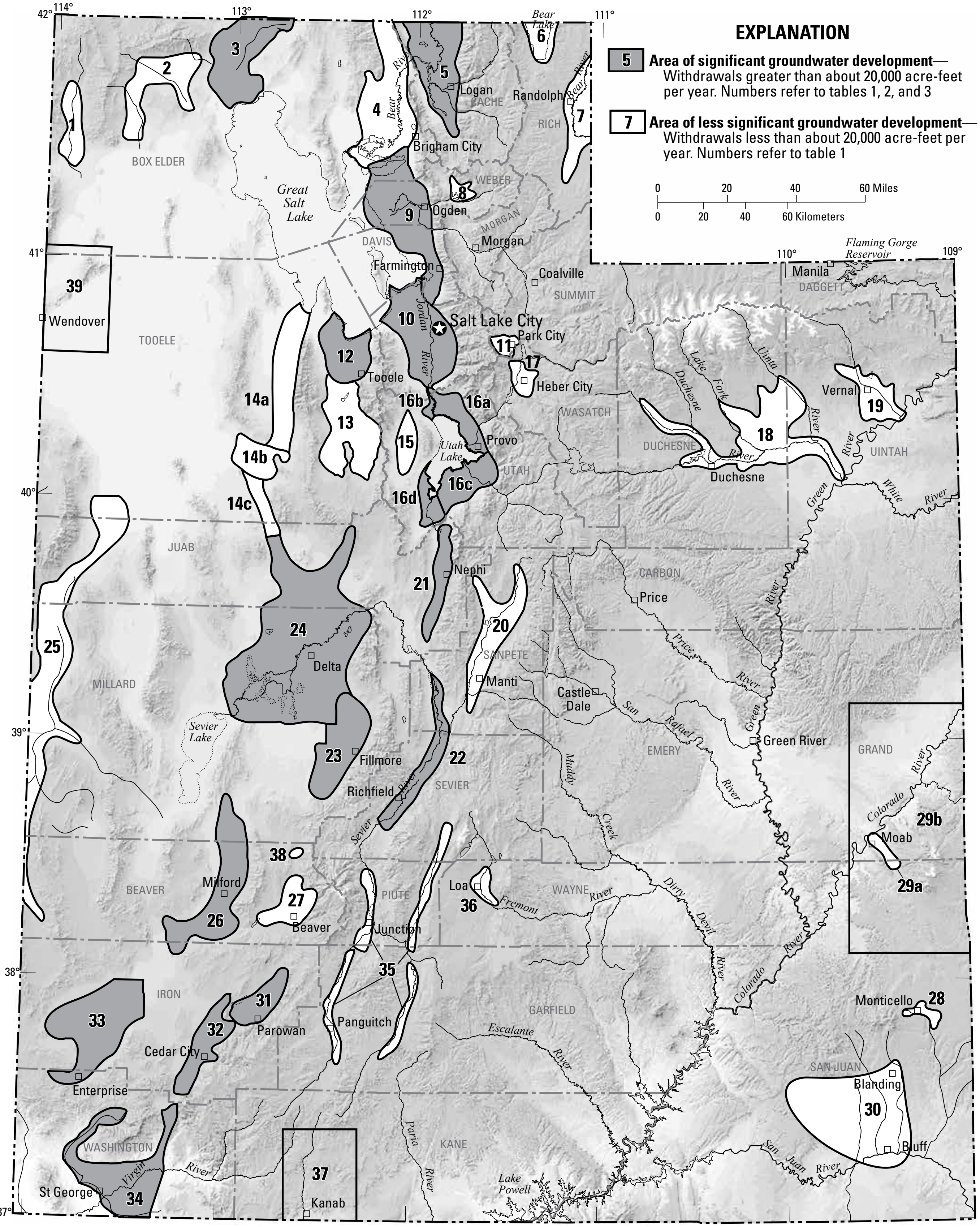


Figure 1. Areas of groundwater development in Utah specifically referred to in this report.

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

Number in figure 1	Area	Principal types of water-bearing lithologies
1	Grouse Creek Valley	Unconsolidated deposits
2	Park Valley area	Ditto
3	Curlew Valley	Unconsolidated and consolidated-rock deposits
4	Lower Bear River area	Unconsolidated deposits
5	Cache Valley	Ditto
6	Bear Lake Valley	Ditto
7	Upper Bear River area	Ditto
8	Ogden Valley	Ditto
9	East Shore area	Ditto
10	Salt Lake Valley	Ditto
11	Park City area	Unconsolidated and consolidated-rock deposits
12	Tooele Valley	Ditto
13	Rush Valley	Ditto
14a	Skull Valley	Unconsolidated deposits
14b	Dugway area	Ditto
14c	Old River Bed	Ditto
15	Cedar Valley, Utah County	Ditto
16a	Northern Utah Valley-east	Ditto
16b	Northern Utah Valley-west	Ditto
16c	Southern Utah Valley	Ditto
16d	Goshen Valley	Ditto
17	Heber Valley	Ditto
18	Duchesne River area	Unconsolidated and consolidated-rock deposits
19	Vernal area	Ditto
20	Sanpete Valley	Ditto
21	Juab Valley	Unconsolidated deposits
22	Central Sevier Valley	Ditto
23	Pahvant Valley	Unconsolidated and consolidated-rock deposits
24	Sevier Desert	Unconsolidated deposits
25	Snake Valley	Ditto
26	Escalante Valley, Milford area	Ditto
27	Beaver Valley	Ditto
28	Monticello area	Consolidated-rock deposits
29a	Spanish Valley	Unconsolidated and consolidated-rock deposits
29b	Upper Colorado River area	Ditto
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	Ditto
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
39	Wendover area	Ditto

Table 2. Number of wells constructed and estimated withdrawal of water from wells in Utah, 2014.

Area	Number in figure 1	Number of wells[1] constructed in 2014		Estimated withdrawal from wells, in acre-feet (rounded)					
				2014					
		Total	Diameter of 12 inches or more	Irrigation	Industrial[1]	Public supply[1]	Domestic and stock	Total	2013 total[2]
Curlew Valley	3	1	0	35,000	0	200	100	35,000	40,000
Cache Valley	5	27	1	11,000	5,500	8,900	2,000	27,000	38,000
East Shore area	9	3	0	4,000	4,000	29,400	3,000	40,000	49,000
Salt Lake Valley	10	6	4	600	[3] 41,200	80,800	22,000	145,000	153,000
Tooele Valley	12	18	0	[4, 5] 10,000	400	11,000	1,100	22,000	25,000
Utah and Goshen Valleys	16	28	2	31,200	10,300	53,000	12,400	107,000	[6] 115,000
Northern Utah Valley-east[7]	16a	(7)	(2)	(2,000)	(7,000)	(36,400)	(4,000)	(49,400)	(56,200)
Northern Utah Valley-west[7]	16b	(0)	(0)	(0)	(0)	(2,400)	(2,000)	(4,400)	(3,900)
Southern Utah Valley[7]	16c	(21)	(0)	(7,000)	(3,300)	(14,000)	(6,300)	(30,600)	(35,200)
Goshen Valley[7]	16d	(0)	(0)	(22,200)	(0)	(200)	(60)	(22,500)	[6] (19,500)
Juab Valley	21	6	0	28,000	100	[8] 720	470	29,000	27,000
Sevier Desert	24	9	1	43,900	7,100	1,500	890	53,000	[6] 46,000
Central Sevier Valley	22	9	0	26,600	60	3,200	840	31,000	28,000
Pahvant Valley	23	3	1	117,000	0	800	320	118,000	103,000
Cedar Valley, Iron County	32	8	1	32,600	100	7,700	2,400	43,000	39,000
Parowan Valley	31	4	3	[9] 35,600	1,400	440	350	38,000	32,000
Escalante Valley									
Milford area	26	5	3	45,700	[10] 20,700	730	130	67,000	68,000
Beryl-Enterprise area	33	21	7	97,500	[11] 4,100	570	650	103,000	93,000
Central Virgin River area	34	2	0	6,800	570	21,000	2,400	31,000	29,000
Other areas[12, 13]		198	9	71,400	33,300	47,600	6,500	159,000	145,000
Total (rounded)		348	32	596,900	128,800	267,600	55,600	1,048,000	[6] 1,030,000

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

[2] From Burden and others (2014, table 2).

[3] Includes some use for air conditioning, about 2,700 acre-feet, of which about 92 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-east, Northern Utah Valley-west, 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 18,000 acre-feet for geothermal power generation, of which about 99 percent was injected back into the aquifer.

[11] Includes 2,810 acre-feet for heating greenhouses, of which 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 (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, 2004–2013.

Area	Number in figure 1	Thousands of acre-feet[1] (rounded)											
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2004–2013 average (rounded)	2014
Curlew Valley	3	38	29	31	38	44	34	39	32	42	40	37	35
Cache Valley	5	27	29	31	36	34	31	33	30	38	38	33	27
East Shore area	9	46	41	46	52	54	46	43	37	46	49	46	40
Salt Lake Valley	10	125	110	131	151	135	137	140	126	167	153	138	145
Tooele Valley	12	21	[2] 18	[2] 21	[2] 27	[2] 28	25	24	21	30	25	24	22
Utah and Goshen Valleys	16	[2] 105	[2] 87	[2] 99	126	[2] 120	[2] 105	[2] 106	[2] 90	[2] 113	[2] 115	107	107
Northern Utah Valley[3]	16a,b	[2] (66)	[2] (46)	(58)	(72)	[2] (67)	[2] (60)	[2] (58)	[2] (45)	[2] (62)	(60)	(59)	(54)
Southern Utah Valley[3]	16c	(30)	(31)	(29)	(38)	(34)	(30)	(31)	(28)	[2] (35)	(35)	(32)	(31)
Goshen Valley[3]	16d	(9)	(10)	(12)	(16)	(19)	(15)	(17)	(17)	[2] (16)	[2] (20)	(15)	(22)
Juab Valley	21	26	14	21	26	26	21	22	15	28	27	23	29
Sevier Desert	24	41	24	20	34	44	48	46	20	24	[2] 46	35	53
Central Sevier Valley	22	15	17	16	19	24	27	26	31	28	28	23	31
Pahvant Valley	23	85	80	86	89	94	104	106	89	114	103	95	118
Cedar Valley, Iron County	32	40	30	35	40	40	38	38	34	40	39	37	43
Parowan Valley	31	37	27	33	34	38	37	34	32	38	32	34	38
Escalante Valley													
Milford area	26	44	40	45	49	51	56	62	53	67	68	54	67
Beryl-Enterprise area	33	98	68	79	92	93	93	90	84	91	93	88	103
Central Virgin River area	34	26	29	32	33	29	33	29	28	29	29	30	31
Other areas		129	111	130	155	144	130	134	123	156	145	136	159
Total (rounded)		[2] 903	[2] 754	[2] 856	[2] 1,001	[2] 998	[2] 965	[2] 972	[2] 845	[2] 1,051	[2] 1,030	940	1,048

[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. Birken

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.

The principal source of water in Curlew Valley is groundwater. The groundwater reservoir consists primarily 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 2014 was about 35,000 acre-feet, which is 5,000 acre-feet less than the value for 2013 and 2,000 acre-feet less than the average annual withdrawal for 2004–2013 (tables 2 and 3).

The location of wells in Curlew Valley in which the water level was measured during March 2015 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 (62 miles northwest of Snowville), 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 (62 miles northwest of Snowville) in 2014 was about 16.0 inches, which is 7.2 inches more than in 2013 and 5.0 inches more than the average annual precipitation for 1930–2014.

Water levels in Curlew Valley generally declined from March 2014 to March 2015. The largest decline, about 1.7 feet, occurred in a well about 4 miles west of Snowville. These declines are most likely the result of large localized withdrawals for irrigation.

Water levels declined from March 1985 to March 2015 in all areas of Curlew Valley for which data are available (fig. 4). The largest decline, more than 87 feet, occurred in a well about 4 miles west of Snowville. Declines are probably the result of continued large withdrawals for irrigation.

The concentration of dissolved solids in water samples collected from well (B-12-11)8abb-1, located 3 miles north of Kelton, and well (B-14-9)5bbb-1, located 10 miles west of Snowville, from 1972–2014 and 1971–2014, respectively, is shown in figure 3. The dissolved-solids concentration in water from well (B-12-11)8abb-1 increased substantially from July 2013 to June 2014; the 2014 concentration is the maximum on record (4,790 mg/L). Dissolved-solids concentrations in water from both wells have generally increased since the early 1970s.

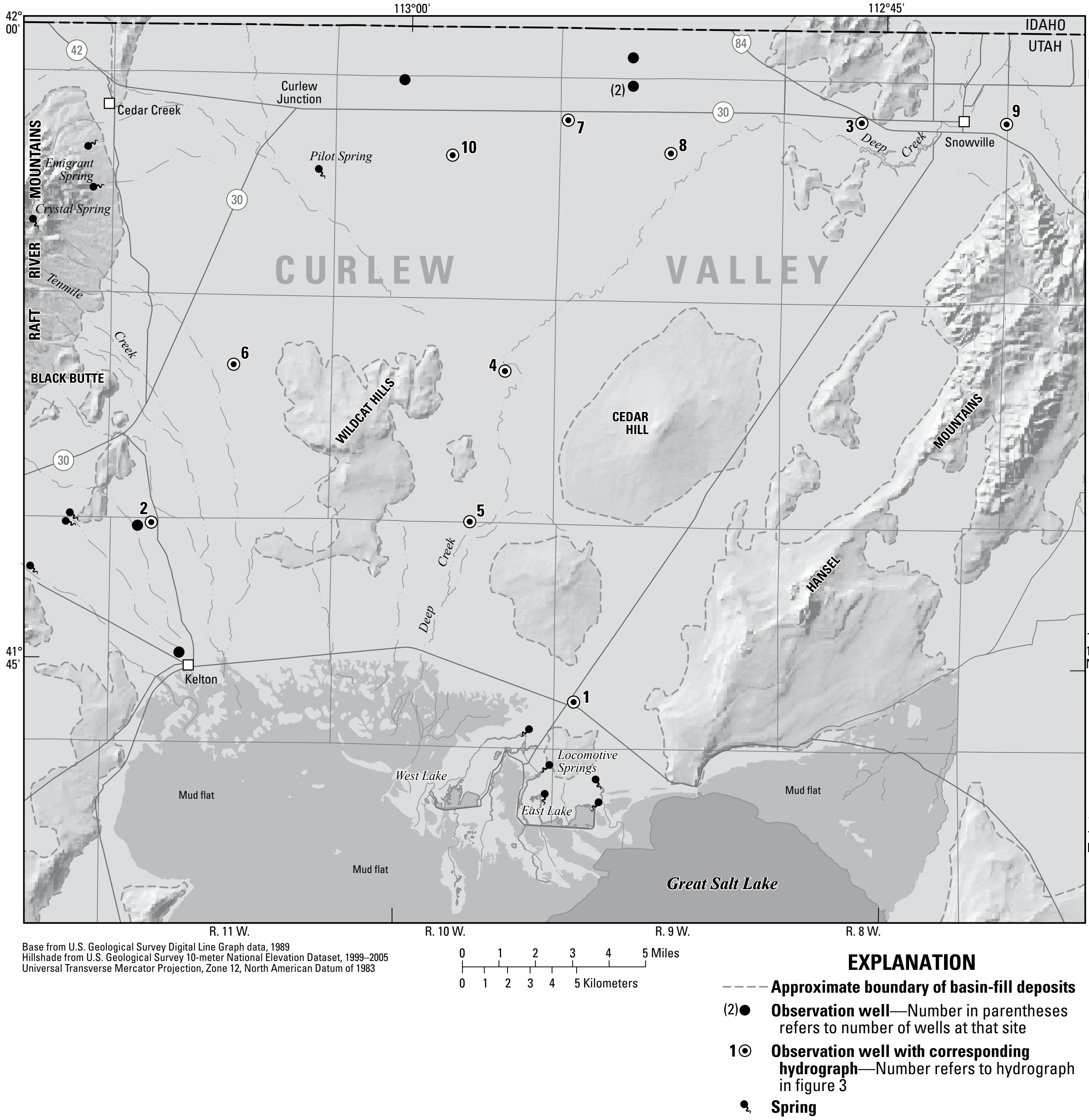


Figure 2. Location of wells in Curlew Valley in which the water level was measured during March 2015.

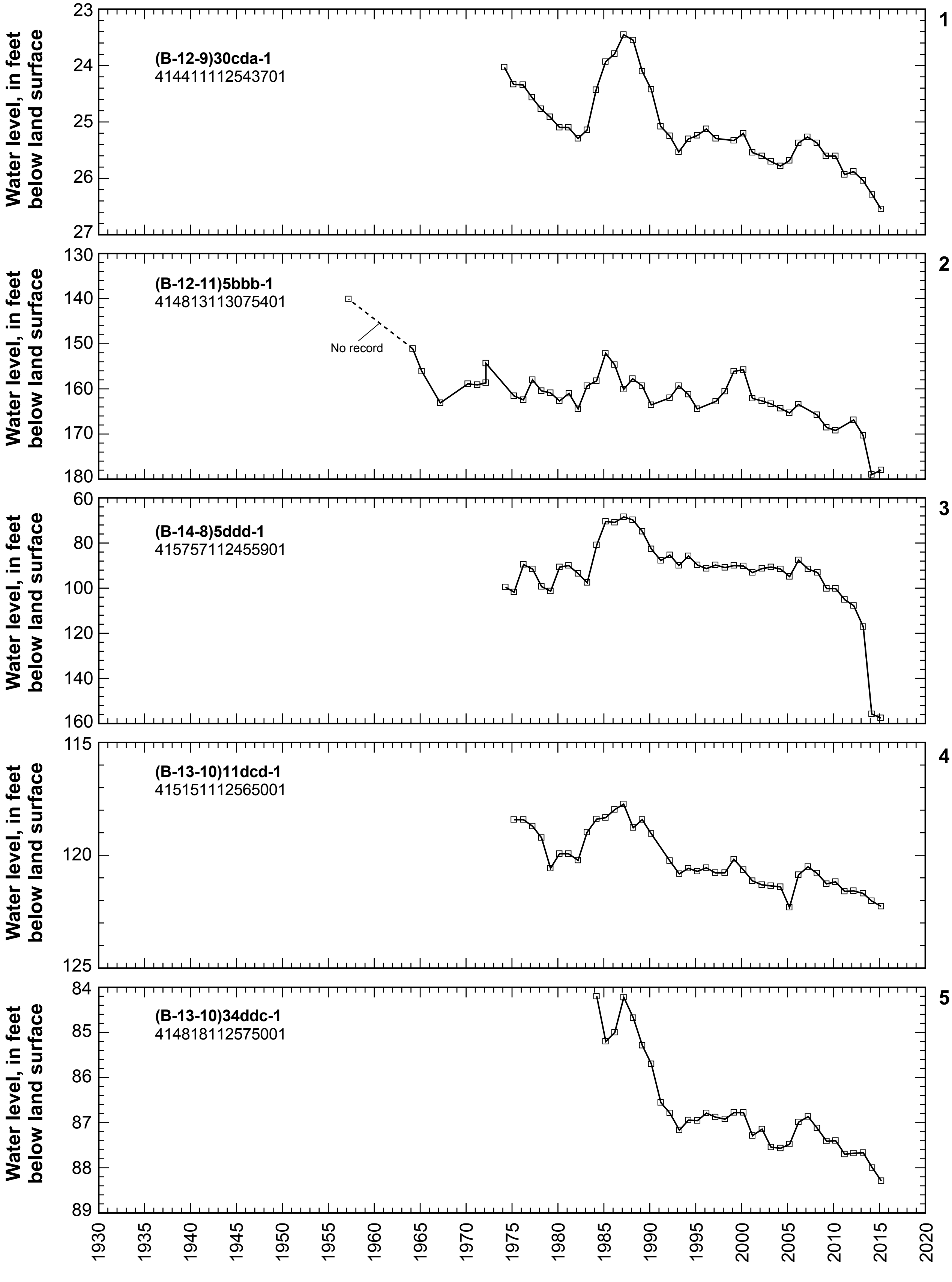


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

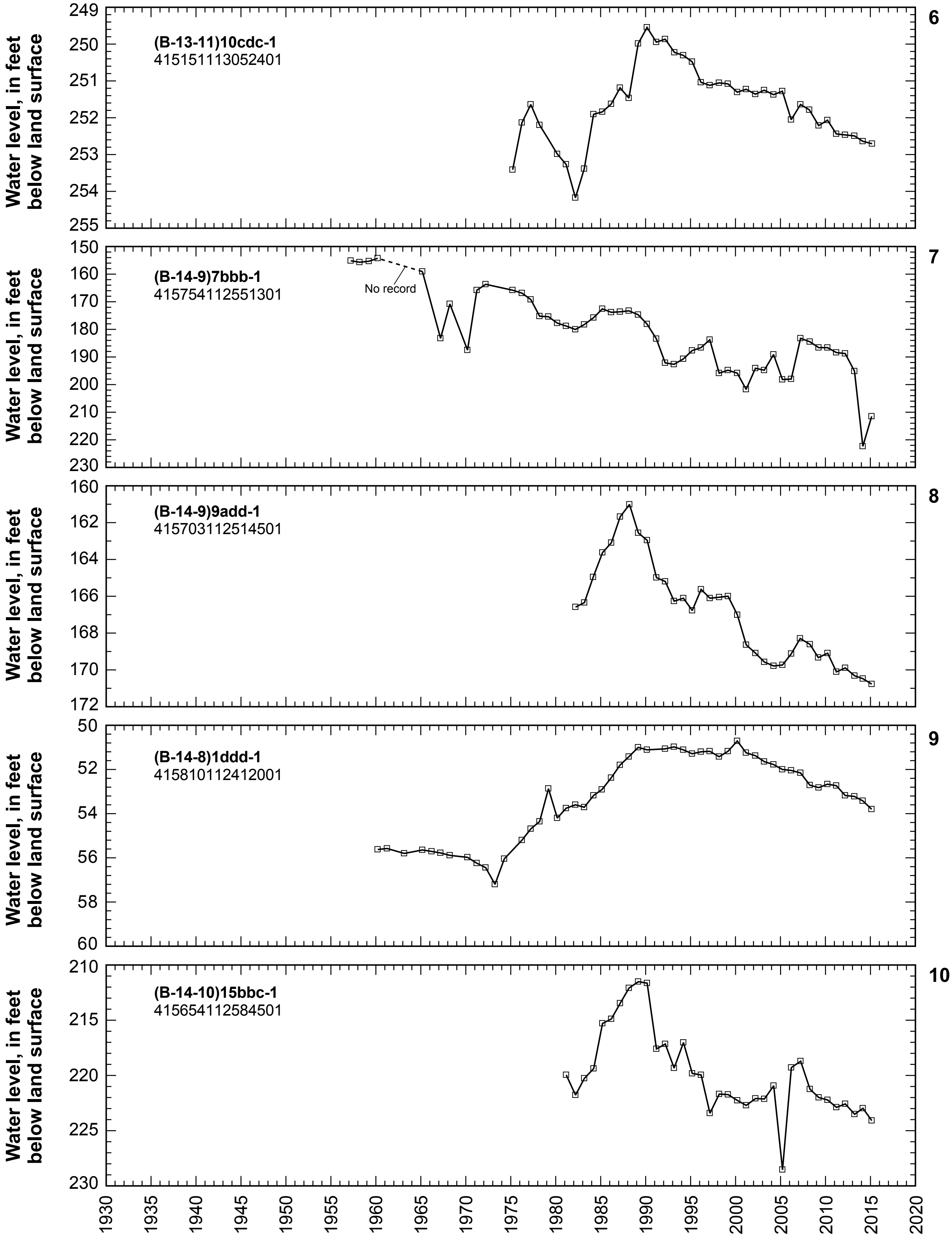


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

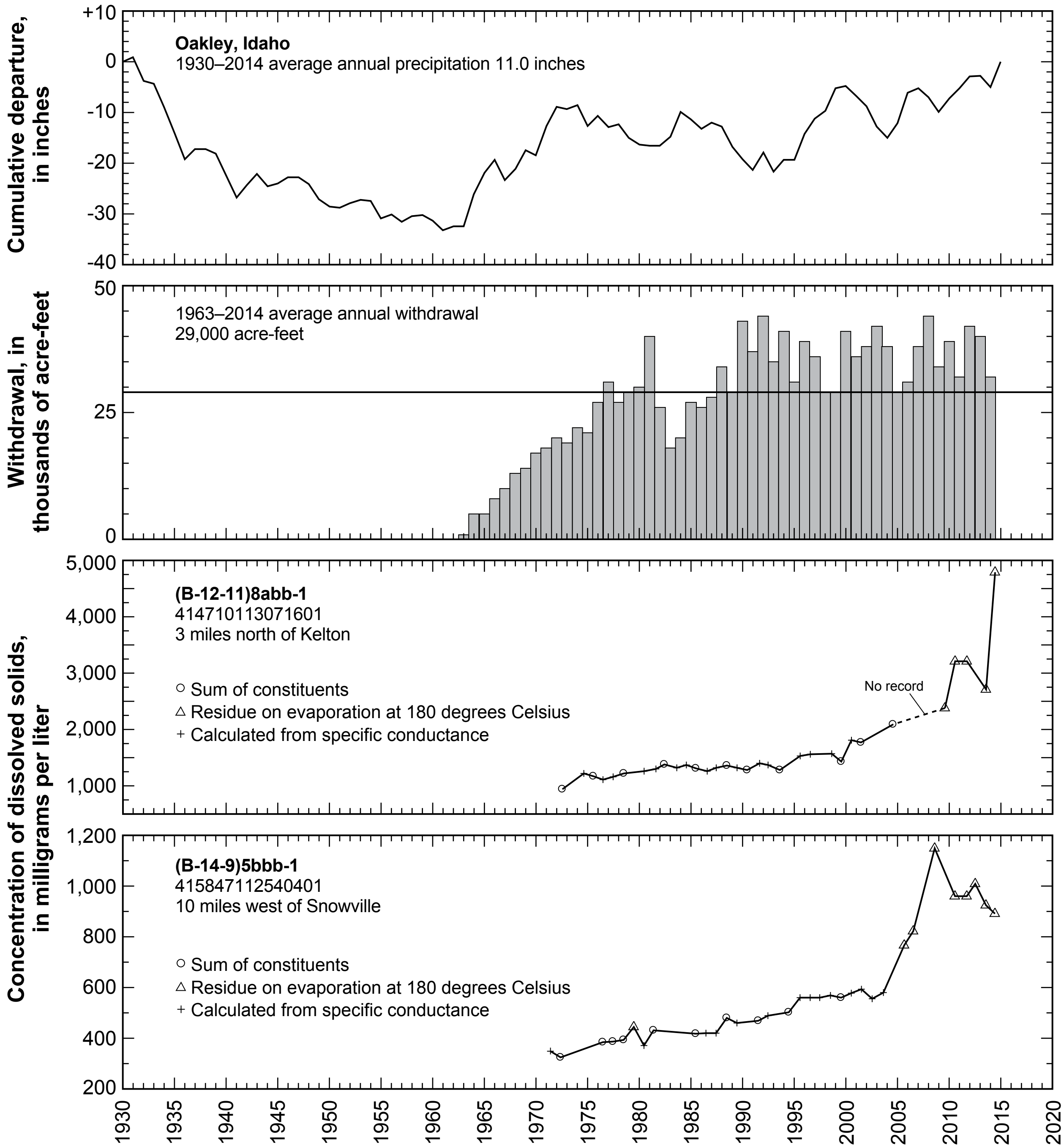


Figure 3. Relation of water level in selected wells in Curlew Valley to cumulative departure from average annual precipitation at Oakley, Idaho, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

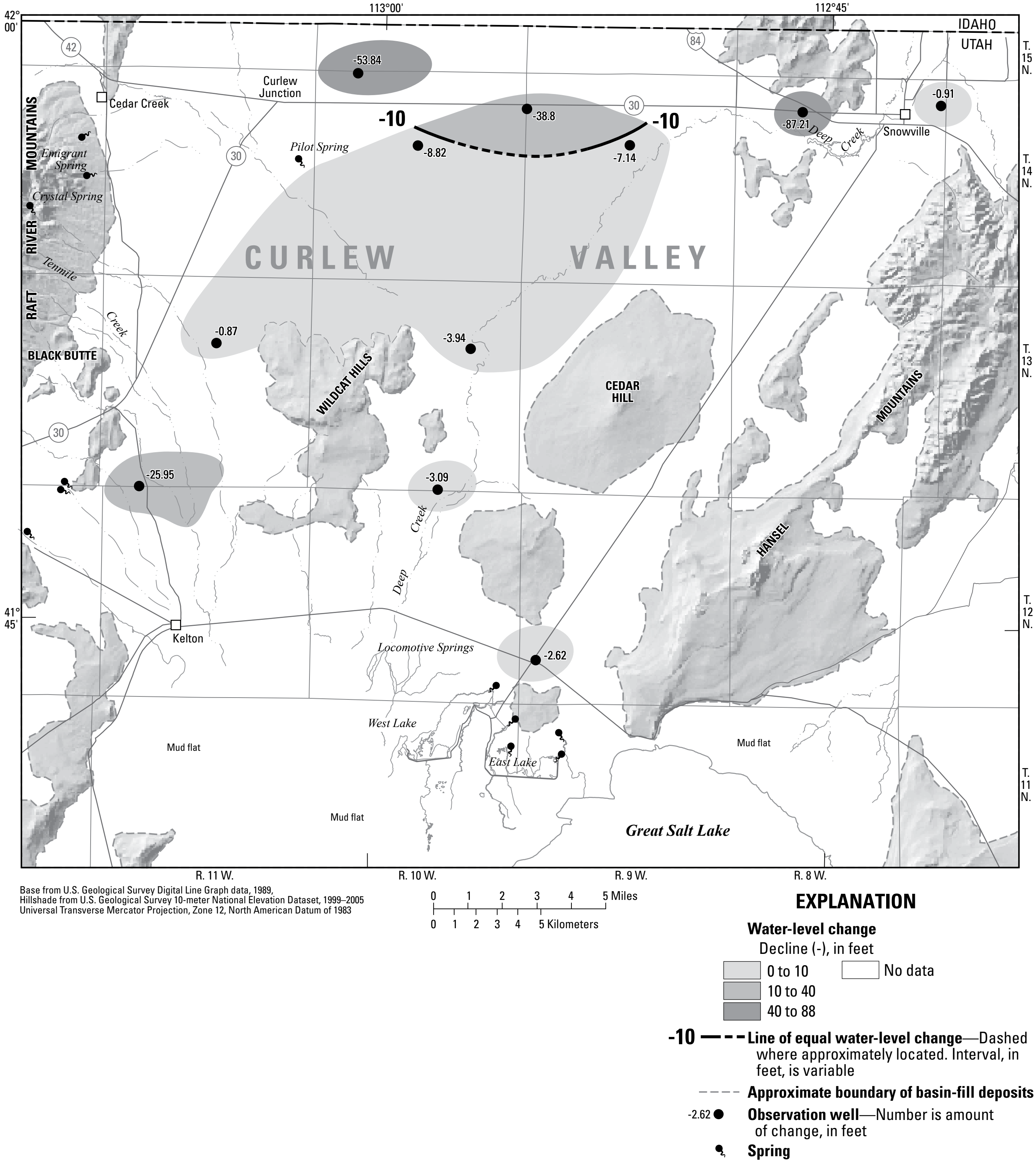


Figure 4. Water-level change in Curlew Valley from March 1985 to March 2015.

Cache Valley

By John P. Carricaburu

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. 5). 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 2014 was about 27,000 acre-feet, which is 11,000 acre-feet less than in 2013 and 6,000 acre-feet less than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal for irrigation was 11,000 acre-feet, of which an estimated 9,000 acre-feet was from flowing wells. Irrigation withdrawals were 6,500 acre-feet less than in 2013. Withdrawal for public supply was 8,900 acre-feet, which is 4,200 acre-feet less than in 2013.

The location of wells in Cache Valley in which the water level was measured during March 2015 is shown in figure 5. 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 6.

Total discharge of the Logan River (combined flow from the Logan River above State Dam and Cache Highline Canal, near Logan) during 2014 was about 144,200 acre-feet, which is 42,200 acre-feet more than the 2013 total and 34,800 acre-feet less than the 1941–2014 average annual discharge. Precipitation at Logan, Utah State University, was about 19.2 inches in 2014. This is about 7.4 inches more than for 2013 and about 1.0 inch more than the average annual precipitation for 1930–2014.

Water levels throughout the valley generally rose from March 2014 to March 2015. Rises are probably the result of greater-than-average precipitation and less-than-average withdrawals. 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.

Water levels declined from March 1985 to March 2015 in most parts of Cache Valley for which data are available (fig. 7). The largest decline, about 12.4 feet, occurred in a well northeast of Hyrum. Declines are probably the result of continued large withdrawals.

The concentration of dissolved solids in water samples collected during 1970 to 2014 from well (A-13-1)29bcd-1, located 1.5 miles west of Smithfield, is shown in figure 6. The concentration has ranged from 215 to 278 mg/L, with a median value of 258 mg/L. The dissolved-solids concentration from the August 2014 sample was the lowest on record.

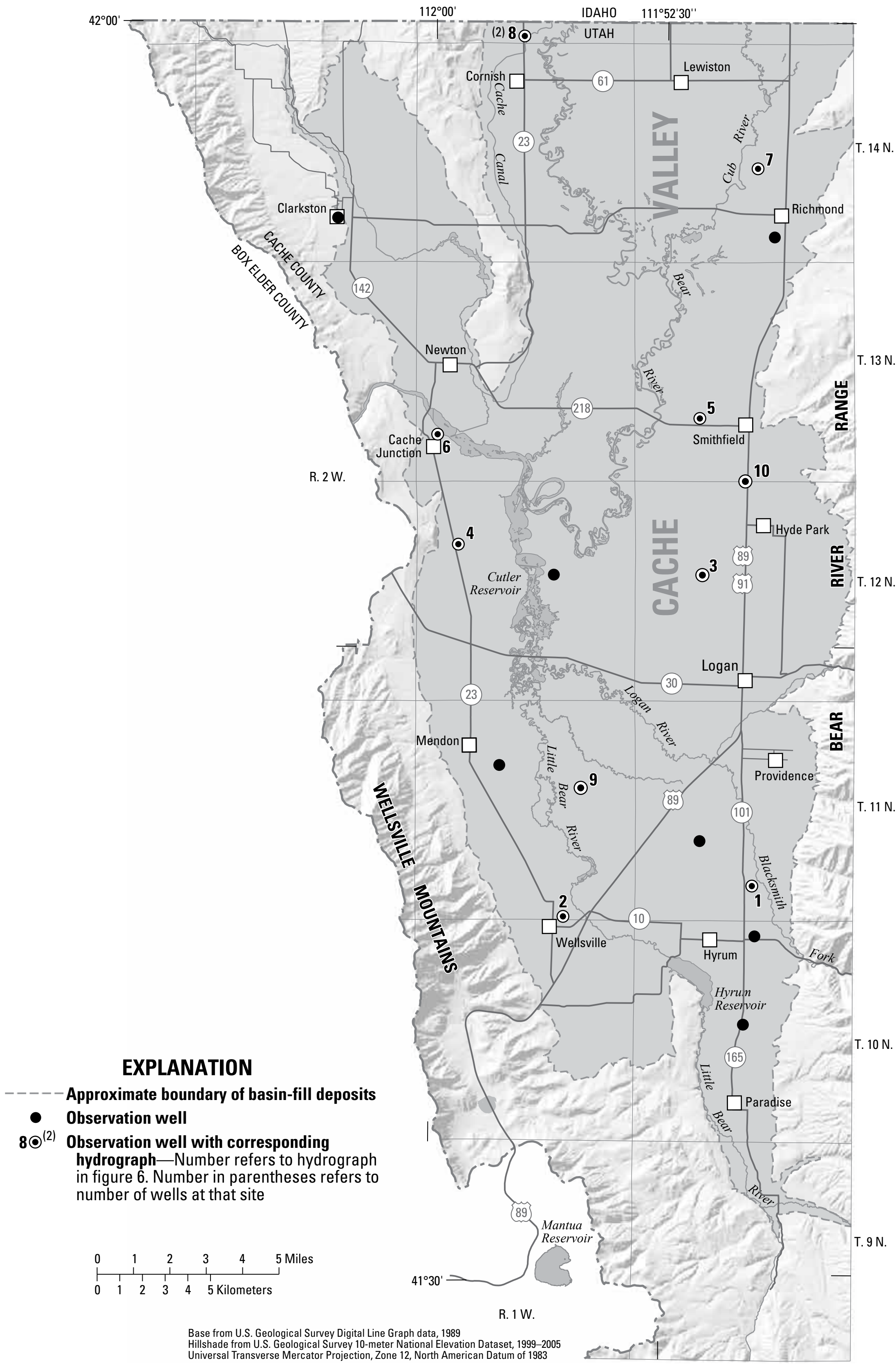


Figure 5. Location of wells in Cache Valley in which the water level was measured during March 2015.

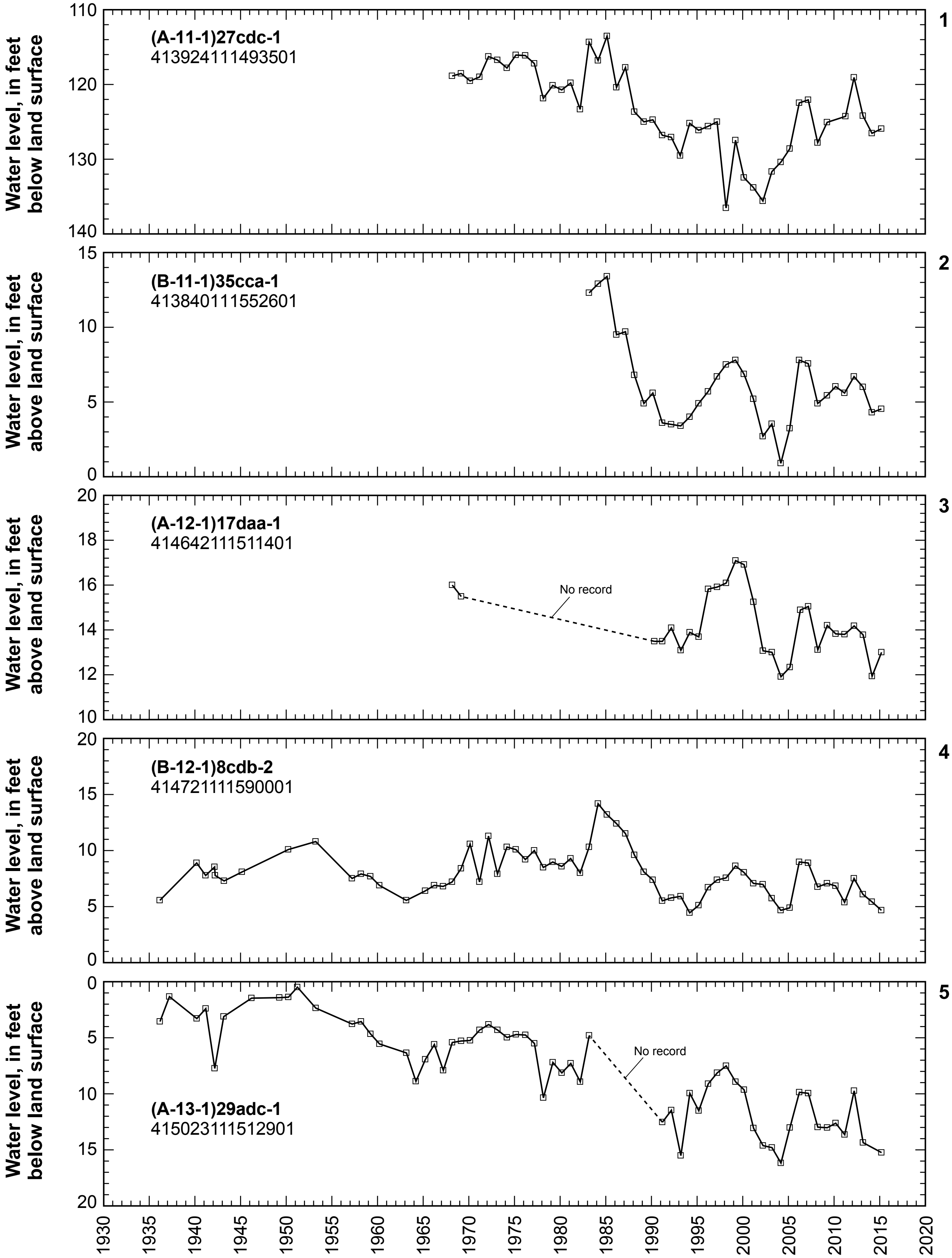


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.

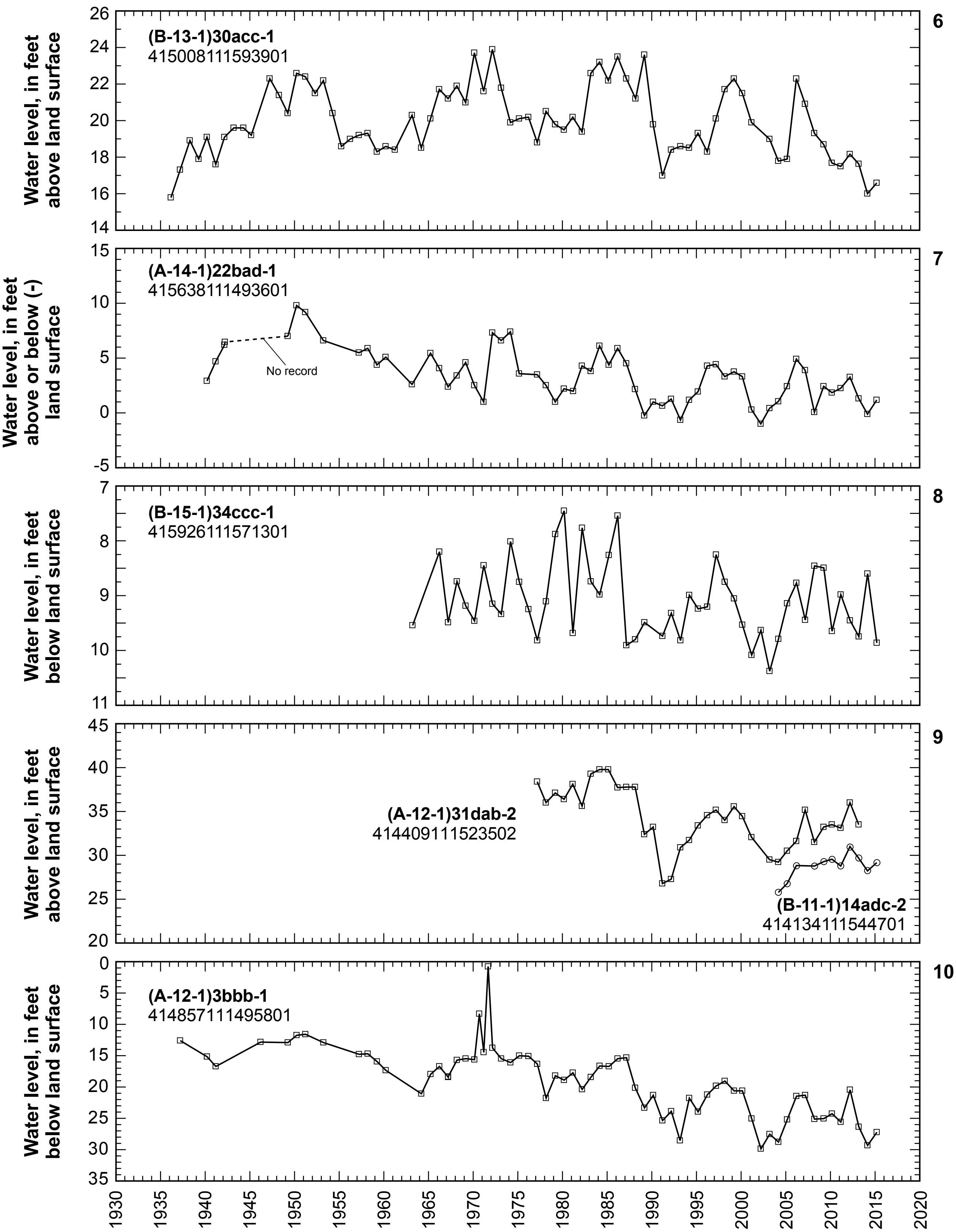


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.—Continued

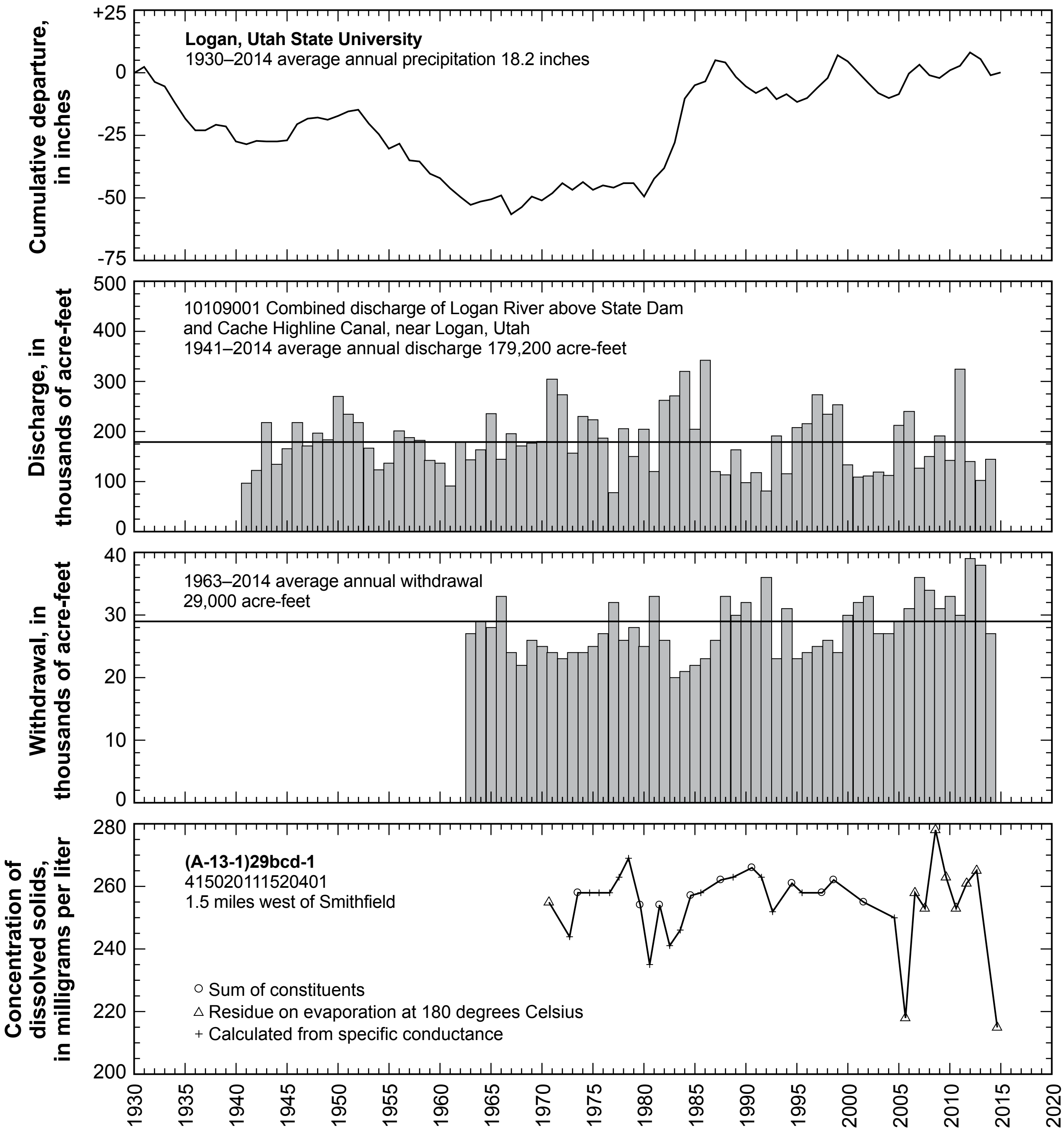


Figure 6. Relation of water level in selected wells in Cache Valley to total annual discharge of the Logan River near Logan, to cumulative departure from average annual precipitation at Logan, Utah State University, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (A-13-1)29bcd-1.—Continued

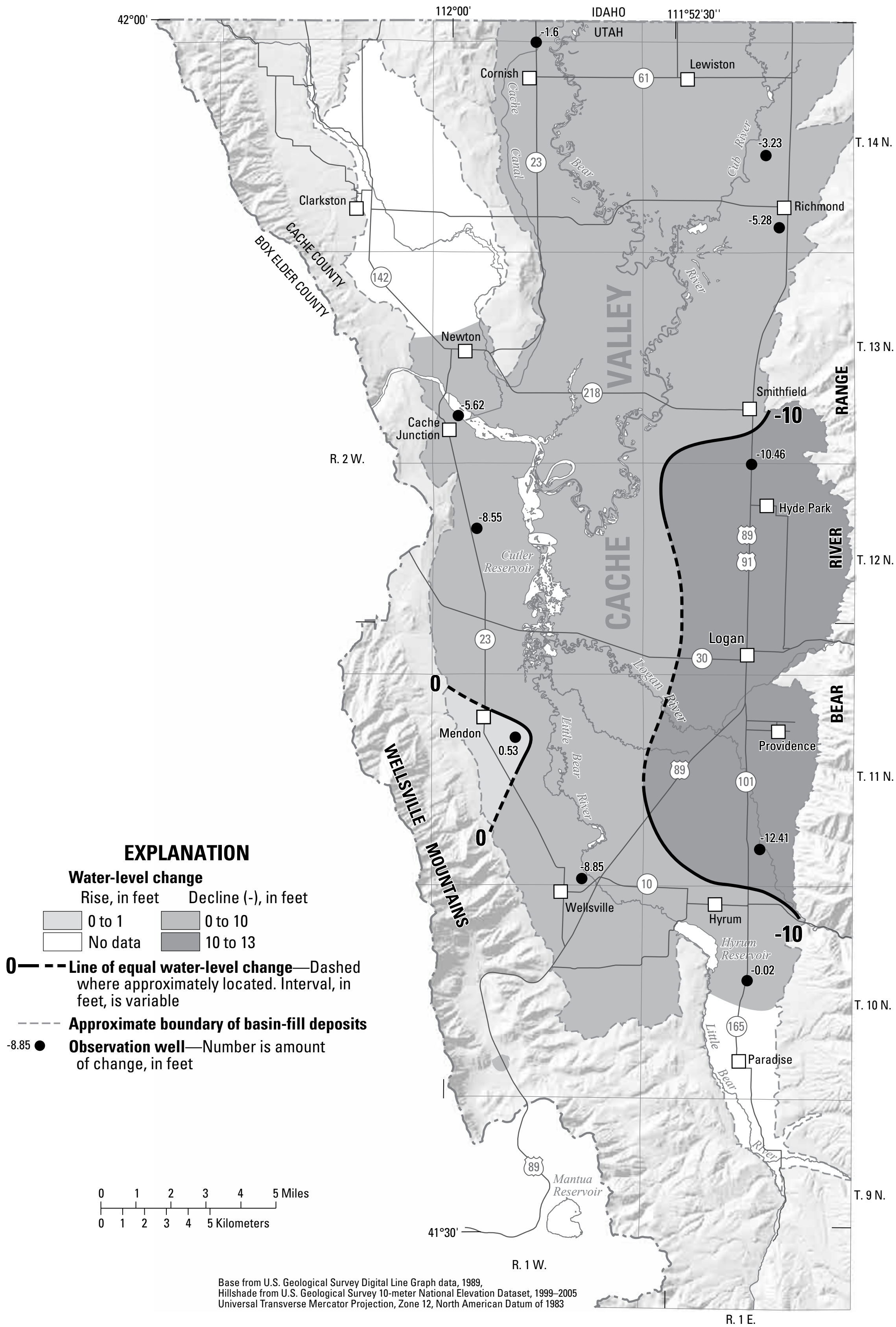


Figure 7. Water-level change in Cache Valley from March 1985 to March 2015.

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. 8). 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 2014 was about 40,000 acre-feet, which is 9,000 acre-feet less than was reported for 2013 and 6,000 acre-feet less than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal for public supply was 29,400 acre-feet in 2014, about 4,300 acre-feet less than in 2013. Withdrawal for irrigation was about 4,000 acre-feet, which is 2,800 acre-feet less than was reported for 2013. Withdrawal for industrial use was also about 4,000 acre-feet, which is 700 acre-feet more than in 2013.

The location of wells in the East Shore area in which the water level was measured during March 2015 is shown in figure 8. 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 9.

Precipitation at Pineview Dam in 2014 was about 31.2 inches, which is about 0.7 inch more than the average annual precipitation for 1949–2014 and about 12.5 inches more than in 2013.

Water levels declined from March 2014 to March 2015 in most of the wells measured in the East Shore area. Declines are probably due to continued large withdrawals for public-supply use. Water levels have generally declined since the mid-1980s in wells south of Kaysville and have generally declined since the mid-1950s in wells north of Kaysville.

Water levels declined from March 1985 to March 2015 in all areas of the East Shore area for which data are available (fig. 10). The largest decline, more than 36 feet, occurred in a well in the Bountiful area. Declines are probably the result of continued large withdrawals.

The concentration of dissolved solids in water samples collected from well (B-4-2)27aba-1, located 2.3 miles south-southeast of Syracuse, from 1969 to 2014, is shown in figure 9. The median concentration during this period was 393 mg/L. From 1969 to 1993, dissolved-solids concentrations in water samples ranged from 287 to 633 mg/L. Dissolved-solid concentrations in water samples collected from 1995 to 2014 were much less variable, ranging from 362 to 399 mg/L. The dissolved-solids concentration in the water sample collected in June 2014 (388 mg/L) was similar to the median concentration.

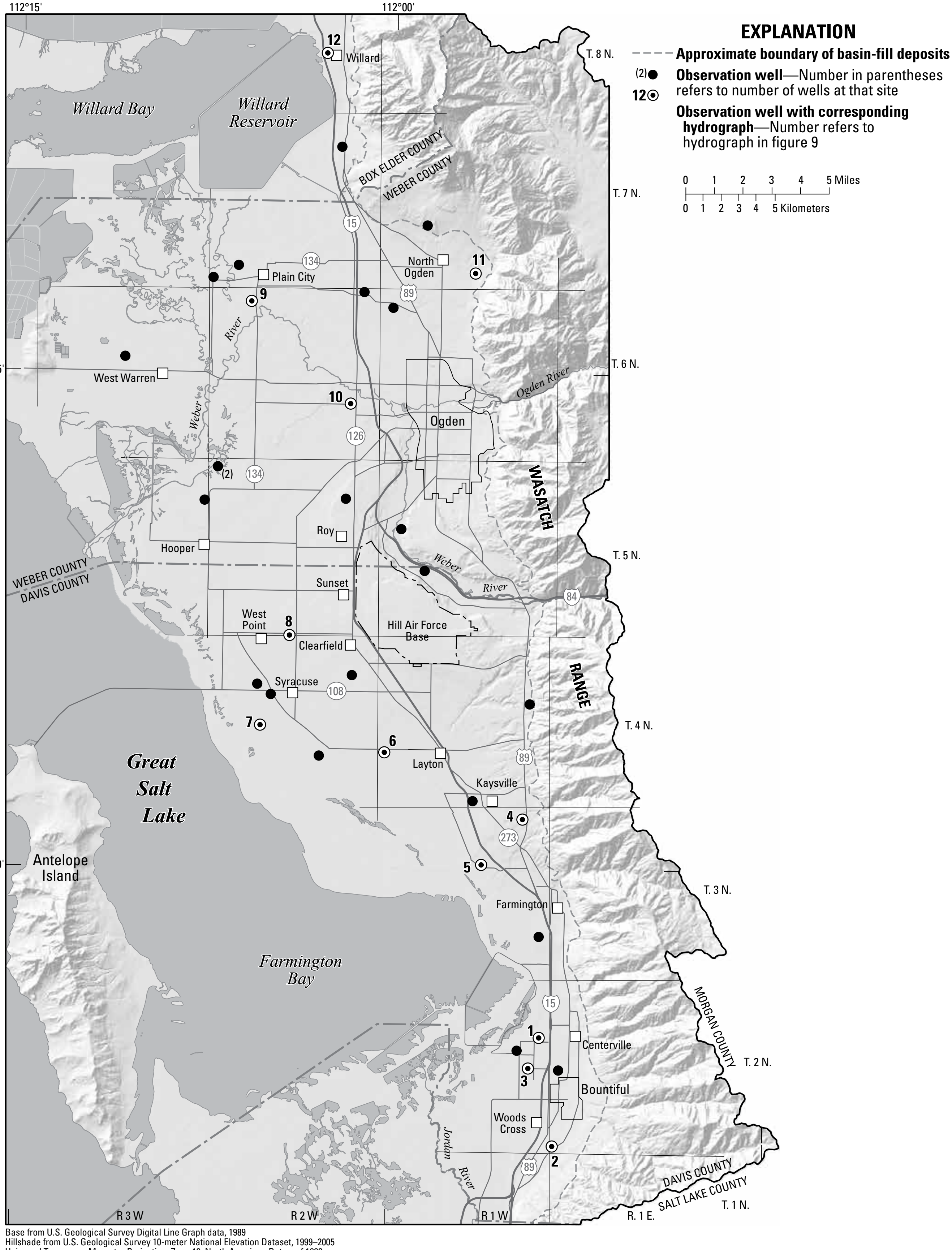


Figure 8. Location of wells in the East Shore area in which the water level was measured during March 2015.

