Hydrologic, Lithologic, and Chemical Data For Sediment in the Shallow Alluvial Aquifer at Two Sites near Fallon, Churchill County, Nevada, 1984-85

By Michael S. Lico, Alan H. Welch, and Jennifer L. Hughes

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"Inch-pound" units of measure used in this report may be converted to International System (metric) units by using the following factors:

Multiply	*By*	*To obtain*
Acres	0.4047	Square hectometers (hm^2)
Feet (ft)	0.3048	Meters (m)
Feet per day (ft/d)	0.3048	Meters per day (m/d)
Inches (in.)	25.40	Millimeters (mm)
Miles (mi)	1.609	Kilometers (km)
Square miles (mi^2)	2.590	Square kilometers (km^2)

To convert from the phi (ϕ) size scale to the millimeter scale:
size, in millimeters = $10^{-\phi/3.322}$

HYDROLOGIC, LITHOLOGIC, AND CHEMICAL DATA FOR SEDIMENT IN THE SHALLOW ALLUVIAL AQUIFER AT TWO SITES NEAR FALLON, CHURCHILL COUNTY, NEVADA, 1984-85

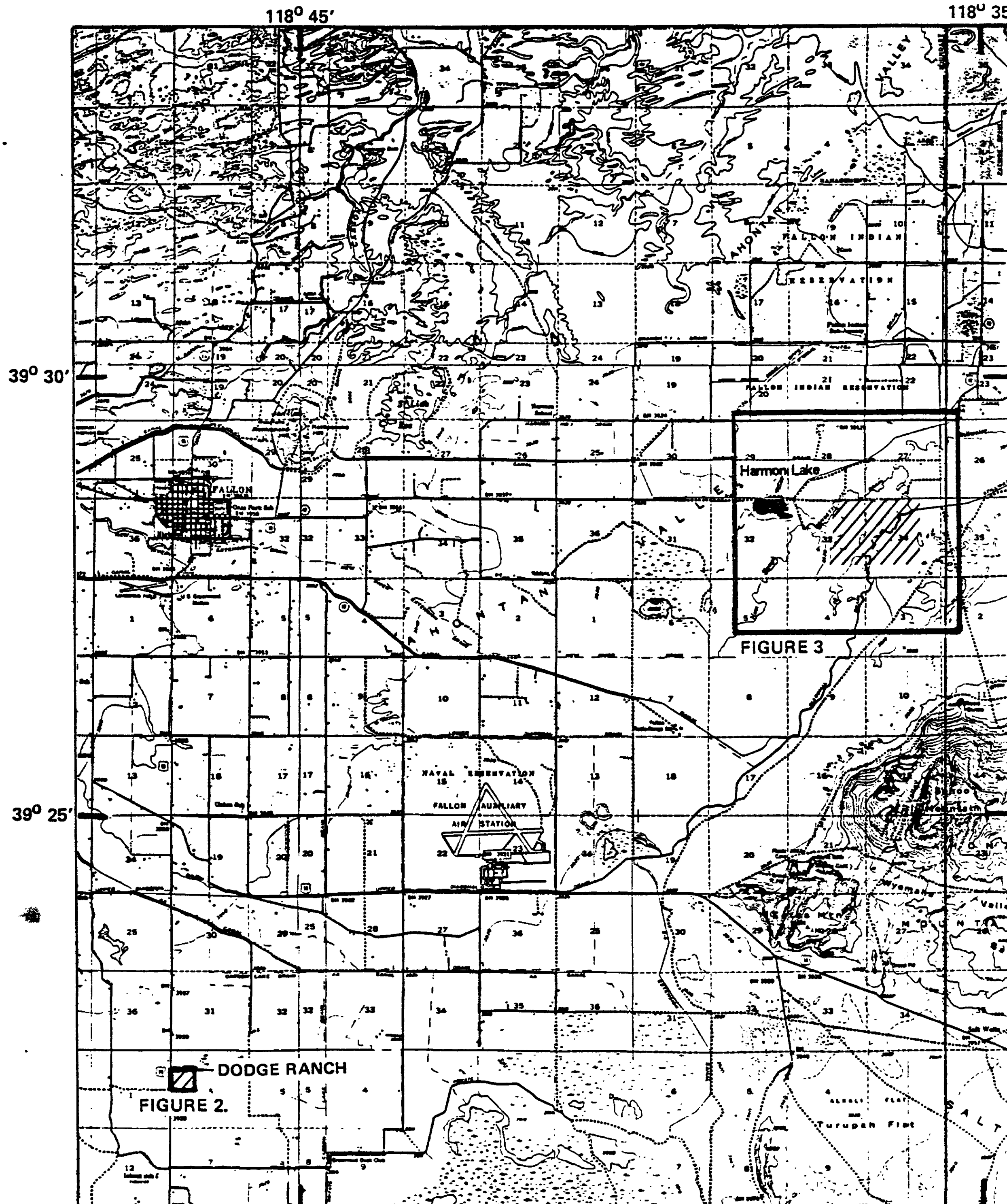
By Michael S. Lico, Alan H. Welch,
and Jennifer L. Hughes

ABSTRACT

The U.S. Geological Survey collected an extensive amount of hydrogeologic data from the shallow alluvial aquifer at two study sites near Fallon, Nevada, from 1984 through 1985. These data were collected as part of a study to determine the geochemical controls on the mobility of arsenic and other trace elements in shallow ground-water systems. The main study area is approximately 7 miles south of Fallon. A subsidiary study area is about 8 miles east of Fallon. The data collected include lithologic logs and water-level altitudes for the augered sampling wells and piezometers, and determinations of arsenic and selenium content, grain size, porosity, hydraulic conductivity, and mineralogy for sediment samples from cores.

INTRODUCTION

The U.S. Geological Survey collected hydrologic, lithologic, and chemical data from the shallow alluvial aquifer near Fallon, Nev. (fig. 1) in 1984 and 1985. These data were collected as part of the national Toxic Waste Program of the U.S. Geological Survey. The purpose of this specific study is to ascertain the geochemical controls affecting the mobility of arsenic and other trace elements in a variety of geochemical environments. The data presented in this report are from a study of a shallow alluvial ground-water system. The bulk of the data were collected from an area approximately 7 miles south of the city of Fallon, Nev., designated as the Dodge Ranch study area (fig. 2). Other data were collected approximately 8 miles east of Fallon in the Harmon Lake study area (fig. 3). The Dodge Ranch study area consists of an array of 10 sampling wells, 22 piezometers (water-level monitoring wells), and 4 staff gages within an area of approximately 0.06 square mile. The staff gages are located in irrigation ditches and drains. The Harmon Lake study area consists of nine sampling wells within an area of approximately 0.5 square mile. The locations of wells, piezometers, and staff gages are shown in figures 2 and 3, and basic information regarding the sites is listed in tables 1 and 2.



Base from U. S. Geological Survey
1:62,500, Soda Lake, Fallon, Carson
Lake, 1951; Stillwater 1950

NEVADA

FIGURE 1.--Location of study areas (crosshatched).

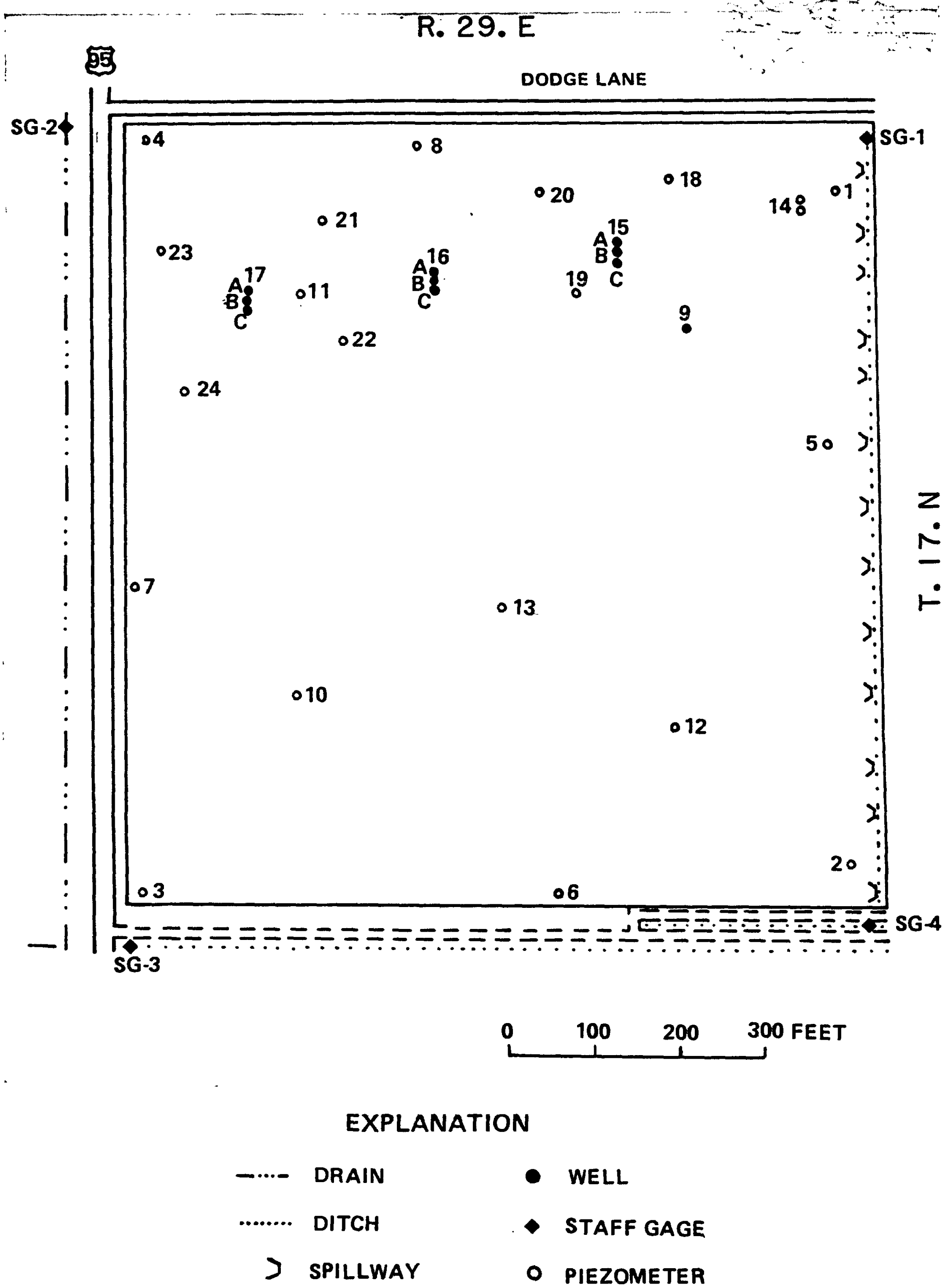


FIGURE 2.--Locations of sampling wells, piezometers, and staff gages at Dodge Ranch study area (SW¼NW¼ of section 6). Numbers and letters next to well, piezometer, and staff-gage symbols are abbreviated forms of those listed in tables 1 and 2.

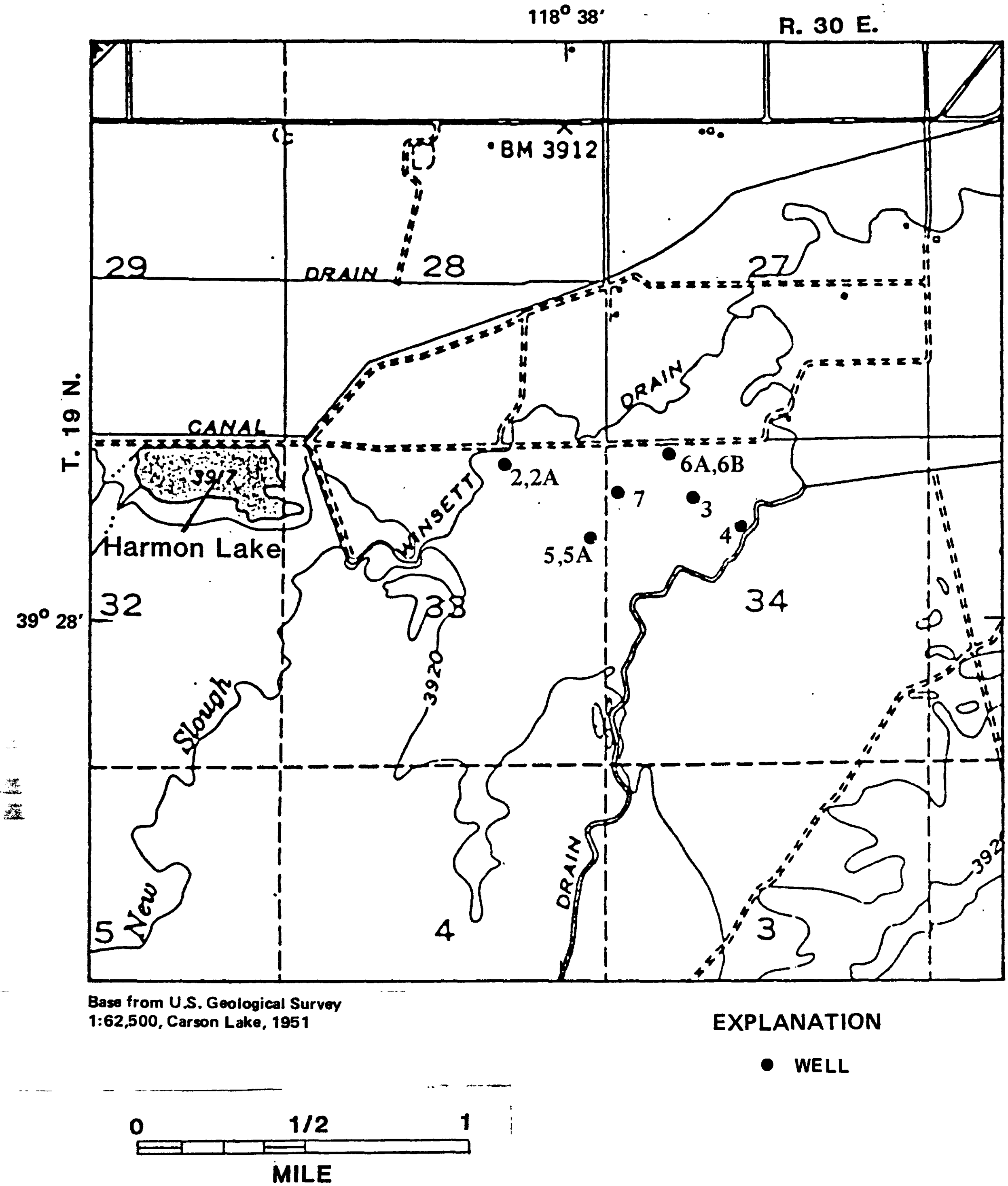


FIGURE 3.--Location of sampling wells at Harmon Lake study area. Numbers and letters next to well symbols are abbreviated forms of those listed in table 1.

TABLE 1.--*Well locations, numbers, altitudes, and depths*

Well	Location: Latitude	Location: Longitude	Well number	Land-surface altitude (feet above sea level)	Well depth[1] (feet)	Total depth drilled (feet)
DODGE RANCH STUDY AREA						
Sampling Wells						
DR-AH-15A	392208	1184638	N17 E29 06BCA07	3,932.6	19.7	19.7
DR-AH-15B	392208	1184638	N17 E29 06BCA08	3,932.9	11.3	11.3
DR-AH-15C	392208	1184638	N17 E29 06BCA09	3,932.7	45.2	61.5
DR-AH-16A	392208	1184642	N17 E29 06BCB02	3,931.6	28.8	29.0
DR-AH-16B	392208	1184642	N17 E29 06BCB03	3,931.7	20.2	20.2
DR-AH-16C	392208	1184642	N17 E29 06BCB04	3,931.7	9.7	9.7
DR-AH-17A	392207	1184646	N17 E29 06BCB08	3,930.7	26.2	45.0
DR-AH-17B	392207	1184646	N17 E29 06BCB09	3,930.6	19.9	19.9
DR-AH-17C	392207	1184646	N17 E29 06BCB10	3,930.7	9.8	9.8
DR-AH-17D	392207	1184646	N17 E29 06BCB18	3,930.7	19.2	19.2
Piezometers						
DR-AH-1	392209	1184634	N17 E29 06BCA01	3,933.2	6.3	6.3
DR-AH-2	392159	1184634	N17 E29 06BCD03	3,932.4	9.7	9.7
DR-AH-3	392158	1184648	N17 E29 06BCC02	3,929.4	8.8	8.8
DR-AH-4	392210	1184648	N17 E29 06BCB13	3,930.7	9.9	9.9
DR-AH-5	392205	1184634	N17 E29 06BCA04	3,933.2	7.6	7.6
DR-AH-6	392158	1184640	N17 E29 06BCD01	3,930.9	11.0	11.0
DR-AH-7	392203	1184648	N17 E29 06BCC01	3,929.8	11.3	11.3
DR-AH-8	392210	1184642	N17 E29 06BCB01	3,931.6	7.0	7.0
DR-AH-9	392207	1184636	N17 E29 06BCA05	3,932.4	10.1	13.0
DR-AH-10	392201	1184645	N17 E29 06BCC03	3,930.1	7.1	7.1
DR-AH-11	392207	1184645	N17 E29 06BCB07	3,930.9	10.9	10.9
DR-AH-12	392201	1184637	N17 E29 06BCD02	3,931.8	9.2	9.2
DR-AH-13	392203	1184641	N17 E29 06BCC04	3,931.0	12.3	12.3
DR-AH-14A	392209	1184634	N17 E29 06BCA02	3,933.1	19.6	19.6
DR-AH-14B	392209	1184634	N17 E29 06BCA03	3,933.0	10.3	10.3
DR-AH-18	392209	1184637	N17 E29 06BCA06	3,933.0	9.8	9.8
DR-AH-19	392207	1184639	N17 E29 06BCA10	3,932.3	9.8	9.8
DR-AH-20	392209	1184640	N17 E29 06BCA11	3,932.2	8.4	8.4

TABLE 1.--*Well locations, numbers, altitudes, and depths*--Continued

Well	Location: Latitude	Location: Longitude	Well number	Land-surface altitude (feet above sea level)	Well depth[1] (feet)	Total depth drilled (feet)
DR-AH-22	392207	1184644	N17 E29 06BCB05	3,930.8	9.9	9.9
DR-AH-23	392208	1184648	N17 E29 06BCB12	3,930.5	9.8	9.8
DR-AH-24	392206	1184647	N17 E29 06BCB11	3,930.4	9.5	9.5
			HARMON LAKE STUDY AREA			
			Sampling Wells			
HL-AH-2	392823	1183707	N19 E30 33ABA02	3,917.4	18.1	19.0
HL-AH-2A	392823	1183707	N19 E30 33ABA01	3,917.1	29.9	30.0
HL-AH-3	392823	1183621	N19 E30 34BAB01	3,917.3	21.4	23.0
HL-AH-4	392821	1183615	N19 E30 34BAD01	3,915.2	12.9	17.0
HL-AH-5	392758	1183651	N19 E30 33ADB02	3,915.9	13.4	13.4
HL-AH-5A	392758	1183651	N19 E30 33ADB01	3,916.0	30.5	30.5
HL-AH-6A	392828	1183612	N19 E30 34BAA01	3,914.2	25.2	25.2
HL-AH-6B	392828	1183612	N19 E30 34BAA02	3,914.2	12.8	14.6
HL-AH-7	392811	1183637	N19 E30 33ADD01	3,914.8	10.8	30.0

[1] Completed well depth is bottom of screened interval, relative to land surface.

