Synoptic Groundwater-Level Survey, November 18, 2016
Hālawa Area, Oʻahu, Hawaiʻi

A multi-agency synoptic groundwater-level survey was completed on November 18, 2016 (between 09:00 a.m. and 12:00 p.m.) in the Hālawa area, Oʻahu, Hawaiʻi, to provide a "snapshot" of water levels in selected wells in the area (fig. 1) (U.S. Geological Survey, 2017). The Honolulu Board of Water Supply, Hawaiʻi Commission on Water Resource Management, U.S. Navy, and U.S. Geological Survey participated in the groundwater-level survey. Water-level measurements in wells (table 1, fig. 2) were made by manually using electronic-sensor tapes or chalked metal tapes and may contain errors associated with (1) the measuring tapes used, (2) the measuring-point altitudes at the top of the well, and (3) the plumbness of the well. Each of these sources of error is discussed briefly below.

Measuring tapes.—Measuring tapes that are excessively stretched or kinked may have errors that exceed 0.1 feet per 100 feet of tape. To avoid errors associated with the different measuring tapes, water-level measurements are best made using measuring tapes that are calibrated with a reference steel tape. For the November 18, 2016 survey, all tapes were calibrated.

Well-measuring-point altitudes.—Measuring-point altitudes of wells are the reference elevations from which groundwater levels are determined. Errors associated with measuring-point altitudes have exceeded 1 foot in some cases in Hawaiʻi. Recent advances in the portability and operation of traditional surveying equipment, and in Global Positioning System (GPS) technology, have simplified the process of obtaining a fast, accurate survey of well location coordinates and altitudes. For the November 18, 2016 survey, best available measuring-point altitudes were used to determine water levels relative to mean sea level.

Plumbness of the well.—If the tape used to measure a water level does not hang vertically because the well is out of plumb, then the measured depth to water in the well will be too great relative to the true depth from the measuring point. For example, if the top and bottom of a small-diameter well are displaced horizontally by 1 foot relative to each other, and the true vertical distance from the top to the bottom is exactly 100 feet, a measuring tape would indicate an incorrect distance of 100.005 feet. For shallow or large-diameter wells, vertical alignment errors generally do not cause any error in measured water levels because measuring tapes are able to hang freely and vertically in the well. For the November 18, 2016 survey, no plumbness corrections were made to measured water levels because (1) corrections were deemed unnecessary, or (2) plumbness information was not available.

Previous multi-agency *synoptic groundwater-level surveys of the Pearl Harbor area*, Oʻahu, Hawaiʻi were completed on October 31, 2002, May 15, 2003, August 17, 2011, and April 26, 2012, and include the Hālawa area (U.S. Geological Survey, 2017). Links to the data for these synoptic groundwater-level surveys are provided below in the section **National Water Information System Links to Data**.

References Cited

U.S. Geological Survey, 2017, National Water Information System—Web interface, accessed March 22, 2017, at http://dx.doi.org/10.5066/F7P55KJN.

National Water Information System Links to Data

Hālawa area synoptic groundwater-level survey of November 18, 2016:

https://nwis.waterdata.usgs.gov/hi/nwis/gwlevels?multiple_site_no=212046157531401%2C212117157534601%2C212123157535501%2C212127157532001%2C212144157534701%2C212209157535201%2C212210157540201%2C212214157535401%2C212214157542601%2C212216157534701%2C212216157535801%2C212219157533901%2C212222157535201%2C212225157533001%2C212225157542601%2C212226157534101%2C212231157532901%2C212233157552301%2C212233157552302%2C212238157561101%2C212241157535501%2C212340157552301&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=2016-11-18&end_date=2016-11-18&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=multiple_site_no.

Pearl Harbor area synoptic groundwater-level survey of October 31, 2002:

https://nwis.waterdata.usgs.gov/hi/nwis/gwlevels?multiple_site_no=212132158035701%2C212154158015201%2C212225157542601%2C212233157552301%2C212238157561101%2C212238157561102%2C212250158015801%2C212313158032401%2C212318157583401%2C212333157565701%2C212340157552301%2C212340158001901%2C212353157583101%2C212415157593401%2C212416157554301%2C212425158035901%2C212435157561401%2C212515157574501%2C212516158004601%2C212614157594301%2C212621157590201%2C212621158021901%2C212635158004001%2C212721158020801%2C212738158034301&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=2002-10-31&end_date=2002-10-31&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=multiple_site_no.

