Hydrologic and Geochemical Monitoring in Long Valley Caldera, Mono County, California, 1986

By C. D. Farrar, M. L. Sorey, S. A. Rojstaczer, and A. C. Steinemann

U. S. Geological Survey

and

M. D. Clark

U.S. Forest Service

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 89-4033

Sacramento, California
1989

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., *Secretary*

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, *Director*

For additional information
write to:

District Chief
U.S. Geological Survey
Federal Building, Room W-2234
2800 Cottage Way
Sacramento, CA 95825

Copies of this report may
be purchased from:

U.S. Geological Survey
Books and Open-File Reports
Box 25425
Federal Center, Bldg. 810
Denver, CO 80225

CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS

Except as noted below, inch-pound units were used in this report. For those readers who prefer metric (International System) units, the conversion factors are listed below.

Multiply inch-pound unit	By	To obtain metric unit
acres	0.4047	hectares (ha)
feet (ft)	0.3048	meters (m)
cubic feet per second (ft^3/s)	28.32	liters per second (L/s)
gallons per minute (gal/min)	0.0631	liters per second (L/s)
inches (in.)	25.40	millimeters (mm)
miles (mi)	1.609	kilometers (km)
square miles (mi^2)	2.590	square kilometers (km^2)
cubic miles (mi^3)	4.168	cubic kilometers (km^3)
pounds (lb)	0.4536	kilograms (kg)
feet of water	29.90	millibars of air pressure at standard temperature and pressure (mb)
	2.989	kilopascals (kPa)

Metric units were used for discharge of streams, springs, and wells. To convert metric units to inch-pound units, multiply the metric unit by the reciprocal of the applicable conversion factor listed above. For example, multiply liters per second by 1/0.0631 or 15.85 to obtain gallons per minute.

Degrees Celsius are used in this report. To convert degrees Celsius (°C) to degrees Fahrenheit (°F), use the formula:

$$\text{Temp } ^\circ F = 1.8 (\text{temp } ^\circ C) + 32.$$

Explanation of abbreviations

cm	centimeters
g/L	grams per liter
L/s	liters per second
mg/L	milligrams per liter
µg/L	micrograms per liter
µg/g	micrograms per gram

Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

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

HYDROLOGIC AND GEOCHEMICAL MONITORING IN LONG VALLEY CALDERA, MONO COUNTY, CALIFORNIA, 1986

By C.D. Farrar, M.L. Sorey, S.A. Rojstaczer,
A.C. Steinemann, *and* M.D. Clark

ABSTRACT

The U.S. Geological Survey continued to monitor hydrologic and geochemical conditions in the Long Valley caldera during 1986. The monitoring is directed toward detecting changes in the hydrologic system caused by tectonic or magmatic processes. Data collected during 1986 include chemical and isotopic composition of water from selected stream sites, springs, and wells; pumpage from four geothermal wells; flow rates of selected springs and stream sites; mean daily water or gas temperatures at selected sites; mean daily atmospheric pressures and water levels at selected wells, and precipitation records for two sites.

Seismicity within the caldera persisted at a relatively low level compared with the more active periods of 1978-84. The most significant events of seismicity that affected hydrologic monitoring sites in Long Valley during 1986 occurred during July, in response to the Chalfant Valley earthquakes, centered about 20 miles southeast of the caldera. Water-level records for three wells show distinct responses to the Chalfant Valley earthquakes.

INTRODUCTION

This report presents hydrologic and geochemical data collected during 1986 in the Long Valley caldera study area in California (fig. 1). The data were collected by the U.S. Geological Survey to study the response of the hydrologic system to crustal disturbances, including seismic and tectonic crustal strain and magmatic processes. The program of hydrologic and geochemical monitoring by the U.S. Geological Survey began in 1982 following a period of significant seismicity and ground deformation (Miller and others, 1982). The results of this monitoring program for previous years are given by Farrar and others (1985, 1987) and Sorey and others (1984, 1986).

Seismicity and crustal deformation in the Long Valley caldera persisted at relatively low levels in 1986 compared with the more active periods during 1978-84 (Savage and Cockerham, 1987). However, significant ground shaking within the caldera accompanied the July 1986 Chalfant Valley sequence of earthquakes centered about 20 miles southeast of the caldera. The water levels in three monitor wells in Long Valley showed distinct responses to the Chalfant Valley seismicity.

Acknowledgments

The authors wish to extend their gratitude to several individuals who provided data or assisted in collection of data included in this report. William Asper, Plant Manager, Mammoth Pacific Powerplant, provided data on well pumpage in the geothermal production field and allowed access to the wells for sampling. Keith Higginson, Higginson and Barnett, Bountiful, Utah, provided data collected at Fish Hatchery Spring group AB. Dennis Jackson, U.S. Forest Service, provided streamflow data on Mammoth and Hot Creeks. James Kuykendall and Gary Sisson, Mammoth County Water District, provided data for Water District wells and allowed access to the wells for further data collection. Gene Suemnicht, Unocal Geothermal Division, Union Oil Co., provided data and access to the IDFU 44-16 geothermal test well.

HYDROLOGIC AND GEOCHEMICAL DATA

Chemical and Isotopic Analyses of Waters

The location of sites sampled for chemical and isotope analyses are shown in figures 2 and 3. The results of the analyses are given in tables 1 and 2; the names of the laboratories that performed the analyses are included. The samples analyzed in the various U.S. Geological Survey laboratories were collected according to the procedures described by Farrar and others (1985, 1987).

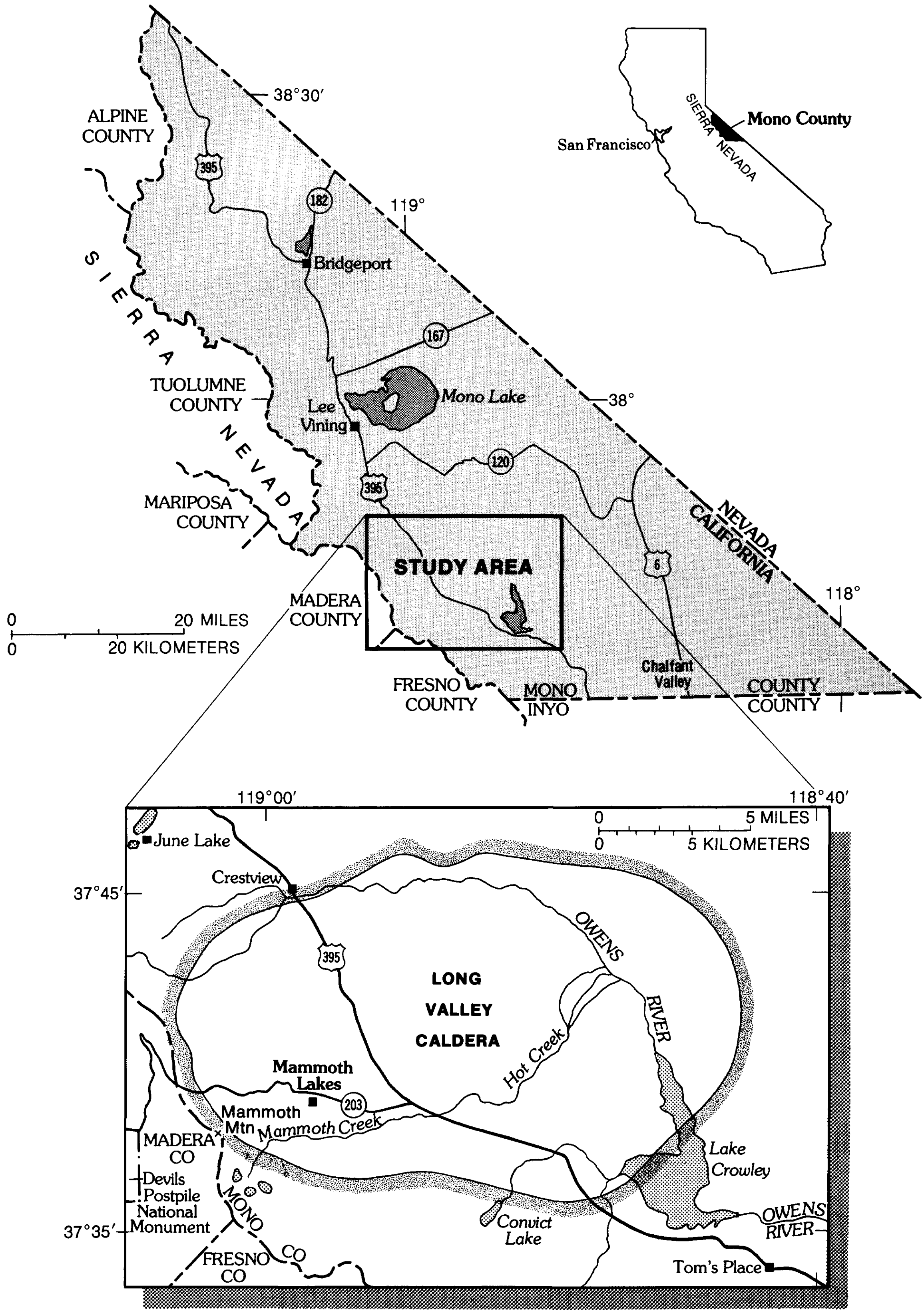

FIGURE 1. — Location of Long Valley study area.

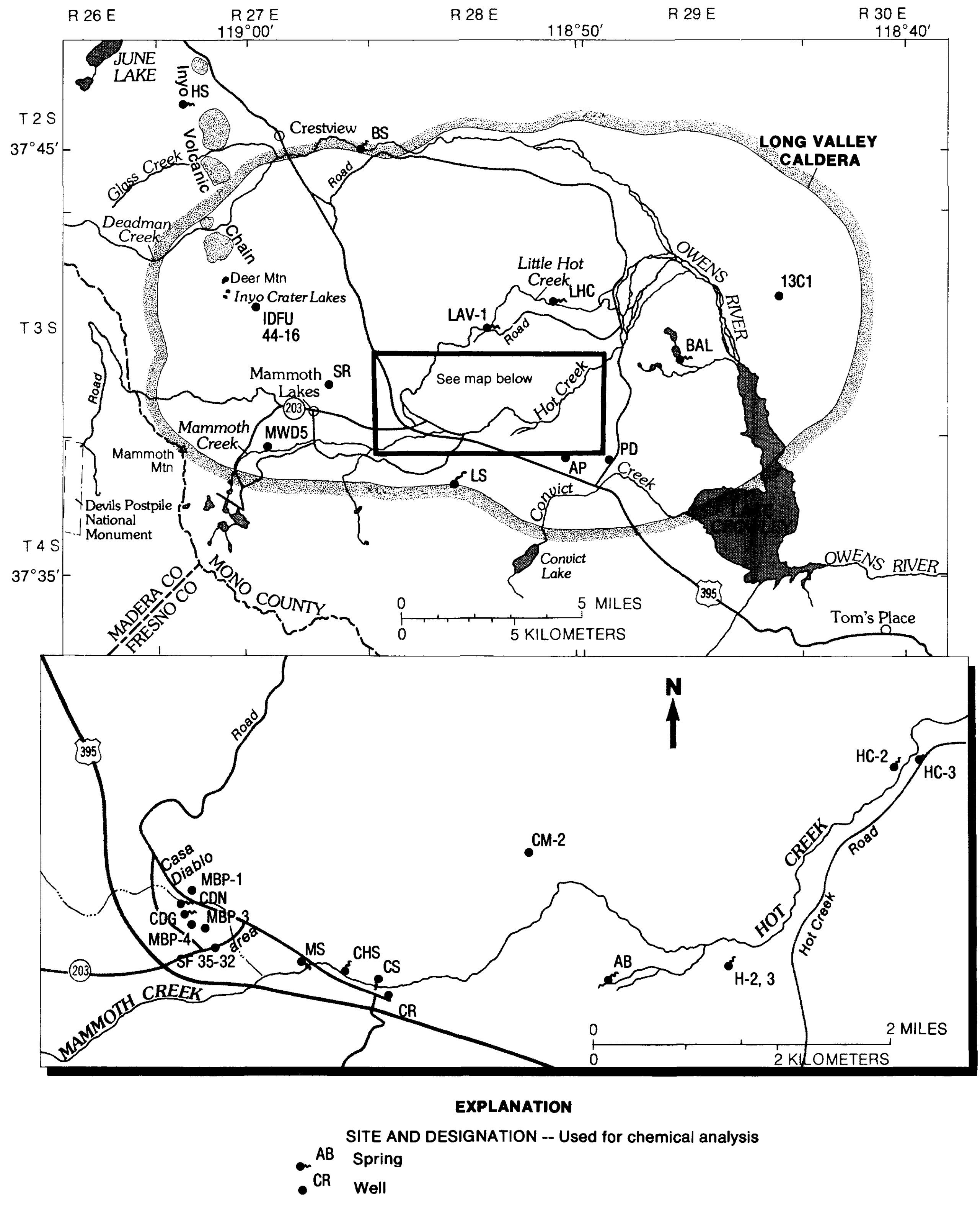

FIGURE 2.-- Long Valley study area showing sites with chemical analyses of water.

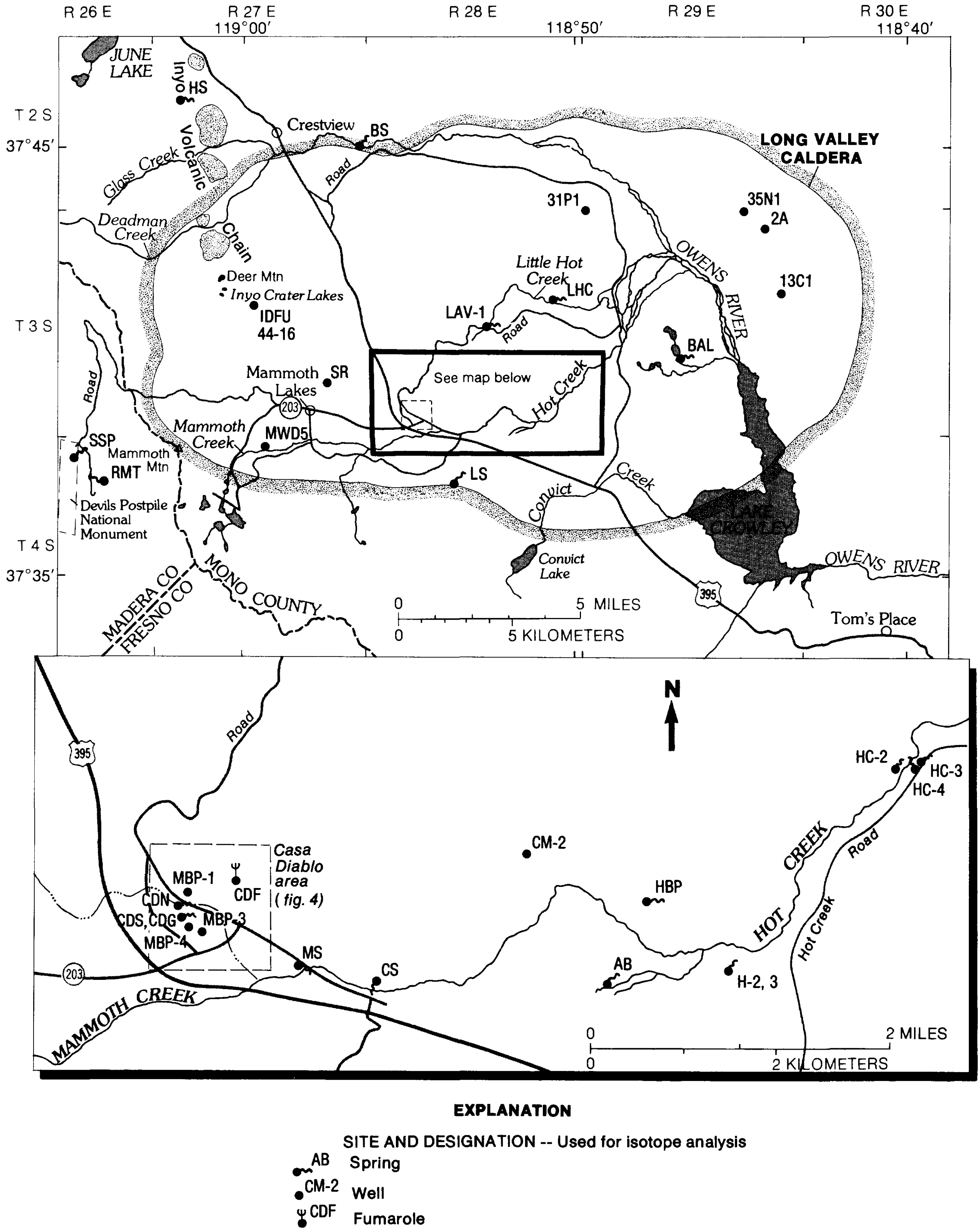

FIGURE 3.-- Long Valley study area showing sites with isotopic analyses of water.

TABLE 1.--*Chemical analyses of water from selected*

[Results in milligrams per liter except iron, mercury, manganese, and zinc, which are in micrograms per liter; -- signifies not determined; <, less than]

Name: Sample site and designation (in parentheses) used in figures and tables throughout report.

Laboratory: LBL, Lawrence Berkeley Laboratory, Berkeley, California; USGS-C, U.S. Geological Survey Central Laboratory, Arvada, Colorado; USGS-X, U.S. Geological Survey Contract Laboratory; LANL, Los Alamos National Laboratory; Union, Data provided by Unocal Geothermal; UURI, University of Utah Research Institute.
Temperature: "M" indicates maximum well-bore temperature. "W" indicates wellhead temperature.

Name (designation)	Collection date	Laboratory	Temperature (°C)	pH	Calcium	Magnesium	Sodium	Potassium
Springs in T. 2 S., R. 27 E.								
Big Spring (BS)	04-09-86	USGS-C	10.9	7.4	5.1	6.3	23	3.8
Hartley Spring (HS)	06-11-86	USGS-C	4.1	L6.9	2.5	.6	3.9	2.9
Wells in T. 3 S., R. 27 E.								
IDFU 44-16	11- -85	Union[1]	M214	9.3	7.9	.49	549	34
Shady Rest (SR)	11-15-86	USGS-C[2]	M202	5.9	7.4	.20	369	43
		LANL[2]	--	--	7.3	.12	382	45
		LBL[2]	--	--	14.1	<.25	418	50
		USGS-C[3]	--	--	7.3	--	390	44
		LANL[3]	--	--	9.9	.17	374	42
		LBL[3]	--	5.9	18.0	.35	380	48
Springs and wells in T. 3 S., R. 28 E.								
[Sites near Casa Diablo]								
Casa Diablo Geyser (CDG)	11-15-86	LANL	94.0	8.5	1.7	<.01	450	43
Chance Ranch (CR)	07-21-86	USGS-C	--	L7.0	15	11	29	6.7
Chance Spring (CHS)	05-22-86	USGS-C	20.1	--	--	--	--	--
	07-20-86	USGS-C	15.5	--	--	--	--	--
Colton Spring (CS)	04-09-86	USGS-C	92.2	8.2	1.4	<.01	380	28
	07-20-86	USGS-C	--	--	--	--	--	--
	10-18-86	USGS-C	93.1	L8.7	1.6	<.01	380	30
MBP-1	04-11-86	USGS-C	W 168	6.2	2.6	.64	370	34
	05-23-86	USGS-C	W 167	6.3	--	--	--	--
MBP-3	04-11-86	USGS-C	W 171	6.1	2.5	.55	360	33
	05-23-86	USGS-C	W 171	6.1	--	--	--	--
	11-16-86	USGS-C	W 170	6.0	5.7	.12	330	30
		LANL	W 170	6.1	5.5	.20	336	32
MBP-4	07-14-86	USGS-X	W 174	6.0	6.9	.24	350	36

See footnotes at end of table.

Alkalinity: Calculated as the equivalent concentration of calcium carbonate; field measurement except for laboratory measurements noted by "L."
Dissolved solids: Residue on evaporation at 180 °C, except calculated values indicated by "c."

Alkalinity	Sulfate	Chloride	Fluoride	Silica	Dissolved solids	Arsenic	Boron	Lithium	Iron	Mercury	Manganese	Zinc
80	6.7	5.8	0.5	55	155	0.02	0.28	0.04	6	--	<1	--
20	1.0	.4	.1	48	65	.001	<.01	<.004	4	<0.1	<1	<3
500	282	270	9.8	311	1,900	1.3	12.2	2.1	--	--	--	--
L376	159	280	12.0	250	1,430	.10	12.0	2.80	35,000	--	290	--
L382	138	296	10.2	290	c1,398	<.10	12.3	2.83	29,200	<100	310	40
561	185	267	--	--	--	--	10.6	--	34,100	--	290	--
L376	200	--	--	--	--	--	--	2.80	--	--	--	--
--	141	279	8.6	290	--	.90	12.2	2.78	35,300	<100	860	20
483	179	263	--	--	--	--	9.9	--	38,100	--	790	--
220	144	317	13.7	290	c1,391	1.7	13.3	3.41	20	<100	<10	<10
100	20	31	.2	63	230	.011	1.3	.18	50	--	10	--
--	--	15	--	--	--	--	.70	--	--	--	--	--
--	--	8.2	--	--	--	.07	.40	--	--	--	--	--
384	130	250	12.0	260	1,320	1.70	11.0	3.0	4	--	6	--
--	--	259	10.0	--	--	1.60	11.0	--	--	--	--	--
L380	140	259	12.0	259	1,380	1.40	12.0	3.0	12	.3	5	--
350	130	260	12	270	1,260	1.10	11.0	2.70	380	6	31	--
	--	260	--	--	--	--	10.0	--	--	--	--	--
346	120	250	11	270	1,210	.720	10.0	2.80	830	5.3	43	--
--	--	250	--	--	--	--	10.0	--	--	--	--	--
L359	110	250	11	240	1,220	2.10	9.9	2.60	320	.4	45	--
L370	107	230	9.4	225	c1,220	1.20	9.9	2.66	290	<100	40	<10
382	110	230	10	260	1,260	1.60	10.0	--	150	<.2	38	--

TABLE 1.--*Chemical analyses of water from selected*

Name (designation)	Collection date	Laboratory	Temperature (°C)	pH	Calcium	Magnesium	Sodium	Potassium
SF 35-32	09-06-86	UURI	W 173	L6.1	6.1	<1	382	40
Meadow Spring (MS)	04-09-86	USGS-C	55.0	6.2	3.5	.60	210	36
	08-30-86	USGS-C	66.4	--	--	--	--	--
North Spring (CDN)	04-09-86	USGS-C	81.0	6.7	16.0	2.4	260	23
[Sites near the State Fish Hatchery]								
AB Spring	04-08-86	USGS-C	15.5	7.3	14.0	11.0	26	6.1
	06-14-86	USGS-C	[4]14.6	7.2	--	--	--	--
	10-16-86	USGS-C	[4]15.0	7.2	--	--	--	--
CM-2	06-08-86	USGS-C	W 54	L6.6	21.0	.60	219	25
H-2,3 Spring	04-08-86	USGS-C	11.0	7.1	15.0	5.3	12	3.0
	07-19-86	USGS-C		--	--	--	--	--
	10-16-86	USGS-C		7.3	--	--	--	--
[Sites in Hot Creek Gorge]								
HC-2 Spring	04-08-86	USGS-C	75.5	7.5	5.4	.2	350	21
HC-3 Spring	04-08-86	USGS-C	92.3	8.0	3.8	.2	370	23
	07-20-86	USGS-C	--	--	--	--	--	--
	11-14-86	LANL	93.0	8.0	5.2	.16	380	23
[Sites in Little Hot Creek drainage]								
Little Antelope Valley Spring (LAV)	08-24-86	USGS-C	12.3	6.8	2.3	.76	8.7	4.3
Little Hot Creek Spring (LHC)	04-10-86	USGS-C	82.4	6.5	23.0	.60	390	29
<u>Springs and wells in T. 3 S., R. 29 E.</u>								
13C	05-24-86	USGS-C	9.9	9.2	4.0	.20	39	1.3
BAL Spring	04-10-86	USGS-C	56.6	6.6	25.0	.60	370	30
<u>Well in T. 4 S., R. 27 E.</u>								
MWD-5	06-10-86	USGS-C	19.9	6.4	24.0	28.0	63.0	6.7
<u>Spring and well in T. 4 S., R. 28 E.</u>								
Laurel Spring (LS)	04-10-86	USGS-C	11.8	8.6	15.0	.57	5.8	1.2
AP	09-29-85	USGS-C	14.0	5.9 L7.7	27.0	4.3	11.0	2.8
<u>Well in T. 4 S., R. 29 E.</u>								
PD	06-13-86	USGS-C	11.6	8.0	27.0	3.5	11.0	2.1

[1]Average values from three different laboratories for one sample collected from the wellhead during airlift operations. Steam fraction unknown.
[2]Sample collected with bailer.
[3]Sample collected with downhole sampler.
[4]Temperature measured and sample collected at 5-foot weir about 150 feet from main vent.

springs and wells in the Long Valley study area--Continued

Alkalinity	Sulfate	Chloride	Fluoride	Silica	Dissolved solids	Arsenic	Boron	Lithium	Iron	Mercury	Manganese	Zinc
378	115	251	11.6	275	1,554	1.5	7.8	2.63	230	2.3	--	--
102	130	200	9.1	190	845	2.5	8.7	1.40	8	--	21	--
--	--	200	--	--	--	--	9.5	--	--	--	--	--
96	150	230	8.5	240	1,010	1.70	11.0	1.20	120	.1	81	--
111	12	9	.3	61	197	.038	.39	.09	<3	<.1	<1	5
--	--	6.7	--	--	--	--	.26	--	--	--	--	--
--	--	4.3	.3	--	--	--	.21	--	--	--	--	--
L270	98	159	3.6	250	962	1.1	6.40	1.30	86	.2	91	5
72	11	4	.1	40	130	.017	.08	.035	<3	<.1	<1	7
--	--	4.6	.2	--	--	--	.08	--	--	--	--	--
--	--	3.6	.2	--	--	--	.09	--	--	--	--	--
L429	97	210	9.6	150	1,120	1.10	9.30	2.30	6	--	10	--
500	87	210	10.0	150	1,190	1.10	9.90	2.50	<3	--	<1	--
--	--	190	8.0	--	--	.82	8.60	--	--	--	--	--
473	95	223	9.9	150	c1,390	.90	10.7	2.43	<10	<100	<10	30
L32	2.0	.7	.3	78	122	.007	.02	<.01	21	<.1	2	--
584	120	200	8.7	96	1,230	.72	8.8	2.80	40	<.1	200	--
L84	3.4	5.5	1.1	61	161	.057	.22	.13	9	<0.1	4	7
628	78	150	4.9	200	1,250	.470	6.30	1.60	180	--	150	--
317	20	.6	.7	95	400	.022	.06	.25	5,200	<.1	1,200	<3
40	15	.4	<.1	20	93	.004	.01	<.01	<3	--	<1	--
90	12	2.0	.2	39	140	.010	.006	.019	15	--	5	61
L91	14	.8	.2	37	144	.012	.05	.006	<3	<.1	<1	10

TABLE 2.--*Isotopic analyses of water and gas from selected springs, fumaroles, and wells in the Long Valley study area*

[Results represent ratios of deuterium to hydrogen (δD) in water, oxygen-18 to oxygen-16 ($\delta^{18}O$) in water, and carbon-13 to carbon-12 ($\delta^{13}C$) in water and gas expressed in standard delta notation in parts per thousand (o/oo); -- signifies not determined]

Name: Name of sample site and designation (in parentheses) used in figures and tables throughout report.

Laboratory: USGS-M, U.S. Geological Survey, Menlo Park, California; SMU, Southern Methodist University; LBL, Lawrence Berkeley Laboratory, Berkeley, California; USGS-R, U.S. Geological Survey Laboratory, Reston, Virginia; USGS-C, U.S. Geological Survey Central Laboratory, Arvada, Colorado.

Name (designation)	Collection date	Laboratory	δD (o/oo)	$\delta^{18}O$ (o/oo)	$\delta^{13}C$ (o/oo)	Fluid phase
<u>Springs in T. 2 S., R. 27 E.</u>						
Big Spring (BS)	04-09-86	USGS-C	-113	-15.7	-9.7	Liquid
	07-17-86	SMU, USGS-M	-114.6	-15.84	--	Liquid
Hartley Spring (HS)	06-11-86	USGS-C	-124	-16.5	--	Liquid
<u>Wells in T. 2 S., R. 29 E.</u>						
31P1	05-20-86	LBL	-125	-16.8	--	Liquid
	05-20-86	USGS-C	-129.0	-16.9	--	Liquid
35N1	05-20-86	LBL	-107	-14.3	--	Liquid
	05-20-86	USGS-C	-108.0	-14.8	--	Liquid
<u>Wells in T. 3 S., R. 27 E.</u>						
IDFU 44-16	01-20-86	USGS-M[1]	-115	-14.0	--	Liquid
Shady Rest (SR)	11-15-86	USGS-R[2]	-116.5	-14.35	--	Liquid
		LBL[2]	--	-14.23	--	Liquid
		USGS-M[2]	-115.2	-14.23	--	Liquid
		USGS-R[3]	-115	-14.35	--	Liquid
		LBL[3]	--	-14.26	--	Liquid
<u>Springs and wells in T. 3 S., R. 28 E.</u> <u>Sites near Casa Diablo</u>						
Casa Diablo Geyser (CDG)	07-12-86	SMU, USGS-M	-113.0	-13.7	--	Liquid
Colton Spring (CS)	04-09-86	USGS-C	[4]-112.0	[4]-13.8	--	Liquid
	07-13-86	SMU, USGS-M	[4]-114.7	[4]-14.2	--	Liquid
Clay Pit Fumerole (CDF)	07-12-86	SMU, USGS-M	-135.4	-18.9	--	Steam
MBP-1	04-11-86	USGS-C	--	--	-8.7	Total flow
	07-14-86	SMU	-118.4	-14.7	--	Total flow
MBP-3	04-11-86	USGS-C	-115.0	-14.8	-8.1	Total flow
	11-16-86	USGS-R	-117.0	-14.8	--	Total flow
		USGS-M	-115.8	-14.8		Total flow
MBP-4	07-14-86	USGS-C	-115.0	-14.9	-5.7	Total flow
	07-14-86	SMU	-118.4	-14.7	--	Total flow
Meadow Spring	04-09-86	USGS-C	-115.0	-14.4	--	Liquid
	07-17-86	SMU, USGS-M	[4]-118.4	[4]-14.8	--	Liquid
North Spring (CDN)	04-09-86	USGS-C	-115.0	-14.2	-4.7	Liquid
	07-17-86	SMU, USGS-M	[4]-117.5	-14.2	--	Liquid
South Spring (CDS)	07-17-86	SMU, USGS-M	-117.9	-14.2	--	Liquid

See footnotes at end of table.