TABLE 2.--*Staff-gage locations and water-level altitudes at Dodge Ranch study area*

[Altitudes are expressed in feet above 3,900 feet; "--" indicates no data available]

Staff gage:	DR-SG-1	DR-SG-2	DR-SG-3	DR-SG-4
Latitude:	392209	392210	392158	392159
Longitude:	1184634	1184648	1184648	1184634
Date	Water-level altitude			
Aug. 17, 1984	32.69	--	--	--
Aug. 20, 1984	32.55	--	--	--
Aug. 22, 1984	32.51	--	--	--
Aug. 23, 1984	32.50	--	--	--
Aug. 24, 1984	32.49	--	--	--
Aug. 27, 1984	32.48	--	--	--
Aug. 29, 1984	32.87	--	--	--
Aug. 31, 1984	32.93	--	--	--
Sept. 11, 1984	32.57	24.89	28.15	27.77
Sept. 18, 1984	32.63	25.02	27.60	27.75
Oct. 25, 1984	32.37	25.06	--	--
Oct. 30, 1984	--	--	--	--
Nov. 20, 1984	32.56	25.00	27.81	27.60
Dec. 12, 1984	32.43	24.94	27.01	27.36
Apr. 8, 1985	--	25.40	28.55	--
Apr. 17, 1985	--	25.26	--	--
May 1, 1985	32.73	25.34	--	--

The local well numbering system used in this report is based on the rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian. Each number consists of three units separated by spaces: The first unit is the township, preceded by an N or S to indicate location north or south of the base line. The second unit is the range, preceded by an E to indicate location east of the meridian. The third unit consists of the section number and letters designating the quarter section, quarter-quarter section, and so on (A, B, C, and D indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the well was recorded. For example, well N17 E29 06BCB06 is the sixth well recorded in NW¼ of the SW¼ of the NW¼ of section 6, Township 17 North, Range 29 East, Mount Diablo base line and meridian.

The site-naming system used in the tables and figures of this report indicates the study area, type of measuring point, and site number. The first segment of the designation indicates study area: DR for Dodge Ranch and HL for Harmon Lake. The second segment indicates the type of measuring site: AH for auger hole (sampling wells and piezometers) and SG for staff gage. The third segment indicates the site number within each study area.

The authors thank William Slentz and Ray Lannen of Island Ranch and Circle D Feeds for access to their property, as well as the U.S. Bureau of Reclamation and the Truckee-Carson Irrigation District for information on irrigation of the Fallon area. We also acknowledge Darrell K. Nordstrom and Ivan Barnes of the U.S. Geological Survey, Menlo Park, Calif., for use of their analytical facilities. Special thanks are extended to Patrick A. Glancy of the U.S. Geological Survey, Carson City, Nev., for his insight into the geochemistry and stratigraphy of the Fallon area.

METHODS OF STUDY

Emplacement of Sampling Wells and Piezometers

Sampling wells and piezometers in the Dodge Ranch and Harmon Lake study areas were drilled with either a 3-inch solid-stem auger or a 7-inch hollow-stem auger. No drilling fluids were used during drilling. The sampling wells and piezometers were logged by noting each change in lithology. Selected logs are listed in table 5. Wells and piezometers were cased with 2-inch inside-diameter polyvinyl chloride (PVC) pipe. Perforated intervals consisted of premanufactured machine-slit PVC well screens (0.006-inch slots). Washed Monterey sand was added to the annulus to cover the screened interval; then bentonite pellets were added to create a seal at least 1 foot thick. The remainder of the annular space was back-filled with drill cuttings. A surface seal was emplaced with bentonite pellets. The wells and piezometers were capped and cement water-meter boxes were placed over the wells.

Water Levels

Water levels were periodically measured in the sampling wells and piezometers at the Dodge Ranch and Harmon Lake study areas. These data are tabulated in tables 3 and 4. Hydrographs showing the water-level variations with time in 10 representative wells at the Dodge Ranch area are presented in figure 4. Water levels for a representative date, September 11, 1985, are shown for the Dodge Ranch area in figure 5. Water-level data for the staff gages are listed in table 2.

Collection of Sediment Samples

Sediment samples were collected during the drilling. Cores were taken through the hollow-stem auger with a stainless-steel, split-spoon drive sampler fitted with a polycarbonate liner. The cores were removed from the sampler, capped, and the ends sealed with paraffin. All cores were kept refrigerated until analysis. In addition, bulk sediment samples were obtained as the auger brought the cuttings to land surface. These samples were placed into plastic containers and sealed.

Laboratory Analysis of Sediment Samples

Lithologic and chemical analyses made on the sediment samples from the Dodge Ranch study area included determinations of grain-size, porosity, hydraulic conductivity, total arsenic content, total selenium content, arsenic content of specific grain-size fractions, and arsenic content of specific grain types. Tables 6 through 10 list the results of these analyses.

Grain-size analysis was made on the unconsolidated sediment by standard dry and wet sieving methods (Folk, 1955, p. 33-40). The silt- and clay-sized fractions were analyzed by the pipette method of Folk (1955, p. 37-40).

Statistical data for the sieve analysis of sediments from the Dodge Ranch study area were calculated using methods outlined by Folk (1955, p. 42-53) and Pettijohn (1975, p. 39), and are presented in table 9. The grain-size distribution in sediment samples is shown in figures 6-29. To convert the grain sizes from the phi-size scale used in figures 6-29 to the millimeter scale, use the following table:

Phi size	Millimeters	Phi size	Millimeters
-2	4.00	5	0.0312
-1	2.00	6	.0156
0	1.00	7	.0078
1	.50	8	.0039
2	.25	9	.0020
3	.125	10	.00098
4	.0625		

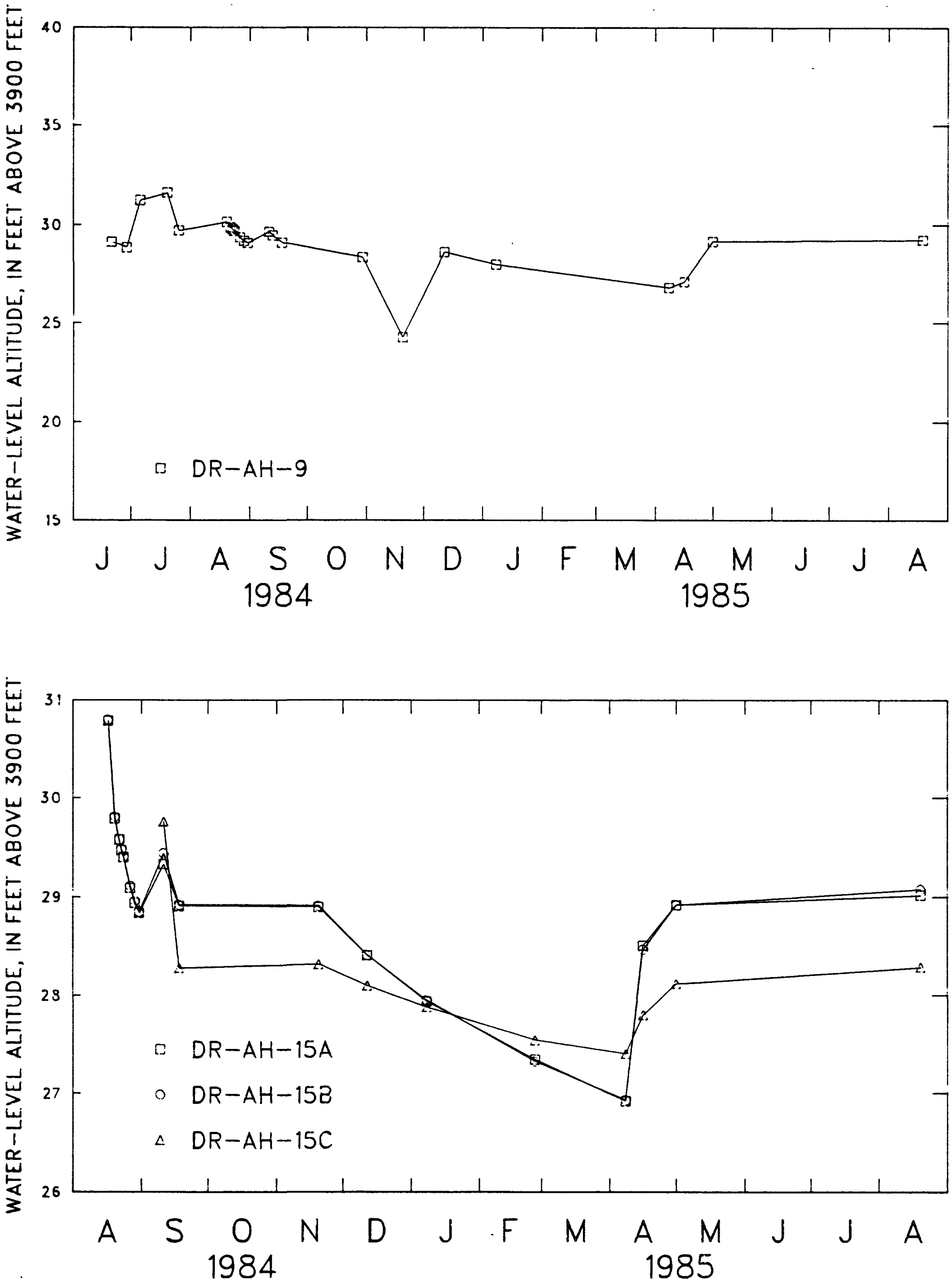
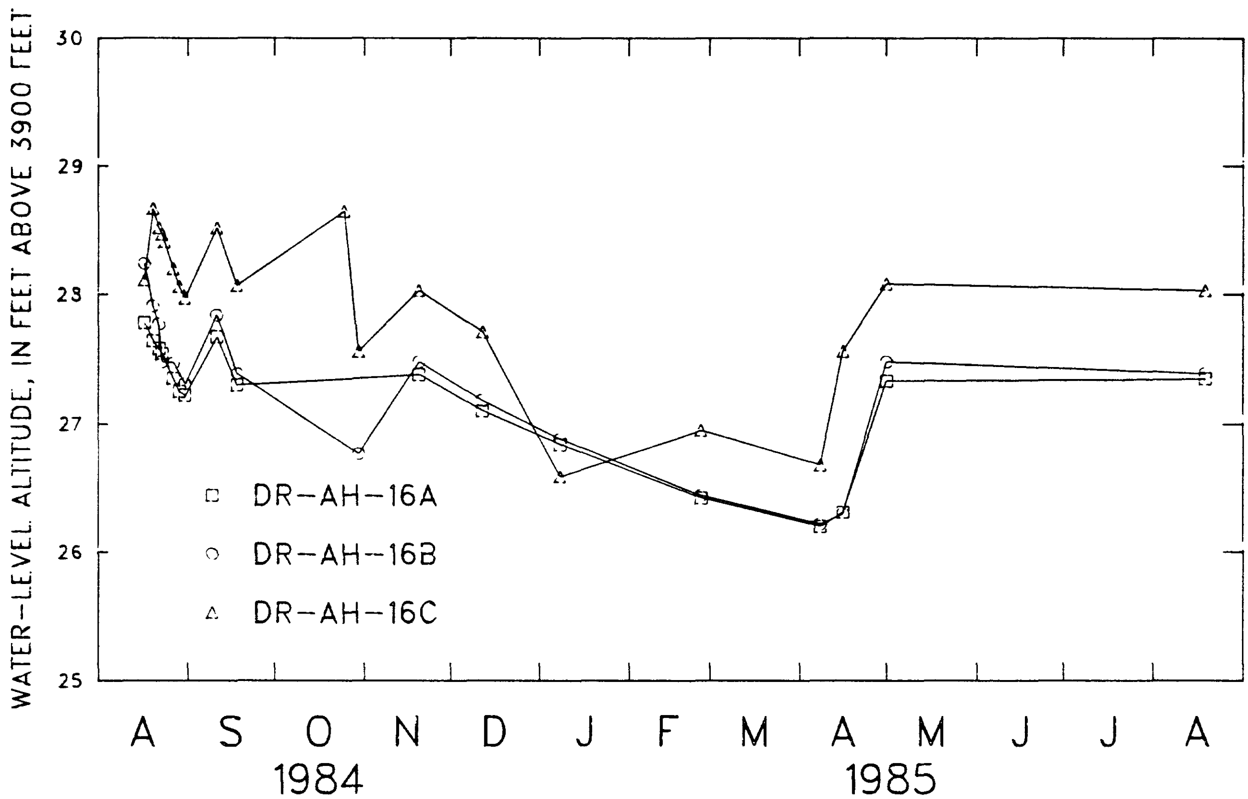


FIGURE 4.--Changes in water-level altitudes with time in selected wells at Dodge Ranch study area.



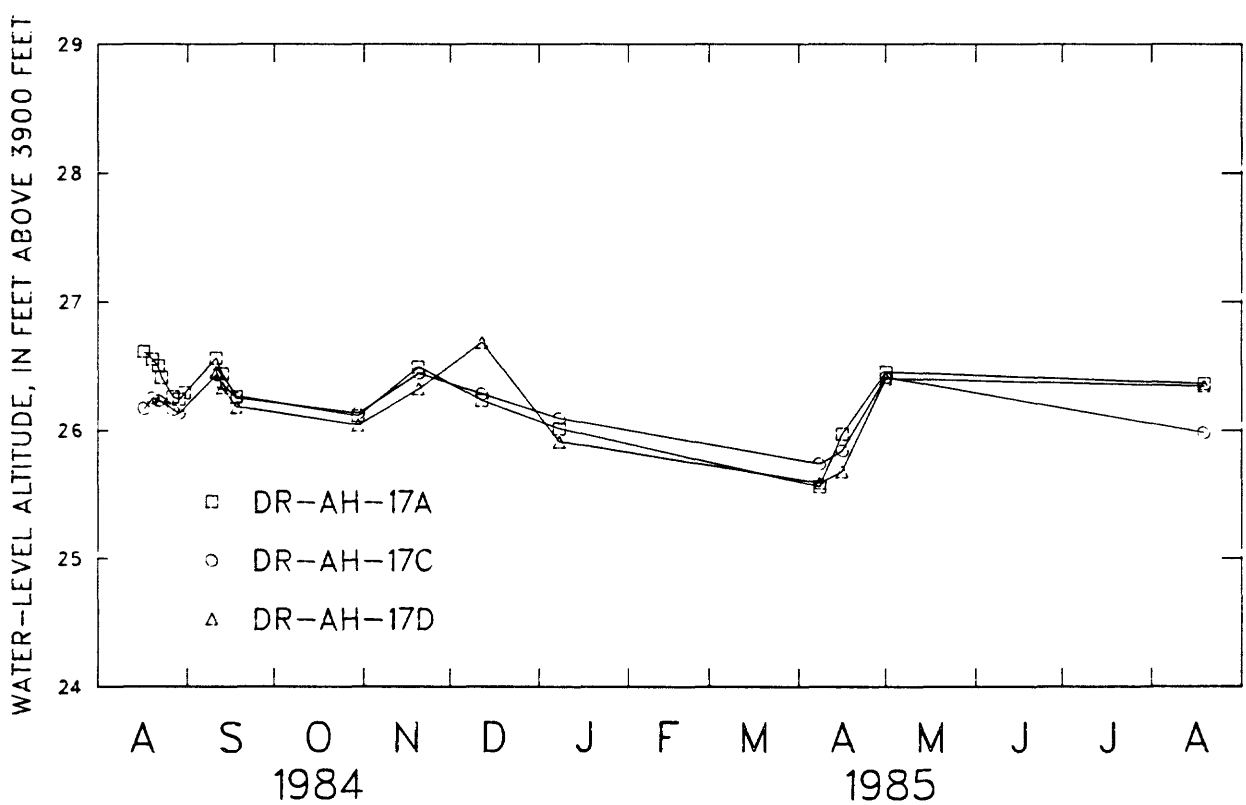


FIGURE 4.--continued.

