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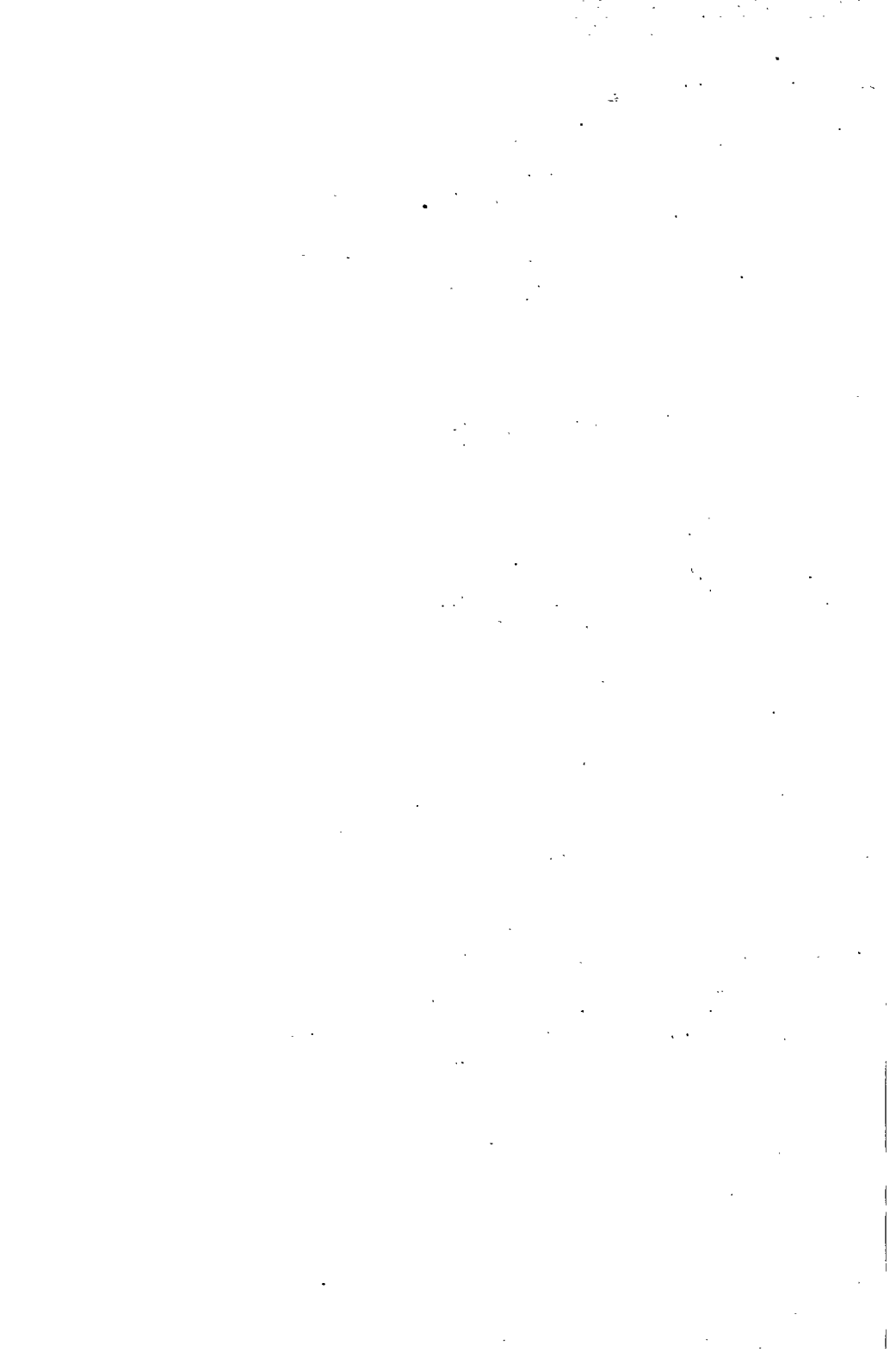
INFORMATION CIRCULAR NO. 16

CHANGES IN THE CHLORIDE CONTENT OF
GROUND WATER IN PINELLAS COUNTY, FLORIDA
BETWEEN 1947 AND 1956

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Prepared by U. S. Geological Survey
in cooperation with the Florida Geological Survey
and Pinellas County

