U. S. GEOLOGICAL SURVEY
Reston, VA 22092

Date 3-22-91

Memorandum

To: Books and Open File Reports Section

From: Chief, Office of Scientific Publications

Subject: New USGS open-file report

The following report was authorized by Henry Spall for the Director on 2/22/91 for release in the open files:

Project Number: 9980-03401 (M91-424)

TITLE: Composition of Waters from the Research Drill Hole at Summit of Kilauea Volcano and of Selected Thermal and Non-Thermal Groundwaters, Hawaii

AUTHOR: Robert I. Tilling, Blair F. Jones

CONTENTS: 28 p., _____ over-size sheets (i.e., larger than 8 1/2 by 14 inches)

Map Scale: _____

DEPOSITORIES

(NC) USGS Library, Room 4A100, 12201 Sunrise Valley Dr., Reston, VA 22092
(Da) USGS Library, RoomcC2002, Bldg.20, Denver Federal Center, Lakewood, CO 80225
(Mail address: Stop 914, Box 25046, Federal Center, Denver, CO 80225
(M) USGS Library, 345 Middlefield Rd., Menlo Park, CA 94025

(SF) USGS, Room 504, Custom House, 555 Battery Street, San Francisco, CA 94111
(LA) USGS, Room 7638, Federal Bldg., 300 North Los Angeles Street, Los Angeles, CA 90012

PRICE:	ORIGINATING OFFICE	Release date: MARCH 1991
Fiche $_____	Name: USGS, BWTR, MS 951, Menlo Park, CA	Area: HAWAII
Paper $_____	Telephone: FTS 459-5038	OFR No. 91-133 A

Note for List of New Publications

Open-File Report 91-133-A and -B. Composition of waters from the research drill hole at summit of Kilauea Volcano and of selected thermal and non-thermal groundwaters, Hawaii, by Robert I. Tilling and Blair F. Jones. 1991. 27 p.

This report presents analytical data--chemical and isotopic (δO^{18} and δD)--and other information on water samples collected during the period 1973-1976 from a 1262-m (4137-ft) deep research borehole at the summit of Kilauea Volcano, Hawaii. To facilitate comparison of the summit-borehole data, analytical data on selected water samples from the State of Hawaii (mostly from the Island of Hawaii) are also presented. This report is issued both as paper copy (Open-File Report 91-133-A) and as 3.5-inch diskette (Open-File Report 91-133-B). The diskette version requires an Apple II or Macintosh II; the text, which includes inserted graphics (Figs. 1-3), is in Microsoft Word, v. 4.0.

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Composition of Waters from the Research Drill Hole at Summit of Kilauea Volcano and of Selected Thermal and Non-Thermal Groundwaters, Hawaii

by

Robert I. Tilling[1]

and

Blair F. Jones[2]

Open-File Report 91-133-A

[1]Menlo Park, California 94025

[2]Reston, Virginia 22092

INTRODUCTION

Kilauea, on the Island of Hawaii (Fig. 1), is the one of the most active volcanoes in the world, and the current eruption on its east rift zone, which began in January 1983, continues unabated (Wolfe, 1988; Moulds and others, 1990) as of this writing (January 1991). In February 1972, George V. Keller (Department of Geophysics, Colorado School of Mines) submitted a proposal to the National Science Foundation (NSF) to drill a

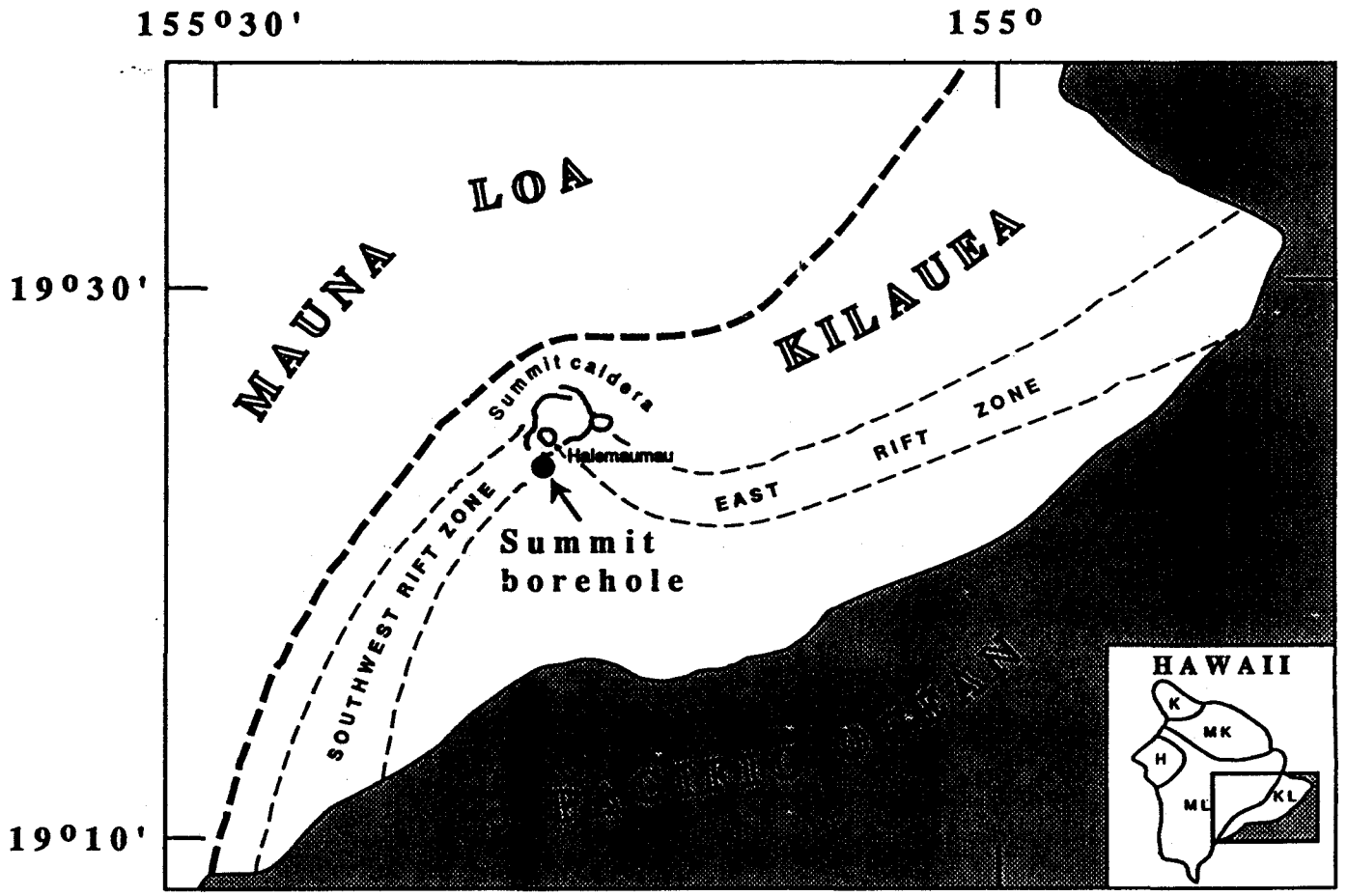


Figure 1. Sketch map showing the location of the research borehole at the summit of Kilauea Volcano, Hawaii, drilled during the period April-July 1973, and neighboring Mauna Loa Volcano. Kilauea is the southeastern-most and youngest of the five volcanoes that make up the Island of Hawaii (see inset): K, Kohala; MK, Mauna Kea; ML, Mauna Loa; H, Hualalai, KL, Kilauea. Beginning in 1976, a number of deep geothermal exploration and scientific observation wells have been completed in the lower part of Kilauea's east-rift zone (see Thomas, 1987; Thomas and others, 1990).

SAMPLING AND TEMPERATURE MEASUREMENT

In-hole temperature logs suggested that drilling-induced thermal disturbance of the summit borehole had largely, or possibly completely, dissipated by early August 1973, about a month after cessation of drilling on 9 July 1973 (Keller and others, 1979, Fig. 14). However, to allow additional time for total elimination of drilling effects, sampling (Fig. 2) was not initiated until 4 September 1973, nearly two months after well completion .

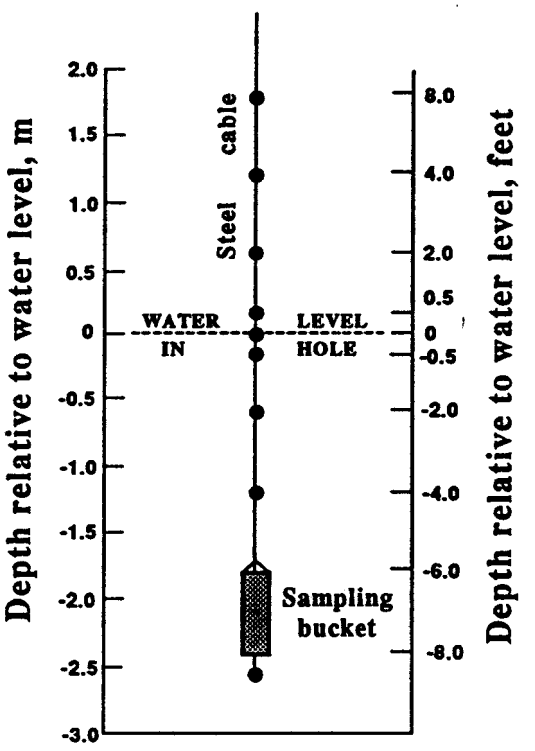


Figure 2. Diagram showing a typical configuration used to sample water from the top of the water column (i.e., the regional water table) in the summit borehole; the dots along the cable indicate the positions of maximum thermometers used to determine the temperature profile in the immediate vicinity of the water table (see Figure 3). The water level in the hole, arbitrary designated "0" for convenience, is about 488 m (~ 1,600 ft) below the ground surface, with little measurable variation. Seasonal fluctuation in the water level possibly is suggested by the observation that the level on 08/27/74 (summer "dry" season) was about 4 feet (~ 1.2 m) lower than that on 02/21/74 (winter "wet" season). Geophysical surveys indicate that the water level in the hole coincides with the regional high-level water table at Kilauea's summit (Jackson and Lenat, 1989; Jackson and Kauahikaua, 1990).

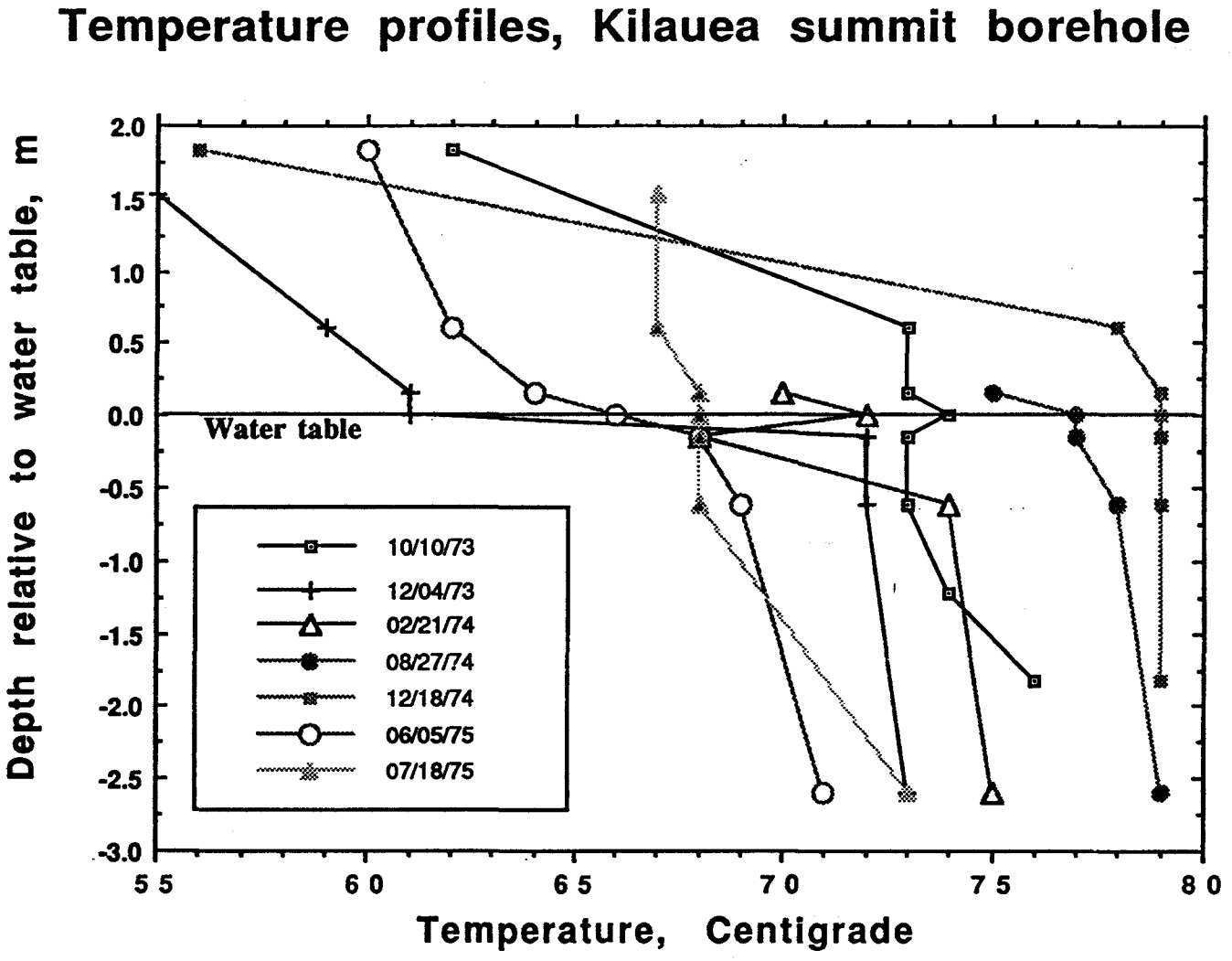


Figure 3. Temperature profiles in the borehole a few meters above and below the regional water level. The lowest air temperatures above the water level were registered for the 12/04/73 profile, measured just two days after 14.6 inches of rain fell in a 3-day period (11/30/73-12/02/73).

REFERENCES

Bodine, M. W., Jr., and Jones, B.F., 1986, The salt norm: A quantitative chemical-mineralogical characterization of natural waters: U.S. Geological Survey, Water Resources Investigations Report 86-4086, 130 p.

Coplen, T.B., 1973, A double-focusing, double-collecting mass spectrometer for light stable isotope ratio analysis: International Journal of Mass Spectrometry Ion Physics, v. 11, p. 37-40.

Dodge, F.C.W., Millard, H.T., Jr., and Elsheimer, H.N., 1982, Compositional variations and abundances of selected elements in granitoid rocks and constituent minerals, central Sierra Nevada batholith, California: U.S. Geological Survey Professional Paper 1248, 24 p.

Jackson, D.B., and Lenat, J.-F., 1989, High-level water tables on Hawaiian type volcanoes and intermediate depth geoelectric structures, Kilauea Volcano, Hawaii and Piton de la Fournaise Volcano, Isle de la Reunion [abstract]: Abstracts Volume, IAVCEI General Assembly on Continental Magmatism, 25 June-1 July 1989, Santa Fe, New Mexico: Bulletin 131, New Mexico Bureau of Mines & Mineral Resources, p. 142.

Jackson, D.B., and Kauahikaua, Jim, 1990, The high-level water table beneath Kilauea Volcano, Hawai'i [abstract]: Transactions, American Geophysical Union, Eos, v. 71, no. 43, p. 1676.

Jones, B.F., and Bodine, M.W., Jr., 1987, Normative salt characterization of natural waters, in Fritz, P., and Frape, S.K., eds., Saline water and gases in crystalline rocks: Geological Association of Canada Special Paper 33, p. 5-18.

Keller, G.V., Murray, J.C., and Towle, G.H., 1974a, Geophysical logs from the Kilauea geothermal research drill hole: Proceedings, Society of Professional Well Log Analysts, June 2-5, 1974, v. 15. p. 1-17.

Keller, G.V., Murray, J.C., Skokan, J.J., and Skokan, C.K., 1974b, CSM research drill hole at summit of Kilauea volcano: Mines Magazine, v. 64, no. 5, p. 14-18.

Keller, G.V., Murray, J.C., Zablocki, C.J., Tilling, R.I., Peterson, D.W., and Christiansen, R.L., 1976, Deep research drillhole at Kilauea Volcano, Hawaii--Summary, in Halbouty, M.T., Maher, J.C., and Lian, H.M., eds., Proceedings, Circum-Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii, August 1974: Memoir 25, American Association of Petroleum Geologists, p. 154-155.

Zablocki, C.J., Tilling, R.I., Peterson, D.W., Christiansen, R.L., Keller, G.V., and Murray, J.C., 1974, A deep research drill hole at the summit of an active volcano, Kilauea, Hawaii: Geophysical Research Letters, v. 1, no. 7, p. 323-326.

Zablocki, C.J., Tilling, R.I., Peterson, D.W., Christiansen, R.L., and Keller, G.V., 1976, A deep research drill hole at Kilauea Volcano, Hawaii: U.S. Geological Survey Open-File Report 76-538, 35 pp.

Zielinski, R.A., Lipman, P.W., and Millard, H.T., Jr., 1977, Minor-element abundances in obsidian, perlite, and felsite of calc-alkalic rhyolites: American Mineralogist, v. 62, nos. 5-6, p. 426-437.

