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U.S. GEOLOGICAL SURVEY

TEST DATA FROM THE CHLORIDE-MONITOR WELL AT SUN CITY CENTER, HILLSBOROUGH COUNTY, FLORIDA

OPEN-FILE REPORT 78-1030

Prepared by the U.S. GEOLOGICAL SURVEY
in cooperation with the
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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By William C. Sinclair

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Tallahassee, Florida

1979

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INTRODUCTION

The U.S. Geological Survey, as part of its cooperative program with the Southwest Florida Water Management District, collected samples of water and cuttings during drilling of a chloride-monitor well at Sun City Center. The well, the second inland chloride-monitor well in the Water Management District's monitor-well program, was drilled for the District by the Meredith Drilling Corporation of Orlando. The first is at Bartow, 34 miles northeast of Sun City. At both sites, information was needed concerning the depth below land surface at which chloride water occurs. For purposes of the monitor-well program, chloride water is defined as water whose chloride concentration is at least 250 mg/L (milligrams per liter). At Bartow, chloride water was found at about 900 feet below sea level and at Sun City Center, within the depth range 1,355-1,365 feet below. This report lists data for the well at Sun City Center.

WELL CONSTRUCTION

The Sun City Center chloride-monitor well is near Trinity Lakes Condominium, in Sun City, southwest Hillsborough County (fig. 1). The well was drilled by Meredith Drilling Corporation, Orlando, from October 1976 to February 1977. The rotary mud drilling method was used to a depth of 460 feet and the reverse air method to a depth of 1,670 feet. After testing and sampling, the well was back filled to 1,434 feet below land surface. As shown schematically on figure 2, the well is cased to 1,394 feet and is open to the formation from 1,394 to 1,434 feet. The casing is grouted from 1,100 to 1,394 feet and the annulus is open from the bottom of the 10-inch casing at 641 feet to the top of the grout at 1,100 feet. Measurements of water level in this reach can be made and water samples collected by means of 1/2-inch PVC tubing which extends from land surface to a depth of 760 feet. The freshwater-chloride water interface is within the interval of open hole from 1,394 to 1,434 feet.

GEOLOGIC DATA

Drill cuttings were collected at 5-foot intervals from 115 to 1,670 feet below land surface. The lithologic log of table 1 is based on descriptions of the cuttings. Stratigraphy, inferred from the cuttings, is

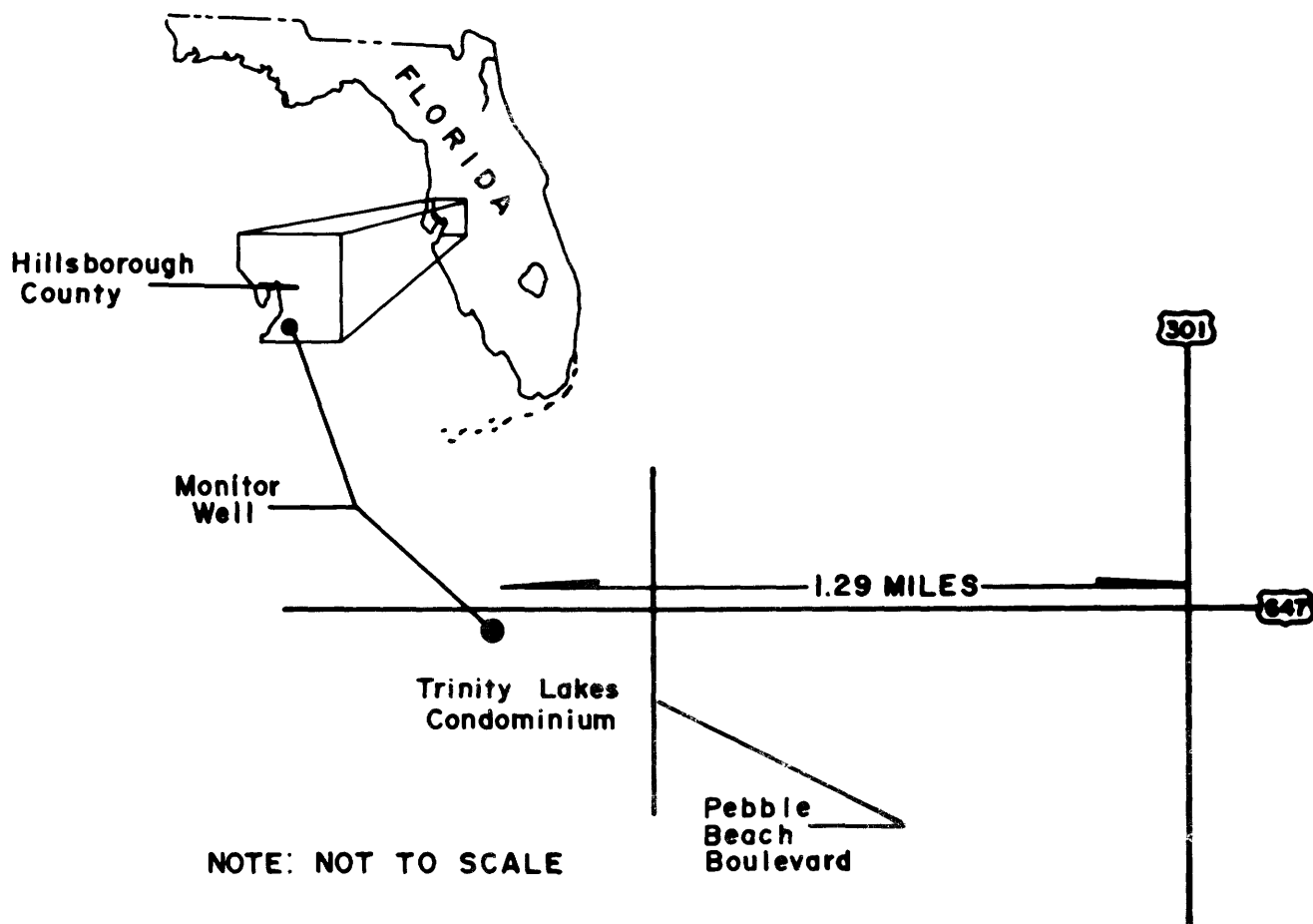


Figure 1.--Location of Sun City Center chloride-monitor well.