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CHANGES IN THE CHLORIDE CONTENT OF GROUND
WATER IN PINELLAS COUNTY, FLORIDA,
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In December 1956 the U. S. Geological Survey, in cooperation with the Florida Geological Survey and the Board of County Commissioners of Pinellas County, collected water-level and chloride content of water in 94 wells in Pinellas County. The locations of these wells are shown in figure 1 and the chloride content of water from these wells is given in table 1. These wells were measured and sampled by the U. S. Geological Survey in 1947 and the data were published in the report entitled "Ground-Water Resources of Pinellas County, Florida," by R. C. Heath and P. C. Smith. That report contains also a section on salt-water encroachment in Pinellas County.

The reason for resampling and reanalyzing the water from these wells was to determine the change in the chloride content of the ground water from 1947 to 1956. The chloride content of ground water is generally a reliable indication of the contamination of ground water by sea water, as 90 percent of the dissolved solids of sea water are chloride salts. The chloride content (in parts per million) of the water from each well, in 1947 and 1956, is shown beside the proper well symbol in figure 2. A study of this figure shows that there is no definable pattern to the changes in chloride content between 1947 and 1956. During this period the chloride content increased in the water from 48 wells and decreased in that from 29 wells. The maximum increase and decrease in chloride content were found in the water from wells 49 and 67, respectively. The chloride content of water from well 49, near Lake Tarpon, increased by 1,370 ppm and that from well 67, near Palm Harbor, decreased by 2,030 ppm.

