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ARIZONA STATE LAND DEPARTMENT
OBED M. LASSEN, COMMISSIONER

GROUND-WATER CONDITIONS IN McMULLEN VALLEY, MARICOPA, YUMA AND YAVAPAI COUNTIES, ARIZONA

BY P. C. BRIGGS

PREPARED BY THE GEOLOGICAL SURVEY
UNITED STATES DEPARTMENT OF THE INTERIOR

PHOENIX, ARIZONA
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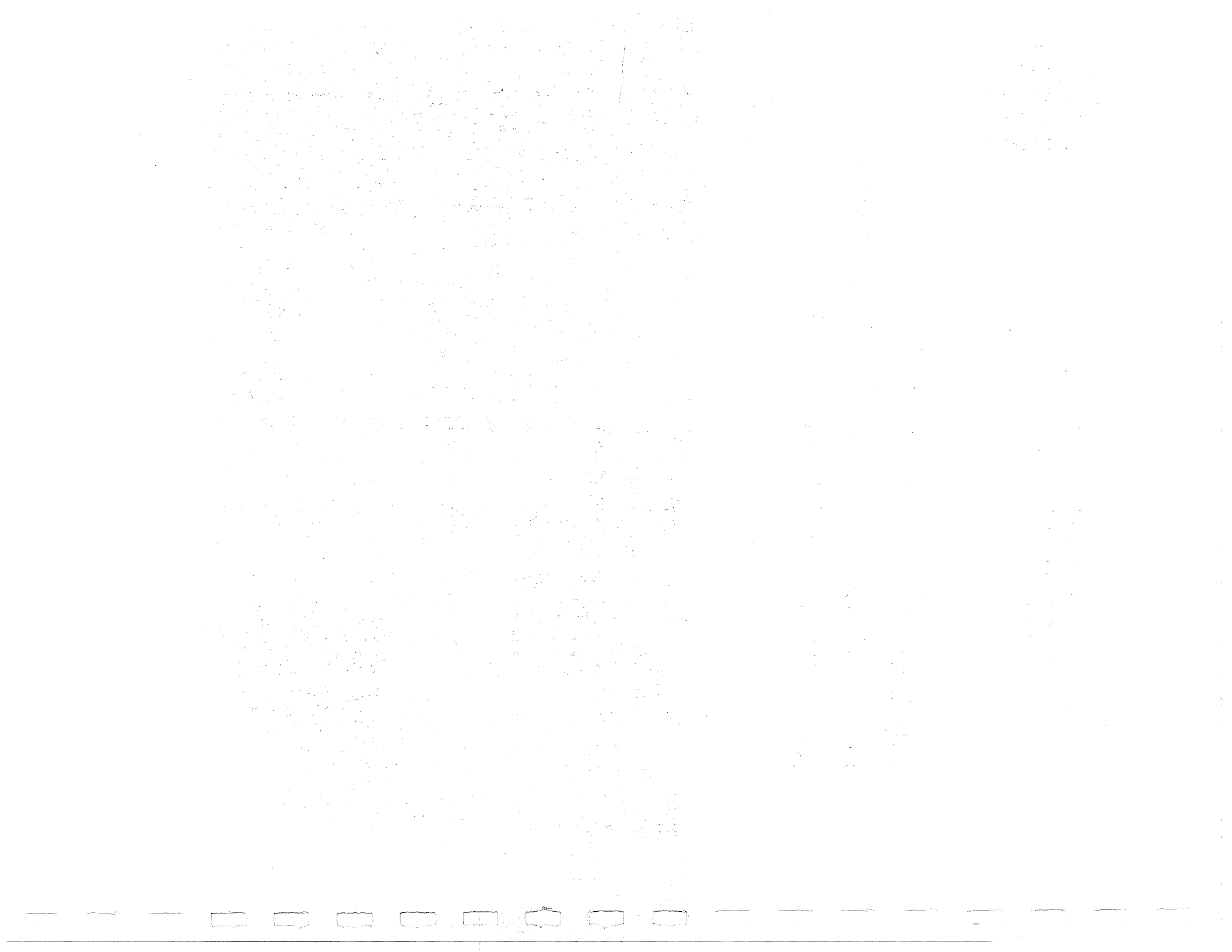

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GROUND-WATER CONDITIONS IN MC MULLEN VALLEY, MARICOPA, YUMA, AND YAVAPAI COUNTIES, ARIZONA

