CONSTRUCTION, GEOLOGIC LOG, AND AQUIFER TESTS OF THE HANAMAULU MONITOR WELL (STATE WELL 2-5923-08), LIHUE, KAUAI, HAWAII

By Scot K. Izuka and Stephen B. Gingerich

U.S. GEOLOGICAL SURVEY

Open-File Report 97-36

Prepared in cooperation with the

COUNTY OF KAUAI DEPARTMENT OF WATER

Honolulu, Hawaii
1997

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

For additional information write to:

District Chief
U.S. Geological Survey
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813

Copies of this report can be purchased from:
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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	By	To obtain
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
cubic foot per minute (ft^3/min)	0.02832	cubic meter per minute
gallon per minute (gal/min)	3.785	liter per minute
mile, statute (mi)	1.609	kilometer

Other Useful Conversions

1 ft^3/s = 448.8 gal/min

1 ft^3/s = 0.6463 Mgal/d

Vertical datum

All elevations in this report are referenced relative to mean sea level.

Abbreviation:

µS/cm, microsiemens per centimeter at 25 degrees Celsius.

Construction, Geologic log, and Aquifer Tests of the Hanamaulu Monitor Well (State Well 2-5923-08), Lihue, Kauai, Hawaii

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Abstract

The Hanamaulu monitor well, located in the center of the Lihue basin, was drilled in 1995 and tested to study the hydrology and geology in an area where sparse well information is available. The well was drilled to a depth of 1,002 feet from a ground elevation of about 272 feet. Water was found first at an elevation of 243 feet, but decreased to 217 feet elevation after the well was completed. The well penetrated a 1,002-foot section of mafic lava flows (which may include nephelinite, melilitite, basanite, and alkalic basalt), fossiliferous marine mud, beach gravel, coral, and alluvium.

A sustained-rate aquifer test conducted prior to casing installation lasted about 69 hours with pumping rates of about 300 to 360 gallons per minute and a maximum drawdown of 168.43 feet in the pumping well. A second sustained-rate test, conducted after the casing and gravel pack were installed, had a maximum drawdown of 110.56 feet measured in the pumped well after 2,880 minutes of pumping at an average of 76 gallons per minute. The temperature and specific conductance of the pumped water remained steady throughout both sustained-rate tests. Analysis of a step-drawdown aquifer test conducted after the casing and gravel pack were installed indicates that for an average pumping rate of 76 gallons per minute, the well loss was 11.83 feet.

INTRODUCTION

The Lihue basin is the center of population, government, and industry for Kauai. Recent population growth in the basin has greatly increased the demand for water in the area. The economic setback caused by Hurricane Iniki in 1993 slowed growth on Kauai and may have kept the water supply from reaching a critical stage; however, an ample water supply is needed for the island's economic recovery. Pre-Iniki studies placed Lihue's supply at the highest priority in Kauai's water plans (Commission on Water Resources Management, 1990).

The Hanamaulu monitor well (State well 2-5923-08) is one of six monitor wells drilled in the period from April 1995 to April 1996 by the U.S. Geological Survey (USGS) in cooperation with the County of Kauai Department of Water to study the availability of ground-water in the southern Lihue basin (fig. 1). The six monitor wells were sited in areas where no wells had been drilled and no subsurface information was available. Five of the six monitor wells were drilled in the central part of the Lihue basin. The sixth well was drilled in the southern part of the basin. The Hanamaulu monitor well is about 0.7 mi from the nearest pumping wells and provides data for defining the regional ground-water system of the Lihue basin. The Department of Water considers the Hanamaulu area as a potential site for future ground-water exploration and development.

The objectives of this study were met by analysis of data collected during and after the drilling operation. These data included (1) the driller's description of the well-construction details and the drilling history,

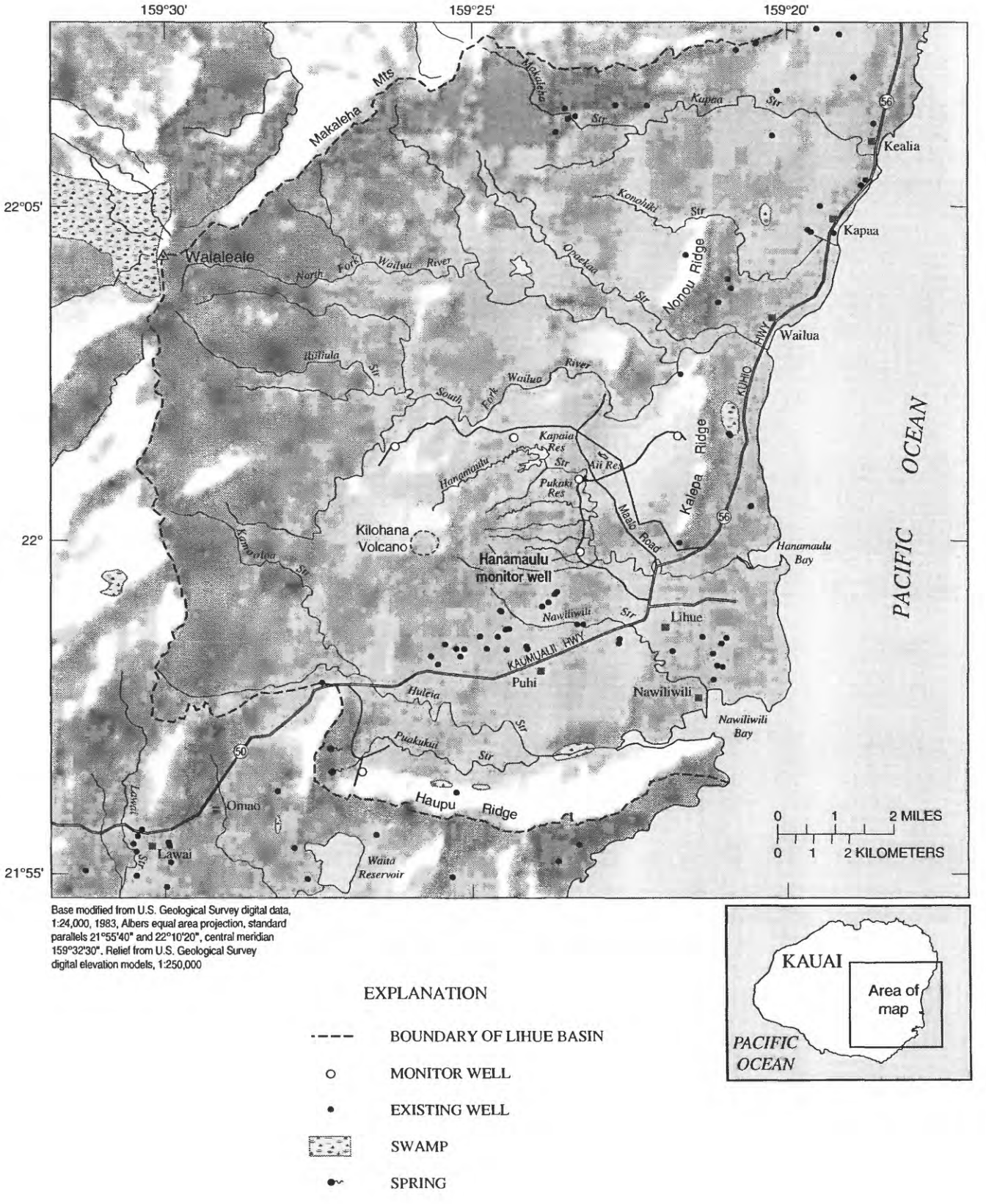

Figure 1. Location of the Hanamaulu monitor well (State well 2-5923-08) and existing wells in the Lihue basin, Kauai, Hawaii.

(2) water levels monitored as the well was deepened, (3) a caliper log of the uncased well boring, (4) a description of the geology from rock chips (cuttings) brought to the surface during drilling, and (5) a step-drawdown and two sustained-rate aquifer tests. This report documents the location, drilling history, construction details, geologic log, and aquifer-test results of the Hanamaulu monitor well.

Setting

The Hanamaulu monitor well (State well 2-5923-08) is located in the Lihue basin, a large depression bounded on the west by the high mountains of central Kauai, on the south by Haupu Ridge, and on the north by the Makaleha Mountains (fig. 1). The area has undergone substantial stream erosion, weathering, and faulting followed by rejuvenated, sporadic, scattered volcanism. Two major stratigraphic units are found in the Lihue basin (fig. 2): (1) the Waimea Canyon Basalt of Pliocene and Miocene (?) age which was erupted during the main shield-volcano-building stage of Kauai and forms the bulk of the island, including the mountains surrounding the Lihue basin; and (2) the Koloa Volcanics of Pleistocene and Pliocene age which include the rejuvenated-stage lava flows and sedimentary units that partly cover and fill the floor of the basin (Hinds, 1930; Stearns, 1946; Macdonald and others, 1960). Both the Waimea Canyon Basalt and the Koloa Volcanics have been given formational rank (Langenheim and Clague, 1987).

Kilohana Volcano in the center of the Lihue basin is a prominent edifice of the Koloa Volcanics. Macdonald and others (1960) described the Lihue basin as a subsidiary caldera that formed to the east of a central main caldera of the Kauai shield volcano. Stearns (1946) described the basin as the result of advanced stream erosion and the coalescing of many amphitheater-headed valleys. Numerous subsequent geologic investigations include a gravity survey (Kivroy, and others, 1965), petrologic and geochemical analyses (Macdonald, 1968; Feigenson, 1984; Clague and Dalrymple, 1988; Maaloe and others, 1992), and radiometric dating (Clague and Dalrymple, 1988). These studies have advanced the understanding of the geology of Kauai, yet the origin of the Lihue basin remains an enigma.