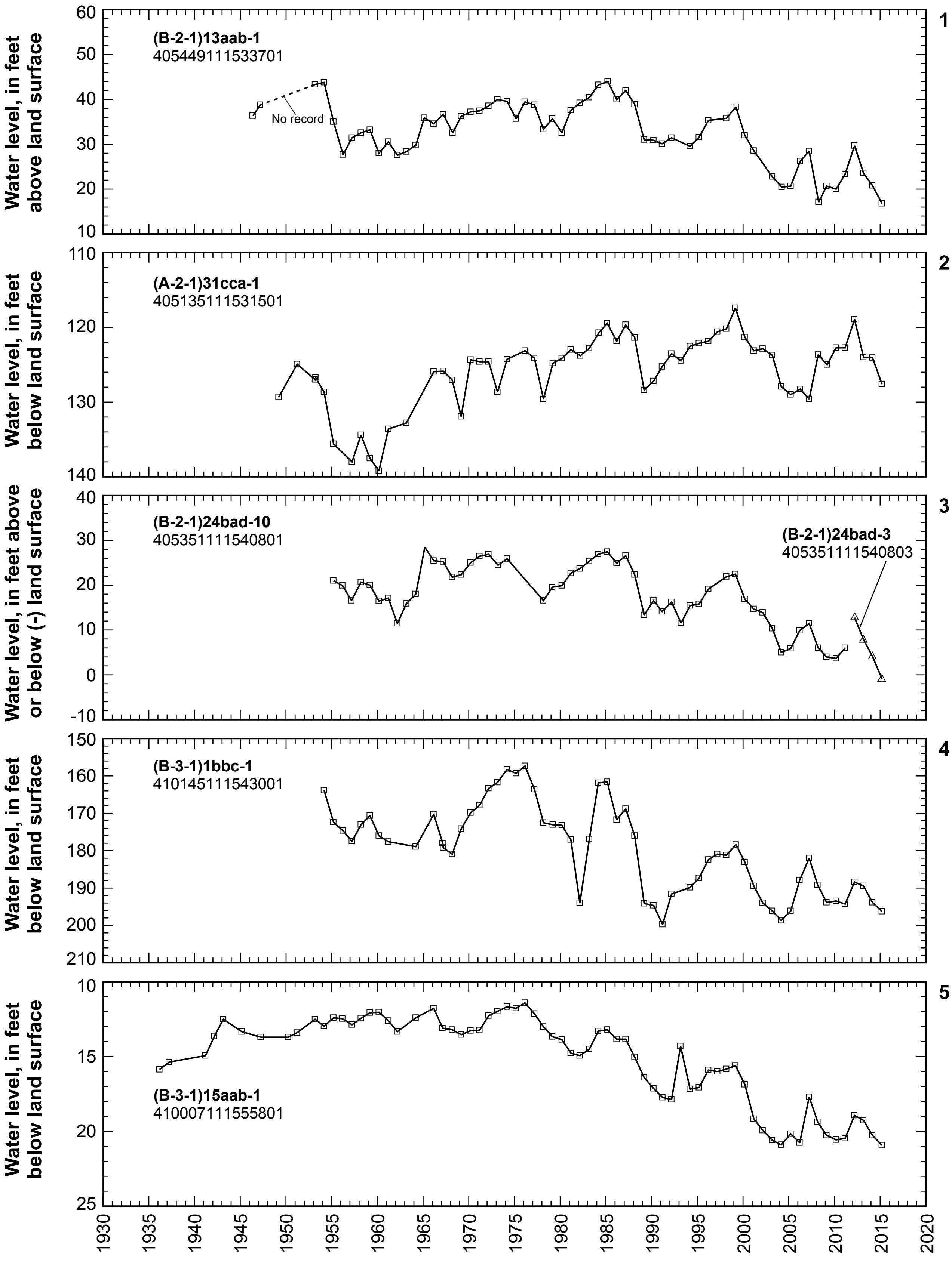


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.

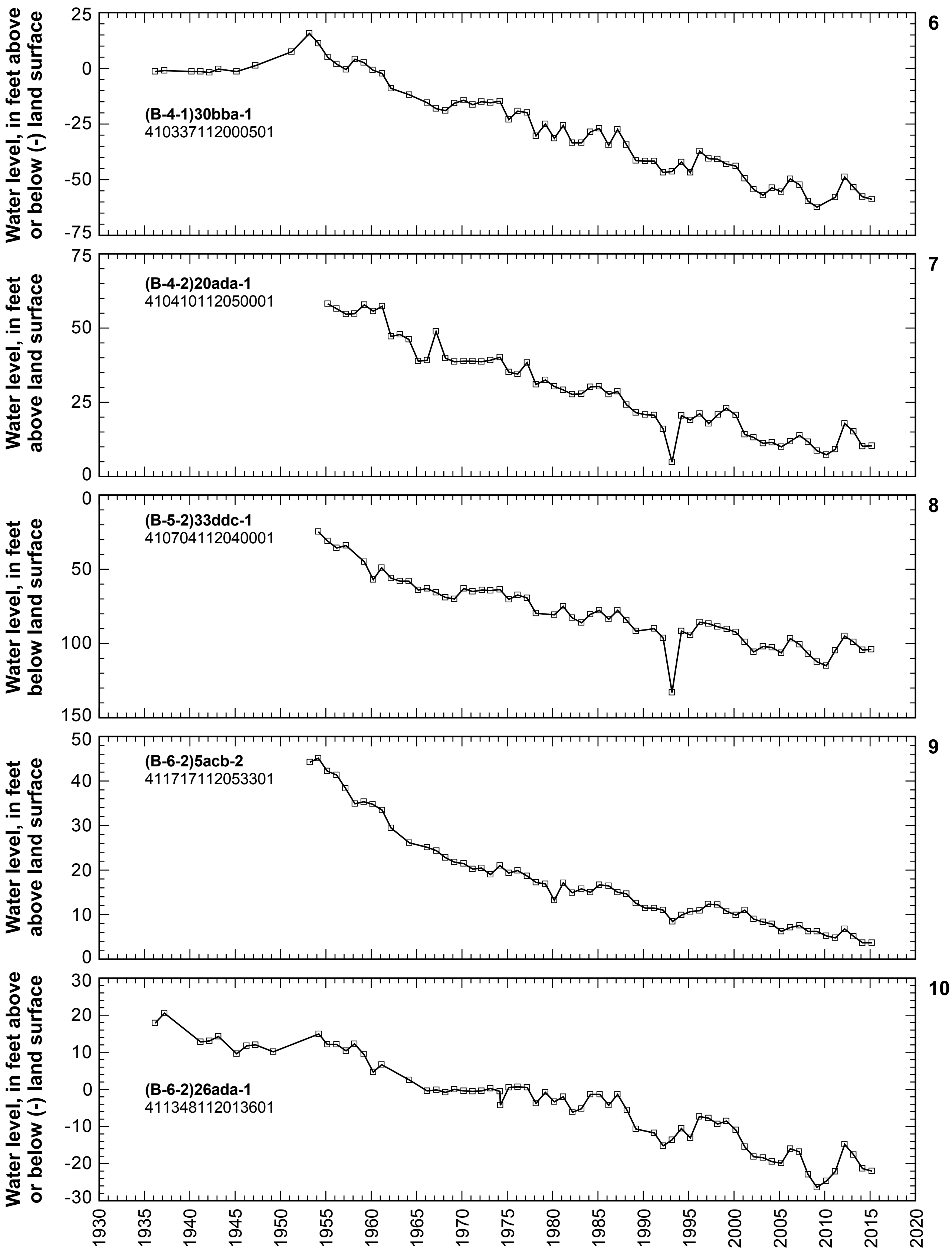


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.—Continued

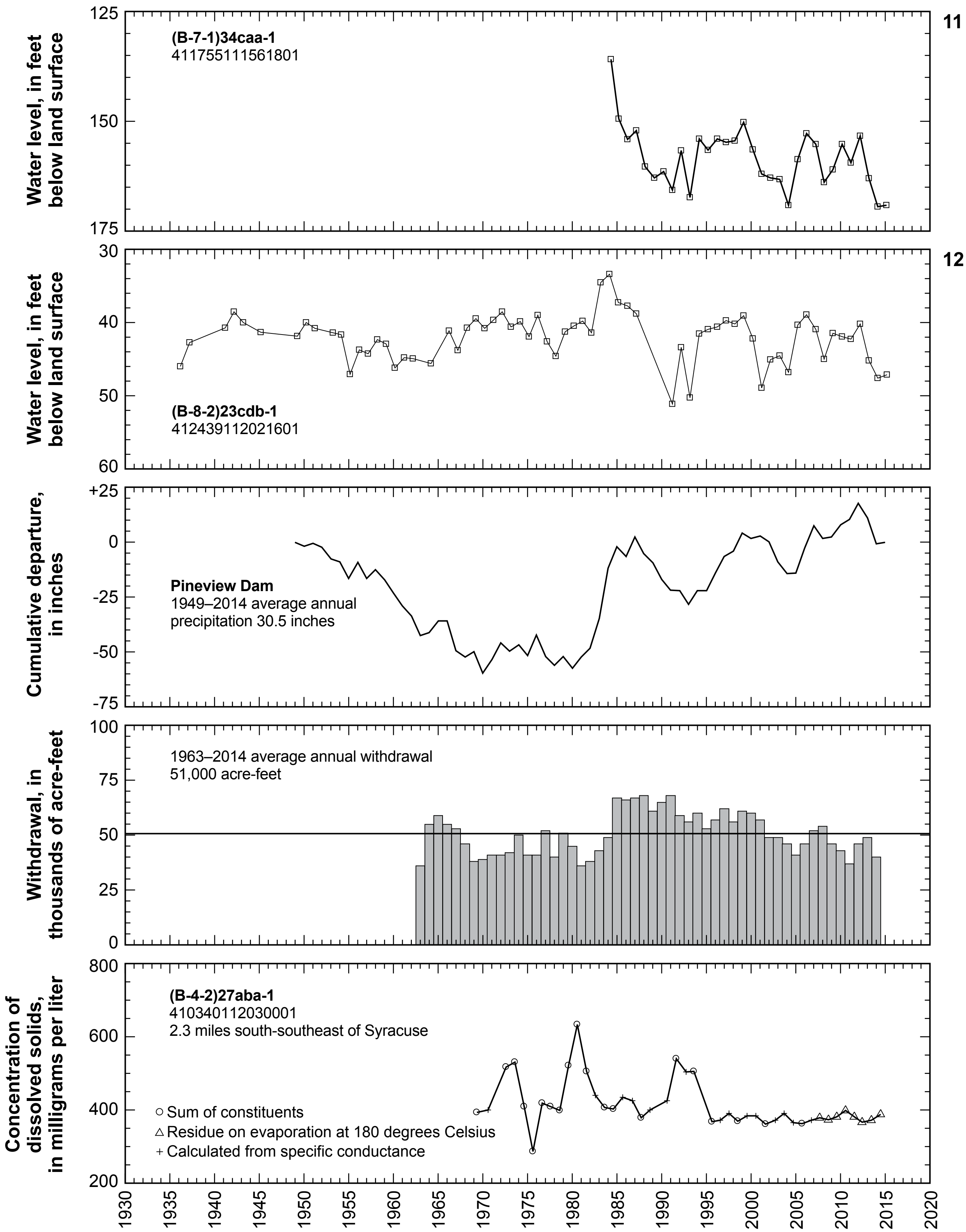
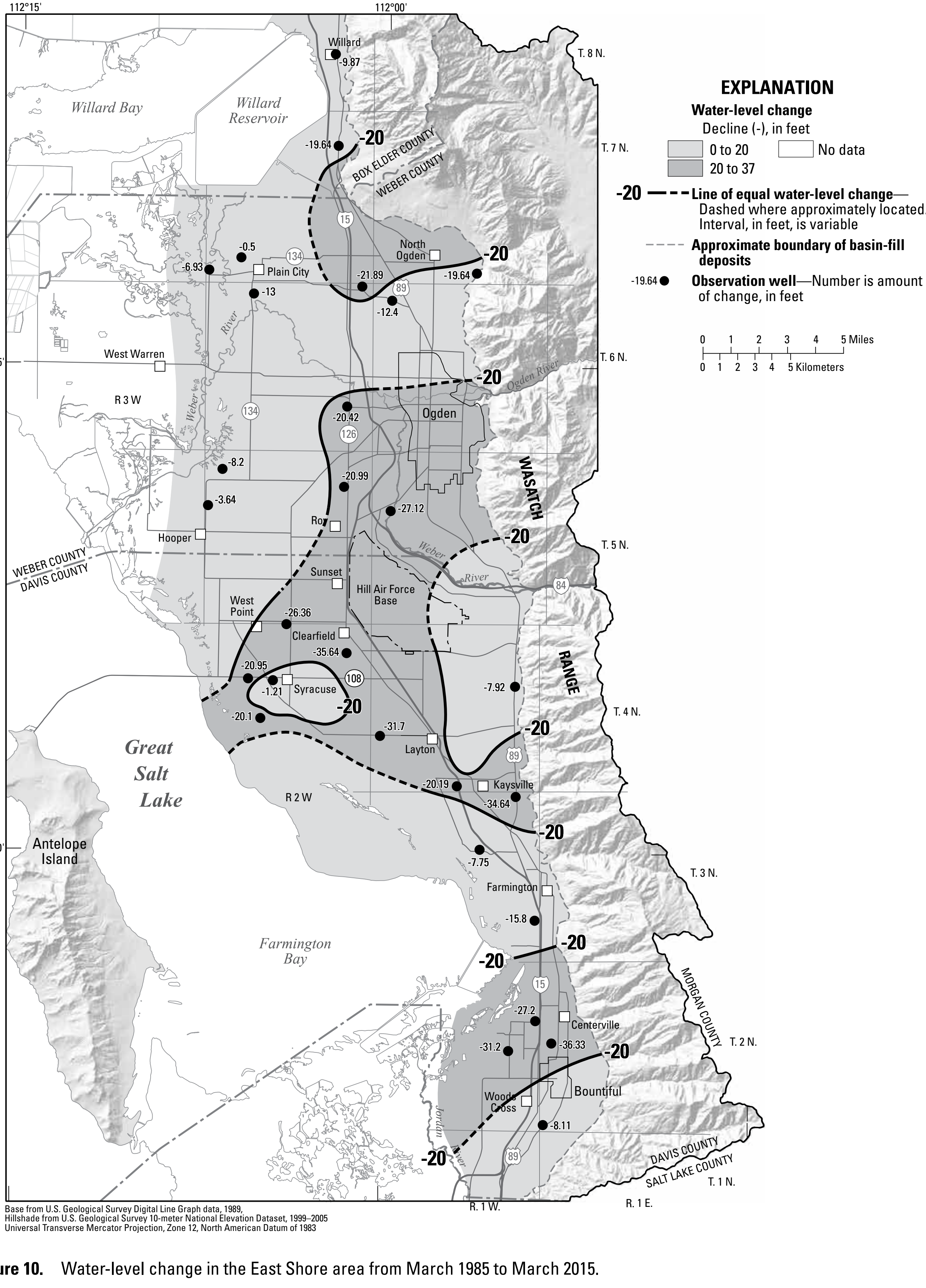


Figure 9. Relation of water level in selected wells in the East Shore area to cumulative departure from average annual precipitation at Pineview Dam, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (B-4-2)27aba-1.—Continued



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 10. Water-level change in the East Shore area from March 1985 to March 2015.

Salt Lake Valley

By V. Noah Derrick

Salt Lake Valley covers about 400 square miles between the Wasatch Range and the Oquirrh and Traverse Mountains in Salt Lake County (fig. 11). 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 2014 was about 145,000 acre-feet, which is 8,000 acre-feet less than in 2013 and 7,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal for public supply was about 80,800 acre-feet, which is 10,800 acre-feet less than the total for 2013. Withdrawal for industrial use was about 41,200 acre-feet, which is 2,300 acre-feet more than the total for 2013.

The location of wells in Salt Lake Valley in which the water level was measured during February 2015 is shown in figure 11. 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) are shown in figure 12. Precipitation at Salt Lake City during 2014 was about 14.5 inches, about 2.8 inches more than in 2013 and about 0.7 inch less than the average annual precipitation for 1931–2014.

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 13. Precipitation at Silver Lake Brighton was about 44.0 inches in 2014, which is about 12.7 inches more than in 2013 and about 1.7 inches more than the average annual precipitation for 1931–2014.

Water levels declined from February 2014 to February 2015 in most of the wells measured in Salt Lake Valley. Declines are probably the result of continued large withdrawals for public supply and industrial use. 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.

Water levels in the principal aquifer declined from February 1985 to February 2015 in all areas where data are available (fig. 14). The largest decline, more than 38 feet, occurred in a well southwest of Holladay. Declines are probably the result of continued large withdrawals for public supply and industrial use.

The concentrations of dissolved solids and dissolved chloride (from 1931–2014 and 1935–2014, 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 13. The concentration of dissolved solids has ranged from 554 to 879 mg/L with a median value of 706 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 June 2014, 805 mg/L, increased slightly (17 mg/L) from June 2013, but overall, decreased from the value of 874mg/L in 2012. The dissolved chloride concentration generally increased from 52 mg/L in July 1935 to 193 mg/L in June 2014, with a median value of 120 mg/L.

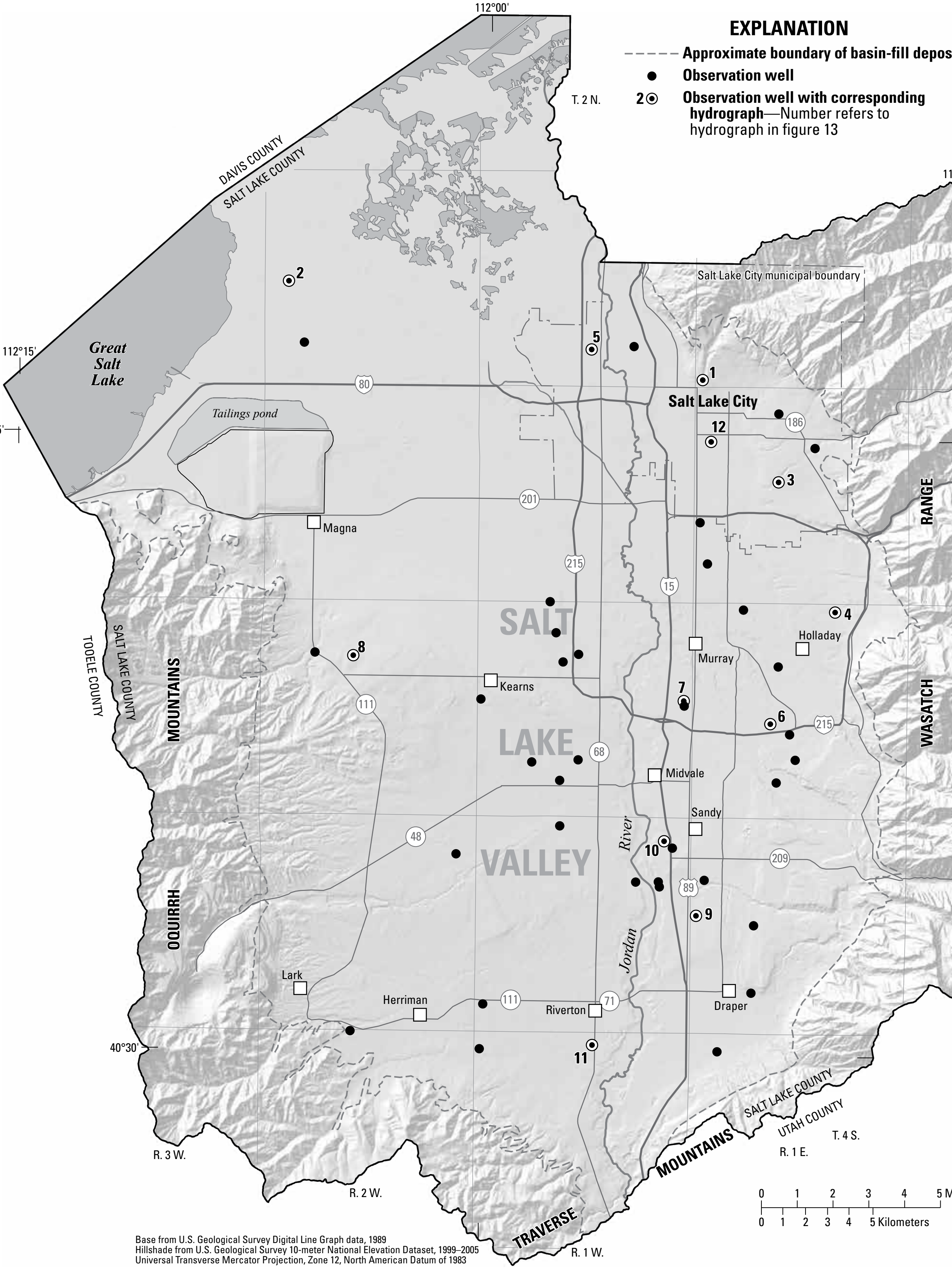


Figure 11. Location of wells in Salt Lake Valley in which the water level was measured during February 2015.

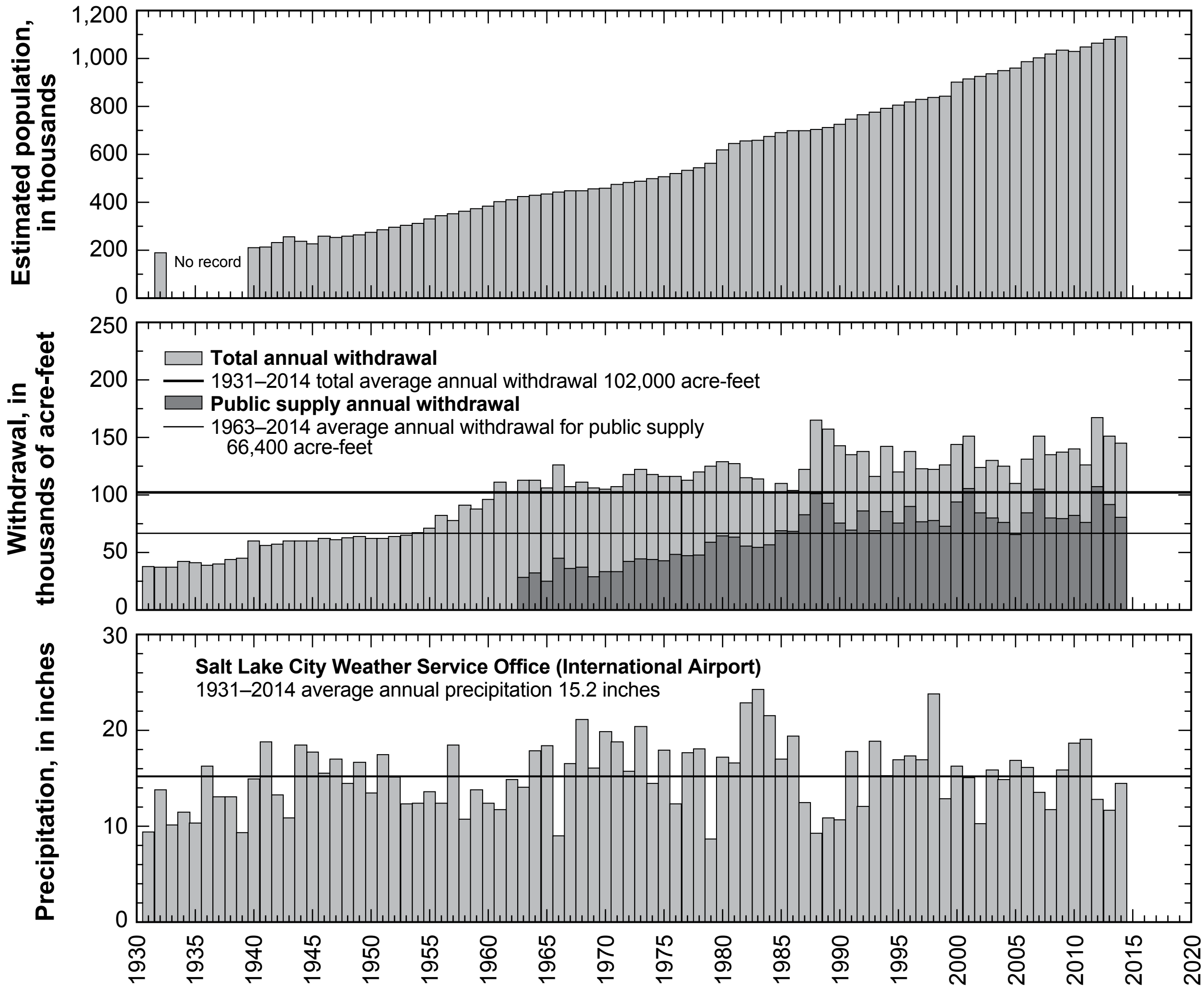


Figure 12. Estimated population of Salt Lake County, total annual withdrawal from wells, annual withdrawal for public supply, and average annual precipitation at Salt Lake City Weather Service Office (International Airport).

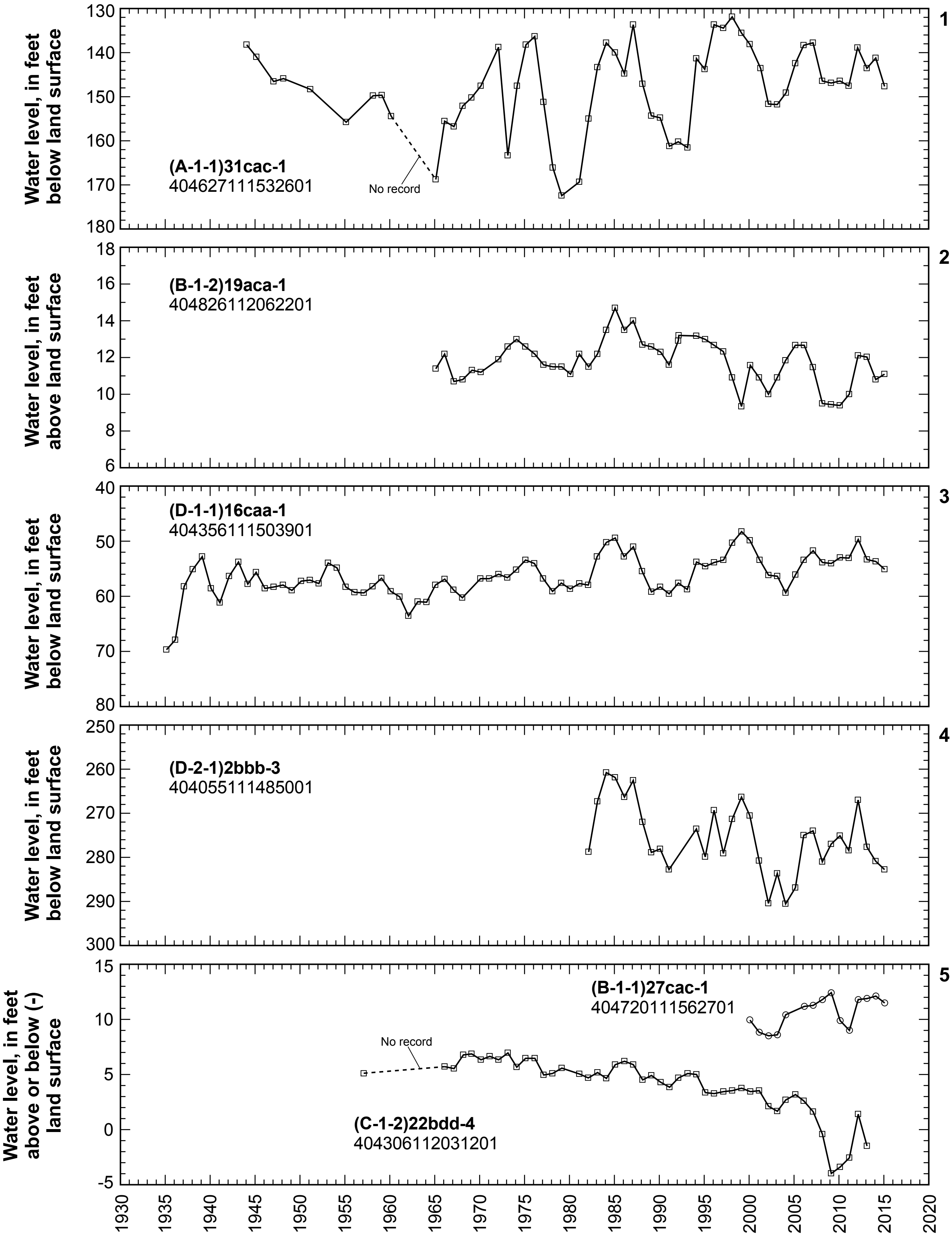


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.

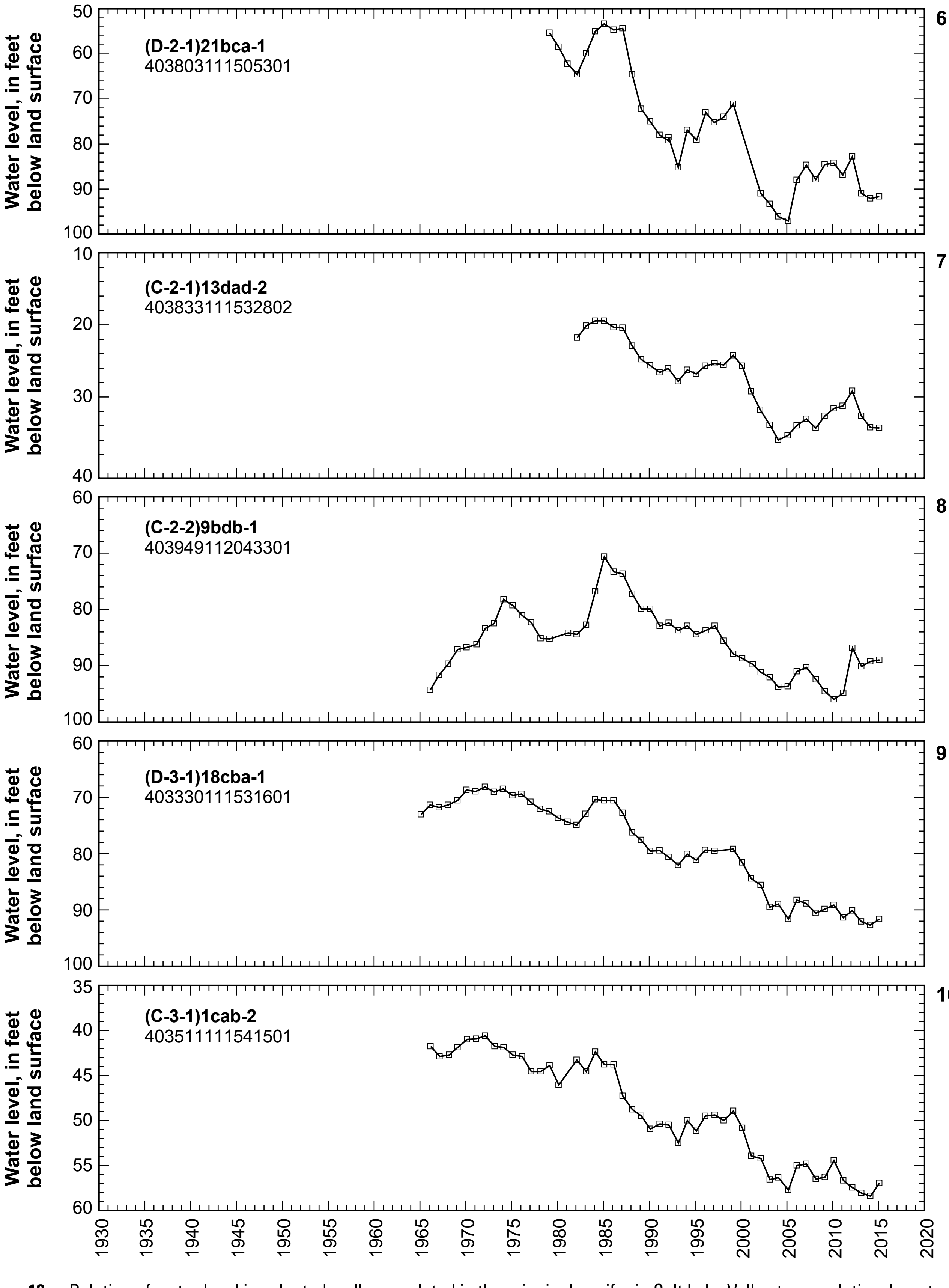


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.—Continued

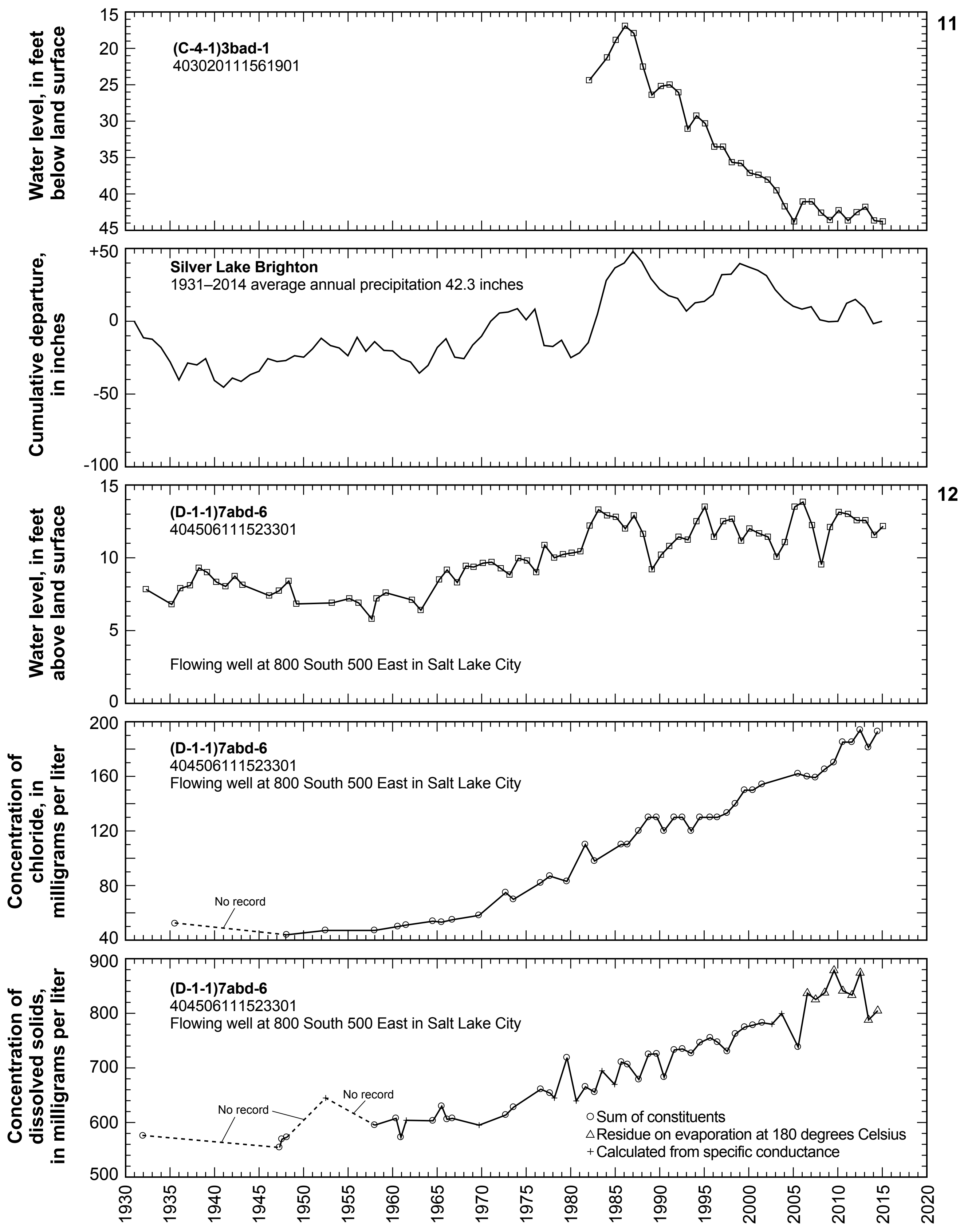


Figure 13. Relation of water level in selected wells completed in the principal aquifer in Salt Lake Valley to cumulative departure from average annual precipitation at Silver Lake Brighton, and relation of water level in well (D-1-1)7abd-6 to concentration of chloride and dissolved solids in water from the well.—Continued

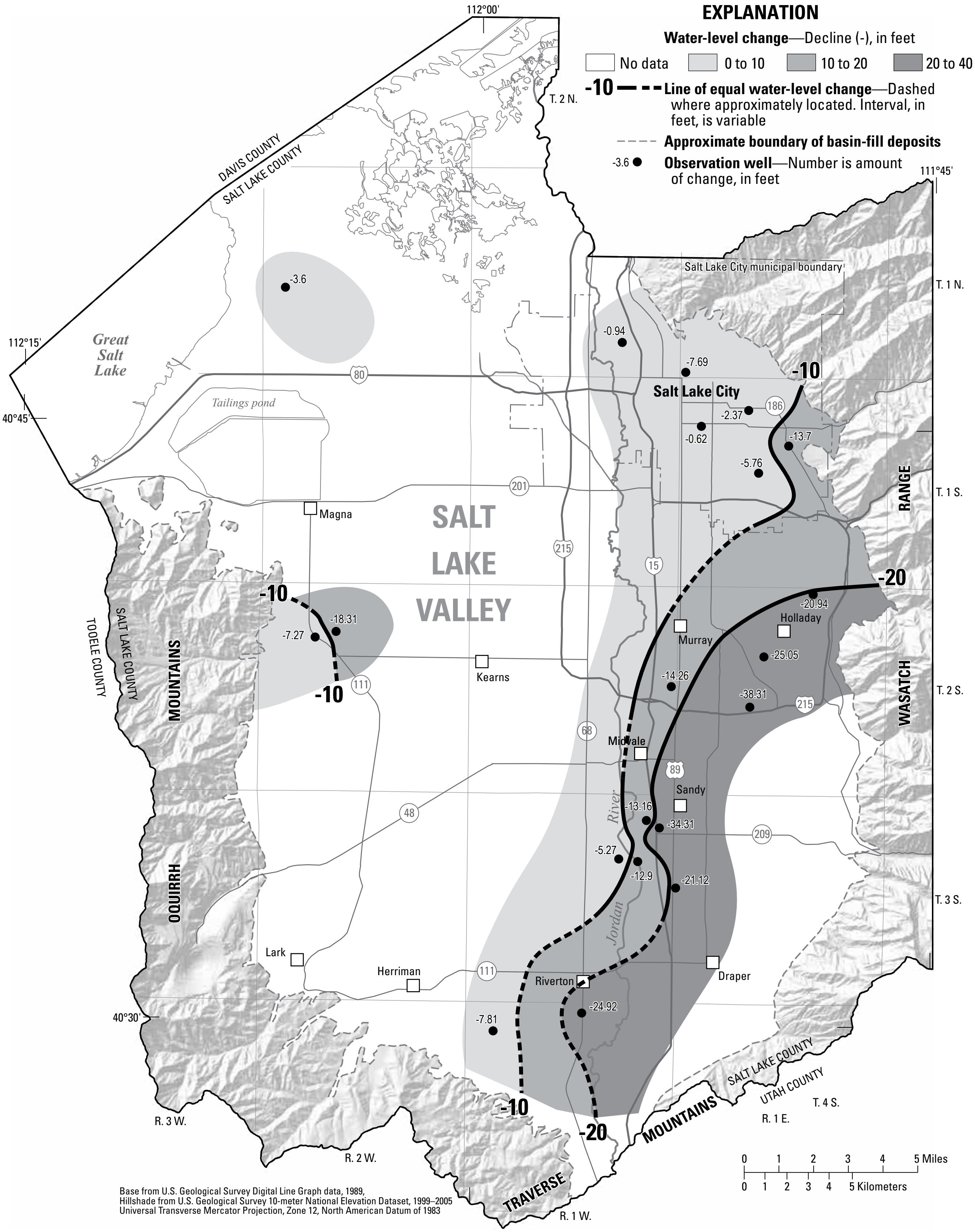


Figure 14. Water-level change in Salt Lake Valley from February 1985 to February 2015.

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. 15). 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.

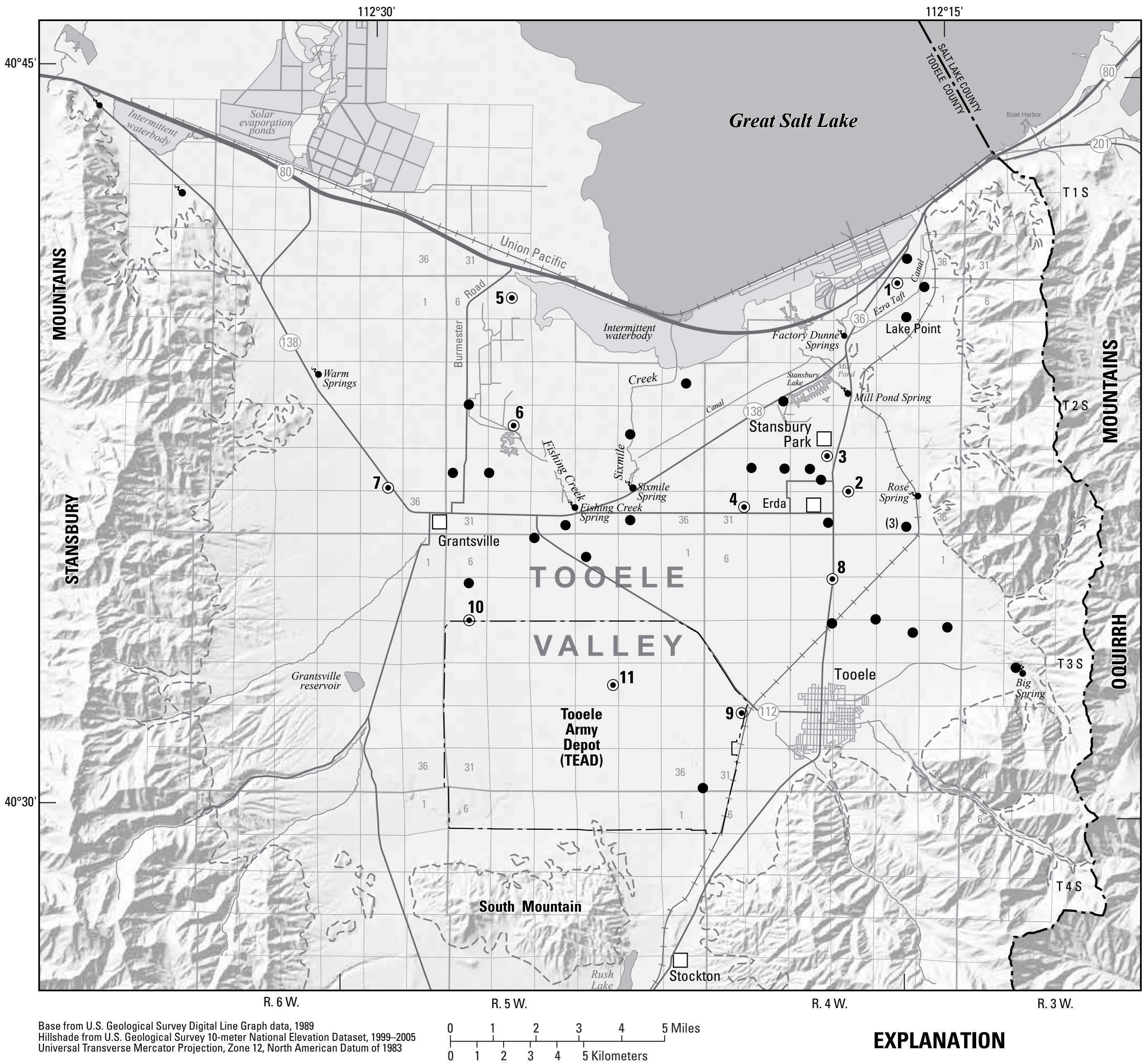
Total estimated withdrawal of water from wells in Tooele Valley in 2014 was about 22,000 acre-feet, which is about 3,000 acre-feet less than the total for 2013 and 2,000 acre-feet less than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal for irrigation was about 10,000 acre-feet, which is 2,100 acre-feet less than the total for 2013. Withdrawal for public supply was about 11,000 acre-feet, which is 600 acre-feet less than in 2013. Withdrawal for industrial use was about 400 acre-feet, which is the same as in 2013.

The location of wells in Tooele Valley in which the water level was measured during March 2015 is shown in figure 15. 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 16. Precipitation at Tooele during 2014 was about 15.4 inches, which is about 3.8 inches less than in 2013 and about 2.5 inches less than the average annual precipitation for 1936–2014.

Water levels declined from March 2014 to March 2015 in most of the wells measured in Tooele Valley. The largest decline, about 3.9 feet, occurred in a well about 3 miles northeast of Tooele.

Water levels declined from March 1985 to March 2015 in all parts of Tooele Valley for which data are available (fig. 17). The largest decline, almost 58 feet, occurred in a well southeast of Erda. Declines are probably the result of continued large withdrawals for irrigation and public supply.

The concentration of dissolved solids in water samples collected from well (C-2-4)33bdd-1, located at Erda, from 1977 to 2014, is shown in figure 16. The concentration has ranged from 456 to 616 mg/L with a median value of 577 mg/L. The concentration of dissolved solids in the water sample collected during June 2014 was 594 mg/L. The dissolved-solids concentration has generally increased since 1977.



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 16

Figure 15. Location of wells in Tooele Valley in which the water level was measured during March 2015.

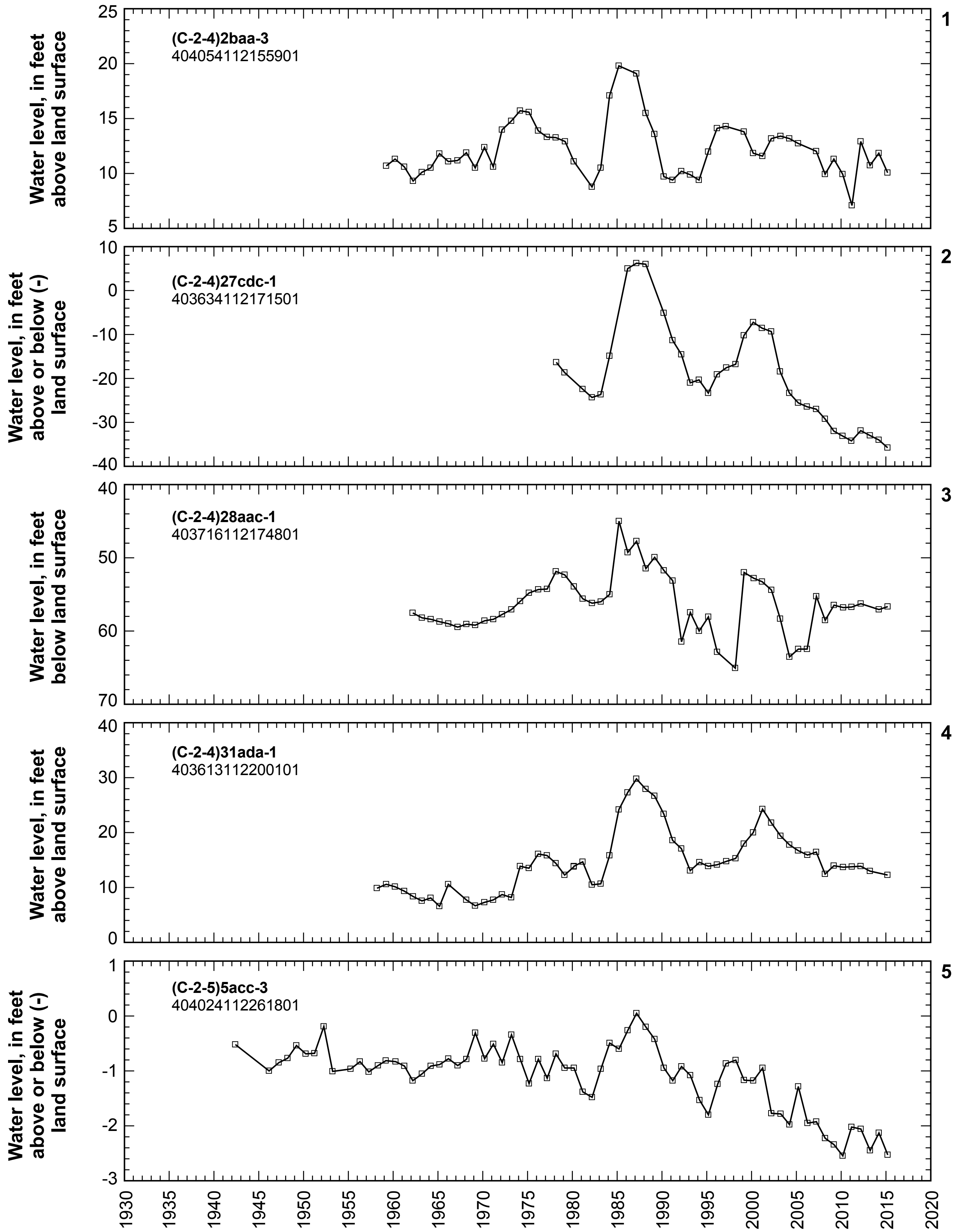


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.

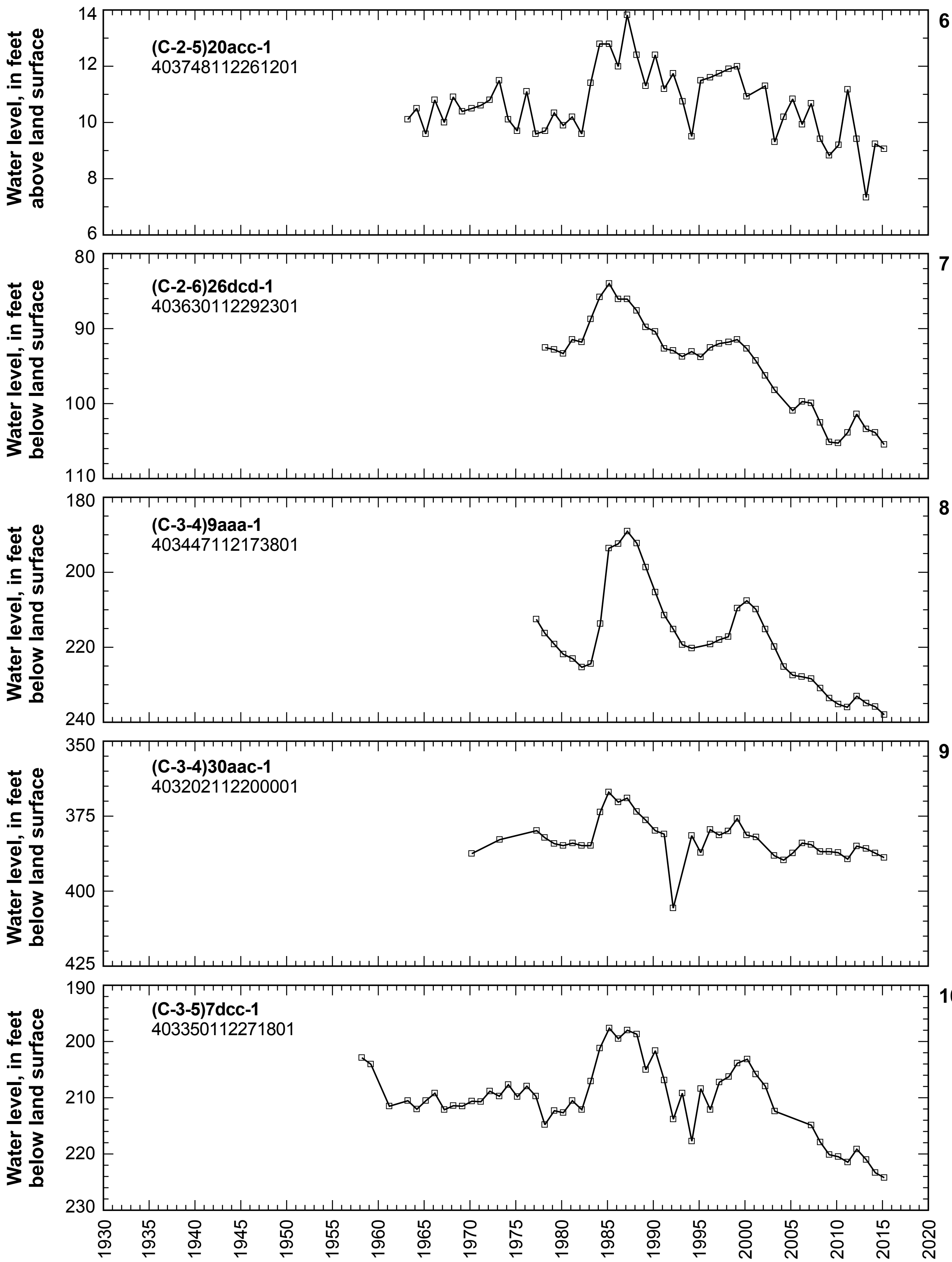


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.—Continued

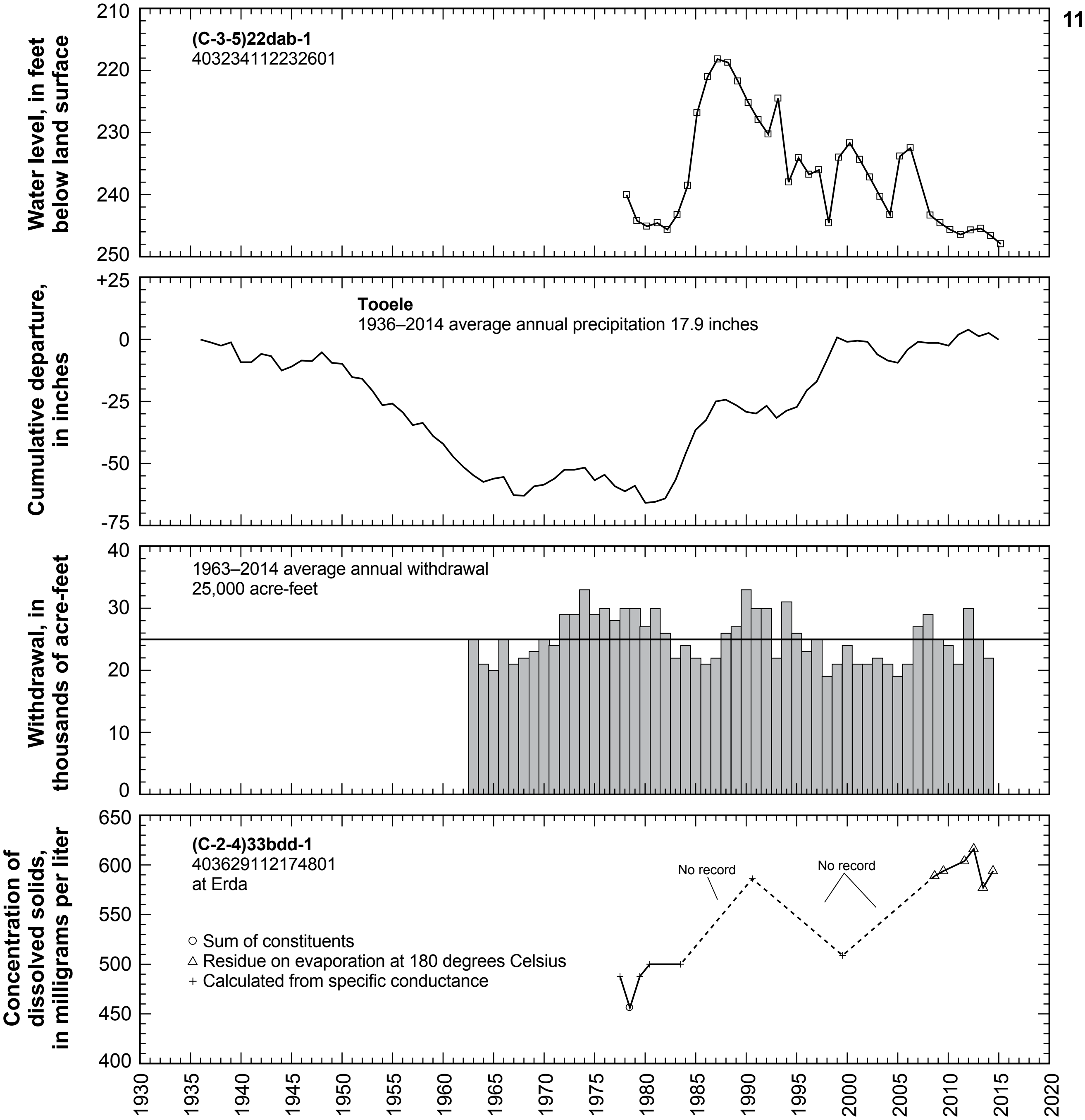


Figure 16. Relation of water level in selected wells in Tooele Valley to cumulative departure from average annual precipitation at Tooele, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-2-4)33bdd-1.—Continued

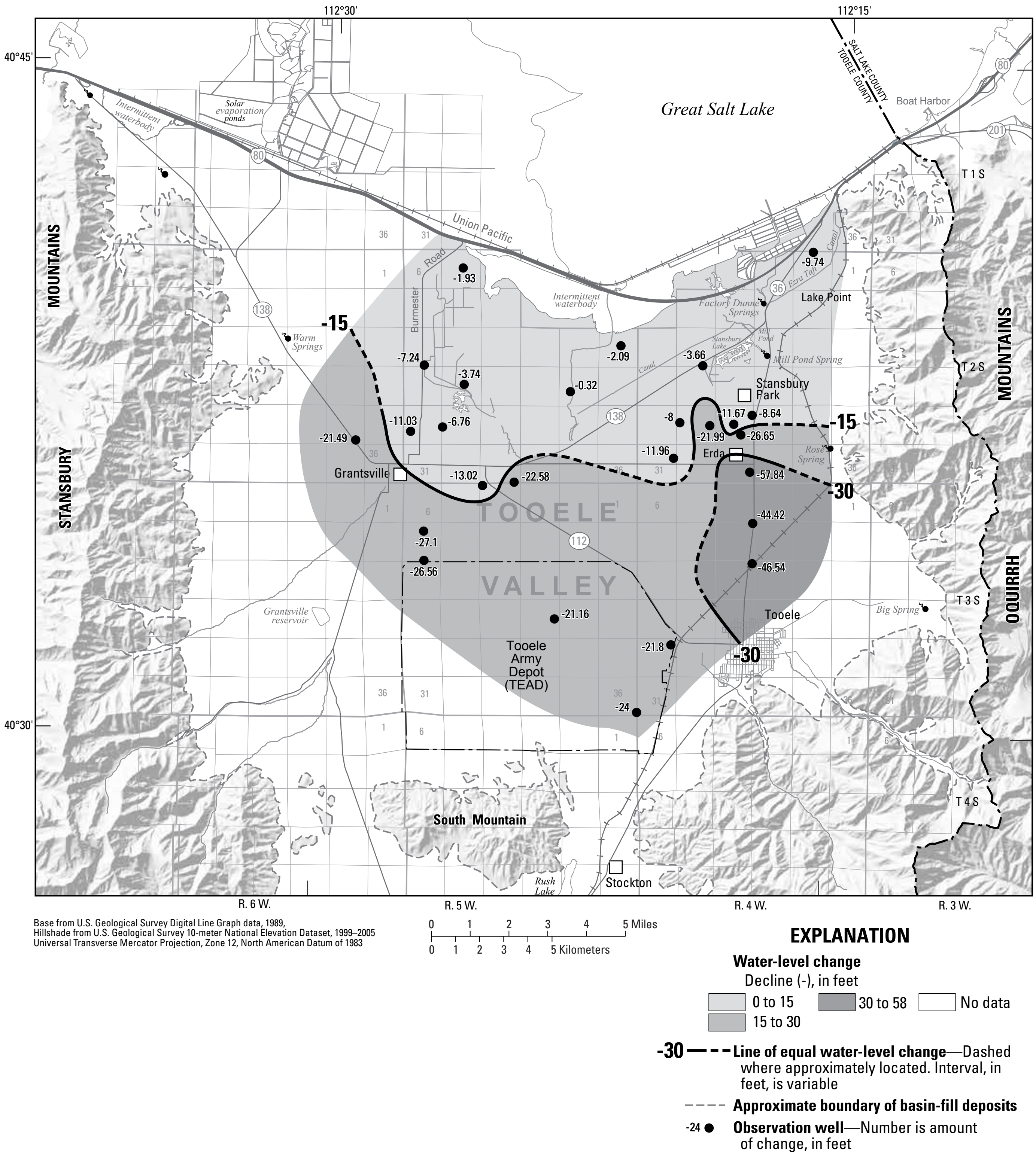


Figure 17. Water-level change in Tooele Valley from March 1985 to March 2015.