By

P. C. Briggs

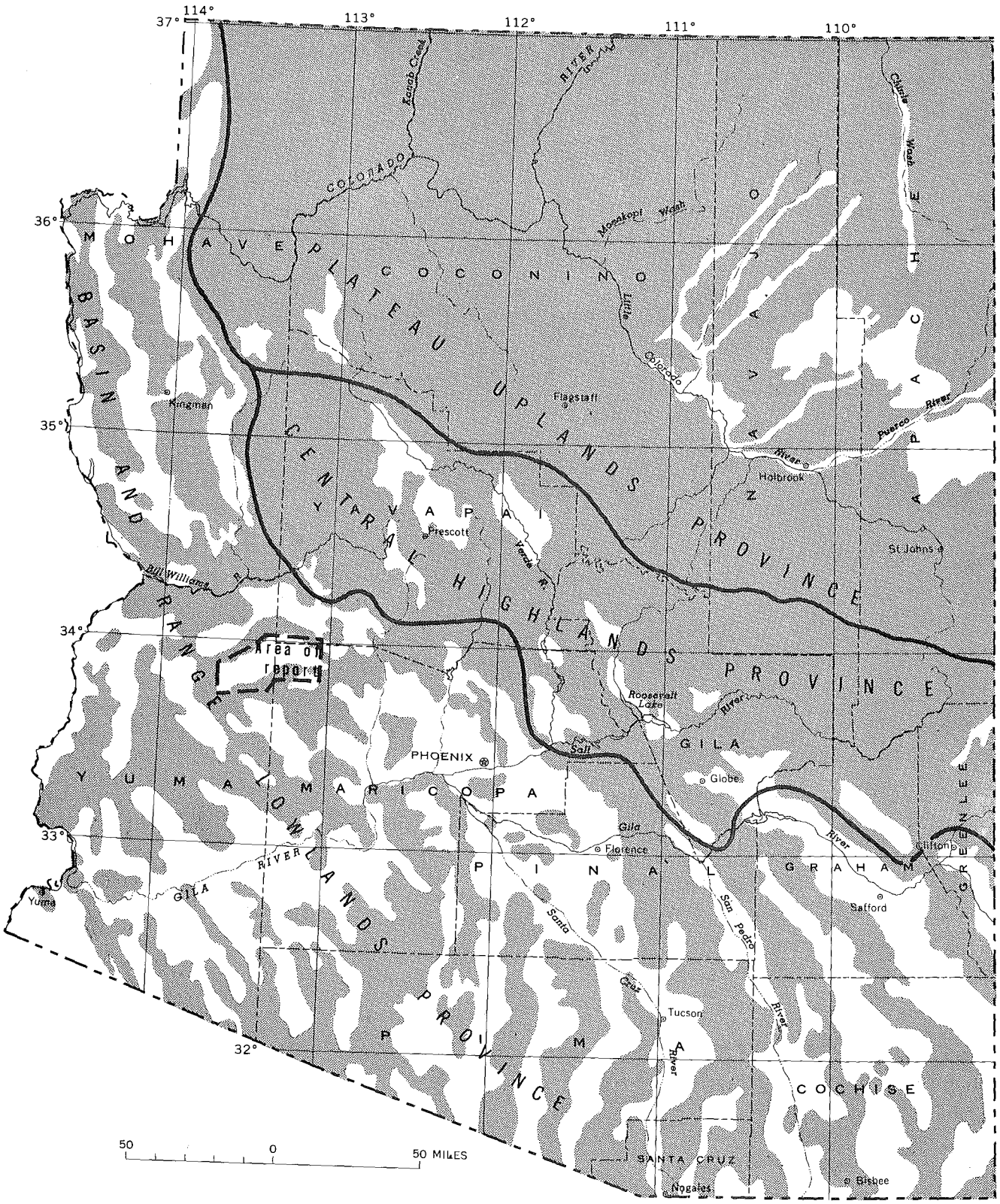
Introduction

McMullen Valley is in western Arizona about 80 miles northwest of Phoenix (fig. 1). The valley, which is about 48 miles long and 15 miles wide, is bordered on the south by the Harquahala and Little Harquahala Mountains, on the north by the Harcuvar Mountains, and on the west by the Granite Wash Mountains. The major stream in the area is Centennial Wash, an ephemeral tributary of the Gila River; the wash leaves McMullen Valley through Harrisburg Valley at the southwest edge of the area. The ground-water reservoir is the only dependable source of water in McMullen Valley (fig. 1), and it is important that this supply be managed properly in order to obtain the maximum benefit. Therefore, a comprehensive knowledge of all the factors that affect the ground-water reservoir is necessary.

The purpose of this report is to describe the ground-water conditions and water-level trends in McMullen Valley and to make available the basic hydrologic data that have been acquired since the publication of the comprehensive report (Kam, 1964). In the comprehensive report Kam (1964) described the geology of the area, the occurrence of ground water, and the use of ground water from the earliest known development in the 1900's to 1958.

For the most part, the data presented in this report were collected as a part of the continuing ground-water program of the U.S. Geological Survey, which is conducted mainly in cooperation with the Arizona State Land Department, O. M. Lassen, Commissioner. The study was conducted under the immediate supervision of H. M. Babcock, district chief of the Water Resources Division of the U. S. Geological Survey in Arizona.

Much of the basic hydrologic data for McMullen Valley is given in the tables in the appendix. Data for the wells—including date drilled, casing information, water levels, pumping data, and other information—are given in table 1. Drillers' logs of selected wells are given in table 2; chemical analyses of water from selected wells are given in table 3; and field



Alluvial contacts by M. E. Cooley, 1967

EXPLANATION

ALLUVIAL DEPOSITS

CONSOLIDATED ROCKS

FIGURE 1.--AREA OF REPORT AND ARIZONA'S WATER PROVINCES.

determinations of temperature and specific conductance of water from selected wells are given in table 4. The well locations are described by township, range, and section according to the well-numbering system used in Arizona (fig. 2).

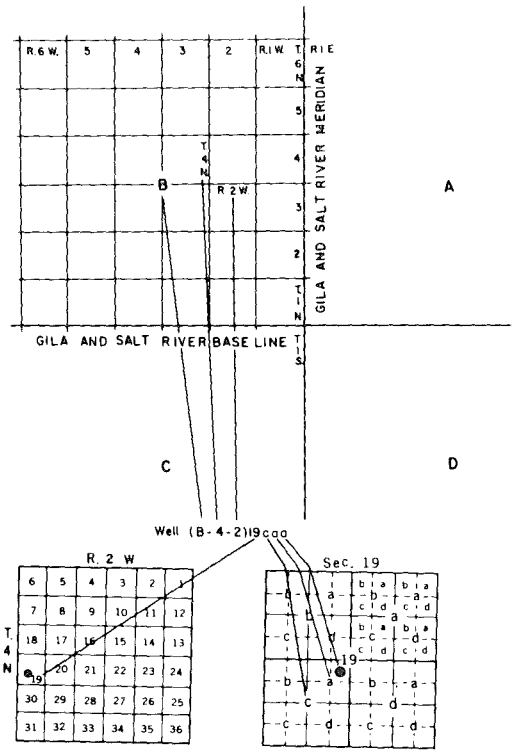
Ground-Water Development

The ground-water reservoir in McMullen Valley consists of the valley-fill deposits that occupy the structural trough between the mountains. Before pumping of ground water began, the configuration of the water table was similar to that of the land surface; however, the slope of the water table was less than the slope of the land surface, and the depth to water increased both up the valley and toward the sides (Kam, 1964, p. 32).

In McMullen Valley ground water is used for irrigation, domestic, and stock purposes. Although ground water has been used for irrigation in the valley since the early part of the century, large withdrawals were not made until 1952, when several wells were drilled south of Salome in Harrisburg Valley. In 1958 about 17 square miles of land was cultivated, and by 1965, 36 square miles was cultivated (fig. 3). The increase in cultivated acreage was accompanied by corresponding increases in the number of irrigation wells (table 1 and fig. 3) and the amount of ground water pumped.

The cultivated acreage and pumping of ground water are concentrated mainly in two areas in the valley—the Salome-Wenden area, which is near the outlet of the valley, and the Aguila area, which is about 25 miles farther upstream. In the Salome-Wenden area about 6,000 acre-feet of ground-water was withdrawn in 1953, 8,000 acre-feet was withdrawn in 1957, and 40,000 acre-feet was withdrawn in 1965. In the Aguila area large-scale irrigation began in 1954; in 1955, 2,000 acre-feet of water was withdrawn; the withdrawal has increased steadily, and in 1957, 13,000 acre-feet was withdrawn; and in 1965, 50,000 acre-feet was withdrawn. The withdrawal has caused water-level declines, changes in the flow pattern, and a decrease in the amount of ground water in storage.

In 1958, after several years of pumping, the original down-valley flow pattern was altered; in the Aguila area a cone of depression formed, and water moved into it from all sides. In the Salome-Wenden area only a small amount of pumping caused a slight decline and a lessening of the slope of the water table (fig. 4). In this report the contours of the altitude of the water level in 1958 (fig. 4) in the Salome area differ slightly from the contours shown by Kam (1964). The differences in the contours are the result of more accurate topographic data.



The well numbers used by the Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the State into four quadrants. These quadrants are designated counterclockwise by the capital letters A B, C, and D. All land north and east of the point of origin is in A quadrant, that north and west in B quadrant, that south and west in C quadrant, and that south and east in D quadrant. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract, the second the 40-acre tract, and the third the 10-acre tract. These letters also are assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre tract, three lowercase letters are shown in the well number. In the example shown, well number (B-4-2)19caa designates the well as being in the $NE\frac{1}{4}NE\frac{1}{4}SW\frac{1}{4}$ sec. 19, T. 4 N., R. 2 W. Where there is more than one well within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes.