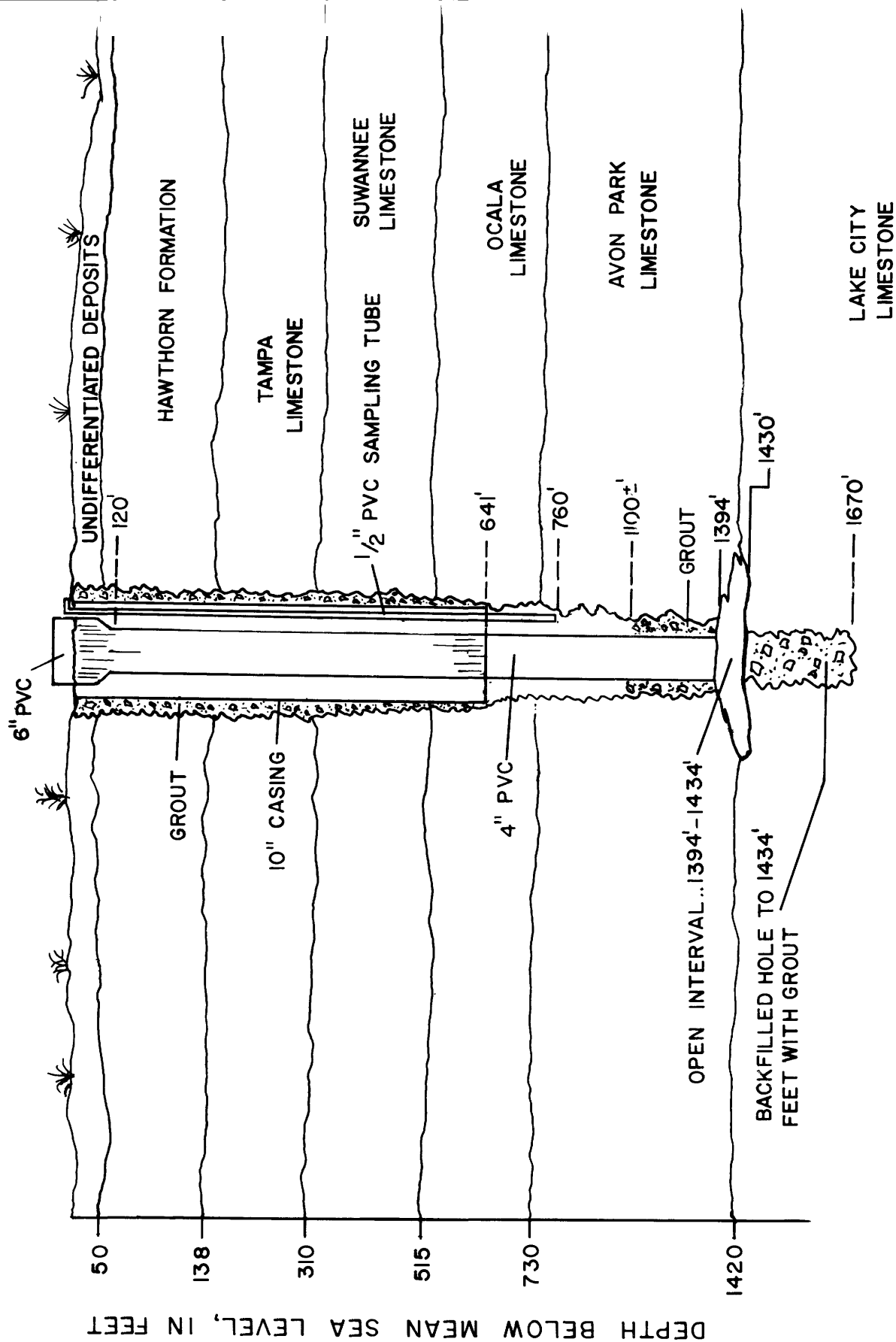


Figure 2.--Schematic diagram of well construction and stratigraphy at Sun City Center.

Table 1.--Lithologic log of Sun City Center chloride-monitor well

[Depth is distance to top of lithology described, below land surface.]

Lithology	Depth (ft)	Thickness (ft)
No samples	0	115
LIMESTONE, very light gray, micritic, very fine quartz and phosphate sand and up to 20 percent dark gray phosphate pebbles.	115	10
LIMESTONE, very light gray, micritic, variable sand content, very fine to fine grain clear quartz and gray phosphate, sub-angular to rounded. Phosphate pebbles rare.	125	55
LIMESTONE, white, dense, micritic, occasional quartz sand and light olive gray sandy limestone; some brown chert.	180	50
LIMESTONE, as above but very fossiliferous.	230	15
LIMESTONE, light gray, dense, crystalline, sandy.	245	15
LIMESTONE, white to pinkish-gray, sandy.	260	35
LIMESTONE, light gray and very pale orange, granular, many fossil fragments, occasionally drusy, rarely crystalline, dark gray chert rare.	295	125
LIMESTONE, as above with occasional chips of dense light gray limestone and occasional quartz sand.	420	5
LIMESTONE, very pale orange, very fossiliferous, and pale brown granular limestone, crystalline.	425	35
LIMESTONE, very pale orange, micritic, fossiliferous and pinkish-gray dense limestone, also fossiliferous.	460	25
LIMESTONE, very pale orange, dense, micritic, moderate micro-porosity.	485	15
LIMESTONE, very pale orange, very fine-grain calcarenite, sucrosic, fossiliferous, with drusy and crystalline chips, slight micro-porosity.	500	70
DOLOMITE, grayish-orange, finely crystalline, dense to sucrosic, moderate micro-porosity, moderate reaction to HCl.	570	55
LIMESTONE, pinkish-gray, very fossiliferous, micritic, occasional quartz grains and black phosphate pebbles, some sparry fossils and transparent calcite crystals to 1 cm.	625	15

