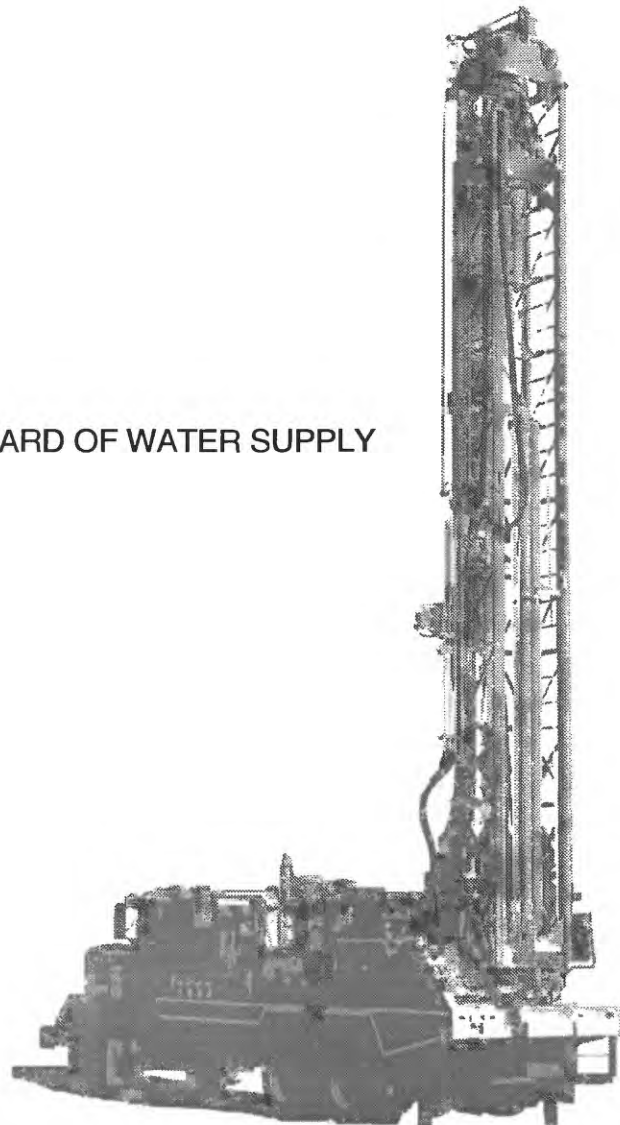


DRILLING AND CONSTRUCTION DATA FOR WELL 3-3406-13, KAAMOOLOA EXPLORATORY WELL, OAHU, HAWAII

U.S. GEOLOGICAL SURVEY

Open-File Report 96-424

Prepared in cooperation with the
CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY



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

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

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Conversion Factors

	Multiply	By	To obtain
	foot (ft)	0.3048	meter
	mile (mi)	1.609	kilometer
	inch (in.)	25.4	millimeter

Elevations in this report are referenced relative to mean sea level.

Drilling and Construction Data for Well 3-3406-13, Kaamooloa Exploratory Well, Oahu, Hawaii

By Todd K. Presley and Delwyn S. Oki

Abstract

The Kaamooloa exploratory well (State well number 3-3406-13) was drilled about 1.6 miles south of the town of Haleiwa. The well is on agricultural land in the Waialua ground-water area. The well penetrates about 20 feet into a basalt aquifer to an elevation of -10 feet below mean sea level. Well-construction data, logs of drilling notes, and geologic descriptions for the samples are presented for the well. The well is one of 12 exploratory wells drilled in the north-central Oahu area between July 1993 and May 1994 in cooperation with the Honolulu Board of Water Supply.