FIGURE 2.--WELL-NUMBERING SYSTEM IN ARIZONA.

BASE MAP PREPARED FROM MAPS COMPILED BY THE BUREAU OF LAND MANAGEMENT, 1945

HYDROLOGY BY P. C. BRIGGS, 1966

EXPLANATION

VALLEY-FILL DEPOSITS NOT MAPPED SOUTH OF DRAINAGE DIVIDE

BASEMENT ROCK

CONTACT, APPROXIMATE

DRAINAGE DIVIDE

FLOOD-CONTROL DAM

CULTIVATED AREA AS OF FALL 1958

AREA BROUGHT INTO CULTIVATION BETWEEN FALL 1958 AND FALL 1965

IRRIGATION WELL (L,C)

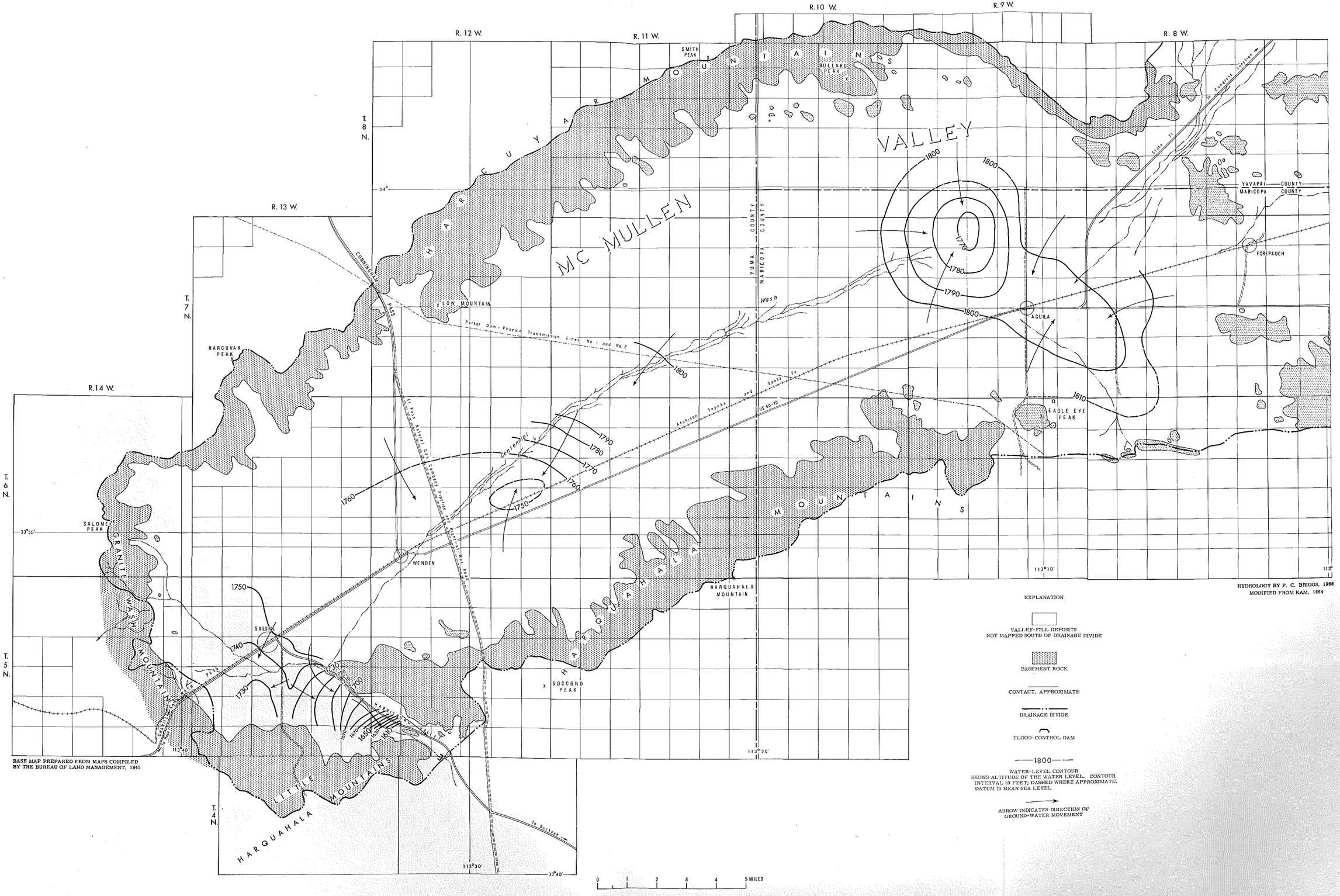
DOMESTIC OR STOCK WELL (S,H)

LETTERS INDICATE DATA FOR WELL SHOWN ELSEWHERE AS FOLLOWS:

L, DRILLER'S LOG IN TABLE 2
C, CHEMICAL ANALYSIS OF WATER IN TABLE 3
S, SPECIFIC CONDUCTANCE OF WATER IN TABLE 4
H, HYDROGRAPH IN FIGURE 6, 7, 8

—30— LINE OF EQUAL CHANGE IN WATER LEVEL INTERVAL 10 FEET; DASHED WHERE APPROXIMATE

FIGURE 3.--LOCATION OF SELECTED WELLS, CULTIVATED AREAS, AND CHANGE IN WATER LEVELS FROM FALL 1958 TO FALL 1965 IN MC MULLEN VALLEY



BASE MAP PREPARED FROM MAPS COMPILED BY THE BUREAU OF LAND MANAGEMENT, 1945

HYDROLOGY BY P. C. BRIGGS, 1966
MODIFIED FROM KAM, 1954

EXPLANATION

VALLEY-FILL DEPOSITS NOT MAPPED SOUTH OF DRAINAGE DIVIDE

BASEMENT ROCK

CONTACT, APPROXIMATE

DRAINAGE DIVIDE

FLOOD-CONTROL DAM

—1800— WATER-LEVEL CONTOUR SHOWS ALTITUDE OF THE WATER LEVEL. CONTOUR INTERVAL 10 FEET; DASHED WHERE APPROXIMATE. DATUM IS MEAN SEA LEVEL

ARROW INDICATES DIRECTION OF GROUND-WATER MOVEMENT

FIGURE 4.--WATER-LEVEL CONTOURS, FALL 1958, IN MCMULLEN VALLEY.

By 1965 the cone of depression near Aguila had enlarged, and another cone had developed near Wenden (fig. 5). The cone near Wenden extends southeast to the Harquahala Mountains and southwest to Salome; therefore, the direction of ground-water flow in that area has been reversed (fig. 5).