Utah and Goshen Valleys

By Lincoln Smith

Utah Valley is bounded by the Traverse Mountains, 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. 18). Northern Utah Valley is further divided by the Jordan River into two subbasins, northern Utah Valley-east and northern Utah Valley-west. Goshen Valley is bounded by West Mountain, Long Ridge, the Lake Mountains, and the East Tintic Mountains. 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.

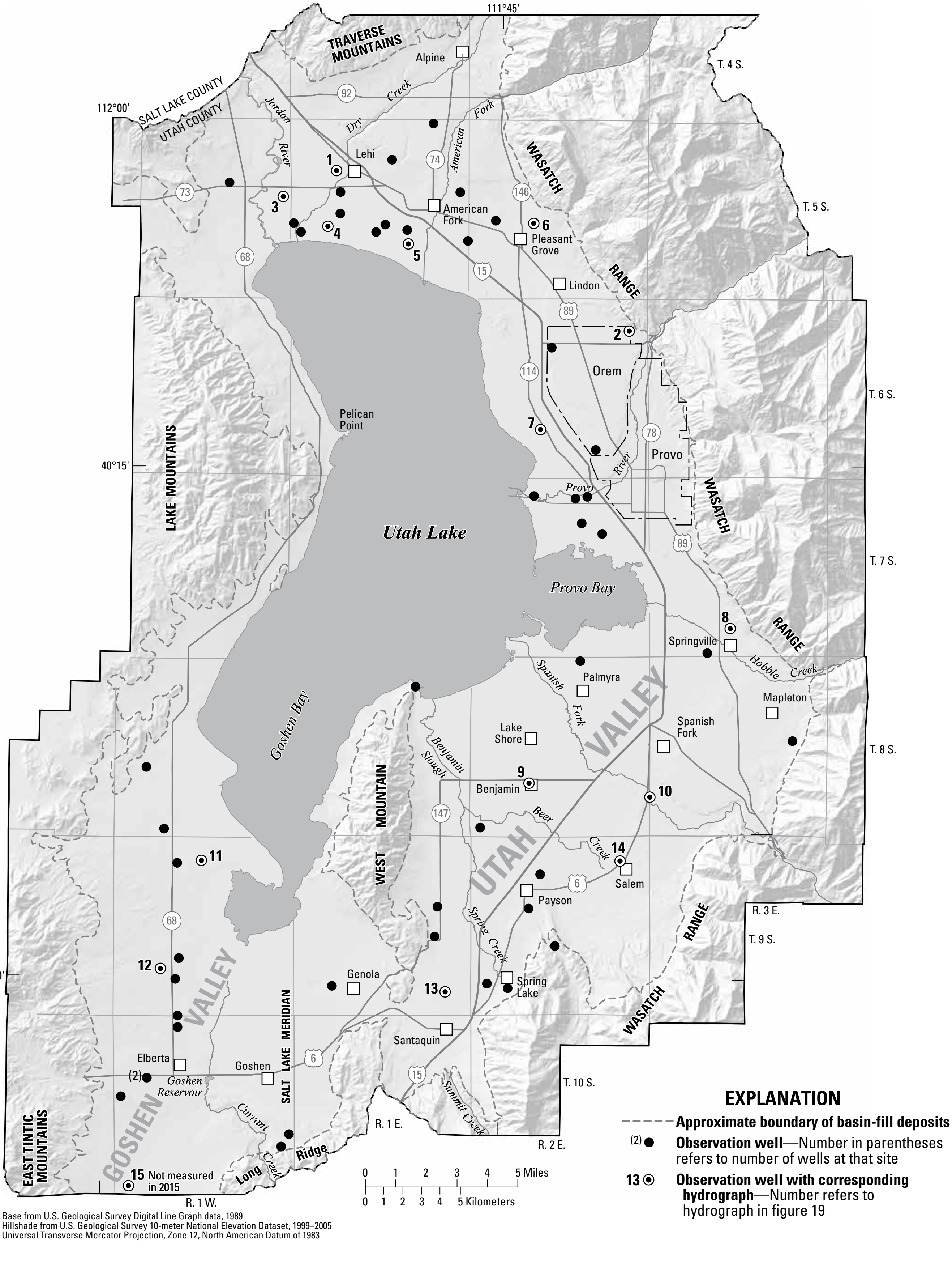
Total estimated withdrawal of water from wells in Utah and Goshen Valleys in 2014 was about 107,000 acre-feet, which is 8,000 acre-feet less than the revised value for 2013, and 1,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal in northern Utah Valley (-east and -west) was about 53,800 acre-feet, which is 6,300 acre-feet less than the value for 2013. Total estimated withdrawal in northern Utah Valley-west was about 4,400 acre-feet, or about 8 percent of the total withdrawal in northern Utah Valley. Withdrawal in southern Utah Valley was 30,600 acre-feet, which is 4,600 acre-feet less than the value for 2013. Withdrawal in Goshen Valley was 22,500 acre-feet, which is 3,000 acre-feet more than the revised value for 2013. The overall decrease in total pumpage from all three valleys in 2014 was mainly due to decreased withdrawals for public-supply use.

The location of wells in Utah and Goshen Valleys in which the water level was measured during March 2015 is shown in figure 18. Water levels declined from March 2014 to March 2015 in most of the wells measured in Utah and Goshen Valleys. Declines are probably due to continued large withdrawals for public supply and irrigation. Water levels have, overall, declined since the mid- to late 1980s. There have been intervening periods (1993–98, 2005–07, 2009–11) when water levels generally rose. These periods correspond to greater-than-average precipitation.

Water levels declined from March 1985 to March 2015 in all parts of Utah and Goshen Valleys for which data are available (fig. 20). The largest decline, more than 61 feet, occurred in a well northeast of American Fork. Declines are probably the result of continued large withdrawals, particularly for public-supply use.

The relation of the water level in selected observation wells 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, Utah, and to concentration of dissolved solids in water from three wells is shown in figure 19. Discharge of Spanish Fork at Castilla in 2014 was about 145,800 acre-feet, which is 24,100 acre-feet less than the 1933–2014 average annual discharge and 12,600 acre-feet less than in 2013. Precipitation at Silver Lake Brighton in 2014 was about 44.0 inches, which is about 1.7 inches more than the long-term average (1931–2014) and about 12.7 inches more than in 2013. Precipitation at Spanish Fork Power House in 2014 was about 19.9 inches, which is about 0.6 inch more than the long-term average (1930–2014) and about 3.0 inches more than the revised value for 2013.

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 19. The concentration of dissolved solids in water from well (C-9-1)28ccb-1 has ranged from 498 to 1,970 mg/L with a median value of 728 mg/L. The concentration of dissolved solids in the July 2014 sample was the maximum measured in this well (1,970 mg/L). The dissolved-solids concentration in water from well (D-7-2)4cbb-2 has ranged from 270 to 539 mg/L with a median value of 321 mg/L. The concentration of dissolved solids in the July 2014 sample was the lowest measured in this well (270 mg/L). The dissolved-solids concentration in water from well (D-9-1)36bbc-1 has ranged from 166 to 311 mg/L with a median value of 294 mg/L. The concentration of dissolved solids in the July 2014 sample was 248 mg/L.



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 18. Location of wells in Utah and Goshen Valleys in which the water level was measured during March 2015.

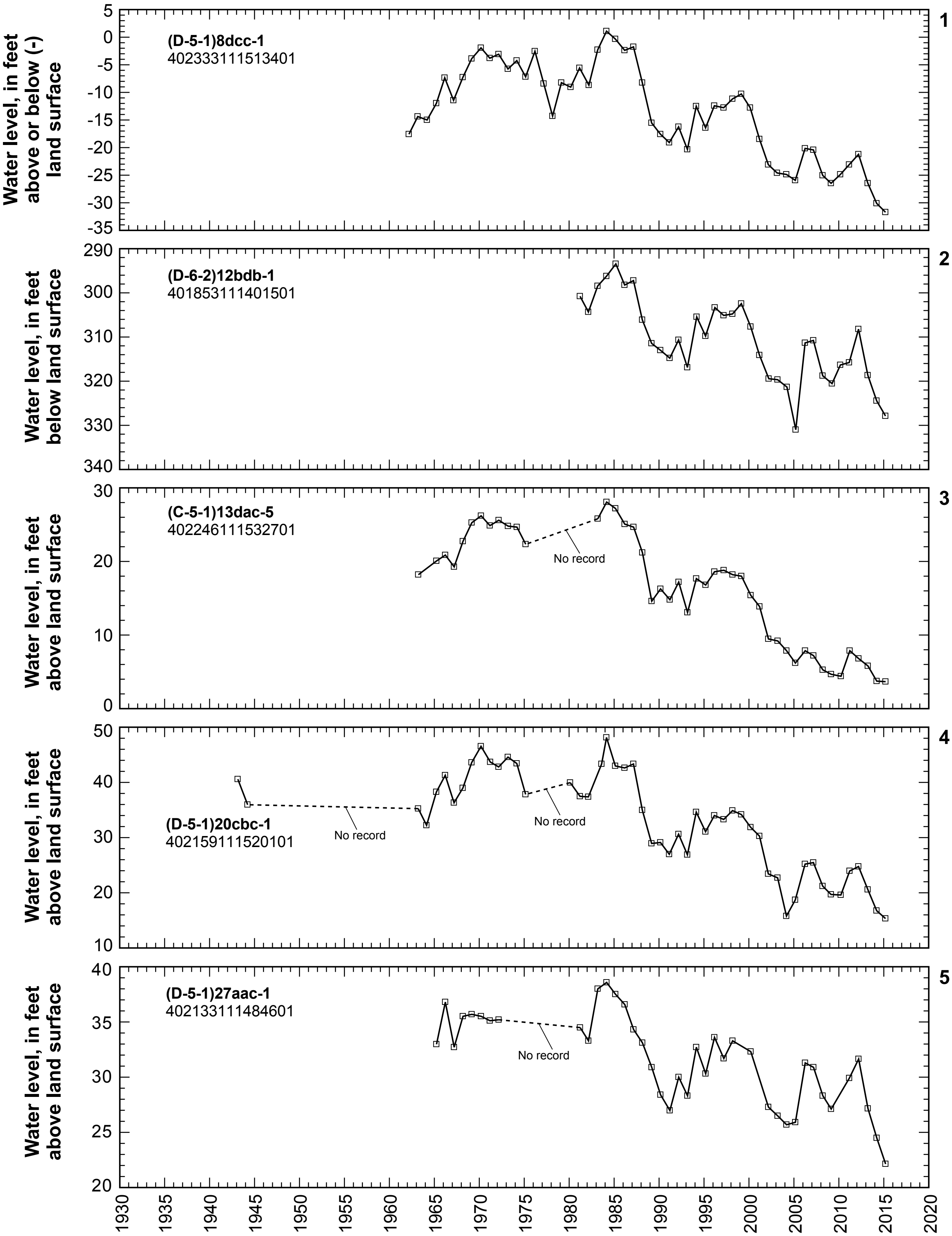


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, Utah, and to concentration of dissolved solids in water from three wells.

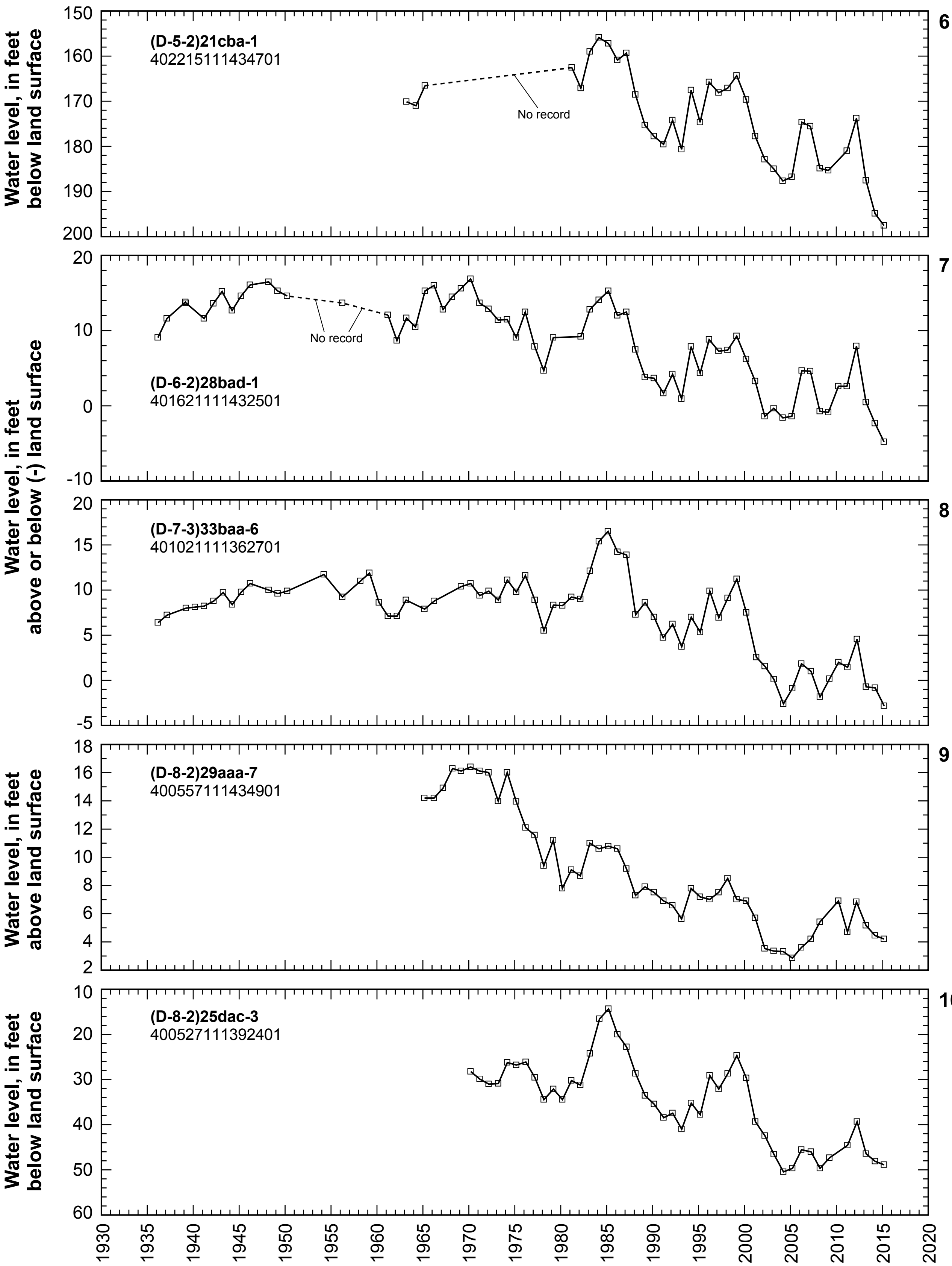


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, Utah, and to concentration of dissolved solids in water from three wells.—Continued

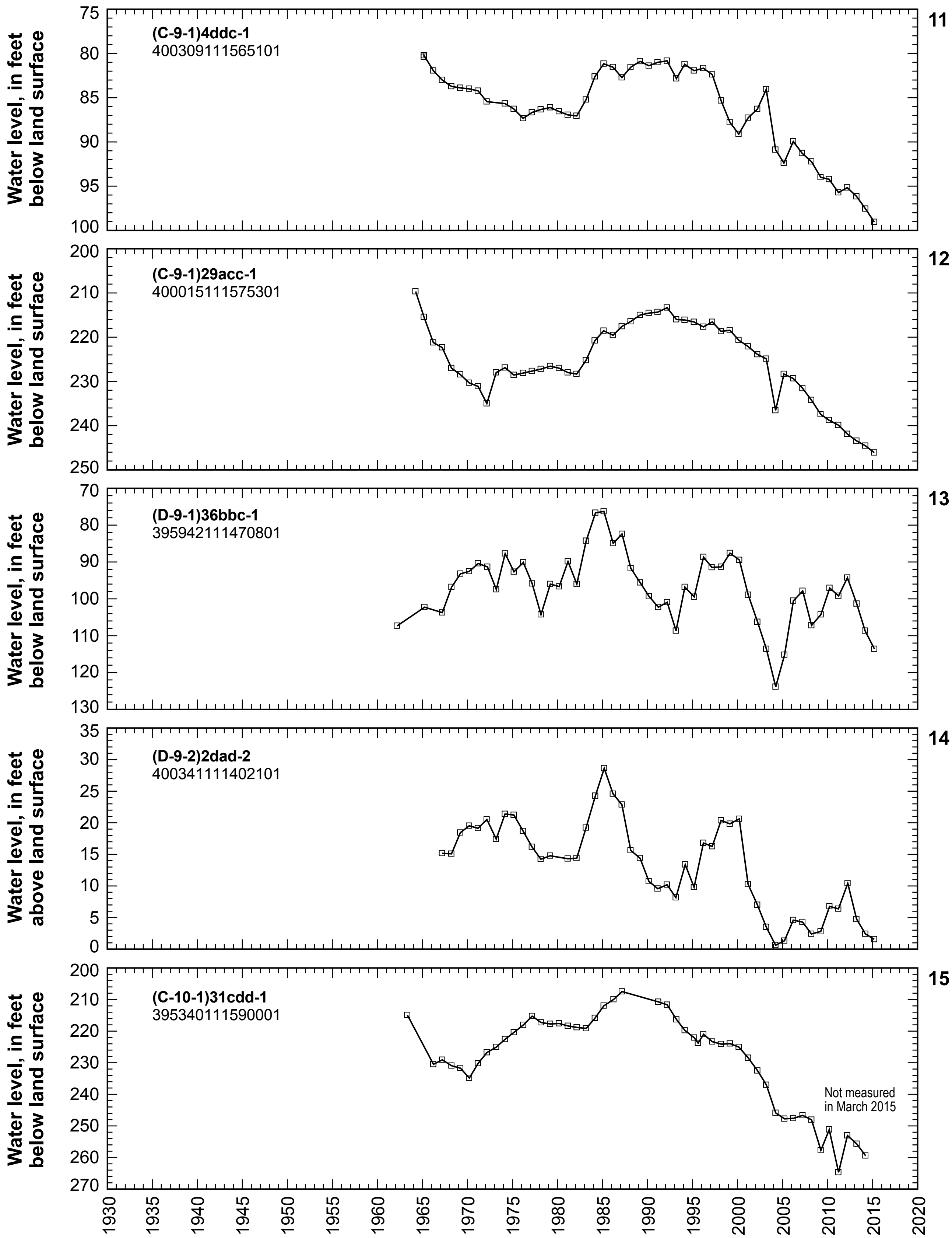


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, Utah, and to concentration of dissolved solids in water from three wells.—Continued

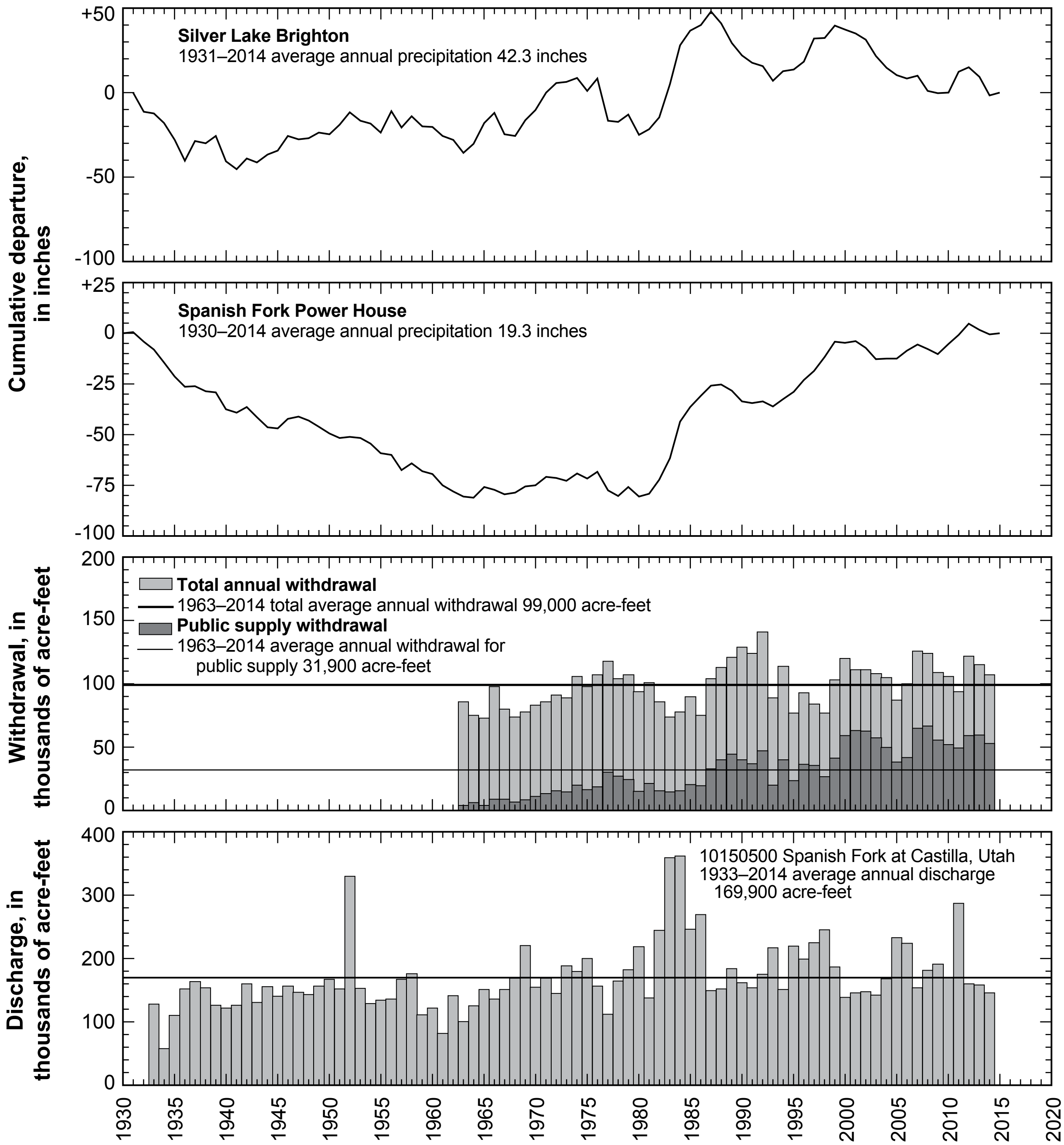


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, Utah, and to concentration of dissolved solids in water from three wells.—Continued

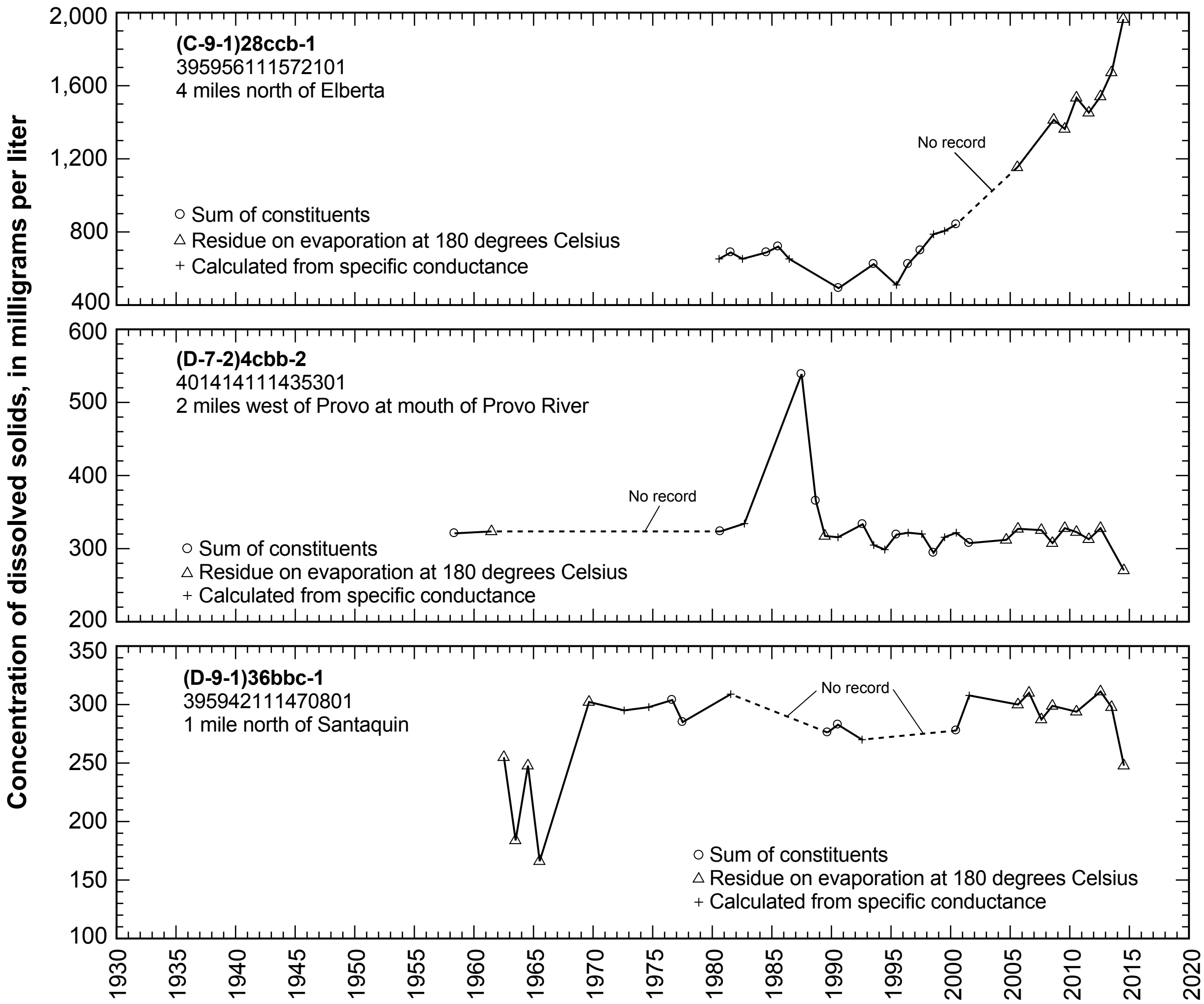


Figure 19. Relation of water level in selected wells in Utah and Goshen Valleys to cumulative departure from average annual precipitation at Silver Lake Brighton and Spanish Fork Power House, to total annual withdrawal from wells, to annual withdrawal for public supply, to annual discharge of Spanish Fork at Castilla, Utah, and to concentration of dissolved solids in water from three wells.—Continued

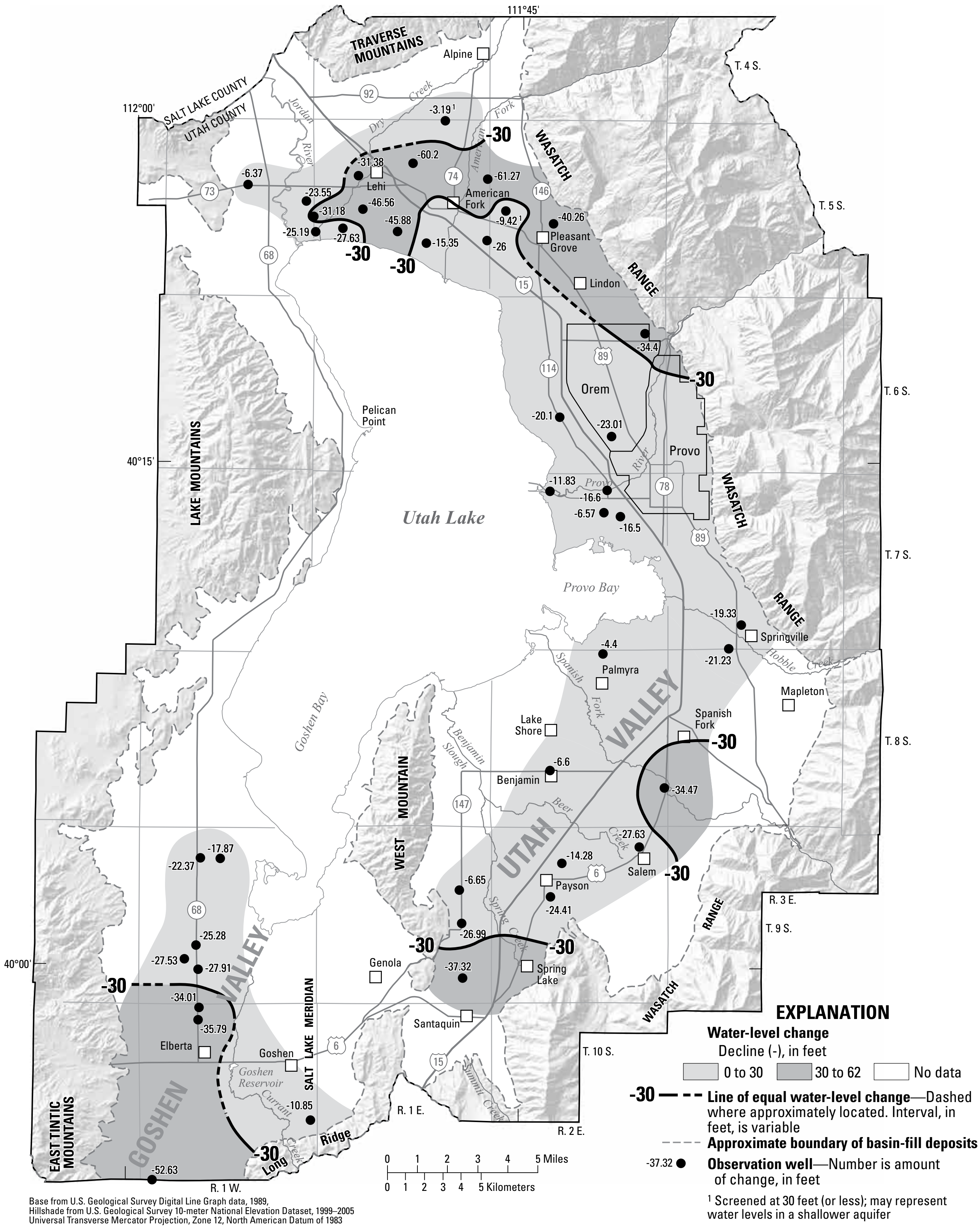


Figure 20. Water-level change in Utah and Goshen Valleys from March 1985 to March 2015.

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. 21). 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.

Total estimated withdrawal of water from wells in Juab Valley in 2014 was about 29,000 acre-feet, which is 2,000 acre-feet more than the amount reported for 2013 and 6,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3).

The location of wells in Juab Valley in which the water level was measured during March 2015 is shown in figure 21. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1, is shown in figure 22. Precipitation at Nephi during 2014 was about 11.3 inches, which is about 2.9 inches less than the average annual precipitation for 1935–2014, and about 2.9 inches more than in 2013.

Water levels declined in all of the wells measured in Juab Valley from March 2014 to March 2015 (fig. 22). Declines are probably the result of continued large withdrawals 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 2014, although there was a substantial rise from 1993 to 1999.

Water levels declined from March 1985 to March 2015 in all areas of Juab Valley for which data are available (fig. 23). The largest decline, over 99 feet, occurred in a well southeast of Levan. Declines are probably the result of continued large withdrawals for irrigation.

The concentration of dissolved solids in water from well (C-14-1)26dbd-1, located 2 miles west of Levan, is shown in figure 22. The dissolved-solids concentration in the water sample collected in July 2014 was 765 mg/L.

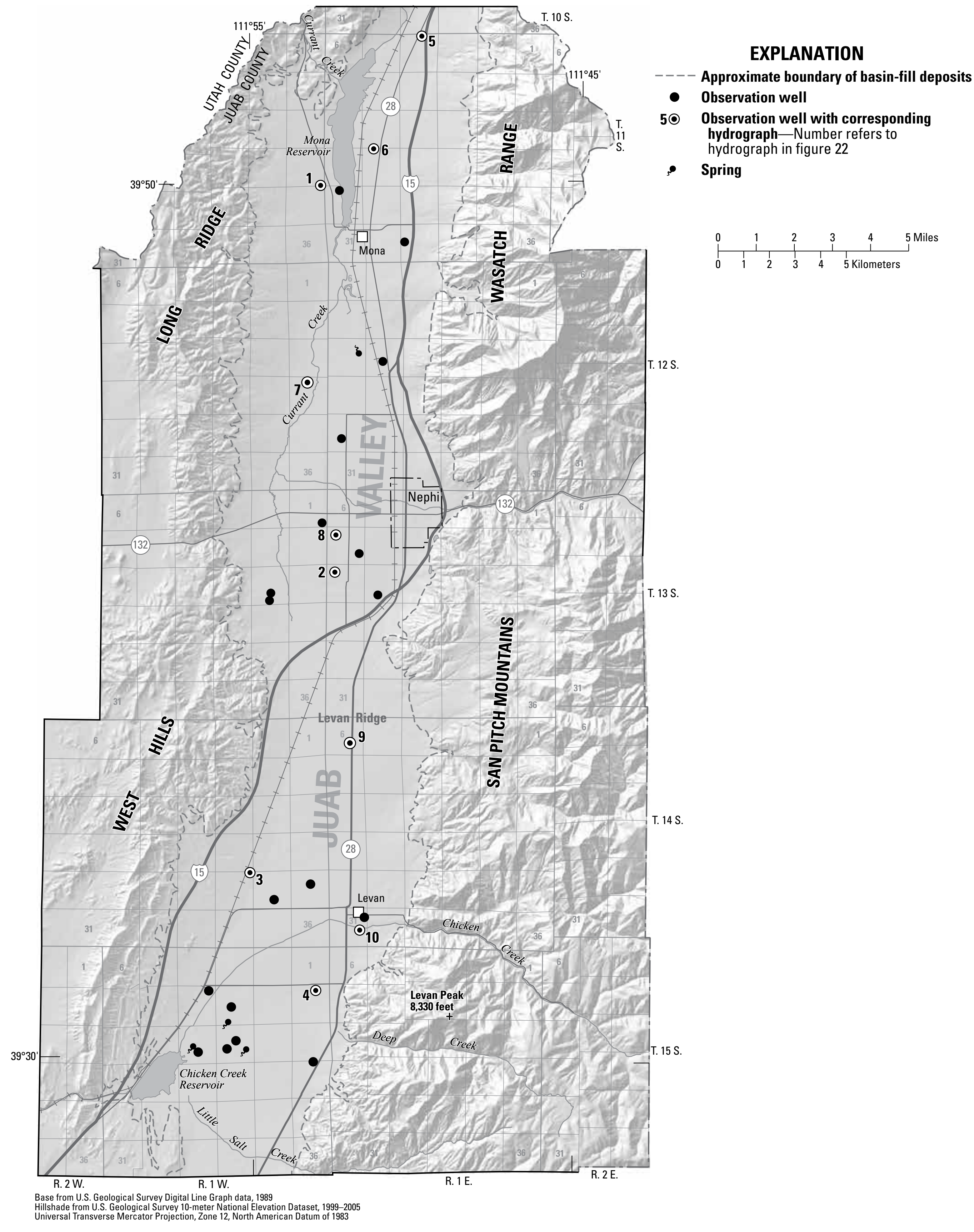


Figure 21. Location of wells in Juab Valley in which the water level was measured during March 2015.

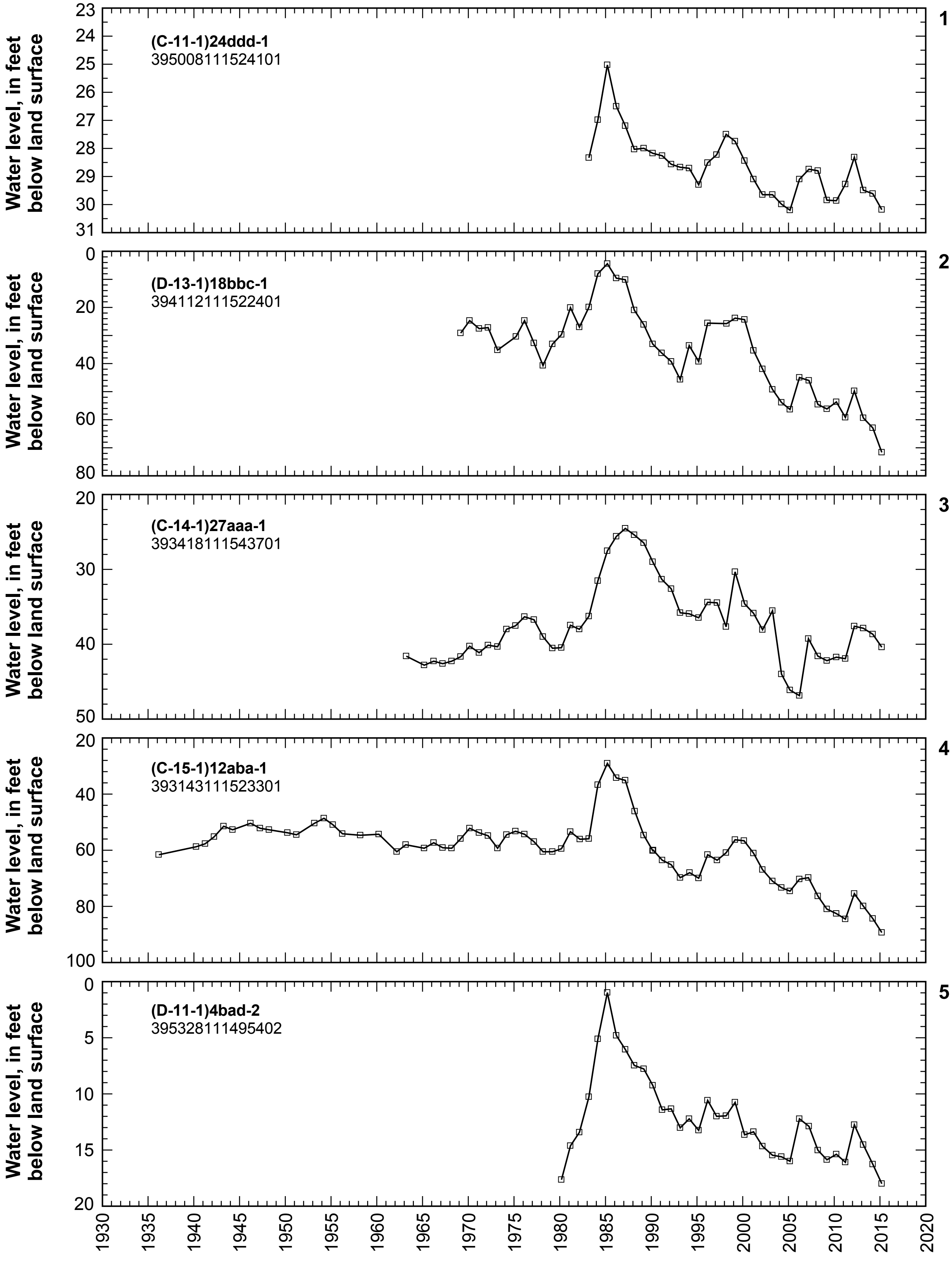


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.

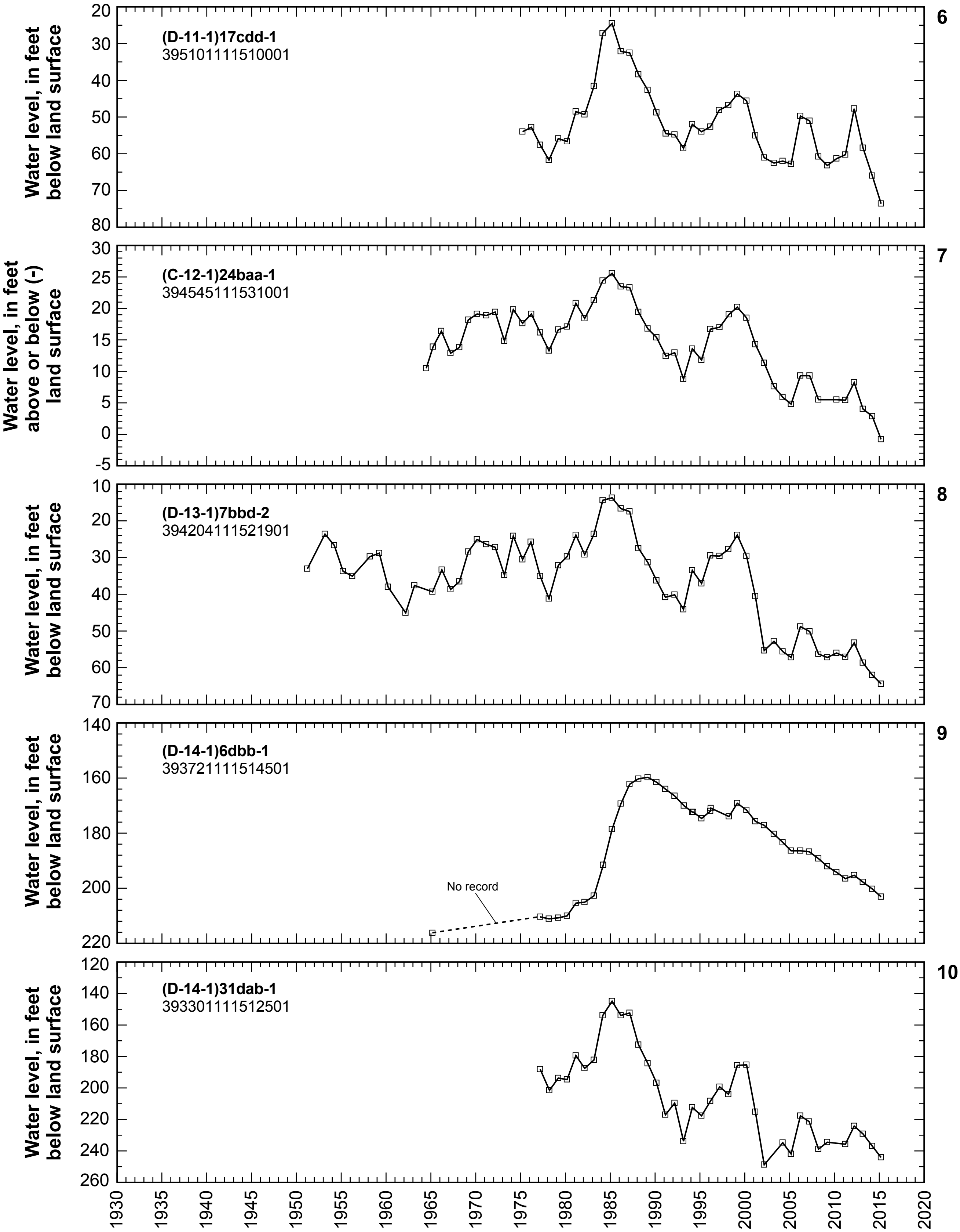


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.—Continued

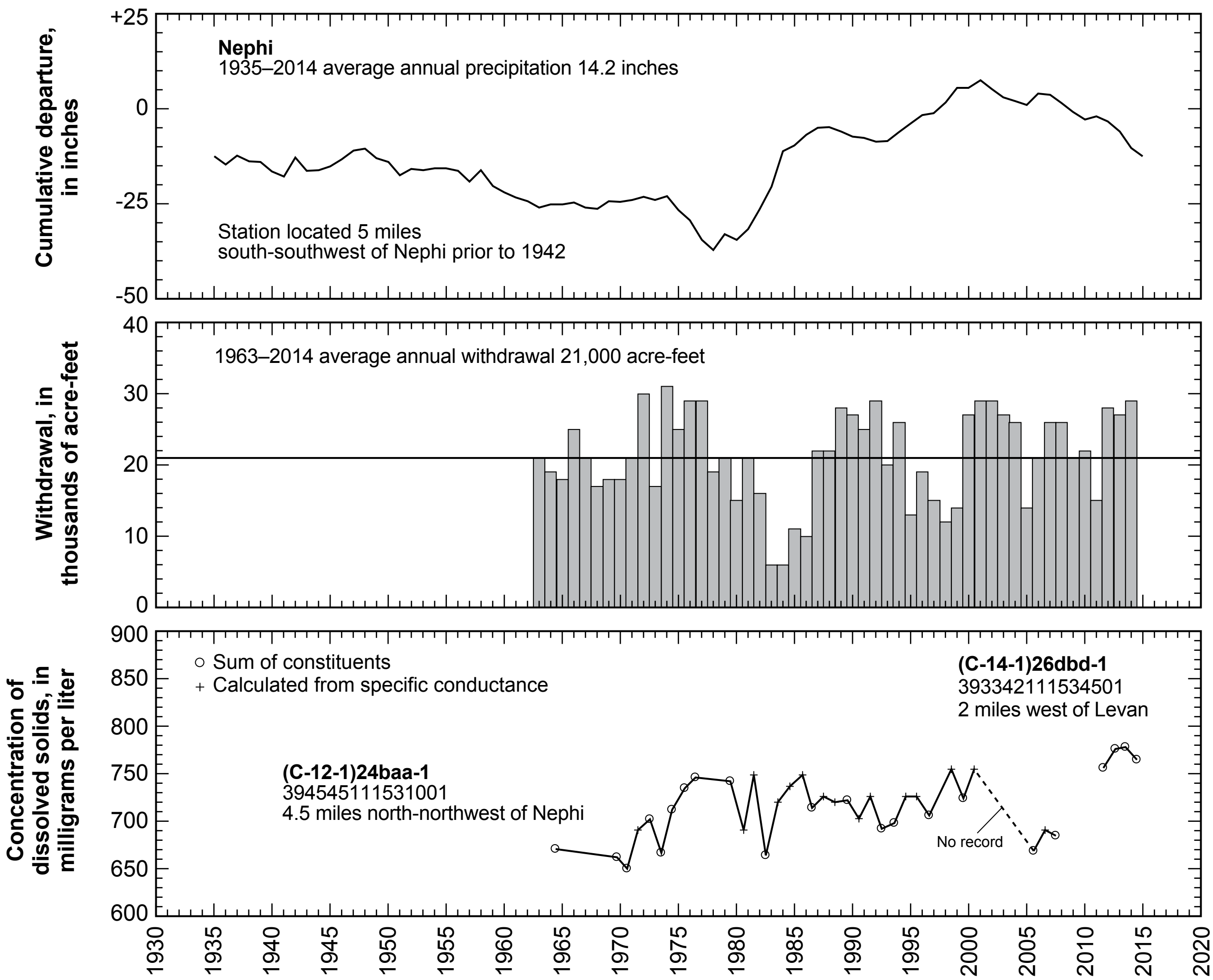


Figure 22. Relation of water level in selected wells in Juab Valley to cumulative departure from average annual precipitation at Nephi, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-14-1)26dbd-1.—Continued

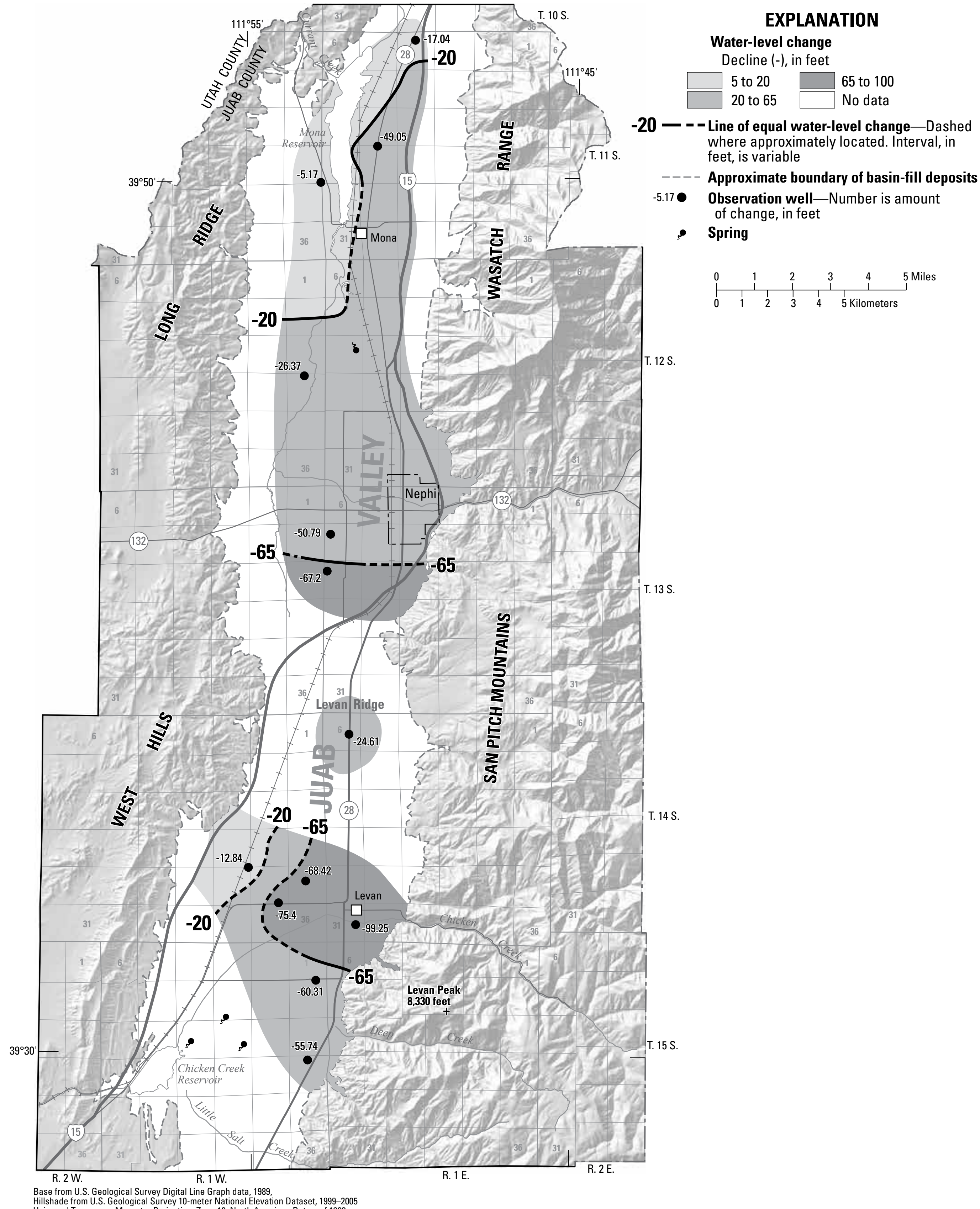


Figure 23. Water-level change in Juab Valley from March 1985 to March 2015.

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. 24 and 25). It principally includes the broad, gently sloping areas that radiate from the Canyon and Gilson 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 2014 was about 53,000 acre-feet, which is 7,000 acre-feet more than the revised total for 2013 and about 18,000 acre-feet more than the 2004–2013 average annual withdrawal (tables 2 and 3). The increase in withdrawals was mainly due to increased pumpage for irrigation, which coincides with less-than-average discharge of, and corresponding decreased withdrawal of water from, the Sevier River.

The location of wells in the Sevier Desert in which the water level was measured during March 2015 is shown in figures 24 and 25. 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 26.

Discharge of the Sevier River near Juab in 2014 was 117,400 acre-feet, which is 2,600 acre-feet less than in 2013 and 62,400 acre-feet less than the long-term average (1935–2014). Precipitation at Oak City was about 11.7 inches in 2014, about 1.3 inches less than the 1930–2014 average annual precipitation and about the same as in 2013.

Most water levels in the shallow artesian and deep artesian aquifers declined from March 2014 to March 2015 (fig. 26). In the shallow artesian aquifer, declines of over 5 feet occurred. In the deep artesian aquifer, declines of over 7 feet occurred. Declines are probably the result of increased withdrawals for irrigation and less-than-average precipitation.

Periods when the water level in the shallow and deep aquifers generally rose (including 1980–89, 1995–99, 2006–07, and 2010–12) correspond to greater-than-average precipitation, less-than-average groundwater withdrawals, and greater than average discharge of the Sevier River, with apparent persistent recharge occurring to the deep aquifer in years following greater-than-average surface-water availability. Periods when the water level in the shallow and deep aquifers generally declined (including 1988–94, 2001–05, 2008–10, and 2013–14) correspond to less-than-average precipitation, greater-than-average groundwater withdrawals, and less-than-average discharge of the Sevier River.

Water levels declined in both the shallow and deep artesian aquifers from March 1985 to March 2015 in all areas of the Sevier Desert for which data are available (figs. 27 and 28). In the shallow artesian aquifer, a decline of almost 30 feet occurred in a well about 4 miles south of Leamington. In the deep artesian aquifer, a decline of 37 feet was observed in a well about 8 miles northwest of Oak City. Declines are probably the result of continued large withdrawals for irrigation.

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 2014, is shown in figure 26. The concentration has ranged from 1,490 to 2,340 mg/L, with a median value of 2,030 mg/L. The dissolved-solids concentration in the water sample from July 2014 was 2,140 mg/L.

