Water-Level Changes and Directions of Ground-Water Flow in the Shallow Aquifer, Fallon Area, Churchill County, Nevada

By Ralph L. Seiler *and* Kip K. Allander

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PLATE

[Plate is in pocket at back of report]

FIGURES

TABLE

CONVERSION FACTORS, ABBREVIATED WATER-QUALITY UNITS, AND VERTICAL DATUM

Multiply	By	To obtain
acre	0.4047	square hectometer
acre-foot (acre-ft)	1,223	cubic meter
acre-foot per day (acre-ft/d)	0.001233	cubic hectometer per day
acre-foot per year (acre-ft/yr)	0.001233	cubic hectometer per year
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per mile (ft/mi)	0.1894	meter per kilometer
inch (in.)	2.540	centimeter
mile (mi)	1.609	kilometer
square foot per day (ft^2/d)	0.09290	square meter per day
square mile (mi^2)	2.590	square kilometer

Abbreviated Water-Quality Units Used in This Report

µg/L (microgram per liter);
mg/L (milligram per liter)

Sea Level

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called "Sea-Level Datum of 1929"), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.

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ABSTRACT

The Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990 directed the U.S. Fish and Wildlife Service to acquire water for wetland areas in the Carson Desert. The public is concerned that this acquisition of water rights and delivery of the water directly to the wetland areas would reduce recharge to the shallow ground water in the Fallon area and cause domestic wells to go dry. In January 1992, the U.S. Geological Survey, in cooperation with the U.S. Fish and Wildlife Service, began a study of the shallow ground-water system in the Fallon area in Churchill County, Nevada.

A network of 126 wells in the study area was monitored. Water levels were measured in wells before, during, and after the 1992 irrigation season. Water levels in 24 of the wells were measured every 2 weeks beginning in January 1992. Many wells in the network had been monitored during earlier investigations, allowing determination of changes in water level during the last 15 years.

Newlands Project water deliveries to the study area began soon after the turn of the century. Since then, water levels have risen more than 15 feet across much of the study area. Water lost from unlined irrigation canals caused Big Soda Lake to rise nearly 60 feet; ground-water levels near the lake have risen 30 to 40 feet. The depth to water in most irrigated areas is now less than 10 feet.

The net change in water level over the 15-year period between early 1977 and early 1992 has been small in spite of 6 years of drought. Water levels in most wells for which data are available declined less than 1 foot. Some wells in the south and north parts of the study area showed rises in water level during this period. The lake level in Big Soda Lake declined slightly more than 3 feet between 1971 and 1992.

Between January and November 1992, water levels in most wells declined, generally less than 2 feet. The maximum measured decline over this period was 2.68 feet in a well in the Stillwater area. Between April and July, however, water levels rose in irrigated areas—typically 1 to 2 feet.

When the upper reaches of the T-Line Canal were lined in 1983-84 to reduce seepage to ground water, the water levels declined from 7.5 feet to more than 10 feet in wells near the canal. Water levels in a well near an unlined reach of the canal are essentially unchanged from what they were before the upper reaches of the canal were lined.

The altitude of the water table ranges from 4,025 feet above sea level 11 miles west of Fallon to 3,865 feet in the Stillwater Marsh area. The hydraulic gradient is small and ranges from about 6 to 9 feet per mile from west to east.

The principal recharge area is in the west part of the study area along the Carson River and major canals. Ground water flows eastward and divides; some flow goes northeast toward the Carson Sink and Stillwater areas, and some goes southeast to Carson Lake. Carson Lake is a regional discharge area.

Future declines in water level can be expected in irrigated areas if canals are lined or if the amount of water carried in the canals is greatly reduced. The amount and rate of water-level change at a particular site will depend on site-specific geohydrologic factors. The effect of these water-level changes at a specific shallow well will depend on the depth and condition of the well.

INTRODUCTION

In 1903, the U.S. Bureau of Reclamation began construction of Truckee Canal and the Derby Diversion Dam as one of the first reclamation projects in the Nation (U.S. Bureau of Reclamation, 1988). (See inset map, pl. 1.) Delivery of water to farmers in the Fallon area in northwest Nevada (fig. 1) began shortly afterwards. Construction of Lahontan Dam was completed in 1915. The construction of water-storage reservoirs, the addition of an extensive system of canals and drains, and the application of irrigation water to fields have altered ground-water levels, directions of ground-water flow, and ground-water quality in the Fallon area.

Most shallow ground water in the Carson Desert (fig. 1) is of poor quality and contains some trace elements, such as arsenic and selenium, in concentrations above State water-quality standards and criteria (Michael S. Lico and Ralph L. Seiler, U.S. Geological Survey, written commun., 1993). This poor-quality ground water discharges to deep open drains and is carried to the Carson Desert wetlands, such as Carson Lake and Stillwater National Wildlife Refuge. Delivery of saline water containing high concentrations of trace elements to the Carson Desert wetlands has resulted in habitat degradation and accumulation of potentially toxic concentrations of arsenic and selenium in the biota (Hoffman and others, 1990).

Currently, domestic wells tapping shallow ground water are an important source of potable water for rural residents of the Carson Desert. Consequently, the quality and quantity of water in the shallow aquifer are important public issues.

The Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990 directed the U.S. Fish and Wildlife Service to acquire water for wetland areas in the Carson Desert. The public has expressed concern that acquisition of water rights and delivery of the water directly to the wetland areas would cause shallow domestic wells to go dry by lowering water levels in the shallow aquifer. In January 1992, the U.S. Geological Survey, in cooperation with the U.S. Fish and Wildlife Service, began a 2-year study of the shallow ground-water system in the Fallon area. The information generated by the study is needed by the U.S. Fish and Wildlife Service to help prepare an environmental impact statement and by water planners to assess the hydrologic consequences of water-rights acquisitions and to address public concerns.

Purpose and Scope of this Investigation and Report

The principal objectives of this study were:

(1) to establish a network of observation wells in the Carson Desert to be used to collect water-level data for this study and to monitor the future effects of water-rights acquisitions on the shallow aquifer;
(2) to determine the depth to water in these wells and the altitude of the water table;
(3) to examine long-term changes in water levels in the shallow aquifer using available historical data and seasonal changes using frequent 1992 water-level measurements; and
(4) to determine the directions of shallow ground-water flow.

The study area is the agricultural area that receives water from the Newlands Project and other parts of Churchill County in and around the Carson Desert wetlands (fig. 1). The city of Fallon is at the center of the study area; in the rest of this report, therefore, the study area is referred to as the "Fallon area."

This report describes long-term changes in water level since the turn of the century and during the last 15 years. Also described are seasonal water-level changes and directions of ground-water movement in the shallow aquifer. Data collection will continue through 1993 in selected wells, and those data will be available from the U.S. Geological Survey National Water Information System data base and will be published in the U.S. Geological Survey's annual "Water Resources Data, Nevada" series.

Previous Investigations

Many investigators have studied the ground-water hydrology of the Carson Desert. Stabler (1904) presented results of the first comprehensive investigation of the shallow aquifer in the Carson Desert; between June and September 1904, 150 boreholes, ranging in depth from 4 to 31 ft, were augered, and nearly 300 water samples from wells and boreholes were analyzed. From data collected at these sites, Stabler (1904) constructed maps showing the depth to water and water quality in the Carson Desert in 1904.

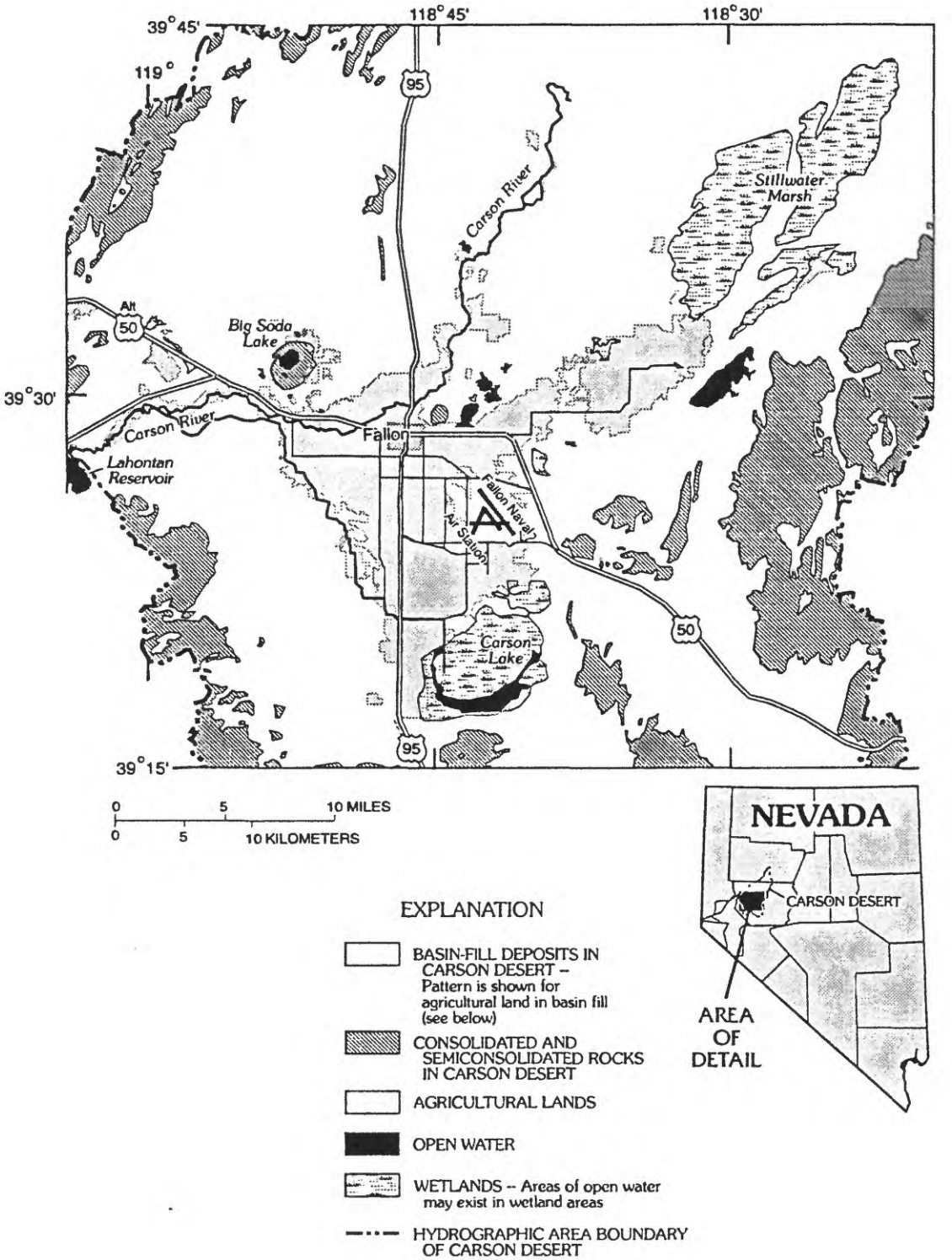


FIGURE 1. Location of the Fallon area and extent of agricultural land use. Land use in the Fallon area has historically been related to agriculture.

Lee and Clark (1916) prepared the first report describing the effects of Newlands Project water deliveries on the ground-water system in the Carson Desert. Water levels in the Fallon area rose rapidly after delivery of irrigation water to the area began. In 1915, a comprehensive drain system had not been constructed in the Project area, and there were numerous seeps (Lee and Clark, 1916). After completion of the drain system, water levels declined, and in 1992, the seeps no longer existed.

Lee and Clark's investigation was conducted at the request of the U.S. Department of Justice to determine the causes of water-level rises in the Soda Lakes. (Soda Lake is known locally as Big Soda Lake and is referred to as Big Soda Lake in this report.) At the turn of the century, water in Big and Little Soda Lakes was used to manufacture crude soda. Between January 1908 and December 1915, water levels rose 15.6 ft in Big Soda Lake and partly submerged buildings and machinery. Newspaper articles describing the rise in water level in Big Soda Lake were published in the Churchill Standard (June 14, 1907, p. 1) and the Nevada State Journal (June 1, 1941, p. 10). Lee and Clark (1916, p. 685) attributed 66 to 74 percent of the rise between 1908 and 1915 to seepage from the T, upper U, and N Canals (pl. 1; the T, U, and N Canals are now referred to as the T-Line, U-Line, and N-Line Canals, respectively).

Rush (1972; fig. 3) shows how the stage in Big Soda Lake varied between 1880 and 1972. The lake stage rose more than 60 ft between 1907, when extensive irrigation began, and about 1930; the stage has remained fairly constant since 1930.

During the early 1960's, the hydrology of the Carson Lake area was studied as part of the preparations for the Shoal Event—an underground nuclear-bomb test that took place in October 1963 in the Sand Springs Range, which is about 30 miles southeast of Fallon (Mifflin and others, 1964). Chemical and water-level data were collected at several wells in the study area, including two used in this investigation.

Glancy (1986) presented the results of the first comprehensive investigation of the ground-water system in the Carson Desert. He identified four aquifer subsystems: (1) a shallow unconsolidated sedimentary aquifer; (2) an intermediate-depth unconsolidated sedimentary aquifer; (3) a deep, generally unconsolidated sedimentary aquifer; and (4) a highly permeable basalt aquifer that stratigraphically transects all three sedimentary aquifers.

Several investigators have studied the geothermal resources of the Upsal Hogback and Soda Lakes areas north and northwest of the town of Fallon. Olmsted and others (1973) summarized published and unpublished sources of data for the area available at that time. Olmsted and others (1975) drilled 34 wells from 70 to 150 ft deep during 1973-74 in the area. A few years later, Olmsted and others (1984) drilled shallow wells adjacent to the deeper wells to determine vertical hydraulic gradients. Their map shows the altitude of the water table in the Upsal Hogback and Soda Lakes areas (Olmsted and others; 1984, fig. 3).

Morgan (1982) investigated the hydrology of the Stillwater geothermal area. Both deep and shallow wells were drilled at 14 sites. He used water levels to determine vertical and lateral hydraulic gradients, the direction of ground-water flow, and the altitude of the water table in the Stillwater geothermal area in April 1978 (Morgan, 1982, fig. 4).

In 1983 and 1984, the U.S. Bureau of Reclamation conducted studies of the T-Line Canal before and after it was lined with concrete (U.S. Bureau of Reclamation, 1985). In four ponding tests before the canal was lined, the canal lost an average of 0.74 ft/d of water. After being lined, the canal lost only 0.03 ft of water in 21 days. They concluded that lining the 1.5-mi reach of the canal would save about 750 acre-ft/yr. Water levels in several wells adjacent to the canal were measured in that study, including three wells used in this investigation.

The ground-water system on the Fallon Indian Reservation has been extensively studied. CH2M HILL (1989) prepared maps of the Reservation showing the depth to water, altitude of the water table, and water quality during October 1985. Tokunaga and Benson (1991) drilled several wells on the Reservation as part of an evaluation of methods to dispose of saline water from the shallow ground water that now discharges into TJ Drain. Water levels in three of these wells were measured as part of this investigation.

Information about the "seasonal high water table" (SHWT) in the Fallon area is provided in soil maps and associated descriptions prepared by Dollarhide (1975). Additional information about the SHWT is provided in a map to determine bench and bottom-land designations under the Operating Criteria and Procedures (OCAP) for the Newlands Project by the U.S. Bureau of Reclamation (1990, Appendix A).

The SHWT is defined as "a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick..." (U.S. Bureau of Reclamation, 1990, p. 19). The depth of the SHWT is based on soil characteristics, such as the depth to low-chroma mottles, as well as actual water-level measurements. The SHWT differs from the term 'water table' as used in this report: water table is defined as the upper surface of the zone of continuous saturation, and its depth is determined primarily by measuring the water level in shallow wells.

Oak Ridge National Laboratory (1992) investigated fuel spills at the Naval Air Station (NAS), Fallon, and prepared detailed maps of the potentiometric surface at sites under investigation at the NAS. As part of that and subsequent investigations, many wells and piezometers were installed. Tests were performed at several wells to determine hydraulic conductivities in the shallow aquifer. Water levels in several of those wells at the NAS were measured as part of this investigation.

Geochemical processes controlling the mobility of arsenic and other trace elements in the shallow aquifer were investigated by Lico and others (1986). As part of that investigation, several wells were drilled near Harmon Reservoir about 7 mi east of Fallon and at a ranch about 8 mi south of Fallon. Water levels in wells near Harmon Reservoir were measured as part of the present investigation; wells at the ranch south of Fallon had been destroyed.

As a part of the Carson River Basin National Water-Quality Assessment (NAWQA) project, observation wells were drilled and water samples were collected for chemical analyses from public-supply, industrial, domestic, and observation wells in the Carson Desert during 1988-89; Rita Whitney (U.S. Geological Survey, written commun., 1993) tabulated the results of the analyses. Water levels at many of the shallow wells were measured as part of the present investigation.

Michael S. Lico and Ralph L. Seiler (U.S. Geological Survey, written commun., 1993) described the quality of the shallow ground water in the Carson Desert. In the shallow aquifers, ground water varies from a dilute calcium bicarbonate water to a concentrated sodium chloride water. Generally, the more dilute water is associated with irrigated areas, and the more saline water is associated with non-irrigated areas.

As part of a U.S. Department of Interior investigation to determine causes of trace-element contamination in the Stillwater Marsh, several wells were drilled near Lead Lake. Rowe and others (1991) present water-level measurements and results of chemical analyses of water sampled from the wells in 1987-89. Water levels at several of those wells were measured as part of this investigation. Lico (1992) analyzed data from Rowe and others (1991) to describe the occurrence, distribution, and processes responsible for the mobilization and transport of potentially toxic constituents to Lead Lake in the Stillwater WMA.

Study Methods

Emphasis was placed on locating existing observation wells that had been used for previous investigations to determine long-term changes in water level. In areas where no existing observation wells could be located, private domestic wells were selected; preference was given to unpumped wells. Twenty-one new observation wells were drilled to complete the network.

Previous investigations have shown that water levels can change rapidly during the irrigation season; therefore, water levels in 24 wells were measured every 2 weeks beginning in 1992. Water levels were measured in January before the irrigation season began, in April at the very beginning of irrigation season, in July late in the irrigation season, in early August soon after the end of the irrigation season, and in late November well after the irrigation season ended.

Wells that showed very little change in water levels over a 2- to 3-month period were tested to verify that the well was open to the aquifer. Plugged wells were cleaned and developed. If a plugged well could not be cleaned, it was either replaced with a new well drilled at the same location or was dropped from the network.

At many of the existing wells, the altitude of the land surface had been determined previously using surveying techniques. Attempts to measure altitudes of other wells using Global Positioning System (GPS) techniques failed to provide the necessary accuracy; therefore, levels from surveying were obtained for selected wells. In some cases, altitudes were surveyed using reference marks instead of benchmarks because many benchmarks in the Carson Desert have been destroyed or covered. The altitudes of the reference marks were taken from U.S. Geological Survey 7.5-minute topographic maps and are reported to a tenth of a meter (about 3 in.).

Some existing observation wells that were unprotected had protective surface casings placed over the polyvinyl chloride casing and cemented in place.

Acknowledgments

The authors express their appreciation to the residents of the Carson Desert for access to their property to collect data. The Fallon Paiute-Shoshone Tribes provided information and access to tribal lands

for data collection and installation of an observation well. The U.S. Bureau of Reclamation and the Naval Air Station, Fallon, and their contractors provided construction details about their wells and access to measure them. The Truckee-Carson Irrigation District provided copies of reports and permission to install observation wells on their land. The U.S. Soil Conservation Service in Fallon provided useful information.

PHYSICAL AND HYDROLOGIC SETTING

The Newlands Project delivers water from the Sierra Nevada near Lake Tahoe to the Carson Desert (pl. 1 and fig. 1), which is the principal water-use area of this irrigation project. The Carson Desert, known locally as Lahontan Valley, covers an area of 2,182 mi^2 near the city of Fallon and is the terminus of the Carson River (Rush, 1968).

Topography

The Carson Desert is surrounded by the Hot Springs Mountains to the northwest, by the West Humboldt Range to the north, by the Lahontan Mountains and Stillwater Range to the east, by the Sand Springs Range and the Bunejug and Cocoon Mountains to the southeast, by the Blow Sand, White Throne, and Desert Mountains to the south, and by the Virginia Range and Dead Camel Mountains to the west (pl. 1). The altitudes in these mountains range from 4,500 to 8,800 ft along the basin divides (Morrison, 1964, p. 5).

The valley floor contains the flood plain of the Carson River and the Carson Sink. The Carson Sink is a flat, barren, salt-encrusted playa covering nearly 400 mi^2 in the northern part of the Carson Desert. An outcrop of basalt near the center of Fallon forms Rattlesnake Hill. Big Soda Lake and Little Soda Lake to the west of Fallon occupy craters formed by repeated explosive volcanic eruptions during Quaternary time (Olmsted and others, 1984, p. 21).

Climate

The Fallon area has cold winters and hot summers and is classified as mid-latitude desert. The area lies in the rain shadow of the Sierra Nevada (Houghton and others, 1975, p. 6), and little precipitation reaches the area. The average annual precipitation for 1951-80 was 4.88 in. at the Fallon weather station (National Climatic Center, 1991). Evapotranspiration rates have been estimated to be from 34.2 to 38.8 in/yr (Pennington, 1980, p. 58-61). U.S. Bureau of Reclamation (1987, p. 2-24) reported a pan-evaporation rate of 59.5 in/yr. From 1987 to 1992, the area has been experiencing a drought which has resulted in much less water than normal being received by the farmers and the wetlands in the Fallon area.

Land Use

Land use in the Fallon area historically has been related to agriculture. When the Newlands Project was initiated, about 14,000 acres in the Fallon area were under partial irrigation (Lee and Clark, 1916, p. 670). The amount of land irrigated by water from the Newlands Project (including land along the Truckee Canal in the Fernley area) has ranged from 39,449 acres in 1916 to 67,294 acres in 1979 (Welch and others, 1989). The average area irrigated for the period 1984-90 was 60,000 acres (rounded) (U.S. Fish and Wildlife Service, unpublished data, 1993). The principal crops in the Newlands Project area are alfalfa hay and seed alfalfa, which are flood irrigated.

The NAS, Fallon, covers about 8,000 acres and is one of the main employers in Churchill County. It is about 5 mi southeast of Fallon and serves primarily as a facility for aircraft-weapons delivery and tactical air-combat training (Oak Ridge National Laboratory, 1992).

Wetlands in the Carson Desert are important to migratory birds using the Pacific Flyway (Hoffman and others, 1990, p. 6). Stillwater Wildlife Management Area and Stillwater National Wildlife Refuge to the northeast of Fallon are part of the largest remaining marsh in Nevada and provide nesting, feeding, and resting areas for ducks, geese, and other migratory birds. Carson Lake (formerly called South Carson Lake), about 10 mi south of Fallon, is managed for wildlife, and pasture lands bordering the lake are managed for cattle grazing.

Hydrology

Surface Water

During the first part of the 19th century, the Carson River discharged directly to Carson Lake and, when the lake overflowed, water moved through Stillwater Slough north to the Carson Sink (Russell, 1885, p. 44-45). In 1862, however, a large flood captured an old channel; the river forked and flow went both northward to Carson Sink and southward to

Carson Lake. Prior to the 19th century, the drainage probably shifted back and forth between Carson Lake and Carson Sink in response to channel alterations caused by episodic floods.

Flow in the Carson River entering the Fallon area has been regulated since completion of Carson Diversion Dam in 1906 and Lahontan Dam in 1915. Lahontan Reservoir, which stores water for use in the Fallon area, contains water diverted from the Truckee River through the Truckee Canal along with natural flow of the Carson River.

Downstream from the Lahontan Reservoir, the water-distribution system in the Fallon area is complex. Hoffman and others (1990, fig. 4) present a simplified schematic diagram of the flow system. The Newlands Project delivery system has 68.5 mi of main canals, 312 mi of laterals, and about 345 mi of open return drains (U.S. Bureau of Reclamation, 1986, p. I-4). The drains are typically about 10 ft deep, and almost all of the canals are unlined.

During average years, the study area receives more than 300,000 acre-ft of water from Lahontan Reservoir (fig. 2). Average flow of the Carson River below the dam was 378,000 acre-ft/yr for the period 1919-69 (Glancy and Katzer, 1976, p. 26). The median annual discharge at the Carson River below Lahontan Reservoir surface-water gaging station for the 1967 to 1992 water years[1] is 356,000 acre-ft (rounded), and the mean is about 375,000 acre-ft. Between Lahontan Dam and the gaging station, water is diverted through Rock Dam Ditch for use upstream from the Carson Diversion Dam; during 1985-91, an average of about 4,200 acre-feet/yr was diverted (data provided by Wyllis Hyde, Truckee-Carson Irrigation District, written commun., 1992).

In 1983, the Carson River overflowed its banks and flooded parts of Fallon. That year, the Carson Sink flooded and also received water from the Humboldt River when the Humboldt Sink overflowed. In 1983, the release from Lahontan Reservoir in June alone (127,700 acre-ft) was greater than the total amount of water released from the reservoir during the 1992 irrigation season.

In 1992, the study area was in the sixth year of a drought; water deliveries to the farmers were much less in 1992 than in 1989 and the irrigation season was much shorter (fig. 3). During 1989—the last year in which all water users received 100 percent of their allocation—about 313,000 acre-ft was measured at the Carson River below Lahontan Reservoir gaging station during the irrigation season. During the 1992 irrigation season, only about 116,400 acre-ft was measured at the gaging station. In normal years, irrigation continues from mid-March to mid-November; during 1992, however, the irrigation season lasted from early April to late July. In 1992, the Carson Sink and much of the wetlands in the Stillwater Marsh and Carson Lake areas were dry as a result of the drought and reduced water deliveries.

Ground Water

The ground-water system in the Fallon area is divided into four subsystems on the basis of hydrologic characteristics (Glancy, 1986, p. 6). The subsystems are (1) a shallow, unconsolidated sedimentary aquifer (0 to 50 ft below land surface); (2) an intermediate-depth, unconsolidated sedimentary aquifer (from 50 ft below land surface to 500-1,000 ft); (3) a deep, generally unconsolidated sedimentary aquifer (beginning 500 to 1,000 ft below land surface); and (4) a highly permeable basalt aquifer that stratigraphically transects all three sedimentary aquifers. The basalt aquifer is the principal source of domestic and industrial water to the city of Fallon and the nearby Naval Air Station. The shallow aquifer is the principal source of domestic water to the rural population of Carson Desert.

The shallow aquifer subsystem is differentiated from the other sedimentary aquifers primarily on the basis of water hardness (Glancy, 1986, p. 33). Water from wells deeper than 50 ft commonly is very soft (hardness generally less than 25 mg/L), whereas water from shallower wells is typically much harder (Glancy, 1986, p. 41). For the purposes of this study, the definition of the shallow aquifer follows that of Glancy (1986, p. 36)—water-yielding deposits within unconsolidated basin-fill deposits not more than 50 ft below land surface. The shallow aquifer extends throughout the study area except for areas of volcanic outcrops near Big and Little Soda Lakes, the Upsal Hogback, and Rattlesnake Hill (Glancy, 1986, p. 36).

The shallow basin-fill sediments were deposited during Pleistocene time in ancient Lake Lahontan (Morrison, 1964). The deposits consist mainly of interlayered sand, silt, clay, and stringers of gravel (Glancy, 1986, p. 36). Individual strata are not areally extensive (Glancy, 1986, p. 36), with the possible exception of some clay layers. Hydraulic properties of the basin-fill aquifers are quite variable over short

[1] Water year is the 12-month period from October 1 to September 30, designated by the calendar year in which it ends

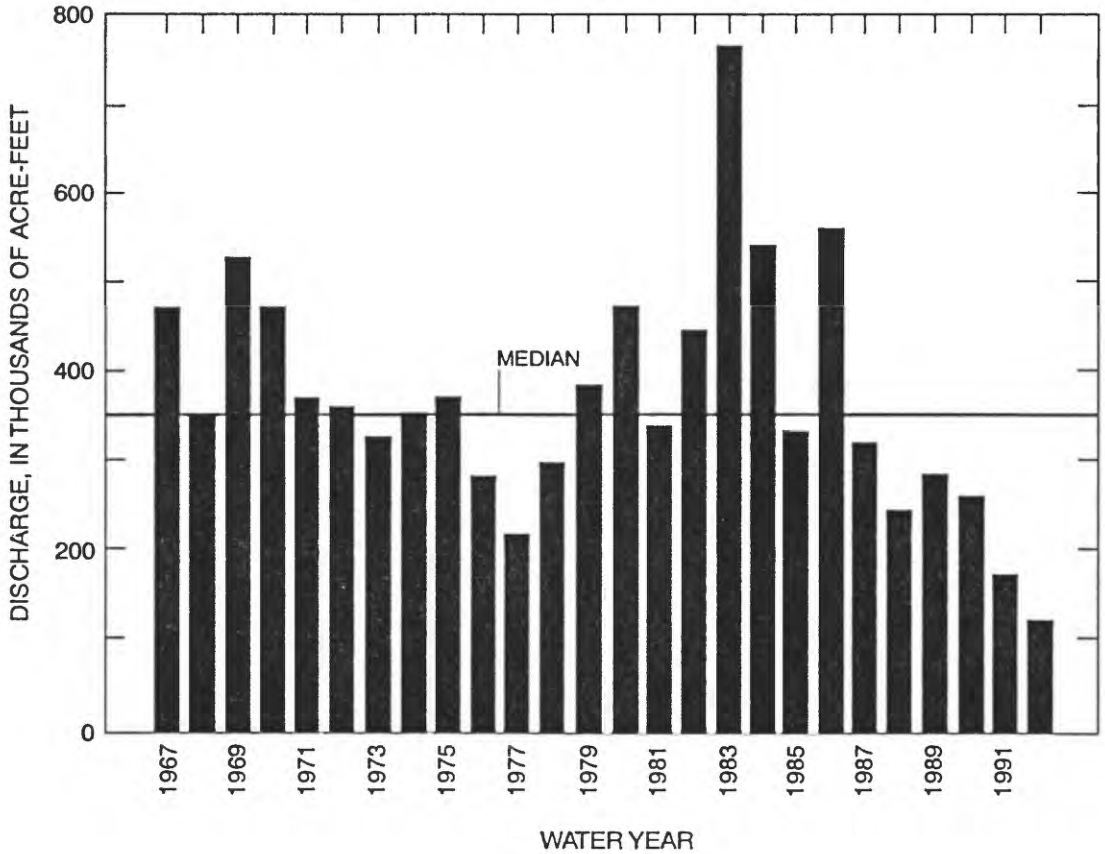


FIGURE 2. Annual discharge at the Carson River below Lahontan Reservoir gaging station (10312150), water years 1967-92. Regional climatic conditions resulted in flooding during the wet period of the early 1980's and reduced water deliveries during the drought of the late 1970's and during the current (1987-92) drought.

distances as a result of complex stratigraphic relations and rapidly changing sedimentary facies (Glancy, 1986, p. 58). Most of the ground-water flow in the basin-fill aquifers is probably through highly transmissive sand and gravel deposits.

Glancy (1986) calculated specific capacity for about 430 wells in the shallow aquifer and estimated transmissivities (T) using the relation:

$$T \approx 267 \text{ (specific capacity)}.$$

Estimated transmissivities ranged from 2,000 to 15,000 ft^2/d. Almost all of the wells had values less than 3,000 ft^2/d. In general, the highest values are to the west of Fallon.