Changes in water levels that have resulted from the withdrawal of ground water in McMullen Valley are shown in hydrographs for individual wells (figs. 6, 7, and 8) and in the map showing contours of equal change in water level (fig. 3). The change in water level in a well at Salome is compared with the annual ground-water pumpage in the valley from 1945 to 1965 in figure 6. Changes in water levels resulting from ground-water development during the 7-year period 1958-65 are shown in figure 3. Near Aguila, the water-level decline was more than 70 feet; northeast of Wenden the decline was as much as 60 feet. In an area in Harrisburg Valley southeast of Salome there was no change in water level in the 7-year period. In well (B-5-12)32adb water-level declines were offset by water-level rises in the period (fig. 7), which resulted in no net change in water level. The water-level rises probably were caused by recharge from the surface water ponded behind the flood-control dam, which was built at the outlet to the valley in 1958. This is the only developed area in McMullen Valley where the change in water levels in observation wells was not a steady decline. The water-level decline was as much as 10 feet per year in the Aguila area in the 7-year period (fig. 8). In 1965, measured depths to water ranged from about 75 feet in Harrisburg Valley to about 500 feet east of Aguila (fig. 9).

Chemical Quality of Ground Water

The Director of the U.S. Geological Survey has approved the change from the English to the metric system in reporting of Survey water-quality data. Therefore, the water-quality data in this report are given in milligrams per liter (mg/l), degrees Celsius (°C), and micromhos at 25°C. The terms "parts per million" and "milligrams per liter" are practically synonymous for water containing as much as 5,000 to 10,000 mg/l of dissolved solids. The exact amount is dependent on the nature of the dissolved material. The Survey has set 7,000 mg/l dissolved solids as the point above which the difference in parts per million and milligrams per liter becomes significant. In order to convert data from one system to the other, a density factor must be applied to the analytical results of all water containing more than 7,000 mg/l of dissolved solids.

Temperature data given in tables 3 and 4 (see appendix) can be converted to degrees Fahrenheit (°F) by using the following:

°F	°C	°F	°C	°F	°C	°F	°C
32	0	55	13	78	26	101	38
33	1	56	13	79	26	102	39
34	1	57	14	80	27	103	39
35	2	58	14	81	27	104	40
36	2	59	15	82	28	105	41
37	3	60	16	83	28	106	41
38	3	61	16	84	29	107	42
39	4	62	17	85	29	108	42
40	4	63	17	86	30	109	43
41	5	64	18	87	31	110	43
42	6	65	18	88	31	111	44
43	6	66	19	89	32	112	44
44	7	67	19	90	32	113	45
45	7	68	20	91	33	114	46
46	8	69	21	92	33	115	46
47	8	70	21	93	34	116	47
48	9	71	22	94	34	117	47
49	9	72	22	95	35	118	48
50	10	73	23	96	36	119	48
51	11	74	23	97	36	120	49
52	11	75	24	98	37	121	49
53	12	76	24	99	37	122	50
54	12	77	25	100	38		

The chemical quality of water—that is, the amount and type of dissolved solids the water contains—determines its suitability for use by plant and animal life. Table 3 contains chemical analyses of water from selected wells, and field determinations of the specific conductance (expressed in micromhos at 25°C) of water from selected wells are given in table 4. The total dissolved-solids content of water is about 0.6 times the specific-conductance value.

The U.S. Public Health Service (1962) has established chemical-quality standards for public drinking water. All the water samples analyzed from McMullen Valley contained less than the maximum allowable limit of dissolved solids—500 mg/l. The fluoride content of the water, however, is from two to 10 times the maximum recommended for drinking water. In general, the water is well suited for irrigation use because of the low dissolved-solids content, but in places the different dissolved constituents limit its use, depending on the soil type and crop being grown.

R.17 W. R.16 W. R.15 W. R.14 W.

T. 8 N. T. 7 N. T. 6 N. T. 5 N. T. 4 N. T. 3 N. T. 2 N.

EXPLANATION

975

WELL IN WHICH WATER LEVEL WAS MEASURED IN 1967 NUMBER (975) IS ALTITUDE OF WATER LEVEL, IN FEET ABOVE MEAN SEA LEVEL

960

WATER-LEVEL CONTOUR SHOWS ALTITUDE OF THE WATER LEVEL. CONTOUR INTERVAL 20 FEET; DATUM IS MEAN SEA LEVEL

GENERALIZED GROUND-WATER FLOW LINE

BASE FROM U.S. GEOLOGICAL SURVEY

114°

113°45'

33°45'

1 0 1 2 3 4 MILES

HYDROLOGY BY P. C. BRIGGS, 1968

FIGURE 5.--WATER-LEVEL CONTOURS AND GENERALIZED FLOW PATTERN, 1967, IN THE RANEGRAS PLAIN.