INTRODUCTION

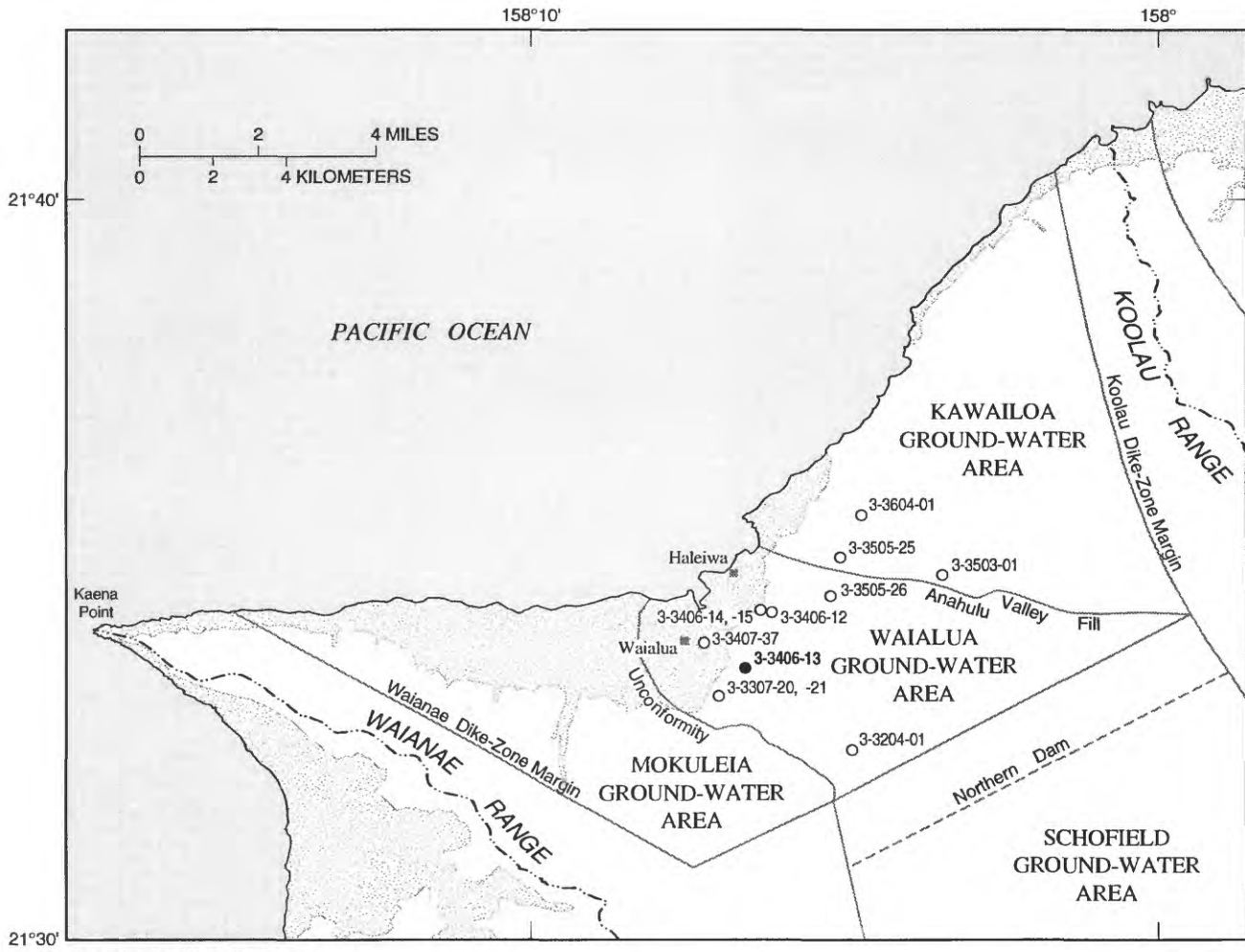
Because of water-supply concerns associated with population increase on the island of Oahu, the Honolulu Board of Water Supply, in cooperation with the U.S. Geological Survey (USGS), conducted a study to assess the availability of ground water in north-central Oahu. This study included drilling 12 exploratory and monitoring wells between July 1993 and May 1994.

This report presents drilling data for the Kaamooloa exploratory well (State well number 3-3406-13). The well is about 1.6 mi south of the town of Haleiwa, about 4,000 ft south of Weed Circle and about 2,000 ft northeast of Thompson Corner (figs. 1 and 2). The purpose of the Kaamooloa exploratory well is to increase spatial coverage of water-levels in the Waialua ground-water area (Rosenau and others, 1971; Dale, 1978; Hunt, in press) and to provide a water-level observation well for long-term monitoring.