Table 1.--Lithologic log of Sun City Center chloride-monitor well - continued

Lithology	Depth (ft)	Thickness (ft)
LIMESTONE, very pale orange, crystalline, fossil fragments cemented to layers of calcite spar 1-5 mm thick. Occasional pebbles of dark gray phosphate.	640	25
LIMESTONE, very pale orange, poorly consolidated grains of limestone sand and microfossils, micritic to crystalline.	665	50
LIMESTONE, grayish-orange, very fine grain calcarenite, sucrosic, slight micro-porosity.	615	10
DOLOMITE, grayish-orange, very fine grain calcarenite, sucrosic, greater porosity than above.	725	10
DOLOMITE, as above but more dense, slight micro-porosity. Increasingly crystalline.	735	15
LIMESTONE, pinkish-gray, hard, fossiliferous with sparry calcite cement.	750	5
LIMESTONE, grayish-orange, unconsolidated very fine-grain crystalline limestone sand.	755	15
DOLOMITE, grayish-orange, dense, sucrosic, some micro-porosity; some pinkish-gray limestone, fossiliferous with micritic matrix.	770	40
DOLOMITE, pale yellowish-brown, dense, crystalline to drusy; sand-size rhombs.	810	20
DOLOMITE, grayish-orange, sand-size rhombs, friable, porous, moderate reaction to HCl.	830	30
DOLOMITE, pale yellowish-brown, dense, crystalline, minor sand-size rhombs.	860	105
DOLOMITE, light brown to light olive gray, dense to finely crystalline, occasional vugs, occasional iron stain.	965	5
DOLOMITE, as above but mostly sand-size grains.	970	20
DOLOMITE, gray, dense, more platy than above; and light brown dolomite, dense to crystalline, fewer vugs than above, occasional iron stain.	990	5
LIMESTONE, gray to dark gray, well-rounded sand-size grains and angular pieces to 5 mm; some light olive gray clay.	995	2

Table 1.--Lithologic log of Sun City Center chloride-monitor
well - continued

Lithology	Depth (ft)	Thickness (ft)
DOLOMITE, pale yellowish-brown, well-rounded sand-size grains.	997	23
DOLOMITE, pale yellowish-brown, fine oolitic sand to 5 mm sub-angular to rounded grains.	1,020	5
DOLOMITE, pale yellowish-brown, as above with extensive small-scale porosity; varying amounts of drusy and crystalline grains. Layers of more dense, micritic, dolomite of varying thickness throughout.	1,025	365
DOLOMITE, as above with occasional laminae of grayish-orange to moderate brown CLAY.	1,390	20
DOLOMITE, very pale orange, fine oolitic sand to 5 mm sub-angular to rounded grains. Micro-porosity, varying amounts crystalline grains.	1,410	5
DOLOMITE, very pale orange, dense; and drusy, darker-hue dolomite, both with extensive micro-porosity, gypsum, white, clayey; selenite crystals to 2 cm; some brownish-black chert.	1,415	20
DOLOMITE, very pale orange, fine sand size to 5 mm round to sub-angular; drusy and crystalline material; selenite crystals; some dense dolomite, varying amounts of white clayey gypsum.	1,435	140
DOLOMITE, as above with dense micritic dolomite, with extensive micro-porosity more common, varying amounts of gypsum.	1,575	25
DOLOMITE, as above with brownish-gray chert.	1,600	5
DOLOMITE, very pale orange, fine sand size to 5 mm round to sub-angular; crystalline; selenite crystals; some dense dolomite; varying amounts of white clayey gypsum.	1,605	65
Total depth of well.	1,670	

summarized on figure 2. Geophysical logs were made at several stages during construction of the well. Selected logs are included in this report as figures 3 through 10.

COLLECTION AND ANALYSIS OF WATER SAMPLES

Water samples were collected periodically as drilling progressed, during the specific capacity tests, the packer tests, from discrete depths by means of wire-line (thief) sampler, and by pumping the completed well.

The chemical analyses of water samples collected during drilling are listed in table 2.

Chloride and sulfate concentrations and specific conductance of water samples obtained with the wire-line sampler from discrete depths are listed in table 3. Samples were also submitted to the U.S. Geological Survey Laboratory for analysis and the analyses are listed in table 4. Some of the complete analyses of samples from discrete depths are plotted on Stiff diagrams on the log of fluid resistivity (fig. 8). The diagrams and fluid resistivity log summarize the chemistry of the water in the borehole from 642 feet to 1,670 feet.

Chloride and specific conductance of water pumped during two of the packer tests decreased with pumping, suggesting that less-mineralized water was leaking around the packer (table 5).

Most domestic and public-supply wells in the area bottom at less than 500 feet where the aquifer contains potable water of the calcium bicarbonate type. Limestone of low permeability, from about 600 to 740 feet, limits vertical movement of water in the aquifer. The sulfate concentration of the water increases from 380 mg/L at 700 feet to 1,200 mg/L at 1,400 feet. The chloride concentration of water from these depths is about 30 mg/L.

The freshwater-chloride water interface is very sharp, occurring abruptly within the depth range 1,400-1,410 feet below land surface (1,355-1,365 feet below sea level). Chloride concentration increased from 30 mg/L at 1,400 feet to 1,700 mg/L at 1,410 feet. The chloride concentration was greatest, 34,000 mg/L, in a sample obtained during drilling when the bottom of the borehole was at a depth of 1,500 feet.

Relative concentrations of major ions in water from the 1,500-foot depth in the well are compared with those in seawater by plotting the principal ions in both on the trilinear diagram of figure 11. It is apparent that, although the major ions in the well water average more than twice the concentration of seawater, the proportions of ions present in the two waters are nearly identical.

