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Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1996

By Richard J. La Camera and Glenn L. Locke

Open-File Report 97-821

Prepared in cooperation with the
NEVADA OPERATIONS OFFICE of the
U.S. DEPARTMENT OF ENERGY, under
Interagency Agreement DE-AI08-92NV10874

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
acre-foot (acre-ft)	1,233	cubic meter
foot (ft)	0.3048	meter
gallon per minute (gal/min)	0.06309	liter per second
inch (in.)	2.54	centimeter
mile (mi)	1.609	kilometer
million gallons (Mgal)	3,785	cubic meter
pound per square inch (lb/in^2)	6.895	kilopascal

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 U.S. Geological Survey, in support of the U.S. Department of Energy, Yucca Mountain Site Characterization Project, collects, compiles, and summarizes hydrologic data in the Yucca Mountain region. The data are collected to allow assessments of ground-water resources during studies to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste.

Data on ground-water levels at 36 sites, ground-water discharge at 6 sites, and ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and the Amargosa Desert are presented for calendar year 1996. Data collected prior to 1996 are graphically presented and data collected by other agencies (or as part of other programs) are included to further indicate variations of ground-water levels, discharges, and withdrawals through time.

A statistical summary of ground-water levels at seven wells in Jackass Flats is presented to indicate potential effects of ground-water withdrawals in support of U.S. Department of Energy activities near Yucca Mountain. The statistical summary includes the number of measurements, the maximum, minimum, and median water-level altitudes, and the average deviation of measured water-level altitudes for selected baseline periods and for calendar years 1992-96. At two water-supply wells and a nearby observation well, median water levels for calendar year 1996 were slightly lower (0.3 to 0.4 foot) than for the respective baseline periods. At four other wells in Jackass Flats, median water levels for 1996 were unchanged, slightly lower (0.2 foot), and slightly higher (0.2 and 0.7 foot) than for the respective baseline periods.

INTRODUCTION

Investigations are in progress or planned to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste. The U.S. Department of Energy (DOE) has declared that all facilities and activities associated with such investigations will be operated in a manner that maintains or protects environmental quality, and has established programs to allow assessments of environmental quality. In April 1989, the U.S. Geological Survey (USGS) began a cooperative program with DOE to develop a ground-water-resources monitoring program in the vicinity of Yucca Mountain. The purposes of the monitoring program are to (1) document the historical and current conditions of ground-water resources, (2) detect and document changes in those resources during the investigations of Yucca Mountain, and (3) provide a basis for analyzing and identifying potential adverse effects on ground-water resources resulting from investigations of Yucca Mountain.

Purpose and Scope

This report presents and summarizes, in tabular and graphical form, data collected as part of the U.S. Geological Survey Environmental-Monitoring Program. Included are 1996 data on ground-water levels at 36 sites, ground-water discharge at 6 sites, and ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and Amargosa Desert. Data on ground-water levels, discharges, and withdrawals collected by other agencies (or collected as part of other programs) at the sites are included also to further indicate variations through time at selected monitoring locations.

A discussion of ground-water data for Jackass Flats includes a statistical summary of that data to indicate potential effects of withdrawals from wells in Jackass Flats on water levels near Yucca Mountain.

Effects of these withdrawals may be detected in Jackass Flats before they are detected elsewhere in the Yucca Mountain region.

This report is the fifth of a series as part of the U.S. Geological Survey Environmental-Monitoring Program. The first report in the series was prepared by La Camera and Westenburg (1994) and includes data through December 1992; the second report, by Hale and Westenburg (1995), includes data through 1993; the third report, by Westenburg and La Camera (1996), includes data through 1994; and the fourth report, by La Camera, Westenburg, and Locke (1996), includes data through 1995. Hereafter, the first four reports of this series are referred to as previous reports on selected ground-water data for the Yucca Mountain region.

Additional information for sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12 is presented by Robison (1984), Robison and others (1988), Gemmel (1990), McKinley and others (1991), O'Brien (1991, 1993), Luckey and others (1993), Boucher (1994), Lobmeyer and others (1995), O'Brien and others (1995), Graves and others (1996), and Tucci and others (1996a, 1996b).

Acknowledgments

Several organizations and programs contributed to this report. Specifically, data were provided by National Park Service; U.S. Fish and Wildlife Service; Nevada Department of Conservation and Natural Resources, Division of Water Resources; Nevada Department of Transportation; Barrick Bullfrog Inc.; Bechtel Nevada; Cathedral Gold U.S. Corporation; Cind-R-Lite Company; Daisy Gold Mining Company; Fenix and Scisson, Inc.; Raytheon Services Nevada; Reynolds Electrical and Engineering Company; U.S. Borax Corporation; U.S. Nevada Gold Search; USGS-Hydrologic Resources Management and Environmental Restoration Programs; and USGS-Yucca Mountain Project Branch studies of saturated-zone site hydrology and saturated-zone regional hydrology.

Additionally, the authors acknowledge the cooperation of the many individual property owners throughout the Amargosa Desert who allowed access to their property and the collection of hydrologic data.

DESCRIPTION OF STUDY AREA

The study area is the Yucca Mountain region of southern Nevada and eastern California (fig. 1). The boundary of the Yucca Mountain region, for purposes of this report, roughly coincides with the northern parts of Crater Flat and Jackass Flats, eastern parts of Rock Valley, Mercury Valley, and Amargosa Desert, and Death Valley Junction and Furnace Creek, Calif., to the south and west. The region is within the Great Basin, a subdivision of the Basin and Range Physiographic Province (Fenneman, 1931, p. 328).

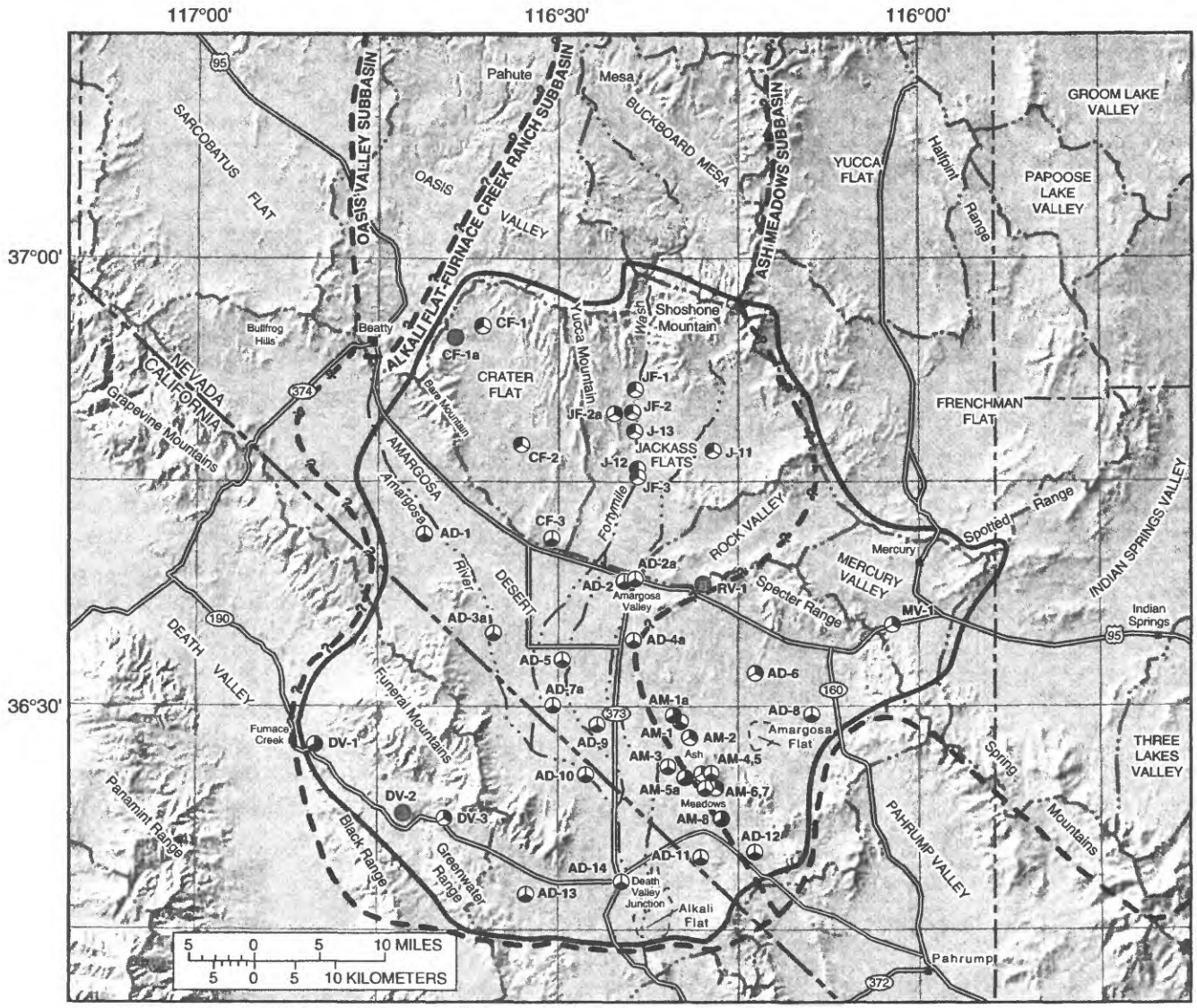
The study area is in the Death Valley ground-water flow system (Harrill and others, 1988, sheet 1) and, within that flow system, the Alkali Flat-Furnace Creek Ranch and Ash Meadows ground-water subbasins. Each ground-water subbasin is a zone consisting of ground-water recharge areas and flow paths to points of discharge at land surface (Waddell and others, 1984, p. 36; Laczniak and others, 1996, p. 16 and pl. 1). Boundaries of the subbasins are defined on the basis of the location of recharge areas, discharge areas, low-permeability rocks, hydraulic gradients, and water chemistry. These boundaries are general indicators of restrictions on ground-water movement in the region.

Within the Alkali Flat-Furnace Creek Ranch and Ash Meadows subbasins, the study area is further subdivided by hydrographic areas[1] (fig. 1). As defined by Rush (1968, p. 4), hydrographic areas generally consist of valleys (topographic lows) extending to their surrounding surface-water drainage divides (topographic highs). Hydrographic areas in the study area include Crater Flat, Jackass Flats, and Rock Valley, most of Mercury Valley and Amargosa Desert, and part of Death Valley (Rush, 1968; Harrill and others, 1988, sheet 2).

Alkali Flat-Furnace Creek Ranch Ground-Water Subbasin

In the Alkali Flat-Furnace Creek Ranch ground-water subbasin, sources of ground water principally are subsurface interbasin inflow and precipitation on

[1]Formal hydrographic areas in Nevada were delineated systematically by the U.S. Geological Survey and Nevada Division of Water Resources in the late 1960's for scientific and administrative purposes (Rush, 1968; Cardinalli and others, 1968). The official hydrographic area names, numbers, and geographic boundaries continue to be used in Geological Survey scientific reports and Division of Water Resources administrative activities.



Base from U.S. Geological Survey digital elevation data, 1:250,000, 1987, and digital data, 1:100,000, 1981-89; Universal Transverse Mercator projection, Zone 11. Shaded-relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon

EXPLANATION

Study-area boundary

Ground-water subbasin boundary—From Laczniak and others (1996, pl. 1). Queried where location uncertain

Hydrographic-area boundary

Data-collection site—Site number (table 1) and primary contributing unit are indicated

AD-6 **Carbonate rock**

CF-1 **Volcanic rock**

AD-1 **Valley fill**

DV-2 **Undifferentiated sedimentary rock**

DV-1 **Combined carbonate rock and valley fill**

Figure 1. Location of data-collection sites for calendar year 1996, Yucca Mountain region of southern Nevada and eastern California

mesas and mountains north of the study area. Subsurface interbasin inflow also may occur near the Ash Meadows area in the Amargosa Desert (Waddell and others, 1984, p. 36; Harrill and others, 1988, sheet 2). Ground water discharges principally in Death Valley and at Alkali Flat (Laczniak and others, 1996, p. 19).

In the northern half of the study area within the subbasin, ground-water flow is generally to the south or southeast (Tucci and Burkhardt, 1995, p. 8). In the southern half of the study area within the subbasin, ground-water flow is to the southeast toward Alkali Flat or southwest toward Death Valley (Kilroy, 1991, p. 9-13; Laczniak and others, 1996, pl. 1).

Crater Flat and Jackass Flats (which include Yucca Mountain), most of Rock Valley, the west-central part of the Amargosa Desert, and part of the Death Valley hydrographic areas are within the Alkali Flat-Furnace Creek Ranch subbasin (fig. 1).

Ash Meadows Ground-Water Subbasin

In the Ash Meadows ground-water subbasin, sources of ground water principally are subsurface interbasin inflow and precipitation on mountains to the east and northeast of the study area (Harrill and others, 1988, sheet 2). Ground water discharges principally as springflow in the Ash Meadows area and possibly as underflow into the Alkali Flat-Furnace Creek Ranch ground-water subbasin. Ground water in the subbasin generally flows to the west or southwest (Harrill and others, 1988, sheet 2; Laczniak and others, 1996, p. 16-18 and pl. 1).

Part of Rock Valley, Mercury Valley, and the eastern part of the Amargosa Desert hydrographic areas are within the Ash Meadows subbasin (fig. 1). The southeastern part of the Amargosa Desert includes the Ash Meadows spring-discharge area. The Ash Meadows spring-discharge area is the gently sloping land watered by numerous springs (Dudley and Larson, 1976, p. 5) at the southwestern edge of the subbasin.

DATA-COLLECTION SITES

Locations of data-collection sites are shown on figure 1. Table 1 includes information on site identification, site location, site owner, and the types of data contained in this report for each site. Table 2 includes information on site identification, well construction, source of well-construction data, and contributing lithologic units. All sites are wells or springs except site AM-4 (Devils Hole), which is an open fissure that intersects the ground-water table.

Site Number

Sites are identified on figure 1 and in table 1 by an alphanumeric number that also is used in the tables, figures, and text of this report. The site number consists of two parts. The first part represents the hydrographic area in which the site is located: "CF" represents Crater Flat; "JF" or "J," Jackass Flats; "RV," Rock Valley; "MV," Mercury Valley; "AD" or "AM," Amargosa Desert; and "DV," Death Valley. "AM" further indicates that the site is located in the Ash Meadows spring-discharge area. The second part of the number represents the relative location of the site within the hydrographic area (or Ash Meadows spring-discharge area). Within each hydrographic area, sites generally are numbered sequentially in a north-to-south, then west-to-east order. Sites added subsequent to the initial numbering also are numbered as indicated above or are assigned the number of a nearby site and given the suffix of "a." Exceptions are sites J-13, J-11, and J-12, which are or were water-supply wells and were previously numbered by Raytheon Services Nevada; they were not renumbered for this report. The sequence of sites given in table 1 is used elsewhere throughout the report.

U.S. Geological Survey Site Identification

Sites are identified by the standard U.S. Geological Survey identification number, which is based on an initial determination of latitude and longitude for the site. The site identification serves as a unique identification number in files and data bases of the USGS and indicates the approximate geographic location of each site. The identification consists of 15 digits: The first 6 denote the degrees, minutes, and seconds of latitude; the next 7 denote degrees, minutes, and seconds of longitude; and the last 2 digits (assigned sequentially) identify the site within a 1-second grid. For example, site 363530116021401 is at approximately 36°35'30" latitude and 116°02'14" longitude, and it is the first site recorded in that 1-second grid. If a more precise latitude and longitude are subsequently determined, the unique identification number remains unchanged. Latitude and longitude shown for a site, therefore, are the most accurate locators.

Table 1. Index to monitoring sites in Yucca Mountain region for calendar year 1996

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section titled "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for sites as stored in files and data bases of U.S. Geological Survey.

Local site number: Alphanumeric number based on location of site within hydrographic areas and rectangular subdivisions of public lands. See text section titled "Local Site Number" for further discussion.

Owner: Abbreviations listed for sites owned by federal agencies: BLM, Bureau of Land Management; NPS, National Park Service; DOE, U.S. Department of Energy; USFWS, U.S. Fish and Wildlife Service; USGS, U.S. Geological Survey.

Data type: Type of data included in this report. D, ground-water discharge; L, ground-water level.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Local site number		Owner	Data type
CF-1	365520116370301	GEXA Well 4	365520	1163703	229	S12 E48 04DBB1	Rayrock Mines, Inc.	L
CF-1a	365445116383901	GEXA Well 3	365445	1163839	229	S12 E48 07ADD1	Rayrock Mines, Inc.	L
CF-2	364732116330701	USW VH-1	364732	1163307	229	S13 E48 27C1	DOE	L
CF-3	364105116302601	Cind-R-Lite Well	364105	1163026	229	S15 E48 01AAA1	Cind-R-Lite Block Company	L
JF-1	365116116233801	UE-25 WT 15	365116	1162338	227A	S12 E50 33A1	DOE	L
JF-2	364945116235001	UE-25 WT 13	364943	1162351	227A	S13 E50 18B1	DOE	L
JF-2a	364938116252102	UE-25p 1 PTH	364938	1162521	227A	S13 E49 14A1	DOE	L
J-13	364828116234001	J-13 WW	364828	1162340	227A	S13 E50 19C1	DOE	L
J-11	364706116170601	J-11 WW	364706	1161706	227A	S13 E51 31B1	DOE	L
J-12	364554116232401	J-12 WW	364554	1162324	227A	S14 E50 06A1	DOE	L
JF-3	364528116232201	JF-3 Well	364528	1162322	227A	S14 E50 06D1	DOE	L
RV-1	363815116175901	TW-5	363815	1161759	226	S15 E50 24A1	DOE	L
MV-1	363530116021401	Army 1 WW	363530	1160214	225	S16 E53 05ADB1	DOE	L
AD-1	364141116351401	NA-6 Well BGMW-10	364130	1164112	230	S14 E47 32DA1	USGS	L
AD-2	363830116241401	Airport Well	363825	1162433	230	S15 E49 24ABB1	Doing, Warren	L
AD-2a	363835116234001	NDOT Well	363835	1162358	230	S15 E50 18CCDB1	NV Dept. of Transportation	L
AD-3a	363521116352501	Davidson Well	363526	1163529	230	S16 E48 05CAB1	Davidson, Robert	L
AD-4a	363428116234701	Cooks East Well	363428	1162347	230	S16 E50 07CABB1	Cook, Lewis C.	L
AD-5	363310116294001	USBLM Well	363323	1162944	230	S16 E49 18DCCA1	BLM	L
AD-6	363213116133800	Tracer Well 3	363213	1161338	230	S16 E51 27BAA3	USGS	L
AD-7a	363009116302702	Blackman Well	363009	1163027	230	S17 E48 01AB2	Naxos Mining Company	L
AD-8	362929116085701	Cherry Patch Well	362929	1160857	230	S17 E52 08CDB1	Clark, Hershel and others	L
AD-9	362848116264201	Gilgans North Well	362848	1162646	230	S17 E49 15BBBB1	Steelman, James C.	L
AD-10	362525116274301	NA-9 Well	362525	1162743	230	026N005E05E001S	USGS	L
AD-11	361954116181201	GS-3 Well	361957	1161752	230	S19 E50 01BBD1	USGS	L
AD-12	362014116133901	GS-1 Well	362021	1161330	230	S18 E51 34CBD1	USGS	L
AD-13	361724116324201	S-1 Well	361724	1163242	230	025N004E21M001S	USGS	L
AD-14	361817116244701	Death Valley Jct Well	361817	1162447	230	025N005E14M001S	Ettie, Lee	L
AM-1	362858116195301	Rogers Spring Well	362855	1161950	230	S17 E50 10CDD1	USFWS	L
AM-1a	362924116203001	Fairbanks Spring	362926	1162028	230	S17 E50 09AD1	USFWS	D
AM-2	362755116190401	Five Springs Well	362755	1161904	230	S17 E50 23BBCA1	USFWS	D,L
AM-3	362555116205301	Garners Well	362555	1162053	230	S17 E50 33CAAB1	Garner, George	L
AM-4	362532116172700	Devils Hole	362532	1161727	230	S17 E50 36DC1	NPS	L
AM-5	362529116171100	Devils Hole Well	362530	1161715	230	S17 E50 36DDC1	USFWS	L
AM-5a	362502116192301	Crystal Pool	362513	1161927	230	S18 E50 03ADBA1	USFWS	D
AM-6	362432116165701	Point of Rocks North Well	362432	1161657	230	S18 E51 07BBBB1	USFWS	L
AM-7	362417116163600	Point of Rocks South Well	362420	1161637	230	S18 E51 07BDB1	USFWS	L
AM-8	362230116162001	Big Spring	362229	1161625	230	S18 E51 19ACB1	USFWS	D
DV-1	362728116501101	Texas Spring	362728	1165011	243	027N001E23BS01S	NPS	D
DV-2	362252116425301	Navel Spring	362252	1164253	243	026N002E13FS01S	U.S. Borax & Chem. Corp.	D
DV-3	362230116392901	Travertine Point 1 Well	362235	1163929	243	026N003E21L001S	U.S. Borax & Chem. Corp.	L

Table 2. Well-completion data at monitoring sites in Yucca Mountain region

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Accessible well depth: Well depths listed are as reported in sources listed in explanation for Data source below or as measured by USGS personnel (noted with 's'). See section "Accessible Well Depth" for further discussion.

Casing diameter at land surface: Casing segment most prominent at land surface. Outside diameter has been rounded to nearest inch.

Top of open interval: Depth to top part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for Data source. U, unknown, no data.

Bottom of open interval: Depth to bottom part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for Data source. U, unknown, no data.

Diameter of open interval: Casing inside diameter has been rounded to nearest inch. Hole diameter is listed where no casing is present. U, unknown, no data.

Type of open interval: Description of open interval. P, perforated or slotted casing; S, screened casing, type not known; U, unknown, no data; X, uncased borehole.

Data source: D, Well driller's log, well-completion report, or Fenix & Scisson, Inc., or Raytheon Services Nevada hole-history data; J, Johnston (1968); M, no source, data not available; O, Owner of well; R, Robison and others (1988); T, Thordarson and others (1967).

Contributing units: Saturated lithologic interval yielding water to well. C, carbonate rock; F, valley fill; S, undifferentiated sedimentary rock; V, volcanic rock. See section "Contributing Units" for further discussion.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
CF-1	365520116370301	GEXA Well 4	1,600	16	800	1,600	10	P	D	V
CF-1a	365445116383901	GEXA Well 3	700	7	208	313	6	P	D	S
					513	618	6	P		
					658	700	6	P		
CF-2	364732116330701	USW VH-1	2,501	10	911	912	9	X	R	V
					912	2,501	6	X		
CF-3	364105116302601	Cind-R-Lite Well	460	9	320	460	8	P	D	F
JF-1	365116116233801	UE-25 WT 15	1,360	11	127	130	15	X	D	V
					130	1,360	9	X		
JF-2	364945116235001	UE-25 WT 13	1,160	11	222	224	15	X	D	V
					224	1,150	9	X		
					1,150	1,160	8	X		

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
JF-2a	364938116252102	UE-25p 1 PTH	5,923	24	4,256	4,279	10	X	R	C
					4,279	5,900	7	X		
					5,900	5,923	6	X		
J-13	364828116234001	J -13 WW	3,488	13	996	1,301	13	P	T	V
					1,301	1,386	11	P		
					2,690	3,312	5	P		
					3,385	3,488	8	X		
J-11	364706116170601	J -11 WW	1,327	13	1,075	1,095	12	P	D	V
					1,242	1,298	12	P		
J-12	364554116232401	J -12 WW	1,139	13	793	868	12	P	D	V
					887	1,139	12	X		
JF-3	364528116232201	JF- 3 Well	1,138	9	735	1,138	8	P	D	V
RV-1	363815116175901	TW- 5	800 s	7	735	800	6	P	T	S
					800	916	U	X		
MV-1	363530116021401	Army 1 WW	1,953	11	800	1,050	11	P	D	C
					1,368	1,370	10	X		
					1,370	1,684	9	X		
					1,684	1,953	7	X		
AD-1	364141116351401	NA-6 Well BGMW-10	960	2	930	940	2	S	D	F
AD-2	363830116241401	Airport Well	750 s	14	360	777	14	P	D	F
AD-2a	363835116234001	NDOT Well	495	9	395	495	8	P	D	F
AD-3a	363521116352501	Davidson Well	240 s	16	120	250	15	P	D	F
AD-4a	363428116234701	Cooks East Well	269 s	13	147	213	12	P	D	F
					238	286	12	P		
AD-5	363310116294001	USBLM Well	348 s	12	U	U	U	U	M	F
AD-6	363213116133800	Tracer Well 3	678 s	9	620	807	6	X	J	C

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
AD-7a	363009116302702	Blackman Well	210	7	U	U	U	U	O	F
AD-8	362929116085701	Cherry Patch Well	215 s	15	U	U	U	U	M	F
AD-9	362848116264201	Gilgans North Well	396 s	13	60	90	12	P	D	F
					154	244	12	P		
					245	396	15	X		
AD-10	362525116274301	NA-9 Well	1,090	2	1,063	1,066	2	S	D	F
AD-11	361954116181201	GS-3 Well	2,000	2	1,969	1,979	2	S	D	F
AD-12	362014116133901	GS-1 Well	1,580	2	1,549	1,559	2	S	D	F
AD-13	361724116324201	S-1 Well	2,000	2	1,969	1,979	2	S	D	F
AD-14	361817116244701	Death Valley Jct Well	225 s	12	160	200	12	S	D	F
AM-1	362858116195301	Rogers Spring Well	202 s	16	100	240	12	P	D	F
					240	420	16	X		
AM-2	362755116190401	Five Springs Well	123 s	14	0	100	13	P	D	C
					100	140	14	X		
AM-3	362555116205301	Garners Well	202 s	9	140	180	8	P	O	F
AM-5	362529116171100	Devils Hole Well	200 s	16	48	248	16	P	D	F
AM-6	362432116165701	Point of Rocks North Well	500	16	139	500	16	P	D	F
AM-7	362417116163600	Point of Rocks South Well	586 s	14	132	467	14	P	D	C
					468	818	U	X		
DV-3	362230116392901	Travertine Point 1 Well	650 s	5	100	970	5	X	D	C

Local Site Number

The local site number (table 1) is based on an index of hydrographic areas (Rush, 1968; Harrill and others, 1988) and on the rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian for sites in Nevada or San Bernadino base line and meridian for sites in California. Numbering conventions differ depending on whether a site is located in Nevada or California.

For sites in Nevada, each local number consists of four units separated by spaces: The first unit is the hydrographic area number. The second unit is the township, preceded by an N or S to indicate location north or south of the base line. The third unit is the range, preceded by an E to indicate location east of the meridian. The fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section and so on (A, B, C, and D, indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the well was recorded. For example, site 230 S18 E51 34CBD1 is in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the southeast quarter of the northwest quarter of the southwest quarter of section 34, Township 18 South, Range 51 East, Mount Diablo base line and meridian.

For sites in California, the local number consists of the hydrographic area number followed by two spaces. The next 10 characters indicate the township and location north or south of the baseline, the range and location east or west of the meridian, and the section number. The letter following the section number designates the 40-acre subdivision of the section in which the site is located (U.S. Geological Survey, 1996). The final letter indicates that the location is referenced to the San Bernardino (S) base line and meridian and is preceded by a 3-digit number (for wells) or an "S" and 2-digit number (for springs) indicating the sequence in which the site was recorded. For example, well 230 025N005E14M001S is in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the 40-acre subdivision designated M of section 14, Township 25 North, Range 5 East, San Bernardino base line and meridian.

Data Type

Data type (table 1) identifies the types of data (water level and discharge) presented for each site. Ground-water-level data are in tables 5-7 and ground-water-discharge data are in table 8.

Accessible Well Depth

Accessible well depth (table 2) is the measurable depth to the bottom of the well. The drilled depth may be greater than the accessible depth of the well due to modifications of the well, obstructions, or accumulation of sediment at the bottom of the well. The depth of each well was measured by USGS (depths noted with "s") or was reported by other data sources. The USGS measured depths less than 1,000 ft by "sounding" the bottom of the well with weighted steel or electric tapes.

Top and Bottom of Open Interval

Open intervals (table 2) are parts of the well that are open to the surrounding lithologic intervals and may allow water to enter the well. An uncased section of a well is considered an open interval in this report.

Type of Open Interval

Type of open interval (table 2) is a physical description of the open intervals of a borehole. The types of openings are perforated or slotted casing, screened casing, and open hole with no casing.

Data Source

Data sources (table 2) are organizations or publications from which information on depth of the well, open interval, and type of opening was obtained. Drillers' logs or records are filed with the Nevada Division of Water Resources (NDWR) or maintained by the well owner; Fenix and Scisson, Inc., and Raytheon Services Nevada were contractors for DOE and maintained a summary of well-construction information for selected wells in the area. Publications are USGS reports written for DOE as part of cooperative studies associated with weapons-testing hydrology programs (Thordarson and others, 1967; Johnston, 1968) or Yucca Mountain site-characterization studies (Robison and others, 1988).

Contributing Lithologic Units

Contributing units (table 2) are the principal lithologic intervals at the site that yield water to the well. For purposes of this report, contributing units are one or a combination of four general types. Wells characterized as having a contributing unit of carbonate or volcanic rock are wells with open intervals in those consolidated rocks. In and near the Amargosa Desert, wells characterized as having a contributing unit of valley fill are those with open intervals in unconsolidated valley-filling materials, including lakebed deposits. Wells with open intervals in clastic rock (including argillite, limy sandstones and siltstones, or silty, sandy, and shaley limestones) are characterized as having a contributing unit of undifferentiated sedimentary rock.

Robison and others (1988) describe the contributing units at sites CF-2, JF-1, JF-2, JF-2a, and J-13. McKinley and others (1991) describe the contributing units for sites J-11, J-12, MV-1, AD-4a, AD-5, AD-6, AD-8, and AM-4. Thordarson and others (1967) describe the contributing unit at site RV-1. Dudley and Larson (1976) describe the contributing units for sites AM-2, AM-5, and AM-7. Contributing-unit data are not available from listed data sources for some wells; the contributing units indicated for those wells are derived from drillers' logs or well-completion reports that describe geology in the boreholes, open intervals in the wells, and measurements of depth to water.

Contributing units for springs (fig. 1) indicate sources of water discharged at the sites. Winograd and Thordarson (1975, p. C75-C97) describe sources of discharge at sites AM-1a, AM-5a, AM-8, and DV-1. McKinley and others (1991) describe the source of discharge at site DV-2.

DATA-COLLECTION PROCEDURES AND EQUIPMENT

Water-level and discharge data for monitoring sites were compiled from available sources, from USGS files and data bases, and from measurements made by U.S. Geological Survey Environmental-Monitoring Program (USGS-EMP) personnel. Data-collection procedures and equipment used by USGS-EMP are described in detail, and procedures or equipment used by other sources are described briefly. Water-use data are compiled from available sources as described in the section "Ground-Water Withdrawal Data."