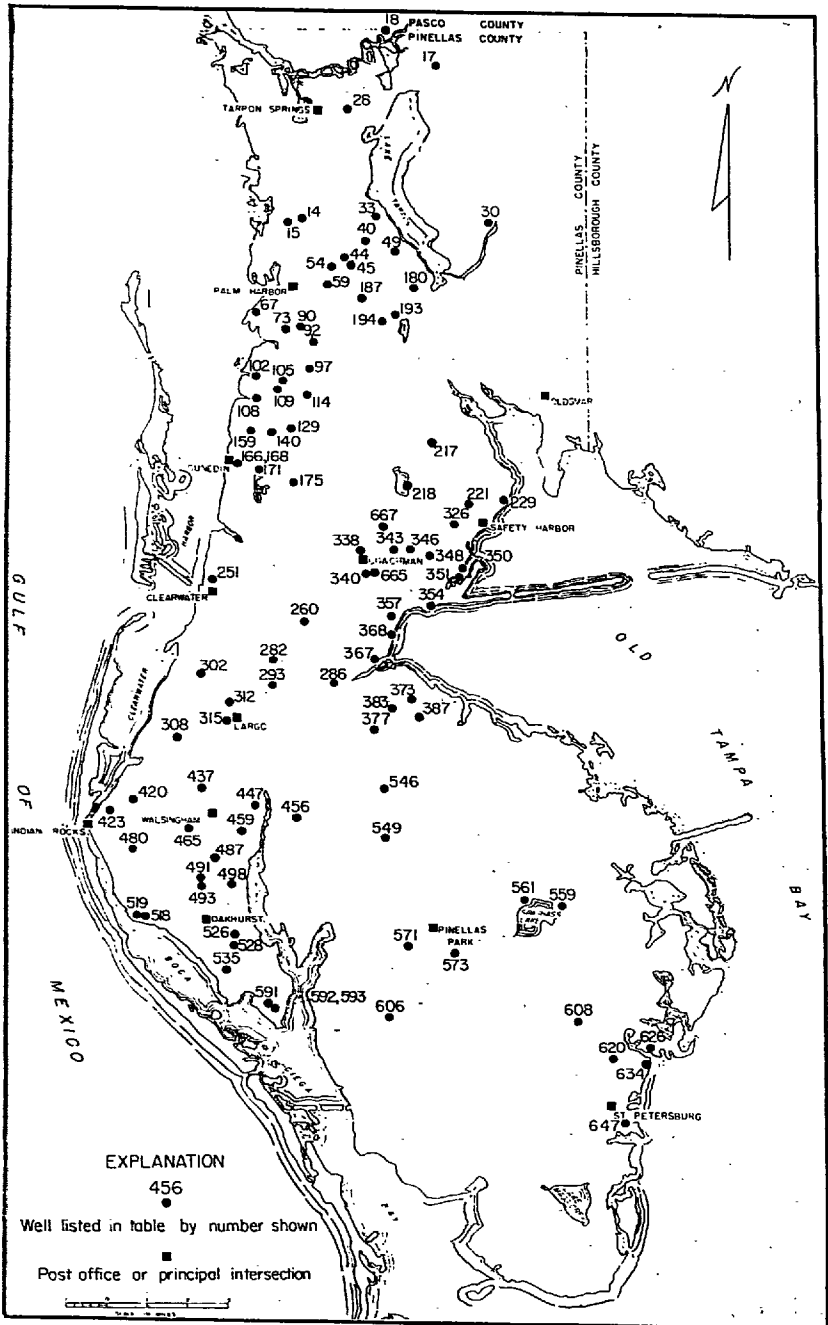


Figure 1. Map of Pinellas County showing the locations of wells from which water samples were taken for determinations of the chloride content of ground water in 1956.

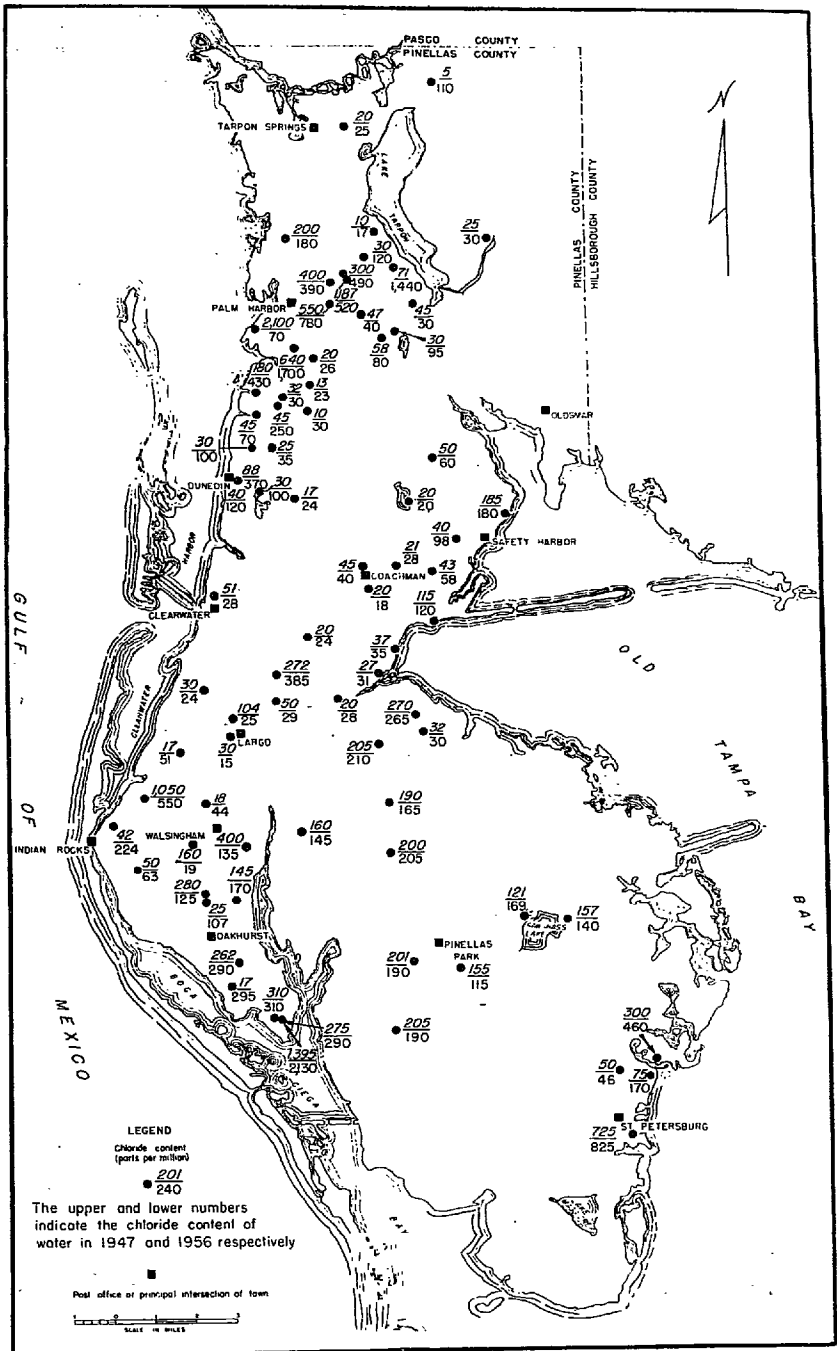


Figure 2. Map of Pinellas County showing the chloride content of water from wells in 1947 and 1956.