Table 2.--Chemical analyses of water samples collected during
drilling of Sun City Center chloride-monitor well

Date	Time	Method of sample collection	Well depth (ft)	Specific conductance (umho/cm)	Chloride (mg/L)	Sulfate (mg/L)
1976						
Oct. 19	1500	pump	520	600	13	150
20	0900	do.	550	560	14	150
20	1430	do.	610	660	15	160
20	1635	do.	640	670	14	160
Nov. 1	0830	drill stem	750	810	18	250
2	1140	pump	810	790	16	--
2	1235	do.	810	760	8	--
8	1058	do.	820	800	16	--
8	1228	do.	820	800	16	--
8	1230	do.	820	840	16	250
9	1600	drill stem	830	840	17	--
10	1600	do.	850	849	16	260
11	1015	do.	870	850	18	--
12	1015	do.	890	840	17	--
12	1330	do.	910	920	17	290
15	1500	do.	930	890	17	280
17		pump	935	805	17	
19	1400	drill stem	950	940	18	300
22	1245	do.	970	900	19	
29	1600	do.	1,010	930	17	310
30	1330	do.	1,050	950	17	300
Dec. 1	1300	do.	1,110	930	17	290
7	1000	do.	1,150	940	18	310
7	1600	do.	1,210	940	18	300
8	1300	do.	1,250	990	18	350
16	0730 ^a	do.	1,273	990	18	350
16	1000	do.	1,290	1,130	20	440
16	1230	do.	1,310	1,260	20	530
16	1430	do.	1,330	1,550	23	720
17	0730 ^a	do.	1,350	1,730	25	850
17	0830	do.	1,370	1,730	24	840
17	0930	do.	1,390	1,720	24	840
17	1100	do.	1,410	1,810	25	850
20	0730 ^a	do.	1,423	3,000	20	2,000
20	0930	do.	1,430	2,890	31	1,800
20	1130	do.	1,450	2,810	23	1,800
20	1400	do.	1,460	2,740	20	1,800
20	1600	do.	1,476	2,760	25	1,800
21	0730 ^a	do.	1,479	7,410	1,700	2,000
21	0900	do.	1,485	2,160	40	1,400
30	1740	pump	1,500	1,080	19	--

a - morning sample collected after clearing drill stem.

Table 3.--Chemical analyses of water samples collected at discrete depths with wire-line (thief) sampler

Date	Time	Well depth (ft)	Sample depth (ft)	Specific conductance (umho/cm)	Chloride (mg/L)	Sulfate (mg/L)
1976						
Nov. 18	0900 ^a	935	668	810	16	270
16	1415	935	670	650	18	
16	1440	935	720	780	16	
16		935	790	785	17	
18	1020 ^a	935	798	800	15	280
16	1520	935	830	850	19	
17		935	930	850	16	
18	1045 ^a	935	930	848	16	300
Dec. 9	1525	1,250	760	960	17	350
9	1545	1,250	830	840	15	290
9	1610	1,250	980	890	15	320
9	1640	1,250	1,235	1,000	18	350
1977						
Jan. 3	1300	1,500	760	1,080	21	
3	1260 ^a	1,500	1,260	1,070	18	400
3	1440 ^a	1,500	1,300	1,940	27	1,000
3	1520 ^a	1,500	1,400	2,140	26	1,200
3	1725 ^a	1,500	1,420	5,100	720	1,900
3	1830	1,500	1,440	28,000	8,700	
3	1920	1,500	1,460	78,500	32,000	
3	2020	1,500	1,480	81,600	33,000	
3	2115 ^a	1,500	1,500	83,600	33,000	5,400
8	1650 ^a	1,670	1,410	7,600	1,700	1,700
8	1750 ^a	1,670	1,550	71,900	28,000	5,500
18	1530 ^a	1,670	1,600	55,600	22,000	3,800
18	1630 ^a	1,670	1,660	61,100	22,000	4,600
Feb. 17	1310	1,434	1,434	6,700	1,400	
21	0930	1,434	1,400	7,500	1,300	
21	1010	1,434	1,430	20,000	5,300	

a - sample also collected for analysis listed in table 4.

Table 4.--Chemical analyses of water from various depths in the chloride-monitor well

[All analyses are by the U.S. Geological Survey and are in milligrams per liter except where noted.]