Pearl Harbor area synoptic groundwater-level survey of May 15, 2003:

https://nwis.waterdata.usgs.gov/hi/nwis/gwlevels?multiple_site_no=212132158035701%2C212154158015201%2C212233157552301%2C212238157561101%2C212238157561102%2C212241157535501%2C212250158015801%2C212313158032401%2C212318157583401%2C212333157565701%2C212340157552301%2C212340158001901%2C212353157583101%2C212411157582801%2C212415157593401%2C212416157554301%2C212425158035901%2C212435157561401%2C212515157574501%2C212516158004601%2C212614157594301%2C212621157590201%2C212621158021901%2C212738158034301&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=2003-05-15&end_date=2003-05-15&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=multiple_site_no.

Pearl Harbor area synoptic groundwater-level survey of August 17, 2011:

https://nwis.waterdata.usgs.gov/hi/nwis/gwlevels?multiple_site_no=212046157531401%2C212106157533701%2C212117157534601%2C212132158035701%2C212154158015201%2C212233157552301%2C212233157552302%2C212238157561101%2C212241157535501%2C212250158015801%2C212333157565701%2C212340157552301%2C212340158001901%2C212351157560501%2C212353157583101%2C212411157582801%2C212414157570601%2C212415157593401%2C212416157554301%2C212425158035901%2C212435157561401%2C212515157574501%2C212516158004601%2C212537158034401%2C212537158034402%2C212614157594301%2C212621158021901%2C212738158034301&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=2011-08-17&end_date=2011-08-17&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=multiple_site_no.

Pearl Harbor area synoptic groundwater-level survey of April 26, 2012:

https://nwis.waterdata.usgs.gov/hi/nwis/gwlevels?multiple_site_no=212046157531401%2C212106157533701%2C212117157534601%2C212132158035701%2C212154158015201%2C212233157552301%2C212233157552302%2C212238157561101%2C212241157535501%2C212250158015801%2C212333157565701%2C212340157552301%2C212340158001901%2C212351157560501%2C212353157583101%2C212411157582801%2C212414157570601%2C212415157593401%2C212425158035901%2C212435157561401%2C212515157574501%2C212516158004601%2C212537158034401%2C212537158034402%2C212614157594301%2C212621158021901%2C212738158034301&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=2012-04-26&end_date=2012-04-26&format=rdb&date_format=YYYY-MM-DD&rdb_compression=value&list_of_search_criteria=multiple_site_no.