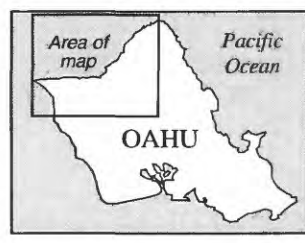
Regional Setting

The study area is located in north-central Oahu between the crests of the Koolau Range and the Waianae Range (fig. 1). The mountain ranges are the eroded remnants of two shield volcanoes. The Mokuleia ground-water area lies within the basalt aquifer of the Koolau Volcano. Previous studies (Rosenau and others, 1971; Dale, 1978; Hunt, in press) that describe the physical and geological aspects of the ground-water area are summarized here. The Mokuleia and Waialua ground-water areas are separated by low-permeability paleosols and saprolite of the Waianae Volcano that lie below the geologic contact between the Waianae and Koolau Volcanoes. The Waialua and Kawaiiloa ground-water areas are separated by alluvium and weathered basalt in and beneath Anahulu Gulch. Seaward flow of ground water in the Mokuleia and Waialua ground-water areas is impeded by a coastal confining unit that is composed of marine and terrestrial sediment known locally as "caprock." The caprock creates a confined artesian condition at low elevations near the shore. Further inland however, the aquifer is unconfined.

Water levels in the Waialua and Kawaiiloa ground-water areas are about 12 ft and 4 ft, respectively, above mean sea level. Water levels in the Mokuleia ground-water area are about 20 ft. Withdrawal from the Waialua, Kawaiiloa and Mokuleia ground-water areas is primarily for sugarcane irrigation, although there are also several municipal wells and numerous small capacity private wells. Natural ground-water discharge occurs at springs and by subsurface flow through the caprock to the ocean (Rosenau and others, 1971).



Base modified from U.S. Geological Survey digital data, 1:24,000, 1983, Albers equal area projection, standard parallels 21°15' and 21°45', central meridian 157°59'



EXPLANATION






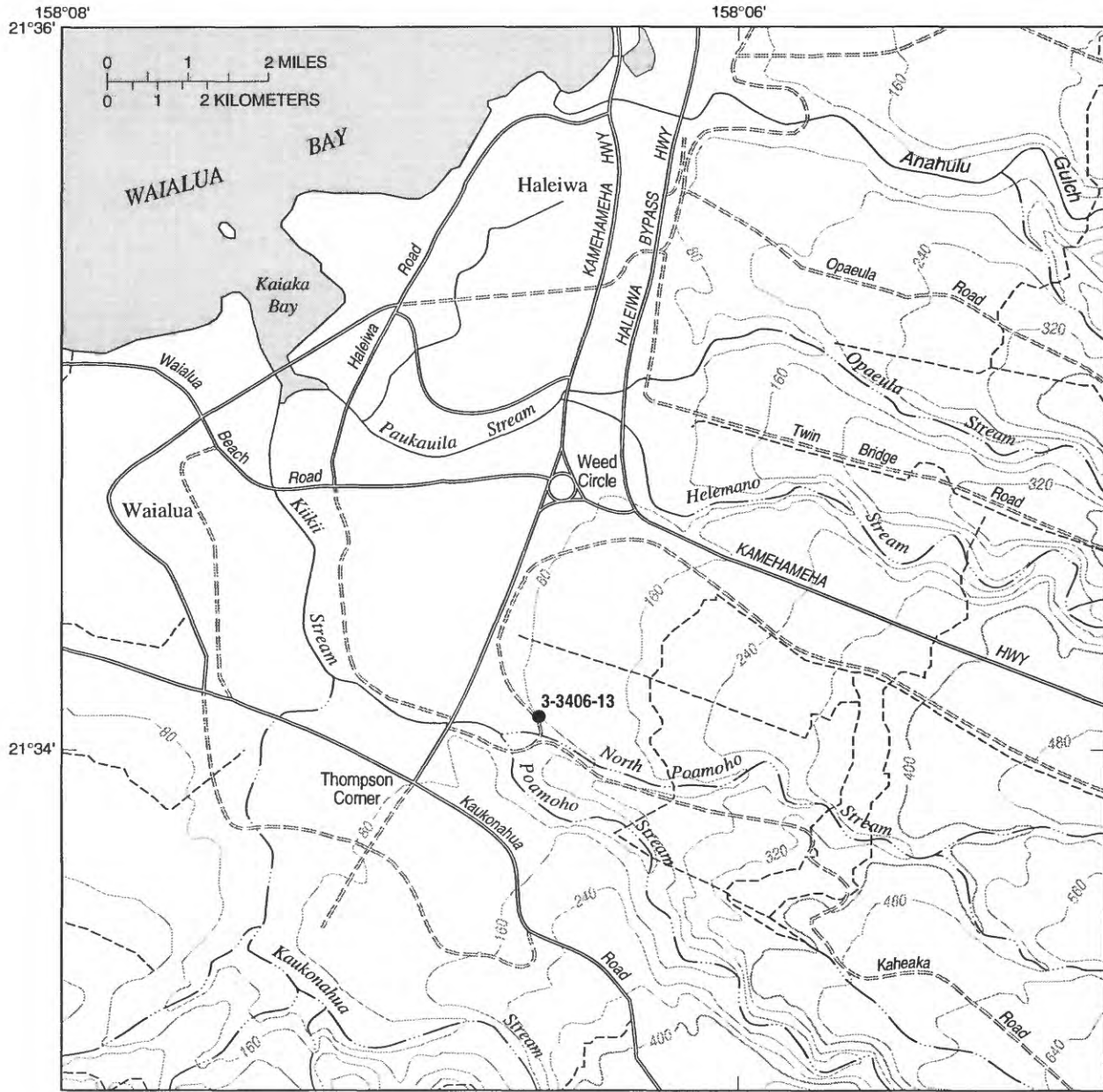
-  SEDIMENTARY DEPOSITS (CAPROCK)
-  BOUNDARY OF GROUND-WATER AREA
-  TOPOGRAPHIC DIVIDE
-  KAAMOOLOA EXPLORATORY WELL AND STATE WELL NUMBER
-  WELL AND STATE WELL NUMBER