Ground-water exploration in the Lihue basin has been only moderately successful, owing in part to the basin's complex ground-water hydrology. Most of the ground water in the Lihue basin is developed from wells in the Koloa Volcanics, which cover almost the entire basin floor. The Koloa Volcanics generally are considered to have low to moderate permeabilities (Macdonald and others, 1960), but specific capacities of wells in this unit are highly variable. Water levels during drilling in many of these wells declined with depth in the aquifer, indicating substantial vertical head gradients. At the base of the Koloa Volcanics and resting unconformably on the underlying Waimea Canyon Basalt, are the weathered rocks and sedimentary deposits that formed during the period of erosion between the shield-volcano eruptions and the rejuvenated volcanism. These deposits probably have low permeabilities and may retard the flow of water between the Koloa Volcanics and the Waimea Canyon Basalt.

The Waimea Canyon Basalt in the Lihue basin is represented by the Napali Member, the thick accumulations of thin lava flows that formed on the flank of the Kauai shield volcano. In western Kauai, the Napali Member is extensive and forms the most permeable aquifers on Kauai, but in the Lihue basin, the Napali Member crops out only in the mountains encircling the basin. It is not certain whether any of the wells drilled thus far in the center of the basin have penetrated the Koloa Volcanics and into the underlying Napali Member. Therefore, the thickness of the Koloa Volcanics and the hydrologic properties of the underlying Napali Member are unknown.

Location

The Hanamaulu monitor well is located in the center of the Lihue basin near sugarcane fields at the eastern base of Kilohana Crater. The site is on the eastern shoulder of a sugar plantation road, about 1.6 mi west of the intersection with State Route 50. The well was assigned the well number 2-5923-08 by the State of Hawaii Commission on Water Resources Management using the State well numbering system (table 1).

The area within a 1 mi radius of the well is covered by a network of artificial and natural surface-water bodies (fig. 1). Hanamaulu Stream and two irrigation ditches are within 1,000 ft of the well. The well is

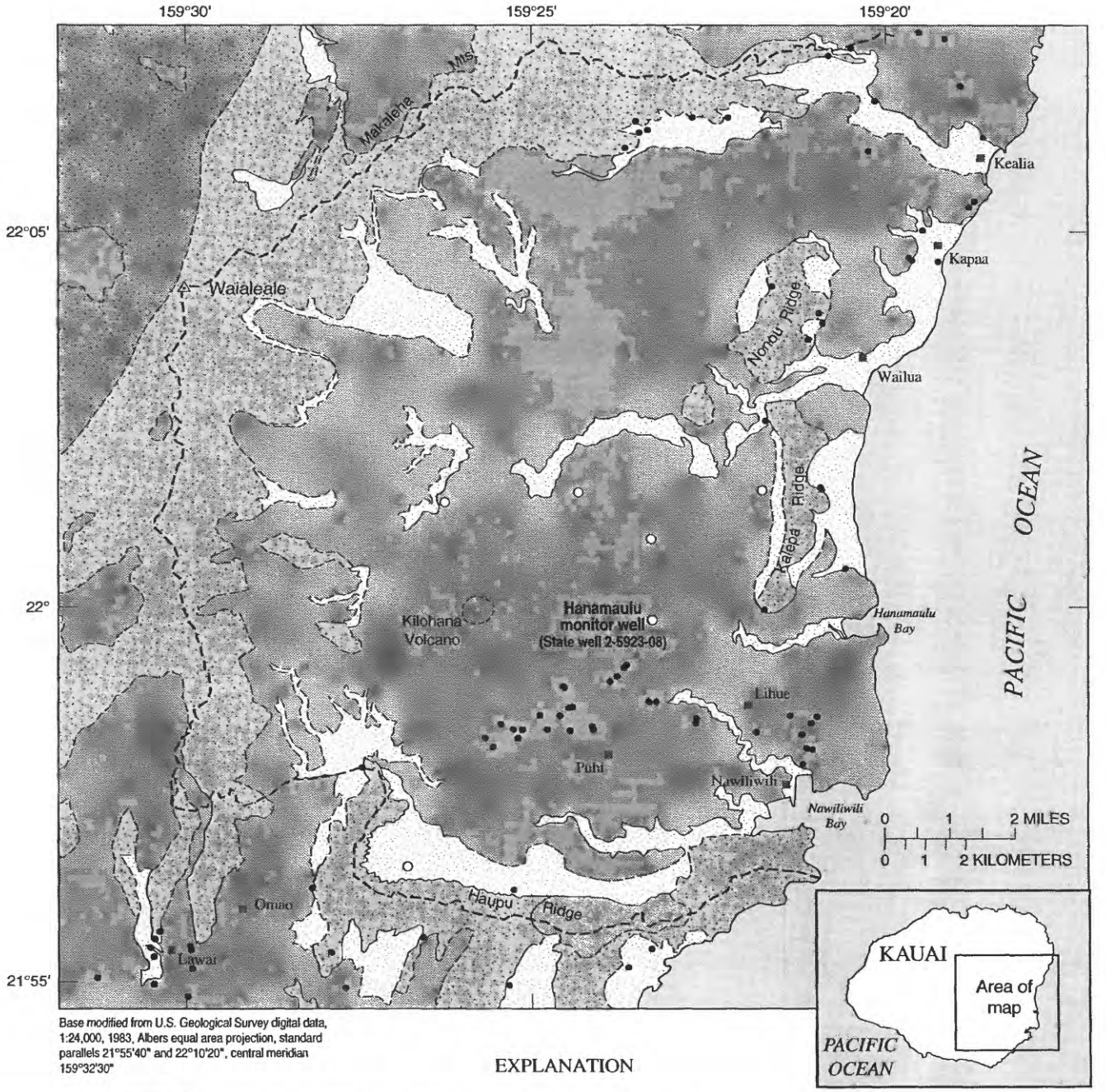

Figure 2. Geology of the Lihue basin area, Kauai, Hawaii (modified from Macdonald and others, 1960).

Table 1. Location, elevation, and State number of the Hanamaulu monitor well, Kauai, Hawaii
[Datum is mean sea level]

Latitude	21°59′50″N
Longitude	159°23′16″W
Ground elevation at brass plate in concrete pad	272.55 feet
Measuring-point elevation at top of 4-inch well casing	273.49 feet
Distance and direction from Lihue	1.5 miles northwest
Distance and direction from nearest shoreline	2.8 miles west
State well number	2-5923-08

located about 2.8 mi inland from the eastern coast of Kauai.

Acknowledgments

The construction, data collection, and testing of the Hanamaulu monitor well was made possible with the cooperation and assistance of Mr. Murl Nielsen, Manager and Chief Engineer, and the staff of the County of Kauai Department of Water. We are grateful to Mr. Michael Furukawa for permitting the construction of the well on Amfac/JMB Hawaii, Lihue Plantation land. Drilling, aquifer-test, and elevation information were drawn extensively from the notes of G. Wayne Heick of the U.S. Geological Survey.

DRILLING METHODS AND HISTORY

The well was bored by rotary drilling with a 7-7/8-in. diameter tungsten-carbide bit. Air and foam were injected down through the hollow drill stem and circulated back up the space between the stem and the well boring to remove cuttings and water from the hole. Greater lifting power was needed as the drilling penetrated deeper below the water table. The depth of drilling was thus limited by the capacity of the air compressor to provide the circulation. Flush-jointed 4-in. (outer diameter) polyvinyl-chloride (PVC) casing, with slots between the water table and the bottom, was installed and gravel was packed in the annular space between the casing and the well boring. Table 2 summarizes the construction history of the well. The elevation of the brass plate in the cement pad at the well is 272.55 ft above sea level and the well is 1,002 ft deep (bottom is at -730 ft elevation). Construction details of the finished well are shown in figure 3.

Water levels decreased as the well was deepened. Water levels measured daily before the start of drilling show a sharply decreasing trend from an initial water level of 243 ft elevation when the bottom of the well was at 148 ft elevation, to a water level of 187 ft elevation when the bottom of the well was at -730 ft elevation. However, several weeks after the well was completed, the water level rose to 217 ft elevation. This gradual rise in water level may indicate that the water table had been drawn down by air-lifting of water by the compressor during the drilling process and that it took several days to recover. Even so, the water level never recovered to the initial elevation of 243 ft, indicating that there may be a head gradient with depth in the aquifer.

Step-drawdown and sustained-rate aquifer tests were conducted in the open hole before casing was installed. During the first sustained-rate test, the well was pumped at an average of 340 gal/min. The test was terminated 4 days later because the pump clogged. A caliper tool was run down the hole to record the caliper arm extension, an indication of the variation in hole diameter with depth. The caliper log indicated that part of the well had caved. Step-drawdown and sustained-rate aquifer tests were repeated after the casing was installed and the annular space packed with gravel. The second sustained-rate test was conducted at an average rate of 76 gal/min but was terminated 2 days later because the water level was approaching the pump intake.

GEOLOGIC LOG

A geologic log of the Hanamaulu monitor well was compiled by examination of cuttings brought to the surface by the air and foam circulated through the well bore. Samples were collected at 5-ft depth intervals and air dried before being examined macroscopically. The complete lithologic descriptions appear in appendix 1; the geologic log is shown in figure 4.