Glancy (1986, figs. 10 and 26) shows directions of movement among the aquifers in the Carson Desert and identified discharge and recharge areas of the shallow aquifer. The shallow aquifer is recharged by seepage from the Carson River and irrigation canals, and by percolation of water applied to fields. The shallow aquifer discharges to drains and, in areas where the water is accessible to vegetation, by transpiration. The shallow aquifer is also recharged by the underlying intermediate aquifer where there is an upward vertical hydraulic gradient and discharges to the underlying aquifer where there is a downward vertical gradient.

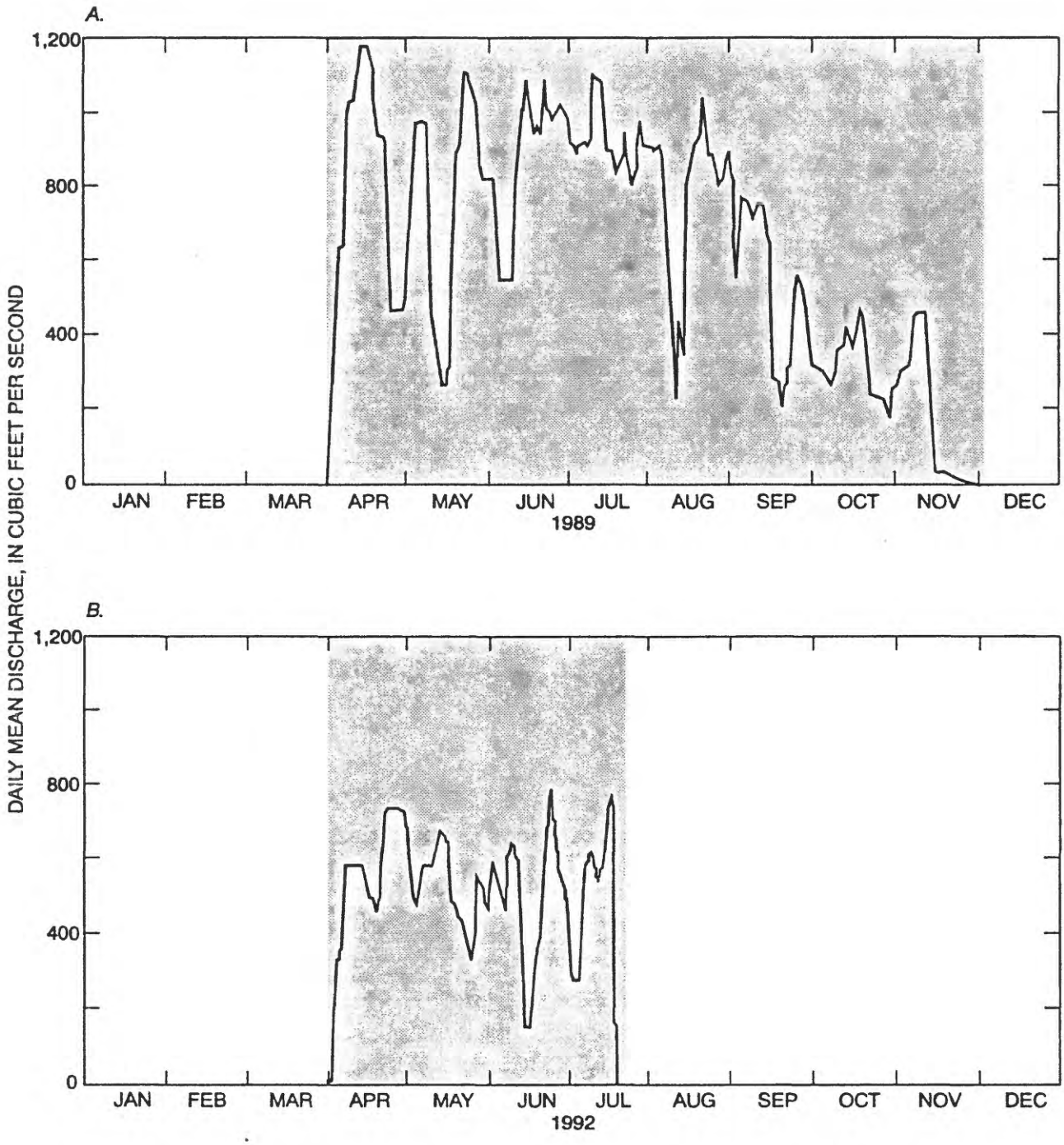


FIGURE 3. Daily mean discharge at the Carson River below Lahontan Reservoir gaging station (10312150) during *(A)* 1989 and *(B)* 1992. Much less water than normal was delivered to the Fallon area in 1992 and the irrigation season (shaded area) was much shorter than normal.

On the basis of differences between the stable-isotope composition of present-day Carson and Truckee River water and water from the intermediate aquifer, the origin of water in the shallow aquifer can be identified (Michael S. Lico and Ralph L. Seiler, written commun., 1993). Water in the shallow aquifer is a mixture, in varying proportions, of water from the intermediate aquifer and present-day Newlands Project water supplied by both the Carson and Truckee Rivers.

Several authors (Lico and others, 1987; Michael S. Lico and Ralph L. Seiler, written commun., 1993) have noted the variability in water quality over short distances in the Carson Desert. For example, about 8 mi south of Fallon, the arsenic concentration of water in one shallow well was 26 µg/L, and in another shallow well about 200 ft away, it was 2,200 µg/L (Lico and others, 1987). Because of the complex lithology that controls movement of water through the subsurface, wells unsuitable as sources of potable water can be less than 30 feet from a well that yields potable water.

According to Glancy (1986, p. 33), 3,000 to 4,000 wells tapped the shallow aquifer and supplied more than 50 percent of the water to Fallon's population during the late 1970's. More recent estimates of the number of people depending on the shallow aquifer for drinking water have not been identified.

CHANGES IN SHALLOW GROUND-WATER LEVELS

The shallow ground-water system in the Fallon area is now controlled principally by the extensive network of canals and drains. Basinwide changes in water levels result from changes in the amount of water released from Lahontan Reservoir. Local changes in water levels can result from a long-term or seasonal change in the amount of water carried by nearby canals, changes in the 'leakiness' of those canals, and changes in the amount of water applied to nearby fields.

Observation Network

The ground-water observation network includes 126 wells in the Fallon area. Most wells in the shallow aquifer are small-diameter piezometers, mostly 10 to 30 ft deep. Some wells along the Stillwater Range east of Fallon that are believed to tap the water table were included in the network even though they are deeper than 50 ft. Some well sites included two to four wells drilled to different depths. Fourteen wells in the network can be pumped for household, stock, or small-scale irrigation use.

Information about the wells is given in Appendix 1. Many of the wells included in the network were used by other investigators. Appendix 2 lists sources of available data for these wells. All available water-level measurements for wells in the observation network are given in Appendix 3. Appendix 4 presents hydrographs of 48 observation wells to show both seasonal and long-term trends in water levels.

General Water-Level Trends, 1904-92

Delivery of water to the Fallon area and construction of the canal and drain network for the Newlands Project has greatly changed water levels in the shallow aquifer since the turn of the century. Maps showing depth to water in 1904 and 1992 are presented in figure 4. The water-level data for 1904, a few years before water deliveries began as part of the Newlands Project, were collected between May and September by Stabler (1904). Water-level data in 1992 were collected between April and November, and most measurements were made between June 30 and July 15. Construction of the 1992 depth-to-water map was guided by the areal distribution of unlined canals and drains.

In areas along the Carson River and Stillwater Slough, the depth to water was less than 5 ft below land surface in 1904. The depth to water at that time generally was greater than 10 ft at distances greater than 1-2 mi from the river channels. The depth to water was greater than 25 ft in large areas northwest and northeast of Fallon.

The depth to water in the Fallon area was much more uniform in 1992 than in 1904. Water lost from unlined canals and from application of water to fields raised water levels in some areas, and the construction of open drains deeper than the water table lowered water levels in other areas. In 1992, the water table in much of the Fallon area was between 5 and 10 ft below land surface. The few wells with water closer than 5 ft to land surface were primarily in sink areas or very near canals. Water levels have risen more than 15 ft in large areas northeast of Fallon.

These water-level changes are approximate and some of the changes may result from factors other than changes in the amount of ground water in storage. For example, in 1904, drillers selected topographically low areas, where depth to water is the shallowest, to drill wells, which makes it appear that the water table was higher than it actually was. Furthermore, as fields were brought into agricultural use they were leveled, and this process changed the depth to water even

though the altitude of the water surface did not change. The amount of leveling that was required depended on the original topography and may have been several feet in some areas. No attempt has been made to correct for these effects.

Lee and Clark (1916, tables 27-28) present data for several wells that can be used to calculate the altitude of the water table for the period 1904-5. Data for some of the wells are listed in table 1. Locations for these wells are given only to the section, so precise estimates of ground-water changes since 1904-5 cannot be made by locating the wells on a map of the 1992 water table. The water-surface altitude in two wells located within a mile of the Carson River, in sections 28 and 30 of T. 19 N., R. 28 E., shows essentially no change since 1904 compared with measurements in this study of nearby wells.

Three of the wells measured in 1904-5 are near Big Soda Lake (Lee and Clark, 1916, p. 673) and are more than a mile from the Carson River. The data indicate that the water table near Soda Lake is about 25 to 40 ft higher in 1992 than it was in 1904-5. The stage in Big Soda Lake rose nearly 60 ft since 1904 (Rush, 1972). The reason the lake rose more than the local water table is that before the turn of the century, the stage in Big Soda Lake was at least 15 ft below the local water table. Russell (1885, p. 75) reports, "Around the immediate shores of the larger lake there are a number of fresh-water springs; the largest of these is situated on the northern border of the basin, and issues from a small fault at an elevation of about 15 ft above the water surface." The water level in the lake was lower than the water level in the surrounding sediments because the rate of evaporation from the lake surface was greater than the rate of ground-water inflow.

The water table in the area near Big Soda Lake is now contiguous with the lake surface (Glancy, 1986, p. 36), and changes in the lake stage reflect local changes in the depth to water. The altitude of the lake surface has been relatively stable since about 1930. It was about 3,987 ft in 1930 (Rush, 1972, fig. 3) and 3,989.3 ft on June 29, 1971 (Rush, 1972). On October 23, 1992, it was 3,986.16 ft—only about 3 ft below the level in 1971.

Measured Water-Level Changes, 1977-92

Hydrographs of selected wells showing both long-term (1970's to the present) and seasonal changes in water level are shown in Appendix 4. Between the late 1970's and the mid-1980's, water levels in the shallow basin-fill deposits rose in response to the wet period in the early 1980's. During the current drought (1986-92), water levels have declined to about the same level as they were during the late 1970's. Thus, the net change in water levels in the shallow aquifer over the last 15 yr in most places has been small. Between early 1977 and early 1992, water levels in most wells declined less than a foot. The median change in water level for 14 wells between January to April 1977 and January to April 1992 was a decline of 0.58 ft. The maximum observed decline for any of the 14 shallow wells during this period was about 2.7 ft in well 67.

Table 1. Water-table altitudes near Big Soda Lake in 1904-5. (Data from Lee and Clark, 1916, tables 27-28)

Well number in Lee and Clark (1916)	Location[1]	Date	Depth to water (feet below land surface)	Altitude of water surface[2]
80	T19N R28E sec. 09	Autumn 1904	51.5	3,947.04
86	T19N R28E sec. 17	December 1905	46.0	3,962.41
87	T19N R28E sec. 17	Autumn 1904	40.0	3,960.32
120	T19N R28E sec. 28	July 1904	8	3,982
125	T19N R28E sec. 30	July 1904	16	3,995

[1] A location designation is used to identify a site by the official rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian. Each site designation consists of three units: the first unit is the township, followed by an N or S to indicate location north or south of the base line. The second unit is the range, followed by an E to indicate location east of the meridian. The third unit consists of the section number.

[2] Water-level altitudes published in Lee and Clark (1916) use the 1912 Mean Sea Level datum. No adjustment was made to correct the old datum to NGVD of 1929, because there is little difference between the two in Nevada (Emery Balaz, National Geodetic Survey, oral commun., March 1993).

A.

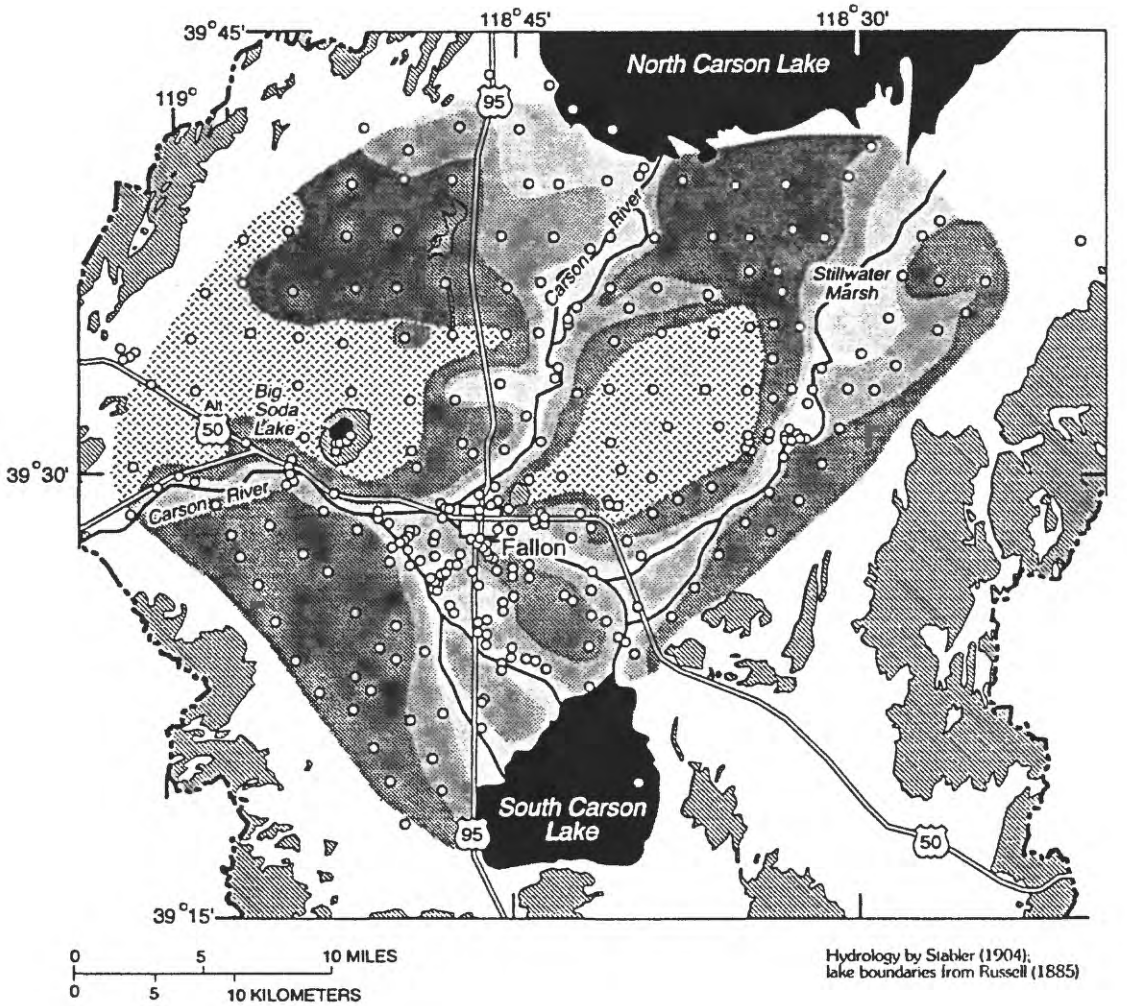
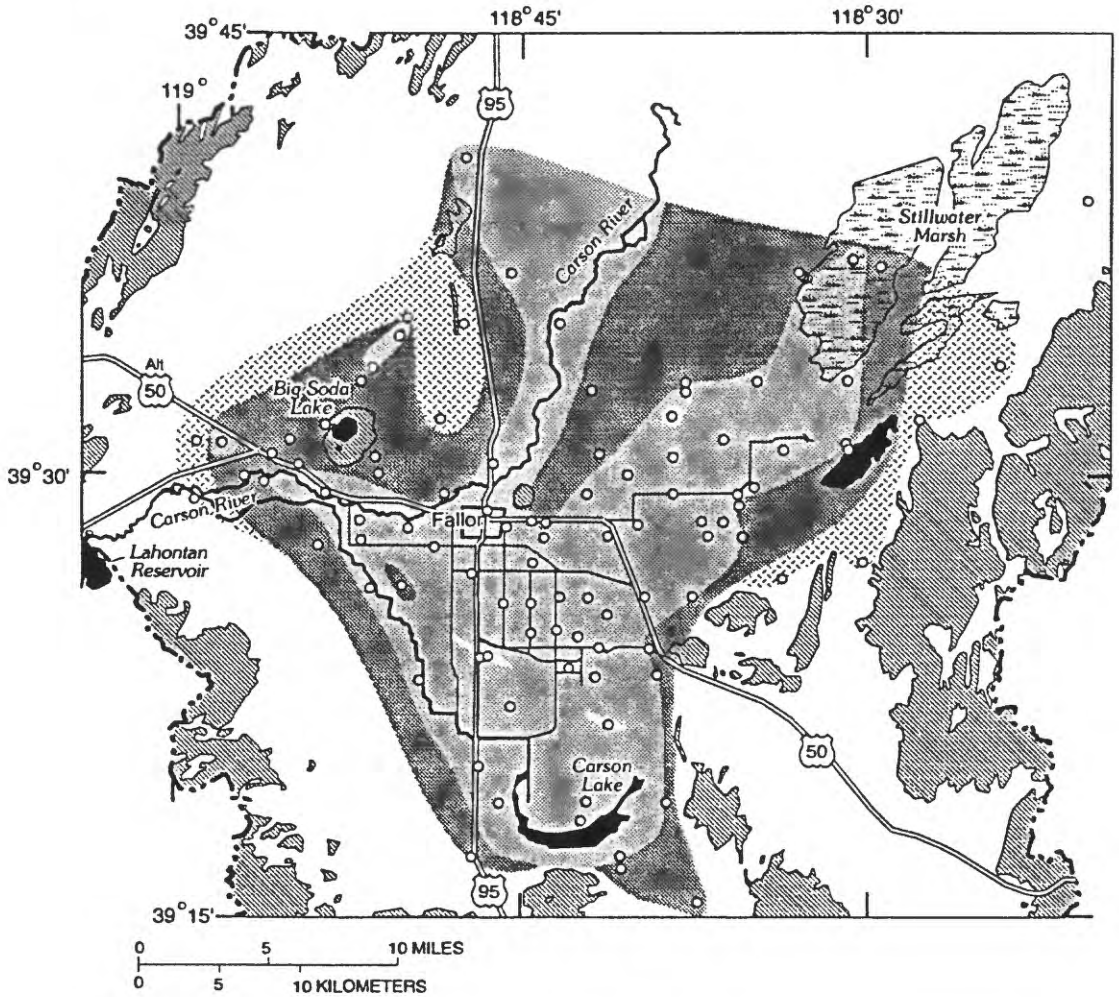


FIGURE 4. Depth to water in the shallow aquifer of the Fallon area, *(A)* 1904 and *(B)* 1992. Before Newlands Project water deliveries began, ground water was near land surface along main channels and more than 25 feet below land surface in large areas west and east of Fallon. (Principal present-day roads are included on 1904 map).

B.



EXPLANATION

- BASIN-FILL DEPOSITS IN CARSON DESERT -- Patterns are shown for depth to water in basin fill (see below)
- CONSOLIDATED AND SEMICONSOLIDATED ROCKS IN CARSON DESERT
- OPEN WATER
- DEPTH TO WATER IN BASIN-FILL DEPOSITS -- Depth intervals, in feet below land surface. Approximately located
  - Less than 5
  - 5-10
  - 10-25
  - Greater than 25
- HYDROGRAPHIC AREA BOUNDARY OF CARSON DESERT
- DATA POINT

FIGURE 4. Continued

Well 67 is located about 5 mi northeast of Fallon. The small declines are shown in wells 68, 5, 77, and 55—which are north, south, east, and west of Fallon, respectively—and in well 73, which is in the center of Fallon.

In the southern and northern parts of the study area, there were a few exceptions to the general decline in water levels since the late 1970's. Water levels in well 1, about 13 mi south of Fallon, were about 4 ft higher in January 1992 than in January 1977. Water levels in well 101, north of Fallon, were slightly higher in 1992 than during 1977. These wells are all in or near topographically low areas. The rises in water level were probably due to local recharge when ponds near them were filled during the wet period in the early 1980's. Olmsted (1985) attributed rises of several feet in water levels in other wells near well 101 between May 1982 and July 1983 to local recharge from ponds. In addition, water levels may have risen in well 1 because the nearby G-3 Canal is used more now than during the late 1970's (Norman A. Saake, Nevada Department of Wildlife, oral commun., September 23, 1992).

The period 1980-84 was wetter than normal, and water levels rose in shallow wells. The median change in water levels for five wells between January to February 1977 and February 1984 was a rise of 2.13 ft, and the maximum measured rise was 2.67 ft in well 109—about 10 mi north of Fallon.

Since then, water levels have declined during the current drought. An index of that decline is the difference between the shallowest measured water level during 1983-84 and the deepest measured water level in 1992. This difference was calculated for 13 shallow wells, yielding a median decline of 2.49 ft; the maximum decline was 7.53 ft in well 49.

Since 1988, the greatest measured declines have been in the Stillwater area. The water level in well 120, which is near Lead Lake in the Stillwater Marsh, was slightly more than 4 ft lower in November 1992 than in December 1988. Lead Lake has been dry since 1990 (Norman A. Saake, oral commun., 1992). The water level in well 82, located in irrigated lands near the town of Stillwater, declined slightly more than 4 ft between February 1988 and November 1992. The median change in water levels for 10 wells with measurements in February 1988 and January to February 1992 was a decline of 1.35 ft.

Seasonal Changes

Seasonal changes in water levels in the Fallon area are strongly related to recharge from water lost along unlined canals and application of water to fields during the irrigation season. Wells 86 and 18 (Appendix 4) are typical of wells in irrigated areas. Well 86 is east of Fallon in an alfalfa field about 100 ft from an unlined canal. The water level declined about a foot between January 25 and April 4, 1992. On April 4, water was released from Lahontan Reservoir, filling the nearby canal, and water levels began to rise in the well. Water levels in the well began to decline in late July at the end of the irrigation season, and the well went dry in October. Well 18 is southwest of Fallon, about 300 ft from the A-Line Canal, and although it did not go dry, the seasonal water-level changes follow a similar pattern.

Water levels in many wells in irrigated areas rose 1 to 2 ft during the 1992 irrigation season. Seasonal water-level rises in some wells were greater during 1976-78 than during 1992. This trend is shown in well 35 about 5.5 mi south of Fallon. Water levels rose about 2.5 ft during the 1977-78 irrigation seasons and only about 1 ft during the 1992 season. Even though the late 1970's were also a drought period, the present drought is much more severe, and the reduced water deliveries could account for the difference in response. During the 1977 irrigation season (April to September), about 207,000 acre-ft was measured at the Carson River below Lahontan Reservoir gaging station; during the 1992 irrigation season, only about 116,400 acre-ft was measured.

Some wells, especially those distant from canals and agricultural areas, show little seasonal change in water level. Wells 1 to the south, 55 to the west, 125 to the north, and 94 to the east of Fallon showed only small seasonal changes during the late 1970's and during 1992. Other wells previously showed seasonal changes in water levels but did not during 1992. Well 73 in the center of Fallon showed seasonal rises of more than a foot during the late 1970's but not during 1992. The change in seasonal response may be due to lining of canals or decrease in agricultural areas because of increasing urbanization. The well is near large municipal wells where water levels may be affected by water-level changes in the basalt aquifer; the hydraulic gradient between the basalt and shallow aquifer is downward in this area. Water levels in the basalt aquifer near well 73 declined slightly more than 5 ft between January 1977 and January 1992 (fig. 5).

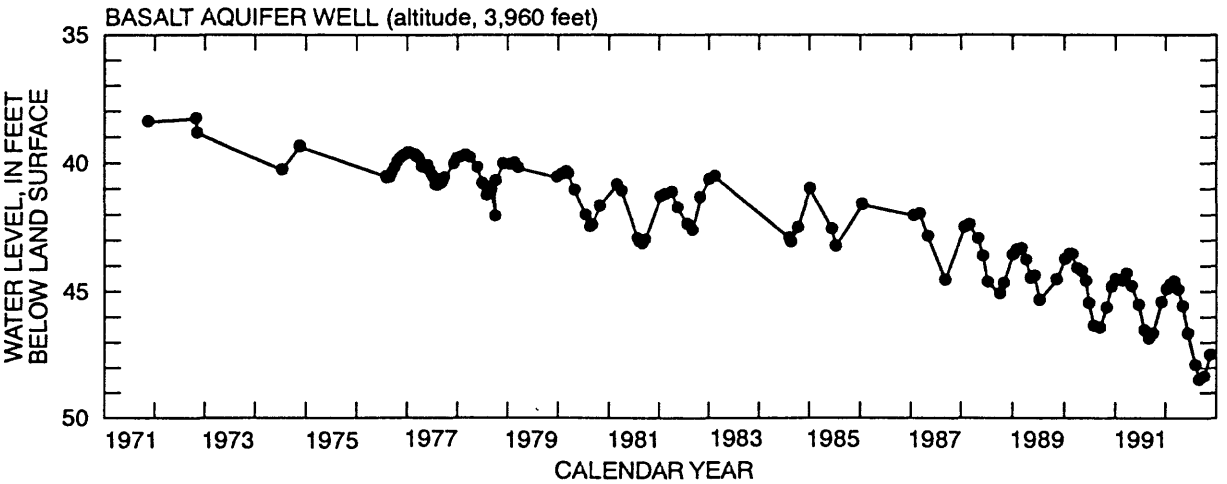


FIGURE 5. Water-level changes in a monitor well in the basalt aquifer near the center of Fallon, 1971-92. Declining water levels in the basalt aquifer may cause declines in water level in the surrounding intermediate and shallow alluvial aquifers.

The net change in water level over a single year was greater in 1992 than it was in past years. The median water-level change for 29 wells in the shallow aquifer between January and November 1992 was a decline of 1.16 ft. For comparison, the median change between January and December 1977 for 17 wells in this network was a decline of 0.35 ft. The largest declines during 1992 occurred in the Stillwater area; the maximum observed decline for this period was 2.68 ft in well 82 and declines greater than 2 ft were observed in other wells in the area.

Changes Related to Canal Lining

Reducing water loss along canals by lining them has resulted in water-level declines of 10 ft or greater in some areas. Wells were installed near the T-Line Canal in 1983 as part of a study to assess the effects of lining a 1.5-mi reach of canal with concrete during the winter of 1983-84 (U.S. Bureau of Reclamation, 1985). The study estimated that water losses would be reduced by about 2.5 acre-ft/d.

Three of the wells used to monitor changes in water level after the canal was lined (wells 47, 51, and 56) were incorporated into the observation network as part of this investigation. Hydrographs of water levels in these wells before and after lining of the canal are shown in figure 6.

Water levels in well 51 have declined more than 10 ft since the canal was lined; the well was dry at 19.5 ft in September 1992, so the total decline cannot be determined. Even after the canal was lined, the well continued to show seasonal fluctuations in water level. During 1985, large amounts of water were first released from Lahontan Reservoir on March 20; between March 15 and March 29, water levels rose about 0.9 ft in the well. The continued response to water in the canal after the canal was lined is probably because this well is only about 800 ft downstream from where the canal lining begins. Consequently, water levels in the well are likely affected by recharge from canal leakage upstream from the well.

Water levels in well 47 declined about 7.5 ft since the canal was lined, and measurements in 1992 showed continued decline. Water levels in this well did not show seasonal fluctuations after the canal was lined, probably because the well is about a mile downstream from unlined reaches of the canal.

Well 56 is near a reach of the T-Line Canal that was not lined and is about 2 mi downstream from well 47. Water levels in well 56 were about the same in 1992 as they were during 1983-85.

GROUND-WATER FLOW

The altitude and configuration of the water table and the directions of ground-water flow during the irrigation season in 1992 are shown on plate 1. Water-level measurements used to construct the map were made principally between June 30 and July 15. A few of the wells in the observation network were not

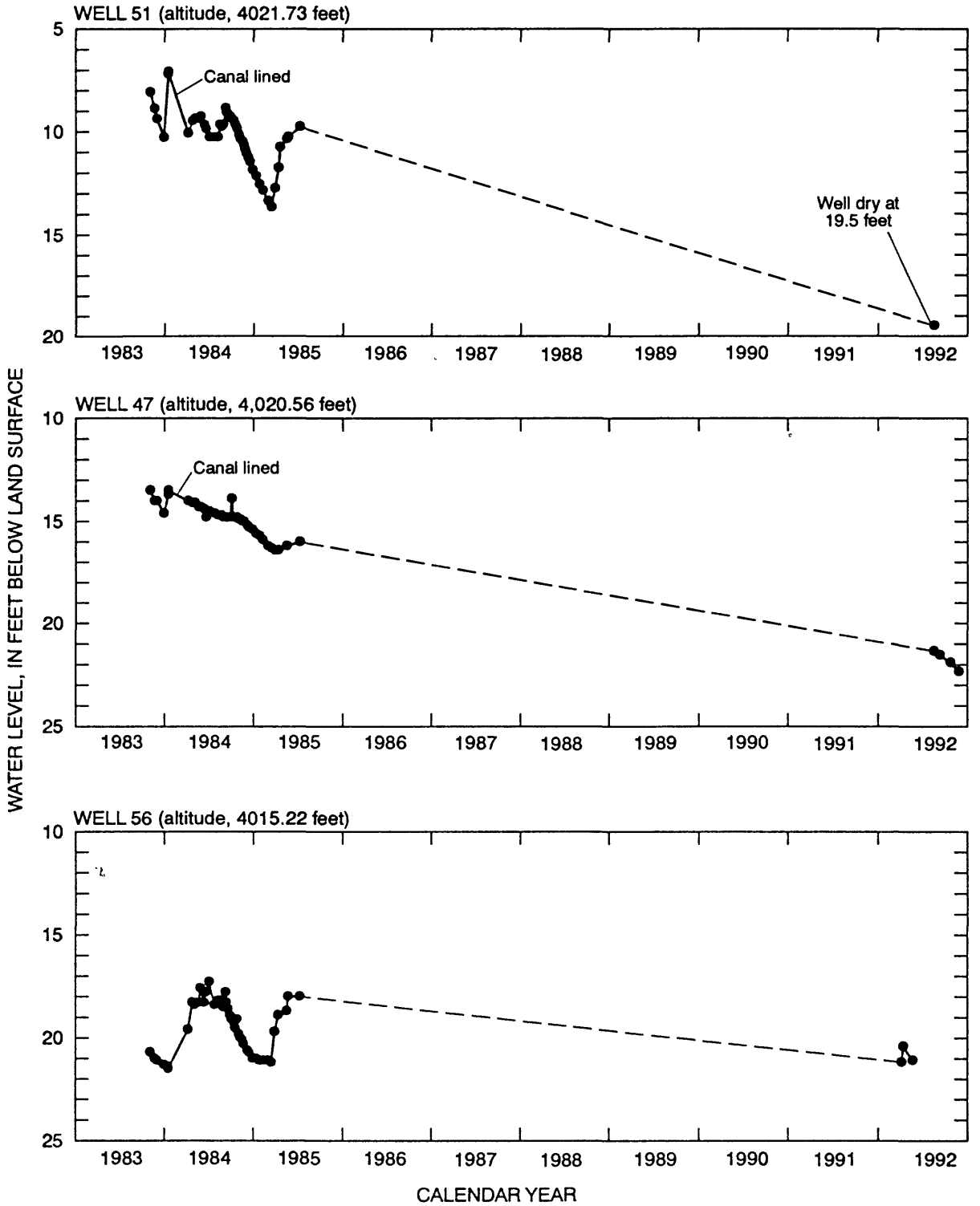


FIGURE 6. Water-level changes in wells 51 and 47 near the T-Line Canal before and after it was lined with concrete during the winter of 1983-84. Lining the canal reduced canal losses and resulted in water-level declines of 7 feet to more than 10 feet near the canal. Well 56 is near an unlined reach of the canal about 2 miles downstream from well 47. (Dashed line indicates period of no record.)

measured during this period, and for those wells, water levels measured between April and November were used to construct the map. This substitution is justifiable because the maximum water-level change during January to November 1992 was 2.68 ft, which is less than one-third the contour interval.