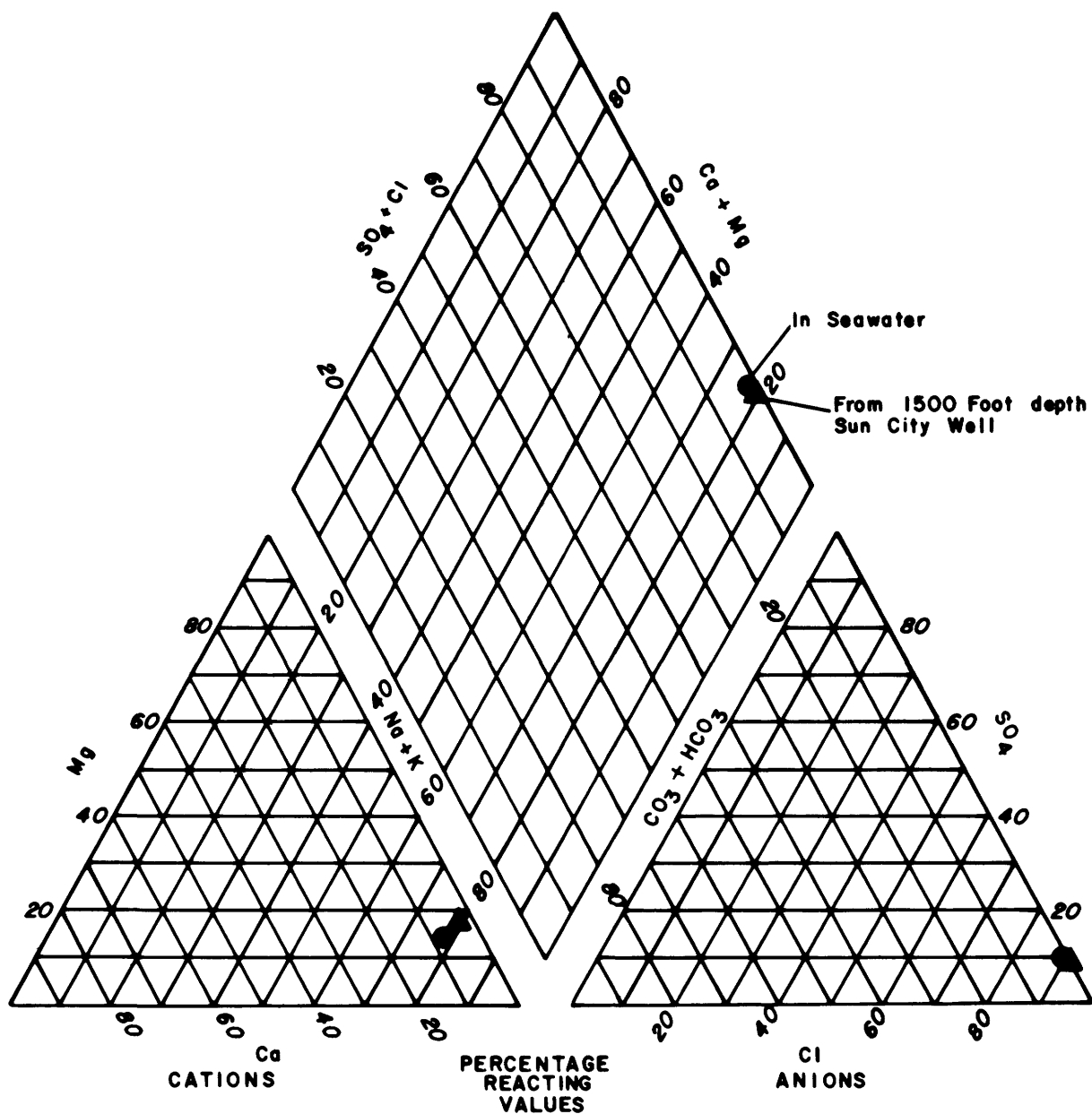
Date	Time	Well depth (ft)	Sample depth (ft)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)
11-18-76	0900	935	668	100	43	12	1.6	168	0	270	17	0.5
	1020	935	798	100	41	12	1.7	173	0	280	16	0.5
11-15-76	1420	935	930	140	63	13	1.9	258	0	310	17	0.5
11-17-76	1200	935	641-935	110	41	12	1.7	174	0	280	17	0.5
11-18-76	1045	935	930	110	44	12	1.7	175	0	300	17	0.5
1-03-77	1345	1,500	1,260	150	50	13	2.0	170	0	400	21	0.6
	1440	1,500	1,300	320	110	16	2.8	147	0	1,000	35	0.7
	1520	1,500	1,400	350	120	16	3.0	141	0	1,200	30	0.9
1-08-77	1650	1,670	1,410	700	140	950	39	174	0	1,700	1,700	0.9
1-03-77	1725	1,500	1,420	500	190	440	24	151	0	1,900	720	1.7
	2115	1,500	1,500	1,700	1,700	18,000	760	311	0	5,400	34,000	5.0
1-08-77	1750	1,670	1,550	1,500	1,600	16,000	680	315	0	5,500	28,000	3.6
1-18-77	1530	1,670	1,600	1,200	1,600	12,000	470	260	0	3,800	22,000	3.3
	1630	1,670	1,660	140	1,300	13,000	500	281	0	4,600	22,000	4.2
2-16-77	0800	1,934	1,395-1,434	490	4.2	430	36	50	0	1,200	750	0.4

Date	Time	Well depth (ft)	Sample depth (ft)	Strontium (Sr)	Silica (SiO ₄)	Specific conductance (umho/cm at 25°C)	Lab pH (units)	Alkalinity as CaCO ₃	Hardness		Dissolved solids		Color (units)	Remarks
									Total	non-carbonate	Sum	Residue at 180°C		
11-18-76	0900	935	668	4,700	23	831	7.7	138	430	290	555	596	0	
	1020	935	798	4,500	22	821	7.8	142	420	280	563	584	5	
11-15-76	1420	935	930	5,500	21	912	7.9	212	620	400	699	689	20	Pumped through drill stem
11-17-76	1200	935	641-935	4,600	22	827	7.6	143	450	310	575	593	0	Pumped 1,000 gal/min for 3 hours
11-18-76	1045	935	930	5,100	22	861	7.7	144	460	320	599	632	5	
1-03-77	1345	1,500	1,260	7,600	21	1,030	7.7	139	590	450	749	790	0	
	1440	1,500	1,300	13,000	22	1,890	7.6	121	1,300	1,100	1,590	1,720	0	
	1520	1,500	1,400	--	--	2,090	---	116	1,400	1,300	--	--	--	
1-08-77	1650	1,670	1,410	--	--	7,600	---	143	2,300	2,200	--	--	--	
1-03-77	1725	1,500	1,420	--	--	4,990	---	124	2,000	1,900	--	--	--	
	2115	1,500	1,500	28,000	14	79,600	7.3	255	11,000	11,000	61,800	61,900	0	
1-08-77	1750	1,670	1,550	--	--	71,900	---	258	10,000	10,000	--	--	--	
1-18-77	1530	1,670	1,600	--	--	55,600	---	213	9,600	9,400	--	--	--	
	1630	1,670	1,660	20,000	16	61,100	7.8	230	5,700	5,500	41,700	45,900	0	
2-16-77	0800	1,934	1,395-1,434	900	2.6	4,100	6.8	41	1,200	1,200	2,940	2,940	5	Pumped at 0.75 gal/min for 18 hours

1/ ug/L

Table 5.--Chemical analyses of water samples collected during packer tests of the
Sun City Center chloride-monitor well