The Hanamaulu monitor well penetrated a 1,002-ft section of mafic lava flows, marine sediments, and alluvium ("mafic rock" in this report includes basanite, melilitite, nephelinite, and alkalic basalt all of which are dark, fine-grained, igneous rocks but have specific compositions that are not distinguishable in hand specimen). The uppermost part of the section consists of a 60-ft layer of residual soil underlain by a 75-ft-thick section

Table 2. Summary of construction of the Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii
[Datum for water-level and bottom-of-hole elevations is mean sea level. Land surface elevation is about 272 ft above mean sea level; ft, feet]

Date		Significant events
April 1995	8	Drilling began
	11	Water level about 243 ft elevation and bottom-of-hole 148 ft elevation; surface casing installed
	19	Water level before drilling about 250 ft elevation and bottom-of-hole 148 ft elevation; continued drilling to 92 ft elevation
	20	Water level before drilling about 229 ft elevation and bottom-of-hole 92 ft elevation; increase in water lifted out of well at 50 ft elevation; continued drilling to -5 ft elevation
	21	Water level before drilling about 221 ft elevation and bottom-of-hole -5 ft elevation; increase in water lifted out of hole at -8 ft, -184 ft, and -228 ft elevation; continued drilling to -228 ft elevation
	22	Continued drilling to -390 ft elevation
	25	Increase in water lifted out of well at -435 ft elevation; continued drilling to -530 ft elevation
	26	Drilling terminated at -730 ft elevation (total depth of 1,002 ft)
May 1995	2	Water level 187.2 ft elevation; logged upper 880 ft of hole with caliper, blockage at -606 ft elevation discovered
	8	Water level about 200 ft elevation; performed step-drawdown test
	9	Water level about 192 ft elevation; began sustained pumping test at 340 gallons per minute
	13	Terminated sustained pumping test due to clogged pump, drawdown of 168.43 ft
	21	Water level 66.8 ft elevation; logged upper 830 ft of hole with caliper, blockage at -556 ft elevation discovered
	31	Logged upper 992 ft of hole with caliper, blockage at -718 ft elevation discovered; 4-inch casing installed
June 1995	2	Water level 199.4 ft elevation; gravel pack and grout installed
	3	Water level 203.7 ft elevation; well completed
October 1995	5	Water level 217.3 ft elevation; performed second step-drawdown test
	6	Water level 213.5 ft elevation; began second sustained-rate pumping test at 76 gallons per minute
	8	Ended pumping test, water level approached pump intake, drawdown of 110 ft

of alternating mafic lava flows and alluvium. The mafic rock and alluvium are underlain by a 10-ft-thick layer of ash. The next 285 ft is composed of dense lava flows, some of which are slightly to highly weathered. Underlying the thick section of mafic lava flows is a 50-ft-thick section composed of dark-brown, sticky, fossiliferous mud and marine gravel. The mud contains fossils of marine mollusks and foraminifera. The next 60 ft of rock penetrated by the well is again formed by dense mafic lava flows, but underlying the mafic rock is another 165-ft-thick section of mostly marine sediments including greenish-gray, fossiliferous mudstone, beach gravel, and coral. Underlying the marine sediments is a 35-ft section of alluvium and a 130-ft section of dense, amygdaloidal, mafic lava flows.

The caliper log of the Hanamaulu monitor well (fig. 4) shows intervals where the hole size deviates from the drill-bit diameter. Rock layers that are unconsolidated or thin tend to crumble and cave to produce enlargements in the well boring. In contrast, rocks that are hard, massive, and thick tend to hold the shape of the boring, and thus give a smoother, unvarying log. A few feet below the surface casing (surface casing shows as the smooth upper 130 ft of the caliper log), the log shows prominent enlargements between 150 ft and 120 ft elevation and between 40 ft and -30 ft elevation that correspond approximately with the interval of unconsolidated alluvium in the geologic log. The remaining caliper log shows a relatively smooth boring, even through the marine sediments, down to the blockage at -718 ft elevation.

AQUIFER TESTS

Step-drawdown and sustained-rate aquifer tests were conducted before and after the installation of casing and gravel pack. The purpose of the step-drawdown test was to determine well efficiency. The purpose of the sustained-rate test was to collect data that can be used to estimate aquifer properties in the vicinity of the well. Measurements of the depth to water in the pumping well were made using an electric tape. The flow rate was measured using a totalizing flow meter.

The test of the uncased, open well boring was conducted using a 50-horsepower, 6-in. outer-diameter submersible pump with the intake set at an elevation of -167 ft. The step-drawdown test was conducted on May

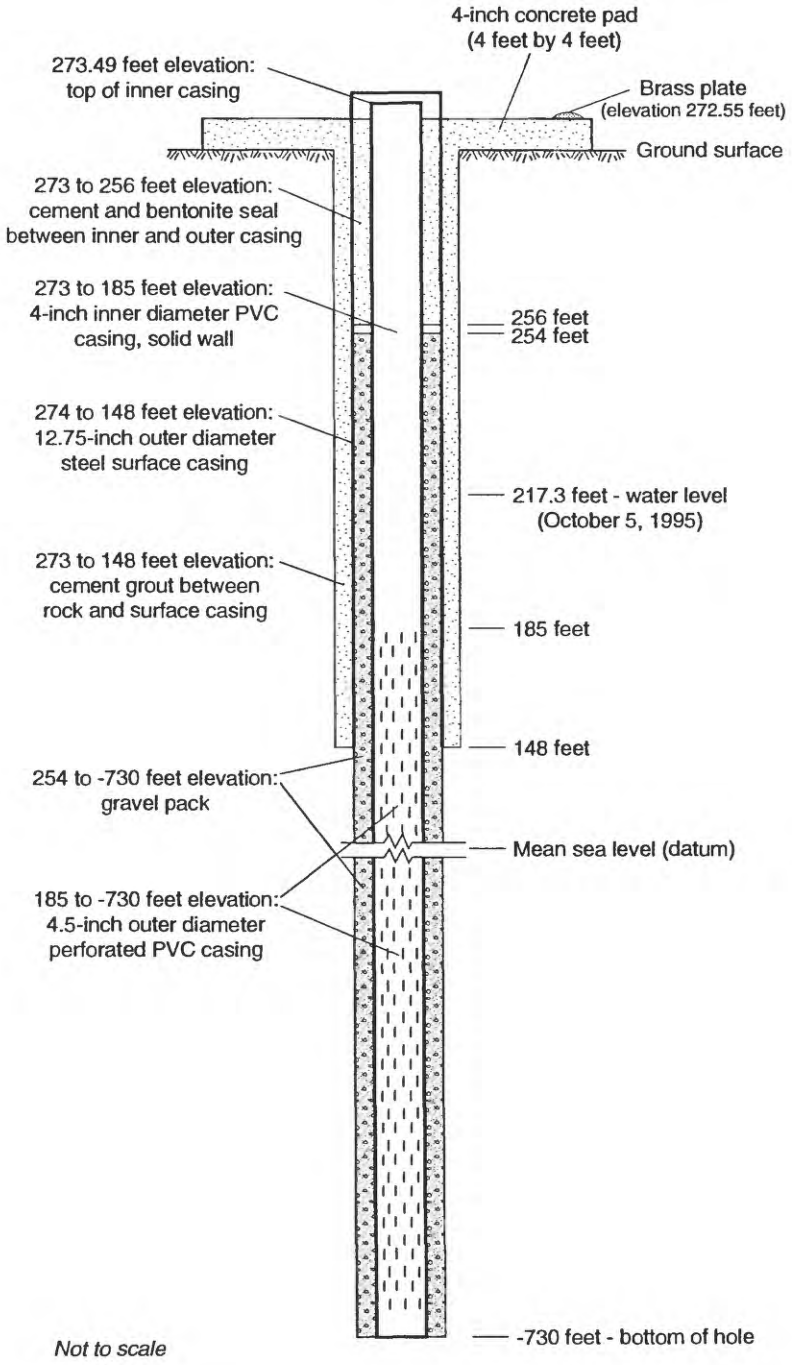

Figure 3. Construction details of the Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii.