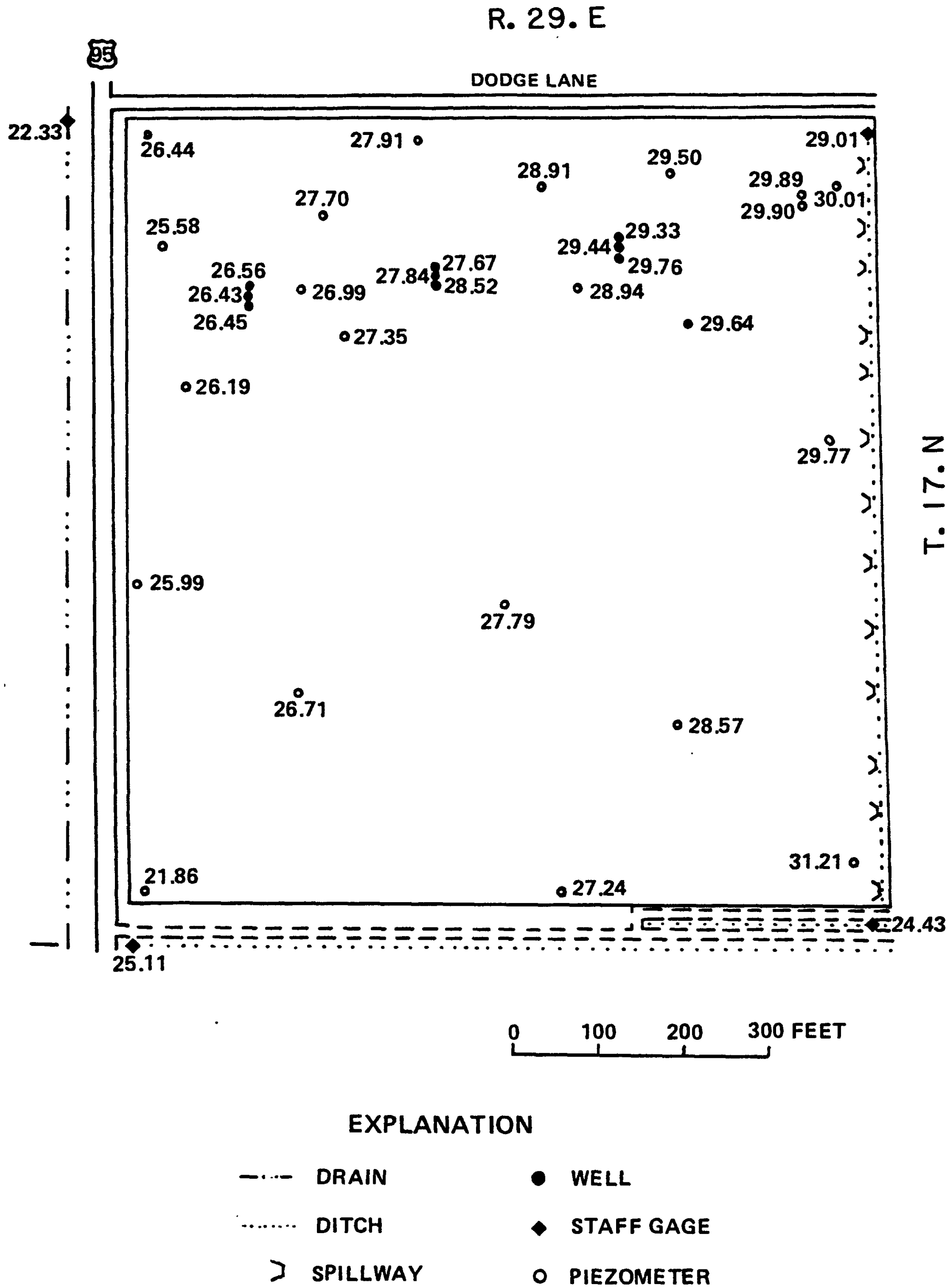


FIGURE 5.--Water-level altitudes for September 11, 1985, in wells at Dodge Ranch study area. Values listed are in feet above 3,900 feet.

Samples for arsenic and selenium analysis were prepared by grinding the sediment to a fine powder and dissolving it in a mixture of hydrofluoric, hydrochloric, and perchloric acids to which nitric acid was added to maintain oxidizing conditions. Arsenic and selenium were then determined by hydride-generation atomic-absorption analysis (Skougstad and others, 1979, p. 61-63).

Porosity was determined using the resaturation method described by Amyx and others (1960, p. 39-57).

Hydraulic conductivity was determined using standard steady-state techniques incorporating the Darcy Law of homogeneous flow (Amyx and others, 1960, p. 71-83). Deionized water was used as the permeating fluid at ambient temperature. These data are listed in table 10.

The sediment from a few wells at the Dodge Ranch study area was analyzed for mineral content by x-ray diffraction analysis using a Picker[1] diffractometer. Sediment samples were split into two size fractions (greater than 2 micrometers and less than 2 micrometers) by centrifugation. The two fractions were analyzed by the authors using standard x-ray diffraction techniques (Carroll, 1970, p. 51-61; Nuffield, 1966, p. 130-137). Results of the x-ray diffraction analyses are listed in tables 11 and 12.

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[1] The use of a trade name in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

(p. 15 follows)

HYDROGEOLOGIC DATA

TABLE 3.--*Water-level altitudes in wells at Dodge Ranch study area*

[Values are expressed in feet above 3,900 feet; "--" indicates no data available]

Well	June 21, 1984	June 29, 1984	July 6, 1984	July 20, 1984	July 26, 1984	Aug. 17, 1984	Aug. 20, 1984	Aug. 22, 1984	Aug. 23, 1984	Aug. 24, 1984	Aug. 27, 1984	Aug. 29, 1984	Aug. 31, 1984
DR-AH-1	29.32	28.80	30.62	31.15	30.37	31.81	30.49	30.21	30.11	30.02	29.68	29.49	29.49
DR-AH-2	23.99	24.83	31.91	32.09	23.81	--	31.95	31.89	31.82	31.77	31.56	31.43	31.32
DR-AH-3	23.72	23.78	24.29	26.28	20.16	--	22.92	22.95	22.97	21.24	21.34	21.38	21.48
DR-AH-4	26.29	26.00	26.87	26.93	26.51	26.78	26.49	26.42	26.38	26.35	26.12	26.10	26.12
DR-AH-5	29.13	28.60	30.65	30.95	29.79	--	30.35	30.04	29.93	29.84	29.49	29.28	29.31
DR-AH-6	27.29	27.09	27.42	28.02	27.37	27.48	27.17	27.11	27.06	27.02	26.84	26.82	26.70
DR-AH-7	25.91	26.02	26.71	28.94	20.94	--	26.34	26.16	26.10	26.07	25.95	25.79	25.88
DR-AH-8	27.45	26.93	28.16	28.90	28.06	28.63	28.05	27.90	27.84	27.81	27.53	27.36	27.32
DR-AH-9	29.12	28.84	31.22	31.60	29.70	--	30.13	29.85	29.77	29.68	29.35	29.17	29.06
DR-AH-10	26.42	25.95	26.70	28.65	26.86	28.63	26.77	26.63	26.58	26.56	26.31	26.23	26.18
DR-AH-11	26.82	26.52	27.15	27.54	27.03	27.26	26.97	26.87	--	26.81	26.67	26.63	26.62
DR-AH-12	28.32	27.87	29.19	30.09	28.69	30.16	28.69	28.64	28.59	28.54	28.66	28.10	28.04
DR-AH-13	27.29	27.02	28.20	29.56	28.05	28.84	27.83	27.65	27.60	27.55	27.38	27.25	27.17
DR-AH-14A	--	--	--	--	--	31.54	30.31	30.11	29.97	29.89	29.56	29.38	29.34
DR-AH-14B	--	--	--	--	--	31.56	30.32	30.12	29.99	29.91	29.58	29.39	29.35
DR-AH-15A	--	--	--	--	--	30.79	29.79	29.58	29.47	29.40	29.09	28.94	28.84
DR-AH-15B	--	--	--	--	--	30.80	29.81	29.58	29.48	29.41	29.11	28.96	28.85
DR-AH-15C	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-16A	--	--	--	--	--	27.78	27.64	27.58	27.54	--	27.35	27.25	27.22
DR-AH-16B	--	--	--	--	--	28.24	27.91	27.77	27.48	--	27.47	--	27.31
DR-AH-16C	--	--	--	--	--	28.11	28.67	28.52	28.47	28.41	28.20	28.06	27.97
DR-AH-17A	--	--	--	--	--	26.61	26.55	26.50	26.41	--	26.26	26.24	26.29
DR-AH-17B	--	--	--	--	--	23.83	25.20	25.60	--	--	20.56	--	--
DR-AH-17C	--	--	--	--	--	26.17	26.25	26.23	26.22	--	26.16	26.13	--
DR-AH-17D	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-18	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-19	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-20	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-21	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-22	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-23	--	--	--	--	--	--	--	--	--	--	--	--	--
DR-AH-24	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 3.—*Water-level altitudes in wells at Dodge Ranch study area*—Continued

Well	Measurement date												
	Sept. 11, 1984	Sept. 13, 1984	Sept. 18, 1984	Oct. 25, 1984	Oct. 30, 1984	Nov. 20, 1984	Dec. 12, 1984	Jan. 8, 1985	Feb. 27, 1985	Apr. 8, 1985	Apr. 17, 1985	May 1, 1985	Aug. 19, 1985
DR-AH-1	30.01	29.82	29.39	—	28.61	29.46	28.82	28.21	27.43	26.99	—	29.32	—
DR-AH-2	31.21	31.12	30.87	—	—	—	31.04	30.21	—	28.39	—	—	—
DR-AH-3	21.86	21.92	22.08	—	—	—	23.08	23.40	—	24.15	—	—	—
DR-AH-4	26.44	26.31	26.03	—	26.01	26.30	26.15	26.13	25.93	25.71	—	26.41	—
DR-AH-5	29.77	29.55	29.13	—	28.22	29.43	28.62	27.83	26.92	26.51	—	—	—
DR-AH-6	27.24	27.06	26.77	—	—	—	26.99	26.41	—	26.22	—	—	—
DR-AH-7	25.99	26.01	25.94	—	—	—	26.31	25.66	—	25.26	—	—	—
DR-AH-8	27.91	27.74	27.37	—	27.08	27.51	27.24	27.02	26.69	26.46	—	27.61	—
DR-AH-9	29.64	29.45	29.08	—	28.35	24.26	28.62	27.98	—	26.80	27.10	29.15	29.24
DR-AH-10	26.71	26.58	26.27	—	—	—	26.63	26.24	—	25.62	—	—	—
DR-AH-11	26.99	26.85	26.63	—	26.41	26.81	26.55	26.33	26.02	25.88	—	26.81	—
DR-AH-12	28.57	28.42	28.06	—	—	—	28.05	27.39	—	26.24	—	—	—
DR-AH-13	27.79	27.65	27.33	—	—	—	27.56	27.01	—	26.10	—	—	—
DR-AH-14A	29.89	29.71	29.31	—	29.55	29.35	28.74	28.17	27.41	26.98	—	29.26	—
DR-AH-14B	29.90	29.72	29.33	—	28.55	29.37	28.75	28.19	27.42	26.99	—	28.26	—
DR-AH-15A	29.33	—	28.91	—	—	28.90	28.41	27.94	27.34	26.92	28.51	28.92	29.02
DR-AH-15B	29.44	—	28.92	—	—	28.91	28.41	27.95	27.32	26.93	28.47	28.92	29.08
DR-AH-15C	29.76	—	28.28	—	—	28.32	28.10	27.88	27.54	27.40	27.80	28.12	28.29
DR-AH-16A	27.67	—	27.30	—	—	27.38	27.10	26.84	26.42	26.20	26.31	27.33	27.35
DR-AH-16B	27.84	—	27.39	—	26.77	27.48	27.18	26.88	26.44	26.22	26.30	27.48	27.39
DR-AH-16C	28.52	—	28.07	28.65	27.56	28.03	27.71	26.59	26.95	26.68	27.56	28.08	28.03
DR-AH-17A	26.56	26.44	26.26	—	26.11	26.49	26.23	26.01	—	25.56	25.97	26.45	26.36
DR-AH-17B	—	24.91	26.22	26.41	26.12	26.47	26.22	25.97	—	25.61	25.71	26.45	—
DR-AH-17C	26.43	26.36	26.25	—	26.13	26.44	26.28	26.09	—	25.74	25.84	26.41	25.98
DR-AH-17D	26.45	26.33	26.18	—	26.04	26.32	26.68	25.91	—	25.59	25.68	26.40	26.34
DR-AH-18	29.50	—	29.13	—	28.40	29.04	28.54	28.08	28.40	27.01	—	29.07	—
DR-AH-19	28.94	—	28.49	—	27.88	28.50	28.05	27.69	27.10	26.75	—	28.48	—
DR-AH-20	28.91	28.40	—	—	27.80	28.42	27.97	27.59	27.03	26.72	—	28.46	—
DR-AH-21	27.70	27.54	27.18	—	26.93	27.43	27.16	26.93	26.61	26.34	—	27.51	—
DR-AH-22	27.35	27.23	27.03	—	26.89	27.55	27.16	26.83	26.41	26.16	—	27.16	—
DR-AH-23	25.58	25.52	25.42	—	25.44	25.60	25.44	25.76	25.09	25.14	—	25.67	—
DR-AH-24	26.19	26.10	25.94	—	25.86	26.36	25.97	25.72	25.41	25.30	—	26.20	—

TABLE 4.—*Water-level altitudes in wells at Harmon Lake study area*

[Values are expressed in feet above 3,900 feet; "--" indicates no data available]

Well	Measurement date							
	July 17, 1984	Aug. 9, 1984	Aug. 15, 1984	Aug. 16, 1984	Aug. 20, 1984	Aug. 21, 1984	Aug. 24, 1984	Aug. 30, 1984
HL-AH-2	6.90	6.45	7.49	7.61	7.86	7.90	--	--
HL-AH-2A	--	--	8.46	8.45	8.44	8.45	--	--
HL-AH-3	7.42	--	7.25	7.24	7.22	7.21	7.23	7.23
HL-AH-4	7.34	--	6.91	6.90	6.83	6.83	6.90	6.84
HL-AH-5	--	--	8.66	8.62	8.60	8.60	8.60	8.59
HL-AH-5A	--	--	10.06	9.95	9.80	9.78	8.60	8.58
HL-AH-6A	--	--	6.61	6.60	6.60	6.59	6.61	6.61
HL-AH-6B	--	--	6.03	6.64	6.65	6.61	6.64	6.65
HL-AH-7	--	--	7.61	7.60	7.58	7.58	7.57	7.55

Well	Feb. 25, 1985	Feb. 26, 1985	Feb. 27, 1985	Apr. 10, 1985	May 1, 1985	June 25, 1985	Oct. 28, 1985
HL-AH-2	8.46	8.47	--	8.60	8.58	8.21	9.82
HL-AH-2A	8.27	7.48	--	6.46	6.89	7.14	7.40
HL-AH-3	7.61	7.55	7.57	7.70	7.75	6.92	7.14
HL-AH-4	--	--	7.86	7.35	7.38	6.10	6.91
HL-AH-5	8.15	8.09	8.13	8.18	8.22	8.23	7.86
HL-AH-5A	9.09	9.08	9.04	8.16	8.20	8.18	7.88
HL-AH-6A	6.18	6.19	6.18	6.26	6.32	6.30	5.96
HL-AH-6B	6.20	6.24	6.18	6.29	6.36	6.28	5.97
HL-AH-7	7.14	7.16	7.14	7.23	7.26	9.53	6.92

TABLE 5.--*Lithologic logs of selected wells at the Dodge Ranch study area*[1]

Material	Thickness (feet)	Depth (feet)
WELL DR-AH-9:		
Sand, very-fine-grained, silty, dark yellowish brown (10YR4/2), well-sorted, sub-rounded, quartz-rich, 5 percent muscovite	4.0	4.0
Sand, very-fine-grained, silty, dark yellowish brown (10YR4/2), well-sorted, rounded, quartz-rich	2.5	6.5
Sand, very-fine-grained, silty, dark yellowish brown (10YR4/2), well-sorted, rounded, quartz-rich, 1 percent muscovite	6.5	13.0
WELL DR-AH-14A:		
Sand, very-fine- to medium-grained, dark yellowish brown (10YR4/2), quartz-rich, clay pods up to 0.5 inch	5.0	5.0
Sand, very-fine- to fine-grained, dark yellowish brown (10YR4/2), quartz-rich	5.0	10.0
Sand, fine-grained, dark yellowish brown (10YR4/2), moderately well-sorted, well-rounded, quartz-rich	3.0	13.0
Sand, fine-grained, dark yellowish brown (10YR4/2), moderately well-sorted, well-rounded, quartz-rich, 1 percent muscovite	4.0	17.0
Clay, dark yellowish brown (10YR4/2)	2.6	19.6
WELL DR-AH-15C:		
Sand, fine-grained, dark yellowish brown (10YR4/2), poorly sorted, quartz-rich	5.0	5.0
Sand, very-fine- to fine-grained, dark yellowish brown (10YR4/2), quartz-rich	5.0	10.0
Sand, fine-grained, dark yellowish brown (10YR4/2), well sorted, quartz-rich	5.0	15.0
Sand, fine- to medium-grained, dark yellowish brown (10YR4/2), quartz-rich	5.0	20.0

TABLE 5.—*Lithologic logs of selected wells at the Dodge Ranch study area*[1]—Continued

Material	Thickness (feet)	Depth (feet)
WELL DR-AH-15C (continued):		
Clay, sandy, dark yellowish brown (10YR4/2)	13.0	33.0
Clay, black (N1), stiff, minor sand lenses, sulfurous odor	28.5	61.5
WELL DR-AH-16A:		
Sand, fine- to very-coarse-grained, dark yellowish brown (10YR4/2), poorly sorted, sub-rounded, quartz-rich, minor clay pods	3.0	3.0
Sand, very-coarse-grained, dark yellowish brown (10YR4/2), poorly sorted, sub-angular, quartz-rich	6.0	9.0
Sand, fine- to coarse-grained, silty, dark yellowish brown (10YR4/2), quartz-rich	8.0	17.0
Clay, dark yellowish brown (10YR4/2), silty	2.0	19.0
Sand, fine- to coarse-grained, silty, dark yellowish brown (10YR4/2), quartz-rich	6.0	25.0
Clay, silty, dark yellowish brown (10YR4/2)	1.0	26.0
Sand, fine- to coarse-grained, silty, dark yellowish brown (10YR4/2), quartz-rich	1.0	27.0
Clay, light olive-gray (5Y5/2)	2.0	29.0
WELL DR-AH-17A:		
Sand, fine- to medium-grained, dark yellowish brown (10YR4/2), quartz-rich, minor clay pods	4.5	4.5
Clay, silty, dark yellowish brown (10YR4/2)	3.5	8.0
Sand, fine- to very-coarse-grained, dark yellowish brown (10YR4/2), sub-rounded, quartz-rich, some clay pods	7.0	15.0
Sand, fine-grained, dark yellowish brown (10YR4/2), well sorted, sub-rounded, quartz-rich, silty in places	10.0	25.0

TABLE 5.--*Lithologic logs of selected wells at the Dodge Ranch study area*[1]--Continued

Material	Thickness (feet)	Depth (feet)
WELL DR-AH-17A (continued):		
Sand, very-fine- to fine-grained, dark yellowish brown (10YR4/2), sub-rounded to rounded, quartz-rich --------	2.0	27.0
Clay, light olive-gray (5Y5/2) --------------------------	18.0	45.0

[1] Colors are for undried samples and are based on Rock-Color Chart (Munsell System) distributed by Geological Society of America.