Date	Time	Depth of zone pumped (ft)	Discharge (gal/min)	Minutes pumped	Quantity in pipe (gal)	Quantity pumped (gal)	Analyses		
							Specific conductance (umho/cm at 25°C)	Chloride (mg/L)	Sulfate (mg/L)
1976									
Dec. 14	1400	1,128-1,250	60	120	684	7,200	1,010	18	360
29	1043	1,395-1,500	57	18	820	1,080	1,950	30	---
	1152			87		5,220	1,750	28	---
	1320			175		10,500	1,700	27	---
1977									
Jan. 11	1600	1,425-1,670	36	60	832	2,400	2,360	230	---
13	1100	1,525-1,670	52	30	882	1,500	5,300	1,100	---
	1110			40		2,000	3,870	350	---
	1120			50		2,500	3,150	750	---
	1125			55		2,750	2,900	400	---
	1130			60		3,000	2,750	360	---



Ion	Equivalents	Percent	Equivalents	Percent
	per liter		per liter	
Calcium	20	3.4	84.8	8.1
Magnesium	105	17.7	139.8	13.6
Sodium and potassium	469.1	79	802.4	78.1
Chloride	535.8	90.6	959.1	89.1
Sulfate	53.3	9.	112.4	10.4
Bicarbonate and carbonate	2.3	0.4	5.1	0.5

Figure 11.--Comparison of major ions from the 1,500-foot depth in Sun City well, January 3, 1977, with those in average seawater.

After the casing was cemented in at 1,394 feet, the hole was reamed open to 1,434 feet and developed with freshwater from a nearby ditch.

On February 15 and 16, 1977, when the well was pumped at a rate of 0.75 gallon per minute, the drawdown was in excess of 200 feet. Samples were collected on February 16, the second day of pumping, as follows:

<u>Date</u>	<u>Time</u>	<u>Quantity in well casing (gal)</u>	<u>Minutes since pumping began</u>	<u>Quantity pumped (gal)</u>	<u>Chloride (mg/L)</u>
2-16-77	0005	1,020	605	454	22
	0400		845	634	230
	0800 pump off		1,080	810	790

To determine whether the position of the interface had stabilized within the depth range 1,400-1,410 feet below land surface, samples of water were obtained from specific depths with the wire-line sampler as follows:

<u>Date</u>	<u>Time</u>	<u>Depth of sample (ft)</u>	<u>Chloride (mg/L)</u>
2-17-77	1310	1,434	1,400
2-21-77	0930	1,400	1,300
	1010	1,430	5,300
3-30-77	1950	1,425	4,400

The water level in the well was allowed to approach static conditions and on August 4, 1977, when pumping was resumed at a rate of about 0.5 gallon per minute, the drawdown was 100 feet. Samples of water were taken on August 4, 5, and 6:

<u>Date</u>	<u>Time</u>	<u>Quantity in well casing (gal)</u>	<u>Minutes since pumping began</u>	<u>Quantity pumped (gal)</u>	<u>Chloride (mg/L)</u>
8-4-77	1500	1,020	180	90	840
	1620		260	130	850
	2100		540	270	920
8-5-77	0700		1,140	570	970
	1500		1,620	810	1,100
8-6-77	0830		2,670	1,335	1,300
	1530		3,090	1,545	1,100

FLOWMETER DATA

On November 16, 1976, when the well was 934 feet deep with casing to 641 feet, it was pumped at a rate of 1,000 gallon per minute and the velocity of water flowing in the borehole was measured. The measurements were made at various depths selected on the basis of an examination of the caliper log. The volume of water flowing in the borehole was calculated from velocity and borehole diameter using the equation:

$$Q_h = \frac{V_h A_h Q_p}{V_p A_p}$$

where Q_h = volume of flow at the point of flowmeter measurement in the borehole;
 Q_p = volume of flow in the well casing (measured at the point of surface discharge by orifice plate and manometer);
 V_h = velocity in the borehole (flowmeter rpm);
 A_h = cross-sectional area of the borehole (from caliper log);
 V_p = velocity in the well casing (flowmeter rpm);
 A_p = cross-section area of the well casing.

The rate of flow, as calculated for each depth range tested is tabulated below:

Depth of flowmeter (ft)	Well yield (gal/min)	Depth range of aquifer section tested (ft)	Flow from aquifer section tested ^d (gal/min)	Flow rate from each foot of aquifer tested (gal/min)
930	0	934-930	0	0
925	114	930-925	114	23
900	150	925-900	36	1
870	280	900-870	130	4
780	630	870-780	350	4
733	^b 1,095	780-733	---	--
^a 500	1,003	733- ^c 641	^e 139	3

a - in cased part of borehole.

b - measurement apparently in error.

c - at bottom of casing (fig. 2).

d - difference between well yield at indicated depth range and at next previous depth range.

e - includes flow from depth range 780-733 feet.

AQUIFER TESTS

The specific capacity of the well was determined at various depths during drilling and at selected intervals using a packer to allow only certain zones to yield water to the well. Four tests conducted by the driller on October 19 and 20, when the well bottomed at various depths from 520 to 640 feet, are probably representative of those parts of the aquifer within that depth range. Once the well began to penetrate the highly productive zone below about 800 feet, it was impossible to pump the well at a rate sufficient to produce measureable drawdown. The tests by the driller are summarized in table 6.

Four packer tests in all were made, one each on December 14 and 29, 1976, and on January 11 and 13, 1977, as summarized in table 6. Leakage around the packer was indicated by the test data and was confirmed, in some tests, by chemical analyses of water sampled at intervals throughout the tests (table 5). Specific capacities calculated for the packer tests, therefore, are probably high.

A specific capacity of 143 gallons per minute per foot of drawdown was obtained during the flowmeter test. At the time of the test, the borehole was open from 641 to 934 feet.