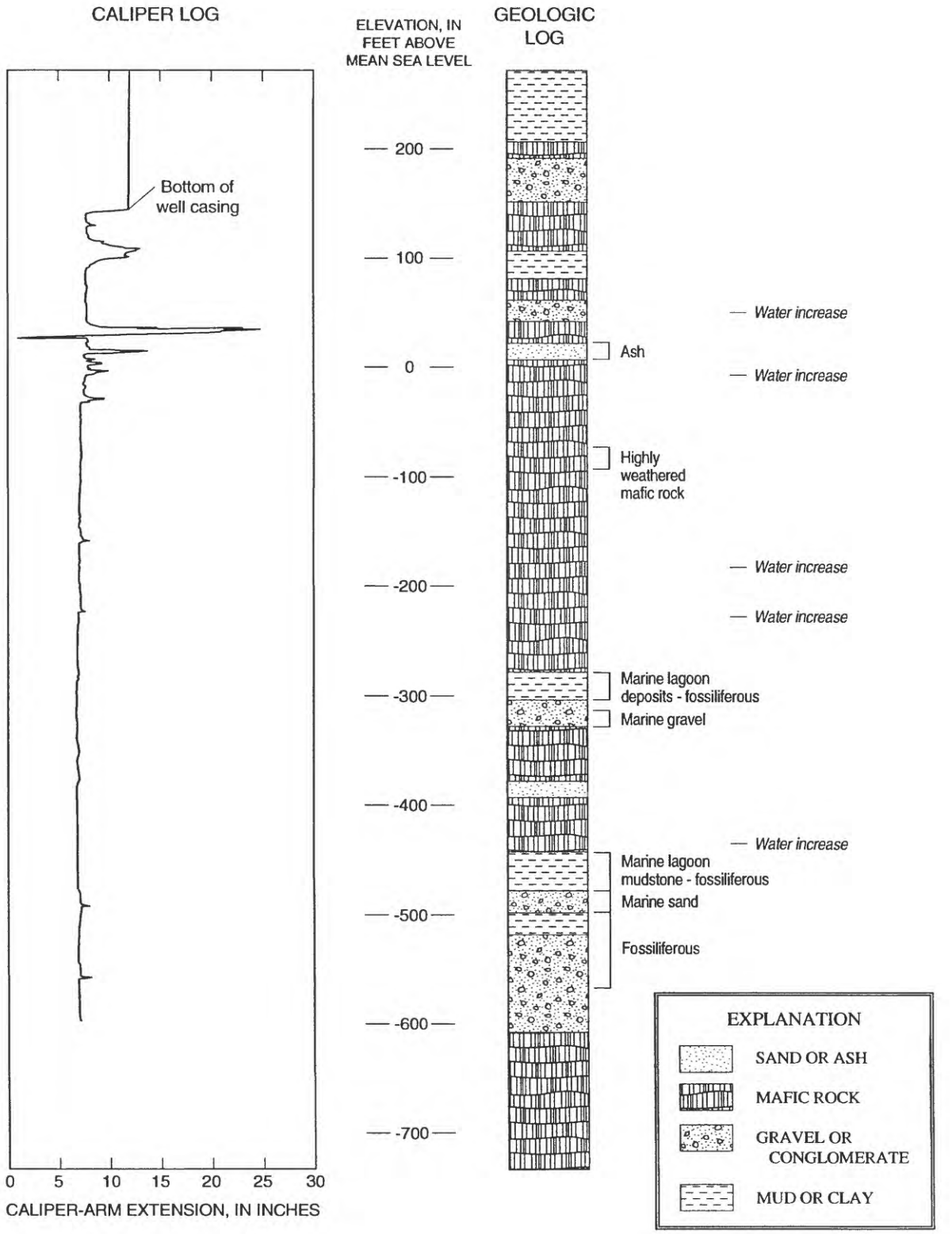

Figure 4. Geologic log and caliper-arm extension with depth in the Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii.

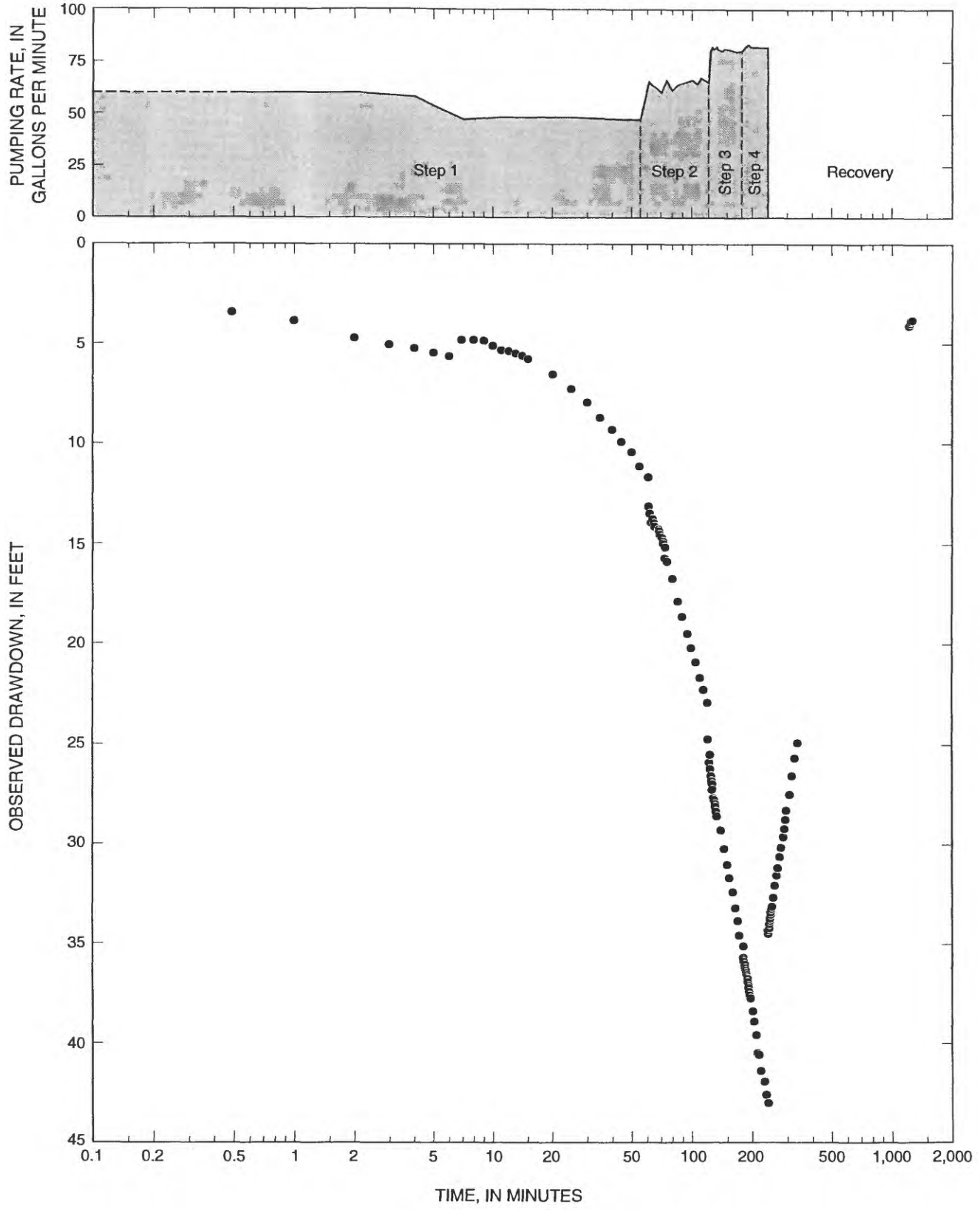

Figure 5. Drawdown with time during step-drawdown aquifer test (October 5, 1995), Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii.

Table 3. Step-drawdown aquifer-test results, Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii
[min/ft^2, minutes per square foot; min^2/ft^5, minutes squared per feet raised to the fifth power]

Analysis method[1]	Aquifer loss, *B* (min/ft^2)	Well loss, *C* (min^2/ft^5)	Well loss at pumping rate of 76 gallons per minute (feet)
Hantush and Bierschenk	1.100	1.146×10^{-1}	11.83

[1]Method of analysis documented in Kruseman and de Ridder (1994)

8, 1995, but the data were not sufficient to allow analysis for well loss and are therefore not included in this report. The sustained-rate test was started on May 9, 1995. During the first 2,940 min of the test, the pumping rate fluctuated between 360 and 320 gal/min, but then began to decrease rapidly because sediment began clogging the pump. By 4,800 min, the pumping rate had dropped to 120 gal/min, and the test was halted at 5,520 min. The maximum drawdown measured in the pumped well during this test was 168.43 ft after 4,140 min (69 hours) of pumping (appendix 2).

The aquifer tests conducted after the casing was installed used a 10-horsepower, 4-in. diameter submersible pump with the intake elevation set at 97 ft. The step-drawdown test, conducted on October 5, 1995, consisted of four 60-min steps at average rates of 48, 64, 81, and 82 gal/min followed by 1,020 min of recovery monitoring (fig. 5 and appendix 3). The elevation of static water level at the start of the test was 217.3 ft. The data were analyzed to estimate the two components of drawdown in the pumped well: (1) the hydraulic head loss in the aquifer, and (2) the hydraulic head losses from water entering the well. Estimates of the aquifer loss and well loss shown in table 3 were obtained using the methods of Hantush and Bierschenk (in Kruseman and de Ridder, 1994).

Values of drawdown measured in the pumped well during the sustained test were corrected by subtracting the estimated well loss at the measured pumping rate from the observed drawdown. Well loss at a specific pumping rate is calculated using:

$$s_w = CQ^2, \qquad (1)$$

where:

s_w = well loss, in feet;

C = coefficient of well loss, in minutes squared per feet raised to the fifth power; and

Q = pumping rate, in feet cubed per minute.

For an average pumping rate of 76 gal/min, the estimated well loss from equation 1 is 11.83 ft.

The sustained-rate aquifer test of the cased well was started on October 6, 1995. The elevation of the static water level at the beginning of the test was 213.5 ft. The pumped water was discharged about 500 ft from the well head to a natural channel which leads to Hanamaulu Stream. The test was conducted at an average pumping rate of 76 gal/min for 2,880 min (48 hours) before the test was halted because the water level approached the pump intake. Recovery was monitored for 12,060 min at the end of the test (appendix 4, fig. 6). Flow rates decreased from 85 to 70 gal/min during the period of the test. The maximum drawdown measured in the pumped well was 110.56 ft after 2,880 min into the test. When corrected for well loss, the resulting maximum aquifer drawdown is 98.73 ft.