TABLE 2.--*Isotopic analyses of water and gas from selected springs, fumaroles, and wells in the Long Valley study area*--Continued

Name (designation)	Collection date	Laboratory	δD (o/oo)	$\delta^{18}O$ (o/oo)	$\delta^{13}C$ (o/oo)	Fluid phase
Sites near the Hot Creek State Fish Hatchery						
CM-2	06-08-86	USGS-C	-111.0	-14.5	-6.3	Liquid
AB Spring	04-08-86	USGS-C	-116.0	-15.0	--	Liquid
	11-18-86	USGS-C	-115.0	-15.6	--	Liquid
H-2,3 Spring	11-18-86	USGS-C	-120.0	-16.2	--	Liquid
HBP Spring	07-13-86	SMU, USGS-M	-115.0	-13.3	--	Liquid
Sites in Hot Creek Gorge						
HC-2 Spring	04-08-86	USGS-C	-118.0	-14.2	--	Liquid
HC-3 Spring	04-08-86	USGS-C	[4]-115.0	[4]-14.4	-4.5	Liquid
HC-4 Spring	07-17-86	SMU, USGS-M	-117.3	-15.1	--	Liquid
Sites in Little Hot Creek drainage						
LAV Spring	05-20-86	USGS-C	-125.0	-14.3	--	Liquid
	08-27-86	USGS-C	-122.0	-16.1	--	Liquid
Flume Spring (LHC-1)	04-10-86	USGS-C	-122.0	-15.5	-4.2	Liquid
	07-13-86	SMU, USGS-M	-122.8	-15.7	--	Liquid
Spring near road (LHC-3)	07-13-86	SMU, USGS-M	-123.9	-15.7	--	Liquid
Springs and wells in T. 3 S., R. 29 E.						
2A	05-20-86	USGS-C	-127.0	-17.0	--	Liquid
13C	05-24-86	USGS-C	-128.0	-17.1	-6.3	Liquid
BAL Spring	04-10-86	USGS-C	-120.0	-16.2	-5.2	Liquid
	07-17-86	SMU, USGS-M	-125.2	-15.6	--	Liquid
Well in T. 4 S., R. 27 E.						
MWDPW-5	06-10-86	USGS-C	-110.0	-14.9	--	Liquid
Spring in T. 4 S., R. 28 E.						
Laurel Spring	04-10-86	USGS-C	-128.0	-17.1	-12.6	Liquid
	07-17-86	SMU, USGS-M	-127.1	-17.2	--	Liquid
Springs outside Long Valley caldera						
Reds Meadow Spring (RMT)	07-17-86	SMU, USGS-M	[4]-109.5	-15.3	--	Liquid
Devil's Postpile Soda Spring (SSP)	07-12-86	SMU, USGS-M	-108.6	-14.7	--	Liquid

[1]Collected at wellhead during airlift operations; steam fraction unknown.
[2]Collected with bailer from 800-foot depth.
[3]Collected with downhole sampler from 100-foot depth.
[4]Value is mean of two analyses.

The analytical methods used are shown below and are described by Skougstad and others (1979).

(Constituent)	(Analytical Method)
Alkalinity	Titration
Chloride	Colorimetric
Fluoride	Ion specific electrode
Nitrite-Nitrate	Colorimetric
Phosphorus	Colorimetric
Sulfate	Turbidimetric
Calcium	ICAP Inductively Coupled Argon Plasma Spectroscopy
Magnesium	ICAP
Sodium	ICAP
Potassium	Atomic absorption
Silica	ICAP
Boron	ICAP
Arsenic	Hydride-AAS Atomic Adsorption Spectroscopy or ICAP
Lithium	ICAP
Mercury	Cold vapor AAS
Iron	ICAP
Manganese	ICAP
Dissolved solids	Residue on evaporation, gravimetry
Zinc	ICAP
Oxygen 18/16 ratio	Mass spectrometer
Deuterium/hydrogen	Mass spectrometer

Methods of sample collection and analyses for samples analyzed in laboratories other than the U.S. Geological Survey may vary. The table headnotes and footnotes provide additional information regarding sampling conditions that further qualify the methods used.

Natural Discharge and Well Pumpage at Casa Diablo

The location of thermal springs, fumaroles, wells, and surface-water monitoring sites in the Casa Diablo area are shown in figure 4. The Casa Diablo area, a natural discharge area for thermal fluids, is the site of a binary electric power-generating plant that uses geothermal fluids for energy production. The natural thermal features and some historical observations of the area have been described previously (Farrar and others, 1985, 1987; and Sorey and others, 1984).

Mean daily pumpage from four geothermal production wells (MBP 1, 3, 4, and 5) for 1986 is given in table 3. Total fluid production was metered in the powerplant, and individual well pumpage figures were derived from the electric-power consumption for each pump.

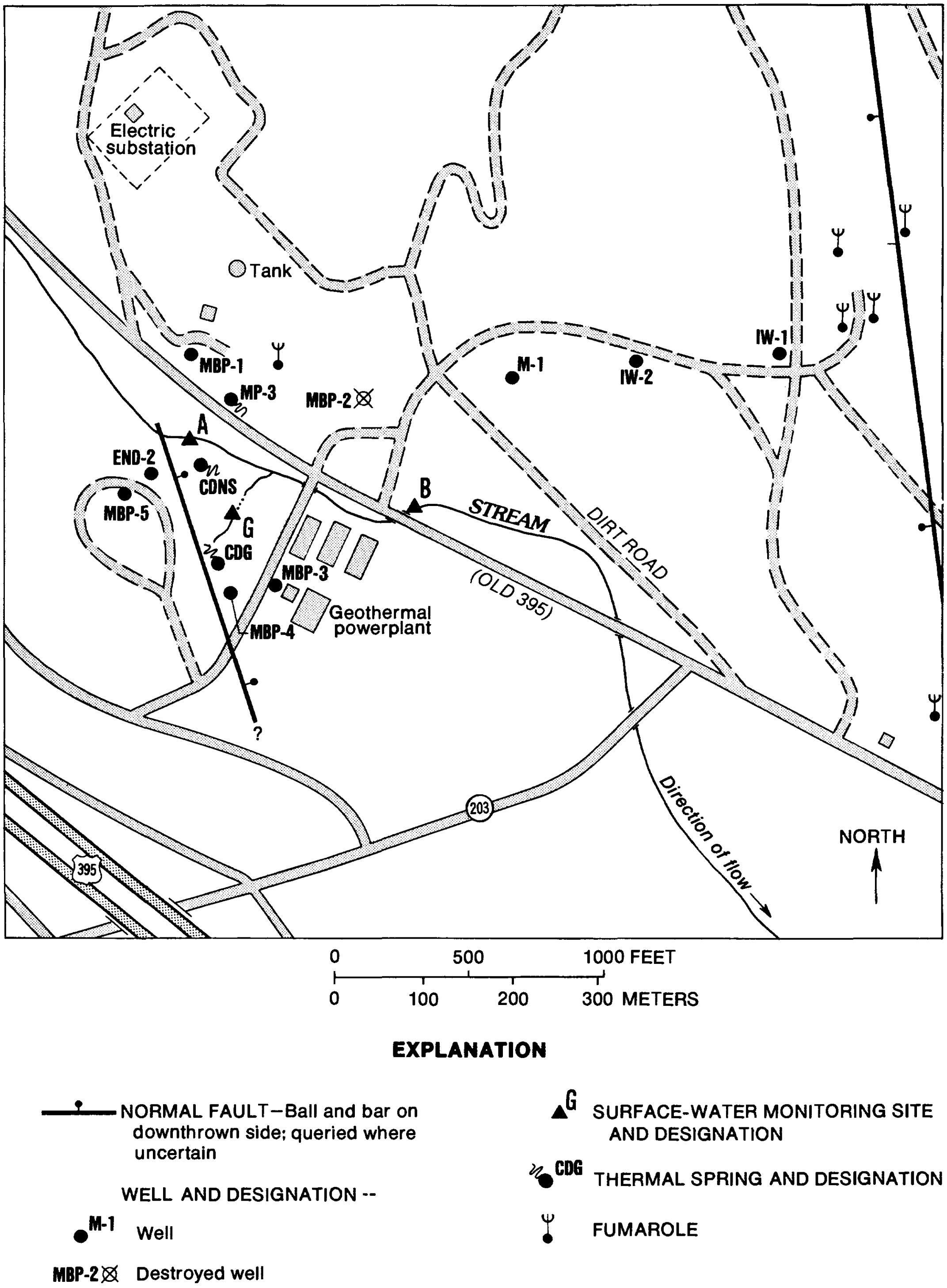

FIGURE 4.-- Casa Diablo area showing location of thermal springs, fumaroles, wells, and surface-water monitoring sites. See figure 3 for location of map.

TABLE 3.--*Mean daily pumpage for wells MBP-1, MBP-3, MBP-4, and MBP-5, and the total, in gallons per minute, for 1986*

[--, missing record]

	January					February					March				
Date	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL
1...	1,090	1,227	1,318	0	3,635	1,125	1,251	1,351	0	3,727	1,238	1,320	0	0	2,558
2...	1,115	1,219	1,295	0	3,629	1,135	1,252	1,336	0	3,723	1,247	1,315	0	0	2,562
3...	1,105	1,229	1,296	0	3,630	1,125	1,252	1,356	0	3,733	1,185	1,311	0	284	2,780
4...	1,115	1,226	1,293	0	3,634	1,125	1,253	1,351	0	3,729	1,185	1,309	0	171	2,665
5...	1,105	1,225	1,300	0	3,630	1,105	1,250	1,336	0	3,691	1,237	1,321	0	0	2,558
6...	1,100	1,223	1,313	0	3,636	1,110	1,259	1,354	0	3,723	1,247	1,321	0	0	2,568
7...	1,095	1,224	1,318	0	3,637	1,125	1,254	1,344	0	3,723	1,241	1,318	0	0	2,559
8...	1,090	1,225	1,321	0	3,636	1,125	1,249	1,353	0	3,727	1,245	1,318	0	0	2,563
9...	1,100	1,225	1,307	0	3,632	1,140	1,248	1,337	0	3,725	1,243	1,320	0	0	2,563
10...	1,065	1,222	1,345	0	3,632	1,125	1,253	1,337	0	3,715	1,245	1,321	0	0	2,566
11...	1,095	1,221	1,318	0	3,634	1,130	1,254	1,327	0	3,711	1,241	1,323	0	0	2,559
12...	1,105	1,221	1,305	0	3,631	1,125	1,253	1,333	0	3,711	1,231	1,324	0	0	2,549
13...	1,085	1,223	1,316	0	3,624	1,125	1,256	1,326	0	3,707	1,188	1,256	855	0	3,299
14...	1,085	1,219	1,316	0	3,620	933	1,039	1,003	0	2,975	1,090	1,212	1,573	0	3,875
15...	1,085	1,219	1,318	0	3,622	1,120	1,256	1,318	0	3,694	1,100	1,217	1,572	0	3,889
16...	1,085	1,219	1,314	0	3,618	1,140	1,252	1,310	0	3,702	1,100	1,214	1,577	0	3,891
17...	1,080	1,226	1,318	0	3,624	1,125	1,257	1,329	0	3,711	1,085	1,218	1,579	0	3,882
18...	1,080	1,221	1,308	0	3,609	1,130	1,252	1,336	0	3,718	1,085	1,214	1,577	0	3,876
19...	1,080	1,219	1,308	0	3,607	1,125	1,256	1,328	0	3,709	1,085	1,213	1,570	0	3,868
20...	1,080	1,221	1,321	0	3,622	1,125	1,253	1,328	0	3,706	1,105	1,213	1,551	0	3,869
21...	1,080	1,222	1,329	0	3,631	1,130	1,253	1,308	0	3,691	1,085	1,210	1,561	0	3,856
22...	1,085	0	955	0	2,040	1,130	1,253	1,306	0	3,689	1,070	1,207	1,577	0	3,854
23...	1,085	862	1,144	0	3,091	1,130	1,253	1,306	0	3,689	1,090	1,210	1,551	0	3,851
24...	1,080	1,225	1,327	0	3,632	1,180	1,285	562	105	3,100	1,090	1,210	1,542	0	3,842
25...	1,090	1,232	1,304	0	3,626	1,185	1,301	0	288	2,774	1,085	1,204	1,560	0	3,849
26...	1,090	1,223	1,309	0	3,622	1,175	1,303	0	328	2,806	1,095	1,204	1,548	0	3,847
27...	1,100	1,225	1,305	0	3,630	1,200	1,300	0	280	2,780	1,090	1,206	1,539	0	3,835
28...	1,100	1,226	1,306	0	3,632	1,185	1,313	0	105	2,603	1,085	1,203	1,537	0	3,825
29...	1,080	1,222	1,337	0	3,639						1,090	1,204	1,524	0	3,818
30...	1,120	1,236	1,330	0	3,686						1,085	1,206	1,521	0	3,812
31...	1,125	1,253	1,353	0	3,731						1,085	1,200	1,527	0	3,812
MEAN:	1,093	1,174	1,298	0	3,565	1,130	1,254	1,103	40	3,525	1,148	1,253	930	15	3,345
MAX:	1,125	1,253	1,353	0	3,731	1,200	1,313	1,356	328	3,733	1,247	1,324	1,579	284	3,891
MIN:	1,065	0	955	0	2,040	933	1,039	0	0	2,603	1,070	1,200	0	0	2,549

TABLE 3.--*Mean daily pumpage for wells MBP-1, MBP-3, MBP-4, and MBP-5, and the total, in gallons per minute, for 1986*--Continued

	April					May					June				
Date	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL
1...	814	993	1,053	0	2,860	1,100	1,220	1,467	0	3,787	871	1,122	0	0	1,993
2...	1,090	1,214	1,518	0	3,822	1,095	1,217	1,487	0	3,799	871	1,108	145	0	2,124
3...	1,090	1,216	1,502	0	3,808	1,085	1,211	1,504	0	3,800	870	1,115	0	0	1,985
4...	1,090	1,207	1,510	0	3,807	1,085	1,208	1,520	0	3,813	878	1,121	0	0	1,999
5...	1,090	1,209	1,499	0	3,798	1,090	1,212	1,492	0	3,794	891	1,107	0	0	1,998
6...	1,090	1,209	1,515	0	3,814	1,085	1,206	1,517	0	3,808	877	1,109	0	0	1,986
7...	1,105	1,209	1,486	0	3,800	1,095	1,215	1,488	0	3,798	879	1,116	0	0	1,995
8...	1,100	1,207	1,496	0	3,803	1,085	1,211	1,503	0	3,799	879	1,114	0	0	1,993
9...	1,090	1,211	1,493	0	3,794	1,085	1,210	1,509	0	3,804	866	1,128	0	0	1,994
10...	1,105	1,209	1,489	0	3,803	1,085	1,210	1,508	0	3,803	893	1,142	141	0	2,176
11...	1,090	1,204	1,139	403	3,836	1,080	1,208	1,505	0	3,793	1,045	1,180	1,371	0	3,596
12...	1,070	1,193	1,139	423	3,825	1,085	1,207	1,509	0	3,801	1,040	1,191	1,511	0	3,742
13...	1,075	1,201	1,150	420	3,846	1,080	1,202	1,509	0	3,791	1,050	1,190	1,404	0	3,644
14...	1,070	1,194	1,155	420	3,839	1,085	1,206	1,495	0	3,786	1,040	1,191	1,492	0	3,723
15...	1,085	1,190	1,172	415	3,862	1,085	1,205	1,507	0	3,797	1,040	1,189	1,499	0	3,728
16...	1,080	1,191	1,174	415	3,860	1,085	1,205	1,507	0	3,797	1,040	1,185	1,502	0	3,727
17...	1,075	1,189	1,180	420	3,864	1,090	1,209	1,496	0	3,795	1,040	1,194	1,504	0	3,738
18...	1,060	1,178	1,177	456	3,871	1,085	1,204	1,502	0	3,791	1,035	1,198	1,537	0	3,770
19...	1,050	1,171	1,171	480	3,872	1,085	1,210	1,506	0	3,801	1,050	1,194	1,523	0	3,767
20...	1,045	1,166	1,162	485	3,858	1,090	1,205	1,507	0	3,802	1,040	1,189	1,500	0	3,729
21...	1,085	1,187	1,135	490	3,897	1,085	1,205	1,503	0	3,793	1,050	1,184	1,477	0	3,711
22...	1,080	1,205	1,126	490	3,901	1,080	1,200	1,515	0	3,795	1,045	1,190	1,501	0	3,736
23...	1,105	1,208	1,429	40	3,782	1,060	1,163	1,408	0	3,631	1,050	1,195	1,491	0	3,736
24...	1,100	1,210	1,494	0	3,804	1,040	934	1,375	0	3,349	1,050	1,191	1,502	0	3,743
25...	1,105	1,208	1,493	0	3,806	1,020	893	1,382	0	3,295	1,050	1,189	1,500	0	3,739
26...	1,105	1,212	1,502	0	3,819	1,050	410	997	0	2,457	1,040	1,191	1,504	0	3,735
27...	1,085	1,211	1,513	0	3,809	1,060	899	1,323	0	3,282	1,045	1,187	1,502	0	3,734
28...	1,085	1,218	1,495	0	3,798	1,080	1,197	1,502	0	3,779	1,045	1,188	1,500	0	3,733
29...	1,105	1,222	1,460	0	3,787	1,085	1,199	1,503	0	3,787	1,045	1,193	1,489	0	3,727
30...	1,095	1,215	1,484	0	3,794	1,090	1,205	1,500	0	3,795	1,040	1,185	1,497	0	3,722
31...						888	79	700	0	2,567					
MEAN:	1,077	1,195	1,344	179	3,795	1,074	1,144	1,443	0	3,661	988	1,166	1,003	0	3,157
MAX:	1,105	1,222	1,518	490	3,901	1,100	1,220	1,520	0	3,813	1,050	1,198	1,537	0	3,770
MIN:	814	993	1,053	0	2,860	888	410	700	0	2,457	866	1,107	0	0	1,985

TABLE 3.--*Mean daily pumpage for wells MBP-1, MBP-3, MBP-4, and MBP-5, and the total, in gallons per minute, for 1986*--Continued

	July					August					September				
Date	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL
1...	1,040	1,187	1,495	0	3,722	1,030	1,198	1,527	0	3,755	1,040	1,191	1,499	0	3,730
2...	1,045	1,185	1,495	0	3,725	1,040	1,194	1,504	0	3,738	1,040	1,189	1,502	0	3,731
3...	1,035	1,187	1,510	0	3,732	1,045	1,194	1,530	0	3,769	1,040	1,191	1,499	0	3,730
4...	1,040	1,184	1,504	0	3,728	1,040	1,195	1,526	0	3,761	730	492	1,396	0	2,618
5...	1,040	1,186	1,502	0	3,728	1,040	1,192	1,526	0	3,758	117	0	1,042	0	1,159
6...	1,020	1,167	1,167	0	3,354	1,045	1,186	1,492	0	3,723	531	0	1,399	0	1,930
7...	995	1,127	375	0	2,497	1,045	1,180	1,473	0	3,698	730	0	1,176	0	1,906
8...	1,035	1,175	1,521	0	3,731	1,040	1,191	1,499	0	3,730	1,040	0	910	0	1,950
9...	1,040	1,190	1,512	0	3,742	1,035	1,182	1,500	0	3,717	940	0	1,052	0	1,992
10...	1,040	1,192	1,517	0	3,749	1,040	1,189	1,514	0	3,743	735	0	1,261	0	1,996
11...	1,040	1,190	1,524	0	3,754	1,045	1,188	1,521	0	3,754	122	963	900	0	1,985
12...	1,040	1,192	1,529	0	3,761	1,050	1,198	1,526	0	3,774	0	1,159	826	0	1,985
13...	1,045	1,195	1,517	0	3,757	1,055	1,194	1,523	0	3,772	0	1,164	825	0	1,989
14...	970	601	1,138	0	2,709	1,065	1,194	1,478	0	3,737	0	1,172	818	0	1,990
15...	880	0	1,078	0	1,958	1,050	1,192	1,507	0	3,749	0	1,173	817	0	1,990
16...	930	0	1,070	0	2,000	1,050	1,195	1,509	0	3,754	0	1,203	725	0	1,928
17...	1,025	592	1,012	0	2,629	1,050	1,193	1,515	0	3,758	0	1,187	825	0	2,012
18...	1,045	1,196	1,505	0	3,746	1,050	1,194	1,523	0	3,767	0	1,183	825	0	2,008
19...	1,040	1,196	1,509	0	3,745	1,045	1,192	1,522	0	3,759	682	1,162	170	0	2,014
20...	1,035	1,190	1,514	0	3,739	1,040	1,186	1,535	0	3,761	864	1,149	0	0	2,013
21...	1,035	1,190	1,497	0	3,722	1,045	1,196	1,513	0	3,754	897	1,116	0	0	2,013
22...	1,040	1,198	1,515	0	3,753	1,055	1,190	1,510	0	3,755	885	1,128	0	0	2,013
23...	1,035	1,204	1,517	0	3,756	1,055	1,191	1,516	0	3,762	712	186	948	0	1,846
24...	1,045	1,209	1,522	0	3,776	1,050	1,192	1,513	0	3,755	910	0	1,102	0	2,012
25...	1,045	1,198	1,506	0	3,749	1,045	1,189	1,522	0	3,756	920	0	1,092	0	2,012
26...	1,050	1,203	1,519	0	3,772	1,050	1,194	1,516	0	3,760	945	0	1,066	0	2,011
27...	1,045	1,202	1,515	0	3,762	1,050	1,191	1,518	0	3,759	930	0	1,082	0	2,012
28...	1,040	1,199	1,096	0	3,335	1,080	893	1,539	0	3,512	--	--	--	--	--
29...	1,035	1,179	794	0	3,008	1,040	1,183	1,513	0	3,736	950	0	1,063	0	2,013
30...	1,055	1,201	1,523	0	3,779	1,035	1,198	1,510	0	3,743	940	614	959	0	2,513
31...	1,055	1,203	1,512	0	3,770	1,035	1,190	1,516	0	3,741					
MEAN:	1,028	1,075	1,371	0	3,474	1,046	1,182	1,514	0	3,742	610	642	923	0	2,176
MAX:	1,055	1,209	1,529	0	3,779	1,080	1,198	1,539	0	3,774	1,040	1,203	1,502	0	3,731
MIN:	880	0	375	0	1,958	1,030	893	1,473	0	3,512	0	0	0	0	1,159

TABLE 3.--*Mean daily pumpage for wells MBP-1, MBP-3, MBP-4, and MBP-5, and the total, in gallons per minute, for 1986*--Continued

	October					November					December				
Date	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL	MBP-1	MBP-3	MBP-4	MBP-5	TOTAL
1...	935	951	984	0	2,870	1,032	1,177	1,492	0	3,701	1,082	1,131	1,377	0	3,590
2...	885	887	805	0	2,577	1,032	1,168	1,500	0	3,700	1,075	1,136	1,368	0	3,579
3...	1,010	1,034	1,113	0	3,157	1,039	1,174	1,488	0	3,701	1,092	1,145	1,389	0	3,626
4...	1,052	1,212	1,488	0	3,752	1,027	1,172	1,499	0	3,698	1,081	1,076	1,375	0	3,532
5...	1,030	1,006	1,426	0	3,462	940	1,127	784	0	2,851	1,087	1,151	1,384	0	3,622
6...	1,049	1,103	1,459	0	3,611	1,037	1,166	1,462	0	3,665	1,091	1,146	1,389	0	3,626
7...	1,047	1,203	1,516	0	3,766	1,042	1,172	1,505	0	3,719	1,096	1,143	1,395	0	3,634
8...	1,049	1,201	1,521	0	3,771	1,034	1,176	1,512	0	3,722	1,095	1,153	1,393	0	3,641
9...	1,052	1,197	1,517	0	3,766	1,037	1,171	1,506	0	3,714	1,097	1,147	1,396	0	3,640
10...	1,020	1,129	1,366	0	3,515	1,034	1,170	1,501	0	3,705	1,093	1,147	1,391	0	3,631
11...	1,049	1,196	1,513	0	3,758	1,032	1,167	1,488	0	3,687	1,096	1,144	1,394	0	3,634
12...	1,047	1,193	1,509	0	3,749	1,027	1,151	1,495	0	3,673	1,094	1,142	1,393	0	3,629
13...	1,044	1,196	1,473	0	3,713	1,032	1,147	1,438	0	3,617	1,093	1,147	1,390	0	3,630
14...	1,042	1,198	1,498	0	3,738	1,034	1,162	1,470	0	3,666	1,093	1,148	1,390	0	3,631
15...	1,030	1,179	1,502	0	3,711	1,034	1,166	1,421	0	3,621	1,095	1,137	1,394	0	3,626
16...	1,042	1,192	1,501	0	3,735	1,032	1,167	1,481	0	3,680	1,085	1,141	1,380	0	3,606
17...	1,042	1,198	1,520	0	3,760	1,027	1,162	1,479	0	3,668	1,084	1,143	1,379	0	3,606
18...	1,042	1,193	1,506	0	3,741	1,003	1,124	1,213	471	3,811	1,078	1,141	1,372	0	3,591
19...	1,039	1,192	1,471	0	3,702	998	1,117	1,169	566	3,850	1,083	1,134	1,378	0	3,595
20...	981	199	1,094	0	2,274	993	1,113	1,167	556	3,829	1,083	1,136	1,378	0	3,597
21...	938	0	1,052	0	1,990	1,000	1,123	1,153	556	3,832	1,086	1,133	1,382	0	3,601
22...	940	0	1,040	0	1,980	1,000	1,119	1,176	550	3,845	1,087	1,142	1,396	0	3,625
23...	938	0	1,053	0	1,991	998	1,119	1,175	550	3,842	1,089	1,146	1,385	0	3,620
24...	938	0	1,055	0	1,993	1,007	1,128	1,329	229	3,693	1,085	1,130	1,381	0	3,596
25...	943	0	1,048	0	1,991	1,015	1,137	1,458	0	3,610	1,078	1,136	1,372	0	3,586
26...	933	0	1,062	0	1,995	1,017	1,140	1,445	0	3,602	1,080	1,132	1,375	0	3,587
27...	945	0	1,051	0	1,996	1,017	1,143	1,456	0	3,616	1,078	1,130	1,373	0	3,581
28...	938	0	1,059	0	1,997	1,017	1,137	1,447	0	3,601	1,076	1,129	1,369	0	3,574
29...	988	553	1,245	0	2,786	1,017	1,138	1,443	0	3,598	1,044	1,233	1,581	0	3,858
30...	1,027	1,163	1,492	0	3,682	1,015	1,133	1,430	0	3,578	1,105	1,216	1,525	0	3,846
31...	1,030	1,177	1,493	0	3,700						1,141	1,230	1,575	0	3,946
MEAN:	1,002	798	1,304	0	3,104	1,019	1,149	1,386	116	3,670	1,088	1,147	1,401	0	3,635
MAX:	1,052	1,212	1,521	0	3,771	1,042	1,177	1,512	566	3,850	1,141	1,233	1,581	0	3,946
MIN:	885	0	805	0	1,980	940	1,113	784	0	2,851	1,044	1,076	1,368	0	3,532

Surface-water flow was recorded for most of 1986 at sites A and B on an unnamed tributary to Mammoth Creek (fig. 4). Flow at site A, located upstream from any significant inflow of thermal water, was determined by recording stage of the stream using a 90° V-notch weir for control. Flow at site B, located downstream from all significant inflow from thermal springs, was determined by recording the stream stage using a 6-inch modified Parshall flume as the control. Streamflows at both sites were determined from rating tabulations of stage versus discharge. Mean daily streamflow for sites A and B are given in table 4 and are shown as hydrographs in figure 5. Periods of missing record were caused by a variety of problems, including ice formation during winter months, water bypassing the control due to seepage and erosion of streambanks, and direct pumping of water from the stream for landscape and construction uses.

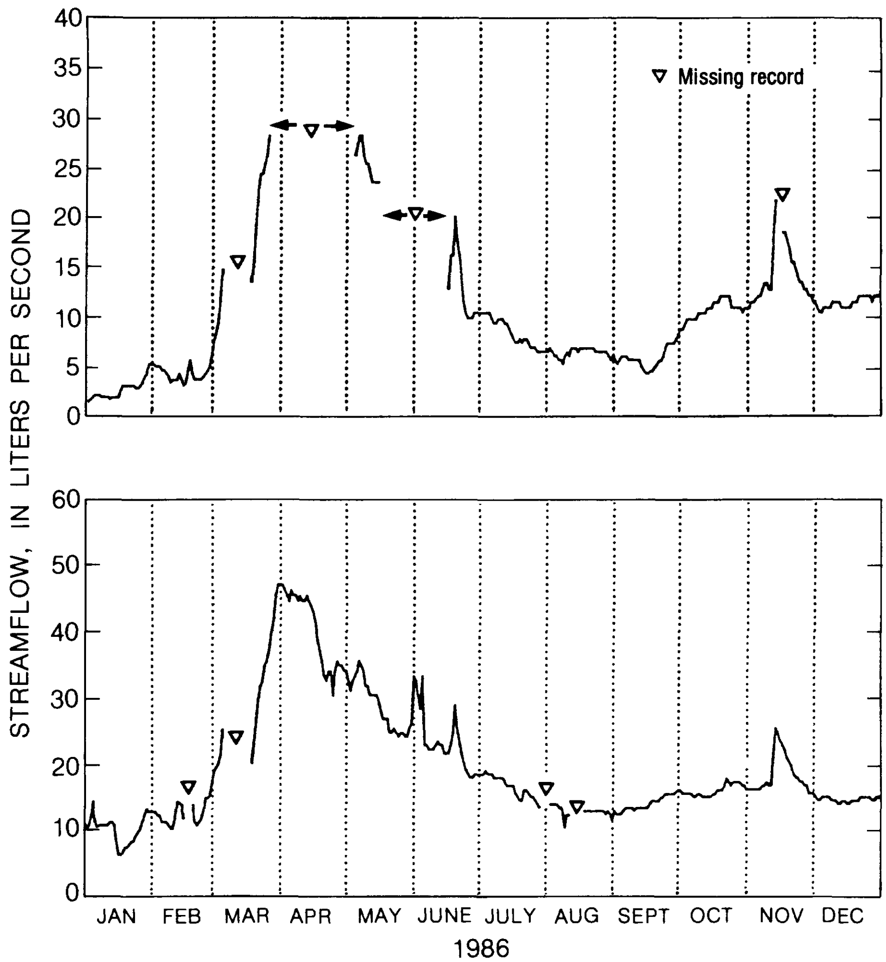

FIGURE 5.-- Mean daily streamflow in unnamed creek at site A upstream from thermal springs (upper graph) and site B downstream from thermal springs at Casa Diablo (lower graph).