Figure 1. Ground-water areas of north-central Oahu (modified from Hunt, in press) and wells drilled during the study, Hawaii.



Base modified from U.S. Geological Survey digital data, 1:24,000, 1983, Albers equal area projection, standard parallels 21°15' and 21°45', central meridian 157°59'

EXPLANATION

- 3-3406-13 KAAMOOLOA EXPLORATORY WELL AND STATE WELL NUMBER
- 400 — TOPOGRAPHIC CONTOUR—Interval 80 feet
- - - - - DITCH

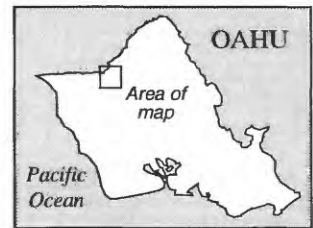


Figure 2. Location of Kaamooloa exploratory well, Oahu, Hawaii.

Acknowledgments

The USGS gratefully acknowledges the Waialua Sugar Company for their assistance in identifying and preparing the drill site. The USGS also thanks the Castle and Cooke Land Company for permission to drill on their land.

DRILLING AND CONSTRUCTION DATA

The Kaamooloa exploratory well (State well number 3-3406-13) is about 2,000 ft northeast of Thompson Corner along a sugarcane plantation road. Well-construction data is provided in table 1 and construction details are shown in figure 3.

The Kaamooloa exploratory well was drilled using an air-rotary system with flush-jointed 4 1/2-in. diameter drill pipe. Drilling foam and polymer were injected into the air-circulation system to assist the removal of drill cuttings and to stabilize the hole. The elevation of the ground surface in the area of the drill site is about 42 ft above mean sea level. An 7 7/8-in. diameter hole was drilled to an elevation of 10 ft and cased with 30 ft of 6 5/8-in. outside-diameter steel casing. The annular space was grouted with cement to provide a surface seal. A 6 1/4-in. diameter tri-cone tungsten-carbide button bit was then used to drill to an elevation of -10 ft. The well was cased with 4 1/2-in. outside-diameter flush-threaded PVC casing. PVC screen with 0.02-in. horizontal slots was installed through the water column.

Samples of the materials expelled by the circulation system while drilling were collected every 5 ft. The geologic log (geologic descriptions of the recovered samples from drilling) is presented in table 2, and the driller's log (driller's observations while drilling) is presented in table 3. From the surface, the bore penetrated about 25 ft of saprolite and 20 ft of weathered basalt.

The measuring point (elevation 42.35 ft) for water-level determination is located on the northwest side of the aluminum well-cap bracket affixed to the top of the 8 5/8-in. steel surface casing. An additional reference mark (elevation 42.30 ft) for the well site is located on the top of a stainless steel bolt emplaced into the concrete pad surrounding the well.

ADDITIONAL INFORMATION

Information for the 12 wells drilled during the north-central Oahu study is listed in table 4. Nine of the wells, including the Kaamooloa exploratory well (State well number 3-3406-13), were drilled in the Waialua ground-water area, and three wells were drilled north of Anahulu Gulch in the Kawaihoa ground-water area. Water-level time-series data were collected for all of the wells drilled and for numerous other existing wells as part of the overall monitoring effort for the project (unpublished data in files of the USGS, Honolulu). Data were collected using electronic data loggers coupled to shaft encoder-float systems or pressure transducers.