TABLE 2. INFORMATION ON OTHER SAMPLES FROM THE ISLAND OF HAWAII ANALYZED IN THIS STUDY

Sample No.	Date(s) Collected	Temp. (°C)	Field pH	Lab. pH	Remarks
PSM-1	05/16/74	18	---	7.60	Pumped well water from Puna Sugar Mill, Olaa
WR-1	03/10/75	---	---	8.31	Wright Road borehole # 1, Volcano Village; total depth, 105 m, water level, 99 m
WR-3	03/10/75	---	---	7.94	Wright Road borehole # 3, Volcano Village; total depth, 111 m, water level, 101 m
WR-4	03/10/75	---	---	7.93	Wright Road borehole # 4, Volcano Village; total depth, 99 m, water level, 79 m
HVO-1	04/24/76-04/27/76	---	---	4.25	Aggregate sample of rainfall collected at the Hawaiian Volcano Observatory in the period April 24-27, 1976
HVO-2	05/03/76-06/01/76	---	---	5.04	Aggregate sample of rainfall collected at the Hawaiian Volcano Observatory on May 3, 20, 21, and June 1, 1976.
ERZ-1	07/22/76	---	---	5.52	Side-stream sample (mixture of brine and steam condensate) taken during extended production testing of geothermal well HGP-A, lower east-rift zone, Kilauea Volcano
MLS-1	08/04/76	---	---	6.35	Permafrost crack water, rim of Mokuaweoweo caldera, summit of Mauna Loa Volcano
HILEA-1	08/10/76	15	7.2	7.03	Hilea Gulch tributary, near Honuapo, SE flank of Mauna Loa Volcano; discharge 0.18 cfs at time of sampling
WLK-1	10/19/76	16	---	7.01	Wailuku River, near Humu'ula station 7017.5, saddle area between Mauna Kea and Mauna Loa Volcanoes; stream not flowing at time of collection--estimated date of stoppage ~1 week before sampling
MLS-2	06/06/78	---	---	---	Permafrost crack water, rim of Mokuaweoweo caldera, summit of Mauna Loa Volcano

TABLE 4. CHEMICAL ANALYSES OF OTHER WATER SAMPLES COLLECTED FOR THIS STUDY

[Concentrations of chemical constituents in mg/L; analysts: Shirley Rettig for element concentrations, Tyler B. Coplen for isotopic ratios]

Sample No.	Date Collected	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	B	PO_4	SiO_2	TDS	Sp. Cond.	Lab. pH	$\delta^{18}O$ (‰ SMOW)	δD (‰ SMOW)
PSM-1	05/16/74	5.1	2.8	6.5	2.0	35	8.2	3.5	0.1	0.12	0.09	36	82	88	7.6	-3.78	-18.4
WR-1*	03/10/75	18	12	7.1	2.3	129	3.0	3.0	0.2	0.01	0.00	50	159	212	8.31		
WR-3*	03/10/75	22	13	6.8	1.4	154	2.2	2.2	0.2	0.00	0.04	54	178	250	7.94	-4.49	-21.1
WR-4*	03/10/75	17	11	6.2	1.7	126	2.8	2.3	0.2	0.00	0.11	52	155	207	7.93	-4.61	-21.3
HVO-1	04/24/76-04/27/76	0.5	0.1	2.6	0.1	0	7.3	1.2	---	---	---	1.0	---	---	4.25	-4.89	-24.5
HVO-2	05/03/76-06/01/76	0.2	0.0	0.2	0.0	1	0.7	0.8	---	---	---	0	---	---	5.04	---	-20.9
ERZ-1*	07/22/76	35	0.4	552	70	136	87	950	0.4	0.83	0.54	296	2190	2930	5.52	---	---
MLS-1*	08/04/76	4.2	1.1	5.3	2.0	12	19	3.6	0.2	0.00	0.02	12	56	100	6.35	-12.5	-91.5
HILEA-1	08/10/76	3.8	2.2	3.3	0.7	19	6.7	4.4	0.1	0.02	---	14	50	56	7.03	---	---
WLK-1*	10/19/76	1.9	1.9	2.0	0.8	18	0.2	1.6	---	0.02	---	9.2	18	33	7.01	---	---
MLS-2	06/06/78	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-12.53	-91.5

* Notes:
(1) WR-1: Sr, 0.15; NH_4^+, 0.24.
(2) WR-3: Sr, 0.14; NH_4^+, 0.09.
(3) WR-4: Sr, 0.12; NH_4^+, 0.07.
(4) ERZ-1: NO_3, 1.2; Sr, 0.2; Li, 0.2; Fe (T), 3.3; $S^=$as H_2S, 42.
(5) MLS-1: NO_3, 0.4; Sr., 0.0; Li, 0.0; Fe (T), 0.02, $S^=$as H_2S, 0.06.
(6) WLK-1: Fe (T), 0.07.

TABLE 6. INSTSRUMENTAL NEUTRON-ACTIVATION ANALYSES (INAA) OF WATER AND DRILLING MUD SAMPLES FROM SUMMIT BOREHOLE, KILAUEA VOLCANO, HAWAII

[Concentrations in ppm; -.-, below detection level or poor counting statistics. Analysts: R.J. Knight and H.T. Millard, Jr.]

	Drilling mud (original, dry)	Water samples from borehole						Drilling water
Sample No.	ZTEL-7*	KELL-1*	KELL-2	KELL-4	KELL-6	KELL-8	KELL-10	PSC*
Date Collected	Before 06/15/73	06/15/73	06/23/73	06/28/73	07/03/73	07/05/73	07/08/73	05/16/74
Cs	0.392	0.018	0.024	0.006	-.-	-.-	-.-	-.-
Rb	14.4	0.3	-.-	0.5	-.-	0.5	-.-	0.3
Ba	382	9.0	37.9	7.3	-.-	4.8	16.3	-.-
Sr	246	-.-	-.-	-.-	-.-	-.-	-.-	0.3
K	4410	-.-	-.-	-.-	-.-	41	-.-	40
Na	19700	31	24	33	25	33	54	27
Th	33.7	0.01	0.02	-.-	-.-	0.01	0.01	-.-
U	13.0	-.-	-.-	-.-	-.-	-.-	-.-	-.-
La	49.7	0.16	-.-	0.23	-.-	-.-	-.-	-.-
Ce	95.3	-.-	-.-	-.-	-.-	-.-	-.-	-.-
Nd	42.6	-.-	-.-	-.-	-.-	-.-	-.-	1.6
Sm	9.4	-.-	-.-	-.-	-.-	-.-	-.-	-.-
Eu	0.697	0.001	-.-	0.002	0.002	0.002	-.-	0.002
Gd	10.2	-.-	-.-	-.-	-.-	-.-	-.-	-.-
Tb	1.42	-.-	-.-	0.014	-.-	-.-	-.-	-.-
Dy	8.29	-.-	-.-	-.-	-.-	-.-	-.-	-.-
Tm	0.52	0.06	-.-	-.-	0.06	-.-	0.06	-.-
Yb	3.27	-.-	-.-	-.-	0.02	-.-	-.-	0.02
Lu	0.553	-.-	-.-	-.-	-.-	0.003	-.-	-.-
Ta	3.42	-.-	-.-	0.004	-.-	-.-	-.-	0.004
Zr	260	-.-	-.-	-.-	-.-	-.-	0.9	-.-
Hf	7.07	-.-	-.-	0.005	-.-	-.-	-.-	-.-
Sb	0.968	-.-	0.003	-.-	0.001	-.-	0.001	0.193
Sc	4.75	0.004	0.002	0.001	0.003	0.002	0.001	0.004
Mn	223	0.15	-.-	0.06	0.02	-.-	0.14	-.-
Fe	25000	-.-	8.4	17.1	-.-	11.5	-.-	16.3
Cr	3.79	0.13	0.56	0.14	0.27	0.29	0.30	0.42
Co	1.35	0.089	4.500	1.020	0.278	0.066	0.111	0.022

* Notes: (1) Collection date of sample ZTEL-7 unknown but sometime before 06/15/73.
(2) KELL-1 collected before contamination with cobalt in tracer experiment.
(3) PSC is from same well as PSM-1, source of the drilling water.

TABLE 8. PARTIAL ANALYSES OF WATER, FLUIDS, AND MUD SAMPLES FROM SUMMIT BOREHOLE, KILAUEA VOLCANO, HAWAII

[Concentrations of constituents in mg/L; -.-, not determined. Analytical data obtained by Skyline Labs, Inc., Wheat Ridge, Colorado]

[Provided by George V. Keller, Consultant, Golden, Colorado 80401]

Sample No.	Date Collected	Ca	Mg	Na	K	Co	Cl	F	Material
KELL-1	06/15/73	-.-	-.-	-.-	-.-	0.1	-.-	-.-	drill water*
KELL-2	06/23/73	-.-	-.-	-.-	-.-	5.2	-.-	-.-	drill water
KELL-3	06/28/73	-.-	-.-	-.-	-.-	3.0	-.-	-.-	mud
KELL-4	06/28/73	-.-	-.-	-.-	-.-	3.4	-.-	-.-	drill water
KELL-5	07/03/73	-.-	-.-	-.-	-.-	1.6	-.-	-.-	mud
KELL-6	07/03/73	-.-	-.-	-.-	-.-	1.7	-.-	-.-	drill water
KELL-7	07/05/73	330	135	1300	34	2.1	4.6	-.-	mud
KELL-8	07/05/73	5.8	3.4	12	2.4	1.9	3.4	0.1	drill water
KELL-9	07/08/73	360	130	1250	32	2.2	5.0	-.-	mud
KELL-10	07/08/83	5.5	4.1	14	2.4	1.5	3.7	0.2	drill water
KELL-11	07/10/73	52	11	155	21	1.2	30	0.4	well fluid
KELL-12	07/10/73	88	28	400	13	0.5	100	-.-	formation fluid, 3733'
KELL-13	07/11/73	76	25	180	12	1.1	22	0.4	well fluid
KELL-14	07/11/73	34	10	230	8.1	0.1	55	1.0	formation fluid, 3400'
KELL-15	07/11/73	125	37	240	16	1.3	15	0.4	well fluid
KELL-16	07/11/73	25	7.0	120	9.3	0.5	50	0.7	formation fluid, 3100'

* Before contamination by spiking with cobalt in tracer experiment; all other drill water samples collected after spiking.

TABLE 10. PREVIOUSLY PUBLISHED INFORMATION ON OTHER WATER SAMPLES FROM THE ISLANDS OF HAWAII, MAUI, AND OAHU

[From McMurtry et al., 1977, Table 1]

Sample No.	Name	Date Collected	Temp (°C)[1]	Salinity (‰)	SiO_2 (ppm)[2]	$\delta^{18}O$ (‰ SMOW)	δD (‰ SMOW)
	ISLAND OF HAWAII						
1	Pohoiki Spring	01/29/74	35	8.2	96	-2.7	-14
2	Allison Spring	01/29/74	31	11.9	100	-2.2	-12
3	Kapoho Landing Strip Well	01/29/74	38	1.1	56	-3.2	-15
40	Kapoho Landing Strip Well	12/13/74	34	1.4	53	-3.0	-12
41	Kapoho Landing Strip Well	12/13/74	34	1.2	70	-3.1	-15
4	Pahoa Well 2	01/30/74	23*	0.2	60	-3.8	-18
5	Kapoho Cone Shaft	01/30/74	25	0.7	56	-3.6	-19
6	Keauohana Well	01/30/74	24*	0.5	48	-3.4	-16
27	Olaa Mill Well	06/11/74	22*	0.1	39	-3.9	-20
8	Pulama Well	01/31/74	28	0.6	59	-4.0	-21
9	Allison Well	01/31/74	38	2.6	53	-3.3	-17
10	Malama-Ki Well	01/31/74	56	22.8	90	-1.7	-9
38	Malama-Ki Well	12/13/74	53	19.5	63**	-1.6	-9
39	Malama-Ki Well	12/13/74	54	20.1	54**	-1.5	-10
7	Geothermal test hole 2	01/30/74	83	< 0.1	0.0	-4.5	-10
42	Geothermal test hole 2	12/14/74	86	0.1	1.1	-2.4	-4
31	Geothermal test hole 3	09/10/74	93	7.2	178	-2.4	-13
44	Geothermal test hole 3	12/14/74	95	6.8	184	-2.5	-12
45	Geothermal test hole 3	12/14/74	88	6.5	187	-2.5	-12
57	Geothermal test hole 3	12/16/74	86	7.1	184	-2.5	-12
32	Kilauea Research Drill Hole	09/11/74	75	2.9	159	-4.7	-31
50	Kilauea Research Drill Hole	12/15/74	83	3.0	180	-4.7	-29
11	Palima Well	02/01/74	21*	0.1	54	-6.7	-42

Notes:
1 Temperatures marked by * were measured directly after sample recovery; all other temperatures were measured *in-situ*.
2 Questionable values are indicated by **; these samples produced a blue compound during analysis.

TABLE 11. SELECTED CHEMICAL ANALYSES OF HAWAII GROUNDWATERS (From Swain, 1973, Appendix A)

[Concentrations of chemical constituents in mg/L]

Locatior.	Well. No.	Date Collected	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	F	NO_3	SiO_2	TDS (calc.)	Cond.	pH	Temp. (°C)
Naalehu	0335-01	05/14/71	6.0	4.8	12	1.5	---	44	14	8.0	0.3	1.9	45	114	128	7.0	19.5
Honuapo	0533-01	04/12/72	33	86	680	24	---	46	169	1240	0.2	0.0	43	2230	4180	7.0	19.0
"	0533-02	04/12/72	20	44	320	14	---	42	86	580	0.1	0.7	43	1130	2120	7.1	19.0
"	0533-03	04/12/72	18	38	272	12	---	41	75	500	0.2	1.7	43	980	1850	7.0	19.0
"	0632-01	04/12/72	17	33	245	11	---	44	66	440	0.2	1.3	41	876	1620	7.3	19.0
Punaluu	0830-01	04/12/72	9.6	16	118	5.5	---	34	37	205	0.2	0.7	32	440	830	7.1	19.0
Ninole	0831-01	04/12/72	9.2	12	80	4.4	---	43	24	136	0.2	1.2	41	329	561	7.3	19.0
"	0831-02	03/01/72	10	16	88	4.8	---	40	28	165	0.2	0.8	46	378	681	7.1	18.5
Pahala	1128-01	04/13/72	6.6	3.6	7.2	1.0	---	43	10	3.5	0.2	0.9	42	96	99	7.2	19.0
Pulama	2102-01	12/06/63	16	31	170	8.5	---	54	65	345	0.1	0.3	72	734	---	7.4	---
Kalapana	2487-01	03/03/72	6.6	3.3	54	3.8	---	42	22	70	0.2	0.0	41	221	344	7.3	23.0
Keei	2753-01	12/17/58	22	8.5	54	---	34	10	30	90	0.2	0.4	24	268	---	9.4	---
		03/14/68	15	12	60	6.1	---	59	19	93	0.2	4.6	31	269	---	7.4	---
		06/02/70	20	11	60	5.0	---	49	23	108	0.0	4.8	45	300	---	7.6	---
		03/16/72	9.4	11	64	4.3	---	47	22	107	0.4	1.0	50	292	474	7.3	19.0
"	2753-02	05/16/63	7.6	8.9	68	2.0	---	49	28	106	0.3	1.1	49	295	---	7.0	---
		03/20/67	6.1	8.2	53	7.5	---	49	14	72	0.2	1.9	36	223	---	7.3	---
		06/02/70	8	8.2	54	5.0	---	49	20	89	0.0	3.6	44	265	---	7.6	---
		03/16/72	9.6	12	77	4.8	---	44	25	129	0.3	1.3	52	332	555	6.7	19.0
Malama-ki	2783-01	09/06/62	182	324	3090	---	---	262	681	5850	1.5	0.5	59	10300	---	6.9	---
Pahoa	2986-01	03/03/72	3.9	3.3	16	3.3	---	51	12	6.0	0.3	0.5	54	124	126	7.6	22.5
"	2986-02	03/03/72	2.7	3.3	17	3.4	---	50	13	6.0	0.8	0.2	50	121	127	7.4	22.5
Kapoho	3080-02	03/15/68	48	26	97	14	---	283	5.5	125	0.3	2.4	44	501	---	7.7	---
		05/22/70	120	96	64	10	---	975	3.8	72	0.2	9.7	39	895	---	7.0	---
		03/03/72	72	31	57	7.6	6	393	11	54	0.3	27	39	498	793	8.4	---
Pahoa	3185-01	05/05/64	4.2	4.8	16	2.0	---	46	6.7	16	0.2	0.2	59	131	---	7.3	---
"	3185-02	05/22/72	5.8	3.6	23	3.2	---	56	6.9	23	0.3	0.0	49	142	165	7.6	---
Kahaluu	3557-01	03/16/72	7.2	4.0	12	2.1	---	49	9.9	7.0	0.3	3.9	49	119	126	7.2	20.0
"	3557-02	03/20/67	5.5	4.8	20	7.5	---	74	8.0	15	0.2	3.4	46	146	---	7.2	---
"	3557-03	02/28/70	6.5	4.0	14	2.2	---	48	9.0	8.5	0.4	4.6	45	117	133	7.8	---
"	3557-04	02/05/71	6.7	4.4	18	2.5	---	46	11	16	0.3	5.4	46	132	162	7.6	20.5
		03/16/72	4.9	5.0	17	2.3	---	52	10	14	0.3	3.5	41	123	147	7.5	20.0
Keaau	3702-01	06/07/72	6.0	2.7	5.8	2.4	---	38	5.5	4.0	0.1	2.8	40	88	87	7.0	23.0