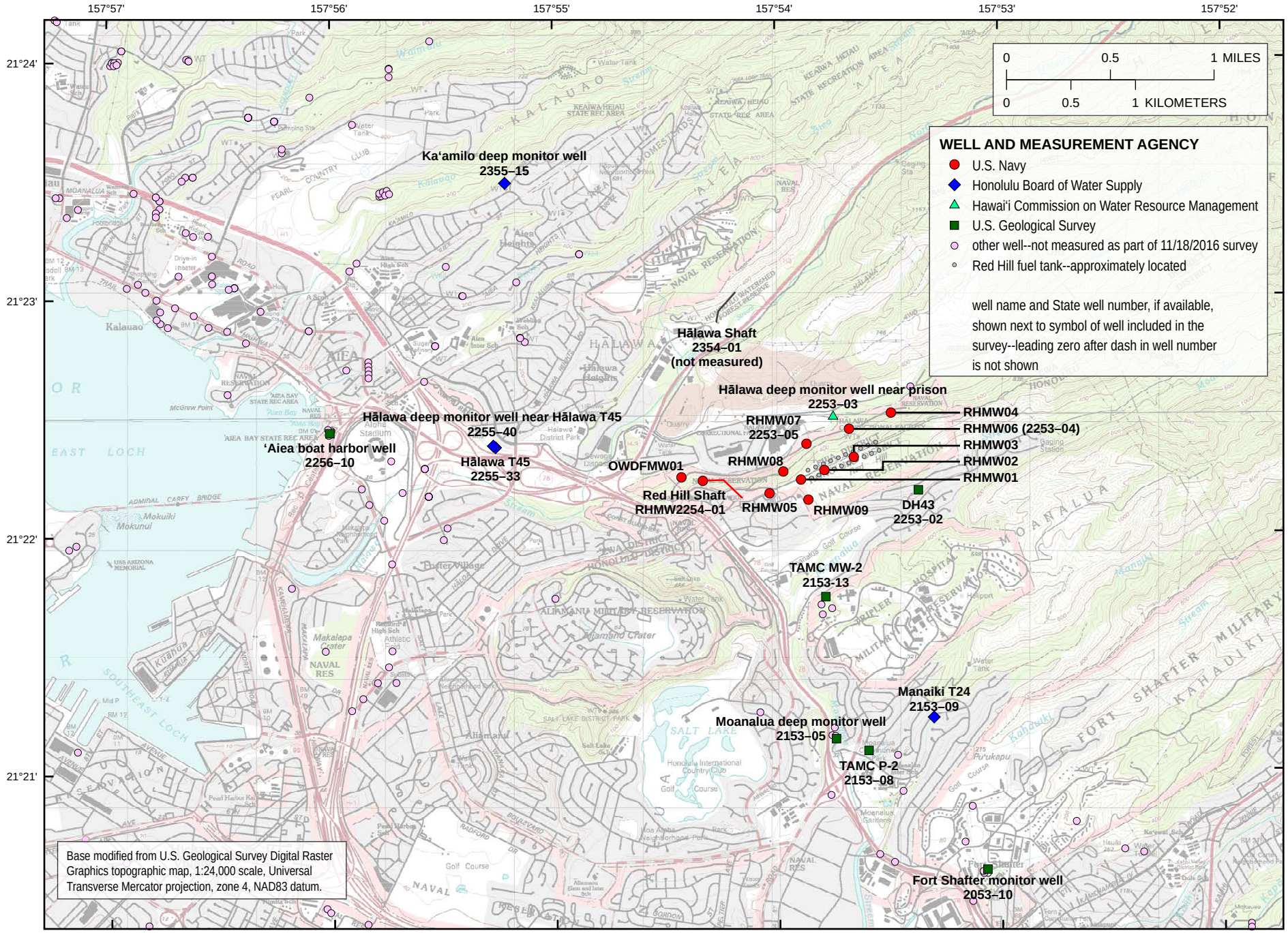

Figure 1. Wells included in the November 18, 2016, synoptic groundwater-level survey, Hālawa area, O'ahu, Hawai'i.

Table 1. November 18, 2016 synoptic water-level measurements for the Hālawa area, Oʻahu, Hawaiʻi

[CWRM, Hawaiʻi Commission on Water Resource Management; BWS, Honolulu Board of Water Supply; USN, U.S. Navy or their consultant; USGS, U.S. Geological Survey; --, not applicable or not available at the time of the survey]