TABLE 6.--*Total arsenic in sediment from wells at Dodge Ranch study area*

Well	Depth (feet)	Size fraction (millimeters)	Total arsenic (milligrams per kilogram as As)[1]	Sediment description
DR-AH-1	7.0	Whole rock	4	--
DR-AH-2	4.0	Whole rock	10	--
DR-AH-2	7.0	Whole rock	6	--
DR-AH-3	9.0	Whole rock	7	--
DR-AH-4	7.0	Whole rock	6	--
DR-AH-4	10.0	Whole rock	10	--
DR-AH-5	4.0	Whole rock	4	--
DR-AH-7	3.0	Whole rock	17	--
DR-AH-8	4.0	Whole rock	6	--
DR-AH-9	13.0	Whole rock	8	--
DR-AH-10	7.5	Whole rock	6	--
DR-AH-12	10.0	Whole rock	8	--
DR-AH-14A	3.5-4.0	< 0.0625	13	--
DR-AH-14A	9.0-9.5	< 0.0625	11	--
DR-AH-15A	8.5-10	0.25-0.125	6.0	--
DR-AH-15A	8.5-10	0.125-0.0625	7.0	--
DR-AH-15A	8.5-10	< 0.0625	11	--
DR-AH-15A	19.5-20	2.00-1.00	14	--
DR-AH-15A	19.5-20	1.00-0.50	4.0	--
DR-AH-15A	19.5-20	0.50-0.25	5.0	--
DR-AH-15A	19.5-20	0.25-0.125	3.8	--
DR-AH-15A	19.5-20	0.125-0.0625	10	--
DR-AH-15A	19.5-20	< 0.0625	14	--
DR-AH-15C	4-5	2.00-1.00	12	--
DR-AH-15C	4-5	1.00-0.50	7.0	--
DR-AH-15C	4-5	0.50-0.25	5.0	--
DR-AH-15C	4-5	0.25-0.125	6.0	--
DR-AH-15C	4-5	0.125-0.0625	6.4	--
DR-AH-15C	4-5	< 0.0625	10	--
DR-AH-15C	4-5	Whole rock	4.4	Fine silty sand
DR-AH-15C	21	Whole rock	16	Brown clay
DR-AH-15C	25.5-26.5	Whole rock	16	Sandy brown clay
DR-AH-15C	50-50.5	0.25-0.125	8.4	--
DR-AH-15C	50-50.5	0.125-0.0625	8.0	--
DR-AH-15C	50-50.5	< 0.0625	7.0	--

TABLE 6.—*Total arsenic in sediment from wells at Dodge Ranch study area*—Continued

Well	Depth (feet)	Size fraction (millimeters)	Total arsenic (milligrams per kilogram as As)[1]	Sediment description
DR-AH-15C	50-50.5	Whole rock	6.4	Black clay
DR-AH-15C	60-60.5	Whole rock	25	Black clay
DR-AH-16A	4.5-5.0	< 0.0625	9.1	--
DR-AH-16A	9.5-10	2.00-1.00	14	--
DR-AH-16A	9.5-10	1.00-0.50	4.4	--
DR-AH-16A	9.5-10	0.50-0.25	4.0	--
DR-AH-16A	9.5-10	0.25-0.125	8.0	--
DR-AH-16A	9.5-10	0.125-0.0625	12	--
DR-AH-16A	9.5-10	< 0.0625	17	--
DR-AH-16A	19.5-20	1.00-0.71	30	Red-stained lithic fragments
DR-AH-16A	19.5-20	1.00-0.71	5.1	Feldspar
DR-AH-16A	19.5-20	1.00-0.71	17	Stained feldspar
DR-AH-16A	19.5-20	1.00-0.71	31	Dark lithic fragments
DR-AH-16A	19.5-20	1.00-0.71	32	Light lithic fragments
DR-AH-16A	19.5-20	1.00-0.71	2.2	Clear quartz
DR-AH-16A	19.5-20	2.00-1.00	0.7	Feldspar
DR-AH-16A	19.5-20	2.00-1.00	36	Dark lithic fragments
DR-AH-16A	19.5-20	2.00-1.00	28	Light lithic fragments
DR-AH-16A	19.5-20	2.00-1.00	0.4	Clear quartz
DR-AH-16A	19.5-20	2.00-1.00	9.0	--
DR-AH-16A	19.5-20	1.00-0.50	3.6	--
DR-AH-16A	19.5-20	0.50-0.25	4.6	--
DR-AH-16A	19.5-20	0.25-0.125	5.6	--
DR-AH-16A	19.5-20	0.125-0.0625	10	--
DR-AH-16A	19.5-20	< 0.0625	19	--
DR-AH-16A	29.5-30	2.00-1.00	13	--
DR-AH-16A	29.5-30	1.00-0.50	6.4	--
DR-AH-16A	29.5-30	0.50-0.25	4.0	--
DR-AH-16A	29.5-30	0.25-0.125	5.0	--
DR-AH-16A	29.5-30	0.125-0.0625	12	--
DR-AH-16A	29.5-30	< 0.0625	14	--
DR-AH-17A	9-10	0.25-0.125	18	--
DR-AH-17A	9-10	0.125-0.0625	19	--
DR-AH-17A	9-10	< 0.0625	15	--
DR-AH-17A	9-10	Whole rock	18	Fine clayey sand

TABLE 6.--*Total arsenic in sediment from wells at Dodge Ranch study area*--Continued

Well	Depth (feet)	Size fraction (millimeters)	Total arsenic (milligrams per kilogram as As)[1]	Sediment description
DR-AH-17A	19.5-20	1.00-0.50	16	--
DR-AH-17A	19.5-20	0.50-0.25	18	--
DR-AH-17A	19.5-20	0.25-0.125	9.0	--
DR-AH-17A	19.5-20	0.125-0.0625	11	--
DR-AH-17A	19.5-20	< 0.0625	20	--
DR-AH-17A	28-29	0.25-0.125	14	--
DR-AH-17A	28-29	0.125-0.0625	12	--
DR-AH-17A	28-29	< 0.0625	13	--
DR-AH-17A	28-29	Whole rock	16	Silty sand
DR-AH-17A	45.5-46.5	Whole rock	7.5	Light olive-gray clay

[1] Analysts: wells DR-AH-1 through 12, U.S. Geological Survey Central Laboratory, Arvada, Colo.; all other wells, Terra-Tek Core Services, Salt Lake City, Utah.

TABLE 7.--*Total selenium in sediment from wells at Dodge Ranch study area*[1]

Well	Depth (feet)	Size fraction (millimeters)	Selenium (milligrams per kilogram)
DR-AH-14A	3.5-4.0	< 0.0625	0.03
DR-AH-14A	9.0-9.5	< 0.0625	.06
DR-AH-15A	9.5-10.0	< 0.0625	.04
DR-AH-15A	19.5-20.0	< 0.0625	.03
DR-AH-15C	25.5-26.5	Whole rock	.07
DR-AH-15C	60.0-60.5	Whole rock	.02
DR-AH-16A	4.5-5.0	< 0.0625	.30
DR-AH-16A	9.5-10.0	< 0.0625	< .02
DR-AH-16A	19.5-20.0	< 0.0625	< .03
DR-AH-16A	29.5-30.0	< 0.0625	.13
DR-AH-17A	19.5-20.0	< 0.0625	.10
DR-AH-17A	28.0-29.0	Whole rock	.06
DR-AH-17A	45.5-46.5	Whole rock	.08

[1] Analyst: Terra-Tek Core Services, Salt Lake City, Utah.

TABLE 8.--*Grain-size distribution of sediment from wells at Dodge Ranch study area*

Well	Depth (feet)	Percent, by weight, in each millimeter size interval											
		>2.00	2.00-1.00	1.00-0.50	0.50-0.25	0.25-0.125	0.125-0.0625	<0.0625	0.0625-0.031	0.031-0.0156	0.0156-0.0078	0.0078-0.0039	0.0039-0.001
DR-AH-9	3.5	0.05	0.11	0.49	2.95	24.12	16.02	55.35	24.44	13.50	8.27	5.50	3.64
DR-AH-9	6.0	.12	.15	.35	4.01	43.59	25.52	26.25	9.31	6.19	3.69	2.78	4.28
DR-AH-9	12.5	.08	.12	.42	2.88	23.28	29.66	43.57	17.87	7.15	7.20	1.83	9.52
DR-AH-14A	3.5	.22	1.39	7.51	18.50	35.99	24.47	11.92	—	—	—	—	—
DR-AH-14A	9.0	.00	.00	.03	.41	25.72	54.30	19.55	—	—	—	—	—
DR-AH-14A	13.0	.00	.18	.28	4.48	44.54	24.93	25.54	12.06	3.48	2.89	2.47	4.64
DR-AH-14A	17.0	.00	.22	.91	6.13	40.81	25.34	26.59	12.62	3.85	3.36	2.70	4.06
DR-AH-15A	4.0	.17	.41	1.94	9.50	25.99	9.47	52.51	14.97	13.04	8.84	6.94	8.72
DR-AH-15C	4.5	.00	.76	8.03	20.20	36.14	22.25	12.61	—	—	—	—	—
DR-AH-15A	7.0	.63	.78	2.02	8.84	23.68	15.38	48.65	17.81	10.50	7.72	5.11	7.51
DR-AH-15A	9.5	.14	.05	.04	2.62	59.88	32.18	5.09	—	—	—	—	—
DR-AH-15A	14.0	.00	.07	.36	2.44	46.22	26.85	24.08	7.68	4.12	3.20	3.34	5.74
DR-AH-15A	19.5	4.08	10.16	21.78	39.61	17.20	5.04	2.61	—	—	—	—	—
DR-AH-16A	4.5	1.17	9.05	28.47	32.68	18.07	7.31	3.24	—	—	—	—	—
DR-AH-16A	9.5	4.01	9.44	24.81	35.67	19.05	4.97	2.00	—	—	—	—	—
DR-AH-16A	19.5	2.50	11.77	31.82	33.96	14.70	3.53	1.72	—	—	—	—	—
DR-AH-16A	26.5	.20	.23	.63	2.55	13.24	14.78	68.37	9.97	11.13	11.97	14.44	20.86
DR-AH-16A	29.5	1.84	6.61	24.86	36.29	18.13	7.50	4.78	—	—	—	—	—
DR-AH-17A	4.0	.64	1.63	4.36	7.27	12.52	10.63	62.96	4.15	8.84	15.96	16.77	17.24
DR-AH-17A	8.0	2.95	8.41	11.11	15.71	23.46	13.82	24.53	6.61	4.33	3.97	3.67	5.95
DR-AH-17A	14.5	.00	.00	.00	.00	0.00	3.67	96.33	1.79	7.88	17.67	30.93	38.06
DR-AH-17A	15.0	.16	.58	1.57	8.32	45.81	20.85	22.68	7.09	3.37	3.89	3.45	4.88
DR-AH-17A	19.5	.00	.04	.44	2.20	44.33	44.05	8.95	—	—	—	—	—
DR-AH-17A	24.0	.00	.43	1.76	6.43	41.22	20.43	29.72	11.32	5.75	4.35	3.52	4.78
DR-AH-17A	25.0	.00	.18	.87	3.86	31.03	32.96	31.08	11.60	6.85	3.22	4.32	5.09

TABLE 9.—*Statistics of grain-size distribution of sediment from wells at Dodge Ranch study area*

Statistical parameter[1]	DR-AH-14A 3.5-4 ft	DR-AH-14A 9-9.5 ft	DR-AH-15A 8.5-10 ft	DR-AH-15A 19.5-20 ft	DR-AH-16A 4.5-5 ft	DR-AH-16A 9.5-10 ft	DR-AH-16A 19.5-20 ft	DR-AH-16A 29.5-30 ft	DR-AH-17A 19.5-20 ft
	Well and depth								
Median: phi	2.65	3.30	2.87	1.40	1.38	1.35	1.15	1.45	3.08
mm	0.159	0.102	0.137	0.379	0.384	0.392	0.451	0.366	0.118
Mode: phi	2.75	2.75	2.75	1.75	0.75	1.75	0.75	1.25	2.75
mm	0.149	0.149	0.149	0.297	0.595	0.297	0.595	0.420	0.149
Standard deviation	1.103	0.666	0.476	1.199	1.184	1.209	1.098	1.214	0.566
Coefficient of sorting	0.617	0.769	0.846	0.615	0.594	0.574	0.609	0.601	0.824
Phi quartile deviation	0.700	0.375	0.245	0.700	0.750	0.800	0.715	0.735	0.280
Phi deviation measure	1.100	0.620	0.415	1.125	1.140	1.175	1.075	1.125	0.445
Inclusive skewness	-0.048	0.451	0.281	-0.104	0.095	-0.048	0.002	0.137	0.311
Coefficient of skewness	1.040	0.943	0.975	1.034	0.986	1.000	1.009	0.955	0.957
Phi quartile skewness	-0.050	0.075	0.035	-0.050	0.020	0.000	-0.015	0.130	0.070
Phi skewness measure	-2.568	-4.315	-6.205	-1.422	-0.996	-1.277	-1.023	-0.978	-6.169
Graphic Kurtosis	1.069	1.284	1.480	1.230	1.107	1.050	1.060	1.199	1.661
Kelley's quartile kurtosis	0.209	0.266	0.221	0.183	0.235	0.219	0.231	0.229	0.218
Phi quartile kurtosis	0.230	0.221	0.208	0.230	0.248	0.262	0.255	0.239	0.206
Phi kurtosis measure	0.659	0.895	1.133	0.867	0.776	0.745	0.721	0.911	1.551

[1] Statistical parameters are defined as follows (Folk, 1955, p. 42-53; Pettijohn, 1975, p. 39; variables used in equations below are: Pn = nth percentile; Qn = ntH quartile):

Median: Md = P50

Mode: Mo = midpoint of most abundant class

Standard deviation: Sigma (I) = ([P84(ϕ)-P16(ϕ)]/4)+([P95(ϕ)-P5(ϕ)]/6.6)

Coefficient of sorting: So = $\sqrt{(Q3/Q1)}$

Phi quartile deviation: Sigma (ϕ) = 0.5[Q3(ϕ)-Q1(ϕ)]

Phi deviation measure: Sigma (ϕ) = 0.5[P84(ϕ)-P16(ϕ)]

Inclusive skewness: Sk (I) = {[P16(ϕ)+P84(ϕ)-2P50(ϕ)]/2[P84(ϕ)-P16(ϕ)]}+{[P5(ϕ)+P95(ϕ)-2P50(ϕ)]/2[P95(ϕ)-P5(ϕ)]}

Coefficient of skewness: Sk = $\sqrt{[(Q1)(Q3)/Md]}$

Phi quartile skewness: Sk(ϕ) = 0.5[(Q1(ϕ)+Q3(ϕ))-2Md(ϕ)]

Phi Skewness meaaure: a(2ϕ) = [0.5(P5(ϕ)+P95(ϕ))-2Md(ϕ)]/Sigma(ϕ)

Graphic Kurtosis: Kg = [P95(ϕ)-P5(ϕ)]/2.44[P75(ϕ)-P25(ϕ)]

Kelley's quartile kurtosis: K = (Q3-Q1)/2(P90-P10)

Phi quartile kurtosis: K (ϕ) = [Q3(ϕ)-Q1(ϕ)]/2[P90(ϕ)-P10(ϕ)]

Phi kurtosis measure: Beta (ϕ) = [0.5(P95(ϕ)-P5(ϕ))-Sigma(ϕ)]/Sigma(ϕ)

TABLE 10.--*Porosity and hydraulic conductivity of sediment from wells at Dodge Ranch study area*[1]

Well	Depth (feet)	Porosity (percent)	Hydraulic conductivity (feet per day)
DR-AH-14A	3.5-4.0	44.8	1.02×10^{-3}
DR-AH-14A	9.0-9.5	41.3	2.50×10^{-5}
DR-AH-14A	19.5-20	53.0	3.62×10^{-3}
DR-AH-15A	4.0-4.5	22.6	1.29×10^{-4}
DR-AH-15A	9.5-10	22.4	6.16×10^{-4}
DR-AH-15A	19.5-20	32.6	7.33×10^{-3}
DR-AH-16A	4.5-5.0	30.3	1.80×10^{-2}
DR-AH-16A	9.5-10	23.7	1.77×10^{-3}
DR-AH-16A	19.5-20	30.6	1.49×10^{-2}
DR-AH-16A	29.5-30	29.8	4.78×10^{-3}
DR-AH-17A	19.5-20	26.3	2.74×10^{-6}

[1] Analyst: Terra-Tek Core Services, Salt Lake City, Utah

TABLE 11.--*Mineralogy of grain-size fraction greater than 2 micrometers in sediment from wells at Dodge Ranch study area*[1]

Well	Depth (feet)	Minerals present	Minerals possibly present
DR-AH-14A	4.0	Quartz, orthoclase, albite, anorthite	Muscovite, biotite, augite, hematite, dolomite
DR-AH-14A	9.5	Quartz, orthoclase, microcline, albite, anorthite, hornblende, hypersthene	Biotite, tremolite, enstatite
DR-AH-14A	20.0	Quartz, orthoclase, albite, microcline, hypersthene	Anorthite, muscovite, arsenopyrite, dolomite
DR-AH-15A	4.5	Quartz, orthoclase, albite, anorthite, muscovite, hypersthene, actinolite	Biotite, hornblende, augite, dolomite
DR-AH-15A	10.0	Quartz, orthoclase, albite, microcline, anorthite, muscovite	Hornblende, actinolite, enstatite, diopside, hypersthene, calcite, dolomite
DR-AH-15A	20.0	Quartz, albite, anorthite, muscovite, augite, hypersthene	Orthoclase, microcline, biotite, actinolite, arsenopyrite, dolomite
DR-AH-16A	5.0	Quartz, orthoclase, anorthite, muscovite, biotite, tremolite	Albite, augite
DR-AH-16A	10.0	Quartz, orthoclase, albite, anorthite, biotite	Microcline, muscovite, actinolite, diopside, hematite, dimorphite II
DR-AH-16A	20.0	Quartz	Orthoclase, microcline, albite, anorthite, hypersthene, gypsum
DR-AH-16A	30.0	Quartz, microcline, albite, anorthite, hematite, gypsum	Orthoclase, muscovite, biotite, augite, diopside
DR-AH-17A	20.0	Quartz, orthoclase, anorthite, muscovite	Microcline, albite, biotite, hypersthene, gypsum

[1] X-ray diffraction analysis.

TABLE 12.--*Mineralogy of clay fraction (grain size less than 2 micrometers) in sediment from wells at Dodge Ranch study area*[1]

Well	Depth (feet)	Minerals present[2]	Minerals possibly present
DR-AH-14A	4.0	Montmorillonite, illite, chlorite, I-M	--
DR-AH-14A	9.5	Montmorillonite, illite, chlorite	Halloysite
DR-AH-14A	20.0	Montmorillonite, illite, chlorite	--
DR-AH-15A	4.5	Chlorite	Montmorillonite, illite, dickite
DR-AH-15A	10.0	Montmorillonite, illite	Halloysite, dickite
DR-AH-15A	20.0	Montmorillonite, illite, chlorite	Dickite
DR-AH-16A	5.0	Montmorillonite, M-CH	Illite, attapulgite
DR-AH-16A	10.0	Montmorillonite, illite, I-M	Chlorite
DR-AH-16A	20.0	Montmorillonite, illite, chlorite	Dickite
DR-AH-16A	30.0	Montmorillonite, chlorite	Illite, attapulgite
DR-AH-17A	20.0	Montmorillonite, illite, chlorite, I-M	--

[1] X-ray diffraction analysis.