TABLE 11. Continued

Location	Well. No.	Date Collected	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	F	NO_3	SiO_2	TDS (calc.)	Cond.	pH	Temp. (°C)
(MKB Hotel)	6049-01	05/17/72	21	34	216	15	---	95	62	390	0.3	1.9	51	837	1520	8.1	---
	6049-02	05/17/72	58	119	974	50	---	106	249	1740	0.3	3.8	50	3300	5840	7.8	26.0
	6049-03	05/17/72	58	111	896	46	---	103	236	1610	0.2	3.2	50	3060	5480	7.5	26.0
Ookala	6117-01	07/20/54	34	13	22	---	---	36	31	85	0.1	0.1	24	226	---	7.9	---
		06/22/55	22	6.9	16	---	---	44	21	40	0.0	0.0	28	155	---	6.9	---
		02/27/67	17	21	75	9.5	---	54	17	160	0.1	1.3	25	352	---	7.5	---
		06/16/70	18	21	125	8.0	---	54	36	230	---	0.0	43	507	---	7.3	---
		04/18/72	11	14	78	4.9	---	62	21	135	0.2	1.0	43	338	599	7.6	---
Kawaihae	6147-01	06/25/63	32	33	135	14	---	109	54	250	0.2	2.9	89	663	---	7.3	---
		06/25/63	32	31	128	13	---	101	49	255	0.2	4.2	78	640	1070	6.9	35.8
"	6148-01	03/22/72	24	32	180	13	---	82	42	340	0.3	3.8	66	741	1330	7.8	28.0
		06/20/72	32	30	175	14	---	---	70	340	0.3	0.8	32	694	---	---	---
Paauilo	6321-01	02/28/67	15	21	77	8.8	---	66	20	165	0.2	2.0	27	368	---	7.3	---
		04/18/72	16	19	102	5.6	---	53	29	195	0.1	0.0	37	429	806	7.6	18.0
Halaula	7347-01	07/19/49	8.0	5.5	15	---	---	43	9.6	22	0.1	0.9	42	125	---	---	---
"	7446-01	03/28/72	60	72	450	20	---	98	120	890	0.2	3.7	63	1730	3230	7.2	24.5

TABLE 13. NORMATIVE SIMPLE SALTS (WT. %)* OF OTHER WATER SAMPLES FROM THE ISLAND OF HAWAII COLLECTED FOR THIS STUDY

[Calculated from data in Table 4 using the computer program SNORM of Bodine and Jones (1986)]

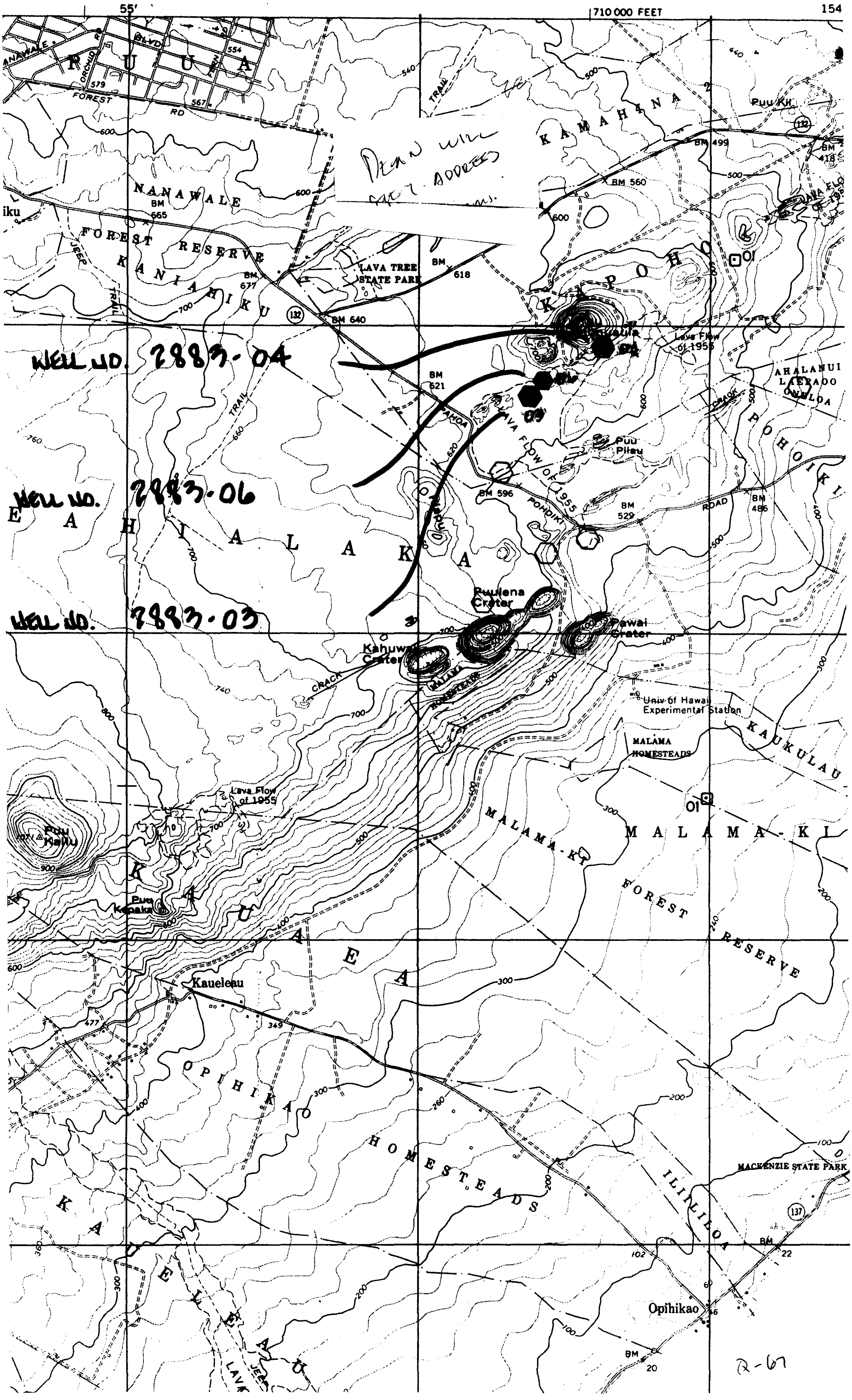
Sample No.	Date Collected	$CaCO_3$	$MgCO_3$	Na_2CO_3	$CaSO_4$	$MgSO_4$	Na_2SO_4	K_2SO_4	Na_2Cl_2	K_2Cl_2	$MgCl_2$	$CaCl_2$
PSM-1	05/16/74	28.6	22.1	8.5			18.2	10.1	12.6			
WR-1	03/10/75	41.6	38.5	10.4			1.0	3.7	3.8	0.9		
WR-3	03/10/75	46.2	38.0	9.8			0.6	2.3	2.7	0.2		
WR-4	03/10/75	43.0	38.7	10.3			1.0	3.6	3.2	0.2		
HVO-1	04/24/76-04/27/76				16.8	4.9	60.4	2.2	15.7			
HVO-2	05/03/76-06/01/76	38.3			0.7				49.8			11.2
ERZ-1	07/22/76*	4.6	0.1		0.6		1.4	6.0	84.3	2.9		
MLS-1	08/04/76	9.9	10.7		24.9		29.5	11.2	13.7			
HILEA-1	08/10/76	18.5	26.4		19.4		7.0	5.4	23.2			
WLK-1	10/19/76	26.9	37.4	16.6			0.4	1.6	9.8	7.3		

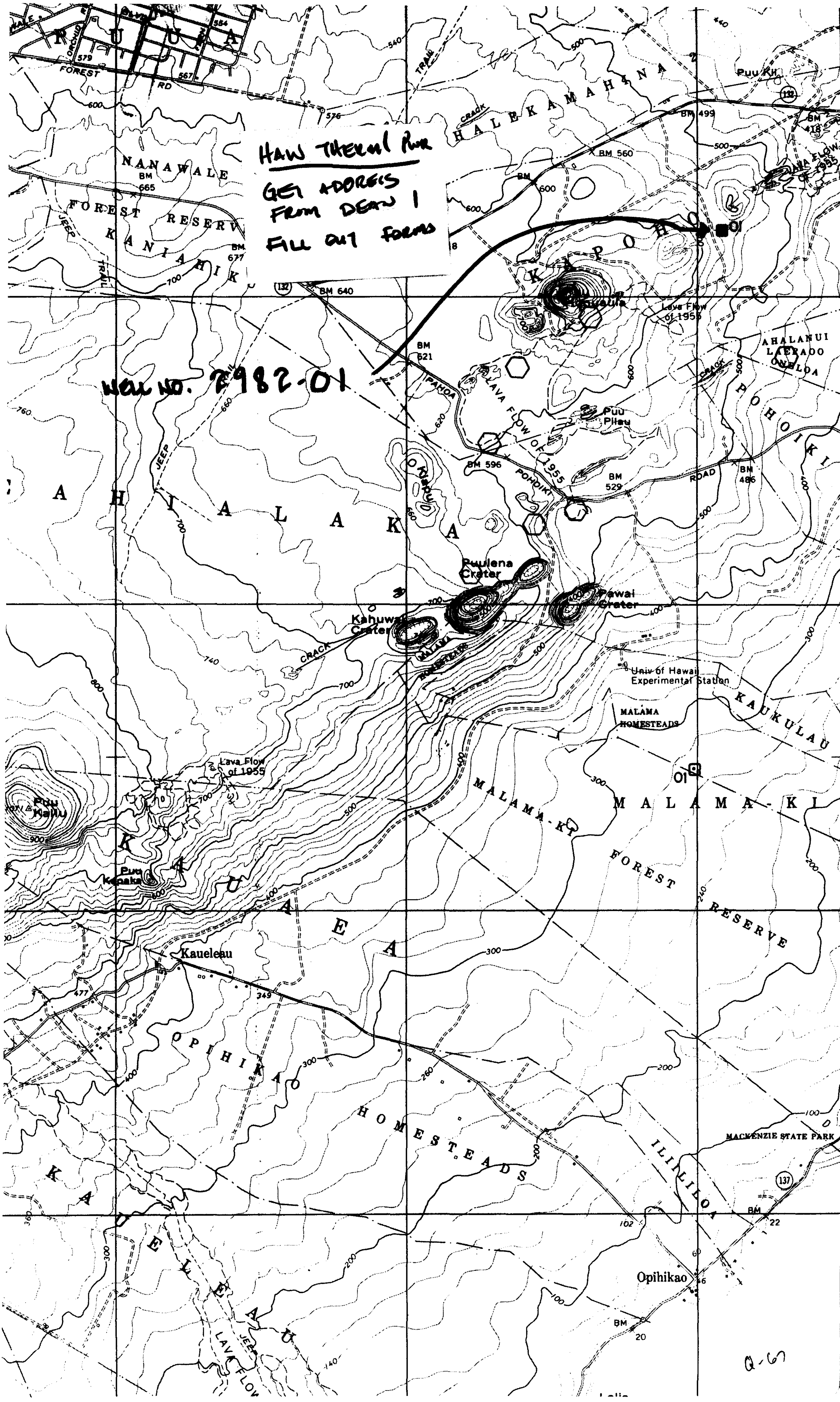
Note: * Total of the weight-percent values may not exactly equal 100 % because of rounding to one decimal.

TABLE 14. Continued

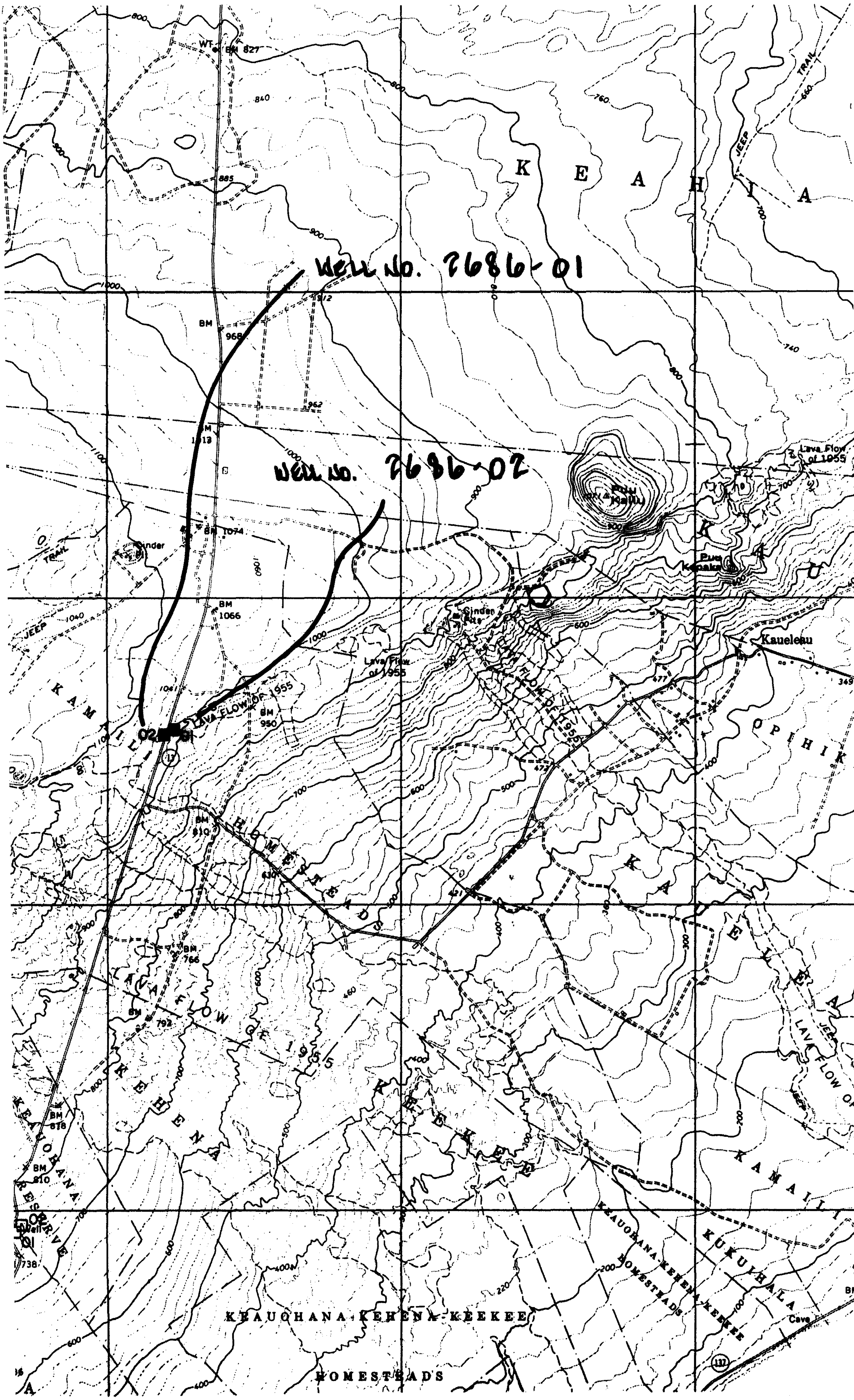
USGS Well No.	Name	$CaCO_3$	$MgCO_3$	Na_2CO_3	$CaSO_4$	$MgSO_4$	Na_2SO_4	K_2SO_4	Na_2Cl_2	K_2Cl_2	$MgCl_2$
					Other Hawaii Island Wells***						
10	Honuapo Mill		1.4		5.0	4.9			77.1	2.0	9.5
12-4,8	Keei	2.0	12.0		14.3				65.8	2.8	3.0
12-5,6	Kahaluu	20.8	19.9	19.2			10.2	7.5	22.3		
12	Kailua****										
12-7	Kaupulehu	5.2	25.0		1.6		6.6	1.9	59.7		
15	MKB Hotel		8.2		9.2	1.7			71.0	3.7	6.2
16	Kawaihae	3.6	10.0		13.2				58.2	4.6	10.4
8-2	Hilo Electric	40.5	19.4	10.8			1.8	6.8	19.8	0.8	

Notes:
* Total of the weight-percent values may not exactly equal 100 % because of rounding to one decimal.
** Wells at Olaa Mill and Keaau Orchard penetrate lavas of Mauna Loa Volcano; the other wells in the Puna District are in lavas of Kilauea Volcano.
*** Wells at Pahala Mill, Ninole Springs, Hilo Electric, and Keei are in lavas of Mauna Loa Volcano; wells at Kahaluu, Kailua, and Kaupulehu are in lavas of Hualalai Volcano; well no. 15 is on Mauna Kea Volcano; and well no. 16 is on Kohala Volcano.
**** Normative salt assemblage indeterminable--calculation abandoned.
Δ This study.