The irregular changes in chloride content are due partly to the fact that the wells differed considerably in depth and partly to the fact that ground-water levels were probably not the same in 1956 as they were in 1947.

In Pinellas County the chloride content of water from deep wells is generally higher than that of water from shallow wells, and the chloride content of the water from any well in the area generally increases as the well is pumped.

Water-level fluctuations in artesian wells may be caused by recharge, natural discharge, pumping, ocean tides, changing barometric pressure, and earthquakes. Fluctuation caused by tides, barometric pressure, and earthquakes are usually small and of short duration. Such fluctuations do not materially affect salt-water encroachment but are an indication of the elastic properties of the aquifer. The water-level fluctuations caused by recharge, natural and pumping discharge are important because they show changes in storage within the aquifer. These changes in storage have an appreciable effect on the encroachment of salt water into the aquifer. Figure 3 shows the mean daily water levels in three wells compared with the monthly rainfall at weather stations near the cities of Tarpon Springs, Clearwater, and St. Petersburg. This figure shows that ground-water levels respond to rainfall, thus indicating recharge to the artesian limestone aquifer. The extreme range of water-level fluctuations is not shown in figure 3, but the water levels have fluctuated during the period of record through a range of 4.07 feet in well 13, 5.49 feet in well 77, and 4.00 feet in well 561. Although the range of fluctuation is not great, the water levels were probably at different elevations during the sampling periods in 1947 and 1956.

The future ground-water observation program in Pinellas County will consist of the operation of automatic water-level recorders on six wells, the periodic measurement of water levels in four wells, and the periodic determination of the chloride content of the water from 10 wells. The locations of these observation wells are shown in figure 4. The periodic determinations of the chloride content and the water-level measurements will be made at 6-week

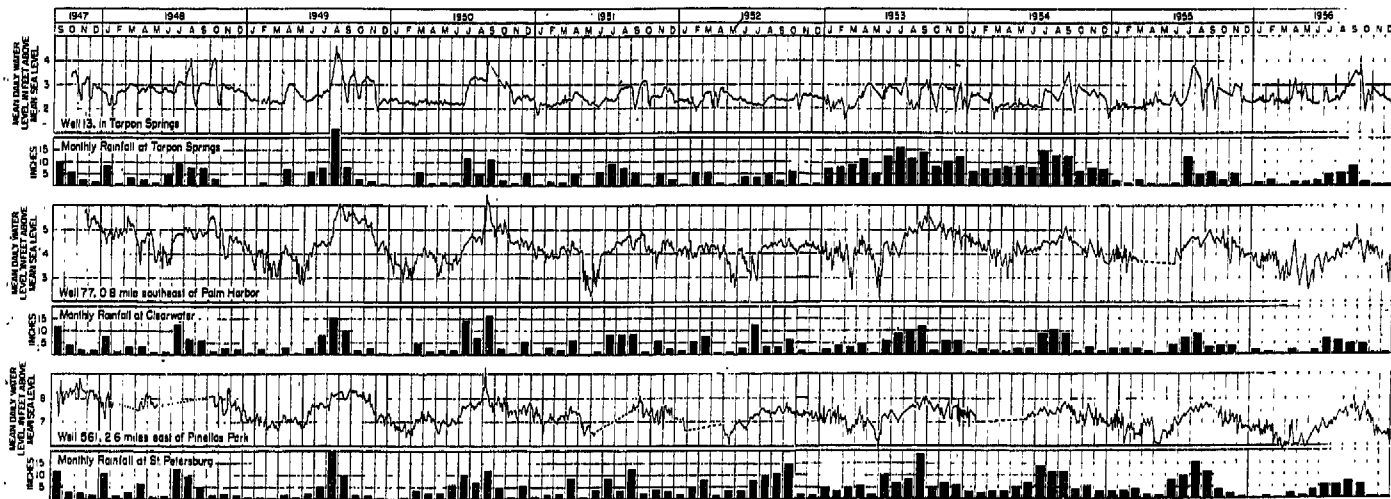


Figure 3. Hydrographs of wells 13, 77, and 561 and monthly rainfall at stations near Tarpon Springs, Clearwater, and St. Petersburg, Florida.