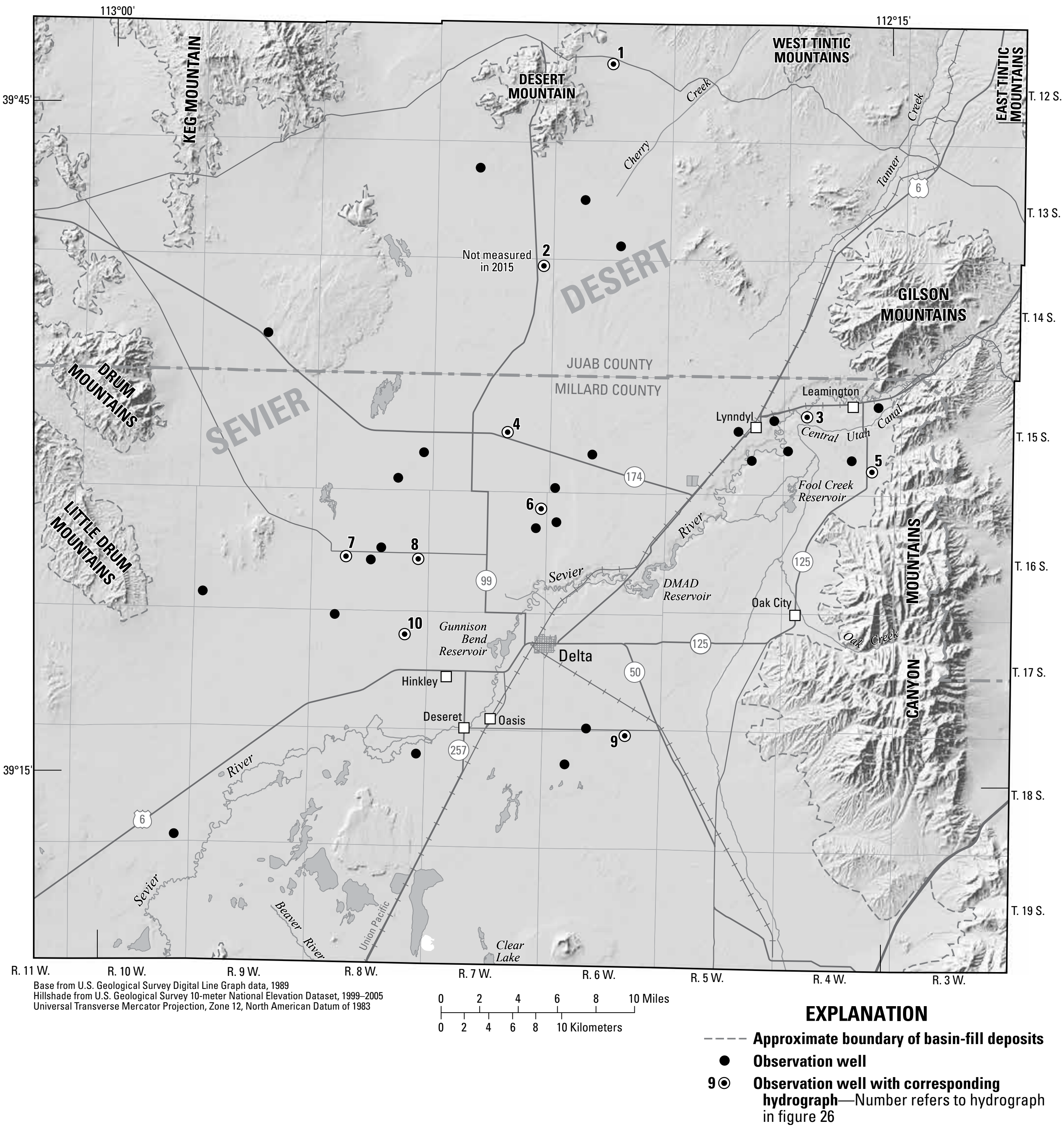
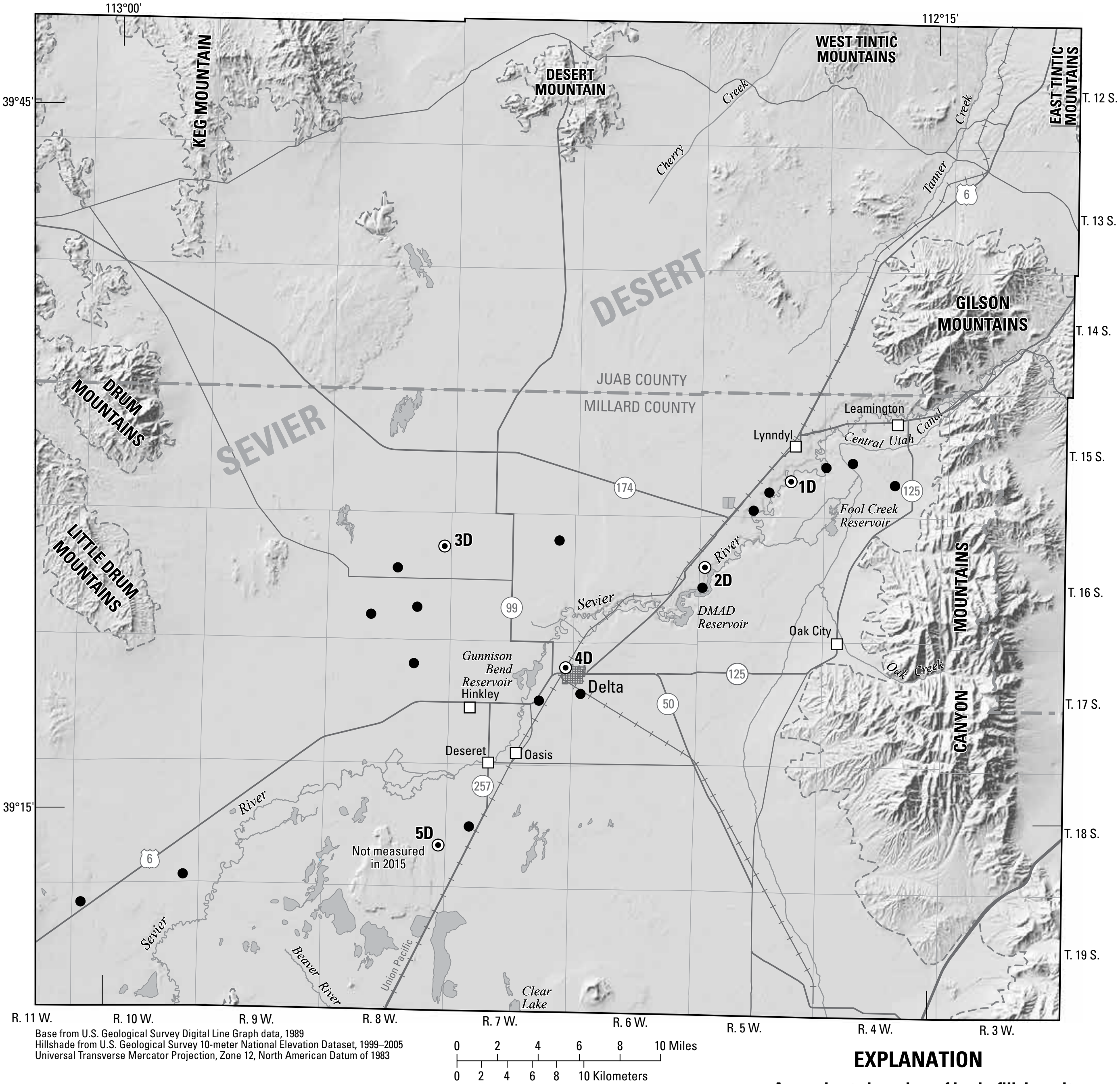


Figure 24. Location of wells in the shallow artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2015.



EXPLANATION

- **Approximate boundary of basin-fill deposits**
- **Observation well**
- 5D **Observation well with corresponding hydrograph**—Number with letter 'D' refers to deep artesian aquifer hydrograph in figure 26

Figure 25. Location of wells in the deep artesian aquifer in part of the Sevier Desert in which the water level was measured during March 2015.

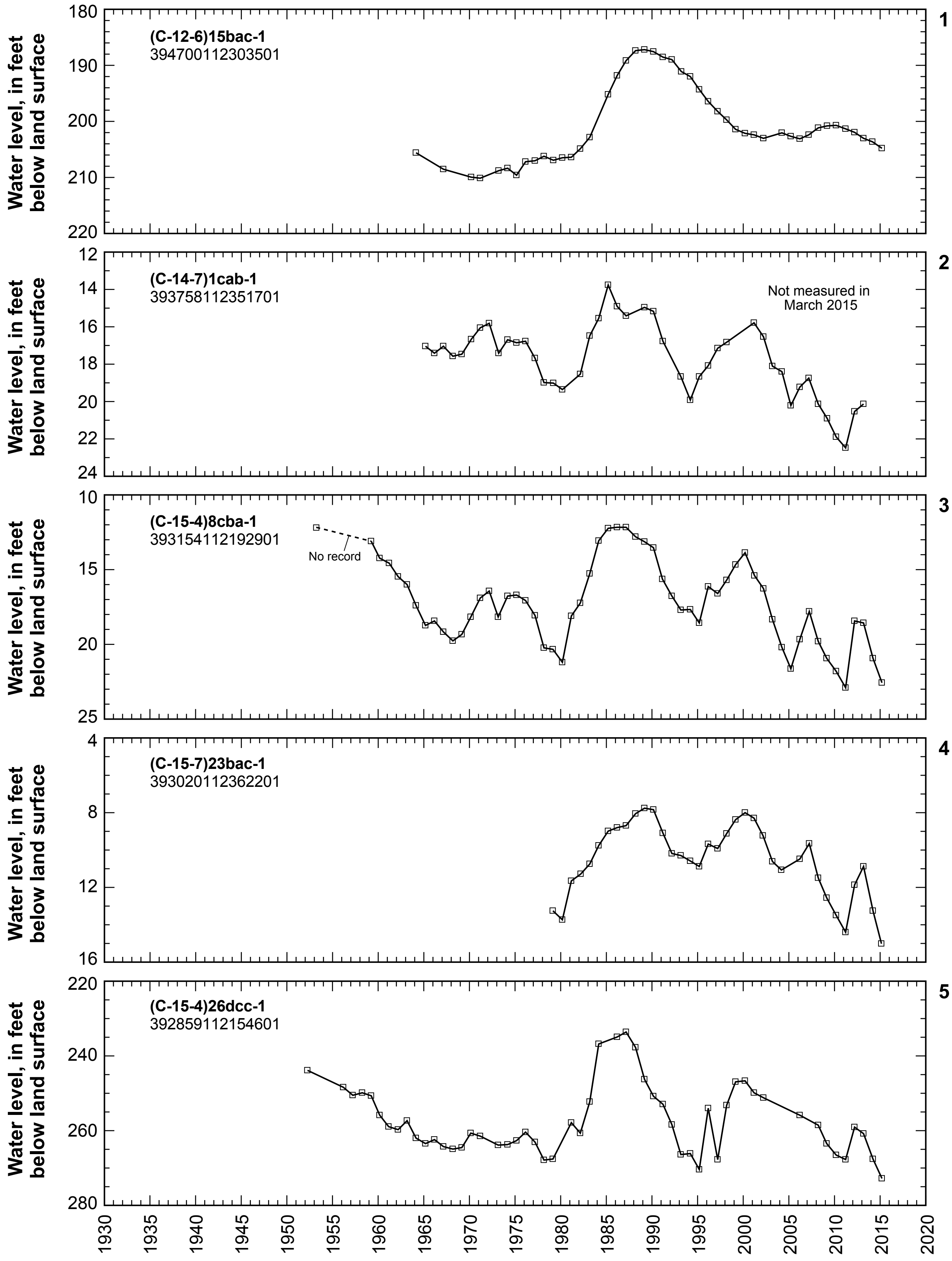


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.

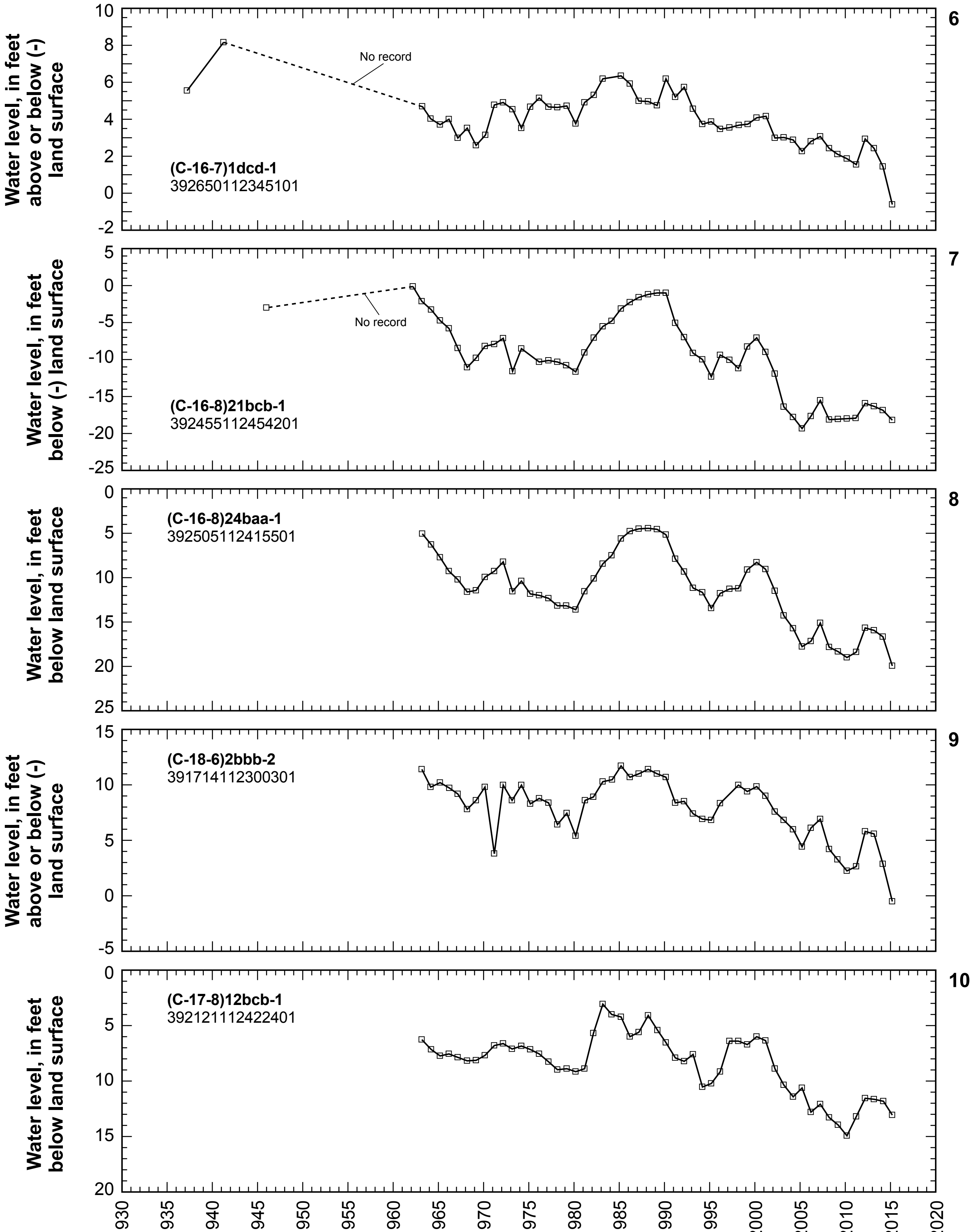


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

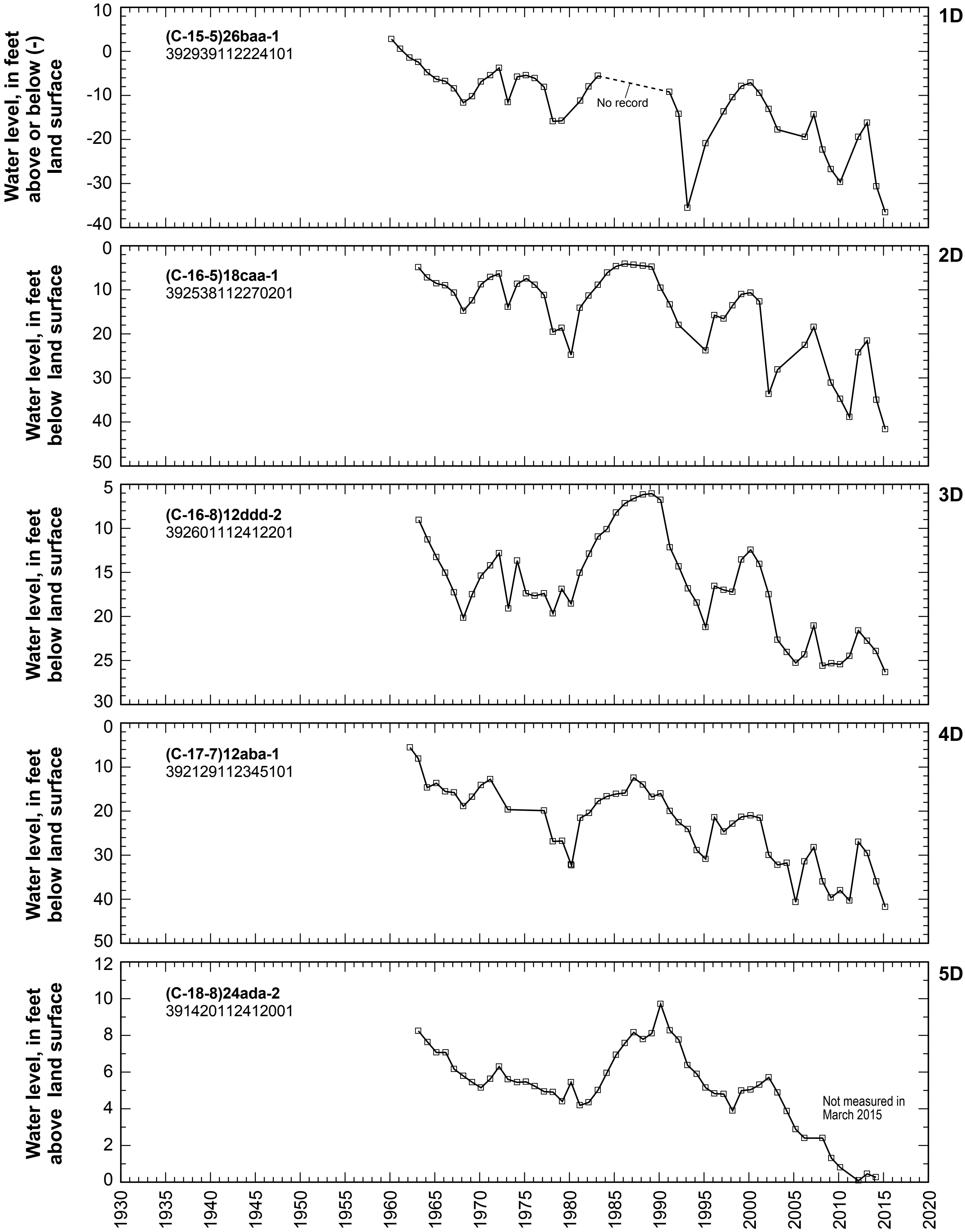


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

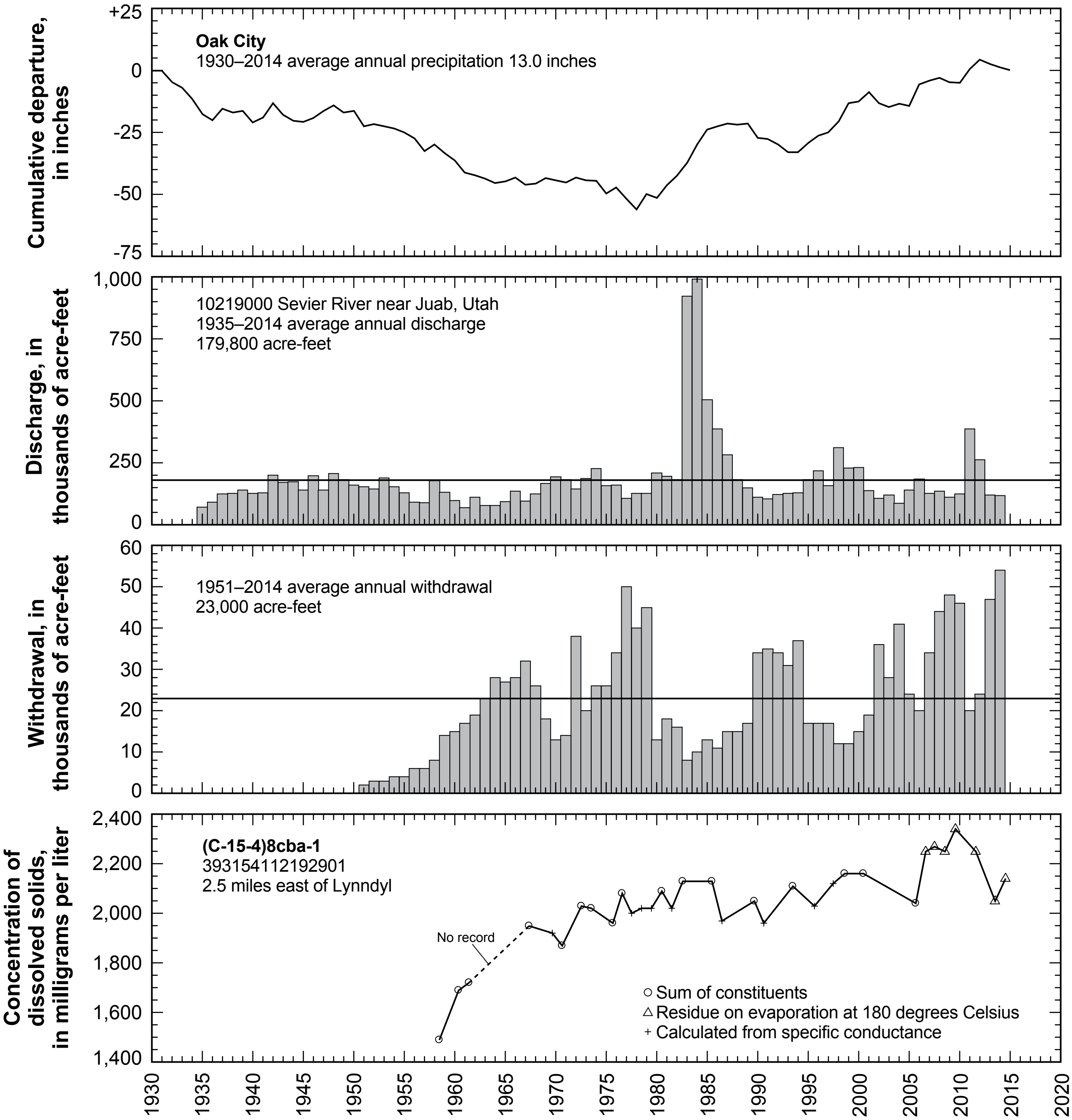


Figure 26. Relation of water level in selected wells in the Sevier Desert to annual discharge of the Sevier River near Juab, to cumulative departure from average annual precipitation at Oak City, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-15-4)8cba-1.—Continued

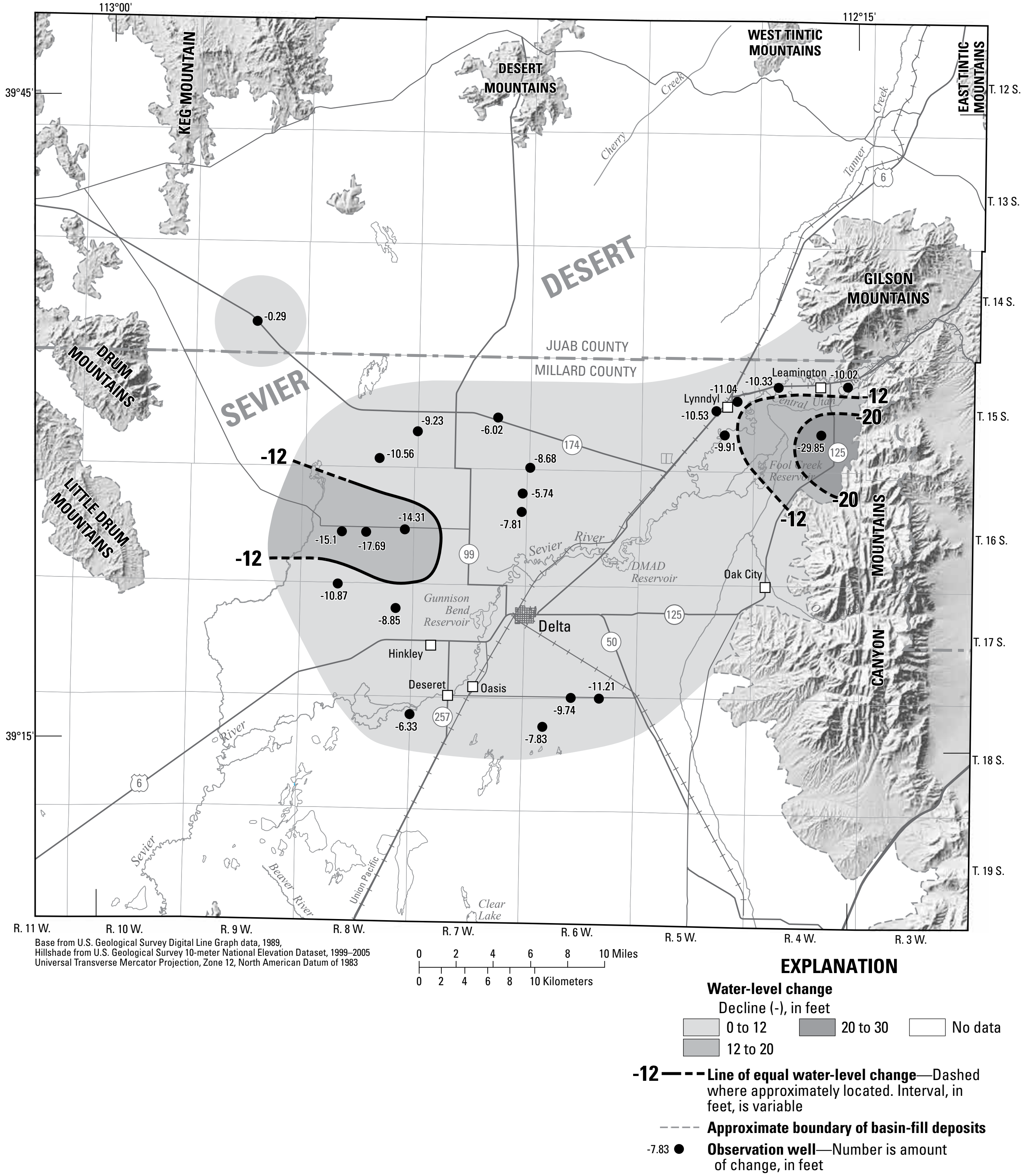


Figure 27. Water-level change in the shallow artesian aquifer in part of the Sevier Desert from March 1985 to March 2015.

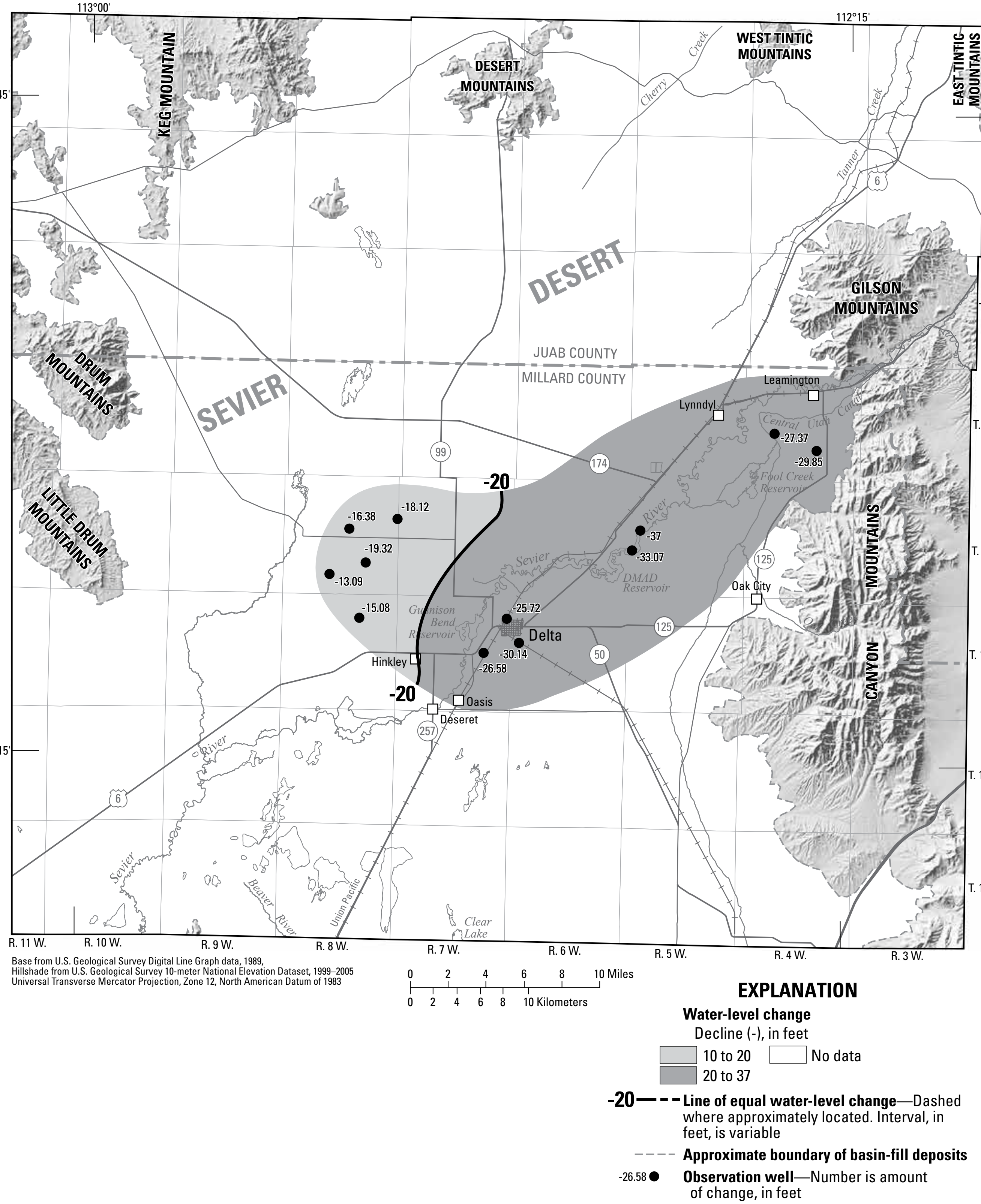


Figure 28. Water-level change in the deep artesian aquifer in part of the Sevier Desert from March 1985 to March 2015.

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. 29). 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 2014 was about 31,000 acre-feet, which is 3,000 acre-feet more than reported for 2013 and 8,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3).

The location of 24 wells in central Sevier Valley in which the water level was measured during March 2015 is shown in figure 29. The relation of the water level in selected observation wells to annual discharge of the Sevier River at Hatch, Utah, to cumulative departure from average annual precipitation at Richfield Radio KVSC, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4 is shown in figure 30.

Discharge of the Sevier River at Hatch, Utah, in 2014 was about 46,200 acre-feet, which is about 33,900 acre-feet less than the 1940–2014 average annual discharge. Precipitation at Richfield Radio KVSC was about 10.0 inches in 2014, which is about 1.9 inches more than the 1950–2014 average annual precipitation and about 1.0 inch more than in 2013.

Water levels in central Sevier Valley generally declined in most areas from March 2014 to March 2015. 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.

Water levels declined from March 1985 to March 2015 in the central Sevier Valley in areas where data are available (fig. 31). The greatest decline, about 20.5 feet, occurred in a well about 1 mile northeast of Richfield. Declines are probably the result of continued large withdrawals, particularly for irrigation.

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 2014, is shown in figure 30. The concentration has ranged from 307 to 630 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 2014 show little variability and are generally near the median value for all sample concentrations.

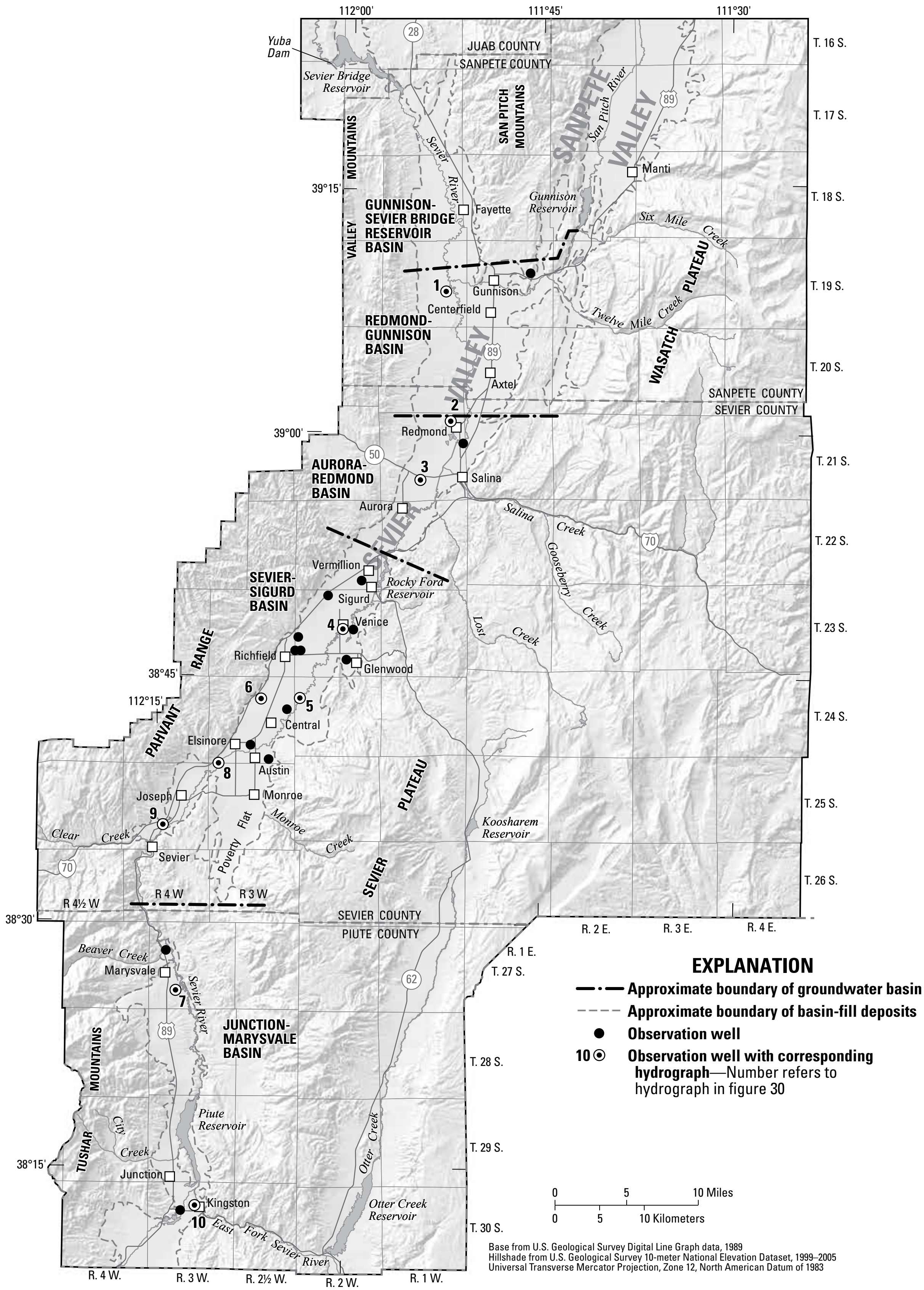


Figure 29. Location of wells in central Sevier Valley in which the water level was measured during March 2015.

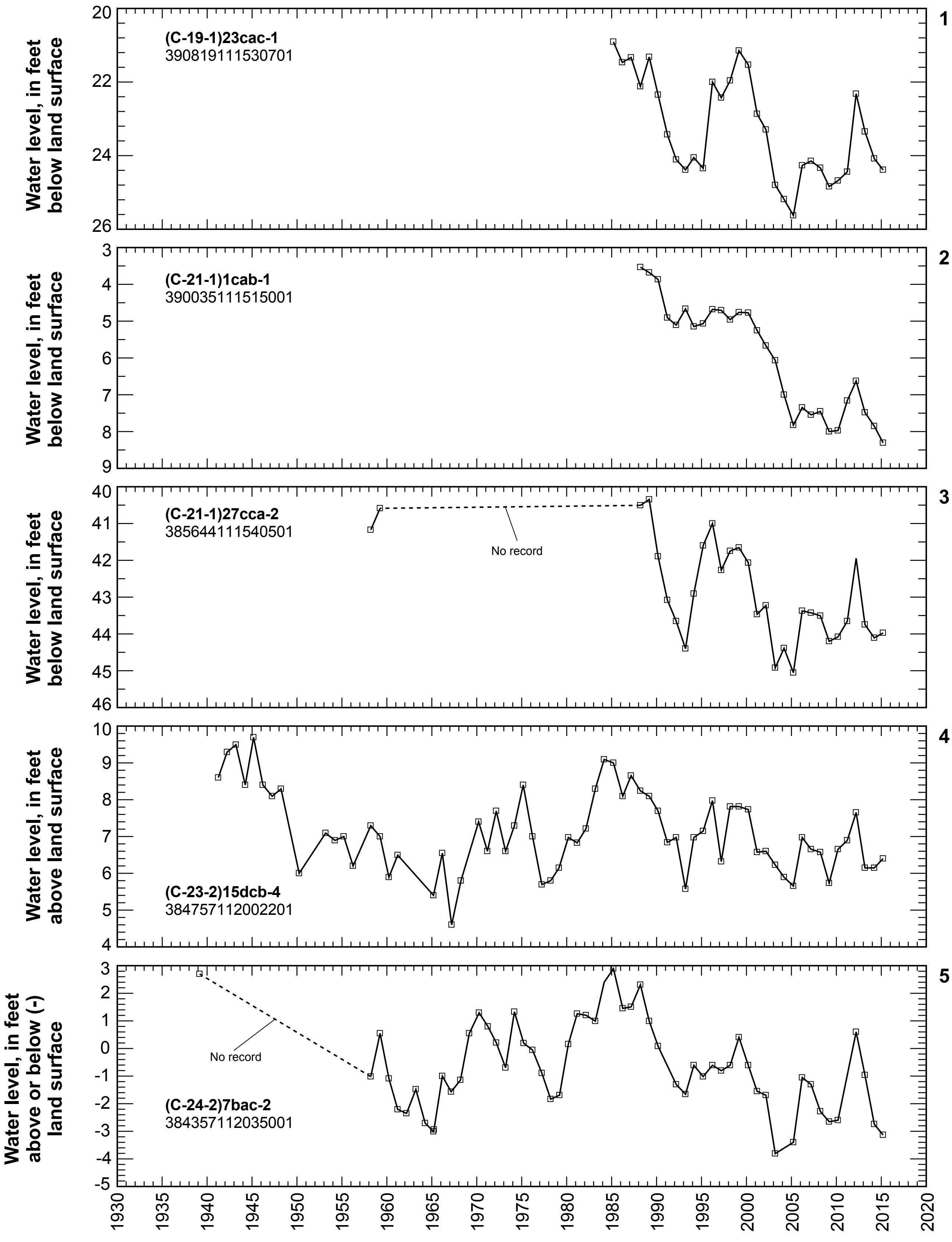


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, Utah, to cumulative departure from average annual precipitation at Richfield Radio KVSC, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.

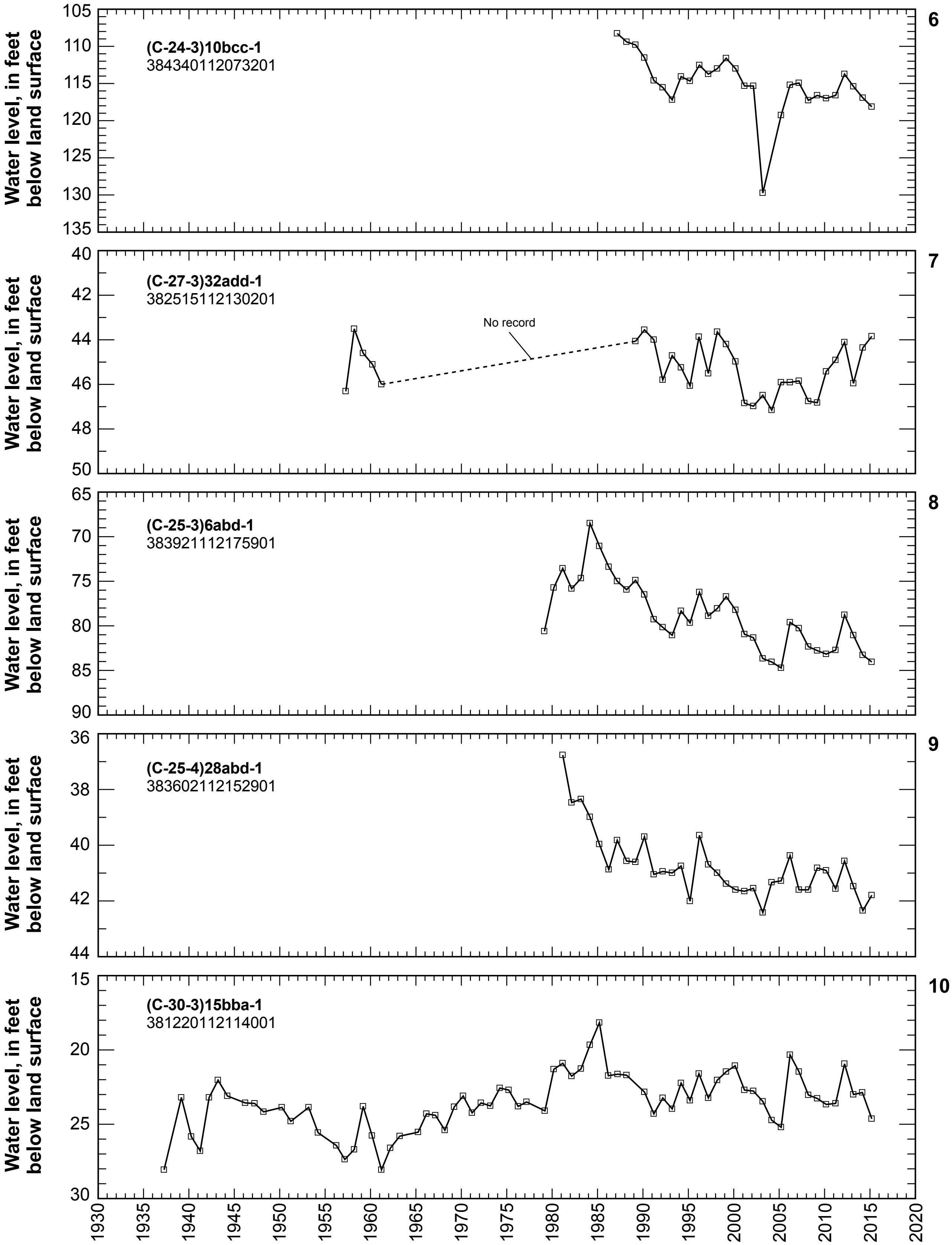


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, Utah, to cumulative departure from average annual precipitation at Richfield Radio KVSC, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.—Continued

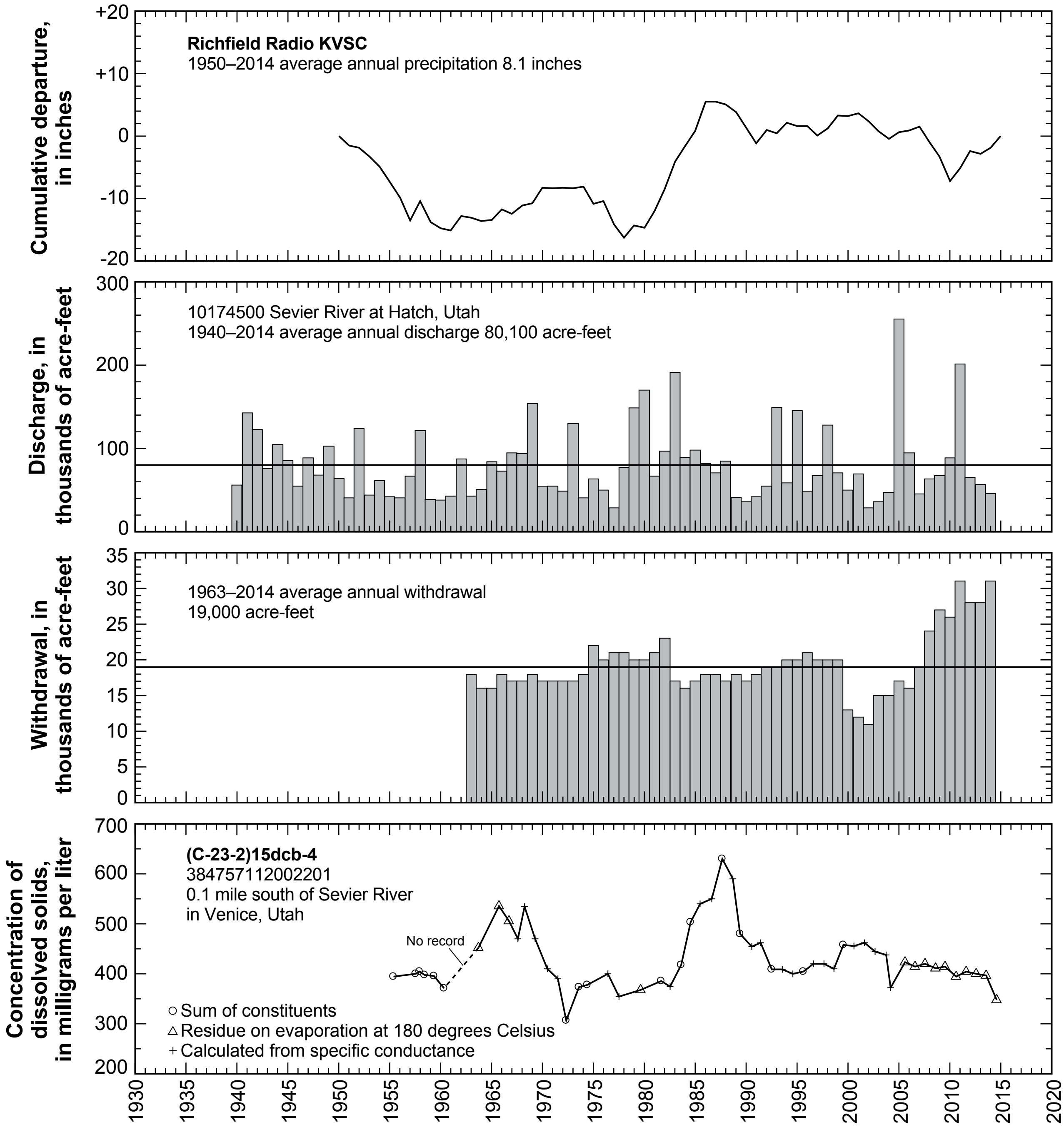


Figure 30. Relation of water level in selected wells in central Sevier Valley to annual discharge of the Sevier River at Hatch, Utah, to cumulative departure from average annual precipitation at Richfield Radio KVSC, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-23-2)15dcb-4.—Continued

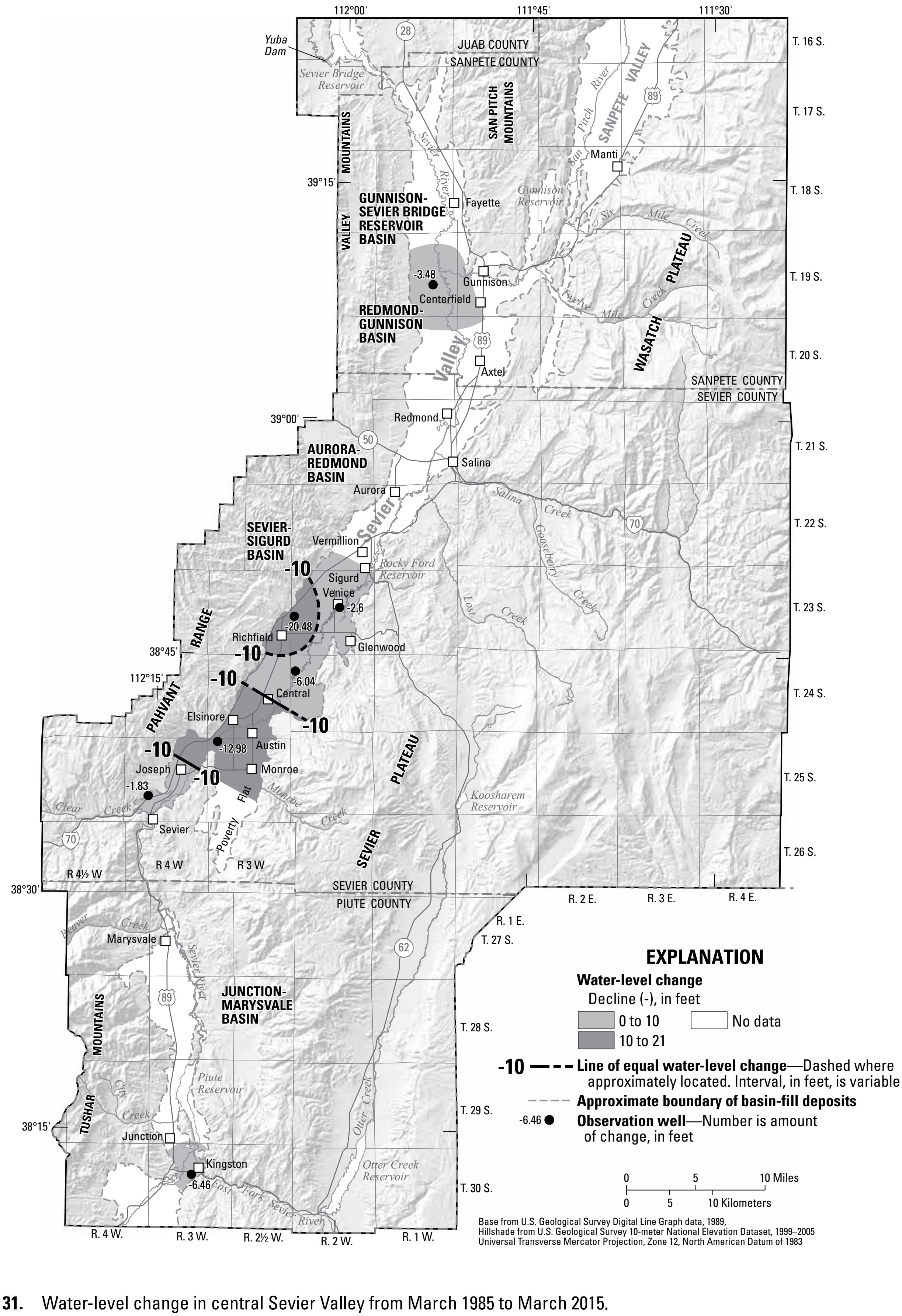


Figure 31. Water-level change in central Sevier Valley from March 1985 to March 2015.

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. 32). 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 and basalt in the valley under both water-table and artesian conditions.

Total estimated withdrawal of water from wells in Pahvant Valley in 2014 was about 118,000 acre-feet, which is about 15,000 acre-feet more than was reported in 2013 and 23,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawal for irrigation in 2014 was about 117,000 acre-feet, which is 15,500 acre-feet more than was reported in 2013.

The location of wells in Pahvant Valley in which the water level was measured during March 2015 is shown in figure 32. 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 33.

Precipitation at Fillmore during 2014 was about 16.9 inches, which is about 1.6 inches more than the average annual precipitation for 1930–2014 and about 2.1 inches more than in 2013.

Water levels declined from March 2014 to March 2015 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 8 feet occurred 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.

Water levels declined from March 1985 to March 2015 in all parts of Pahvant Valley for which data are available (fig. 34). The greatest decline, almost 130 feet, occurred in a well near McCornick in the northern part of the valley. Declines are probably the result of continued large withdrawals for irrigation.

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 1958 and 1960 to 2014, respectively, and from well (C-23-6)8abd-1, located in the Kanosh area, from 1957 to 2014, is shown in figure 33. 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 these wells have ranged from 707 to 1,080 mg/L. The concentration of dissolved solids in the water sample collected in June 2014 was 989 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. The concentration of dissolved solids in the water sample collected from this well in June 2014 was 5,490 mg/L.

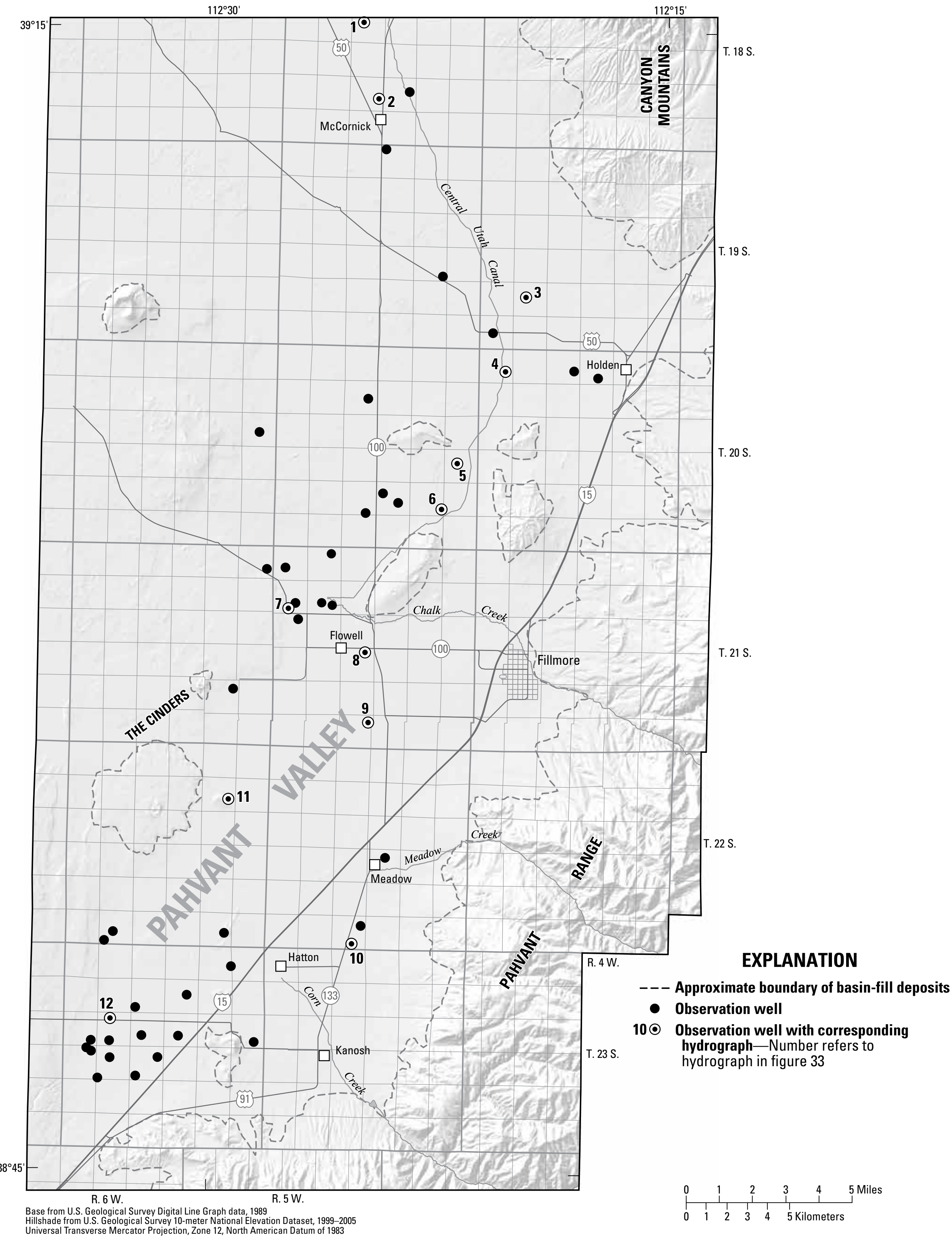


Figure 32. Location of wells in Pahvant Valley in which the water level was measured during March 2015.