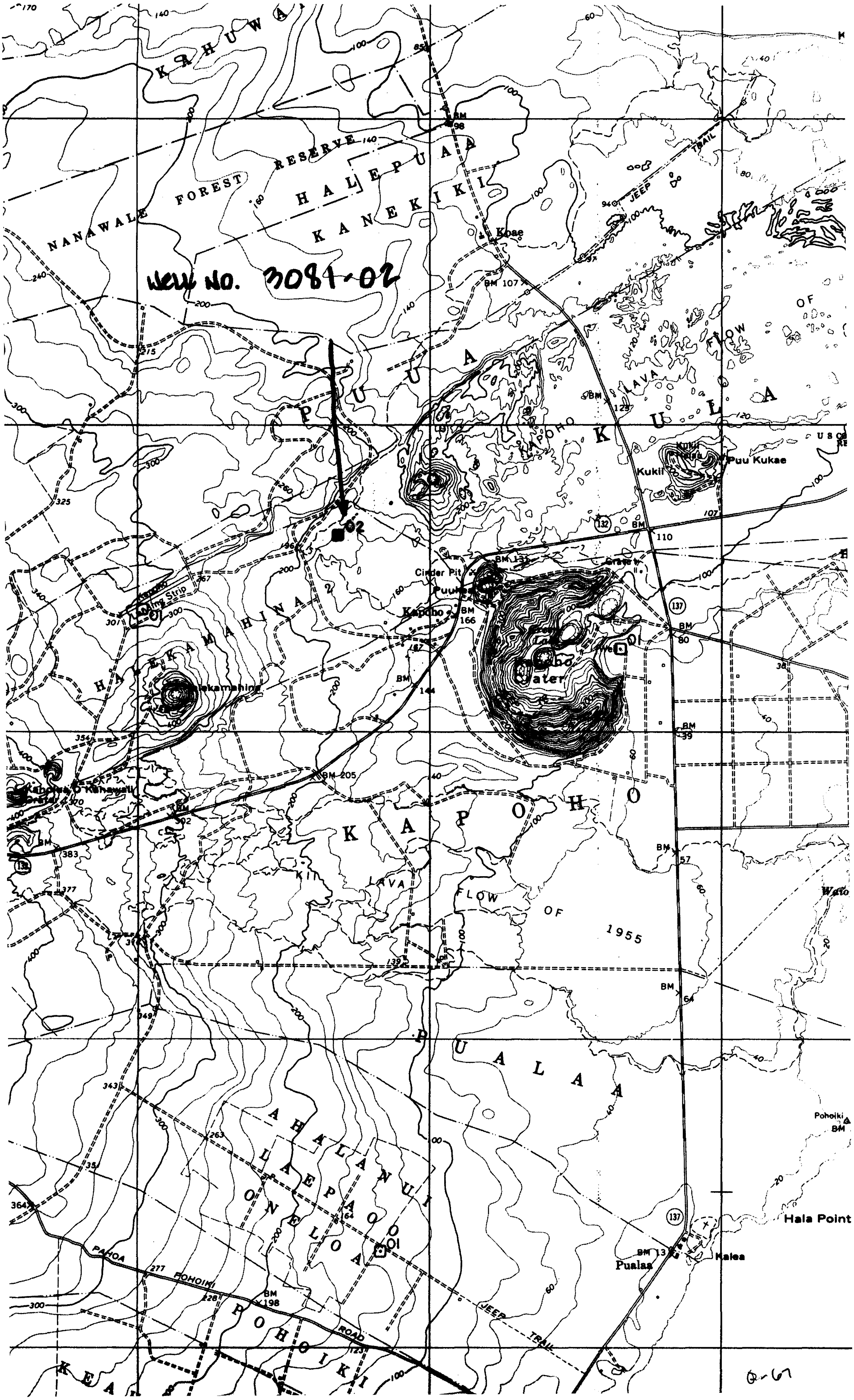

55′
710 000 FEET
154
PUUA
FOREST RD
ORCHID
BLVD
579
567
554
NANAWALE
BM 665
FOREST RESERVE
KANIAHIKU
JEEP TRAIL
BM 677
132
BM 640
LAVA TREE STATE PARK
BM 618
KAMAHINA
Puu Kii
BM 499
BM 560
BM 418
KAPOHO
Lava Flow of 1955
AHALANUI
LAEPAOO
ONELOA
POHOIKI
WELL NO. 2883-04
WELL NO. 2883-06
WELL NO. 2883-03
BM 621
PAHOA
TRAIL
Puu Pilau
LAVA FLOW OF 1955
BM 596
POHOIKI ROAD
BM 529
BM 486
KEAHIALAKA
Puulena Crater
Kahuwai Crater
Pawai Crater
CRACK
MALAMA HOMESTEADS
Univ of Hawaii Experimental Station
KAUKULAU
MALAMA-KI
MALAMA-KI FOREST RESERVE
Lava Flow of 1955
Puu Kaliu
Puu Kepaka
KAUAEA
Kaueleau
477
349
OPIHIKAO HOMESTEADS
ILIILILOA
MACKENZIE STATE PARK
137
BM 22
102
Opihikao
BM 20
KAUELEAU
LAVA
JEEP
R-67



HAW THERMAL PWR
GET ADDRESS FROM DEAN I
FILL OUT FORMS
WELL NO. 7982-01
FOREST RD
ORCHID
NANAWALE
FOREST RESERVE
KANIAHIKU
HALEKAMAHINA
KAPOHO
Puu Kii
BM 499
BM 560
BM 665
BM 677
BM 640
BM 621
BM 596
BM 529
BM 486
BM 418
Lava Flow of 1955
LAVA FLOW OF 1955
AHALANUI
LAEPAOO
ONELOA
POHOIKI
POHOIKI ROAD
PAHOA
Puu Pilau
Kapoho Crater
Heiheiahulu
Kapoho Lighthouse
Kapoho Beach
Kapoho Bay
Puulena Crater
Pawai Crater
Kahuwai Crater
MALAMA HOMESTEADS
Univ of Hawaii Experimental Station
KAUKULAU
MALAMA-KI
MALAMA-KI FOREST RESERVE
Puu Kaliu
Puu Kepaka
KAUAEA
Kaueleau
OPIHIKAO
HOMESTEADS
ILILILOA
MACKENZIE STATE PARK
Opihikao
KAUELEAU
LAVA FLOW
JEEP TRAIL
CRACK
TRAIL
01
137
132
BM 22
BM 20
349
477
Q-67



WELL NO. 2686-01
WELL NO. 2686-02
K E A H I A
K A M A I L I
H O M E S T E A D
LAVA FLOW OF 1955
Lava Flow of 1955
K E H E N A
K E E K E E
KEAUOHANA-KEHENA-KEEKEE HOMESTEADS
KEAUOHANA-KEHENA-KEEKEE
HOMESTEADS
K E A U O H A N A RESERVE
K A U E L E A U
Kaueleau
KAMAILI
KUKUIHALA
Cinder Pit
JEEP TRAIL
TRAIL
Cave
Well


WELL NO. 3081-02
K A H U W A
N A N A W A L E F O R E S T R E S E R V E
H A L E P U A A
K A N E K I K I
Koae
JEEP TRAIL
P U U A
K U L A
KAPOHO LAVA FLOW OF
Kukii
Puu Kukae
Cinder Pit
Kapoho
H A L E K A M A H I N A
Halekamahina
Kapoho Crater
Kaholua O Kahawali Crater
K A P O H O
LAVA FLOW OF 1955
P U A L A A
A H A L A N U I
L A E P A O O
O N E L O A
Pohoiki
Hala Point
Kalea
Pualaa
PAHOA POHOIKI ROAD
JEEP TRAIL
P O H O I K I
Q-67

Form 6510-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL AND DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 7883-03 ISLAND: HAWAII
WELL NAME OR DESIGNATION: KAPOHO ST. GEO. VENTURE
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: PUNA GEO VENTURE
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For **Drilled Wells**, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For **Tunnels and Shafts**, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND
DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 7883-04 ISLAND: HAWAII
WELL NAME OR DESIGNATION: KAPOLO ST. 1A
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: PUNA GEO. VENTURE
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For Drilled Wells, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For Tunnels and Shafts, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____
_____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND
DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 7887-06 ISLAND: HAWAII
WELL NAME OR DESIGNATION: KAPOHO ST 1-A
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: PUNA GEO. VENTURE
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For **Drilled Wells**, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For **Tunnels and Shafts**, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.

Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

SEE DRAW.

STATE OF HAWAII
DN ON WATER RESOURCE MANAGEMENT
TMENT OF LAND AND NATURAL RESOURCES
SION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND
DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 7686-01 ISLAND: HAWAII
WELL NAME OR DESIGNATION: PUNA THERMAL T.H. 1
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: HAWAII THERMAL POWER
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For **Drilled Wells**, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For **Tunnels and Shafts**, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____
_____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL AND DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 2686-02 ISLAND: HAWAII
WELL NAME OR DESIGNATION: PUNA THERMAL T.H. 2
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: HAWAII THERMAL POWER
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For Drilled Wells, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For Tunnels and Shafts, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____
_____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND
DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 2982-01 ISLAND: Hawaii
WELL NAME OR DESIGNATION: PUNA THERMAL T.H. 3
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: HAWAII NATURAL ENERGY LAB
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For **Drilled Wells**, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For **Tunnels and Shafts**, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____
_____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

Form 8810-1

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND
DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE WELL NO.: 7081-02 ISLAND: Hawaii
WELL NAME OR DESIGNATION: PUNA THERMAL T.H. A
SOURCE OR STATION NAME (For a battery of wells): _____

A. WELL OPERATOR
Firm name: HAWAII THERMAL POWER
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

B. OWNER OF WELL SITE
Firm name: _____
Contact person: _____
Address: _____
_____
Zip: _____ Phone: _____

C. WELL LOCATION
Tax Map Key: _____ Town, Place, District: _____
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA
For Drilled Wells, submit "as-built" drawing, driller's log, and pump test results, and complete items below.
For Tunnels and Shafts, submit construction drawings, plot plan, or sketch map.

Ground elevation (Mean sea level): _____ ft.
Reference point (Used to measure depth to water):
Elevation: _____ ft.
Description: _____
_____
Depth to water (Below reference point): _____ ft.
Maximum recorded chloride: _____ ppm
Minimum recorded chloride: _____ ppm
Maximum chloride in 1987: _____ ppm

Year drilled or constructed: _____
Well contractor: _____
_____
Casing diameter: _____ in.
Solid casing depth (Below ground): _____ ft.
Perforated casing depth (Below ground): _____ ft.
Total depth of well: _____ ft.
Minimum chloride in 1987: _____ ppm

E. INSTALLED PUMP DATA
Pump type: ☐ Vertical shaft ☐ Submersible ☐ Centrifugal ☐ Other (specify): _____
Power: ☐ Diesel, ____ HP ☐ Gas, ____ HP ☐ Electric, ____ HP ☐ Other (specify): _____
Pump capacity: _____ gallons per minute
Pump installation contractor: _____
_____

. . . (continued over)

For Official Use Only:
Date received: _____ *Date accepted:* _____
Field checked by: _____ *Date:* _____ *Latitude:* _____ *Hydrologic Unit:* _____
Comments: _____ *Longitude:* _____ *State Well No.:* _____

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: ☐ Daily ☐ Weekly ☐ Monthly
☐ Other (Describe): _____

Method of measurement: ☐ Flow Meter ☐ Orifice
☐ Other (Describe): _____
_____

Quantity of Use (Report metered or estimated monthly water use from the well described on the reverse side of this form, for the calendar years 1983 through 1987. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery.):

WATER USE, IN GALLONS x 1000

	1983	1984	1985	1986	1987
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
ANNUAL					

Minimum day's use: _____ gallons Maximum day's use: _____ gallons
Typical times of usage: _____

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including resorts, hotels, businesses)	_____
☐ Domestic (systems serving 25 people or less)	Number of service connections: _____
☐ Irrigation	Acres Irrigated: _____ Crop(s): ☐ Sugar ☐ Pineapple ☐ Other (specify): _____ Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): _____ Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify): _____
☐ Military	_____
☐ Other	Specify (livestock, aquaculture, etc.): _____

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: _____ Date: _____
Printed Name: _____
Firm or Title (Well Operator, etc.): _____

7/23 per Dan He ~~spoke~~ to Bowden and stated that if DOWALD did not contact him by Friday afternoon, that (Bowden) Buddy was to take a water samples for us and that water level measurements would not be needed since accurate W.L. data was available for Exxon's State No. 1. Therefore no action was taken by Dowald and arrangements are being made for Don Thomas to plug samples for us.

K.S.#1@ (624.18')

WATER RESOURCES & FLOOD CONTROL BRANCH
Division of Water and Land Development

FROM: Dean DATE: 3/24/82 FILE IN: _____

TO:	INITIAL:		PLEASE:	
___	_____	T. FUJII	___	See Me
			___	Call
✓	_____	D. Lum	___	Review & Comment
___	_____	E. Sakoda	___	Take Action
___	_____	D. Nakano	___	Investigate & Report
___	_____	J. Menor	___	Draft Reply
___	_____	M. Ohye	___	Acknowledge Receipt
			___	Type Draft
			___	Type Final cc: _____
___	_____	_____	___	Xerox _____ copies
___	_____	_____	___	File
			___	Mail
___	_____	S. Samuels		
___	_____	W. Koyanagi		
___	_____	D. Hamada		
___	_____	K. Oshiro	FOR YOUR:	
___	_____	M. Tagomori	___	Approval
___	_____	H. Sakai	___	Signature
___	_____	H. Morimatsu	✓	Information
___	_____	J. Sato		
___	_____	_____		

REMARKS:

Dan,
I called Joe Lovaitti of Thermal Power (707-576-7232) @ 2:00 pm. He will be coming to see you or me on Tuesday 3/25/82 @ ~4:00 pm. He would like to review all of Barnwell's data and has requested copies of all groundwater sampling data and analyses for Lanipuna 1 & 6 and Kapoho State 1, 1-A and 2.
Pls see my attached list re: available data that we have on file

Dean

Lanipuna No. 6 :

1) Well inspected by Mitchell on 2/28/84
2) Depth to Fluid : (568.4' − 18') = 550.4' (prior to bailing)
(R.T. above grade)
3) Temp of fluid @ 89°F
4) No groundwater sample taken, as water was still too muddy even after continuous bailing from 2:00 pm to 5:30 pm.
5) Confidentiality period has expired effective 12/25/85

Lanipuna No. 1 :

1) Inspected by Steve Nishimoto on 3/10/81, 6/1/81, 6/22/81, and 7/9/81
2) Depth to Fluid data not available
3) Temp @ 700°F (BOT. hole temp)
4) No groundwater sample taken
5) Confidentiality period has expired effective 4/17/85

Lanipuna No. 1 (Directional Drilling)

1) No field inspection conducted at all
2) Confidentiality period has expired effective 4/17/85

Jack pine K.S. #2 water sample / date

Kapoho State No. 2

1) Inspected by Steve Nishimoto on 2/10/82
" " Dan & Ed on 4/21/82 (Venting)

2) No groundwater samples taken

3) Confidentiality expired on 8/17/83

Kapoho State No 1

1) Inspected by A Nishimoto 9/8/81, 12/17/81
" " Yoshi Akiroma 9/21/82

2) Depth to water $(624.18 + 1.5' - 18') = 607.68'$ from grnd level with static water level @ +11.32' above sea level

3) Temp of sample @ 113° F
Chloride @ 1200 ppm
} see Brewer chemical analysis (unknown where analysis is filed.)

4) Confidentiality expired on 12/12/82

Kapoho State No. 1-A

1) No field inspection conducted during drilling

2) groundwater sample taken by Thermal Power Co. representative and transported to Hon. by Don Thomas

3) Depth to water @ 608' from grnd level

4) Temp of sample @ 110° F
Chloride @ 1098 ppm

5) see attached U.S.G.S. Chemical Analyses + analysis does not report Chloride content. 1098 ppm figure is from D Thomas statute.

6) Confidentiality period still in effect.

Joe to send K.S. #2 water sample data

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY

19264915453360[illegible] THERMAL POWER CO, KAPOHO HAWAII DISTRICT CODE 15

WATER QUALITY DATA

DATE	TEMPERATURE (DEG C) (00010)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA) (01007)
JUL , 1985 20...	43.5	.45	39	7.0	860	42	.40	9.5	4	300

DATE	BERYLLIUM, TOTAL RECOVERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD) (01027)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COBALT, TOTAL RECOVERABLE (UG/L AS CO) (01037)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN) (01055)	MANGANESE, DIS-SOLVED (UG/L AS MN) (01056)
JUL , 1985 20...	<10	<1	10	1	4	140	20	3	10	<10

DATE	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO) (01062)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI) (01067)	SILVER, TOTAL RECOVERABLE (UG/L AS AG) (01077)	ZINC, TOTAL RECOVERABLE (UG/L AS ZN) (01092)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL) (01105)	LITHIUM TOTAL RECOVERABLE (UG/L AS LI) (01132)	SELENIUM, TOTAL (UG/L AS SE) (01147)	MERCURY TOTAL RECOVERABLE (UG/L AS HG) (71900)	ALKALINITY LAB (MG/L AS CACO3) (90410)
JUL , 1985 20...	13	1	<1	30	990	90	2	<.1	71

per Don Thomas preliminary analysis - Cl @ 1098 ppm

PROGRESSIVO
PER DATE
DI ESECUZIONE
DEI POZZI

11-14-89
Need to:
- verify coordinates of Geoth wells.
- copy of GRS map w/ well locations plotted.