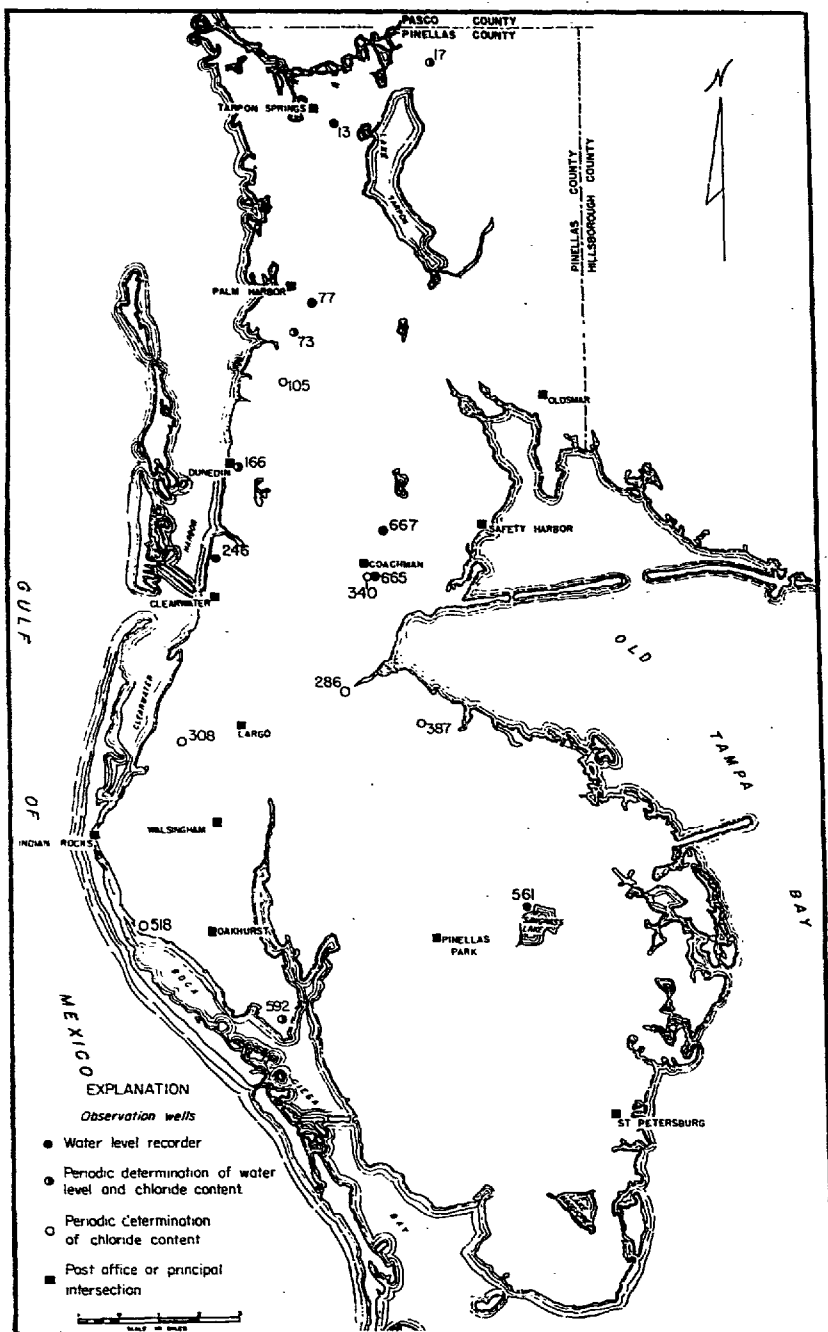


Figure 4. Map of Pinellas County showing the locations of the wells to be used for obtaining data on water levels and chloride content of water.

intervals. The chloride content of the water from a large number of wells will be determined during periods of extremely high or low water levels. In addition, water samples will be collected at different depths in a few wells to determine the chemical quality of the water in different zones of the aquifer.