REFERENCES CITED

- Dale, R.H., 1978, A ground-water inventory of the Waialua basal-water body, island of Oahu, Hawaii: U.S. Geological Survey Open-File Report 78-24, 71 p.
- Hunt, C.D. Jr., in press, Geohydrology of the island of Oahu, Hawaii: U.S. Geological Survey Professional Paper 1412-B.
- Rosenau, J.C., Lubke, E.R., and Nakahara, R.H., 1971, Water resources of north-central Oahu, Hawaii: U.S. Geological Survey Water-Supply Paper 1899-D, 40 p.

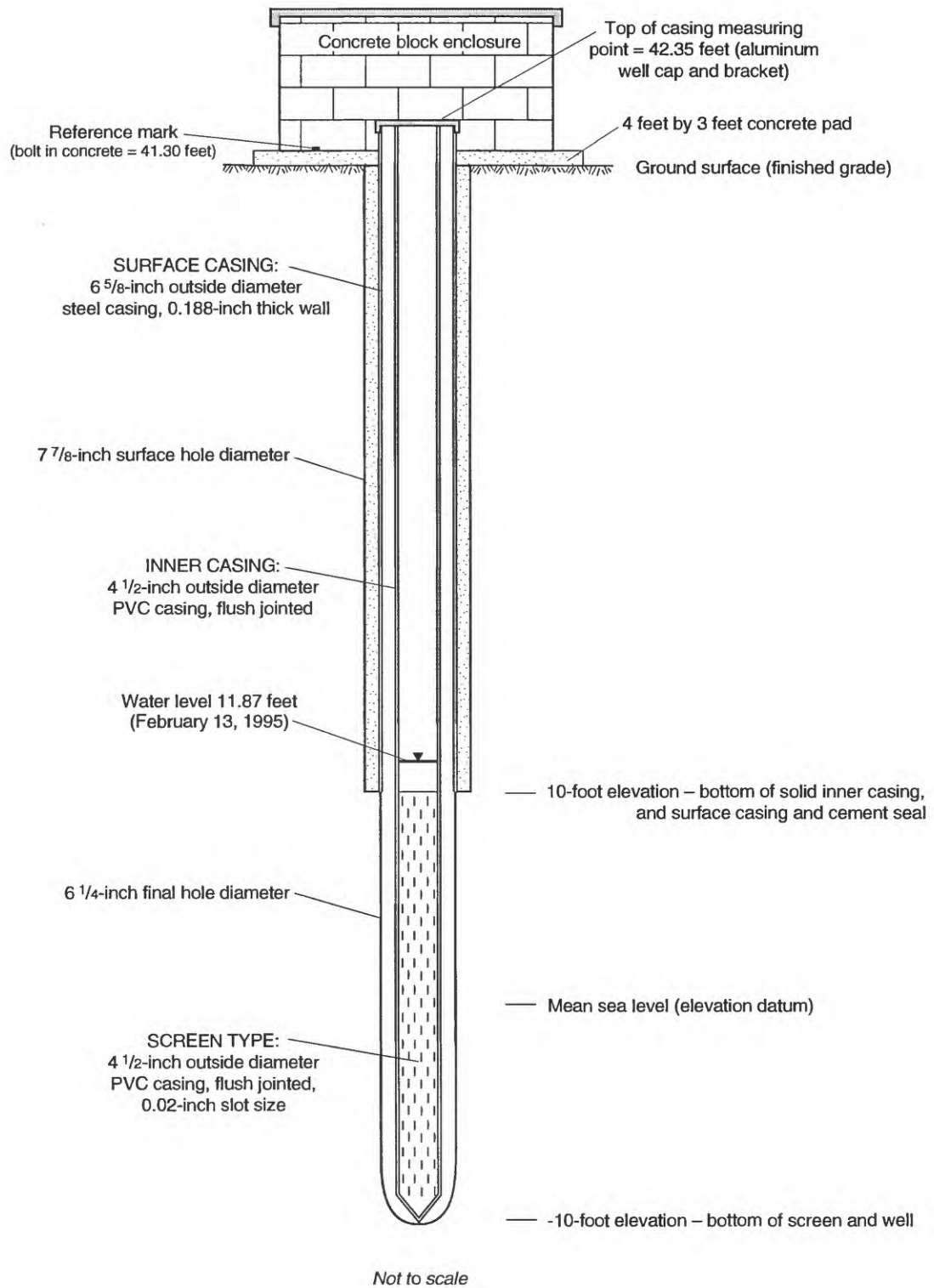


Figure 3. Construction details for Kaamooloa exploratory well (State well number 3-3406-13), Oahu, Hawaii.