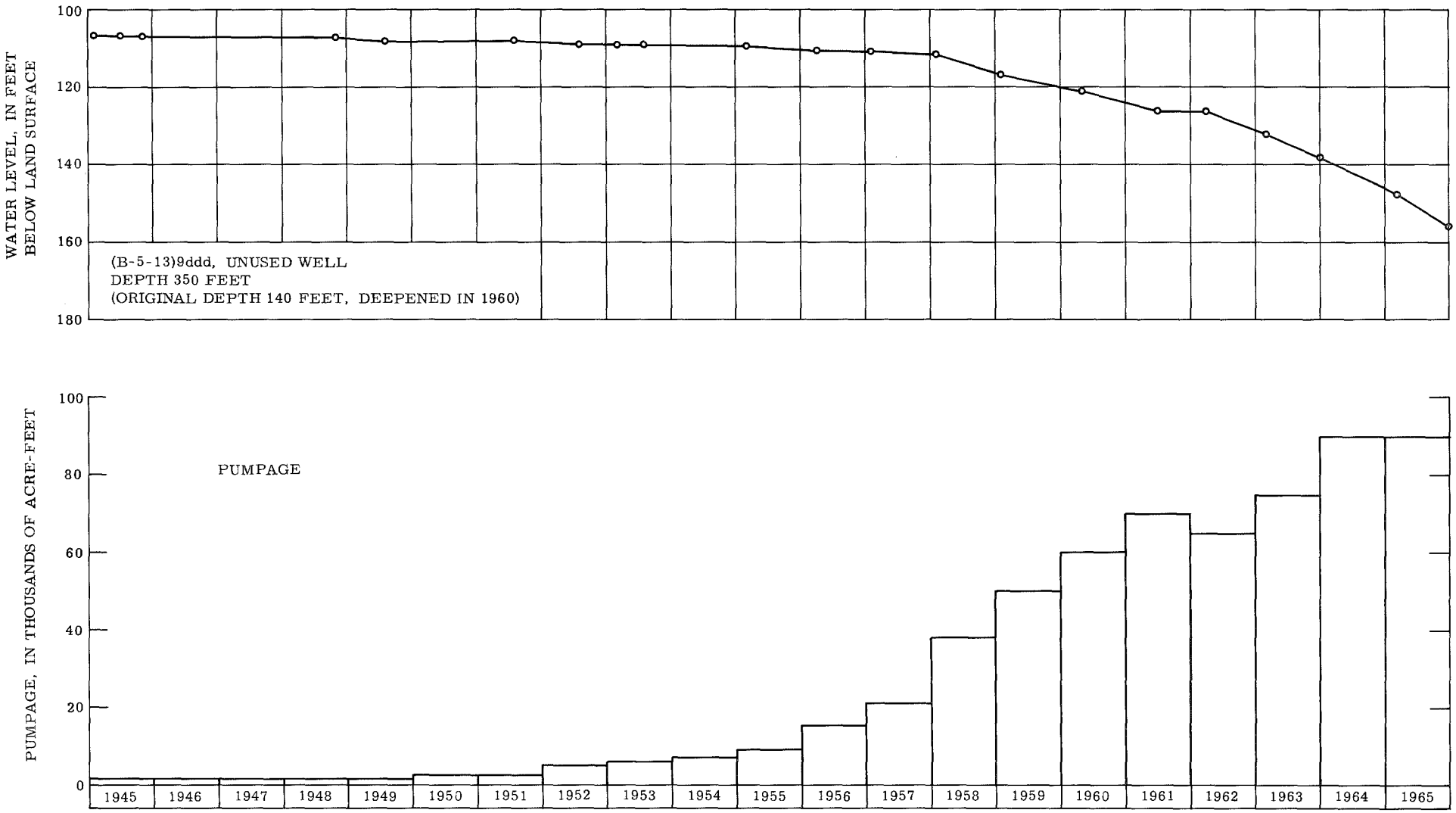


FIGURE 6.--WATER LEVELS IN A REPRESENTATIVE WELL AND ANNUAL PUMPAGE.

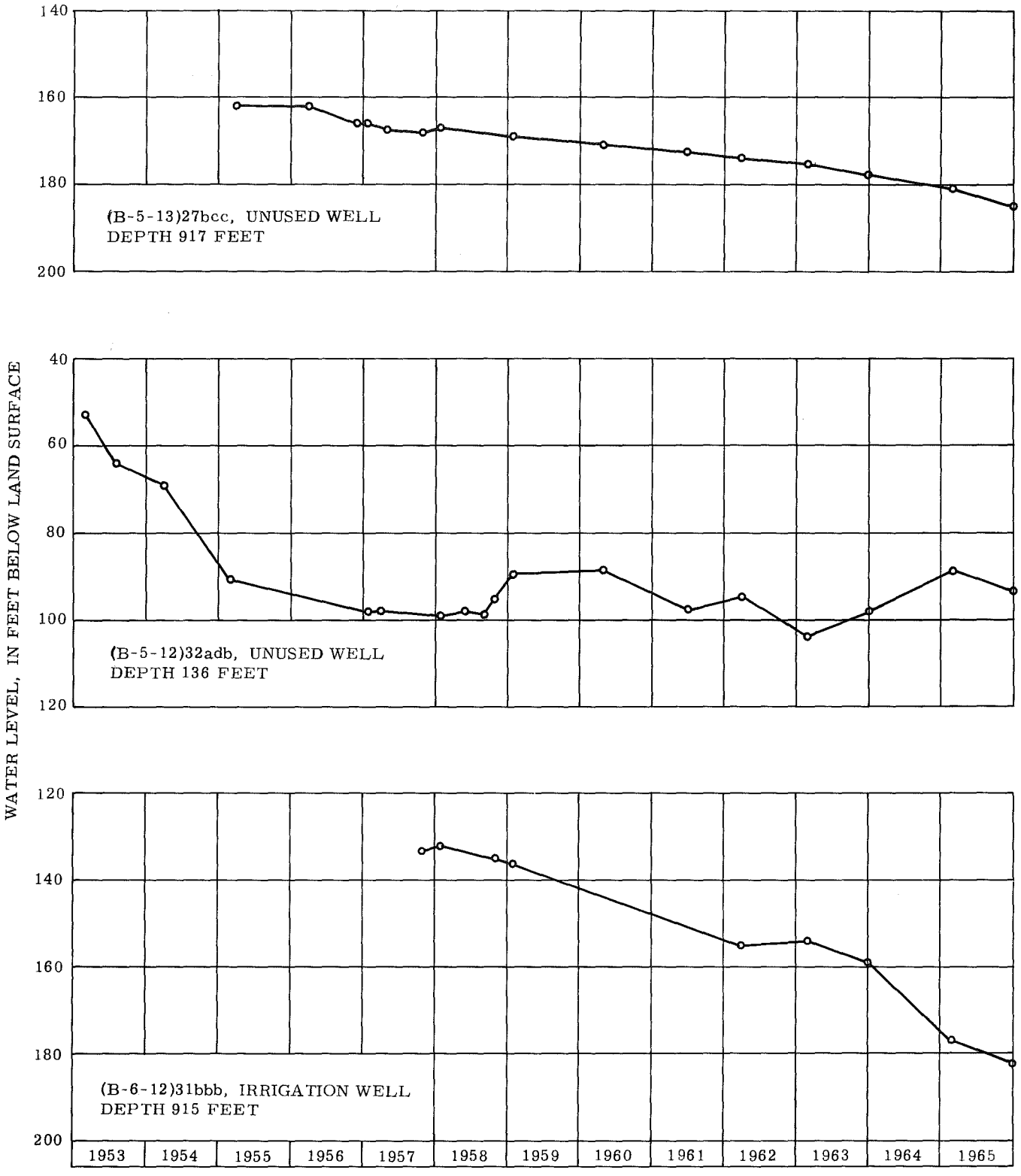


FIGURE 7.--WATER LEVELS IN SELECTED WELLS IN THE SALOME-WENDEN AREA.