Periodic Water-Level Data

Periodic water-level measurements (table 5) are generally made during site visits, using one of the methods described in the section "Water-Level Measurements." An exception is data that are based on water levels continually collected by the National Park Service at site AM-4 (Devils Hole); data included in table 5 that are not based on measurements during site visits are discussed in the section "Other". Supplemental information, including land-surface altitude, height of measurement point, method of measurement, site status, and source of data, is listed in table 5 also.

Land-Surface Altitude and Height of Measurement Point

Land-surface altitude and height of the measurement point (MP) above (or depth below) land surface are included with periodically collected data in table 5. Land-surface altitude is a representative altitude of land at or near the site. An exception is site AM-4, where the land-surface altitude represents the altitude of the measurement point (a bolt fastened to the south wall of the fissure) that is not referenced to land surface. Land surveys were made by USGS personnel at the monitoring sites to determine the altitudes of land surface or the MP.

Heights of MP's for sites in Amargosa Desert (except AM-4), Death Valley, and Rock Valley were determined by measuring the distance of the MP above (or depth below) a representative point on the land surface at or near the well. The altitude of the MP was determined during the USGS land survey, and land-surface altitude was computed by adding or subtracting the MP height from the surveyed MP altitude.

At sites JF-1, JF-2, JF-2a, and J-13, USGS land surveys verified previously reported land-surface and MP altitudes. At sites CF-2, J-11, and J-12, USGS land surveys verified the previously reported land-surface altitudes and determined the MP altitude by adding the height of the MP to the land-surface altitude. At sites CF-1, CF-1a, and MV-1, USGS land surveys determined the land surface and MP altitudes; the height of the MP is the difference between the MP altitude and land-surface altitude. Land-surface altitudes are reported to the nearest tenth of a foot.

Depth to Water and Altitude of Water Surface

Depth to water is the depth to water in feet below land surface. It is computed as the measured depth to water below the MP minus the height of the MP (above land surface) at the well. An exception is site AM-4, where depth to water is measured below the MP, and the MP is not referenced to land surface. Where depth to water is negative (site AM-2), the water surface is above land surface.

The altitude of water surface is the depth to water subtracted from the altitude of land surface and is reported to the nearest tenth of a foot.

Water-Level Measurements

Periodic water-level measurements were made or calculated using the procedures and equipment described in the following sections.

Calibrated Electric Tape

USGS-EMP personnel used six calibrated 1,000-ft electric tapes and one calibrated 2,000-ft electric tape during 1996. Each tape was marked with a unique identifier (YMP-1, YMP-2, YMP-4, YMP-6, YMP-7, YMP-10, and PRT-2) for quality-assurance purposes. The electric tapes were calibrated against steel tapes. At depths greater than 500 feet the electric tapes were calibrated against the U.S. Geological Survey Site-Characterization Program (USGS-SCP) 2,600-ft calibrated steel tape identified by USGS-SCP as Chain #3. For shallower depths, the USGS-EMP 500-ft reference steel tape #1 was used for calibration. Selected calibration data for the electric tapes are summarized in table 3. Calibration data for tapes YMP-2, YMP-4, and YMP-6 presented in Westenburg and La Camera (1996) and La Camera and others (1996) are not repeated in this report.

The corrections to the USGS-SCP calibrated steel tape account for mechanical stretch and thermal expansion of the tape. No corrections were necessary for the USGS-EMP 500-ft reference steel tape because mechanical stretch and thermal expansion of the tape are considered negligible at the depths to water measured. The correction for the electric tapes is the difference between the corrected steel-tape measurement and the uncorrected electric-tape measurement.

A summary of correction factors applied to USGS-EMP electric tapes is listed in table 4. The correction factor is used to adjust depth-to-water measurements made with an electric tape to account for mechanical stretch, incorrect markings, and changes to the physical condition of the tape. The measurement period represents the time during which the correction factors were applied. Applied correction factors for 1996 usually are averages of individual correction factors; individual correction factors include discrete corrections presented in table 3 of this report and applied factors listed in table 4 of previous reports on selected ground-water data for the Yucca Mountain Region.

Applied correction factors for specific depth ranges are based on measurement periods in which differences of 0.05 ft or less are calculated between (1) the average of individual correction factors within a particular range of depths to water and (2) the individual correction factors within that range. For example, the -0.08 ft for applied correction factor for tape YMP-1 (in the depth range 100-299 ft) is an average of the individual correction factors -0.09 ft and -0.08 ft determined on January 12 and September 17, 1996. When an applied correction factor for a depth range cannot be derived accordingly, presumably due to an indeterminate change in the physical condition of a tape, the applied correction factor for a measurement period is calculated from a linear proration of factors determined for successive calibrations. Linear prorations of correction factors are represented by listing the beginning and ending factors separated by "to" in table 4.

Applied correction factors also may be based on measurement periods in which differences of 0.05 ft or less are calculated between (1) an average of factors for specific depth ranges (as derived above) and (2) all individual correction factors within those ranges. For example, the -0.39 ft applied correction factor for tape YMP-7 (in the 500-699 ft and 700-899 ft depth ranges) is an average of the -0.36 ft and -0.42 ft factors determined for each depth range and is within 0.05 ft of the individual correction factors -0.37, -0.36, -0.39 and -0.44 ft.

Correction factors applied to electric-tape measurements in 1996 ranged from -0.01 to about 0.6 ft. Electric tape YMP-2 was dedicated for use at site CF-1 due to measurement difficulties and placed in the well on April 23, 1993; the tape was damaged in late March or early April 1996. The correction factor for that tape, therefore, is based on calibration data collected prior to placement in the well and subsequent damage. No ending calibration was possible for electric tape YMP-4 because the tape was unexpectedly damaged on March 13, 1996; the correction factors for that tape in

Table 3. Electric-tape calibration data used to derive correction factors for calendar year 1996. Calibration data for tapes used during 1996 but not listed herein are presented in previous reports on selected ground-water data for Yucca Mountain region.

[USGS-EMP ST1, U.S. Geological Survey Environmental-Monitoring Program 500-ft reference steel tape #1; USGS-SCP ST3, U.S. Geological Survey Site-Characterization Program Chain #3 (steel tape)]

Date	Site number (fig. 1)	Tape used	Depth below measuring point		Correction (feet)
			Uncorrected (feet)	Corrected (feet)	
01/12/96	AD-5	USGS-EMP ST1	123.78	123.78	0.00
		YMP-1	123.87	123.78	-.09
		YMP-7	123.84	123.78	-.06
	AD-13	USGS-EMP ST1	383.62	383.62	.00
		YMP-1	383.87	383.62	-.25
		YMP-7	383.87	383.62	-.25
02/07/96	CF-2	USGS-SCP ST3	604.99	604.95	-.04
		YMP-1	605.45	604.95	-.50
		YMP-7	605.32	604.95	-.37
	J-12	USGS-SCP ST3	744.34	744.31	-.03
		YMP-1	744.93	744.31	-.62
		YMP-7	744.70	744.31	-.39
09/16/96	AD-13	USGS-EMP ST1	382.60	382.60	.00
		YMP-1	382.89	382.60	-.29
		YMP-7	382.89	382.60	-.29
		YMP-10	382.65	382.60	-.05
09/17/96	AD-5	USGS-EMP ST1	127.72	127.72	.00
		YMP-1	127.80	127.72	-.08
		YMP-7	127.79	127.72	-.07
		YMP-10	127.72	127.72	.00
	CF-2	USGS-SCP ST3	605.25	605.21	-.04
		PRT-2	605.29	605.21	-.08
		YMP-1	605.71	605.21	-.50
		YMP-7	605.57	605.21	-.36
		YMP-10	605.26	605.21	-.05
09/18/96	J-12	USGS-SCP ST3	744.54	744.52	-.02
		PRT-2	744.60	744.52	-.08
		YMP-1	745.15	744.52	-.63
		YMP-6	744.81	744.52	-.29
		YMP-7	744.96	744.52	-.44
		YMP-10	744.58	744.52	-.06
	J-13	USGS-SCP ST3	929.44	929.42	-.02
		PRT-2	929.69	929.42	-.27
	JF-2	USGS-SCP ST3	996.67	996.64	-.03
		PRT-2	996.94	996.64	-.30
	JF-1	USGS-SCP ST3	1162.36	1162.34	-.02
		PRT-2	1162.61	1162.34	-.27
01/13/97	J-12	USGS-SCP ST3	743.96	743.93	-0.03
		PRT-2	744.03	743.93	-.10
		YMP-6	744.21	743.93	-.28
		YMP-10	744.12	743.93	-.19

Table 3. Electric-tape calibration data used to derive correction factors for calendar year 1996—Continued

Date	Site number (fig. 1)	Tape used	Depth below measuring point		Correction (feet)
			Uncorrected (feet)	Corrected (feet)	
01/14/97	JF-2	USGS-SCP ST3	996.58	996.55	-.03
		PRT-2	996.74	996.55	-.19
	JF-1	USGS-SCP ST3	1162.32	1162.30	-.02
		PRT-2	1162.48	1162.30	-.18
01/15/97	AD-5	USGS-EMP ST1	125.14	125.14	.00
		YMP-10	125.16	125.14	-.02
	AD-13	USGS-EMP ST1	383.18	383.18	.00
		YMP-10	383.31	383.18	-.13
	CF-2	USGS-SCP ST3	605.40	605.36	-.04
		PRT-2	605.46	605.36	-.10
		YMP-10	605.54	605.36	-.18

Table 4. Applied correction factors for electric tapes used during 1996. Correction factors for 1996 are based on calibration data listed in table 3 of this report and data listed in table 4 of previous reports on selected ground-water data for Yucca Mountain Region.

[--, no measurements made for given depth-to-water range during period specified]

Tape	Measurement period		Correction factors for indicated depth ranges (feet)					
	Start	End	100-299 feet	300-499 feet	500-699 feet	700-899 feet	900-1,099 feet	1,100-1,299 feet
PRT-2	09/17/96	01/15/97	--	--	-0.09	-0.09	-0.28 to -0.19	-0.22
YMP-1	01/12/96	09/18/96	-0.08	-0.27	-.50	-.62	--	--
YMP-2	01/01/96	04/17/96	--	--	-.47	--	--	--
YMP-4	02/08/96	03/14/96	-.13	-.13	+.13	+.55	--	--
YMP-6	01/01/96	01/15/97	--	--	--	-.29	--	--
YMP-7	01/12/96	09/18/96	-.06	-.27	-.39	-.39	--	--
YMP-10	09/16/96	01/15/97	-.01	-.09	-.06 to -.18	-.06 to -.18	--	--

1996 were determined from calibration data collected prior to the damage. Electric tape YMP-6 was used only at sites J-12 and JF-3.

Calibrated electric tapes were used at wells when frequent repetitive measurements were required due to fluctuating water levels, depths to water were greater than 500 ft, or wet conditions inside a well prevented measurements using chalked steel tapes. Electric-tape measurements are made by lowering the end of the tape to the water surface until a light or buzzer is activated when a probe on the end of the tape contacts the water. The tape is raised and lowered slowly until the exact point of contact is located. While holding the tape on the MP, the depth to water below the MP is read from markings on the tape. At least two measurements are made during each site visit, and supplemental measurements are made if those two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to rapidly changing water levels, the measured depths and appropriate site status are recorded. Measurements using calibrated electric tapes are indicated by method "V" in table 5.

An example calculation of depth to water below land surface for a site, using USGS-EMP calibrated electric tape YMP-6, is shown below:

Location: JF-3
Date: June 20, 1996
Tape ID: YMP-6 Correction factor: -0.29 ft
(for depths from 700 to 899 ft)

Depth below MP	712.80 ft
Correction factor	-.29 ft
Corrected depth below MP	712.51 ft
Height of MP above land surface	-2.27 ft
Depth to water below land surface	710.24 ft

Steel Tape

In 1996, USGS-EMP personnel maintained one 500-ft steel tape as a reference tape and used five field steel tapes (two 500-ft and three 300-ft tapes) for routine measurements. The steel tapes are uniquely marked (reference steel tape #1, ST-2, ST-3, ST-4, ST-5, and ST-7). Steel tapes used for routine measurements were checked against the reference tape at several depths to water during September 1996 to verify their accuracy.

General procedures for using 300- and 500-ft reeled steel tapes are to (1) chalk the bottom section of the tape, (2) lower the tape into the well until part of the chalked section is below the water surface, (3) hold the tape on the MP and record the "hold" reading, (4) raise the end of the tape to the surface, observing the "cut" (the top of the wet part of the chalked tape), (5) record the reading of the cut, (6) calculate the depth to water below the MP by subtracting the "cut" reading from the "hold" reading, and (7) calculate the depth to water below land surface by subtracting the height of the MP from the depth to water below MP. USGS-EMP personnel make a minimum of two measurements during each site visit to verify the initial measurement. Supplemental measurements are made if the two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to fluctuating water levels, the measured depths and appropriate site status are recorded.

USGS-SCP personnel made water-level measurements using calibrated steel tapes at sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12. Descriptions of the steel tapes, applicable corrections, and procedures used by USGS-SCP for making steel-tape measurements are given by Robison and others (1988, p. 6-11), Gemmell (1990, p. 8-12), O'Brien (1991, p. 8-13), O'Brien and others (1995, p. 4-7), Graves and others, (1996, p. 5-10), Tucci and others (1996a, p. 5-8), and Tucci and others (1996b, p. 5-8). USGS-SCP steel-tape measurements were compiled from information provided by USGS-SCP (Robert L. Goemaat, U.S. Geological Survey, written communs., 1996 and 1997). Corrected depth-below-MP measurements were provided by USGS-SCP personnel and converted to depth below land surface by USGS-EMP personnel by subtracting the height of the MP above land surface.

Water-level measurements at some monitoring sites were made by other personnel from the USGS using 300- or 500-ft reeled steel tapes and the general procedures previously described. All measurements using steel tapes are listed with method "S" in table 5.

Other

Site AM-4 (Devils Hole) has a small metal bolt fastened to the south wall of the fissure; the bolt is the measurement point and depth-to-water below the MP is measured with a ruled tape by USGS-EMP personnel during site visits. Such measurements are listed with method "N" in table 5. A continual recorder, operated by the National Park Service (NPS) at site AM-4, also records water level based on depth to water below the measurement point. The daily mean water levels

reported by the NPS are used to compute monthly average water levels; those monthly average water levels, indicated with method "A" in table 5, are listed as periodic water-level data for the 15th of the month.

Site JF-2a (UE-25p 1 PTH) was equipped with a pressure transducer in March 1985 as part of site-characterization studies (Luckey and others, 1993, p. 117). USGS-SCP personnel calibrate the pressure transducer, develop an equation to convert transducer voltage to depth to water below the MP, and record voltage of the transducer during each site visit. Owing to the small diameter of the access tubes, the transducer must be removed to provide access for measuring the water level with a steel tape. When a steel-tape measurement cannot be made, the depth to water can be computed using the USGS-SCP transducer voltage data and current conversion equation. Periodic water-level measurements at site JF-2a, indicated with method "B" in table 5, are computed using this procedure. Steel tape measurements, transducer voltage and conversion equations for 1996 were provided by USGS-SCP (Robert L. Goemaat, U.S. Geological Survey, written communs., 1996 and 1997). Installation, calibration, and operation of pressure transducers by USGS-SCP are described by Luckey and others (1993, p. 14-21), Lobmeyer and others, (1995, p. 12-14), O'Brien and others (1995, p. 8-10), Graves and others, (1996, p. 5-10), Tucci and others (1996a, p. 10-12), and Tucci and others (1996b, p. 9-11).

Water-level measurements were made by U.S. Fish and Wildlife Service (USFWS) with uncalibrated electric tapes and are listed with method "T" in table 5. The measurement procedure used is similar to that for a calibrated electric tape, except measurements are not corrected on the basis of comparisons to reference steel tapes.

Methods of water-level measurement were not specified for some data provided by private owners and the Nevada Division of Water Resources. Measurements made using unknown methods are indicated by "Z" in table 5.

Continual Water-Level Data

Two sites, JF-3 and AD-6, are instrumented by USGS-EMP to continually record ground-water level, atmospheric pressure, and battery voltage at 15-minute intervals. Instrumentation includes a gaged (vented) pressure sensor installed below the water surface, a barometer, and a data logger. Recorded data are processed to produce data on continual depth to water, atmospheric pressure, battery voltage, and daily average depth to water.

The pressure sensors at sites JF-3 and AD-6 transmit data to the data logger in pounds per square inch, which varies with the height of the water above the sensor. The range of output is 0 to 5.000 lb/in^2, which corresponds to a theoretical range of 0 to 11.53 ft of water above the pressure sensor. The general steps for installing and calibrating pressure sensors and processing pressure-sensor data are as follows:

1. Depth to water below MP is measured with a steel or calibrated-electric tape and recorded. If a calibrated electric-tape measurement is made, a correction factor is applied. Depth to water below MP is used for pressure-sensor calibration, rather than depth to water below land surface, because a fixed point of reference is required.

2. The pressure-sensor cable is connected to a data logger and the sensor is lowered down the well until a substantial change in readings indicates the water surface has been reached. These readings are recorded in the data logger and on a field sheet.

3. The sensor is lowered to a set point and the pressure-sensor readings are recorded after the sensor equilibrates. The set-point depth of the sensor is determined by adding the depth-to-water measurement to the depth at which the sensor is installed below the water surface. For example, if the depth-to-water is 710 ft below the MP and the sensor is installed 5 ft below the water surface, the set-point depth is 715 ft. The sensor cable is marked or tagged at the MP. This mark or tag is used for making measurements when the pressure sensor is raised or lowered.

4. Following installation, the sensor is calibrated for a range of depths that spans the anticipated range of water-level fluctuation. Water-level fluctuations (differing depths to water below the MP) are simulated by raising and lowering the pressure sensor. Raising the sensor 1 ft above the set point will decrease the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft increase in depth to water. For example, if the depth to water is 710 ft below the MP (step 1) and the sensor is raised 1 ft, the simulated depth to water below the MP would be 711 ft (710+1=711 ft). Lowering the sensor 1 ft below the set point will increase the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft decrease in depth to water. If the depth to water is

710 ft below the MP and the sensor is lowered 1 ft, the simulated depth to water below the MP would be 709 ft (710-1=709 ft).

The sensor is raised and lowered at 1/2-, 1-, or 2-ft intervals above or below the set point. The tag or marking placed on the sensor cable at the set point (step 3) provides a reference for measuring the distance the sensor is raised or lowered. After the sensor output has stabilized at each interval, the time, pressure readings from the data logger (in pounds per square inch), distance of sensor above or below the set point, and simulated depth to water are recorded. The sensor cable is marked or tagged at the measured intervals and later used for calibration checks.

5. Upon completion of pressure-sensor calibration, the sensor is returned to the set point and the time and pressure readings from the data logger are recorded. Another water-level measurement is made with a steel or calibrated-electric tape and recorded to check for fluctuation of the water level during installation or calibration of the sensor.

6. Data recorded while calibrating the sensor are used to develop a regression equation to convert pressure readings to water level below MP. The pressure readings from the data logger and corresponding simulated depths below the MP are regressed using pressure (in pounds per square inch) as the independent variable and depth below the MP (in feet) as the dependent variable.

The applicable period for utilizing a particular regression equation (to convert pressure readings to depth to water below the MP) generally corresponds with calibrations at the beginning and ending of that period. In some cases, however, the applicable period for a regression equation does not correspond with successive calibrations and a period is selected that minimizes differences between reference measurements made during site visits and computed water levels at dates intermediate to the two calibrations.

Water-level measurements are made with a steel or calibrated-electric tape when a continual monitoring site is visited. The pressure-sensor reading is recorded at the time of the measurement. The reading is converted to depth to water, using the established regression equation, and recorded as computed water level. The steel tape or calibrated-electric tape water-level measurement is used as a reference measurement and is compared to the computed value. Any difference between the reference measurement and computed value is applied as a correction to the continual record by linearly prorating the difference with time between consecutive visits to account for drift in pressure-sensor output.

Data are retrieved from the data logger using a portable computer, transferred to the USGS National Water-Information System (NWIS), and processed using data-base programs. The pressure-sensor data are converted to depths below land surface and stored. Daily average values are computed from the continual data and stored in the data base. Daily average depth-to-water values are used to compute daily average water-level altitudes, which also are stored in the data base.

Pressure-Sensor System at Site JF-3

Instrumentation is installed at JF-3 to continually collect water-level data every 15 minutes. Equipment was calibrated on January 18, 1995, and May 9, 1996. On the basis of calibration data collected on May 9, a regression equation was developed: depth to water below land surface = (-2.351 x pressure reading) + 715.290. To minimize corrections to computed water levels, this equation replaced the regression equation developed on January 18, 1995, and was used to convert pressure readings stored in the data base to water levels for January 1 to December 27, 1996. The pressure sensor malfunctioned on December 27, 1996.

Differences between reference measurements made with calibrated electric tapes and computed water levels based on conversion of pressure readings during January 1 to December 27, 1996, ranged from -0.08 ft (December 12) to 0.10 ft (January 24).

Depth-to-water measurements made with calibrated electric tapes during 1996 (table 5) ranged from 709.82 ft (November 15) to 710.89 ft (October 21) below land surface. The daily average water levels (table 6) ranged from 709.84 ft (March 22) to 710.84 ft (October 21) below land surface.

Pressure-Sensor System at Site AD-6

Instrumentation is installed at AD-6 to continually collect water-level data every 15 minutes. Equipment was calibrated on June 28, 1995. A regression equation was developed: depth to water below land surface = (-2.364 x pressure reading) + 46.110. Pressure readings stored in the data base for January 1 to March 19, 1996, were converted to depth below land surface with this equation. Differences between

reference measurements made with steel tapes and computed water levels, using the regression equation, ranged from -0.01 ft (January 23) to 0.00 ft (February 22, 1996). The pressure sensor malfunctioned on March 19, 1996.

On April 15, 1996, a new pressure sensor was installed and a new regression equation was developed: depth to water below land surface = (-2.320 x pressure reading) + 47.010. Pressure readings stored in the data base for April 15 to May 22, 1996, were converted to depth to water below land surface with this equation. The difference between reference measurements made with a steel tape and computed water levels based on the conversion of concurrent pressure readings ranged from 0.03 ft on April 15 to 0.07 ft on April 18, 1996. This pressure sensor malfunctioned on May 22, 1996.

On August 16, 1996, another pressure sensor was installed and a regression equation was developed: depth to water below land surface = (-2.346 x pressure reading) + 47.876. Pressure readings stored in the data base for August 16 to December 18, 1996, were converted to depth to water below land surface with this equation. Differences between reference measurements made with reeled steel tapes and computed water levels, using the regression equation, ranged from -0.03 ft on December 16 to -0.01 ft on August 22, September 23, and October 21, 1996. On December 18, 1996, the pressure sensor again malfunctioned.

Depth-to-water measurements made with calibrated electric tapes during 1996 (table 5) ranged from 41.45 ft (March 28) to 41.90 ft (October 21) below land surface. The daily average water levels (table 7) ranged from 41.51 ft (January 16 and April 16) to 41.90 ft (October 21) below land surface.

Other

Three monitoring sites also are instrumented to continually collect water-level data as part of other programs; those data are collected, processed, and reviewed by personnel associated with other programs and can be obtained from principal investigators for those programs. Site JF-2a was instrumented by USGS-SCP personnel. Sites AM-5 and AM-7 were instrumented as part of USGS, Nevada District programs.

Ground-Water Discharge Data

Measurements of ground-water discharge were collected and compiled for five springs and one flowing well. Four of the sites, AM-1a, AM-2, AM-5a, and AM-8, are in the Ash Meadows spring-discharge area of the Amargosa Desert. The other two sites, DV-1 and DV-2, are in Death Valley. Discharge measurements were made by NPS, USFWS, and USGS-EMP. Periodic and monthly mean discharge data were determined by the use of current meters, flumes, and volumetric techniques.

The most commonly used method for measuring discharge, indicated by method "C" in table 8, was the vertical-axis current meter. This method is used to determine the average velocity of a partial section within a channel cross section. The average velocity within the partial section times the area of the partial section equals the discharge of that section. The summation of the discharges for all the partial sections is the total discharge in the channel. This method is described in more detail by Buchanan and Somers (1969).

Some discharge values were determined by measuring the depth of water inside a flume. This depth, or stage, is compared to an applicable stage-discharge relation for the flume to determine discharge. Determining discharges by the use of flumes is further described by Kilpatrick and Schneider (1983). Where an instrument has been installed to continually record stage in a flume, mean discharges can be computed for specific periods. This method is indicated in table 8 by method "Z" and was used for site DV-1, where monthly mean discharge (reported for the 15th of the month) was computed on the basis of daily data collected by NPS.

The volumetric method, indicated by method "V" in table 8, was used for measuring ground-water discharge from sites AM-2 and DV-2. A container with markings indicating known volumes was used to collect all discharge from the site while a stopwatch was used to determine the amount of time the discharge was collected. The container was positioned to collect the discharge and the stopwatch was started simultaneously. The container was removed, before it was overfilled, and the stopwatch was stopped simultaneously. The volume collected and elapsed time were recorded. The discharge rate is the volume collected

divided by the time. This procedure was repeated three times and an average rate was computed for each site visit.

The accuracy of the methods is directly related to the operational conditions of the equipment used and to the environmental conditions in which the equipment operated. Discharge values are reported to two significant figures. Discharge determined by all methods ranged from 1.1 gal/min at sites AM-2 and DV-2 to 2,800 gal/min at site AM-5a for 1996 (table 8).

Ground-Water Withdrawal Data

Ground-water withdrawals were estimated from compiled data and are listed in table 9. Withdrawal data were supplied by public agencies including DOE, USGS, and the Nevada Division of Water Resources (NDWR), and private organizations including Bechtel Nevada, Daisy Gold Mining Company, and Cathedral Gold U.S. Corporation. In addition, Cind-R-Lite Company permitted USGS access to their well and water-use compilations.

Estimated annual ground-water withdrawals are based solely on available data. Estimates for some years, therefore, reflect a lack of information for an entire area or underestimate total withdrawals within an area.

Withdrawals from Alkali Flat-Furnace Creek Ranch Ground-Water Subbasin

Withdrawals from the part of the Amargosa Desert within the subbasin were recompiled from ground-water pumpage inventories taken by NDWR. The pumpage inventories were for the entire Amargosa Desert hydrographic area during 1996, and include estimated withdrawals for irrigation, mining or industrial, quasi-municipal and commercial, domestic, and other uses. All reported withdrawals for mining or industrial use and almost all withdrawals (about 99.9 percent) for irrigation and quasi-municipal and commercial uses are from the Alkali Flat-Furnace Creek Ranch ground-water subbasin. All domestic use for the Amargosa Desert is included in the subbasin because data were not available to estimate or exclude the amount used in the Ash Meadows ground-water subbasin.

Withdrawals from Crater Flat were determined from totalizing flowmeters at site CF-1, site CF-3, and well USW VH-2 (about 1.5 mi northwest of site CF-2). Withdrawals from site CF-1 and well USW VH-2 are based on information supplied by the Daisy Gold Mining Company (Brian Strain, written commun., 1997) and the Cathedral Gold U.S. Corporation (Charles Stevens, written commun., 1996), respectively. Data on withdrawals from well USW VH-2 were available only for January through May 1996, although ground water is known to have been pumped from that well during the remainder of the year. Withdrawals from site CF-3 were recompiled from flowmeter readings recorded by USGS-EMP personnel.

Withdrawals from Jackass Flats were determined from totalizing flowmeters at sites J-13 and J-12 and at wells UE-25c #3 (about 2.5 mi northwest of site J-13) and USW G-2 (about 6.75 mi northwest of site J-13). Withdrawals at sites J-13 and J-12 were recompiled from flowmeter readings supplied by Bechtel Nevada as part of the USGS Hydrologic Resources Management Program (David B. Wood, U.S. Geological Survey, written commun., 1997). Withdrawals from wells UE-25c #3 and USW G-2 are based on quarterly pumpage reports provided by DOE (Wendy Dixon, U.S. Department of Energy, written communs., 1996 and 1997). Withdrawals from Rock Valley are considered negligible on the basis of knowledge of activities in that area.

Withdrawals from Ash Meadows Ground-Water Subbasin

Withdrawals from Mercury Valley were recompiled from flowmeter readings supplied by Bechtel Nevada for site MV-1 as part of the USGS Hydrologic Resources Management Program (David B. Wood, U.S. Geological Survey, written commun., 1997). Withdrawals for domestic use from the part of the Amargosa Desert within the subbasin were not available, although ground water is known to have been pumped in 1996. Withdrawals for irrigation and quasi-municipal use in the Amargosa Desert (excluding the Ash Meadows area) within this subbasin include withdrawals from two wells located in T. 17 S., R. 52 E. Withdrawals from the Ash Meadows area of the Amargosa Desert within this subbasin include withdrawals for quasi-municipal and other uses from two wells located in T. 18 S., R. 50 E. and T. 18 S., R. 51 E.

Quality Assurance

Stringent quality assurance is required for all work pertaining to Yucca Mountain studies to establish adequate confidence in the reliability of data collection, processing, and reporting. In the context of this data-collection program, quality assurance is defined as all planned or systematic actions designed to provide data and records of a desired quality. A variety of quality-control procedures, which are the operational techniques and activities used to meet the required quality objectives, have been implemented.

The numerous management and administrative procedures that control processing, record keeping, and reporting of data by USGS-EMP are not detailed in this report. Generally, data such as location, date and time of determinations, and field measurements are recorded onsite. Those data are reviewed for completeness and accuracy, stored in project files and data bases, and are subsequently included in publications by the USGS. Following publication, data are stored in a comprehensive record-keeping facility maintained by contractors for DOE.

In addition to standard USGS practices and the procedures previously described, formal unpublished technical procedures associated with the Yucca Mountain Site Characterization Project have been developed for the collection of water-level and discharge data. Those technical procedures include equipment tests and calibrations, in addition to measurement techniques, to ensure that necessary and expected precision and accuracy are attained. The principal technical procedures that control the collection of data by project personnel are listed by La Camera and Westenburg (1994, p. 17).

PRESENTATION OF GROUND-WATER DATA

Tables included in this report generally list only 1996 ground-water data, whereas figures 2-12 show data for the period of record to illustrate changes in ground-water resources through time. Exceptions are tables 3, 4, and 10; tables 3 and 4 include data from 1997 used to determine correction factors for electric-tape measurements made during 1996 and table 10 includes a summary of historical water-level measurements at monitoring sites in Jackass Flats. Below is a description of the content of the tables and figures presented in this report.

Tables 5-9 list ground-water data that have been collected and compiled in the Yucca Mountain region as part of this study; they are included at the back of this report. Figures 2-14 are hydrographs and other graphical representations of selected data from the tables in this report, previous reports on selected ground-water data for the Yucca Mountain region, and data collected by USGS-SCP.

Pumping of water from or injecting water into a well or nearby well may result in short-term variations in water levels that differ from long-term or sustained ground-water levels. Observations about such activities (noted by field personnel during site visits) and corresponding water levels, which may represent short-term conditions, are reported for "site status" in the data tables. Data which may reflect short-term conditions, however, are excluded from the figures showing variations in water level through time.