[2] Abbreviations: I-M, mixed-layer illite-montmorillonite; M-CH, mixed-layer montmorillonite-chlorite.

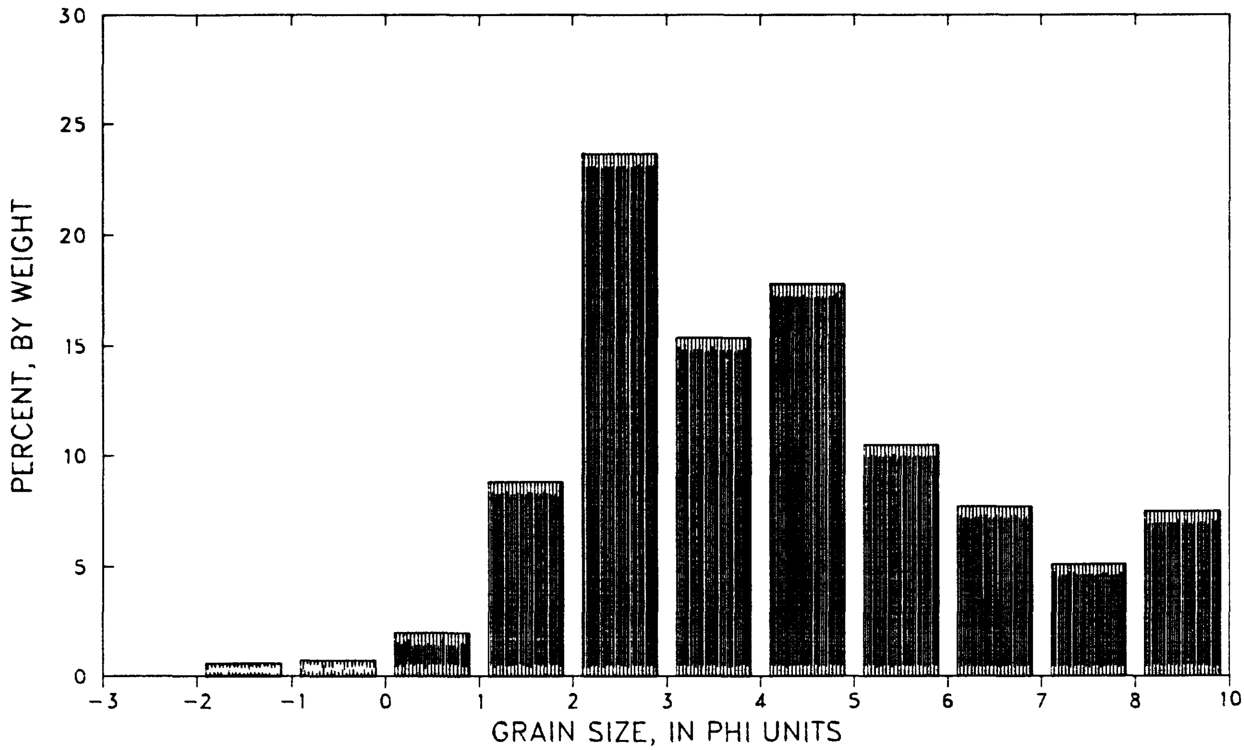

FIGURE 6.--Grain-size distribution of sediment from well DR–AH–9, depth 3.5 feet.

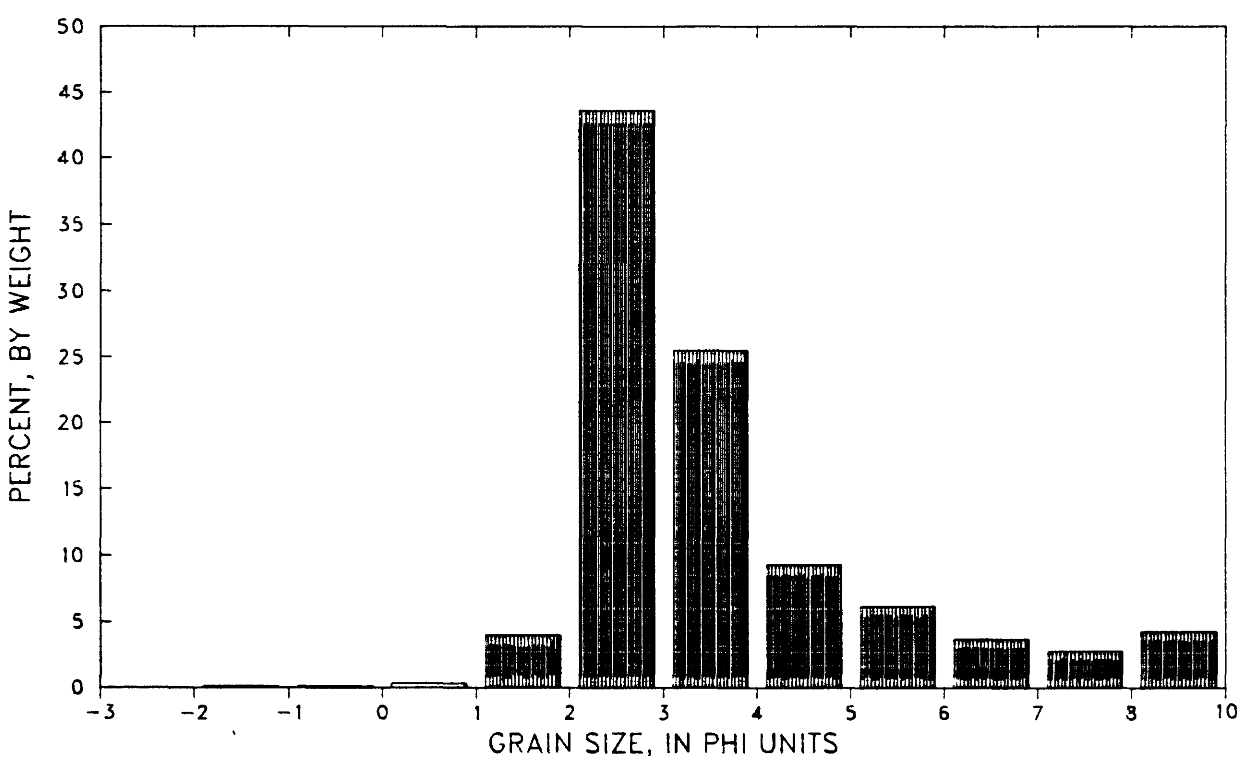

FIGURE 7.--Grain-size distribution of sediment from well DR–AH–9, depth 6.0 feet.

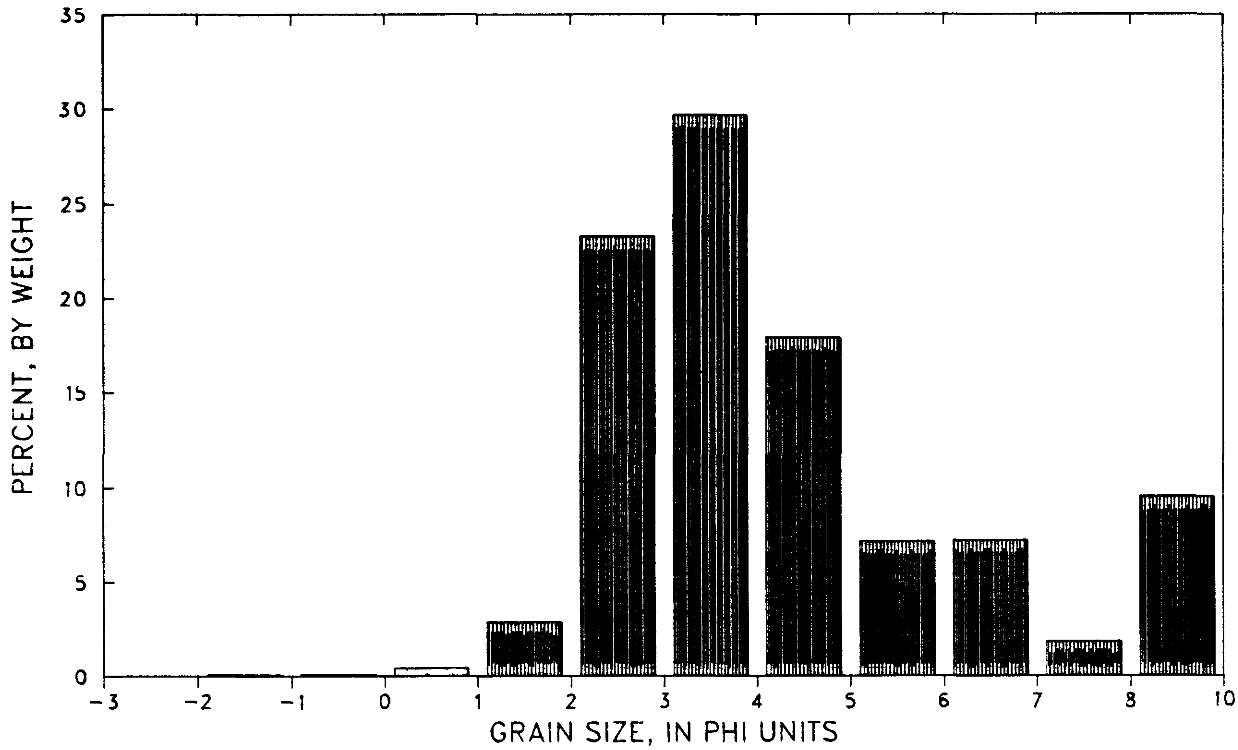

FIGURE 8.--Grain-size distribution of sediment from well DR–AH–9, depth 12.5 feet.

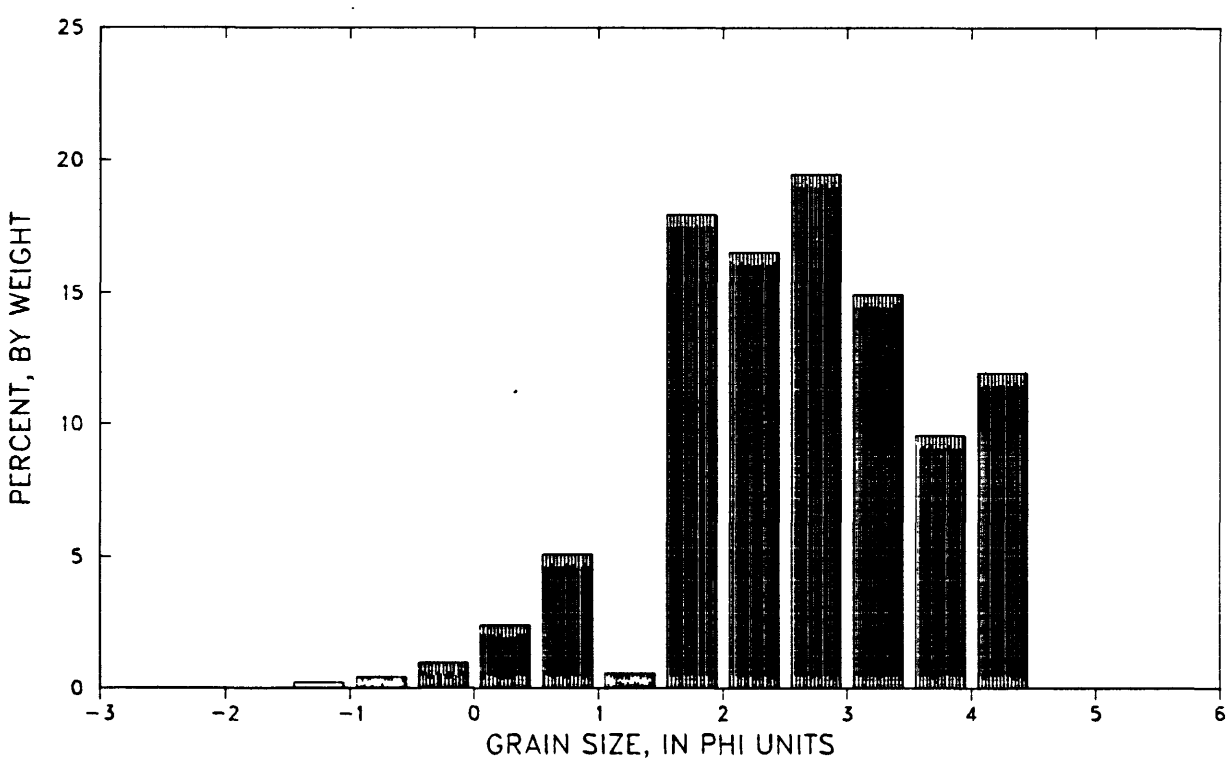

FIGURE 9.--Grain-size distribution of sediment from well DR–AH–14A, depth 3.5 feet.

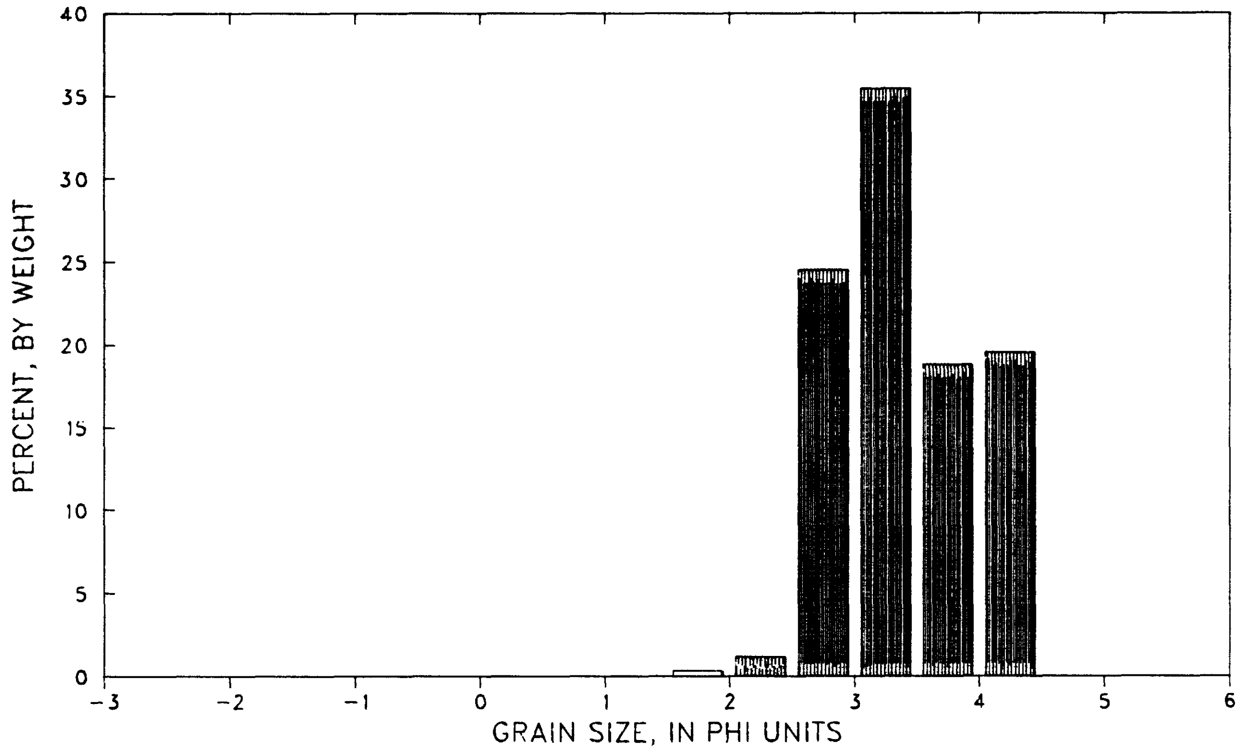

FIGURE 10.--Grain-size distribution of sediment from well DR—AH—14A, depth 9.0 feet.

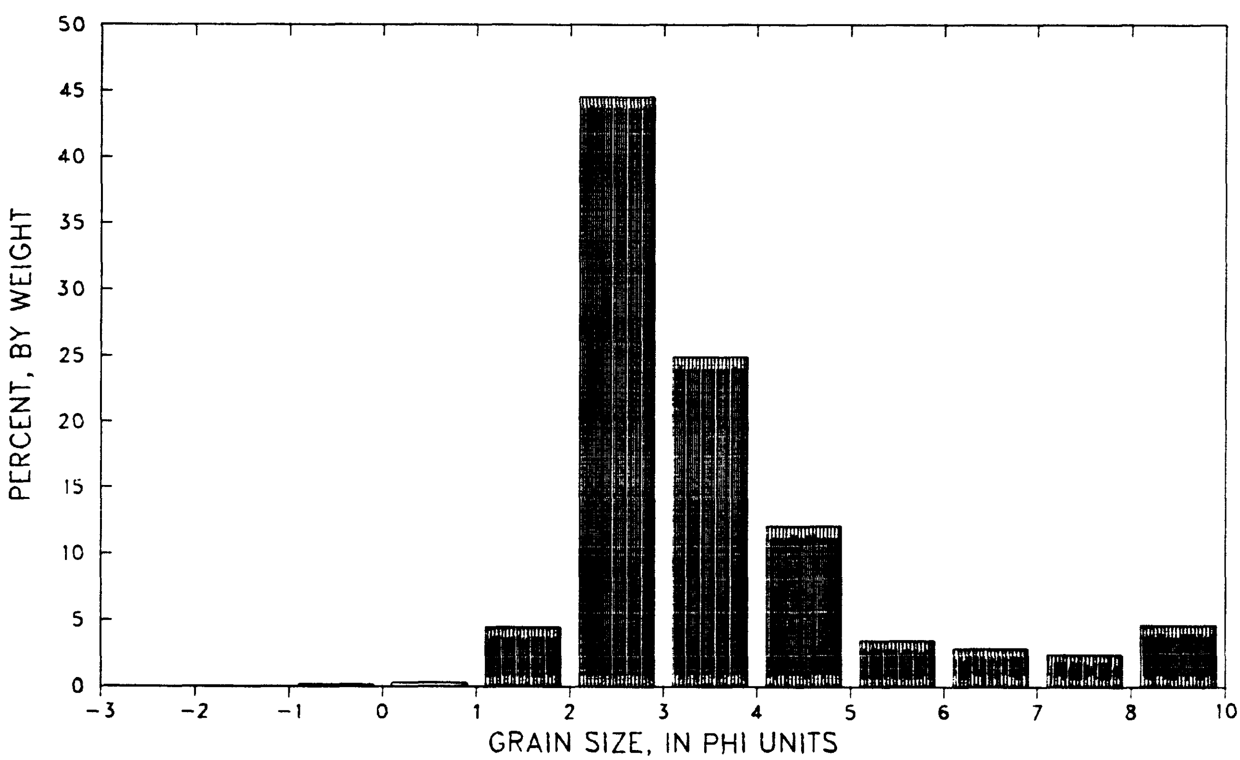

FIGURE 11.--Grain-size distribution of sediment from well DR—AH—14A, depth 13.0 feet.