TEMPERATURE

Temperature of water in the well increased from 23.8° Celsius at the water surface, about 40 feet below land surface, to 31° Celsius at the bottom of the borehole, 1,670 feet deep (figs. 7 and 13). Natural increase of temperature with depth, called the geothermal gradient, ranges from 10° Celsius per vertical kilometer to 50° Celsius per vertical kilometer (1° Celsius per 66 feet to 1° Celsius per 328 feet) depending on the heat-conducting properties of the rocks and the circulation of gases and fluids--such as ground water. The temperature profile of the well illustrates the moderating effects of circulating ground water on the geothermal gradient, and by inference, the zones of most vigorous ground-water circulation.

Temperature increased 1° Celsius in only 80 feet in the section of the borehole from 680 to 760 feet (fig. 12). By contrast, the temperature did not increase in the 320-foot reach from 840 to 1,160 feet. The temperature again increased below about 1,300 feet.

Table 6.--Summary of data collected during aquifer tests of the Sun City Center chloride-monitor well

Date	Section of borehole open to aquifer (ft)	Length of open hole (ft)	Discharge (gal/min)	Drawdown (ft)	Specific capacity [(gal/min)/ft]	Remarks
1976						
Oct. 19	103- 520	417	230	3.25	71	Measurements by driller.
20	103- 550	447	230	3.58	64	Do.
20	103- 610	507	397	3.08	128	Do.
20	103- 640	537	397	2.71	146	Do.
Nov. 1	641- 790	149	50	--	--	
2	641- 810	169	100	1	100	
8	641- 820	179	310	1	310	
16	641- 934	294	1,003	7	143	Flowmeter test.
Dec. 20	641-1,240	599	1,000	4.75	210	
13	641-1,240	599	490	0.93	526	
14	1,128-1,250	122	60	7	9	Packer test.
29	1,395-1,500	105	57	14	4	Do.
30	641-1,500	859	290	(a)	--	Attempted fluid resistivity log while pumping; logger failed.
1977						
Jan. 11	1,425-1,670	245	36	18	2	Packer test.
13	1,525-1,670	145	52	16	3	Do.
Feb. 15	1,394-1,430	34	0.75	200+	(a)	
Aug. 4	1,394-1,430	34	.5	100	(a)	

a - Negligible.

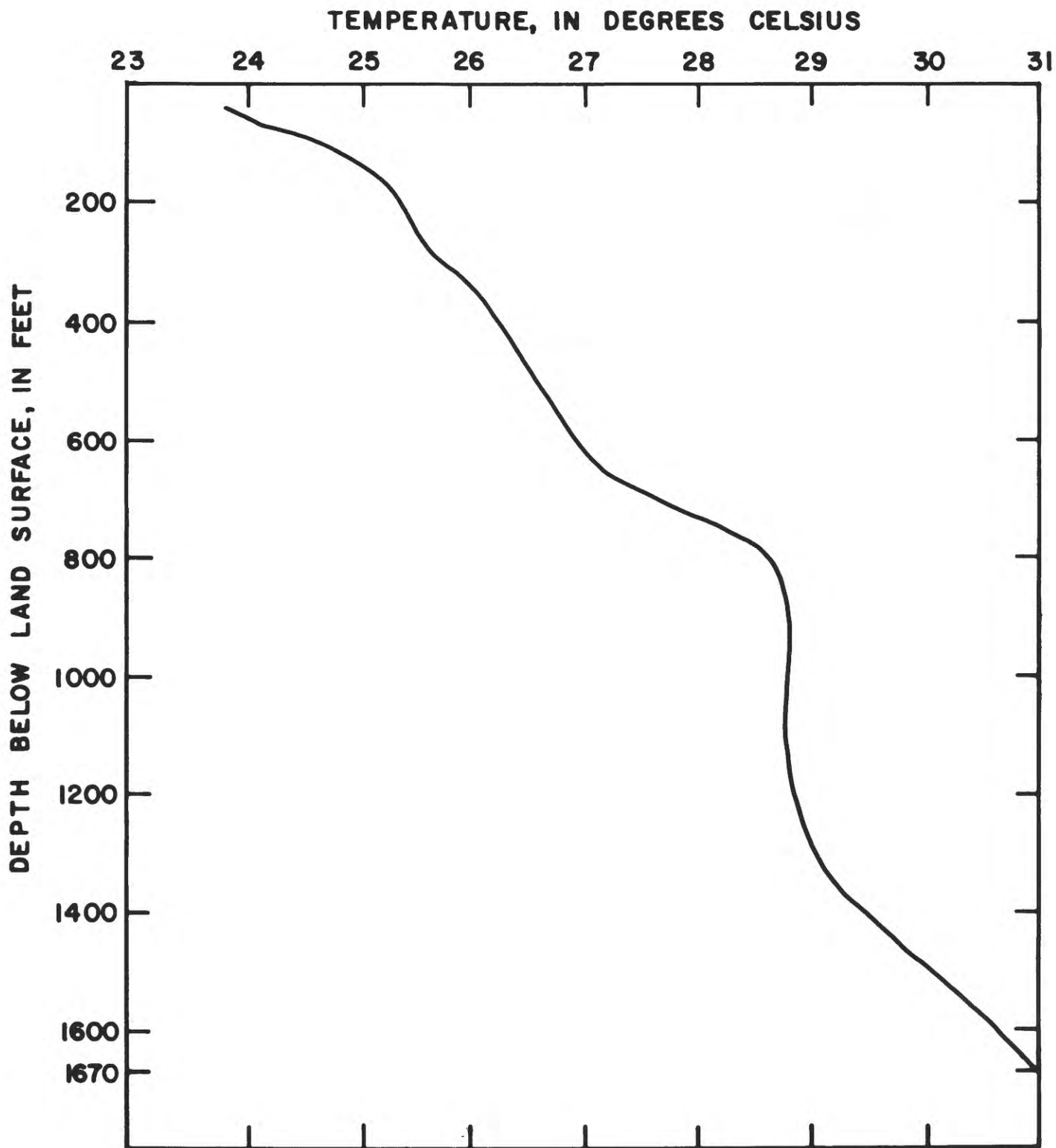


Figure 12.--Temperature profile in the Sun City chloride-monitor well.