TABLE 4.--*Mean daily streamflow for site A upstream and site B downstream from thermal springs, and for site G at Casa Diablo, 1986*

[Streamflow values are in liters per second. Monthly means, maximums, and minimums for months with partial record are for days with record. A, Streamflow of unnamed stream at site upstream from hot spring inflow; B, Streamflow of unnamed stream at site downstream from hot spring inflow; B-A, Difference in streamflow between A and B, representing total hot spring inflow; G, Flow measuring site for discharge from main thermal springs, measurements began July 25; --, missing record]

Date	January			February			March			April		
	A	B	B-A	A	B	B-A	A	B	B-A	A	B	B-A
1.......	1.3	10.2	8.9	5.2	12.7	7.5	6.0	17.2	11.2	--	47.1	--
2.......	1.3	10.2	8.9	5.2	12.7	7.5	7.3	18.9	11.6	--	47.1	--
3.......	1.3	10.2	8.9	4.9	12.7	7.8	8.2	19.6	11.4	--	46.2	--
4.......	1.6	11.7	10.1	4.9	12.2	7.3	9.2	20.2	11.0	--	45.4	--
5.......	1.8	14.3	12.5	4.9	12.2	7.3	11.4	21.4	10.0	--	44.5	--
6.......	2.0	10.7	8.7	4.5	11.2	6.7	14.6	25.4	10.8	--	46.2	--
7.......	2.0	10.2	8.2	4.5	11.2	6.7	--	--	--	--	45.4	--
8.......	2.0	10.7	8.7	4.2	11.2	7.0	--	--	--	--	45.4	--
9.......	1.8	10.7	8.9	3.9	10.7	6.8	--	--	--	--	44.5	--
10......	1.8	10.7	8.9	3.3	10.2	6.9	--	--	--	--	45.4	--
11......	1.8	10.7	8.9	3.6	10.2	6.6	--	--	--	--	44.5	--
12......	1.8	10.7	8.9	3.6	11.7	8.1	--	--	--	--	44.5	--
13......	1.6	11.2	9.6	3.6	14.3	10.7	--	--	--	--	45.4	--
14......	1.8	11.2	9.4	4.2	--	--	--	--	--	--	44.5	--
15......	1.8	10.7	8.9	3.6	13.8	10.2	--	--	--	--	43.7	--
16......	1.8	8.3	6.5	3.0	11.7	8.7	--	--	--	--	42.9	--
17......	1.8	6.2	4.4	3.3	--	--	--	--	--	--	41.2	--
18......	2.5	6.2	3.7	4.5	--	--	--	--	--	--	38.8	--
19......	3.0	6.6	3.6	5.6	--	--	13.3	20.2	6.9	--	37.2	--
20......	3.0	7.4	4.4	4.2	13.8	9.6	15.3	22.8	7.5	--	35.6	--
21......	3.0	7.4	4.4	3.6	11.2	7.6	19.0	26.1	7.1	--	33.3	--
22......	3.0	7.9	4.9	3.6	10.7	7.1	22.4	29.6	7.2	--	32.6	--
23......	3.0	8.3	5.3	3.6	11.2	7.6	24.2	31.8	7.6	--	34.1	--
24......	3.0	8.3	5.3	3.6	11.7	8.1	24.2	32.6	8.4	--	34.1	--
25......	2.7	9.2	6.5	3.9	12.7	8.8	25.2	34.9	9.7	--	30.4	--
26......	2.7	9.7	7.0	4.2	14.9	10.7	26.1	35.6	9.5	--	34.1	--
27......	3.0	10.2	7.2	4.5	14.9	10.4	28.1	37.2	9.1	--	35.6	--
28......	3.3	11.2	7.9	4.9	15.4	10.5	--	39.6	--	--	34.9	--
29......	3.9	12.2	8.3				--	42.0	--	--	34.9	--
30......	4.2	13.2	9.0				--	45.4	--	--	34.1	--
31......	5.2	12.7	7.5				--	47.1	--			
MEAN:	2.4	10.0	7.6	4.2	12.2	8.2	17.0	29.9	9.3	--	40.5	--
MAX:	5.2	14.3	12.5	5.6	15.4	10.7	28.1	47.1	11.6	--	47.1	--
MIN:	1.3	6.2	3.6	3.0	10.2	6.6	6.0	17.2	6.9	--	30.4	--

TABLE 4.--*Mean daily streamflow for site A upstream and site B downstream from thermal springs, and for site G at Casa Diablo, 1986*--Continued

Date	May			June			July				August			
	A	B	B-A	A	B	B-A	A	B	B-A	G	A	B	B-A	G
1.....	--	34.1	--	--	33.3	--	10.3	18.4	8.1	--	6.4	--	--	5.4
2.....	--	32.6	--	--	32.6	--	10.3	18.4	8.1	--	6.4	--	--	5.8
3.....	--	31.1	--	--	30.4	--	10.3	18.4	8.1	--	6.8	13.8	7.0	5.4
4.....	--	32.6	--	--	28.3	--	10.3	19.0	8.7	--	6.4	13.8	7.4	5.4
5.....	26.1	33.3	7.2	--	33.3	--	10.3	18.4	8.1	--	6.0	13.8	7.8	5.4
6.....	27.1	34.1	7.0	--	22.8	--	10.3	18.4	8.1	--	6.0	13.8	7.8	5.8
7.....	28.1	35.6	7.5	--	22.8	--	9.7	18.4	8.7	--	5.6	13.2	7.6	5.4
8.....	28.1	34.9	6.8	--	22.1	--	9.2	17.8	8.6	--	5.6	13.2	7.6	5.4
9.....	26.1	34.1	8.0	--	22.1	--	9.2	17.8	8.6	--	5.2	12.7	7.5	5.4
10....	25.2	31.8	6.6	--	22.1	--	9.7	17.8	8.1	--	6.0	10.2	4.2	5.4
11....	25.2	31.8	6.6	--	22.8	--	9.7	17.8	8.1	--	6.4	12.2	5.8	5.4
12....	24.3	30.4	6.1	--	23.4	--	9.7	17.8	8.1	--	6.0	12.2	6.2	5.4
13....	23.3	30.4	7.1	--	22.8	--	9.2	17.2	8.0	--	6.8	12.7	5.9	5.4
14....	23.3	30.4	7.1	--	22.8	--	9.2	16.6	7.4	--	6.8	--	--	5.4
15....	23.3	30.4	7.1	--	21.5	--	8.7	16.6	7.9	--	6.8	--	--	5.4
16....	23.3	29.6	6.3	--	21.5	--	8.2	16.6	8.4	--	6.4	--	--	5.4
17....	--	28.2	--	12.6	21.5	8.9	7.7	16.6	8.9	--	6.8	--	--	5.1
18....	--	26.8	--	16.0	22.8	6.8	7.3	15.4	8.1	--	6.8	--	--	5.1
19....	--	26.8	--	16.0	24.7	8.7	7.3	14.9	7.6	--	6.8	12.7	5.9	5.1
20....	--	26.8	--	19.9	28.9	9.0	7.7	14.3	6.6	--	6.8	12.7	5.9	5.1
21....	--	24.7	--	17.5	25.4	7.9	7.3	14.3	7.0	--	6.8	12.7	5.9	5.1
22....	--	24.7	--	16.0	23.4	7.4	7.7	16.0	8.3	--	6.8	12.7	5.9	5.1
23....	--	25.4	--	13.9	21.5	7.6	7.7	16.0	8.3	--	6.8	12.7	5.9	5.1
24....	--	24.7	--	11.4	20.2	8.8	7.3	15.4	8.1	--	6.4	12.7	6.3	5.1
25....	--	24.1	--	10.3	19.0	8.7	6.8	14.9	8.1	5.8	6.4	12.7	6.3	5.1
26....	--	24.7	--	9.7	18.4	8.7	6.8	14.9	8.1	5.8	6.4	12.7	6.3	5.1
27....	--	24.7	--	9.7	17.8	8.1	6.8	14.3	7.5	5.4	6.4	--	--	5.1
28....	--	24.1	--	9.7	17.8	8.1	6.4	13.8	7.4	5.4	6.4	12.7	6.3	5.1
29....	--	24.1	--	10.3	18.4	8.1	6.4	13.2	6.8	5.8	6.4	12.2	5.8	5.1
30....	--	25.4	--	10.3	18.4	8.1	6.4	--	--	5.4	6.0	12.7	6.7	5.1
31....	--	26.1	--				6.4	--	--	5.4	5.6	12.2	6.6	5.1
MEAN:	25.3	29.0	7.0	13.1	23.4	8.2	8.4	16.5	8.0	5.6	6.4	12.7	6.5	5.3
MAX:	28.1	35.6	8.0	19.9	33.3	9.0	10.3	19.0	8.9	5.8	6.8	13.8	7.8	5.8
MIN:	23.3	24.1	6.1	9.7	17.8	6.8	6.4	13.2	6.6	5.4	5.2	10.2	4.2	5.1

TABLE 4.--*Mean daily streamflow for site A upstream and site B downstream from thermal springs, and for site G at Casa Diablo, 1986*--Continued

Date	September				October				November				December			
	A	B	B-A	G	A	B	B-A	G	A	B	B-A	G	A	B	B-A	G
1.....	6.0	11.2	5.2	5.1	8.2	16.0	7.8	5.1	10.8	16.0	5.2	2.4	11.4	15.4	4.0	1.9
2.....	5.6	12.7	7.1	4.7	8.7	16.0	7.3	4.7	10.8	16.0	5.2	2.4	11.4	14.9	3.5	1.7
3.....	5.2	12.2	7.0	4.7	8.7	15.4	6.7	4.0	11.4	16.0	4.6	2.2	10.8	14.3	3.5	1.7
4.....	5.6	12.2	6.6	4.7	9.2	15.4	6.2	2.7	11.4	16.0	4.6	2.2	10.3	14.3	4.0	1.7
5.....	6.0	12.7	6.7	4.3	9.7	15.4	5.7	2.7	11.4	16.0	4.6	2.2	10.3	14.9	4.6	1.9
6.....	6.0	12.7	6.7	5.1	9.7	15.4	5.7	2.4	12.0	16.0	4.0	2.2	10.8	14.9	4.1	1.7
7.....	6.0	13.2	7.2	5.1	9.7	15.4	5.7	2.4	12.0	16.0	4.0	2.2	10.8	14.9	4.1	1.7
8.....	5.6	13.2	7.6	5.4	9.7	14.9	5.2	2.4	12.6	16.6	4.0	1.7	10.8	14.9	4.1	1.4
9.....	5.6	13.2	7.6	5.4	9.7	14.9	5.2	2.4	13.3	16.6	3.3	1.4	10.8	14.3	3.5	1.7
10....	5.6	13.2	7.6	5.4	10.3	15.4	5.1	2.4	13.3	17.2	3.9	1.9	11.4	14.3	2.9	1.7
11....	5.6	12.7	7.1	5.1	10.3	15.4	5.1	2.4	12.6	16.6	4.0	1.7	11.4	14.3	2.9	1.7
12....	5.6	13.2	7.6	5.1	10.3	14.9	4.6	2.2	12.6	16.6	4.0	1.9	11.4	13.8	2.4	1.7
13....	5.6	13.2	7.6	5.1	10.3	14.9	4.6	2.2	18.3	21.4	3.1	1.9	11.4	13.8	2.4	1.7
14....	4.9	13.2	8.3	5.1	10.8	14.9	4.1	2.2	21.6	25.4	3.8	1.9	10.8	14.3	3.5	1.7
15....	4.5	13.2	8.7	5.1	10.8	14.9	4.1	2.2	--	24.7	--	1.9	10.8	14.3	3.5	1.7
16....	4.2	13.2	9.0	5.1	10.8	14.9	4.1	2.2	--	23.4	--	1.9	10.8	13.8	3.0	1.4
17....	4.2	13.2	9.0	5.4	11.4	15.4	4.0	2.2	18.3	22.8	4.5	2.2	10.3	13.8	3.0	1.4
18....	4.5	13.8	9.3	5.4	11.4	15.4	4.0	2.2	18.3	22.1	3.8	2.2	10.8	14.3	3.5	1.4
19....	4.5	14.3	9.8	5.4	11.4	16.0	4.6	2.2	17.5	20.8	3.3	1.9	11.4	14.3	2.9	1.4
20....	4.9	14.3	9.4	5.4	12.0	16.0	4.0	2.4	16.7	20.2	3.5	1.9	11.4	14.3	2.9	1.4
21....	5.2	14.3	9.1	5.4	12.0	16.0	4.0	2.7	15.3	19.6	4.3	1.9	11.4	14.3	2.9	1.4
22....	5.6	14.3	8.7	5.4	12.0	16.6	4.6	3.0	15.3	18.4	3.1	1.7	12.0	14.9	2.9	1.4
23....	5.6	14.9	9.3	5.8	12.0	17.8	5.8	3.0	14.6	17.8	3.2	1.7	12.0	14.9	2.9	1.4
24....	6.0	14.9	8.9	5.8	12.0	17.2	5.2	3.0	13.9	17.8	3.9	1.7	12.0	14.9	2.9	1.4
25....	6.8	15.4	8.6	5.4	10.8	16.6	5.8	3.0	13.3	17.2	3.9	1.9	12.0	14.9	2.9	1.4
26....	7.3	15.4	8.1	5.4	10.8	17.2	6.4	3.0	13.3	17.2	3.9	1.9	12.0	14.9	2.9	1.4
27....	7.3	15.4	8.1	5.4	10.8	17.2	6.4	3.0	12.6	16.6	4.0	1.9	12.0	14.3	2.3	1.4
28....	7.3	15.4	8.1	5.1	10.8	17.2	6.4	3.0	12.6	16.6	4.0	1.9	11.4	14.3	2.9	1.4
29....	7.3	15.4	8.1	5.1	10.8	17.2	6.4	3.0	12.0	15.4	3.4	1.9	12.0	14.9	2.9	1.2
30....	7.7	--	--	5.1	10.3	16.6	6.3	2.7	12.0	15.4	3.4	1.9	12.0	14.9	2.9	1.4
31....					10.8	16.6	5.8	2.7					12.0	--	--	1.2
MEAN:	5.7	13.6	8.0	5.2	10.5	15.9	5.4	2.8	13.0	18.3	3.9	1.9	11.3	14.5	3.2	1.5
MAX:	7.7	15.4	9.8	5.8	12.0	17.8	7.8	5.1	21.6	25.4	5.2	2.4	12.0	15.4	4.6	1.9
MIN:	4.2	11.2	5.2	4.3	8.2	14.9	4.0	2.2	10.8	15.4	3.1	1.4	10.3	13.8	2.3	1.2

The difference between streamflow at sites B and A (table 4) is related to the total inflow of thermal spring discharge from the area between sites A and B. Some of the thermal water discharged from springs is probably not measured at site B due to evaporation and seepage losses. The difference in flow (B-A) and total well pumpage is compared in table 5, and hydrographs of the difference and pumpage are shown in figure 6.

TABLE 5.--*Mean daily differences in streamflow between sites A and B and total well pumpage at Casa Diablo, 1986*

[Spring flow (S), in liters per second is the difference in discharge recorded on an unnamed stream at sites upstream (A) and downstream (B) from the thermal springs. Total well pumpage (W), in gallons per minute, is the sum of production from wells MBP-1, MBP-3, MBP-4, and MBP-5; --, missing record]

Date	January		February		March		April		May		June	
	S	W	S	W	S	W	S	W	S	W	S	W
1......	8.9	3,635	7.5	3,727	11.2	2,558	9.0	2,860	7.5	3,787	--	1,993
2......	8.9	3,629	7.5	3,723	11.6	2,562	8.9	3,822	7.4	3,799	--	2,124
3......	8.9	3,630	7.8	3,733	11.4	2,780	8.9	3,808	7.4	3,800	--	1,985
4......	10.1	3,634	7.3	3,729	11.0	2,665	8.8	3,807	7.3	3,813	--	1,999
5......	12.5	3,630	7.3	3,691	10.0	2,558	8.8	3,798	7.3	3,794	--	1,998
6......	8.7	3,636	6.7	3,723	10.8	2,568	8.7	3,814	7.2	3,808	--	1,986
7......	8.2	3,637	6.7	3,723	--	2,559	8.7	3,800	7.0	3,798	--	1,995
8......	8.7	3,636	7.0	3,727	--	2,563	8.6	3,803	7.5	3,799	--	1,993
9......	8.9	3,632	6.8	3,725	--	2,563	8.6	3,794	6.8	3,804	--	1,994
10.....	8.9	3,632	6.9	3,715	--	2,566	8.5	3,803	8.0	3,803	--	2,176
11.....	8.9	3,634	6.6	3,711	--	2,559	8.5	3,836	6.6	3,793	--	3,596
12.....	8.9	3,631	8.1	3,711	--	2,549	8.4	3,825	6.6	3,801	--	3,742
13.....	9.6	3,624	10.7	3,707	--	3,299	8.4	3,846	6.1	3,791	--	3,644
14.....	9.4	3,620	--	2,975	--	3,875	8.3	3,839	7.1	3,786	--	3,723
15.....	8.9	3,622	10.2	3,694	--	3,889	8.3	3,862	7.1	3,797	--	3,728
16.....	6.5	3,618	8.7	3,702	--	3,891	8.2	3,860	7.1	3,797	--	3,727
17.....	4.4	3,624	--	3,711	--	3,882	8.2	3,864	6.3	3,795	--	3,738
18.....	3.7	3,609	--	3,718	--	3,876	8.1	3,871	--	3,791	8.9	3,770
19.....	3.6	3,607	--	3,709	6.9	3,868	8.1	3,872	--	3,801	6.8	3,767
20.....	4.4	3,622	9.6	3,706	7.5	3,869	8.0	3,858	--	3,802	8.7	3,729
21.....	4.4	3,631	7.6	3,691	7.1	3,856	8.0	3,897	--	3,793	9.0	3,711
22.....	4.9	2,040	7.1	3,689	7.2	3,854	7.9	3,901	--	3,795	7.9	3,736
23.....	5.3	3,091	7.6	3,689	7.6	3,851	7.9	3,782	--	3,631	7.4	3,736
24.....	5.3	3,632	8.1	3,100	8.4	3,842	7.8	3,804	--	3,349	7.6	3,743
25.....	6.5	3,626	8.8	2,774	9.7	3,849	7.8	3,806	--	3,295	8.8	3,739
26.....	7.0	3,622	10.7	2,806	9.5	3,847	7.7	3,819	--	2,457	8.7	3,735
27.....	7.2	3,630	10.4	2,780	9.1	3,835	7.7	3,809	--	3,282	8.7	3,734
28.....	7.9	3,632	10.5	2,603	--	3,825	7.6	3,798	--	3,779	8.1	3,733
29.....	8.3	3,639			--	3,818	7.6	3,787	--	3,787	8.1	3,727
30.....	9.0	3,686			--	3,812	7.5	3,794	--	3,795	8.1	3,722
31.....	7.5	3,731			--	3,812			--	2,567		
MEAN:	7.6	3,565	8.2	3,525	9.3	3,345	8.2	3,795	7.1	3,661	8.2	3,157
MAX:	12.5	3,731	10.7	3,733	11.6	3,891	9.0	3,901	8.0	3,813	9.0	3,770
MIN:	3.6	2,040	6.6	2,603	6.9	2,549	7.5	2,860	6.1	2,457	6.8	1,985

A third flow-measuring site (G) is located about 100 feet downstream from the main thermal springs at Casa Diablo. Flow data were obtained by recording the stage in a 6-inch modified Parshall flume installed in the channel that carries thermal water from the springs to the unnamed tributary to Mammoth Creek. The recording equipment was installed during July 1986. Mean daily values of flow are given in table 4, and a hydrograph is shown in figure 6. Total well pumpage from the geothermal wells also is shown in figure 6 for comparison to spring discharge.

TABLE 5.--*Mean daily differences in streamflow between sites A and B and total well pumpage at Casa Diablo, 1986*--**Continued**

Date	July		August		September		October		November		December	
	S	W	S	W	S	W	S	W	S	W	S	W
1.....	8.1	3,722	--	3,755	5.2	3,730	7.8	2,870	5.2	3,701	4.0	3,590
2.....	8.1	3,725	--	3,738	7.1	3,731	7.3	2,577	5.2	3,700	3.5	3,579
3.....	8.1	3,732	7.0	3,769	7.0	3,730	6.7	3,157	4.6	3,701	3.5	3,626
4.....	8.7	3,728	7.4	3,761	6.6	2,618	6.2	3,752	4.6	3,698	4.0	3,532
5.....	8.1	3,728	7.8	3,758	6.2	1,159	5.7	3,462	4.6	2,851	4.6	3,622
6.....	8.1	3,354	7.8	3,723	6.7	1,930	5.7	3,611	4.0	3,665	4.1	3,626
7.....	8.7	2,497	7.6	3,698	7.2	1,906	5.7	3,766	4.0	3,719	4.1	3,634
8.....	8.6	3,731	7.6	3,730	7.6	1,950	5.2	3,771	4.0	3,722	4.1	3,641
9.....	8.6	3,742	7.5	3,717	7.6	1,992	5.2	3,766	3.3	3,714	3.5	3,640
10.....	8.1	3,749	4.2	3,743	7.6	1,996	5.1	3,515	3.9	3,705	2.9	3,631
11.....	8.1	3,754	5.8	3,754	7.1	1,985	5.1	3,758	4.0	3,687	2.9	3,634
12.....	8.1	3,761	6.2	3,774	7.6	1,985	4.6	3,749	4.0	3,673	2.4	3,629
13.....	8.0	3,757	5.9	3,772	7.6	1,989	4.6	3,713	3.1	3,617	2.4	3,630
14.....	7.4	2,709	--	3,737	8.3	1,990	4.1	3,738	3.8	3,666	3.5	3,631
15.....	7.9	1,958	--	3,749	8.7	1,990	4.1	3,711	--	3,621	3.5	3,626
16.....	8.4	2,000	--	3,754	9.0	1,928	4.1	3,735	--	3,680	3.0	3,606
17.....	8.9	2,629	--	3,758	9.0	2,012	4.0	3,760	4.5	3,668	3.0	3,606
18.....	8.1	3,746	--	3,767	9.3	2,008	4.0	3,741	3.8	3,811	3.5	3,591
19.....	7.6	3,745	5.9	3,759	9.8	2,014	4.6	3,702	3.3	3,850	2.9	3,595
20.....	6.6	3,739	5.9	3,761	9.4	2,013	4.0	2,274	3.5	3,829	2.9	3,597
21.....	7.0	3,722	5.9	3,754	9.1	2,013	4.0	1,990	4.3	3,832	2.9	3,601
22.....	8.3	3,753	5.9	3,755	8.7	2,013	4.6	1,980	3.1	3,845	2.9	3,625
23.....	8.3	3,756	5.9	3,762	9.3	1,846	5.8	1,991	3.2	3,842	2.9	3,620
24.....	8.1	3,776	6.3	3,755	8.9	2,012	5.2	1,993	3.9	3,693	2.9	3,596
25.....	8.1	3,749	6.3	3,756	8.6	2,012	5.8	1,991	3.9	3,610	2.9	3,586
26.....	8.1	3,772	6.3	3,760	8.1	2,011	6.4	1,995	3.9	3,602	2.9	3,587
27.....	7.5	3,762	--	3,759	8.1	2,012	6.4	1,996	4.0	3,616	2.3	3,581
28.....	7.4	3,335	6.3	3,512	8.1	--	6.4	1,997	4.0	3,601	2.9	3,574
29.....	6.8	3,008	5.8	3,736	8.1	2,013	6.4	2,786	3.4	3,598	2.9	3,858
30.....	--	3,779	6.7	3,743	--	2,513	6.3	3,682	3.4	3,578	2.9	3,846
31.....	--	3,770	6.6	3,741			5.8	3,700			--	3,946
MEAN:	8.0	3,474	6.5	3,742	8.0	2,176	5.4	3,104	3.9	3,670	3.2	3,635
MAX:	8.9	3,779	7.8	3,774	9.8	3,731	7.8	3,771	5.2	3,850	4.6	3,946
MIN:	6.6	1,958	4.2	3,512	5.2	1,159	4.0	1,980	3.1	2,851	2.3	3,532

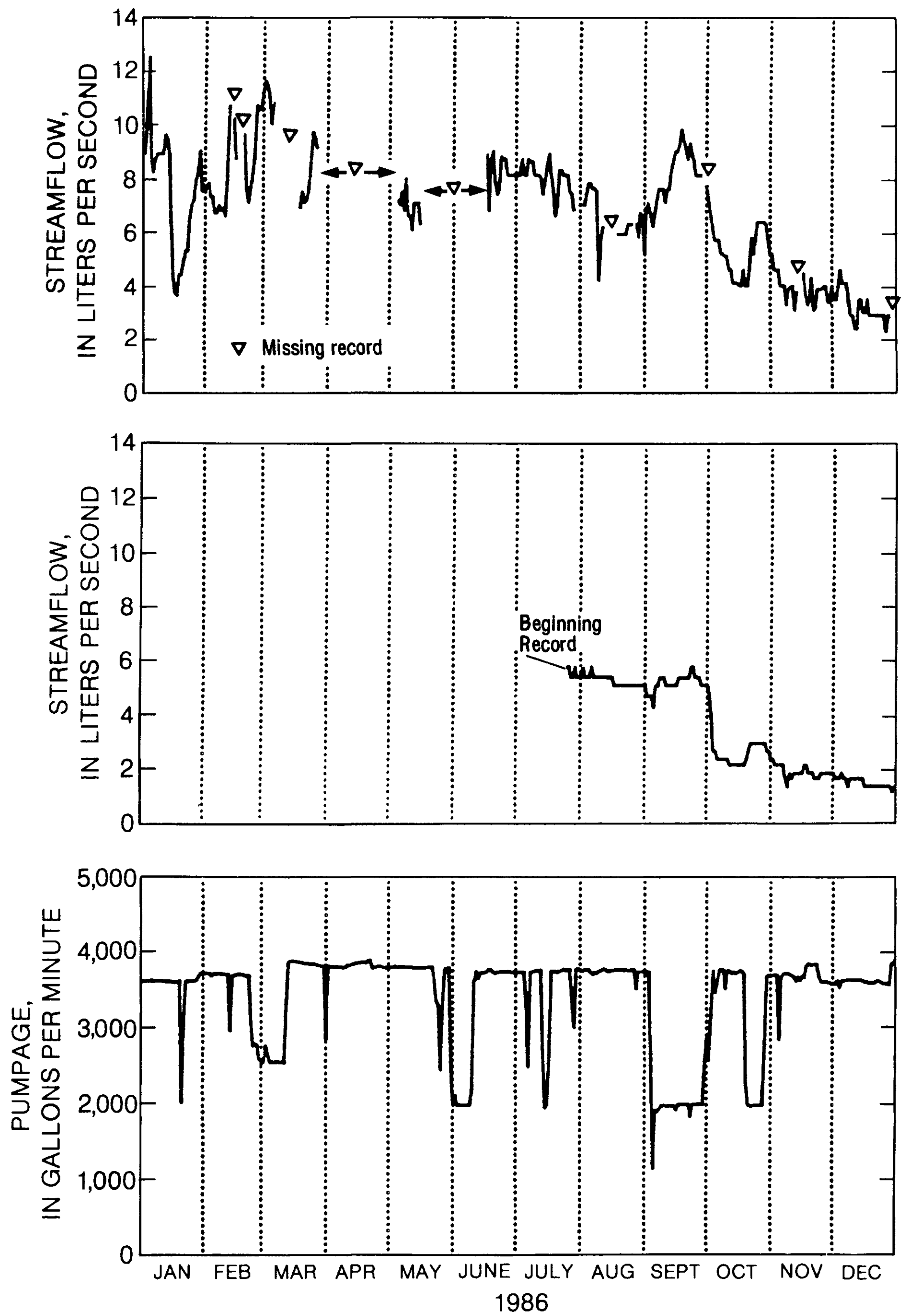

FIGURE 6.-- Mean daily differences in streamflow in unnamed creek between site B downstream and site A upstream from thermal springs at Casa Diablo (upper graph), mean daily flow at site G (middle graph), and mean daily well pumpage at Casa Diablo geothermal power plant (lower graph).

The difference between flow at site G and the estimate of total spring flow (B-A) is variable for the period of record. Factors that may contribute to this variability include changes in discharge of many small thermal springs in the area; variations in shallow, nonthermal ground-water discharge; fluctuations in the discharge from the main spring vents gaged at site G; variations in evaporation rates, and variations in pumpage from the four geothermal production wells at Casa Diablo. An apparent inverse relation between well pumpage and springflow is evident in figure 6.

Intermittent, instantaneous discharge measurements were made at a thermal spring known locally as Colton Spring (CS), about 1.5 miles east-southeast of the Casa Diablo area (fig. 7). Discharge was measured using a 45° V-notch weir. On December 22, 1986, a recorder was set up at the site, giving continuous record of discharge by using a standard V-notch weir rating table. Discharge values given in table 6 are shown as a hydrograph in figure 8. A hydrograph of well pumpage from the production wells at Casa Diablo also is shown in figure 8 for comparison to the discharge from Colton Spring.