In constructing the water-level contours, the effects of the water-distribution system, topography, and geologic structure on the configuration of the water table in shallow aquifer systems were considered. The altitude of the water table is equivalent to the water surface in drains and small ponds and lakes when the evapotranspiration rate is insufficient to lower the water table below land surface. The altitude of the water table is assumed to be that of the land-surface altitude of flowing springs. The configuration of the water table in parts of the Upsal Hogback area where no new data were collected is from Olmsted and others (1984).

Ground water moves from areas of higher head (recharge areas) downgradient to areas of lower head (discharge areas). The measured altitude of the water table in the study area ranged from 4,025 ft above sea level on the Swingle Bench (11 mi west of Fallon) to 3,865 ft in the Stillwater Marsh (18 mi northeast of Fallon). The measured hydraulic gradient toward the southeast is about 6 ft/mi, the gradient to the northeast is about 9 ft/mi, and the gradient due east is about 6 ft/mi.

The configuration of the water table indicates that the flow system throughout the study area is dominated by ground water originating as recharge from the Carson River and irrigation. Some recharge also originates in the Lahontan and Bunejug Mountains, Bass Flat, and Stillwater Range (pl. 1).

The principal recharge area for the shallow ground-water system is in the western part of the study area along the Carson River and major canals. Although the amount of streamflow from the Carson River entering the study area is less than that from direct precipitation on the valley floor, seepage lost from the river and canal system is the principal source of the recharge to the ground-water system in the Fallon area (Glancy, 1986, p. 6). Virtually all precipitation on the valley floor is consumed by evapotranspiration. In the western part of the study area, water flows downward from the shallow aquifer to the intermediate aquifer, which indicates that this is a recharge area. About 7 mi west of Fallon, this downward flow is illustrated by water levels in wells 48 and 50 (Appendix 1); the shallow well has a head about 12 ft greater than the deeper well.

The configuration of the water table in the western part of the study area indicates that ground-water flow divides with flow going northeast toward the Carson Sink and Stillwater area and southeast toward Carson Lake (pl. 1). This division in the direction of flow occurs west of Big Soda Lake and continues eastward to the base of the Lahontan Mountains. The configuration of the water table indicates that the Stillwater Range and Lahontan Mountains are sources of recharge to the study area and are barriers to eastward movement of ground water from the study area. A system of faults east of Fallon near Rainbow Mountain (Bell, 1984; Greene and others, 1991) probably controls the water-table configuration near Stillwater Point Reservoir.

Within the region north of Grimes Point, east of Highway 50, and south of Harmon Reservoir, a broad, saddle-shaped, ground-water divide was mapped during this investigation. Flow westward from the Lahontan Mountains converges with flow eastward from the western and central parts of the study area; part moves south to Carson Lake and part moves northeast to the Stillwater area.

The configuration of the water table indicates that no flow leaves Carson Lake and that the lake serves as a regional discharge area. Springs east of Carson Lake in the Salt Wells Basin (pl. 1) discharge at altitudes higher than ground-water levels in the Carson Lake area; therefore, ground water does not flow from the Carson Desert to the Salt Wells Basin.

Data show a gradient to the south between wells 2 and 3, an indication that water moves southward from Carson Lake to Bass Flat. However, the water level in well 3 probably is anomalous. Well 3 is drilled in the Wildcat Fault Zone mapped by Morrison (1964, pl. 3), where water levels may be affected by faults. The hydraulic gradient between well 4 and wells 2 and 3 indicates that ground water flows northward from Bass Flat to Carson Lake.

The vertical gradient is upward in the area near the Naval Air Station (NAS), Fallon, and Carson Lake. Within the NAS, the deeper wells have heads from about 4.3 ft to about 8.6 ft higher than the shallow wells. In wells 37 and 38, about 1 mi south of the NAS, the head in the deeper well is about 8.6 ft higher than in the shallow well. The gradient for wells near Carson Lake is also upward. In wells 7-10, the head in the deepest well is about 0.2 ft higher than in the shallowest well.

The Stillwater Marsh and Carson Sink area is probably a regional discharge area, but the data collected during this study are insufficient to verify it. Northward flow from the Lahontan Mountains combines with flow from the Stillwater Range and with flow from the central part of the study area. Whether the flow converges on the Stillwater Marsh or in the Carson Sink is not known. The vertical gradient in the Stillwater Marsh is upward. Water in the deeper well 121 has a head about 11 ft higher than that of the shallow well 122.

SUMMARY AND CONCLUSIONS

In 1903, the U.S. Bureau of Reclamation began construction of Truckee Canal and the Derby Diversion Dam in northwestern Nevada as one of the first reclamation projects in the Nation. Delivery of water to farmers in the Fallon area began shortly afterwards. Delivery of water and construction of the water-distribution and drain systems have greatly changed the ground-water system in the Fallon area.

The Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990 directed the U.S. Fish and Wildlife Service to acquire water for wetland areas in the Carson Desert. The public is concerned that acquisition of water rights and delivery of the water directly to the wetland areas would reduce recharge to the shallow ground water in the Fallon area and cause domestic wells to go dry.

A ground-water observation network of 126 wells was created in the Fallon area and data were collected to provide information to planners who must assess the potential effects of the water-rights acquisition. Water levels in 24 wells were measured every 2 weeks beginning in January 1992. Water levels were measured before the irrigation season began, at the beginning of the irrigation season, during the irrigation season, and after the end of the irrigation season. Many of the 126 wells in the network were also used during earlier investigations. Records from these wells allowed determination of long-term changes in water level.

Since water deliveries began at the turn of the century, ground-water levels have risen more than 15 ft beneath large parts of the study area. In 1904, the depth to water generally was less than 5 ft below land surface near the Carson River and greater than 10 ft at distances more than 1-2 mi from the river. In 1992, the depth to water in most irrigated areas was between 5 and 10 ft. Even near canals, water in most wells is now more than 5 ft below land surface. Water levels in the shallow aquifer probably are lowered by the system of deep open drains near the canals.

The stage in Big Soda Lake rose nearly 60 ft between 1907 and 1930, primarily because of seepage from nearby irrigation canals. Ground-water levels near the lake rose 25 to 40 ft between 1904-5 and 1992. The altitude of the lake surface now represents the local water table and has been stable since the early 1930's.

The net change in water level during the last 15 yr has been small. Between early 1977 and early 1992, water levels in most wells for which data are available declined less than 1 ft. The maximum measured decline during this period was about 2.7 ft. Some wells in the south and north parts of the study area showed rises in water level during this period.

During the early 1980's, water levels in the shallow aquifer rose in response to a wetter-than-normal period, and have declined during the subsequent drought. Since 1988, the greatest declines—slightly more than 4 feet—were in the Stillwater Marsh area and in irrigated lands near the town of Stillwater. The median change in water level between February 1988 and January to February 1992 was a decline of 1.35 ft.

The net change in water level over a single year was greater in 1992 than in past years. The median water-level change for 29 wells in the shallow aquifer between January and November 1992 was a decline of 1.16 ft. For comparison, the median water-level change for 17 wells between January and December 1977 was a decline of 0.35 ft. The largest decline for 1992, 2.68 ft, was near the town of Stillwater. Superimposed on the net decline during 1992 was a rise of 1 to 2 ft in wells in irrigated areas during the irrigation season.

Reduction in water lost from canals to ground water by lining the upper reaches of the T-Line Canal in 1983-84 has resulted in water-level declines of 7.5 to more than 10 ft in wells near the canal. Water levels in a well near an unlined reach of the canal are essentially unchanged.

The measured altitude of the water table ranged from 4,025 ft 11 mi west of Fallon to 3,865 ft in the Stillwater Marsh. The measured hydraulic gradient is small and ranged from about 6 to 9 ft/mi from west to east.

The principal recharge area is in the western part of the study area along the Carson River and major canals. Ground water moves eastward and divides, some flow going to the northeast toward the Carson Sink and Stillwater area and some going southeast to Carson Lake. Carson Lake is a regional discharge area.

Future declines in water level can be expected in irrigated areas if canals are lined or if the amount of water carried in the canals is greatly reduced. The amount and rate of water-level change at a particular site will depend on site-specific geohydrologic factors. The effect of these water-level changes at a specific shallow well will depend on the depth and condition of the well.

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APPENDIXES OF BASIC DATA

This section includes tables and hydrographs summarizing data for wells in the study area. Appendix 1 is a list of well identifications; land-surface altitudes; well-casing diameters, depths, open intervals; and representative water levels for wells in the observation network. Appendix 2 provides sources of additional data about wells used in the network. Appendix 3 presents current and historical water-level measurements. Appendix 4 contains hydrographs showing depth to water for 48 shallow wells in the study area (depths of wells range from 9 to 39 feet below land surface). The hydrographs include historical water-level measurements.

Appendix 1. Records of observation wells referred to in this report

Land-surface altitude: Altitude surveyed from bench mark is listed to nearest hundredth of a foot; altitude surveyed from reference mark is identified with 'S' following altitude and is accurate to within a foot of of true altitude (altitudes at adjacent wells 7-10 are nonetheless listed to the nearest hundredth of a foot to permit comparison of water-level altitudes); altitude interpolated from U.S. Geological Survey topographic maps is recorded to nearest foot.
Well-casing depth: Depth to which finished well was completed; drilled depth may be greater.
Open interval: Top and bottom perforations of screen.
Representative water level: Water-level measurement made between April and November 1992 and used for preparation of plate 1. Most measurements were made in period June 30 to July 15. Negative value indicates feet above land surface.

[Abbreviations and symbol: D, dry; F, flowing; --, unknown]

Well No. (plate 1)	Local identification[1]	U.S. Geological Survey site identification[2]	Land-surface altitude (feet above sea level)	Date drilling completed	Well casing			Representative water level	
					Diameter (inches)	Depth (feet below land surface)	Open interval (feet below land surface)	Depth (feet below land surface)	Date measured
1	N16 E28 01AAAA2	391705118465402	3,910.95	01-08-76	2	27	22-27	17.54	07-08-92
2	N16 E29 01A 1	391706118403801	3,907	10-29-92	2	32	22-32	8.77	10-30-92
3	N16 E29 01D 1	391641118403501	3,910	10-29-92	2	40	30-40	19.84	10-30-92
4	N16 E30 09CDAA1	391532118371601	3,943	--	6	27	--	21.77	09-28-92
5	N17 E28 13DAA 1	392008118465501	3,918.04	01-08-76	1.5	17	15-17	5.53	07-08-92
6	N17 E29 05BCAA1	392208118452701	3,928S	05-12-92	2	28	23-28	8.27	06-30-92
7	N17 E29 12BBBB1	392132118411001	3,910.27S	09-19-88	2	50	45-50	1.85	07-07-92
8	N17 E29 12BBBB2	392132118411002	3,910.46S	09-19-88	2	30	25-30	2.49	07-07-92
9	N17 E29 12BBBB3	392132118411003	3,910.12S	09-19-88	2	19	14-19	1.97	07-07-92
10	N17 E29 12BBBB4	392132118411004	3,910.16S	09-20-88	2	15	10-15	2.04	07-07-92
11	N17 E29 19DD 1	391853118455801	3,908	10-28-92	2	23	18-23	7.33	10-30-92
12	N17 E29 23C 1	391855118420601	3,906	10-29-92	2	40	30-40	7.49	10-30-92
13	N17 E29 23C 2	391855118420602	3,906	10-29-92	2	11	6-11	7.54	10-30-92
14	N17 E29 27D 1	391819118422401	3,906	10-28-92	2	48	43-48	8.24	10-30-92
15	N17 E30 20CD 1	391857118383801	3,913	11-04-92	2	24	19-24	14.10	11-20-92
16	N18 E28 02BABB1	392735118484501	3,970	--	--	12	--	7.25	06-30-92
17	N18 E28 08DACB1	392609118513401	3,972	03-09-68	10	29	16-28	9.03	06-30-92
18	N18 E28 10CBBC1	392615118500901	3,973	--	12	19	--	10.23	07-08-92
19	N18 E28 12ABAC1	392642118470901	3,960	--	--	15	--	8.60	07-08-92
20	N18 E28 34ACAA1	392359118492501	3,947.03	01-12-76	2	10	7-10	5.29	07-08-92
21	N18 E29 04CBBD1	392705118443001	3,945	--	6	19	--	6.67	08-04-92
22	N18 E29 14BBAA1	392551118420601	3,930.45	06-28-90	2	15	5-15	6.44	07-15-92
23	N18 E29 14BBAA2	392551118420602	3,930.45	07-11-90	2	84	74-84	2.14	07-15-92
24	N18 E29 14DADD1	392516118411501	3,925.97	03-17-91	2	15	5-15	6.04	07-15-92
25	N18 E29 15BBAB1	392552118431901	3,935.95	06-22-90	2	15	5-15	7.23	07-15-92

Appendix 1. Records of observation wells referred to in this report--Continued

Well No. (plate 1)	Local identification[1]	U.S. Geological Survey site identification[2]	Land-surface altitude (feet above sea level)	Date drilling completed	Well casing			Representative water level	
					Diameter (inches)	Depth (feet below land surface)	Open interval (feet below land surface)	Depth (feet below land surface)	Date measured
26	N18 E29 15BBAB2	392552118431902	3,935.70	06-21-90	2	84	74-84	1.74	07-15-92
27	N18 E29 16BBCC1	392540118443301	3,940	01-25-91	6.6	39	35-39	5.20	07-01-92
28	N18 E29 18AADD1	392540118454501	3,951.17	05-12-92	2	23	18-23	8.42	06-30-92
29	N18 E29 21BCCB1	392439118443401	3,934	--	5	30	--	8.70	07-08-92
30	N18 E29 22BCBB1	392445118432601	3,929.64	03-12-90	2	15	5-15	4.30	07-15-92
31	N18 E29 22DAAB1	392432118423001	3,925.94	06-26-90	2	15	5-15	6.69	07-15-92
32	N18 E29 22DAAB2	392432118423002	3,925.86	06-25-90	2	80	70-80	-2.01	07-15-92
33	N18 E29 23DCDC1	392409118413601	3,924.38	03-10-91	2	15	--	7.13	07-15-92
34	N18 E29 27CDAD1	392327118425401	3,920	06-16-87	2	13	11-13	7.12	07-08-92
35	N18 E29 30BCBD1	392348118464401	3,942.16	01-07-76	2	29	27-29	4.55	07-08-92
36	N18 E29 30BDBA1	392351118462601	3,940	03-06-77	6	24	14-24	4.64	06-30-92
37	N18 E29 35ABCB1	392309118414601	3,917	07-21-76	6	32	25-30	7.18	06-30-92
38	N18 E29 35ABCC1	392305118414601	3,917	10-22-85	6	128	124-128	-1.39	06-30-92
39	N18 E30 07CDDC1	392558118393701	3,923	11-03-92	2	24	19-24	8.88	11-07-92
40	N18 E30 09CDCC1	392554118373001	3,931	--	1	111	--	5.06	10-02-92
41	N18 E30 12ACAA1	392631118334001	3,941	--	4	41	--	4.64	07-01-92
42	N18 E30 30ABAB1	392407118392301	3,925	11-03-92	2	24	19-24	11.63	11-07-92
43	N18 E30 30DDDC1	392316118390001	3,926	11-03-92	2	30	25-30	9.80	11-07-92
44	N18 E31 04DBDA1	392652118300701	4,026	01-01-41	8	136	--	126.15	05-07-92
45	N19 E27 08CCCB1	393108118590801	4,081	--	8	69	--	55.86	06-30-92
46	N19 E27 09CCCC1	393106118580301	4,019	05-12-92	2	21	16-21	7.66	06-30-92
47	N19 E27 11DCAC1	393120118545501	4,020.56	--	2	24	--	21.35	08-17-92
48	N19 E27 13CCB 1	393023118544101	4,013.58	11-16-72	1.5	143	141-143	24.57	06-30-92
49	N19 E27 13CCB 2	393023118544102	4,013.58	10-03-74	4	14	12-14	11.56	06-03-92
50	N19 E27 13CCBB3	393023118544103	4,013.60	05-11-92	2	28	23-28	12.39	06-30-92
51	N19 E27 15ADDA1	393043118555101	4,021.73	--	2	21	--	D	09-11-92
52	N19 E27 21ADAB1	392959118570201	4,021	12-18-57	8	59	52-57	15.30	06-30-92
53	N19 E27 22DBAB1	392948118561101	4,014S	05-15-92	2	13	8-13	10.80	06-30-92
54	N19 E27 29BBCC1	392911118591001	4,053S	06-08-78	8	103	83-103	47.10	06-30-92
55	N19 E27 36DDCD1	392828118534901	3,998	01-06-76	2	26	23-26	15.85	07-08-92

Appendix 1. Records of observation wells referred to in this report--Continued

Well No. (plate 1)	Local identification[1]	U.S. Geological Survey site identification[2]	Land-surface altitude (feet above sea level)	Date drilling completed	Well casing			Representative water level	
					Diameter (inches)	Depth (feet below land surface)	Open interval (feet below land surface)	Depth (feet below land surface)	Date measured
56	N19 E28 07BCBB1	393142118533201	4,015.22	--	2	26	--	21.10	06-30-92
57	N19 E28 11ABB 1	393155118483001	3,982.11	01-07-76	1.5	97	96-97	28.22	06-30-92
58	N19 E28 11ABB 2	393155118483002	3,982.11	01-07-76	1.5	35	31-32	30.73	06-30-92
59	N19 E28 17DAAC1	393038118512201	4,001.52	--	--	13	--	10.47	07-08-92
60	N19 E28 19CCCB1	392926118533001	4,000	06-04-87	2	18	16-18	8.33	07-08-92
61	N19 E28 21BBCA1	393004118511301	3,998.82	01-01-63	--	--	--	13.94	06-30-92
62	N19 E28 23DCDB1	392925118482001	3,975	--	8	30	--	13.69	07-08-92
63	N19 E28 32BAAB1	392829118520001	3,996	06-05-87	2	13	10-12	7.32	06-30-92
64	N19 E28 32CDAB1	392748118515701	3,980	06-05-87	2	13	10-13	6.30	07-08-92
65	N19 E28 34BCAA1	392817118495501	3,980	--	--	13	--	4.52	06-30-92
66	N19 E29 02BABB1	393252118415901	3,927S	05-15-92	2	21	16-21	10.07	06-30-92
67	N19 E29 14ACB 2	393049118413501	3,931.36	01-09-76	2	12	10-12	10.70	04-14-92
68	N19 E29 18DCBB1	393026118461401	3,957.69	01-08-76	2	10	7-10	7.78	07-08-92
69	N19 E29 18DCBB3	393026118461403	3,957.59	01-08-76	1.5	62	60-62	12.10	07-08-92
70	N19 E29 23CCDC1	392924118420901	3,937	--	--	19	--	8.34	07-01-92
71	N19 E29 24ABDD1	393003118402001	3,920	--	--	12	--	5.43	07-01-92
72	N19 E29 28CCCC1	392831118443201	3,950.25	12-27-58	6	26	19-26	9.11	07-01-92
73	N19 E29 30CBAD3	392850118463502	3,959.90	01-09-76	1.5	12	10-12	6.24	07-08-92
74	N19 E29 32BCBB1	392816118453901	3,955	01-01-82	--	21	--	9.69	05-21-92
75	N19 E29 33ABAC1	392825118435501	3,949.02	04-03-90	8.6	28	24-28	11.94	09-29-92
76	N19 E29 33DBCB1	392755118440001	3,944.42	05-05-59	8	36	28-36	6.69	06-30-92
77	N19 E29 35DAA 1	392759118411601	3,935.59	01-09-76	2	10	8-10	8.85	07-01-92
78	N19 E30 04BBBC1	393248118374901	3,900S	09-27-85	3	15	4-15	8.30	08-05-92
79	N19 E30 08BAAA1	393200118382601	3,907	--	2	9	--	3.71	08-05-92
80	N19 E30 10CDDA1	393114118361001	3,904	09-18-85	1	15	11-15	6.05	07-01-92
81	N19 E30 10CDDD1	393110118361001	3,904	--	2	8	--	6.89	05-27-92
82	N19 E30 13ACAA1	393052118333501	3,900	06-15-87	2	12	10-12	5.23	07-08-92
83	N19 E30 17DBBB1	393039118382301	3,911	--	1	11	-11	6.13	07-01-92
84	N19 E30 20DCCC1	392924118382101	3,918.08	01-09-76	2	10	8-10	8.04	07-08-92
85	N19 E30 22DDDD1	392924118353501	3,914	--	2	10	--	D	08-05-92

Appendix 1. Records of observation wells referred to in this report--Continued

Well No. (plate 1)	Local identification[1]	U.S. Geological Survey site identification[2]	Land-surface altitude (feet above sea level)	Date drilling completed	Well casing			Representative water level	
					Diameter (inches)	Depth (feet below land surface)	Open interval (feet below land surface)	Depth (feet below land surface)	Date measured
86	N19 E30 23DBDD2	392938118344301	3,908.79	--	12	10	--	6.74	07-08-92
87	N19 E30 27ADDA1	392902118353201	3,910.22	06-06-87	2	28	26-28	12.17	08-05-92
88	N19 E30 31BBAD1	392825118395001	3,930	06-06-87	2	11	8-11	5.50	07-08-92
89	N19 E30 33ABAB1	392828118370701	3,917.13	08-09-84	2	30	--	1.04	07-01-92
90	N19 E30 33ABAB2	392828118370702	3,917.36	07-05-84	2	18	--	9.58	07-01-92
91	N19 E30 33ADD 1	392758118365101	3,914.84	08-09-84	2	11	--	8.72	07-01-92
92	N19 E30 34BAA 1	392828118361201	3,914.19	08-09-84	2	25	--	9.24	07-08-92
93	N19 E30 34BAA 2	392828118361202	3,914.18	--	2	13	--	9.21	07-08-92
94	N19 E30 35CBD 1	392756118352201	3,915.60	01-08-76	2	17	14-17	9.88	07-01-92
95	N19 E31 11AACA1	393153118275101	3,940	--	6	81	--	41.09	05-06-92
96	N19 E31 16BBAD1	393106118305301	3,897	11-04-92	2	25	22-25	8.62	11-20-92
97	N19 E31 16BCAA1	393056118304901	3,903	11-04-92	2	30	26-30	11.83	11-20-92
98	N20 E28 21DDDC1	393442118501801	3,956.68	--	1.5	67	66-67	3.96	06-30-92
99	N20 E28 21DDDC2	393442118501802	3,956.68	--	2	9	7-9	4.91	06-30-92
100	N20 E28 22BCA 1	393515118495601	3,974.41	11-14-72	1.5	87	84-86	30.37	06-30-92
101	N20 E28 22BCA 2	393515118495602	3,974.41	10-01-74	1.5	35	32-34	30.99	06-30-92
102	N20 E28 24BDD 1	393506118473001	3,962.50	11-18-72	1.5	131	129-131	28.49	06-30-92
103	N20 E28 24BDD 2	393506118473002	3,962.50	10-02-74	1.5	33	31-33	29.62	06-30-92
104	N20 E28 32AAD 1	393335118512701	3,977.04	--	1.5	32	29-31	8.53	06-30-92
105	N20 E28 32AADA2	393335118512702	3,977.04	--	1.5	22	20-22	8.32	06-30-92
106	N20 E28 32CAD 1	393309118515901	3,990.37	--	1.5	128	125-127	18.23	06-30-92
107	N20 E28 32CADA2	393309118515902	3,990.37	--	1.5	--	10-12	11.19	05-22-92
108	N20 E29 08BDC 1	393650118452501	3,907.22	01-29-75	2	66	63-66	F	06-30-92
109	N20 E29 08BDC 2	393650118452502	3,907.22	12-16-75	2	9	7-8	5.96	06-30-92
110	N20 E29 22CBAC1	393458118431101	3,914S	06-05-87	2	12	9-12	7.72	07-08-92
111	N20 E30 33CBCC1	393308118374901	3,904S	09-12-85	1	17	14-17	15.01	08-05-92
112	N20 E30 35DBDD1	393309118344701	3,891	05-14-92	2	27	22-27	9.41	07-01-92
113	N20 E30 35DBDD2	393309118344702	3,891	--	4	110	50-100	6.69	07-01-92
114	N20 E30 35DBDD3	393309118344703	3,891	--	4	200	150-190	-4.84	07-07-92
115	N20 E30 35DBDD4	393309118344704	3,891	--	4	280	240-270	-8.17	07-07-92

Appendix 1. Records of observation wells referred to in this report--Continued

Well No. (plate 1)	Local identification[1]	U.S. Geological Survey site identification[2]	Land-surface altitude (feet above sea level)	Date drilling completed	Well casing: Diameter (inches)	Well casing: Depth (feet below land surface)	Well casing: Open interval (feet below land surface)	Representative water level: Depth (feet below land surface)	Representative water level: Date measured
116	N20 E31 04CADD1	393719118303301	3,874.74	12-02-88	2	14	9-14	9.91	04-08-92
117	N20 E31 07BDCA1	393651118325701	3,884.81	11-29-88	2	20	15-20	14.18	07-01-92
118	N20 E31 07CAAB1	393648118325101	3,882.20	11-29-88	2	18	13-18	11.81	07-01-92
119	N20 E31 07DBBC1	393645118324201	3,878.18	11-30-88	2	15	10-15	10.63	07-01-92
120	N20 E31 10ABCB1	393705118292401	3,879.12	12-01-88	2	16	11-16	14.26	07-01-92
121	N20 E31 33CACB1	393311118304701	3,890.44	--	2	183	179-183	-7.35	07-07-92
122	N20 E31 33CACB3	393311118304703	3,890.44	05-14-92	2	28	23-28	5.53	07-01-92
123	N20 E32 33BBBD1	393341118241401	3,936	--	4	--	--	39.52	05-06-92
124	N21 E28 24BBA 1	394046118472601	3,903.36	11-19-72	1.5	109	106-109	8.43	06-30-92
125	N21 E28 24BBA 3	394046118472603	3,903.36	12-17-75	2	13	11-13	9.46	06-30-92
126	N21 E32 25CBCD1	393918118202701	3,932	--	--	--	--	33.46	11-16-92
				Basalt Aquifer Well					
B	N19 E28 36AABC1	392825118470501	3,962	--	14	540	505-540	46.65	06-10-92

[1] Locations are assigned using a grid system referenced to Mount Diablo base line and meridian for official rectangular subdivision of public lands. Location consists of four units: First unit is township, preceeded by N or S to indicate location north or south of base line. Second unit is range, preceeded by E to indicate location east of meridian. Third unit consists of section number and letters designating quarter section, quarter-quarter section, and so on (A, B, C, and D indicate northeast, northwest, southwest, and southeast quarters, respectively), followed by number indicating sequence in which site was recorded. For example, well N17 E28 13DAA 1 is first well recorded in northeast quarter of northeast quarter of southeast quarter of section 13, Township 17 North, Range 28 East, Mount Diablo base line and meridian.

[2] Sites are identified by standard U.S. Geological Survey identification number, which is unique number based on grid system of latitude and longitude of the site. Number consists of 15 digits: First six denote degrees, minutes, and seconds of latitude; next seven denote degrees, minutes, and seconds of longitude; and last two digits (assigned sequentially) identify sites within 1-second grid. For example, site 392132118411002 refers to 39° 21′ 32" latitude and 118° 41′ 10" longitude, and is second site recorded in that 1-second grid. If more precise latitude and longitude subsequently are determined, initial site-identification number is retained.