Table 5 lists periodic measurements of depth to water and water-level altitude at 36 sites (including a flowing well) for 1996. Periodically collected data generally are from manual onsite measurements of depth to water. Data at site AM-4 (Devils Hole) reported as data source "NPS," however, are monthly average water levels and are based on continual water levels recorded by instrumentation that is operated by the National Park Service. Data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Figures 2-5 show water levels listed in this report and previous reports on selected ground-water data for the Yucca Mountain region. Data for wells with primary contributing units of carbonate rock, volcanic rock, valley fill, and undifferentiated sedimentary rock are presented.

Tables 6 and 7 list daily average water levels at sites JF-3 and AD-6, respectively, for 1996. The daily average water levels are computed from continual water levels recorded by instrumentation at 15-minute intervals.

Figures 6 and 7 show daily average depth to water and water-level altitude for sites JF-3 and AD-6, respectively. Daily averages are calculated on the basis of continually collected data listed in tables 6 and 7 of this report and previous reports on selected ground-water data for the Yucca Mountain region. Data are presented for 1992 through 1996.

Table 8 lists periodic measurements of ground-water discharge at six sites for 1996. The data for site DV-1 (Texas Spring) reported with data source "NPS" represent monthly average discharge on the basis of

instrumentation operated by the National Park Service. Discharge data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Discharge measured at site AM-2 (a combination of flow directly through slotted casing near the land surface and leakage from the casing's annular space) increased from 1.4 gal/min to more than 40 gal/min between January and July 1996. The increase in discharge corresponds with the periodic removal of debris from around the well casing near land surface (between April and July 1996) and decline in water level in the flowing well (table 5). Declines in water level and increases in discharge at the well may have resulted from increased water flow through previously clogged slots in the well's casing or through fractures in rock surrounding the casing (also previously clogged with debris). Further monitoring is needed to indicate whether ground-water discharge actually increased in the area or whether the apparent increase is related to disturbances at site AM-2.

Figure 8 shows measurements of ground-water discharge at sites AM-1a, AM-5a, and AM-8 through 1996, as listed in this and previous reports on selected ground-water data for the Yucca Mountain region. **Figures 9 and 10** show measurements of ground-water discharge through 1996 at sites AM-2 and DV-2, and DV-1, respectively, listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Periodic USGS measurements for 1990, 1991, and 1992 that were tabulated by La Camera and Westenburg (1994, table 5) have been revised to reflect previously unaccounted water at site DV-1.

Table 9 shows estimates of annual ground-water withdrawals from wells in the Yucca Mountain region for 1996. Estimated annual ground-water withdrawals are based solely on available data, and information on withdrawals provided by other agencies or programs are subject to revision upon further review by that agency or program. Ground-water withdrawals, in millions of gallons and in acre-feet, from water-supply wells are grouped by ground-water subbasin and totaled by hydrographic area (or part of a hydrographic area) for calendar year 1996.

Figures 11 and 12 show estimates of annual ground-water withdrawals listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Shown are withdrawals for areas with available data within the Alkali Flat-Furnace Creek Ranch and Ash Meadows ground-water subbasins, respectively, through 1996.

DISCUSSION OF GROUND-WATER LEVELS AND GROUND-WATER WITHDRAWALS IN JACKASS FLATS

In Jackass Flats, ground water is withdrawn to support several DOE activities (including site characterization); if those withdrawals affect ground-water levels, the effects may be detected in Jackass Flats before they are detected elsewhere within the Yucca Mountain region. The following section discusses data on ground-water levels and ground-water withdrawals in Jackass Flats. Changes in water-level altitudes at a particular site through time, discussed in the text towards the end of this section, are described in an order generally corresponding to increasing distance of the site from water-supply wells J-13 and J-12.

Figure 13 shows water-level altitudes for seven wells in Jackass Flats and estimated annual ground-water withdrawals in Jackass Flats from 1983 through 1996. Prior to 1983, available data on ground-water withdrawals in Jackass Flats generally represent only the withdrawals from well J-12 rather than total withdrawals from Jackass Flats. For greater consistency and comparability of data on water-level altitudes, water levels in wells J-13, J-12, and JF-3 that may have been affected by pumping or recent pumping of the well (water-level measurements associated with site status "P" or "R") are excluded from figure 13.

Water-level altitudes presented are based on periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half the year). Water levels based on periodic measurements made during site visits are shown for all sites prior to 1985; for sites JF-1, J-13, J-11, and J-12 since 1985; for site JF-2 since 1994; and for site JF-3 prior to May 1992. Daily average water levels from the U.S. Geological Survey Site-Characterization Program (R.P. Graves and J.M. Gemmell, U.S. Geological Survey, written communs., 1997) are shown for site JF-2 for 1985-93 and site JF-2a for 1985-96; continual data collection at site JF-2 was discontinued in June 1994 and only periodic water levels were shown following December 1993. Daily average water levels also are shown for site JF-3 from May 1992 through December 1996; long-term monitoring and continual data collection at this site began in May 1992.

Total ground-water withdrawals in 1996 consisted principally of combined pumpage from water-supply wells J-13 and J-12 and test well UE-25c #3

(about 2.5 mi northwest of well J-13), which penetrate volcanic rock. About 27.6, 43.2, and 55.0 Mgal, respectively were withdrawn from those three wells during 1996. Ground water also was withdrawn from volcanic rock penetrated by well USW G-2 (about 6.75 mi northwest of well J-13) during hydraulic testing of the well in 1996; the amounts were minor compared with annual withdrawals from the water-supply wells and well UE-25c #3. Total ground-water withdrawals in Jackass Flats, from 1983 through 1996, are from data presented in this and previous reports on selected ground-water data for the Yucca Mountain region.

Total 1996 withdrawals in Jackass Flats were about 127 Mgal. Ground-water withdrawals during 1996 were about 41 percent greater than withdrawals during 1995 and about 145 percent greater than the median withdrawal of 52 Mgal for 1983 through 1991 (La Camera and Westenburg, 1994, p. 30).

Table 10 lists selected statistics derived from data shown in figure 13 for water-level altitudes in Jackass Flats. Data for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 are summarized for the selected baseline periods and for subsequent calendar years through 1996. The table shows the number of measurements; the minimum, maximum, and median water-level altitude; and the average deviation of measured water-levels about the median water level for each period.

To minimize effects of variability in measurement frequency on median water-level altitudes calculated for the period prior to 1992, the selection of a baseline period for each site was based on (1) the maximum number of consecutive years for which water-level measurements are available and (2) consecutive years containing approximately similar frequencies of water-level measurements. For consistency, the baseline period selected at instrumented wells JF-2 and JF-2a was the period following installation of continual recorders. The baseline period for JF-3 was based solely on the availability of daily average water levels from the continual data recorder, which was installed in May 1992. These baseline periods are the standard to which following years are compared.

The median water-level altitudes shown in table 10 indicate a statistically representative ground-water level for a particular time. The median of water-level measurements is listed because the calculated median is less affected by a few high or low values than the arithmetic mean. When more than half a year of continual data at a site were available (recorded hourly or more frequently by instrumentation), the median of daily average water levels is listed.

The average deviation indicates the dispersion of the individual measurements about the median; it provides an indication of how precisely the median approximates a typical water-level altitude during the period. The average deviation equals the sum of the absolute differences between individual measurements and the median, divided by the number of individual measurements.

Figure 14 shows the median water-level altitudes and the average deviation of the water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 for baseline periods and for subsequent years through 1996. Selected information presented in the figure is summarized in the following discussion.

Median water-level altitude in water-supply well J-13 is 2,390.0 ft above sea level for the baseline period. Median water-level altitude in well J-13 for 1996 was 2,389.6 ft, which is 0.2 ft lower than the median water level in 1995 and 0.4 ft lower than that for the baseline period. The decrease in median water-level altitude between the baseline period and 1996 is greater than the apparent precision of the median for the baseline period (as indicated by the average deviation for 1989-91).

Median water-level altitude in water-supply well J-12 is 2,388.3 ft above sea level for the baseline period. Median water-level altitude in well J-12 for 1996 was 2,388.0 ft, which also is 0.2 ft lower than that for 1995 and is 0.3 ft lower than the median water level for the baseline period. The amount of change in median water-level altitude between the baseline period and 1996 is greater than the calculated precision (average deviation) of the median for 1990-91.

Median water-level altitude in well JF-3, which is 0.5 mi south of water-supply well J-12 and penetrates volcanic rock, is 2,388.3 ft above sea level for the baseline period. Median water-level altitude for 1996 was 2,388.0 ft and is 0.1 ft and 0.3 ft lower, respectively, than median water-level altitudes for 1995 and the baseline period. The decrease in median water-level altitude between the baseline period and 1996 exceeds the apparent precision of the median for 1992-93.

Compared to their respective baseline periods, calculated declines in median water-level altitudes for wells J-13, J-12, and JF-3 (which penetrate volcanic rock and also are at or near principal points of ground-water withdrawals from volcanic rock) are greater than

the historical variability of water levels represented by the average deviation. Continued monitoring of ground-water withdrawals in Jackass Flats and water levels at wells J-13, J-12, and JF-3 should indicate whether further declines in water levels are observed during or after periods of withdrawals that are greater than those prior to 1993 (figure 13).

Median water-level altitude in well JF-2, which is north of the water-supply wells and penetrates volcanic rock, is 2,392.1 ft above sea level for the baseline period. Median water-level altitude for 1996 was 2,392.1 ft in well JF-2, which is 0.3 ft lower than the median for 1995 but identical to the median for the baseline period. Changes in median water levels were equal to or less than the average deviation of water levels during the baseline period 1985-91.

Median water-level altitude in well JF-2a, which is northwest of the supply wells and penetrates carbonate rock, is 2,468.6 ft above sea level for the baseline period. The median water-level altitude for 1996 was 2,469.3 ft, which is 0.2 ft higher than the median water level for 1995 and 0.7 ft higher than that for the baseline period. The increase in water level between the baseline period and 1996 is greater than the apparent precision of the median water-level altitude for 1985-91; further monitoring at the well should indicate whether water levels continue to rise, stabilize at higher levels, or subsequently decrease to pre-1996 or baseline levels.

Median water-level altitude in well JF-1, which is north of the water-supply wells and penetrates volcanic rock, is 2,392.5 ft above sea level for the baseline period. Median water-level altitude in well JF-1 for 1996 is 2,392.3 ft, which is 0.2 ft lower than that for 1995 and the baseline period. Compared to the baseline period, the apparent 0.2 ft decline in 1996 is equal to the calculated precision of the median for 1985-91.

Median water-level altitude in well J-11, which is east of water-supply wells J-13 and J-12 and penetrates volcanic rock, is 2,402.2 ft above sea level for the baseline period. Median water-level altitude in well J-11 for 1996 was 2,402.4 ft, and is identical to that for 1995 but 0.2 ft higher than the median for the baseline period. The amount of change in median water-level altitude between the baseline period and 1996 exceeds the calculated precision (average deviation) of the median for 1990-91. Similar to site JF-2a, continued monitoring at site J-11 should indicate whether water levels will stabilize near higher levels or subsequently decrease to pre-1996 levels.

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BASIC DATA

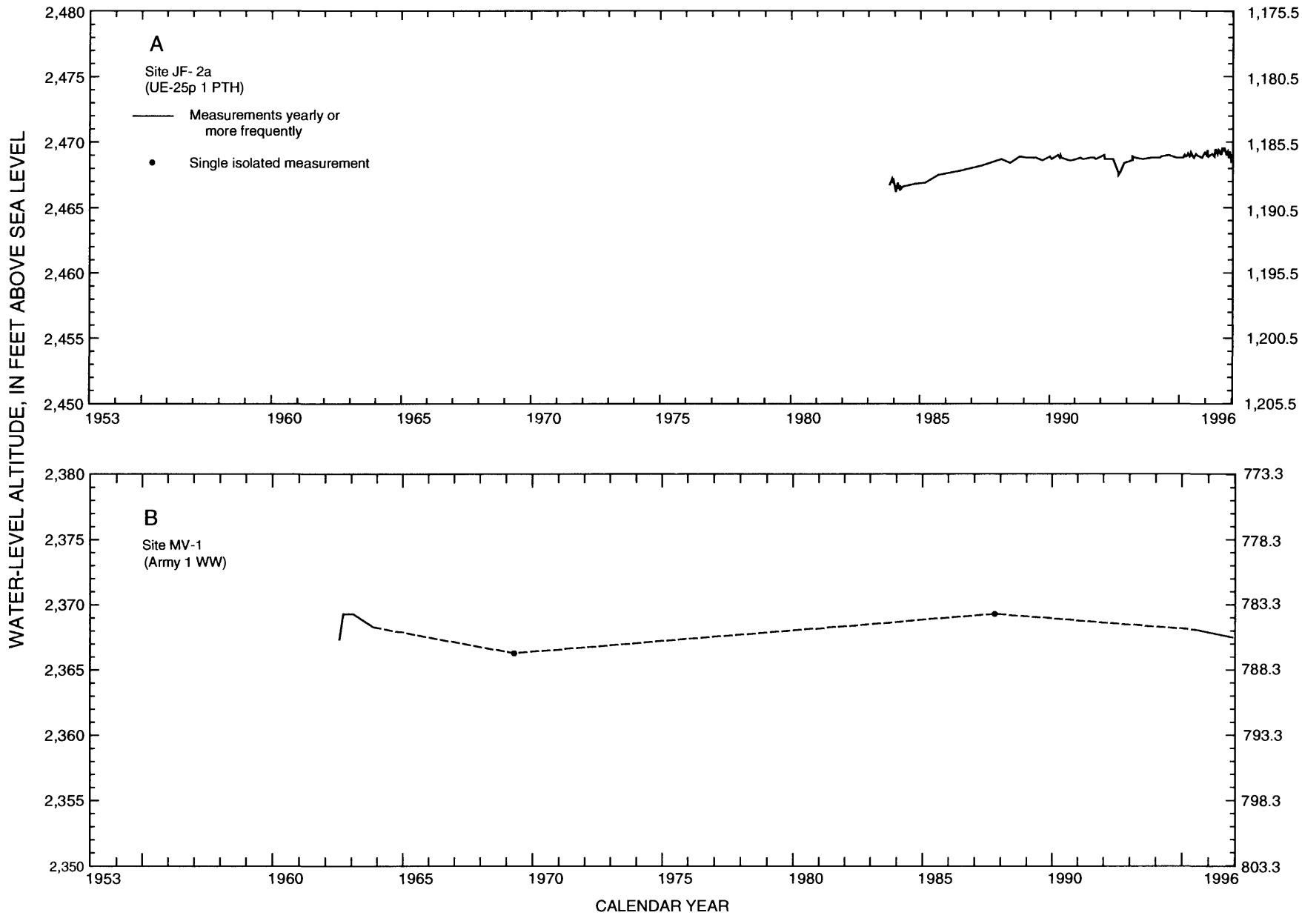
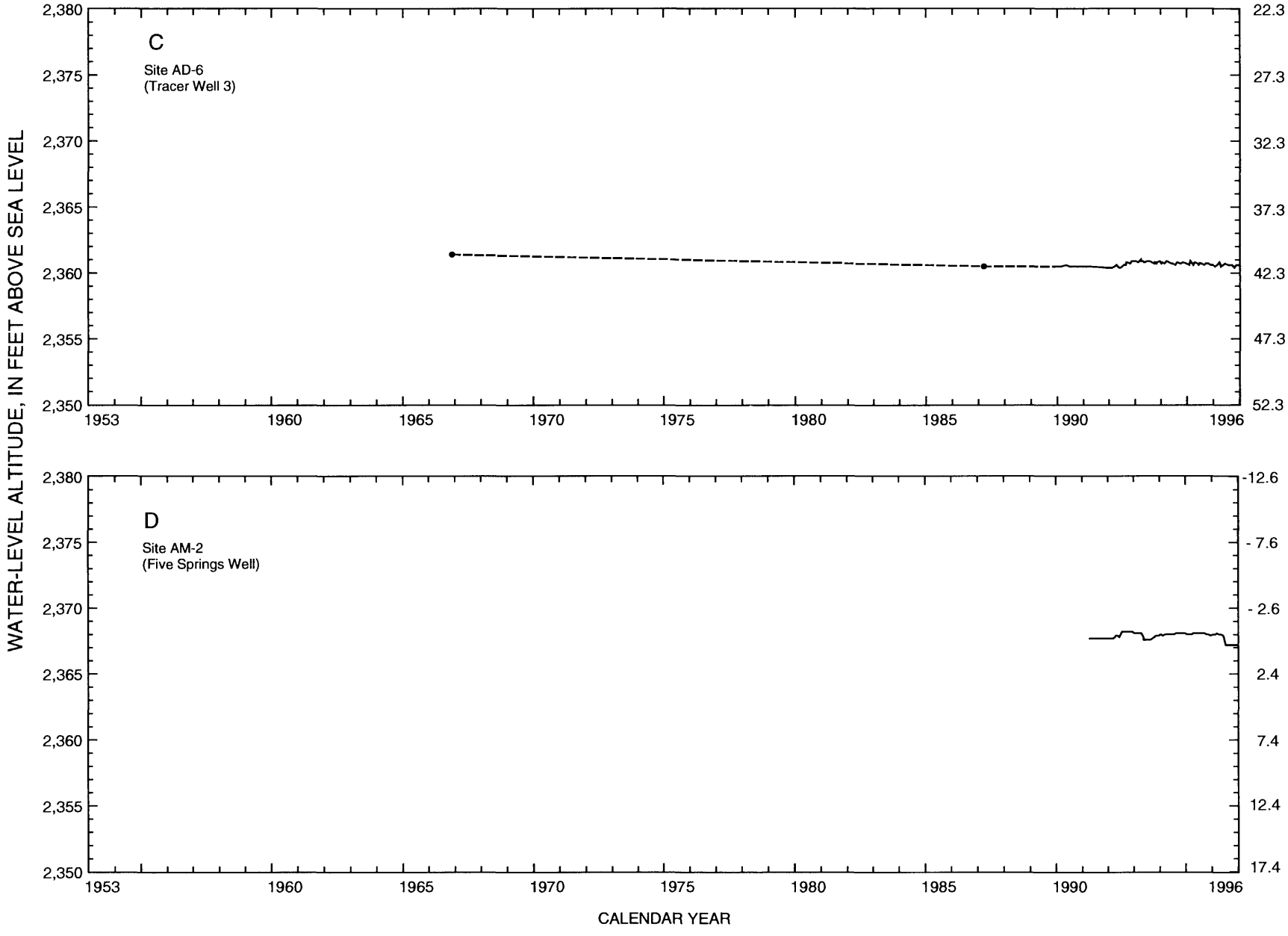


Figure 2. Periodic water levels through 1996 for selected sites at which primary contributing units are carbonate rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region and are dashed where measurements were not available for consecutive calendar years. Data that may represent short-term conditions at a site have been excluded (see section titled "Presentation of Ground-Water Data").



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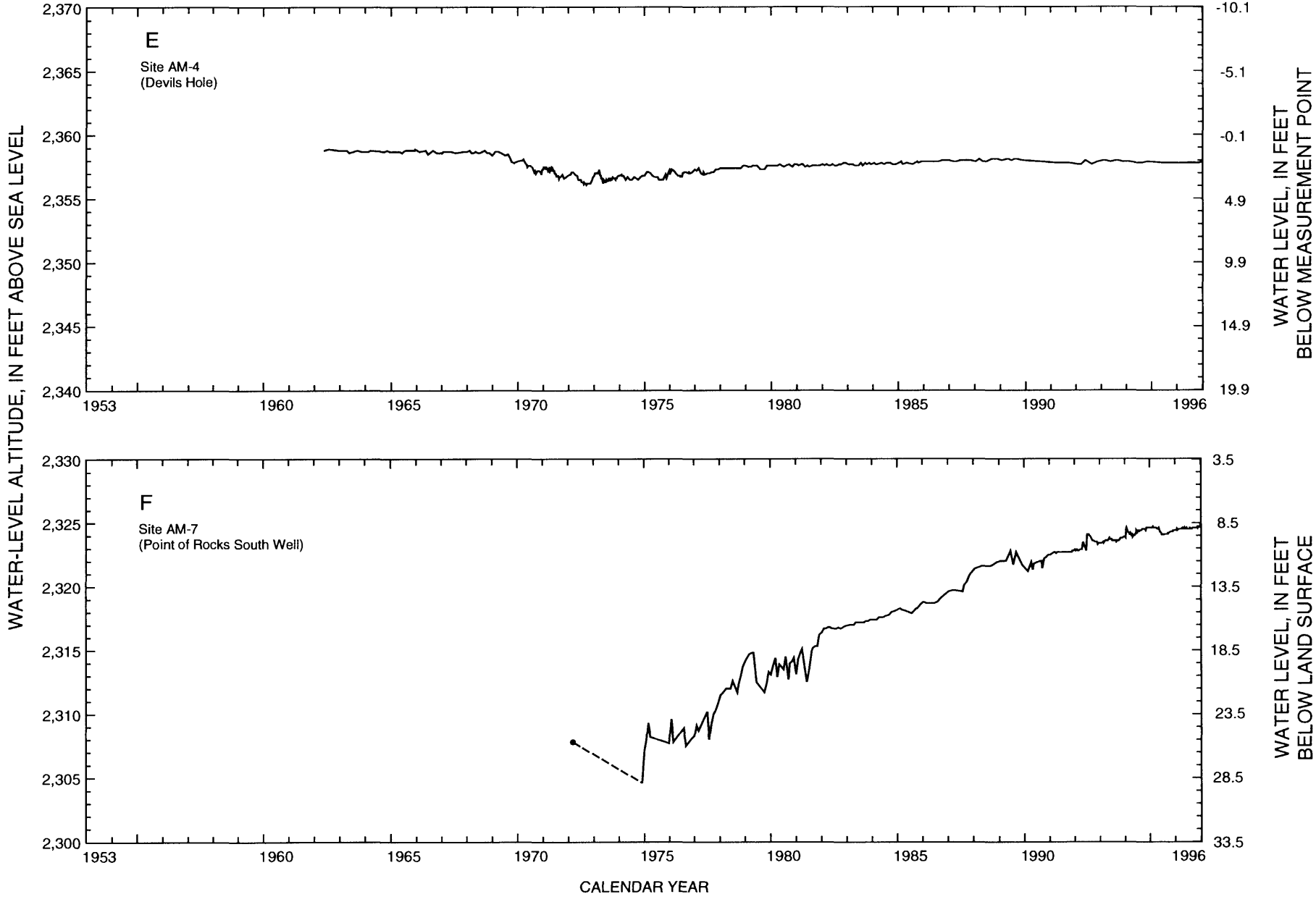

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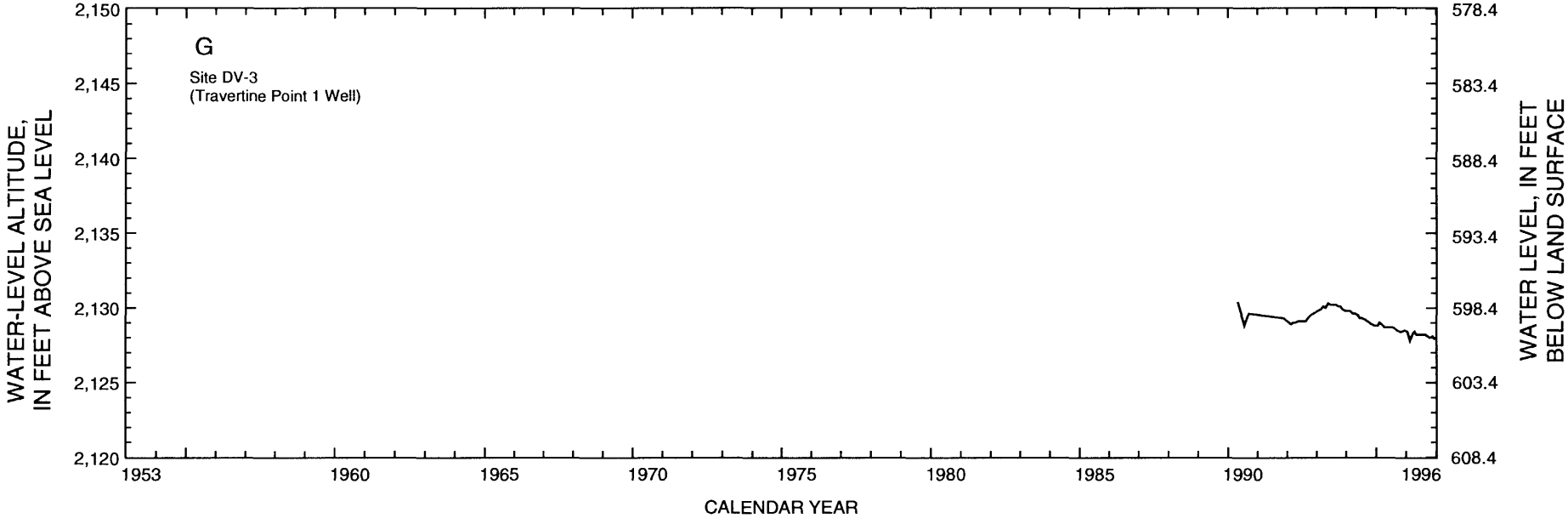

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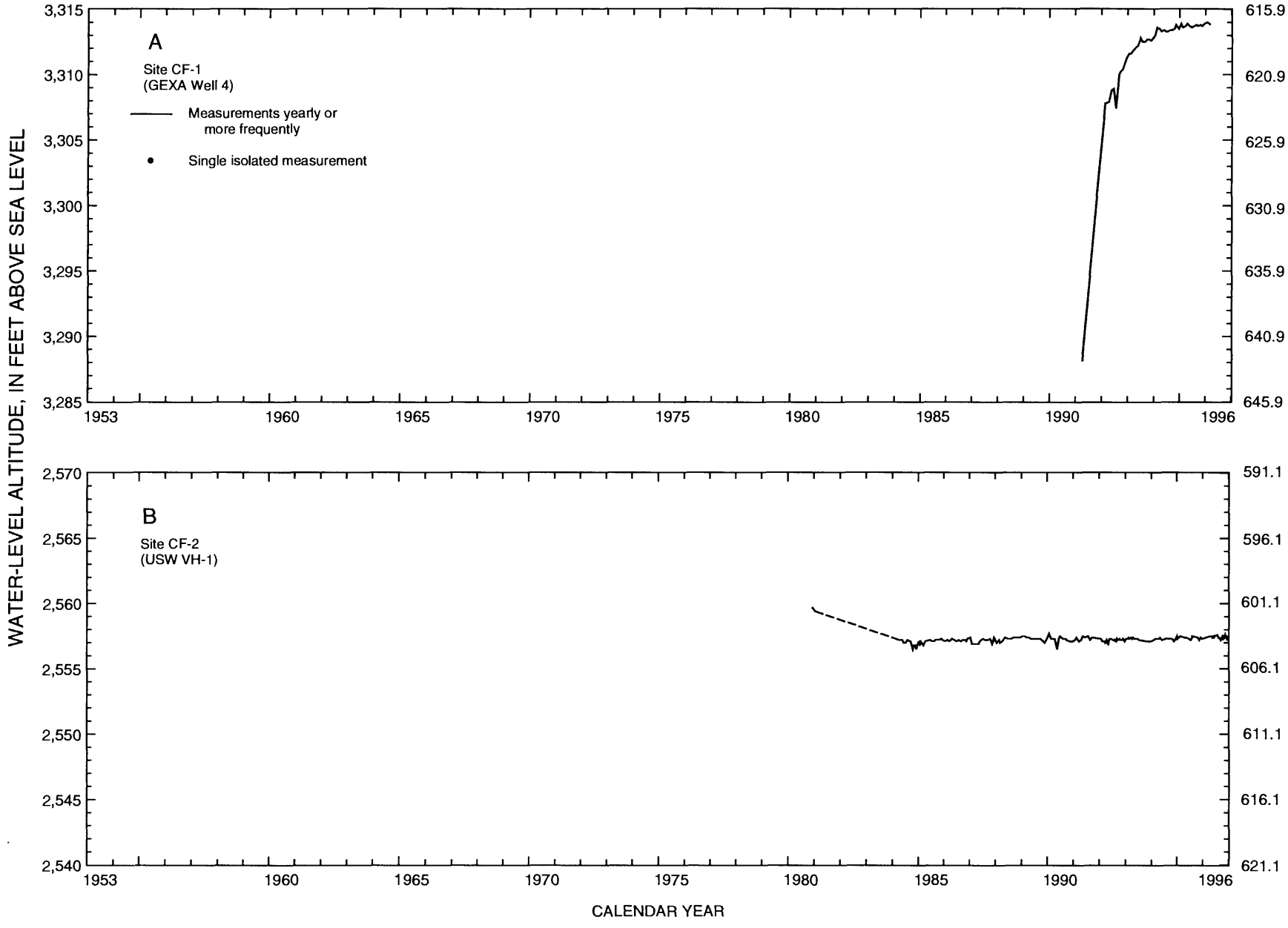
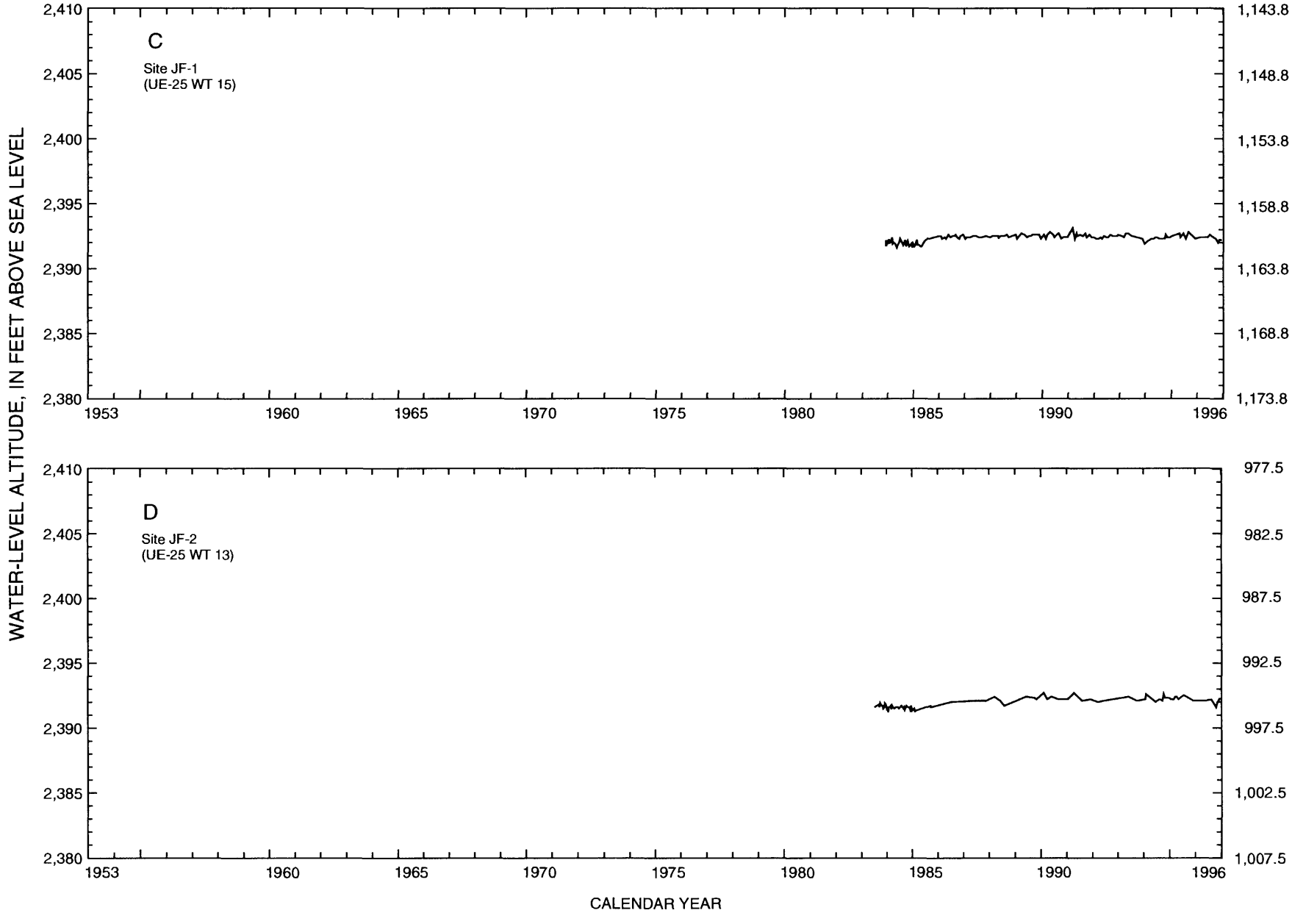


Figure 3. Periodic water levels through 1996 for selected sites at which primary contributing units are volcanic rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region and are dashed where measurements were not available for consecutive calendar years. Data that may represent short-term conditions at a site have been excluded (see section titled "Presentation of Ground-Water Data").