TABLE 6.--*Discharge, in liters per second, of Colton Spring, CS, 1986*

[From January 1 to December 18, values are instantaneous. From December 22 to 31, values are daily means estimated from continuous chart record. The 45° V-notch weir used for control has a precision of about 0.04 liter per second; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	0.74	--	--	--	--	--	--	--	--	--	--	--
2.......	--	--	--	--	--	--	--	--	--	--	--	--
3.......	.66	--	--	--	--	0.92	0.92	--	1.20	--	--	--
4.......	--	--	--	--	--	--	--	--	--	--	--	--
5.......	--	--	--	--	--	--	--	--	--	--	0.46	--
6.......	--	--	0.83	--	--	--	--	--	--	--	.59	--
7.......	.66	0.74	--	--	--	--	--	1.10	--	--	--	--
8.......	--	--	--	--	--	--	--	--	--	--	--	--
9.......	--	--	--	--	--	.92	.83	--	1.20	--	--	0.83
10......	--	--	.83	--	--	--	--	--	--	--	--	--
11......	--	--	--	--	--	.92	--	1.10	--	--	--	--
12......	--	--	--	--	--	--	--	--	--	--	--	--
13......	--	--	--	--	--	--	--	--	--	--	.59	--
14......	--	--	.83	--	--	--	--	--	--	--	--	--
15......	--	--	--	--	0.83	--	--	--	--	--	--	--
16......	--	--	--	--	--	.92	--	--	--	1.00	--	--
17......	--	--	--	--	--	--	.92	--	1.10	--	--	--
18......	--	--	--	--	--	--	--	--	--	--	--	.83
19......	--	--	--	--	--	--	--	--	--	--	--	--
20......	--	.83	--	--	--	--	--	--	--	--	.59	--
21......	--	--	--	--	--	--	--	1.10	--	--	--	--
22......	--	--	--	--	--	--	--	--	--	--	--	.83
23......	.66	--	--	--	--	--	--	--	--	--	--	.83
24......	--	--	--	--	--	--	--	--	--	--	--	.83
25......	--	--	--	--	--	--	--	1.10	--	--	--	.83
26......	--	--	--	--	--	--	--	--	--	--	--	.83
27......	--	--	--	--	--	--	--	--	--	1.00	--	.83
28......	.74	--	--	--	--	--	--	--	--	--	.83	.74
29......	--	--	--	--	--		1.10	--	1.00	--	--	.74
30......	--	--	--	--	--	.83	--	--	--	--	--	.74
31......	--	--	--	--	--	--	--	--	--	--	--	.74

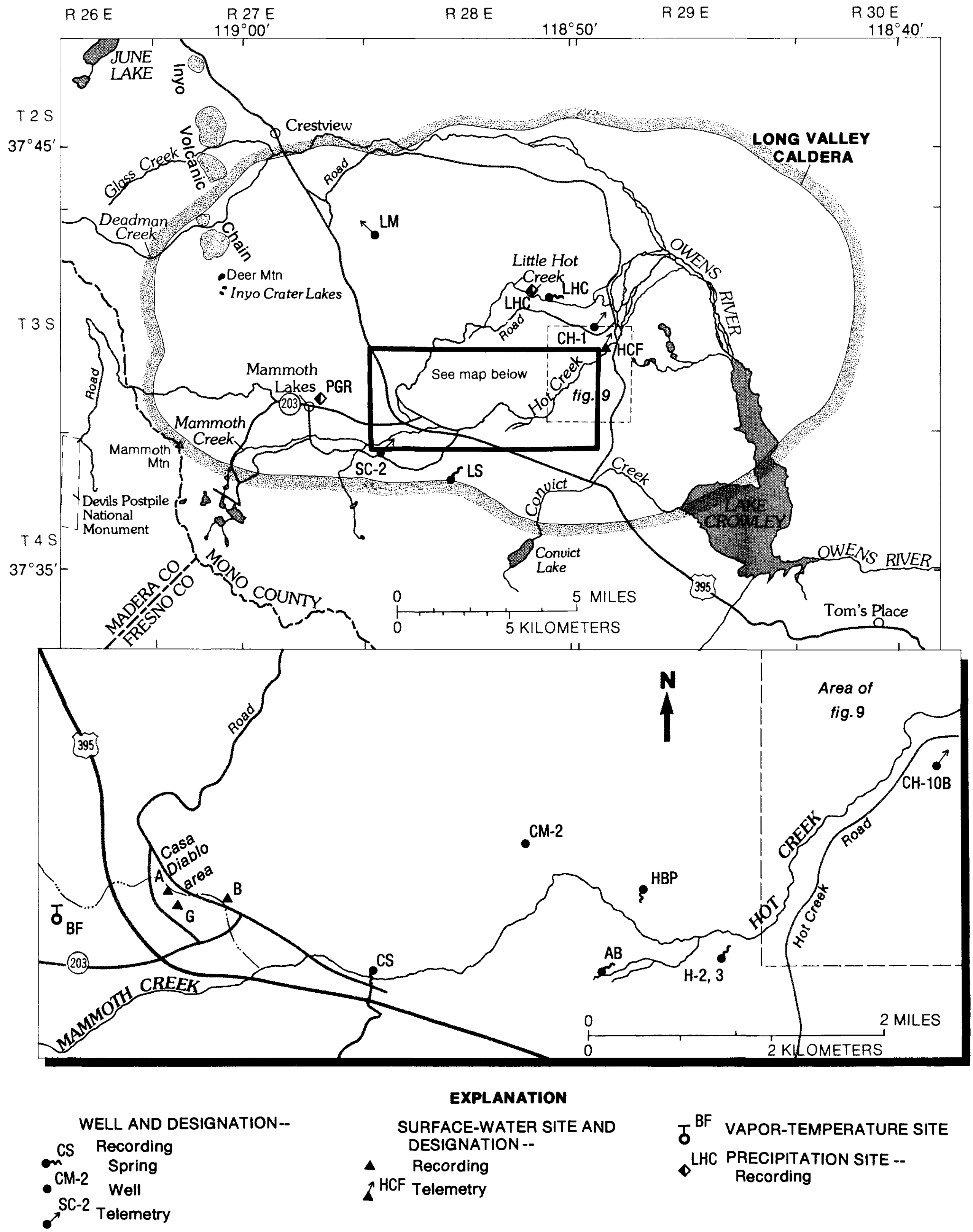

FIGURE 7.-- Long Valley study area showing location of sites with recording instrumentation.

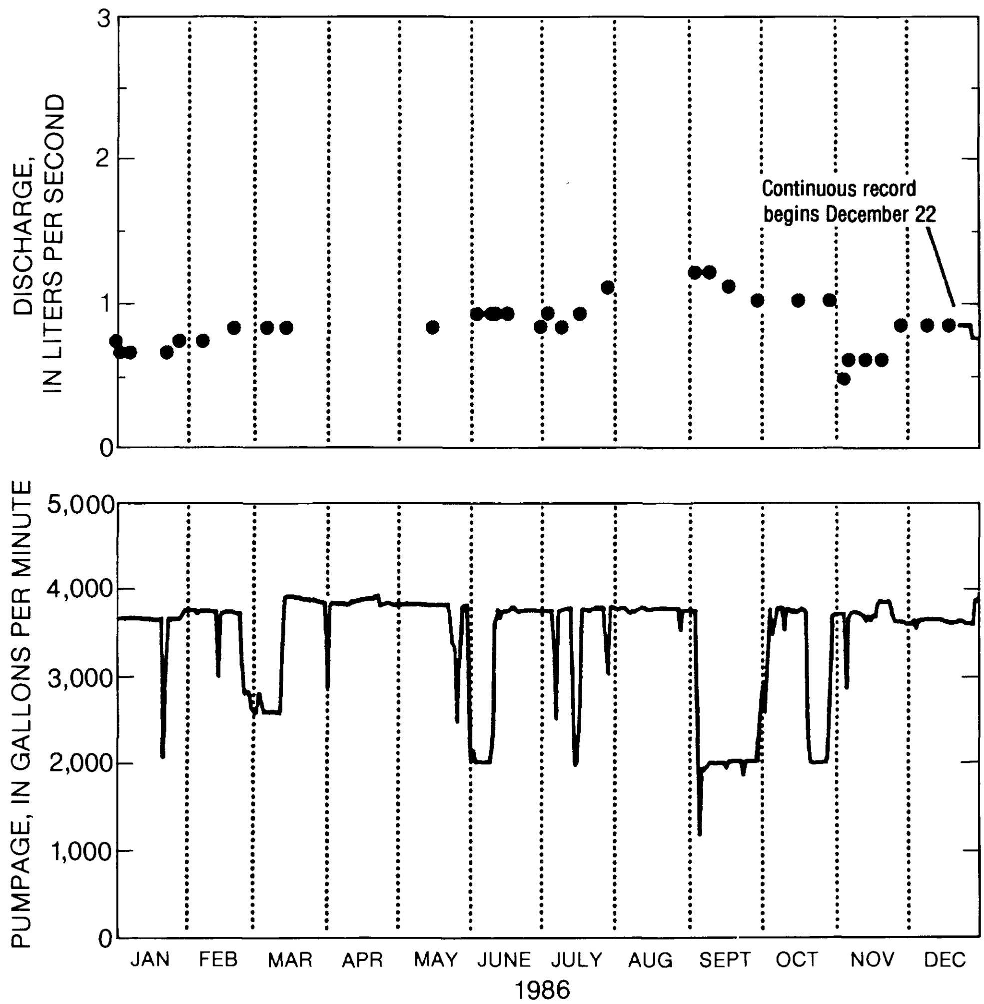

FIGURE 8.-- Instantaneous measurements and mean daily values of discharge at Colton Spring, CS (upper graph), and mean daily total well pumpage at Casa Diablo (lower graph).

Hot Creek

Streamflow and chemical data were collected at sites HCA and HCF along Hot Creek (fig. 9). A general description of the Hot Creek Gorge area and the methods and equipment used for data collection are given by Farrar and others (1985, 1987). Site HCA is upstream from most of the thermal springs in Hot Creek Gorge. Site HCF, Hot Creek flume, located downstream from the thermal springs, is equipped with a system to record water temperature, specific conductance, and stage at 15-minute intervals. Mean daily values of streamflow, specific conductance, and temperature for site HCF are given in tables 7 through 9 and are shown graphically in figure 10. Chloride and boron fluxes are calculated as described by Farrar and others (1985, 1987). Mean daily values for the chemical fluxes at site HCF given in tables 10 and 11 are shown graphically in figure 11. Discharge or stream stage measurements and water samples, analyzed for dissolved boron and chloride, were collected monthly at sites HCA and HCF (table 12).

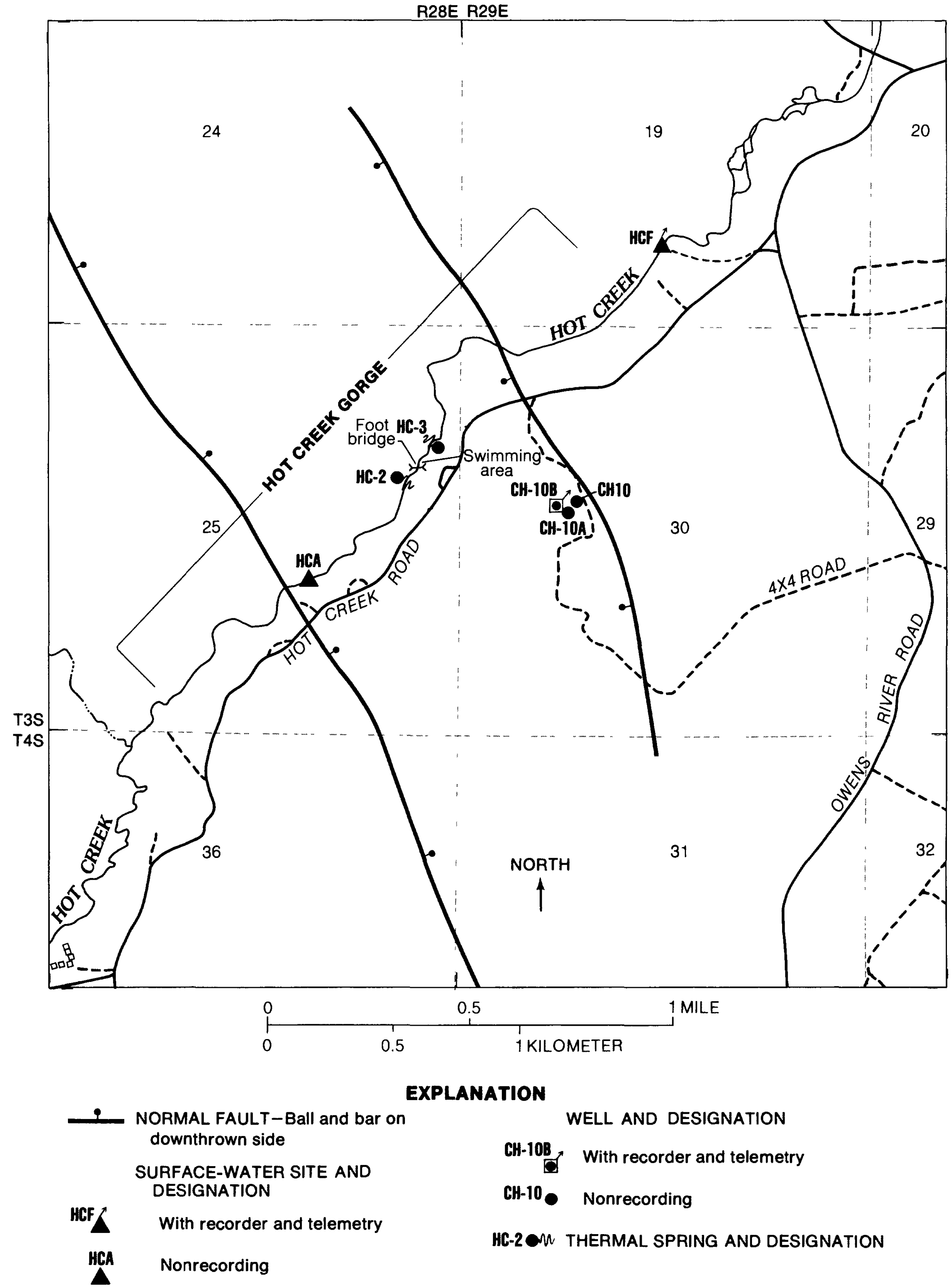

FIGURE 9.-- Hot Creek Gorge and vicinity showing location of wells, thermal springs, and surface-water sites. See figure 8 for location of map.

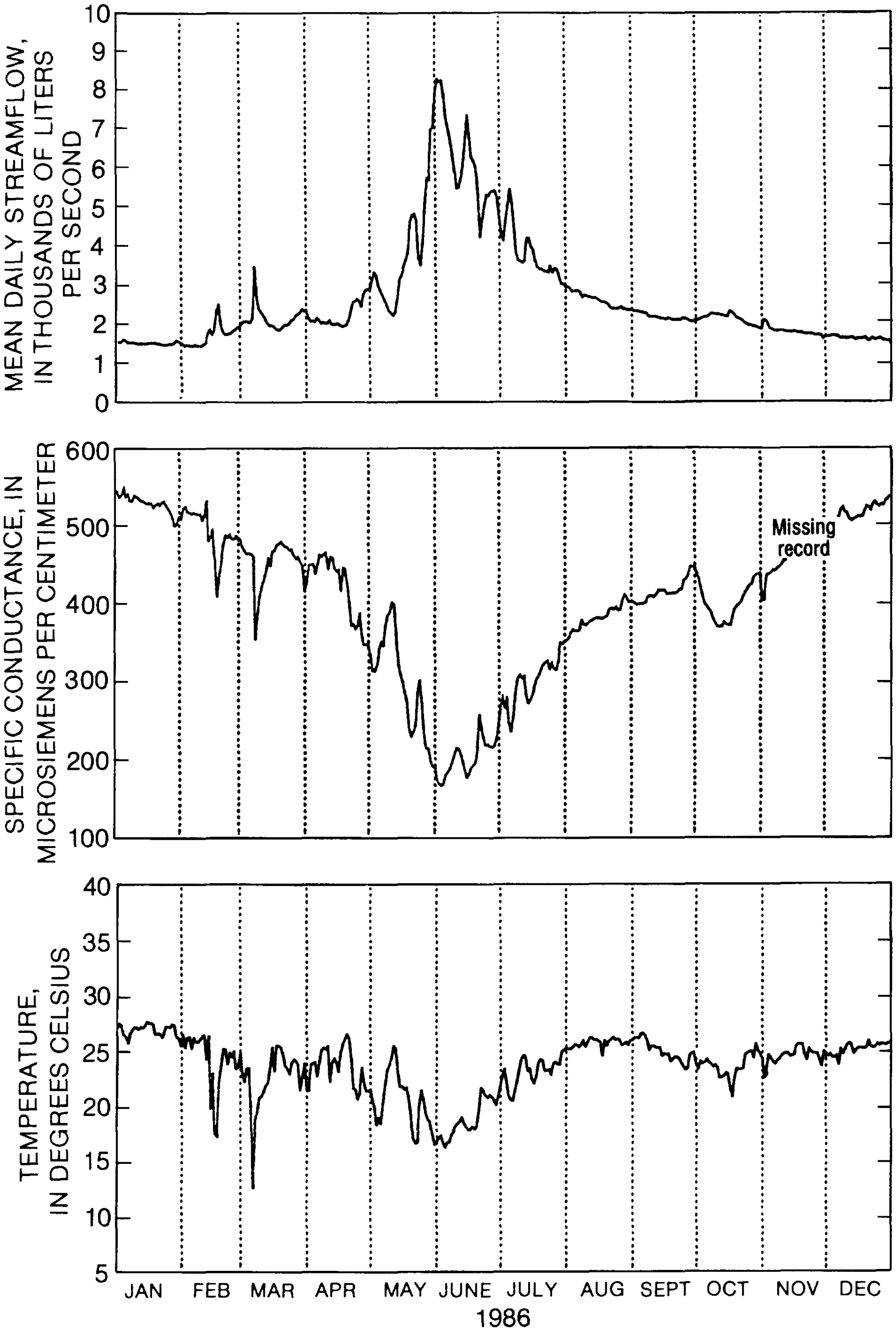

FIGURE 10.-- Mean daily values of streamflow, specific conductance, and water temperature at Hot Creek flume, site HCF.

TABLE 7.--*Mean daily streamflow, in liters per second, at Hot Creek flume, HCF, 1986*

[Mean computed from values recorded at 15-minute intervals]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	1,412	1,378	1,818	2,255	2,778	7,761	4,607	2,834	2,214	1,948	1,709	1,507
2......	1,407	1,357	1,934	2,073	3,020	8,099	4,182	2,824	2,204	1,948	1,947	1,515
3......	1,387	1,299	1,962	1,974	3,223	8,015	4,020	2,781	2,211	1,982	1,919	1,514
4......	1,410	1,317	1,963	1,962	3,146	8,060	4,506	2,711	2,205	2,031	1,854	1,557
5......	1,471	1,310	1,936	1,946	2,881	7,704	4,907	2,707	2,184	2,052	1,711	1,530
6......	1,443	1,283	1,937	2,065	2,737	7,113	5,293	2,735	2,161	2,062	1,699	1,532
7......	1,391	1,292	2,040	1,996	2,629	6,818	4,925	2,724	2,154	2,083	1,669	1,523
8......	1,393	1,311	3,351	1,916	2,518	6,571	4,326	2,690	2,131	2,135	1,669	1,445
9......	1,382	1,282	2,575	1,920	2,358	6,208	3,694	2,580	2,062	2,157	1,666	1,486
10.....	1,371	1,286	2,275	1,916	2,213	5,829	3,493	2,616	2,061	2,122	1,666	1,466
11.....	1,360	1,303	2,191	1,917	2,166	5,327	3,472	2,591	2,059	2,108	1,650	1,449
12.....	1,358	1,368	2,098	2,013	2,121	5,376	3,450	2,561	2,060	2,096	1,639	1,460
13.....	1,360	1,400	2,015	1,897	2,189	5,571	3,507	2,539	2,047	2,076	1,626	1,471
14.....	1,359	1,671	1,909	1,898	2,532	5,873	4,076	2,535	2,026	2,084	1,622	1,469
15.....	1,352	1,759	1,835	1,898	3,021	6,410	4,049	2,531	2,008	2,061	1,619	1,425
16.....	1,375	1,605	1,845	1,900	3,124	7,171	3,849	2,496	1,999	2,068	1,623	1,441
17.....	1,390	1,736	1,807	1,845	3,318	6,687	3,756	2,442	1,969	2,212	1,623	1,445
18.....	1,385	2,258	1,744	1,838	3,513	6,119	3,495	2,436	2,019	2,192	1,622	1,454
19.....	1,394	2,391	1,730	1,850	3,710	5,998	3,321	2,440	1,995	2,099	1,618	1,474
20.....	1,400	1,895	1,762	1,897	4,478	5,843	3,273	2,402	1,970	2,031	1,608	1,471
21.....	1,362	1,682	1,824	2,009	4,663	5,206	3,278	2,371	1,953	1,978	1,585	1,400
22.....	1,342	1,604	1,878	2,225	4,682	4,091	3,224	2,293	1,945	1,947	1,583	1,438
23.....	1,339	1,590	1,886	2,466	4,508	4,503	3,197	2,246	1,948	1,919	1,592	1,482
24.....	1,331	1,624	1,917	2,473	3,590	4,882	3,172	2,244	1,969	1,888	1,570	1,410
25.....	1,332	1,665	1,994	2,526	3,381	5,173	3,356	2,238	2,035	1,850	1,554	1,421
26.....	1,338	1,714	2,041	2,465	3,924	5,130	3,200	2,302	1,975	1,826	1,529	1,462
27.....	1,344	1,759	2,108	2,350	4,897	5,240	3,311	2,302	1,938	1,812	1,553	1,450
28.....	1,354	1,806	2,171	2,653	5,570	5,266	3,277	2,261	1,925	1,793	1,532	1,404
29.....	1,381		2,204	2,781	5,540	5,237	3,091	2,264	1,913	1,776	1,533	1,402
30.....	1,453		2,276	2,782	6,814	5,036	2,894	2,239	1,936	1,740	1,470	1,354
31.....	1,425		2,232		6,880		2,918	2,224		1,726		1,394
MEAN:	1,381	1,570	2,041	2,124	3,617	6,077	3,714	2,489	2,043	1,994	1,642	1,460
MAX:	1,471	2,391	3,351	2,782	6,880	8,099	5,293	2,834	2,214	2,212	1,947	1,557
MIN:	1,331	1,282	1,730	1,838	2,121	4,091	2,894	2,224	1,913	1,726	1,470	1,354

TABLE 8.--*Mean daily specific conductance, in microsiemens per centimeter at 25° Celsius, at Hot Creek flume, HCF, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	546	512	482	415	348	192	244	350	401	447	437	--
2......	542	509	468	428	331	173	268	352	401	438	402	--
3......	547	520	468	450	313	168	281	355	398	431	403	--
4......	541	519	465	450	313	166	265	362	396	418	412	--
5......	534	515	466	451	322	168	279	366	398	406	436	--
6......	540	517	465	438	340	179	246	363	399	397	438	--
7......	549	518	459	451	351	184	235	364	398	394	442	--
8......	541	516	347	463	345	188	256	365	400	390	441	509
9......	534	513	387	460	371	196	285	378	408	386	445	519
10.....	530	515	413	464	385	205	304	372	408	378	447	523
11.....	537	513	423	466	388	214	308	371	408	372	449	515
12.....	539	512	435	444	401	213	303	374	406	368	454	514
13.....	536	528	445	460	398	207	306	376	411	368	454	506
14.....	533	493	459	458	363	198	282	377	416	368	--	505
15.....	533	470	465	444	320	187	271	380	414	375	--	507
16.....	529	498	470	441	309	176	276	380	415	371	--	508
17.....	529	478	471	444	299	180	283	380	416	371	--	511
18.....	529	425	478	416	285	190	295	379	410	370	--	510
19.....	529	407	481	446	273	192	303	379	411	381	--	509
20.....	524	453	478	443	240	196	308	381	411	391	--	516
21.....	528	473	473	425	229	212	315	383	412	395	--	524
22.....	529	486	472	400	235	256	321	392	411	398	--	522
23.....	526	480	470	371	243	240	324	393	413	401	--	518
24.....	531	491	468	373	288	226	326	390	417	408	--	527
25.....	531	484	462	367	301	217	315	394	417	413	--	529
26.....	527	482	456	372	272	218	324	389	429	418	--	524
27.....	522	487	449	387	234	215	315	390	430	423	--	522
28.....	518	482	436	360	213	215	313	402	436	424	--	526
29.....	514		432	346	213	217	326	410	446	433	--	524
30.....	500		417	347	197	225	349	406	446	436	--	530
31.....	502		417		190		347	400		437		533

TABLE 9.--*Mean daily water temperature, in degrees Celsius, at Hot Creek flume, HCF, 1986*

[Mean computed from values recorded at 15-minute intervals]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	27.0	26.3	24.1	21.5	21.4	16.8	21.7	25.2	26.0	23.8	24.3	24.5
2......	27.0	25.6	22.9	21.3	20.5	17.1	22.7	25.1	26.2	23.3	22.6	24.6
3......	27.4	25.4	23.3	23.7	19.9	17.4	23.3	25.1	26.2	24.1	22.9	24.8
4......	27.1	26.3	23.0	23.8	18.2	16.7	22.2	25.3	26.1	23.8	23.5	24.4
5......	26.7	25.1	23.4	23.9	18.9	16.2	20.9	25.5	26.6	24.0	24.7	24.5
6......	26.3	24.7	23.0	22.6	18.4	16.7	20.5	25.5	26.7	24.2	24.0	24.6
7......	26.7	25.8	22.1	23.8	20.2	16.7	20.4	25.3	26.4	23.9	23.8	23.8
8......	26.7	26.2	13.0	25.0	21.7	17.4	21.4	25.6	25.8	23.8	24.2	25.3
9......	27.0	25.5	16.6	25.2	23.1	17.7	22.2	26.0	25.0	23.5	24.3	24.7
10.....	27.0	26.0	18.6	25.0	23.7	18.2	23.3	25.4	25.4	23.7	24.6	25.2
11.....	27.0	26.5	19.4	25.3	24.3	18.5	24.2	25.8	25.4	23.5	24.7	25.6
12.....	27.0	25.7	20.7	22.1	25.4	18.6	24.6	26.2	25.2	22.6	24.8	25.8
13.....	27.2	25.2	21.1	23.9	25.0	19.0	24.3	26.2	25.2	22.6	24.8	25.5
14.....	27.2	23.9	22.0	24.2	23.0	18.4	23.1	26.0	25.2	22.7	24.5	24.8
15.....	27.4	20.2	21.6	23.8	21.6	18.1	23.3	26.0	24.5	23.0	24.6	25.1
16.....	27.4	23.6	23.5	23.0	21.7	17.8	22.4	25.8	24.7	22.8	24.7	25.3
17.....	27.8	21.9	23.0	24.7	21.4	17.9	22.0	25.7	24.6	21.7	25.5	25.3
18.....	27.3	18.2	24.1	25.5	21.6	18.2	22.6	24.5	24.7	20.9	25.7	25.3
19.....	26.8	16.0	24.8	26.1	20.7	17.9	23.9	25.9	24.0	22.5	25.7	25.2
20.....	26.3	20.4	24.9	26.4	19.3	18.2	24.2	25.4	24.2	23.4	25.6	25.4
21.....	26.2	22.5	24.8	26.0	17.0	19.5	24.0	25.9	24.5	23.3	24.7	26.0
22.....	26.7	24.1	24.4	24.1	16.6	21.6	23.1	26.1	24.4	23.3	24.2	25.4
23.....	25.5	24.8	23.7	21.4	16.7	21.3	23.2	26.2	24.2	23.4	25.2	25.4
24.....	27.0	25.0	23.4	21.3	20.0	20.9	23.3	26.0	23.9	24.7	24.9	25.4
25.....	27.2	24.7	23.8	20.5	21.3	20.7	22.8	26.1	23.5	24.8	24.8	25.7
26.....	27.1	24.6	23.8	21.0	20.6	21.0	23.8	25.9	23.2	25.0	24.8	25.5
27.....	27.1	24.5	23.6	23.4	19.3	20.8	23.9	25.5	23.4	25.0	24.8	25.7
28.....	27.4	24.1	23.0	22.1	18.7	20.5	23.7	25.6	24.6	24.4	24.2	25.6
29.....	27.0		23.2	21.2	18.5	20.0	23.7	25.8	24.8	25.7	23.6	25.5
30.....	25.5		22.7	21.2	17.4	20.8	24.9	25.5	24.9	25.0	25.0	25.8
31.....	25.8		22.5		16.5		25.1	26.0		24.7		25.8

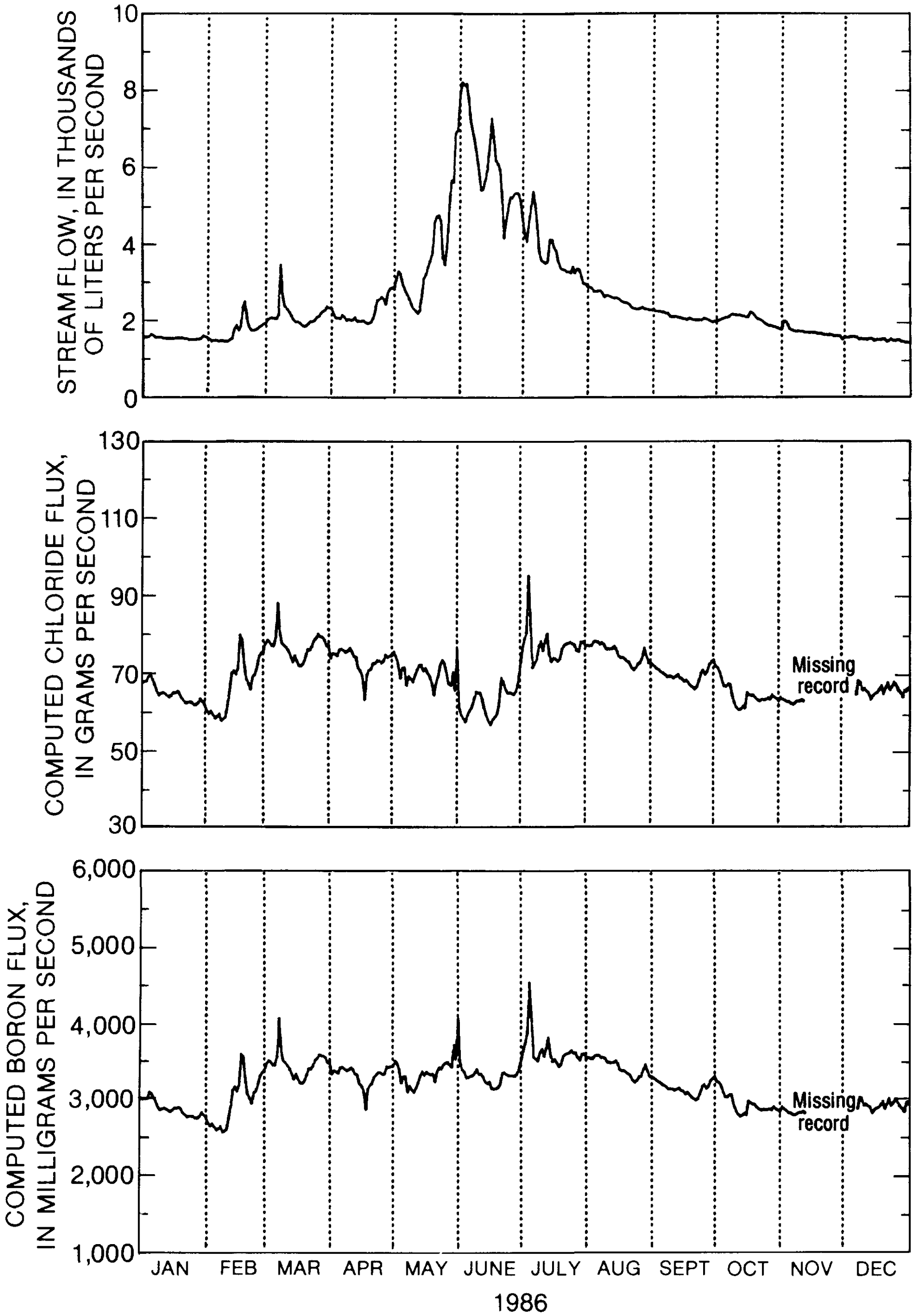

FIGURE 11.--Mean daily values of streamflow, computed chloride flux, and computed boron flux at Hot Creek flume, site HCF.