Appendix 2. Additional sources of information about wells in the observation network

[Type of data: C, chemical analyses; G, geophysical logs; H, hydraulic characteristics; L, water levels; LL, lithologic logs; TP, temperature profile; W, well-drillers' information]

Well No. (pl. 1)	Identification used in reference	Type of data	Reference
1	N16 E28 01AAAA2	L	Glancy (1986, p. 40)
4	W.P. 8	C, L	Mifflin and others (1964, p. 306, 323)
5	N17 E28 13DAA 1	L	Glancy (1986, p. 40)
8	12	C	Whitney (tables 36-46)[1]
9	13	C	Whitney (tables 36-46)[1]
10	14	C	Whitney (tables 36-46)[1]
19	26	C	Whitney (tables 36-46)[1]
20	N18 E28 34ACAA1	L	Glancy (1986, p. 40)
22	MW-12U	C	Oak Ridge National Laboratory (1992, p. 107)
23	MW-12L	C	Oak Ridge National Laboratory (1992, p. 107)
24	MW-47	C	Oak Ridge National Laboratory (1992, p. 107)
25	MW-06U	C, L	Oak Ridge National Laboratory (1992, p. 85, D-22)
26	MW-06L	C	Oak Ridge National Laboratory (1992, p. 85)
30	MW-35	C	Oak Ridge National Laboratory (1992, p. 32, 34)
31	MW-11U	C, L	Oak Ridge National Laboratory (1992, p. 32, 34)
32	MW-11L	C, L	Oak Ridge National Laboratory (1992, p. 32, 34)
33	MW-31	C	Oak Ridge National Laboratory (1992, p. 123)
34	18	C	Whitney (tables 36-46)[1]
35	N18 E29 30BCBD1	L	Glancy (1986, p. 40)
36	19	C	Whitney (tables 36-46)[1]
44	W.P. 37	C, L	Mifflin and others (1964, p. 307.323)
51	13-100L	L, W	U.S. Bureau of Reclamation (1985, Appendices A and B)
55	N19 E27 36DDCD1	L	Glancy (1986, p. 40)
57	AH-63A	W	Olmsted and others (1984, P. 44, 160)
57	63A	H	Olmsted (1985, table 2)
58	AH-63B	W	Olmsted and others (1984, p. 44, 160)
58	63B	H	Olmsted (1985, table 2)
59	72	C	Whitney (tables 36-46)[1]
59	84	C	Lico and Seiler[2]
60	62	C	Whitney (tables 36-46)[1]
61	68	C	Whitney (tables 36-46)[1]
62	61	C	Whitney (tables 36-46)[1]
63	48	C	Whitney (tables 36-46)[1]
64	44	C	Whitney (tables 36-46)[1]
65	46	C	Whitney (tables 36-46)[1]
68	N19 E29 18DCBB2	L	Glancy (1986, p. 40)

Appendix 2. Additional sources of information about wells in the observation network--Continued

Well No. (pl. 1)	Identification used in reference	Type of data	Reference
71	67	C	Whitney (tables 36-46)[1]
73	N19 E29 30CBAD3	L	Glancy (1986, p. 40)
77	N19 E29 35DAA 1	L	Glancy (1986, p. 40)
78	OW-33	L, LL, W	CH2M HILL (1989, Appendix B)
80	OW-27	L, LL, W	CH2M HILL (1989, Appendix B)
82	83	C	Lico and Seiler[2]
82	74	C	Whitney (tables 36-46)[1]
84	N19 E30 20DCCC1	L	Glancy (1986, p. 40)
87	55	C	Whitney (tables 36-46)[1]
88	47	C	Whitney (tables 36-46)[1]
91	HL-AH-7	L, W	Lico and others (1986, tables 1 and 4)
92	HL-AH-6A	L, W	Lico and others (1986, tables 1 and 4)
93	HL-AH-6B	L, W	Lico and others (1986, tables 1 and 4)
94	N19 E30 35CBD 1	L	Glancy (1986, p. 40)
94	OB-01A	L, W	Morgan (1982, table 1)
98	AH-35A	TP, W	Olmsted and others (1984, p. 43, 156, 89)
98	35A	H	Olmsted (1985, table2)
99	AH-35B	W	Olmsted and others (1984, p. 43, 156)
99	35B	H	Olmsted (1985, table2)
100	AH-2A	C, TP, W	Olmsted and others (1984, p. 42, 89, 154, 162)
100	2A	H	Olmsted (1985, table 2)
101	AH-2B	W	Olmsted and others (1984, p. 42, 154)
101	2B	H	Olmsted (1985, table 2)
102	AH-9A	C, TP, W	Olmsted and others (1984, p. 42, 89, 154, 162)
102	9A	H	Olmsted (1985, table 2)
103	AH-9B	W	Olmsted and others (1984, p. 42, 154)
103	9B	H	Olmsted (1985, table 2)
104	AH-17A	TP, W	Olmsted and others (1984, p. 42, 89, 155)
104	17A	H	Olmsted (1985, table 2)
107	8B	H	Olmsted (1985, table 2)
108	DH-50A	C, TP, W	Olmsted and others (1984, p. 43, 90, 158, 163)
108	50A	H	Olmsted (1985, table 2)
109	AH-50B	W	Olmsted and others (1984, p. 43, 158)
109	50B	H	Olmsted (1985, table 2)
110	79	C	Whitney (tables 36-46)[1]
111	OW-9	L, LL, W	CH2M HILL (1989, Appendix B)
113	FIRE-33	C, W	Tokunaga and Benson (1991, p. 88, 125)
114	FIRE-75	C, W	Tokunaga and Benson (1991, p. 88, 125)
115	FIRE-100	C, G, LL, W	Tokunaga and Benson (1991, p. 88, 99, 104, 125)
116	LLAH-8	C	Lico (1992)
116	66	C, L, LL, W	Rowe and others (1991, tables 22-23, 25, 30-31)
117	LLAH-1	C	Lico (1992)
117	59	C, L, LL, W	Rowe and others (1991, tables 22-23, 25, 30-31)
118	LLAH-2	C	Lico (1992)

Appendix 2. Additional sources of information about wells in the observation network--Continued

Well No. (pl. 1)	Identification used in reference	Type of data	Reference
118	60	C, L, LL, W	Rowe and others (1991, tables 22-23, 25, 30-31)
119	LLAH-3	C	Lico (1992)
119	61	C, L, LL, W	Rowe and others (1991, tables 22-23, 25, 30-31)
120	LLAH-6	C	Lico (1992)
120	64	C, L, LL, W	Rowe and others (1991, tables 22-23, 25, 30-31)
121	DH-112A	W	Morgan (1982, table 1)
124	AH-10A	C, TP, W	Olmsted and others (1984, p. 42, 154, 89, 162)
124	10A	H	Olmsted (1985, table 2)
125	AH-10C	W	Olmsted and others (1984, p. 42, 154)
125	10C	H	Olmsted (1985, table 2)

[1]Rita Whitney, U.S. Geological Survey, written commun., 1993

[2]Michael S. Lico and Ralph L. Seiler, U.S. Geological Survey, written commun., 1993

Appendix 3. Water levels in observation wells included in this investigation

Well is listed in appendix 1 with additional information; location is shown on plate 1.

Altitude of land surface: Feet above sea level. Altitude surveyed from bench mark is listed to nearest hundredth of a foot; altitude surveyed from reference mark is identified with '*S*' following altitude and is accurate to within a foot of true altitude; altitude interpolated from U.S. Geological Survey topographic maps is recorded to nearest foot.

Water level: Positive value indicates feet below land surface; negative value indicates feet above land surface. Abbreviation following water level describes site status: *D*, dry well; *F*, flowing well, but head could not be measured; *O*, obstruction encountered in well above water surface; *P*, well being pumped; *R*, well pumped recently; *S*, nearby well being pumped; *T*, nearby well pumped recently; *X*, surface water may have affected water level; *Z*, other. If no status is indicated, reported water-level measurement represents static level. Water level may represent local conditions only.

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well 1 (location, N16 E28 01AAAA2; altitude of land surface, 3,910.95 feet)							
01-21-76	21.35	12-16-76	20.84	12-07-77	21.09	03-07-92	16.88
02-05-76	21.23	01-04-77	20.80	01-03-78	21.12	03-21-92	16.91
02-19-76	21.22	01-25-77	20.80	02-02-78	21.19	04-04-92	17.00
03-10-76	21.23	02-17-77	20.87	03-01-78	21.12	04-18-92	17.14
03-24-76	21.25	03-09-77	20.84	04-03-78	21.20	04-30-92	17.12
04-09-76	21.37	03-28-77	20.93	05-26-78	21.08	05-21-92	17.26
04-22-76	21.26	04-19-77	21.02	07-07-78	21.15	06-10-92	17.39
05-07-76	21.33	05-04-77	21.00	08-07-78	21.34	06-24-92	17.44
05-19-76	21.29	05-19-77	21.10	09-08-78	21.30	07-08-92	17.54
06-02-76	21.29	06-01-77	21.09	03-17-80	20.43	07-22-92	17.54
06-15-76	21.30	06-16-77	21.04	07-18-80	20.37	08-04-92	17.63
07-08-76	21.26	06-30-77	20.95	08-20-80	20.53	08-17-92	17.70
07-23-76	21.25	07-12-77	20.83	04-07-81	20.14	08-29-92	17.71
08-12-76	21.22	07-26-77	20.85	08-11-81	20.32	09-12-92	17.74
09-01-76	21.17	08-10-77	20.88	04-01-83	18.30	09-28-92	17.82
09-16-76	21.12	08-22-77	20.91	01-07-92	16.81	10-10-92	17.87
10-05-76	21.14	09-09-77	21.04	01-25-92	16.80	10-24-92	17.86
10-27-76	21.07	09-30-77	21.12	02-08-92	16.81	11-07-92	17.86
11-12-76	20.87	10-25-77	21.13	02-22-92	16.94	11-27-92	17.94
11-30-76	21.93						

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well 2 (location, N16 E29 01A 1; altitude of land surface, 3,907 feet)							
10-30-92	8.77	11-20-92	9.13				
Well 3 (location, N16 E29 01D 1; altitude of land surface, 3,910 feet)							
10-30-92	19.84	11-20-92	20.18				
Well No. 4 (location, N16 E30 09; altitude of land surface, 3,943 feet)							
04-17-62	21.46	03-30-63	21.90	08-02-63	21.96	10-02-63	22.05
10-02-62	21.46	04-18-63	22.35	08-20-63	21.97	10-22-63	21.99
10-23-62	21.90	06-24-63	21.92	08-26-63	22.03	10-28-63	22.52
11-28-62	23.36	07-10-63	21.92	08-30-63	21.96	11-27-63	21.95
12-14-62	22.00	07-16-63	21.75	09-03-63	21.96	06-24-64	22.44
01-23-63	22.10	07-22-63	21.85	09-09-63	21.98	09-28-92	21.77
03-04-63	21.96	07-26-63	21.93	09-23-63	21.97		
Well No. 5 (location, N17 E28 13DAA 1; altitude of land surface, 3,918.04 feet)							
01-21-76	4.40	10-27-76	4.00	08-10-77	5.11	04-07-81	4.45
02-05-76	4.44	11-12-76	4.16	08-22-77	5.38	08-11-81	4.58
02-19-76	4.36	11-30-76	4.43	09-09-77	5.35	01-07-92	6.04
03-10-76	4.31	12-16-76	4.47	09-30-77	3.97	01-25-92	6.00
03-24-76	4.33	01-04-77	4.55	10-25-77	4.59	02-08-92	6.03
04-09-76	4.49	01-25-77	4.56	12-07-77	4.90	02-22-92	6.11
04-22-76	4.25	02-17-77	4.72	01-03-78	4.97	03-07-92	6.03*T*
05-07-76	2.83	03-09-77	4.67	02-02-78	5.12	03-21-92	6.09
05-19-76	4.05	03-28-77	4.69	03-01-78	4.97	04-04-92	6.14
06-02-76	3.89	04-19-77	4.61	04-03-78	5.07	04-18-92	6.30
06-15-76	4.19	05-04-77	4.43	05-26-78	4.14	04-30-92	5.80
07-08-76	4.54	05-19-77	3.66	07-07-78	3.67	05-21-92	--*O*
07-23-76	4.28	06-01-77	4.11	08-07-78	4.42	06-10-92	5.27
08-12-76	4.87	06-16-77	3.20	09-08-78	3.39	06-24-92	5.61
09-01-76	4.93	06-30-77	4.06	03-17-80	3.97	07-08-92	5.53
09-16-76	4.75	07-12-77	4.61	07-18-80	2.47	07-22-92	--*O*
10-05-76	3.86	07-26-77	4.84	08-20-80	3.72	08-04-92	--*O*
Well No. 6 (location, N17 E29 05BCAA1; altitude of land surface, 3,927.67S feet)							
05-12-92	7.97	06-30-92	8.27	09-12-92	9.12	11-27-92	9.98
05-21-92	9.62	08-03-92	8.18				
Well No. 7 (location, N17 E29 12BBBB1; altitude of land surface, 3,910.27S feet							
09-21-88	2.30	04-08-92	1.42	08-06-92	1.94	09-28-92	3.37
01-28-92	--*O*	06-03-92	1.59	09-22-92	3.22	11-28-92	4.16
02-25-92	1.98	07-07-92	1.85				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 8 (location, N17 E29 12BBBB2; altitude of land surface, 3,910.46S feet							
09-21-88	2.80	04-08-92	2.05	08-06-92	2.61	09-28-92	4.02
01-28-92	2.85	06-03-92	2.29	09-22-92	3.83	11-28-92	4.81
02-25-92	2.57	07-07-92	2.49				
Well No. 9 (location, N17 E29 12BBBB3; altitude of land surface, 3,910.12S feet)							
09-21-88	2.70	06-03-92	1.77	08-06-92	2.06	09-28-92	3.46
02-25-92	2.14	07-07-92	1.97	09-22-92	3.29	11-28-92	4.27
04-08-92	1.54						
Well No. 10 (location, N17 E29 12BBBB4; altitude of land surface, 3,910.16S feet)							
09-21-88	2.77	04-08-92	1.55	08-06-92	2.08	09-28-92	3.59
01-28-92	2.49	06-03-92	1.87	09-22-92	3.38	11-28-92	4.38
02-25-92	2.05	07-07-92	2.04				
Well No. 11 (location, N17 E29 19DD 1; altitude of land surface, 3,908 feet)							
10-30-92	7.33	11-20-92	7.57				
Well No. 12 (location, N17 E29 23C 1; altitude of land surface, 3,906 feet)							
10-30-92	7.49	11-27-92	7.99				
Well No. 13 (location, N17 E29 23C 2; altitude of land surface, 3,906 feet)							
10-30-92	7.54	11-27-92	7.65				
Well No. 14 (location, N17 E29 27D 1; altitude of land surface, 3,906 feet)							
10-30-92	8.24	11-27-92	6.70				
Well No. 15 (location, N17 E30 20CD 1; altitude of land surface, 3,913 feet)							
11-20-92	14.10						
Well No. 16 (location, N18 E28 02BABB1; altitude of land surface, 3,970 feet)							
05-11-92	7.97	06-09-92	6.99	08-03-92	7.95	11-27-92	9.88
05-21-92	8.19	06-30-92	7.25	09-12-92	9.12		

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 17 (location, N18 E28 08DACB1; altitude of land surface, 3,972 feet)							
04-08-92	9.09	06-30-92	9.03	09-12-92	9.81	11-27-92	9.95
04-16-92	8.85	08-03-92	9.32				
Well No. 18 (location, N18 E28 10CBBC1; altitude of land surface, 3,973 feet)							
03-26-92	12.30	06-10-92	10.34	08-17-92	10.59	10-10-92	11.59
04-04-92	12.33	06-24-92	9.51	08-29-92	10.88	10-24-92	11.77
04-16-92	11.62	07-08-92	10.23	09-12-92	11.15	11-07-92	11.92
04-30-92	11.12	07-22-92	9.46	09-28-92	11.39	11-27-92	12.13
05-19-92	10.56	08-03-92	10.21				
Well No. 19 (location, N18 E28 12ABAC1; altitude of land surface, 3,960 feet)							
06-19-87	6.70	03-21-92	9.37	06-24-92	8.61	09-12-92	9.56
02-12-88	8.30	04-04-92	9.41	07-08-92	8.60	09-28-92	9.71
01-14-92	9.25	04-18-92	9.42	07-22-92	8.44	10-10-92	9.82
01-25-92	9.28	04-30-92	9.16	08-03-92	8.90	10-24-92	9.95
02-08-92	9.31	05-21-92	9.15	08-17-92	9.16	11-07-92	10.01
02-22-92	9.32	06-10-92	8.86	08-29-92	9.43	11-27-92	10.05
03-07-92	9.34						
Well No. 20 (location, N18 E28 34ACAA1; altitude of land surface, 3,947.03 feet)							
01-21-76	4.58	11-30-76	4.59	09-30-77	4.23	02-22-92	5.33
02-05-76	4.68	12-16-76	4.75	10-25-77	4.87	03-07-92	5.35
02-19-76	4.71	01-04-77	4.90	12-07-77	5.36	03-21-92	5.41
03-10-76	4.82	01-25-77	5.05	01-03-78	5.49	04-04-92	5.50
03-24-76	4.93	02-17-77	5.15	02-02-78	5.58	04-18-92	5.67
04-09-76	4.25	03-09-77	5.22	03-01-78	5.65	04-30-92	4.47
04-22-76	4.57	03-28-77	5.33	04-03-78	5.68	05-21-92	3.81
05-07-76	4.83	04-19-77	4.81	05-26-78	4.14	06-10-92	5.12
05-19-76	3.46	05-04-77	5.18	07-07-78	3.36	06-24-92	4.64
06-02-76	3.40	05-19-77	4.53	08-07-78	3.77	07-08-92	5.29
06-15-76	3.60	06-01-77	2.44	10-27-78	2.69	07-22-92	5.01
07-08-76	3.38	06-15-77	3.21	03-17-80	4.23	08-04-92	5.88
07-23-76	4.15	06-30-77	3.72	07-18-80	1.81	08-17-92	6.28
08-12-76	3.36	07-12-77	3.37	08-20-80	3.28	08-29-92	6.57
09-01-76	2.93	07-26-77	3.70	04-07-81	4.65	09-12-92	6.78
09-16-76	3.62	08-10-77	3.92	08-11-81	3.03	10-10-92	7.11
10-05-76	3.45	08-22-77	2.44	01-07-92	5.27	10-24-92	7.18
10-27-76	3.86	09-08-77	3.29	01-25-92	5.30	11-07-92	7.19
11-12-76	4.29	09-09-77	1.96	02-08-92	5.31	11-27-92	7.07
Well No. 21 (location, N18 E29 04CBBD1; altitude of land surface, 3,945 feet)							
04-16-92	7.13	07-01-92	5.01	09-15-92	7.74	11-27-92	8.55
06-03-92	5.49	08-04-92	6.67				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 22 (location, N18 E29 14BBAA1; altitude of land surface, 3,930.45 feet)							
01-28-92	6.38	03-14-92	6.37	04-15-92	6.39	07-15-92	6.44
Well No. 23[a] (location, N18 E29 14BBAA2; altitude of land surface, 3,930.45 feet)							
01-28-92	2.09	03-14-92	2.10	04-15-92	2.13	07-15-92	2.14
Well No. 24[a] (location, N18 E29 14DADD1; altitude of land surface, 3,925.97 feet)							
01-28-92	5.97	03-14-92	5.88	04-15-92	5.83	07-15-92	6.04
Well No. 25[a] (location, N18 E29 15BBAB1; altitude of land surface, 3,935.95 feet)							
01-28-92	7.35	03-14-92	7.28	04-10-92	7.26	07-15-92	7.23
Well No. 26[a] (location, N18 E29 15BBAB2; altitude of land surface, 3,935.70 feet)							
01-28-92	1.72	03-14-92	1.84	04-10-92	1.86	07-15-92	1.74
Well No. 27 (location, N18 E29 16BBCC1; altitude of land surface, 3,940 feet)							
04-16-92	6.21	07-01-92	5.20	08-17-92	6.02	11-27-92	7.23
05-21-92	5.47	08-04-92	5.53	09-15-92	6.67		
Well No. 28 (location, N18 E29 18AADD1; altitude of land surface, 3,951.17 feet)							
05-12-92	9.89	06-30-92	8.42	09-12-92	10.62	10-24-92	11.52
05-21-92	9.42	08-04-92	9.11	10-10-92	11.25	11-27-92	11.57
06-09-92	8.05						
Well No. 29 (location, N18 E29 21BCCB1; altitude of land surface, 3,934 feet)							
01-14-92	9.77	03-07-92	--P	04-30-92	9.09R	07-22-92	--P
01-25-92	9.76	03-21-92	--P	06-10-92	7.95R	08-06-92	--P
02-08-92	9.78	04-04-92	9.95R	06-24-92	--P	08-17-92	--P
02-22-92	--P	04-18-92	9.69R	07-08-92	8.70R	08-29-92	9.91R
Well No. 30[a] (location, N18 E29 22BCBB1; altitude of land surface, 3,929.64 feet)							
01-27-92	6.23	03-14-92	6.35	04-15-92	6.35	07-15-92	4.30

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 31[a] (location, N18 E29 22DAAB1; altitude of land surface, 3,925.94 feet)							
01-27-92	6.65	03-14-92	6.55	04-12-92	6.53	07-15-92	6.69
Well No. 32[a] (location, N18 E29 22DAAB2; altitude of land surface, 3,925.86 feet)							
01-27-92	-2.72	03-14-92	-3.15	04-12-92	-2.45	07-15-92	-2.01
Well No. 33[a] (location, N18 E29 23DCDC1; altitude of land surface, 3,924.38 feet)							
01-27-92	8.31	03-14-92	8.09	04-15-92	8.29	07-15-92	7.13
Well No. 34 (location, N18 E29 27CDAD1; altitude of land surface, 3,920 feet)							
06-19-87	8.30	03-07-92	7.34	06-10-92	6.99	08-29-92	7.76
02-18-88	5.70	03-21-92	7.36	06-24-92	6.74	09-12-92	7.88
04-06-88	5.80	04-04-92	7.40	07-08-92	7.12	10-10-92	8.04
01-14-92	7.42	04-18-92	7.45	07-22-92	7.05	10-24-92	8.03
01-25-92	7.42	04-30-92	7.31	08-04-92	7.49	11-07-92	8.04
02-08-92	7.36	05-21-92	6.41	08-17-92	7.66	11-27-92	8.11
02-22-92	7.36						
Well No. 35 (location, N18 E29 30BCBD1; altitude of land surface, 3,942.16 feet)							
01-21-76	3.52	11-30-76	3.81	10-25-77	3.60	02-22-92	5.35
02-05-76	3.66	12-16-76	4.04	12-07-77	4.17	03-07-92	5.42
02-19-76	3.78	01-04-77	4.24	01-03-78	4.45	03-21-92	5.51
03-10-76	3.92	01-25-77	4.40	02-02-78	4.69	04-04-92	5.61
03-24-76	4.06	02-17-77	4.53	03-01-78	4.78	04-18-92	5.61
04-09-76	3.19	03-09-77	4.62	04-03-78	4.86	04-30-92	5.54
04-22-76	3.12	03-28-77	4.72	05-26-78	3.18	05-21-92	4.66
05-07-76	2.17	04-19-77	4.69	07-07-78	2.25	06-10-92	5.20
05-19-76	2.67	05-04-77	4.66	08-07-78	2.96	06-24-92	5.08
06-02-76	1.60	05-19-77	3.54	09-08-78	2.55	07-08-92	4.55
06-15-76	2.72	06-01-77	3.77	03-17-80	4.24	07-22-92	4.60
07-08-76	3.14	06-16-77	3.12	07-02-80	2.69	08-04-92	5.12
07-23-76	2.84	06-30-77	2.75	07-18-80	2.47	08-17-92	5.58
08-12-76	3.33	07-12-77	2.91	08-20-80	2.69	08-29-92	5.96
09-01-76	2.79	07-26-77	2.23	04-07-81	3.27	09-12-92	6.27
09-16-76	3.23	08-10-77	2.22	08-11-81	2.88	09-28-92	6.59
10-05-76	3.82	08-22-77	2.29	01-07-92	5.16	10-10-92	6.73
10-27-76	3.09	09-09-77	2.63	01-25-92	5.25	10-24-92	6.93
11-12-76	3.47	09-30-77	2.67	02-08-92	5.30	11-07-92	7.06

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 36 (location, N18 E29 30BDBA1; altitude of land surface, 3,940 feet)							
03-06-77	6.00	04-09-92	7.92	06-30-92	4.64	09-12-92	8.18
01-14-92	7.54	05-21-92	4.96	08-04-92	--P	11-27-92	9.37
Well No. 37 (location, N18 E29 35ABCB1; altitude of land surface, 3,917 feet)							
03-26-92	7.73	06-03-92	7.87	08-04-92	7.63	11-27-92	9.77
04-08-92	8.17	06-30-92	7.18	09-12-92	8.89		
Well No. 38 (location, N18 E29 35ABCC1; altitude of land surface, 3,917 feet)							
03-26-92	-1.35	06-03-92	-1.36	08-04-92	-1.33	11-27-92	-.59
04-08-92	-1.34	06-30-92	-1.39	09-12-92	-1.15		
Well No. 39 (location, N18 E30 07CDDC1; altitude of land surface, 3,923 feet)							
11-07-92	8.88	11-20-92	8.92				
Well No. 40 (location, N18 E30 09CDCC1; altitude of land surface, 3,931 feet)							
10-02-92	5.06	11-28-92	5.11				
Well No. 41 (location, N18 E30 12ACAA1; altitude of land surface, 3,941 feet)							
05-07-92	4.64	07-01-92	4.64	08-05-92	4.67	09-24-92	4.64
Well No. 42 (location, N18 E30 30ABAB1; altitude of land surface, 3,925 feet)							
11-07-92	11.63	11-20-92	11.58				
Well No. 43 (location, N18 E30 30DDDC1; altitude of land surface, 3,926 feet)							
11-07-92	9.80	11-20-92	9.83				
Well No. 44 (location, N18 E31 04; altitude of land surface, 4,026 feet)							
04-12-62	127.37	06-23-63	126.02	08-15-63	126.07	10-23-63	126.17
11-28-62	126.25	07-08-63	126.00	08-22-63	126.02	10-28-63	126.14
12-14-62	126.19	07-15-63	126.60	08-28-63	126.00	11-27-63	126.10
01-20-63	126.20	07-22-63	126.00	09-12-63	126.00	05-07-92	126.15
03-02-63	126.20	07-26-63	126.00	09-25-63	126.02	09-24-92	126.10
03-30-63	126.24	08-01-63	126.02				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 45 (location, N19 E27 08CCCB1; altitude of land surface, 4,081 feet)							
04-21-92	54.83*R*	06-30-92	55.86	08-03-92	56.33	11-27-92	57.84
05-19-92	55.70						
Well No. 46 (location, N19 E27 09CCCC1; altitude of land surface, 4,019 feet)							
05-19-92	7.30	06-30-92	7.66	09-15-92	8.47	11-27-92	8.38
06-11-92	7.55	08-03-92	8.09				
Well No. 47[b] (location, N19 E27 11DCAC1; altitude of land surface, 4,020.56 feet)							
11-04-83	13.50	06-22-84	14.80	10-12-84	14.80	02-08-85	15.90
11-22-83	14.00	07-06-84	14.50	10-19-84	14.80	03-01-85	16.20
12-02-83	14.00	07-27-84	14.60	10-26-84	14.80	03-15-85	16.30
12-30-83	14.60	08-10-84	14.70	11-02-84	14.90	03-29-85	16.40
01-17-84	13.70	08-17-84	14.70	11-09-84	14.90	04-12-85	16.40
01-18-84	13.50	08-24-84	14.70	11-16-84	15.00	05-16-85	16.20
04-09-84	14.00	08-31-84	14.80	11-23-84	15.00	07-09-85	16.00
04-27-84	14.10	09-10-84	14.80	12-07-84	15.20	08-17-92	21.35
05-07-84	14.10	09-14-84	14.80	12-14-84	15.30	09-11-92	21.54
05-22-84	14.30	09-21-84	14.80	12-28-84	15.40	10-24-92	21.90
05-31-84	14.30	09-28-84	14.80	01-11-85	15.60	11-27-92	22.34
06-15-84	14.40	10-05-84	13.90	01-25-85	15.70		

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 48^{C} (location, N19 E27 13CCB 1; altitude of land surface, 4,013.58 feet)							
05-18-73	21.56	12-15-76	22.57	05-26-78	22.95	10-21-83	21.32
12-18-73	21.77	01-03-77	22.67	07-03-78	21.90	02-04-84	21.52
06-08-74	20.62	01-26-77	22.88	07-11-78	20.98	04-20-84	21.91
10-12-74	21.71	02-24-77	23.01	08-07-78	21.46	07-12-84	21.67
12-18-74	22.00	03-14-77	23.12	08-24-78	21.45	08-26-84	21.69
07-18-75	21.58	04-01-77	23.24	09-08-78	21.50	02-01-85	22.09
12-19-75	21.90	04-18-77	23.15	10-13-78	21.52	06-14-85	22.12
02-06-76	22.29	05-02-77	22.89	12-15-78	21.98	03-20-86	22.00
02-20-76	22.37	05-19-77	22.68	02-02-79	22.40	10-17-86	21.65
03-11-76	22.50	05-31-77	22.63	07-20-79	21.36	02-04-87	22.01
03-23-76	22.59	06-16-77	22.54	10-13-79	21.47	06-12-87	21.75
04-07-76	22.49	06-27-77	22.48	12-14-79	21.17	11-18-87	21.57
04-22-76	22.36	07-05-77	22.48	03-17-80	21.89Z	01-17-92	24.14
05-07-76	22.21	07-12-77	22.45	07-17-80	21.48Z	04-06-92	23.43
05-19-76	22.14	07-28-77	22.43	08-20-80	21.45Z	05-22-92	24.25
06-02-76	22.04	08-10-77	22.44	10-15-80	21.77	06-03-92	24.48
06-15-76	21.98	08-25-77	22.31	04-07-81	22.53	06-30-92	24.57
07-07-76	21.93	09-09-77	22.25	08-10-81	22.10	07-15-92	25.18
07-18-76	21.91	09-29-77	22.32	08-21-81	22.07	08-03-92	25.29
07-26-76	21.93	10-27-77	22.70	11-19-81	21.93	08-17-92	25.28
08-12-76	21.99	12-05-77	23.12	03-17-82	22.51	08-29-92	25.66
08-31-76	22.01	12-09-77	23.15	04-08-82	22.53	09-12-92	25.63
09-16-76	22.00	12-30-77	23.01	05-19-82	22.17	10-10-92	25.99
10-05-76	22.06	02-03-78	23.48	04-01-83	22.07	10-24-92	26.00
10-26-76	22.15	03-01-78	23.37	04-20-83	22.04	11-07-92	26.06
11-11-76	22.25	04-03-78	23.49	07-22-83	21.30	11-27-92	25.83
11-29-76	22.45						