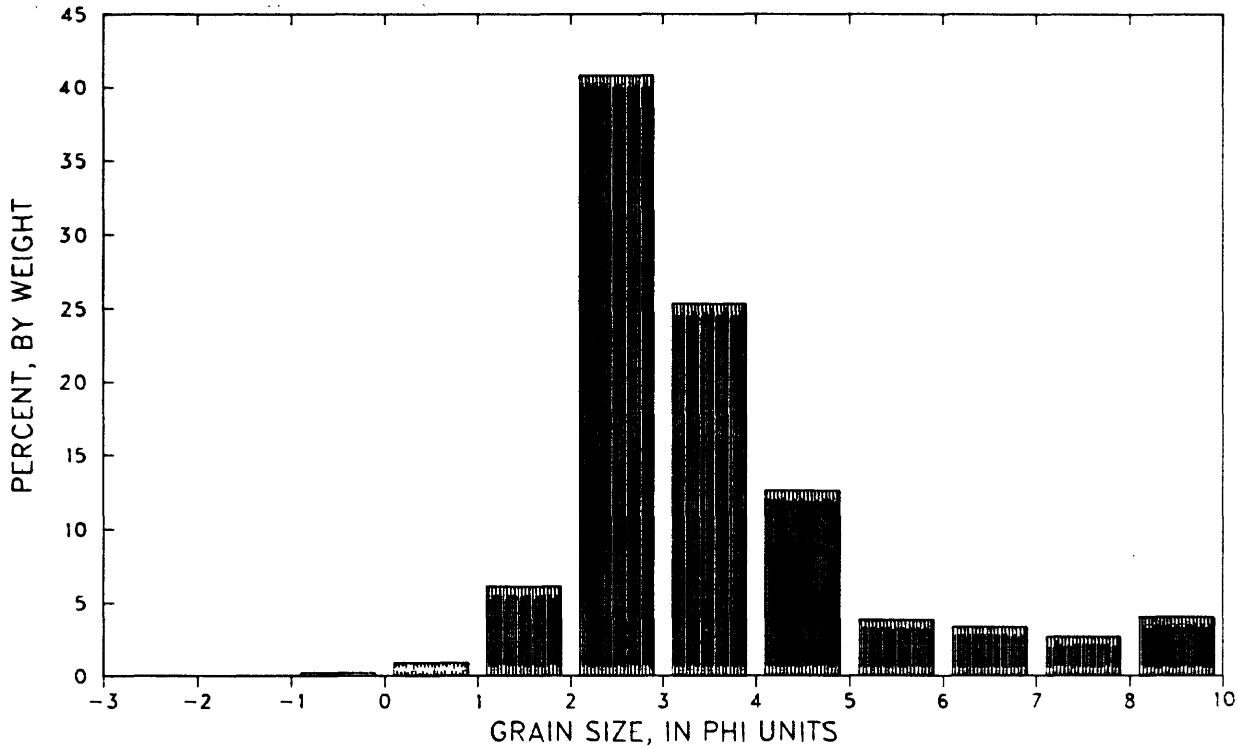

FIGURE 12.--Grain-size distribution of sediment from well DR—AH—14A, depth 17.0 feet.

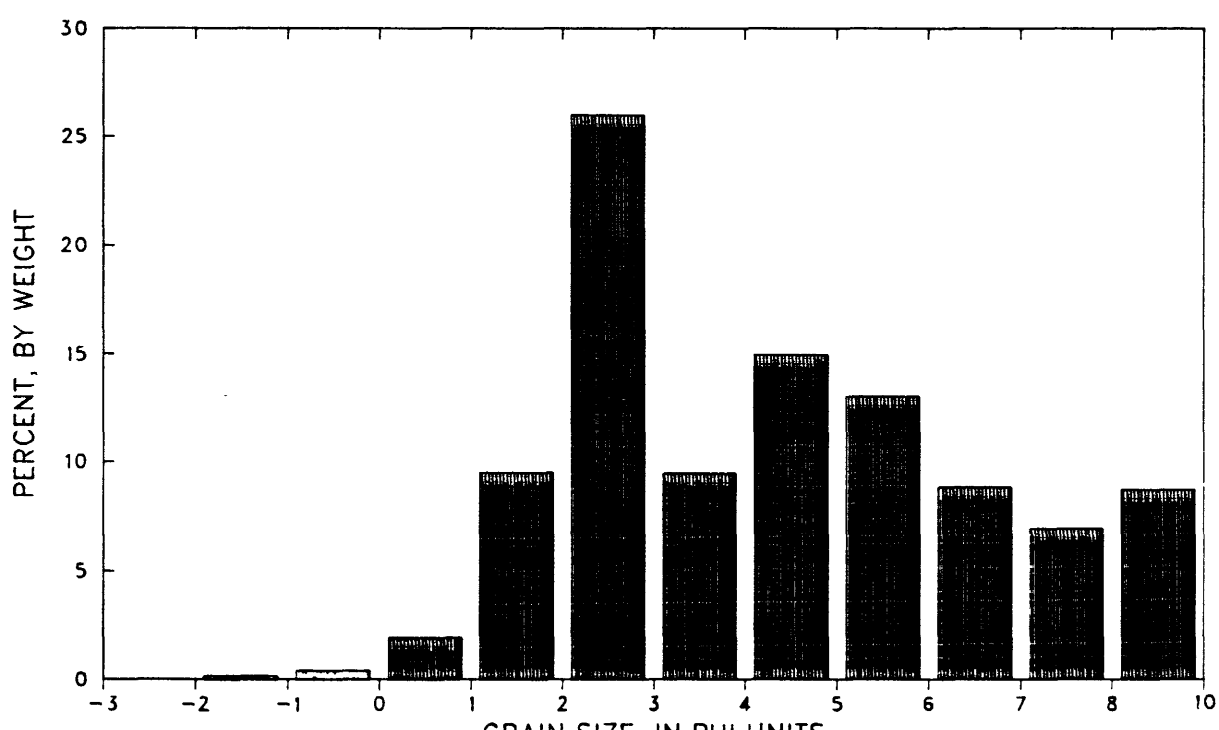

FIGURE 13.--Grain-size distribution of sediment from well DR—AH—15A, depth 4.0 feet.

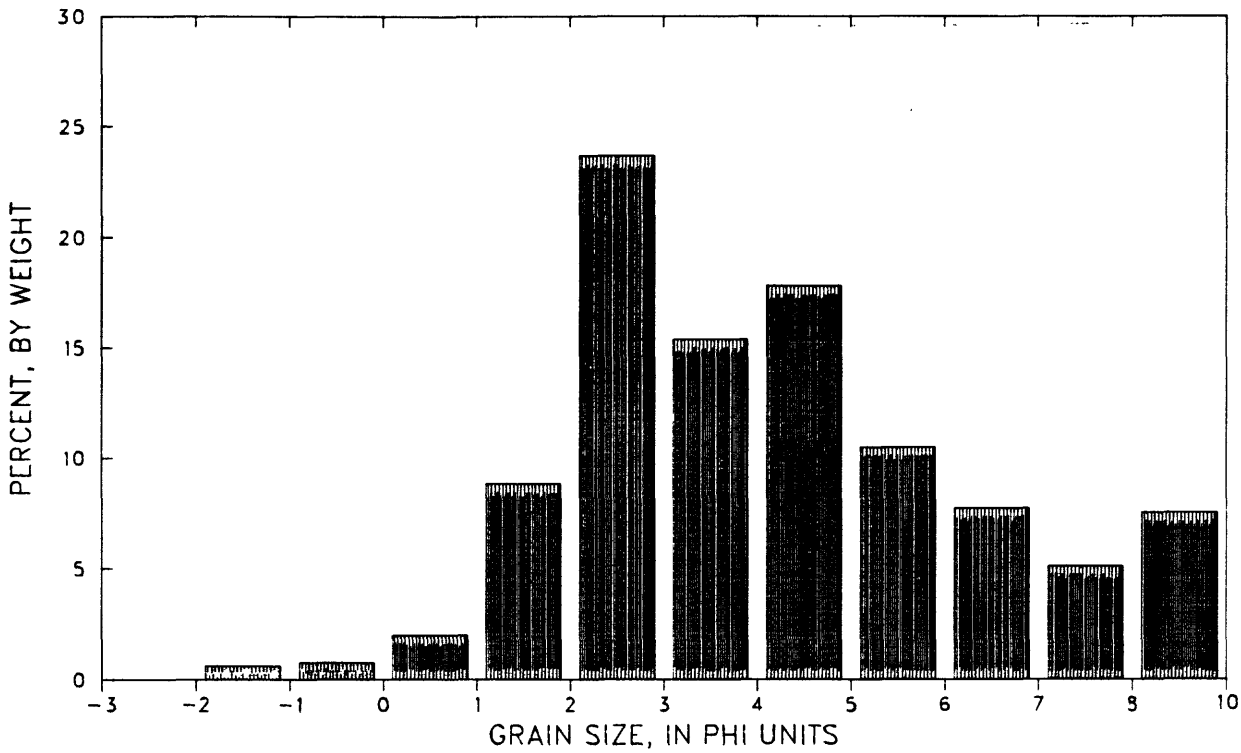

FIGURE 14.--Grain-size distribution of sediment from well DR—AH—15A, depth 7.0 feet.

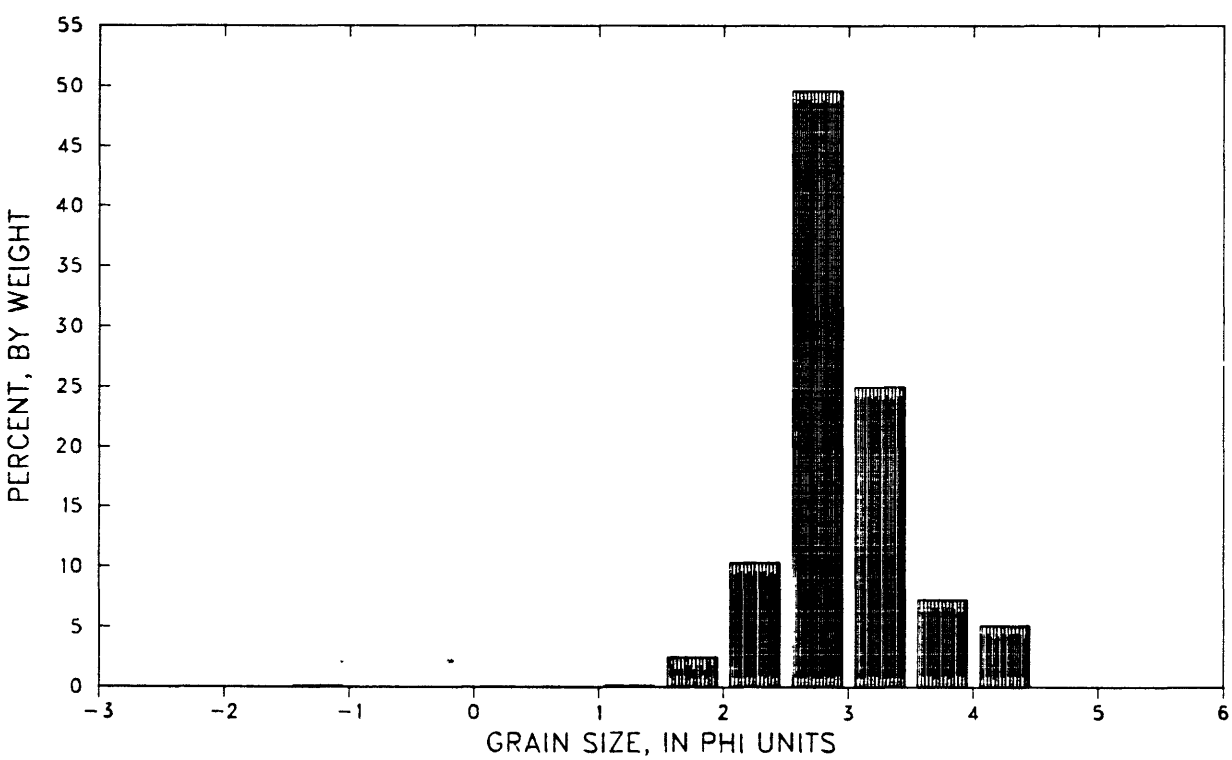

FIGURE 15.--Grain-size distribution of sediment from well DR—AH—15A, depth 9.5 feet.

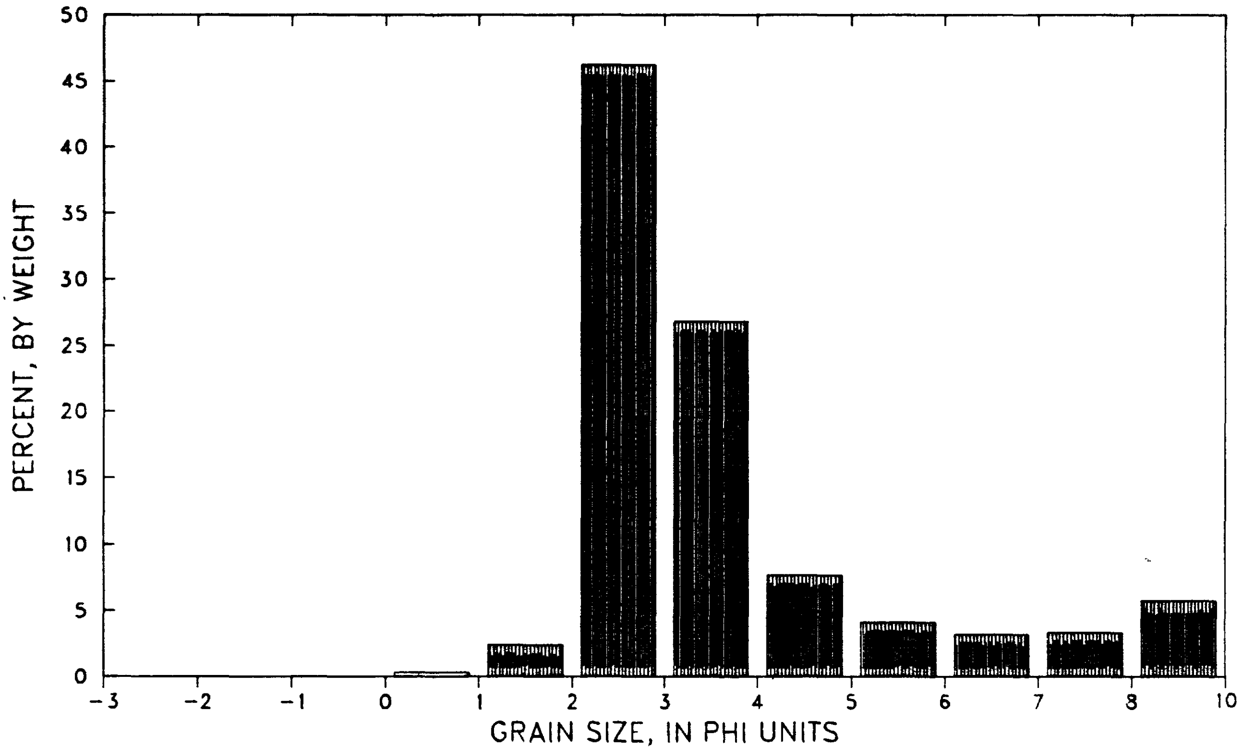

FIGURE 16.--Grain-size distribution of sediment from well DR—AH—15A, depth 14.0 feet.

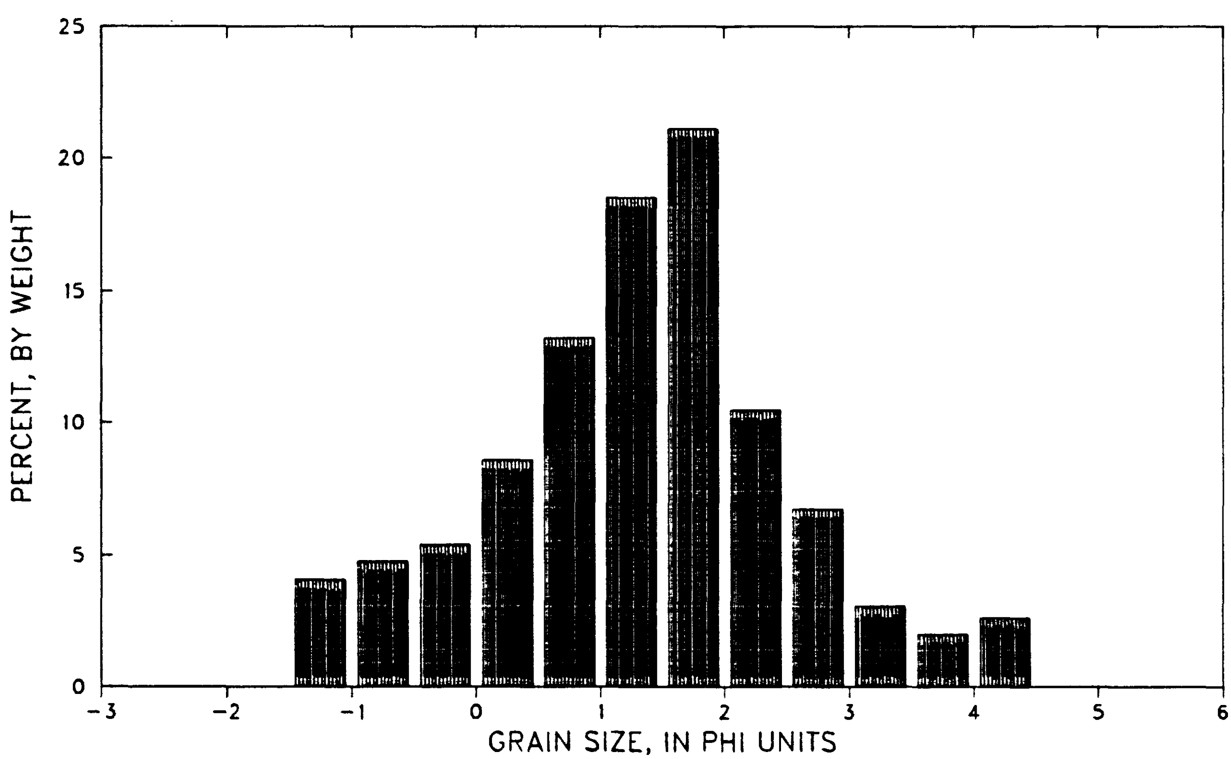

FIGURE 17.--Grain-size distribution of sediment from well DR—AH—15A, depth 19.5 feet.