TABLE 10.--*Mean daily computed chloride flux, in milligrams per second, at Hot Creek flume, HCF, 1986*

[Chloride flux computed from specific conductance and streamflow recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1....	68,980	62,060	75,860	77,430	74,750	76,160	71,510	77,260	72,790	73,780	62,940	--
2....	68,000	60,670	77,730	74,130	75,790	61,500	75,740	77,390	72,360	71,990	64,100	--
3....	67,850	59,700	78,760	75,440	74,460	59,380	78,910	77,140	71,860	71,610	63,370	--
4....	68,110	60,370	78,230	75,110	72,710	58,480	80,550	77,250	71,310	70,480	63,100	--
5....	69,930	59,440	77,310	74,710	69,060	57,630	95,280	78,300	71,020	68,660	62,710	--
6....	69,540	58,510	77,280	76,260	71,600	59,520	83,530	78,430	70,450	66,850	62,810	--
7....	68,400	59,020	79,700	76,470	71,710	60,590	71,650	78,340	70,120	66,710	62,270	--
8....	67,190	59,640	88,160	76,040	67,150	61,500	72,720	77,630	69,740	67,480	62,120	64,740
9....	65,550	57,950	80,440	75,610	69,480	63,400	73,920	78,070	69,250	67,290	62,650	68,230
10...	64,550	58,360	77,790	75,930	68,680	65,450	77,270	77,550	69,390	64,380	63,130	67,800
11...	65,050	58,810	77,270	76,600	67,990	65,160	78,460	76,440	69,300	62,590	62,950	65,770
12...	65,240	61,810	76,670	75,760	69,630	65,120	76,070	76,450	69,000	61,260	63,430	66,210
13...	64,850	65,600	75,840	74,530	71,110	63,610	78,550	76,400	69,420	60,710	62,850	65,390
14...	64,420	70,150	74,760	74,210	72,300	61,150	80,300	76,570	69,860	60,930	--	65,060
15...	64,020	70,900	73,080	71,420	72,300	59,240	75,140	77,100	68,900	61,730	--	63,370
16...	64,540	69,910	74,690	70,760	70,870	57,790	73,280	76,140	68,760	61,140	--	64,420
17...	65,240	71,460	73,310	69,280	71,480	56,920	74,310	74,500	68,000	65,170	--	64,920
18...	65,080	79,970	72,110	63,490	70,220	58,290	73,930	74,100	68,420	64,590	--	65,200
19...	65,490	78,830	72,040	69,870	69,320	58,910	73,270	74,250	67,680	64,400	--	66,050
20...	64,930	72,820	72,780	71,050	67,720	59,640	73,950	73,640	66,980	64,570	--	66,980
21...	63,740	68,670	74,360	71,270	64,630	62,370	76,500	73,210	66,590	63,750	--	64,900
22...	63,050	67,750	76,360	72,690	68,000	68,930	77,480	72,910	66,130	63,220	--	66,400
23...	62,430	66,100	76,200	72,820	69,650	68,060	77,820	71,650	66,640	62,960	--	67,780
24...	62,710	69,460	77,150	73,540	72,530	66,280	78,040	71,050	68,220	63,470	--	65,820
25...	62,750	69,940	78,800	73,400	73,570	65,160	78,280	71,800	70,310	63,260	--	66,710
26...	62,530	71,710	79,230	72,950	72,690	65,240	77,780	72,690	71,040	63,450	--	67,880
27...	62,000	74,420	80,270	73,400	70,350	64,300	77,440	72,910	69,910	63,830	--	67,010
28...	62,000	75,440	79,610	74,320	67,460	64,690	75,980	74,170	70,600	63,400	--	65,490
29...	62,590		79,470	74,330	67,010	65,480	75,800	76,590	72,400	64,640	--	65,020
30...	63,580		78,690	74,720	70,590	67,420	78,330	74,870	73,210	63,850	--	63,830
31...	62,700		77,250		65,830		78,320	72,810		63,570		66,100

TABLE 11.--*Mean daily computed boron flux, in milligrams per second, at Hot Creek flume, HCF, 1986*

[Boron flux computed from specific conductance and streamflow recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	3,020	2,730	3,350	3,470	3,420	4,040	3,490	3,530	3,270	3,280	2,810	--
2......	2,980	2,670	3,440	3,310	3,490	3,470	3,620	3,530	3,250	3,210	2,880	--
3......	2,970	2,630	3,490	3,360	3,460	3,370	3,730	3,520	3,230	3,200	2,850	--
4......	2,990	2,660	3,470	3,340	3,370	3,340	3,850	3,510	3,210	3,160	2,830	--
5......	3,070	2,620	3,430	3,320	3,190	3,260	4,510	3,560	3,200	3,080	2,800	--
6......	3,050	2,570	3,430	3,400	3,280	3,270	4,060	3,570	3,170	3,010	2,800	--
7......	3,000	2,600	3,540	3,400	3,270	3,280	3,530	3,560	3,150	3,010	2,770	--
8......	2,950	2,620	4,040	3,370	3,070	3,290	3,510	3,530	3,140	3,040	2,770	2,850
9......	2,880	2,550	3,630	3,360	3,150	3,330	3,490	3,530	3,110	3,040	2,790	3,000
10.....	2,830	2,570	3,480	3,370	3,100	3,370	3,600	3,520	3,110	2,910	2,810	2,980
11.....	2,850	2,590	3,450	3,400	3,070	3,310	3,650	3,470	3,110	2,840	2,800	2,900
12.....	2,860	2,720	3,420	3,370	3,130	3,310	3,550	3,460	3,090	2,780	2,820	2,910
13.....	2,850	2,880	3,380	3,310	3,200	3,270	3,660	3,460	3,110	2,760	2,790	2,880
14.....	2,830	3,100	3,320	3,300	3,290	3,200	3,790	3,470	3,130	2,770	--	2,870
15.....	2,810	3,140	3,240	3,180	3,340	3,180	3,580	3,490	3,090	2,800	--	2,790
16.....	2,830	3,080	3,310	3,150	3,290	3,210	3,480	3,440	3,080	2,770	--	2,840
17.....	2,860	3,160	3,250	3,090	3,340	3,120	3,510	3,370	3,050	2,960	--	2,860
18.....	2,860	3,570	3,190	2,840	3,310	3,110	3,470	3,350	3,070	2,930	--	2,870
19.....	2,880	3,540	3,190	3,110	3,300	3,120	3,420	3,360	3,040	2,910	--	2,910
20.....	2,850	3,240	3,220	3,160	3,320	3,130	3,440	3,330	3,000	2,910	--	2,950
21.....	2,800	3,040	3,290	3,190	3,210	3,180	3,550	3,310	2,990	2,870	--	2,850
22.....	2,770	2,990	3,380	3,270	3,350	3,320	3,580	3,290	2,970	2,840	--	2,920
23.....	2,740	2,920	3,380	3,300	3,400	3,330	3,590	3,230	2,990	2,830	--	2,980
24.....	2,750	3,070	3,420	3,330	3,380	3,300	3,600	3,200	3,060	2,850	--	2,890
25.....	2,760	3,090	3,500	3,330	3,440	3,290	3,630	3,230	3,150	2,840	--	2,930
26.....	2,750	3,170	3,520	3,310	3,460	3,290	3,590	3,280	3,170	2,840	--	2,980
27.....	2,730	3,290	3,570	3,310	3,470	3,280	3,590	3,290	3,120	2,860	--	2,950
28.....	2,730	3,340	3,550	3,410	3,430	3,280	3,520	3,370	3,150	2,840	--	2,880
29.....	2,750		3,550	3,400	3,410	3,310	3,500	3,440	3,220	2,880	--	2,860
30.....	2,800		3,520	3,420	3,700	3,370	3,580	3,360	3,260	2,850	--	2,800
31.....	2,760		3,460		3,510		3,580	3,280		2,830		2,900

An estimate of the total thermal spring discharge is calculated (table 12) using differences in chloride and boron fluxes between sites HCF and HCA and dividing the results by the average concentrations of those elements dissolved in the thermal waters discharging from springs in the gorge.

TABLE 12.--*Calculated chloride and boron flux upstream and downstream from thermal springs in Hot Creek Gorge, and calculated thermal-spring discharge in Hot Creek Gorge, 1986*

Site HCA: Located 0.3 mile upstream from bridge at swimming area in gorge.
Site HCF: Located 1.0 mile downstream from bridge at swimming area in gorge.
Q: Streamflow measured at site HCA by wading with current meter; streamflow measured at site HCF from stage at concrete flume using adjusted rating curve.
L/s, liters per second; mg/L, milligrams per liter; mg/s, milligrams per second.
Cl: Chloride concentration in stream from chemical analysis by U.S. Geological Survey Central Laboratory, Arvada, Colorado.
Cl flux: Calculated as Q × Cl.
B: Boron concentration in stream from chemical analysis by U.S. Geological Survey Central Laboratory, Arvada, Colorado.
B flux: Calculated as Q × B.
Calculated thermal-spring discharge: Total discharge of thermal springs in Hot Creek Gorge calculated from chloride data (Cl) as (Cl flux at site HCF - CL flux at site HCA) / 220 mg/L; and boron data (B) as (B flux at site HCF - B flux at site HCA) / 10 mg/L.
NC indicates value not calculated due to insufficient data.
-- indicates not determined.

	HCA					HCF					Calculated thermal-spring discharge	
DATE	Q (L/s)	Cl (mg/L)	Cl flux (mg/s)	B (mg/L)	B flux (mg/s)	Q (L/s)	Cl (mg/L)	Cl flux (mg/s)	B (mg/L)	B flux (mg/s)	From Cl flux (L/s)	From B flux (L/s)
01-09-86	1,229	7.1	8,730	0.30	369	1,453	47	68,290	2.1	3,050	271	268
02-24-86	1,416	3.1	4,390	--	NC	1,611	43	69,270	1.9	3,060	295	NC
03-20-86	1,504	9.6	14,440	.36	541	1,728	46	79,490	1.9	3,280	296	274
04-11-86	1,762	--	NC	.31	546	1,909	46	87,810	1.7	3,240	NC	270
06-23-86	4,163	4.2	17,480	.17	708	4,676	--	NC	.81	3,790	NC	300
07-20-86	2,860	5.1	14,590	.21	601	3,197	23	73,530	1.10	3,520	268	292
08-28-86	2,096	6.0	12,580	.25	524	2,342	30	70,260	1.40	3,280	262	276
09-23-86	1,711	6.6	11,290	.25	428	1,954	35	68,390	1.60	3,130	260	270
11-05-86	1,490	5.8	8,640	.25	372	1,728	38	65,660	1.80	3,110	259	274
11-28-86	1,184	8.2	9,710	.24	284	1,430	48	68,640	2.00	2,860	268	258
12-22-86	1,260	6.1	7,690	.23	290	1,362	45	61,290	2.10	2,860	244	257
Mean ± standard deviation											274±21.5	273±13.0

Little Hot Creek Springs

Several small thermal springs discharge water at temperatures as high as 82 °C in an area of about 3 acres along the course of Little Hot Creek. Discharge from one prominent thermal spring vent (LHC in fig. 7) in this area was monitored in 1986. Mean daily values of discharge are given in table 13 and figure 12. Discharge values were obtained by recording the stage in a 3-inch modified Parshall flume and converting the stage to discharge using a standard rating. Earlier records and further site description are given by Sorey and Clark (1981), Farrar and others (1985, 1987), and in unpublished water-resources data reports by the U.S. Forest Service (1980-84).

TABLE 13.--*Mean daily discharge, in liters per second, of Little Hot Creek Springs, LHC, 1986*

[Mean estimated from continuous chart record. Precision of record is about 0.1 liter per second; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3
2.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3
3.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	--	3.3	3.3	3.3
4.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
5.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	--	3.3
6.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
7.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
8.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
9.......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
10......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
11......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.3	3.3	3.3
12......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
13......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
14......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
15......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
16......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
17......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
18......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
19......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
20......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
21......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
22......	3.3	3.3	3.3	3.3	3.3	3.3	--	3.5	3.5	3.3	3.3	3.3
23......	3.3	3.3	3.3	3.3	3.3	--	--	3.5	3.5	3.3	3.3	3.3
24......	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.5	3.3	3.3	3.3
25......	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.5	3.3	3.3	3.3
26......	3.3	3.3	3.3	3.3	3.3	--	3.3	3.5	3.5	3.3	3.3	3.3
27......	3.3	3.3	3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3	3.3
28......	3.3	3.3	3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3	3.3
29......	3.3		3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3	3.3
30......	3.3		3.3	3.3	3.3	--	3.3	--	3.5	3.3	3.3	3.3
31......	3.3		3.3		3.3		3.3	--		3.3		3.3

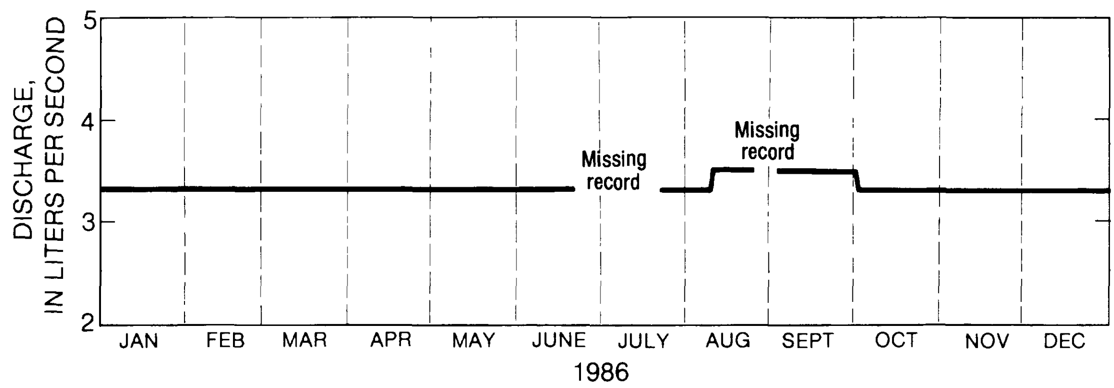

FIGURE 12.-- Mean daily discharge of Little Hot Creek spring.

Laurel Springs

Two springs separated by about 300 feet, located along the central part of the southern margin of the caldera at the base of Laurel Mountain, are known locally as Laurel Springs. The spring monitored for this study is the easternmost vent (LS in fig. 7). The spring discharges nonthermal water (about 12 °C) from colluvial material overlying granitic, Sierran basement rocks. Mean daily discharge from the spring is given in table 14 and figure 13. The record was obtained from the standard stage-discharge relation for a 90° V-notch weir. The stage was recorded on a chart recorder. Additional data from earlier periods are found in Sorey and others (1984), and Farrar and others (1987), and in unpublished water-resources data reports by the U.S. Forest Service (1980-84).

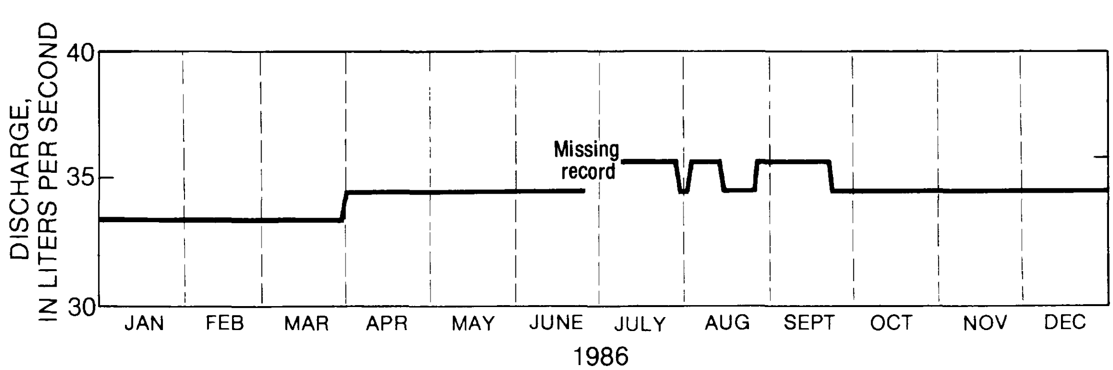

FIGURE 13.-- Mean daily discharge of Laurel Spring, LS.

TABLE 14.--*Mean daily discharge, in liters per second, of Laurel Spring, LS, 1986*

[Mean estimated from continuous chart records; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	33.4	33.4	33.4	34.5	34.5	34.5	--	34.5	35.7	34.5	34.5	34.5
2......	33.4	33.4	33.4	34.5	34.5	34.5	--	34.5	35.7	34.5	34.5	34.5
3......	33.4	33.4	33.4	34.5	34.5	34.5	--	34.5	35.7	34.5	34.5	34.5
4......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
5......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
6......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
7......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
8......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
9......	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
10.....	33.4	33.4	33.4	34.5	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5
11.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	35.7	35.7	34.5	34.5	34.5
12.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	35.7	35.7	34.5	34.5	34.5
13.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	35.7	35.7	34.5	34.5	34.5
14.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	35.7	35.7	34.5	34.5	34.5
15.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	35.7	35.7	34.5	34.5	34.5
16.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
17.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
18.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
19.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
20.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
21.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
22.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
23.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	35.7	34.5	34.5	34.5
24.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	34.5	34.5	34.5	34.5
25.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	34.5	34.5	34.5	34.5
26.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	34.5	34.5	34.5	34.5
27.....	33.4	33.4	33.4	34.5	34.5	34.5	35.7	34.5	34.5	34.5	34.5	34.5
28.....	33.4	33.4	33.4	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5	34.5
29.....	33.4		33.4	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5	34.5
30.....	33.4		33.4	34.5	34.5	--	35.7	35.7	34.5	34.5	34.5	34.5
31.....	33.4		33.4		34.5		34.5	35.7		34.5		34.5

Hot Bubbling Pool

Hot Bubbling Pool (also known as Casa Diablo Hot Pool) is located in the south-central part of the caldera (HBP in fig. 7). General descriptions of this feature and the equipment used for monitoring stage and water temperature are given by Sorey and others (1984) and Farrar and others (1987). During 1986, the stage of the pool was measured using a pressure transducer, and water temperature was measured using a platinum resistance temperature detector; the values were automatically recorded every 15 minutes. Mean daily values of stage and water temperature given in tables 15 and 16 are shown in figure 14.

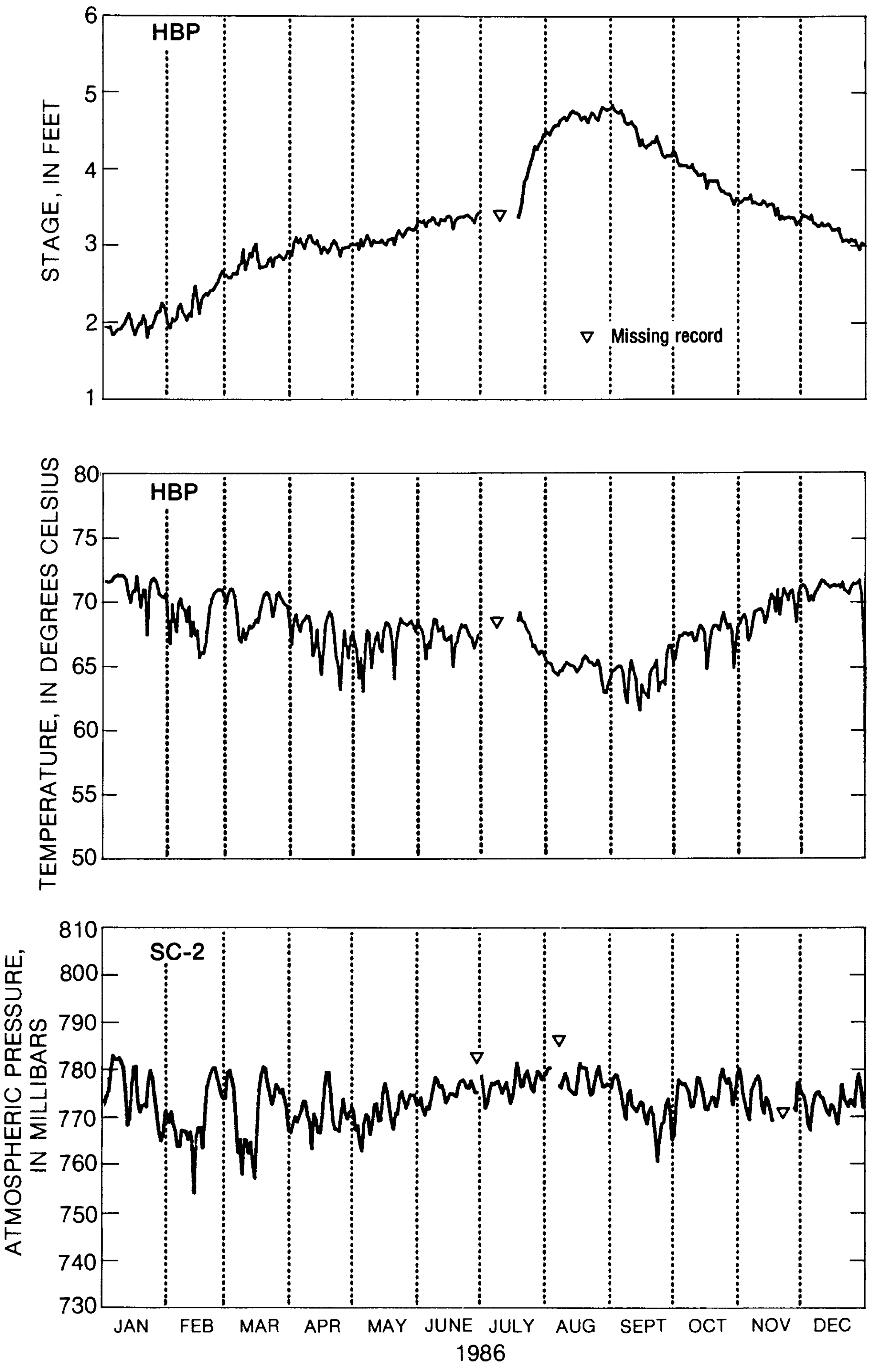

FIGURE 14.-- Mean daily values of stage and water temperature of Hot Bubbling Pool, HBP, and atmospheric pressure at Sherwin Creek site, SC-2.

TABLE 15.--*Mean daily stage, in feet, at Hot Bubbling Pool, HBP, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1........	1.9	2.1	2.6	2.9	3.0	3.3	--	4.5	4.8	4.2	3.6	3.3
2........	1.9	2.0	2.6	2.9	3.0	3.3	--	4.5	4.8	4.2	3.5	3.4
3........	1.9	1.9	2.6	3.0	3.0	3.3	--	4.4	4.7	4.1	3.6	3.4
4........	1.9	2.0	2.6	3.1	2.9	3.3	--	4.5	4.7	4.0	3.6	3.3
5........	1.9	2.0	2.6	3.0	3.1	3.2	--	4.5	4.7	4.0	3.6	3.3
6........	1.8	2.0	2.6	3.1	3.0	3.3	--	4.5	4.7	4.0	3.6	3.4
7........	1.8	2.2	2.6	3.0	3.1	3.3	--	4.5	4.7	4.0	3.6	3.3
8........	1.9	2.2	2.7	3.0	3.1	3.3	--	4.6	4.6	4.0	3.5	3.3
9........	1.9	2.1	2.8	3.1	3.1	3.3	--	4.6	4.6	4.0	3.6	3.2
10.......	1.9	2.1	2.9	3.1	3.0	3.3	--	4.7	4.6	4.0	3.5	3.2
11.......	2.0	2.0	2.7	3.1	3.1	3.3	--	4.6	4.6	4.0	3.5	3.3
12.......	2.0	2.1	2.8	3.0	3.0	3.3	--	4.7	4.5	3.9	3.5	3.2
13.......	2.1	2.1	2.9	3.0	3.0	3.3	--	4.7	4.5	3.9	3.6	3.2
14.......	2.1	2.3	2.8	3.1	3.0	3.3	--	4.7	4.4	3.9	3.5	3.3
15.......	2.0	2.5	3.0	3.0	3.1	3.4	--	4.7	4.3	3.9	3.5	3.2
16.......	1.9	2.3	3.0	2.9	3.0	3.4	--	4.7	4.4	3.9	3.5	3.2
17.......	1.8	2.1	2.8	3.0	3.0	3.3	--	4.7	4.3	3.7	3.5	3.2
18.......	1.9	2.3	2.7	2.9	3.1	3.2	--	4.6	4.2	3.8	3.5	3.2
19.......	2.0	2.3	2.7	2.9	3.1	3.3	3.4	4.7	4.3	3.8	3.4	3.2
20.......	2.0	2.4	2.7	2.9	3.1	3.3	3.4	4.7	4.3	3.8	3.5	3.1
21.......	2.1	2.3	2.7	3.0	3.0	3.4	3.6	4.6	4.3	3.8	3.3	3.0
22.......	2.0	2.4	2.8	3.1	3.1	3.4	3.8	4.6	4.3	3.8	3.4	3.1
23.......	1.8	2.4	2.8	3.0	3.2	3.4	3.9	4.7	4.4	3.7	3.3	3.1
24.......	1.9	2.4	2.7	3.0	3.1	3.4	4.0	4.7	4.3	3.7	3.3	3.0
25.......	1.9	2.5	2.8	2.9	3.1	3.4	4.1	4.6	4.2	3.7	3.4	3.1
26.......	2.0	2.5	2.8	3.0	3.2	3.4	4.2	4.6	4.1	3.7	3.3	3.0
27.......	2.1	2.6	2.9	3.0	3.2	3.3	4.3	4.7	4.1	3.7	3.3	3.1
28.......	2.1	2.7	2.8	3.0	3.2	3.3	4.2	4.8	4.2	3.6	3.3	3.0
29.......	2.1		2.8	3.0	3.2	3.4	4.3	4.8	4.1	3.6	3.3	2.9
30.......	2.2		2.8	3.0	3.2	3.4	4.4	4.7	4.2	3.5	3.3	3.0
31.......	2.2		2.9		3.2		4.4	4.8		3.6		3.0

Atmospheric pressure recorded at site SC-2 about 4.5 miles (fig. 7) west-southwest of Hot Bubbling Pool also is shown in figure 14. A correspondence between atmospheric pressure and pool stage has been noted (Farrar and others, 1987); however, the correspondence is obscured, in part, by the annual hydrologic cycle. The stage increases from January through late summer and then begins to decline again. Earlier records of stage and temperature fluctuations are given by Bezore and Sherburne (1985).

TABLE 16.--*Mean daily water temperature, in degrees Celsius, of Hot Bubbling Pool, HBP, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	71.7	70.6	70.4	68.4	67.5	68.3	--	65.6	64.0	65.3	68.1	71.1
2.......	71.5	68.7	69.8	66.6	66.8	68.0	--	65.2	64.5	65.6	68.3	71.2
3.......	71.6	66.7	70.6	68.6	66.2	67.7	--	65.1	64.6	66.6	68.7	71.1
4.......	71.5	69.8	71.0	69.0	64.0	67.2	--	65.0	64.8	67.3	68.9	70.8
5.......	71.6	68.6	70.9	68.1	65.6	65.5	--	64.5	64.9	67.2	68.5	69.9
6.......	71.6	67.6	70.4	67.6	63.0	66.8	--	64.4	64.9	67.5	66.9	70.3
7.......	71.9	69.9	69.1	68.4	66.1	66.4	--	64.2	64.5	67.5	67.3	70.0
8.......	72.0	70.2	67.0	68.5	67.7	67.7	--	64.6	62.9	67.3	68.2	70.6
9.......	72.1	69.5	66.8	68.8	67.4	68.6	--	64.6	62.1	67.4	69.1	70.9
10......	72.0	69.3	67.8	68.8	64.8	68.5	--	64.9	64.3	67.5	69.2	71.1
11......	72.0	68.4	67.0	68.2	66.3	67.6	--	65.2	65.3	66.8	69.3	71.5
12......	71.9	69.6	67.5	65.8	67.0	67.7	--	65.1	64.6	66.9	69.3	71.5
13......	71.6	67.3	68.1	66.3	67.5	68.0	--	64.9	64.0	67.7	69.0	71.2
14......	70.6	68.4	67.9	67.7	66.3	67.0	--	64.9	62.5	68.1	68.2	71.1
15......	69.9	67.3	68.1	66.1	66.0	66.9	--	64.8	61.5	67.8	68.7	71.0
16......	70.8	67.7	68.5	64.3	67.7	67.2	--	64.4	63.4	67.5	69.7	71.1
17......	70.8	65.7	68.4	66.2	68.3	67.3	--	64.7	62.9	64.7	70.5	71.2
18......	71.9	66.1	69.2	68.1	68.2	64.9	--	64.9	62.7	66.1	70.2	71.1
19......	70.8	65.9	69.9	68.8	67.9	66.7	68.5	65.5	62.4	67.3	69.1	71.2
20......	69.6	66.8	70.5	69.1	66.7	66.9	69.1	65.7	64.4	68.0	70.8	71.0
21......	70.9	68.2	70.7	68.9	64.0	67.6	68.4	65.5	64.7	68.1	68.9	71.4
22......	70.9	69.5	70.5	67.6	67.0	68.1	68.3	65.2	64.9	68.0	70.1	70.8
23......	67.4	70.1	70.0	65.7	67.9	68.0	67.9	65.2	65.4	67.7	70.9	70.6
24......	70.9	70.6	68.8	65.1	68.6	68.1	67.5	65.0	63.0	68.4	70.5	70.5
25......	71.6	70.8	69.5	63.1	68.3	67.7	67.1	65.0	63.6	69.0	70.0	71.0
26......	71.8	70.9	70.5	65.8	68.2	67.2	66.4	65.4	63.8	68.4	70.7	71.3
27......	71.6	70.9	70.7	67.7	68.1	67.1	66.5	64.8	63.5	67.8	70.8	71.3
28......	71.2	70.9	70.2	66.6	68.3	66.3	66.1	63.7	65.8	68.2	69.9	71.3
29......	70.5		69.9	65.6	68.4	66.8	65.8	62.9	66.5	67.6	68.3	71.5
30......	70.4		69.7	67.2	68.1	67.4	66.1	62.9	66.5	64.8	70.5	70.6
31......	70.3		69.6		67.6		66.0	63.6		67.1		66.2

Hot Creek State Fish Hatchery

Discharges were measured during 1986 from two of the main spring groups (AB and H-2,3) that supply water for the Hot Creek State Fish Hatchery (fig. 7). Mean daily values of discharges given in tables 17 and 18 are shown in figure 15. The record for Spring group AB was provided by Keith Higginson, Higginson and Barnett Consulting, Bountiful, Utah; discharge was computed from the standard rating for a 5-foot Cipolletti weir that controls stage in the gage pool. The stage was recorded on a chart recorder

Discharge at spring group H-2,3 was computed from the standard rating for a 3-foot Cipolletti weir that controls stage in the gage pool. The stage was recorded on a chart recorder.

Earlier records of discharge for the spring groups are given by Sorey and Lewis (1976) and Farrar and others (1985 and 1987). Revised values of mean daily discharge for 1985 given in table 19 are 25 percent lower than those published by Farrar and others (1987). The erroneous discharge values were computed from chart records of the stage using the rating for a 4-foot wide Cipolletti weir; however, the weir is only 3 feet wide.