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 49[C] (location, N19 E27 13CCB 2; altitude of land surface, 4,013.58 feet)							
10-12-74	8.31	11-29-76	9.52	12-30-77	11.17	04-08-82	11.16
12-18-74	9.78	12-15-76	9.94	02-03-78	11.85	05-19-82	8.64
07-18-75	7.14	01-03-77	10.41	03-01-78	12.29	04-01-83	10.08
09-05-75	5.76	01-26-77	10.93	04-03-78	12.62	04-20-83	4.03
12-19-75	8.28	02-24-77	11.52	05-26-78	9.31	07-22-83	6.49
02-06-76	9.60	03-14-77	11.79	07-03-78	7.84	10-21-83	7.14
02-20-76	9.92	04-01-77	12.08	08-07-78	7.84	02-04-84	8.80
03-11-76	10.35	04-18-77	11.88	09-08-78	6.75	04-20-84	7.60
03-23-76	10.60	05-02-77	10.68	10-13-78	7.57	07-12-84	6.79
04-07-76	10.20	05-19-77	11.03	12-15-78	8.95	08-26-84	6.96
04-22-76	9.55	05-31-77	10.20	02-02-79	10.15	02-01-85	9.27
05-07-76	8.77	06-16-77	10.18	07-20-79	6.36	06-14-85	7.71
05-19-76	8.63	06-27-77	9.57	10-13-79	5.86	03-20-86	9.81
06-02-76	8.34	07-05-77	9.77	12-14-79	7.11	10-17-86	7.16
06-15-76	8.24	07-12-77	9.36	03-17-80	9.28	02-04-87	9.18
07-07-76	8.03	07-28-77	8.43	07-17-80	6.93	06-12-87	7.67
07-26-76	8.01	08-10-77	8.79	08-20-80	6.62	11-18-87	7.49
08-12-76	7.99	08-25-77	8.45	10-15-80	4.12	01-17-92	--*O*
08-31-76	7.56	09-09-77	7.85	08-10-81	7.40	04-06-92	--*O*
09-16-76	7.95	09-29-77	8.46	08-21-81	7.16	04-14-92	--*O*
10-05-76	8.37	10-27-77	9.54	11-19-81	8.21	05-22-92	--*O*
10-26-76	8.71	12-05-77	10.63	03-17-82	10.90	06-03-92	11.56
11-11-76	9.02						
Well No. 50 (location, N19 E27 13CCBB3; altitude of land surface, 4,013.60 feet)							
05-22-92	12.52	07-15-92	11.54	08-29-92	12.82	10-24-92	14.00
06-03-92	12.53	08-03-92	11.66	09-12-92	13.18	11-07-92	14.17
06-30-92	12.39	08-17-92	12.43	10-10-92	13.78	11-27-92	14.47
Well No. 51[B] (location, N19 E27 15ADDA1; altitude of land surface, 4,021.73 feet)							
11-04-83	8.10	07-06-84	10.30	10-26-84	9.90	02-08-85	12.90
11-22-83	8.90	07-27-84	10.30	11-02-84	10.20	03-01-85	13.40
12-02-83	9.40	08-10-84	10.30	11-09-84	10.40	03-15-85	13.70
12-30-83	10.30	08-17-84	9.70	11-16-84	10.50	03-29-85	12.80
01-17-84	7.20	08-24-84	9.80	11-23-84	10.70	04-12-85	11.80
01-18-84	7.10	08-31-84	9.70	11-27-84	10.90	04-19-85	10.80
04-09-84	10.10	09-10-84	8.90	12-03-84	11.10	05-16-85	10.40
04-27-84	9.50	09-14-84	9.10	12-10-84	11.30	05-23-85	10.30
05-07-84	9.40	09-21-84	9.20	12-17-84	11.50	07-09-85	9.80
05-22-84	9.40	09-28-84	9.30	12-28-84	11.90	09-11-92	--*D*
05-31-84	9.30	10-05-84	9.40	01-11-85	12.20	10-24-92	--*D*
06-15-84	9.70	10-12-84	9.50	01-25-85	12.60	11-27-92	--*D*
06-22-84	9.90	10-19-84	9.70				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 52 (location, N19 E27 21ADAB1; altitude of land surface, 4,021 feet)							
12-18-57	16.00	06-30-92	15.30*S*	09-11-92	17.78	11-22-92	19.75
04-14-92	17.78	08-03-92	16.81				
Well No. 53 (location, N19 E27 22DBAB1; altitude of land surface, 4,013.61S feet)							
05-19-92	11.06	06-30-92	10.80	09-15-92	11.20	11-27-92	11.94
06-08-92	10.95	08-03-92	10.60				
Well No. 54 (location, N19 E27 29BBCC1; altitude of land surface, 4,052.91S feet)							
06-08-78	35.00	05-19-92	44.49	08-03-92	48.08	11-27-92	43.54
04-14-92	43.52	06-30-92	47.10	09-11-92	48.25		
Well No. 55 (location, N19 E27 36DDCD1; altitude of land surface, 3,998 feet)							
01-21-76	14.33	12-16-76	14.65	01-03-78	15.10	04-04-92	--*O*
02-05-76	14.20	01-04-77	14.59	02-08-78	15.09	04-18-92	--*O*
02-19-76	14.20	01-25-77	14.60	03-01-78	15.04	04-21-92	--*O*
03-10-76	14.17	02-16-77	14.60	04-03-78	14.98	04-23-92	--*O*
03-24-76	14.21	03-08-77	14.60	05-26-78	14.92	04-30-92	15.63
04-09-76	14.18	03-28-77	14.59	07-07-78	14.93	05-21-92	15.70
04-22-76	14.18	04-19-77	14.60	08-07-78	15.04	06-10-92	15.76
05-07-76	14.14	05-04-77	14.59	09-08-78	15.18	06-24-92	15.80
05-19-76	14.18	05-19-77	14.61	03-17-80	13.10*Z*	07-08-92	15.85
06-02-76	14.30	06-01-77	14.60	07-18-80	13.05*Z*	07-22-92	15.87
06-15-76	14.34	06-14-77	14.62	08-20-80	13.10*Z*	08-03-92	15.91
07-07-76	14.45	06-30-77	14.68	04-07-81	12.94	08-17-92	15.98
07-23-76	14.57	07-12-77	14.70	08-11-81	13.37	08-29-92	15.99
08-12-76	14.69	07-26-77	14.79	01-07-92	--*O*	09-12-92	16.00
09-01-76	14.75	08-10-77	14.88	01-25-92	--*O*	09-26-92	16.02
09-16-76	14.79	08-22-77	14.93	02-08-92	--*O*	10-10-92	16.04
10-05-76	14.67	09-09-77	15.05	02-22-92	--*O*	10-24-92	16.05
10-27-76	14.77	09-29-77	15.11	03-07-92	--*O*	11-07-92	16.05
11-12-76	14.72	10-26-77	15.19	03-21-92	--*O*	11-27-92	16.08
11-30-76	14.68	12-07-77	15.14				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 56[b] (location, N19 E28 07BCBB1; altitude of land surface, 4,015.22 feet)							
11-04-83	20.70	07-27-84	18.40	11-02-84	19.80	04-12-85	18.90
11-22-83	21.00	08-10-84	18.20	11-09-84	20.00	05-16-85	18.70
12-02-83	21.10	08-17-84	18.20	11-16-84	20.10	05-23-85	18.00
12-30-83	21.30	08-24-84	18.40	11-23-84	20.30	07-09-85	18.00
01-17-84	21.40	08-31-84	18.50	12-07-84	20.60	02-25-92	21.17
01-18-84	21.50	09-10-84	17.80	12-14-84	20.70	04-06-92	21.17
04-09-84	19.60	09-14-84	18.30	12-28-84	21.00	04-14-92	20.41
04-27-84	18.30	09-21-84	18.60	01-11-85	21.00	05-22-92	21.09
05-07-84	18.40	09-28-84	18.90	01-25-85	21.10	06-30-92	21.10
05-22-84	18.30	10-05-84	19.10	02-08-85	21.10	08-03-92	21.12
05-31-84	17.60	10-12-84	19.20	03-01-85	21.10	09-11-92	21.33
06-15-84	18.30	10-19-84	19.50	03-15-85	21.20	10-24-92	21.31
06-22-84	17.80	10-26-84	19.10	03-29-85	19.70	11-27-92	21.40
07-06-84	17.30						
Well No. 57[c] (location, N19 E28 11ABB 1; altitude of land surface, 3,982.11 feet)							
04-22-76	26.25	07-12-77	26.41	04-14-78	26.83	08-26-84	25.80
07-17-76	26.32	07-28-77	26.60	05-31-78	26.58	03-19-86	26.08
12-15-76	26.25	08-11-77	26.66	07-03-78	26.67	06-12-87	26.25
01-26-77	26.29	08-23-77	26.66	08-09-78	26.86	03-25-92	27.78
02-23-77	26.31	09-09-77	26.80	09-08-78	26.85	04-08-92	27.80
03-29-77	26.48	09-27-77	26.83	12-14-78	26.56	05-22-92	27.97
04-19-77	26.46	10-26-77	26.94	07-20-79	26.57	06-30-92	28.22
05-04-77	26.39	12-05-77	26.99	12-13-79	26.35	08-04-92	28.57
06-02-77	26.30	12-30-77	26.87	10-16-80	25.42	09-11-92	28.97
06-16-77	26.20	02-03-78	26.90	07-22-83	25.23	11-27-92	28.94
06-30-77	26.36						
Well No. 58[c] (location, N19 E28 11ABB 2; altitude of land surface, 3,982.11 feet)							
01-22-76	29.01	06-30-77	29.34	02-03-78	29.81	07-22-83	27.20
04-22-76	28.99	07-12-77	29.51	04-14-78	29.51	08-26-84	28.27
07-17-76	29.57	07-28-77	29.83	05-31-78	29.56	03-19-86	28.22
12-15-76	29.31	08-11-77	30.01	07-03-78	30.00	06-12-87	28.57
01-26-77	29.11	08-23-77	30.11	07-12-78	30.10	03-25-92	30.06
02-23-77	28.98	09-09-77	30.23	08-09-78	30.49	04-08-92	30.17
03-29-77	29.01	09-27-77	30.29	09-08-78	30.83	05-22-92	30.45
04-19-77	29.06	10-26-77	30.20	12-14-78	30.23	06-30-92	30.73
05-04-77	29.01	12-05-77	30.08	07-20-79	30.01	08-04-92	31.00
06-02-77	29.07	12-12-77	30.03	12-13-79	30.00	09-11-92	30.94
06-16-77	29.19	12-30-77	29.93	10-16-80	29.30	11-27-92	31.20

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 59 (location, N19 E28 17DAAC1; altitude of land surface, 4,001.52 feet)							
06-04-87	8.50	03-21-92	11.84	06-24-92	10.55	09-12-92	11.70
02-09-88	9.20	04-04-92	11.95	07-08-92	10.47	09-30-92	12.05
01-08-92	11.19	04-18-92	11.69	07-22-92	9.81	10-10-92	12.16
01-25-92	11.36	04-30-92	11.62	08-03-92	10.46	10-24-92	12.34
02-08-92	11.48	05-22-92	10.86	08-17-92	11.10	11-07-92	12.46
02-22-92	11.60	06-10-92	10.68	08-24-92	11.39	11-27-92	12.64
03-07-92	11.71						
Well No. 60 (location, N19 E28 19CCCB1; altitude of land surface, 4,000 feet)							
11-27-87	6.40	02-08-92	8.01	05-19-92	7.49	08-29-92	8.67
02-09-88	7.10	02-22-92	8.12	06-10-92	8.31	09-12-92	8.82
02-11-88	9.20	03-07-92	8.18	06-24-92	8.22	09-26-92	8.97
02-21-88	7.70	03-21-92	8.23	07-08-92	8.33	10-10-92	9.09
03-14-88	7.40	04-04-92	8.32	07-22-92	8.00	10-24-92	9.21
01-14-92	7.92	04-18-92	8.40	08-03-92	8.25	11-07-92	9.25
01-25-92	8.01	04-30-92	8.40	08-17-92	8.51	11-27-92	9.31
Well No. 61 (location, N19 E28 21BBCA1; altitude of land surface, 3,998.82 feet)							
01-17-92	13.54	05-22-92	14.00	08-03-92	14.29	09-28-92	14.68
04-06-92	13.99	06-30-92	13.94	09-12-92	--P	11-27-92	15.25
Well No. 62 (location, N19 E28 23DCDB1; altitude of land surface, 3,975 feet)							
09-26-78	11.90	03-21-92	--P	06-24-92	14.34	09-12-92	15.50
01-17-92	14.67	04-04-92	14.94	07-08-92	13.69	10-10-92	--P
01-25-92	14.73	04-18-92	15.02	07-22-92	--P	10-24-92	15.33
02-08-92	14.77	04-30-92	--P	08-04-92	14.86	11-07-92	15.89
02-22-92	14.82	05-22-92	14.58	08-17-92	15.05	11-28-92	16.00
03-07-92	14.90	06-10-92	13.92	08-29-92	--P		
Well No. 63 (location, N19 E28 32BAAB1; altitude of land surface, 3,996 feet)							
06-05-87	8.00	04-09-92	9.26	06-30-92	7.32	09-12-92	9.62
02-10-88	9.40	05-19-92	6.90	08-03-92	7.81	11-27-92	11.05
01-14-92	9.41						
Well No. 64 (location, N19 E28 32CDAB1; altitude of land surface, 3,980 feet)							
06-05-87	7.00	03-21-92	7.45	06-24-92	6.01	09-12-92	7.41
02-11-88	6.10	04-04-92	7.57	07-08-92	6.30	09-28-92	7.58
01-14-92	7.00	04-18-92	6.81	07-22-92	6.35	10-10-92	7.71
01-25-92	7.06	04-30-92	6.22	08-03-92	6.73	10-24-92	7.84
02-08-92	7.14	05-21-92	5.91	08-17-92	7.01	11-07-92	7.95
02-22-92	7.24	06-10-92	5.45	08-29-92	7.21	11-27-92	8.10
03-07-92	7.34						

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 65 (location, N19 E28 34BCAA1; altitude of land surface, 3,980 feet)							
07-22-88	5.90	04-09-92	6.12	06-30-92	4.52	09-12-92	6.10
01-14-92	5.57	05-19-92	4.24	08-03-92	5.11	11-27-92	7.17
Well No. 66 (location, N19 E29 02BABB1; altitude of land surface, 3,927.38S feet)							
5-15-92	10.33	06-24-92	10.04	08-04-92	10.39	10-23-92	12.32
5-27-92	10.69	06-30-92	10.07	09-12-92	11.61	11-28-92	12.63
Well No. 67 (location, N19 E29 14ACB 2; altitude of land surface, 3,931.36 feet)							
01-21-76	8.59	09-16-76	8.69	06-14-77	8.18	07-07-78	7.87
02-05-76	8.57	10-05-76	8.76	06-30-77	8.11	08-07-78	8.25
02-19-76	8.55	10-27-76	8.46	07-12-77	8.48	09-08-78	8.53
03-11-76	8.59	11-12-76	8.53	07-26-77	8.67	03-17-80	7.81
03-23-76	8.43	11-30-76	8.64	08-10-77	8.75	07-17-80	8.35
04-07-76	8.23	12-16-76	8.57	08-22-77	8.64	08-20-80	8.64
04-22-76	7.91	01-05-77	8.39	09-09-77	8.95	04-07-81	9.34
05-06-76	8.25	01-25-77	8.20	09-30-77	9.05	08-10-81	9.81
05-19-76	8.10	02-16-77	7.99	10-25-77	9.12	01-08-92	--O
06-02-76	8.66	03-08-77	7.97	12-06-77	8.85	02-26-92	--O
06-15-76	8.73	03-28-77	8.00	12-28-77	8.68	04-14-92	10.70
07-07-76	8.80	04-19-77	8.00	02-02-78	8.50	05-27-92	--O
07-29-76	8.73	05-05-77	7.97	03-01-78	8.09	07-01-92	--O
08-12-76	8.66	05-19-77	8.13	04-04-78	7.99	08-04-92	--O
09-01-76	8.65	06-01-77	8.19	05-26-78	7.59		
Well No. 68 (location, N19 E29 18DCBB1; altitude of land surface, 3,957.69 feet)							
01-22-76	7.99	12-15-76	7.66	12-06-77	8.23	03-07-92	8.64
02-05-76	8.00	01-05-77	7.85	12-28-77	8.23	03-21-92	8.66
02-19-76	8.08	01-25-77	7.98	02-02-78	8.47	04-04-92	8.71
03-11-76	8.19	02-16-77	8.12	03-01-78	8.41	04-18-92	8.54
03-23-76	8.25	03-08-77	8.25	04-04-78	8.23	04-30-92	8.45
04-07-76	8.24	03-28-77	8.32	05-26-78	7.48	05-22-92	8.08
04-22-76	8.16	04-19-77	8.30	07-07-78	7.30	06-10-92	8.13
05-07-76	8.11	05-04-77	8.17	08-07-78	7.62	06-24-92	7.72
05-19-76	7.87	05-19-77	7.99	09-08-78	7.23	07-08-92	7.78
06-02-76	7.68	06-01-77	7.93	03-17-80	8.51Z	07-22-92	7.64
06-15-76	7.65	06-14-77	7.69	07-17-80	7.75Z	08-04-92	8.21
07-07-76	7.63	06-30-77	8.00	08-20-80	8.05Z	08-17-92	8.53
08-11-76	7.61	07-12-77	7.86	04-07-81	8.49	08-29-92	8.68
08-31-76	7.43	07-26-77	7.90	08-10-81	8.31	09-12-92	8.82
09-17-76	7.31	08-10-77	7.79	01-08-92	8.47	10-10-92	9.03
10-05-76	6.92	08-23-77	7.83	01-25-92	8.53	10-24-92	9.12
10-26-76	7.20	09-09-77	7.71	02-08-92	8.55	11-07-92	9.22
11-11-76	7.30	09-30-77	7.74	02-22-92	8.60	11-27-92	9.37
11-29-76	7.45	10-26-77	7.97				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 69 (location, N19 E29 18DCBB3; altitude of land surface, 3,957.59 feet)							
01-22-76	13.15	12-15-76	9.52	12-06-77	10.29	03-07-92	11.59
02-05-76	10.47	01-05-77	9.65	12-28-77	10.32	03-21-92	11.64
02-19-76	9.89	01-25-77	9.79	02-02-78	10.44	04-04-92	11.72
03-11-76	9.86	02-16-77	9.90	03-01-78	10.49	04-18-92	11.82
03-23-76	9.94	03-08-77	9.98	04-04-78	10.55	04-30-92	11.90
04-07-76	10.00	03-28-77	10.10	05-26-78	9.98	05-22-92	11.94S
04-22-76	9.94	04-19-77	10.14	07-07-78	9.51	06-10-92	12.04
05-07-76	9.77	05-04-77	10.02	08-07-78	9.49	06-24-92	12.06*S*
05-19-76	9.64	05-10-77	9.80	09-08-78	9.57	07-08-92	12.10*S*
06-02-76	9.49	06-01-77	9.73	03-17-80	9.81*Z*	07-22-92	12.19*S*
06-15-76	9.37	06-14-77	9.59	07-17-80	9.30*Z*	08-04-92	12.30*S*
07-07-76	9.33	06-30-77	9.59	08-20-80	9.45	08-17-92	12.50
08-11-76	9.28	07-12-77	9.59	04-07-81	10.09	08-29-92	12.67*S*
08-31-76	9.23	07-26-77	9.59	08-10-81	9.95*S*	09-12-92	12.84
09-17-76	9.17	08-10-77	9.56	01-08-92	11.60	10-10-92	13.09
10-05-76	9.16	08-23-77	9.54	01-25-92	11.58	10-24-92	13.16
10-26-76	9.10	09-09-77	9.58	02-08-92	11.56	11-07-92	13.20
11-11-76	9.20	09-30-77	9.68	02-22-92	11.58	11-27-92	13.20
11-29-76	9.25	10-25-77	9.99				
Well No. 70 (location, N19 E29 23CCDC1; altitude of land surface, 3,937 feet)							
01-27-92	8.80	05-27-92	8.88	07-22-92	7.10	09-11-92	8.43
02-26-92	8.78	06-08-92	8.87	08-04-92	7.58	11-27-92	9.19
04-06-92	8.80	07-01-92	8.34				
Well No. 71 (location, N19 E29 24ABDD1; altitude of land surface, 3,920 feet)							
06-06-87	8.20	04-06-92	4.55	07-01-92	5.43	09-11-92	6.60
02-19-88	2.50	05-27-92	4.88	08-04-92	6.11	11-27-92	6.44
01-08-92	4.68						
Well No. 72 (location, N19 E29 28CCCC1; altitude of land surface, 3,950.25 feet)							
12-27-58	6.00	05-27-92	9.21	08-05-92	9.49	09-28-92	10.65
04-16-92	10.24	07-01-92	9.11	09-11-92	10.36	11-27-92	11.38

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 73 (location, N19 E29 30CBAD3; altitude of land surface, 3,959.90 feet)							
01-22-76	5.01	11-30-76	5.16	12-06-77	5.95	03-21-92	6.03
02-05-76	5.13	12-15-76	5.30	12-28-77	6.01	04-04-92	6.00
02-19-76	5.21	01-06-77	5.45	02-02-78	6.14	04-18-92	6.10
03-11-76	5.37	01-25-77	5.58	03-01-78	6.14	04-30-92	6.15
03-23-76	5.44	02-16-77	5.67	04-04-78	6.00	05-22-92	6.17
04-07-76	5.50	03-07-77	5.72	05-26-78	5.41	06-10-92	6.23
04-22-76	5.42	03-28-77	5.83	07-07-78	4.47	06-24-92	6.22
05-07-76	5.12	04-19-77	5.88	08-07-78	4.12	07-08-92	6.24
05-17-76	4.95	05-05-77	5.69	09-08-78	4.05	07-22-92	6.22
06-02-76	4.42	05-19-77	5.19	03-17-80	4.39*Z*	08-04-92	6.29
06-15-76	4.58	06-01-77	5.33	07-18-80	4.15*Z*	08-17-92	6.41
07-07-76	4.45	06-16-77	4.81	08-20-80	4.15*Z*	08-29-92	6.50
07-29-76	4.30	06-30-77	4.69	04-07-81	5.58	09-12-92	6.57
08-12-76	4.62	07-12-77	5.00	08-10-81	4.88S	10-02-92	6.72
09-01-76	4.20	07-26-77	4.71	01-08-92	5.89	10-10-92	6.77
09-17-76	4.50	08-10-77	4.56	01-25-92	5.92	10-24-92	6.84
10-05-76	4.26	08-23-77	4.78	02-08-92	5.93	11-07-92	6.91
10-26-76	4.75	09-09-77	4.89	02-22-92	5.96	11-27-92	7.03
11-12-76	4.97	09-30-77	5.31	03-07-92	6.00		
Well No. 74 (location, N19 E29 32BCBB1; altitude of land surface, 3,955 feet)							
04-21-92	9.93*R*	05-21-92	9.69*R*	07-01-92	--*P*	08-04-92	--*P*
Well No. 75 (location, N19 E29 33ABAC1; altitude of land surface, 3,949.02 feet)							
09-29-92	11.94	11-27-92	12.59				
Well No. 76 (location, N19 E29 33DBCB1; altitude of land surface, 3,944.42 feet)							
05-05-59	11.00	06-03-92	7.03	08-04-92	7.45	09-30-92	8.57
04-16-92	7.33	06-30-92	6.69	09-15-92	8.27	11-27-92	8.78

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 77 (location, N19 E29 35DAA 1; altitude of land surface, 3,935.59 feet)							
01-21-76	6.89	10-05-76	6.95	07-12-77	6.74	09-08-78	6.19
02-05-76	7.05	10-27-76	7.23	07-26-77	6.32	03-17-80	7.21
02-19-76	7.16	11-12-76	7.38	08-10-77	7.14	07-17-80	5.57
03-10-76	7.25	11-30-76	7.54	08-22-77	6.64	08-20-80	6.13
03-24-76	7.38	12-16-76	7.61	09-09-77	6.64	04-07-81	7.61
04-09-76	7.52	01-05-77	7.69	09-30-77	6.91	08-10-81	6.24
04-22-76	6.71	01-25-77	7.80	10-25-77	7.55	01-07-92	--O
05-06-76	6.65	02-16-77	7.66	12-06-77	7.99	02-26-92	8.75R
05-19-76	6.56	03-09-77	7.97	01-04-78	8.14	04-06-92	8.78
06-02-76	6.21	03-28-77	8.02	02-02-78	8.22	05-27-92	8.79
06-15-76	6.74	04-19-77	7.79	03-01-78	8.23	06-08-92	8.78
07-07-76	6.48	05-05-77	6.89	04-03-78	8.24	07-01-92	8.85
07-29-76	6.49	05-19-77	7.21	05-26-78	7.64	08-04-92	8.49
08-12-76	7.14	06-01-77	6.85	07-07-78	6.38	09-11-92	9.06
09-01-76	7.06	06-16-77	6.54	08-07-78	6.51	11-27-92	9.13
09-16-76	6.32	06-30-77	6.40				
Well No. 78 (location, N19 E30 04BBBC1; altitude of land surface, 3,900.23S feet)							
09-27-85	7.00	05-27-92	8.28	07-01-92	8.30	09-30-92	8.36
04-24-92	8.29	06-11-92	8.30	08-05-92	8.30	11-28-92	8.41
Well No. 79 (location, N19 E30 08BAAA1; altitude of land surface, 3,907 feet)							
04-21-92	3.82	06-11-92	3.84	08-05-92	3.71	11-28-92	3.78
05-27-92	3.83	07-01-92	4.15	09-15-92	3.67		
Well No. 80 (location, N19 E30 10CDDA1; altitude of land surface, 3,904 feet)							
10-09-85	6.00	05-27-92	5.86	08-05-92	6.28	11-28-92	7.77
04-23-92	6.45	07-01-92	6.05				
Well No. 81 (location, N19 E30 10CDDD1; altitude of land surface, 3,904 feet)							
04-23-92	6.78	05-27-92	6.89	07-01-92	--D	08-05-92	--D
Well No. 82 (location, N19 E30 13ACAA1; altitude of land surface, 3,900 feet)							
06-15-87	7.00	02-22-92	6.79	06-10-92	5.28	08-29-92	7.09
02-18-88	4.60	03-07-92	6.90	06-24-92	4.76	09-12-92	7.54
03-15-88	5.60	03-21-92	7.04	07-08-92	5.23	10-10-92	8.23
04-06-88	5.50	04-04-92	7.22	07-22-92	3.72	10-24-92	8.50
01-08-92	6.29	04-18-92	6.19	08-05-92	5.72	11-07-92	8.72
01-25-92	6.44	04-30-92	5.89	08-17-92	6.50	11-27-92	8.97
02-08-92	6.68	05-27-92	5.02				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 83 (location, N19 E30 17DBBB1; altitude of land surface, 3,911 feet)							
04-21-92	6.18	07-01-92	6.13	09-11-92	6.31	11-28-92	6.46
05-27-92	6.10	08-05-92	6.22				
Well No. 84 (location, N19 E30 20DCCC1; altitude of land surface, 3,918.08 feet)							
01-21-76	7.12	12-16-76	6.98	12-07-77	7.48	03-21-92	7.91
02-05-76	7.11	01-05-77	7.00	12-28-77	7.47	04-04-92	7.93
02-19-76	7.10	01-25-77	7.12	02-01-78	7.39	04-18-92	7.98
03-10-76	7.05	02-16-77	7.15	03-01-78	7.19	04-21-92	7.99
03-23-76	7.07	03-14-77	7.13	04-04-78	7.00	04-30-92	7.99
04-07-76	7.05	03-28-77	7.15	05-26-78	6.92	05-27-92	7.98
04-22-76	7.05	04-19-77	7.10	07-07-78	7.37	06-10-92	8.01
05-07-76	7.03	05-05-77	7.10	08-07-78	7.69	06-24-92	8.00
05-19-76	7.09	05-19-77	7.05	09-08-78	7.73	07-08-92	8.04
06-02-76	7.19	06-01-77	7.02	03-17-80	7.98*Z*	07-22-92	8.09
06-15-76	7.18	06-16-77	6.95	07-17-80	6.86*Z*	08-05-92	8.16
07-07-76	7.25	06-30-77	7.00	08-20-80	6.99*Z*	08-17-92	8.21
07-29-76	7.38	07-13-77	7.14	04-07-81	6.70	08-29-92	8.24
08-12-76	7.39	07-26-77	7.33	08-10-81	7.07	09-12-92	8.27
09-01-76	7.41	08-10-77	7.47	01-07-92	7.92	09-30-92	8.32
09-16-76	7.37	08-22-77	7.55	01-25-92	7.93	10-10-92	8.32
10-05-76	7.28	09-09-77	7.15	02-08-92	7.91	10-24-92	8.32
10-27-76	7.07	09-30-77	7.65	02-22-92	7.95	11-07-92	8.35
11-12-76	6.99	10-25-77	7.59	03-07-92	7.90	11-27-92	8.43
11-30-76	7.00						
Well No. 85 (location, N19 E30 22DDDD1; altitude of land surface, 3,914 feet)							
03-25-92	--*D*	04-16-92	--*D*	07-01-92	--*D*	08-05-92	--*D*
Well No. 86 (location, N19 E30 23DBCD2; altitude of land surface, 3,908.79 feet)							
01-25-92	7.69	04-04-92	8.67	07-08-92	6.74	08-29-92	8.15
02-08-92	7.84	04-18-92	8.09	07-22-92	6.31	09-12-92	8.87
02-22-92	8.00	04-30-92	7.06	08-05-92	7.10	09-30-92	9.67
03-07-92	8.14	06-10-92	6.36	08-17-92	7.85	10-10-92	9.98
03-21-92	8.37	06-24-92	6.26				
Well No. 87 (location, N19 E30 27ADDA1; altitude of land surface, 3,910.22 feet)							
02-18-88	9.30	05-27-92	11.92	08-05-92	12.17	09-28-92	12.55
01-08-92	11.88	06-11-92	11.94	09-11-92	12.43	11-27-92	12.84
04-06-92	11.94*X*	07-01-92	11.89	09-12-92	12.42		

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 88 (location, N19 E30 31BBAD1; altitude of land surface, 3,930 feet)							
06-06-87	4.80	03-21-92	5.32	06-24-92	5.49	09-12-92	5.79
01-08-92	5.15	04-04-92	5.38	07-08-92	5.50	10-10-92	6.01
01-25-92	5.19	04-18-92	5.41	07-22-92	5.22	10-24-92	6.11
02-08-92	5.22	04-30-92	5.33	08-04-92	5.23	11-07-92	6.19
02-22-92	5.27	05-27-92	5.35	08-17-92	5.54	11-27-92	6.30
03-07-92	5.27	06-10-92	5.39	08-29-92	5.67		
Well No. 89 (location, N19 E30 33ABAB1; altitude of land surface, 3,917.13 feet)							
08-15-84	8.67	08-30-84	11.60	05-01-85	10.24	06-09-92	0.95
08-16-84	8.68	02-25-85	8.86	06-25-85	9.99	07-01-92	1.04
08-20-84	8.69	02-26-85	9.65	10-28-85	9.73	08-04-92	1.15
08-21-84	8.68	02-27-85	11.18	04-09-92	0.74	11-28-92	0.70
08-24-84	12.50	04-10-85	10.67	05-27-92	0.91		
Well No. 90 (location, N19 E30 33ABAB2; altitude of land surface, 3,917.36 feet)							
07-11-84	10.46	08-24-84	18.45	05-01-85	8.78	05-27-92	9.40
08-09-84	11.01	08-30-84	15.25	06-25-85	9.15	06-09-92	9.54
08-15-84	9.87	02-25-85	8.90	10-28-85	7.54	07-01-92	9.58
08-16-84	9.75	02-26-85	8.89	07-22-86	9.18	08-04-92	9.84
08-20-84	9.50	02-27-85	17.40	01-07-92	9.44	09-12-92	9.93
08-21-84	9.46	04-10-85	8.76	04-09-92	9.38	11-28-92	9.87
Well No. 91 (location, N19 E30 33ADD 1; altitude of land surface, 3,914.84 feet)							
08-15-84	7.23	02-25-85	7.72	06-25-85	5.33	05-27-92	8.67
08-16-84	7.24	02-26-85	7.70	10-28-85	7.92	07-01-92	8.72
08-20-84	7.26	02-27-85	7.72	07-22-86	7.70	08-04-92	8.81
08-21-84	7.26	02-28-85	8.72	01-22-92	8.84	09-12-92	8.86
08-24-84	7.27	04-10-85	7.63	04-07-92	8.75	11-28-92	8.96
08-30-84	7.29	05-01-85	7.60				
Well No. 92 (location, N19 E30 34BAA 1; altitude of land surface, 3,914.19 feet)							
08-15-84	7.58	04-10-85	7.93	03-07-92	9.22	07-22-92	9.27
08-16-84	7.59	05-01-85	7.87	03-21-92	9.18	08-04-92	9.30
08-20-84	7.59	06-25-85	7.89	04-04-92	9.16	08-17-92	9.34
08-21-84	7.60	10-28-85	8.23	04-18-92	9.15	08-29-92	9.35
08-24-84	7.58	07-22-86	8.09	04-30-92	9.11	09-12-92	9.37
08-30-84	7.58	01-07-92	9.30	05-27-92	9.12	10-10-92	9.42
02-25-85	8.01	01-25-92	9.29	06-10-92	9.16	10-24-92	9.39
02-26-85	8.00	02-08-92	9.30	06-24-92	9.16	11-07-92	9.39
02-27-85	8.01	02-22-92	9.31	07-08-92	9.24	11-28-92	9.42