Well name	State well number[1]	Time of measurement	Latest available top-of-casing or measuring-point altitude, in feet above mean sea level	Measured depth to water, in feet below top of casing or measuring point	Tape correction, in feet	Corrected depth to water, in feet below top of casing or measuring point	Water level, in feet above mean sea level	Measurement agency	Tape identifier
Hālawa deep monitor well near prison	2253-03	10:30	226.48	206.80	-0.12	206.68	19.80	CWRM	CWRM C1, 2000-foot Geotech
Manaiki T24	2153-09	09:15	61.12	41.21	0.00	41.21	19.91	BWS	CWRM C3 1000-foot Solinst TLC
Kaʻamilo deep monitor well	2355-15	09:50	493.29	476.31	0.07	476.38	16.91	BWS	CWRM C3 1000-foot Solinst TLC
Hālawa deep monitor well near Hālawa T45	2250-40	10:20	60.04	42.87	0.00	42.87	17.17	BWS	CWRM C3 1000-foot Solinst TLC
Hālawa T45	2255-33	10:30	57.85	40.68	0.00	40.68	17.17	BWS	CWRM C3 1000-foot Solinst TLC
Manaiki T24	2153-09	11:20	61.12	41.19	0.00	41.19	19.93	BWS	CWRM C3 1000-foot Solinst TLC
RHMW2254-01	2254-01	09:29	([2])	80.45	-0.04	80.41	([3])	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW03	--	10:12	120.80	101.78	-0.04	101.74	19.06	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW02	--	10:34	104.50	[4] 85.54	-0.04	85.50	19.00	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW01	--	10:48	101.90	82.85	-0.04	82.81	19.09	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW05	--	11:06	101.22	[5] 82.18	-0.04	82.14	19.08	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW2254-01	2254-01	11:39	([2])	[6] 80.45	-0.04	80.41	([3])	USN	Solinst 101 P2 reel SN 225213; tape SN 128649
RHMW04	--	09:01	312.09	293.11	0.00	293.11	18.98	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW06	2253-04	09:27	([2])	240.28	0.00	240.28	([3])	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW06, standpipe	2253-04	09:33	259.09	240.17	0.00	240.17	([7])	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW07	2253-05	09:48	220.58	197.58	0.00	197.58	23.00	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW07, standpipe	2253-05	09:54	220.36	[8] 197.44	0.00	197.44	([7])	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW08	--	10:13	([2])	291.63	0.00	291.63	([3])	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW09	--	10:44	([2])	[9] 376.73	0.00	376.73	([3])	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
OWDFMW01	--	11:09	138.05	119.07	0.00	119.07	18.98	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
RHMW04	--	11:29	312.09	293.03	0.00	293.03	19.06	USN	Solinst 101 P7 reel SN 236327; tape SN 125246
Moanalua deep monitor well	2153-05	09:00	37.03	17.22	0.00	17.22	19.81	USGS	steel tape OAST10
TAMC MW-2	2153-13	09:38	179.70	159.89	-0.01	159.88	19.82	USGS	steel tape OAST07
DH43	2253-02	10:19	234.32	213.98	-0.02	213.96	20.36	USGS	steel tape OAST07
Moanalua deep monitor well	2153-05	10:42	37.03	17.21	0.00	17.21	19.82	USGS	steel tape OAST10
ʻAiea boat harbor well	2256-10	08:34	26.07	8.97	0.00	8.97	17.10	USGS	steel tape OAST05
Fort Shafter monitor well	2053-10	09:02	24.79	4.80	0.00	4.80	19.99	USGS	steel tape OAST05
TAMC P-2	2153-08	09:25	33.21	13.35	0.00	13.35	19.86	USGS	steel tape OAST05
ʻAiea boat harbor well	2256-10	10:44	26.07	8.98	0.00	8.98	17.09	USGS	steel tape OAST05

[1]Leading zero after the dash not shown in State well number.

[2]Top-of-casing or measuring-point altitude unavailable or uncertain.

[3]Water level relative to mean sea level cannot be accurately determined because top-of-casing or measuring-point altitude unavailable or uncertain.

[4]Used measurement at 10:34 and check measurement at 10:35, which agreed (applied USGS rounding from 80.545 to 80.54 feet). Additional measurements at 10:30, 10:31, and 10:32 were 85.52, 85.53, and 85.53 feet, respectively.

[5]Applied USGS rounding from 82.185 to 82.18 feet.

[6]Used measurement at 11:39 and check measurement at 11:41, which agreed (measurement at 11:38 was 80.46 feet).

[7]Water level measured in standpipe can be determined but is not reported because it is considered less reliable than the water level measured 6 minutes earlier in the main, cased part of well. Data not included in the National Water Information System (NWIS) database.

[8]Check measurement at 09:55 was 197.45 feet.

[9]Check measurement at 10:46 was 376.74 feet.