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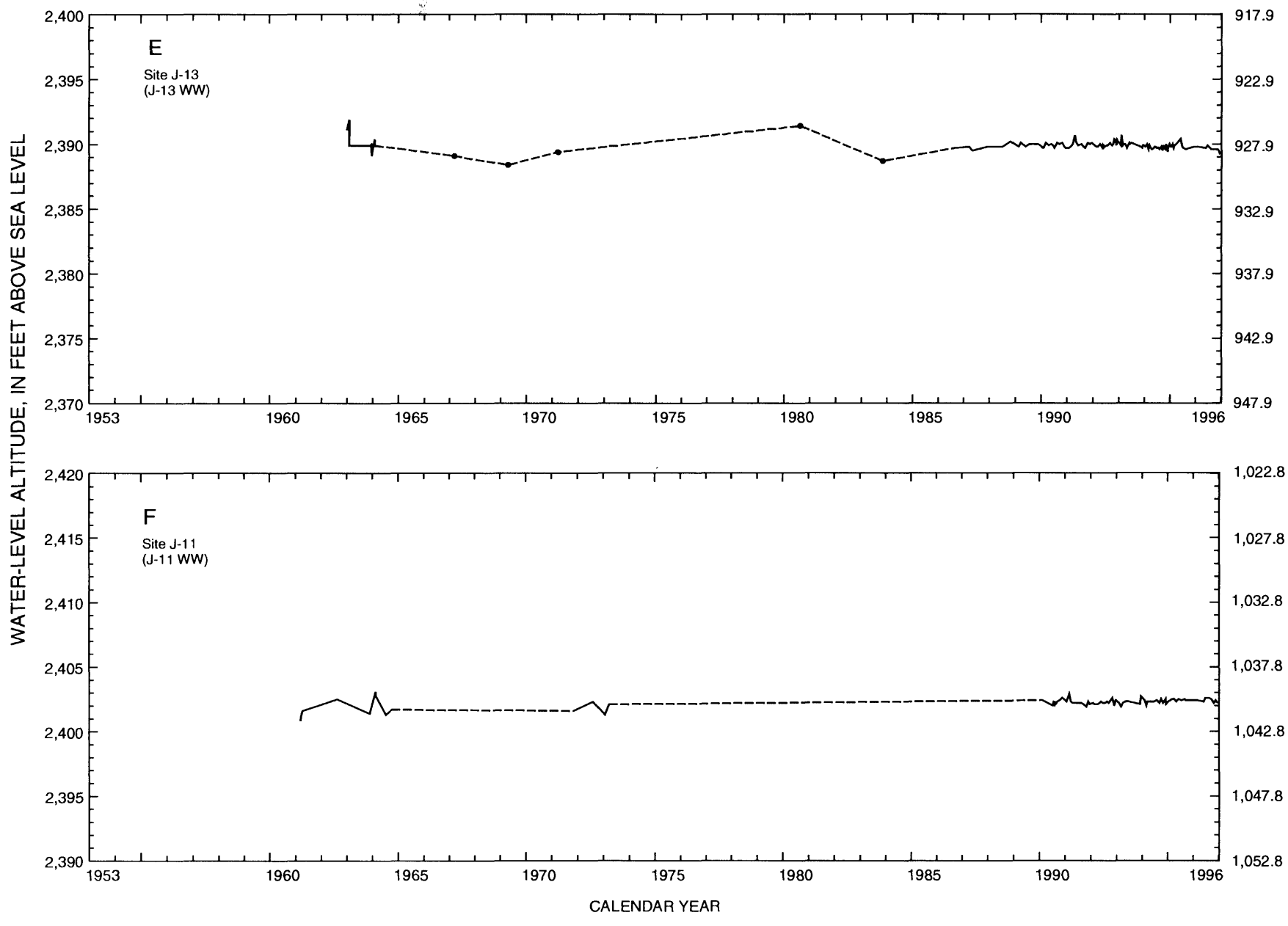

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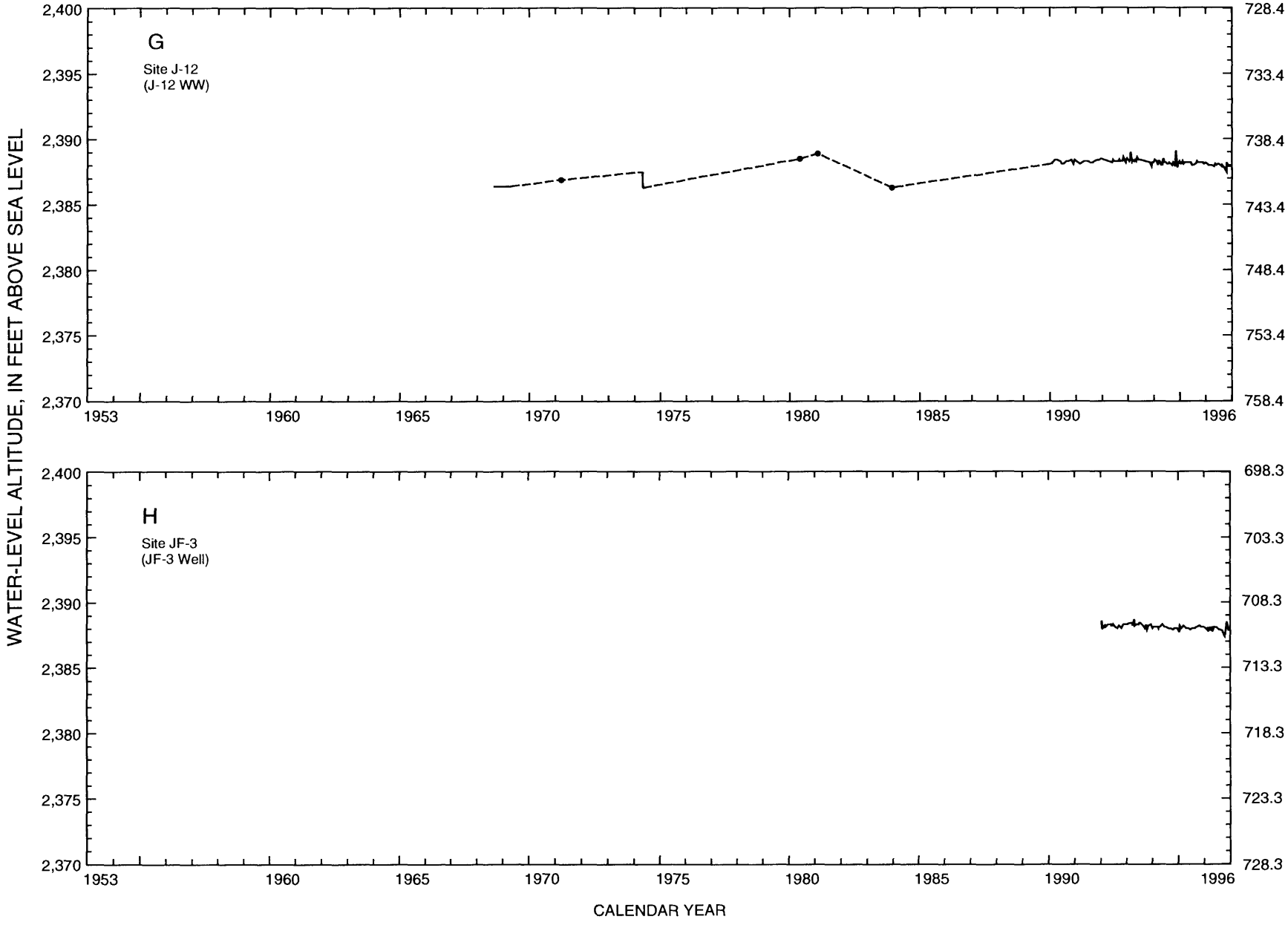

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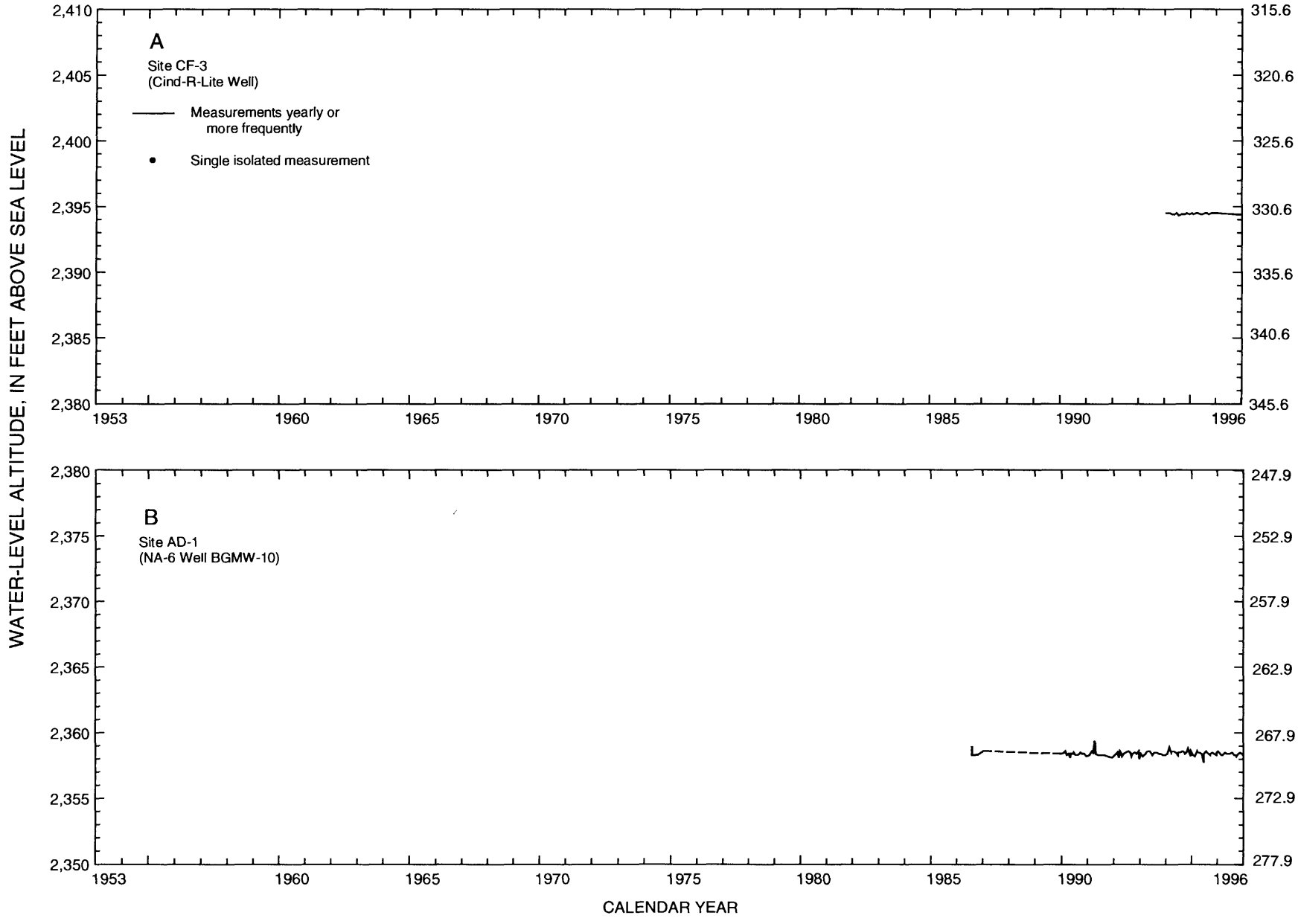
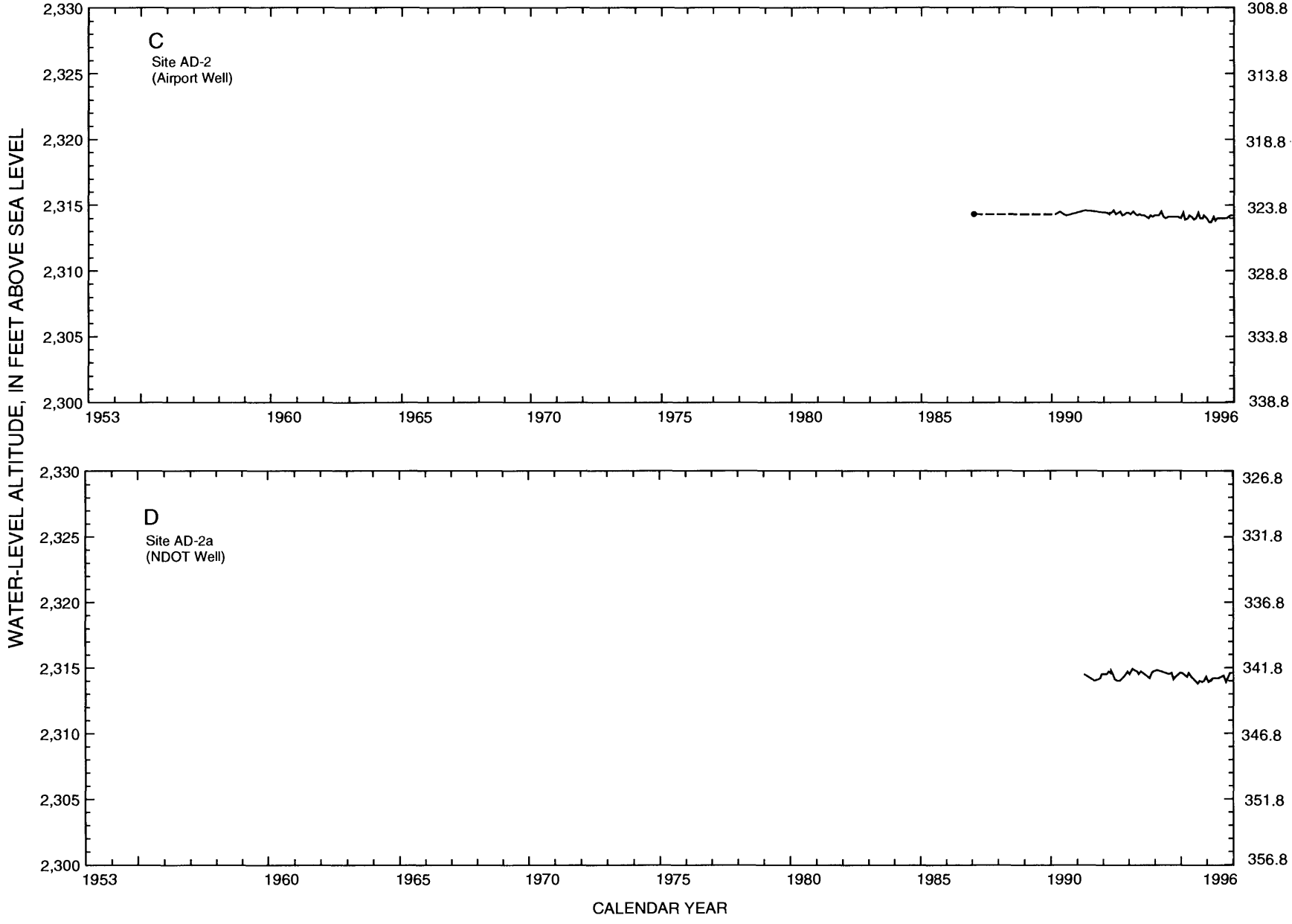


Figure 4. Periodic water levels through 1996 for selected sites at which primary contributing units are valley fill. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region and are dashed where measurements were not available for consecutive calendar years. Data that may represent short-term conditions at a site have been excluded (see section titled "Presentation of Ground-Water Data").



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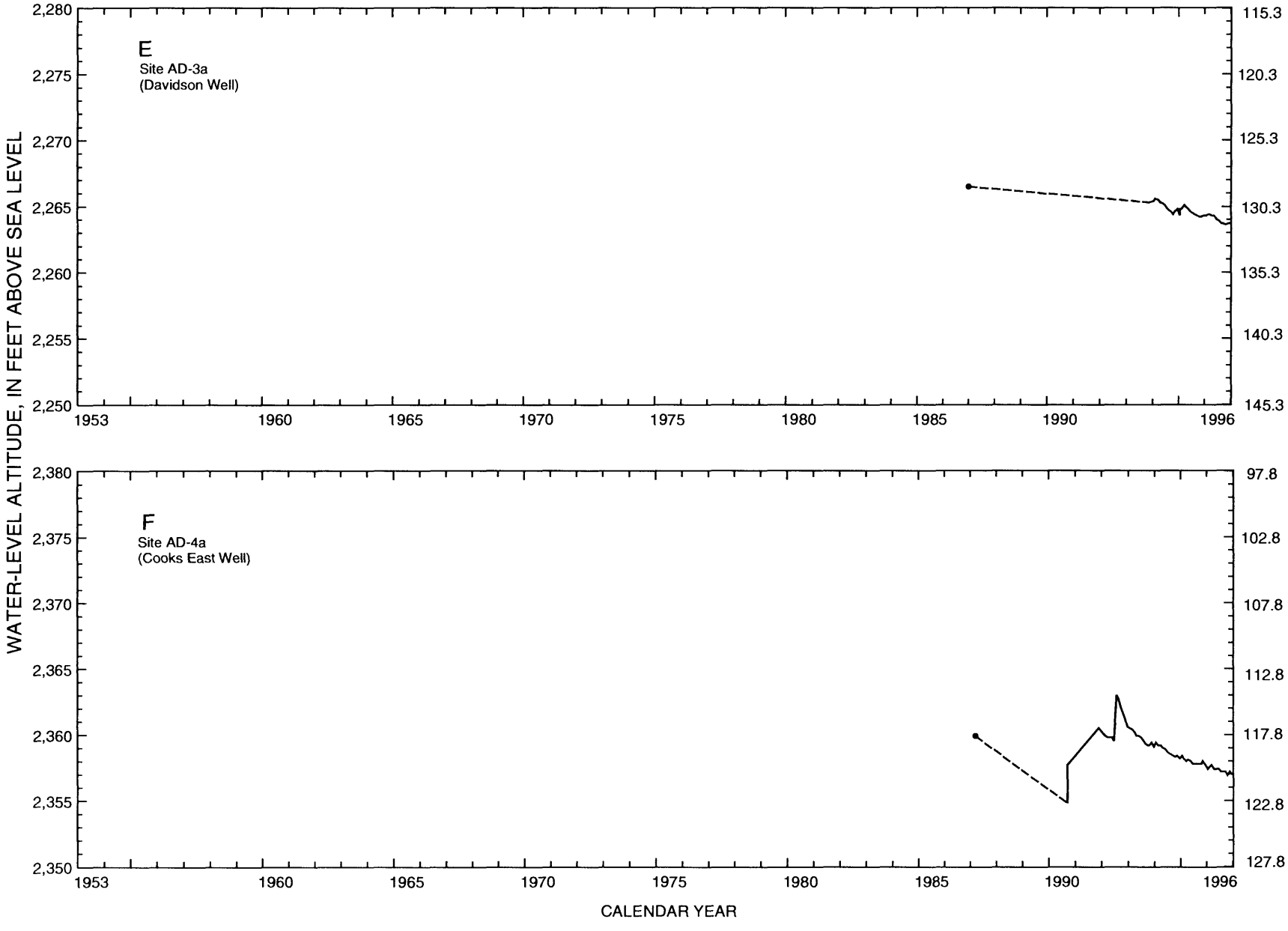

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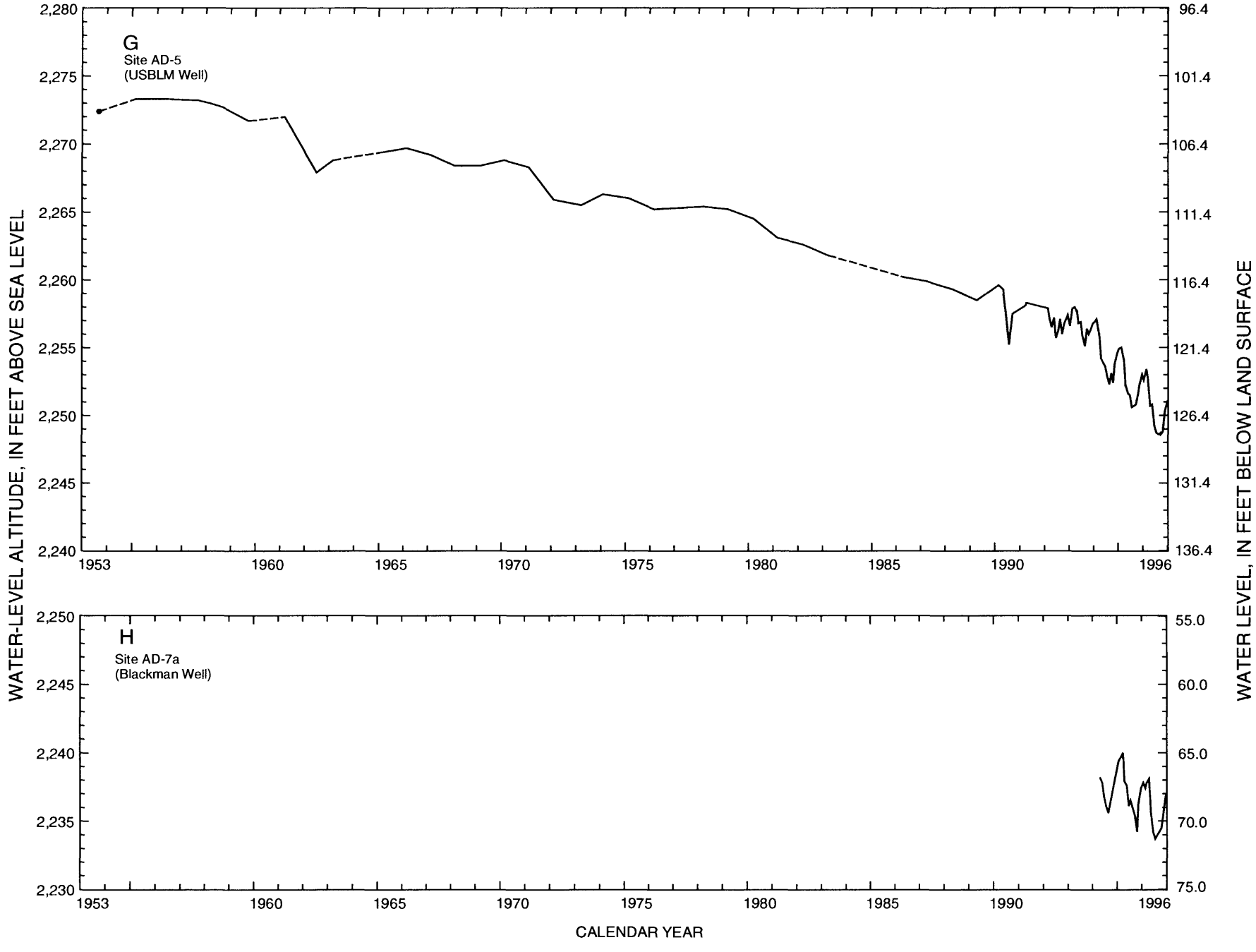

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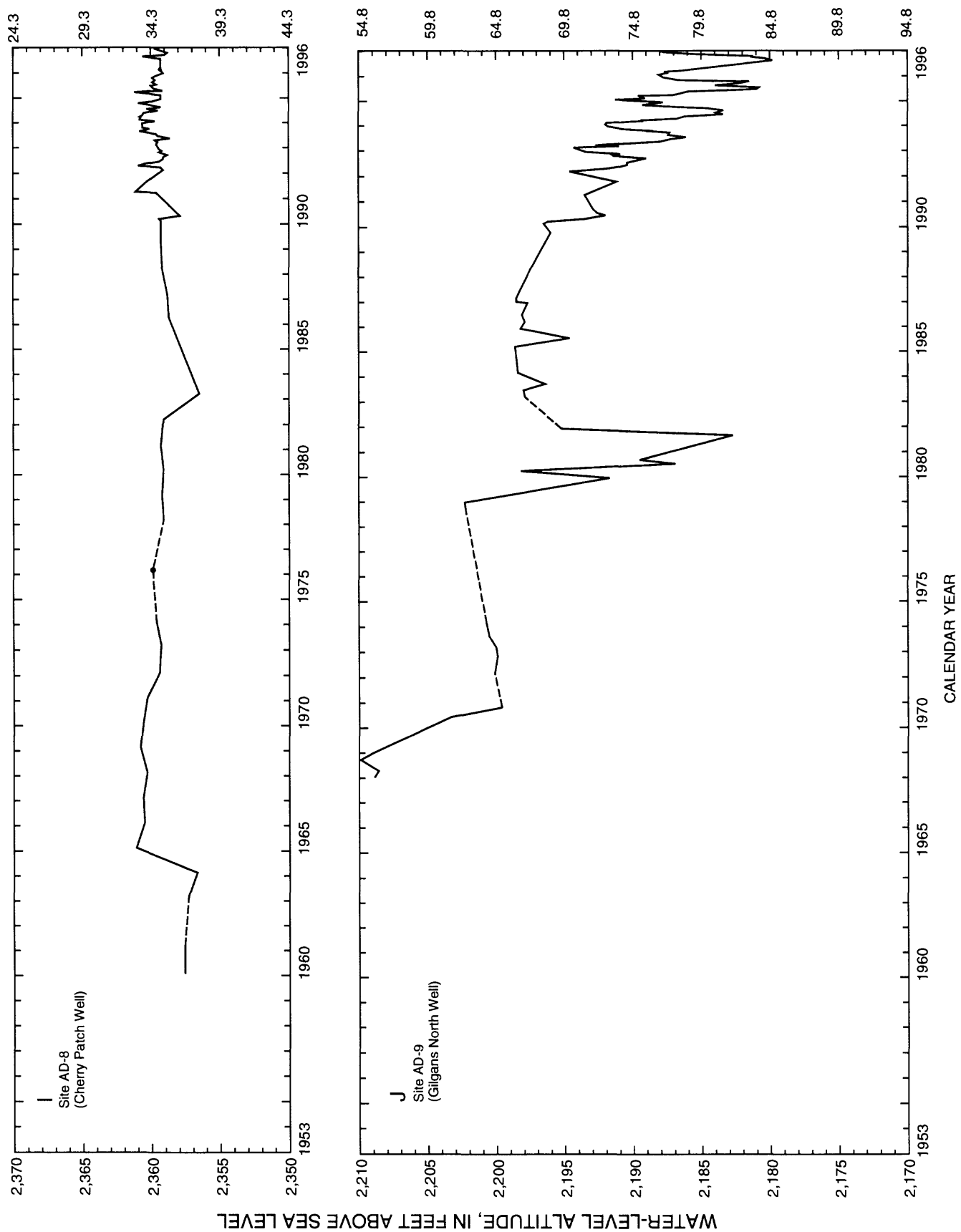

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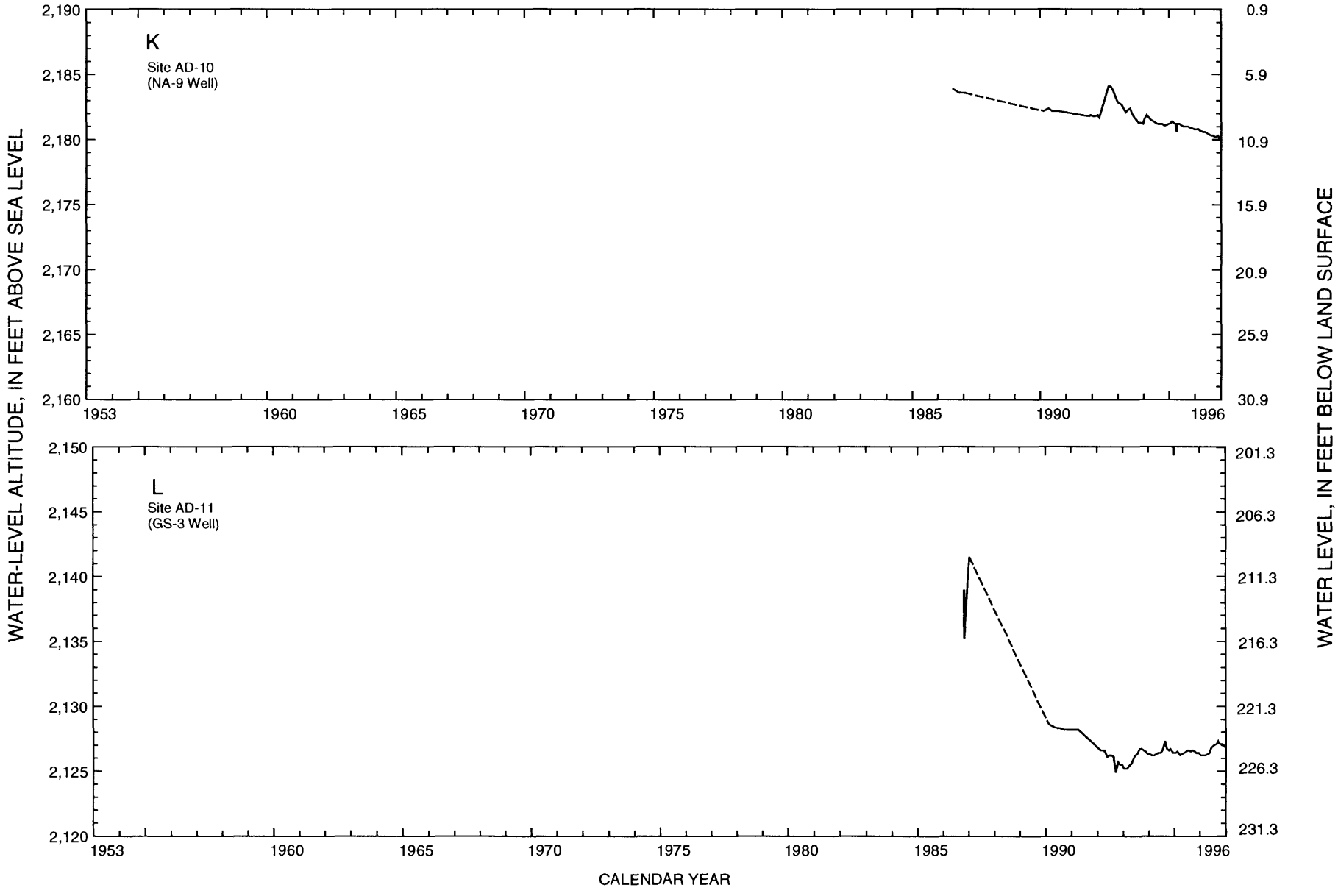