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 93 (location, N19 E30 34BAA 2; altitude of land surface, 3,914.18 feet)							
08-15-84	8.15	04-10-85	7.89	03-07-92	9.20	07-22-92	9.23
08-16-84	7.54	05-01-85	7.82	03-21-92	9.15	08-04-92	9.27
08-20-84	7.53	06-25-85	7.90	04-04-92	9.12	08-17-92	9.31
08-21-84	7.57	10-28-85	8.21	04-18-92	9.13	08-29-92	9.31
08-24-84	7.54	07-22-86	8.14	04-30-92	9.08	09-12-92	9.34
08-30-84	7.53	01-07-92	9.28	05-27-92	9.10	10-10-92	9.38
02-25-85	7.98	01-25-92	9.26	06-10-92	9.13	10-24-92	9.36
02-26-85	7.94	02-08-92	9.27	06-24-92	9.13	11-07-92	9.36
02-27-85	8.00	02-22-92	9.28	07-08-92	9.21	11-24-92	9.39
Well No. 94 (location, N19 E30 35CBD 1; altitude of land surface, 3,915.60 feet)							
02-05-76	9.29	09-16-76	9.42	06-27-77	9.37	08-07-78	9.78
02-19-76	9.29	10-27-76	9.40	07-13-77	9.40	09-13-78	9.80
03-10-76	9.27	11-12-76	9.35	07-26-77	9.49	03-17-80	9.95*Z*
03-23-76	9.30	11-30-76	9.40	08-10-77	9.54	07-17-80	9.98*Z*
04-07-76	9.27	12-16-76	9.39	08-22-77	9.54	08-20-80	10.04*Z*
04-22-76	9.32	01-05-77	9.40	09-09-77	9.60	04-07-81	9.83
05-07-76	9.30	01-25-77	9.46	09-30-77	9.63	08-10-81	9.97
05-19-76	9.28	02-16-77	9.49	10-25-77	9.63	03-25-92	10.04
06-02-76	9.32	03-14-77	9.48	12-07-77	9.57	04-09-92	10.03
06-15-76	9.34	03-28-77	9.50	12-28-77	9.58	04-24-92	10.05
07-07-76	9.34	04-19-77	9.48	02-02-78	9.65	07-01-92	9.88
07-29-76	9.39	05-05-77	9.42	04-14-78	9.61	08-05-92	9.92
08-12-76	9.40	05-19-77	9.46	05-26-78	9.59	09-24-92	9.89
09-01-76	9.42	06-01-77	9.41	07-07-78	9.71	11-28-92	9.88
Well No. 95 (location, N19 E31 11; altitude of land surface, 3,940 feet)							
05-06-92	41.09	11-16-92	37.55				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 98[C] (location, N20 E28 21DDDC1; altitude of land surface, 3,956.68 feet)							
10-12-74	4.55	12-14-78	4.77	03-31-80	4.37	02-04-84	1.65
12-16-74	4.40	02-01-79	4.53	05-17-80	4.51	04-20-84	1.50
07-18-75	4.44	04-10-79	4.47	10-15-80	3.96	02-25-92	3.58
12-18-75	4.34	04-13-79	4.52	03-17-81	4.03	04-06-92	3.54
07-17-76	4.56	06-16-79	4.75	08-21-81	4.86	05-22-92	3.74
12-14-76	4.32	07-19-79	4.91	03-17-82	4.28	06-30-92	3.96
07-12-77	4.26	08-27-79	4.86	05-19-82	4.45	08-03-92	4.09
12-08-77	4.71	10-10-79	4.95	07-22-83	1.70	09-11-92	4.18
07-11-78	4.77	10-12-79	4.89	10-21-83	1.62	11-27-92	4.27
08-23-78	5.02	12-13-79	4.75				
Well No. 99[C] (location, N20 E28 21DDDC2; altitude of land surface, 3,956.68 feet)							
10-12-74	5.72	12-14-78	5.73	03-31-80	5.25	02-04-84	2.40
12-16-74	5.43	02-01-79	5.45	05-17-80	5.36	04-20-84	3.21
07-18-75	5.56	04-10-79	5.31	10-15-80	5.01	02-25-92	4.38
12-18-75	5.38	04-13-79	5.37	03-17-81	4.88	04-06-92	4.40
07-17-76	5.47	06-16-79	5.60	08-21-81	5.54	05-22-92	4.67
12-14-76	5.28	07-19-79	5.81	03-17-82	5.24	06-30-92	4.91
07-12-77	4.78	08-27-79	5.84	05-19-82	5.28	08-03-92	5.12
12-08-77	5.66	10-10-79	5.83	07-22-83	3.71	09-11-92	5.02
07-11-78	5.67	10-12-79	5.84	10-21-83	3.35	11-27-92	5.08
08-23-78	5.88	12-13-79	5.73				
Well No. 100[C] (location, N20 E28 22BCA 1; altitude of land surface, 3,974.41 feet)							
11-14-72	30.47	05-19-76	31.20	07-28-77	30.70	08-21-81	30.91
12-15-72	30.40	06-02-76	30.61	08-11-77	30.79	03-17-82	30.60
05-06-73	30.19	06-16-76	30.62	08-25-77	30.76	05-19-82	30.67
05-15-73	30.40	07-07-76	30.72	09-09-77	30.89	04-20-83	29.76
12-17-73	30.47	07-23-76	30.80	09-28-77	30.90	07-22-83	29.63
02-26-74	30.39	08-11-76	30.77	10-27-77	30.84	10-21-83	29.45
06-08-74	30.55	08-31-76	30.82	12-05-77	30.85	02-04-84	29.06
10-01-74	30.90	09-17-76	30.80	12-30-77	30.71	04-20-84	29.59
10-02-74	30.86	10-07-76	30.76	02-03-78	30.71	05-17-84	29.24
10-03-74	30.89	10-26-76	30.75	04-11-78	30.57	07-12-84	29.48
10-04-74	30.89	11-11-76	30.67	05-31-78	30.64	08-26-84	29.68
10-10-74	30.88	11-29-76	30.70	07-03-78	30.79	03-18-86	29.95
12-18-74	30.70	12-15-76	30.65	07-12-78	30.82	10-17-86	30.06
01-11-75	30.68	01-03-77	30.15	08-09-78	30.98	02-04-87	29.93
07-18-75	30.72	01-26-77	30.55	08-23-78	30.99	06-11-87	29.98
09-05-75	30.92	02-23-77	30.47	09-13-78	31.00	11-19-87	30.35
12-18-75	30.74	03-14-77	30.50	10-13-78	31.00	02-25-92	30.18
02-06-76	30.58	03-31-77	30.50	12-14-78	30.86	04-06-92	30.15
02-20-76	30.57	04-18-77	30.54*Z*	02-01-79	30.64	05-22-92	30.28
03-11-76	30.52	05-02-77	30.52	06-16-79	30.84	06-30-92	30.37
03-23-76	30.52	06-01-77	30.52	07-19-79	30.92	08-03-92	30.49
04-07-76	30.52	06-16-77	30.52	12-14-79	30.89	09-11-92	30.60
04-26-76	30.58	06-28-77	30.54	10-16-80	30.58	11-27-92	30.70
05-03-76	30.53	07-12-77	30.56	03-17-81	30.49		

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 101[C] (location, N20 E28 22BCA 2; altitude of land surface, 3,974.41 feet)							
10-03-74	31.52	09-17-76	31.66	10-27-77	31.60	04-20-83	31.09
10-04-74	31.90	10-07-76	31.60	12-05-77	31.60	07-22-83	31.33
10-10-74	31.65	10-26-76	31.67	12-30-77	31.60	10-21-83	30.62
12-18-74	31.46	11-11-76	31.47	02-03-78	31.52	02-04-84	31.04
01-11-75	31.65	11-29-76	31.61	04-11-78	31.42	04-20-84	31.00
07-18-75	31.52	12-15-76	31.60	05-31-78	31.42	05-17-84	30.57
09-05-75	31.66	01-03-77	31.49	07-03-78	31.54	07-12-84	30.88
12-18-75	31.47	01-26-77	31.46	07-12-78	31.56	08-26-84	30.63
02-06-76	31.52	02-23-77	31.35	08-09-78	31.64	03-18-86	30.61
02-20-76	31.59	03-14-77	31.43	08-23-78	31.65	10-17-86	30.81
03-11-76	31.50	03-31-77	31.33	09-13-78	31.65	02-04-87	30.81
03-23-76	31.43	04-18-77	31.39	10-13-78	31.81	06-11-87	30.68
04-07-76	31.38	05-02-77	31.32	12-14-78	31.61	11-19-87	31.02
04-26-76	31.33	06-01-77	31.35	02-01-79	31.60	02-25-92	30.97
05-03-76	31.30	06-16-77	31.33	06-16-79	31.38	04-06-92	30.97
05-19-76	31.42	06-28-77	31.41	07-19-79	31.47	05-22-92	30.96
06-02-76	31.35	07-12-77	31.33	12-14-79	31.61	06-05-92	30.96
06-16-76	31.40	07-28-77	31.47	10-16-80	31.48	06-30-92	30.99
07-07-76	31.52	08-11-77	31.55	03-17-81	31.53	08-03-92	31.08
07-23-76	31.65	08-25-77	31.52	08-21-81	31.52	09-11-92	31.24
08-11-76	31.55	09-09-77	31.56	03-17-82	31.36	11-27-92	31.24
08-31-76	31.59	09-28-77	31.57	05-19-82	31.43		
Well No. 102[C] (location, N20 E28 24BDD 1; altitude of land surface, 3,962.50 feet)							
04-11-73	27.69	07-23-76	28.20	06-16-77	27.99	09-13-78	28.37
05-18-73	28.39	08-11-76	28.22	06-30-77	28.01	12-14-78	28.24
12-18-73	29.96	08-31-76	28.27	07-12-77	28.05	07-20-79	28.18
06-08-74	27.90	09-17-76	28.26	07-28-77	28.13	12-13-79	28.26
12-18-74	28.20	10-07-76	27.67	08-11-77	28.19	10-15-80	28.09
07-18-75	28.02	10-26-76	28.23	08-23-77	28.18	08-22-81	28.35
12-19-75	28.16	11-11-76	28.17	09-09-77	28.27	07-20-83	27.24
02-06-76	28.04	11-29-76	28.18	09-27-77	28.31	03-19-86	27.65
02-19-76	28.06	12-15-76	28.15	10-26-77	28.34	06-11-87	27.78
03-11-76	28.07	01-03-77	28.07	12-05-77	28.36	01-27-92	28.69
03-23-76	28.07	01-26-77	28.08	12-08-77	28.36	02-26-92	28.46
04-07-76	28.06	02-17-77	28.08	12-30-77	28.26	04-08-92	28.39
04-26-76	28.09	03-14-77	28.02	02-03-78	28.26	05-22-92	28.39
05-07-76	28.08	03-30-77	28.01	04-04-78	28.08	06-05-92	28.42
05-19-76	28.07	04-18-77	28.05	05-31-78	28.09	06-30-92	28.49
06-02-76	28.08	05-03-77	27.99	07-04-78	28.18	08-04-92	28.66
06-16-76	28.08	05-24-77	28.05	07-12-78	28.15	09-11-92	28.94
07-07-76	28.15	06-02-77	28.00	08-09-78	28.29	11-27-92	29.10
07-17-76	28.15						

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 103[C] (location, N20 E28 24BDD 2; altitude of land surface, 3,962.50 feet)							
12-04-74	30.07	07-23-76	29.84	05-24-77	29.68	05-31-78	29.67
01-31-75	29.75	08-11-76	29.83	06-02-77	29.63	07-04-78	29.73
07-18-75	29.78	08-31-76	29.88	06-16-77	29.65	07-12-78	29.80
09-05-75	30.13	09-17-76	29.88	06-30-77	29.65	08-09-78	29.81
12-19-75	29.82	10-07-76	29.86	07-12-77	29.64	09-13-78	29.88
02-06-76	29.80	10-26-76	29.84	07-28-77	29.72	12-14-78	30.74
02-19-76	29.79	11-11-76	29.79	08-11-77	29.77	07-20-79	29.58
03-11-76	29.78	11-29-76	29.82	08-23-77	29.74	01-27-92	--O
03-23-76	29.74	12-15-76	29.80	09-09-77	29.82	02-26-92	--O
04-07-76	29.69	01-03-77	29.78	09-27-77	29.84	04-08-92	29.48
04-26-76	29.72	01-26-77	29.76	10-26-77	29.84	04-14-92	--O
05-07-76	29.70	02-17-77	29.73	12-05-77	29.85	06-05-92	--O
06-02-76	29.71	03-14-77	29.71	12-08-77	29.93	06-30-92	29.62
06-16-76	29.75	03-30-77	29.70	12-30-77	29.83	08-04-92	29.67
07-07-76	29.78	04-18-77	29.69	02-03-78	29.80	09-11-92	29.65
07-17-76	29.86	05-03-77	29.65	04-04-78	29.73	11-27-92	29.72
Well No. 104[C] (location, N20 E28 32AAD 1; altitude of land surface, 3,977.04 feet)							
12-15-72	8.05	07-11-78	10.51	02-07-80	10.03	02-01-85	9.10
03-02-73	8.01	08-24-78	10.60	03-31-80	9.81	03-18-86	9.13
05-15-73	9.10	10-13-78	10.60	05-17-80	10.06	10-17-86	8.34
12-04-73	9.30	02-01-79	9.90	10-15-80	9.07	02-04-87	8.43
03-06-74	8.63	03-13-79	10.08	03-17-81	9.35	06-11-87	8.67
06-08-74	9.51	04-10-79	10.07	08-21-81	10.27	11-18-87	9.47
10-04-74	9.82	05-22-79	8.01	03-17-82	9.55	02-25-92	8.05
12-17-74	9.61	06-16-79	10.28	05-19-82	9.90	04-06-92	8.03
07-18-75	9.63	07-19-79	10.36	11-17-82	8.06	05-22-92	8.24
12-18-75	9.00	08-27-79	10.43	10-21-83	7.15	06-30-92	8.53
07-18-76	9.84	10-10-79	10.56	02-04-84	7.06	08-03-92	8.40
01-24-77	9.55	10-12-79	10.43	04-17-84	7.14	09-11-92	8.95
07-14-77	10.01	12-10-79	10.14	08-26-84	7.99	11-27-92	9.05
12-08-77	10.33	12-12-79	8.83				
Well No. 105[C] (location, N20 E28 32AADA2; altitude of land surface, 3,977.04 feet)							
10-04-74	9.53	04-10-79	9.95	03-17-81	9.16	10-17-86	8.16
12-18-75	8.40	05-22-79	9.71	08-21-81	10.15	02-04-87	8.31
07-18-76	9.74	06-16-79	10.17	03-17-82	9.79	06-11-87	8.53
01-24-77	9.45	07-19-79	10.29	05-19-82	9.71	11-18-87	9.24
07-14-77	9.91	08-27-79	10.28	11-17-82	8.12	02-25-92	7.87
12-08-77	10.22	10-10-79	10.38	10-21-83	7.01	04-06-92	7.79
07-11-78	10.24	10-12-79	10.34	02-04-84	7.15	05-22-92	8.05
08-24-78	10.46	12-10-79	9.98	04-17-84	7.11	06-30-92	8.32
10-13-78	10.44	02-07-80	9.95	08-26-84	7.58	08-03-92	8.20
12-12-78	10.01	03-31-80	9.75	02-01-85	7.99	09-11-92	8.84
02-01-79	9.77	05-17-80	9.92	03-18-86	8.81	11-27-92	9.50
03-13-79	9.98	10-15-80	8.96				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 106[C] (location, N20 E28 32CAD 1; altitude of land surface, 3,990.37 feet)							
05-14-73	16.89	12-08-77	18.34	08-21-81	18.14	02-04-87	16.82
12-18-73	17.25	07-11-78	18.28	03-17-82	19.34	06-11-87	16.91
03-06-74	17.26	08-24-78	18.35	05-19-82	19.27	11-18-87	17.27
06-08-74	17.31	10-13-78	18.35	07-22-83	16.34	02-25-92	17.68
10-04-74	17.50	12-15-78	18.24	10-21-83	16.29	04-06-92	17.69
12-17-74	17.55	06-16-79	18.14	02-04-84	16.32	05-22-92	17.87
07-18-75	17.56	07-19-79	17.57	04-17-84	16.30	06-30-92	18.23
12-18-75	17.45	12-14-79	17.98	08-26-84	16.61	08-03-92	18.36
07-18-76	17.70	10-15-80	17.65	02-01-85	16.81	09-11-92	18.99
07-12-77	17.96	03-17-81	17.92	03-20-86	17.17	11-27-92	19.13
Well No. 107[C] (location, N20 E28 32CADA2; altitude of land surface, 3,990.37 feet)							
10-04-74	10.74	12-15-78	11.14	07-22-83	9.73	11-18-87	9.94
07-18-75	10.86	06-16-79	11.27	10-21-83	9.65	02-25-92	10.37
12-18-75	10.51	07-19-79	10.62	02-04-84	9.40	04-06-92	11.13
07-18-76	10.66	12-14-79	11.15	04-17-84	9.37	05-22-92	11.19
07-12-77	10.88	10-15-80	10.39	08-26-84	9.81	06-30-92	--O
12-08-77	11.17	03-17-81	9.98	02-01-85	9.43	08-03-92	--O
07-11-78	11.17	08-21-81	10.33	03-20-86	9.47	09-11-92	--O
08-24-78	11.32	03-17-82	10.13	02-04-87	9.34	11-27-92	--O
10-13-78	11.31	05-19-82	10.24	06-11-87	9.46		
Well No. 108[C] (location, N20 E29 08BDC 1; altitude of land surface, 3,907.22 feet)							
02-01-75	-0.85	06-16-76	-1.11	03-30-77	-1.30	02-03-78	-1.00
03-20-75	-1.30	07-07-76	-1.11	04-18-77	-1.30	04-11-78	-1.47
07-21-75	-1.38	07-23-76	-1.12	05-03-77	-1.31	05-31-78	--F
09-08-75	-.88	08-11-76	-1.15	06-02-77	-1.39	07-04-78	--F
12-16-75	-.73	08-31-76	-1.19	06-16-77	--F	08-09-78	--F
01-26-76	-.77	09-17-76	-1.23	06-30-77	--F	09-13-78	--F
02-06-76	-.83	10-07-76	-1.27	07-12-77	--F	10-11-78	-1.48
02-19-76	-.86	10-26-76	-1.36	07-28-77	--F	12-13-78	-1.41
03-11-76	-.97	11-11-76	-1.40	08-11-77	-1.50	01-27-92	--F
03-23-76	-.96	11-29-76	-1.41	08-23-77	-1.50	04-08-92	--F
04-07-76	-.98	12-15-76	-1.39	09-09-77	-1.50	05-22-92	--F
04-26-76	-1.01	01-03-77	-1.34	09-27-77	-1.46	06-30-92	--F
05-07-76	-1.03	01-26-77	-1.29	10-26-77	-1.32	08-04-92	--F
05-20-76	-1.04	02-17-77	-1.26	12-05-77	-1.13	09-11-92	--F
06-02-76	-1.08	03-14-77	-1.28	12-30-77	-1.00	11-27-92	--F

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 109[C] (location, N20 E29 08BDC 2; altitude of land surface, 3,907.22 feet)							
12-16-75	7.84	11-11-76	4.72	02-03-78	4.80	03-16-82	4.51
12-17-75	7.63	11-29-76	5.16	04-11-78	2.49	05-18-82	6.61
12-19-75	7.53	12-15-76	5.53	05-31-78	3.01	11-18-82	5.13
01-26-76	7.26	01-03-77	5.86	07-04-78	3.54	04-19-83	3.21
02-06-76	6.94	01-26-77	5.90	08-09-78	4.34	07-19-83	3.73
02-19-76	6.76	02-17-77	5.70	09-13-78	5.50	02-01-84	3.23
03-11-76	6.47	03-14-77	5.57	10-11-78	5.69	04-18-84	3.82
03-23-76	6.36	03-30-77	5.73	12-13-78	5.41	05-16-84	3.99
04-07-76	6.34	04-18-77	5.95	03-14-79	3.94	07-10-84	4.24
04-26-76	6.46	05-03-77	6.05	04-11-79	3.78	08-23-84	4.57
05-07-76	6.34	06-02-77	4.63	05-23-79	3.72	01-30-85	4.90
05-20-76	6.24	06-16-77	3.60	06-16-79	3.95	06-13-85	4.34
06-02-76	6.22	06-30-77	3.16	07-19-79	4.57	03-19-86	4.68
06-16-76	6.08	07-12-77	3.44	08-29-79	4.06	06-11-87	4.72
07-07-76	5.83	07-28-77	3.74	10-11-79	4.82	01-27-92	5.88
07-16-76	5.80	08-11-77	4.08	12-11-79	6.15	02-26-92	5.56
07-23-76	5.64	08-23-77	4.35	02-08-80	4.39	04-08-92	4.92
08-11-76	4.99	09-09-77	4.95	04-01-80	3.83	05-22-92	5.12
08-31-76	5.01	09-27-77	5.59	05-18-80	3.48	06-30-92	5.96
09-17-76	4.96	10-26-77	6.36	10-15-80	5.11	08-04-92	5.42
10-07-76	4.00	12-05-77	7.13	03-17-81	5.26	09-11-92	5.28
10-26-76	4.41	12-30-77	5.10	08-23-81	5.77	11-27-92	6.67
Well No. 110 (location, N20 E29 22CBAC1; altitude of land surface, 3,914.02S feet)							
06-05-87	5.00	02-08-92	6.05	05-27-92	6.92	08-29-92	8.07
11-06-87	5.50	02-22-92	5.94	06-10-92	7.28	09-12-92	8.19
11-20-87	5.50	03-07-92	5.87	06-24-92	7.49	10-10-92	8.35
11-27-87	5.60	03-21-92	5.88	07-08-92	7.72	10-23-92	8.36
02-21-88	5.50	04-04-92	5.91	07-22-92	7.35	11-07-92	8.26
04-06-88	5.40	04-18-92	5.64	08-04-92	7.73	11-27-92	8.20
01-17-92	6.03	04-30-92	6.34	08-17-92	7.94		
Well No. 111 (location, N20 E30 33CBCC1; altitude of land surface, 3,903.56S feet)							
10-09-85	12.60	05-27-92	14.83	07-01-92	14.94	09-30-92	15.04
04-24-92	14.83	06-11-92	14.90	08-05-92	15.01	11-28-92	14.99
Well No. 112 (location, N20 E30 35DBDD1; altitude of land surface, 3,891 feet)							
05-14-92	8.96	06-03-92	9.68	08-05-92	9.17	11-28-92	10.28
05-27-92	9.69	07-01-92	9.41	09-15-92	9.71		
Well No. 113 (location, N20 E30 35DBDD2; altitude of land surface, 3,891 feet)							
09- -90	5.58	07-01-92	6.69	09-15-92	7.28	11-28-92	7.73
06-03-92	6.65	08-05-92	6.87				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 114 (location, N20 E30 35DBDD3; altitude of land surface, 3,891 feet)							
09- -90	-7.38	07-01-92	--F	09-15-92	--F	11-28-92	--F
06-03-92	--F	07-07-92	-4.84				
Well No. 115 (location, N20 E30 35DBDD4; altitude of land surface, 3,891 feet)							
09- -90	-8.20	07-01-92	--F	08-05-92	-7.98	11-28-92	--F
06-03-92	--F	07-07-92	-8.17	09-15-92	--F		
Well No. 116 (location, N20 E31 04CADD1; altitude of land surface, 3,874.74 feet)							
12-02-88	7.37	12-15-88	6.43	09-14-89	5.22	01-31-92	9.87
12-05-88	6.53	04-04-89	5.70	12-01-89	3.35	04-08-92	9.91
12-06-88	6.48	06-15-89	6.12				
Well No. 117 (location, N20 E31 07BDCA1; altitude of land surface, 3,884.81 feet)							
11-29-88	12.71	04-04-89	12.15	01-31-92	13.11	08-05-92	14.70
12-05-88	12.49	06-14-89	12.24	04-08-92	13.17	09-11-92	15.02
12-06-88	12.44	09-14-89	12.86	05-27-92	13.76	11-27-92	15.19
12-15-88	12.39	12-01-89	11.84	07-01-92	14.18		
Well No. 118 (location, N20 E31 07CAAB1; altitude of land surface, 3,882.20 feet)							
11-29-88	10.48	04-04-89	9.63	01-31-92	10.55	08-05-92	12.37
12-05-88	10.05	06-14-89	9.70	04-08-92	10.65	09-11-92	12.77
12-06-88	9.98	09-14-89	10.25	05-27-92	11.28	11-27-92	12.91
12-14-88	9.90	12-01-89	9.07	07-01-92	11.81		
Well No. 119 (location, N20 E31 07DBBC1; altitude of land surface, 3,878.18 feet)							
11-30-88	11.37	04-04-89	8.20	12-01-89	7.28	05-27-92	9.91
12-05-88	8.76	06-14-89	8.20	01-31-92	9.50	07-01-92	10.63
12-14-88	8.60	09-14-89	8.61	04-08-92	9.35	08-05-92	--D
Well No. 120 (location, N20 E31 10ABCB1; altitude of land surface, 3,879.12 feet)							
12-01-88	10.78	04-26-89	10.62	01-31-92	13.74	08-05-92	14.45
12-06-88	10.71	06-15-89	10.57	04-06-92	13.95	09-15-92	14.63
12-15-88	10.75	09-14-89	10.76	05-27-92	14.11	11-27-92	14.90
04-03-89	10.27	12-01-89	10.00	07-01-92	14.26		
Well No. 121 (location, N20 E31 33CACB1; altitude of land surface, 3,890.44 feet)							
04-05-78	-1.02	05-27-92	--F	07-07-92	-7.35	08-06-92	-7.47
04-06-92	--F	07-01-92	--F				

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 122 (location, N20 E31 33CACB3; altitude of land surface, 3,890.44 feet)							
05-14-92	5.65	06-03-92	6.31	07-01-92	5.53	09-15-92	6.22
05-27-92	6.02	06-11-92	6.67	08-05-92	6.14	11-27-92	6.40
Well No. 123 (location, N20 E32 32; altitude of land surface, 3,936 feet)							
05-06-92	39.52	11-16-92	39.50				
Well No. 124[C] (location, N21 E28 24BBA 1; altitude of land surface, 3,903.36 feet)							
05-06-73	7.73	10-26-76	8.70	04-11-78	8.07	08-22-81	8.20
05-15-73	7.94	11-11-76	8.72	05-31-78	7.90	03-17-82	8.07
06-08-74	8.30	11-29-76	8.74	07-03-78	7.95	05-19-82	8.03
12-18-74	8.74	12-15-76	8.75	07-12-78	7.98	11-18-82	8.02
07-18-75	8.86	01-03-77	8.73	08-09-78	8.09	07-21-83	7.82
12-19-75	9.01	01-26-77	9.00	08-23-78	8.09	02-02-84	7.37
01-26-76	9.19	02-23-77	8.91	09-13-78	8.13	04-18-84	7.34
02-06-76	8.97	03-14-77	8.83	10-11-78	8.20	07-11-84	7.62
02-20-76	8.97	03-31-77	8.81	12-14-78	8.38	08-24-84	7.70
03-11-76	8.96	04-18-77	8.75	01-30-79	8.25	01-31-85	7.65
03-23-76	8.95	05-03-77	8.70	03-14-79	7.95	06-13-85	7.66
04-07-76	8.78	06-01-77	8.59	04-11-79	8.14	03-19-86	7.59
04-26-76	8.76	06-16-77	8.54	05-24-79	8.00	10-16-86	7.75
05-05-76	8.69	06-28-77	8.53	06-15-79	7.99	02-03-87	8.11
05-19-76	8.72	07-12-77	8.47	07-18-79	8.06	06-11-87	7.86
06-02-76	8.67	07-28-77	8.51	08-27-79	8.02	11-19-87	8.09
06-16-76	8.66	08-11-77	8.52	10-10-79	8.18	03-25-92	8.39
07-07-76	8.66	08-24-77	8.51	10-12-79	8.47	04-08-92	8.40
07-17-76	8.67	09-09-77	8.59	12-12-79	8.37	05-22-92	8.41
07-23-76	8.69	09-28-77	8.58	02-08-80	8.19	06-05-92	8.42
08-11-76	8.67	10-27-77	8.57	04-02-80	7.57	06-30-92	8.43
08-31-76	8.74	12-05-77	8.63	05-19-80	7.80	08-04-92	8.51
09-17-76	8.72	12-30-77	8.58	10-16-80	7.92	09-11-92	8.61
10-07-76	8.75	02-03-78	8.54	03-17-81	8.00	11-27-92	8.70

Appendix 3. Water levels in observation wells included in this investigation--Continued

Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)	Date measured	Water level (feet)
Well No. 125[c] (location, N21 E28 24BBA 3; altitude of land surface, 3,903.36 feet)							
12-19-75	9.30	01-03-77	9.30	08-09-78	9.23	11-18-82	9.19
01-26-76	9.29	01-26-77	9.33	09-13-78	9.25	07-21-83	9.23
02-06-76	9.30	02-23-77	9.32	10-11-78	9.27	02-02-84	9.14
02-20-76	9.27	03-31-77	9.26	12-14-78	9.24	04-18-84	9.08
03-11-76	9.29	04-18-77	9.30	01-30-79	9.24	07-11-84	9.73
03-23-76	9.29	05-03-77	9.25	03-14-79	9.24	08-24-84	9.07
04-07-76	9.28	06-01-77	9.26	04-11-79	9.21	01-31-85	8.87
04-26-76	9.30	06-16-77	9.26	05-24-79	9.23	06-13-85	9.05
05-05-76	9.26	06-28-77	9.25	06-15-79	9.22	03-19-86	9.02
05-19-76	9.28	07-12-77	9.26	07-18-79	9.27	10-16-86	9.05
06-02-76	9.27	07-28-77	9.28	08-27-79	9.24	02-03-87	9.10
06-16-76	9.29	08-11-77	9.27	10-10-79	9.26	06-11-87	9.10
07-07-76	9.32	08-24-77	9.25	10-12-79	9.22	11-19-87	9.11
07-23-76	9.31	09-09-77	9.28	12-12-79	9.24	03-25-92	9.47
08-11-76	9.27	09-28-77	9.27	02-08-80	9.27	04-08-92	9.44
08-31-76	9.32	10-27-77	9.23	04-02-80	9.44	05-22-92	9.44
09-17-76	9.28	12-05-77	9.29	05-19-80	9.35	06-05-92	9.46
10-07-76	9.40	12-30-77	9.30	10-16-80	9.12	06-30-92	9.46
10-26-76	9.30	02-03-78	9.31	03-17-81	9.20	08-04-92	9.00
11-11-76	9.29	04-11-78	9.25	08-22-81	9.26	09-11-92	9.56
11-29-76	9.30	05-31-78	9.21	03-17-82	9.31	11-27-92	9.51
12-15-76	9.28	07-03-78	9.22	05-19-82	9.27		

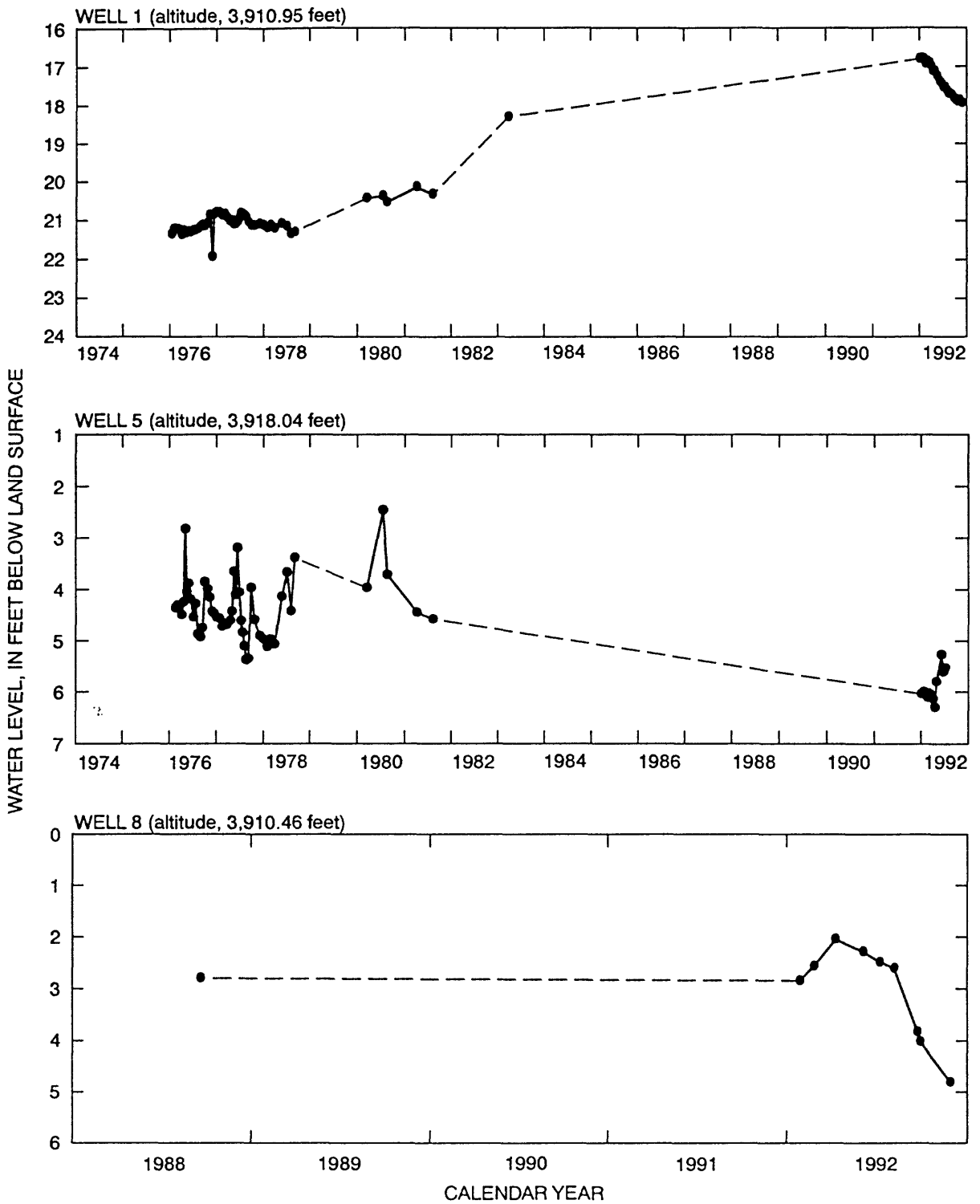
[a] Some water-level measurements from Steven Klausen, Naval Air Station, Fallon, written commun., 1992.