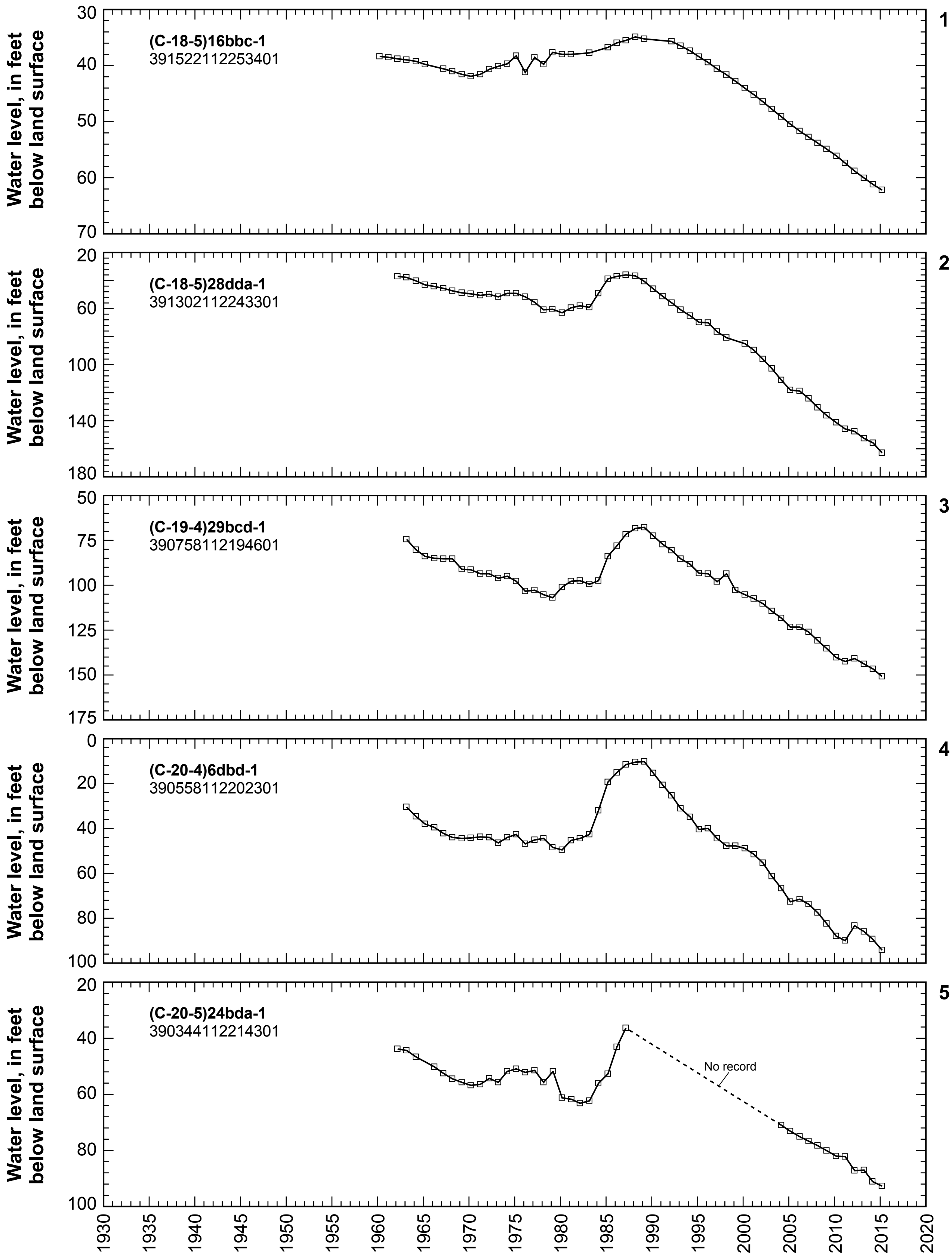


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

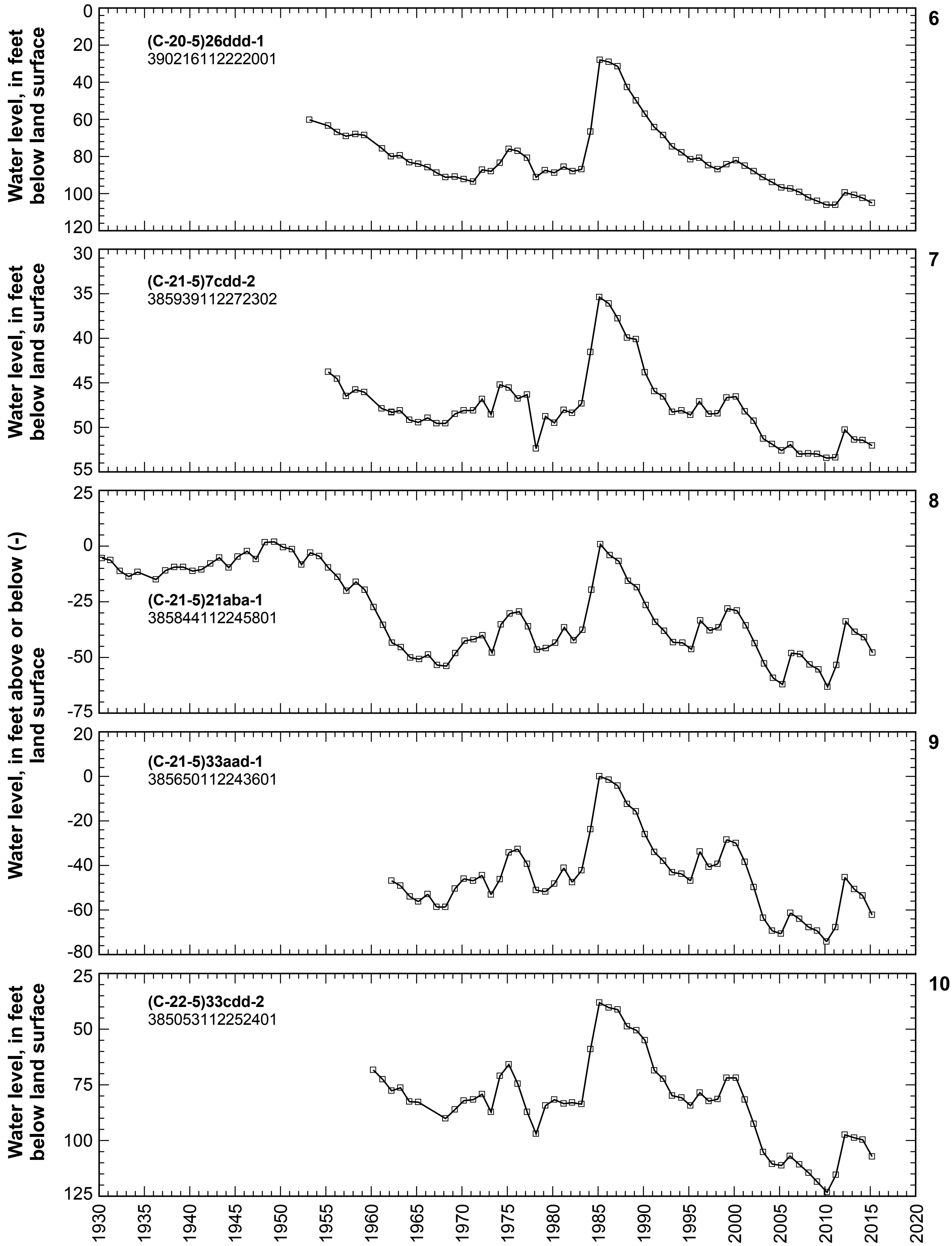


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

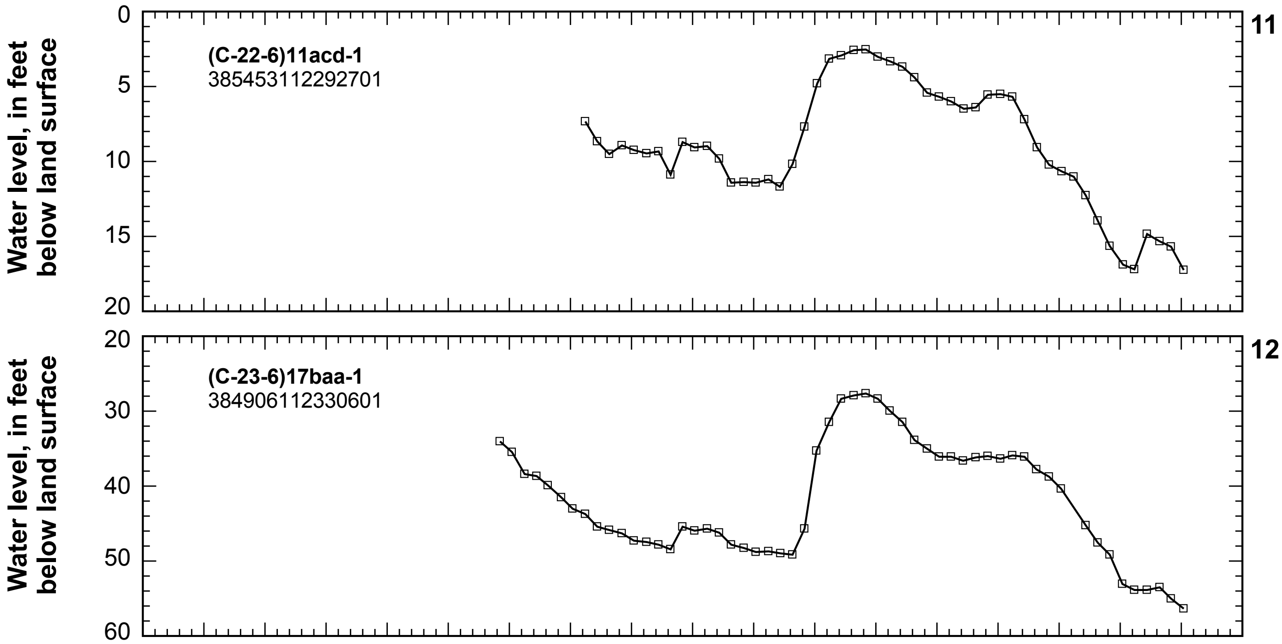


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

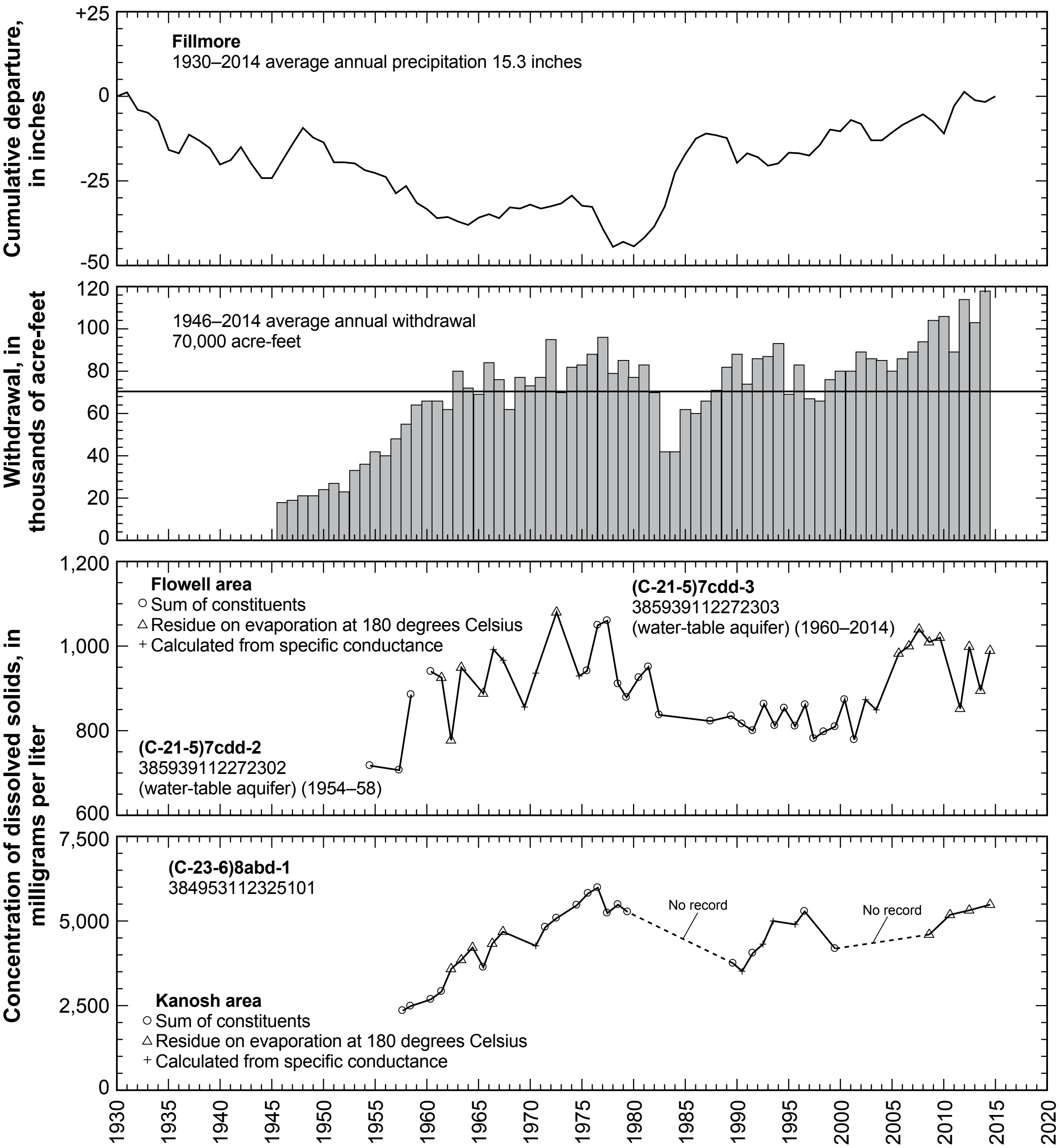


Figure 33. Relation of water level in selected wells in Pahvant Valley to cumulative departure from average annual precipitation at Fillmore, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

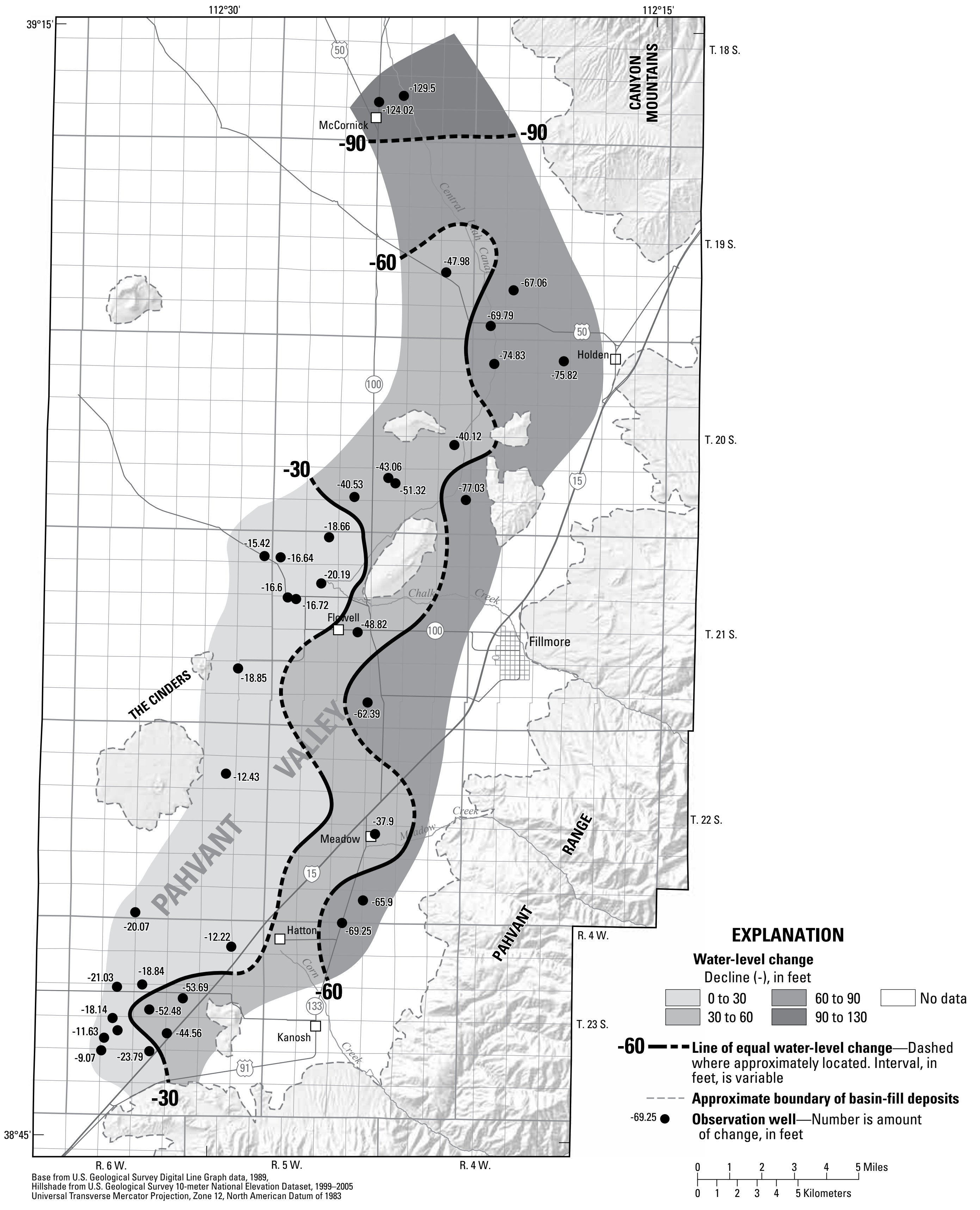


Figure 34. Water-level change in Pahvant Valley from March 1985 to March 2015.

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. 35). 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 2014 was about 43,000 acre-feet, which is 4,000 acre-feet more than in 2013 and 6,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3).

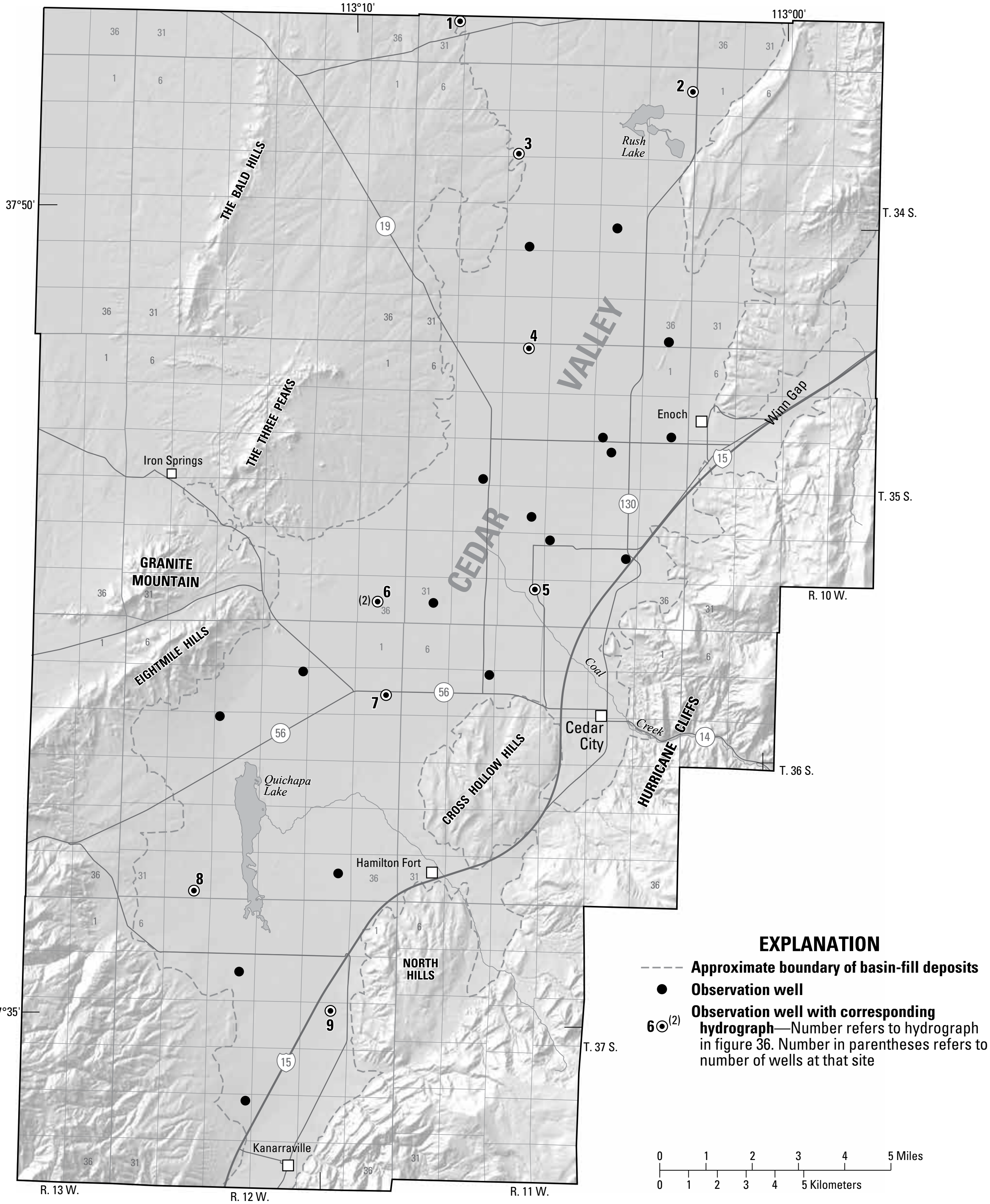
The location of wells in Cedar Valley in which the water level was measured during March 2015 is shown in figure 35. The relation of the water level in selected observation wells to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, Utah, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells is shown in figure 36.

Precipitation at Cedar City Federal Aviation Administration Airport in 2014 was about 9.8 inches, which is about 5.2 inches less than the revised total (15.0 inches) for 2013 and 1.1 inches less than the average annual precipitation for 1949–2014. Discharge of Coal Creek was about 11,800 acre-feet in 2014, which is 6,200 acre-feet less than the revised value (18,000 acre-feet) for 2013, and 12,600 acre-feet less than the average annual discharge for 1936 and 1939–2014.

Groundwater levels declined from March 2014 to March 2015 in most parts of Cedar Valley. The largest decline, greater than 12 feet, was measured in a well about 4 miles north of Cedar City. Water-level declines probably resulted from locally increased withdrawals and decreased recharge. A small water-level rise (0.12 foot) was measured in one well about 3 miles west of Rush Lake in the northern part of the valley. Water-level rises probably resulted from decreased localized withdrawals and increased recharge.

Groundwater levels declined from March 1985 to March 2015 in most parts of Cedar Valley for which data are available (fig. 37). The largest decline, about 71 feet, occurred in a well west of Quichapa Lake. Declines are probably the result of continued large withdrawals for irrigation. Rises of less than 3 feet were measured in three wells in the northern part of the valley. Localized rises may be the result of decreased withdrawals.

The concentration of dissolved solids in water samples collected from well (C-37-12)23abd-1, located about 2.0 miles northeast of Kanarraville, from 1991 to 2014, and well (C-35-11)31dbd-1, located about 4 miles northwest of Cedar City, from 1977 to 2014, is shown in figure 36. The dissolved-solids concentrations in water from both wells have generally increased.



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 35. Location of wells in Cedar Valley, Iron County, in which the water level was measured during March 2015.

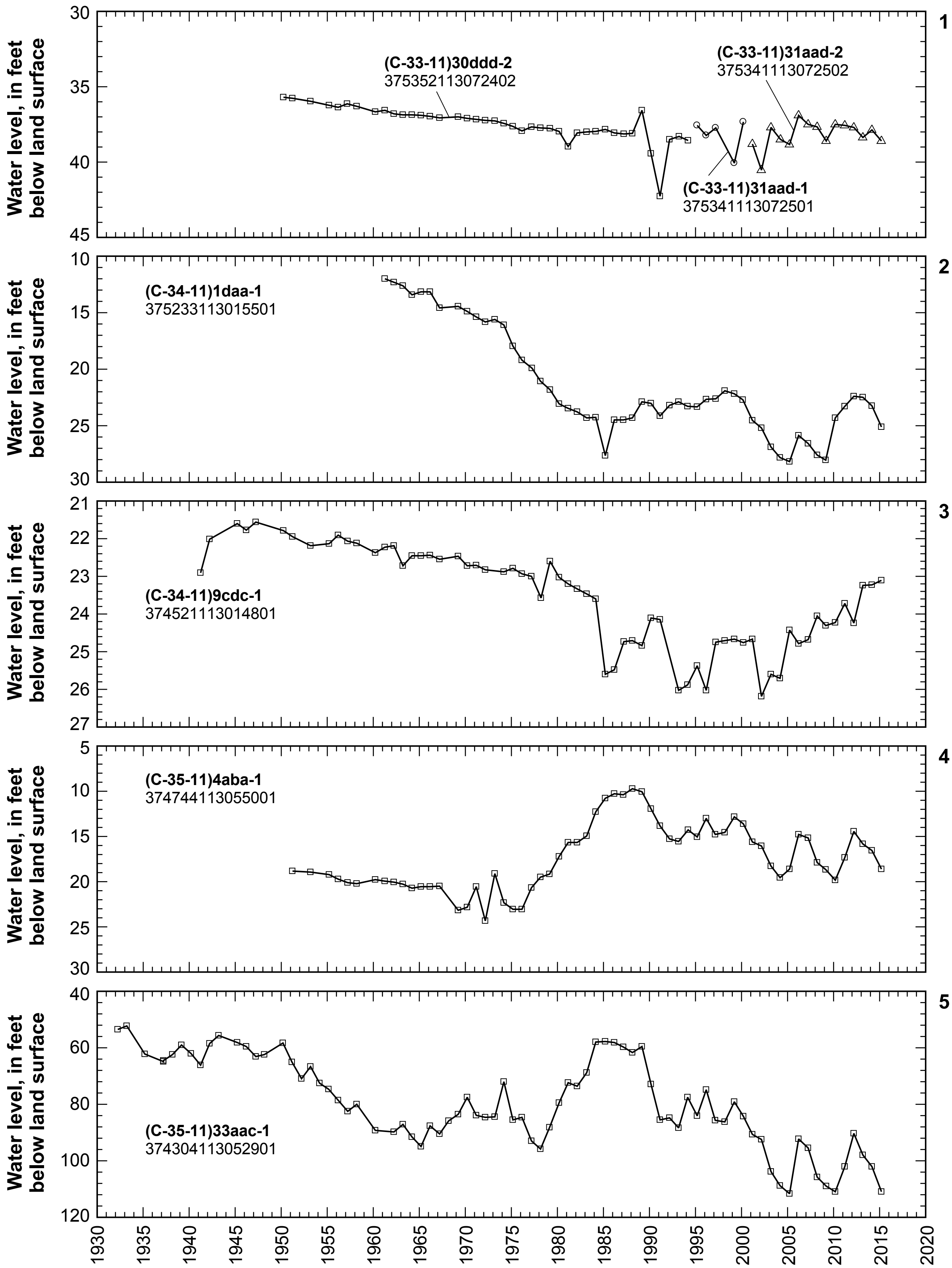


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, Utah, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.

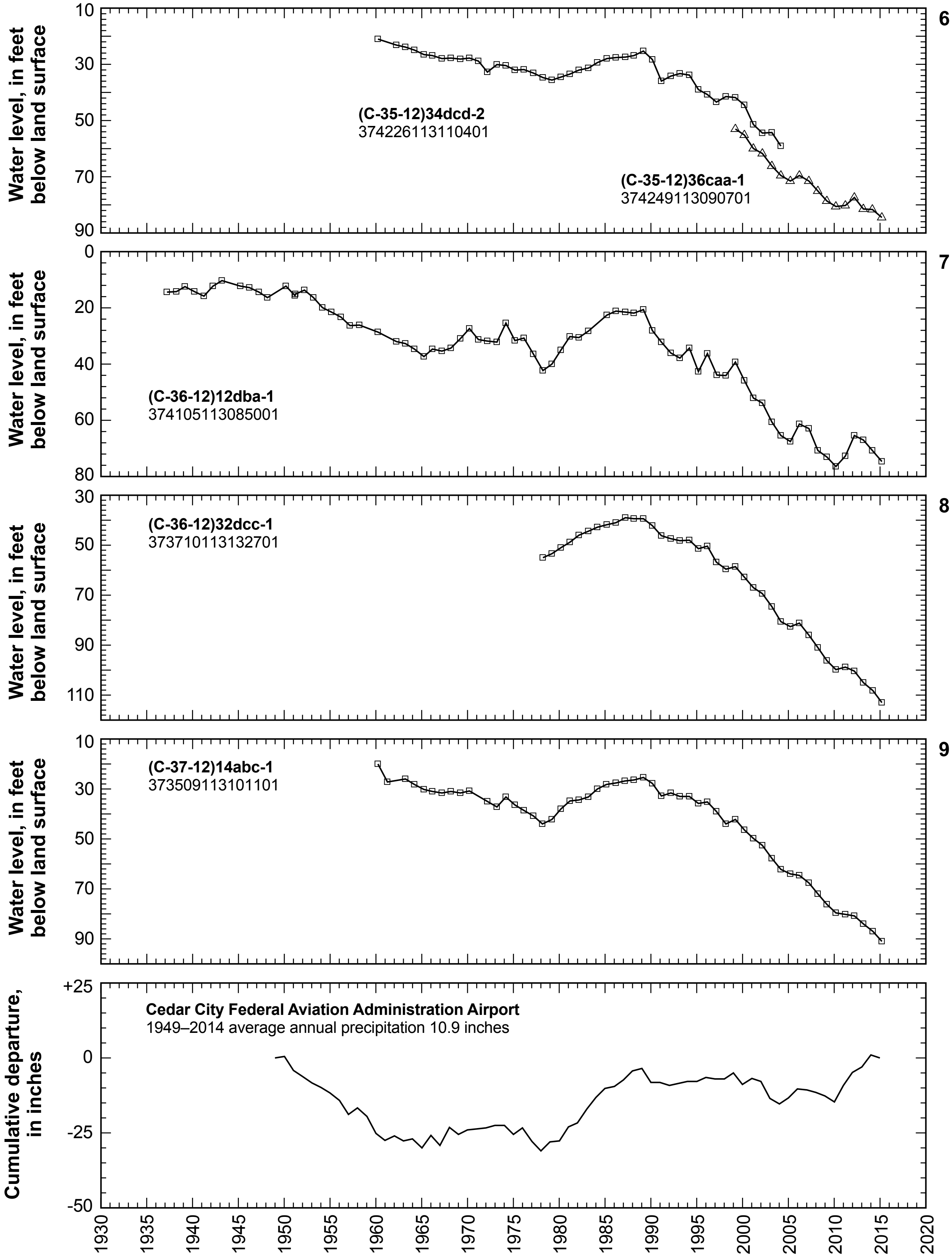


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, Utah, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

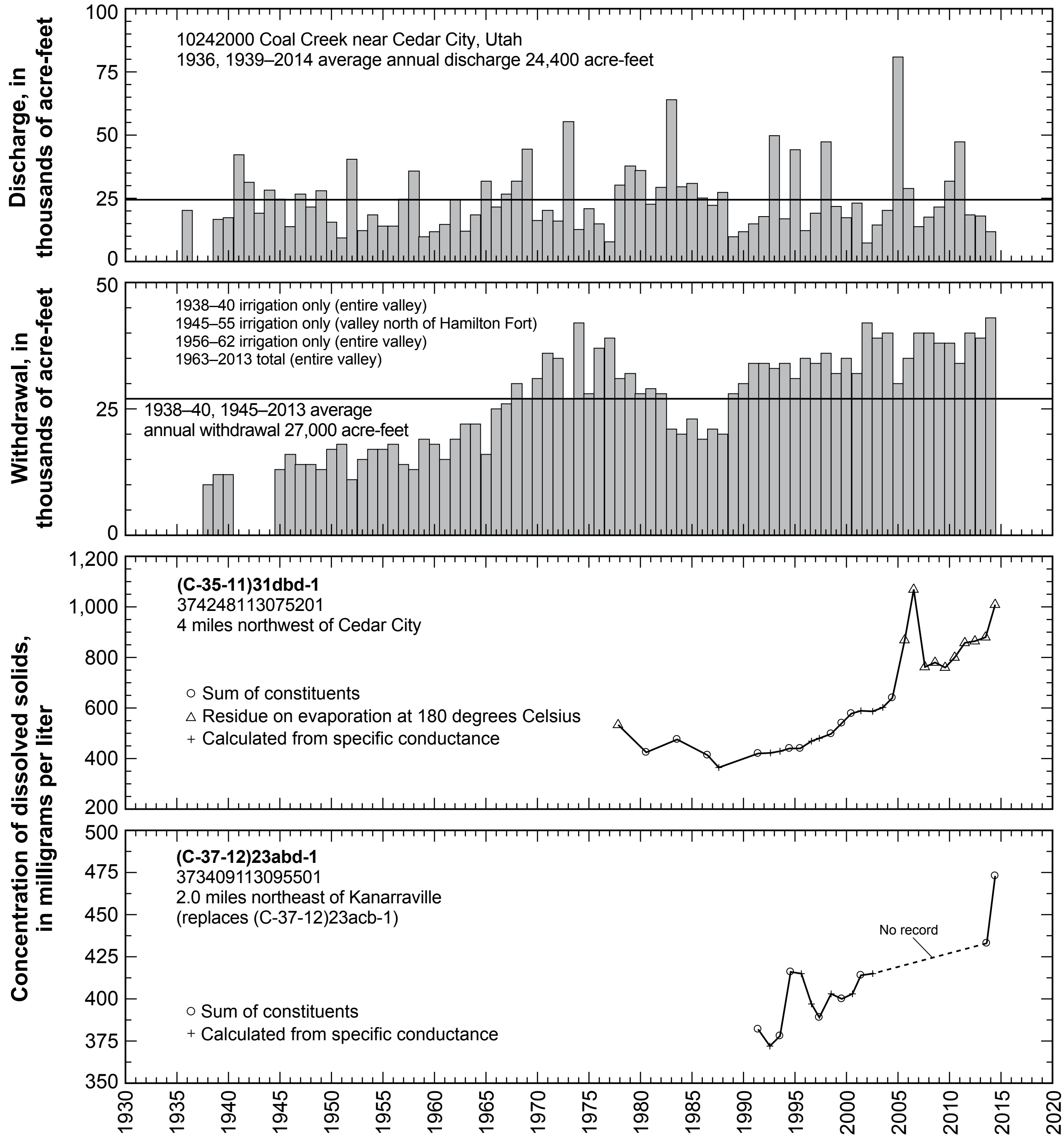


Figure 36. Relation of water level in selected wells in Cedar Valley, Iron County, to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual discharge of Coal Creek near Cedar City, Utah, to annual withdrawal from wells, and to concentration of dissolved solids in water from selected wells.—Continued

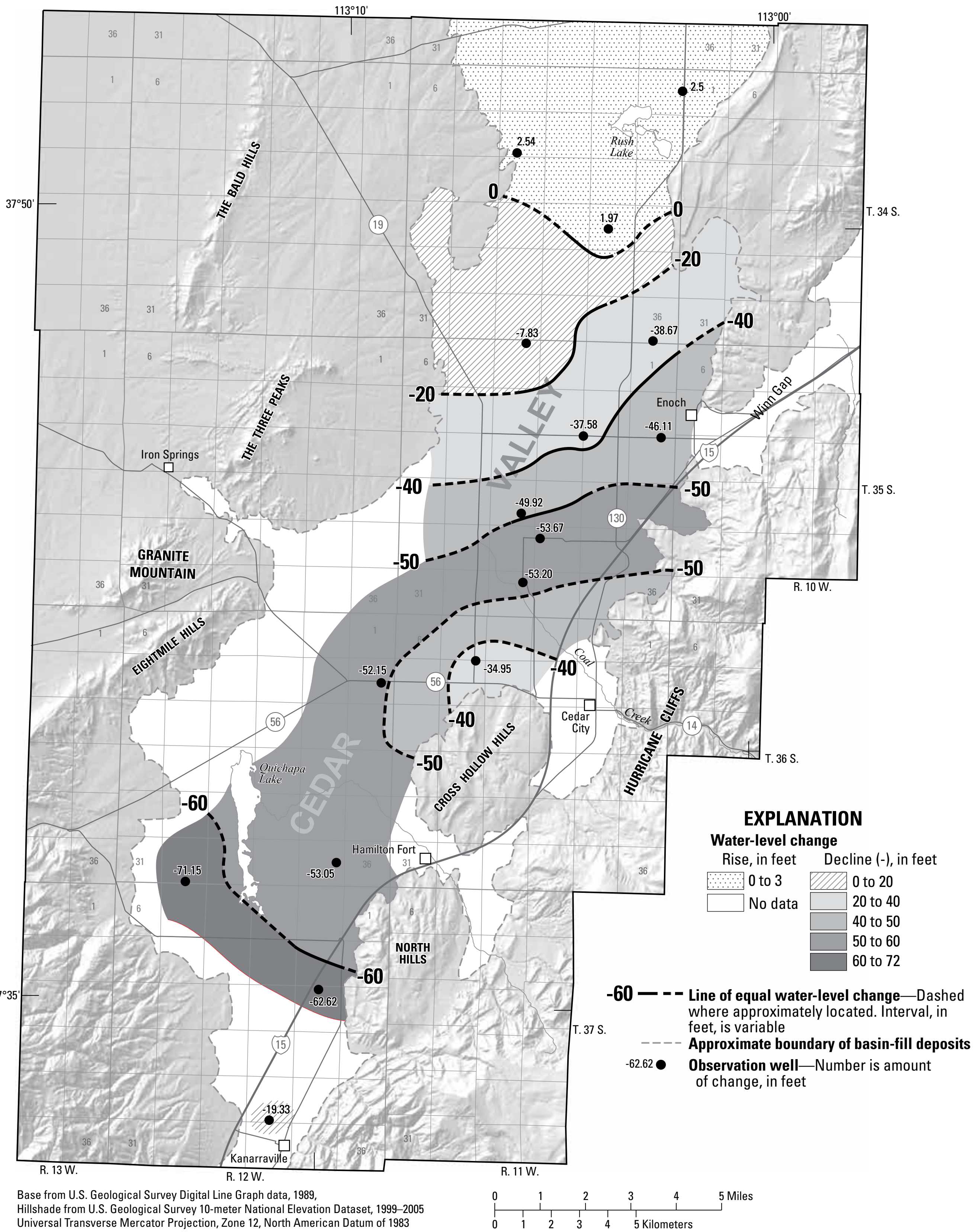


Figure 37. Water-level change in Cedar Valley, Iron County, from March 1985 to March 2015.

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 east of Black Mountain, and includes the towns of Paragonah and Parowan (fig. 38). 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 2014 was about 38,000 acre-feet, which is about 6,000 acre-feet more than was reported for 2013 and 4,000 acre-feet more than the average annual withdrawal for 2004–2013 (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 2015 is shown in figure 38. 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 39.

Precipitation at Cedar City Federal Aviation Administration Airport in 2014 was about 9.8 inches, which is about 5.2 inches less than the revised value for 2013 and 1.1 inches less than the average annual precipitation for 1949–2014.

Water levels declined from March 2014 to March 2015 in all parts of Parowan Valley for which data are available. The largest declines, more than 7 feet, were measured in two wells 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.

Water levels declined from March 1985 to March 2015 in all parts of Parowan Valley for which data are available (fig. 40). The largest decline, about 94 feet, occurred in a well north of Parowan and west of Paragonah. Declines are probably the result of continued large withdrawals for irrigation.

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 2014, is shown in figure 39. The water sample collected in July 2014 had a dissolved-solids concentration of 284 mg/L. With the exception of relatively high dissolved-solids concentrations in water samples collected in 1970, 1973, and 1974, concentrations have varied little.

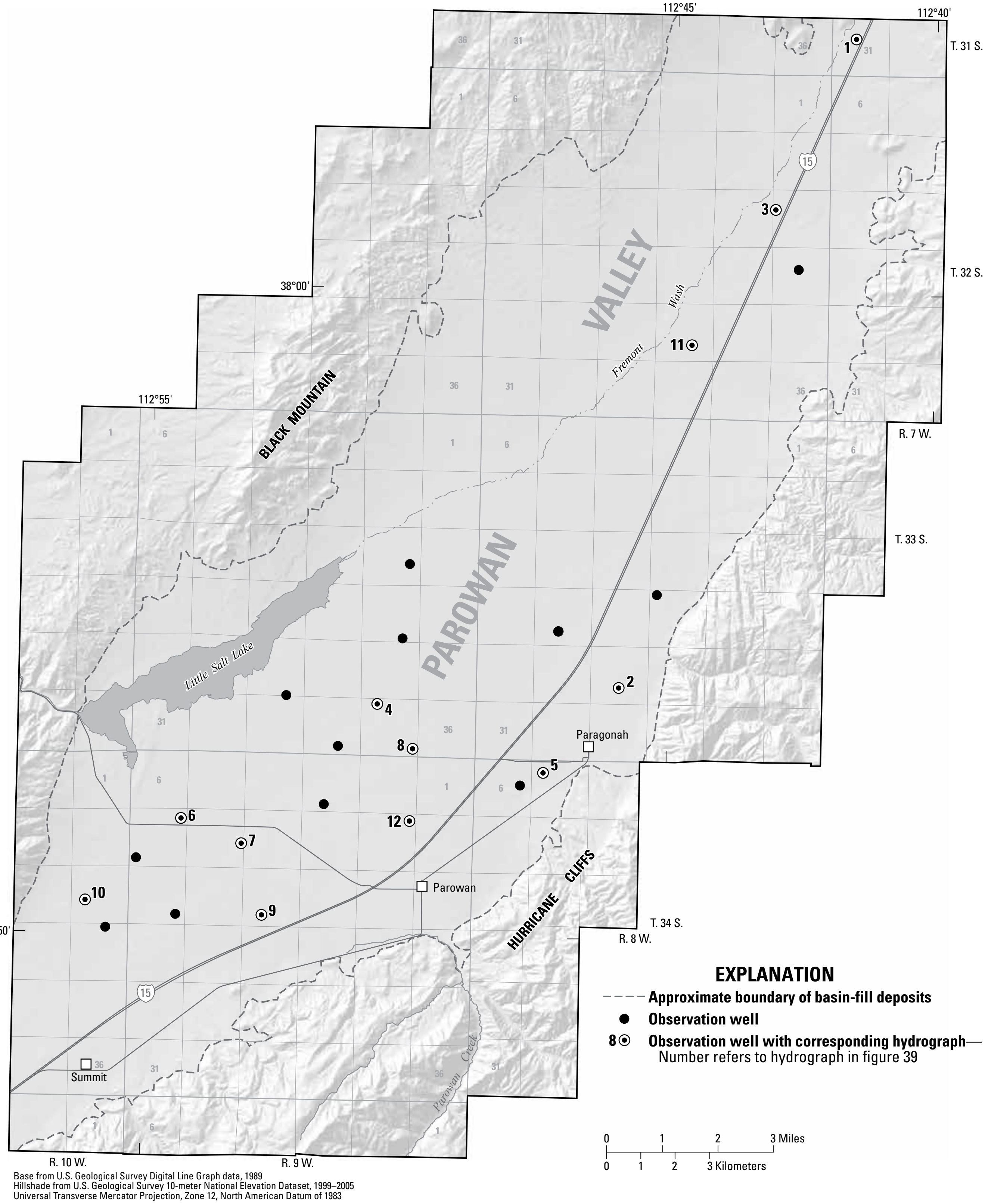


Figure 38. Location of wells in Parowan Valley in which the water level was measured during March 2015.

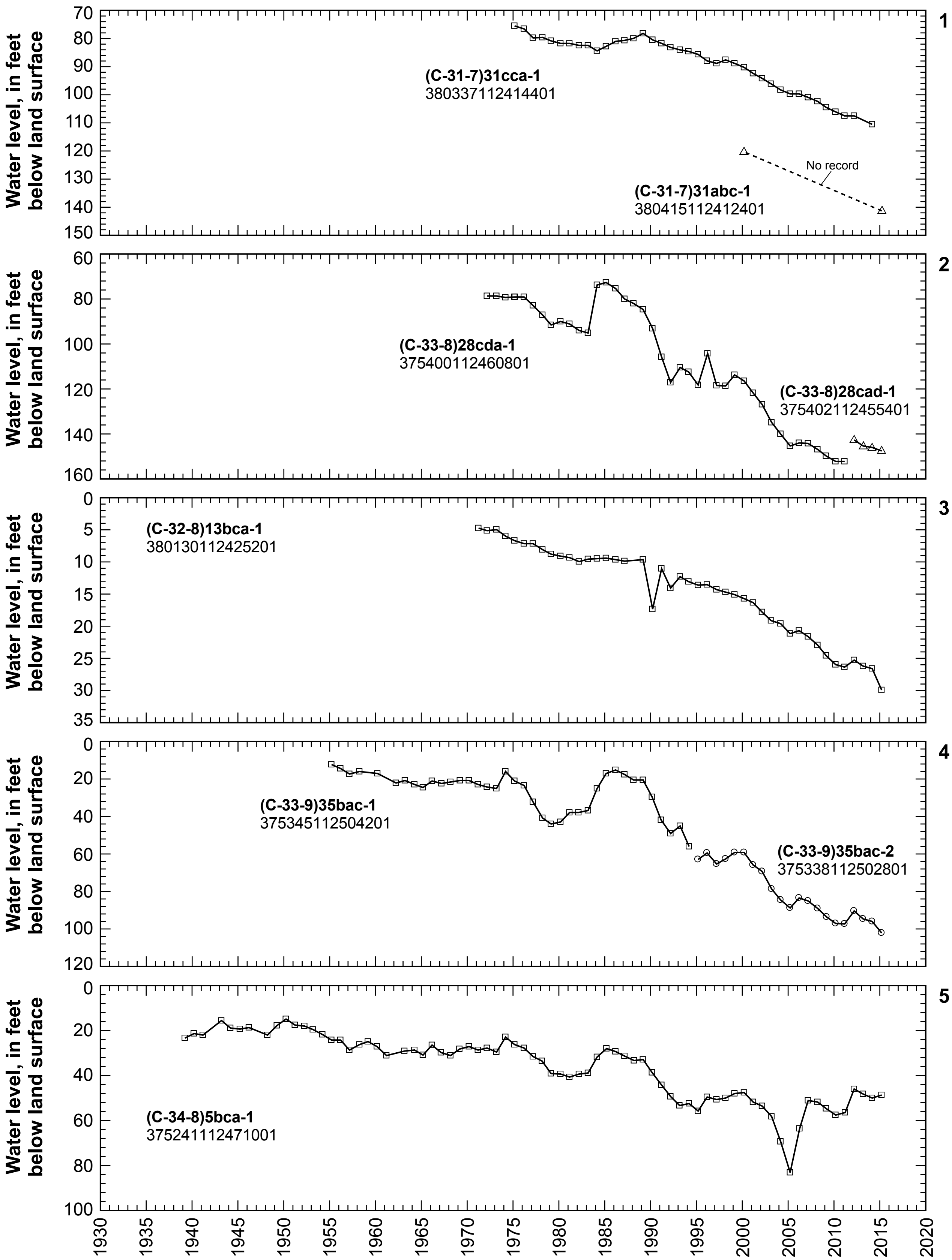


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.

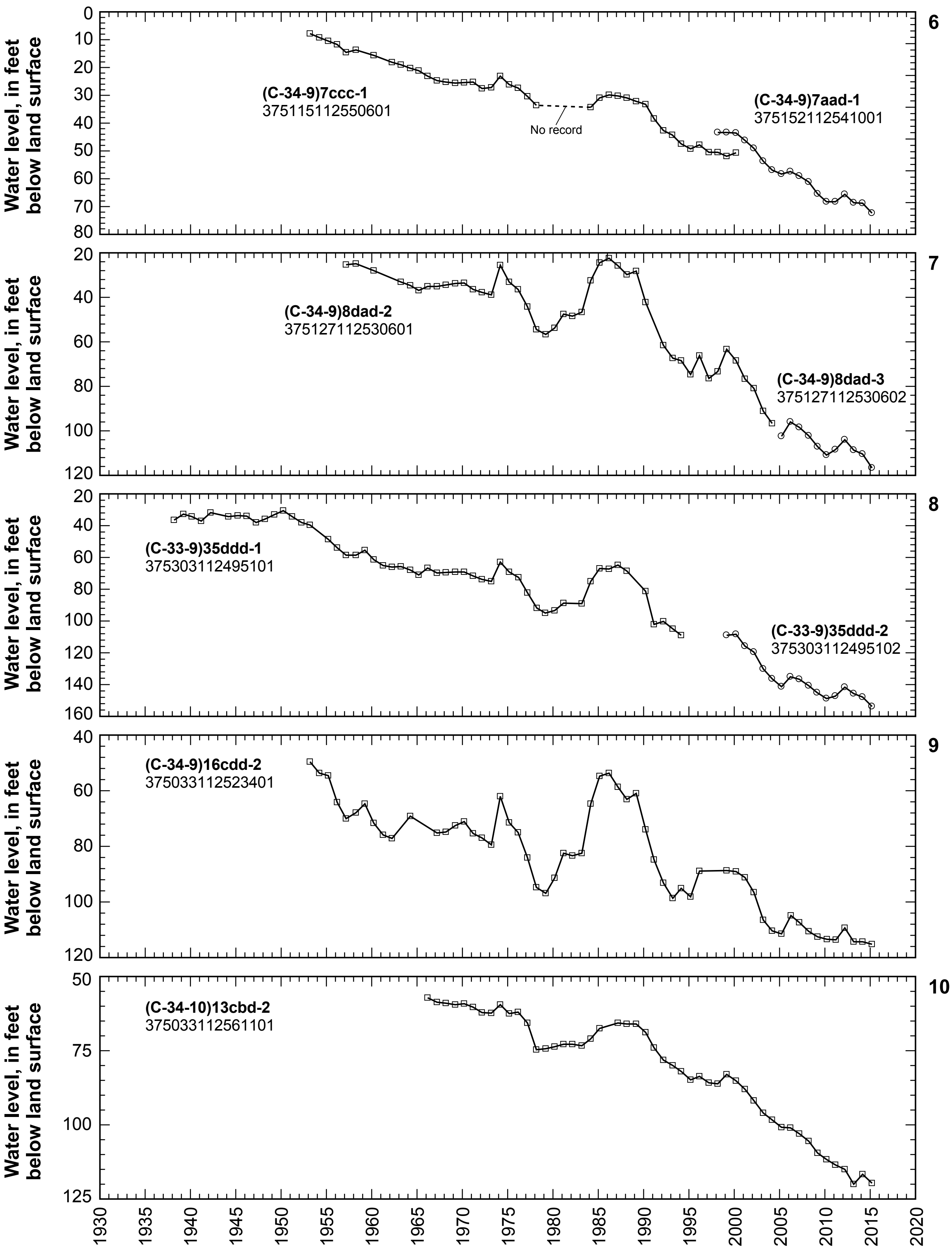


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.—Continued

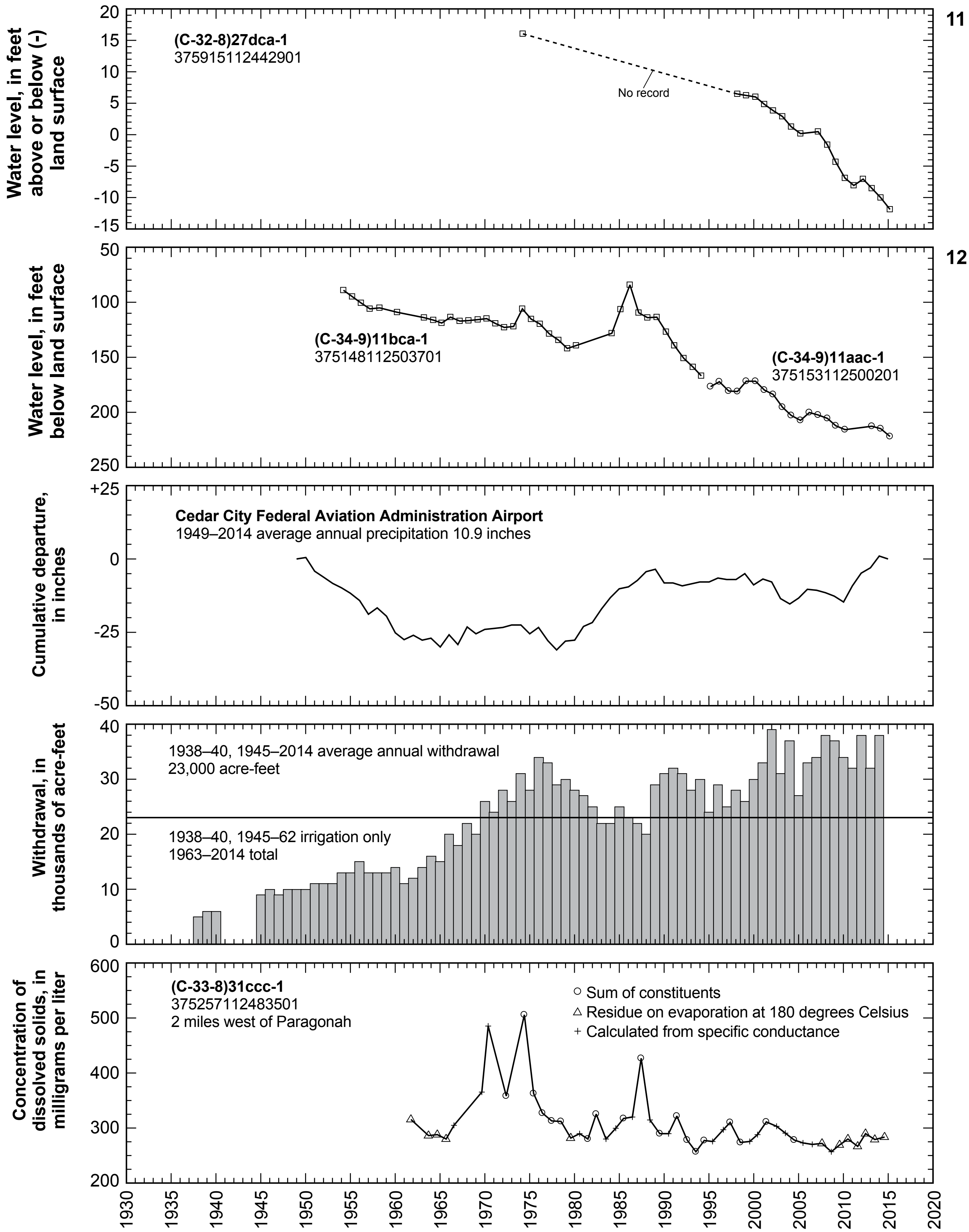


Figure 39. Relation of water level in selected wells in Parowan Valley to cumulative departure from average annual precipitation at Cedar City Federal Aviation Administration Airport, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-33-8)31ccc-1.—Continued

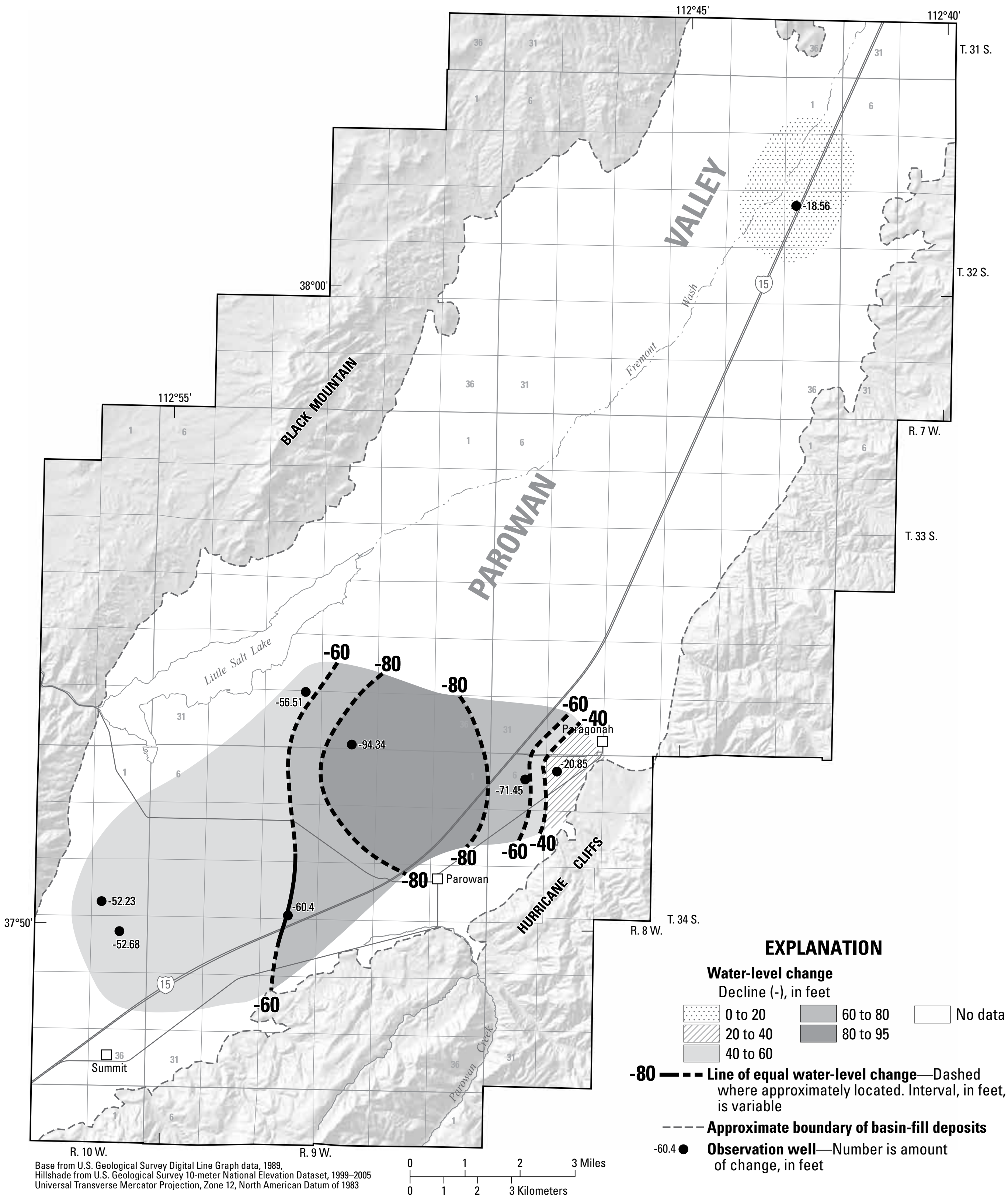


Figure 40. Water-level change in Parowan Valley from March 1985 to March 2015.