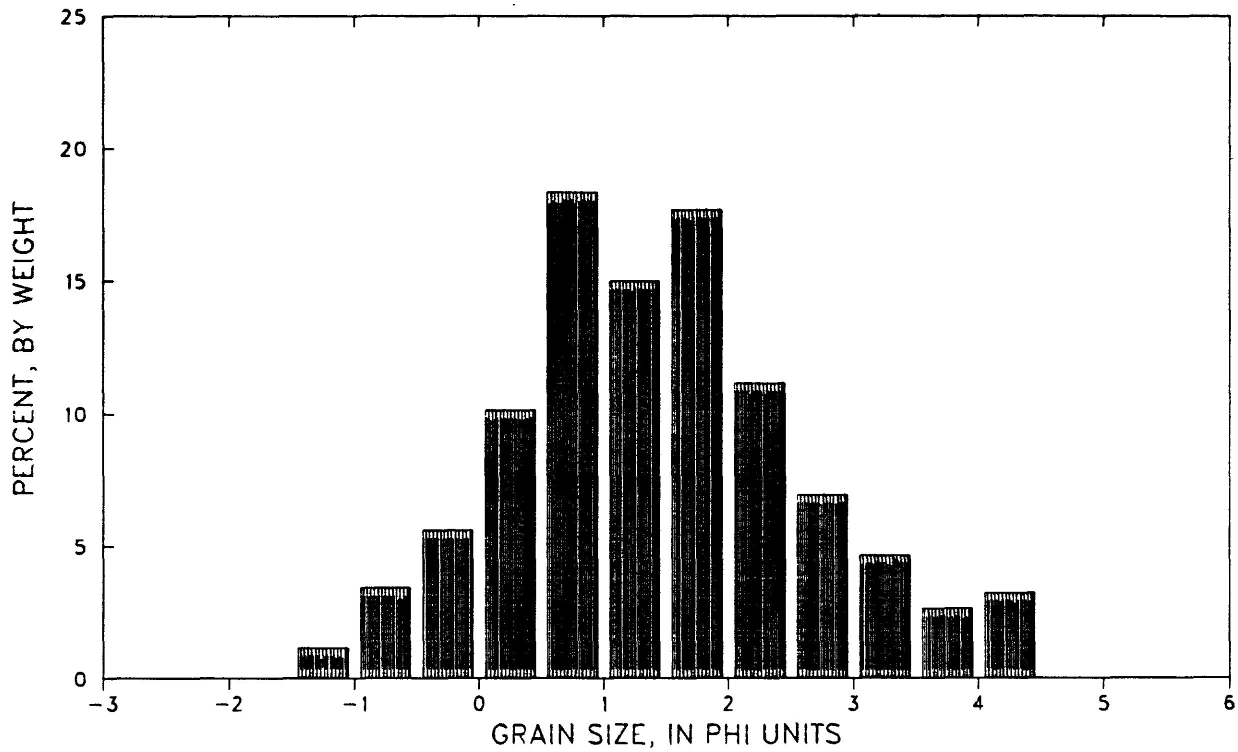

FIGURE 18.--Grain-size distribution of sediment from well DR—AH—16A, depth 4.5 feet.

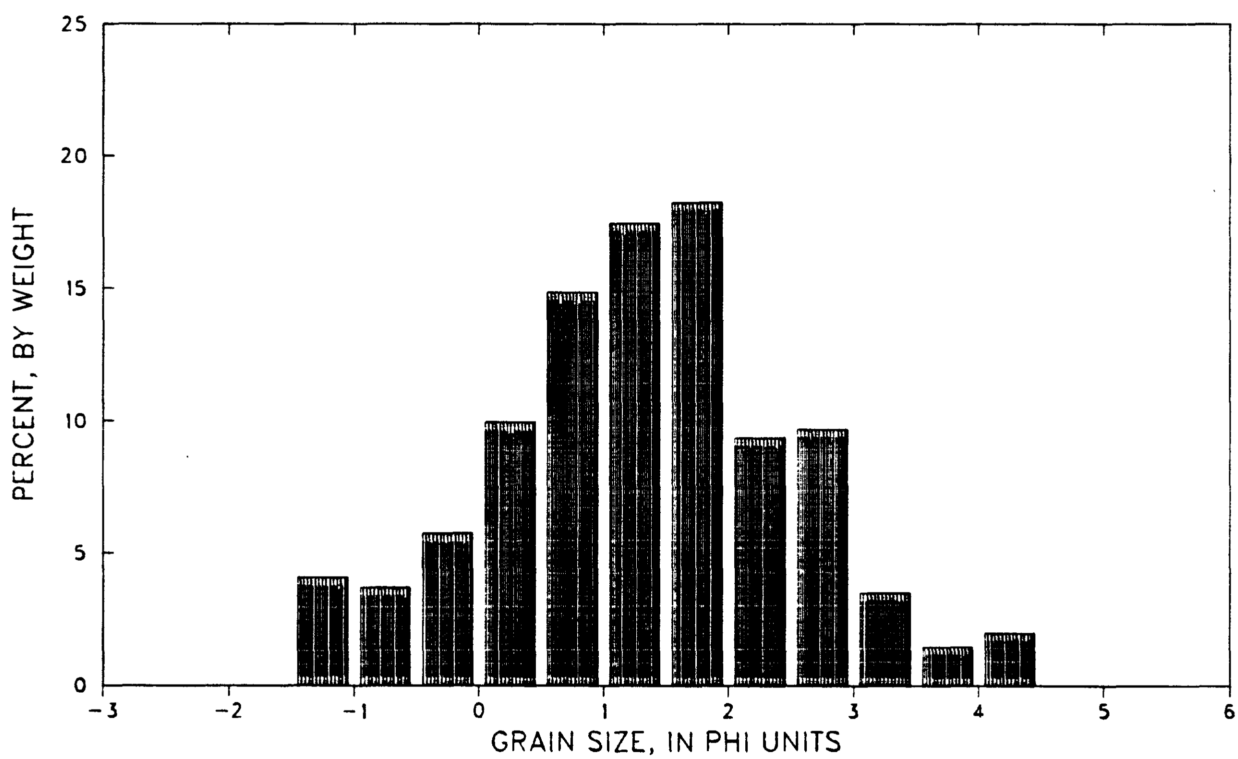

FIGURE 19.--Grain-size distribution of sediment from well DR—AH—16A, depth 9.5 feet.

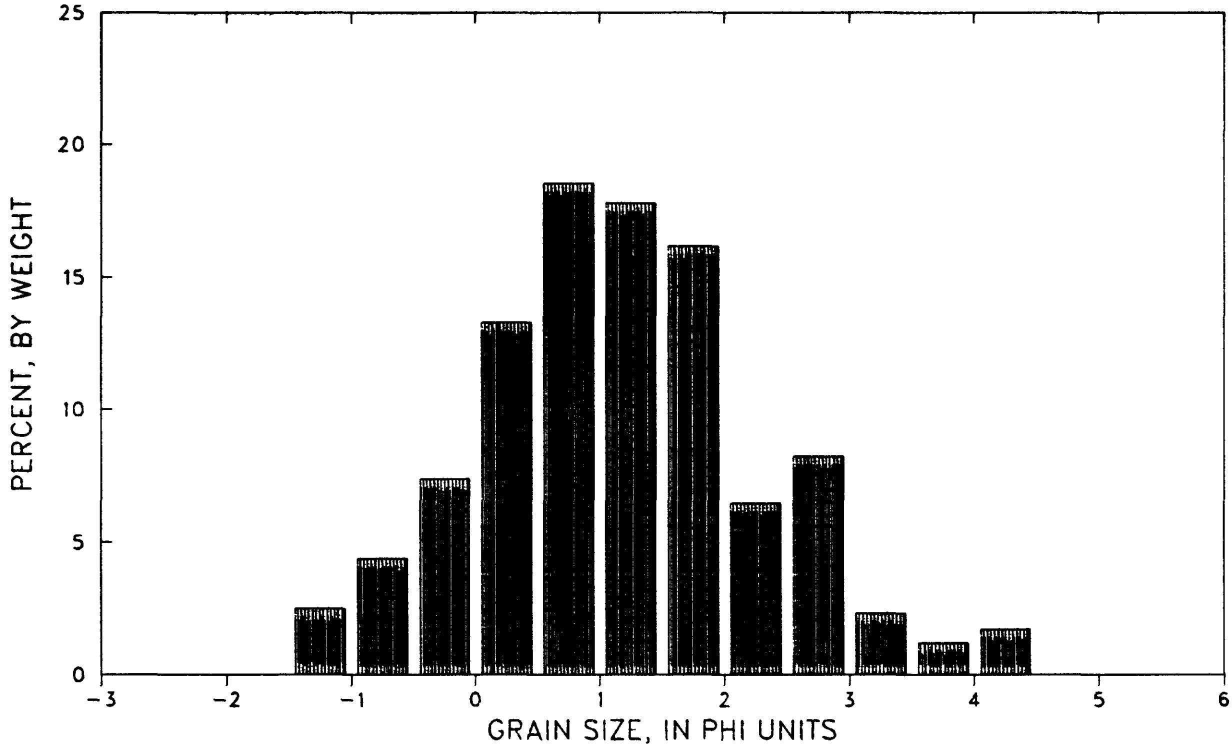

FIGURE 20.--Grain-size distribution of sediment from well DR—AH—16A, depth 19.5 feet.

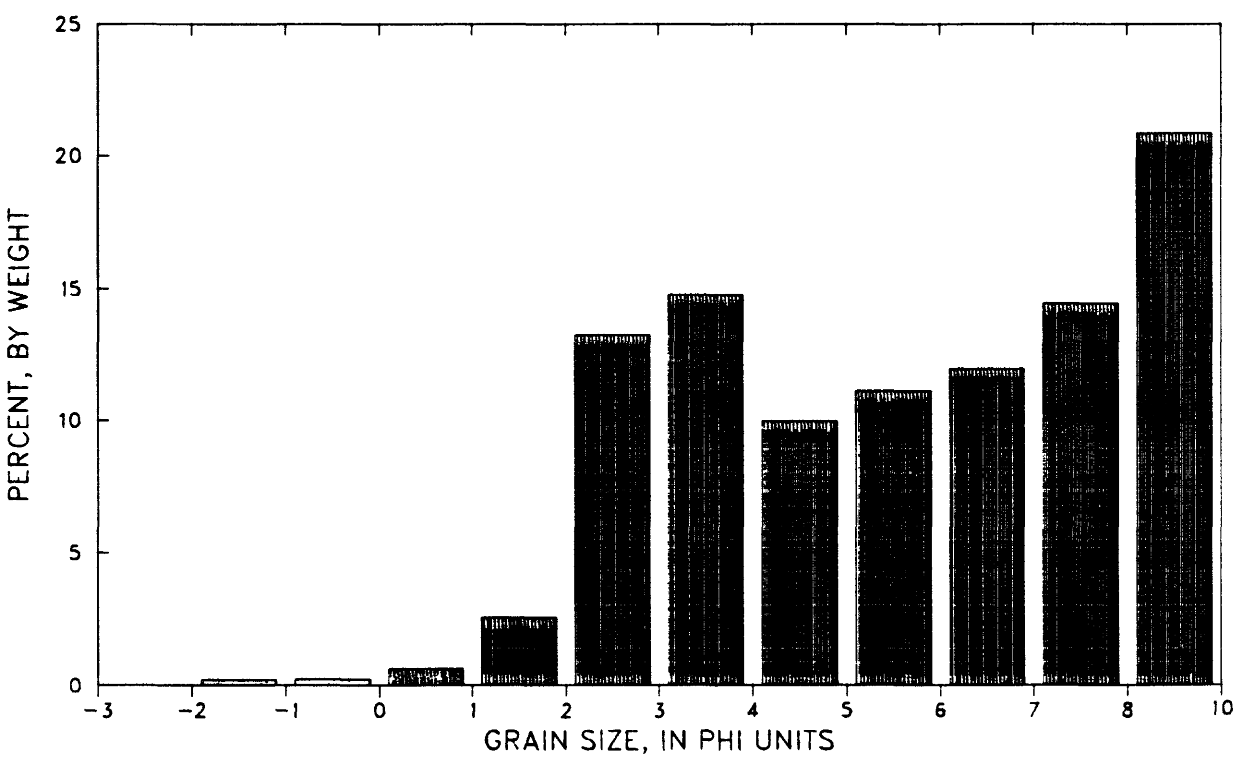

FIGURE 21.--Grain-size distribution of sediment from well DR—AH—16A, depth 26.5 feet.

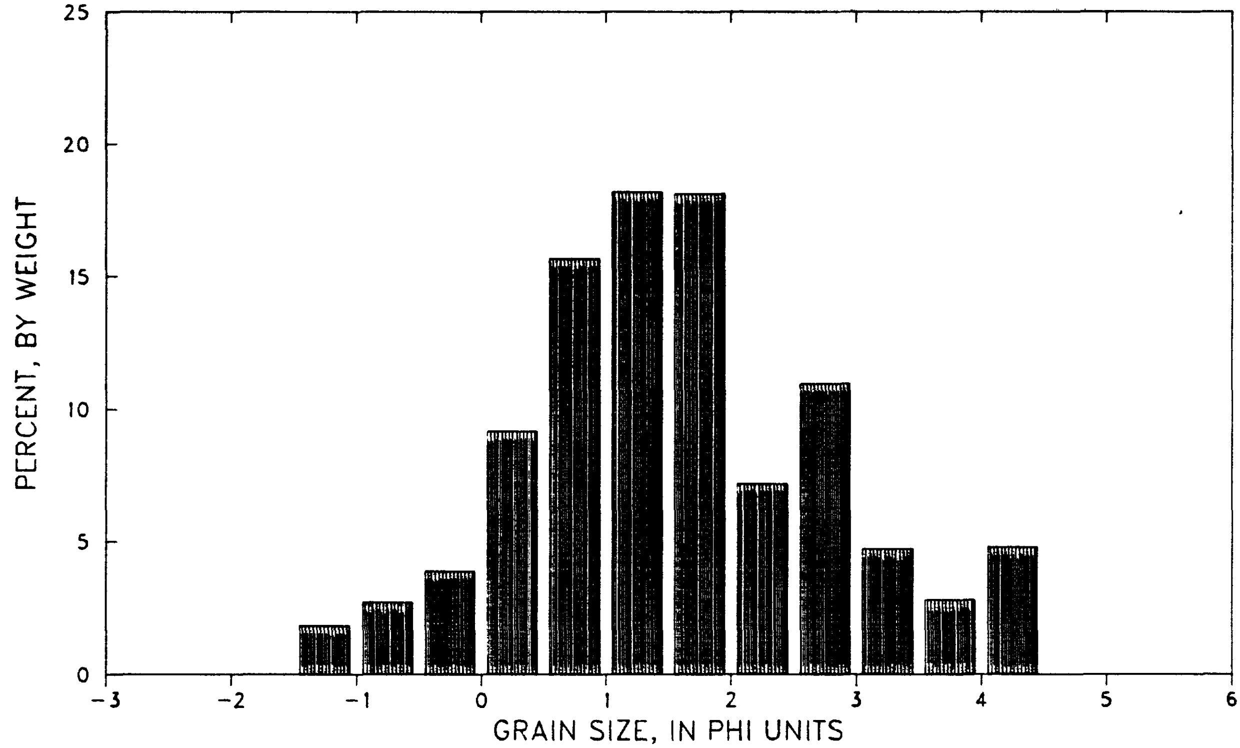

FIGURE 22.--Grain-size distribution of sediment from well DR—AH—16A, depth 29.5 feet.

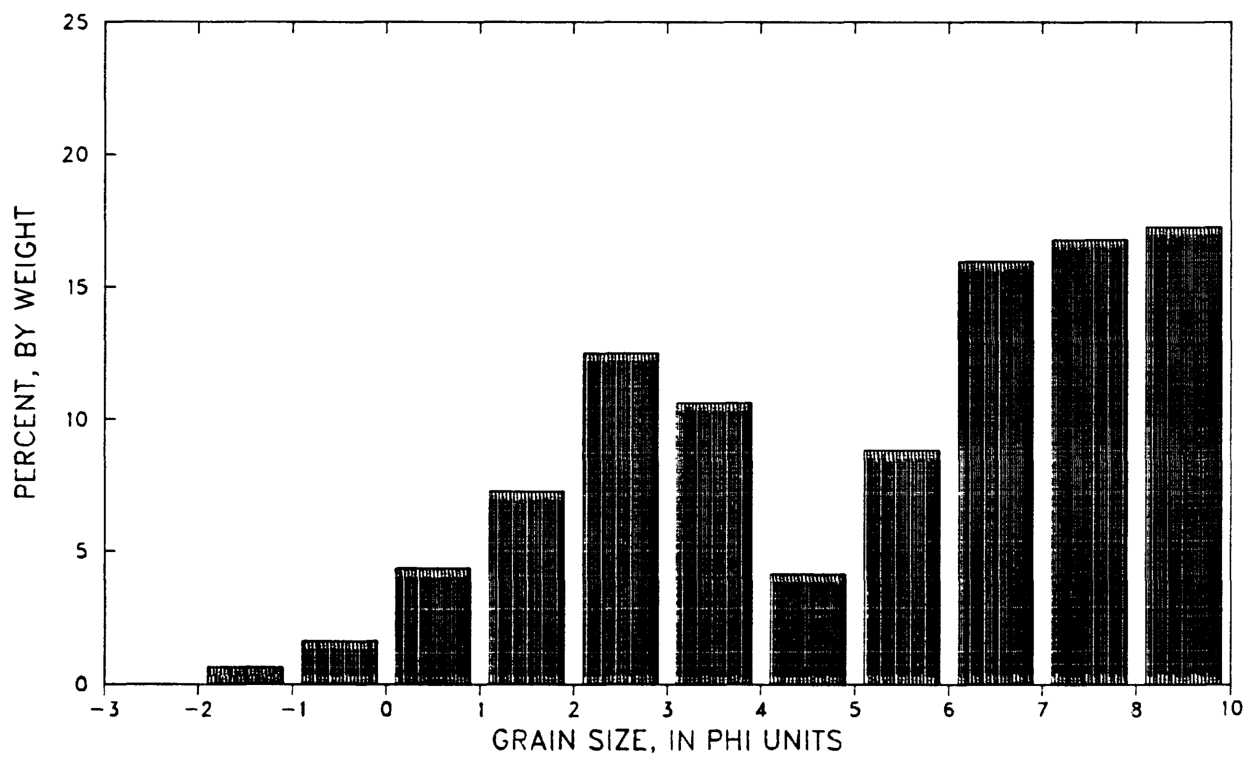

FIGURE 23.--Grain-size distribution of sediment from well DR—AH—17A, depth 4.0 feet.