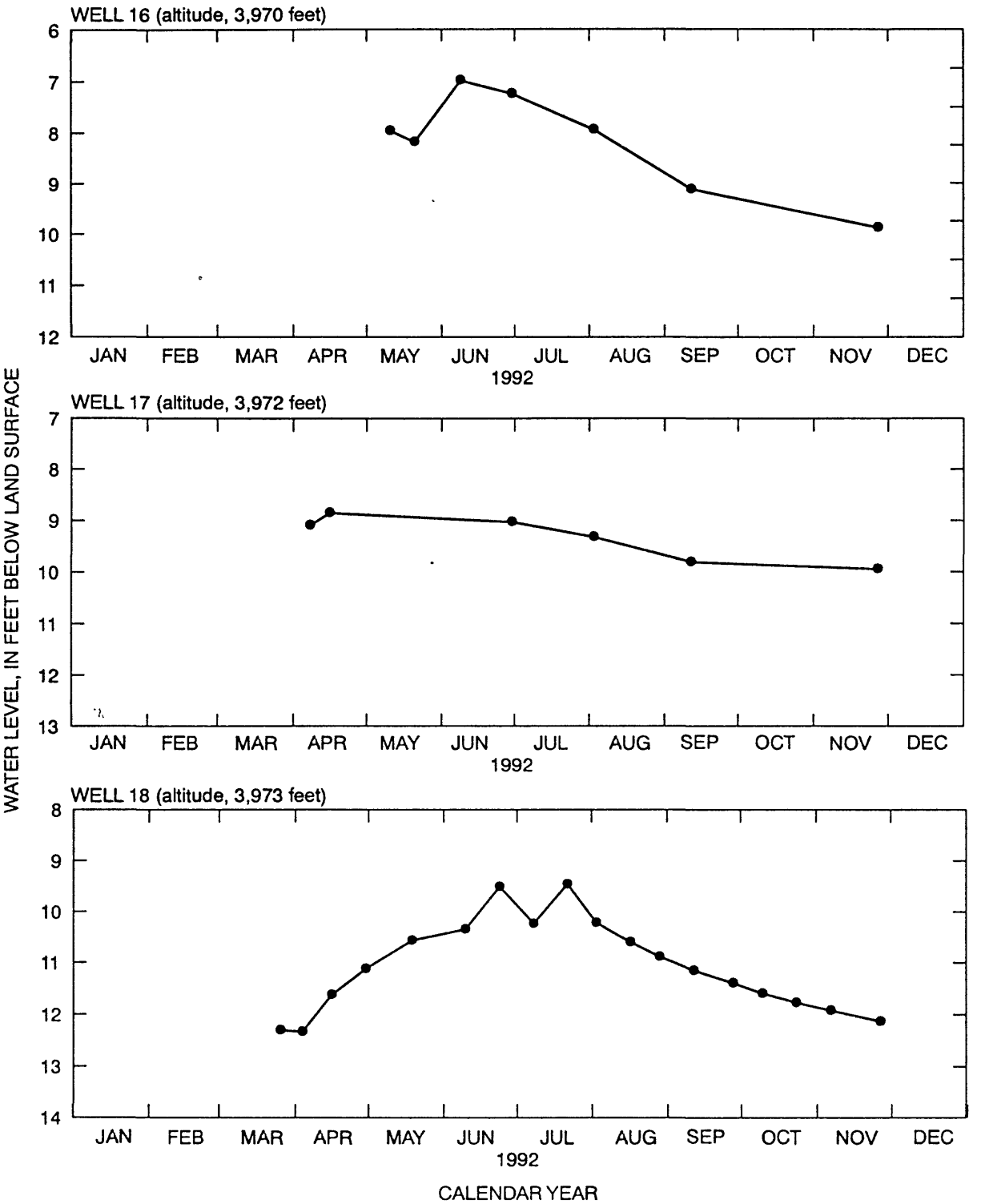
[b] Water-level measurements before 1992 from U.S. Bureau of Reclamation (1985).

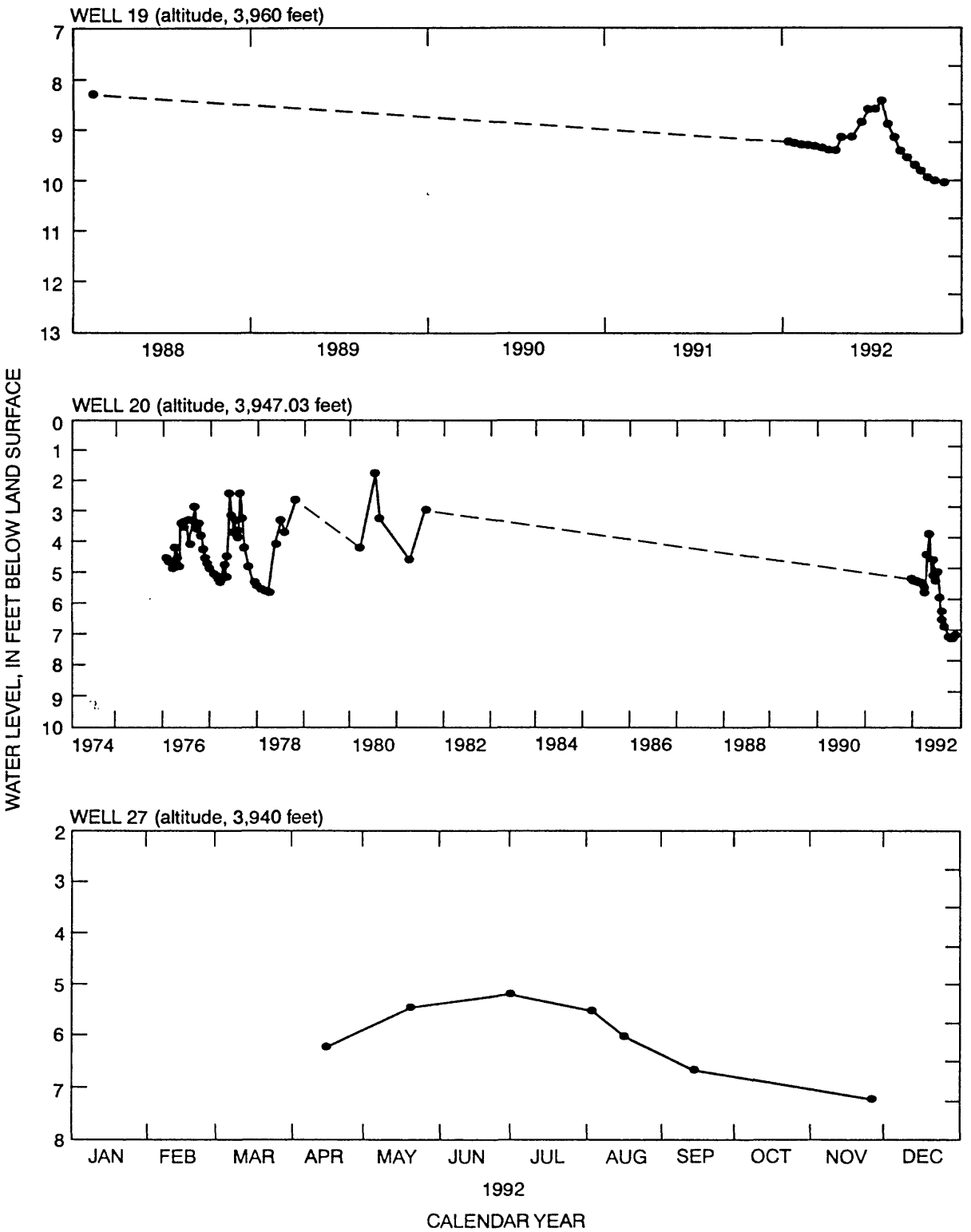
[c] Some water-level measurements from Frank H. Olmsted, U.S. Geological Survey, written commun., 1992.

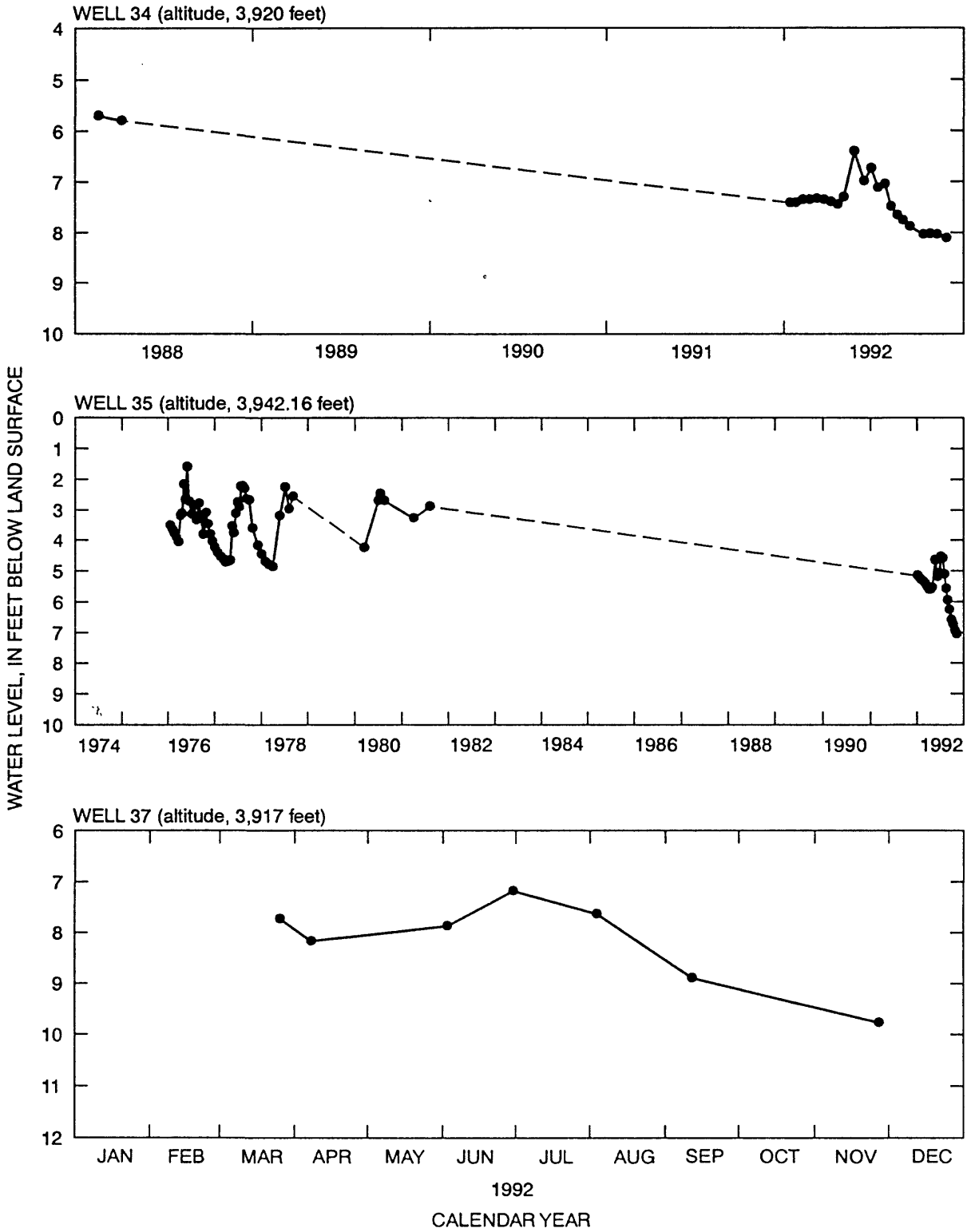
Appendix 4. Hydrographs of selected observation wells in the Fallon area

[The hydrographs included here were selected to show both seasonal changes and long-term trends in water levels. These variations depend on the amount of surface water delivered to the area. Items listed at upper left of each hydrograph: well number (plate 1; appendix 1), and land-surface altitude, in feet above sea level.]




WELL 16 (altitude, 3,970 feet)
6
7
8
9
10
11
12
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1992
WELL 17 (altitude, 3,972 feet)
7
8
9
10
11
12
13
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1992
WELL 18 (altitude, 3,973 feet)
8
9
10
11
12
13
14
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
CALENDAR YEAR


WELL 19 (altitude, 3,960 feet)
7
8
9
10
11
12
13
1988
1989
1990
1991
1992
WELL 20 (altitude, 3,947.03 feet)
0
1
2
3
4
5
6
7
8
9
10
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
WELL 27 (altitude, 3,940 feet)
2
3
4
5
6
7
8
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
CALENDAR YEAR


WELL 34 (altitude, 3,920 feet)
4
5
6
7
8
9
10
1988
1989
1990
1991
1992
WELL 35 (altitude, 3,942.16 feet)
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
WELL 37 (altitude, 3,917 feet)
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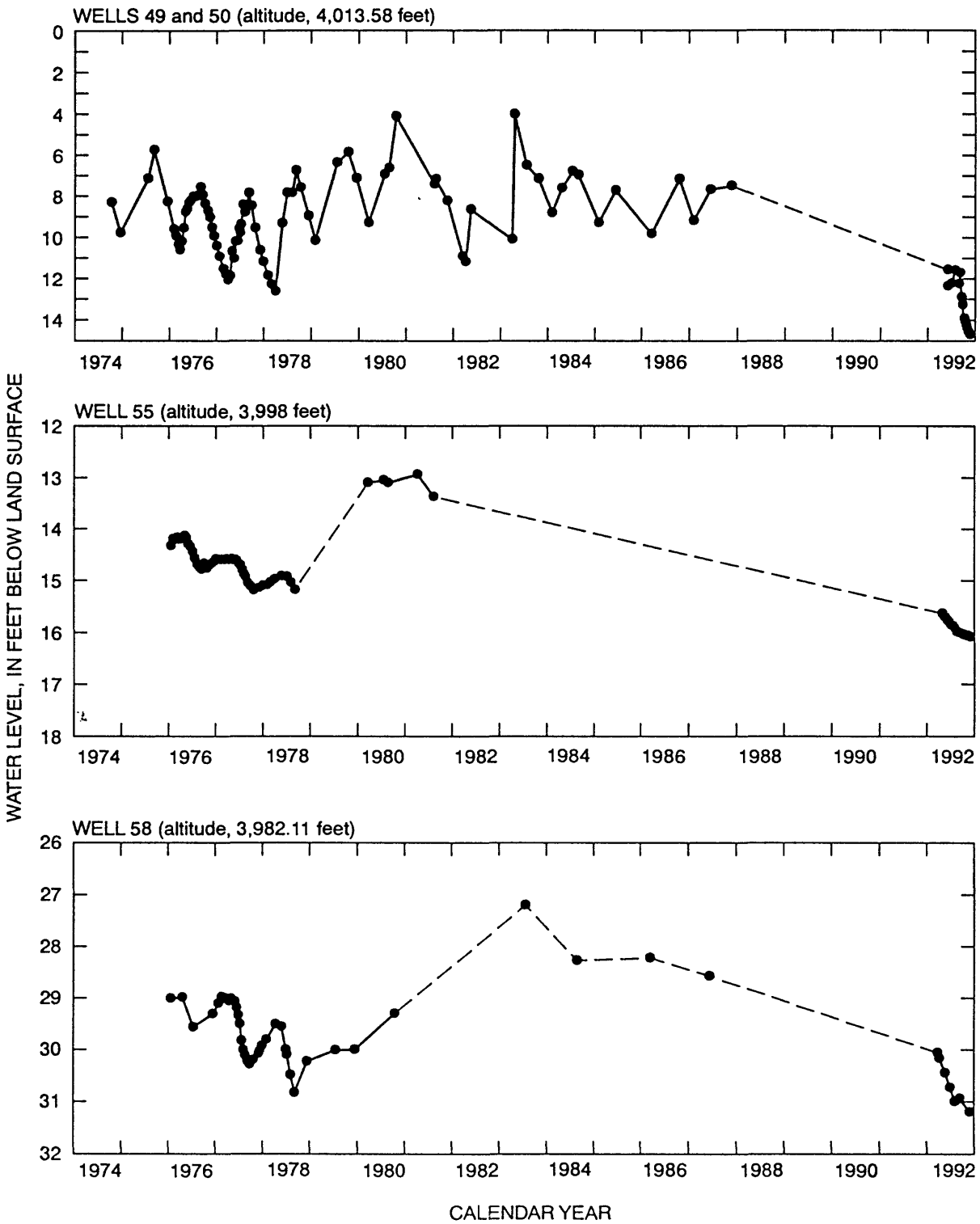
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
CALENDAR YEAR


WELLS 49 and 50 (altitude, 4,013.58 feet)
0
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12
14
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 55 (altitude, 3,998 feet)
12
13
14
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18
WELL 58 (altitude, 3,982.11 feet)
26
27
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29
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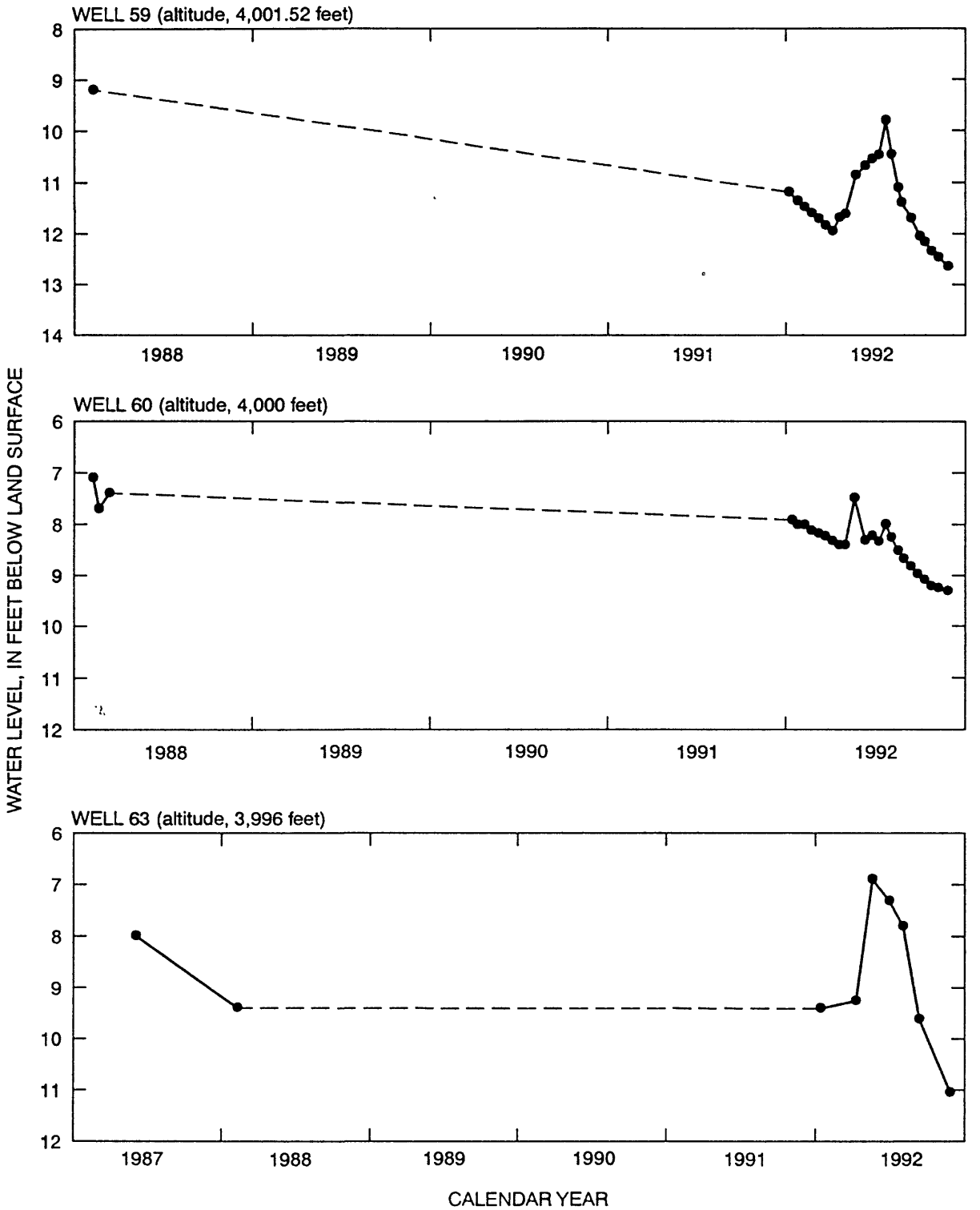
32
WATER LEVEL, IN FEET BELOW LAND SURFACE
CALENDAR YEAR


WELL 59 (altitude, 4,001.52 feet)
8
9
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12
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14
1988
1989
1990
1991
1992
WELL 60 (altitude, 4,000 feet)
6
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12
1988
1989
1990
1991
1992
WELL 63 (altitude, 3,996 feet)
6
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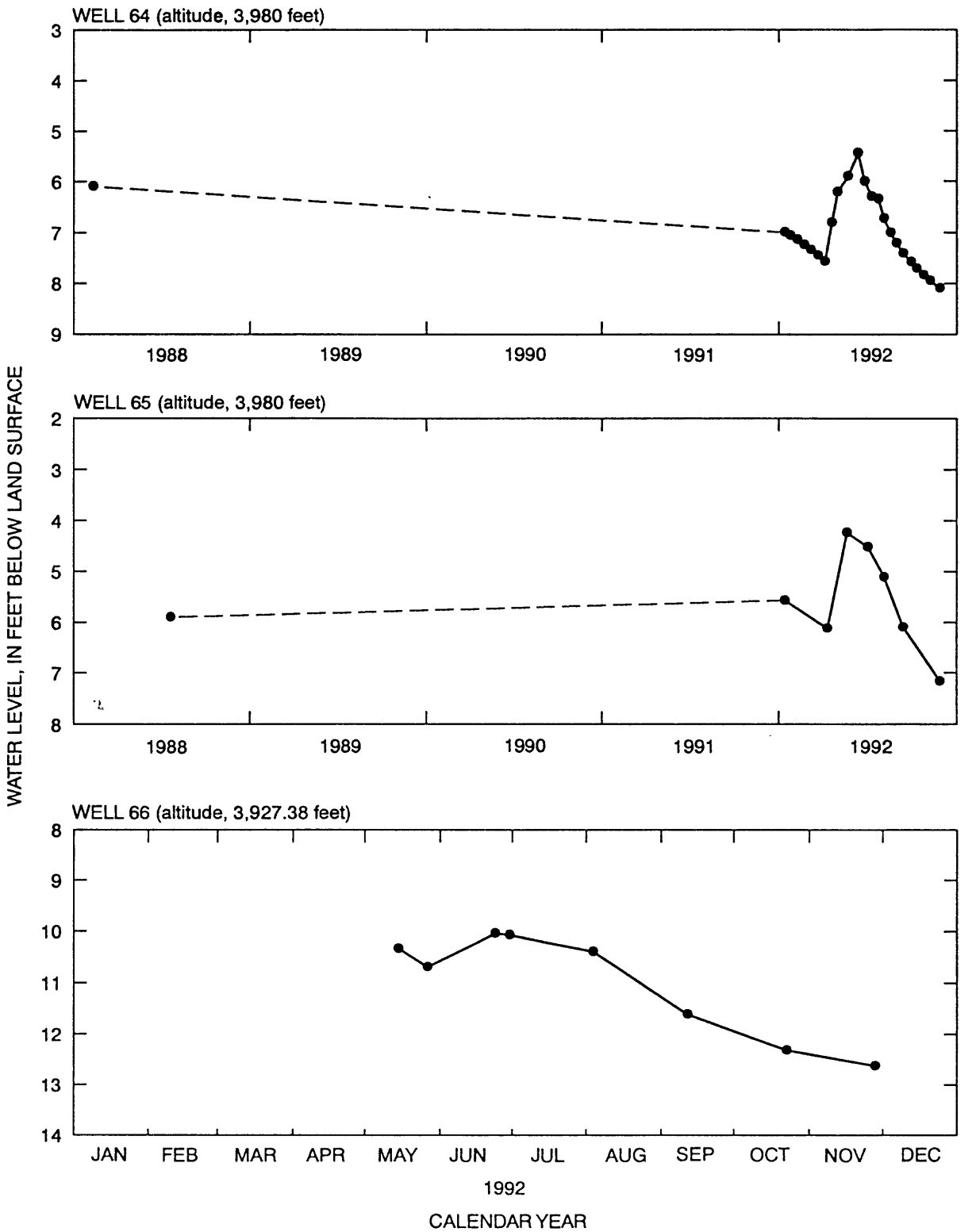
11
12
1987
1988
1989
1990
1991
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
CALENDAR YEAR