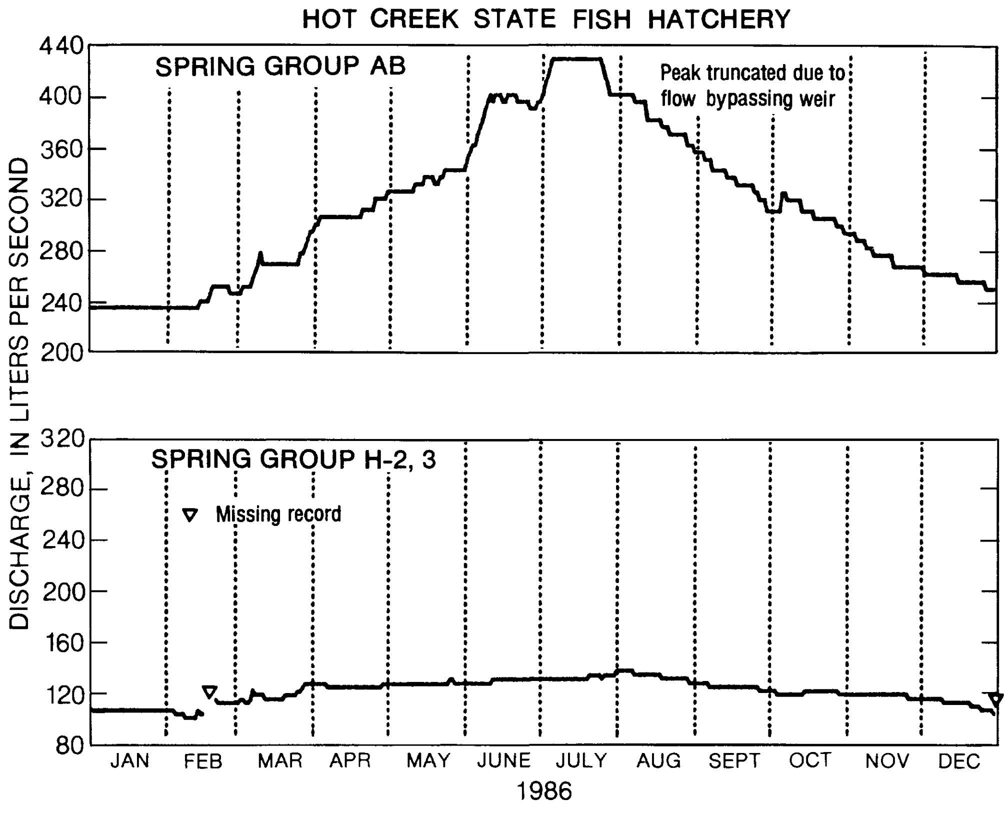

FIGURE 15.-- Mean daily discharge of Fish Hatchery Spring groups AB and H-2, 3.

TABLE 17.--*Mean daily discharge, in liters per second, of Hot Creek State Fish Hatchery Spring group AB, 1986*

[Mean estimated from continuous chart records. Data provided by Keith Higginson, Higginson and Barnett, Bountiful, Utah, written commun., 1987]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1........	232	232	244	297	323	348	399	399	354	309	292	263
2........	232	232	244	297	323	354	408	399	354	309	292	261
3........	232	232	249	303	323	360	413	399	348	309	286	261
4........	232	232	249	303	323	360	422	399	348	323	286	261
5........	232	232	249	303	323	368	428	399	348	323	286	261
6........	232	232	249	303	323	374	428	399	340	317	286	261
7........	232	232	255	303	323	379	428	394	340	317	280	261
8........	232	232	261	303	323	388	428	394	340	317	280	261
9........	232	232	266	303	323	394	428	394	340	317	280	261
10.......	232	232	275	303	323	399	428	394	340	317	275	261
11.......	232	232	266	303	329	394	428	394	340	317	275	261
12.......	232	232	266	303	329	399	428	379	334	309	275	261
13.......	232	232	266	303	329	399	428	379	334	309	275	261
14.......	232	238	266	303	329	399	428	379	334	309	275	261
15.......	232	238	266	303	334	394	428	379	334	309	275	255
16.......	232	238	266	303	334	394	428	379	329	309	275	255
17.......	232	238	266	303	334	399	428	379	329	303	275	255
18.......	232	244	266	303	334	399	428	374	329	303	266	255
19.......	232	249	266	303	329	399	428	374	329	303	266	255
20.......	232	249	266	309	329	399	428	374	329	303	266	255
21.......	232	249	266	309	334	394	428	368	329	303	266	255
22.......	232	249	266	309	334	394	428	368	329	303	266	255
23.......	232	249	266	309	340	394	428	368	323	303	266	255
24.......	232	249	266	309	340	394	428	368	323	303	266	255
25.......	232	249	266	317	340	394	422	368	317	303	266	255
26.......	232	244	275	317	340	388	413	368	317	297	266	249
27.......	232	244	275	317	340	388	408	368	317	297	266	249
28.......	232	244	280	317	340	388	399	360	309	297	266	249
29.......	232		286	317	340	394	399	360	309	292	266	249
30.......	232		292	323	340	394	399	360	309	292	266	249
31.......	232		292		340		399	354		292		249

TABLE 18.--*Mean daily discharge, in liters per second, of Hot Creek State Fish Hatchery Spring group H-2,3, 1986*

[Mean estimated from continuous chart records]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1........	104	104	110	126	126	126	130	136	126	120	117	114
2........	104	104	110	126	126	126	130	136	126	120	117	114
3........	104	104	114	126	126	126	130	136	126	120	117	114
4........	104	104	114	126	126	126	130	136	126	117	117	114
5........	104	101	110	126	126	126	130	136	126	117	117	114
6........	104	101	110	126	126	126	130	136	126	117	117	114
7........	104	101	114	123	126	126	130	136	123	117	117	114
8........	104	101	120	123	126	126	130	133	123	117	117	114
9........	104	98	117	123	126	126	130	133	123	117	117	114
10.......	104	98	117	123	126	126	130	133	123	117	117	110
11.......	104	98	117	123	126	126	130	133	123	117	117	110
12.......	104	98	117	123	126	130	130	133	123	117	117	110
13.......	104	98	114	123	126	130	130	133	123	117	117	110
14.......	104	104	114	123	126	130	130	133	123	117	117	110
15.......	104	101	114	123	126	130	130	133	123	120	117	110
16.......	104	101	114	123	126	130	130	133	123	120	117	110
17.......	104	--	114	123	126	130	130	133	123	120	117	110
18.......	104	--	114	123	126	130	130	133	123	120	117	110
19.......	104	--	114	123	126	130	130	130	123	120	117	110
20.......	104	--	114	123	126	130	130	130	123	120	117	110
21.......	104	114	117	123	126	130	133	130	123	120	117	107
22.......	104	110	117	123	126	130	133	130	123	120	117	107
23.......	104	110	117	123	126	130	133	130	123	120	117	107
24.......	104	110	117	123	126	130	133	130	123	120	117	107
25.......	104	110	117	123	126	130	133	130	123	120	117	104
26.......	104	110	120	123	130	130	130	130	123	120	114	104
27.......	104	110	120	123	130	130	133	130	120	120	114	104
28.......	104	110	123	123	126	130	133	130	120	120	114	104
29.......	104		126	126	126	130	133	130	120	117	114	104
30.......	104		126	126	126	130	133	126	120	117	114	101
31.......	104		126		126		133	126		117		101
MEAN:	104	104	116	124	126	129	131	132	123	119	117	109
MAX:	104	114	126	126	130	130	133	136	126	120	117	114
MIN:	104	98	110	123	126	126	130	126	120	117	114	101

TABLE 19.--*Revised mean daily discharge, in liters per second, of Hot Creek State Fish Hatchery Spring group H-2,3, 1985*

[Start of record February 22, 1985; no record March 1-9, November 6-16, and December 7-12, 14-15 because of ice in the stilling well. The data in this table are revisions to discharge values previously published in Farrar and others (1987); --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.........	--	--	--	110	106	110	113	113	113	110	106	106
2.........	--	--	--	110	106	110	113	117	110	110	106	106
3.........	--	--	--	110	106	110	113	117	110	110	106	106
4.........	--	--	--	110	106	110	113	117	110	110	106	106
5.........	--	--	--	110	106	110	113	117	110	110	106	106
6.........	--	--	--	110	106	110	113	113	110	110	106	106
7.........	--	--	--	110	106	106	113	117	110	110	--	106
8.........	--	--	--	110	106	110	113	117	110	110	--	--
9.........	--	--	106	110	106	110	113	117	110	106	--	--
10........	--	--	106	110	106	110	113	117	110	106	--	--
11........	--	--	106	110	106	110	113	117	110	106	--	--
12........	--	--	106	110	106	110	113	117	110	106	--	--
13........	--	--	106	110	106	110	113	117	110	106	--	106
14........	--	--	106	110	106	110	113	117	110	106	--	--
15........	--	--	106	110	106	113	113	113	110	106	--	--
16........	--	--	106	110	106	113	113	113	110	106	106	104
17........	--	--	106	110	106	117	113	113	110	106	106	104
18........	--	--	106	106	106	106	113	113	110	106	106	104
19........	--	--	106	106	110	106	113	113	110	106	106	104
20........	--	--	106	106	110	106	113	113	110	106	104	104
21........	--	--	106	106	110	106	113	113	110	106	104	104
22........	--	110	106	106	110	106	113	113	110	106	104	104
23........	--	110	106	106	110	106	113	113	110	106	104	104
24........	--	110	106	106	110	106	110	113	110	106	104	104
25........	--	110	110	106	110	113	117	113	110	106	104	104
26........	--	110	110	106	106	113	117	113	110	106	104	104
27........	--	110	96	110	106	113	117	113	110	106	104	104
28........	--	110	96	106	106	113	117	113	110	106	104	104
29........	--		98	106	106	113	117	113	110	106	104	104
30........	--		106	110	106	113	113	113	110	106	106	104
31........	--		110		110		113	113		106		104
MEAN:	--	--	--	109	107	110	113	114	111	107	--	--
MAX:	--	--	--	110	110	117	117	117	113	110	--	--
MIN:	--	--	--	106	106	106	110	113	110	106	--	--

Basalt Fumarole

The steam vent known locally as Basalt Fumarole is located in the southwestern part of the caldera (BF in fig. 7). The steam, mixed with other gases including sulfur compounds, issues from sand and boulder colluvial material at the eroded edge of a basalt flow. Gas temperature was measured using a platinum resistance temperature detector, and temperatures were recorded hourly, as the average of readings made each 10 minutes. Mean daily values of gas temperatures are given in table 20 and figure 16. Mean daily values of atmospheric pressure recorded at site Sherwin Creek (SC-2), located about 1.5 miles south-southeast of Basalt Fumarole (fig. 7), are shown in figure 16. An inverse relation between the atmospheric pressure and temperature is apparent, as was noted from earlier records (Farrar and others, 1987). The period of missing record from August 8 to November 17, 1986, was caused by damage to the temperature sensor from corrosive gases and from power failures.

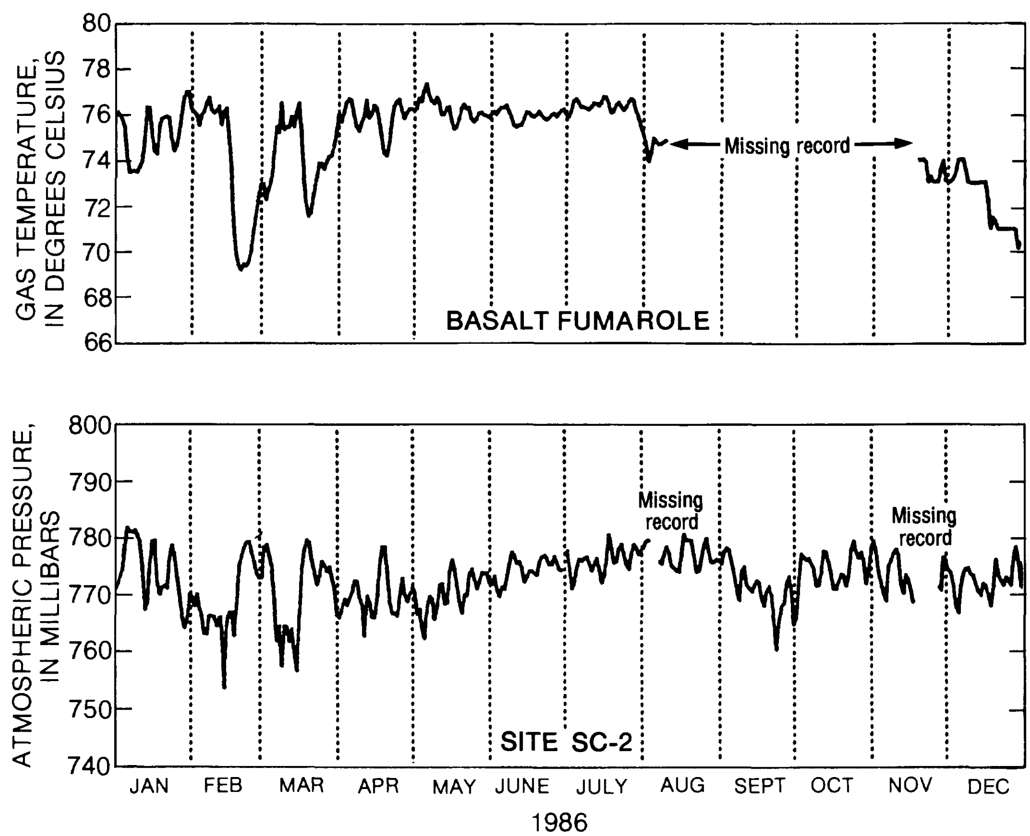

FIGURE 16.-- Mean daily gas temperature of Basalt Fumarole, BF, and mean daily atmospheric pressure at Sherwin Creek site, SC-2.

TABLE 20.--*Mean daily gas temperature, in degrees Celsius, in Basalt Fumarole, BF, 1986*

[Mean computed from values recorded hourly; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	75.8	76.1	72.9	75.6	76.2	76.0	75.8	74.7	--	--	--	73.1
2.......	76.0	76.0	72.2	76.0	76.6	75.9	76.1	73.9	--	--	--	73.2
3.......	75.8	75.9	73.0	76.4	76.5	76.1	76.5	74.3	--	--	--	73.5
4.......	75.6	75.4	74.2	76.6	77.0	76.2	76.6	74.9	--	--	--	74.0
5.......	75.3	75.9	75.3	76.5	77.2	76.2	76.4	74.7	--	--	--	74.1
6.......	74.0	76.0	75.1	75.9	76.8	76.3	76.2	74.6	--	--	--	74.0
7.......	73.4	76.4	76.4	75.4	76.5	76.0	76.3	74.7	--	--	--	73.5
8.......	73.4	76.6	75.2	75.2	76.4	75.8	76.2	74.8	--	--	--	73.1
9.......	73.4	76.1	75.4	75.6	76.6	75.4	76.1	--	--	--	--	73.0
10......	73.4	75.9	75.4	75.8	76.5	75.4	76.3	--	--	--	--	73.0
11......	73.6	76.0	75.8	76.5	75.9	75.5	76.4	--	--	--	--	73.0
12......	73.8	76.2	75.4	75.8	75.9	75.5	76.4	--	--	--	--	73.0
13......	74.7	75.5	76.0	75.9	76.2	75.7	76.3	--	--	--	--	73.1
14......	76.2	76.0	76.4	76.3	76.2	76.0	76.5	--	--	--	--	73.1
15......	76.1	76.2	75.1	76.2	75.7	76.0	76.7	--	--	--	--	73.1
16......	75.1	75.0	73.2	75.7	75.3	75.8	76.7	--	--	--	--	72.3
17......	74.3	73.6	72.1	75.0	75.4	75.8	76.4	--	--	--	--	71.1
18......	74.2	71.3	71.5	74.2	75.7	75.9	76.0	--	--	--	74.8	71.5
19......	75.3	69.9	71.7	74.1	76.2	76.1	76.1	--	--	--	74.0	71.3
20......	75.7	69.3	72.4	74.7	76.4	75.9	76.4	--	--	--	74.0	71.0
21......	75.8	69.1	73.1	75.6	76.2	75.8	76.5	--	--	--	74.0	71.0
22......	75.8	69.4	73.8	76.3	76.2	75.7	76.3	--	--	--	73.9	71.0
23......	75.7	69.3	73.8	76.5	75.7	75.8	76.1	--	--	--	73.1	71.0
24......	74.9	69.5	73.5	76.6	75.6	75.9	76.3	--	--	--	73.3	71.0
25......	74.3	69.9	73.8	76.1	75.7	76.0	76.5	--	--	--	73.1	71.0
26......	74.5	70.8	74.1	75.7	76.0	75.8	76.6	--	--	--	73.1	71.0
27......	75.2	71.5	74.1	76.0	76.0	76.0	76.5	--	--	--	73.1	71.0
28......	75.9	72.3	74.5	76.2	75.9	76.1	76.1	--	--	--	73.7	70.2
29......	76.6		75.1	76.2	75.9	76.2	75.9	--	--	--	74.0	70.5
30......	76.9		75.9	76.1	75.8	75.9	75.4	--	--	--	73.1	--
31......	76.9		75.6		75.9		75.1	--		--		--

Continuous Measurements of Ground-Water Levels in Wells

Ground-water levels and atmospheric pressure were recorded at four sites: Core Hole 1 (CH-1), Core Hole 10-B (CH-10B), Sherwin Creek 2 (SC-2) and Lookout Mountain (LM) (locations shown in fig. 7). Measurements made using pressure transducers were electronically recorded at 15-minute intervals; the equipment is described in more detail by Farrar and others (1985, 1987). Mean daily values of water levels and atmospheric pressure are given for each site in tables 21 through 28 and in figures 17 through 20. The changes in water levels during the year can be related to annual recharge and lesser effects due to atmospheric pressure changes. The record for LM shows a clear inverse relation between atmospheric pressure and water level during January through March.

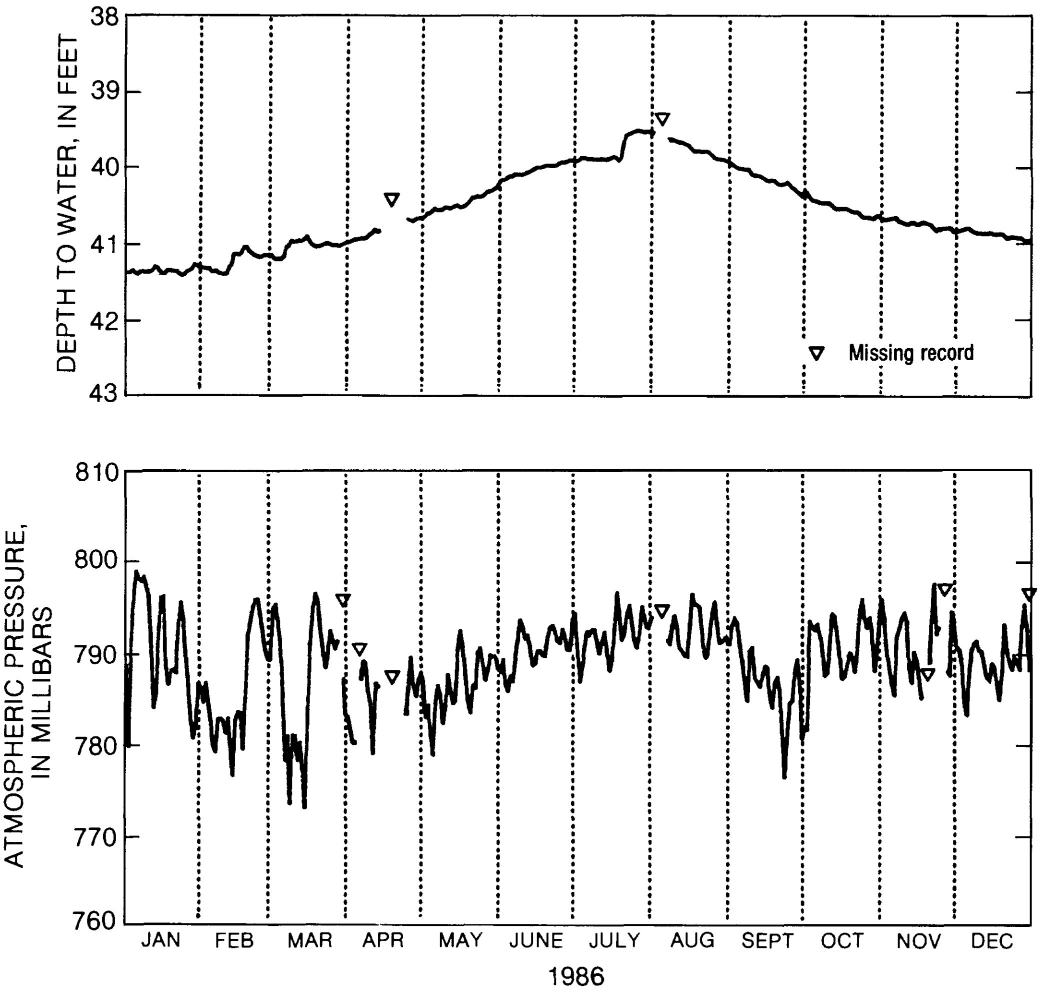

FIGURE 17.-- Mean daily values of water level and atmospheric pressure for Core Hole 1, CH-1.

TABLE 21.--*Mean daily depth to water, in feet, in well CH-1, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	41.4	41.3	41.2	41.0	40.7	40.2	39.9	39.5	39.9	40.3	40.7	40.8
2.......	41.4	41.3	41.2	41.0	40.6	40.2	39.9	39.6	39.9	40.3	40.7	40.8
3.......	41.4	41.3	41.2	--.	40.6	40.2	39.9	--	40.0	40.4	--	40.8
4.......	41.4	41.4	41.2	41.0	40.6	40.1	39.9	--	40.0	40.4	40.7	40.8
5.......	41.4	41.3	41.2	41.0	40.6	40.1	39.9	--	40.0	40.4	40.7	40.8
6.......	41.4	41.4	41.2	--	40.5	40.1	39.9	--	40.0	40.4	40.6	40.8
7.......	41.4	41.4	41.2	40.9	40.6	40.1	39.9	--	40.0	40.5	40.6	40.8
8.......	41.4	41.4	41.1	40.9	40.6	40.1	39.9	39.6	40.0	--	40.7	40.8
9.......	41.4	41.4	41.0	40.9	40.6	40.1	39.9	39.6	40.0	40.5	40.7	40.8
10......	41.4	41.4	41.0	40.9	40.5	40.1	39.9	39.6	40.1	40.5	40.7	40.8
11......	41.4	41.4	41.0	40.9	40.5	40.1	39.9	39.7	40.1	40.5	40.7	40.8
12......	41.4	41.4	41.0	40.8	40.5	40.1	39.9	39.7	40.1	40.5	40.7	40.9
13......	41.4	41.3	41.0	40.9	--	40.1	39.9	39.7	40.1	40.5	40.7	40.8
14......	41.3	41.3	41.0	40.8	40.5	40.0	39.9	39.7	40.1	40.5	40.7	40.8
15......	41.3	41.2	41.0	--	40.5	40.0	39.9	39.7	40.1	40.5	40.7	40.8
16......	41.4	41.2	40.9	--	40.5	40.0	39.9	39.7	40.2	40.5	40.7	40.9
17......	41.4	41.2	41.0	--	40.5	40.0	39.9	39.8	40.2	40.5	40.7	40.9
18......	41.4	41.1	41.0	--	40.5	40.0	39.9	39.8	40.2	40.5	40.7	40.9
19......	41.4	41.1	41.1	--	40.5	40.0	39.9	39.8	40.2	--	--	40.8
20......	41.4	41.1	41.1	--	40.5	40.0	39.9	39.8	40.2	40.6	--	40.9
21......	41.4	41.1	41.1	--	40.4	40.0	39.7	39.8	40.2	40.6	40.7	40.9
22......	41.4	41.2	41.0	--	40.4	40.0	39.6	39.8	40.2	40.6	40.8	40.9
23......	41.4	41.2	41.0	--	40.4	40.0	39.6	39.8	40.2	40.6	40.8	40.9
24......	41.4	41.2	41.0	--	40.4	40.0	39.5	39.8	40.2	40.6	40.8	40.9
25......	41.4	41.2	41.0	40.7	40.4	39.9	39.5	39.8	40.2	40.7	40.8	40.9
26......	41.4	41.2	41.0	40.7	40.4	39.9	39.5	39.9	40.3	40.6	--	40.9
27......	41.4	41.2	41.0	40.7	40.3	39.9	39.5	39.9	40.3	40.6	--	40.9
28......	41.4	41.2	41.0	40.7	40.3	39.9	39.5	39.9	40.3	40.7	40.8	40.9
29......	41.4		41.1	40.7	40.3	39.9	39.5	39.9	40.3	40.7	40.8	41.0
30......	41.3		--	40.7	40.3	39.9	39.5	39.9	40.4	40.6	40.8	40.9
31......	41.3		41.0		40.3		39.5	39.9		40.6		40.9

TABLE 22.--*Mean daily atmospheric pressure, in millibars, at site CH-1, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	789.4	786.6	789.1	783.1	787.8	788.1	793.4	792.8	791.3	780.6	794.3	793.1
2......	787.3	786.1	789.2	782.8	786.8	787.8	794.2	793.8	790.9	781.8	795.7	790.5
3......	788.5	784.5	794.8	--	782.9	789.2	790.8	--	792.8	781.5	--	790.2
4......	779.7	786.6	795.1	780.1	784.2	786.6	786.8	--	793.6	793.3	793.7	788.4
5......	791.2	784.6	793.2	780.0	781.1	785.7	788.1	--	793.1	792.7	790.2	784.5
6......	796.3	782.7	791.2	--	778.8	787.4	790.7	--	791.1	792.4	786.6	783.2
7......	798.7	779.8	785.4	787.0	784.5	786.8	792.2	--	789.0	793.0	785.3	788.0
8......	797.8	779.1	778.1	789.0	786.4	789.2	791.8	791.3	786.6	--	791.6	790.1
9......	797.6	782.7	780.8	788.7	785.4	791.3	792.5	790.8	784.7	790.9	792.4	790.9
10.....	798.1	782.7	773.4	785.6	782.3	793.4	792.4	792.6	790.1	787.4	793.6	791.2
11.....	797.1	782.5	780.9	784.2	784.2	792.7	791.2	793.9	790.5	787.8	794.2	790.1
12.....	796.0	781.2	780.8	778.9	787.6	791.4	789.8	792.7	787.2	790.3	793.3	790.0
13.....	791.6	782.7	778.1	786.6	--	791.7	791.1	790.4	786.7	794.1	788.2	788.5
14.....	783.9	779.7	780.1	786.1	784.4	790.6	792.1	790.0	786.3	793.8	786.7	787.2
15.....	785.3	776.5	777.2	--	784.7	788.6	790.4	789.6	787.3	792.0	790.0	786.9
16.....	791.9	782.5	772.9	--	790.3	788.9	788.0	789.5	788.5	789.8	789.1	788.7
17.....	795.8	783.5	783.0	--	792.3	790.1	789.2	792.5	788.2	787.1	786.9	788.3
18.....	796.0	783.3	790.6	--	790.5	790.1	792.3	796.3	785.3	787.4	784.9	786.5
19.....	788.4	779.4	794.3	--	787.5	789.6	796.4	795.1	784.0	--	--	784.8
20.....	786.5	785.6	796.2	--	784.6	789.5	794.4	795.0	786.8	789.9	--	787.9
21.....	787.9	791.8	795.6	--	783.4	791.5	791.3	794.8	787.3	789.7	788.9	792.9
22.....	788.1	793.4	792.7	--	786.4	792.6	791.9	792.3	785.8	787.9	793.6	790.4
23.....	787.7	794.8	790.5	--	786.1	792.9	794.2	789.4	781.4	789.8	797.4	788.9
24.....	792.6	795.6	788.3	--	789.9	792.3	795.0	789.7	776.3	794.2	792.0	788.1
25.....	795.3	795.7	789.7	783.2	790.4	791.2	793.3	791.9	780.7	795.7	792.7	789.5
26.....	793.6	793.9	792.2	786.4	788.6	791.0	791.3	794.2	784.4	793.7	--	788.9
27.....	789.9	792.1	791.3	789.4	787.0	792.4	790.5	795.4	784.7	792.6	--	788.1
28.....	786.3	790.3	790.3	786.3	788.0	791.7	791.9	792.7	787.7	793.7	787.9	792.7
29.....	782.7		791.2	785.2	789.7	790.2	794.9	791.0	789.2	792.4	787.4	795.1
30.....	780.6		--	786.9	789.4	790.2	793.9	791.2	786.8	788.0	794.3	792.5
31.....	781.6		787.1		789.6		792.2	791.6		790.0		787.9

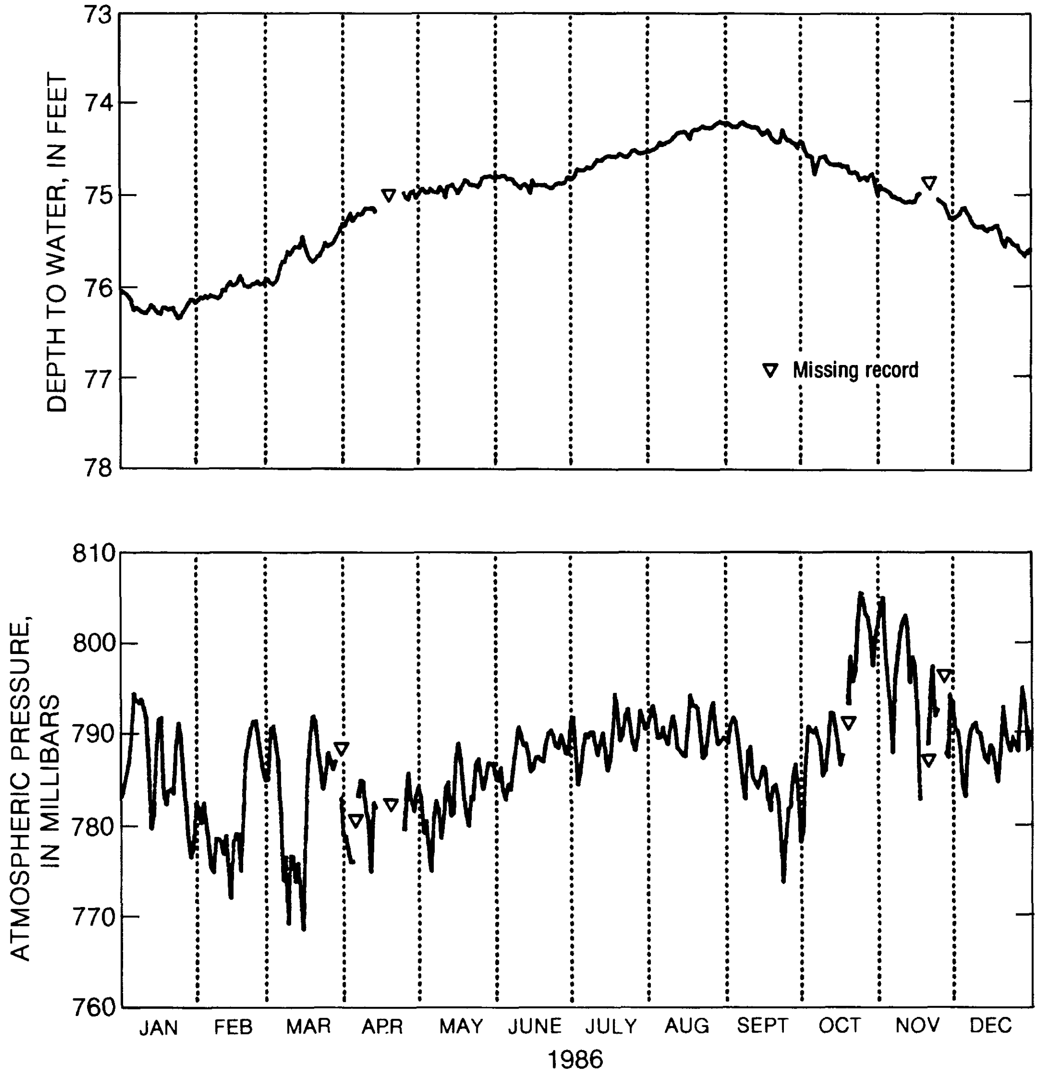

FIGURE 18.-- Mean daily values of water level and atmospheric pressure for Core Hole 10B, CH-10B.