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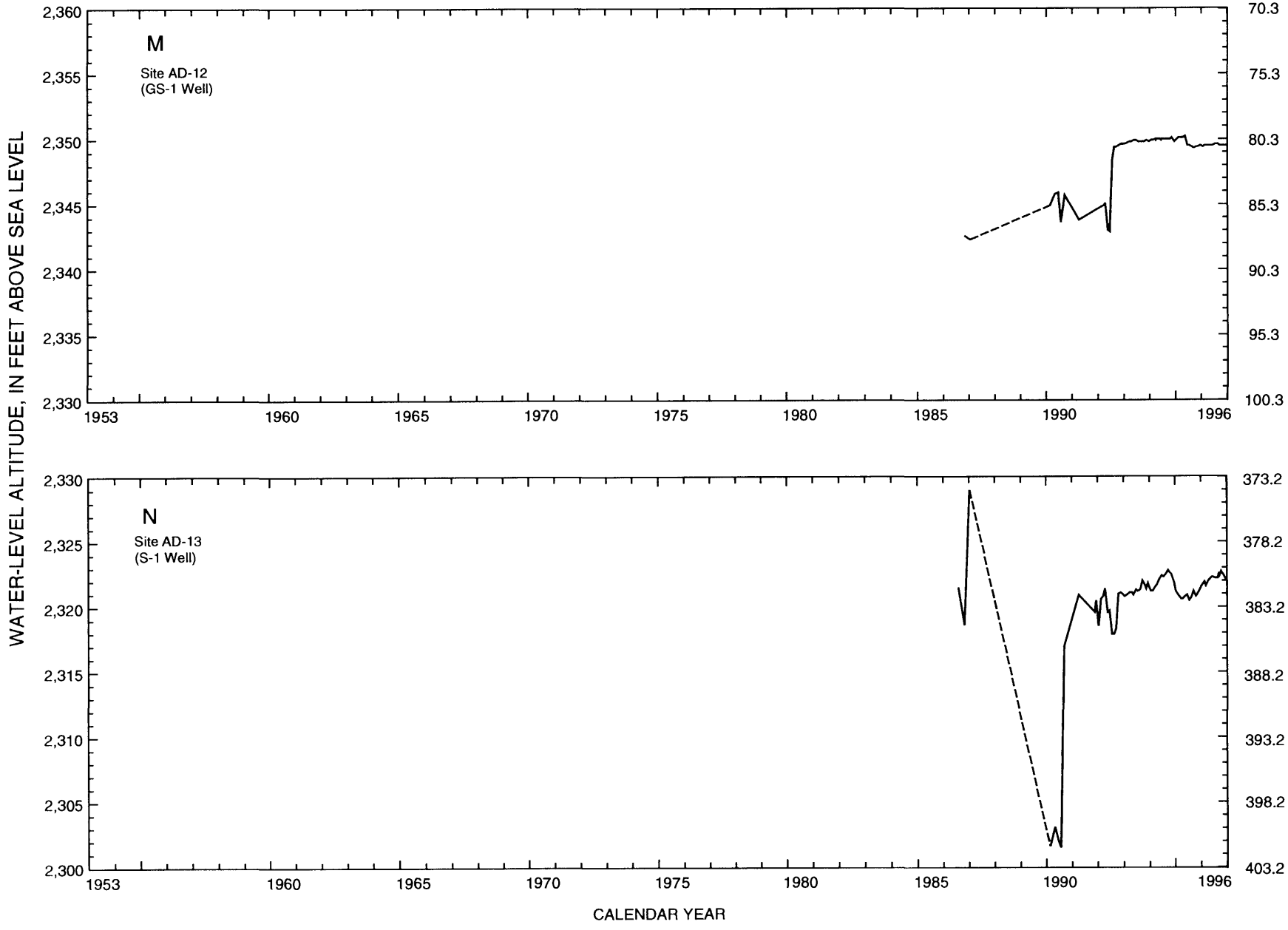

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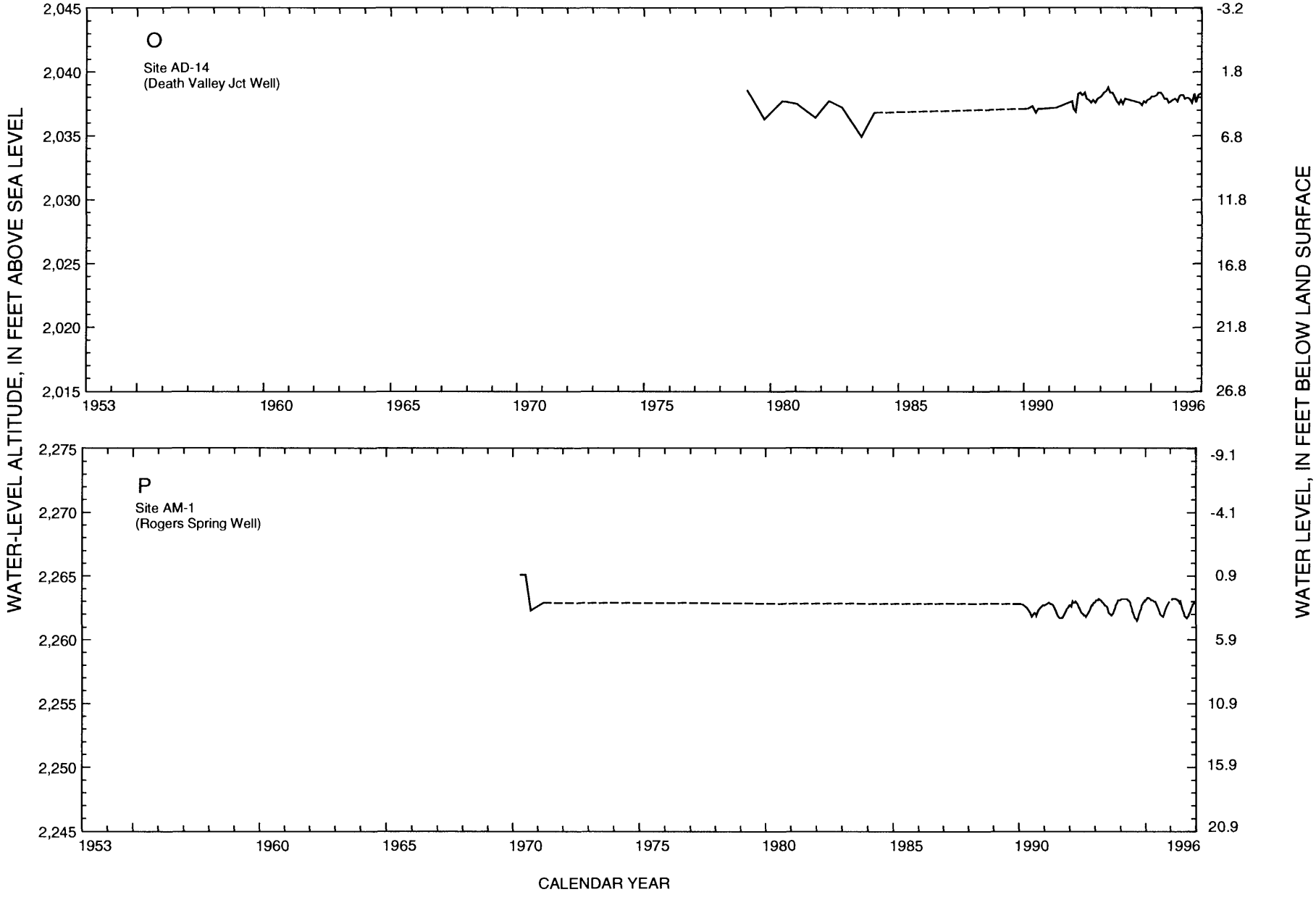

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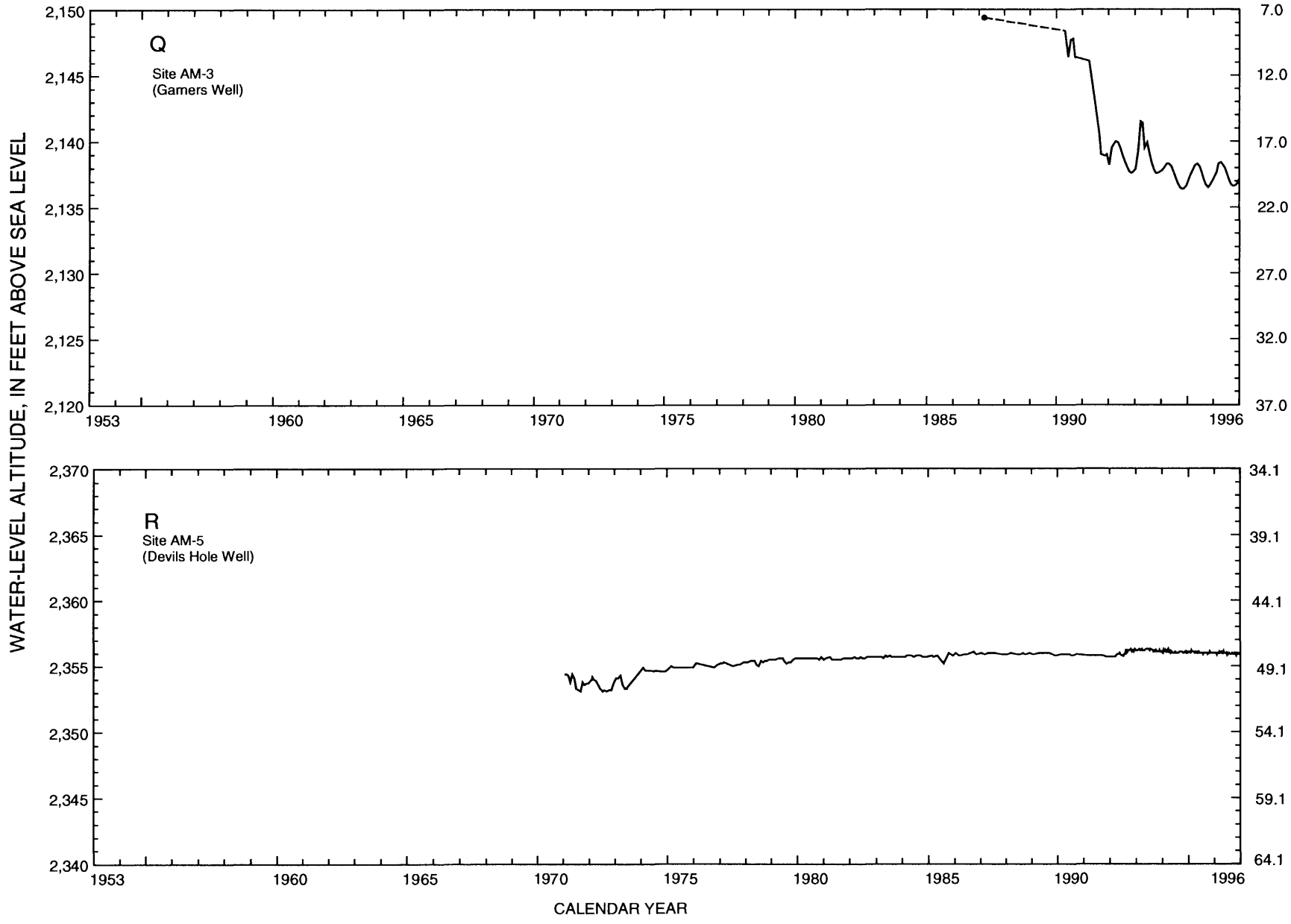

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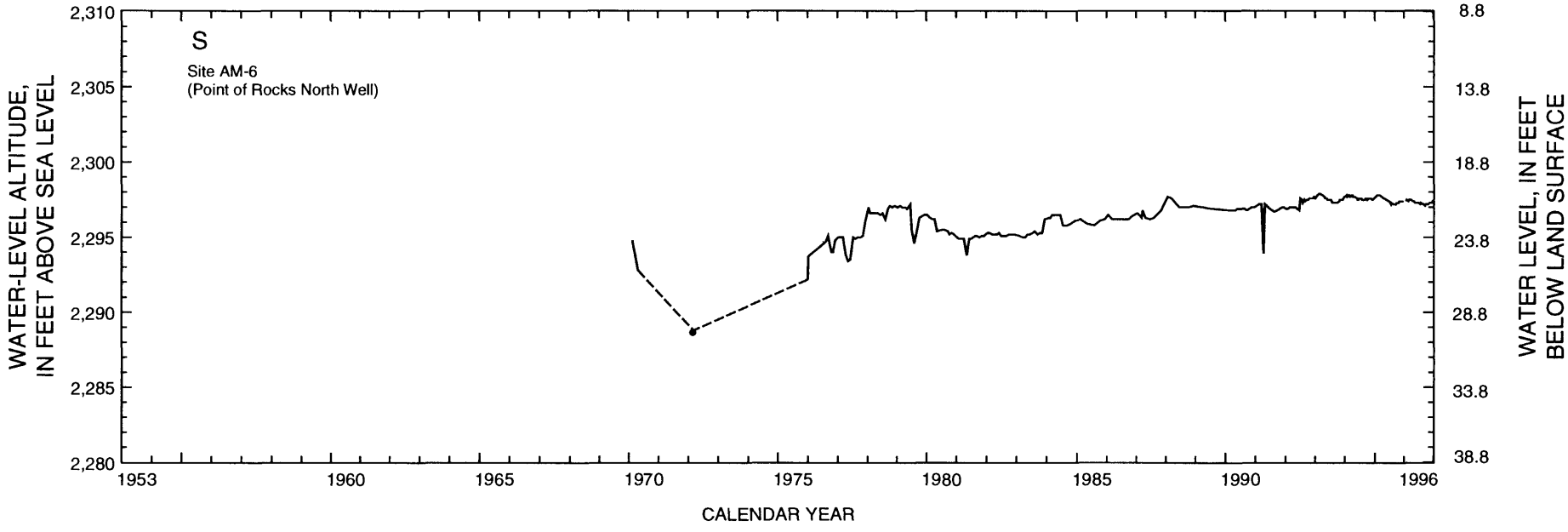

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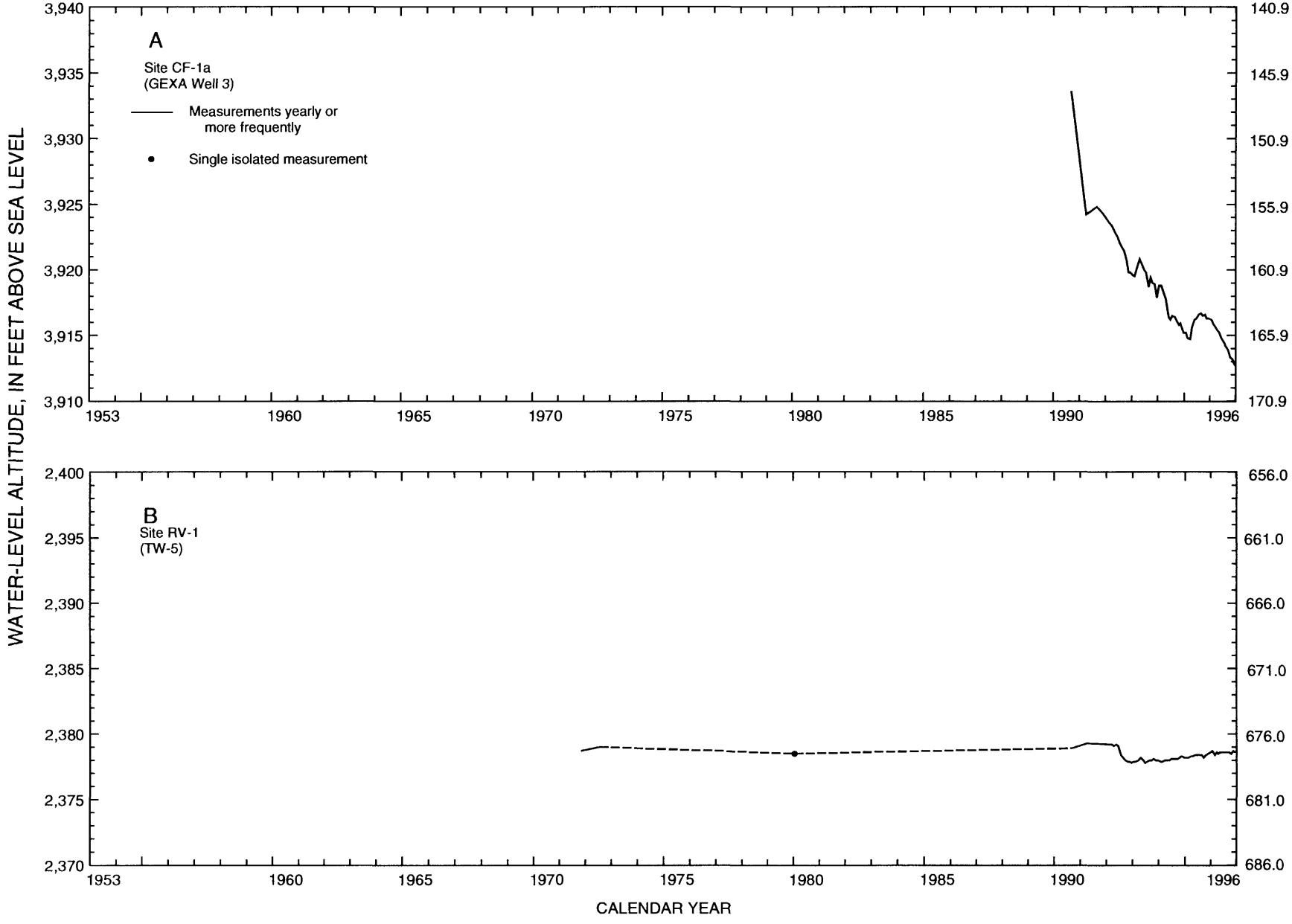


Figure 5. Periodic water levels through 1996 for selected sites at which primary contributing units are undifferentiated sedimentary rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region and are dashed where measurements were not available for consecutive calendar years. Data that may represent short-term conditions at a site have been excluded (see section titled "Presentation of Ground-Water Data").

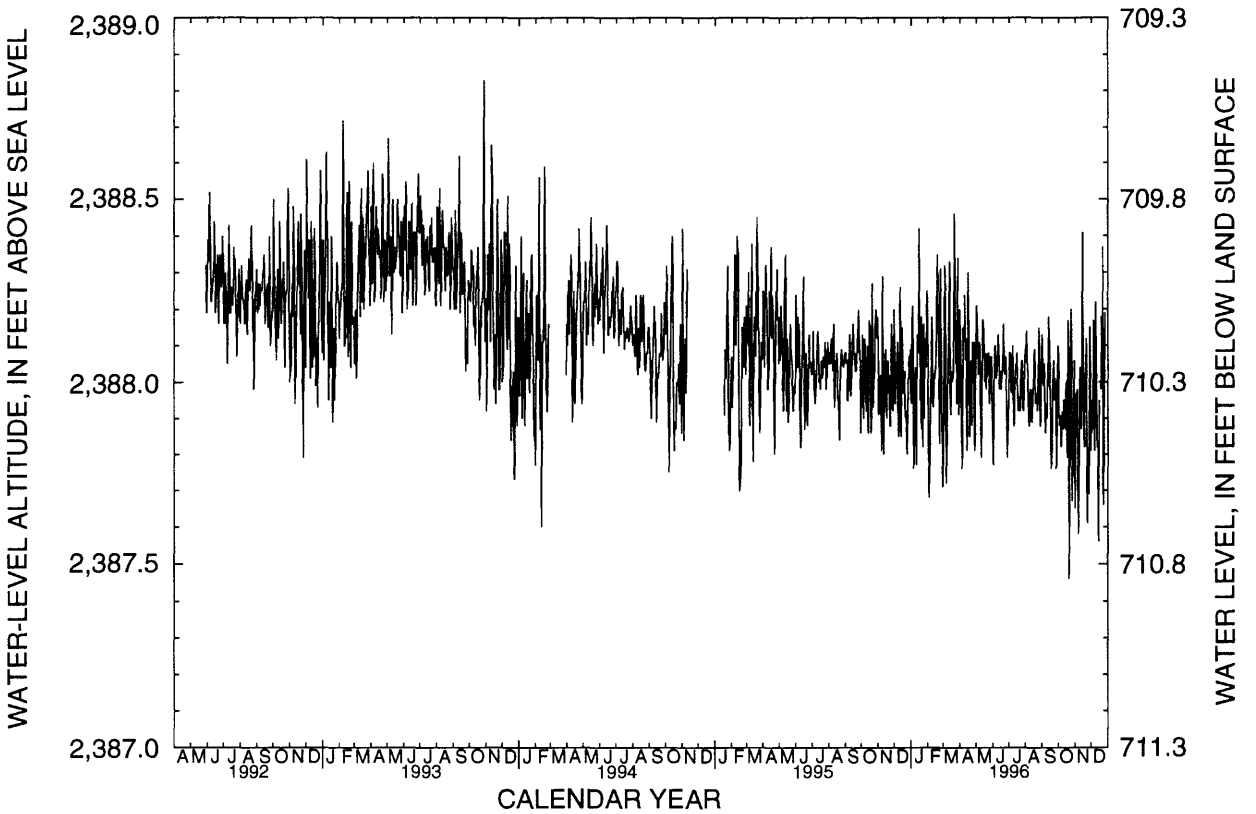


Figure 6. Daily average water levels in well JF-3, May 1992 through December 1996

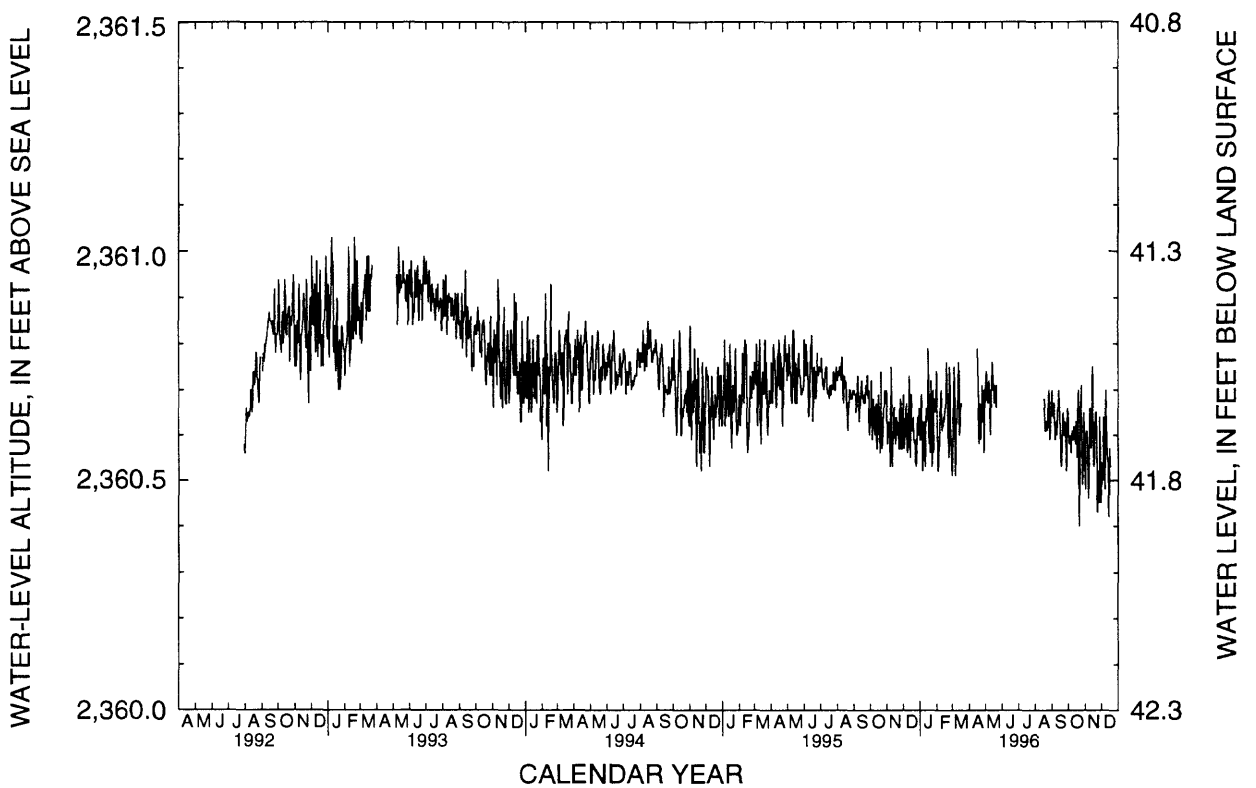


Figure 7. Daily average water levels in well AD-6, July 1992 through December 1996

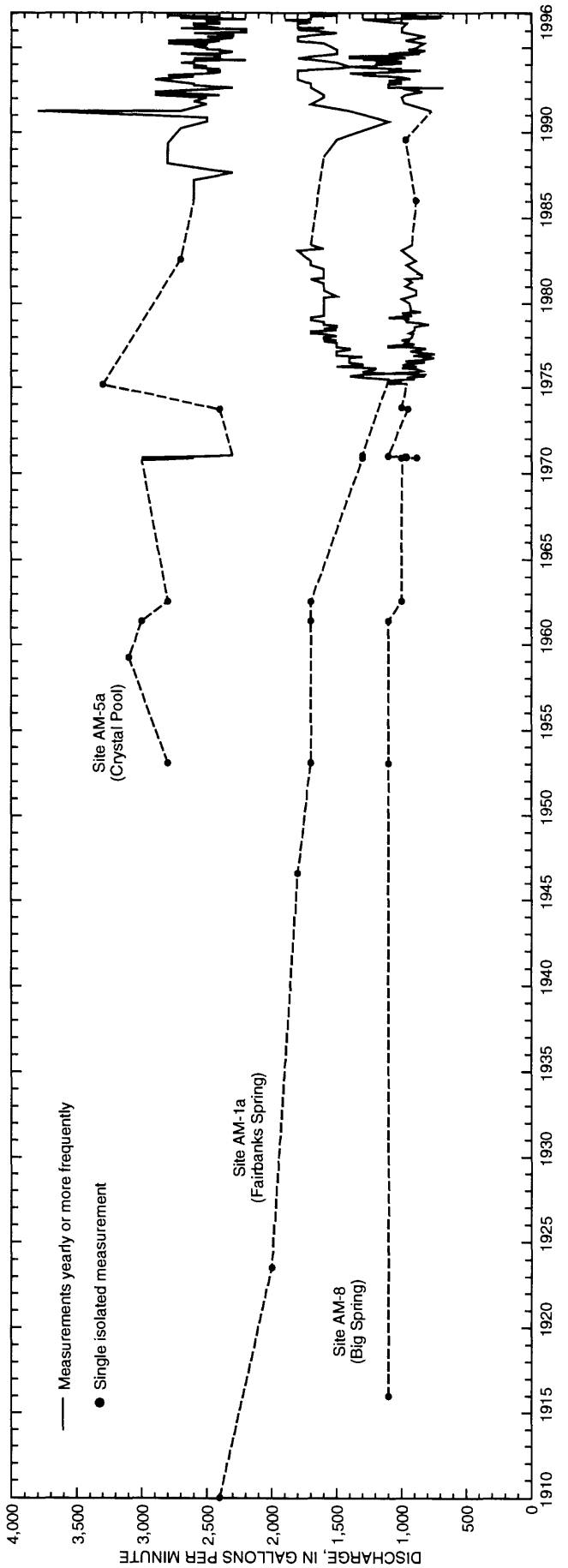


Figure 8. Discharge at sites AM-1a (Fairbanks Spring), AM-5a (Crystal Pool), and AM-8 (Big Spring) through 1996. Lines connect periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region and are dashed where measurements were not available for consecutive calendar years.

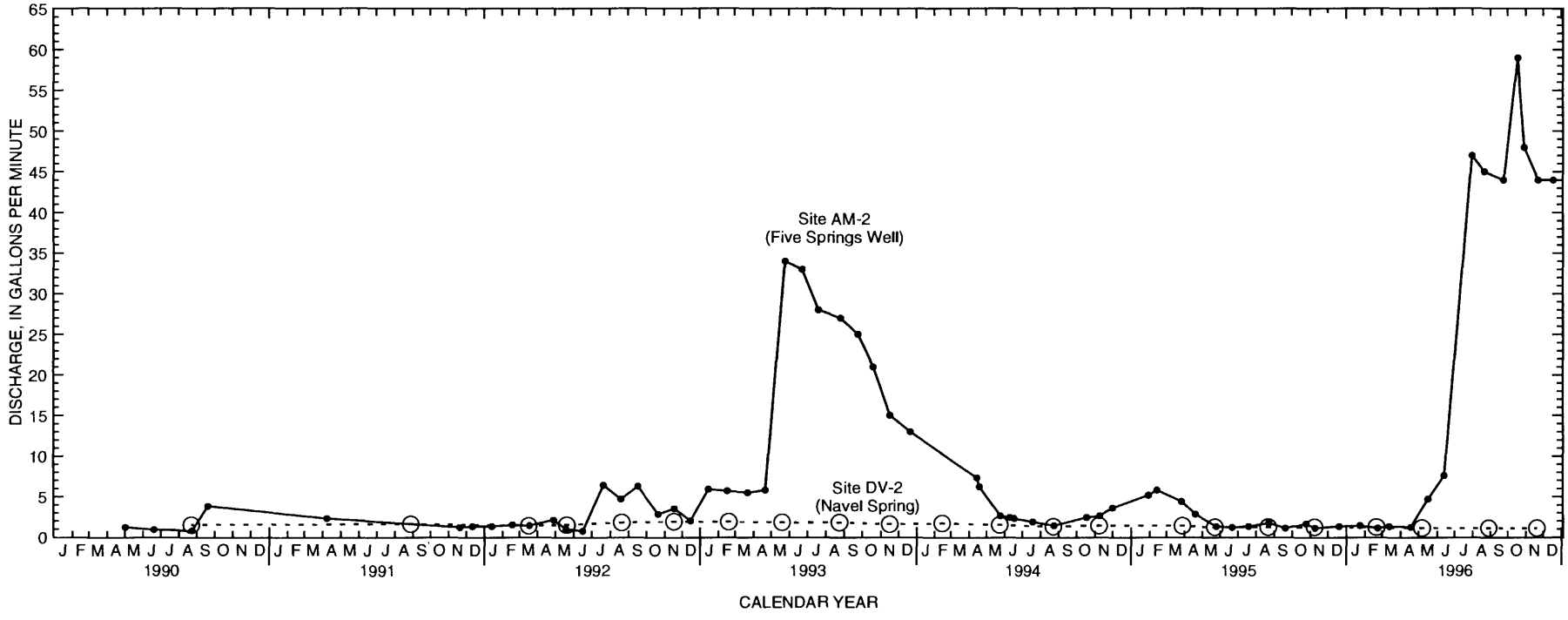


Figure 9. Discharge at sites AM-2 (Five Springs Well) and DV-2 (Navel Spring), 1990 through 1996. Symbols indicate periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region.