During the two sustained-rate tests, samples of the pumped water were analyzed for temperature and specific conductance, both of which remained constant throughout the tests; temperatures ranged between 24.9 and 25.9°C and specific conductance ranged from 313 to 329 µS/cm during the first test and from 309 to 311 µS/cm during the second test.

SUMMARY

The Hanamaulu monitor well (State well number 2-5923-08) is located in the center of the Lihue basin near sugarcane fields at the eastern base of Kilohana Crater. The well was constructed during the period from April 8 to June 3, 1995 to study the hydrology and geology in an area where little well information is available. The elevation of the brass plate embedded in the concrete pad at the well is 272.55 feet and the well is 1,003 feet deep (bottom is at -730 feet elevation). Flush-jointed 4-inch (outer diameter) PVC casing, with perforated sections between the water table and the bottom, was installed in the hole. An apparent decrease in water levels as the well was deepened may be partly the result of a drawdown created by air-lifting of water during drilling, but even after the well was allowed to recover for several weeks, the water level never recovered to the

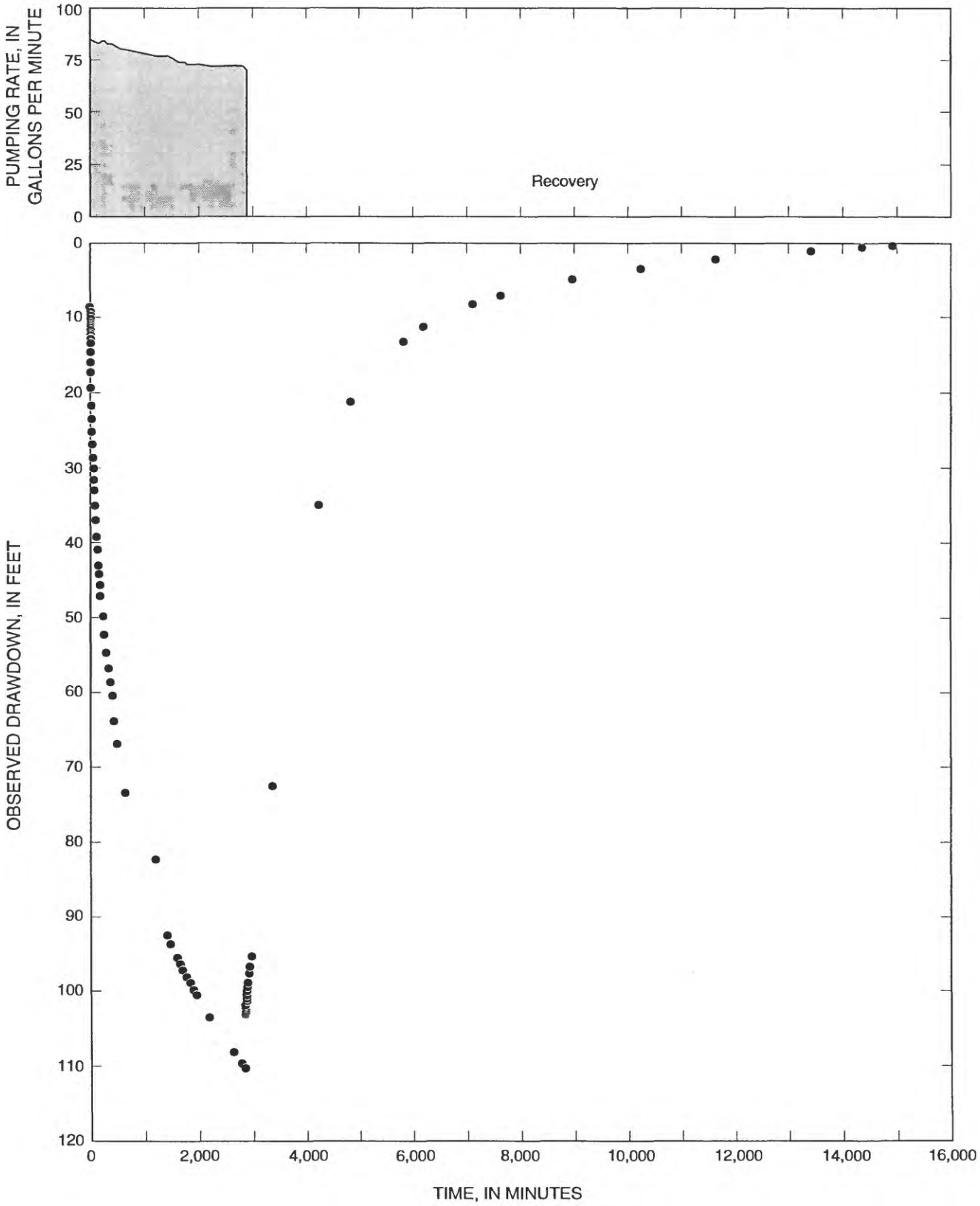

Figure 6. Drawdown with time during 2-day sustained-rate aquifer test (October 6–8, 1995) after installation of casing and gravel pack, Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii.

initial elevation of 243 feet, indicating that there is a head gradient with depth in the aquifer. The initial water level was 243 feet elevation; the water-level elevation after the well was completed, cased, and gravel packed was 217 feet.

The Hanamaulu monitor well penetrated a 1,002-foot section of rock predominated by mafic lava flows, but with substantially thick layers of fossiliferous marine mud, mudstone, beach gravel, coral, and alluvium. The caliper log shows caving of some unconsolidated alluvial layers between 150 feet and 120 feet elevation, and between 40 feet and -30 feet elevation.

A sustained-rate aquifer test conducted prior to casing installation lasted about 69 hours with pumping rates of 300 to 360 gallons per minute and a maximum drawdown of 168.43 feet in the pumping well before the test was shut down due to clogging of the pump. A second sustained-rate test, conducted after the casing and gravel pack were installed, had a maximum drawdown of 110.56 feet measured in the pumped well after 2,880 minutes of pumping at an average of 76 gallons per minute. The test was halted because the water level neared the pump intake. Analysis of a step-drawdown aquifer test conducted after the casing and gravel pack were installed indicates that for an average pumping rate of 76 gallons per minute, the well loss is 11.83 feet. The water-level elevation prior to the second sustained-rate aquifer test was 213.5 feet. The temperature and specific conductance of the pumped water remained steady throughout both sustained-rate tests.

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Appendix 1. Lithologic descriptions of drill cuttings from Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii

[Datum is mean sea level; depth measured from about 272 feet above sea level]

Elevation, in feet			Depth, in feet			Sample description[1]
272	to	267	0	to	5	red-brown silt and clay
267	to	262	5	to	10	red-brown silt and clay
262	to	257	10	to	15	red-brown silt and clay
257	to	252	15	to	20	red-brown silt and clay
252	to	247	20	to	25	red-brown silt and clay
247	to	242	25	to	30	red-brown silt and clay
242	to	237	30	to	35	red-brown silt and clay
237	to	232	35	to	40	red-brown silt and clay
232	to	227	40	to	45	red-brown silt and clay
227	to	222	45	to	50	red-brown silt and clay
222	to	217	50	to	55	red-brown silt and clay
217	to	212	55	to	60	red-brown silt and clay
212	to	207	60	to	65	red-brown silt and clay with pieces of highly weathered mafic rock
207	to	202	65	to	70	red-brown, highly weathered mafic rock
202	to	197	70	to	75	red-brown, highly weathered mafic rock
197	to	192	75	to	80	red-brown to gray, weathered mafic rock
192	to	187	80	to	85	red-brown clay
187	to	182	85	to	90	red-brown, rounded gravel pebbles
182	to	177	90	to	95	red-brown, rounded gravel pebbles
177	to	172	95	to	100	red-brown, rounded gravel pebbles
172	to	152	100	to	120	red-brown, rounded gravel pebbles
152	to	137	120	to	135	medium-gray, slightly weathered, dense mafic rock
137	to	132	135	to	140	mixed dense mafic rock with few red-brown chips
132	to	127	140	to	145	medium-gray, slightly weathered, dense mafic rock
127	to	122	145	to	150	medium-gray, slightly weathered, dense mafic rock
122	to	117	150	to	155	medium-gray dense mafic rock
117	to	112	155	to	160	medium-gray dense mafic rock
112	to	107	160	to	165	medium-gray, dense mafic rock with clumps of clay
107	to	102	165	to	170	red-brown clay
102	to	97	170	to	175	medium-gray, dense mafic rock with clumps of clay
97	to	92	175	to	180	red-brown clay with gray mafic rock chips
92	to	87	180	to	185	rounded mafic rock gravel with red-brown clay
87	to	82	185	to	190	red-brown, sticky clay
82	to	77	190	to	195	red-brown, weathered mafic rock with medium-gray, dense mafic rock
77	to	72	195	to	200	red-brown, weathered mafic rock with medium-gray, dense mafic rock
72	to	67	200	to	205	medium-gray, dense mafic rock
67	to	62	205	to	210	medium-gray, dense mafic rock
62	to	57	210	to	215	brown, weathered gravel
57	to	52	215	to	220	brown, weathered gravel
52	to	47	220	to	225	brown, weathered gravel
47	to	42	225	to	230	brown, weathered gravel
42	to	37	230	to	235	red-brown vesicular mafic rock
37	to	32	235	to	240	brownish-gray and red-brown, moderately to highly weathered mafic rock
32	to	27	240	to	245	brownish-gray and red-brown, moderately to highly weathered mafic rock
27	to	22	245	to	250	light-gray, slightly weathered olivine mafic rock
22	to	17	250	to	255	red-brownish-gray, loose, sand-size particles
17	to	12	255	to	260	red-brownish-gray, loose, sand-size particles
12	to	7	260	to	265	red-brownish-gray, loose, sand-size particles
7	to	2	265	to	270	brownish-gray, moderately vesicular mafic rock with blackened olivine
2	to	-3	270	to	275	red-brown, highly weathered mafic rock
-3	to	-8	275	to	280	red-brown, highly weathered mafic rock
-8	to	-13	280	to	285	reddish-yellow to brownish-gray, vesicular mafic rock with plagioclase
-13	to	-18	285	to	290	reddish-yellow to brownish-gray, vesicular mafic rock with plagioclase