WELLS DRILLED KILAUEA EAST RIFT ZONE

Map #	Name	Location (N/W)	Mo/Yr.	Max Temp. C (°F)	Max Depth (M) (Ft)	Fluids	Operator	1989 Status	Quality of Avail. Data
HA-5	Geothermal 1 (2686-01)	19-26-34/154-56-46 ✓	'61	54 @ 54m	54	No	Hawaii Thermal Power Co.	Aband.	Poor
HA-6	Geothermal 2 (2686-02)	19-26-33/154-56-48 ✓	'61	102 @ 167m	170	No	Hawaii Thermal Power Co.	Aband.	Poor
HA-13	Geothermal 3 (2982-01)	19-29-13/154-~~54~~ 52' 55	'61?	93	210	No	Hawaii Thermal Power Co.	Aband.	Poor
HA-15	Geothermal 4 (3081-02)	19-30-39/154-51-19 ✓	'61	43	88	No	Hawaii Thermal Power Co.	Aband.	Poor
HA-1	NSF Kilauea (2317-01)	19-23-44/155-17-21 ✓	'73	139	1262	No	NSF	Aband.	Poor
HA-9	HGP-A (2883-01)	19-28-31/154-53-~~44~~ 43"	7/76	358 (676°)	1968 (6455')	100,000#/hr.	University of Hawaii	~~Operating~~ Suspended	Excellent
HA-4	Ashida 1 (2685-01)	19-26-59/154-55-32 ✓	10/80	288 (550°)	2530 (8300')	?	GEDCO	Suspended Aband.	Fair
HA-10	Lanipuna 1 (2883-02)	19-28-16/154-53-33 ✓	5/81	360 (686°)	1557 (8389')	Yes	GEDCO	Suspended Aband.	Fair
HA-11	Kapoho Site 1 (2883-03) State	19-28-47/154-53-39 ✓ (50")	11/81	343 @ 1950 (642°)	2222 (7290')	73,000#/hr.	Puna Geothermal Venture (Thermal Power Company)	Plugged (Temp.)	Good
HA-12	Kapoho ~~Site~~ 2 (2883-04) State	19-28-~~47~~ 55" 154-53-~~48~~ 22" (25")	4/82	355 @ 2103 (660°)	2440 (8005')	41,000#/hr.	Puna Geothermal Venture (Thermal Power Company)	Plugged (Temp)	Good
-----	Lanipuna 1 ST	19-28-16/154-53-33 ✓	6/83	~~21T~~ 220 @ 1646 (429°)	1911 (6271')	Yes	GEDCO	Suspended Aband.	Good
-----	Lanipuna 6 (2883-05)	19-28-~~40~~ 44" 154-53-~~22~~ 04"	6/84	168 @ 1290 (335°)	1510 (4956')	No	GEDCO	Suspended Aband.	Good
-----	Kapoho State 1A (2883-06)	19-28-~~47~~ 48" (51") 154-53-~~39~~ 37"	9/85	369 (654°)	1983 (6505')	78,000#/hr.	Puna Geothermal Venture (Thermal Power Company)	~~Capped~~ Plugged Temp	Good

8/14/89 - 1106B

SCALA 1:24000 { LAT 1" = 1.28 mm
LONG 1" = 1.22 mm

[redacted] Energy [illegible]te

FR[redacted] TO: Dean Nakano

[redacted] P 2: 56

[redacted] ATER &
[redacted] LOPMENT

[redacted]eturn
[redacted]rmation and file
[redacted]rmation and return
[redacted]ture and return
[redacted] regarding attached
[redacted]ur files
[redacted]erson listed
[redacted]eturn to this office)

[redacted]sh[redacted]nzaki's figures in [redacted]u[redacted]---

D[redacted]q

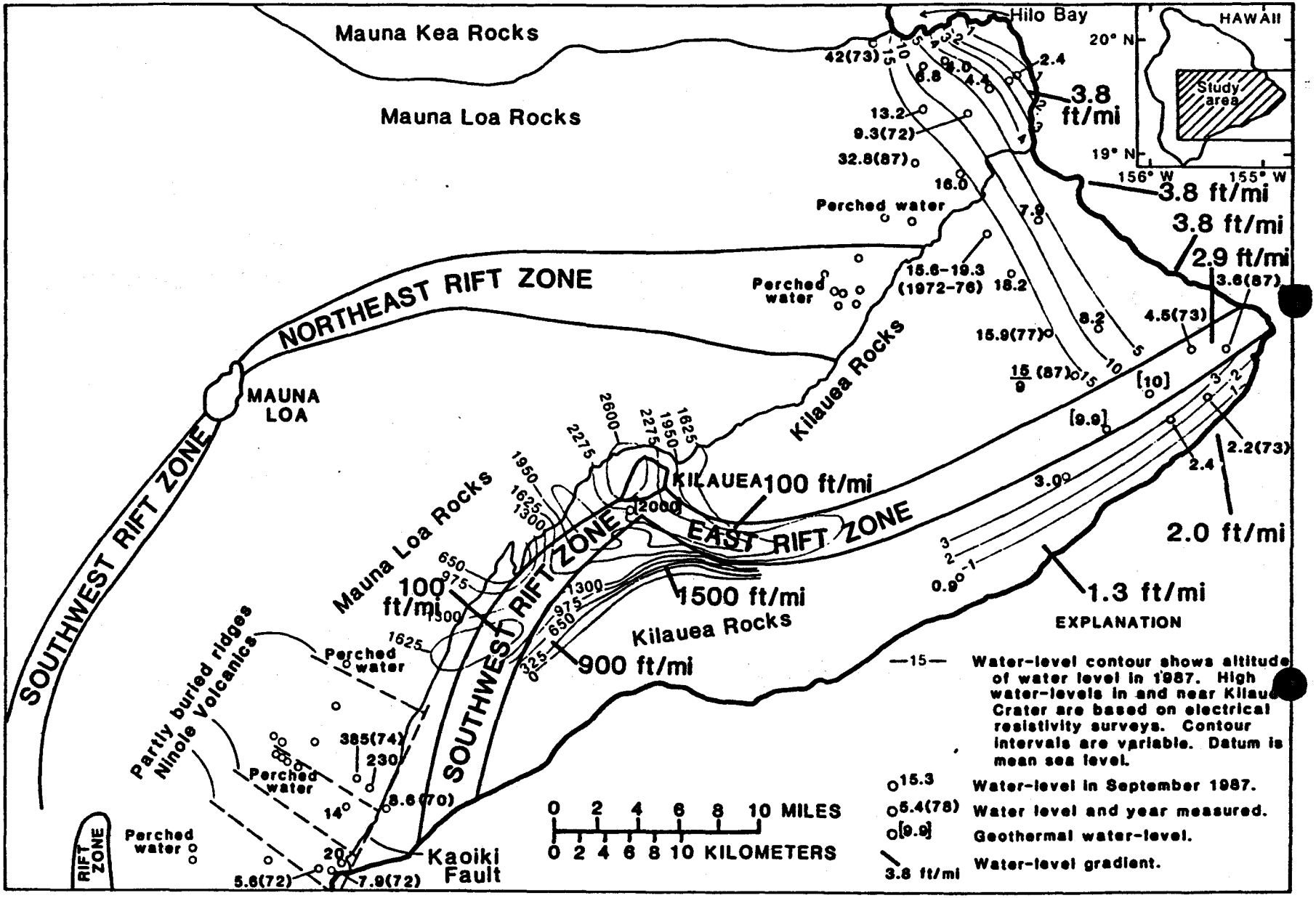


Figure 4.2-1. Water-levels, water-level contours and ground-water gradients.

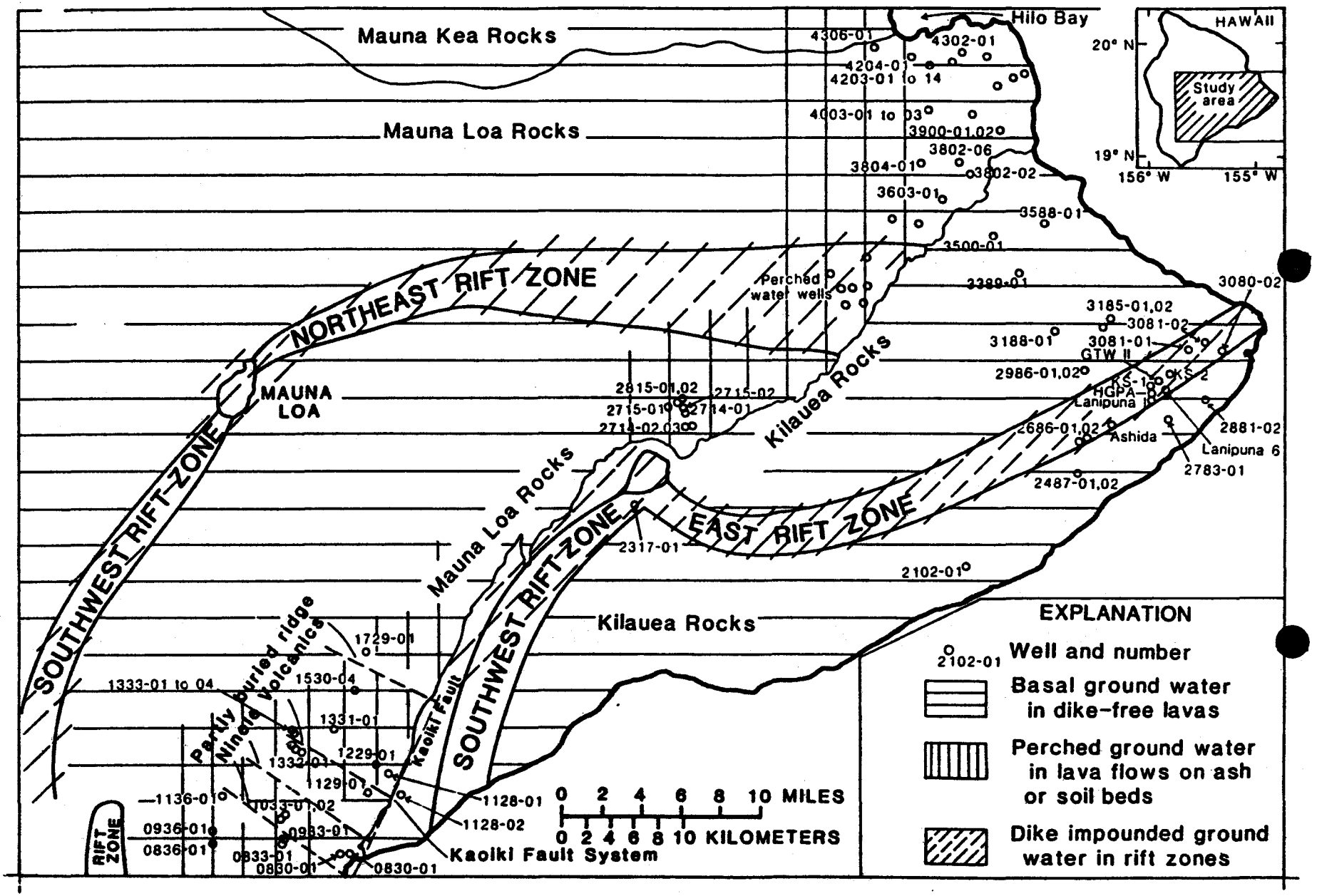
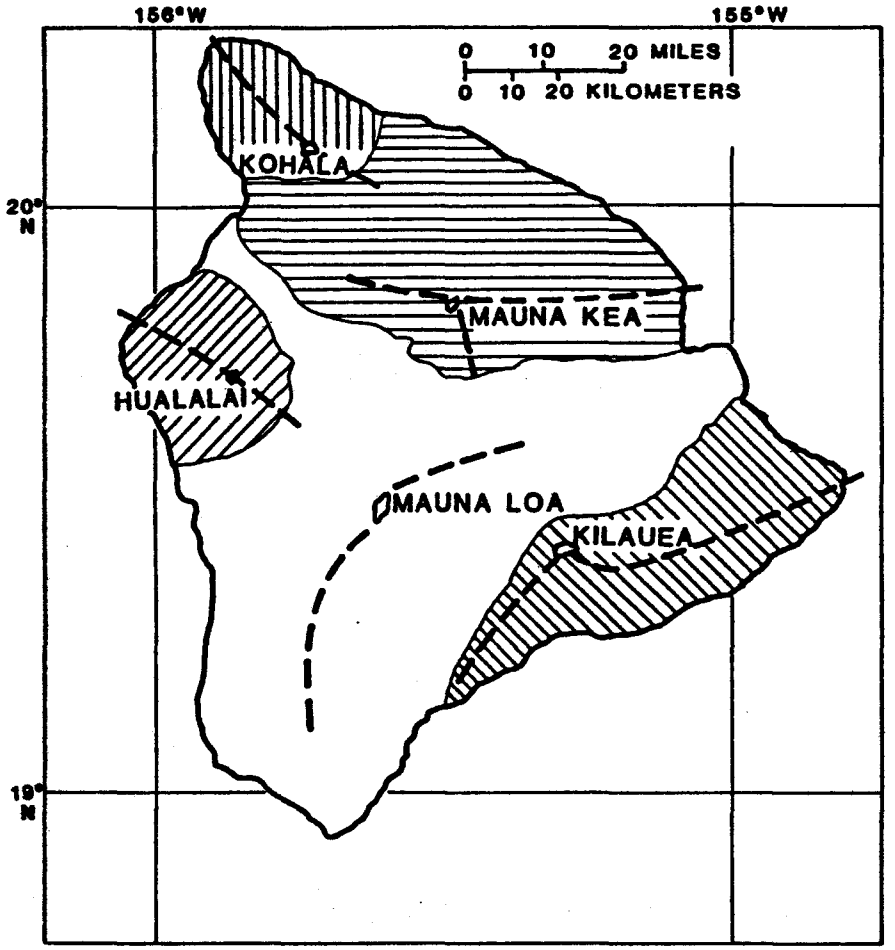


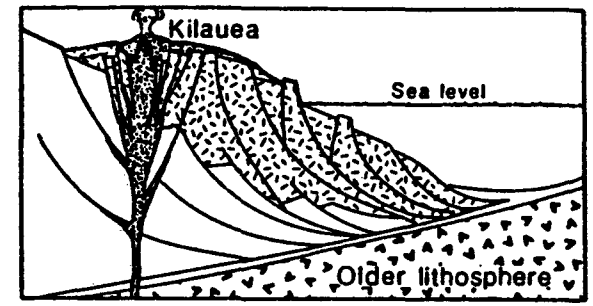
Figure 4.1-1. Occurrence of ground water and location of drilled wells.

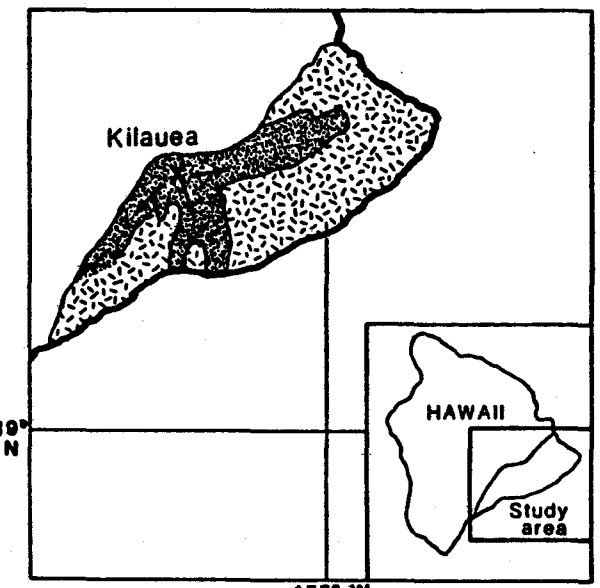


EXPLANATION

Principal rift zone
Kohala rocks
Hualalai rocks
Mauna Kea rocks
Mauna Loa rocks
Kilauea rocks

Figure 1.0-1. Distribution of volcanic rocks and principal rift zones of volcanoes on the island of Hawaii.





EXPLANATION

Mauna Loa rocks
Kilauea rocks
Older flows
Kilauea rocks
Magma and freshest flows

Figure 1.0-2. Position of magma column and surface flows during summit eruption of Kilauea. (Modified after Holcomb, 1987).