Table 1. Chloride Content of Water from the Artesian Aquifer in Pinellas County

Well No.	Chloride content in ppm				Chloride change		
	Year of sampling				Increase - Decrease		
	1947	1948	1951	1956	1947- 1956	1948- 1956	1951- 1956
14	131 (1943)			140			
15	200		255	180	- 20		- 75
17	5			110	+ 105		
28	20			25	+ 5		
30	25			30	+ 5		
33	10			17	+ 7		
40	30			120	+ 90		
44	300	300		490	+ 190	+190	
45	1,187			520	- 667		
49	71			1,440	+1,369		
54	400			390	- 10		
59	550		920	780	+ 230		-140
67	2,100		340	70	-2,030		-270
	640				1,060		
73	400			1,700	+1,300		
90		25		45		+ 20	
92	20			26	+ 6		
97	13	17		23	+ 10	+ 6	
102	180			430	+ 250		
105	32	37		30	- 2	- 7	
108	45			70	+ 25		
109	45			250	+ 205		
114	10			30	+ 20		
129	25			35	+ 10		

Table 1. Chloride Content of Water from the Artesian Aquifer in Pinellas County (continued)

Well No.	Chloride content in ppm				Chloride change		
	Year of sampling				Increase - Decrease		
	1947	1948	1951	1956	1947-1956	1948-1956	1951-1956
140		25		35		+ 10	
159	30			100	+ 70		
166	80			370	+ 290		
168	40			120	+ 80		
171	30			100	+ 70		
175	17			24	+ 7		
180	45			30	- 15		
187	47			40	- 7		
193	30			95	+ 65		
194	58			80	+ 22		
217	50			60	+ 10		
218	20			20	0		
225				50			
229	185			180	- 5		
251	51			28	- 23		
260	20			24	+ 4		
282	272			385	+ 113		
286	20			28	+ 8		
293	50			29	- 21		
302	30			24	- 6		
308	17			51	+ 34		
312	104	75		25	- 79	- 50	
315	30	37		15	- 15	- 22	
326	40			98	+ 58		

Table 1. Chloride Content of Water from the Artesian Aquifer in Pinellas County (continued)

Well No.	Chloride content in ppm				Chloride change		
	Year of sampling				Increase - Decrease		
	1947	1948	1951	1956	1947-1956	1948-1956	1951-1956
338	45			40	- 5		
340	20			18	- 2		
343	21			28	+ 7		
346				34			
348	43			58	+ 15		
350		730	728	710		- 20	- 18
351		210		195		- 15	
354	115		85	120	+ 5		+ 35
357				65			
367	27			31	+ 4		
368	37			35	- 2		
373	270		265	265	- 5		0
377	205	200		210	+ 5	+ 10	
383		37		46		+ 9	
387	32		25	30	- 2		+ 5
420	1,050			550	- 500		
423	42			224	+ 182		
437	18			44	+ 26		
447		25	25	29		+ 4	+ 4
456	160			145	- 15		
459	400			135	- 265		
465	160			19	- 141		
480	50			63	+ 13		
487		25		98		+ 73	

Table 1. Chloride Content of Water from the Artesian Aquifer in Pinellas County (continued)

Well No.	Chloride content in ppm				Chloride change		
	Year of sampling				Increase - Decrease		
	1947	1948	1951	1956	1947-1956	1948-1956	1951-1956
491	280			125	- 155		
493	25			107	+ 82		
498	145			170	+ 25		
518		20		15		- 5	
519		25		20		- 5	
526		655		19		-636	
528	262			290	+ 28		
535	17			295	+ 278		
546	190			165	- 25		
549	200			205	+ 5		
559	157			140	- 17		
561	121			169	+ 48		
571	201			190	- 11		
573	155			115	- 40		
591	310			310	0		
592	1,395		1,365	2,130	+ 735		+765
593	275	300	250	290	+ 15	- 10	+ 40
606	205			190	- 15		
608		25		51		+ 26	
620	50	25		46	- 4	+ 21	
626	300		308	460	+ 160		+152
634	75			170	+ 95		
647	725		675	825	+ 100		+150

1956 sampling and field determinations of chloride by C. F. Essig and Luther Mills. Wells sampled December 10-15, 1956.