Appendix 1. Lithologic descriptions of drill cuttings from Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii --Continued

[Datum is mean sea level; depth measured from about 272 feet above sea level]

Elevation, in feet			Depth, in feet			Sample description[1]
-18	to	-23	290	to	295	reddish-yellow to brownish-gray, vesicular mafic rock with plagioclase
-23	to	-28	295	to	300	reddish-yellow to brownish-gray, vesicular mafic rock with plagioclase
-28	to	-33	300	to	305	reddish-yellow to brownish-gray, vesicular mafic rock with plagioclase
-33	to	-38	305	to	310	reddish-yellow to brownish-gray, weathered, vesicular mafic rock
-38	to	-43	310	to	315	dark-gray, dense mafic rock
-43	to	-48	315	to	320	yellowish-dark-gray, dense mafic rock
-48	to	-53	320	to	325	dark-gray, dense amygdaloidal mafic rock
-53	to	-58	325	to	330	medium-gray dense mafic rock
-58	to	-63	330	to	335	medium-gray dense mafic rock
-63	to	-68	335	to	340	medium-gray dense mafic rock
-68	to	-73	340	to	345	medium-gray dense mafic rock
-73	to	-78	345	to	350	red-brown, deeply weathered, medium soft, rounded, sand-size particles
-78	to	-83	350	to	355	red-brown, deeply weathered, medium soft, rounded, sand-size particles
-83	to	-88	355	to	360	red-brown, deeply weathered, medium soft, rounded, sand-size particles
-88	to	-93	360	to	365	red-brown, deeply weathered, medium soft, rounded, sand-size particles
-93	to	-98	365	to	370	brownish-gray, weathered mafic rock mixed with medium-gray mafic rock
-98	to	-103	370	to	375	brownish-gray, weathered mafic rock mixed with medium-gray mafic rock
-103	to	-108	375	to	380	brownish-gray, weathered mafic rock mixed with medium-gray mafic rock
-108	to	-113	380	to	385	brownish-gray, weathered mafic rock mixed with medium-gray mafic rock
-113	to	-118	385	to	390	light-gray, dense mafic rock with some red-brown chips
-118	to	-123	390	to	395	mix of red-brown, sand-size cuttings with dense mafic rock chips
-123	to	-128	395	to	400	medium-gray dense mafic rock
-128	to	-133	400	to	405	medium-gray dense mafic rock
-133	to	-138	405	to	410	gray, dense mafic rock with red-brown chips
-138	to	-143	410	to	415	gray, dense mafic rock with about 60% red-brown chips
-143	to	-148	415	to	420	gray, dense mafic rock with about 90% red-brown chips
-148	to	-153	420	to	425	gray, dense mafic rock with about 50% red-brown chips, 50% angular chips
-153	to	-158	425	to	430	medium-dark-gray, dense mafic rock
-158	to	-163	430	to	435	medium-dark-gray, dense mafic rock with few weathered chips
-163	to	-168	435	to	440	highly weathered mafic rock and dark-gray dense mafic rock
-168	to	-173	440	to	445	medium-dark-gray, dense mafic rock
-173	to	-178	445	to	450	yellowish-gray, slightly weathered, some highly weathered, dense mafic rock
-178	to	-183	450	to	455	dark-gray, dense mafic rock with some brown, weathered pieces
-183	to	-188	455	to	460	dark-gray, dense mafic rock with some brown, weathered pieces
-188	to	-193	460	to	465	medium-dark-gray, dense mafic rock
-193	to	-198	465	to	470	medium-dark-gray, dense mafic rock with 30% weathered rock
-198	to	-203	470	to	475	yellowish-gray dense mafic rock with 10% weathered rock
-203	to	-208	475	to	480	yellowish-gray dense mafic rock with 10% weathered rock
-208	to	-213	480	to	485	yellowish-gray dense mafic rock
-213	to	-218	485	to	490	weathered to moderately weathered mafic rock
-218	to	-223	490	to	495	weathered to moderately weathered mafic rock
-223	to	-228	495	to	500	weathered to moderately weathered mafic rock
-228	to	-233	500	to	505	mostly weathered mafic sand
-233	to	-238	505	to	510	brownish-green, weathered to moderately weathered, dense mafic rock
-238	to	-243	510	to	515	brownish-gray, mostly moderately to slightly weathered, dense mafic rock
-243	to	-248	515	to	520	yellowish-medium-gray, dense mafic rock
-248	to	-253	500	to	525	medium-gray, dense, amygdaloidal mafic rock with fine clinopyroxene crystals
-253	to	-258	525	to	530	medium-gray, dense, amygdaloidal mafic rock with fine clinopyroxene crystals
-258	to	-263	530	to	535	medium-gray, dense, amygdaloidal mafic rock with fine clinopyroxene crystals
-263	to	-268	535	to	540	yellowish-gray, dense mafic rock with some weathered mafic rock
-268	to	-273	540	to	545	yellowish-gray, dense mafic rock with some weathered amygdaloidal mafic rock
-273	to	-278	545	to	550	yellowish-gray, dense mafic rock with some weathered amygdaloidal mafic rock
-278	to	-283	550	to	555	dark-brown, sticky mud
-283	to	-288	555	to	560	dark-brown mud with shells, mafic rock sand, mudstone sand, foraminifera

Appendix 1. Lithologic descriptions of drill cuttings from Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii --Continued

[Datum is mean sea level; depth measured from about 272 feet above sea level]

Elevation, in feet			Depth, in feet			Sample description[1]
-288	to	-293	560	to	565	NO SAMPLE
-293	to	-298	565	to	570	dark-brown mud with shells, mafic rock sand, mudstone sand, foraminifera
-298	to	-303	570	to	575	dark-brown, sticky mud with mafic rock sand, mudstone sand, few shells
-303	to	-308	575	to	580	mafic rock gravel with some mud
-308	to	-313	580	to	585	yellowish-gray, medium-fine-grained, dense mafic rock
-313	to	-318	585	to	590	mixed mafic rock with gravel
-318	to	-323	590	to	595	mixed mafic rock with gravel
-323	to	-328	595	to	600	mafic rock gravel with some yellowish-gray, dense mafic rock and shells
-328	to	-333	600	to	605	yellowish-gray, dense amygdaloidal mafic rock
-333	to	-338	605	to	610	yellowish-gray, dense amygdaloidal mafic rock
-338	to	-343	610	to	615	yellowish-gray, dense amygdaloidal mafic rock
-343	to	-348	615	to	620	yellowish-gray, dense amygdaloidal mafic rock
-348	to	-353	620	to	625	yellowish-gray, dense amygdaloidal mafic rock
-353	to	-358	625	to	630	mixed weathered mafic rock gravel and carbonate grains
-358	to	-363	630	to	635	yellowish-gray, dense amygdaloidal mafic rock
-363	to	-368	636	to	640	yellowish-gray, dense amygdaloidal mafic rock
-368	to	-373	640	to	645	yellowish-gray, dense amygdaloidal mafic rock
-373	to	-378	645	to	650	yellowish-gray, dense mafic rock with few red-brown, deeply weathered pieces
-378	to	-383	650	to	655	greenish-medium-gray mafic rock sand and gravel
-383	to	-388	655	to	660	greenish-medium-gray mafic rock sand and gravel
-388	to	-393	660	to	665	greenish-medium-gray mafic rock sand and gravel
-393	to	-398	665	to	670	yellowish-gray, dense, amygdaloidal mafic rock
-398	to	-403	670	to	675	yellowish-gray, dense, amygdaloidal mafic rock
-403	to	-408	675	to	680	yellowish-gray, dense, amygdaloidal mafic rock
-408	to	-413	680	to	685	yellowish-gray, dense, amygdaloidal mafic rock
-413	to	-418	685	to	690	yellowish-gray, dense, amygdaloidal mafic rock
-418	to	-423	690	to	695	dark-gray, dense mafic rock mixed with some light-gray mafic rock
-423	to	-428	695	to	700	dark-gray, dense mafic rock
-428	to	-433	700	to	705	dark-gray, dense mafic rock
-433	to	-438	705	to	710	dark-gray, dense mafic rock
-438	to	-443	710	to	715	dark-gray mafic rock mixed with gray, fossiliferous mudstone
-443	to	-448	715	to	720	greenish-gray fossiliferous mudstone
-448	to	-453	720	to	725	greenish-gray fossiliferous mudstone with some mafic rock chips
-453	to	-458	725	to	730	greenish-gray fossiliferous mudstone and gravel
-458	to	-463	730	to	735	greenish-gray fossiliferous mudstone
-463	to	-468	735	to	740	medium-gray mudstone with coral and shell fragments
-468	to	-473	740	to	745	medium-gray mudstone with coral and shell fragments
-473	to	-478	745	to	750	medium-gray mudstone with coral, shell fragments, and mafic rock gravel
-478	to	-483	750	to	755	mafic rock gravel with moderately weathered to weathered clasts
-483	to	-488	755	to	760	mafic rock gravel with moderately weathered to weathered clasts
-488	to	-493	760	to	765	mafic rock gravel with moderately weathered to weathered clasts
-493	to	-498	765	to	770	mafic rock gravel with few shell fragments
-498	to	-503	770	to	775	abundant coral and shell fossils in light-gray mudstone
-503	to	-508	775	to	780	abundant coral and shell fossils in light-gray mudstone
-508	to	-513	780	to	785	abundant coral and shell fossils in light-gray mudstone
-513	to	-518	785	to	790	abundant coral and shell fossils in light-gray mudstone
-518	to	-523	790	to	795	coral and shells mixed with mafic rock
-523	to	-528	795	to	800	brownish-gray, rounded, slightly weathered mafic rock gravel mixed with coral
-528	to	-533	800	to	805	dark gray, slightly weathered mafic rock
-533	to	-538	805	to	810	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel
-538	to	-543	810	to	815	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel
-543	to	-548	815	to	820	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel
-548	to	-553	820	to	825	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel
-553	to	-558	825	to	830	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel

Appendix 1. Lithologic descriptions of drill cuttings from Hanamaulu monitor well (State well 2-5923-08), Kauai, Hawaii --Continued

[Datum is mean sea level; depth measured from about 272 feet above sea level]

Elevation, in feet			Depth, in feet			Sample description[1]
-558	to	-563	830	to	835	brownish-gray, moderately weathered mafic rock, fossils, and mudstone gravel
-563	to	-568	835	to	840	dark gray, dense, slightly weathered mafic rock
-568	to	-573	840	to	845	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-573	to	-578	845	to	850	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-578	to	-583	850	to	855	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-583	to	-588	855	to	860	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-588	to	-593	860	to	865	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-593	to	-598	865	to	870	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-598	to	-603	870	to	875	brownish gray, subrounded, moderately to slightly weathered, mafic rock gravel
-603	to	-608	875	to	880	slightly weathered subrounded dense mafic rock gravel with dense mafic rock chips
-608	to	-613	880	to	885	greenish-gray, dense mafic rock with abundant medium-grained mafic minerals
-613	to	-618	885	to	890	greenish-gray, dense mafic rock with abundant medium-grained mafic minerals
-618	to	-623	890	to	895	greenish-gray, dense mafic rock with abundant medium-grained mafic minerals
-623	to	-628	895	to	900	medium-gray, dense, amygdaloidal mafic rock
-628	to	-633	900	to	905	medium-gray, dense, amygdaloidal mafic rock
-633	to	-638	905	to	910	medium-gray, dense, amygdaloidal mafic rock
-638	to	-643	910	to	915	medium-gray, dense, amygdaloidal mafic rock
-643	to	-648	915	to	920	medium-gray, dense, amygdaloidal mafic rock
-648	to	-653	920	to	925	medium-gray, dense, amygdaloidal mafic rock
-653	to	-658	925	to	930	medium-gray, slightly weathered, dense, mafic rock with few zeolites
-658	to	-663	930	to	935	greenish-gray, dense, amygdaloidal mafic rock
-663	to	-668	935	to	940	greenish-gray, dense, amygdaloidal mafic rock
-668	to	-673	940	to	945	greenish-gray, dense, amygdaloidal mafic rock
-673	to	-678	945	to	950	greenish-gray, dense, amygdaloidal mafic rock
-678	to	-683	950	to	955	greenish-gray, dense, amygdaloidal mafic rock
-683	to	-688	955	to	960	greenish-gray, dense amygdaloidal mafic rock with few weathered chips
-688	to	-693	960	to	965	greenish-gray, moderately weathered, dense, amygdaloidal mafic rock
-693	to	-698	965	to	970	greenish-gray, moderately weathered, dense, amygdaloidal mafic rock
-698	to	-703	970	to	975	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-703	to	-708	975	to	980	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-708	to	-713	980	to	985	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-713	to	-718	985	to	990	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-718	to	-723	990	to	995	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-723	to	-728	995	to	1,000	brownish-gray, moderately weathered, dense, amygdaloidal mafic rock
-728	to	-733	1,000	to	1,005	medium-gray, dense mafic rock

[1]rotary-drill cuttings lifted with air, foam and polymer. Sample repository: U.S. Geological Survey, Hawaii District office. Date of logging: August, 1995

Appendix 2. Data from 3-day sustained-rate aquifer test conducted on May 9, 1995, before installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii

[min, minutes; ft, feet; gal/min, gallons per minute; °C, degrees Celsius, µS/cm, microsiemens per centimeter at 25°C; static water level at start of test was 192 feet above mean sea level; depth to water measured from 274.19 feet above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)	Temperature (°C)	Specific conductance (µS/cm)
1	90.59	8.89	360	-	-
2	91.54	9.84	360	-	-
3	92.56	10.86	-	-	-
4	93.35	11.65	-	-	-
5	94.29	12.59	-	-	-
6	95.13	13.43	360	-	-
7	95.79	14.09	-	-	-
8	96.62	14.92	-	-	-
9	97.22	15.55	-	-	-
10	98.05	16.32	-	-	-
11	98.72	17.02	-	-	-
12	99.18	17.48	-	-	-
13	99.88	18.18	360	-	-
14	100.39	18.69	-	-	-
15	101.03	19.33	-	25.8	326
20	103.95	22.25	355	-	-
25	106.48	24.78	350	-	-
30	109.01	27.31	350	25.8	327
35	111.32	29.32	350	-	-
40	113.55	31.85	350	-	-
50	117.67	35.97	350	-	-
60	121.61	39.91	350	25.6	329
75	126.87	45.17	350	-	-
90	131.86	50.16	350	-	-
105	136.38	54.68	350	-	-
120	140.45	58.75	345	25.6	322
135	144.07	62.37	345	-	-
150	147.65	65.95	345	-	-
165	150.98	69.28	345	-	-
180	154.17	72.47	345	25.4	319
195	157.24	75.54	335	-	-
210	160.02	78.32	340	-	-
225	162.76	81.06	340	-	-
240	165.36	83.66	340	25.3	318
255	167.97	86.27	340	-	-
270	170.41	88.71	-	-	-
285	172.46	90.76	340	-	-
300	175.13	93.43	-	-	-
330	179.32	97.62	-	-	-
360	183.36	101.66	340	25.3	316
390	186.81	105.11	340	-	-
420	189.67	107.97	337	-	-
450	192.35	110.65	335	-	-
480	195.35	113.65	335	24.9	313
540	200.17	116.47	335	-	-
600	204.50	122.80	335	-	-
660	207.88	126.18	335	24.9	313
720	211.21	129.51	330	-	-
780	214.08	132.38	330	-	-
840	216.89	135.19	330	-	-
900	219.23	137.53	330	24.9	313
1,080	232.27	150.57	325	-	-

Appendix 2. Data from 3-day sustained-rate aquifer test conducted on May 9, 1995, before installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii--Continued

[min, minutes; ft, feet; gal/min, gallons per minute; °C, degrees Celsius, µS/cm, microsiemens per centimeter at 25°C; static water level at start of test was 192 feet above mean sea level; depth to water measured from 274.19 feet above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)	Temperature (°C)	Specific conductance (µS/cm)
1,140	236.24	154.54	-	25.2	315
1,200	236.70	155.00	325	24.9	314
1,260	237.15	155.45	325	-	-
1,320	237.54	155.84	325	-	-
1,380	237.97	156.27	325	-	-
1,440	238.44	156.71	325	25.9	318
1,500	238.78	157.08	325	-	-
1,560	239.15	157.45	320	-	-
1,620	239.51	157.81	320	25.3	316
1,680	239.88	158.18	322	-	-
1,740	240.11	158.41	322	25.4	315
1,980	241.45	159.75	322	25.3	315
2,220	242.68	160.68	322	25.3	316
2,700	245.03	163.03	322	25.1	316
2,940	246.02	164.32	320	-	-
3,180	246.88	165.18	315	25.4	315
3,660	248.75	167.05	310	-	-
4,140	250.13	168.43	297	25.3	319
4,800	247.50	156.91	120	-	-

Appendix 3. Data from step-drawdown aquifer test conducted on October 5, 1995 after installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii

[min, minutes; ft, feet; gal/min, gallons per minute; depth to water measured from 274.19 ft above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)
0	56.88	0	0
0.5	60.25	3.37	-
1	60.68	3.80	-
2	61.57	4.69	60
3	61.87	4.99	-
4	62.03	5.15	58
5	62.33	5.45	-
6	62.51	5.63	-
7	61.70	4.82	47
8	61.68	4.80	-
9	61.74	4.86	-
10	61.93	5.05	-
11	62.17	5.29	48
12	62.21	5.33	-
13	62.32	5.44	-
14	62.45	5.57	48
15	62.63	5.75	-
20	63.42	6.54	48
25	64.13	7.25	48
30	64.81	7.93	-
35	65.53	8.65	-
40	66.17	9.29	-
45	66.77	9.89	47
50	67.31	10.43	-
55	67.93	11.05	47
60	68.55	11.67	-
61	69.97	13.09	65
62	70.33	13.45	-
63	70.56	13.68	64
64	70.74	13.86	-
65	70.82	13.94	-
66	70.97	14.09	-
67	71.13	14.25	62
68	71.24	14.36	-
69	71.38	14.50	-
70	71.52	14.64	60
71	71.77	14.89	-
72	71.86	14.98	-
73	71.96	15.08	-
74	72.54	15.66	66
75	72.74	15.86	66
80	73.57	16.69	61
85	74.72	17.84	64
90	75.52	18.64	65
95	76.33	19.45	-
100	77.09	20.21	66
105	77.75	20.87	64
110	78.54	21.66	67
115	79.17	22.29	-
120	79.80	22.92	65
121	81.61	24.73	-
122	82.30	25.42	-
123	82.73	25.85	80

Appendix 3. Data from step-drawdown aquifer test conducted on October 5, 1995 after installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii--Continued

[min, minutes; ft, feet; gal/min, gallons per minute; depth to water measured from 274.19 ft above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)
124	83.07	26.19	-
125	83.42	26.54	-
126	83.64	26.76	82
127	83.87	26.99	-
128	84.10	27.22	81
129	84.53	27.65	-
130	84.63	27.75	-
131	84.81	27.93	-
132	84.89	28.01	82
133	85.01	28.13	-
134	85.27	28.39	81
135	85.50	28.62	-
140	86.20	29.32	80
145	87.07	30.19	81
150	87.89	31.01	-
155	88.58	31.70	81
160	89.31	32.43	-
165	90.12	33.24	80
170	90.75	33.87	-
175	91.45	34.57	80
180	91.97	35.09	-
181	92.53	35.65	-
182	92.88	36.00	-
183	92.99	36.11	82
184	93.10	36.22	-
185	93.25	36.37	-
186	93.36	36.48	-
187	93.51	36.63	-
188	93.62	36.74	-
189	93.83	36.95	-
190	94.03	37.15	-
191	94.08	37.20	83
192	94.29	37.41	-
193	94.38	37.50	-
194	94.47	37.59	-
195	94.61	37.73	82
200	95.26	38.38	-
205	95.78	38.90	-
210	96.44	39.56	-
215	97.40	40.52	82
220	97.43	40.55	-
225	98.30	41.42	-
230	98.83	41.95	-
235	99.53	42.65	-
240	99.87	42.99	-
241	91.32	34.44	-
242	91.19	34.31	-
243	91.05	34.17	-
244	90.90	34.02	-
245	90.72	33.84	-
246	90.54	33.66	-
247	90.45	33.57	-
248	90.40	33.52	-

Appendix 3. Data from step-drawdown aquifer test conducted on October 5, 1995 after installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii--Continued

[min, minutes; ft, feet; gal/min, gallons per minute; depth to water measured from 274.19 ft above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)
249	90.28	33.40	-
250	90.15	33.27	-
255	89.59	32.71	-
260	88.99	32.11	-
265	88.46	31.58	-
270	88.12	31.24	-
275	87.54	30.66	-
280	87.07	30.19	-
285	86.56	29.68	-
290	86.12	29.24	-
295	85.57	28.69	-
300	85.20	28.32	-
310	84.37	27.49	-
320	83.40	26.52	-
330	82.55	25.67	-
340	81.77	24.89	-
1,215	60.89	4.01	-
1,235	60.80	3.92	-
1,250	60.70	3.82	-
1,260	60.70	3.82	-

Appendix 4. Data from 2-day sustained-rate aquifer test conducted October 6–8, 1995, after installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii

[min, minutes; ft, feet; gal/min, gallons per minute; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25°C; static water level at start of test was 213.49 feet above mean sea level; depth to water measured from 274.19 feet above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)	Drawdown, corrected for well loss (ft)	Temperature (°C)	Specific conductance (µS/cm)
0	60.70	0	0	0	-	-
1	69.21	8.51	85	-6.88	-	-
2	69.92	9.22	-	-6.17	-	-
3	70.35	9.65	85	-5.74	-	-
4	70.82	10.12	-	-5.27	-	-
5	71.21	10.51	-	-4.88	-	-
6	71.56	10.86	-	-4.53	-	-
7	71.74	11.04	-	-4.35	-	-
8	72.00	11.30	-	-4.09	-	-
9	72.29	11.59	85	-3.80	-	-
10	72.77	12.07	-	-3.32	-	-
11	72.91	12.21	-	-3.18	-	-
12	73.34	12.64	-	-2.75	-	-
13	73.48	12.78	-	-2.61	-	-
14	73.73	13.03	-	-2.36	-	-
15	74.06	13.36	-	-2.03	-	-
20	75.31	14.61	85	-0.78	-	-
25	76.52	15.82	85	0.43	-	-
30	77.89	17.19	-	1.80	-	-
40	80.07	19.37	85	3.98	-	-
50	82.26	21.56	-	6.17	25.6	311
60	84.08	23.38	85	7.99	-	-
70	85.83	25.13	-	9.74	-	-
80	87.53	26.83	85	11.44	-	-
90	89.27	28.57	-	13.18	-	-
100	90.75	30.05	84	15.02	-	-
110	92.29	31.59	-	16.56	-	-
120	93.68	32.98	-	17.95	25.9	311
135	95.80	35.10	-	20.07	-	-
150	97.75	37.05	-	22.02	-	-
165	99.93	39.23	83	24.56	-	-
180	101.62	40.92	84	25.89	-	-
195	103.87	43.17	84	28.14	-	-
210	104.99	44.29	84	29.26	-	-
225	106.43	45.73	-	30.70	-	-
240	107.90	47.20	84	32.17	-	-
270	110.61	49.91	84	34.88	-	-
300	113.06	52.36	83	37.69	25.7	311
330	115.51	54.81	83	40.14	-	-
360	117.51	56.81	-	42.14	-	-
390	119.45	58.75	83	44.08	-	-
420	121.30	60.60	83	45.93	-	-
480	124.69	63.99	82	49.67	-	-
540	127.68	66.98	81	53.01	25.3	311
690	134.28	73.58	80	59.95	-	-
1,230	143.19	82.49	77	69.86	-	-
1,440	153.35	92.65	77	80.02	25.7	309
1,500	154.62	93.92	76	81.62	-	-
1,620	156.41	95.71	74	84.05	-	-
1,680	157.30	96.60	74	84.94	-	-

Appendix 4. Data from 2-day sustained-rate aquifer test conducted October 6–8, 1995, after installation of casing and gravel pack, Hanamaulu monitor well (2-5923-08), Kauai, Hawaii--Continued

[min, minutes; ft, feet; gal/min, gallons per minute; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25°C; static water level at start of test was 213.49 feet above mean sea level; depth to water measured from 274.19 feet above mean sea level; -, no measurement made]

Time (min)	Depth to water (ft)	Drawdown (ft)	Pumping rate (gal/min)	Drawdown, corrected for well loss (ft)	Temperature (°C)	Specific conductance (µS/cm)
1,740	158.16	97.46	74	85.80	25.6	311
1,800	159.05	98.35	73	87.00	-	-
1,860	159.86	99.16	73	87.81	-	-
1,920	160.81	100.11	73	88.76	-	-
1,980	161.51	100.81	73	89.46	25.4	310
2,220	164.50	103.80	72	92.76	-	-
2,670	169.11	108.41	72	97.37	-	-
2,820	170.65	109.95	72	98.91	25.3	310
2,880	171.26	110.56	70	100.12	-	-
2,881	164.03	103.33	0	103.33	-	-
2,882	163.81	103.11	0	103.11	-	-
2,883	163.75	103.05	0	103.05	-	-
2,884	163.60	102.90	0	102.90	-	-
2,885	163.43	102.73	0	102.73	-	-
2,886	163.34	102.64	0	102.64	-	-
2,887	163.21	102.51	0	102.51	-	-
2,888	163.13	102.43	0	102.43	-	-
2,889	163.06	102.36	0	102.36	-	-
2,890	162.96	102.26	0	102.26	-	-
2,895	162.62	101.92	0	101.92	-	-
2,900	162.26	101.56	0	101.56	-	-
2,905	161.96	101.26	0	101.26	-	-
2,910	161.58	100.88	0	100.88	-	-
2,920	160.99	100.29	0	100.29	-	-
2,930	160.41	99.71	0	99.71	-	-
2,940	159.79	99.09	0	99.09	-	-
2,960	158.58	97.88	0	97.88	-	-
2,980	157.63	96.93	0	96.93	-	-
3,000	156.27	95.57	0	95.57	-	-
3,400	133.52	72.82	0	72.82	-	-
4,260	95.72	35.02	0	35.02	-	-
4,860	81.95	21.25	0	21.25	-	-
5,850	73.84	13.14	0	13.14	-	-
6,210	71.82	11.12	0	11.12	-	-
7,140	68.83	8.13	0	8.13	-	-
7,655	67.67	6.97	0	6.97	-	-
8,985	65.42	4.72	0	4.72	-	-
10,260	63.99	3.29	0	3.29	-	-
11,670	62.75	2.05	0	2.05	-	-
13,440	61.61	0.91	0	0.91	-	-
14,370	61.18	0.48	0	0.48	-	-
14,940	60.91	0.21	0	0.21	-	-