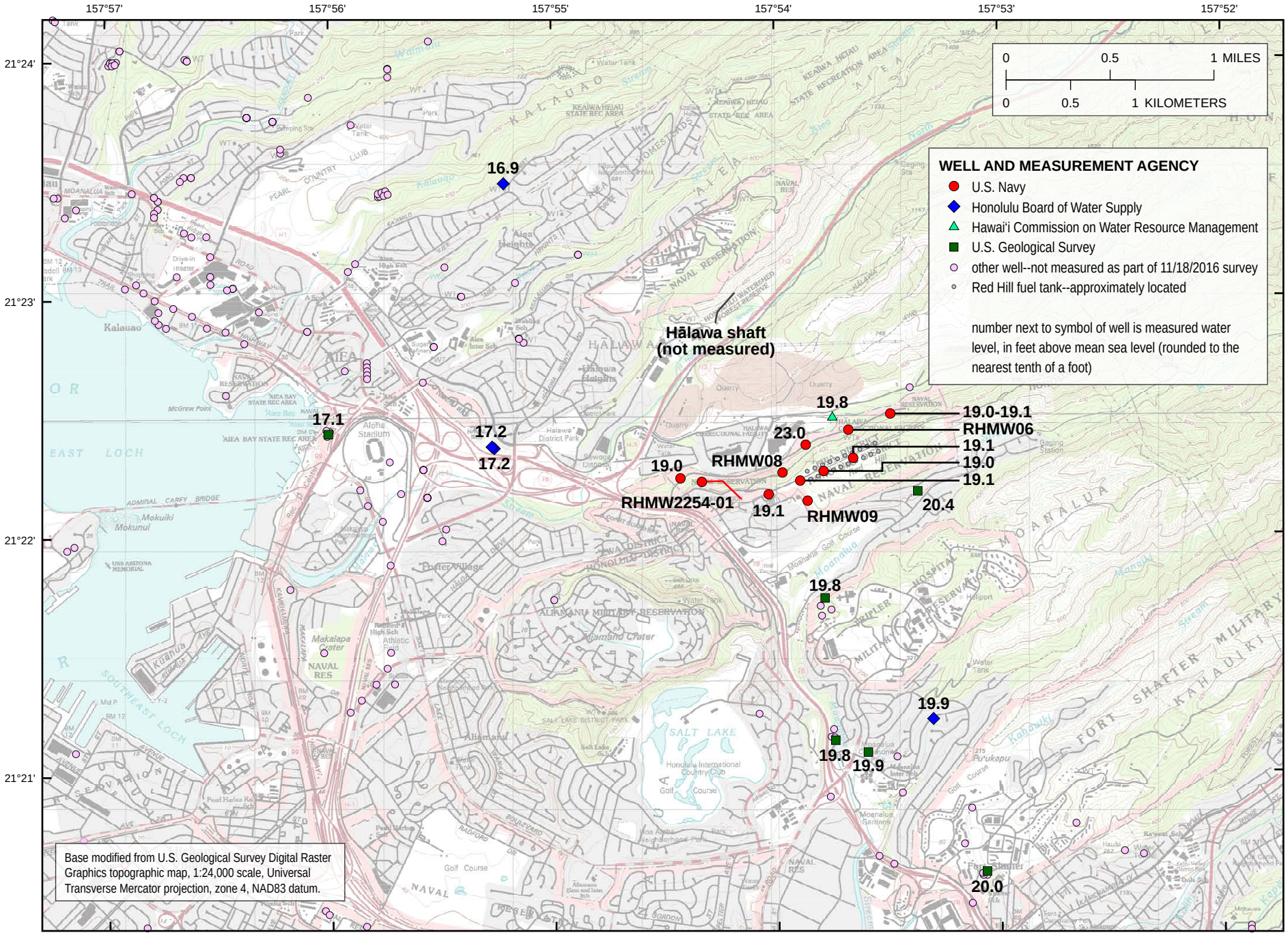

Figure 2. Measured water levels during the November 18, 2016, synoptic groundwater-level survey, Hālawa area, O'ahu, Hawai'i. All water levels were measured during 09:00 a.m. to 12:00 p.m. and reflect best available measuring-point altitudes at the time of the survey. Water levels for RHMW06, RHMW08, RHMW09 and RHMW2254-01 are not shown because measuring-point altitudes for these sites were unavailable or uncertain at the time of the survey, although depth-to-water measurements were made.