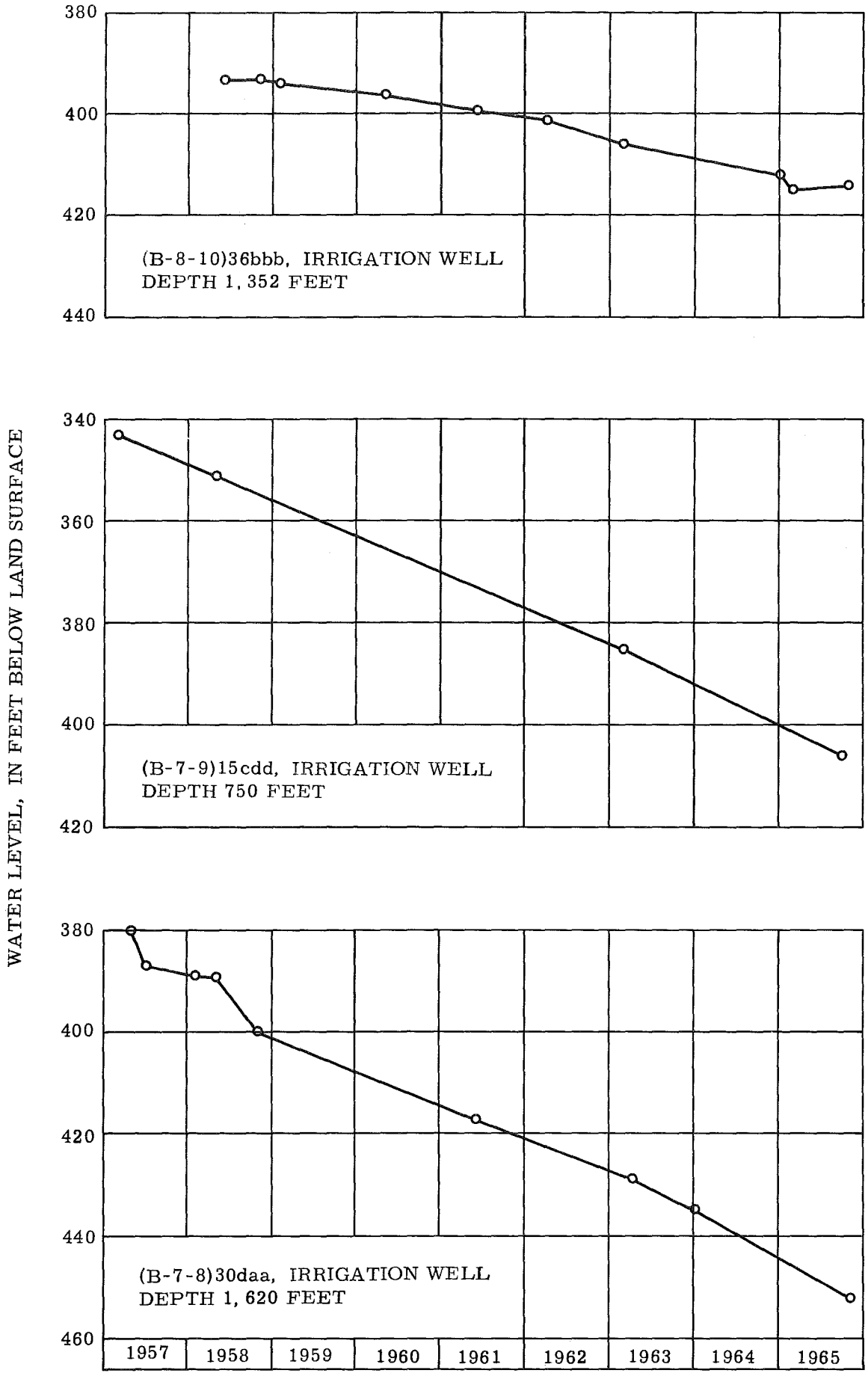


FIGURE 8.--WATER LEVELS IN SELECTED WELLS IN THE AGUILA AREA.

Summary

Pumping of ground water in McMullen Valley is concentrated mainly in two areas—the Salome-Wenden area, which is near the outlet of the valley, and the Aguila area, which is about 25 miles farther upstream. In the Salome-Wenden area about 8,000 acre-feet of ground water was withdrawn in 1957 and about 40,000 acre-feet was withdrawn in 1965; in the Aguila area 13,000 acre-feet was withdrawn in 1957 and 50,000 acre-feet was withdrawn in 1965. The withdrawal has caused water-level declines, changes in the flow pattern, and a decrease in the amount of ground water in storage. Near Aguila, the water-level decline was more than 70 feet, and northeast of the Wenden area the decline was as much as 60 feet in the 7-year period 1958-65. In an area in Harrisburg Valley southeast of Salome there was no net change in water level in the 7-year period. Rises in water level, which offset declines, probably were caused by recharge from the surface water ponded behind a flood-control dam.

In general, the ground water in McMullen Valley is well suited for irrigation because of the low dissolved-solids content, but in places the different dissolved constituents limit its use, depending on the soil type and crop being grown. The fluoride content of the water, however, is from two to 10 times the maximum recommended for drinking water.

Literature Cited

Kam, William, 1964, Geology and ground-water resources of McMullen Valley, Maricopa, Yavapai, and Yuma Counties, Arizona: U.S. Geol. Survey Water-Supply Paper 1665, 64 p.

U.S. Public Health Service, 1962, Drinking water standards: U.S. Public Health Service Pub. 956, 61 p.

R. 14 W. R. 13 W. R. 12 W. R. 11 W. R. 10 W. R. 9 W. R. 8 W.

T. 8 N. T. 7 N. T. 6 N. T. 5 N. T. 4 N.

34° 33°50' 33°40'

113°30' 113°20' 113°10' 113°

MC MULLEN VALLEY

HARCUVAR MOUNTAINS

SMITH PEAK

BULLARD PEAK

HARCUVAR PEAK

LOW MOUNTAIN

CUNNINGHAM PASS

Parker Dam - Phoenix Transmission Lines No. 1 and No. 2

EL PASO NATURAL GAS CO. 30-INCH LOOP LINE

EL PASO NATURAL GAS CO. 24-INCH LINE

SALOME PEAK

GRANITE WASH MOUNTAINS

SALOME

WENDEN

HARQUAHALA MOUNTAINS

HARQUAHALA MOUNTAIN

SOCCORO PEAK

LITTLE HARQUAHALA MOUNTAINS

EAGLE EYE PEAK

FOREPAUGH

YAVAPAI COUNTY

MARICOPA COUNTY

ATCHISON, TOPEKA AND SANTA FE RAILWAY

SANTA FE, PRESCOTT AND PHOENIX RAILWAY

U.S. HIGHWAY 60

U.S. HIGHWAY 60-70-89

To BUCKEYE

BASE MAP PREPARED FROM MAPS COMPILED BY THE BUREAU OF LAND MANAGEMENT, 1945

0 1 2 3 4 5 MILES

HYDROLOGY BY P. C. BRIGGS, 1966

EXPLANATION

BASEMENT ROCK

CONTACT, APPROXIMATE

DRAINAGE DIVIDE

FLOOD-CONTROL DAM

DEPTH TO WATER IN VALLEY-FILL DEPOSITS, IN FEET BELOW LAND SURFACE

- 50-100
- 100-150
- 150-200
- 200-250
- 250-300
- 300-350
- 350-400
- 400-450
- 450-500
- NO WATER-LEVEL DATA OR NOT ANALYZED

AREA BOUNDARY
DASHED WHERE APPROXIMATELY LOCATED

APPENDIX —— BASIC DATA

Table 1.--Records of selected wells in McMullen Valley

Location: See p. 4 for description of well-numbering system.
Land-surface altitude: Determined from Geological Survey topographic maps.
Water level: R, reported.
Log: L, driller's log in table 2.

Chemical analysis: C, chemical analysis in table 3.
Remarks: H, hydrograph shown in figures 6, 7, or 8; S, specific conductance in table 4; WL, additional water-level measurements available in U.S. Geological Survey files.