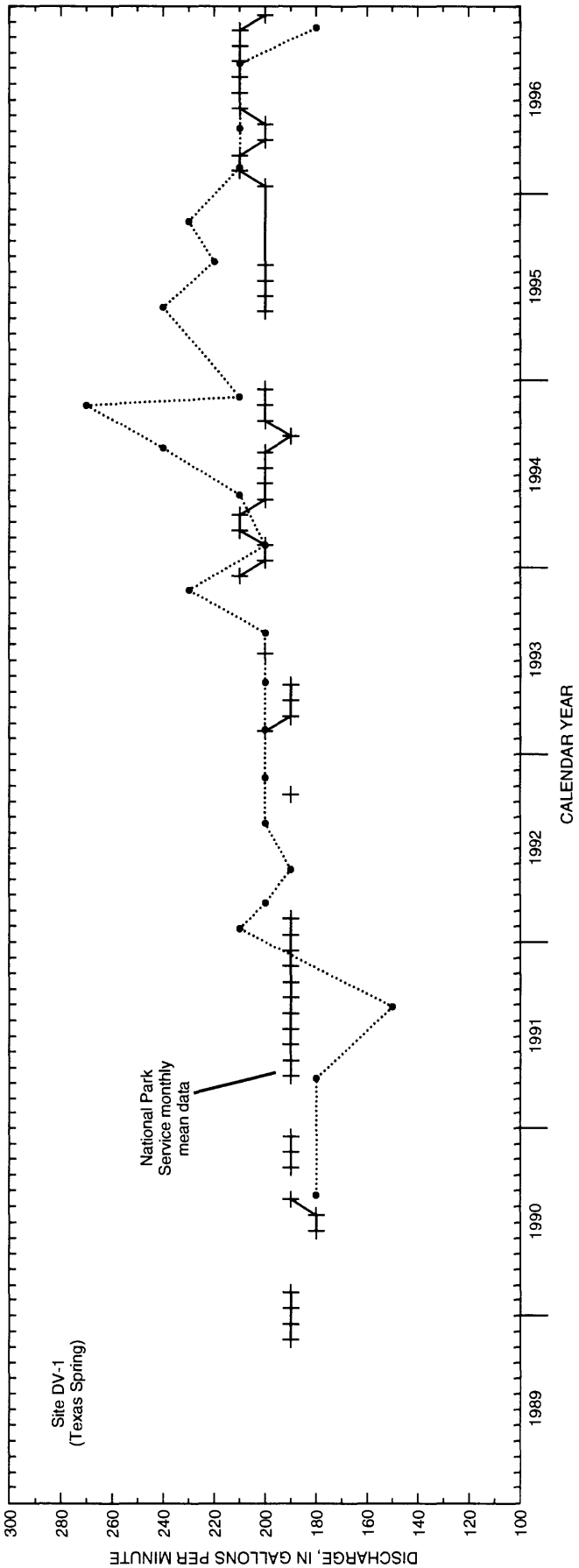


Figure 10. Discharge at site DV-1 (Texas Spring), 1989 through 1996. Dots indicate periodic USGS measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region; periodic measurements for 1990-92 have been revised from those tabulated by La Camera and Westenburg (1994, table 5) to reflect previously unaccounted water at the site. Plus symbol represents National Park Service monthly mean data for any given month and are not connected by a line where that data are not available for consecutive months. Differences between periodic measurements and monthly means may be due to site-specific conditions that affect accuracy of the measurement methods utilized. Accuracy of periodic measurements is limited by unmeasurable flow near the walls of the flume, an unequal distribution of velocities in the limited width of the measurement section, and a large percentage of total flow contained in each measurable portion of flow.

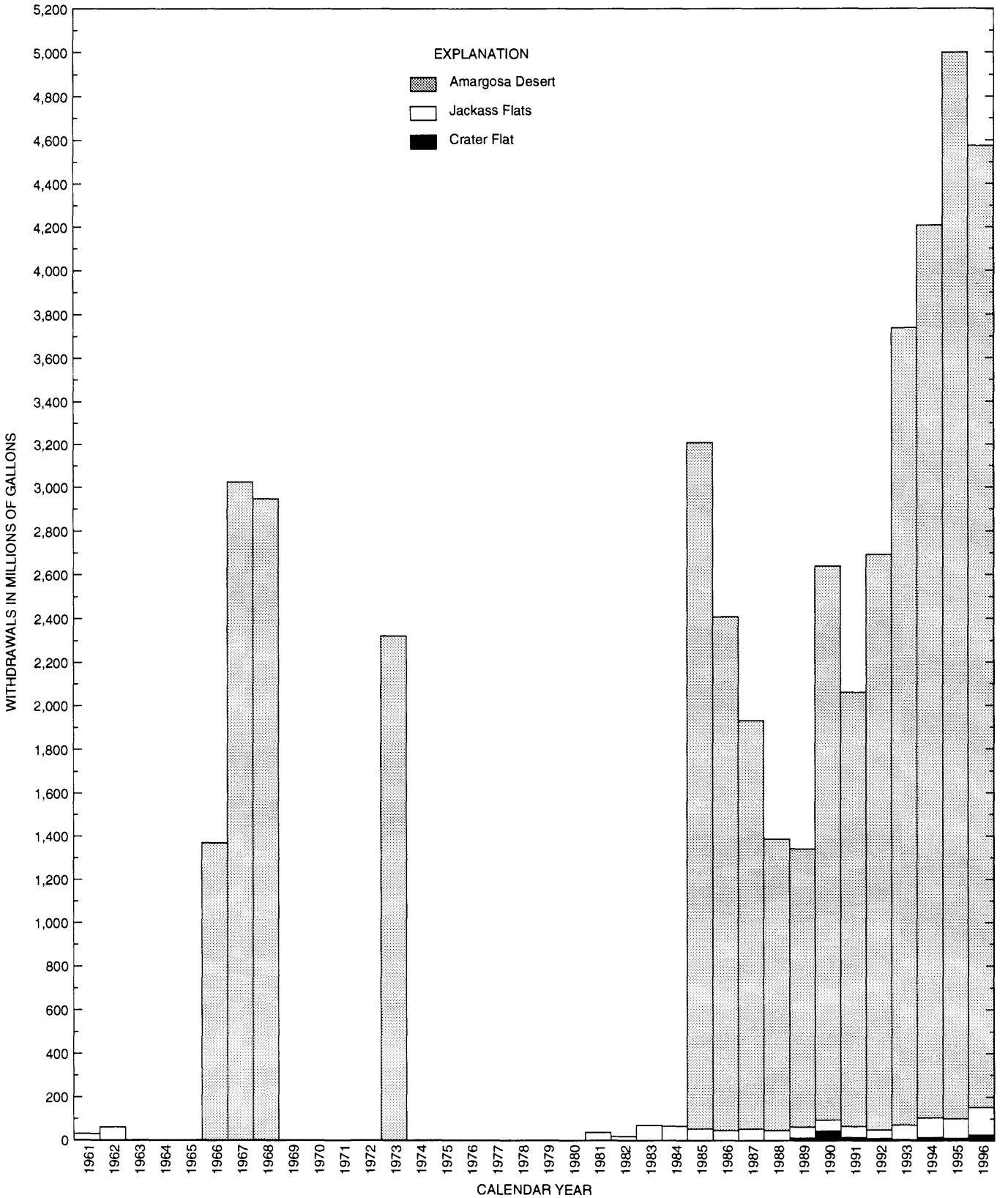


Figure 11. Available estimates of annual ground-water withdrawals for selected areas within Alkali Flat-Furnace Creek Ranch ground-water subbasin, 1961 through 1996. In each hydrographic area, ground water may have been withdrawn in years for which no estimates are available. Total bar height equals the approximate sum of withdrawals from all areas within subbasin for given year.

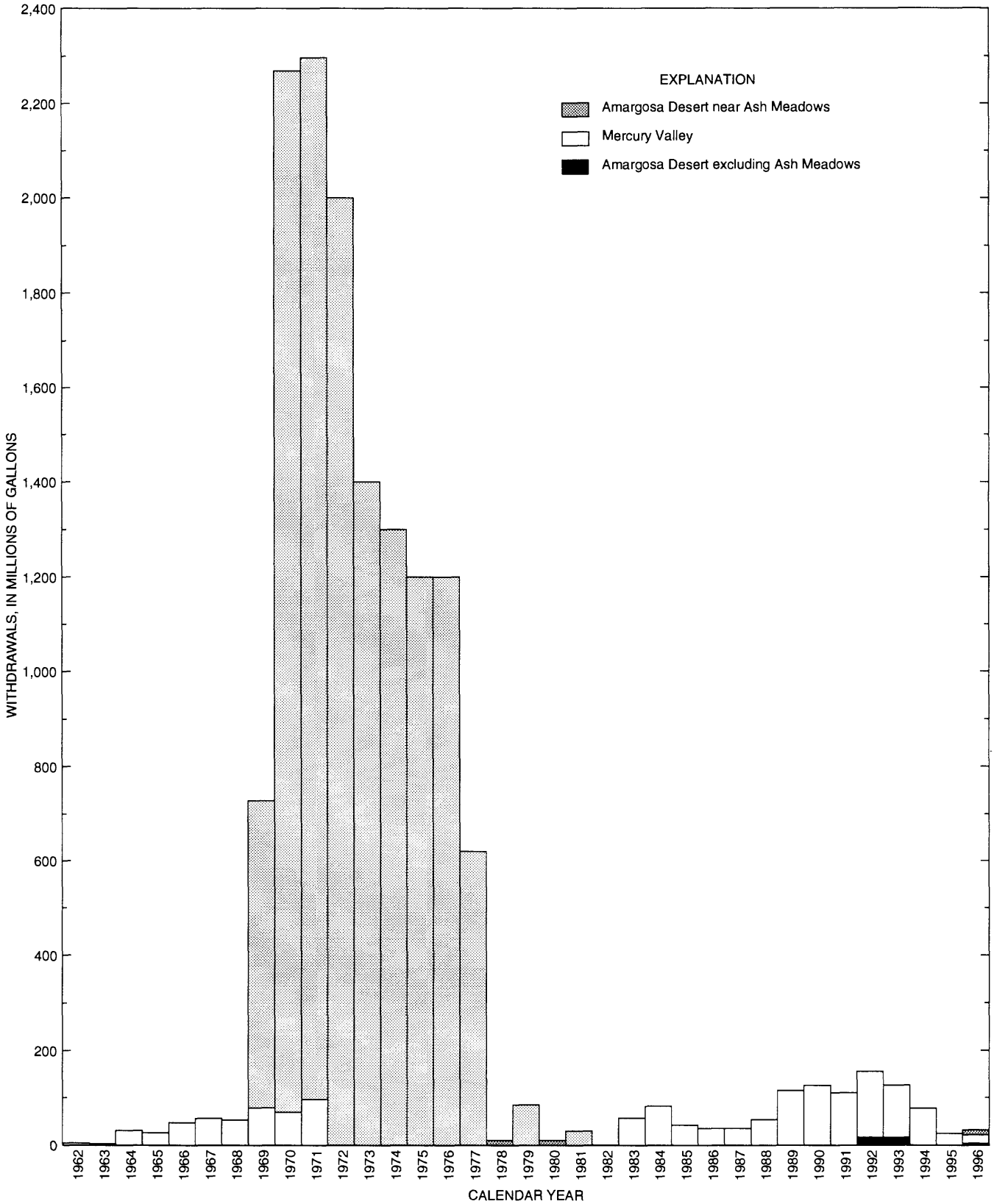


Figure 12. Available estimates of annual ground-water withdrawals for selected areas within Ash Meadows ground-water subbasin, 1962 through 1996. In each hydrographic area, ground water may have been withdrawn in years for which no estimates are available. Total bar height equals the approximate sum of withdrawals from all areas within subbasin for given year.

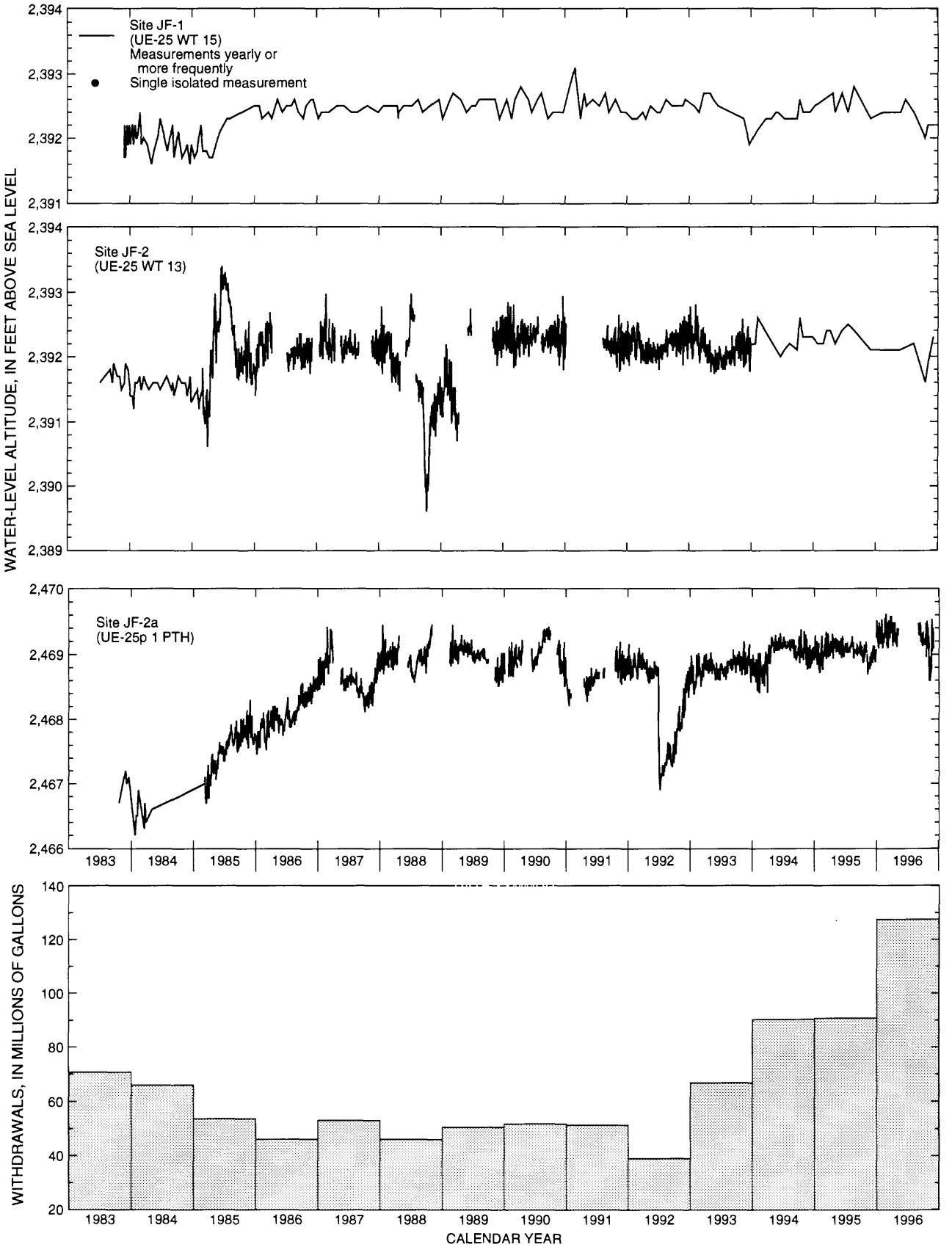
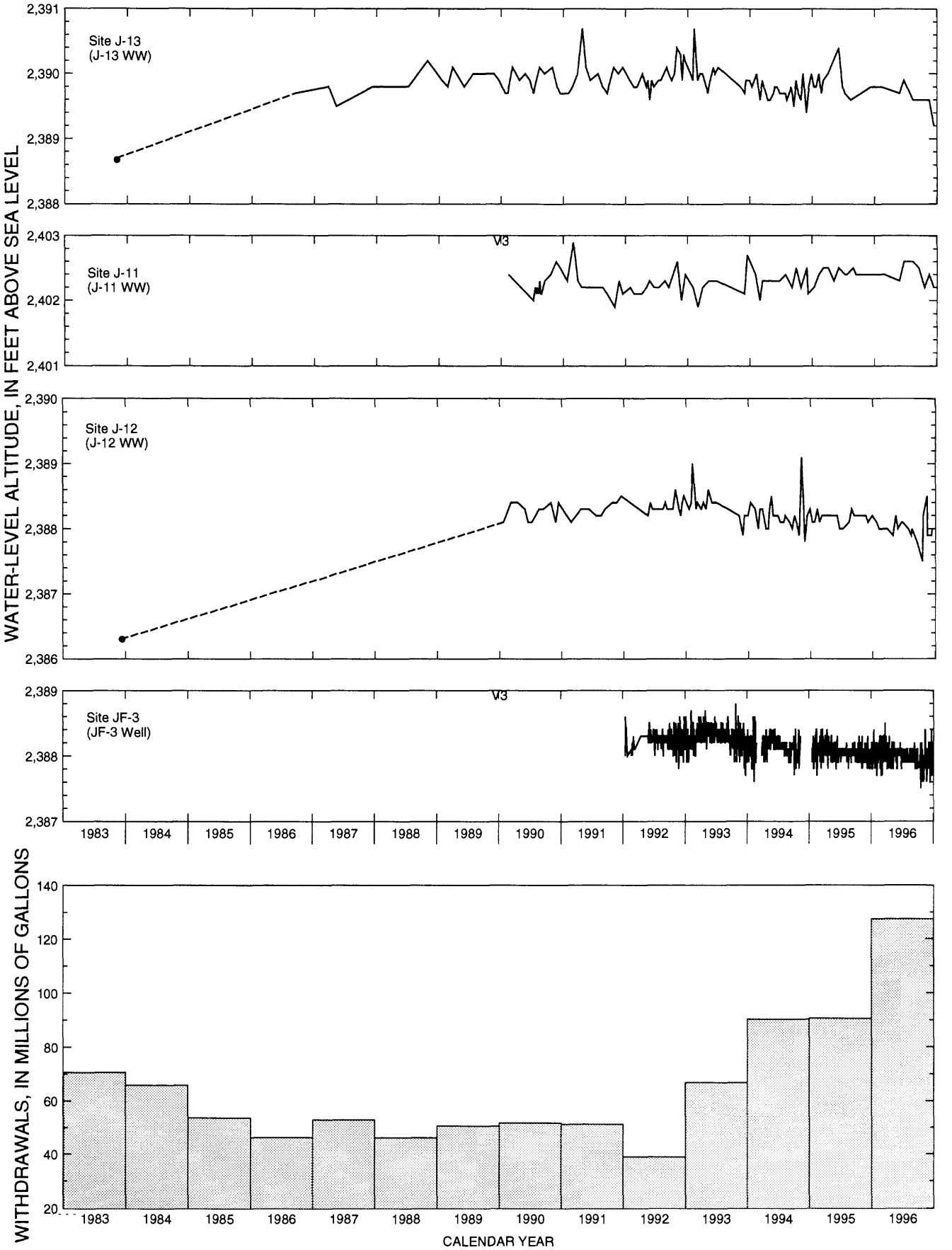


Figure 13. Water-level altitudes in wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3, and estimated annual ground-water withdrawals from Jackass Flats, 1983 through 1996. Lines connect periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half a year), and are dashed where measurements were not available for consecutive calendar years. Periodic measurements that may reflect short-term conditions at a site have been excluded (see section titled "Discussion of Ground-Water Levels and Ground-Water Withdrawals in Jackass Flats").



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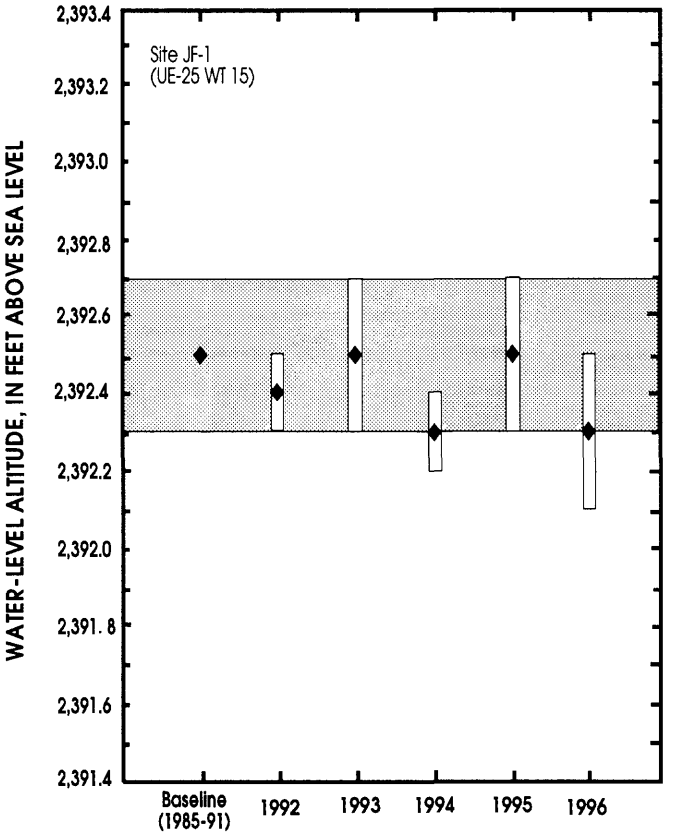
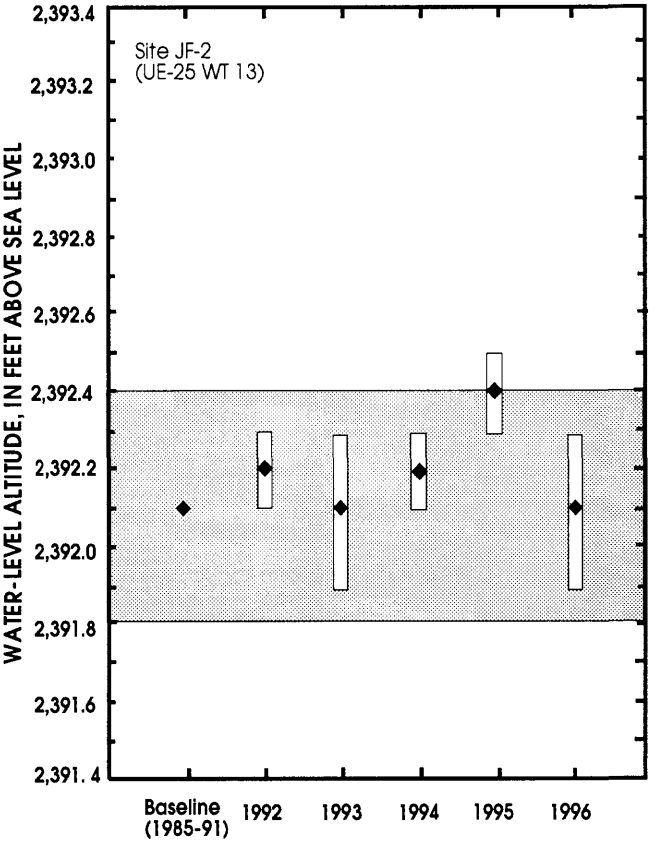
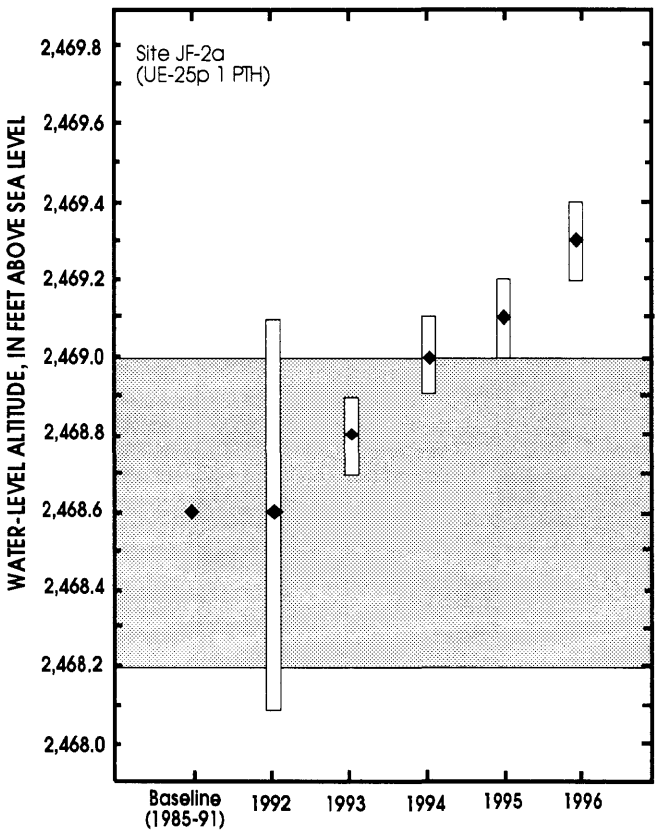






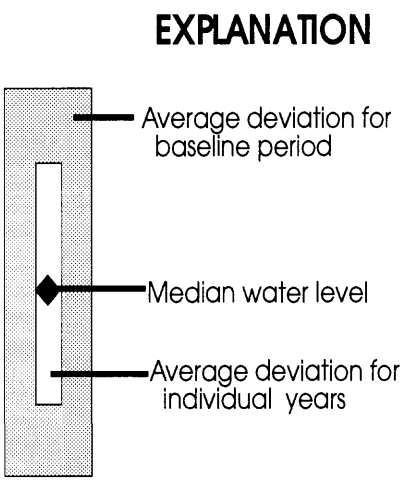
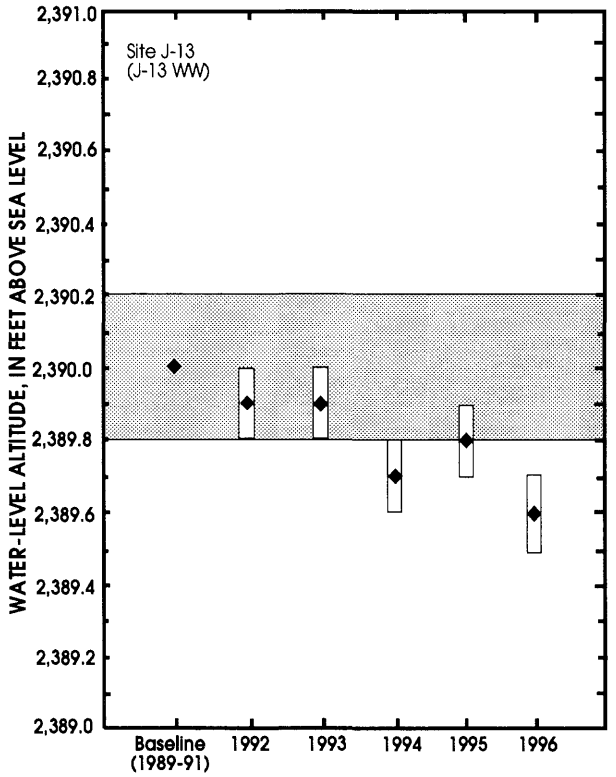
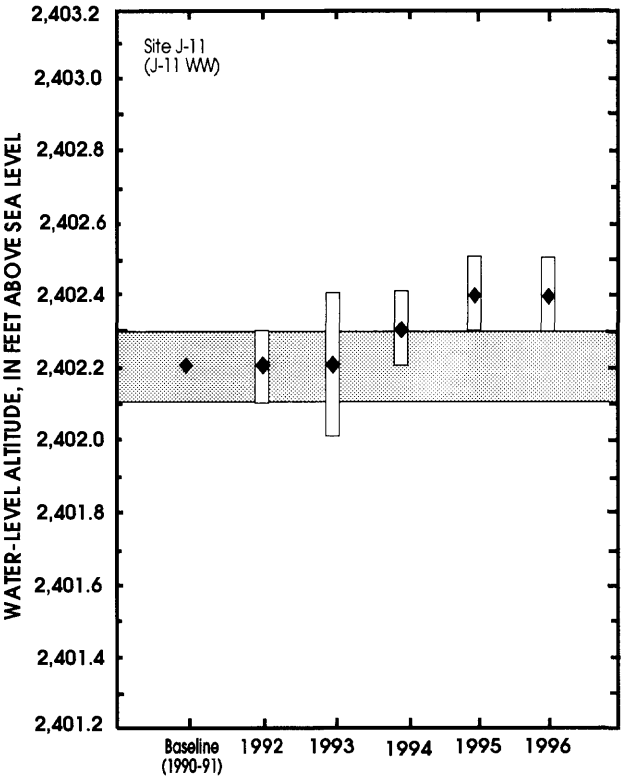
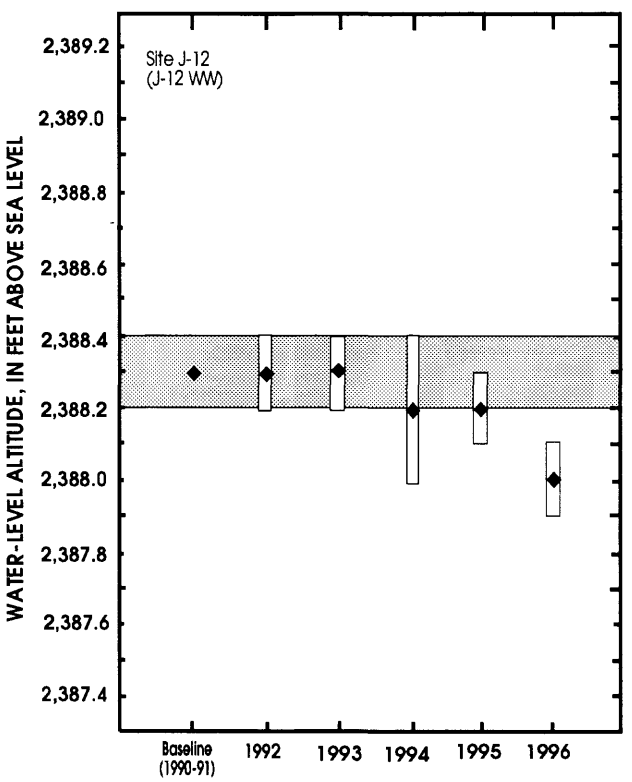


Figure 14. Median water-level altitudes and average deviation of water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 for selected baseline periods and for calendar years 1992 through 1996. Statistical data for individual years included in baseline periods are not shown.