TABLE 23.--*Mean daily depth to water, in feet below datum, in well CH-10B, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	76.0	76.2	75.9	75.3	75.0	74.8	74.8	74.5	74.2	74.4	75.0	75.2
2.......	76.0	76.1	75.9	75.3	74.9	74.8	74.8	74.5	74.2	74.4	74.9	75.2
3.......	76.1	76.1	75.9	--	74.9	74.8	74.8	74.5	74.2	74.5	--	75.2
4.......	76.1	76.1	76.0	75.2	75.0	74.8	74.7	74.5	74.3	74.6	74.9	75.2
5.......	76.1	76.1	75.9	75.3	75.0	74.8	74.7	74.5	74.2	74.6	74.9	75.1
6.......	76.2	76.1	75.9	--	74.9	74.8	74.7	74.4	74.3	74.6	75.0	75.1
7.......	76.3	76.1	75.8	75.2	75.0	74.8	74.7	74.4	74.2	74.8	75.0	75.2
8.......	76.2	76.1	75.7	75.2	75.0	74.8	74.7	74.4	74.2	--	75.0	75.2
9.......	76.2	76.1	75.7	75.2	75.0	74.9	74.7	74.4	74.2	74.6	75.0	75.3
10......	76.3	76.1	75.6	75.1	74.9	74.9	74.7	74.4	74.2	74.6	75.0	75.3
11......	76.3	76.1	75.6	75.1	74.9	74.9	74.6	74.4	74.3	74.6	75.1	75.3
12......	76.3	76.0	75.6	75.1	75.0	74.9	74.6	74.3	74.3	74.6	75.1	75.3
13......	76.2	76.0	75.6	75.1	74.9	74.9	74.6	74.3	74.3	74.7	75.1	75.3
14......	76.2	76.0	75.6	75.2	74.9	74.9	74.6	74.3	74.3	74.7	75.0	75.4
15......	76.2	75.9	75.6	--	74.9	75.0	74.6	74.3	74.3	74.7	75.1	75.4
16......	76.3	76.0	75.4	--	74.9	74.8	74.6	74.3	74.3	74.7	75.0	75.3
17......	76.3	76.0	75.5	--	75.0	74.9	74.6	74.3	74.3	74.6	75.0	75.3
18......	76.3	75.9	75.6	--	74.9	74.9	74.6	74.4	74.3	74.7	75.0	75.3
19......	76.2	75.9	75.7	--	74.9	74.9	74.6	74.3	74.3	--	--	75.3
20......	76.2	75.9	75.7	--	74.8	74.9	74.6	74.3	74.4	74.7	--	75.4
21......	76.3	76.0	75.7	--	74.8	74.9	74.5	74.3	74.4	74.7	--	75.5
22......	76.2	76.0	75.7	--	74.9	74.9	74.6	74.3	74.4	74.7	--	75.5
23......	76.2	76.0	75.6	--	74.9	74.9	74.6	74.2	74.4	74.8	--	75.4
24......	76.3	76.0	75.6	--	74.9	74.9	74.6	74.3	74.3	74.8	--	75.5
25......	76.3	76.0	75.5	75.0	74.9	74.9	74.5	74.3	74.4	74.8	75.0	75.5
26......	76.3	75.9	75.6	75.0	74.9	74.9	74.5	74.3	74.4	74.8	--	75.5
27......	76.3	76.0	75.5	75.0	74.8	74.9	74.5	74.2	74.4	74.8	--	75.5
28......	76.2	76.0	75.5	75.0	74.8	74.9	74.5	74.2	74.4	74.8	75.1	75.6
29......	76.2		75.5	74.9	74.8	74.8	74.5	74.2	74.4	74.8	75.2	75.6
30......	76.1		--	75.0	74.8	74.8	74.5	74.2	74.5	74.8	75.2	75.6
31......	76.1		75.4		74.8		74.5	74.2		74.8		75.6

TABLE 24.--*Mean daily atmospheric pressure, in millibars, at site CH-10B, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	785.1	782.4	784.9	778.9	784.2	785.3	791.3	790.8	789.4	778.2	802.2	--
2.......	783.1	781.9	785.0	778.7	783.2	784.9	791.8	791.9	789.0	779.4	804.1	--
3.......	784.3	780.3	790.6	--	779.2	786.3	788.6	793.1	791.0	786.4	--	--
4.......	785.8	782.5	790.9	776.0	780.5	783.8	784.5	791.8	791.8	790.8	804.9	--
5.......	787.1	780.4	789.0	776.0	777.5	782.9	785.9	789.5	791.2	790.4	799.4	--
6.......	790.7	778.5	787.0	--	775.0	784.5	788.4	789.6	789.3	790.1	793.3	--
7.......	794.4	775.5	781.3	783.2	780.8	783.9	790.0	790.7	787.3	790.6	788.0	--
8.......	793.6	774.9	774.0	784.9	782.7	786.5	789.6	789.5	784.8	--	795.8	--
9.......	793.4	778.6	776.6	784.7	781.8	788.5	790.2	788.9	783.0	788.6	798.2	--
10......	793.8	778.5	769.3	781.6	778.6	790.7	790.2	790.7	788.1	785.4	801.0	--
11......	792.8	778.2	776.7	780.3	780.7	790.0	789.0	791.9	788.6	786.0	802.4	--
12......	791.7	776.9	776.5	775.0	784.2	788.7	787.7	790.7	785.2	788.7	803.0	--
13......	787.3	778.9	773.9	782.5	784.7	788.9	788.9	788.4	784.7	792.3	801.6	--
14......	779.7	775.6	775.9	781.9	781.1	787.9	790.1	788.1	784.2	792.2	795.7	--
15......	781.1	772.1	773.0	--	781.4	785.9	788.3	787.6	785.2	790.6	798.4	--
16......	787.8	778.2	768.6	--	787.0	786.2	786.0	787.6	786.4	788.7	797.4	--
17......	791.6	779.1	778.7	--	789.0	787.5	787.1	790.6	786.0	786.6	791.9	--
18......	791.8	779.0	786.3	--	787.2	787.5	790.1	794.3	783.0	787.7	782.8	--
19......	784.2	775.1	790.0	--	784.2	787.1	794.3	793.1	781.7	--	--	--
20......	782.4	781.3	792.0	--	781.3	787.0	792.3	793.0	784.2	793.3	--	--
21......	783.8	787.4	791.3	--	780.0	788.9	789.3	792.7	784.5	798.5	--	--
22......	784.0	789.1	788.2	--	783.2	790.1	789.9	790.2	783.3	795.8	--	--
23......	783.5	790.6	786.2	--	782.9	790.4	792.0	787.4	779.0	796.8	--	--
24......	788.5	791.4	784.0	--.	786.7	789.8	792.7	787.8	773.8	802.7	--	--
25......	791.2	791.5	785.5	779.6	787.3	788.6	791.0	789.9	778.3	805.4	--	--
26......	789.5	789.6	788.0	782.8	785.6	788.4	789.1	792.3	781.9	804.7	--	--
27......	785.6	787.9	787.1	785.8	784.0	789.9	788.2	793.4	782.2	803.1	--	--
28......	782.2	786.0	786.1	782.7	785.2	789.2	789.7	790.7	785.2	802.6	--	--
29......	778.6		787.1	781.6	786.8	787.8	792.6	788.9	786.7	801.1	--	--
30......	776.5		--	783.3	787.8	791.8	789.2	784.4	797.5	--	--	
31......	777.5		783.0			790.5	789.6		800.7			

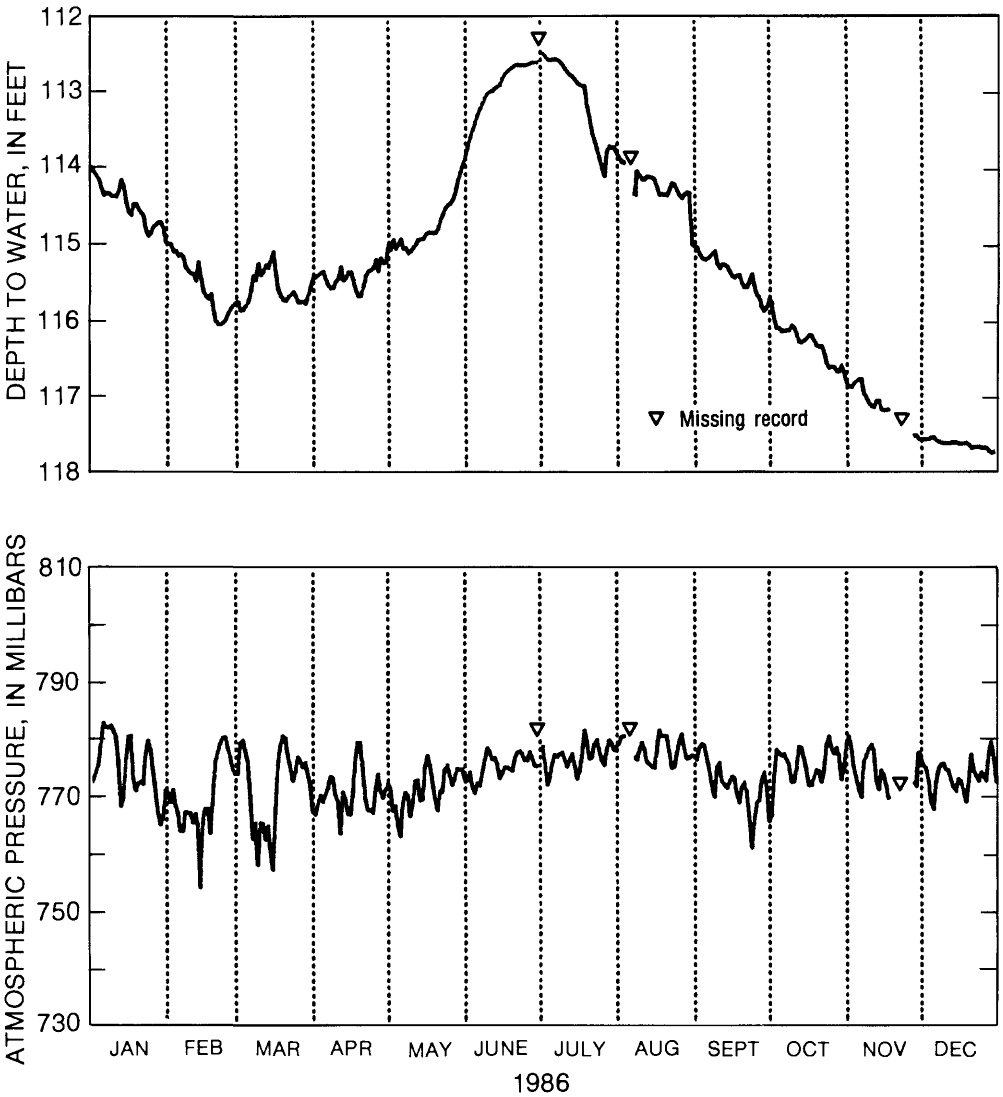

FIGURE 19.-- Mean daily values of water level and atmospheric pressure for well Sherwin Creek 2, SC-2.

TABLE 25.--*Mean daily depth to water, in feet below datum, in Sherwin Creek well SC-2, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	114.0	115.0	115.8	115.4	115.0	113.9	--	--	115.0	115.7	116.8	117.6
2......	114.0	115.0	115.7	--	115.1	113.8	112.5	114.0	115.1	115.8	--	117.6
3......	114.1	115.0	115.9	--	114.9	113.6	112.5	114.2	115.1	116.0	--	117.6
4......	114.1	115.1	115.8	115.4	115.1	113.5	112.6	--	115.2	116.1	116.9	117.6
5......	114.2	115.1	115.8	--	115.0	113.4	112.6	--	115.2	116.1	116.8	117.5
6......	114.3	115.2	115.7	--	114.9	113.3	112.6	--	115.2	116.1	116.8	117.6
7......	114.4	115.1	115.6	115.5	115.1	113.2	112.6	--	115.2	--	116.8	117.6
8......	114.3	115.2	115.4	115.6	115.1	113.2	112.6	114.4	115.1	--	117.0	117.6
9......	114.3	115.3	115.5	115.6	115.1	113.1	112.6	114.1	115.1	116.1	117.0	117.6
10.....	114.4	115.3	115.3	115.5	115.1	113.0	112.7	114.1	115.3	116.1	117.1	117.6
11.....	114.4	115.4	115.4	115.4	115.0	113.0	112.7	114.2	115.3	116.1	117.1	117.6
12.....	114.4	115.4	115.3	115.3	115.0	113.0	112.8	114.2	115.3	116.2	117.2	117.6
13.....	114.3	115.5	115.3	115.5	114.9	113.0	112.8	114.1	115.3	116.3	117.1	117.6
14.....	114.2	115.2	115.3	115.4	114.9	112.9	112.8	114.1	115.3	116.3	117.1	117.6
15.....	114.2	115.4	115.2	115.4	114.9	112.9	112.9	114.1	115.4	116.3	117.2	117.6
16.....	114.4	115.6	115.1	115.4	114.9	112.8	112.9	114.2	115.4	116.2	117.2	117.6
17.....	114.6	115.7	115.4	115.5	114.8	112.8	112.9	114.3	115.4	116.2	117.2	117.6
18.....	114.6	115.7	115.6	115.6	114.8	112.7	112.9	114.4	115.4	--	--	117.6
19.....	114.5	115.6	115.7	115.7	114.9	112.7	112.9	114.4	115.4	--	--	117.6
20.....	114.5	115.8	115.7	115.7	114.8	112.7	113.2	114.4	115.5	116.3	--	117.7
21.....	114.5	116.0	115.7	115.5	114.8	112.7	113.3	114.4	115.6	116.3	--	117.7
22.....	114.6	116.0	115.7	115.4	114.7	112.6	113.5	114.3	115.6	116.3	--	117.7
23.....	114.6	116.0	115.6	115.3	114.6	112.7	113.6	114.2	115.5	116.4	--	117.7
24.....	114.8	116.0	115.6	115.3	114.5	112.7	113.8	114.2	115.4	116.6	--	117.7
25.....	114.9	116.0	115.7	115.3	114.5	112.7	113.9	114.3	115.5	116.6	--	117.7
26.....	114.9	115.9	115.8	115.2	114.5	112.6	114.0	114.4	115.7	116.6	--	117.7
27.....	114.8	115.8	115.8	115.3	114.4	112.6	114.1	114.4	115.7	116.6	--	117.7
28.....	114.7	115.8	115.7	115.2	114.3	112.6	113.8	114.4	115.8	116.7	117.5	117.7
29.....	114.7		115.8	115.2	114.2	112.6	113.7	114.3	115.9	116.7	117.5	117.8
30.....	114.7		--	115.2	114.1	--	113.8	114.4	115.8	116.6	117.6	117.7
31.....	114.8		115.6		114.0		--	115.0		116.7		117.7

TABLE 26.--*Mean daily atmospheric pressure, in millibars, at Sherwin Creek site SC-2, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	774.0	771.2	774.0	767.4	772.3	773.1	--	--	777.0	765.7	779.0	777.0
2......	771.9	770.5	774.1	--	771.3	772.8	778.8	779.4	776.4	766.7	--	775.2
3......	773.1	769.1	779.4	--	767.5	774.3	776.0	780.5	778.5	773.7	--	774.8
4......	774.4	771.2	779.9	770.3	768.4	771.9	772.1	--	779.2	778.1	778.5	772.8
5......	775.7	768.5	778.0	--	765.1	770.7	773.3	--	778.7	777.6	775.1	768.8
6......	779.9	767.2	776.1	--	763.2	772.4	775.8	--	776.7	777.1	771.2	767.7
7......	782.9	764.1	770.1	771.5	768.9	771.9	777.3	--	774.7	--	769.9	772.5
8......	782.1	764.0	762.7	773.5	770.7	774.2	777.0	776.8	772.1	--	775.9	774.6
9......	782.0	767.4	765.4	773.4	770.2	776.4	777.5	776.5	770.0	775.6	776.9	775.5
10.....	782.5	767.2	758.2	770.4	766.7	778.5	777.7	778.0	775.1	772.5	778.3	775.7
11.....	781.5	767.1	765.5	769.1	768.9	777.8	776.6	779.4	775.9	772.7	778.9	774.6
12.....	780.4	765.5	765.2	763.6	772.8	776.5	775.3	778.3	772.6	775.0	777.9	774.4
13.....	776.2	767.1	762.6	770.8	773.0	776.8	776.4	776.0	772.0	778.6	772.8	772.9
14.....	768.5	765.0	765.0	769.7	769.4	775.7	777.4	775.6	771.5	778.4	771.2	771.5
15.....	769.8	761.0	760.8	767.0	769.6	773.3	775.6	775.1	772.5	776.6	774.5	770.9
16.....	776.4	766.2	757.5	766.9	775.1	774.1	773.2	775.0	773.5	774.5	773.6	773.0
17.....	780.5	768.0	767.3	771.0	777.1	775.2	774.5	777.9	773.1	771.9	771.7	772.6
18.....	780.7	767.9	775.8	776.0	775.5	775.2	777.3	781.6	770.5	--	--	770.8
19.....	773.3	763.7	778.9	779.5	772.6	774.8	781.6	780.5	769.0	--	--	769.0
20.....	771.2	769.9	780.6	779.4	769.6	774.5	779.7	780.6	771.5	774.6	--	772.3
21.....	772.4	776.1	780.1	774.9	767.7	776.7	776.6	780.4	772.3	774.4	--	777.2
22.....	772.7	777.8	777.1	769.7	771.0	777.7	776.9	777.9	770.8	772.6	--	774.5
23.....	772.3	779.3	775.2	767.6	770.9	778.0	779.1	775.0	766.6	774.5	--	773.4
24.....	777.5	780.3	772.9	767.7	774.8	777.4	779.9	775.3	761.1	778.8	769.5	772.6
25.....	779.8	780.4	774.4	767.2	775.5	776.3	778.3	777.5	765.5	780.4	--	774.1
26.....	778.2	778.5	776.9	770.8	773.7	776.4	776.4	779.7	769.0	778.5	--	773.4
27.....	774.5	776.9	776.1	773.9	772.1	777.8	775.5	780.9	769.5	777.4	--	772.7
28.....	771.1	774.9	775.2	771.0	773.2	776.7	777.9	778.4	772.7	778.4	772.3	777.2
29.....	767.5		--	769.9	774.9	775.4	779.8	776.6	774.2	777.2	771.7	779.4
30.....	765.2		776.0	771.2	774.8	--	779.2	776.8	771.9	772.9	777.6	776.8
31.....	766.3		772.0		774.8		--	777.3		774.7		772.3

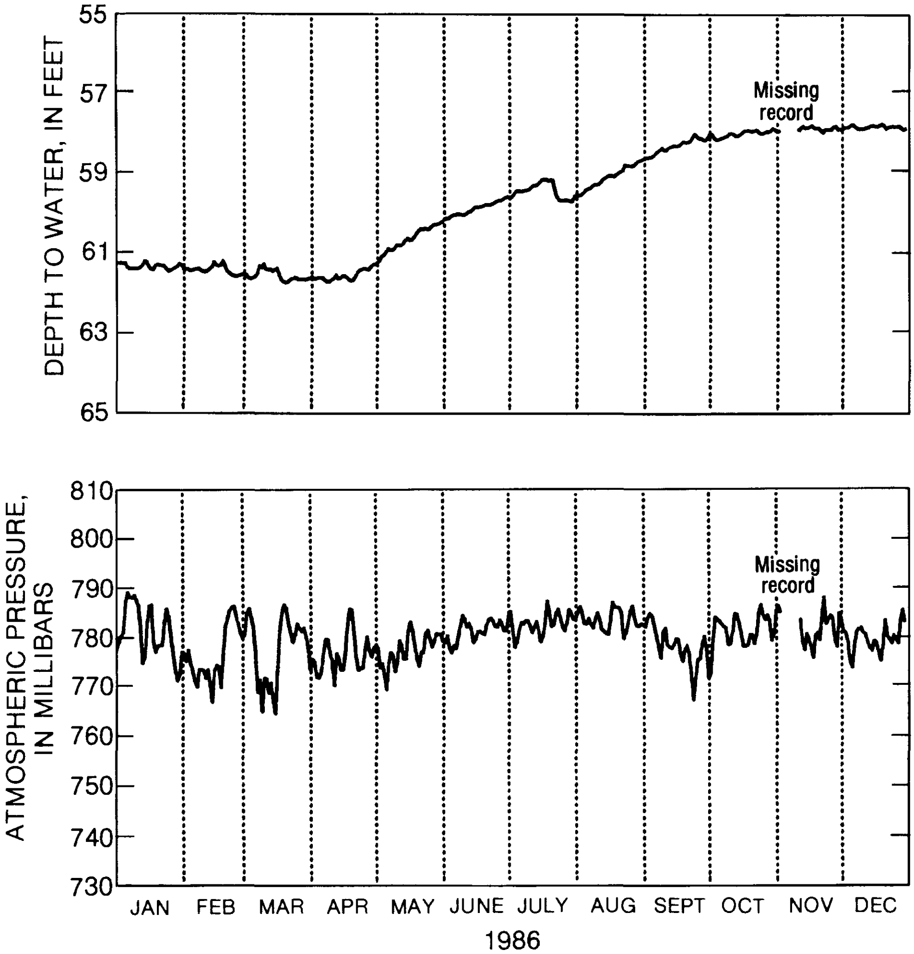

FIGURE 20.-- Mean daily values of water level and atmospheric pressure for Lookout Mountain, LM.

TABLE 27.--*Mean daily depth to water, in feet below datum, in well LM, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	61.26	61.41	61.53	61.59	61.24	60.16	59.61	59.56	58.64	58.03	57.98	57.92
2......	61.24	61.42	61.56	61.65	61.18	60.14	59.61	59.56	58.61	58.03	57.95	57.88
3......	61.27	61.41	61.64	61.65	61.08	60.14	59.54	59.55	58.62	58.13	--	57.87
4......	61.29	61.46	61.65	61.61	61.05	60.08	59.45	59.50	58.61	58.19	--	57.86
5......	61.27	61.44	61.62	61.62	60.97	60.05	59.45	59.44	58.58	58.17	--	57.81
6......	61.38	61.42	61.59	61.63	60.89	60.05	59.46	59.40	58.52	58.14	--	57.80
7......	61.42	61.40	61.51	61.69	60.93	60.02	59.46	59.39	58.47	58.12	--	57.87
8......	61.40	61.40	61.33	61.73	60.93	60.04	59.44	59.34	58.42	58.10	--	57.90
9......	61.40	61.46	61.37	61.72	60.88	60.05	59.42	59.30	58.38	58.08	--	57.92
10.....	61.41	61.47	61.28	61.67	60.79	60.06	59.40	59.29	58.44	58.02	--	57.91
11.....	61.39	61.48	61.41	61.64	60.79	60.02	59.36	59.28	58.44	58.01	57.94	57.89
12.....	61.38	61.45	61.43	61.55	60.81	59.97	59.31	59.23	58.37	58.04	57.87	57.88
13.....	61.32	61.40	61.40	61.64	60.75	59.96	59.30	59.16	58.34	58.09	57.84	57.85
14.....	61.22	61.35	61.46	61.62	60.67	59.92	59.29	59.13	58.33	58.07	57.89	57.83
15.....	61.25	61.24	61.42	61.57	60.63	59.86	59.24	59.09	58.32	58.03	57.88	57.82
16.....	61.36	61.31	61.38	61.57	60.68	59.85	59.18	59.06	58.33	57.99	57.85	57.85
17.....	61.43	61.33	61.53	61.62	60.67	59.86	59.16	59.08	58.31	57.95	57.82	57.84
18.....	61.43	61.31	61.67	61.67	60.60	59.85	59.18	59.10	58.25	57.94	57.89	57.81
19.....	61.32	61.21	61.72	61.70	60.52	59.82	59.21	59.05	58.21	57.94	57.90	57.79
20.....	61.30	61.32	61.74	61.67	60.45	59.79	59.18	59.01	58.24	57.97	57.88	57.83
21.....	61.32	61.46	61.72	61.58	60.40	59.80	59.19	58.98	58.24	57.96	57.95	57.91
22.....	61.33	61.51	61.67	61.48	60.42	59.79	59.42	58.94	58.20	57.93	58.00	57.86
23.....	61.34	61.55	61.64	61.42	60.39	59.78	59.61	58.81	58.12	57.95	57.92	57.85
24.....	61.42	61.58	61.61	61.40	60.42	59.74	59.69	58.82	58.03	58.01	57.93	57.84
25.....	61.47	61.59	61.64	61.38	60.40	59.71	59.70	58.83	58.09	58.03	57.94	57.86
26.....	61.45	61.57	61.67	61.41	60.34	59.68	59.69	58.84	58.15	57.99	57.92	57.85
27.....	61.41	61.56	61.66	61.42	60.29	59.69	59.68	58.83	58.15	57.97	57.85	57.84
28.....	61.38	61.54	61.65	61.34	60.28	59.65	59.69	58.76	58.18	57.98	57.83	57.91
29.....	61.35		61.67	61.28	60.28	59.61	59.72	58.71	58.19	57.95	57.94	57.94
30.....	61.28		61.65	61.27	60.25	59.59	59.72	58.69	58.14	57.88	--	57.90
31.....	61.31		61.62		60.22		59.58	58.67		57.93		57.89

TABLE 28.--*Mean daily atmospheric pressure, in millibars, at site LM, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Ooct	Nov	Dec
1......	779.8	776.9	779.8	773.2	778.4	779.0	784.2	783.6	782.4	771.5	785.0	783.6
2......	777.7	776.6	780.5	775.4	777.5	778.8	785.0	784.8	781.9	772.4	786.2	781.0
3......	778.9	775.0	784.8	774.7	773.5	780.2	781.8	786.0	783.9	779.5	784.9	780.7
4......	780.1	777.2	785.7	771.7	774.5	777.7	777.8	784.8	784.7	783.9	--	778.9
5......	781.0	774.6	783.8	771.6	772.0	776.7	778.8	782.6	784.2	783.4	--	774.9
6......	787.0	772.9	781.9	772.8	769.1	778.2	781.3	782.6	782.0	783.0	--	773.5
7......	789.0	770.9	776.5	776.8	774.7	777.5	782.8	783.7	780.1	782.4	--	778.4
8......	788.0	769.7	768.6	779.6	776.7	780.0	782.6	782.5	777.9	781.9	--	780.7
9......	787.9	773.2	771.2	779.4	776.2	782.2	783.3	781.8	775.6	781.7	--	781.6
10.....	788.4	773.2	764.8	776.5	772.9	784.3	783.2	783.3	781.0	778.4	--	781.8
11.....	787.4	773.0	771.5	775.1	774.9	783.5	782.2	784.8	781.7	778.6	--	780.7
12.....	786.3	771.4	771.3	770.0	779.2	782.0	780.9	783.7	778.3	781.0	783.5	780.3
13.....	782.0	773.2	768.4	776.6	778.3	782.6	781.9	781.3	777.7	784.6	778.8	778.9
14.....	774.6	770.2	770.5	775.7	775.5	781.6	783.1	781.0	777.6	784.4	777.2	777.6
15.....	775.8	766.7	767.1	773.1	775.5	778.9	781.3	780.5	778.4	782.6	780.4	777.1
16.....	782.3	773.0	764.4	773.2	781.0	779.5	778.9	780.4	779.6	780.5	779.5	779.1
17.....	786.3	774.1	772.7	777.1	783.0	781.0	780.0	783.3	779.3	778.0	777.5	778.6
18.....	786.5	773.8	781.2	782.1	781.3	781.2	782.9	786.9	776.4	778.0	775.6	776.8
19.....	779.1	769.6	784.7	785.6	778.4	780.6	787.2	785.9	774.9	778.3	780.1	775.0
20.....	777.0	776.1	786.5	785.4	775.6	780.4	785.2	785.8	777.4	780.4	780.7	778.2
21.....	778.2	782.1	785.7	780.9	774.0	782.4	782.1	785.7	778.1	780.3	779.2	783.3
22.....	778.4	783.7	782.8	775.8	776.9	783.5	782.4	784.8	776.6	778.5	783.9	780.0
23.....	778.4	785.4	780.9	773.1	776.8	783.7	784.7	779.6	772.3	780.3	787.9	779.3
24.....	782.7	786.1	779.0	773.5	780.7	783.2	785.5	780.7	767.0	784.7	782.6	778.6
25.....	785.6	786.2	780.4	773.6	781.3	782.1	784.0	782.8	771.4	786.4	783.5	780.1
26.....	784.1	784.3	782.7	777.0	779.6	781.9	782.1	785.0	775.3	784.4	784.3	779.3
27.....	780.2	782.8	781.7	780.0	778.0	783.4	781.2	786.2	775.5	783.4	783.7	778.6
28.....	776.8	780.8	781.1	777.3	779.1	782.6	782.7	783.7	778.4	784.4	779.2	783.1
29.....	773.3		781.8	775.9	780.6	781.1	785.4	782.1	780.0	783.4	777.8	785.3
30.....	771.0		780.3	777.7	780.5	781.2	784.8	782.1	777.6	779.2	784.7	782.9
31.....	772.0		777.8		780.5		783.5	782.6		780.5		

Wells CH-1, SC-2, and LM show responses to the earthquake sequence during July 20-21 centered in Chalfant Valley about 20 miles east of the wells. Ground-water levels were recorded at 15-minute intervals in well Chance Meadow 2 (CM-2 in fig. 7) using a mechanical system of float and counterweight. The mean daily values of water level for this well are shown in table 29 and in figure 21.

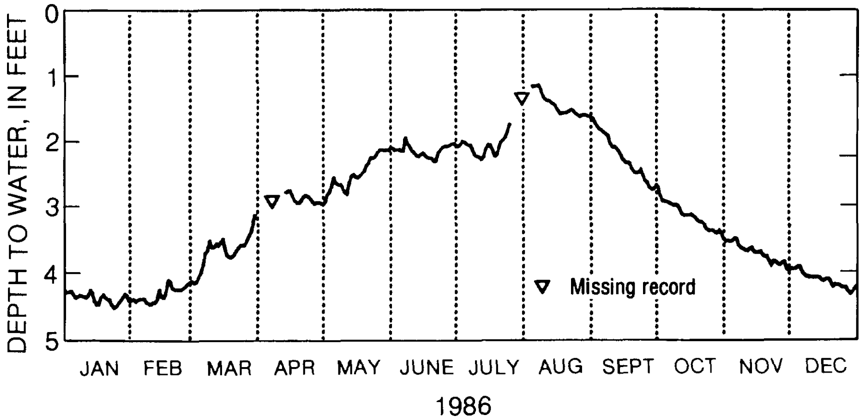

FIGURE 21.-- Mean daily values of water level in well Chance Meadow 2, CM-2.