WELL 64 (altitude, 3,980 feet)
3
4
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1988
1989
1990
1991
1992
WELL 65 (altitude, 3,980 feet)
2
3
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1988
1989
1990
1991
1992
WELL 66 (altitude, 3,927.38 feet)
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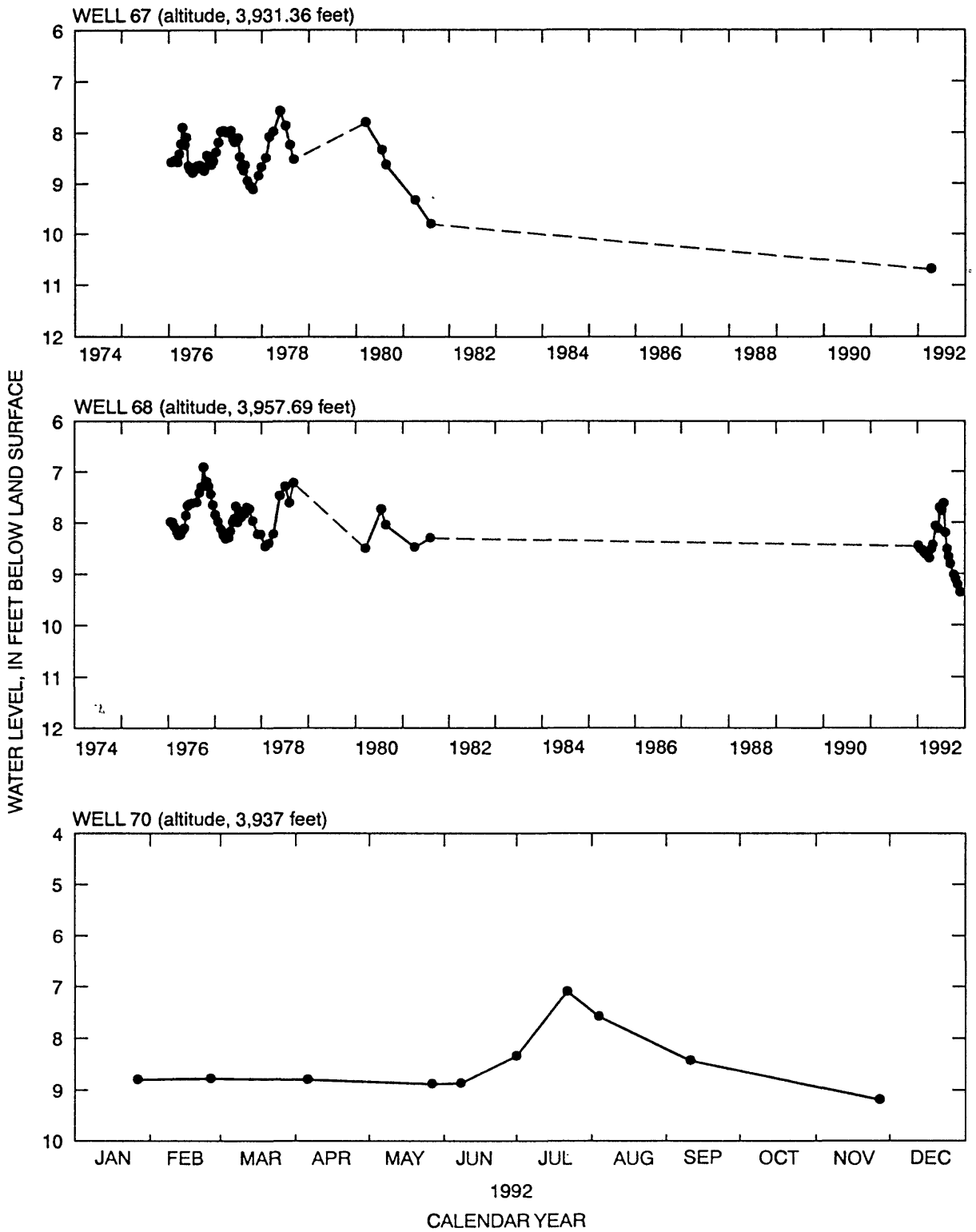
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 67 (altitude, 3,931.36 feet)
6
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 68 (altitude, 3,957.69 feet)
6
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 70 (altitude, 3,937 feet)
4
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8
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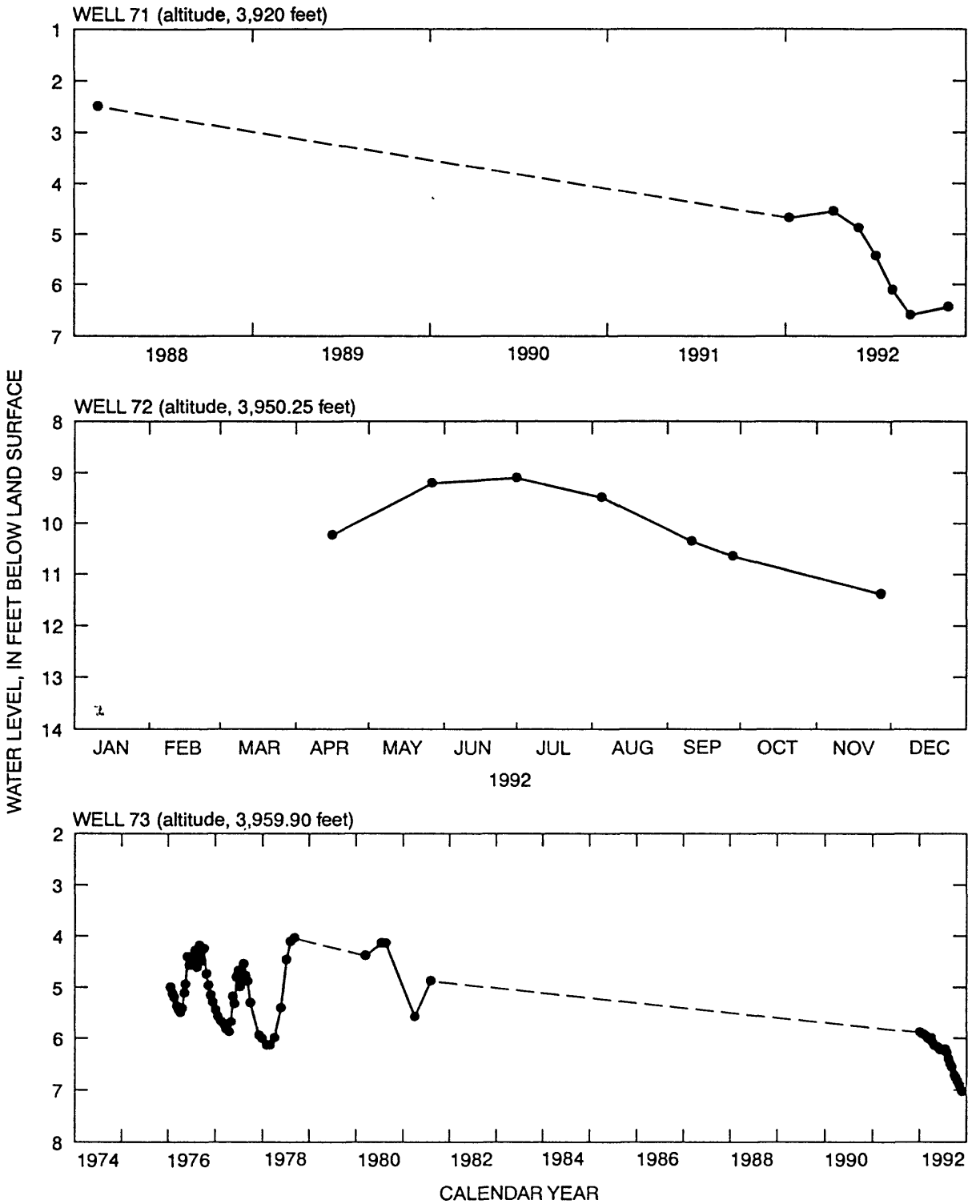
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 71 (altitude, 3,920 feet)
1
2
3
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5
6
7
1988
1989
1990
1991
1992
WELL 72 (altitude, 3,950.25 feet)
8
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JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
WELL 73 (altitude, 3,959.90 feet)
2
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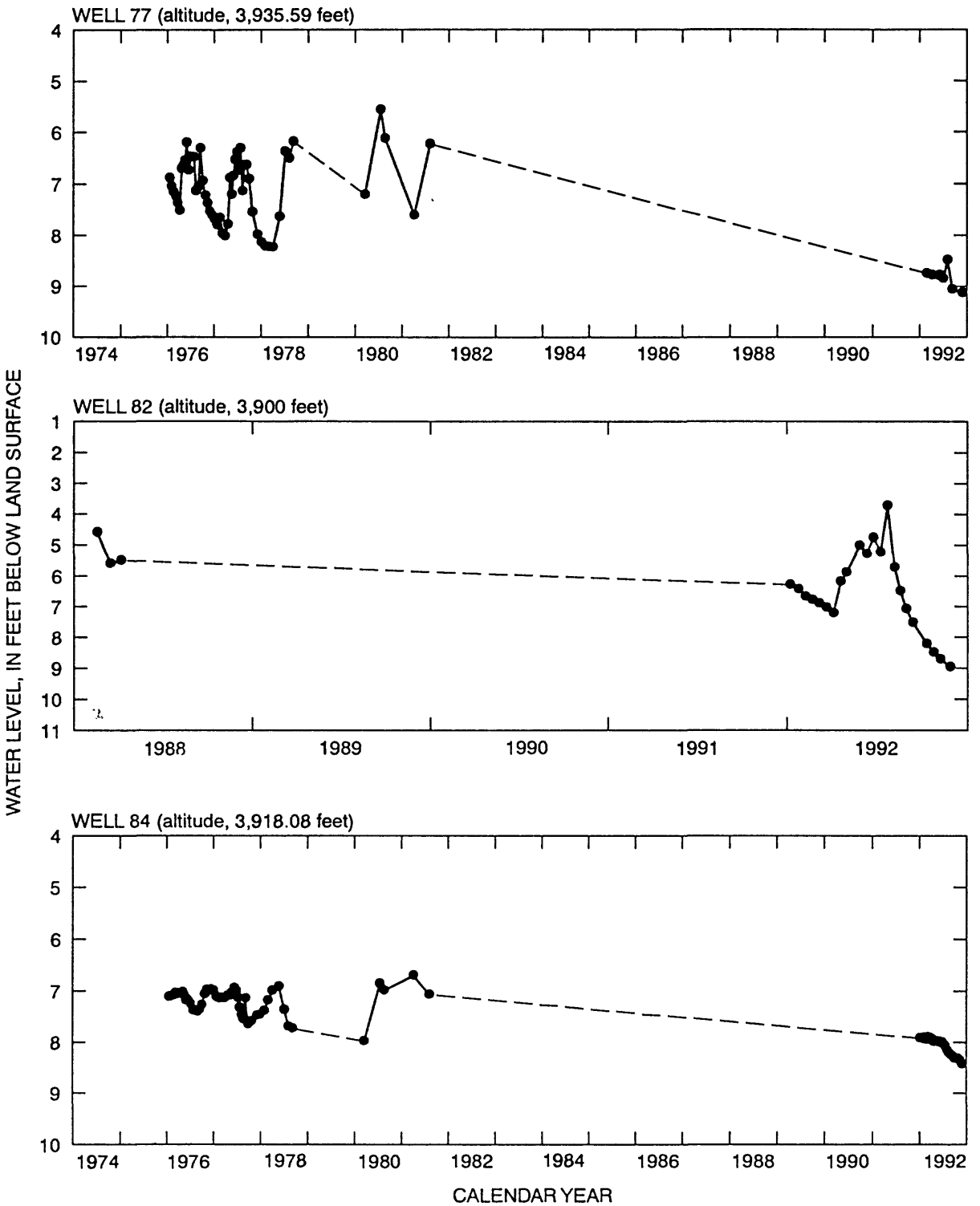
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 77 (altitude, 3,935.59 feet)
4
5
6
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 82 (altitude, 3,900 feet)
1
2
3
4
5
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10
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1988
1989
1990
1991
1992
WELL 84 (altitude, 3,918.08 feet)
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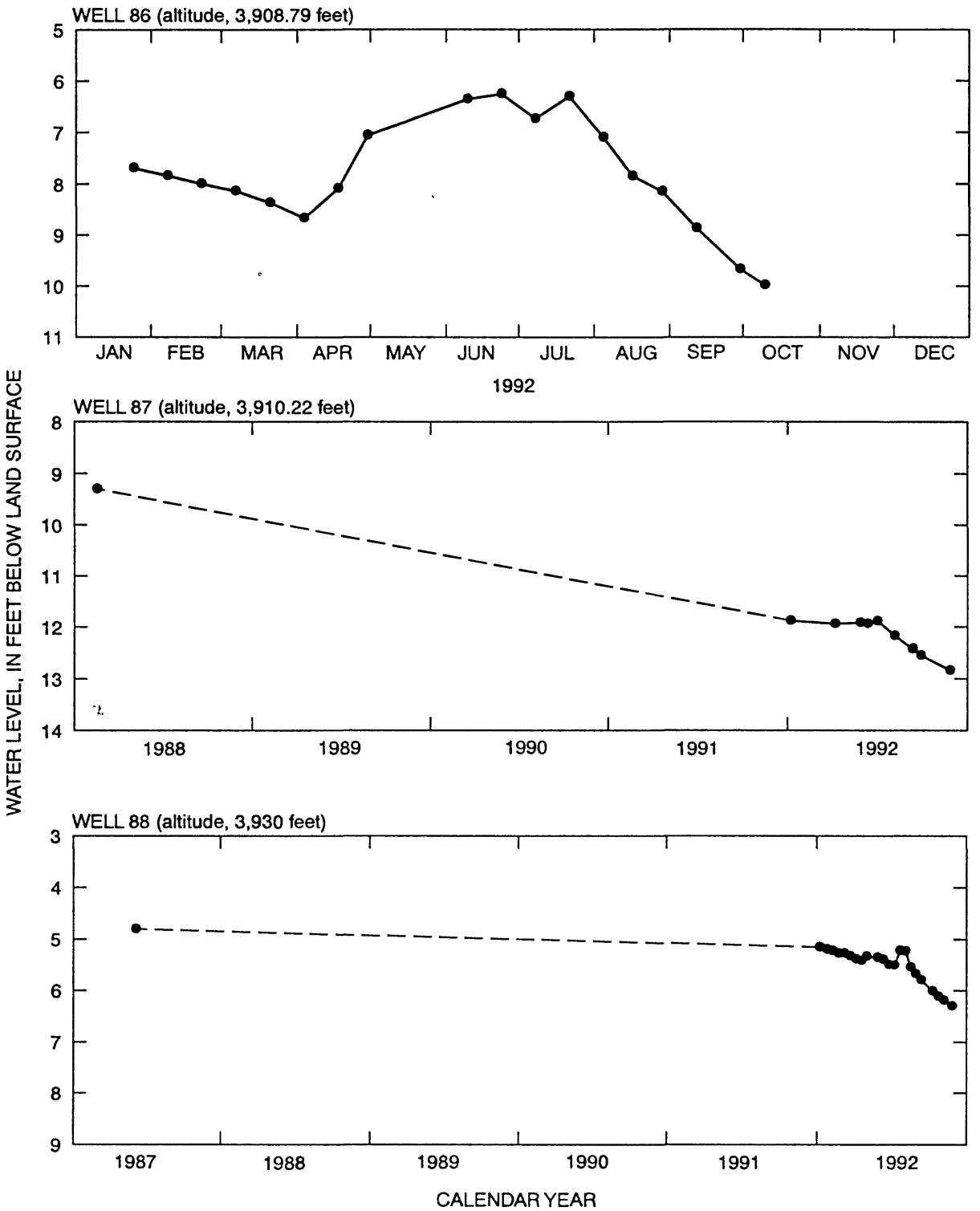
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
CALENDAR YEAR


WELL 86 (altitude, 3,908.79 feet)
5
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11
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
WELL 87 (altitude, 3,910.22 feet)
8
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1988
1989
1990
1991
1992
WELL 88 (altitude, 3,930 feet)
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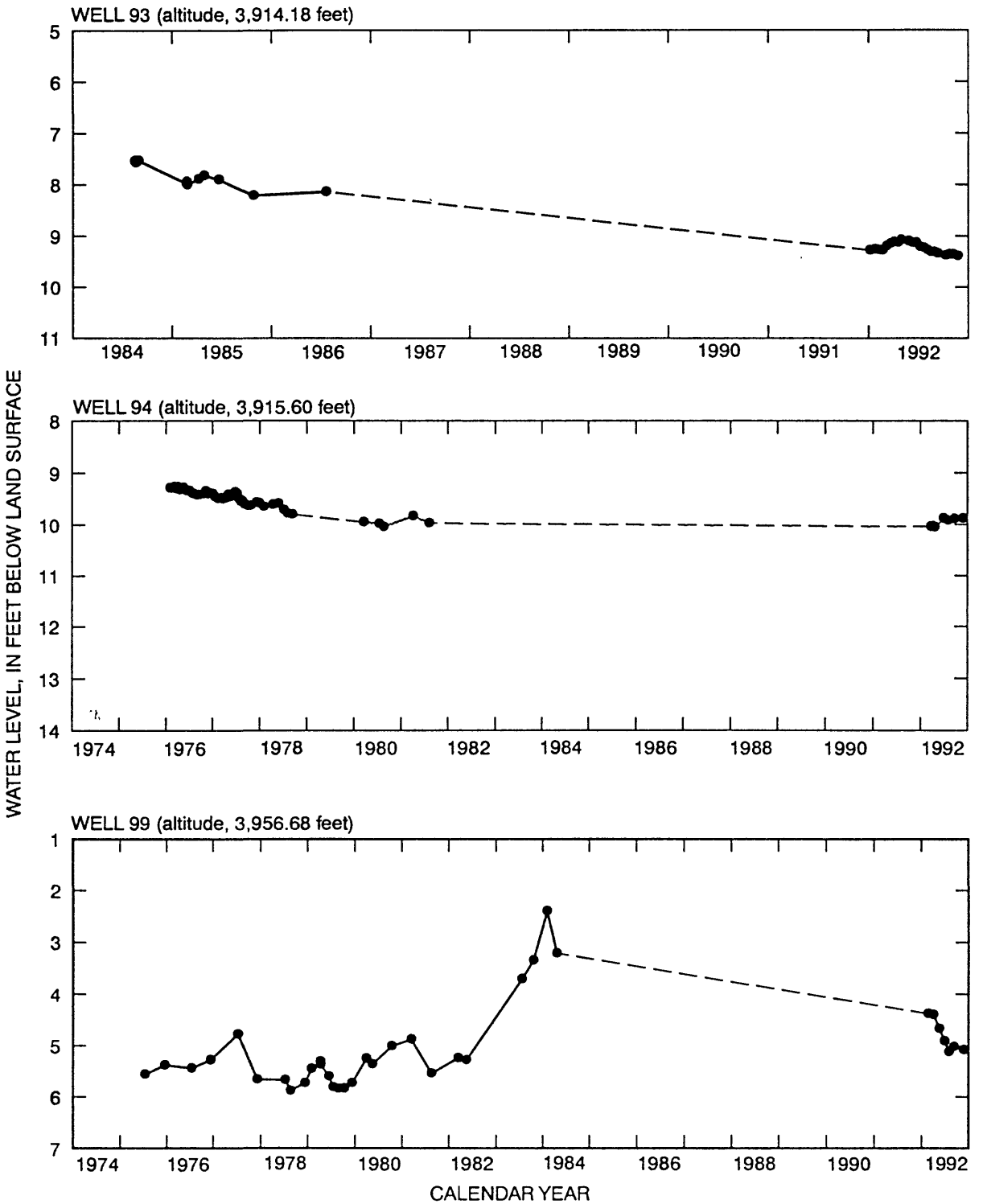
1987
1988
1989
1990
1991
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 93 (altitude, 3,914.18 feet)
5
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1984
1985
1986
1987
1988
1989
1990
1991
1992
WELL 94 (altitude, 3,915.60 feet)
8
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 99 (altitude, 3,956.68 feet)
1
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1974
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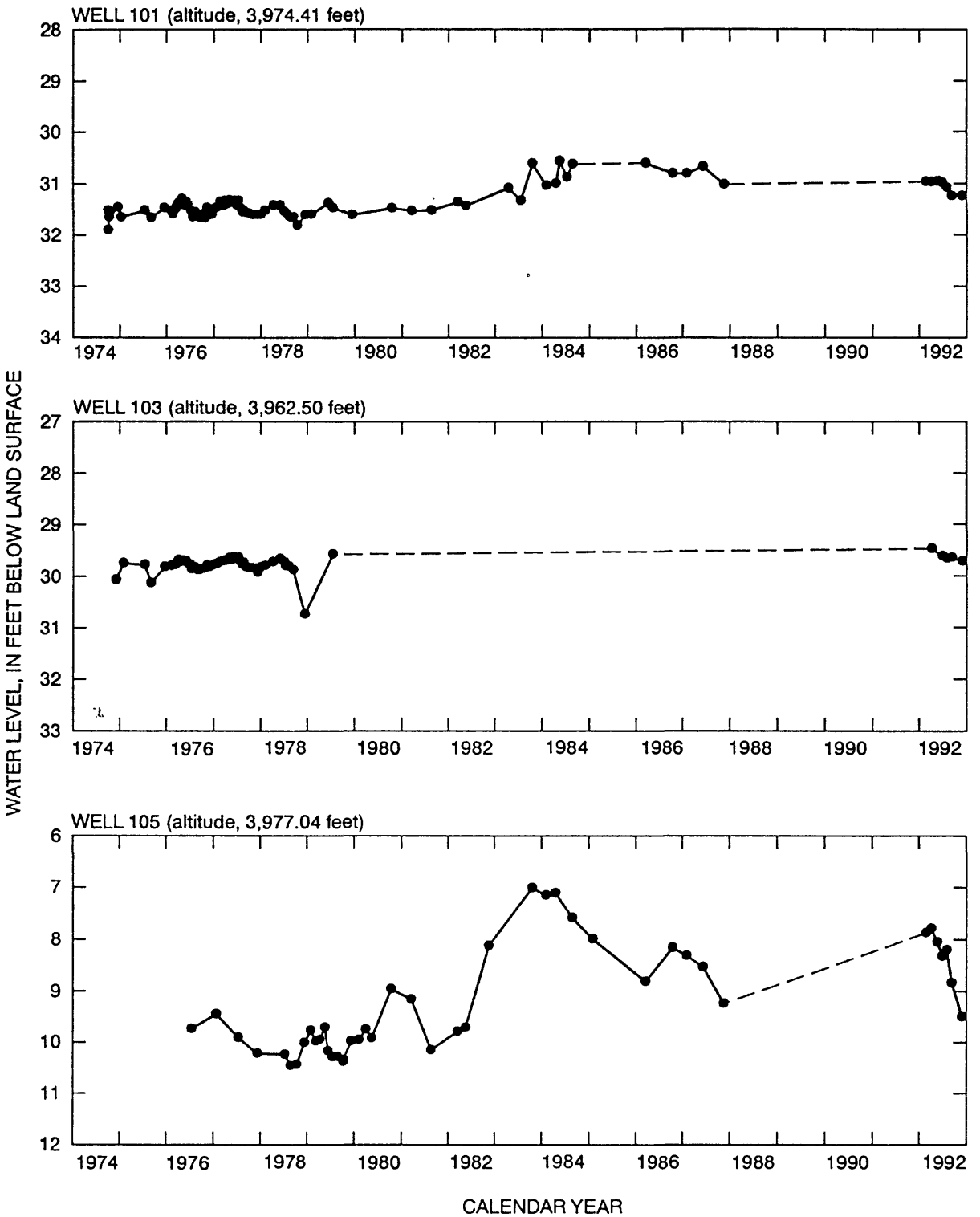
1986
1988
1990
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 101 (altitude, 3,974.41 feet)
28
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34
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 103 (altitude, 3,962.50 feet)
27
28
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 105 (altitude, 3,977.04 feet)
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1974
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1978
1980
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1984
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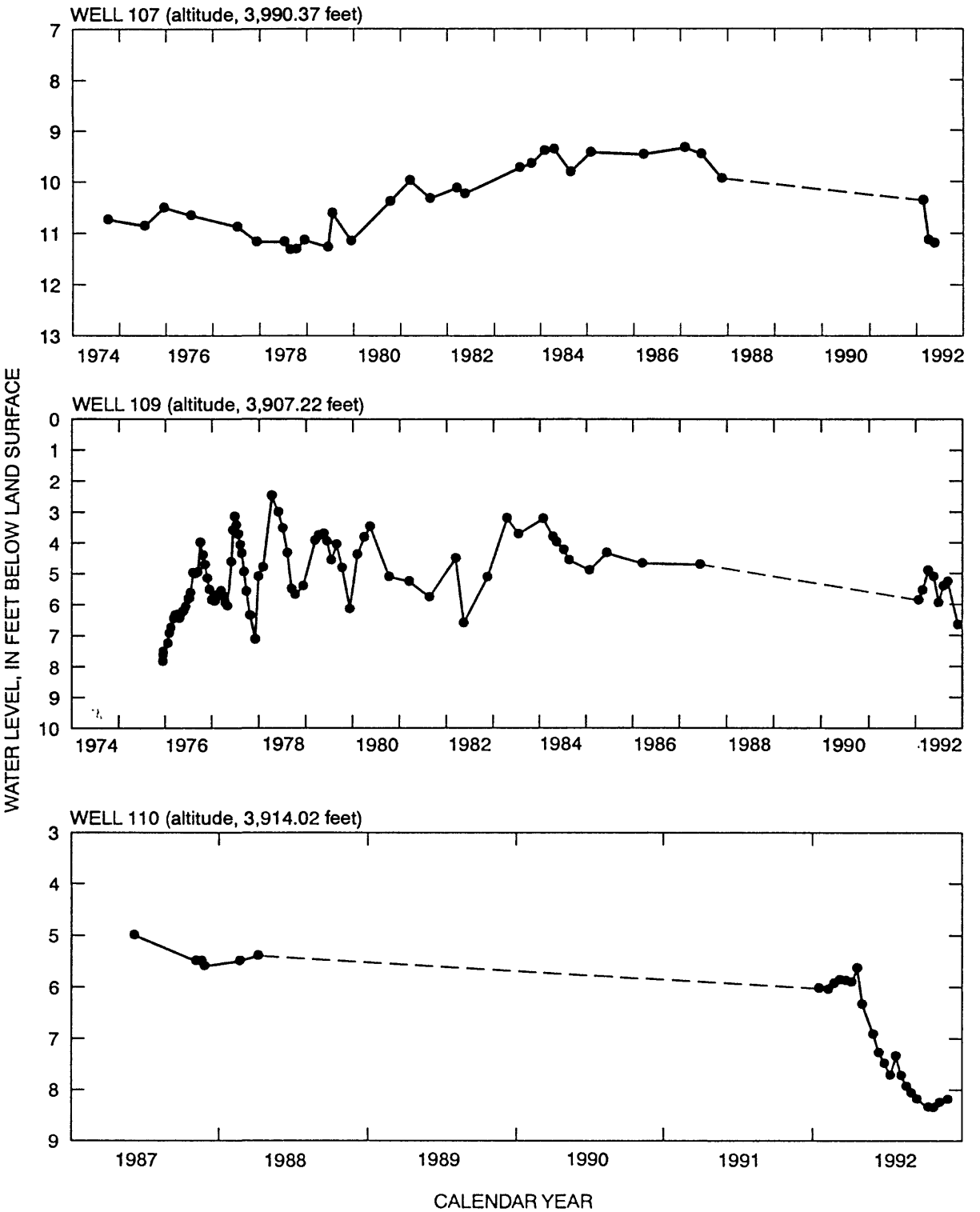
1988
1990
1992
WATER LEVEL, IN FEET BELOW LAND SURFACE
CALENDAR YEAR


WELL 107 (altitude, 3,990.37 feet)
7
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 109 (altitude, 3,907.22 feet)
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
WELL 110 (altitude, 3,914.02 feet)
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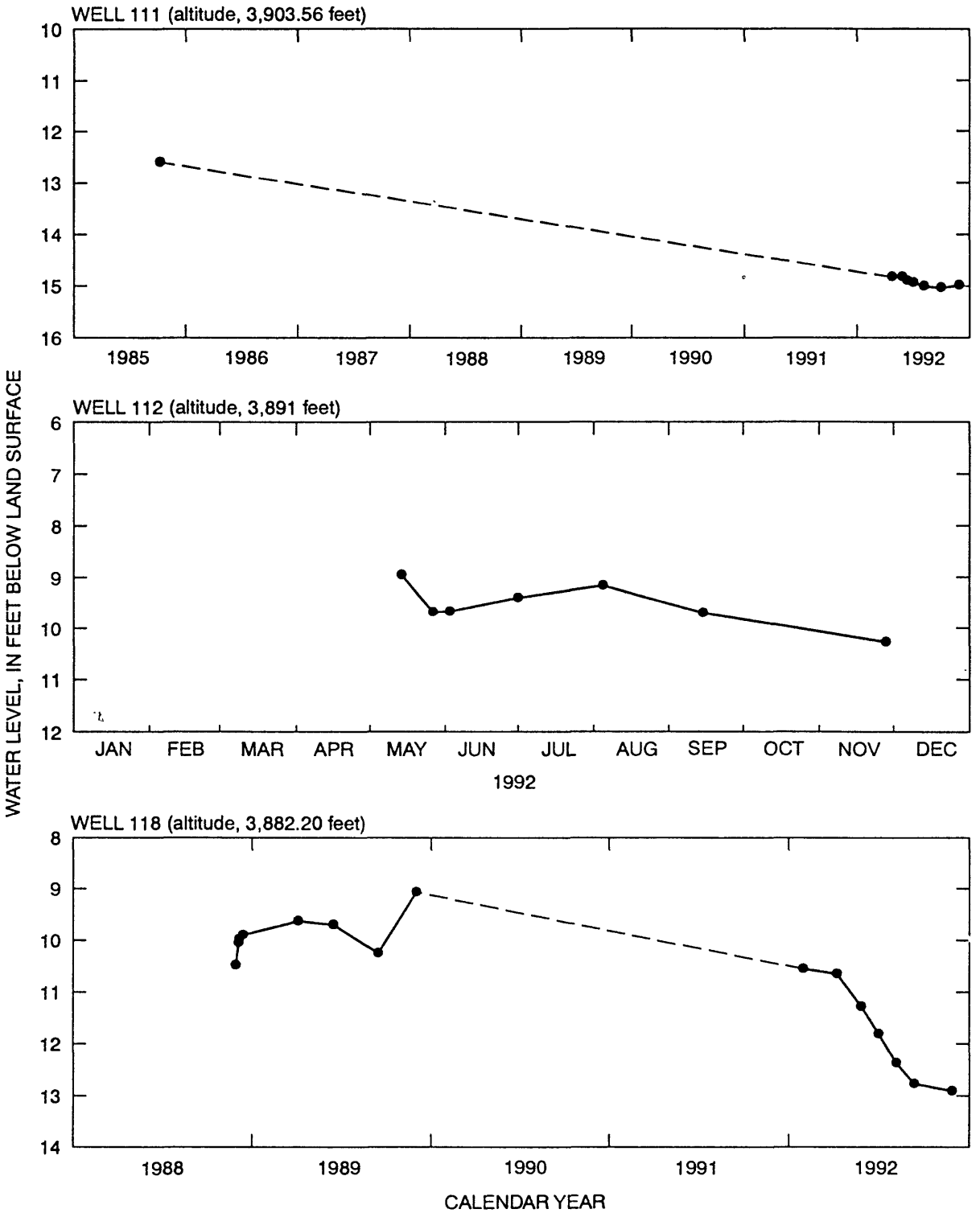
1987
1988
1989
1990
1991
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 111 (altitude, 3,903.56 feet)
10
11
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16
1985
1986
1987
1988
1989
1990
1991
1992
WELL 112 (altitude, 3,891 feet)
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JAN
FEB
MAR
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MAY
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1992
WELL 118 (altitude, 3,882.20 feet)
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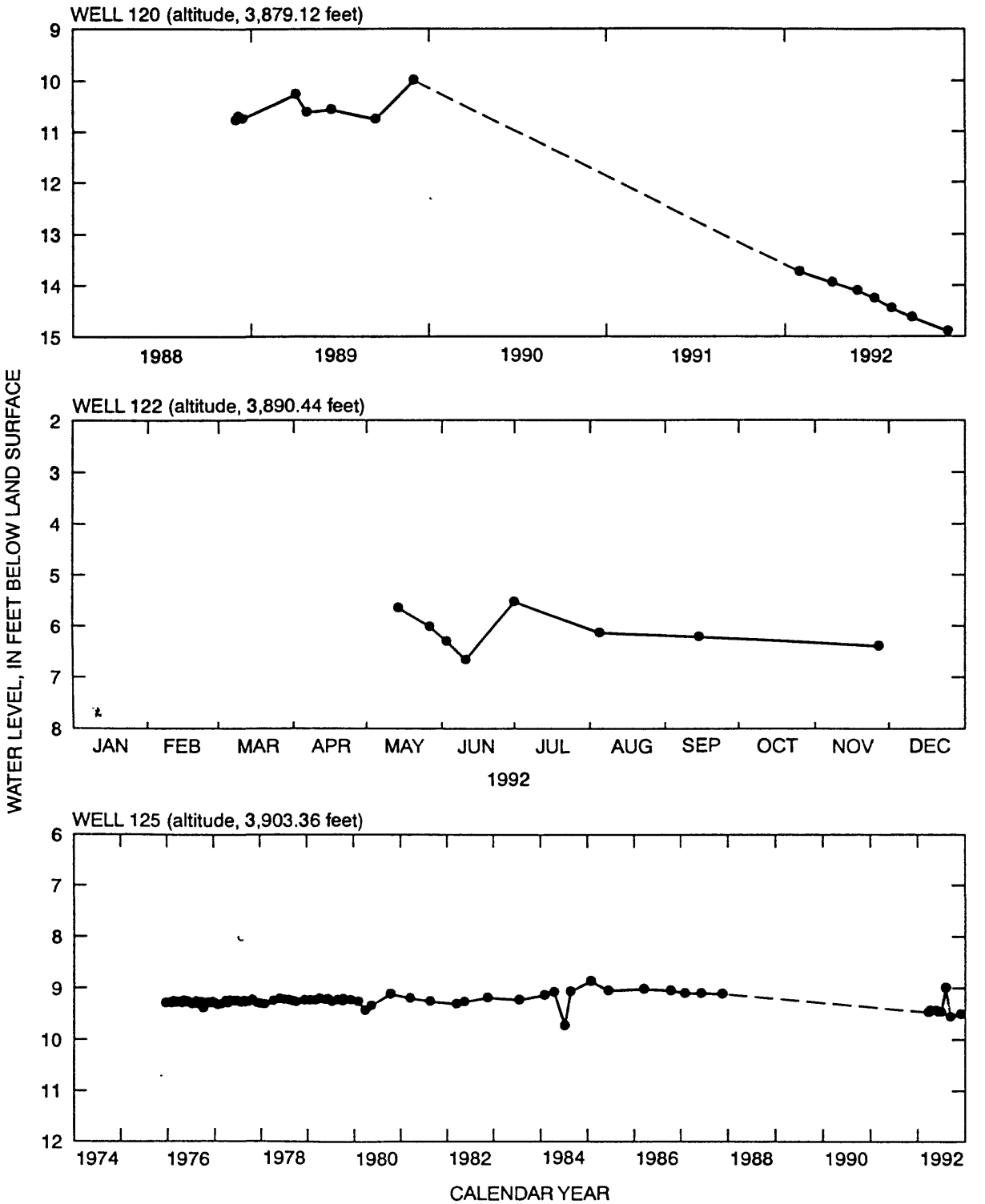
1988
1989
1990
1991
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE


WELL 120 (altitude, 3,879.12 feet)
9
10
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1988
1989
1990
1991
1992
WELL 122 (altitude, 3,890.44 feet)
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JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1992
WELL 125 (altitude, 3,903.36 feet)
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1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
CALENDAR YEAR
WATER LEVEL, IN FEET BELOW LAND SURFACE