Table 1. Construction data for Kaamooloa exploratory well, Oahu, Hawaii.

[Elevation datum is mean sea level; in., inch; ft, feet; od, outside diameter]

Well name	Kaamooloa exploratory well
State well number	3-3406-13
Latitude and longitude	21°34'06"N, 158°06'36"W
Hawaii tax map key number	6-5-01-2
Landowner	Castle and Cooke Land Company
Leaseholder	Waialua Sugar Company
Well completed	January 12, 1994
Working days to complete	4 days
Drillers	Fred Thibedeau and Wayne Heick, USGS
Surface hole diameter	7 7/8 in.
Bottom of surface casing elevation	10 ft
Surface casing diameter and type	6 5/8-in. od steel, 0.188-in. wall thickness
Final hole diameter	6 1/4 in.
Bottom of well elevation	-10 ft
Open interval elevations	10 ft to -10 ft
Screened interval elevations	10 ft to -10 ft
Inner casing diameter and type	4 1/2-in. od PVC, flush-jointed
Screen type	4 1/2-in. od PVC, flush-jointed, 0.02-in. horizontal slots
Reference mark elevation (bolt)	41.30 ft
Top of casing measuring point elevation	42.35 ft (top of aluminum well cap bracket)
Water level and date of measurement	11.87 ft, February 13, 1995

Table 2. Geologic log for Kaamooloa exploratory well (State well number 3-3406-13), Oahu, Hawaii.

[Elevation datum is mean sea level; in., inch; ft, feet; od, outside diameter]

Depth below grade (feet)	Elevation (feet)	Sample description	Comments
0 to 5	41 to 36	Greyish-red, friable saprolite	
5 to 10	36 to 31	Saprolite; grey, vesicular, hard basalt	Hard basalt, possibly a boulder
10 to 15	31 to 26	Orangish-red saprolite	
15 to 20	26 to 21	Brownish-orange saprolite; few grey rock fragments	
20 to 25	21 to 16	Brownish-orange saprolite; few grey rock fragments	
25 to 30	16 to 11	Grey, nonvesicular, hard basalt	Fresh
30 to 35	11 to 6	Brownish-grey, highly weathered, vesicular basalt	
35 to 40	6 to 1	No sample	
40 to 45	1 to -4	Orangish, highly oxidized and weathered clinker; some grey, unweathered, vesicular basalt	

Table 3. Driller's log for Kaamooloa exploratory well (State well number 3-3406-13), Oahu, Hawaii.

[Elevation datum is mean sea level; in., inch; ft, feet; od, outside diameter]

Depth below grade (feet)	Elevation (feet)	Driller's notes
0 to 33	41 to 8	No information
33 to 36	8 to 5	Medium-hard, red-grey rock
36 to 40	5 to 1	Soft, red-gray rock
40 to 44	1 to -3	Soft to medium, red-grey rock
44 to 49	-3 to -8	Medium-hard to soft grey-red rock
49 to 51	-8 to -10	Medium-soft to medium-hard gray rock