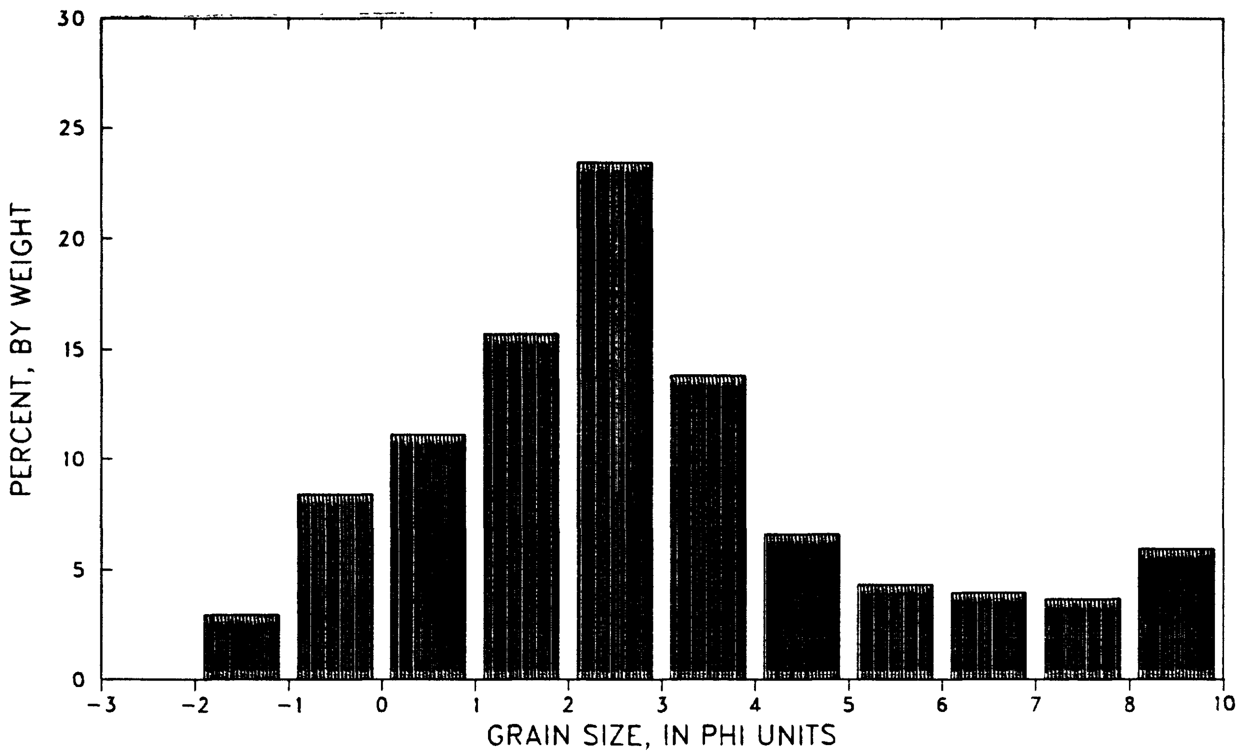

FIGURE 24.--Grain-size distribution of sediment from well DR—AH—17A, depth 8.0 feet.

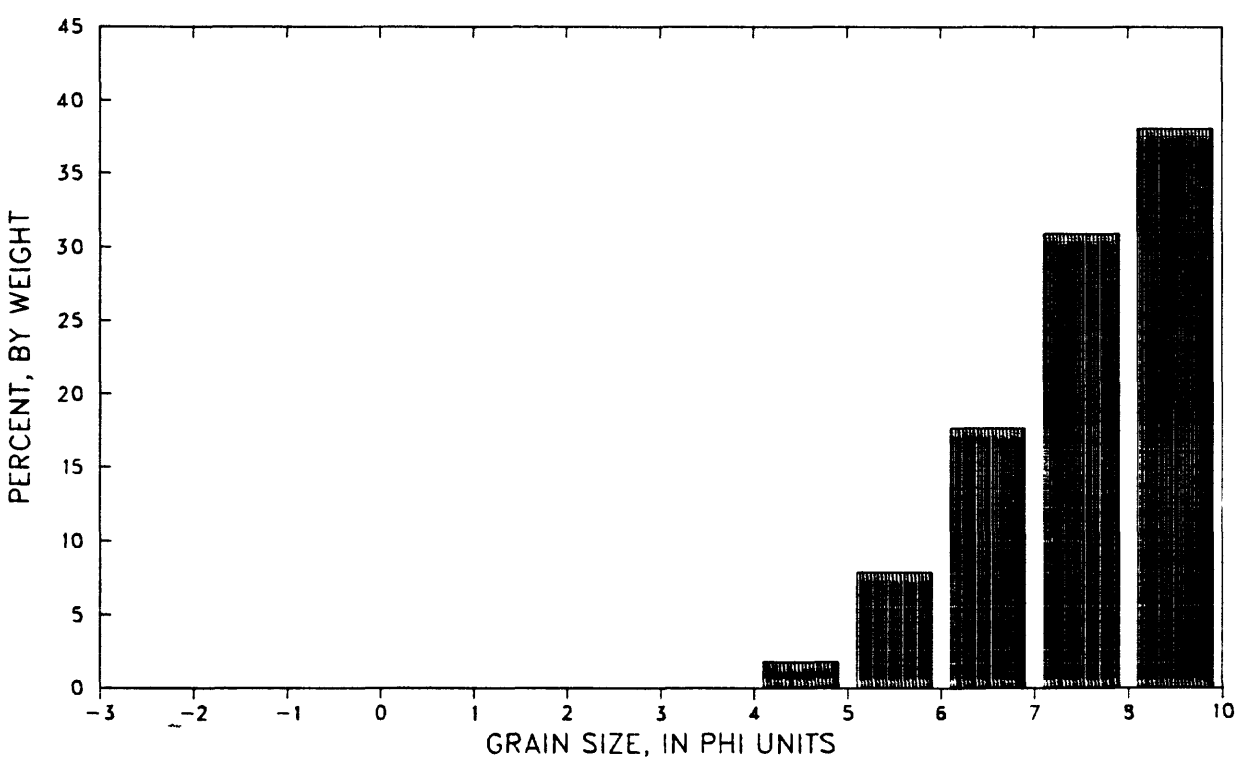

FIGURE 25.--Grain-size distribution of sediment from well DR—AH—17A, depth 14.5 feet.

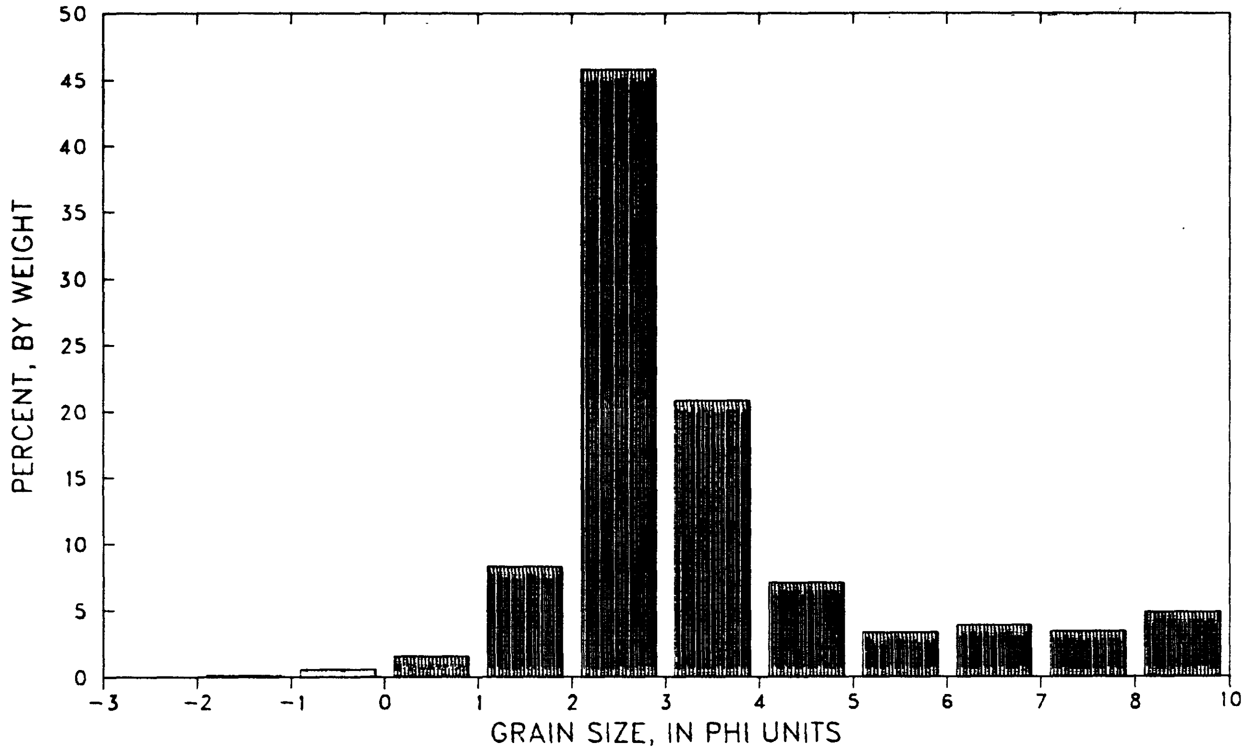

FIGURE 26.--Grain-size distribution of sediment from well DR—AH—17A, depth 15.0 feet.

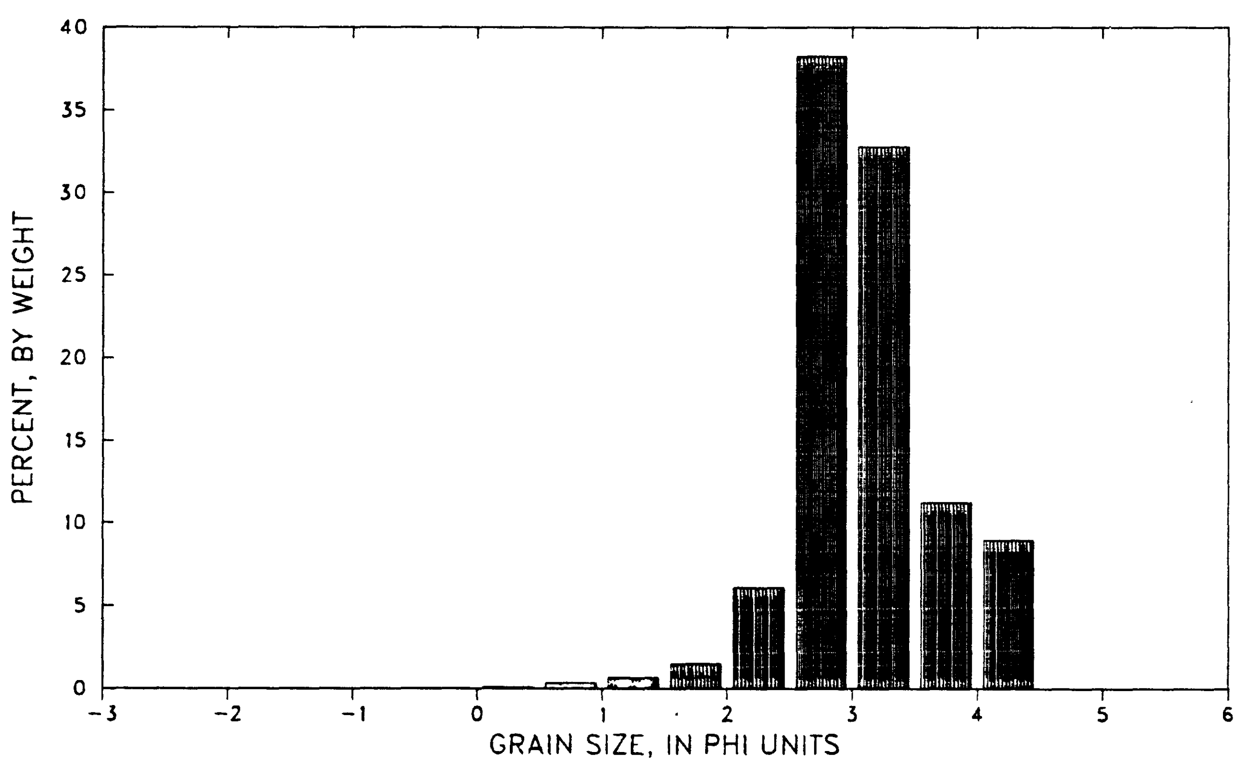

FIGURE 27.--Grain-size distribution of sediment from well DR—AH—17A, depth 19.5 feet.

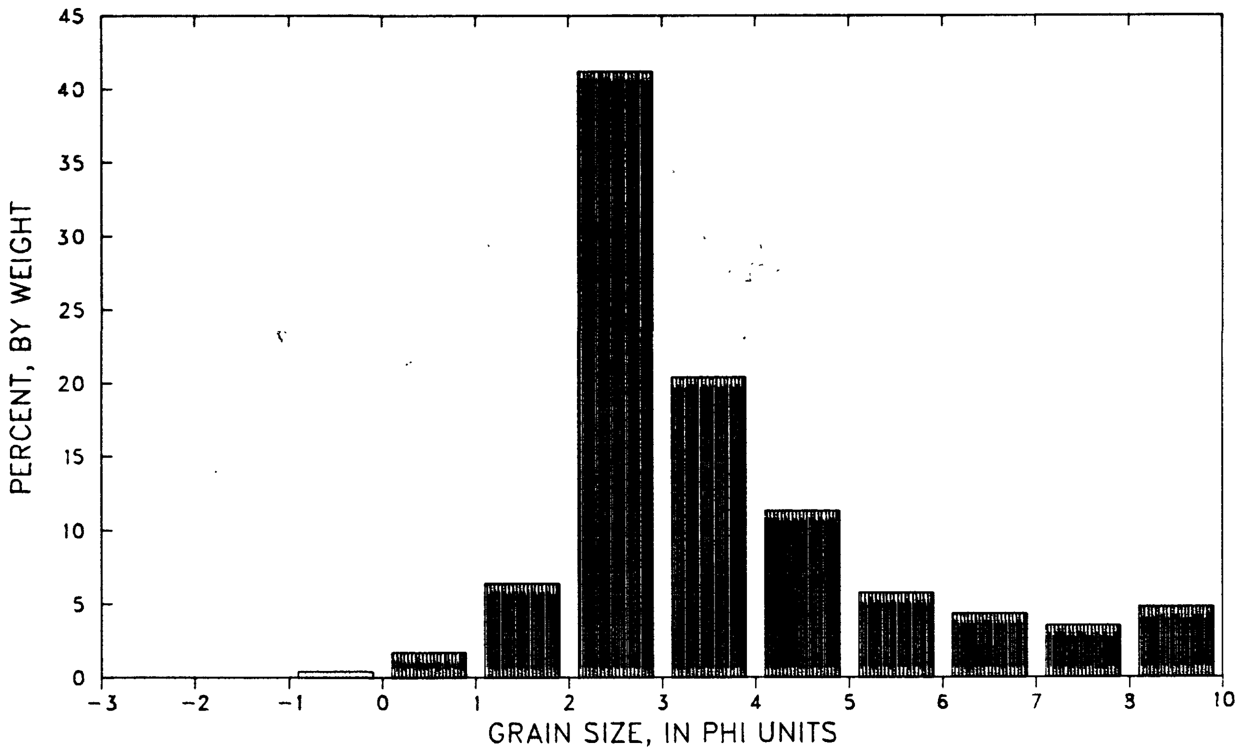

FIGURE 28.--Grain-size distribution of sediment from well DR—AH—17A, depth 24.0 feet.

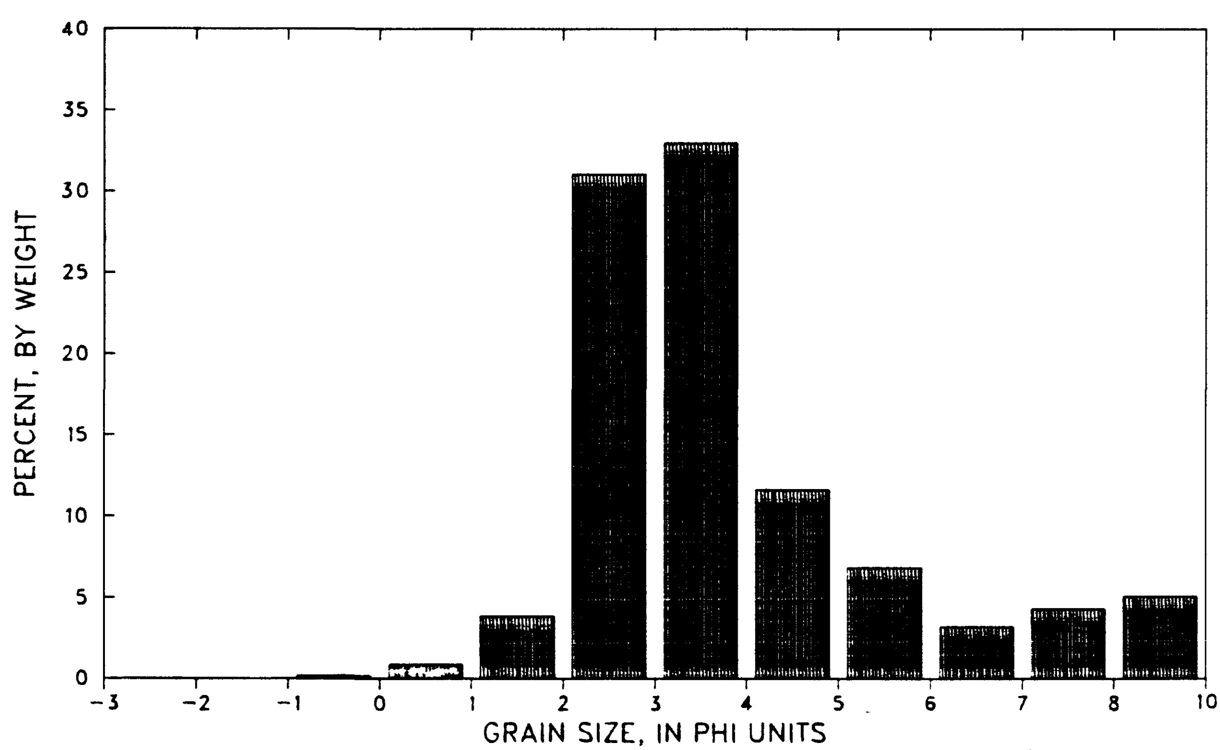

FIGURE 29.--Grain-size distribution of sediment from well DR—AH—17A, depth 25.0 feet.

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