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
Salome-Wenden area													
(B-5-12)6cab....	1930	240	Uncased	.....	1,840	77 48 38	2/51 10/58 12/65	....	.....	.....	....	.....	Windmill; water level affected by stream-flow.
30bcc1 ..	.....	98	16	48- 98	1,746	56 64 75	11/56 10/58 12/65	....	.....	.....	....	.....	
30bcc2 ..	1965	500	16	.....	1,746	41 62	2/51 9/57	....	.....	.....	....	.....	Originally drilled to 250 feet in 1950, deepened in 1965.
30da....	.....	340	20	.....	1,770	130 134	1/57 10/58	....	.....	.....	....	.....	
30db....	1952	500	16	.....	1,760	98 100	5/57 10/58	....	.....	.....	....	.....	
30dcc...	1951	174	16	0-154	1,718	92 86	1/57 12/65	410	173	9/65	....	.....	
30ddc...	1952	400	16	50-200	1,729	95 115	2/53 12/65	....	.....	.....	....	.....	
31aaa...	1952	265	16	47-150	1,714	124	12/65	1,080	144	9/65	....	C	
31aab...	1951	173	16	.....	1,718	104 109 102	1/57 10/58 12/65	....	.....	.....	....	.....	
31ab1...	.....	300	14	.....	1,719	100 102	1/57 10/58	....	.....	.....	....	.....	
32adb...	.....	136	16	.....	1,698	53 95 94	2/53 10/58 12/65	....	.....	.....	....	.....	H, WL.
32add...	1940	135	24	.....	1,697	41 101 90	10/51 1/57 12/65	....	.....	.....	....	.....	
(B-5-13)1cba....	1958	730	20	.....	1,858	107 106 151	6/58 10/58 12/65	....	.....	.....	....	.....	WL.
2baa....	1957	692	.....	.....	1,898	140 147	1/57 10/58	1,130	.....	9/65	....	.....	
2cbb....	1963	700	18	200-700	1,890	184	12/65	2,120	225	9/65	L	.....	
3abb....	1965	....	20	.....	1,923	201	12/65	....	.....	.....	....	.....	

Table 1. --Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
(B-5-13)4cbb. . . .	. . . . .	350	14	. . . . .	1,964	208 216 251	3/55 10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
4ccb. . . .	1956	350	16	30-350	1,953	201 205 243	10/57 10/58 12/65	1,070	. . . . .	9/65	. . .	. . . . .	
5aab. . . .	1962	. . . .	. . . . .	. . . . .	2,000	279	12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
5cbb. . . .	1958	755	16-12	. . . . .	2,018	280 299	3/63 12/65	. . . .	. . . . .	. . . . .	L	. . . . .	WL; originally drilled to 555 feet, deepened in 1958.
8aba. . . .	1959	400	16	200-400	1,954	243	12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
8daa. . . .	1962	504	16	200-504	1,922	182 211	3/62 12/65	1,780	252	9/65	. . .	. . . . .	WL.
9bab. . . .	1958	379	16	180-379	1,935	182 223	1/59 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	WL.
9ddd. . . .	1960	350	6	. . . . .	1,866	107 115 156	1/45 10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	H, WL; originally drilled to 140 feet in 1944, deepened in 1960.
10bbb . . .	1957	504	20	160-499	1,904	148 151 193	11/57 10/58 12/65	2,760	. . . . .	9/65	. . .	. . . . .	
10ccc . . .	1965	906	20-16	200-906	1,863	153	12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
10cdb . . .	1965	918	18	247-907	1,860	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	L	. . . . .	
10dba . . .	1958	. . . .	. . . . .	. . . . .	1,859	108 152	10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
11baa . . .	1958	. . . .	14	. . . . .	1,860	108 127	10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	Perched water level.
12bbb . . .	1963	290	20	160-290	1,842	136	12/65	1,280	227	9/65	. . .	. . . . .	
14bbb1 . .	. . . . .	180	18	. . . . .	1,831	75 80 124	1/57 10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
14bbb2 . .	1964	605	18-16	93-301 300-590	1,830	74 123	1/57 12/65	985	146	10/65	. . .	. . . . .	Originally drilled to 301 feet in 1948, deepened in 1964.
14cbb . . .	. . . . .	100	54	. . . . .	1,816	55 64	3/46 10/58	. . . .	. . . . .	. . . . .	. . .	. . . . .	
15bab . . .	1957	662	20-16	. . . . .	1,853	99 103 146	4/57 10/58 12/65	. . . .	. . . . .	. . . . .	. . .	. . . . .	
15caa . . .	1956	220	6	85-220	1,834	79 84	1/57 10/58	. . . .	. . . . .	. . . . .	. . .	. . . . .	
15dac . . .	1964	745	20	180-372	1,816	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	L	. . . . .	

Table 1.--Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
(B-5-13)15dbb	1965	758	20	140- 758	1,832	112	12/65	....	.....	.....	....	.....	
16bab	1926	....	6	.....	1,894	139 184	1/57 12/65	....	.....	.....	....	.....	
16ddc	1958	....	.....	.....	1,853	140	12/65	....	.....	.....	....	.....	
17dcc2	1963	220	8	.....	1,900	156 187	2/57 12/65	....	.....	.....	....	.....	Originally drilled to 100 feet, deepened in 1963.
21acc	1963	800	16	221- 800	1,869	148	12/65	....	.....	.....	L	.....	
21dcc	1952	550	16	132- 550	1,893	158 163 170	11/56 10/58 12/65	....	.....	.....	....	.....	
23dcc1	1916	365	20	.....	1,796	81 95	10/58 12/65	....	.....	.....	....	.....	
26acc	1954	570	20-16	.....	1,804	92 88 111	1/57 10/58 12/65	....	.....	.....	....	.....	
26bab	1965	....	.....	.....	1,808	107	12/65	....	.....	.....	....	.....	
26dcc	1957	998	20	368- 608	1,803	89 87 131	7/57 10/58 12/65	1,050	428	9/65	....	.....	
27bcc	1953	917	20	.....	1,904	162 169 185	3/55 10/58 12/65	....	.....	.....	....	.....	H, WL.
28acc	1953	723	16	122- 450	1,918	195 196 198	11/56 10/58 12/65	....	.....	.....	....	.....	
(B-6-11)5add	.....	800	16	.....	1,991	203	12/65	....	.....	.....	....	.....	
5bcc	.....	....	.....	.....	1,970	177 177 175	4/54 10/58 12/65	....	.....	.....	....	.....	
13bbb	1957	412	8	.....	2,174	362 391	5/57 10/58	....	.....	.....	....	.....	
31aad1	.....	....	6	.....	2,158	416 420	10/57 10/58	....	.....	.....	....	.....	Abandoned.
31aad2	1964	....	8	.....	2,158	474	12/65	....	.....	.....	....	.....	Stock well.
(B-6-12)13cdc	1963	1,200	20	350-1,200	1,960	274	12/65	1,970	.....	9/65	....	.....	
13dcc	1957	1,200	20-16	350-1,193	1,971	223 225 280	6/57 10/58 12/65	2,830	.....	9/65	....	.....	
13ddd	1955	1,196	20-16	77-1,195	1,982	230 288	1/57 12/65	2,030	.....	9/65	....	C	