WATER LEVELS

While drilling with the reverse air method, the water level in the well was measured each morning before drilling resumed. On figure 13 these measurements are compared with well depth and also with water levels in the nearby upper-aquifer (200-562 feet) observation well.

Table 7 lists some water-level measurements made in the two zones open to the well after the casing was installed. The two zones, as indicated earlier, are 641 to 1,100 feet and 1,394 to 1,434 feet. Also listed in table 7 are measurements of water levels in the nearby well which taps the water-yielding zone at 200 to 562 feet. Water levels in all three zones fluctuated more than 20 feet during the 7 months of record.

SUMMARY

In a test well drilled for the Southwest Florida Water Management District at Sun City Center in Hillsborough County, the interface between freshwater in the aquifer and the underlying chloride water is sharp and occurs within the depth range 1,400-1,410 feet below land surface. The chloride water is similar in composition to seawater but nearly twice as saline.

The sulfate concentration of the water in the aquifer at the well site exceeds 380 mg/L below a depth of about 700 feet. Wells for domestic and public supply in the area bottom at less than 500 feet and are separated from the sulfate water by more than 100 feet of poorly-permeable limestone.

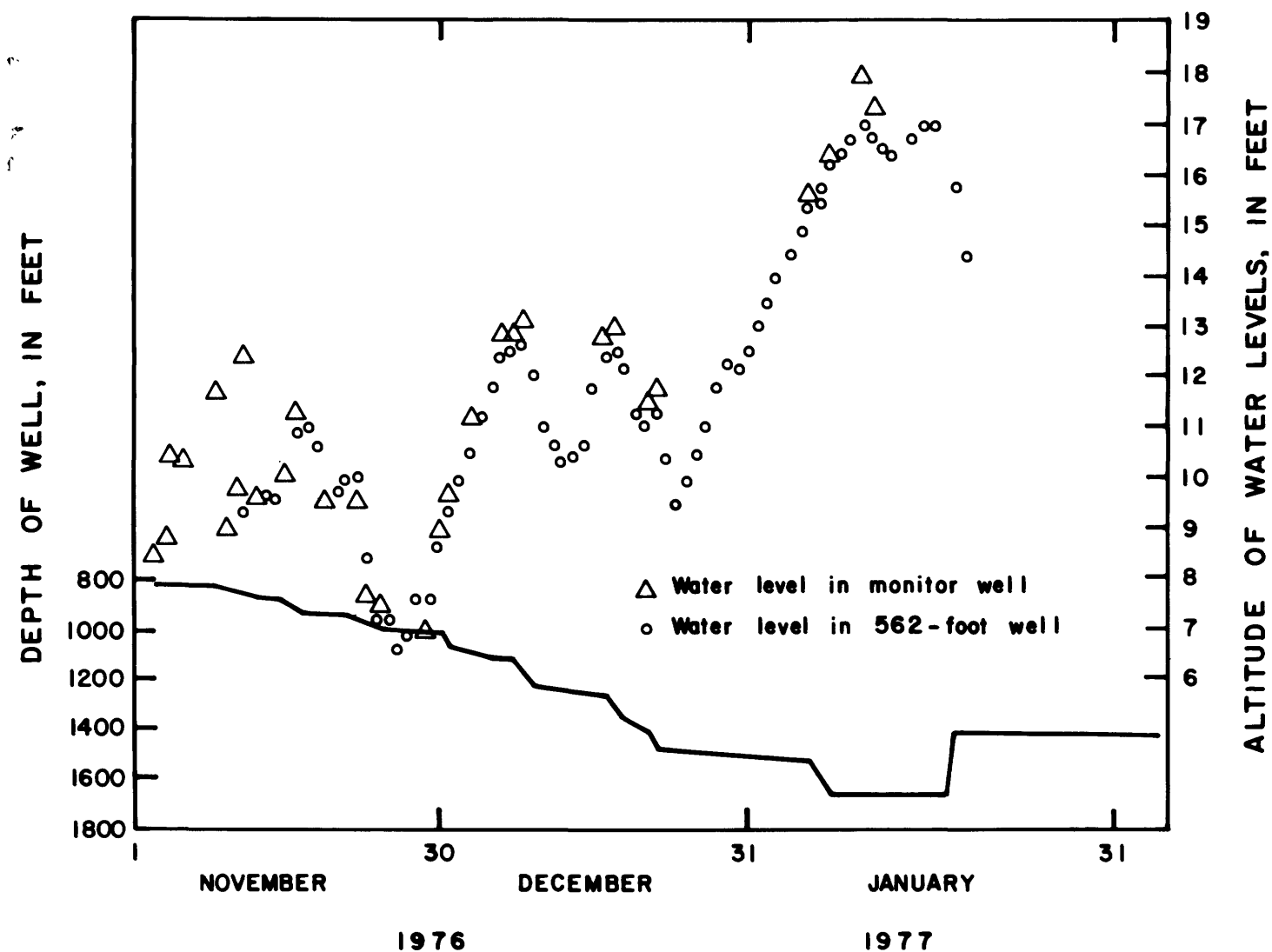


Figure 13.--Water levels in the chloride-monitor well, measured each morning before drilling resumed, compared with depth of the chloride-monitor well and water levels in the 562-foot deep well 26 feet to the south.

Table 7.--Water-level measurements in Sun City Center chloride-monitor well and in nearby well

[Water levels in sections of aquifer from 1,394 to 1,434 feet and from 641 to 1,100 feet measured in chloride-monitor well. Water levels in section of aquifer from 200 to 562 feet measured in nearby well.]

Date	Time	Elevation of water level in feet above or below (-) sea level		
		1,394 to 1,434	641 to 1,100	200 to 562
1977				
Feb. 26	0900	8.96	9.05	9.86
Mar. 17	1720	5.95	7.45	6.75
20	0930	2.27	2.58	2.53
Apr. 21	1100	-6.62	-6.94	-7.76
May 6	0930	-7.35	-6.22	-7.04
Sept. 6	1520	19.71	19.15	18.82