Table 4. Construction data for wells drilled during the study, Oahu, Hawaii

State well number	Well name	Latitude	Longitude	Hawaii state tax map key number	Landowner	Well completed	Working days to complete
3-3204-01	Kaheaka exploratory well	21°32'52"	158°04'52"	6-5-01-2	Castle and Cooke Land Company	March 2, 1994	16 days
3-3307-20	Thompson Corner exploratory well I	21°33'41"	158°07'02"	6-5-01-1	Castle and Cooke Land Company	July 9, 1993	14 days
3-3307-21	Thompson Corner exploratory well II	21°33'41"	158°07'02"	6-5-01-1	Castle and Cooke Land Company	August 9, 1993	15 days
3-3406-12	Twin Bridge Road deep monitor well	21°34'56"	158°06'10"	6-4-01-1	Castle and Cooke Land Company	March 9, 1994	27 days
3-3406-13	Kaamooloa exploratory well	21°34'06"	158°06'36"	6-5-01-2	Castle and Cooke Land Company	January 12, 1994	4 days
3-3406-14	Helemano exploratory well I	21°34'58"	158°06'21"	6-2-07-11	Castle and Cooke Land Company	October 15, 1993	11 days
3-3406-15	Helemano exploratory well II	21°34'58"	158°06'21"	6-2-07-11	Castle and Cooke Land Company	November 15, 1993	15 days
3-3407-37	Kiikii exploratory well	21°34'28"	158°07'16"	6-6-23-3	Castle and Cooke Land Company	April 21, 1994	27 days
3-3503-01	North Upper Anahulu exploratory well	21°35'30"	158°03'25"	6-2-09-1	Bishop Estate	May 5, 1994	8 days
3-3505-25	North Lower Anahulu exploratory well	21°35'45"	158°05'04"	6-2-09-1	Bishop Estate	December 23, 1993	7 days
3-3505-26	Opaaula exploratory well	21°35'11"	158°05'14"	6-2-10-1	Bishop Estate	October 4, 1993	10 days
3-3604-01	Kawailoa deep monitor well	21°36'24"	158°04'44"	6-1-05-1	Bishop Estate	January 9, 1994	28 days

Table 4. Construction data for wells drilled during the study, Oahu, Hawaii--Continued

State well number	Well name	Bottom of surface casing				Hole diameter (inch)	Bottom of well elevation (feet)	Open interval elevations (feet)	Inner casing outside diameter (inch) and type	Screened interval elevations (feet)	Measuring point elevation (feet)	Water level	
		Bottom of surface casing elevation (feet)	Surface casing outside diameter (inch)	Bottom of well elevation (feet)	Open interval elevations (feet)							Height above sea level (feet)	Date and time
3-3204-01	Kaheaka exploratory well	643	8 5/8	6 3/4	-55	643 to -55	4 1/2, steel	25 to -55	741.59 (top of casing)	12.44	Jan. 27, 1995		
3-3307-20	Thompson Corner exploratory well I	-65	12 5/8	12 1/4	-82	-65 to -82	12 5/8, steel	-65 to -82	99.10 (bolt)	11.32	Aug 5, 1993		
3-3307-21	Thompson Corner exploratory well II	17	8 5/8	7 7/8	-80	17 to -80	4 1/2, PVC	20 to -80	101.40 (top of casing)	11.29	Aug. 5, 1993		
3-3406-12	Twin Bridge Road deep monitor well	9	6 5/8	6 1/4	-596	9 to -596	4 1/2, steel	24 to -596	53.10 (top of casing)	11.10	Feb. 15, 1995		
3-3406-13	Kaamooloa exploratory well	10	6 5/8	6 1/4	-10	10 to -10	4 1/2, PVC	10 to -10	42.35 (top of casing)	11.87	Feb. 13, 1995		
3-3406-14	Helemano exploratory well I	-51	8 5/8	7 7/8	-78.5	-72 to -78.5	4 1/2, PVC	-68.5 to -78.5	13.79 (top of casing)	10.92	Feb. 15, 1995		
3-3406-15	Helemano exploratory well II	-52	8 5/8	7 7/8	-291	-271 to -291	4 1/2, steel	-271 to -291	14.41 (top of casing)	11.15	Feb. 15, 1995		
3-3407-37	Kiikii exploratory well	-115	8 5/8	6 3/4	-135	-125 to -135	4 1/2, steel	-115 to -135	14.68 (top of casing)	11.70	Feb. 13, 1995		
3-3503-01	North Upper Anahulu exploratory well	592	8 5/8	6 3/4	-103	592 to -103	4 1/2, steel	17 to -103	671.74 (top of casing)	7.15	Feb 14, 1995		
3-3505-25	North Lower Anahulu exploratory well	182	8 5/8	7 7/8	-18	182 to -18	4 1/2, PVC	22 to -18	234.24 (top of casing)	4.75	Feb. 14, 1995		
3-3505-26	Opaulea exploratory well	229	6 5/8	6 1/4	-65	229 to -65	4 1/2, PVC	15 to -65	288.08 (top of casing)	10.52	Feb. 15, 1995		
3-3604-01	Kawailoa deep monitor well	190	6 5/8	6 1/4	-392	190 to -392	4 1/2, steel	9 to -391	309.01 (top of casing)	4.40	Feb. 14, 1995		