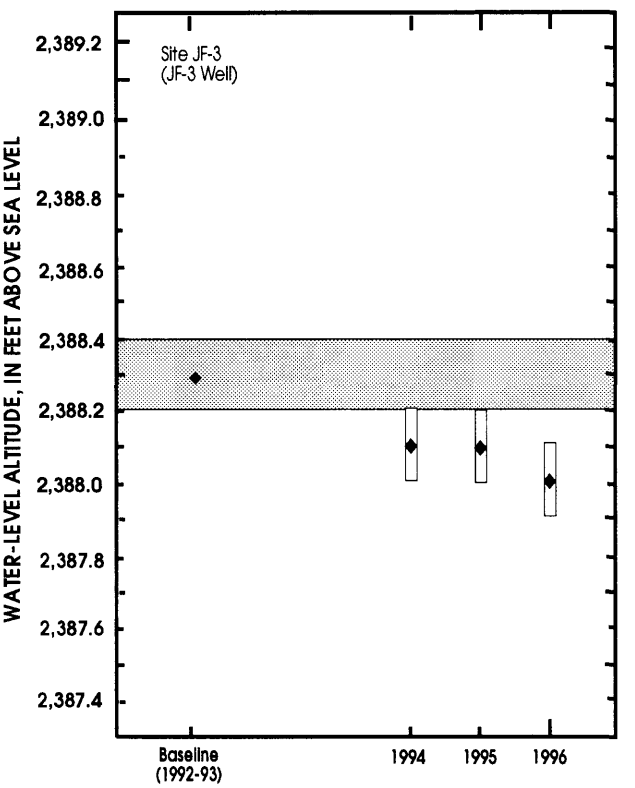


Figure 14. Continued.

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996

Site Number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section titled "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Land-surface altitude: Altitude of land surface in vicinity of site. Exception is altitude for site AM-4, which is altitude of bolt that serves as measurement point. Altitudes are reported to nearest 0.1 foot and were derived from USGS land surveys.

Height of measurement point: Height of measurement point (MP) most recently used. MP is stable, recoverable point from which periodic measurements to depth of water are made. MP at site AM-4 is bolt fastened to south wall of fissure, and is not referenced to land surface. Negative number indicates MP is below land surface.

Depth to water: Depths listed generally represent water level below land surface. Exceptions are site AM-4, where data represent water levels below measurement point, and site AM-2, where negative numbers represent water levels above land surface. Site AM-2 is a flowing well with water standing above land surface in casing at times. Apparent differences in depth to water at sites that list data from several sources may result from differing estimates of distance from land surface to measurement point used.

Method: Method used to measure depth to water. A, average monthly water level, reported for 15th of month; B, depth to water calculated from millivolt output of transducer installed in well and most recent calibration of instrumentation; N, ruled tape; S, steel tape; T, uncalibrated electric tape; V, calibrated electric tape; Z, measurement method unknown.

Site status: Known conditions at site that may have affected measured depth to water. F, flowing; R, well recently pumped; S, nearby pumping.

Data source: EMP, Environmental-Monitoring Program (USGS); NDWR, Nevada Division of Water Resources; NPS, National Park Service; PVT, private owner measurement; SCP, Site-Characterization Project (USGS); USFWS, U.S. Fish and Wildlife Service; USGS-NV, other Nevada District Programs.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-1	365520116370301	GEXA Well 4	3,930.9	1.82	01-25-1996	0915	616.92	3,314.0	V	-	EMP
					02-27-1996	1049	617.00	3,313.9	V	-	EMP
					03-14-1996	1101	617.09	3,313.8	V	-	EMP
CF-1a	365445116383901	GEXA Well 3	4,080.9	1.68	01-25-1996	0850	164.70	3,916.2	S	-	EMP
					02-27-1996	1028	165.07	3,915.8	S	-	EMP
					03-14-1996	1130	165.20	3,915.7	S	-	EMP
					04-17-1996	1203	165.51	3,915.4	S	-	EMP
					05-16-1996	1414	165.72	3,915.2	S	-	EMP
					06-13-1996	1325	166.07	3,914.8	S	-	EMP
					07-30-1996	1651	166.54	3,914.4	S	-	EMP
					08-14-1996	1540	166.74	3,914.2	S	-	EMP
					09-17-1996	1235	167.01	3,913.9	S	-	EMP
					10-22-1996	1140	167.59	3,913.3	S	-	EMP
					11-19-1996	0749	167.74	3,913.2	S	-	EMP
					12-17-1996	0837	168.09	3,912.8	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-2	364732116330701	USW VH-1	3,161.1	1.17	01-25-1996	1025	603.47	2,557.6	V	-	EMP
					02-07-1996	1250	603.62	2,557.5	S	-	SCP
					03-28-1996	1312	603.68	2,557.4	V	-	EMP
					04-17-1996	1425	603.62	2,557.5	V	-	EMP
					05-16-1996	1711	603.57	2,557.5	V	-	EMP
					05-22-1996	1232	603.72	2,557.4	S	-	SCP
					06-11-1996	0918	603.63	2,557.5	S	-	SCP
					06-13-1996	1608	603.67	2,557.4	V	-	EMP
					06-19-1996	1247	603.64	2,557.5	S	-	SCP
					07-30-1996	1505	603.53	2,557.6	V	-	EMP
					08-12-1996	1305	603.69	2,557.4	S	-	SCP
					08-22-1996	1039	603.72	2,557.4	V	-	EMP
					09-17-1996	0830	603.88	2,557.2	S	-	SCP
					10-16-1996	0820	603.54	2,557.6	S	-	SCP
					10-22-1996	1040	603.77	2,557.3	V	-	EMP
					11-13-1996	0837	603.72	2,557.4	S	-	SCP
					11-19-1996	1219	603.50	2,557.6	V	-	EMP
					12-12-1996	0810	603.80	2,557.3	S	-	SCP
					12-17-1996	1246	603.71	2,557.4	V	-	EMP
CF-3	364105116302601	Cind-R-Lite Well	2,725.6	-3.20	01-25-1996	1110	331.14	2,394.5	S	-	EMP
					02-27-1996	1310	331.22	2,394.4	S	R	EMP
					03-28-1996	1227	331.10	2,394.5	S	R	EMP
					04-17-1996	1110	331.29	2,394.3	S	R	EMP
					05-16-1996	1311	331.10	2,394.5	S	R	EMP
					06-20-1996	1437	331.19	2,394.4	S	R	EMP
					07-30-1996	1222	331.29	2,394.3	S	R	EMP
					08-22-1996	1201	331.26	2,394.3	S	R	EMP
					09-17-1996	0820	331.30	2,394.3	S	R	EMP
					10-22-1996	1000	331.22	2,394.4	S	-	EMP
					11-19-1996	1344	331.18	2,394.4	S	R	EMP
					12-17-1996	1341	331.21	2,394.4	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-1	365116116233801	UE-25 WT 15	3,553.8	0.18	02-15-1996	1326	1,161.43	2,392.4	S	-	SCP
					05-28-1996	0926	1,161.37	2,392.4	S	-	SCP
					06-26-1996	1328	1,161.23	2,392.6	S	-	SCP
					08-15-1996	0902	1,161.42	2,392.4	S	-	SCP
					09-18-1996	1011	1,161.55	2,392.2	S	-	SCP
					10-21-1996	1212	1,161.81	2,392.0	S	-	SCP
					11-06-1996	1321	1,161.57	2,392.2	S	-	SCP
					12-10-1996	1356	1,161.59	2,392.2	S	-	SCP
JF-2	364945116235001	UE-25 WT 13	3,387.5	1.00	02-15-1996	1447	995.38	2,392.1	S	-	SCP
					05-23-1996	1038	995.36	2,392.1	S	-	SCP
					08-14-1996	1052	995.31	2,392.2	S	-	SCP
					09-18-1996	1232	995.60	2,391.9	S	-	SCP
					10-21-1996	1142	995.95	2,391.6	S	-	SCP
					11-06-1996	1348	995.59	2,391.9	S	-	SCP
					12-09-1996	1002	995.19	2,392.3	S	-	SCP
JF-2a	364938116252102	UE-25p 1 PTH	3,655.5	.56	01-08-1996	0808	1,186.44	2,469.1	B	-	SCP
					01-10-1996	1238	1,186.59	2,468.9	B	-	SCP
					01-22-1996	0854	1,186.15	2,469.4	B	-	SCP
					01-24-1996	0948	1,186.37	2,469.1	B	-	SCP
					02-06-1996	1050	1,186.58	2,468.9	B	-	SCP
					03-26-1996	1344	1,186.36	2,469.1	B	-	SCP
					04-29-1996	1447	1,186.59	2,468.9	B	-	SCP
					05-08-1996	0850	1,186.10	2,469.4	S	-	SCP
					05-20-1996	0854	1,186.14	2,469.4	B	-	SCP
					06-10-1996	0831	1,186.35	2,469.2	B	-	SCP
					06-25-1996	1438	1,186.06	2,469.4	B	-	SCP
					07-09-1996	1010	1,186.25	2,469.2	B	-	SCP
					07-22-1996	0856	1,186.38	2,469.1	B	-	SCP
					08-05-1996	0937	1,186.44	2,469.1	B	-	SCP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-2a	364938116252102	UE-25p 1 PTH	3,655.5	0.56	09-03-1996	1056	1,186.10	2,469.4	S	-	SCP
					09-16-1996	0907	1,186.01	2,469.5	B	-	SCP
					10-08-1996	0959	1,186.41	2,469.1	B	-	SCP
					10-28-1996	0928	1,186.16	2,469.3	B	-	SCP
					11-12-1996	1014	1,186.68	2,468.8	B	-	SCP
					11-25-1996	0930	1,186.20	2,469.3	B	-	SCP
					12-03-1996	0920	1,186.35	2,469.2	S	-	SCP
					12-16-1996	0856	1,186.87	2,468.6	B	-	SCP
J-13	364828116234001	J-13 WW	3,317.9	1.11	02-07-1996	0858	928.15	2,389.8	S	-	SCP
					05-28-1996	1028	928.16	2,389.7	S	-	SCP
					06-24-1996	1008	928.01	2,389.9	S	-	SCP
					08-15-1996	1019	928.31	2,389.6	S	-	SCP
					09-18-1996	0811	928.31	2,389.6	S	-	SCP
					10-24-1996	0732	928.33	2,389.6	S	-	SCP
					11-18-1996	0702	928.29	2,389.6	S	-	SCP
					12-16-1996	0738	928.73	2,389.2	S	-	SCP
J-11	364706116170601	J-11 WW	3,442.8	2.11	02-28-1996	1316	1,040.45	2,402.4	S	-	SCP
					05-28-1996	1152	1,040.46	2,402.3	S	-	SCP
					06-24-1996	1130	1,040.24	2,402.6	S	-	SCP
					08-15-1996	1212	1,040.17	2,402.6	S	-	SCP
					09-18-1996	1418	1,040.30	2,402.5	S	-	SCP
					10-22-1996	1230	1,040.59	2,402.2	S	-	SCP
					11-18-1996	1226	1,040.42	2,402.4	S	-	SCP
					12-16-1996	0928	1,040.61	2,402.2	S	-	SCP
J-12	364554116232401	J-12 WW	3,128.4	3.95	01-24-1996	1420	740.26	2,388.1	V	-	EMP
					02-07-1996	0933	740.36	2,388.0	S	-	SCP
					03-26-1996	1401	740.38	2,388.0	V	-	EMP
					04-29-1996	1352	740.46	2,387.9	V	-	EMP
					05-15-1996	1041	740.25	2,388.2	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
J-12	364554116232401	J-12 WW	3,128.4	3.95	05-28-1996	1004	740.38	2,388.0	S	-	SCP
					06-20-1996	0957	740.26	2,388.1	V	-	EMP
					06-24-1996	1040	740.28	2,388.1	S	-	SCP
					07-29-1996	1114	740.44	2,388.0	V	-	EMP
					08-15-1996	0954	740.46	2,387.9	S	-	SCP
					08-19-1996	1007	740.40	2,388.0	V	-	EMP
					09-18-1996	1240	740.56	2,387.8	S	-	SCP
					10-21-1996	1220	740.88	2,387.5	V	-	EMP
					10-23-1996	1254	740.21	2,388.2	S	-	SCP
					11-15-1996	1420	739.86	2,388.5	V	-	EMP
					11-18-1996	1351	740.49	2,387.9	S	-	SCP
					12-12-1996	1301	740.46	2,387.9	V	-	EMP
					12-16-1996	1030	740.41	2,388.0	S	-	SCP
JF-3	364528116232201	JF-3 Well	3,098.3	2.27	01-24-1996	1450	710.28	2,388.0	V	-	EMP
					02-28-1996	1245	710.47	2,387.8	V	-	EMP
					03-26-1996	1259	710.36	2,387.9	V	-	EMP
					04-29-1996	1429	710.45	2,387.8	V	-	EMP
					05-09-1996	1115	710.39	2,387.9	V	-	EMP
					05-15-1996	1116	710.24	2,388.1	V	-	EMP
					06-20-1996	0944	710.24	2,388.1	V	-	EMP
					07-29-1996	1315	710.38	2,387.9	V	-	EMP
					08-19-1996	1045	710.40	2,387.9	V	-	EMP
					09-18-1996	1513	710.56	2,387.7	V	-	EMP
					10-21-1996	1200	710.89	2,387.4	V	-	EMP
					11-15-1996	1130	709.82	2,388.5	V	-	EMP
					12-12-1996	1229	710.47	2,387.8	V	-	EMP
RV-1	363815116175901	TW-5	3,056.0	1.6	01-24-1996	1220	677.34	2,378.7	V	-	EMP
					02-28-1996	1038	677.58	2,378.4	V	-	EMP
					03-27-1996	1509	677.43	2,378.6	V	-	EMP
					04-17-1996	0927	677.54	2,378.5	V	-	EMP
					05-15-1996	1543	677.37	2,378.6	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
RV-1	363815116175901	TW-5	3,056.0	1.6	06-20-1996	1819	677.35	2,378.6	V	-	EMP
					07-31-1996	1457	677.39	2,378.6	V	-	EMP
					08-22-1996	1409	677.38	2,378.6	V	-	EMP
					09-23-1996	1527	677.39	2,378.6	V	-	EMP
					10-22-1996	0845	677.53	2,378.5	V	-	EMP
					11-19-1996	1552	677.32	2,378.7	V	-	EMP
					12-16-1996	1422	677.40	2,378.6	V	-	EMP
MV-1	363530116021401	Army 1 WW	3,153.3	3.14	12-12-1996	0915	785.82	2,367.5	V	-	EMP
AD-1	364141116351401	NA-6 Well BGMW-10	2,627.9	1.7	01-12-1996	1410	269.30	2,358.6	S	-	EMP
					02-27-1996	1215	269.60	2,358.3	S	-	EMP
					03-14-1996	0857	269.60	2,358.3	S	-	EMP
					03-14-1996	1200	269.6	2,358.3	Z	-	PVT
					04-17-1996	1622	269.44	2,358.5	S	-	EMP
					05-15-1996	1408	269.45	2,358.4	S	-	EMP
					06-04-1996	--	269.5	2,358.4	Z	-	PVT
					06-13-1996	1043	269.47	2,358.4	S	-	EMP
					07-30-1996	1342	269.43	2,358.5	S	-	EMP
					08-28-1996	1345	269.59	2,358.3	S	-	EMP
					09-17-1996	1232	269.63	2,358.3	S	-	EMP
					09-26-1996	--	269.7	2,358.2	Z	-	PVT
					10-22-1996	1315	269.49	2,358.4	S	-	EMP
					11-19-1996	0944	269.39	2,358.5	S	-	EMP
					12-17-1996	1107	269.48	2,358.4	S	-	EMP
					12-30-1996	--	269.6	2,358.3	Z	-	PVT
AD-2	363830116241401	Airport Well	2,638.8	1.05	01-23-1996	1030	325.06	2,313.7	V	-	EMP
					02-22-1996	1238	325.02	2,313.8	V	-	EMP
					03-27-1996	1346	324.66	2,314.1	V	-	EMP
					04-18-1996	1344	324.96	2,313.8	V	-	EMP
					05-17-1996	1728	324.76	2,314.0	V	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-2	363830116241401	Airport Well	2,638.8	1.05	06-19-1996	0953	324.82	2,314.0	V	-	EMP
					07-30-1996	1120	324.79	2,314.0	V	-	EMP
					08-22-1996	1332	324.82	2,314.0	V	-	EMP
					09-23-1996	1628	324.77	2,314.0	V	-	EMP
					10-18-1996	1147	324.72	2,314.1	V	-	EMP
					11-19-1996	1455	324.64	2,314.2	V	-	EMP
					12-16-1996	1548	324.58	2,314.2	V	-	EMP
AD-2a	363835116234001	NDOT Well	2,656.8	.4	01-23-1996	1050	342.88	2,313.9	S	-	EMP
					02-27-1996	1400	342.79	2,314.0	S	-	EMP
					03-27-1996	1414	342.61	2,314.2	S	-	EMP
					04-30-1996	1219	342.68	2,314.1	S	R	EMP
					05-16-1996	1230	342.52	2,314.3	S	R	EMP
					06-13-1996	0917	342.58	2,314.2	S	-	EMP
					08-22-1996	1240	342.40	2,314.4	S	-	EMP
					09-25-1996	1014	342.89	2,313.9	S	-	EMP
					10-22-1996	0910	343.50	2,313.3	S	R	EMP
					11-19-1996	1412	342.20	2,314.6	S	-	EMP
					12-16-1996	1515	342.23	2,314.6	S	-	EMP
AD-3a	363521116352501	Davidson Well	2,395.3	1.00	01-23-1996	0905	131.00	2,264.3	S	-	EMP
					02-22-1996	1051	130.94	2,264.4	S	-	EMP
					03-13-1996	0949	130.88	2,264.4	S	-	EMP
					04-18-1996	1439	131.01	2,264.3	S	-	EMP
					05-17-1996	1628	131.03	2,264.3	S	-	EMP
					06-20-1996	1524	131.26	2,264.0	S	-	EMP
					07-19-1996	1412	131.43	2,263.9	S	-	EMP
					08-21-1996	1244	131.59	2,263.7	S	-	EMP
					09-17-1996	1346	131.63	2,263.7	S	-	EMP
					10-18-1996	1250	131.69	2,263.6	S	-	EMP
					11-21-1996	1400	131.62	2,263.7	S	-	EMP
					12-18-1996	0928	131.59	2,263.7	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-4a	363428116234701	Cooks East Well	2,477.8	1.0	01-23-1996	1010	120.49	2,357.3	V	-	EMP
					02-22-1996	1214	120.28	2,357.5	V	-	EMP
					03-13-1996	1030	120.13	2,357.7	V	-	EMP
					04-18-1996	1407	120.41	2,357.4	V	-	EMP
					05-17-1996	1707	120.43	2,357.4	V	-	EMP
					06-20-1996	1730	120.42	2,357.4	V	-	EMP
					07-19-1996	1526	120.56	2,357.2	V	-	EMP
					08-21-1996	1429	120.57	2,357.2	V	-	EMP
					09-23-1996	1654	120.59	2,357.2	V	-	EMP
					10-21-1996	1435	120.89	2,356.9	V	-	EMP
					11-22-1996	1325	120.58	2,357.2	V	-	EMP
					12-18-1996	1138	120.82	2,357.0	S	-	EMP
AD-5	363310116294001	USBLM Well	2,376.4	0	01-12-1996	1240	123.78	2,252.6	S	-	EMP
					02-22-1996	1023	123.00	2,253.4	S	-	EMP
					03-13-1996	0920	123.57	2,252.8	S	-	EMP
					04-18-1996	1507	125.72	2,250.7	S	-	EMP
					05-17-1996	1558	125.62	2,250.8	S	-	EMP
					06-20-1996	1615	127.16	2,249.2	S	-	EMP
					07-19-1996	1457	127.69	2,248.7	S	-	EMP
					08-28-1996	1536	127.80	2,248.6	S	-	EMP
					09-17-1996	1420	127.72	2,248.7	S	-	EMP
					09-23-1996	1820	127.77	2,248.6	S	-	EMP
					10-18-1996	1220	127.61	2,248.8	S	-	EMP
					11-21-1996	1324	126.10	2,250.3	S	-	EMP
					12-18-1996	1100	125.47	2,250.9	S	-	EMP
AD-6	363213116133800	Tracer Well 3	2,402.3	.4	01-23-1996	1310	41.80	2,360.5	S	-	EMP
					02-22-1996	1327	41.72	2,360.6	S	-	EMP
					03-28-1996	1335	41.45	2,360.8	S	-	EMP
					04-15-1996	1120	41.74	2,360.6	S	-	EMP
					04-18-1996	1230	41.76	2,360.5	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-6	363213116133800	Tracer Well 3	2,402.3	0.4	05-16-1996	1115	41.70	2,360.6	S	-	EMP
					06-14-1996	1600	41.60	2,360.7	S	-	EMP
					07-31-1996	1345	41.70	2,360.6	S	-	EMP
					08-16-1996	0904	41.66	2,360.6	S	-	EMP
					08-22-1996	1451	41.65	2,360.6	S	-	EMP
					09-23-1996	1356	41.69	2,360.6	S	-	EMP
					10-21-1996	1350	41.90	2,360.4	S	-	EMP
					11-18-1996	1614	41.71	2,360.6	S	-	EMP
					12-16-1996	1244	41.68	2,360.6	S	-	EMP
AD-7a	363009116302702	Blackman Well	2,305.0	.78	01-23-1996	0830	67.24	2,237.8	S	-	EMP
					02-22-1996	0959	67.57	2,237.4	S	-	EMP
					03-13-1996	0858	67.20	2,237.8	S	-	EMP
					04-18-1996	1529	66.85	2,238.2	S	-	EMP
					05-17-1996	1540	69.41	2,235.6	S	-	EMP
					06-20-1996	1635	70.81	2,234.2	S	-	EMP
					07-19-1996	1314	71.32	2,233.7	S	-	EMP
					08-21-1996	1203	71.67	2,233.3	S	R	EMP
					09-17-1996	1535	71.60	2,233.4	S	R	EMP
					10-18-1996	1320	70.52	2,234.5	S	-	EMP
					11-21-1996	1430	68.92	2,236.1	S	R	EMP
					12-18-1996	1315	68.22	2,236.8	S	-	EMP
AD-8	362929116085701	Cherry Patch Well	2,394.3	.6	01-22-1996	0950	35.10	2,359.2	S	-	EMP
					02-20-1996	1102	34.95	2,359.4	S	-	EMP
					03-28-1996	1126	34.96	2,359.3	S	-	EMP
					04-29-1996	1144	34.20	2,360.1	S	R	EMP
					06-19-1996	1350	34.50	2,359.8	S	R	EMP
					07-29-1996	1454	35.04	2,359.3	S	-	EMP
					08-26-1996	1508	33.74	2,360.6	S	-	EMP
					09-23-1996	1235	35.32	2,359.0	S	-	EMP
					10-21-1996	1015	35.46	2,358.8	S	-	EMP
					11-18-1996	1525	34.74	2,359.6	S	R	EMP
					12-16-1996	1137	34.66	2,359.6	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-9	362848116264201	Gilgans North Well	2,264.8	-0.10	01-23-1996	0810	76.75	2,188.0	S	-	EMP
					02-22-1996	0940	77.40	2,187.4	S	-	EMP
					03-13-1996	0829	77.08	2,187.7	S	-	EMP
					03-21-1996	--	78.24	2,186.6	Z	-	NDWR
					04-17-1996	1755	83.18	2,181.6	S	S	EMP
					05-17-1996	1510	83.94	2,180.9	S	S	EMP
					06-20-1996	1704	86.04	2,178.8	S	S	EMP
					07-19-1996	1254	86.53	2,178.3	S	S	EMP
					08-21-1996	1140	84.98	2,179.8	S	-	EMP
					09-17-1996	1552	84.40	2,180.4	S	-	EMP
					10-08-1996	--	83.38	2,181.4	Z	-	NDWR
					10-18-1996	1340	83.62	2,181.2	S	-	EMP
					11-21-1996	1450	79.08	2,185.7	S	-	EMP
					12-18-1996	1234	77.08	2,187.7	S	-	EMP
AD-10	362525116274301	NA-9 Well	2,190.9	1.3	01-22-1996	1405	10.07	2,180.8	S	-	EMP
					02-22-1996	0912	10.09	2,180.8	S	-	EMP
					03-13-1996	0747	10.19	2,180.7	S	-	EMP
					04-17-1996	1830	10.30	2,180.6	S	-	EMP
					05-17-1996	1441	10.33	2,180.6	S	-	EMP
					06-20-1996	0711	10.39	2,180.5	S	-	EMP
					07-19-1996	1200	10.48	2,180.4	S	-	EMP
					08-21-1996	1057	10.57	2,180.3	S	-	EMP
					09-17-1996	1618	10.60	2,180.3	S	-	EMP
					10-17-1996	1430	10.66	2,180.2	S	-	EMP
					11-21-1996	1242	10.64	2,180.3	S	-	EMP
					12-19-1996	0855	10.75	2,180.2	S	-	EMP
AD-11	361954116181201	GS-3 Well	2,351.3	1.1	01-12-1996	0915	225.15	2,126.2	S	-	EMP
					02-20-1996	1314	225.08	2,126.2	S	-	EMP
					03-12-1996	0959	225.13	2,126.2	S	-	EMP
					04-16-1996	0957	224.97	2,126.3	S	-	EMP
					05-17-1996	1253	224.89	2,126.4	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-11	361954116181201	GS-3 Well	2,351.3	1.1	06-12-1996	1559	224.55	2,126.8	S	-	EMP
					07-18-1996	1500	224.33	2,127.0	S	-	EMP
					08-28-1996	1652	224.18	2,127.1	S	-	EMP
					09-16-1996	1111	224.05	2,127.2	S	-	EMP
					09-24-1996	1659	224.07	2,127.2	S	-	EMP
					10-17-1996	1115	224.24	2,127.1	S	-	EMP
					11-18-1996	1120	224.25	2,127.0	S	-	EMP
					12-16-1996	1017	224.42	2,126.9	S	-	EMP
AD-12	362014116133901	GS-1 Well	2,430.3	2.0	01-22-1996	1120	80.85	2,349.4	S	-	EMP
					02-20-1996	1233	80.80	2,349.5	S	-	EMP
					03-27-1996	1003	80.79	2,349.5	S	-	EMP
					04-16-1996	0913	80.77	2,349.5	S	-	EMP
					05-10-1996	0945	80.78	2,349.5	S	-	EMP
					06-12-1996	1726	80.76	2,349.5	S	-	EMP
					07-18-1996	0927	80.66	2,349.6	S	-	EMP
					08-21-1996	0948	80.72	2,349.6	S	-	EMP
					09-19-1996	0950	80.83	2,349.5	S	-	EMP
					10-17-1996	1040	80.84	2,349.5	S	-	EMP
					11-18-1996	1019	80.82	2,349.5	S	-	EMP
					12-16-1996	0917	80.81	2,349.5	S	-	EMP
AD-13	361724116324201	S-1 Well	2,703.2	2.0	01-12-1996	1030	381.62	2,321.6	S	-	EMP
					02-20-1996	1424	381.27	2,321.9	V	-	EMP
					03-12-1996	1222	381.54	2,321.7	V	-	EMP
					04-16-1996	1133	381.16	2,322.0	V	-	EMP
					05-09-1996	1310	381.12	2,322.1	V	-	EMP
					06-12-1996	1201	380.86	2,322.3	V	-	EMP
					07-19-1996	0955	381.02	2,322.2	V	-	EMP
					08-30-1996	1140	380.98	2,322.2	S	-	EMP
					09-16-1996	1313	380.59	2,322.6	S	-	EMP
					09-24-1996	1050	380.75	2,322.4	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-13	361724116324201	S-1 Well	2,703.2	2.0	10-17-1996	1230	380.51	2,322.7	V	-	EMP
					11-21-1996	1630	380.77	2,322.4	V	-	EMP
					12-19-1996	1032	381.10	2,322.1	S	-	EMP
AD-14	361817116244701	Death Valley Jct Well	2,041.8	.7	01-22-1996	1150	4.07	2,037.7	S	-	EMP
					02-20-1996	1353	3.69	2,038.1	S	-	EMP
					03-12-1996	1052	3.63	2,038.2	S	-	EMP
					04-16-1996	1048	3.64	2,038.2	S	-	EMP
					05-09-1996	1410	3.92	2,037.9	S	-	EMP
					06-12-1996	1054	3.78	2,038.0	S	-	EMP
					07-18-1996	1800	3.91	2,037.9	S	-	EMP
					08-21-1996	1027	4.22	2,037.6	S	-	EMP
					09-24-1996	0901	3.49	2,038.3	S	-	EMP
					10-17-1996	1150	4.16	2,037.6	S	-	EMP
					11-21-1996	1605	3.61	2,038.2	S	-	EMP
					12-19-1996	1303	3.54	2,038.3	S	-	EMP
AM-1	362858116195301	Rogers Spring Well	2,265.9	.1	01-24-1996	0820	2.75	2,263.2	S	-	EMP
					01-30-1996	0854	2.73	2,263.2	T	-	USFWS
					02-23-1996	1004	2.72	2,263.2	S	-	EMP
					02-28-1996	1112	2.66	2,263.2	T	-	USFWS
					03-13-1996	1310	2.69	2,263.2	S	-	EMP
					03-27-1996	1027	2.67	2,263.2	T	-	USFWS
					04-18-1996	0906	2.76	2,263.1	S	-	EMP
					04-29-1996	1443	2.81	2,263.1	T	-	USFWS
					05-17-1996	1017	3.03	2,262.9	S	-	EMP
					05-29-1996	0852	2.88	2,263.0	T	-	USFWS
					06-27-1996	1339	3.51	2,262.4	T	-	USFWS
					07-18-1996	1403	3.83	2,262.1	S	-	EMP
					07-27-1996	1220	3.96	2,261.9	T	-	USFWS
					08-28-1996	1352	4.19	2,261.7	T	-	USFWS
					08-30-1996	1820	4.18	2,261.7	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-1	362858116195301	Rogers Spring Well	2,265.9	0.1	09-24-1996	1436	4.00	2,261.9	S	-	EMP
					09-26-1996	1155	3.93	2,262.0	T	-	USFWS
					10-18-1996	0750	3.66	2,262.2	S	-	EMP
					10-28-1996	1107	3.45	2,262.4	T	-	USFWS
					11-21-1996	0838	3.16	2,262.7	S	-	EMP
					11-24-1996	1320	3.14	2,262.8	T	-	USFWS
					12-18-1996	1610	2.96	2,262.9	S	-	EMP
					12-23-1996	--	3.02	2,262.9	T	-	USFWS
AM-2	362755116190401	Five Springs Well	2,367.4	1.17	01-24-1996	0900	-.62	2,368.0	S	F	EMP
					02-23-1996	1033	-.63	2,368.0	S	F	EMP
					03-13-1996	1355	-.66	2,368.1	S	F	EMP
					04-18-1996	0950	-.64	2,368.0	S	F	EMP
					05-17-1996	0928	-.58	2,368.0	S	F	EMP
					06-13-1996	0924	-.54	2,367.9	S	F	EMP
					06-13-1996	0953	-.49	2,367.9	S	F	EMP
					07-18-1996	1317	.21	2,367.2	S	F	EMP
					07-31-1996	0911	.21	2,367.2	S	F	EMP
					08-21-1996	1811	.23	2,367.2	S	F	EMP
					09-24-1996	1312	.24	2,367.2	S	F	EMP
					10-18-1996	0815	.23	2,367.2	S	F	EMP
					10-29-1996	1435	.24	2,367.2	S	F	EMP
					11-22-1996	1033	.23	2,367.2	S	F	EMP
					12-18-1996	1454	.23	2,367.2	S	F	EMP
AM-3	362555116205301	Garners Well	2,157.0	1.15	01-24-1996	0755	19.65	2,137.4	S	-	EMP
					02-23-1996	1109	19.34	2,137.7	S	-	EMP
					03-13-1996	1235	18.74	2,138.3	S	-	EMP
					04-18-1996	0838	18.56	2,138.4	S	-	EMP
					05-07-1996	1650	18.66	2,138.3	S	-	EMP
					06-13-1996	1132	19.02	2,138.0	S	-	EMP
					06-21-1996	1105	19.11	2,137.9	S	-	EMP
					07-18-1996	1524	19.50	2,137.5	S	-	EMP
					08-30-1996	1844	20.09	2,136.9	S	-	EMP
					09-17-1996	1615	20.31	2,136.7	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-3	362555116205301	Garners Well	2,157.0	1.15	10-18-1996	0725	20.45	2,136.6	S	-	EMP
					11-21-1996	1222	20.31	2,136.7	S	-	EMP
					12-18-1996	1632	20.08	2,136.9	S	-	EMP
AM-4	362532116172700	Devils Hole	2,359.9	--	01-15-1996	--	2.08	2,357.8	A	-	NPS
					02-07-1996	--	2.09	2,357.8	N	-	EMP
					02-13-1996	--	2.08	2,357.8	N	-	EMP
					02-15-1996	--	2.07	2,357.8	A	-	NPS
					03-15-1996	--	2.05	2,357.8	A	-	NPS
					04-15-1996	--	2.06	2,357.8	A	-	NPS
					05-07-1996	1726	2.06	2,357.8	N	-	EMP
					05-15-1996	--	2.03	2,357.9	A	-	NPS
					06-15-1996	--	2.06	2,357.8	A	-	NPS
					07-15-1996	--	2.06	2,357.8	A	-	NPS
					08-15-1996	--	2.08	2,357.8	A	-	NPS
					08-29-1996	1604	2.06	2,357.8	N	-	EMP
					09-15-1996	--	2.08	2,357.8	A	-	NPS
					10-15-1996	--	2.09	2,357.8	A	-	NPS
					11-15-1996	--	2.12	2,357.8	A	-	NPS
					11-21-1996	0926	2.10	2,357.8	N	-	EMP
					12-15-1996	--	2.11	2,357.8	A	-	NPS
AM-5	362529116171100	Devils Hole Well	2,404.1	.9	01-09-1996	1238	48.10	2,356.0	S	-	USGS-NV
					01-24-1996	0935	48.10	2,356.0	S	-	EMP
					01-29-1996	1500	48.08	2,356.0	T	-	USFWS
					02-05-1996	1210	48.18	2,355.9	S	-	USGS-NV
					02-09-1996	0915	48.06	2,356.0	S	-	USGS-NV
					02-09-1996	1115	48.08	2,356.0	S	-	USGS-NV
					02-23-1996	0930	48.14	2,356.0	S	-	EMP
					02-28-1996	0935	48.14	2,356.0	T	-	USFWS
					03-01-1996	1025	48.19	2,355.9	S	-	USGS-NV
					03-13-1996	1444	48.05	2,356.0	S	-	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-5	362529116171100	Devils Hole Well	2,404.1	0.9	03-27-1996	1119	48.07	2,356.0	T	-	USFWS
					03-27-1996	1405	48.06	2,356.0	S	-	USGS-NV
					04-16-1996	1540	48.01	2,356.1	S	-	EMP
					04-26-1996	1032	48.11	2,356.0	S	-	USGS-NV
					04-29-1996	1147	48.19	2,355.9	T	-	USFWS
					05-13-1996	1501	48.03	2,356.1	S	-	USGS-NV
					05-17-1996	1050	48.15	2,356.0	S	-	EMP
					05-28-1996	1152	48.15	2,356.0	T	-	USFWS
					06-13-1996	1435	48.09	2,356.0	S	-	EMP
					06-19-1996	1024	48.10	2,356.0	S	-	USGS-NV
					06-27-1996	1040	48.20	2,355.9	T	-	USFWS
					07-02-1996	1145	48.15	2,356.0	S	-	USGS-NV
					07-18-1996	1120	48.17	2,355.9	S	-	EMP
					07-27-1996	1510	48.14	2,356.0	T	-	USFWS
					08-01-1996	0752	48.10	2,356.0	S	-	USGS-NV
					08-19-1996	1401	48.17	2,355.9	S	-	EMP
					08-28-1996	1127	48.23	2,355.9	T	-	USFWS
					09-12-1996	1542	48.09	2,356.0	S	-	USGS-NV
					09-17-1996	1550	48.14	2,356.0	S	-	EMP
					09-26-1996	1023	48.18	2,355.9	T	-	USFWS
					10-02-1996	1003	48.16	2,355.9	S	-	USGS-NV
					10-18-1996	0910	48.14	2,356.0	S	-	EMP
					10-28-1996	0900	48.19	2,355.9	T	-	USFWS
					11-08-1996	0851	48.28	2,355.8	S	-	USGS-NV
					11-18-1996	1406	48.13	2,356.0	S	-	EMP
					11-20-1996	1124	48.12	2,356.0	S	-	USGS-NV
					11-24-1996	1035	48.25	2,355.8	T	-	USFWS
					12-04-1996	0915	48.23	2,355.9	S	-	USGS-NV
					12-17-1996	1608	48.22	2,355.9	S	-	EMP
					12-23-1996	--	48.21	2,355.9	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-6	362432116165701	Point of Rocks North Well	2,318.8	0.0	01-24-1996	1000	21.38	2,297.4	S	-	EMP
					01-29-1996	1100	21.31	2,297.5	T	-	USFWS
					02-23-1996	0839	21.38	2,297.4	S	-	EMP
					02-28-1996	0856	21.34	2,297.5	T	-	USFWS
					03-13-1996	1532	21.29	2,297.5	S	-	EMP
					03-27-1996	1032	21.27	2,297.5	T	-	USFWS
					04-16-1996	1440	21.45	2,297.4	S	-	EMP
					04-29-1996	0853	21.45	2,297.4	T	-	USFWS
					05-17-1996	1125	21.51	2,297.3	S	-	EMP
					05-28-1996	1108	21.50	2,297.3	T	-	USFWS
					06-12-1996	1848	21.54	2,297.3	S	-	EMP
					06-27-1996	0825	21.47	2,297.3	T	-	USFWS
					07-18-1996	1044	21.61	2,297.2	S	-	EMP
					07-27-1996	1407	21.50	2,297.3	T	-	USFWS
					08-19-1996	1424	21.62	2,297.2	S	-	EMP
					08-28-1996	1010	21.59	2,297.2	T	-	USFWS
					09-17-1996	1450	21.66	2,297.1	S	-	EMP
					09-26-1996	0917	21.60	2,297.2	T	-	USFWS
					10-18-1996	0945	21.60	2,297.2	S	-	EMP
					10-28-1996	0939	21.57	2,297.2	T	-	USFWS
					11-18-1996	1230	21.53	2,297.3	S	-	EMP
					11-24-1996	0942	21.51	2,297.3	T	-	USFWS
					12-17-1996	1540	21.51	2,297.3	S	-	EMP
					12-23-1996	--	21.44	2,297.4	T	-	USFWS
AM-7	362417116163600	Point of Rocks South Well	2,333.5	.8	01-09-1996	1207	9.08	2,324.4	S	-	USGS-NV
					01-24-1996	1025	9.07	2,324.4	S	-	EMP
					01-29-1996	1135	9.04	2,324.5	T	-	USFWS
					02-05-1996	1131	9.08	2,324.4	S	-	USGS-NV
					02-23-1996	0907	9.04	2,324.5	S	-	EMP
					02-28-1996	0917	9.03	2,324.5	T	-	USFWS
					03-10-1996	1239	9.01	2,324.5	S	-	USGS-NV
					03-12-1996	0743	8.98	2,324.5	S	-	USGS-NV