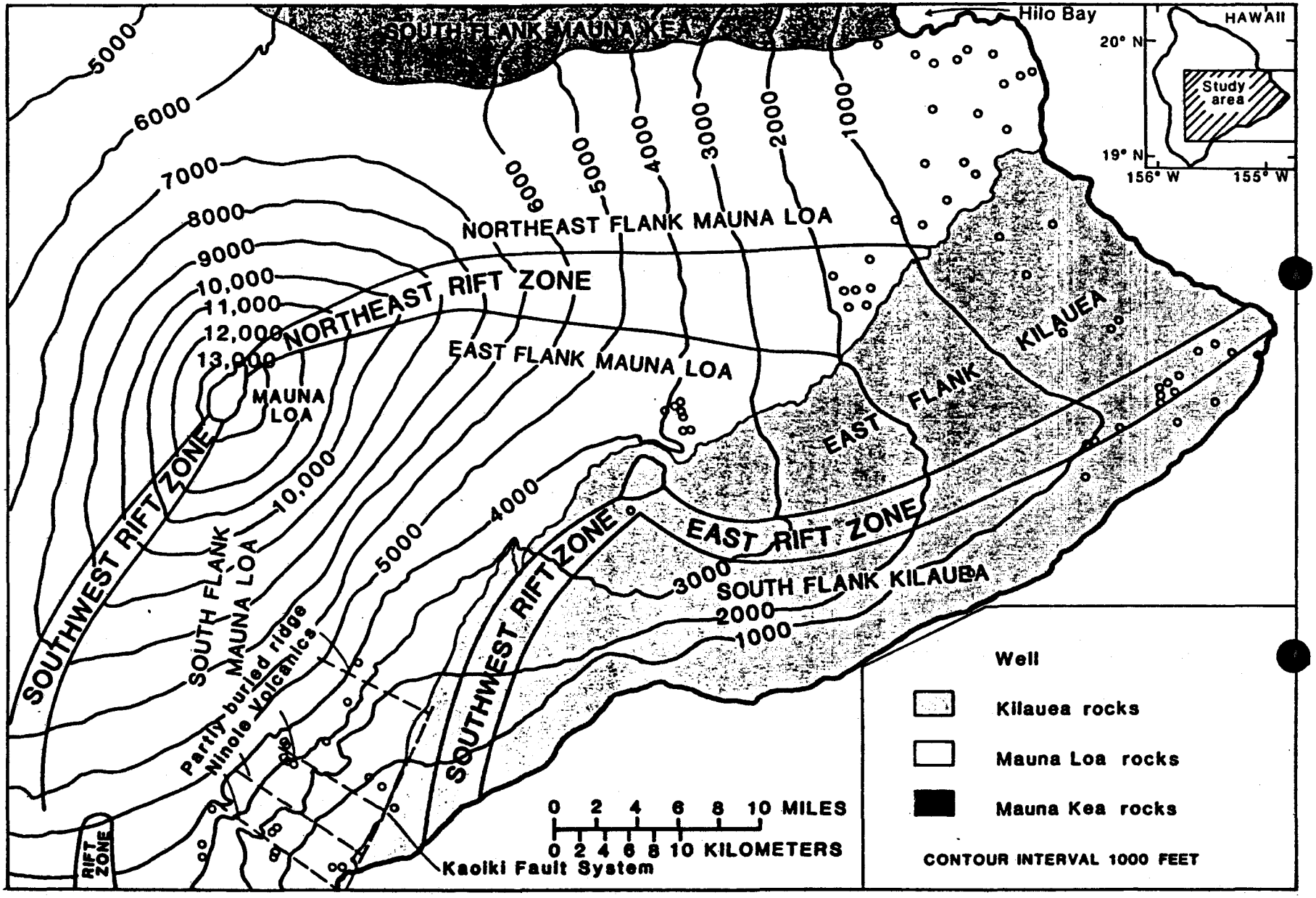
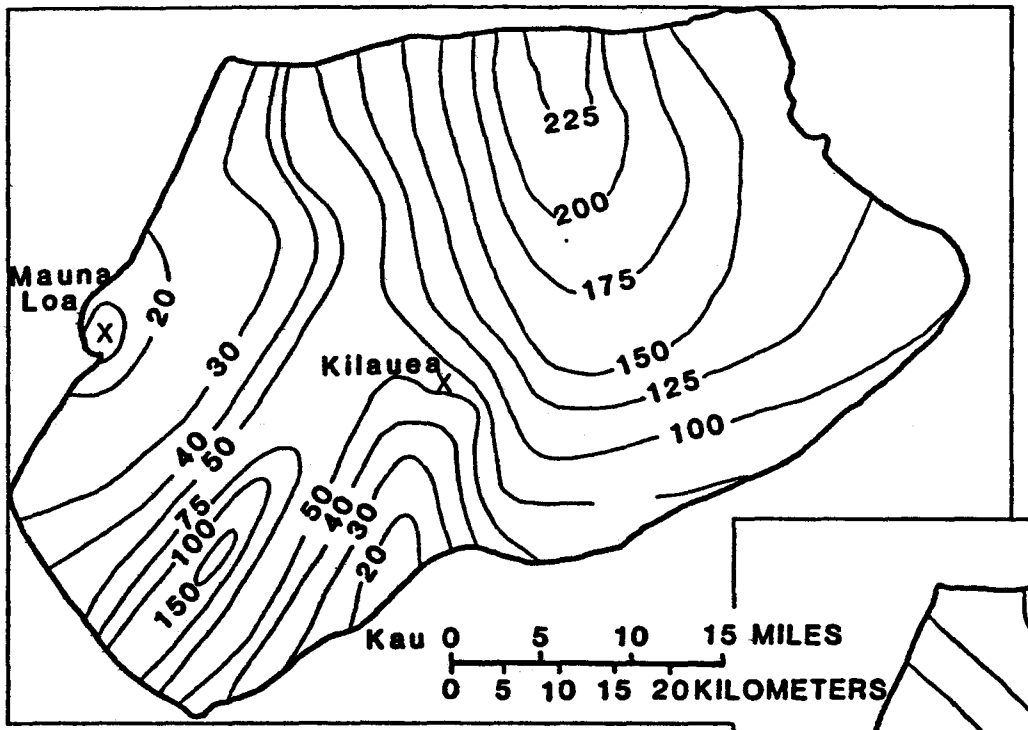


Figure 2.0-1. Volcanic rocks and geologic structures.



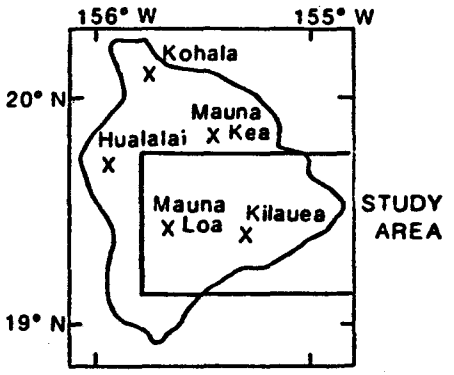


Figure 3.1-1. Lines of equal mean annual rainfall. (From State of Hawaii, 1986, Division of Water and Land Development, Report R76.)

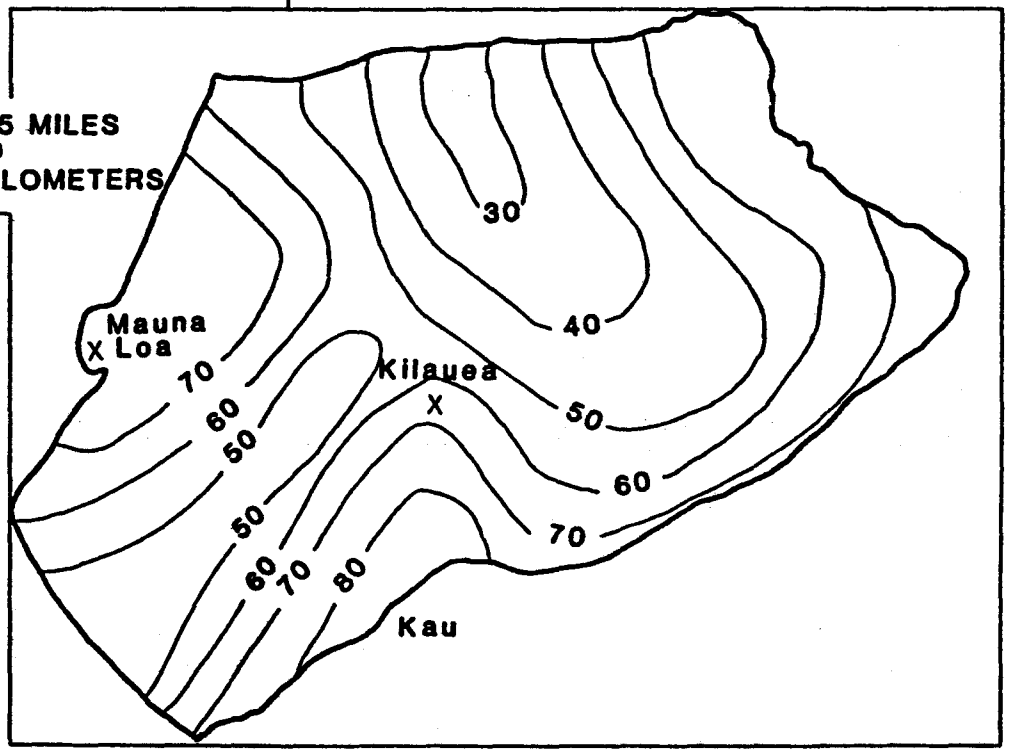


Figure 3.2-1. Lines of equal mean annual pan evaporation. (From State of Hawaii, 1985, Division of Water and Land Development, Report R74.)

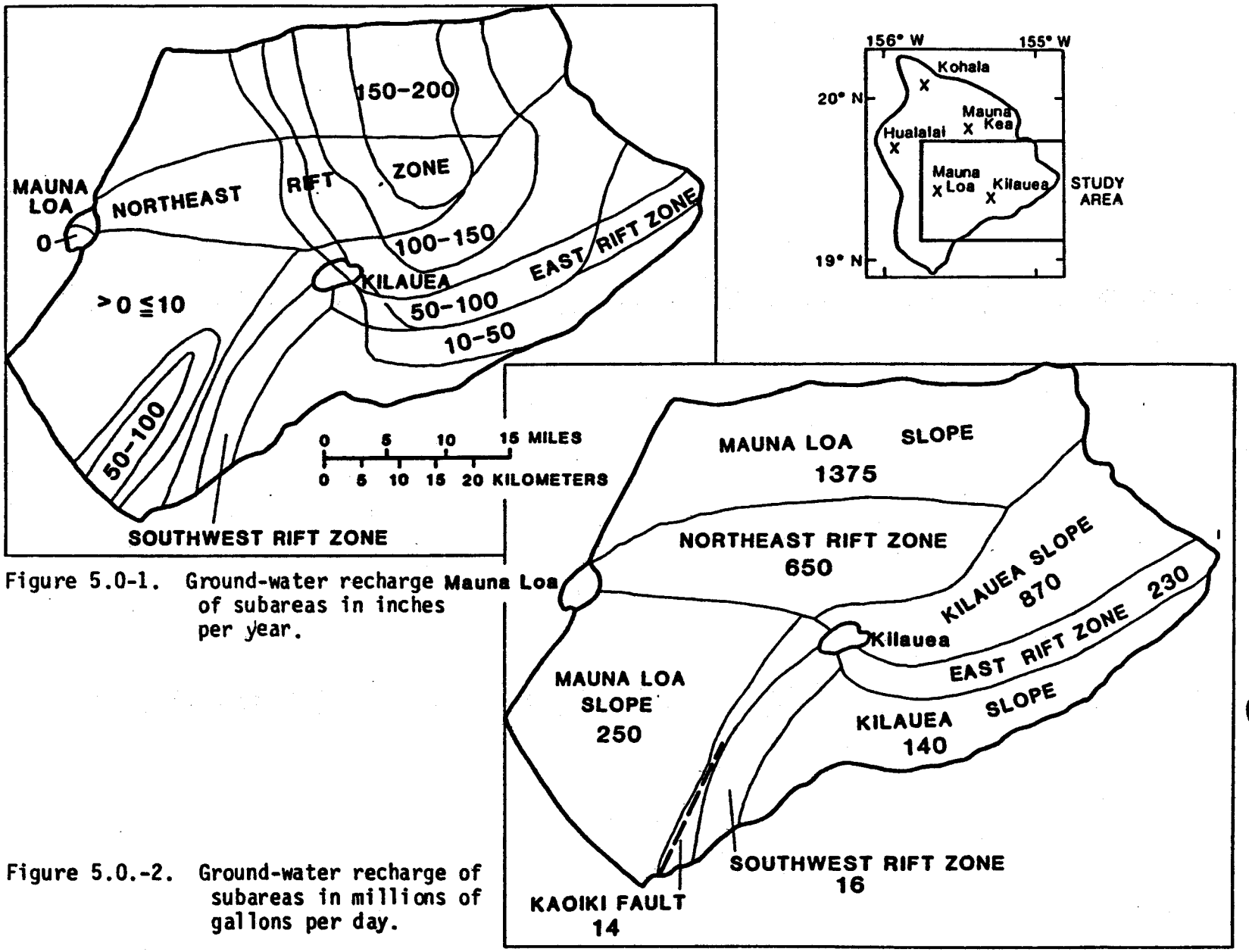


Figure 5.0-1. Ground-water recharge of subareas in inches per year.

Figure 5.0.-2. Ground-water recharge of subareas in millions of gallons per day.

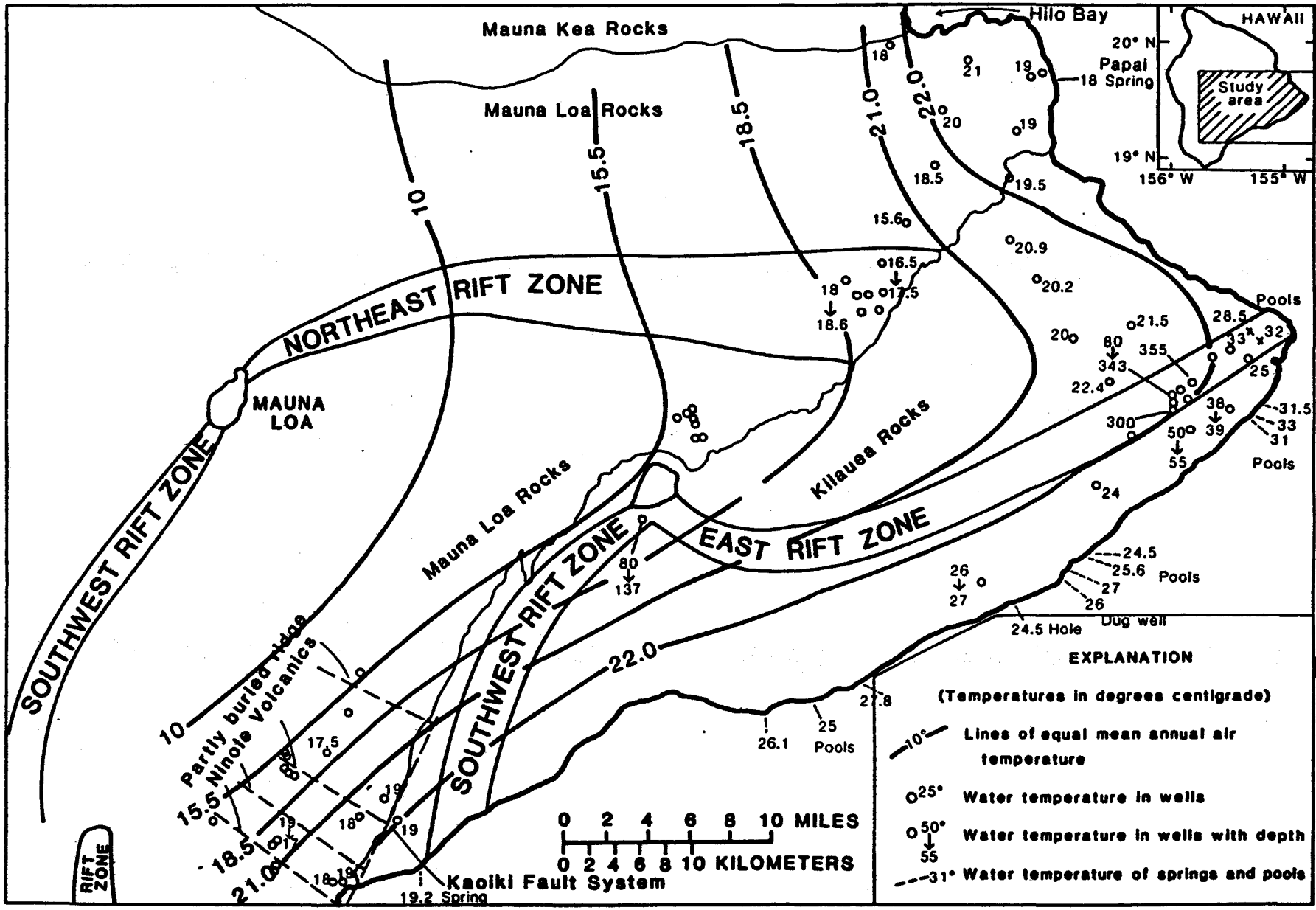


Figure 6.0-1. Ground-water temperatures and lines of equal mean annual air temperature.

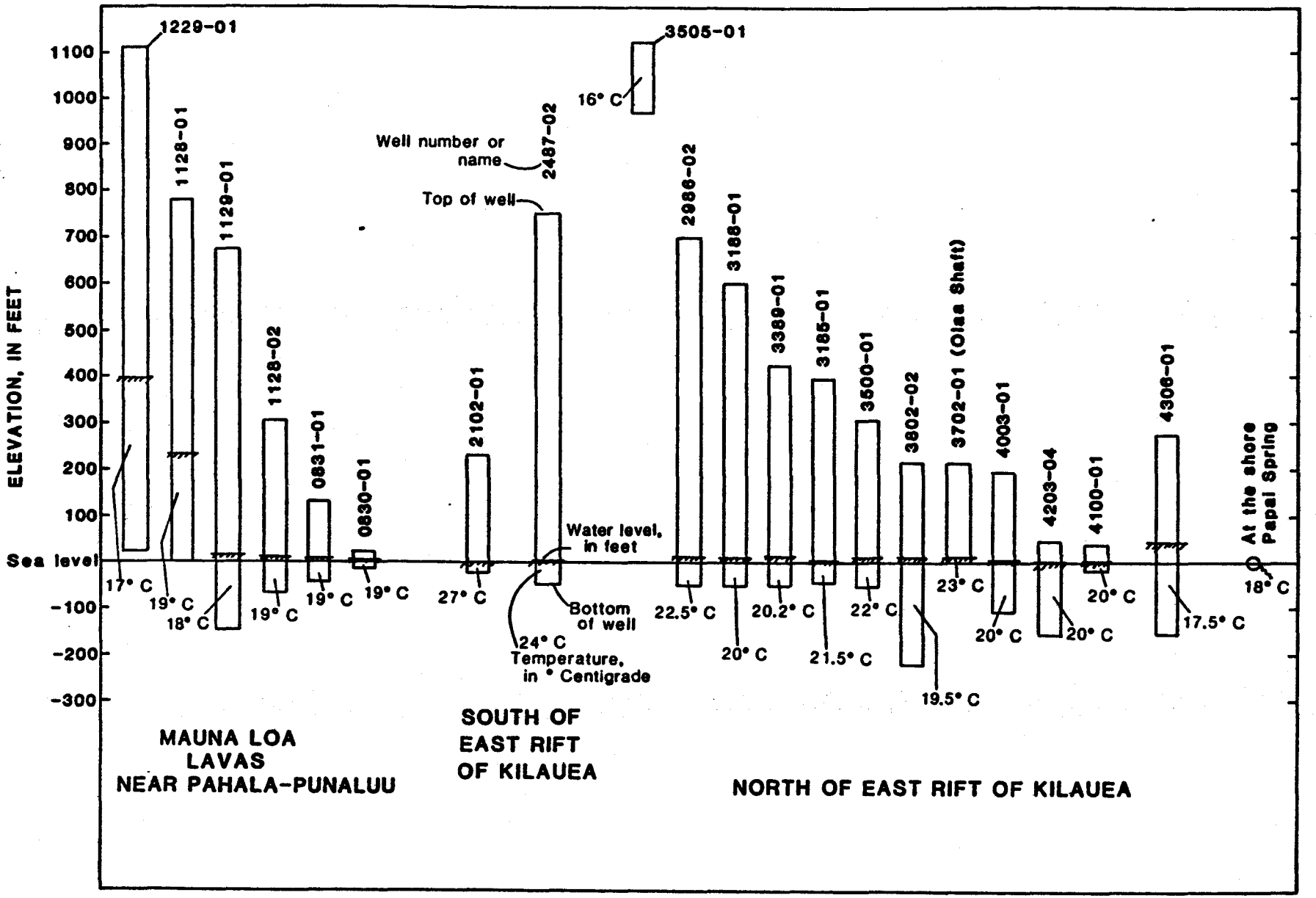


Figure 6.1-1. Temperatures of non-geothermal ground waters in selected wells.