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. 41). 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 2014 was about 67,000 acre-feet, which is 1,000 acre-feet less than was reported for 2013 and 13,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3).

The location of wells in the Milford area in which the water level was measured during March 2015 is shown in figure 41. 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 42. Precipitation at Black Rock in 2014 was about 10.9 inches, about 2.8 inches more than in 2013 and about 1.9 inches more than the 1952–2014 average annual precipitation.

Water levels declined from March 2014 to March 2015 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, greatly reduced withdrawals, and increased recharge to the basin-fill aquifer from record flow in the Beaver River during 1983–84.

Water levels generally declined from March 1985 to March 2015 throughout Milford Valley in areas where data are available (fig. 43). The greatest decline, more than 58 feet, occurred in a well about 4 miles southeast of Milford. Rises in water levels, up to 11 feet, occurred in the northeast part of the valley. Declines are probably the result of continued large withdrawals for irrigation. Localized rises may be due to decreased withdrawals and increased recharge.

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 2014, is shown in figure 42. The dissolved-solids concentration in the July 2014 sample was 469 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.

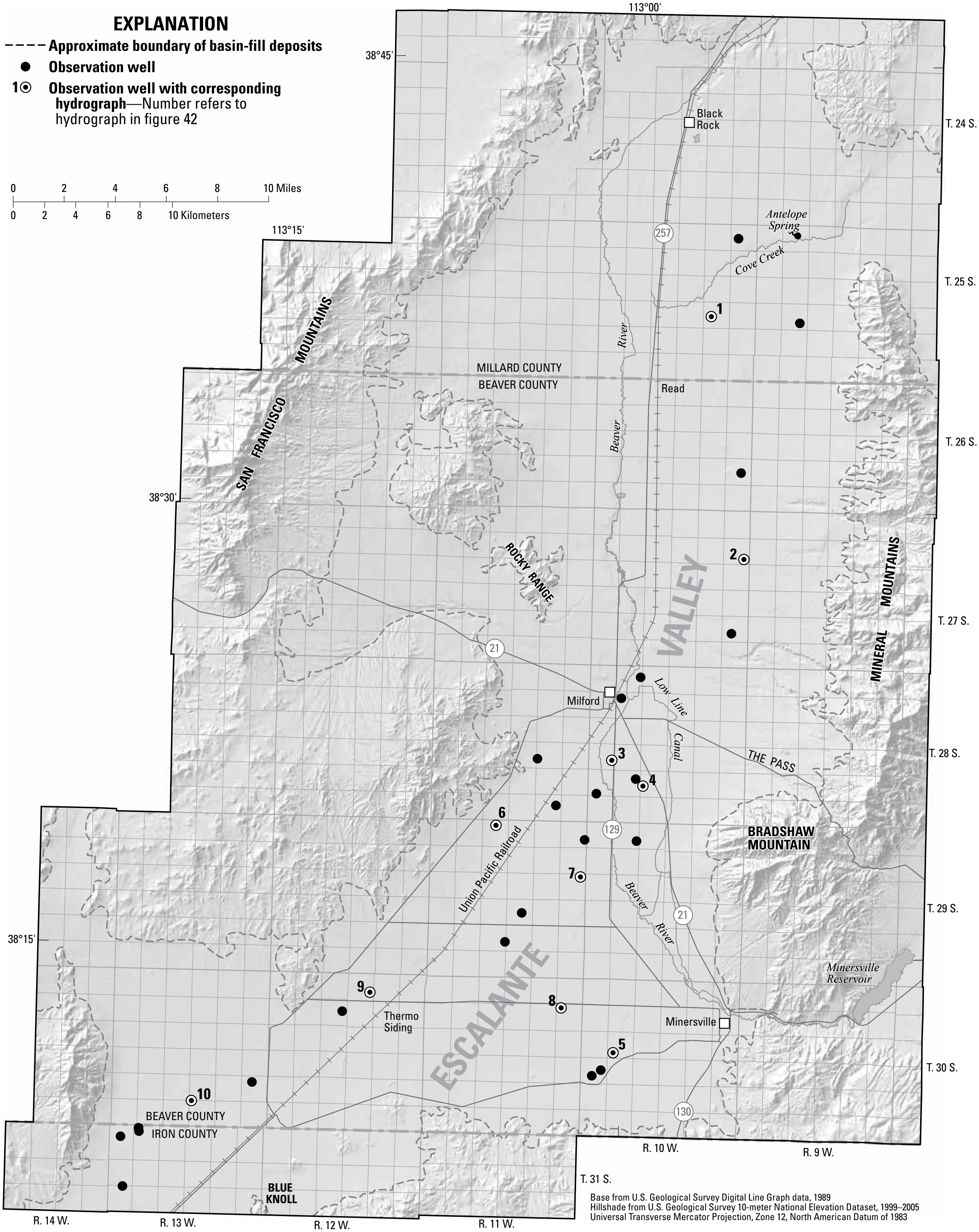


Figure 41. Location of wells in the Milford area in which the water level was measured during March 2015.

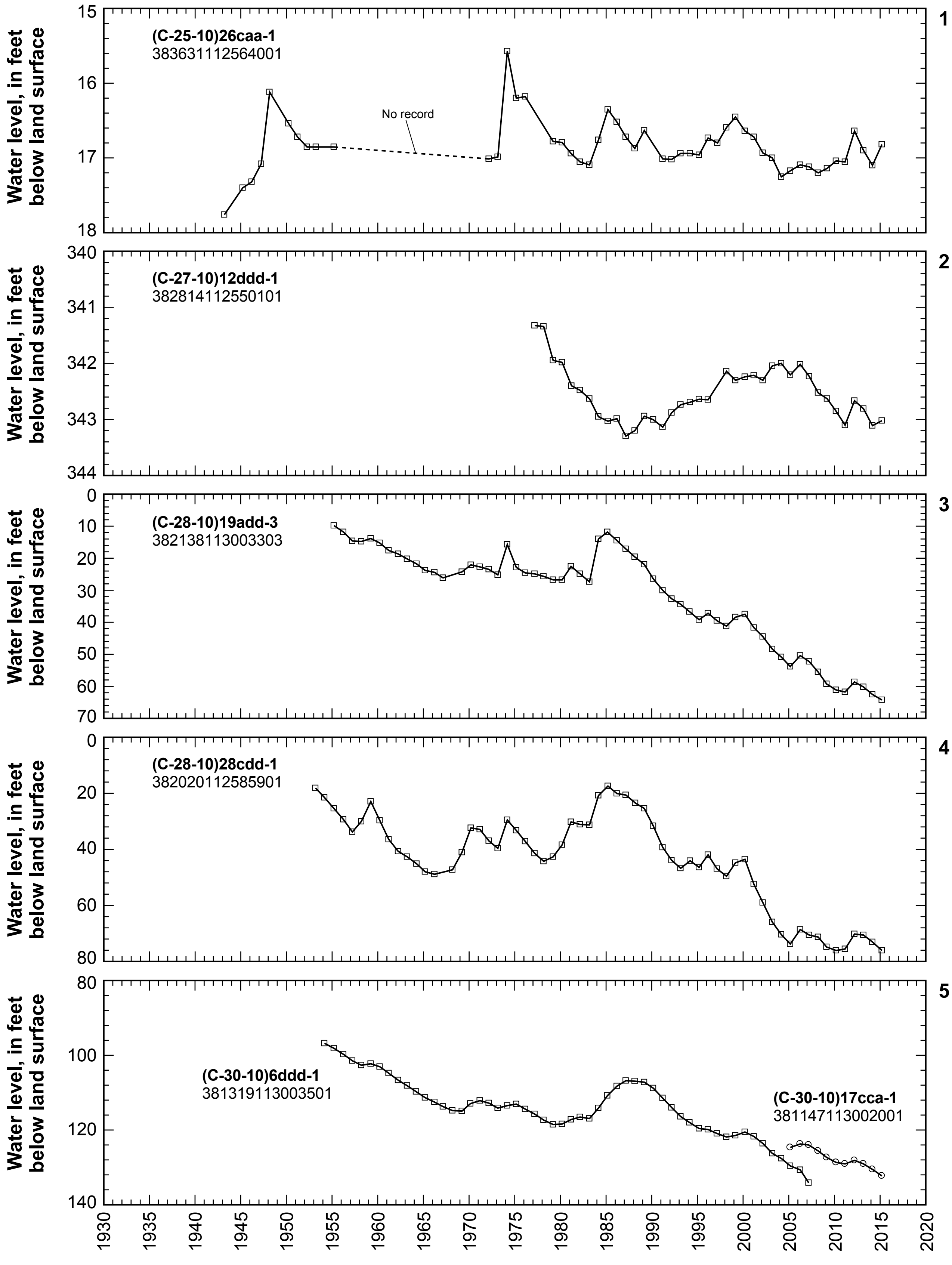


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.

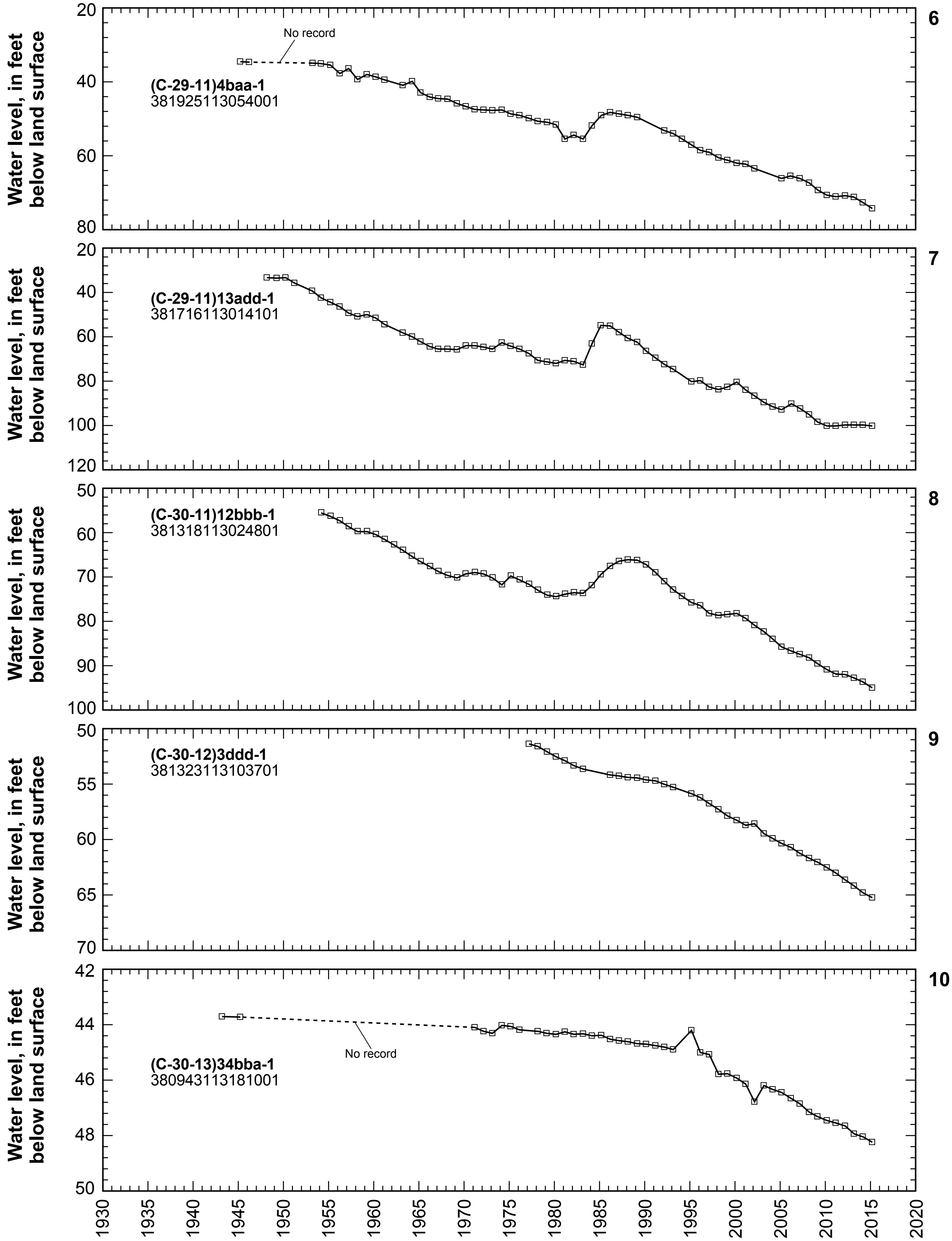


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.—Continued

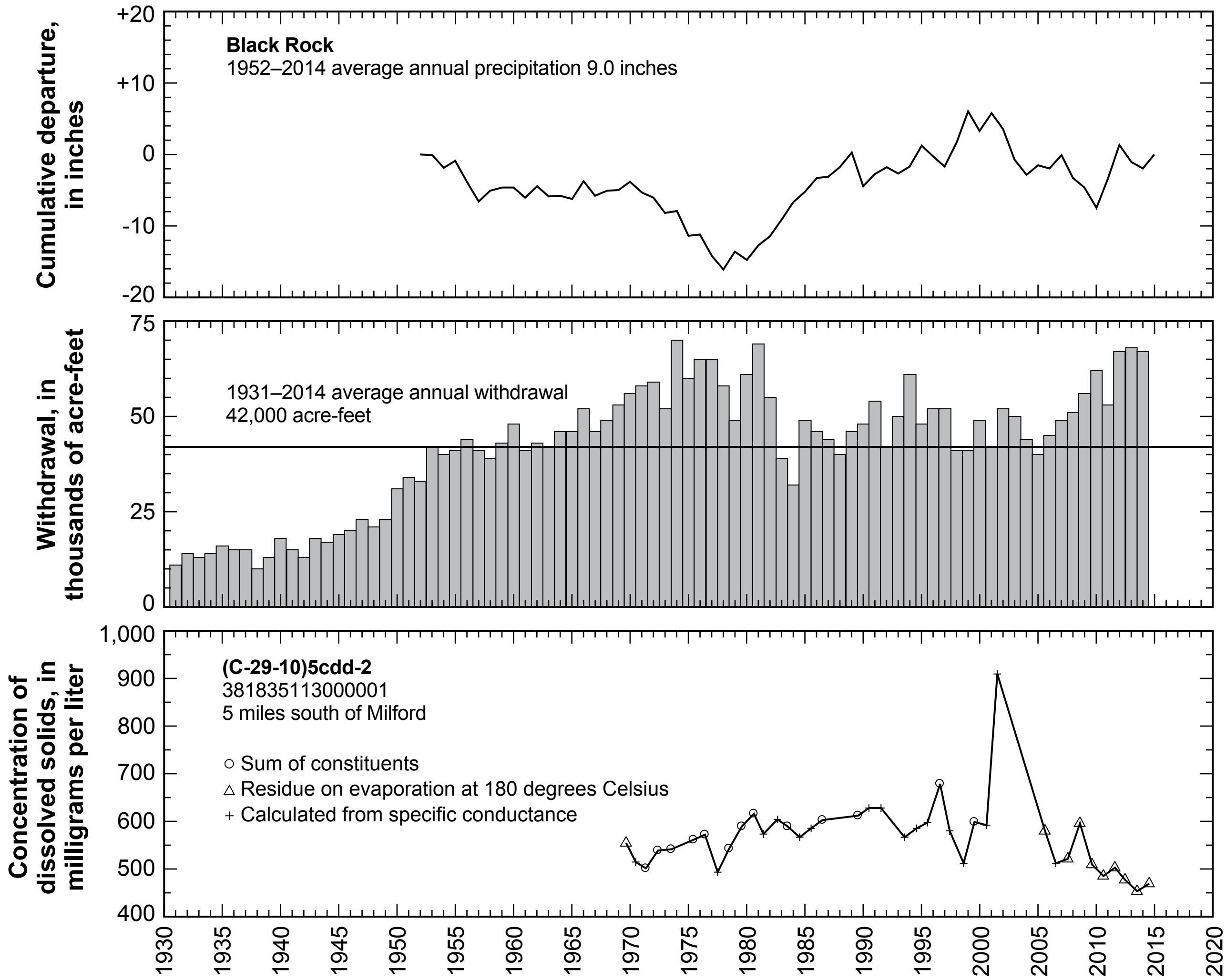


Figure 42. Relation of water level in selected wells in the Milford area to cumulative departure from average annual precipitation at Black Rock, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-29-10)5cdd-2.—Continued

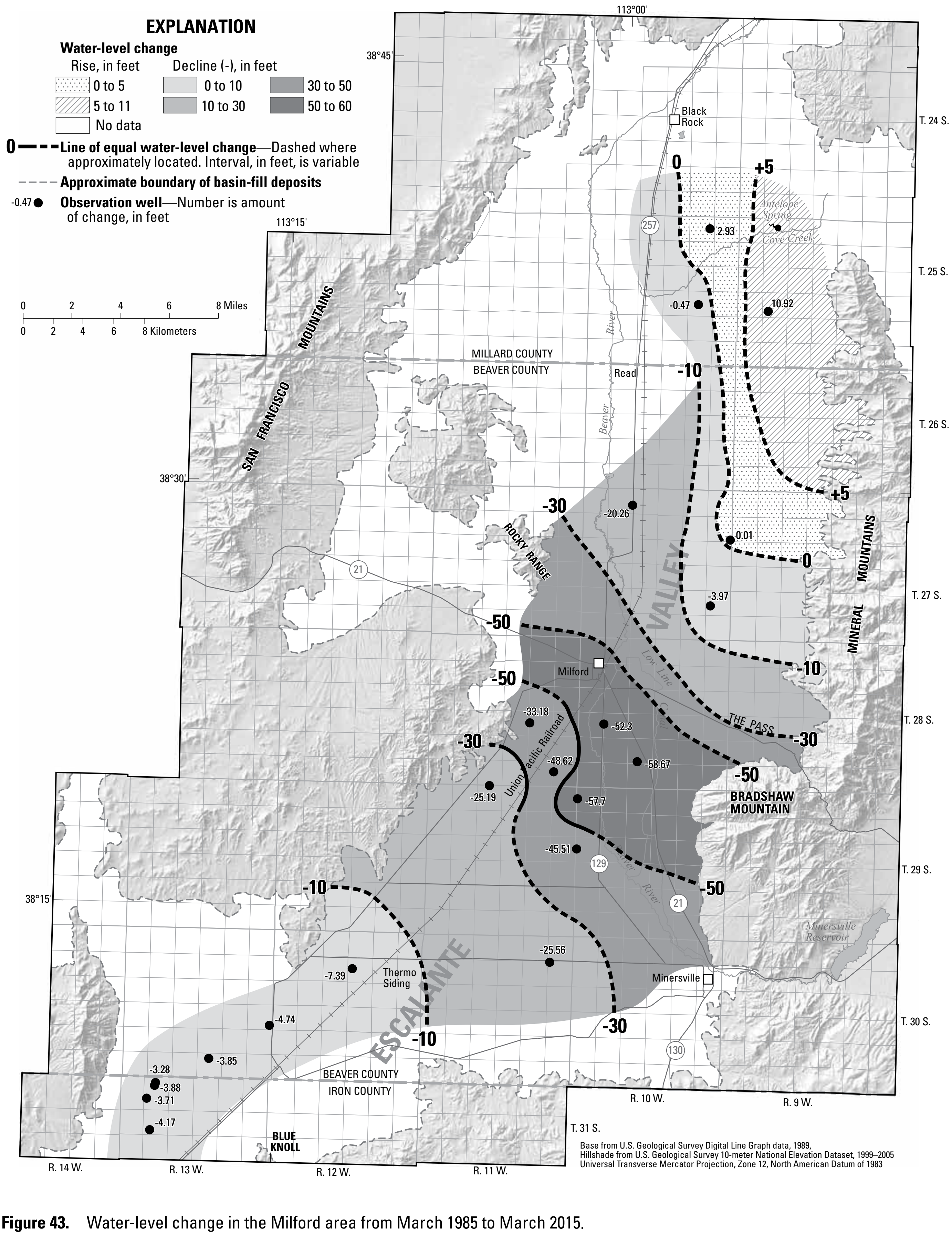


Figure 43. Water-level change in the Milford area from March 1985 to March 2015.

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. 44). Groundwater occurs in unconsolidated basin-fill deposits in the valley.

Total estimated withdrawal of water from wells in the Beryl-Enterprise area in 2014 was about 103,000 acre-feet, which is 10,000 acre-feet more than in 2013 and 15,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3).

The location of wells in the Beryl-Enterprise area in which the water level was measured during March 2015 is shown in figure 44. 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 45.

Precipitation at Enterprise in 2014 was about 14.6 inches, which is about 0.6 inch more than the average annual precipitation for 1955–2014 and about 2.8 inches more than in 2013.

Water levels declined from March 2014 to March 2015 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, even 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, have shown a decline of nearly 139 feet from March 1948 to March 2015 (fig. 45). Declines such as this are a result of continued large withdrawals for irrigation beginning in about 1950.

Water levels from March 1985 to March 2015 declined in all of the Beryl-Enterprise area for which data are available (fig. 46). The greatest decline, more than 86 feet, occurred in a well about 3 miles north-northeast of Enterprise. Declines are probably the result of continued large withdrawals for irrigation.

The concentration of dissolved solids in water samples collected from well (C-34-16)28dcc-3, located 6 miles south-southeast of Beryl, is shown in figure 45. The concentration of dissolved solids in the water sample collected in August 2014 was 582 mg/L, a decrease of greater than 100 mg/L from the 2013 value.

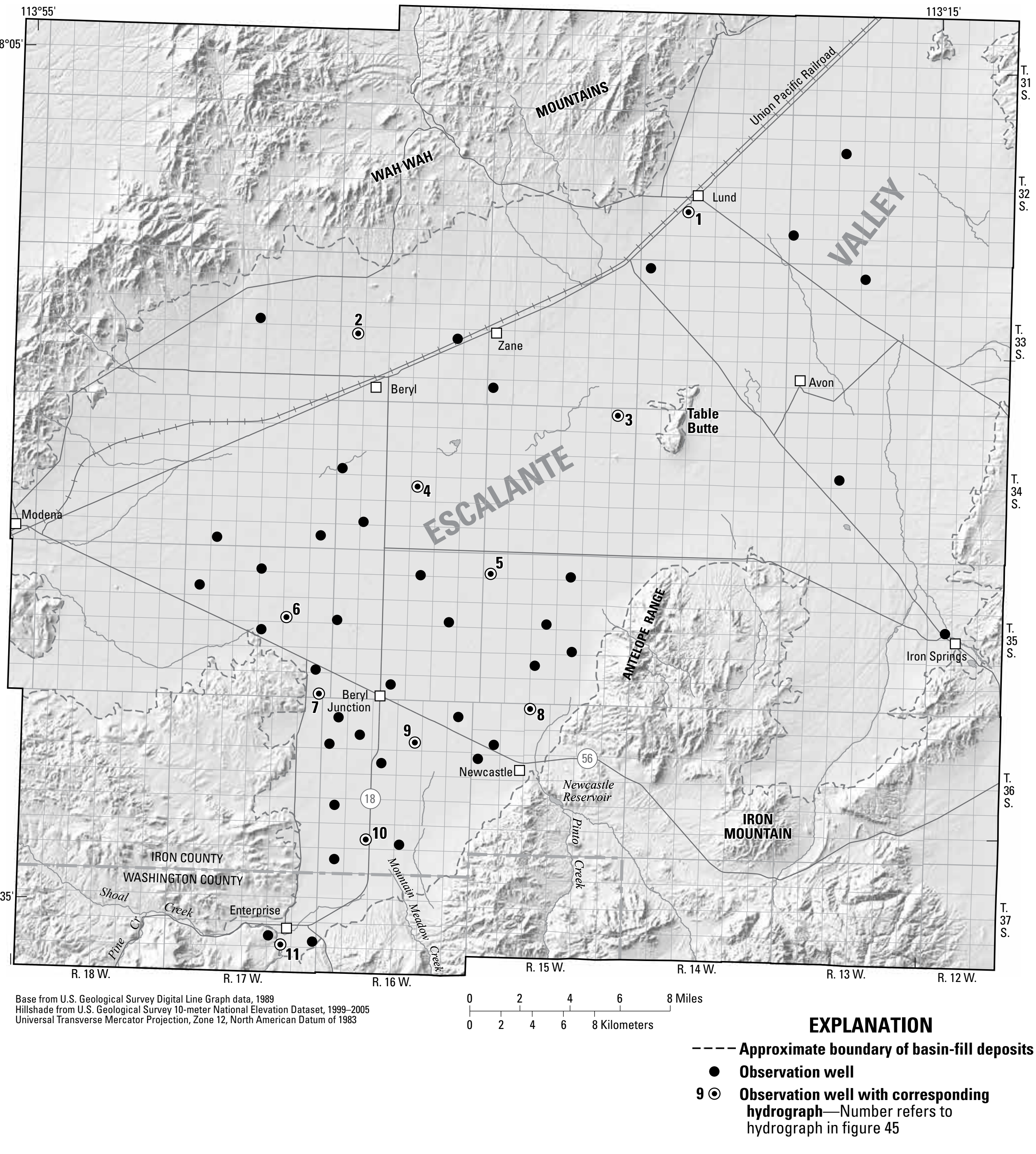


Figure 44. Location of wells in the Beryl-Enterprise area in which the water level was measured during March 2015.

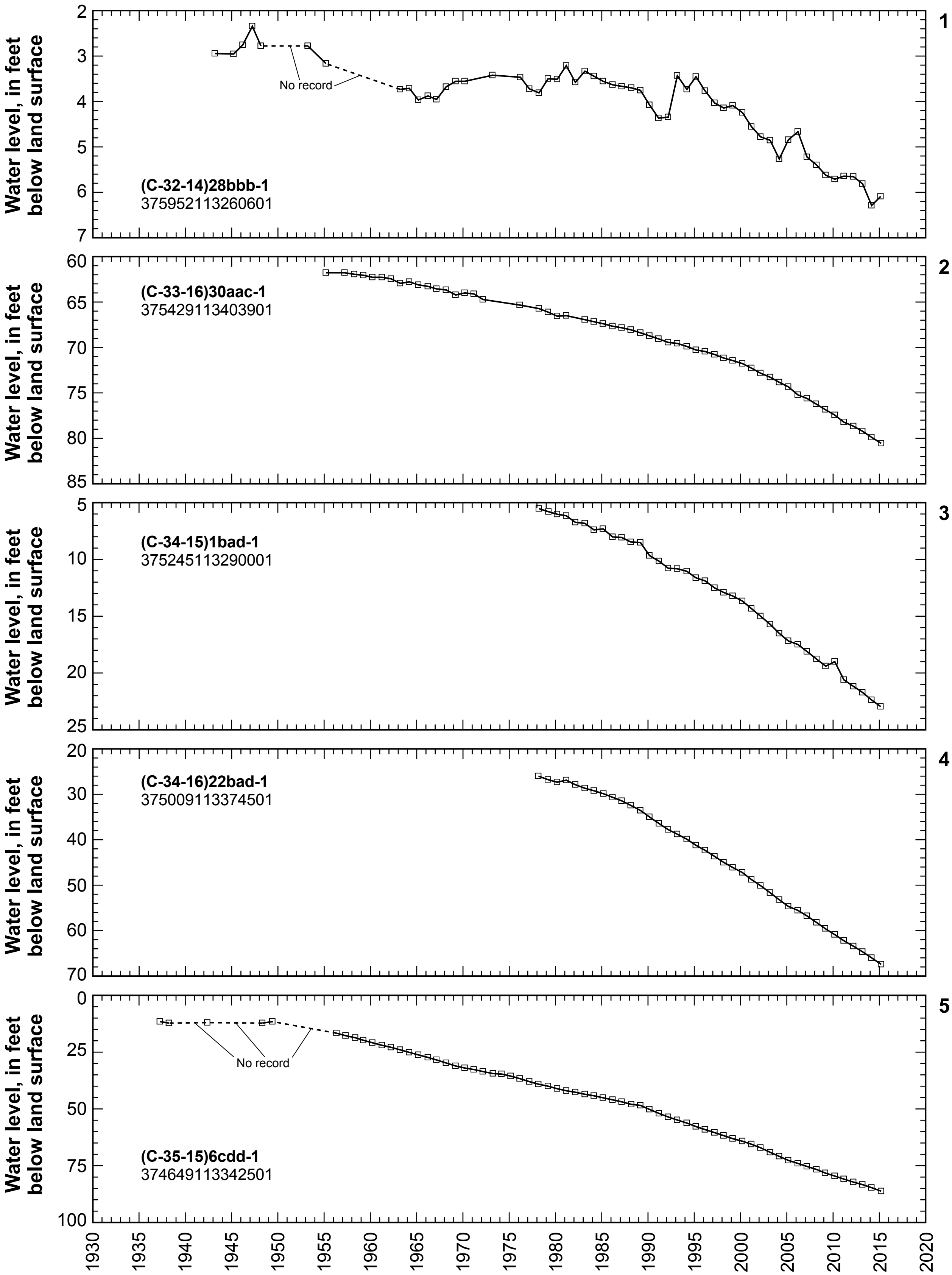


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.

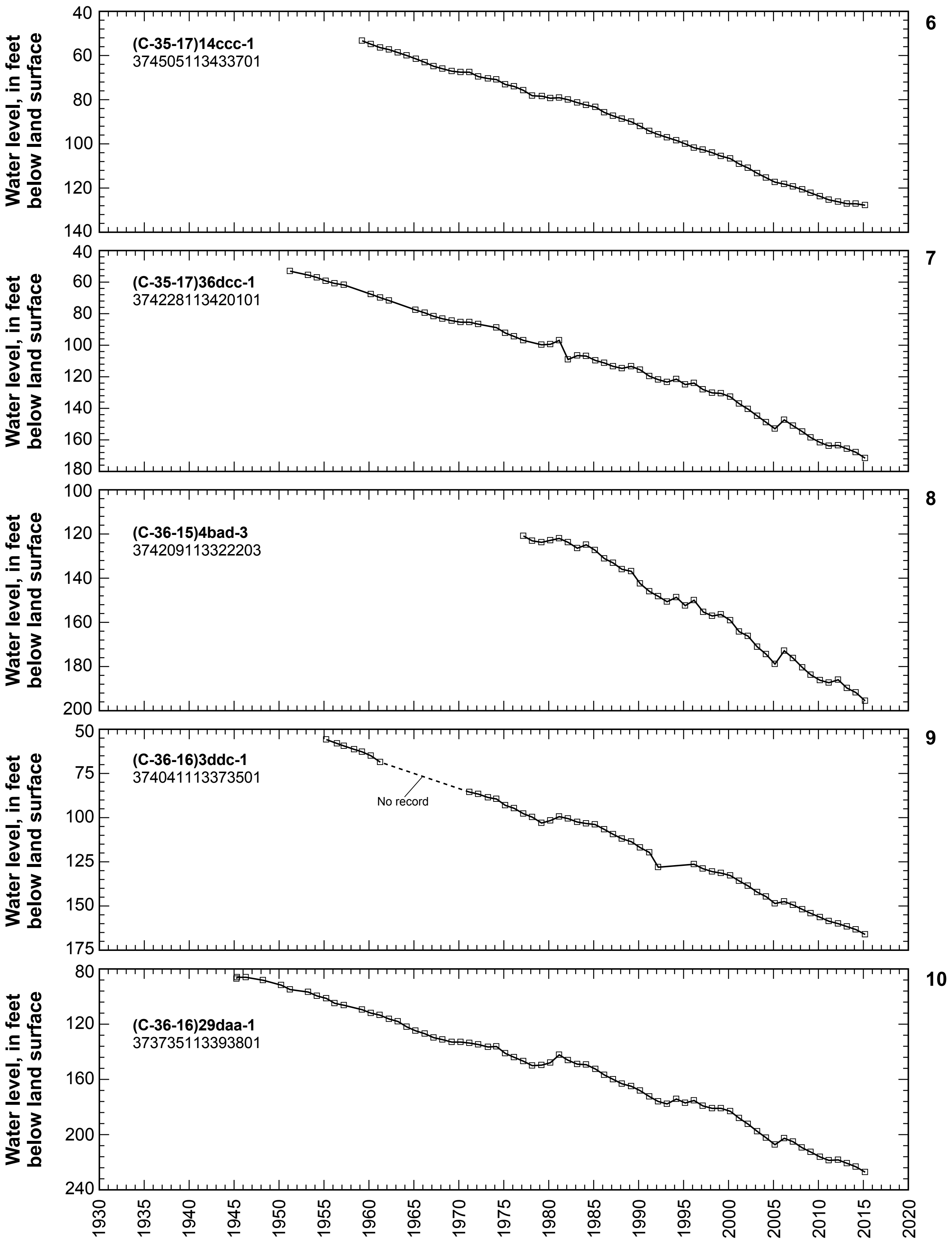


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.—Continued

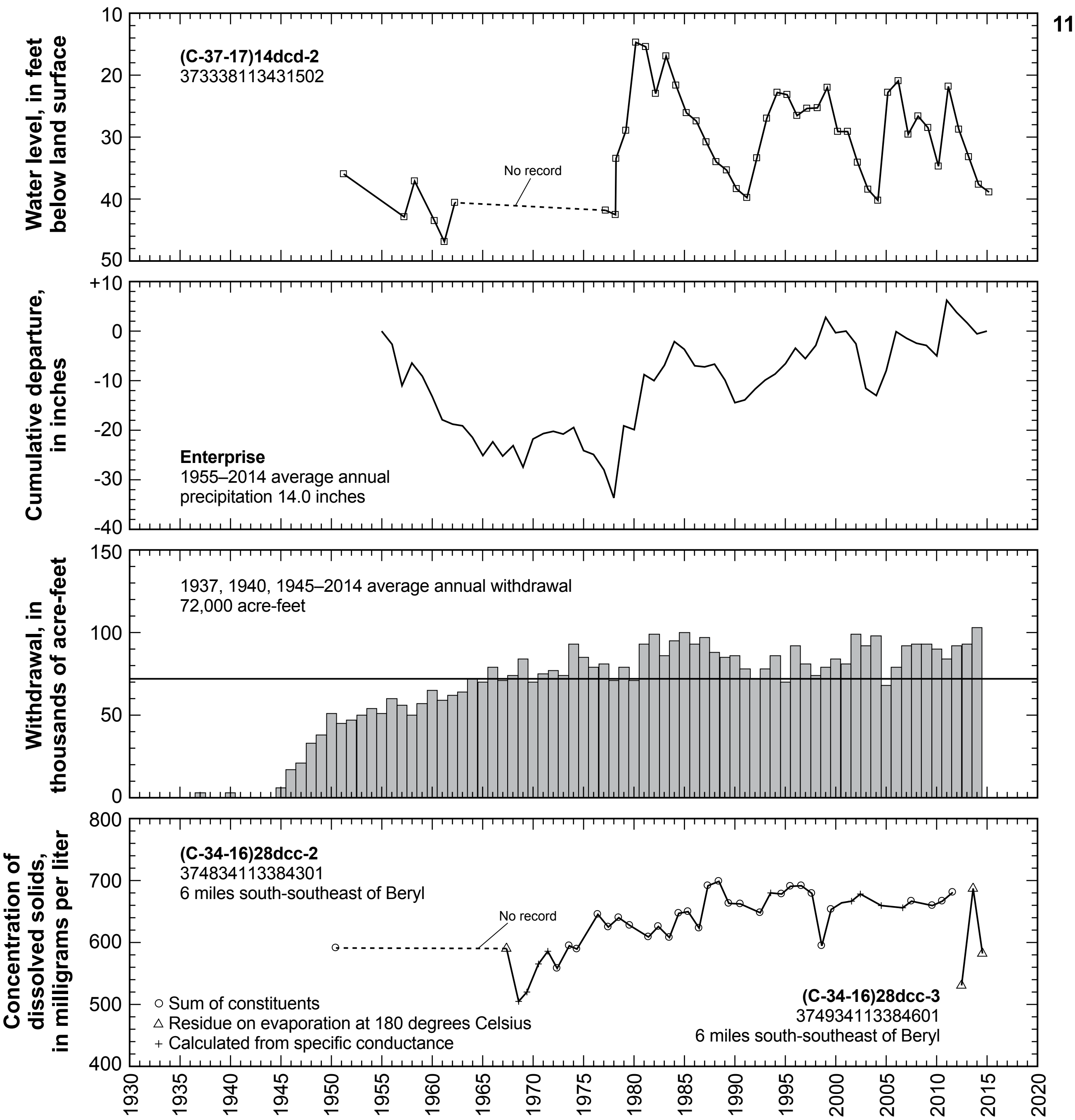


Figure 45. Relation of water level in selected wells in the Beryl-Enterprise area to cumulative departure from average annual precipitation at Enterprise, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-34-16)28dcc-3.—Continued

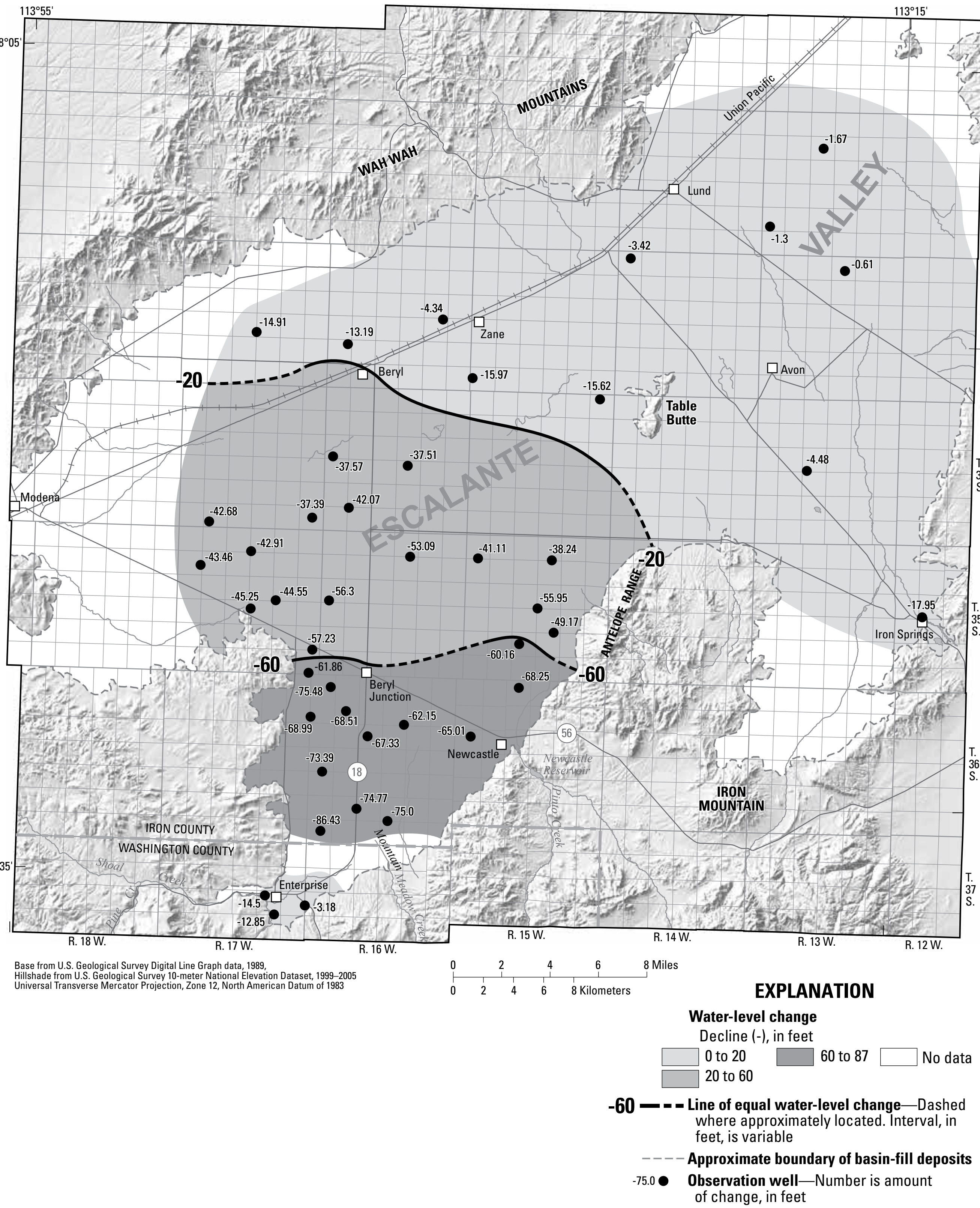


Figure 46. Water-level change in the Beryl-Enterprise area from March 1985 to March 2015.

Central Virgin River Area

By Howard K. Christiansen

The central Virgin River area extends north from the Arizona border in Washington County and includes the Santa Clara and Virgin River drainages. The region is bounded on the west by the Beaver Dam and Bull Valley Mountains, on the north by the northern flank of the Pine Valley Mountains, and on the east and southeast by the Hurricane Cliffs and the Little Creek Mountains (fig. 47). 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 2014 was about 31,000 acre-feet, which is 2,000 acre-feet more than in 2013 and 1,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3). Withdrawals for irrigation, industrial, and public-supply use increased from 2013 to 2014. Domestic and stock use was about the same as in 2013.

The location of wells in the central Virgin River area in which the water level was measured during February 2015 is shown in figure 47. The relation of the water level in selected observation wells to annual discharge of the Virgin River at Virgin, Utah, to cumulative departure from average annual precipitation at La Verkin, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2 is shown in figure 48.

Discharge of the Virgin River at Virgin, Utah, in 2014 was about 78,400 acre-feet, which is 12,600 acre-feet less than the value for 2013 and about 54,200 acre-feet less than the long-term average for 1931–70 and 1979–2014. Precipitation at La Verkin was about 11.6 inches, which is about 0.8 inches more than the average annual precipitation for 1951–2014 and 1.0 inch less than in 2013. Precipitation data for St. George in 2014 were not available.

Water levels from February 2014 to February 2015 declined, or rose only slightly, in most of the central Virgin River area. The largest decline, about 4.4 feet, occurred in a well southeast of New Harmony. Declines are probably the result of continued large withdrawals for public-supply and irrigation use.

Water-level changes from February 1985 to February 2015 are shown in figure 49. Water levels generally declined in most areas where data are available. The greatest decline, about 19 feet, occurred in a well in Kanarraville. Rises occurred in wells in the south-central part of the area. The largest rise, about 12 feet, occurred in a well east-southeast of Washington. Declines are probably the result of continued large withdrawals, particularly for public supply. Localized rises may be the result of decreased withdrawals.

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 2013, is shown in figure 48. 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 on one graph to give an extended temporal record for this constituent. This well was not sampled in 2014.

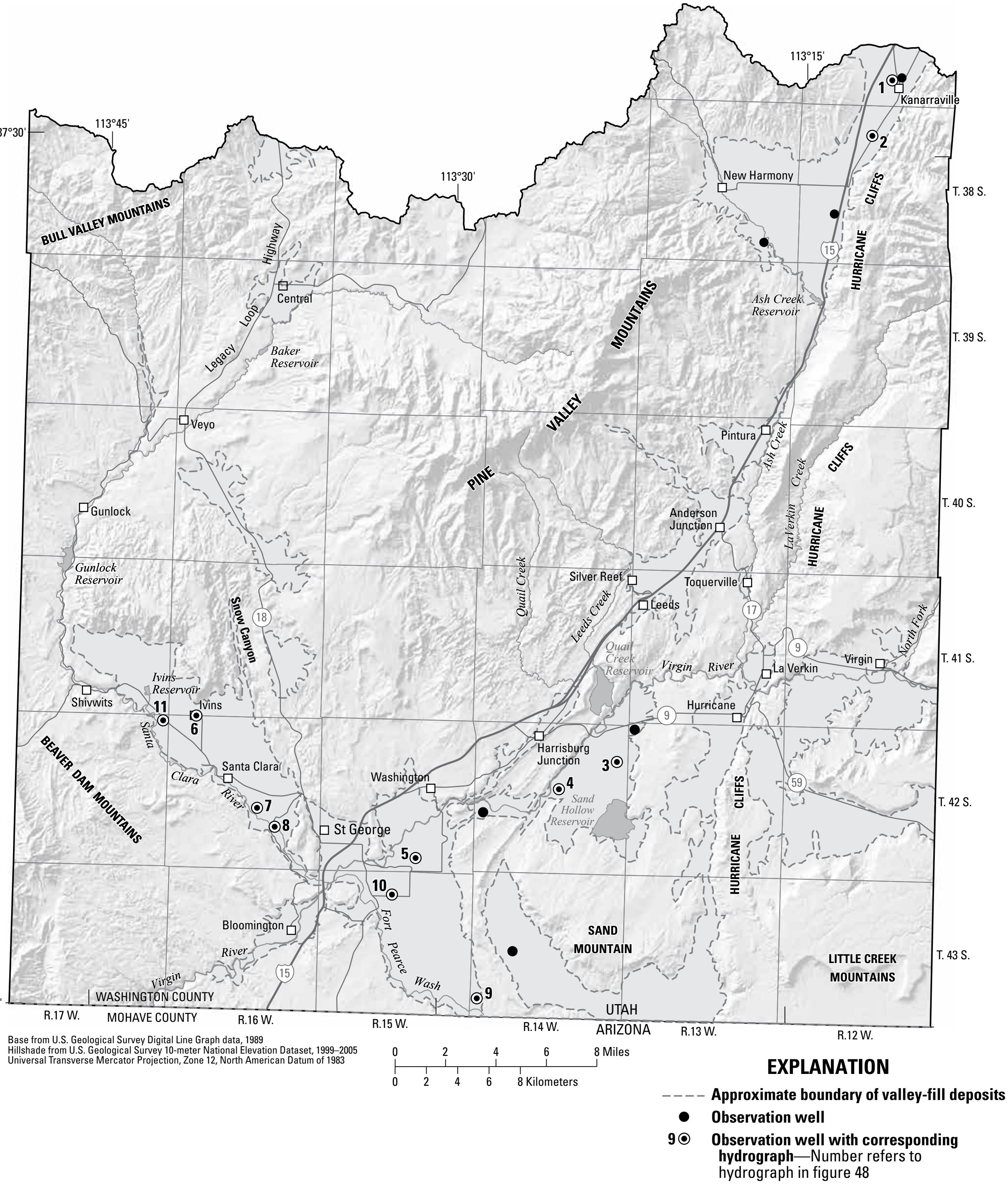


Figure 47. Location of wells in the central Virgin River area in which the water level was measured during February 2015.

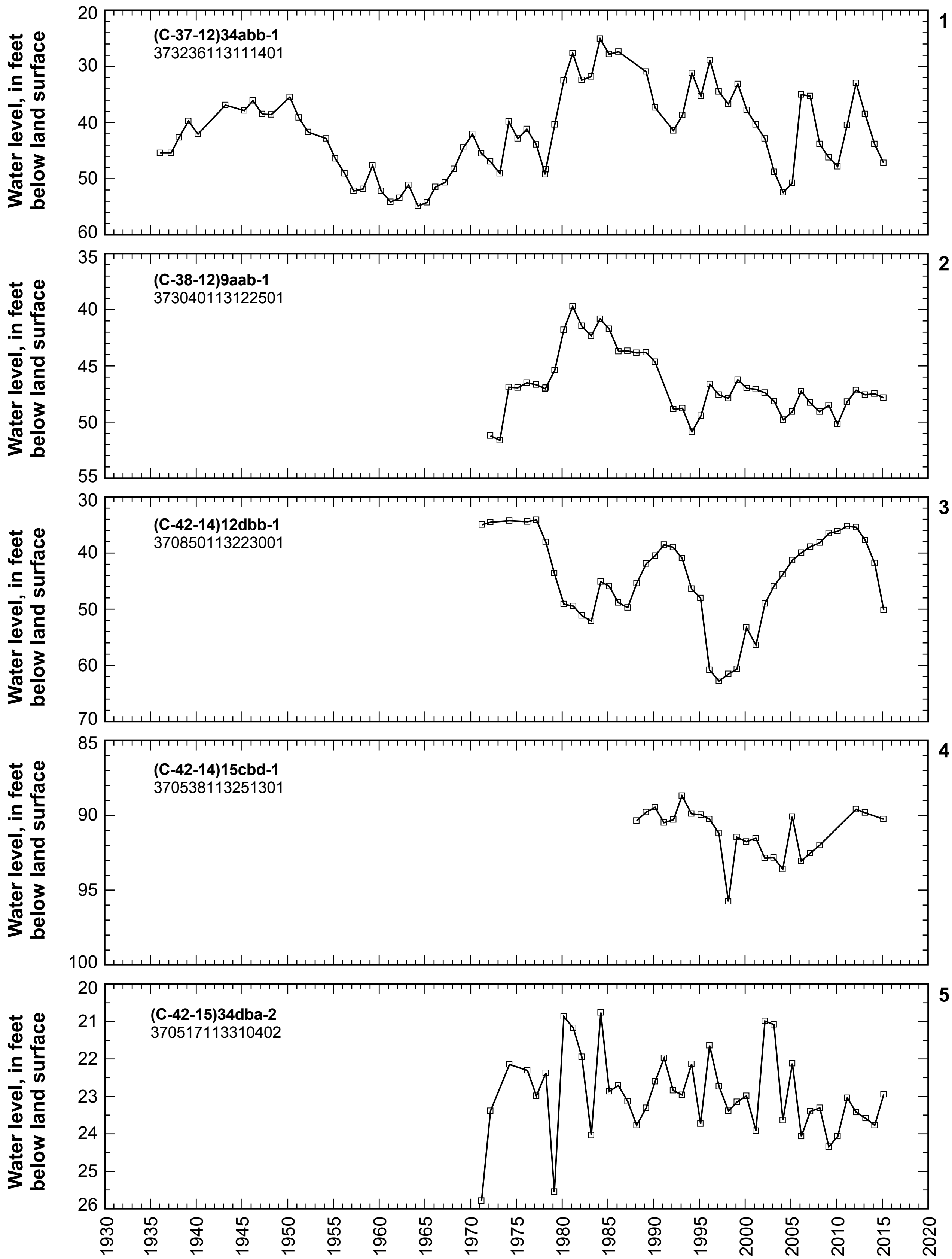


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, Utah, to cumulative departure from average annual precipitation at La Verkin, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2.

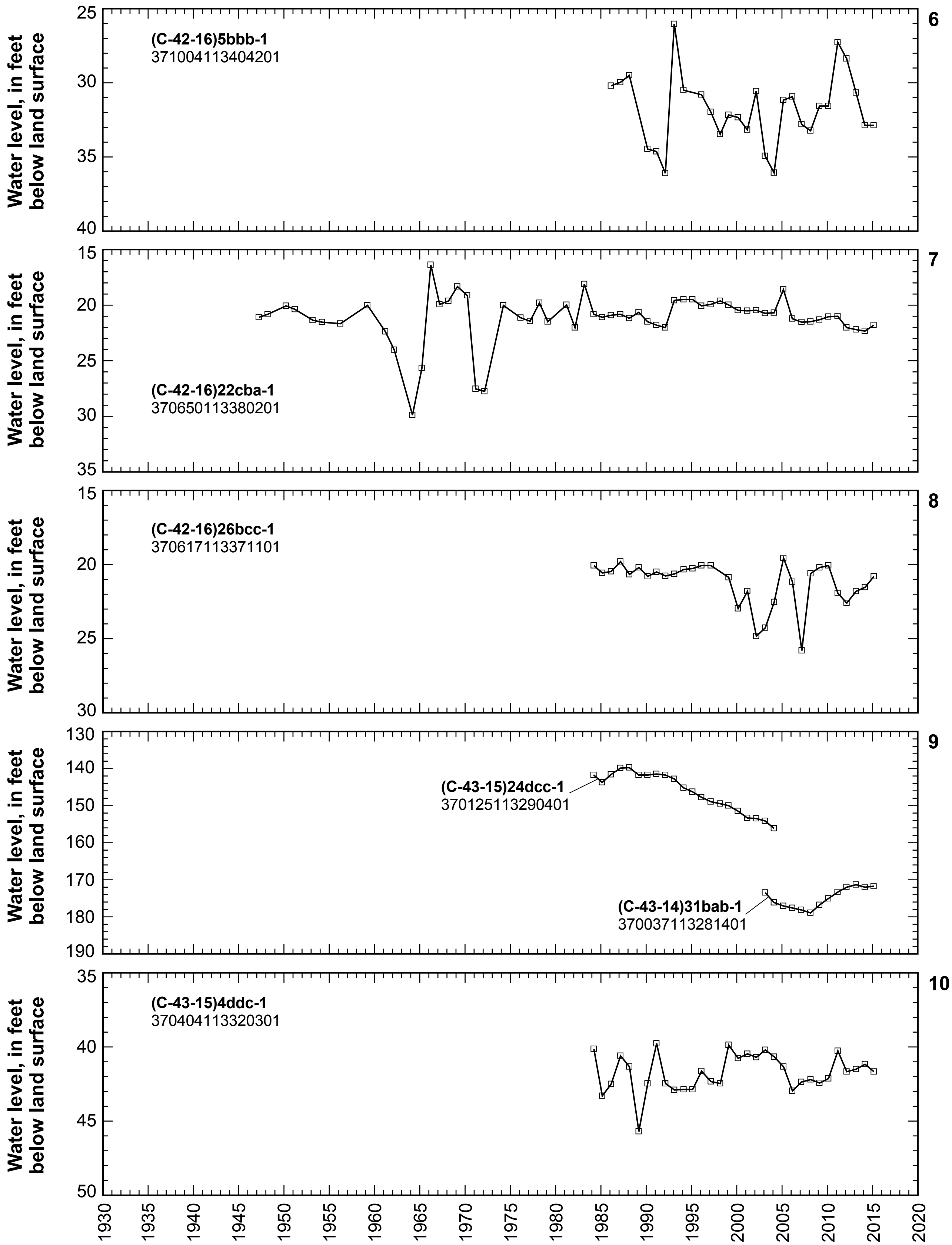


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, Utah, to cumulative departure from average annual precipitation at La Verkin, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2.—Continued

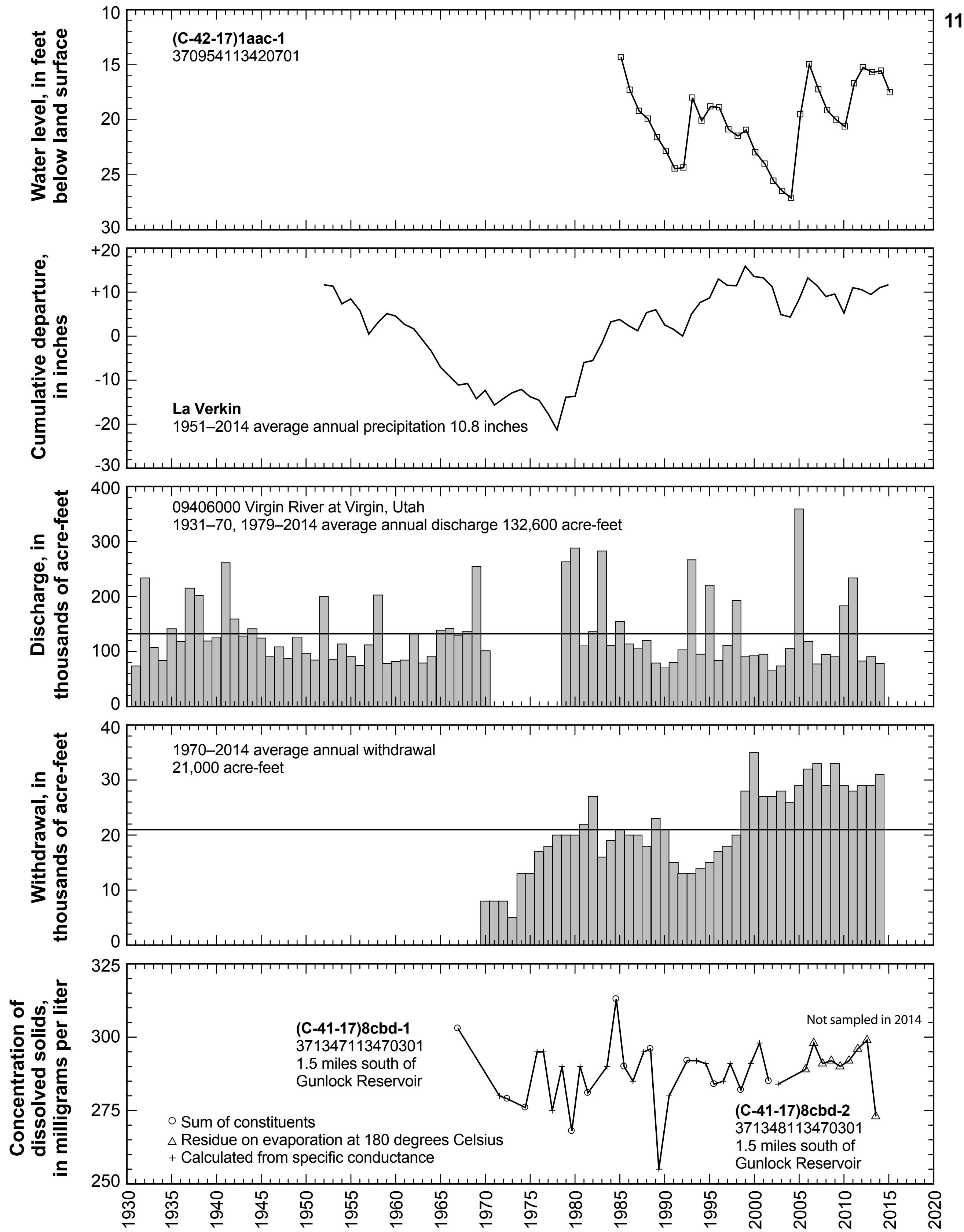


Figure 48. Relation of water level in selected wells in the central Virgin River area to annual discharge of the Virgin River at Virgin, Utah, to cumulative departure from average annual precipitation at La Verkin, to annual withdrawal from wells, and to concentration of dissolved solids in water from well (C-41-17)8cbd-2.—Continued

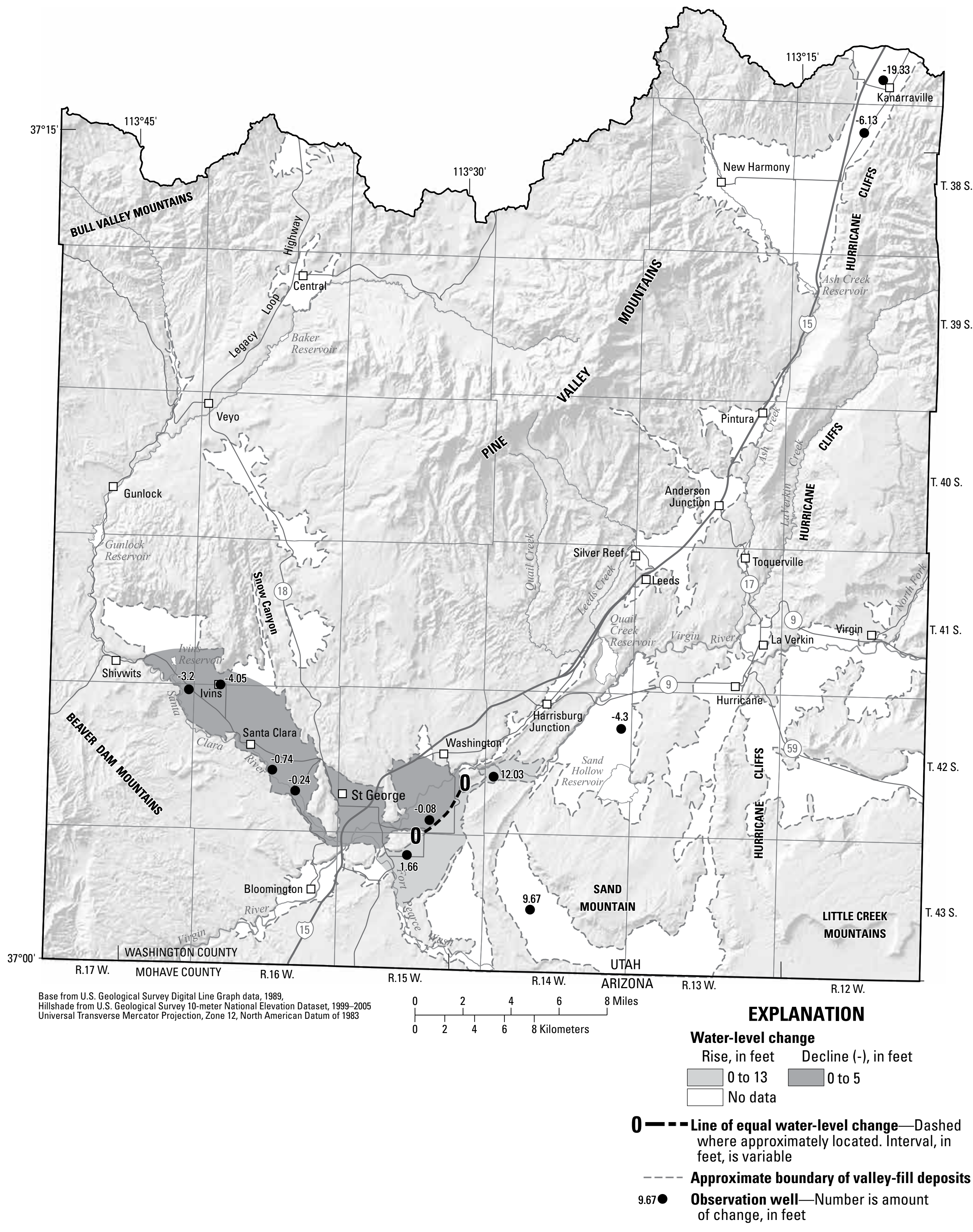


Figure 49. Water-level change in the central Virgin River area from February 1985 to February 2015.