TABLE 29.--*Mean daily depth to water, in feet below datum, in well CM-2, 1986*

[Mean computed from values recorded at 15-minute intervals; --, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1........	4.4	4.4	4.1	--	3.0	2.1	2.1	--	1.6	2.7	3.5	3.9
2........	4.3	4.4	4.1	--	2.9	2.1	2.1	--	1.7	2.7	3.5	3.9
3........	4.3	4.4	4.2	--	2.8	2.2	2.1	--	1.7	2.8	3.5	3.9
4........	4.3	4.4	4.1	--	2.8	2.1	2.0	--	1.8	2.9	3.5	3.9
5........	4.3	4.4	4.1	--	2.7	2.1	2.0	1.2	1.8	2.9	3.5	3.9
6........	4.3	4.4	4.0	--	2.6	2.2	2.0	1.1	1.8	2.9	3.5	3.9
7........	4.4	4.4	3.9	--	2.7	2.2	2.1	1.1	1.9	3.0	3.5	4.0
8........	4.4	4.4	3.7	--	2.7	2.0	2.1	1.1	1.9	3.0	3.6	4.0
9........	4.3	4.5	3.7	--	2.7	2.1	2.1	1.2	1.9	3.0	3.6	4.0
10.......	4.4	4.5	3.5	--	2.7	2.1	2.2	1.3	2.0	3.0	3.6	4.1
11.......	4.4	4.5	3.6	--	2.8	2.2	2.2	1.4	2.1	3.0	3.7	4.0
12.......	4.4	4.5	3.6	--	2.8	2.2	2.2	1.4	2.1	3.1	3.7	4.1
13.......	4.4	4.5	3.6	--	2.7	2.2	2.3	1.4	2.1	3.1	3.6	4.1
14.......	4.3	4.4	3.6	2.8	2.5	2.2	2.2	1.4	2.2	3.1	3.6	4.1
15.......	4.3	4.3	3.6	2.8	2.5	2.2	2.1	1.4	2.2	3.1	3.7	4.1
16.......	4.4	4.4	3.5	2.8	2.6	2.2	2.1	1.5	2.3	3.1	3.7	4.1
17.......	4.5	4.4	3.6	2.9	2.6	2.2	2.1	1.5	2.3	3.1	3.7	4.1
18.......	4.5	4.3	3.8	2.9	2.5	2.3	2.1	1.6	2.3	3.1	3.7	4.1
19.......	4.4	4.1	3.8	3.0	2.5	2.3	2.2	1.6	2.4	3.2	3.7	4.1
20.......	4.3	4.2	3.8	3.0	2.5	2.3	2.2	1.6	2.4	3.2	3.8	4.1
21.......	4.4	4.3	3.7	2.9	2.4	2.3	2.1	1.6	2.5	3.2	3.7	4.2
22.......	4.4	4.3	3.7	2.9	2.3	2.3	2.0	1.5	2.5	3.2	3.8	4.2
23.......	4.4	4.3	3.6	2.8	2.3	2.2	2.0	1.5	2.5	3.3	3.9	4.2
24.......	4.5	4.3	3.6	2.9	2.3	2.1	1.9	1.5	2.4	3.3	3.8	4.2
25.......	4.5	4.3	3.6	2.9	2.2	2.1	1.8	1.6	2.5	3.4	3.8	4.2
26.......	4.5	4.2	3.6	2.9	2.2	2.1	1.7	1.6	2.6	3.4	3.9	4.2
27.......	4.5	4.2	3.5	3.0	2.1	2.1	--	1.6	2.6	3.4	3.9	4.2
28.......	4.4	4.2	3.5	3.0	2.1	2.1	--	1.6	2.7	3.4	3.8	4.3
29.......	4.4		3.4	2.9	2.1	2.0	--	1.6	2.7	3.4	3.8	4.3
30.......	4.3		3.3	3.0	2.2	2.0	--	1.6	2.7	3.4	3.9	4.3
31.......	4.4		3.1		2.1		--	1.6		3.4		4.2

Well Inventory

Information on wells not included in the previous well inventories by Farrar and others (1985, 1987) is given in table 30. Well locations are shown in figure 22 and are given by township, range, and section following the numbering system shown in figure 23.

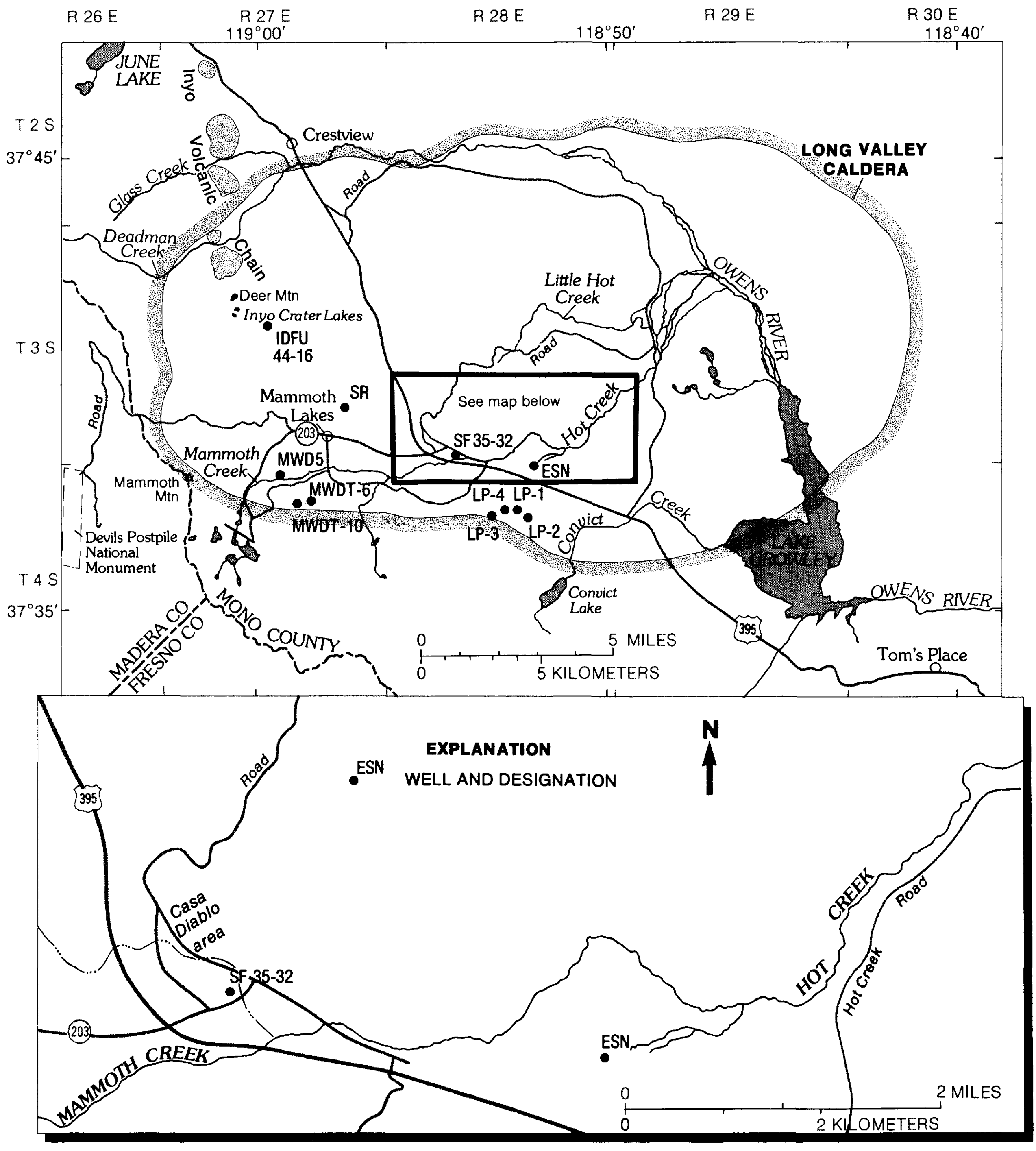

FIGURE 22.-- Location of wells with construction information given in table 30.

TABLE 30.--*Description of wells completed during 1986 in Long Valley area, and wells completed before 1986 but not listed in Farrar and others (1985, 1987)*

<u>Well</u>: Designation used in figures and tables throughout report.
<u>Location</u>: Township, range, section, and quarter section referenced to Mount Diablo base line and meridian.
<u>Date completed</u>: Date drilling completed.
<u>Altitudes</u>: In feet (rounded to nearest foot) above sea level. Altitude of M.P. (measuring point - generally top of casing) as surveyed, except values in parentheses, which were picked from topographic maps with 80- or 40-foot contour intervals. Altitude of W.L. (water level), based on average depth to water.
<u>Accessible depth</u>: Depth to sediment-filled bottom.
<u>Casing</u>: Nominal diameter in inches × length or depth interval in feet; SC, surface conductor.
<u>Zone of perforations</u>: Depth zone of perforations or openings in casing.
<u>Logs</u>: L, lithologic; T, temperature; G, geophysical; D, drillers; P, pressure.
--, information not available.

Well	Location	Date completed	Altitudes M.P./W.L. (feet)	Drilled depth (feet)	Accessible depth (feet)	Casing	Zone of perforations (feet below land surface)	Logs	Comments
IDFU 44-16	3S/27E-16L	1-86	(8,040)/(7,290)	5,900	4,900	9.6×3,889 7×2,990-5,509	3,318-5,079	L,T,G,D,P	Exploration well drilled by Unocal Geothermal.
SR	3S/27E-25E	6-86	7,788/7,345	2,345	1,280	5×300 3.1×892 2.4×1,398	1,110-1,120	L,T,G,D	Research drill hole funded by U.S. Department of Energy and California State Energy Commission. Drilled near Shady Rest Campground.
SF 35-32	3S/28E-32K	1986	7,285/7,302	487	487	16×365 13.4×325-487	380-487	L,T,D,P	Production well drilled by Pacific Lighting Energy Systems for PLES-1 powerplant.
ESN	3S/28E-34R	10-76	(7,080)/(7,076)	75	--	--	--	D	Production well drilled for elementary school near Hot Creek Fish Hatchery. Fifty gallons per minute capacity.
MWD-5	4S/27E-3E	10-82	(7,956)/(7,953)	360	360	12.6×23 8.6×358	60-113 113-358	L,D	Production well drilled for Mammoth County Water District. Gravel packed, slotted casing.
MWDT-10	4S/27E-3Q	10-86	(7,930)/(7,916)	710	--	SC×9	9-710 (open hole)	L,D	Test hole drilled for Mammoth County Water District.
MWDT-6	4S/27E-3R	9-86	(7,905)/(7,907)	660	--	SC×40	40-660 (open-hole)	L,D	Test hole drilled for Mammoth County Water District. Artesian flow encountered.
LP-1	4S/29E-10D	10-5-80	7,126/7,113	25	25	6×25	5-25	L	Observation well for reclaimed water infiltration pond. Referred to as LP in Farrar and others (1985, 1987)
LP-4	4S/29E-10D	11-6-80	(7,126)(7,118)	23	23	6×23	5-23	L	Observation well for reclaimed water infiltration pond.
LP-3	4S/29E-10E	11-6-80	(7,126)(7,120)	23	23	6×23	5-23	L	Observation well for reclaimed water infiltration pond.
LP-2	4S/29E-10F	11-5-80	(7,126)/(7,114)	25	25	6×23	5-23	L	Observation well for reclaimed water infiltration pond.

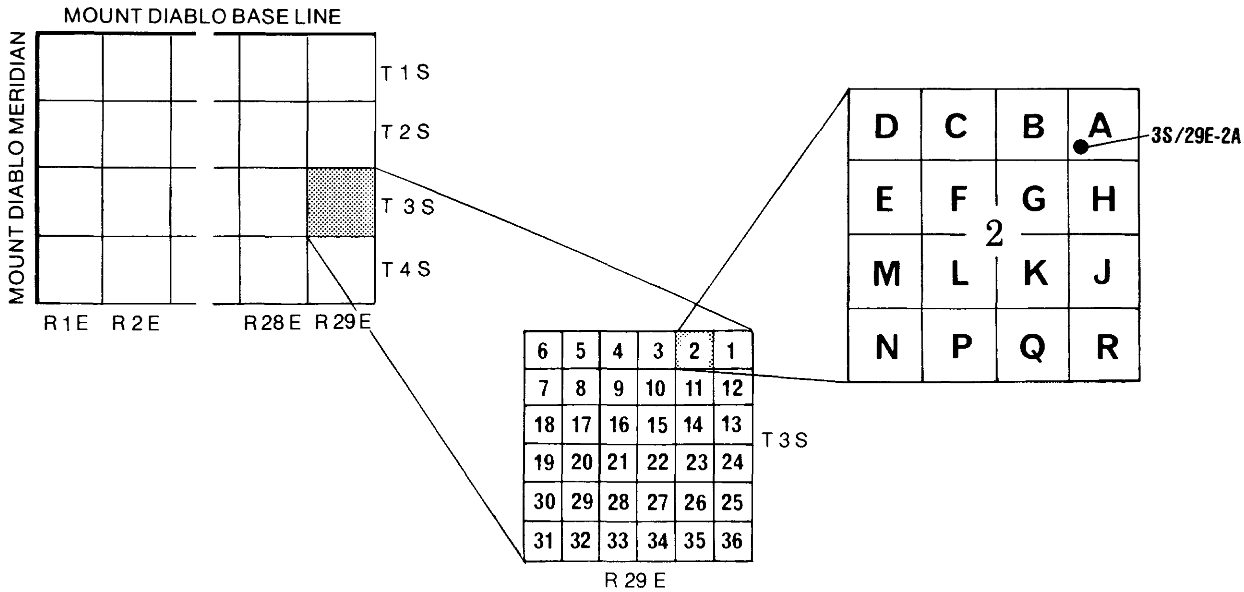

FIGURE 23. -- Well numbering system.

Wells are assigned numbers according to their location in the system for the subdivision of public land. For example, in the well number 3S/29E-2A the part of the number preceding the slash indicates the township (T. 3 S.), the part between the slash and the hyphen indicates the range (R. 29 E.), the number between the hyphen and the letter indicates the section (sec. 2), and the letter indicates the 40-acre subdivision of the section.

Periodic Water-Level Measurements

Depths to water in a network of 49 wells (fig. 24) were measured three times during 1986 (table 31) to assess seasonal variations and long-term trends in the water-table altitude.

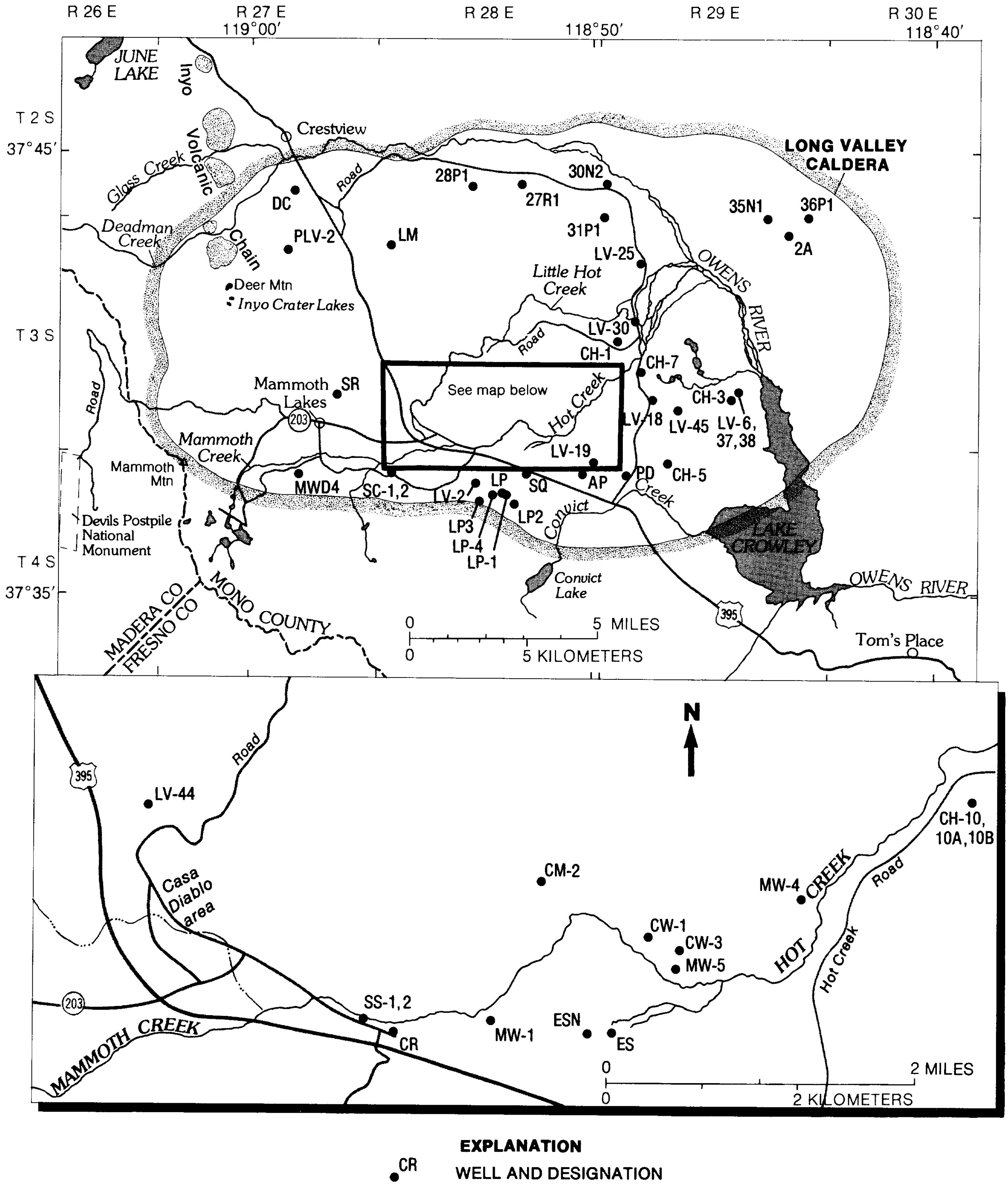

FIGURE 24.-- Location of wells in ground-water-level network.

TABLE 31.--*Water-level measurements in selected wells in Long Valley caldera, 1986*

[Well: Designation used in figures and tables throughout report. Measuring-point altitude: Altitude (rounded to nearest foot) above sea level from leveling done during July-August 1984 and October 1984, except for values in parentheses, which were estimated from topographic maps. Location: Township range, section, and quarter section referenced to Mount Diablo base line and meridian. Depth to water: Depth given in feet below measuring point. Significant figures shown indicate precision of measurement; --, information not available]

Well	Altitude of measuring point (ft)	Location	Depth to water, in feet below measuring point					
			Date	Depth to water	Date	Depth to water	Date	Depth to water
DC	7,515	2S/27E-34A	5-10	201.7	6-19	183.2	9- 1	179.1
27R1	7,041	2S/28E-27R1	5-10	35.13	8-31	35.24	11-29	34.86
28P1	7,110	2S/28E-28P1	5-10	75.97	8-31	81.25	11-29	79.56
30N2	6,914	2S/29E-30N2	5-10	4.75	8-31	8.23	11-29	8.41
31P1	6,916	2S/29E-31P1	5-10	2.10	8-31	4.22	11-29	3.54
35N1	(6,914)	2S/29E-35N1	5-20	2.17	8-31	4.51	11-29	2.95
36P1	(6,980)	2S/29E-36P1	5-20	70.0	8-31	69.97	11-29	71.51
PLV-2	(7,734)	3S/27E-3K	5-22	424.8	8-22	415.9	12-10	417.32
LM	7,330	3S/28E-6L	5-10	60.79	9- 1	58.62	12- 9	57.91
FP-1	7,300	3S/28E-15A	5-10	278.	8-27	277.1	11-29	278.5
LAV-1	7,205	3S/28E-15P	5-10	0	8-27	0	--	--
CH-6	7,249	3S/28E-22C	5-10	205.1	8-27	203.05	11-29	204.36
SS-1	7,179	3S/28E-33P	5-21	18.03	8-30	18.27	12-10	24.69
SS-2	7,180	3S/28E-33P	5-21	7.74	8-30	7.79	12-10	11.27
CR	7,162	3S/28E-33Q	5-21	11.05	9- 2	13.98	12-10	19.08
LV-44	(7,340)	3S/28E-30R	5-21	.10	8-30	.24	12-10	.32
CM-2	(7,077)	3S/28E-34C	5-12	2.66	8-27	0.75	11-16	2.80
ES	(7,090)	3S/28E-34R	5-12	14.75	8-30	15.35	11-18	16.45
ESN	(7,080)	3S/28E-34R	--	--	8-30	3.98	11-18	5.34
CW-1	(7,089)	3S/28E-35E	5-10	12.93	8-27	11.26	11-16	12.75
MW-4	7,082	3S/28E-35A	5- 9	45.5	8-12	43.60	11-11	44.50
CW-3	7,062	3S/28E-35E	5-10	3.85	9- 1	1.82	11-16	3.71
MW-5	7,057	3S/28E-35F	5-10	3.54	9- 1	3.01	11-16	4.09
2A	6,922	3S/29E-2A	5-20	3.58	8-31	4.01	11-29	3.82
LV-25	6,875	3S/29E-7A	5-10	5.82	8-31	6.74	11-29	8.74
LV-30	6,896	3S/29E-18G	5-10	1.78	8-31	4.88	11-29	6.50
CH-1	6,972	3S/29E-19C	5-21	40.54	8-30	40.07	11-20	41.05
CH-7	6,957	3S/29E-19R	5-12	4.09	8-30	5.45	12-10	5.58
CH-3	6,882	3S/29E-27L	5-20	6.50	8-30	7.93	12-10	7.69
LV-6	(6,870)	3S/29E-27L1	5-20	5.74	8-30	7.15	12-10	6.70
LV-37	(6,870)	3S/29E-27L2	5-20	6.89	8-30	8.28	12-10	7.81
LV-38	(6,870)	3S/29E-27L3	5-20	6.85	8-30	8.88	12-10	8.28
LV-18	6,966	3S/29E-29M	5-12	14.29	8-30	17.04	12-10	17.84
LV-45	6,985	3S/29E-29R	5-20	27.30	8-30	28.24	12-10	30.32
CH-10	7,076	3S/29E-30E	5-12	70.66	8-30	69.6	11-17	70.55
CH-10A	7,080	3S/29E-30E	5-12	74.92	8-30	74.10	11-17	74.86
CH-10B	7,080	3S/29E-30E	5-12	74.70	8-30	73.90	11-17	74.58
MWD-4	(7,898)	4S/27E-3J	--	--	8-30	22.81	12-10	24.33
LV-19	(7,085)	4S/28E-1F	--	--	--	--	11-13	34.40
AP	7,090	4S/28E-1M	5-12	23.15	8-30	20.74	11-24	23.63
SQ	7,102	4S/28E-3J	6- 8	10.55	8-31	11.19	11-16	14.79
LV-2	7,168	4S/28E-4P	5-21	31.95	8-31	29.87	11-16	34.30
SC-1	7,471	4S/28E-6L	5- 8	96.74	8-30	100.36	11-20	106.93
SC-2	7,472	4S/28E-6L	5- 8	115.09	8-30	114.95	11-20	117.21
LP-4	(7,126)	4S/28E-10D	5-21	7.69	8-31	6.24	11-19	9.78
LP-1	7,162	4S/28E-10D	5-21	12.23	--	--	11-19	14.73
LP-2	(7,162)	4S/28E-10F	5-21	11.11	--	--	11-19	13.33
CH-5	6,931	4S/29E-5G	5- 8	44.29	8-30	43.57	11-17	43.61
PD	7,014	4S/29E-6K	5-21	21.09	8-30	20.19	12-10	22.09

Daily Precipitation

Daily precipitation records (tables 32 and 33) are given for two sites (fig. 7). The gage at Little Hot Creek, LHC, is in the central part of the caldera at an altitude of 6,960 feet. One day of missing record occurred on July 24. The gage at Mammoth Ranger Station, PGR, is in the southwest part of the caldera at an altitude of 7,840 feet. Records for both sites were collected by the U.S. Forest Service using weighing-type recording rain gages.

TABLE 32.--*Precipitation, in inches, at Little Hot Creek, LHC, 1986*

[--, missing record]

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1......	0.0	0.01	0.0	0.0	0.0	0.92	0.0	0.0	0.0	0.0	0.0	0.0
2......	.0	.04	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3......	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4......	.67	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5......	.27	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6......	.0	.0	.0	.29	.0	.0	.0	.0	.0	.0	.0	.06
7......	.0	.0	.09	.10	.0	.0	.0	.0	.0	.0	.0	.0
8......	.0	.0	1.75	.0	.0	.0	.0	.0	.0	.0	.0	.0
9......	.0	.0	.37	.0	.0	.0	.0	.0	.0	.0	.0	.0
10.....	.0	.0	.39	.0	.0	.0	.0	.05	.0	.0	.0	.0
11.....	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
12.....	.0	1.52	.04	.03	.0	.0	.0	.0	.0	.0	.0	.0
13.....	.0	.27	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
14.....	.0	1.51	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15.....	.0	1.47	.20	.04	.0	.0	.0	.0	.0	.0	.0	.0
16.....	.0	.35	.18	.0	.0	.0	.0	.0	.0	.0	.0	.0
17.....	.0	.94	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18.....	.0	1.03	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
19.....	.0	1.20	.0	.0	.0	.0	.0	.0	.0	.0	.0	.02
20.....	.0	.06	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
21.....	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
22.....	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
23.....	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
24.....	.0	.0	.0	.0	.0	.0	--	.0	.18	.0	.0	.0
25.....	.0	.0	.0	.0	.0	.0	.0	.0	.01	.0	.0	.0
26.....	.0	.0	.0	.0	.0	.0	.0	.05	.0	.0	.0	.0
27.....	.0	.0	.0	.0	.0	.0	.0	.0	.04	.0	.0	.0
28.....	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
29.....	.53		.0	.0	.15	.0	.0	.0	.0	.0	.0	.0
30.....	.47		.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
31.....	.06		.0		.33		.0	.0		.0		.0
TOTAL:	2.00	8.40	3.02	0.46	0.48	0.92	0	0.10	0.23	0	0	0.08
MAX:	.67	1.52	1.75	.29	.33	.92	0	.05	.18	0	0	.06
YEARLY TOTAL:	15.69											

TABLE 33.--*Precipitation, in inches, at Mammoth Ranger Station, PGR, 1986*

Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1.......	0.0	0.0	0.0	0.16	0.0	0.0	0.0	0.0	0.0	0.04	0.0	0.0
2.......	0	.20	.03	0	0	0	0	0	0	0	0	0
3.......	.10	.13	0	0	.20	0	0	0	0	0	0	0
4.......	1.12	0	0	0	0	0	0	0	0	0	0	0
5.......	.12	0	0	.13	.10	0	0	0	0	0	0	.05
6.......	0	.08	0	.24	.15	0	0	0	0	0	0	.35
7.......	0	0	.47	.07	0	0	0	0	0	0	0	0
8.......	0	0	1.85	0	0	0	0	0	0	0	0	0
9.......	0	0	.15	0	0	0	0	0	0	0	0	0
10......	0	0	.67	0	0	0	0	0	0	0	0	0
11......	0	.01	.02	0	0	0	0	0	0	0	0	0
12......	0	2.50	.15	.20	0	0	0	0	0	0	0	0
13......	0	1.06	.05	0	0	0	0	0	0	0	0	0
14......	.08	1.53	0	0	0	0	0	0	0	0	0	0
15......	0	1.56	.48	.09	0	0	0	0	0	0	0	0
16......	0	1.09	.21	.08	0	0	0	0	0	0	0	0
17......	.05	1.30	0	0	0	0	0	0	.15	0	0	0
18......	0	2.57	0	0	0	0	0	0	.08	0	0	0
19......	0	1.61	0	0	0	0	0	0	0	0	0	.06
20......	.03	.22	0	0	0	0	0	0	0	0	0	0
21......	0	0	0	0	0	0	0	0	0	0	0	0
22......	0	0	0	0	0	0	0	0	0	0	0	0
23......	0	0	0	0	0	0	0	0	.10	0	0	0
24......	0	0	0	0	0	0	0.30	0	.47	0	0	0
25......	0	0	0	0	0	0	0	0	0	0	0	0
26......	0	0	0	0	0	0	0	0	0	0	0	0
27......	0	0	0	0	0	0	0	0	0	0	0	0
28......	0	0	0	0	0	0	0	0	0	0	.04	0
29......	.33		0	0	.20	0	0	0	0	0	0	0
30......	1.17		0	0	0	0	0	0	0	0	0	0
31......	.05		0		.50		0	0		0		0
TOTAL:	3.05	13.85	4.08	0.97	1.15	0	0.30	0	0.80	0.04	0.04	0.04
MAX:	1.17	2.57	1.85	.24	.50	0	.30	0	.47	.04	.04	.35
YEARLY TOTAL:	24.75											

REFERENCES CITED

Bezore, S.P., and Sherburne, R.W., 1985, Monitoring geothermal wells and spring conditions in selected areas of California for earthquake precursors: California Division of Mines and Geology, Final Technical Report, Open-File Report 85-12, 56 p.

Farrar, C.D., Sorey, M.L., Rojstaczer, S.A., Janik, C.J., Mariner, R.H., Winnett, T.L., and Clark, M.D., 1985, Hydrologic and geochemical monitoring in Long Valley caldera, Mono County, California, 1982-84: U.S. Geological Survey Water-Resources Investigations Report 85-4183, 127 p.

_____1987, Hydrologic and geochemical monitoring in Long Valley caldera, Mono County, California, 1985: U.S. Geological Survey Water-Resources Investigations Report 87-4090, 71 p.

Miller, C.D., Mullineaux, D.R., Crandell, D.R., and Bailey, R.A., 1982, Potential hazards from future volcanic eruptions in the Long Valley-Mono Lake area, east-central California and southwest Nevada--A preliminary assessment: U.S. Geological Survey Circular 877, 10 p.

Savage, J.C., and Cockerham, R.S., 1987, Quasi-periodic occurrence of earthquakes in the 1978-1986 Bishop-Mammoth Lakes sequence, eastern California: Bulletin of the Seismological Society of America, v. 77, no. 4, p. 1347-1358.

Skougstad, M.W., Fishman, M.J., Friedman, L.C., Erdmann, D.E., and Duncan, S.S., eds., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A1, 626 p.

Sorey, M.L., and Clark, M.D., 1981, Changes in the discharge characteristics of thermal springs and fumaroles in the Long Valley caldera, Mono County, California, resulting from earthquakes on May 25-27, 1980: U.S. Geological Survey Open-File Report 81-203, 22 p.

Sorey, M.L., Farrar, C.D., and Wollenberg, H.A., eds., 1984, Proceedings of the workshop on hydrologic and geochemical monitoring in the Long Valley caldera: Lawrence Berkeley Laboratory Report LBL 20020, 82 p.

_____1986, Proceedings of the second workshop on hydrologic and geochemical monitoring in the Long Valley caldera: Lawrence Berkeley Laboratory Report LBL 22852, 80

Sorey, M.L., and Lewis, R.W., 1976, Convective heat flow from hot springs in the Long Valley caldera, Mono County, California: Journal of Geophysical Research, v. 81, no. 5, p. 785-791.

U.S. Forest Service, 1980-84, Water-resources data for Mammoth Ranger District, Inyo National Forest, California: Unpublished annual reports.