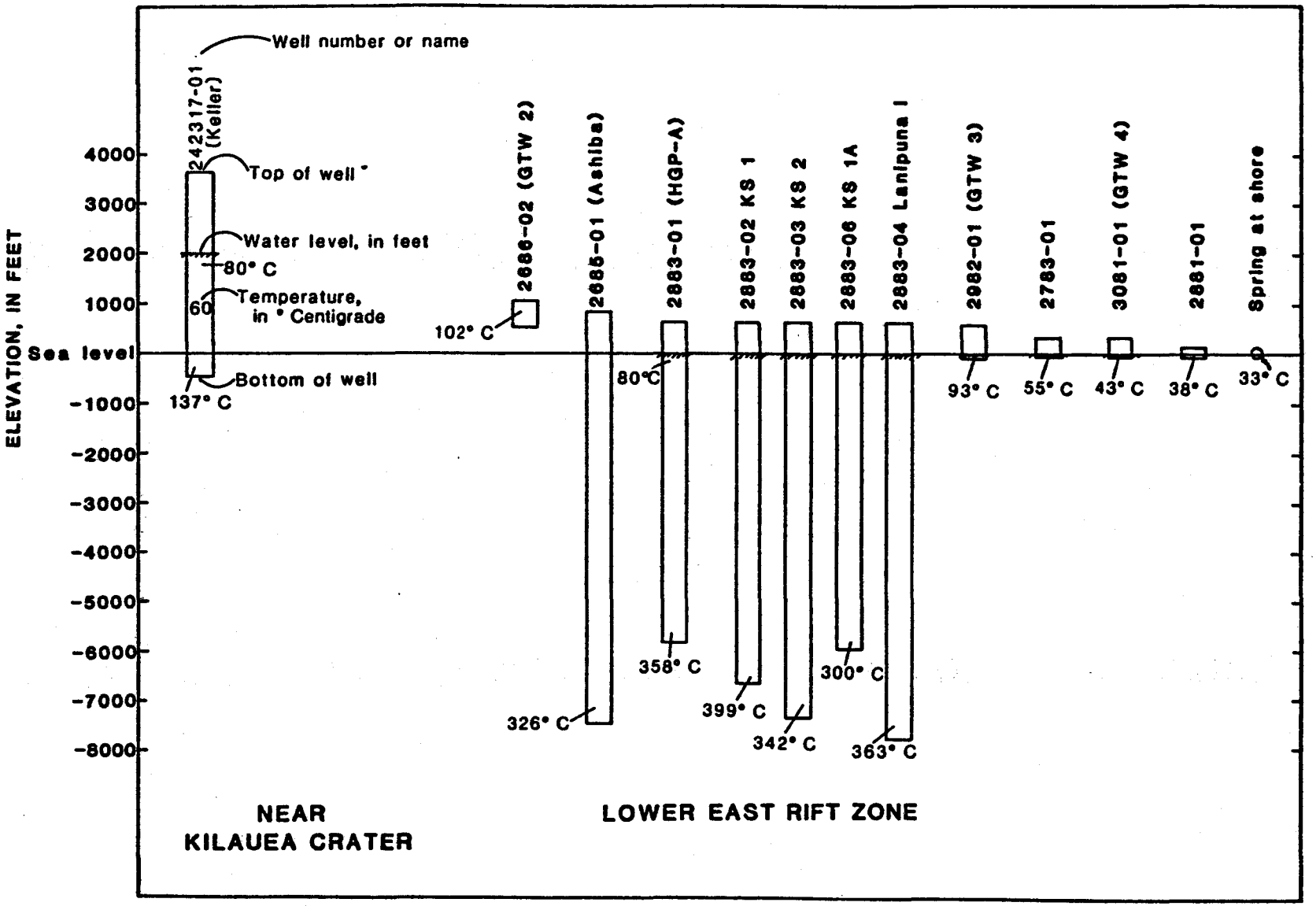


Figure 6.2-1. Temperatures of geothermally heated ground waters in selected wells.

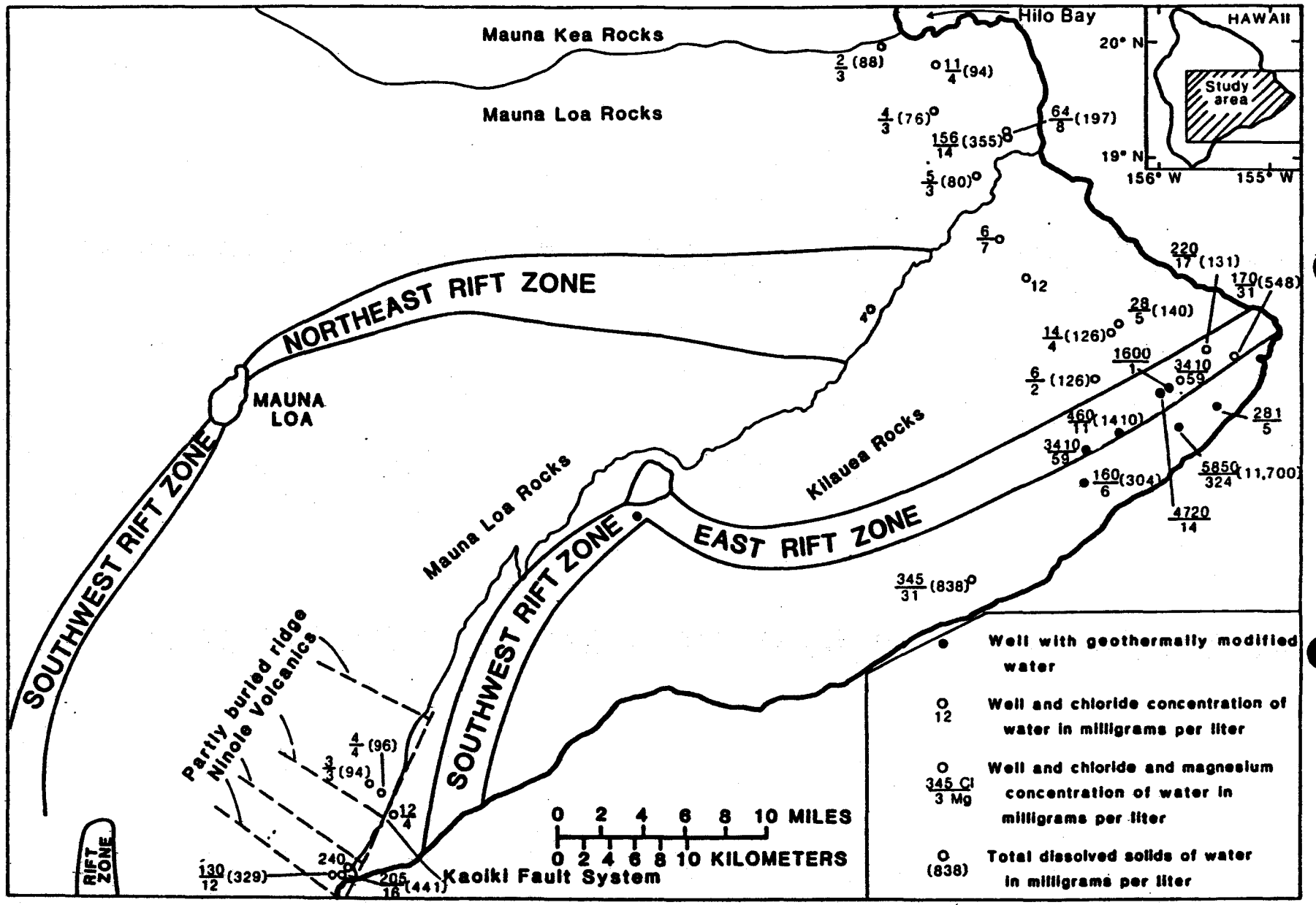


Figure 7.0-1. Ratio of chloride-ion concentration with magnesium-ion concentration and the total dissolved solids concentration of ground waters in selected wells.

Lanipuna No. 6:

1) Well inspected by Mitchell on 2/28/84 (Elev. 600' above sea level)
2) Depth to Fluid: (568.4' − 18') = 550.4' (prior to bailing)
(R.T. above grade)
600' − 550.4 + 9.6' above sea level
3) Temp of fluid @ 89°F
4) ~~groundwater~~ bail sample taken, ~~well~~ water was still ~~was~~ muddy even after continuous bailing from 2:00 pm to 5:30 pm. (260 ppm)
5) Confidentiality period has expired effective 12/25/85

Lanipuna No. 1: (Elev. 600' msl)

1) Inspected by Steve Nishimoto on 3/10/81, 6/1/81, 6/22/81, and 7/9/81
2) Depth to Fluid data not available
3) Temp @ 700°F (Bot. hole temp.)
4) No groundwater sample taken
5) Confidentiality period has expired effective 4/17/85

Lanipuna No. 1 (Directional Drilling) (Elev. 600' msl)

1) No field inspection conducted at all
2) Confidentiality period has expired effective 4/17/85

HGP-A

1) No water sample / water level reading Taken by DLNR.

GEOTHERMAL WELLS

Kapoho State No. 2

(Elev. 717.87' msl)

1) Inspected by Steve Nishimoto on 2/10/82
" " Dan & Ed on 4/21/82 (Heating)

2) No groundwater samples taken

3) Confidentiality expired on 8/17/83

Kapoho State No 1

(Elev. 618.77' msl)

1) Inspected by S. Nishimoto 9/8/81, 12/17/81
" " Yoshi Okuma 9/21/82

2) Drill to water (624.18 + 1.5' − 18') = 607.68' from grnd level
with static water level @ +11.32' above sea level.
618.77' − 607.68' = +11.09' above sea level

3) Temp of sample @ 113° F
Chloride @ 1200 ppm
} see Brewer chemical analysis attached

4) Confidentiality expired on 12/1/82

Kapoho State No. 1-A

(Elev. 619' msl)

1) No field inspection conducted during drilling

2) groundwater samples taken by Thermal Power Co. representative and transported to Hon. by Don Thomas

3) Drill to water @ 608' from ground level
619 − 608 = +11' above sea level

4) Temp of sample @ 110° F

5) see attached U.S.G.S. chemical analysis

6) Confidentiality period still in effect.

9-24-85

per phone call from Jeff Hebein
of Thermal Power:

1) He would like copy of test results from water sample analyses for K.S. # 1, 1-A, 2.

2) He reported the following water level data:

a) K.S. # 1-A - elevation surveyed @ 619' above sea-level
- water level @ 597' - (18' RKB ht.) = 579' from grad. level
- Therefore w.l. @ +40' above sea-level ?

b) K.S. # 1 - water level @ ~~618~~ 626' - (18' RKB) = 608' from grad level
- Therefore w.l. @ +11' above sea-level

c) K.S. # 2 - water level @ ~~723~~ 723' - (18' RKB) = 705' from grad level
- grad elevation @ 717' above s.l.
- Therefore w.l. @ +12' above sea-level

3) Need to evaluate why the large difference in water level between K.S. # 1 and K.S. # 1-A.

a) K.S. # 1 @ +11' vs. K.S. # 1-A @ +40'

			21°28'33"	157°43'33"	30	219	138	8.6	Unconfirmed temperature
OA- 2	2808-01	Lualualei	21°28'13"	158°08'02"	27	118.5	711	5.1	Well plugged
MOLOKAI (4)									
MO- 1	1011-01	Kahalelaui	21°10'20"	157°11'55"	33	162	4764	7.3	Unconfirmed temperature; Well plugged
MAUI (6)									
MA- 1	4600-02	Maui County A	20°46'36"	156°00'26"	20	86.4		29.5	
MA- 2	4600-03	Maui County B	20°46'33"	156°00'32"	18	96.9		20.1	
MA- 3	4835-01	Ukumehame Pump P	20°48'47"	156°35'58"	33	42.9	921	17.7	
MA- 4	5424-01	Specklesville Pump 4	20°54'16"	156°24'43"	23		1180	17.3	
MA- 5	5519-02	Haiku	20°55'50"	156°19'58"	24	68.4	140	21.6	
MA- 6	5620-01	Maliko	20°56'09"	156°20'31"	22			58	
MA- 7	5640-01	Honokowai Pump	20°56'51"	156°40'10"	21		475	17.9	
HAWAII (8)									
			CHLORIDE (mg/l)						
HA- 1	2317-01	NSF-Kilauea	19°23'44"	155°17'21"	137	1262.2		26.1	
HA- 2	2487-01	Keauohana 1	19°24'56"	154°57'19"	24	240.6	222	21.2	
HA- 3	2487-02	Keauohana 2	19°24'57"	154°57'18"	24	240.6	304	27.1	
HA- 4	2685-01	Ashida 1 (460)	19°26'59"	154°55'32"					Proprietary Information
HA- 5	2686-01	Geothermal 1	19°26'34"	154°56'46"	54	54.3			
HA- 6	2686-02	Geothermal 2	19°26'33"	154°56'48"	102	169.5			
HA- 7	2783-01	Malama Ki (6530/6910)	19°27'28"	154°53'01"	55	95.7	11700	18.1	
HA- 8	2881-01	Pohoiki (Allison)	19°28'19"	154°51'10"	38	42		18.7	
HA- 9	2883-01	HGP-A (1000-2000)	19°28'31"	154°53'44"	358	1967.5		1040	
HA-10	2883-X02	Lanipuna 1	19°28'16"	154°53'33"					Proprietary Information.
HA-11	2883-X03	Kapoho State 1 (1200)	19°28'47"	154°53'39"		2187			
HA-12	2883-X04	Kapoho State 2	19°28'47"	154°53'49"					Proprietary Information.
HA-13	2982-01 (2883-05 Lanipuna 6)	Geothermal 3	19°29'13"	154°54'55"	93	210.3		57.8	
HA-14	3081-01 (2883-06 Kapoho State 1A (1098))	Kapoho Test	19°30'24"	154°51'59"	35	101.1	131	18.8	
HA-15	3081-02	Geothermal 4	19°30'39"	154°51'19"	43	88.4			
HA-16	3758-01	Kailua Kona	19°37'50"	155°58'05"	25	184.5	1079	17	
HA-17	4304-01	Waiakea	19°37'50"	155°04'18"	21	6	10900	41	
HA-18	6048-01	Kawaihae 2	20°00'29"	155°48'48"	26	129		18.1	
HA-19	6147-01	Kawaihae 3	20°01'32"	155°47'11"	37	313.8	728	20.1	
HA-20	SP -1*	Waiwelawela Spring			40				
HA-21	SP -2*	Opihikao Spring			38				
HA-22	SP -3*	Isaac Hale Park Spring			36			17.7	

*HIG assigned number

2/2/89

Re- well registration & phone/con w/ Don Thomas

Geo Test wells # 1 and 2 are dry and above the water table/open holes w/ steel cap

Wells #3 is an open hole into the water table, hole is plugged w/ rubbish from land owner who is using it as a cesspool.

Well #4 is also plugged w/ rubbish.

Need to finish location of wells on Trk and contact land owner to register wells w/ DCRR.
Donald to pre-fill form as much as possible w/ all info avail. on our well records. When owner calls, just advise him to sign and return form

speech

PENDING GEOTHERMAL ACTIVITIES (5/18/88)

1)THE DIVISION CONTINUES TO ADMINISTER THE DESIGNATION AND REGULATION OF GEOTHERMAL RESOURCE SUBZONES AND THE LEASING AND DRILLING OF GEOTHERMAL RESOURCES.