Other Areas

By Martel J. Fisher

Total estimated withdrawal of water from wells in other areas of Utah (table 4) in 2014 was about 159,000 acre-feet, which is 14,000 acre-feet more than in 2013 and 23,000 acre-feet more than the average annual withdrawal for 2004–2013 (tables 2 and 3). The largest increases were due to increased withdrawals for irrigation and industrial use. In most of the areas listed in table 4, withdrawals in 2014 were more than in 2013, except in Grouse Creek Valley and Park Valley, where irrigation use decreased; in lower Bear River Valley, where public-supply withdrawals decreased; and in Sanpete Valley, where increased withdrawals for irrigation were offset by decreased withdrawals for industrial, public supply, and domestic and stock use.

The location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2015, is shown in figure 50. The relation of the water level in selected observation wells in Cedar Valley to cumulative departure from average annual precipitation at Provo BYU is shown in figure 51.

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, and 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 2014 to March 2015.

Water levels generally rose in the eastern part of Cedar Valley, and generally declined in the western part, from March 1985 to March 2015, in areas where data are available (fig. 52). The largest rise, more than 26 feet, occurred in a well about 4 miles northeast of Fairfield. The largest decline, nearly 69 feet, occurred in a well near Cedar Fort.

The location of wells in Sanpete Valley in which the water level was measured during March 2015 is shown in figure 53. 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 54.

Water levels in 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 all of the selected observation wells from March 2014 to March 2015.

Water levels declined from March 1985 to March 2015 in all parts of Sanpete Valley for which data are available (fig. 55). The largest decline, almost 33 feet, occurred in a well northeast of Spring City.

The location of wells in Snake Valley in which the water level was measured during March 2015 is shown in figure 56. The relation of the water level in selected observation wells in Snake Valley to cumulative departure from average annual precipitation at Callao is shown in figure 57.

Water levels in all of the selected wells in Snake Valley declined from March 2014 to March 2015. 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.

Water levels declined from March 1985 to March 2015 in all parts of Snake Valley for which data are available (fig. 58). The largest decline, about 21 feet, occurred in a well near Garrison.

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 59. Water levels declined or rose only slightly in most of the selected observation wells from March 2014 to March 2015.

Table 4. Estimated withdrawal of water from wells in other areas of Utah, 2014.

Number in figure 1	Area	Estimated withdrawal from wells (acre-feet)					
		2014					2013 total (rounded)
		Irrigation	Industrial	Public supply	Domestic and stock	Total (rounded)	
1	Grouse Creek Valley	1,600	0	0	20	1,600	2,100
2	Park Valley area	1,800	0	0	10	1,800	2,100
4	Lower Bear River area	3,700	510	6,600	200	11,000	12,100
8	Ogden Valley	0	0	12,400	20	12,400	11,400
13	Rush Valley	5,200	270	170	30	5,700	5,600
14	Skull Valley, Dugway area, and Old River Bed	2,300	5,200	890	10	8,400	8,200
15	Cedar Valley, Utah County	90	0	6,400	40	6,500	6,000
20	Sanpete Valley	9,300	930	870	3,000	14,100	14,400
25	Snake Valley	23,000	0	90	50	23,100	20,300
27	Beaver Valley	11,500	20	330	480	12,300	8,400
	Remainder of State	12,900	26,400	19,800	2,600	61,700	54,600
Total (rounded)		71,400	33,300	47,600	6,500	159,000	145,000

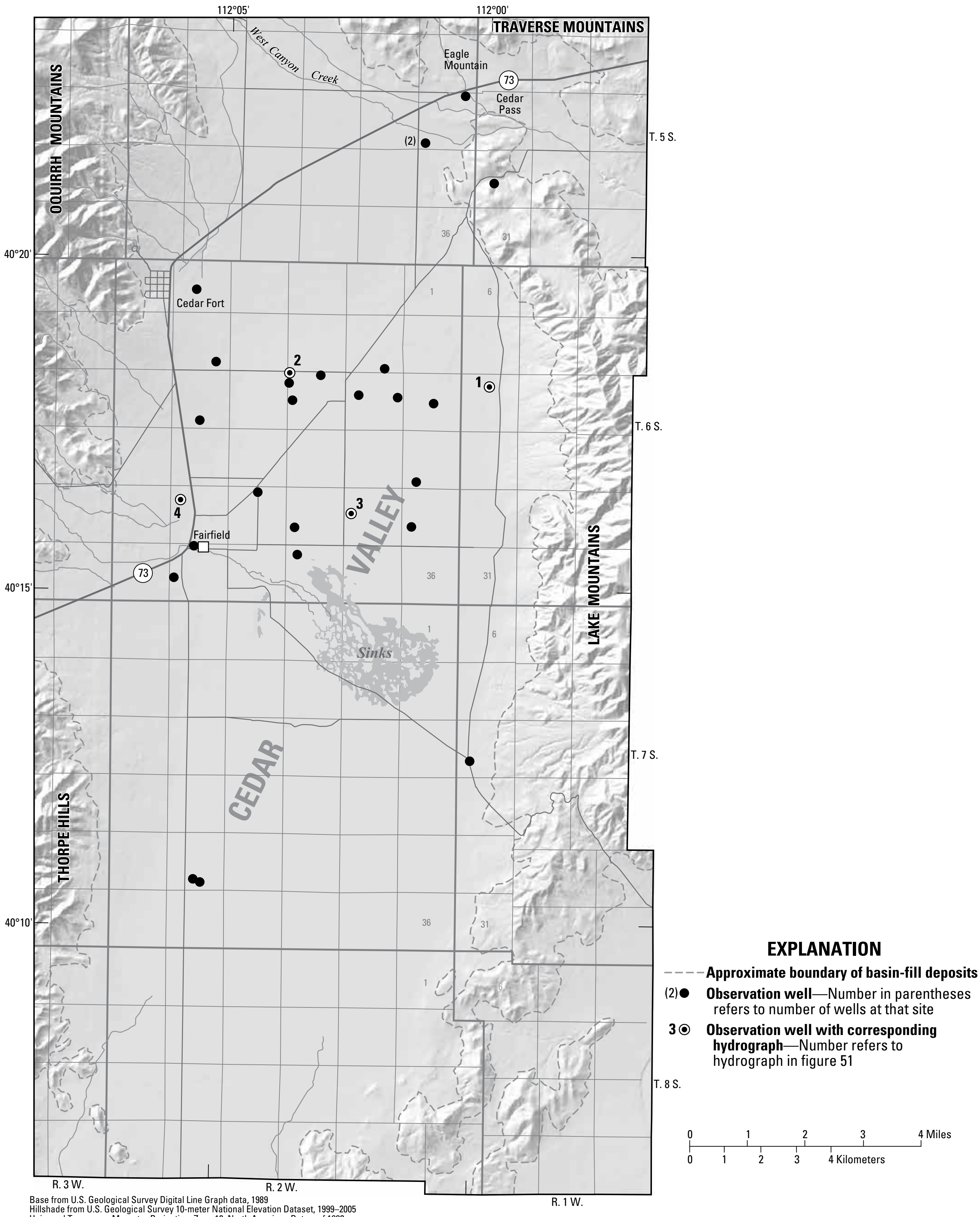


Figure 50. Location of wells in Cedar Valley, Utah County, in which the water level was measured during March 2015.

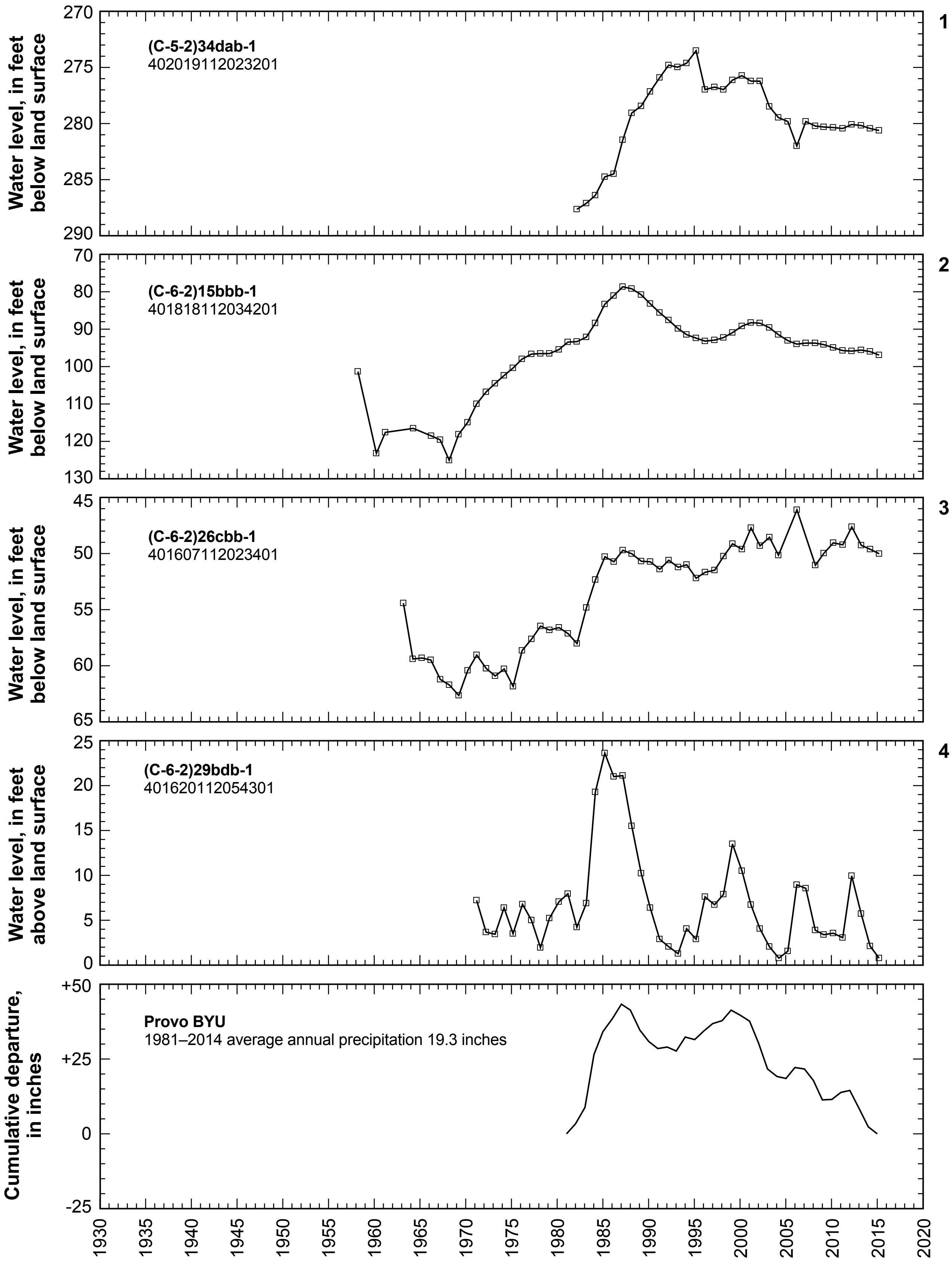


Figure 51. Relation of water level in selected wells in Cedar Valley, Utah County, to cumulative departure from average annual precipitation at Provo BYU.

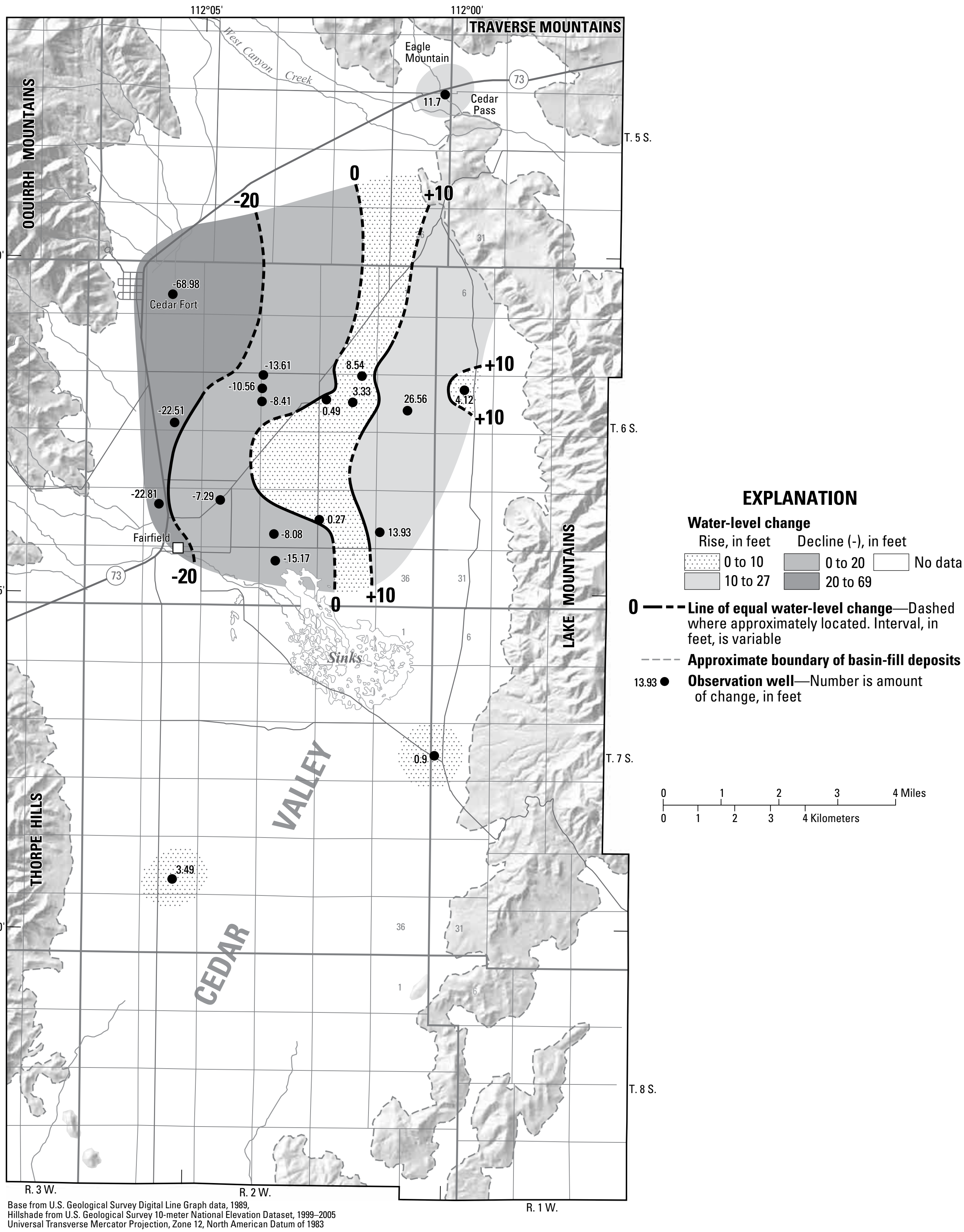


Figure 52. Water-level change in Cedar Valley, Utah County, from March 1985 to March 2015.

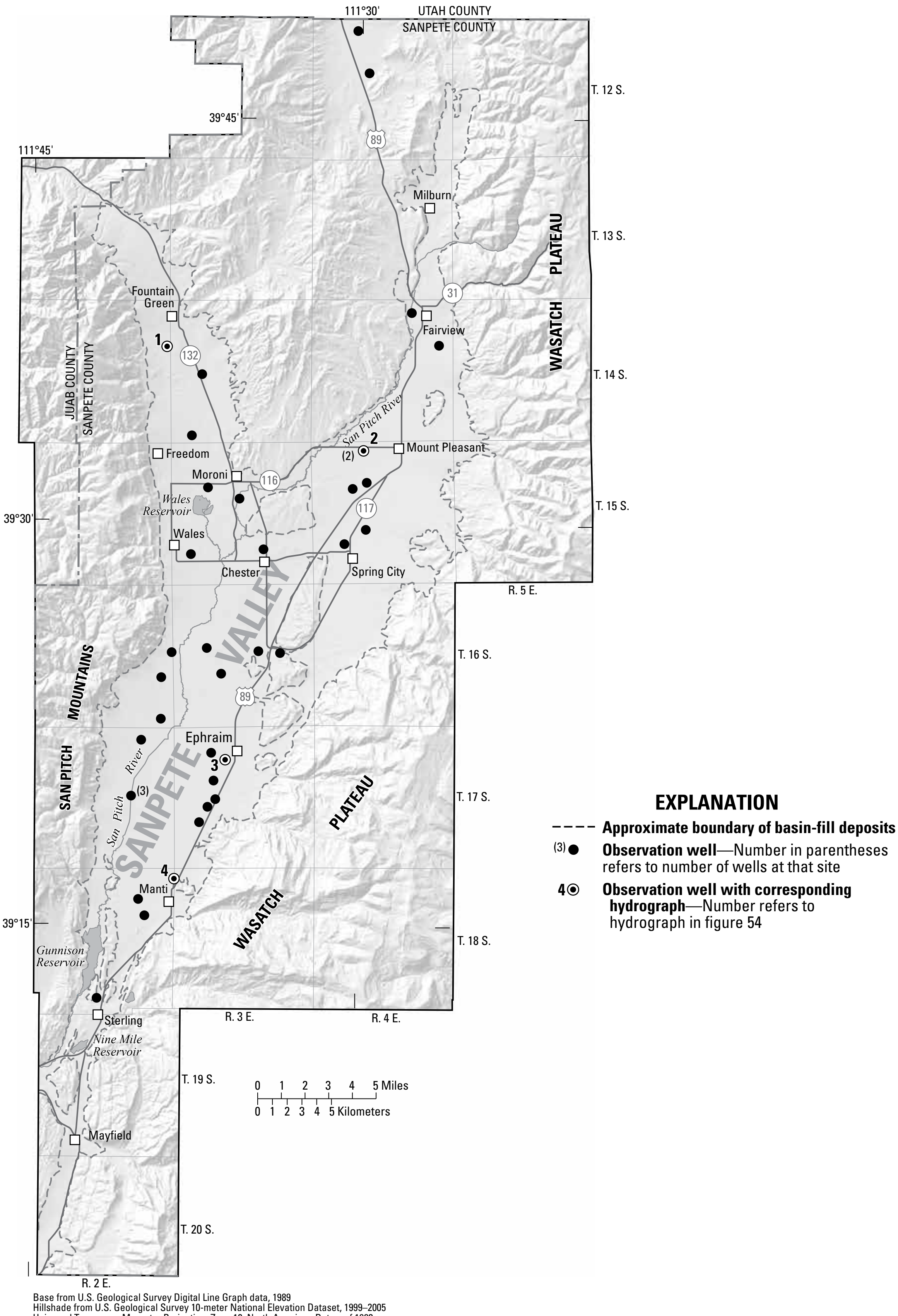


Figure 53. Location of wells in Sanpete Valley in which the water level was measured during March 2015.

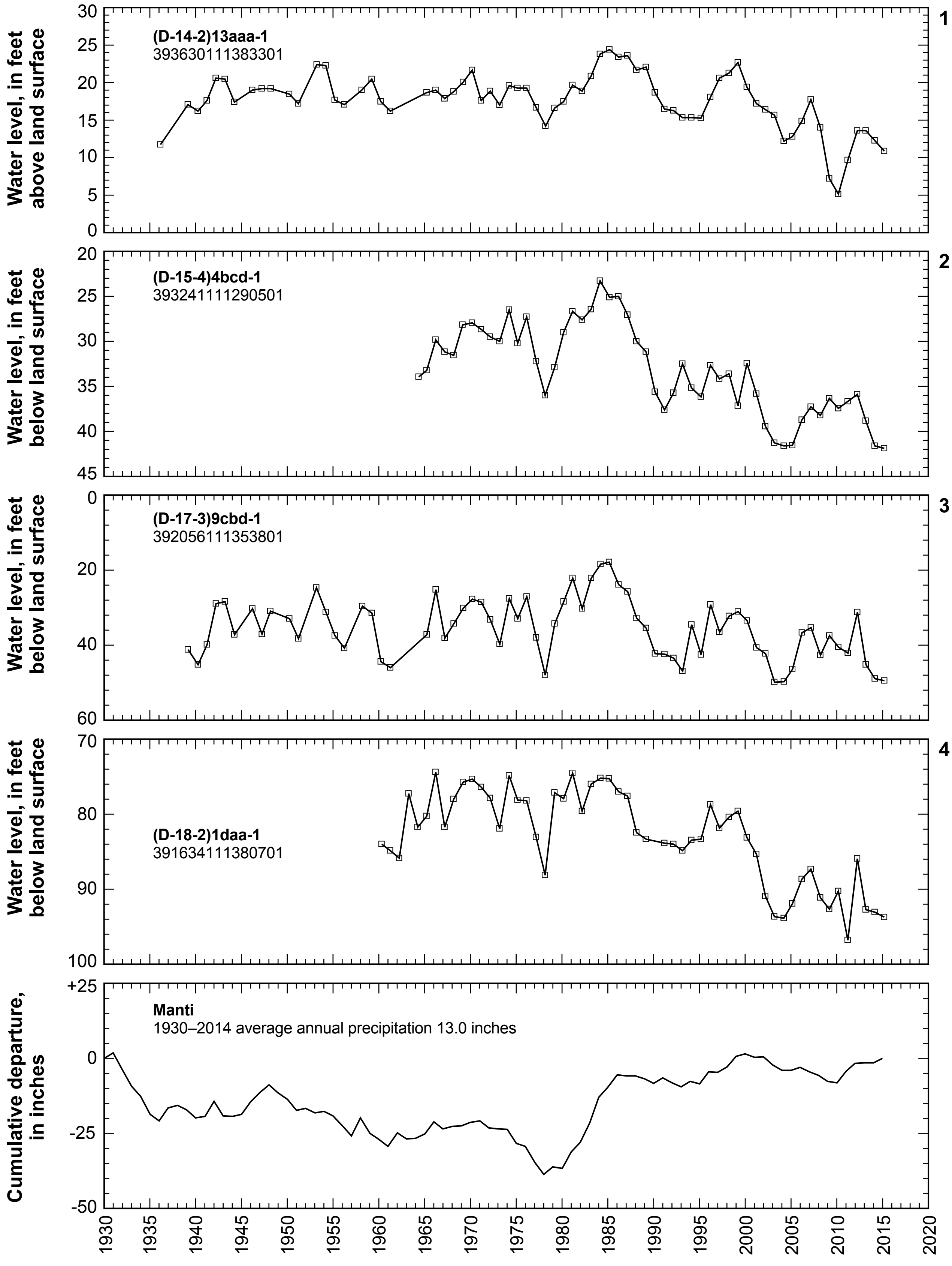
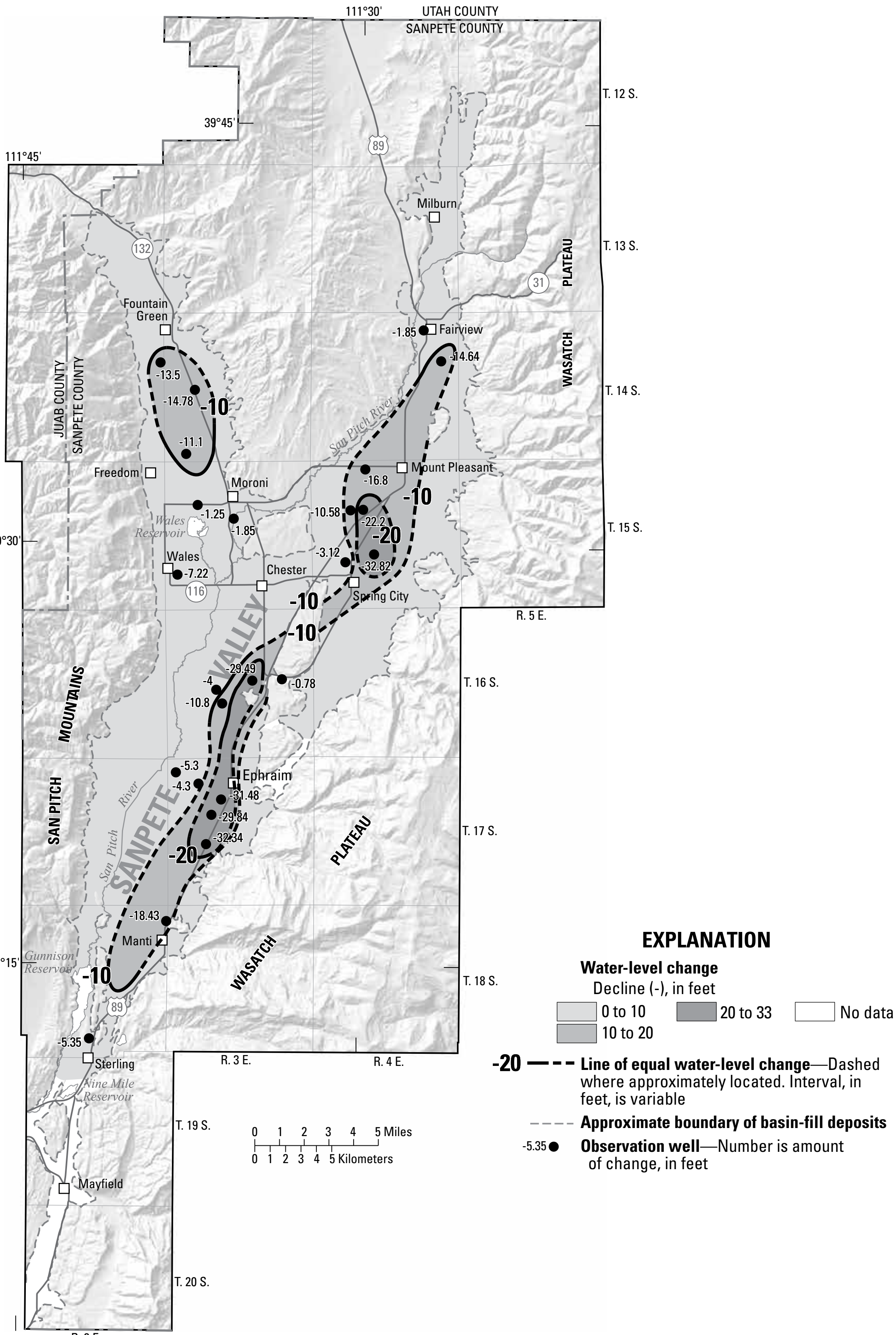


Figure 54. Relation of water level in selected wells in Sanpete Valley to cumulative departure from average annual precipitation at Manti.



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 55. Water-level change in Sanpete Valley from March 1985 to March 2015.

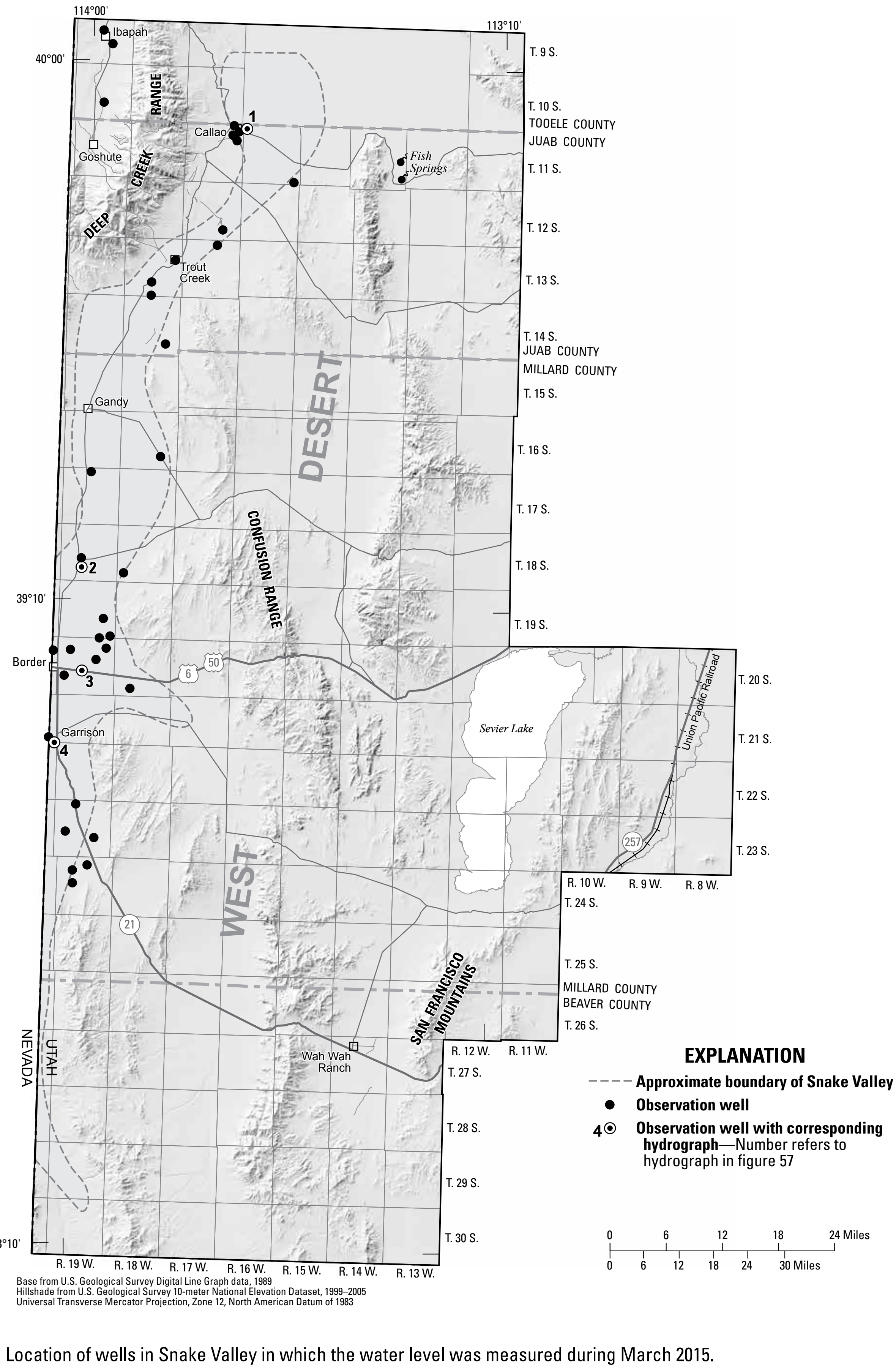


Figure 56. Location of wells in Snake Valley in which the water level was measured during March 2015.

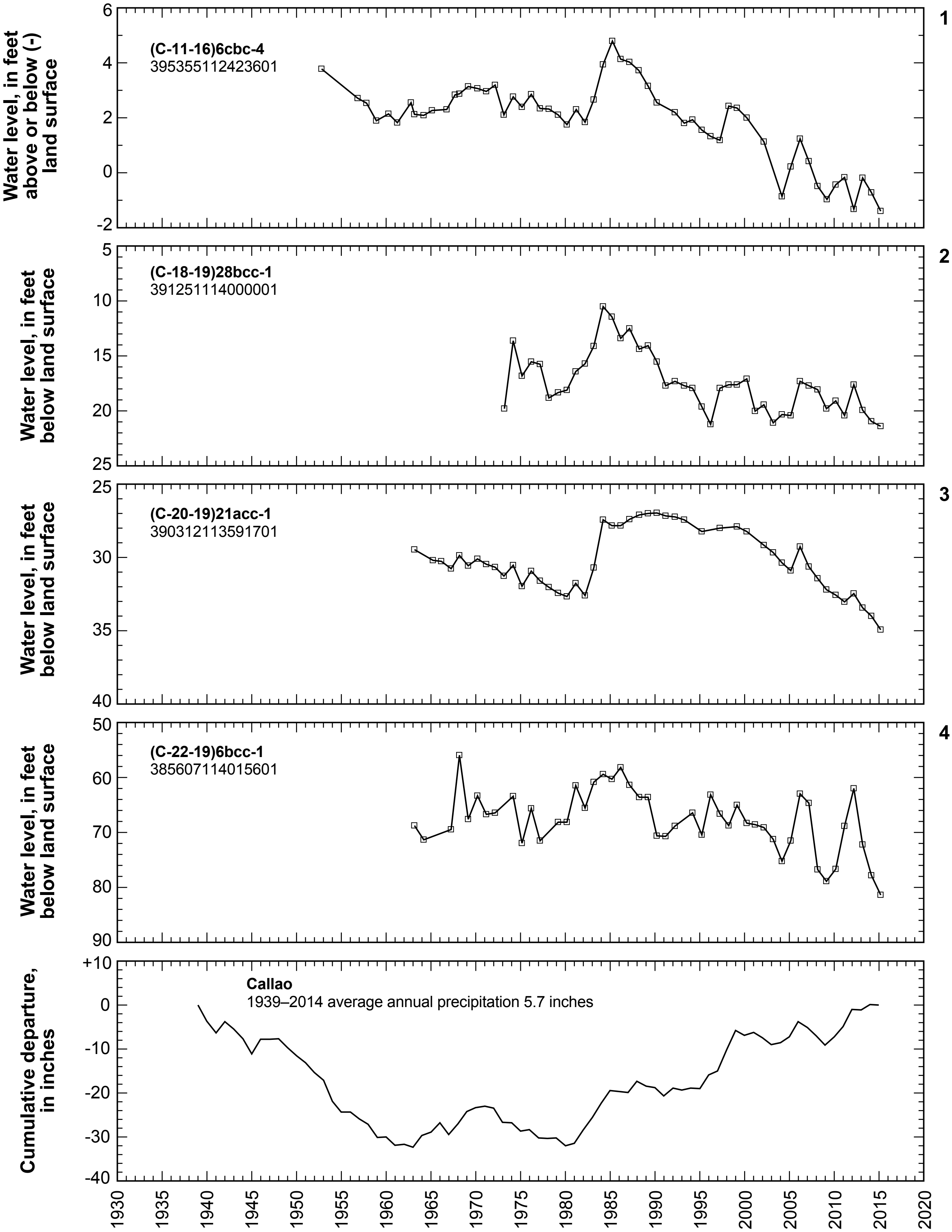


Figure 57. Relation of water level in selected wells in Snake Valley to cumulative departure from average annual precipitation at Callao.

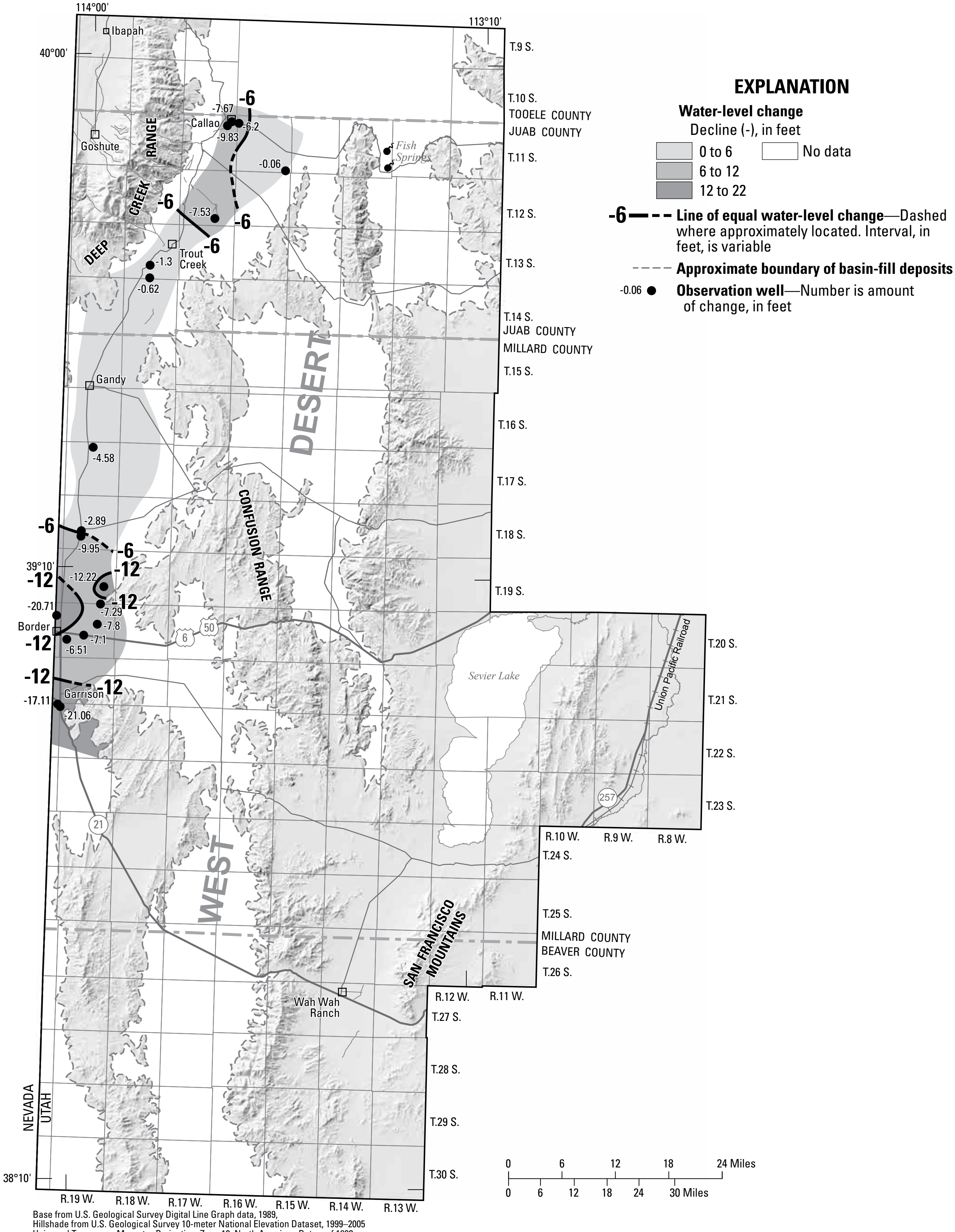


Figure 58. Water-level change in Snake Valley from March 1985 to March 2015.

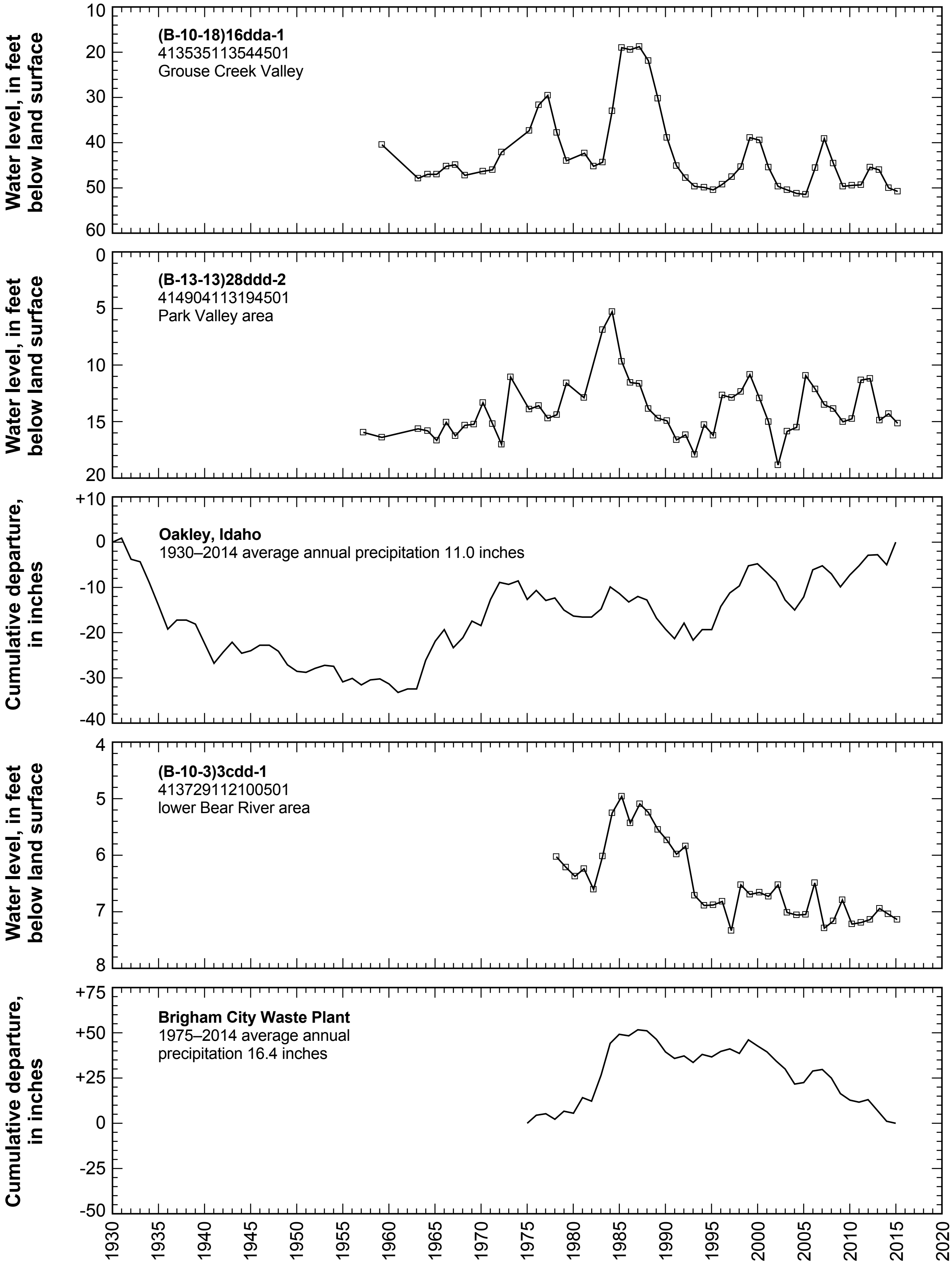


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.