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-7	362417116163600	Point of Rocks South Well	2,333.5	0.8	03-13-1996	1601	8.97	2,324.5	S	-	EMP
					03-27-1996	1102	8.95	2,324.6	T	-	USFWS
					03-27-1996	1446	8.95	2,324.6	S	-	USGS-NV
					04-16-1996	1509	8.92	2,324.6	S	-	EMP
					04-26-1996	1230	8.95	2,324.6	S	-	USGS-NV
					04-29-1996	0925	9.01	2,324.5	T	-	USFWS
					05-01-1996	1125	8.98	2,324.5	S	-	USGS-NV
					05-13-1996	1420	8.92	2,324.6	S	-	USGS-NV
					05-17-1996	1201	9.01	2,324.5	S	-	EMP
					05-29-1996	1112	9.00	2,324.5	T	-	USFWS
					06-12-1996	1923	8.93	2,324.6	S	-	EMP
					06-19-1996	0944	9.00	2,324.5	S	-	USGS-NV
					06-27-1996	0845	9.04	2,324.5	T	-	USFWS
					07-02-1996	1222	8.99	2,324.5	S	-	USGS-NV
					07-27-1996	1455	8.95	2,324.6	T	-	USFWS
					07-29-1996	1603	8.93	2,324.6	S	-	EMP
					08-01-1996	0720	8.90	2,324.6	S	-	USGS-NV
					08-19-1996	1445	8.95	2,324.6	S	-	EMP
					08-28-1996	1030	8.98	2,324.5	T	-	USFWS
					09-12-1996	1625	8.89	2,324.6	S	-	USGS-NV
					09-17-1996	1520	8.93	2,324.6	S	-	EMP
					09-26-1996	0930	8.91	2,324.6	T	-	USFWS
					10-02-1996	0915	8.92	2,324.6	S	-	USGS-NV
					10-18-1996	1015	8.88	2,324.6	S	-	EMP
					10-28-1996	0959	8.86	2,324.6	T	-	USFWS
					11-08-1996	0948	8.91	2,324.6	S	-	USGS-NV
					11-18-1996	1304	8.80	2,324.7	S	-	EMP
					11-20-1996	0902	8.83	2,324.7	S	-	USGS-NV
					11-20-1996	1102	8.81	2,324.7	S	-	USGS-NV
					11-24-1996	0850	8.86	2,324.6	T	-	USFWS
					12-03-1996	1009	8.82	2,324.7	S	-	USGS-NV
					12-17-1996	1506	8.81	2,324.7	S	-	EMP
					12-23-1996	--	8.88	2,324.6	T	-	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measure-ment point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
DV-3	362230116392901	Travertine Point 1 Well	2,728.4	2.0	01-22-1996	1240	599.99	2,128.4	V	-	EMP
					02-21-1996	1054	600.56	2,127.8	V	-	EMP
					03-27-1996	1141	600.06	2,128.3	V	-	EMP
					04-16-1996	1252	600.00	2,128.4	V	-	EMP
					05-09-1996	1200	600.19	2,128.2	V	-	EMP
					06-13-1996	0734	600.18	2,128.2	V	-	EMP
					07-19-1996	0830	600.24	2,128.2	V	-	EMP
					08-26-1996	1331	600.18	2,128.2	V	-	EMP
					09-24-1996	0952	600.31	2,128.1	V	-	EMP
					10-17-1996	1330	600.39	2,128.0	V	-	EMP
					11-20-1996	1548	600.31	2,128.1	V	-	EMP
					12-19-1996	1208	600.50	2,127.9	V	-	EMP

Table 6. Daily average water levels in well JF-3 for calendar year 1996

[--, data not available]

Day	Water level, in feet below land surface											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	710.34	710.07	710.58	710.10	710.16	710.52	710.35	710.20	710.17	710.23	710.65	710.35
2	710.36	710.31	710.34	710.17	710.09	710.53	710.22	710.21	710.27	710.36	710.44	710.44
3	710.14	710.60	710.13	710.29	710.12	710.38	710.22	710.16	710.31	710.42	710.33	710.37
4	710.09	710.62	709.98	710.47	710.25	710.21	710.25	710.26	710.26	710.39	710.35	710.43
5	710.28	710.54	710.06	710.54	710.28	710.20	710.29	710.28	710.25	710.41	710.32	710.13
6	710.54	710.45	710.54	710.33	710.21	710.26	710.33	710.34	710.39	710.48	710.58	710.14
7	710.47	710.32	710.58	710.15	710.19	710.29	710.27	710.42	710.44	710.43	710.72	710.49
8	710.31	710.20	710.42	710.19	710.21	710.27	710.20	710.42	710.41	710.38	710.62	710.40
9	710.26	710.12	710.35	710.18	710.35	710.24	710.30	710.38	710.36	710.41	710.40	710.08
10	710.42	710.25	710.24	710.06	710.51	710.21	710.42	710.32	710.40	710.43	710.26	710.18
11	710.53	710.37	710.17	710.24	710.45	710.17	710.42	710.32	710.33	710.35	710.30	710.38
12	710.31	710.35	709.97	710.18	710.25	710.23	710.36	710.40	710.21	710.35	710.43	710.48
13	710.17	710.33	709.98	710.37	710.13	710.30	710.26	710.41	710.12	710.36	710.34	710.48
14	710.22	710.28	710.34	710.49	710.13	710.32	710.25	710.38	710.18	710.43	710.01	710.72
15	710.20	710.27	710.39	710.28	710.17	710.27	710.26	710.32	710.22	710.32	709.89	710.74
16	709.88	710.25	710.32	710.00	710.22	710.29	710.22	710.31	710.35	710.30	710.29	710.35
17	710.08	710.18	710.27	710.11	710.30	710.32	710.29	710.22	710.50	710.51	710.44	710.39
18	710.35	710.10	710.30	710.32	710.22	710.27	710.37	710.21	710.54	710.28	710.48	---
19	710.22	709.95	710.28	710.45	710.25	710.24	710.38	710.34	710.48	710.13	710.30	710.32
20	710.43	710.11	710.21	710.25	710.32	710.19	710.34	710.36	710.38	710.53	710.27	710.12
21	710.12	710.14	710.05	710.24	710.24	710.14	710.36	710.34	710.27	710.84	710.22	---
22	710.22	710.30	709.84	710.41	710.22	710.27	710.38	710.33	710.24	710.60	710.18	709.93
23	710.48	710.47	710.04	710.42	710.27	710.28	710.32	710.38	710.34	710.24	710.55	710.60
24	710.31	710.01	710.25	710.19	710.22	710.24	710.25	710.35	710.35	710.16	710.69	710.64
25	710.14	709.99	710.21	710.30	710.33	710.23	710.24	710.22	710.29	710.10	710.51	710.28
26	710.40	710.19	710.36	710.26	710.36	710.28	710.30	710.15	710.31	710.42	710.52	710.11
27	710.18	710.37	710.18	710.19	710.23	710.40	710.37	710.23	710.54	710.63	710.61	---
28	710.22	710.46	709.96	710.49	710.33	710.51	710.38	710.42	710.52	710.50	710.15	---
29	710.26	710.59	710.31	710.47	710.23	710.46	710.37	710.42	710.32	710.38	710.15	---
30	710.20	---	710.39	710.22	710.30	710.39	710.26	710.33	710.20	710.24	710.49	---
31	710.05	---	710.28	---	710.40	---	710.22	710.22	---	710.46	---	---
Mean	710.26	710.28	710.24	710.28	710.26	710.30	710.30	710.31	710.33	710.39	710.38	710.36
Maximum	710.54	710.62	710.58	710.54	710.51	710.53	710.42	710.42	710.54	710.84	710.72	710.74
Minimum	709.88	709.95	709.84	710.00	710.09	710.14	710.20	710.15	710.12	710.10	709.89	709.93

(1996 annual summary Mean 710.31 Maximum 710.84 Minimum 709.84)

Table 7. Daily average water levels in well AD-6 for calendar year 1996

[--, data not available]

Day	Water level, in feet below land surface											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	41.71	41.57	41.77	---	41.59	---	---	---	41.60	41.66	41.82	41.76
2	41.71	41.68	41.67	---	41.56	---	---	---	41.65	41.71	41.72	41.81
3	41.62	41.78	41.60	---	41.57	---	---	---	41.66	41.72	41.69	41.78
4	41.61	41.77	41.55	---	41.62	---	---	---	41.63	41.70	41.70	41.80
5	41.69	41.74	41.59	---	41.63	---	---	---	41.63	41.71	41.69	41.66
6	41.78	41.72	41.79	---	41.59	---	---	---	41.70	41.74	41.80	41.68
7	41.74	41.67	41.77	---	41.58	---	---	---	41.71	41.71	41.84	41.82
8	41.68	41.63	41.68	---	41.59	---	---	---	41.69	41.69	41.78	41.75
9	41.67	41.60	41.67	---	41.65	---	---	---	41.67	41.71	41.69	41.60
10	41.74	41.66	41.64	---	41.70	---	---	---	41.70	41.71	41.64	41.66
11	41.77	41.69	41.61	---	41.66	---	---	---	41.67	41.68	41.67	41.73
12	41.68	41.68	41.54	---	41.58	---	---	---	41.63	41.69	41.73	41.75
13	41.64	41.68	41.56	---	41.54	---	---	---	41.60	41.69	41.69	41.76
14	41.67	41.66	41.70	---	41.56	---	---	---	41.64	41.72	41.57	41.86
15	41.65	41.67	41.69	---	41.58	---	---	---	41.64	41.67	41.55	41.88
16	41.51	41.65	41.64	41.51	41.61	---	---	---	41.69	41.67	41.74	41.73
17	41.61	41.63	41.63	41.59	41.63	---	---	41.62	41.75	41.75	41.77	41.77
18	41.72	41.60	---	41.69	41.59	---	---	41.63	41.77	41.65	41.76	---
19	41.63	41.54	---	41.72	41.61	---	---	41.69	41.75	41.60	41.68	---
20	41.74	41.62	---	41.63	41.64	---	---	41.69	41.70	41.79	41.67	---
21	41.58	41.62	---	41.64	41.59	---	---	41.67	41.66	41.90	41.65	---
22	41.66	41.69	---	41.71	---	---	---	41.67	41.65	41.78	41.65	---
23	41.77	41.75	---	41.70	---	---	---	41.69	41.70	41.64	41.82	---
24	41.67	41.55	---	41.59	---	---	---	41.68	41.70	41.62	41.87	---
25	41.60	41.57	---	41.65	---	---	---	41.62	41.67	41.59	41.78	---
26	41.74	41.66	---	41.62	---	---	---	41.60	41.68	41.74	41.80	---
27	41.62	41.72	---	41.60	---	---	---	41.64	41.78	41.81	41.85	---
28	41.64	41.74	---	41.74	---	---	---	41.71	41.76	41.75	41.66	---
29	41.65	41.79	---	41.71	---	---	---	41.70	41.68	41.71	41.70	---
30	41.62	---	---	41.60	---	---	---	41.66	41.64	41.65	41.85	---
31	41.56	---	---	---	---	---	---	41.61	---	41.76	---	---
Mean	41.67	41.67	41.65	41.65	41.60	---	---	41.66	41.68	41.71	41.73	41.75
Maximum	41.78	41.79	41.79	41.74	41.70	---	---	41.71	41.78	41.90	41.87	41.88
Minimum	41.51	41.54	41.54	41.51	41.54	---	---	41.60	41.60	41.59	41.55	41.60
(1996 annual summary		Mean 41.68		Maximum 41.90		Minimum 41.51)						

Table 8. Ground-water-discharge data at monitoring sites in Yucca Mountain region for calendar year 1996

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See text section titled "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey.

Time: Time measurement was made, in military time; --, measurement time unknown.

Discharge: Reported to two significant figures.

Method: Method used to measure discharge. C, current meter; F, flume; V, volumetric; Z, discharge represents monthly mean discharge on basis of continually recorded stage (see text section "Ground-Water Discharge Data" for further discussion).

Data source: EMP, Environmental-Monitoring Program (U.S. Geological Survey); NPS, National Park Service; USFWS, U.S. Fish and Wildlife Service.

Site number (fig. 1)	U.S.Geological Survey site identification	Site name	Discharge measurement				
			Date	Time	Discharge (gallons per minute)	Method	Data source
AM-1a	362924116203001	Fairbanks Spring	01-30-1996	0920	1,800	F	USFWS
			02-26-1996	1240	1,600	C	EMP
			02-29-1996	1035	1,800	F	USFWS
			03-26-1996	1240	1,800	F	USFWS
			04-29-1996	1520	1,800	F	USFWS
			05-29-1996	1000	1,800	C	EMP
			05-30-1996	--	1,800	F	USFWS
			06-27-1996	1400	1,700	F	USFWS
			07-27-1996	1240	1,800	F	USFWS
			08-16-1996	1215	1,900	C	EMP
			08-28-1996	1410	1,700	F	USFWS
			09-26-1996	1210	1,700	F	USFWS
			10-28-1996	1120	1,700	F	USFWS
			11-21-1996	1052	1,500	C	EMP
			11-24-1996	1335	1,700	F	USFWS
			12-23-1996	--	1,700	F	USFWS
AM-2	362755116190401	Five Springs Well	01-24-1996	0905	1.4	V	EMP
			02-23-1996	1035	1.1	V	EMP
			03-13-1996	1400	1.3	V	EMP
			04-18-1996	0958	1.2	V	EMP
			05-17-1996	0931	4.7	V	EMP
			06-13-1996	0935	7.6	V	EMP
			07-31-1996	0937	47	V	EMP
			08-21-1996	1855	45	V	EMP
			09-24-1996	1320	44	V	EMP
			10-18-1996	0820	59	V	EMP
			10-29-1996	1435	48	V	EMP
			11-22-1996	1045	44	V	EMP
			12-18-1996	1535	44	V	EMP
AM-5a	362502116192301	Crystal Pool	01-29-1996	1350	2,200	C	USFWS
			02-23-1996	1159	2,700	C	EMP
			02-27-1996	1115	2,400	C	USFWS
			03-27-1996	1325	2,500	C	USFWS
			04-29-1996	1625	2,600	C	USFWS

Table 8. Ground-water-discharge data at monitoring sites in Yucca Mountain region for calendar year 1996—Continued

Site number (fig. 1)	U.S.Geological Survey site identification	Site name	Discharge measurement				
			Date	Time	Discharge (gallons per minute)	Method	Data source
AM-5a	362502116192301	Crystal Pool	05-29-1996	1225	2,600	C	EMP
			05-30-1996	0925	2,400	C	USFWS
			06-27-1996	1500	2,400	C	USFWS
			07-27-1996	--	2,500	C	USFWS
			08-28-1996	0810	2,500	C	USFWS
			08-29-1996	1808	2,200	C	EMP
			09-26-1996	1130	2,700	C	USFWS
			10-28-1996	--	2,400	C	USFWS
			11-14-1996	1255	2,800	C	EMP
			11-24-1996	1425	2,800	C	USFWS
			12-27-1996	--	2,800	C	USFWS
AM-8	362230116162001	Big Spring	02-26-1996	1550	1,000	C	EMP
			05-29-1996	1340	960	C	EMP
			08-30-1996	1630	1,300	C	EMP
			09-26-1996	0915	720	C	USFWS
			10-28-1996	--	700	C	USFWS
			11-14-1996	1540	990	C	EMP
			11-25-1996	0935	910	C	USFWS
			12-27-1996	--	980	C	USFWS
DV-1	362728116501101	Texas Spring	01-15-1996	--	200	Z	NPS
			02-15-1996	--	210	Z	NPS
			02-21-1996	1345	210	C	EMP
			03-15-1996	--	210	Z	NPS
			04-15-1996	--	200	Z	NPS
			05-07-1996	1320	210	C	EMP
			05-15-1996	--	200	Z	NPS
			06-15-1996	--	210	Z	NPS
			07-15-1996	--	210	Z	NPS
			08-15-1996	--	210	Z	NPS
			09-10-1996	1225	210	C	EMP
			09-15-1996	--	210	Z	NPS
			10-15-1996	--	210	Z	NPS
			11-15-1996	--	210	Z	NPS
			11-20-1996	1235	180	C	EMP
			12-15-1996	--	200	Z	NPS
DV-2	362252116425301	Navel Spring	02-21-1996	1430	1.2	V	EMP
			05-07-1996	1500	1.1	V	EMP
			08-29-1996	1315	1.1	V	EMP
			11-20-1996	1440	1.1	V	EMP

Table 9. Estimated annual ground-water withdrawals from wells in Yucca Mountain region for calendar year 1996

Ground-water subbasin	Hydrographic area	Ground-water withdrawal [1]		
		Year	Millions of gallons	Acre-feet
Alkali Flat-Furnace Creek Ranch	Amargosa Desert [2]	1996	4,422	13,570
	Crater Flat[3]	1996	25.5	78
	Jackass Flats [3]	1996	127.4	391
Ash Meadows	Amargosa Desert[2] (excluding Ash Meadows area)	1996	4	11
	Amargosa Desert[2] (Ash Meadows area)	1996	10	32
	Mercury Valley[3]	1996	17.7	54

[1] See section "Ground-Water Withdrawals" for discussion of data sources.

[2] Data recompiled from ground-water pumpage inventory for entire Amargosa Desert, listed to nearest acre-foot. Conversion to million of gallons is rounded to nearest 1 million gallons. All withdrawals for domestic use in Amargosa Desert are included in Alkali Flat-Furnace Creek Ranch ground-water subbasin because data were not available to separate such withdrawals within each subbasin.

[3] Data reported or recompiled from flowmeter readings and listed to nearest 0.1 million gallons. Conversions to acre-feet are rounded to nearest acre-foot.

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1996. Excludes water-level altitudes that may reflect short-term conditions at a site.

Calendar years: Years for which measurements were used to calculate summary statistics. Italics indicate selected baseline period.

Number: Number of water-level measurements for year(s) specified. For JF-2 (1985-93), JF-2a, and JF-3, value represents number of daily average water levels.

Water level: Based on periodic water-level measurements made during site visits for JF-1, JF-2 (after 1993), J-13, J-11, and J-12. Based on daily average water levels collected from continual data recorders for JF-2 (1985-93), JF-2a, and JF-3.

Minimum: Minimum water-level altitude or minimum daily average water-level altitude for year(s) specified.

Maximum: Maximum water-level altitude or maximum daily average water-level altitude for year(s) specified.

Median: Statistically representative water-level altitude calculated from periodic measurements or daily average water levels for year(s) specified.

Average deviation: Calculated dispersion of measurements about median water-level altitude. Average deviation is equal to sum of absolute differences between measured water levels and median, divided by number of measurements.

Change in median: Differences between median water level for calendar years 1992, 1993, 1994, 1995, and 1996 compared with baseline period. Minus sign indicates that median water-level altitude was lower for the specified year compared with the baseline period.

[Abbreviations and symbols: N/A, not applicable (data field is not related to referenced data set)]

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	1985-91	86	2,391.7	2,393.1	2,392.5	0.2	N/A
JF-2	*1985-91*	1,777	2,389.6	2,393.4	2,392.1	.3	N/A
JF-2a	*1985-91*	1,876	2,466.7	2,469.5	2,468.6	.4	N/A
J-13	*1989-91*	32	2,389.7	2,390.7	2,390.0	.2	N/A
J-11	*1990-91*	25	2,401.9	2,402.9	2,402.2	.1	N/A
J-12	*1990-91*	22	2,388.1	2,388.5	2,388.3	.1	N/A
JF-3	*1992-93*	582	2,387.7	2,388.8	2,388.3	.1	N/A
JF-1	1996	8	2,392.0	2,392.6	2,392.3	.2	-.2
JF-2	1996	7	2,391.6	2,392.3	2,392.1	.2	.0
JF-2a	1996	214	2,468.6	2,469.6	2,469.3	.1	.7
J-13	1996	8	2,389.2	2,389.9	2,389.6	.1	-.4
J-11	1996	8	2,402.2	2,402.6	2,402.4	.1	.2
J-12	1996	18	2,387.5	2,388.5	2,388.0	.1	-.3
JF-3	1996	359	2,387.5	2,388.5	2,388.0	.1	-.3
JF-1	1995	7	2,392.3	2,392.8	2,392.5	.2	.0
JF-2	1995	9	2,392.2	2,392.5	2,392.4	.1	.3
JF-2a	1995	357	2,468.7	2,469.3	2,469.1	.1	.5
J-13	1995	11	2,389.6	2,390.4	2,389.8	.1	-.2
J-11	1995	11	2,402.2	2,402.5	2,402.4	.1	.2
J-12	1995	16	2,388.0	2,388.3	2,388.2	.1	-.1
JF-3	1995	347	2,387.7	2,388.4	2,388.1	.1	-.2
JF-1	1994	12	2,392.1	2,392.6	2,392.3	.1	-.2
JF-2	1994	9	2,392.0	2,392.6	2,392.2	.1	.1
JF-2a	1994	356	2,468.4	2,469.4	2,469.0	.1	.4
J-13	1994	23	2,389.4	2,390.0	2,389.7	.1	-.3
J-11	1994	12	2,402.0	2,402.5	2,402.3	.1	.1
J-12	1994	24	2,387.8	2,389.1	2,388.2	.2	-.1
JF-3	1994	284	2,387.6	2,388.6	2,388.1	.1	-.2

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1996—Continued

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	1993	8	2,391.9	2,392.7	2,392.5	0.2	0.0
JF-2	1993	362	2,391.7	2,392.8	2,392.1	.2	0
JF-2a	1993	365	2,468.4	2,469.2	2,468.8	.1	.2
J-13	1993	16	2,389.7	2,390.7	2,389.9	.1	-.1
J-11	1993	8	2,401.9	2,402.7	2,402.2	.2	0
J-12	1993	19	2,387.9	2,389.0	2,388.3	.1	0
JF-1	1992	12	2,392.3	2,392.6	2,392.4	.1	-.1
JF-2	1992	357	2,391.8	2,392.6	2,392.2	.1	.1
JF-2a	1992	342	2,466.9	2,469.2	2,468.6	.5	0
J-13	1992	21	2,389.6	2,390.4	2,389.9	.1	-.1
J-11	1992	12	2,402.0	2,402.6	2,402.2	.1	0
J-12	1992	17	2,388.2	2,388.6	2,388.3	.1	0

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