2)THE DIVISION CURRENTLY CONDUCTS QUARTERLY SITE INSPECTIONS OF ALL GEOTHERMAL WELLS: 8 WELLS

LANIPUNA NO.1 /BARNWELL/ 8389'/686 TEMP/SUSPENDED
LANIPUNA NO.1 /SIDETRACK/ 6271'/429 TEMP/SUSPENDED
LANIPUNA NO.6 /BARNWELL/ 4956'/335 TEMP/SUSPENDED
ASHIDA NO.1 /BARNWELL/ 8300'/550 TEMP/SUSPENDED
KAPOHO NO.1 /PGV/ 7290'/642 TEMP/SUSPENDED
KAPOHO NO.2 /PGV/ 8005'/660 TEMP/SUSPENDED
KAPOHO NO.1A /PGV/ 6505'/654 TEMP/SUSPENDED
HGP-A /NELH /6455'/676 TEMP/OPERATIONAL/APPROX. 2.1 MW

3)CURRENT PERMITS ISSUED BY THE BOARD INCLUDE:

WELL MODIFICATION PERMIT FOR KS-2 TO RE-DRILL A DIRECTIONAL HOLE FROM THE SAME WELL SITE. PLANS ARE TO DRILL OUT THE EXISTING CEMENT PLUG BELOW 2300' AND KICK OUT A NEW DIRECTIONAL WELL FROM 4200' TO APPROX. 7670' DEPTH. (ISSUED 7-10-87)

WELL MOD. PERMIT FOR KS-1A TO INSTALL TEMPORARY CEMENT PLUG IN WELL BORE CASING AT APPROX. 3000' DEPTH. (ISSUED 3-1-88)

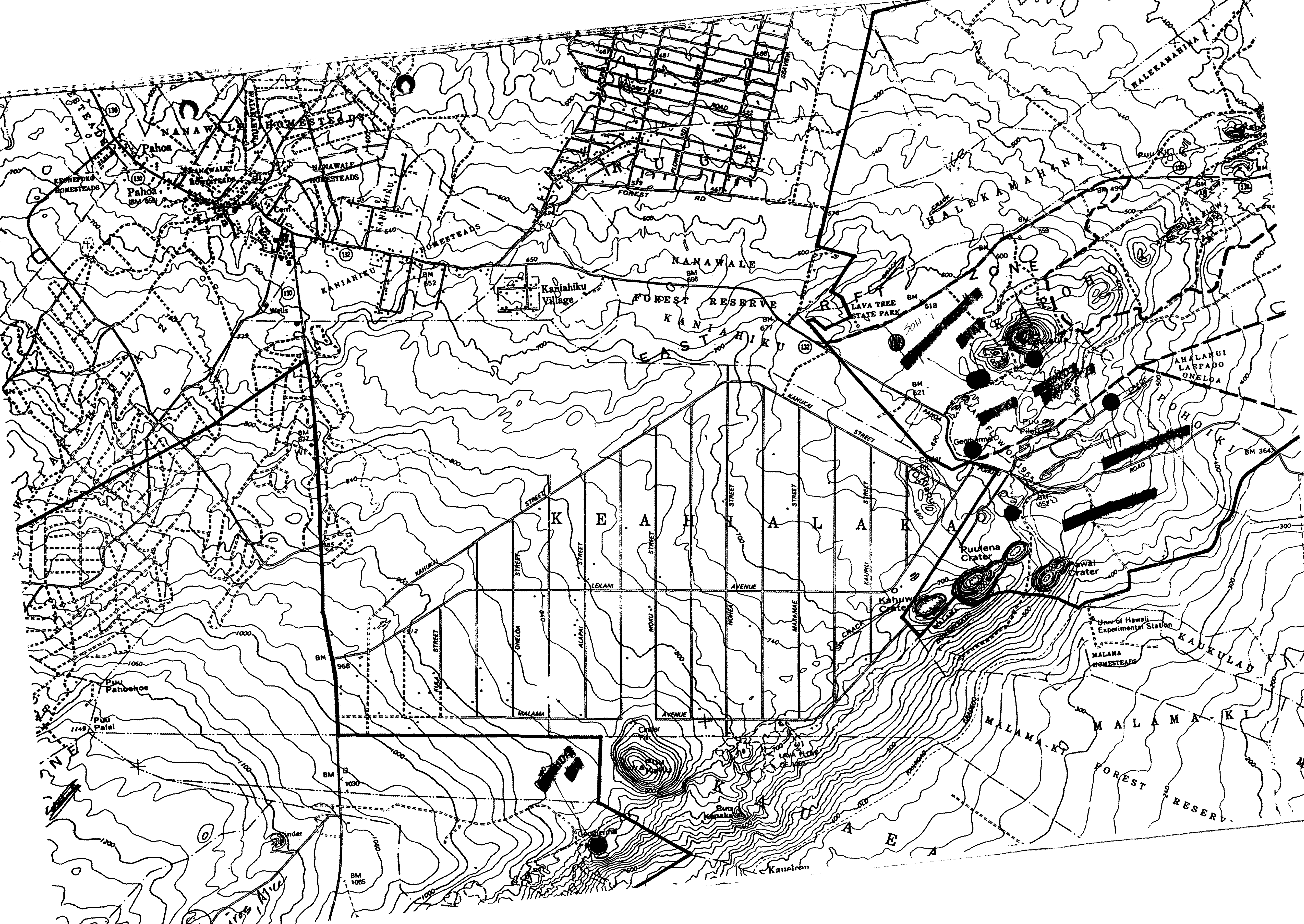
(OPTIONAL COMMENT) THE PROPOSED PIPELINE PROJECT BETWEEN THERMAL POWER CO. AND NELH TO CONNECT WELL KS-1A TO THE HGP-A POWER PLANT FACILITY WAS APPROVED, BUT THE PROJECT IS CURRENTLY SUSPENDED PENDING FURTHER NOTICE FROM THE DEVELOPER. (AMENDMENT TO PLAN OF OPS ISSUED 4-25-88, 4 YR DURATION.)

4)PURSUANT TO ACTS 290, 124, 167, SLH 1986 AND ACTS 372, 378, SLH 1987, THE DIV. IS IN THE PROCESS OF AMENDING THE DEPT.'S ADMIN. RULES CHAP. 13-184, ON THE DESIG. AND REG. OF GEOTHERMAL RES. SUBZONES.

DEFINITION OF GEOTH. DEV. ACTIVITIES EXPANDED/ALLOWS DIRECT USE APPLICATIONS OUTSIDE GRS.
NOTIFICATION OF LANDOWNERS W/IN 1000' OF BOUNDARY.
SETS STNDS FOR THE BOARD TO REVIEW APPL. W/IN CDUA AREA.
ELIMINATES CONTESTED CASE HEARINGS FOR THE DESIG. AND REG. OF GRS AND PROVIDES FOR DIRECT APPEAL TO THE SUPREME CT.

5)IN ADDITION, PURSUANT TO S.B. NO.2750 PASSED DURING THE 1988 SESSION, THE DIV. WILL BE PREPARING DRAFT AMENDMENTS TO THE DEPT.'S CHAP.13-183 ON THE LEASING AND DRILLING OF GEOTH. RES.

6)LASTLY, A REQUEST FOR A CONTESTED CASE HEARING ON THE PROPOSED KILAUEA SOUTHWEST RIFT GRS IS STILL PENDING AND AWAITS A DECISION WHETHER OR NOT TO GRANT A C/C HEARING BASED ON THE PETIONER'S STANDING AND RECENT LEGISLATION THAT ELIMINATES THE PROVISION FOR C/C HEARINGS ON GRS MATTERS. (REQUESTED 9-26-85)



Pahoa
NANAWALE HOMESTEADS
KEONEPOKO HOMESTEADS
NANAWALE HOMESTEADS
KANIAHIKU HOMESTEADS
Kaniahiku Village
Wells
FOREST RD
NANAWALE FOREST RESERVE
KANIAHIKU
EAST
RIFT ZONE
LAVA TREE STATE PARK
HALEKAMAHINA
AHALANUI
LAEPAOO
ONELOA
POHOIKI
POHOIKI ROAD
Geothermal
LAVA FLOW OF 1955
KAHUKAI STREET
K E A H I A L A K A
LEILANI AVENUE
MALAMA AVENUE
KULA STREET
ONELOA STREET
ALAPAI STREET
MOKU STREET
NOHEA STREET
MALAMAE STREET
KAUPILI STREET
CRACK
Kahuwai Crater
Puulena Crater
Pawai Crater
Univ of Hawaii Experimental Station
MALAMA HOMESTEADS
KAUKULAU
MALAMA-KI
MALAMA-KI FOREST RESERVE
Puu Pahoehoe
Puu Palai
Cinder Pit
Puu Kaliu
Puu Kepaka
LAVA FLOW OF 1955
K A U A E A
Kaueleau
Cinder
Geothermal

STATUS OF WELL DRILLING/MODIFICATION ACTIVITIES

DATE APPLIC. RECEIVED	DATE OF WELL PERMIT	WELL NAME	WELL NUMBER	ISLAND	TAX MAP KEY	LAND OWNER	OPERATOR	DRILLER	PRELIMIN. PLOT (Pencil)	DATE DRILLED	DATE D.R. RCVD	FINAL PLOT (Red)	~~CODE SCHED.~~ Elevation	REMARKS
6/3/87	7/10/87	KAPOHO STATE * No. 2 (KS-2)	2883-03	Hawaii	1-4-01:19	Kapoho Land Develop Co., Ltd.	Thermal Power Company	WRII		Permit Expired				Re-drilling per for directional h
1/27/88	3/1/88	KAPOHO STATE No. 1A (KS-1A)	2883-06	Hawaii	1-4-01:07	↓ ↓	↓ ↓	?		Permit Expired				Modification permit plug (temporary) w
7/20/88	(pending)	KAPOHO STATE No. 2	2883-03	Hawaii	1-4-01:19	Same as above	ORMAT ENERGY SYSTEMS, INC.	?		Withdrawn ?				Re-drill (direction. below 4200 ft.
3/7/89	5/25/89	SCIENTIFIC OBSERV HOLE (SOH) - 1			1-4-01:02		UH/HNEI	TONTO DRILLING CO.		✓				OBSERVATION/TEST HOLES
↓	5/25/89	SOH - 2			1-4-02:32			↓						↓
		SOH - 3			1-2-10:03	Campbell Estate								
	5/30/89	SOH - 4			1-2-10:01	↓ ↓				✓				
↓		SOH - 5M		Maui		State of Hawaii								
3/7/89		SOH - 6M		Maui		↓ ↓								
2/6/89	5/30/89	True/Mid-Pacific (T/M-P) AI-1		Hawaii	1-2-10:03	Campbell Est.	True Geothermal Energy Co.	True Geoth. Energy Co.		✓				Proposed depth of 8,000' - 14,000'
5/30/89	6/16/89	KS. 1-A	2883-06	↓	1-4-01:07	Kapoho Land Develop Co., Ltd.	Puna Geothermal Venture (PGV)							Modification Permi set temporary c plug.
7/30/90	8/1/90	T/M-P AI-1, Well Modification		Hawaii	1-2-10:03	Campbell Est.	True Geothermal Energy Co	True Geoth. Energy Co.						Modify by setting and directional drilling from sam
7/10/89	8/31/89	KS #3		"	1-4-01:02	Kapoho Land Development Ltd. Lease to Kapoho Land Partnership	PGV	Parker Drilling Co.					620'±	proposed depth 7000 ft.
7/2/90		Extension request for KS #3												Extension granted 8/31/91

PRINT DATE:01-Jan-85

GEOTHERMAL WELL INFORMATION

	OWNER/OPERATOR	WELL DESIGNATION	AREA	LAT/LONG	SPUD DATE	COMP. DATE	TOTAL DEPTH	CASING LINER	STATUS	ELEV.	TAX MAP KEY	BOT/HOLE TEMP.(F)	CHLORIDE(mg/l)	PH
1.	BARNWELL GEOTHERMAL CORP.	LANIPUNA No.1 USGS# 2883-04	KEAHIALAKA PUNA, HAWAII	19 28'16" 154 53'33"	2/9/81	5/26/81	8389'	7"PERF 3502'-7872'	SUSPENDED	600'	1-3-45:33	696	N/A	
2.	BARNWELL GEOTHERMAL CORP.	LANIPUNA No.1 (SIDETRACK)	KEAHIALAKA PUNA, HAWAII	19 28'16" 154 53'33"	5/17/83	6/19/83	6271'	N/A	SUSPENDED	600'	1-3-45:33	429	N/A	
3.	BARNWELL GEOTHERMAL CORP.	LANIPUNA No.6 USGS# 2883-05	KEAHIALAKA PUNA, HAWAII	19 29'44" 154 53'4"	2/22/84	6/1/84	4956'	7"PERF 1086'-4239'	SUSPENDED	600'	1-3-08:23	335	N/A	
4.	BARNWELL (SEDCO)	PUHIA No.1 USGS# 2685-01	OPIHIKAO PUNA, HAWAII	19 26'59" 154 55'32"	6/10/80	10/29/80	8300'	N/A	SUSPENDED	800'	1-3-01:24	550	174	
5.	PUNA GEOTHERMAL VENTURE (PGV)	KAPOHO No.1 USGS# 2883-02	KAPOHO PUNA, HAWAII	19 28'47" 154 53'39"	9/1/81	11/3/81	7290'	7"PERF 3318'-7216'	SUSPENDED	619'	1-4-01:2	642	1150	
6.	PUNA GEOTHERMAL VENTURE (PGV)	KAPOHO No.2 USGS# 2883-03	KAPOHO PUNA, HAWAII	19 28'55" 154 53'22"	1/19/82	4/2/82	8005'	7"PERF 3981'-7891'	SUSPENDED	718'	1-4-01:19	660	N/A	
7.	PUNA GEOTHERMAL VENTURE (PGV)	KAPOHO No.1-A USGS# 2883-06	KAPOHO PUNA, HAWAII	19 29'48" 154 53'37"	7/8/85	8/3/85	6505'	7"PERF 3874'-6505'	TESTING	619'	1-4-01:2	654	1098	8.5
8.	NATURAL ENERGY LABORATORY OF HAWAII (NELH)	HGP-A USGS# 2883-01	KAPOHO PUNA, HAWAII	19 28'31" 154 53'43"	12/10/76	6/1/76	6435'	7"PERF 2161'-6435'	PRODUCTION	600'	1-4-01:82	676	(1000-2000)	10.04

PRINT DATE:01-Aug-86

GEOTHERMAL WELL INFORMATION

OWNER/OPERATOR	WELL DESIGNATION	AREA	LAT/LONG	SPUD DATE	COMP. DATE	TOTAL DEPTH	CASING LINER	STATUS	ELEV.	TAX MAP KEY	BOTTOMHOLE TEMP.(F)	CHLORIDE(mg/L)	PH
1: BARNWELL GEOTHERMAL CORP.	LANIPUNA No.1 ~~USGS# 2883-04~~ 2883-02 OK	KEAHIALAKA PUNA, HAWAII	19 28'16" ✓ 154 53'33" ✓	2/9/81	5/26/81	8389'	7"PERF 3502'-7872'	SUSPENDED	600'	1-3-45:33	686	N/A	
2: BARNWELL GEOTHERMAL CORP.	LANIPUNA No.1 (SIDETRACK) 2883-02(A) OK	KEAHIALAKA PUNA, HAWAII	19 28'16" ✓ 154 53'33" ✓	5/17/83	6/19/83	6271'	N/A	SUSPENDED	600'	1-3-45:33	429	N/A	
3: BARNWELL GEOTHERMAL CORP.	LANIPUNA No.6 USGS# 2883-05 OK	KEAHIALAKA PUNA, HAWAII	19 28'44" ✓ 154 53'4" ✓	2/22/84	6/1/84	4956'	7"PERF 1086'-4239'	SUSPENDED	600'	1-3-08:23	335	N/A	
4: BARNWELL (GEDCO)	ASHIDA No.1 USGS# 2685-01 OK	OPIHIKAO PUNA, HAWAII	19 26'59" ✓ 154 ~~55~~ 32" (50") ✓	6/10/80	10/29/80	8300'-	N/A	SUSPENDED	800'	1-3-01:24	550	174	/460
5: PUNA GEOTHERMAL VENTURE (PGV)	KAPOHO No.1 ~~USGS# 2883-02~~ 2883-03 OK	KAPOHO PUNA, HAWAII	19 28'47" ✓ 154 53'39" ✓	9/1/81	11/3/81	7290'	7"PERF 3318'-7216'	SUSPENDED (619.7T)	619'	1-4-01:2	642	1150	/1200
6: PUNA GEOTHERMAL VENTURE (PGV)	KAPOHO No.2 ~~USGS# 2883-03~~ 2883-04 OK	KAPOHO PUNA, HAWAII	19 28'55" ✓ 154 53'22" (25") ✓	1/19/82	4/2/82 ? check	8005'	7"PERF 3981'-7891'	SUSPENDED (717.97')	718'	1-4-01:19	660	N/A	
7: PUNA GEOTHERMAL VENTURE (PGV) (CONFIDENTIAL INFO)	KAPOHO No.1-A ~~USGS# 2883-06~~ OK	KAPOHO PUNA, HAWAII	19 28'48" ✓ 154 53'37" ✓	7/8/85	9/3/85	6505'	7"PERF 3874'-6505'	TESTING	619'	1-4-01:2	654	1098	8.5
8: NATURAL ENERGY LABORATORY OF HAWAII (NELH)	HGP-A USGS# 2883-01 OK	KAPOHO PUNA, HAWAII	19 28'31" ✓ 154 53'43" ✓	12/10/75	6/1/76	6455'	7"PERF 2161'-6435'	PRODUCTION	600'	1-4-01:82	676	(1000-2000)	10.04

Well Index 0

9⅝" casing N80 @ 43.5 lb/ft.

7" casing (re-work) 70 joints @ 26-lb K-55 buttress casing.