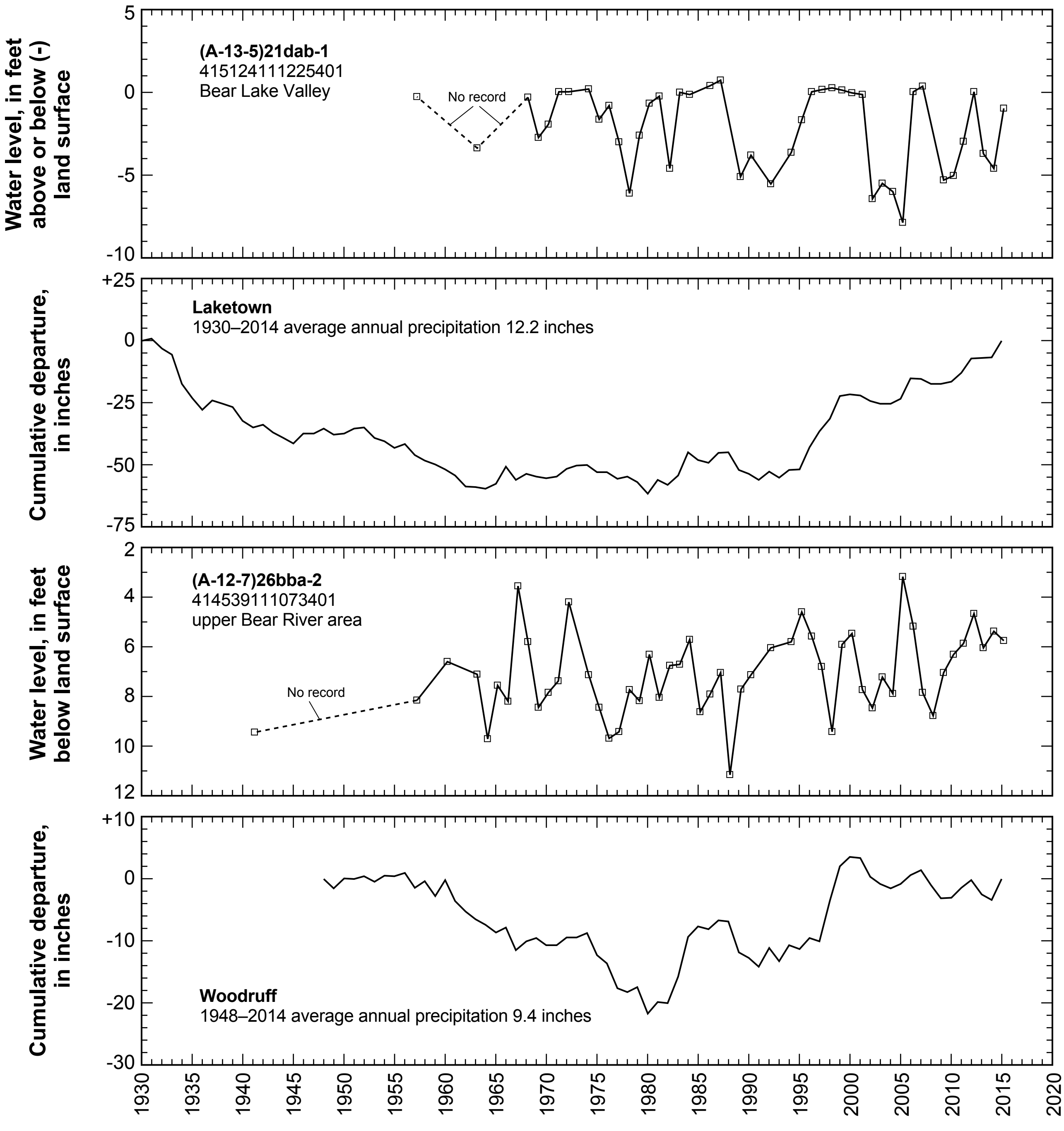


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

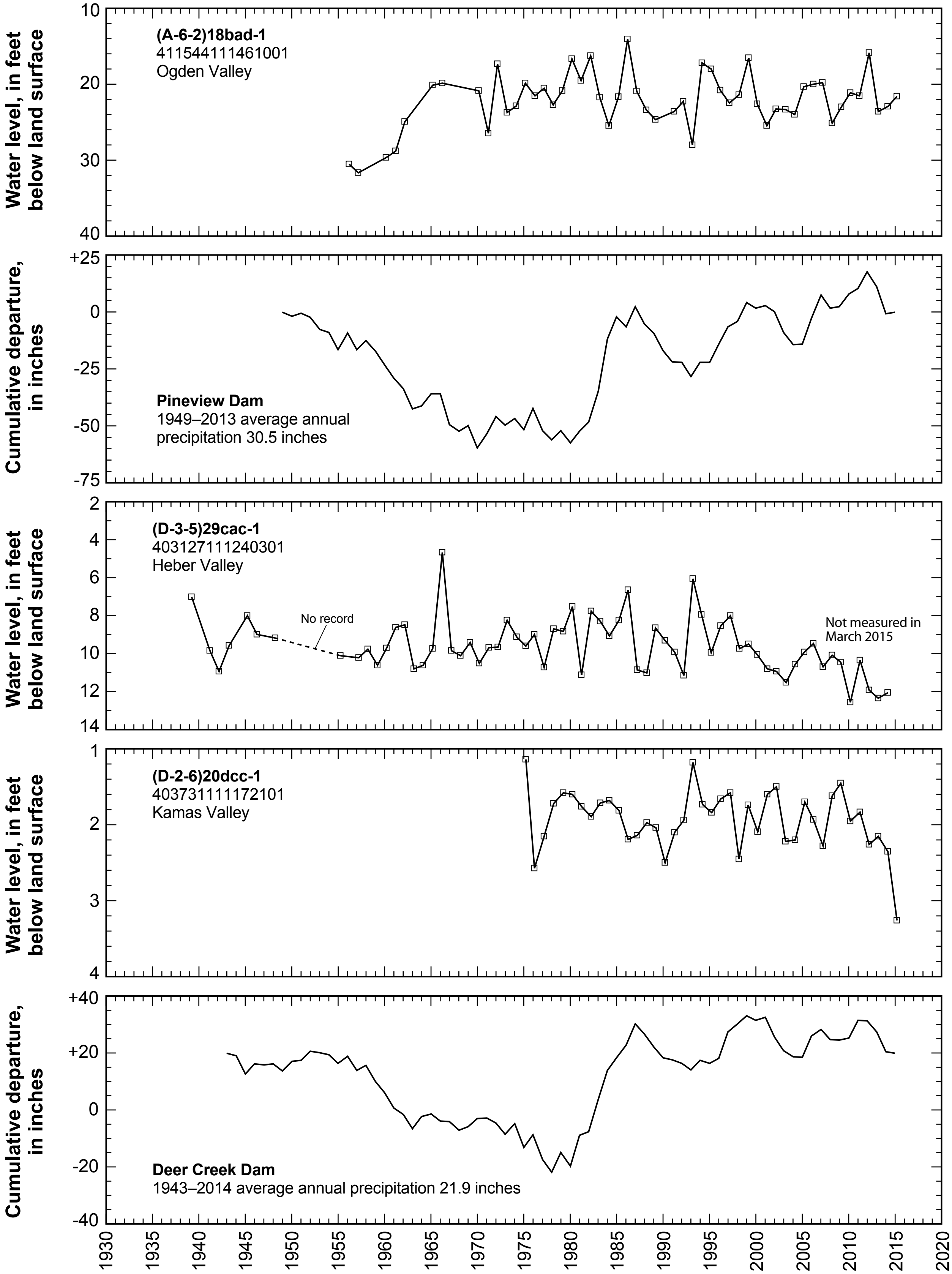


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

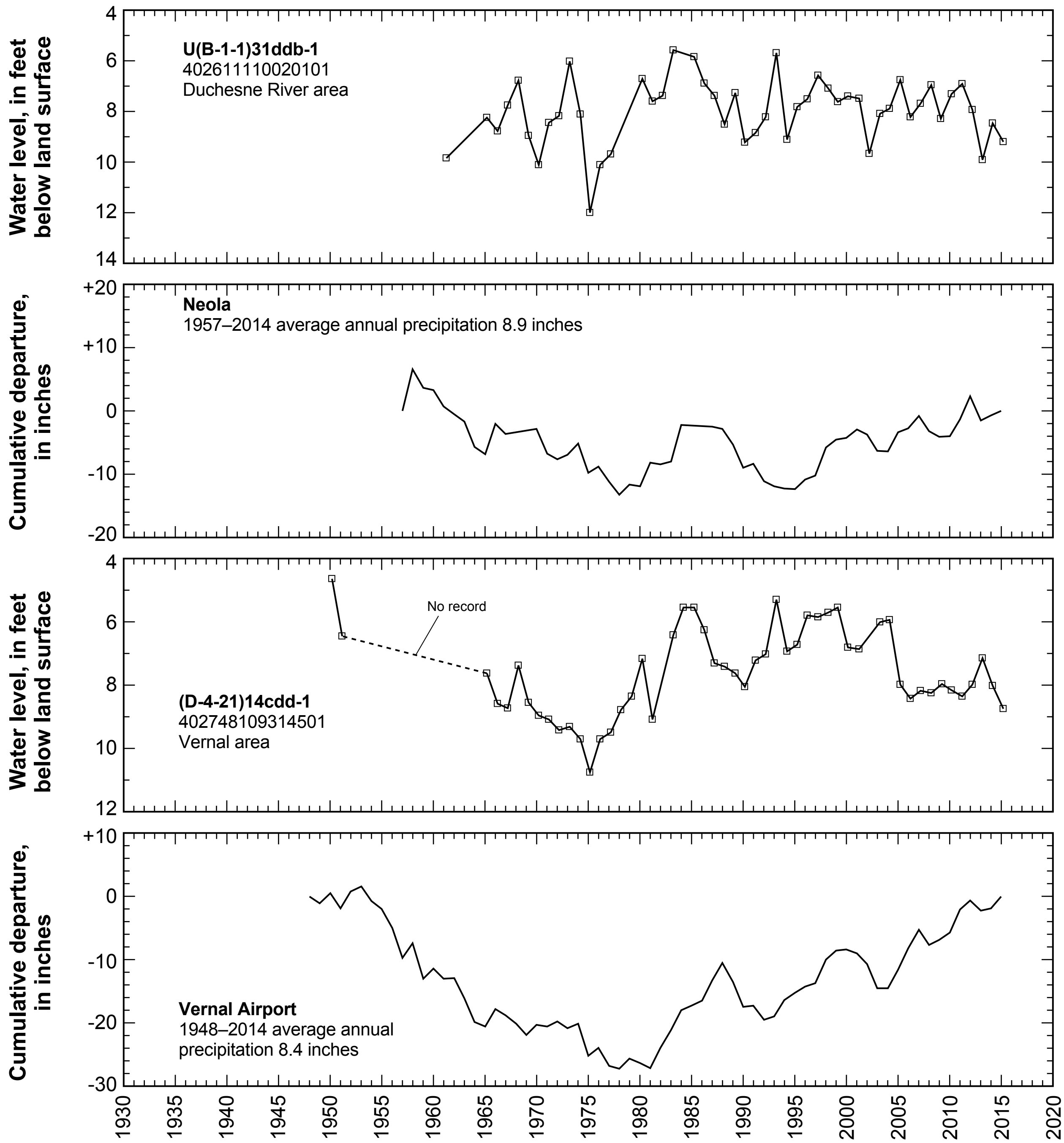


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

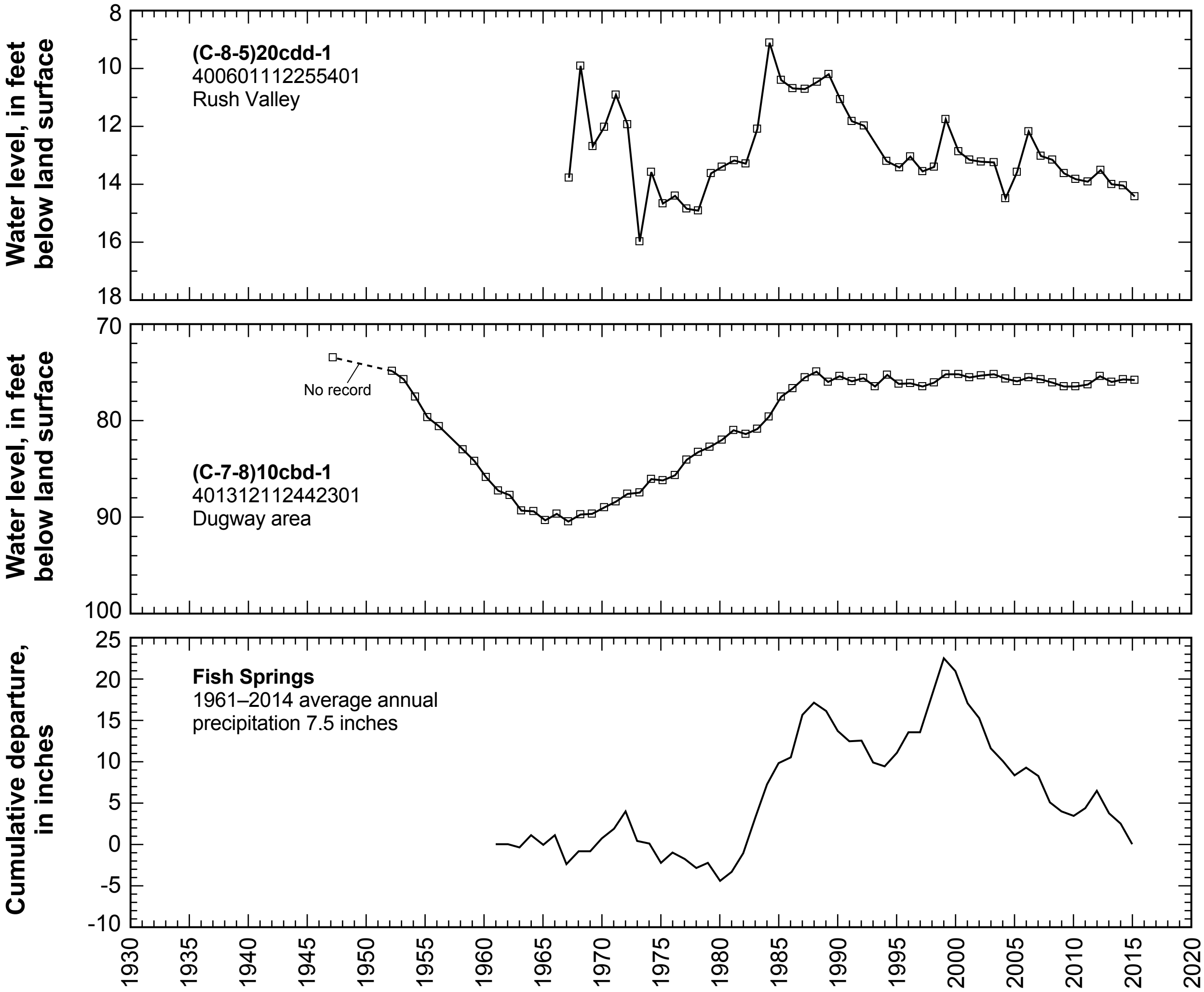


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

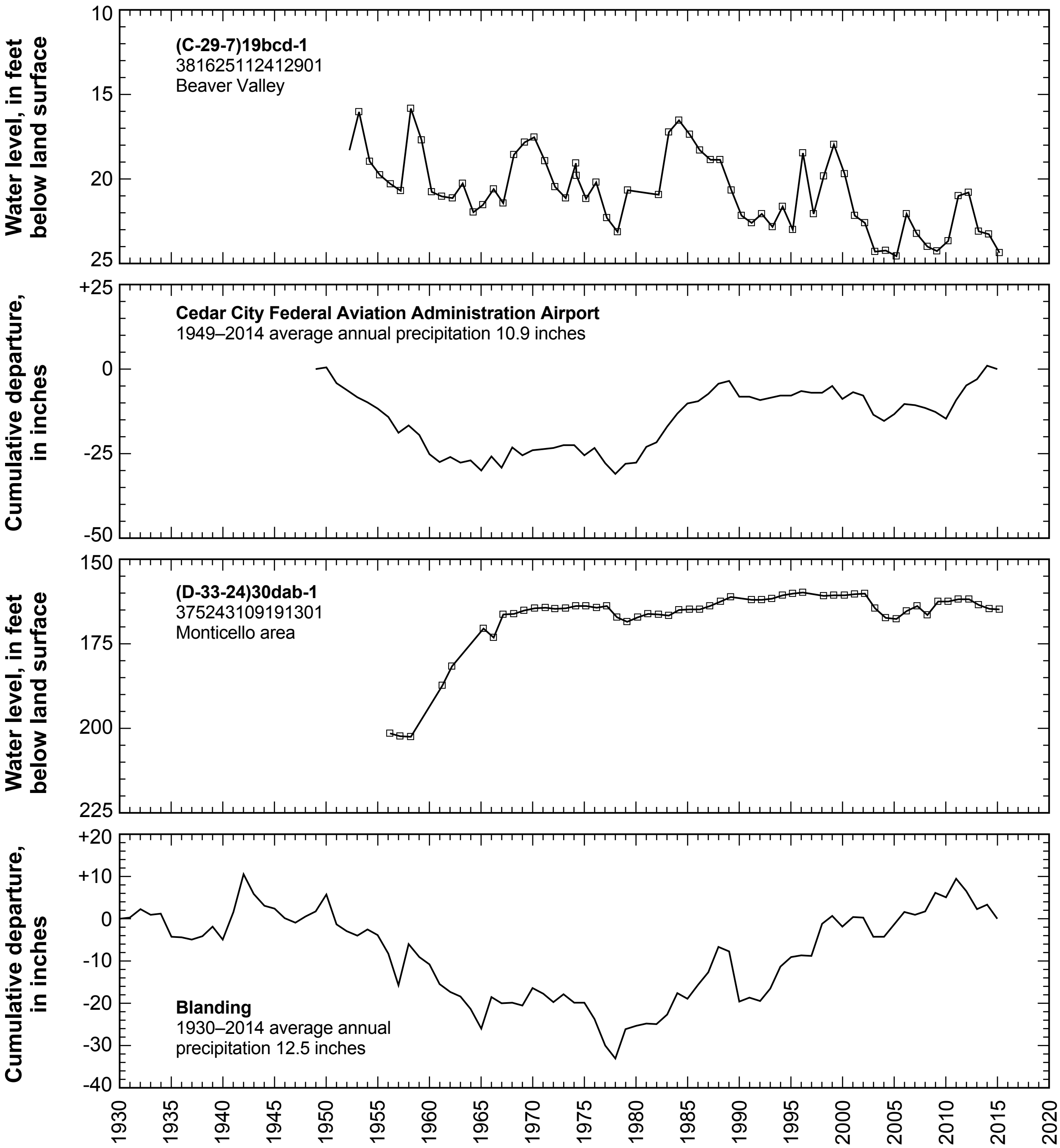


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

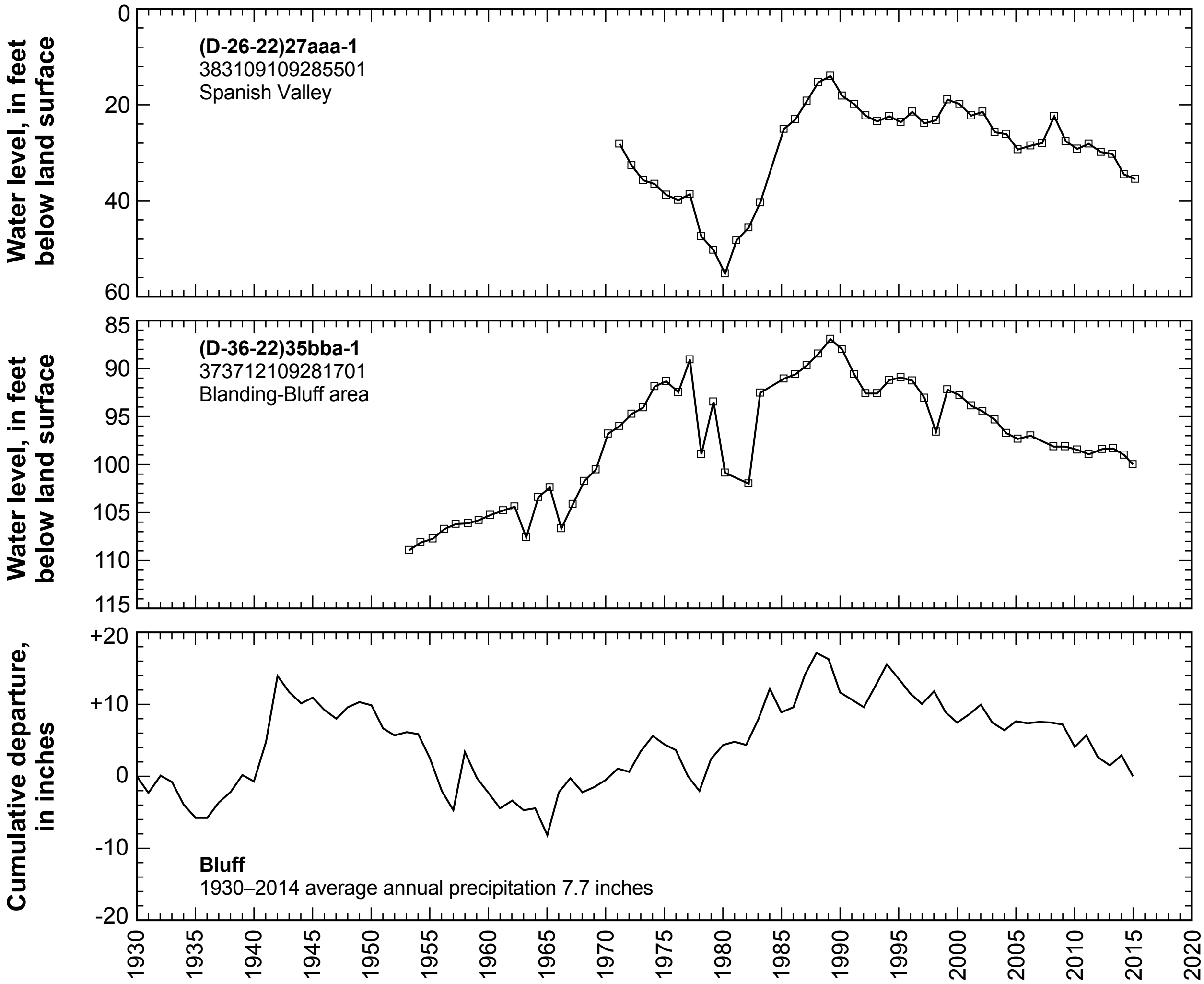


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

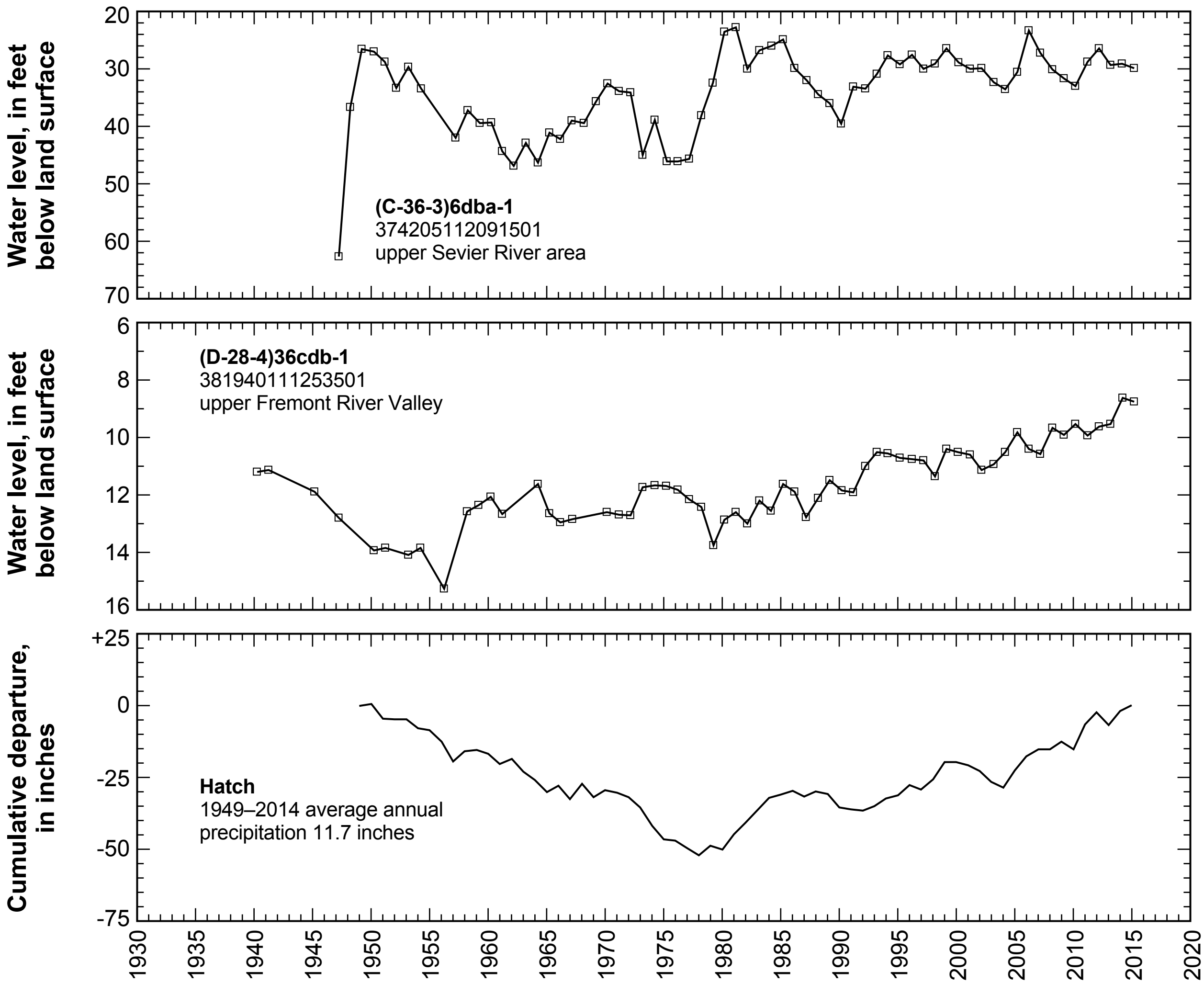


Figure 59. Relation of water level in wells in selected areas of Utah to cumulative departure from average annual precipitation at sites in or near those areas.—Continued

Quality of Water from Selected Wells in Utah, Summer of 2014

From June through September 2014, 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 104 wells located in 21 counties (fig. 60). 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. Fifteen field blank water samples were processed during the 2014 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 results of the environmental samples and within 2 percent for all constituents.

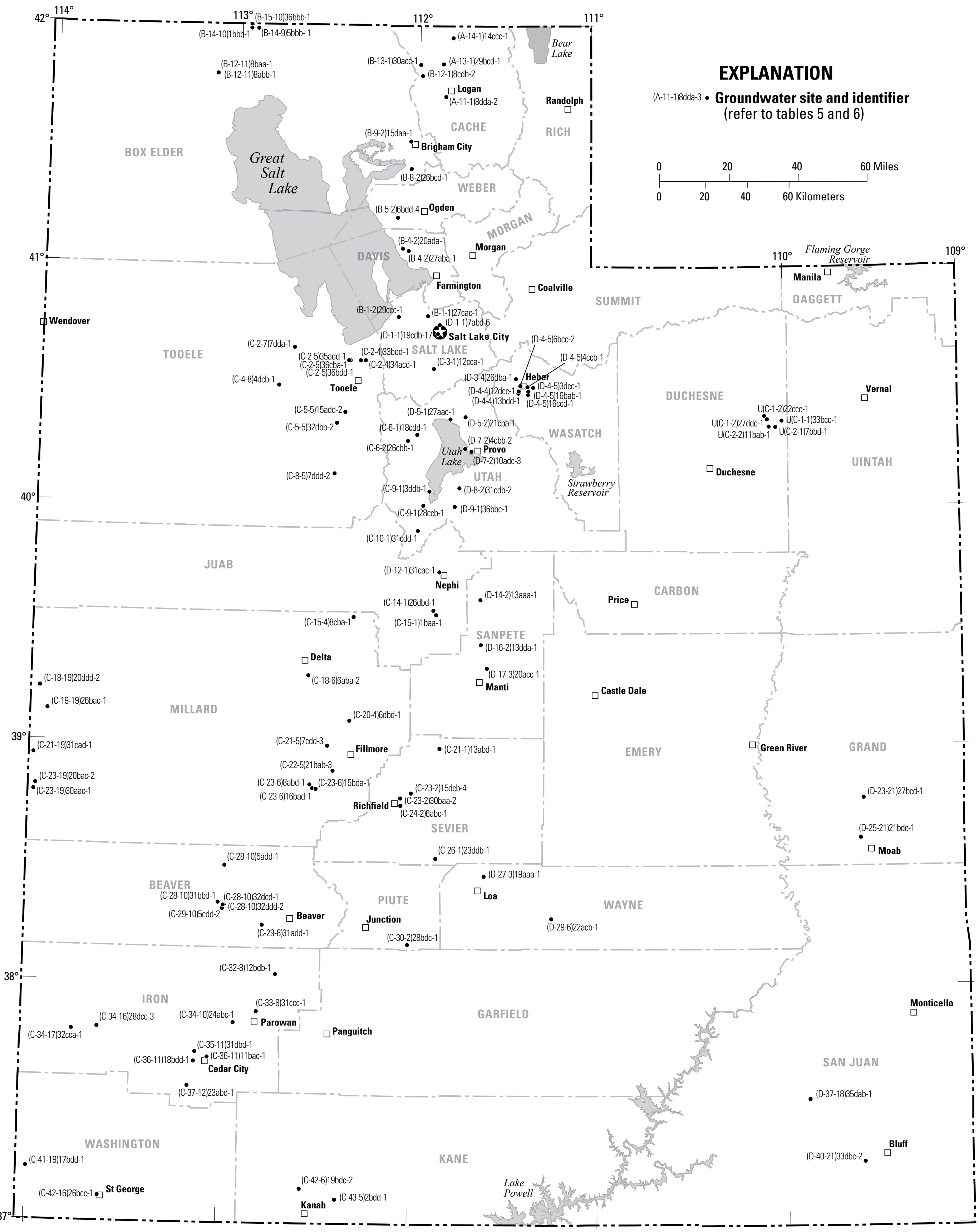


Figure 60. Location of groundwater sites sampled during the summer of 2014.

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2014.

[Date of sample: YYYYMMDD, year, month, day; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; ANC, acid neutralization capacity; <, less than; —, no data]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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-29-8)31add-1	381435112471401	20140618	7.4	955	11.9	324	91.1	23.5
Escalante Valley, Milford area								
(C-28-10)5add-1	382924112592901	20140721	7.2	841	18.4	238	57.2	23.1
(C-28-10)31bbd-1	382008113012301	20140721	7.5	819	18.3	326	90	24.5
(C-28-10)32dcd-1	381927112594501	20140721	7.1	1,180	15.5	515	152	32.7
(C-28-10)32ddd-2	381928112592701	20140721	7.4	1,590	14.8	735	207	52.7
(C-29-10)5cdd-2	381835113000001	20140721	7.1	740	15.9	329	97.9	20.5
Box Elder County								
Curlew Valley								
(B-12-11)8abb-1	414710113071601	20140616	6.9	6,190	13.7	2,100	597	149
(B-12-11)8baa-1	414721113072601	20140616	6.8	2,940	14.1	661	182	50.5
(B-14- 9)5bbb-1	415847112540401	20140616	7.1	1,260	17.1	406	118	27.2
(B-14-10)1bbb-1	415845112562201	20140616	7.2	863	19.2	267	74.7	19.7
(B-15-10)36bbb-1	415939112562201	20140616	7.3	553	15.8	188	55.1	12.2
East Shore area								
(B-8-2)26bcd-1	412405112022501	20140624	7.3	191	14.6	37	7.3	4.51
Lower Bear River area								
(B-9-2)15daa-1	413057112023901	20140624	8.3	606	16.6	8.7	2	0.91
Cache County								
Cache Valley								
(A-11-1)8dda-2	414211111510902	20140821	6.7	549	10.6	293	71	28.1
(A-13-1)29bcd-1	415020111520401	20140820	7.1	449	13.4	199	41.8	23
(A-14-1)14ccc-1	415653111485401	20140820	6.7	435	10.8	301	75.4	27.4
(B-12-1)8cdb-2	414721111590001	20140820	7.2	770	13.7	137	30.3	14.9
(B-13-1)30acc-1	415008111593901	20140821	7.1	645	14.0	231	57	21.6
Davis County								
East Shore area								
(B-4-2)20ada-1	410410112050001	20140623	7.6	344	15.3	143	38.3	11.4
(B-4-2)27aba-1	410340112030001	20140623	7.9	598	14.3	46	11.7	4.11
Duchesne County								
Duchesne River area								
U(C-1-1)33bcc-1	402114110003301	20140908	7.4	1,520	12.3	696	184	57.6
U(C-1-2)22ccc-1	402227110061401	20140909	7.0	386	12.6	202	49.2	19.2
U(C-1-2)27ddc-1	402135110051901	20140910	7.4	333	11.5	174	48.4	12.9
U(C-2-1)7bbd-1	401940110023601	20140909	7.9	770	14.6	52	13.5	4.37
U(C-2-2)11bab-1	401946110044601	20140908	7.2	358	14.5	176	44.1	16
Grand County								
Spanish Valley								
(D-23-21)27bcd-1	384654109353601	20140811	7.9	526	20.8	197	29.7	29.7
(D-25-21)21bdc-1	383655109364001	20140811	7.3	1,430	20.0	391	95.1	37.2

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										
5.71	80.7	303	0.19	67.8	0.61	44.5	86.6	566	3.03	0.07
Escalante Valley, Milford area										
2.56	66.8	107	0.19	138	0.27	24.6	90.7	492	0.72	0.011
4.93	33.6	134	0.23	111	0.43	37.3	99.2	514	2.6	0.016
5.8	37.7	233	0.43	152	0.28	36.4	128	793	4.82	0.037
6.41	38.5	132	0.82	268	0.25	36.4	274	1,160	4.41	0.027
4.46	26.4	232	0.17	52.6	0.27	34.3	67.2	469	2.54	0.048
Box Elder County										
Curlew Valley										
14.3	206	101	<1.5	1,630	<0.2	20.2	30.6	4,790	1.03	0.009
7.96	248	227	0.53	651	<0.15	20.1	51.8	1,830	4.06	0.012
12	40.2	128	0.22	245	0.18	50.2	20.8	891	1.99	0.026
10.2	36.3	144	0.14	138	0.28	52.8	27.3	521	0.52	0.016
8.36	18.4	140	0.05	57.9	0.22	59.3	18.8	338	0.81	0.027
East Shore area										
3.6	25.4	76	<0.03	6.6	0.09	13.9	10.5	115	0.64	0.135
Lower Bear River area										
1.7	144	309	<0.03	13.4	0.67	15.4	1.16	403	<0.04	1.39
Cache County										
Cache Valley										
1.65	9.34	191	<0.03	12.8	0.1	9.68	24.7	241	0.98	0.014
1.69	26.1	188	<0.03	8.5	0.09	10.4	10.9	215	0.12	0.01
0.9	5.48	—	<0.03	15.6	0.07	11.7	4.8	225	3.75	0.01
7.18	122	289	0.06	55	2.45	59.9	38.6	501	<0.04	0.055
9.31	54.9	309	0.05	34.4	0.5	63.8	1.17	411	<0.04	0.152
Davis County										
East Shore area										
2.92	18.2	164	<0.03	14.6	0.17	21.1	0.19	211	<0.04	0.054
5.29	118	266	0.06	42.8	0.38	29.8	0.12	388	<0.04	0.621
Duchesne County										
Duchesne River area										
3.65	143	103	<0.06	0.78	1.15	7.07	733	1,270	<0.04	<0.004
3.64	10.5	166	<0.03	1.39	0.44	8.32	32.3	200	<0.04	<0.004
3.43	4.4	89	<0.03	0.61	0.51	8.53	39.1	191	<0.04	<0.004
2.45	181	236	<0.03	65	1.84	8.05	57.5	444	<0.04	<0.004
3.68	11.3	130	<0.03	1.21	0.57	9.47	51.2	210	<0.04	<0.004
Grand County										
Spanish Valley										
6.05	35	178	0.04	37.6	0.41	9.45	36.4	294	0.76	<0.004
8.68	148	181	0.29	171	0.38	11.8	227	848	5.71	<0.004

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; ANC, acid neutralization capacity; <, less than; —, no data]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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	20140616	7.3	1,170	14.4	664	132	81.3
(C-36-11)11bac-1	374122113034801	20140616	7.5	2,240	—	1,400	310	153
(C-36-11)18bdd-1	374017113080401	20140616	7.4	1,310	14.9	650	138	74.1
(C-37-12)23abd-1	373409113095501	20140618	7.5	747	16.0	317	73	32.6
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-3	374934113384601	20140721	8.0	772	13.5	301	90.7	18.1
(C-34-17)32cca-1	374753113464601	20140721	7.2	1,010	19.6	389	126	17.8
Parowan Valley								
(C-32-8)12bdb-1	380218112424401	20140618	7.8	539	18.2	211	62.7	13.2
(C-33-8)31ccc-1	375257112483501	20140806	7.6	516	14.4	219	45.4	25.7
(C-34-10)24abc-1	375006112554801	20140616	7.5	384	14.6	143	28.8	17.3
Juab County								
Juab Valley								
(C-14-1)26dbd-1	393342111534501	20140702	7.4	1,150	13.7	515	109	59.1
(C-15-1)1baa-1	393236111525300	20140702	6.6	1,260	12.6	631	161	55.7
(D-12-1)31cac-1	394323111515501	20140702	6.8	1,160	12.2	346	84.7	32.8
Kane County								
Kanab area								
(C-42-6)19bdc-2	370843112340602	20140722	7.2	238	13.8	128	23.8	16.6
(C-43-5)2bdd-1	370608112230001	20140722	7.3	714	12.6	359	82.3	37.1
Millard County								
Pahvant Valley								
(C-20-4)6dbd-1	390558112202301	20140623	6.8	1,890	18.5	990	274	74.6
(C-21-5)7cdd-3	385939112272303	20140623	7.4	1,520	11.8	539	118	59.2
(C-22-5)21bab-3	385323112253401	20140623	7.2	1,180	14.7	310	84.8	23.9
(C-23-6)8abd-1	384953112325101	20140623	6.8	7,920	15.8	2,160	536	199
(C-23-6)15bda-1	384848112305101	20140623	7.2	2,290	14.6	662	163	62
(C-23-6)16bad-1	384856112315701	20140623	7.5	6,060	17.1	1,310	355	104
Sevier Desert								
(C-15-4)8cba-1	393154112192901	20140709	6.5	3,360	13.6	970	215	105
(C-18-6)6aba-2	391710112334701	20140709	8.1	406	25.6	37	8.47	3.91
Snake Valley								
(C-18-19)20ddd-2	391324114000001	20140708	7.4	323	22.0	114	28.3	10.6
(C-19-19)26bac-1	390748113572201	20140708	7.5	819	12.7	321	77.8	30.9
(C-21-19)31cad-1	385640114012401	20140708	7.5	521	12.5	240	55	25
(C-23-19)20bac-2	384900114003001	20140708	7.4	820	14.1	254	38	38.7
(C-23-19)30aac-1	384729114010301	20140708	7.3	1,620	12.9	483	94	60.4
Piute County								
Upper Sevier River area								
(C-30-2)28bdc-1	381003112010301	20140804	7.6	417	17.6	182	44.7	17.2

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										
2.47	11.6	128	<0.06	14.8	0.24	19.2	491	1,010	2.72	0.009
4.23	35.4	216	<0.15	34.2	0.22	20.4	981	2,080	7.26	0.009
3.53	45.1	158	0.17	50	0.28	32.5	482	1,040	3.87	0.015
1.45	35.2	170	0.25	45.7	0.1	18.7	152	532	2.77	0.018
Escalante Valley, Beryl-Enterprise area										
8.34	34.8	129	0.48	128	1.15	65.2	61.1	582	1.16	0.025
11	49	133	0.48	157	0.48	68.8	119	801	5.77	0.022
Parowan Valley										
6.41	17.7	116	0.29	63.8	0.21	53.4	47	397	2.15	0.024
2.73	21.6	185	0.07	26.7	0.17	28.1	23.9	284	1.98	0.027
4.26	22.1	154	0.04	16.2	0.38	40.9	22.6	253	0.57	0.021
Juab County										
Juab Valley										
3.19	60.4	207	0.06	59.9	0.25	18.1	323	734	1.92	0.019
2.01	44.6	165	0.05	62.1	0.19	12.4	369	815	2.01	0.008
4.21	108	213	0.08	177	0.17	28.3	75.1	696	2.81	0.034
Kane County										
Kanab area										
2.12	3.54	122	0.04	4	0.07	13.9	4.45	159	2.27	0.015
2.72	21.2	191	0.08	7.53	0.14	11.5	176	478	5.21	0.026
Millard County										
Pahvant Valley										
5.57	54.9	227	0.27	158	0.66	16.3	653	1,490	2.5	0.009
4.86	120	310	0.27	177	0.17	24.2	252	989	5.9	0.022
12.9	112	228	0.25	190	1.08	12.9	79.8	634	0.78	0.009
78.9	896	329	2.34	1,680	1.07	37.6	1,090	5,490	1.93	0.047
22.9	208	222	0.7	459	0.4	29.2	236	1,480	4.13	0.022
72.9	646	346	1.6	1,160	1.0	36	695	3,710	2.44	0.041
Sevier Desert										
8.21	362	406	<0.15	574	0.2	26.6	538	2,140	0.40	0.024
1.57	72.5	140	0.04	31.9	0.59	26.3	21.1	256	<0.04	0.015
Snake Valley										
1.72	21.3	134	0.04	18.8	0.11	13.1	9.61	186	0.18	0.006
3.42	43.4	204	0.15	72.9	0.26	23.4	76.8	472	1.22	0.016
1.49	14.2	203	<0.03	17.5	0.08	15.5	14.1	254	1.73	0.008
3.76	71.5	297	<0.06	55.4	1.21	47.1	61.8	503	0.88	0.051
5.2	159	269	<0.06	174	0.69	40.8	291	1,050	1.52	0.032
Piute County										
Upper Sevier River area										
4.79	16.4	189	0.06	10.3	0.28	33.3	16.4	256	0.24	0.035

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; ANC, acid neutralization capacity; <, less than; —, no data]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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								
(B-1-1)27cac-1	404720111562701	20140625	7.5	962	13.2	154	30.9	18.7
(B-1-2)29ccc-1	404704112060401	20140625	8.0	8,320	15.4	215	31.3	33.3
(C-3-1)12cca-1	403410111542501	20140625	7.3	929	19.7	281	61.3	30.9
(D-1-1)7abd-6	404506111523301	20140625	7.1	1,370	14.3	606	148	57.7
(D-1-1)19cdb-17	404253111530901	20140625	7.0	1,140	14.2	515	136	42.8
San Juan County								
Blanding-Bluff area								
(D-37-18)35dab-1	373130109534501	20140903	7.3	1,060	12.5	511	92.1	68.3
(D-40-21)33dbc-2	371545109364402	20140903	8.0	416	17.3	9	2.38	0.73
Sanpete County								
Sanpete Valley								
(D-14-2)13aaa-1	393630111383301	20140829	7.7	487	12.5	248	63.3	21.9
(D-16-2)13dda-1	392511111382001	20140829	7.5	1,120	14.0	380	64.6	53
(D-17-3)20acc-1	391920111361901	20140829	7.7	732	15.0	364	62.8	50.3
Sevier County								
Central Sevier Valley								
(C-21-1)13abd-1	385910111512101	20140805	7.8	763	17.8	150	31.5	17.4
(C-23-2)15dcb-4	384757112002201	20140805	7.3	660	11.6	312	63.8	37.1
(C-23-2)30baa-2	384641112034601	20140805	6.9	915	14.3	460	93.4	55.1
(C-24-2)6abc-1	384450112034001	20140805	7.1	1,170	12.3	616	152	57.7
Upper Sevier River area								
(C-26-1)23ddb-1	383140111522001	20140804	7.6	225	12.8	88	28.5	4.19
Tooele County								
Rush Valley								
(C-5-5)15add-2	402310112231002	20140604	7.1	565	11.7	265	56.8	29.9
(C-5-5)32dbb-2	402024112254601	20140604	6.9	1,220	10.0	452	130	31
(C-8-5)7ddd-2	400745112263101	20140604	7.5	542	16.7	202	37	26.6
Skull Valley								
(C-2-7)7dda-1	403914112400301	20140605	7.5	5,460	18.0	475	101	54
(C-4-8)4dcb-1	402942112450001	20140605	8.8	3,140	17.9	94	30.2	4.54
Tooele Valley								
(C-2-4)33bdd-1	403629112174801	20140603	7.3	1,060	14.1	300	76.4	26.4
(C-2-4)34acd-1	403609112164201	20140603	7.2	877	14.0	341	75.4	37
(C-2-5)35add-1	403606112221201	20140603	7.2	1,590	18.5	373	92	34.8
(C-2-5)36bdd-1	403605112214201	20140605	7.3	1,640	17.9	285	72.3	25.4
(C-2-5)36cba-1	403603112215801	20140603	7.2	1,810	19.9	313	77.7	28.8

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
Salt Lake County										
Salt Lake Valley										
9.82	153	462	0.10	56.5	0.5	27.9	0.09	580	<0.04	0.244
20.6	1,560	321	<1.5	2,320	1.75	18.8	180	4,750	<0.04	0.183
8.16	77.6	180	0.11	125	0.24	31.8	116	568	0.24	0.017
2.98	59.8	290	0.10	193	0.18	18.6	172	805	4.68	0.04
3.86	46.4	255	0.07	106	0.26	16.2	218	714	2.98	0.016
San Juan County										
Blanding-Bluff area										
7.86	42.6	232	0.17	23.2	0.25	6.28	249	635	<0.04	<0.004
1.08	108	212	<0.03	3.01	0.12	9.68	31	279	<0.04	0.006
Sanpete County										
Sanpete Valley										
1.01	11	190	0.03	11.6	0.08	14.6	11.1	226	2.69	0.018
3.69	101	215	0.11	145	0.45	22.4	139	667	<0.04	0.012
1.48	23.3	262	0.04	14.4	0.27	14.4	69.5	419	2.59	0.008
Sevier County										
Central Sevier Valley										
4.29	92.2	114	0.08	110	0.58	39.5	91.7	462	0.28	0.017
3.19	19.4	250	0.07	26.7	0.39	33.7	47.2	348	1.04	0.041
1.84	31.3	381	0.07	14.6	0.17	15.6	31.9	413	3.62	0.024
3.92	40.3	284	0.08	20	0.16	31.7	352	800	2.51	0.029
Upper Sevier River area										
2.96	9.71	84	0.05	13.4	0.22	42.2	4.81	158	0.45	0.018
Tooele County										
Rush Valley										
1.17	15.4	195	0.06	50.7	0.15	11.3	21.5	292	1.49	0.004
1.32	87.2	256	0.16	186	0.24	17.2	53.5	546	1.77	0.013
2.45	34.9	155	0.06	66.3	0.66	13.1	25.4	312	0.04	0.007
Skull Valley										
33.8	845	147	<1.5	1,580	0.22	21.9	115	3,140	2.92	0.009
24.7	528	96	0.54	825	0.1	8.97	56.7	1,690	0.84	0.106
Tooele Valley										
2.1	120	217	0.12	152	0.12	12.4	112	594	1.83	0.023
1.46	65.6	233	0.07	49.7	0.06	12.6	152	520	2.8	0.021
3.41	258	188	0.33	505	0.16	17.5	33.2	1,170	2.37	0.009
2.95	204	212	0.24	366	0.18	15.6	53.2	895	3.76	0.014
3.28	239	187	0.28	421	0.16	16.6	33	991	3.06	0.013

Table 5. Physical properties and concentration of major ions and nutrients in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; ANC, acid neutralization capacity; <, less than; —, no data]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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-6-1)18cdd-1	401730111594501	20140618	7.2	1,500	29.7	281	68.6	26.6
(C-6-2)26cbb-1	401607112023401	20140618	7.3	1,710	11.0	375	62.6	53
Goshen Valley								
(C-9-1)3ddb-1	400325111552501	20140701	7.0	1,570	14.0	321	81.6	28.4
(C-9-1)28ccb-1	395956111572101	20140701	7.1	2,320	17.5	754	197	63.6
(C-10-1)31cdd-1	395340111590001	20140701	7.1	917	19.2	370	93.7	33
Northern Utah Valley								
(D-5-1)27aac-1	402133111484601	20140715	7.1	678	11.5	327	77.2	32.5
(D-5-2)21cba-1	402215111434701	20140716	7.1	754	13.2	393	89	41.4
Southern Utah Valley								
(D-7-2)4cbb-2	401414111435301	20140715	7.4	537	12.8	259	65.2	23.3
(D-7-2)10adc-3	401332111414401	20140715	7.3	561	13.2	266	63.5	26.1
(D-8-2)31cdb-2	400423111454001	20140715	6.9	3,420	23.9	329	83.2	29.5
(D-9-1)36bbc-1	395942111470801	20140716	7.2	557	11.2	296	76.8	25.3
Wasatch County								
Heber Valley								
(D-3-4)26dba-1	403146111272701	20140805	6.8	846	13.0	396	120	23.6
(D-4-4)12dcc-1	402842111263101	20140806	6.6	750	11.9	344	97	24.8
(D-4-4)13bdd-1	402810111263601	20140805	7.2	508	20.2	239	56.9	23.4
(D-4-5)3dcc-1	402937111214901	20140806	6.5	536	11.3	251	82.9	10.8
(D-4-5)4ccb-1	402946111233901	20140806	6.5	459	13.7	224	71.5	10.9
(D-4-5)6bcc-2	403003111255801	20140805	7.0	396	11.8	192	58.4	11.1
(D-4-5)16bab-1	402840111232201	20140805	6.8	629	11.5	315	86.5	24
(D-4-5)16ccd-1	402750111232701	20140806	7.2	464	12.3	224	54	21.6
Washington County								
Central Virgin River area								
(C-41-19)17bdd-1	371315113594901	20140903	7.1	626	15.8	286	81.7	20
(C-42-16)26bcc-1	370617113371101	20140903	7.0	5,970	17.7	2,340	519	254
Wayne County								
Upper Fremont River Valley								
(D-29-6)22acb-1	381644111152501	20140820	7.3	1,030	12.3	538	159	34.4
Upper Sevier River Valley								
(D-27-3)19aaa-1	382717111365601	20140804	6.9	1,090	10.8	578	175	34.6
Weber County								
East Shore area								
(B-5-2)6bdd-4	411153112064601	20140623	7.8	430	15.6	148	36.2	14.1

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										
3.28	37.6	182	0.09	73	0.58	18.8	67	396	1.07	0.006
3.56	22.2	186	0.16	140	0.32	51.3	32.5	505	0.26	0.028
Goshen Valley										
11.7	171	156	0.29	355	0.45	62.3	104	960	0.93	0.027
17.4	141	105	0.86	576	0.21	59.7	136	1,970	25.7	0.024
7.16	31.1	132	0.23	133	0.21	52.4	84.7	655	11.6	0.03
Northern Utah Valley										
1.46	25.2	225	0.03	19.8	0.28	15.5	107	385	2.33	0.013
1.13	24	231	0.05	28.8	0.23	11.5	134	430	2.68	0.005
Southern Utah Valley										
2.71	16.1	227	0.03	12.8	0.23	19.6	46.3	270	<0.04	0.021
2.36	17.7	232	0.04	17.8	0.25	20.2	51.7	277	<0.04	0.028
34.4	540	463	0.42	708	1.71	48.1	158	1,890	<0.04	0.015
1.48	8.69	220	<0.03	21.4	0.22	16.3	21.6	248	2.92	0.01
Wasatch County										
Heber Valley										
6.41	27.3	226	0.09	35.8	0.52	19.5	122	439	3.01	0.028
1.45	23.3	204	0.04	60.1	0.08	21.5	38.1	357	4.26	0.049
1.74	11.3	163	<0.03	26	0.3	12.9	17.5	200	0.48	0.008
3.08	7.44	186	<0.03	41.1	0.08	36.4	8.25	353	6.03	0.095
2.59	5.49	174	<0.03	21.8	0.08	39.8	13.7	292	4.73	0.1
1.86	7.29	164	<0.03	13.1	0.08	27.2	21.5	231	1.85	0.048
1.55	13.8	217	0.03	23.6	0.18	30.8	21	306	3.01	0.039
1.05	7.95	202	<0.03	10.8	0.14	12.3	27.9	236	0.82	0.012
Washington County										
Central Virgin River area										
3.01	25.6	154	0.11	23.3	0.46	33.3	76.4	414	0.14	0.019
14.5	794	284	<1.5	275	0.46	19	2,490	5,630	18.1	0.025
Wayne County										
Upper Fremont River Valley										
4.85	21.8	228	<0.06	16	0.21	25.5	297	682	0.08	0.008
Upper Sevier River Valley										
3.57	22.8	166	<0.06	10.5	0.16	29.9	332	792	1.78	0.031
Weber County										
East Shore area										
7.23	32.3	215	0.03	16.7	0.22	25.8	0.13	260	0.04	0.154

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2014.

[Date of sample: YYYYMMDD, year, month, day; µg/L, micrograms per liter; < , less than]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	Arsenic, dissolved, in µg/L	Iron, dissolved, in µg/L	Manganese, dissolved, in µg/L	Molybdenum, dissolved, in µg/L	Selenium, dissolved, in µg/L	Uranium, dissolved, in µg/L
Beaver County								
Beaver Valley								
(C-29-8)31add-1	381435112471401	20140618	4	<4	<0.2	2.84	0.9	21.7
Escalante Valley, Milford area								
(C-28-10)5add-1	382924112592901	20140721	1.5	5.5	0.23	1.02	1.5	8.72
(C-28-10)31bbd-1	382008113012301	20140721	5	8	0.21	1.56	3.1	10.7
(C-28-10)32dcd-1	381927112594501	20140721	2.3	<4	<0.2	0.75	1.6	34.2
(C-28-10)32ddd-2	381928112592701	20140721	2.5	4.9	<0.2	1.06	5.2	11.4
(C-29-10)5cdd-2	381835113000001	20140721	2.2	7.6	<0.2	0.61	0.6	24.2
Box Elder County								
Curlew Valley								
(B-12-11)8abb-1	414710113071601	20140616	1.1	12.8	<0.6	0.64	1	3.63
(B-12-11)8baa-1	414721113072601	20140616	1.2	<8	<0.4	0.57	1.7	3.86
(B-14-9)5bbb-1	415847112540401	20140616	2.1	9.8	<0.2	0.88	2	1.47
(B-14-10)1bbb-1	415845112562201	20140616	1.4	40.1	58.5	1.27	1.3	1.93
(B-15-10)36bbb-1	415939112562201	20140616	2.6	<4	<0.2	0.87	1.2	1.74
East Shore area								
(B-8-2)26bcd-1	412405112022501	20140624	0.6	11.5	2.07	0.64	0.4	0.149
Lower Bear River area								
(B-9-2)15daa-1	413057112023901	20140624	<0.1	367	11.3	0.42	<0.05	0.349
Cache County								
Cache Valley								
(A-11-1)8dda-2	414211111510902	20140821	0.23	<4	<0.2	0.40	0.63	0.869
(A-13-1)29bcd-1	415020111520401	20140820	5.6	157	66	0.78	0.05	0.29
(A-14-1)14ccc-1	415653111485401	20140820	0.19	<4	<0.2	0.13	0.05	0.506
(B-12-1)8cdb-2	414721111590001	20140820	17.3	46.1	63.8	5.6	<0.05	2.03
(B-13-1)30acc-1	415008111593901	20140821	<0.1	481	75.5	0.27	<0.05	<0.014
Davis County								
East Shore area								
(B-4-2)20ada-1	410410112050001	20140623	0.84	117	55.8	2.14	<0.05	<0.014
(B-4-2)27aba-1	410340112030001	20140623	19.8	318	50.7	0.35	<0.05	<0.014
Duchesne County								
Duchesne River area								
U(C-1-1)33bcc-1	402114110003301	20140908	3.1	695	25.9	3.74	<0.05	0.95
U(C-1-2)22ccc-1	402227110061401	20140909	1.3	747	9.43	0.85	<0.05	0.193
U(C-1-2)27ddc-1	402135110051901	20140910	0.68	898	13.2	0.45	<0.05	0.18
U(C-2-1)7bbd-1	401940110023601	20140909	0.67	309	7.3	5.85	<0.05	0.135
U(C-2-2)11bab-1	401946110044601	20140908	0.1	278	8.42	0.39	<0.05	0.127
Grand County								
Spanish Valley								
(D-23-21)27bcd-1	384654109353601	20140811	0.17	5.1	<0.2	1.71	3.1	2.21
(D-25-21)21bdc-1	383655109364001	20140811	<0.5	5.6	<0.2	2.21	9.2	6.9

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µg/L, micrograms per liter; < , less than]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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	20140616	0.74	11.3	<0.2	0.49	1.6	2.98
(C-36-11)11bac-1	374122113034801	20140616	0.53	15.7	<0.4	0.46	3.9	6.74
(C-36-11)18bdd-1	374017113080401	20140616	2.7	6.1	<0.2	1.77	3.5	4.39
(C-37-12)23abd-1	373409113095501	20140618	0.81	5.2	0.81	0.72	4.5	1.45
Escalante Valley, Beryl-Enterprise area								
(C-34-16)28dcc-3	374934113384601	20140721	16.4	<4	<0.2	1.65	1.8	3.1
(C-34-17)32cca-1	374753113464601	20140721	3.3	5.3	<0.2	0.83	1.7	4.61
Parowan Valley								
(C-32-8)12bdb-1	380218112424401	20140618	2	<4	<0.2	0.78	2	2.73
(C-33-8)31ccc-1	375257112483501	20140806	3.6	<4	<0.2	0.45	1.1	2.01
(C-34-10)24abc-1	375006112554801	20140616	6.6	8.6	0.55	1.76	0.44	2.92
Juab County								
Juab Valley								
(C-14-1)26dbd-1	393342111534501	20140702	1.4	8.5	<0.2	1.7	0.85	2.18
(C-15-1)1baa-1	393236111525300	20140702	0.7	<4	<0.2	0.38	0.99	1.08
(D-12-1)31cac-1	394323111515501	20140702	2.2	<4	<0.2	0.82	2.2	2.12
Kane County								
Kanab area								
(C-42-6)19bdc-2	370843112340602	20140722	0.9	<4	<0.2	<0.05	0.38	0.434
(C-43-5)2bdd-1	370608112230001	20140722	0.55	14.1	7.85	0.16	3	4.02
Millard County								
Pahvant Valley								
(C-20-4)6dbd-1	390558112202301	20140623	2.8	22.8	<0.2	1.14	2.3	1.09
(C-21-5)7cdd-3	385939112272303	20140623	2.2	<4	<0.2	1.54	3	3.6
(C-22-5)21bab-3	385323112253401	20140623	0.55	15.3	0.96	2.21	0.76	0.46
(C-23-6)8abd-1	384953112325101	20140623	11.4	25.2	<0.8	2.61	16.2	11.9
(C-23-6)15bda-1	384848112305101	20140623	3.1	13	<0.4	0.72	3.6	1.89
(C-23-6)16bad-1	384856112315701	20140623	8.5	<12	<0.6	0.90	2.8	2.92
Sevier Desert								
(C-15-4)8cba-1	393154112192901	20140709	3.1	192	395	2.84	0.2	5.76
(C-18-6)6aba-2	391710112334701	20140709	21.3	<4	3.99	2.03	<0.05	1.59
Snake Valley								
(C-18-19)20ddd-2	391324114000001	20140708	0.99	<4	<0.2	0.45	0.37	1.34
(C-19-19)26bac-1	390748113572201	20140708	3.4	<4	<0.2	1.7	4	7.44
(C-21-19)31cad-1	385640114012401	20140708	0.84	<4	<0.2	0.26	0.32	2.03
(C-23-19)20bac-2	384900114003001	20140708	20.9	<4	<0.2	14.1	14.6	6.38
(C-23-19)30aac-1	384729114010301	20140708	7.5	4.6	<0.2	5.06	21.2	14.5
Piute County								
Upper Sevier River area								
(C-30-2)28bdc-1	381003112010301	20140804	7.1	<4	<0.2	1.26	0.26	2.87

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µg/L, micrograms per liter; < , less than]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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								
(B-1-1)27cac-1	404720111562701	20140625	20.1	1,420	47.1	0.50	0.08	<0.014
(B-1-2)29ccc-1	404704112060401	20140625	238	790	74.8	21.3	0.35	0.174
(C-3-1)12cca-1	403410111542501	20140625	3.4	7.2	<0.2	1.47	1.4	4.71
(D-1-1)7abd-6	404506111523301	20140625	1.1	9.9	4	1.19	1.9	1.75
(D-1-1)19cdb-17	404253111530901	20140625	0.76	6.6	<0.2	0.48	2	1.16
San Juan County								
Blanding-Bluff area								
(D-37-18)35dab-1	373130109534501	20140903	1.3	3,960	26.9	0.62	<0.05	0.05
(D-40-21)33dbc-2	371545109364402	20140903	25.5	<4	3.77	0.85	<0.05	0.1
Sanpete County								
Sanpete Valley								
(D-14-2)13aaa-1	393630111383301	20140829	0.57	<4	<0.2	0.42	1.1	0.955
(D-16-2)13dda-1	392511111382001	20140829	0.65	23.4	50.9	9.7	0.05	2.53
(D-17-3)20acc-1	391920111361901	20140829	0.53	<4	<0.2	1.16	1.8	1.99
Sevier County								
Central Sevier Valley								
(C-21-1)13abd-1	385910111512101	20140805	9.7	<4	<0.2	3.47	0.45	4.25
(C-23-2)15dcb-4	384757112002201	20140805	3.6	<4	<0.2	3.39	1.1	4.93
(C-23-2)30baa-2	384641112034601	20140805	1.9	<4	<0.2	0.32	0.46	2.62
(C-24-2)6abc-1	384450112034001	20140805	1.7	<16	16.8	0.44	0.75	16.3
Upper Sevier River area								
(C-26-1)23ddb-1	383140111522001	20140804	3.3	<4	<0.2	0.42	0.29	2.47
Tooele County								
Rush Valley								
(C-5-5)15add-2	402310112231002	20140604	1.3	<4	<0.2	0.73	1.7	1.77
(C-5-5)32dbb-2	402024112254601	20140604	2.1	91.9	22.7	1	2.3	4.24
(C-8-5)7ddd-2	400745112263101	20140604	16.7	<4	<0.2	2.93	0.09	1.85
Skull Valley								
(C-2-7)7dda-1	403914112400301	20140605	1.7	96.2	6.35	0.92	1.4	1.4
(C-4-8)4dcb-1	402942112450001	20140605	4.9	<8	<0.4	0.22	0.87	0.279
Tooele Valley								
(C-2-4)33bdd-1	403629112174801	20140603	1.2	<4	<0.2	0.50	2.2	2.03
(C-2-4)34acd-1	403609112164201	20140603	1.7	<4	<0.2	0.31	12.6	1.86
(C-2-5)35add-1	403606112221201	20140603	1.1	55.5	2.22	0.66	1.2	1.69
(C-2-5)36bdd-1	403605112214201	20140605	1.4	4.9	<0.2	0.78	2	1.76
(C-2-5)36cba-1	403603112215801	20140603	1.6	11	<0.2	0.75	1.3	1.64

Table 6. Concentration of trace elements in water samples collected from selected wells in Utah, summer of 2014.—Continued

[Date of sample: YYYYMMDD, year, month, day; µg/L, micrograms per liter; < , less than]

Local identifier (refer to figure 60)	Station number	Date (YYYYMMDD)	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
Utah County								
Cedar Valley								
(C-6-1)18cdd-1	401730111594501	20140618	5.1	<4	<0.2	2.43	1.1	2.03
(C-6-2)26cbb-1	401607112023401	20140618	5.8	13.6	23.6	2.66	0.85	4.16
Goshen Valley								
(C-9-1)3ddb-1	400325111552501	20140701	6.7	5.3	<0.2	2.78	3.5	5.23
(C-9-1)28ccb-1	395956111572101	20140701	4.7	<8	<0.4	1.72	10.7	6.14
(C-10-1)31cdd-1	395340111590001	20140701	4.1	<4	<0.2	0.87	3.4	2.57
Northern Utah Valley								
(D-5-1)27aac-1	402133111484601	20140715	1.6	5.3	<0.2	1.35	4.5	2.98
(D-5-2)21cba-1	402215111434701	20140716	0.19	8.5	0.21	1.03	6.1	4.15
Southern Utah Valley								
(D-7-2)4cbb-2	401414111435301	20140715	1.8	698	75.5	0.92	<0.05	0.019
(D-7-2)10adc-3	401332111414401	20140715	5.9	645	222	0.89	<0.05	0.146
(D-8-2)31cdb-2	400423111454001	20140715	5.8	6,800	132	2.15	<0.1	2.19
(D-9-1)36bbc-1	395942111470801	20140716	0.4	5.1	<0.2	0.47	1.5	1.63
Wasatch County								
Heber Valley								
(D-3-4)26dba-1	403146111272701	20140805	11.4	<4	<0.2	0.69	0.46	0.822
(D-4-4)12dcc-1	402842111263101	20140806	1	<4	0.26	0.15	0.23	1.58
(D-4-4)13bdd-1	402810111263601	20140805	0.77	21.8	10.2	1.03	0.77	1.53
(D-4-5)3dcc-1	402937111214901	20140806	1.2	<4	0.76	0.07	0.13	1.36
(D-4-5)4ccb-1	402946111233901	20140806	1.3	6.6	0.79	0.09	0.07	1.22
(D-4-5)6bcc-2	403003111255801	20140805	1.1	<4	0.53	0.18	0.19	1.15
(D-4-5)16bab-1	402840111232201	20140805	1.9	<4	<0.2	0.45	0.36	1.85
(D-4-5)16ccd-1	402750111232701	20140806	1.1	<4	0.56	1.49	1.1	1.82
Washington County								
Central Virgin River area								
(C-41-19)17bdd-1	371315113594901	20140903	2.3	53.9	67.9	1.35	0.34	2.69
(C-42-16)26bcc-1	370617113371101	20140903	2	112	1,720	5.99	19	78.5
Wayne County								
Upper Fremont River Valley								
(D-29-6)22acb-1	381644111152501	20140820	0.45	11.5	<0.2	0.58	0.27	3.19
Upper Sevier River area								
(D-27-3)19aaa-1	382717111365601	20140804	1.1	<4	<0.2	0.21	0.56	11.4
Weber County								
East Shore area								
(B-5-2)6bdd-4	411153112064601	20140623	11.3	335	108	0.42	<0.05	<0.014

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