Table 1.--Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
(B-6-12)15bbb	1958	1,432	16-12	950-1,000 1,200-1,425	1,955	230 199	7/58 12/65	.....	.....	.....	...	.....	WL.
18cdb2	1958	.....	.....	.....	1,977	217 249	10/58 12/65	.....	.....	.....	...	.....	
19aab	1965	1,155	.....	.....	1,955	233	12/65	.....	.....	.....	...	.....	
19bba	.....	.....	.....	.....	1,967	243	12/65	.....	.....	.....	...	.....	
19bbb	.....	.....	.....	.....	1,972	178	12/65	.....	.....	.....	...	.....	Perched water level.
19dbb	1956	1,000	16-12	.....	1,940	168 185 118	11/56 10/58 12/65	.....	.....	.....	...	.....	Perched water level; deepened in 1956.
21dcb	.....	135	36x48	.....	1,893	104 103	1/57 10/58	.....	.....	.....	...	.....	
22add	1957	943	22-20-16	.....	1,924	168 174 236	6/57 10/58 12/65	.....	.....	.....	...	.....	
22bbb	1961	1,500	.....	.....	1,914	126	12/65	.....	.....	.....	...	.....	Perched water level.
24dbd	1961	620	.....	.....	1,998	308	12/65	.....	.....	.....	...	.....	
30cbc	1961	845	16	500- 600	1,899	191	12/65	.....	.....	.....	...	.....	
30ddb	.....	.....	.....	.....	1,889	188	12/65	1,170	.....	10/65	...	.....	
31bbb	1957	915	20-16	.....	1,889	134 136 182	10/57 10/58 12/65	1,720	284	9/65	...	.....	H, WL.
32ddd	1965	.....	16	.....	1,903	203	12/65	.....	.....	.....	...	.....	
(B-6-13)25bda	.....	1,312	.....	500-1,312	1,933	218	12/65	.....	.....	.....	...	.....	
25ccb	1964	1,400	16	500-1,400	1,926	217	12/65	.....	.....	.....	L	.....	
26cbb	.....	.....	20	.....	1,970	241	12/65	.....	.....	.....	...	.....	
35abb	1963	800	20	300- 800	1,931	216	12/65	.....	.....	.....	...	.....	
35cbb	1963	900	20	300- 900	1,927	212	12/65	1,530	.....	9/65	L	.....	
36abb	.....	.....	.....	.....	1,902	198	12/65	1,365	.....	9/65	...	.....	
36acb	.....	.....	.....	.....	1,895	192	12/65	1,790	.....	9/65	...	.....	
36bcb	1963	897	16	300- 897	1,910	200	12/65	.....	.....	.....	L	.....	
36cbc	.....	.....	.....	.....	1,893	173	12/65	.....	.....	.....	...	.....	

Table 1.--Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
Aguila area													
(B-7-8)1daa	1916	466	10- 6	.....	2,305	.....	.....	.....	.....	.....	...	C	
1dac	1953	499	.....	.....	2,305	.....	.....	.....	.....	.....	...	C	
12cdc	1915	510	6	.....	2,310	430 432	4/60 10/65	.....	.....	.....	...	.....	WL.
15baa	1958	1,812	.....	.....	2,257	442 R 494	10/58 10/65	1,170	655	8/65	L	.....	S, WL.
16aaa	1958	1,627	20-16	400-1,627	2,249	435 433 485	7/58 10/58 10/65	1,480	616	8/65	...	.....	WL.
20ddd	1958	1,000	20-18	480- 565 568-1,000	2,224	412 466	9/58 10/65	.....	.....	.....	...	.....	WL.
29ddd	1957	1,720	20-12	400-1,720	2,225	417 417	10/57 4/58	1,630	.....	9/65	L	.....	S.
30daa	1957	1,620	20-12	.....	2,199	380 400 452	4/57 10/58 10/65	.....	.....	.....	...	.....	H, S, WL.
32add	1959	1,700	20	.....	2,226	490	12/65	2,000	651	8/65	...	.....	S; originally drilled to 300 feet in 1958, deepened in 1959.
32ccc2	1963	608	8	200- 608	2,203	453	10/65	.....	.....	.....	...	.....	Domestic water supply.
32ddd	1958	1,265	20-18	500-1,140 1,145-1,265	2,227	418 493	6/58 12/65	365	573	8/65	...	.....	S.
33add	1963	1,442	20-16	300-1,442	2,258	.....	.....	882	.....	10/65	L	.....	
(B-7-9)4bbb	1957	1,650	20-12	400-1,650	2,138	338 375 398	2/57 10/58 12/65	.....	.....	.....	...	C	S.
4cbb	1957	1,650	20-12	400-1,650	2,130	349 366 382	10/57 10/58 12/65	.....	.....	.....	...	C	S.
9aaa	1957	1,650	20-12	400-1,650	2,146	340 354	3/57 4/58	.....	.....	.....	L	C	
10aaa	1958	1,420	20-12	300-1,420	2,174	374 439	10/58 10/65	2,350 2,360	 558	8/63 9/65	...	.....	S.
10daa	1965	1,202	18-16	441-1,202	2,166	439	10/65	.....	.....	.....	...	.....	
11aaa	1954	1,020	16-12	380-1,014	2,195	385	1/57	2,340 2,410	 526	8/63 9/65	...	.....	S.
11add	1956	1,317	20	350-1,317	2,189	379 392 454	1/57 10/58 10/65	2,810	513	9/65	...	.....	S.

Table 1.--Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
(B-7-9)11baa	1958	1,450	20-12	300-1,450	2,186	382 454	10/58 10/65	2,170 2,830	 550	7/63 9/65	.....	.....	S.
12aaa	1958	1,205	20-16	500-1,200	2,217	418 412 478	6/58 9/58 10/65	2,760 254	 535	7/63 9/65	.....	.....	S.
12add	1958	1,415	20-12	500-1,415	2,214	407	9/58	2,770	530	9/65	L	.....	
13cdd	1962	.....	10	.....	2,187	439 438	10/65 12/65	.....	.....	.....	.....	.....	
14aba	1954	717	20	385- 415 425- 712	2,177	365 437	3/54 10/65	.....	.....	.....	.....	.....	
14ccd	1910	450	13-10	357- 388	2,167	357 417	4/42 12/65	.....	.....	.....	.....	.....	
15cdd	1957	750	20	385- 750	2,153	343 351 406	2/57 4/58 9/65	.....	.....	.....	.....	.....	H.
16add	1957	1,660	20-12	400-1,660	2,145	336 342	5/57 4/58	.....	.....	.....	L	C	S.
17ada	1965	2,000	18	380-2,000	2,133	378	9/65	.....	.....	.....	.....	.....	
17dcd	1957	1,610	20-12	390-1,610	2,145	338 337 386	3/58 4/58 9/65	.....	.....	.....	.....	C	S.
20caa	1964	....	.....	.....	2,160	401	11/65	.....	.....	.....	.....	.....	
22bc	1947	380	8	.....	2,155	347 355	2/51 10/58	.....	.....	.....	.....	.....	
22dcc	1963	557	16	387- 537	2,180	426	9/65	.....	.....	.....	.....	.....	
24aaa	1958	1,562	20-12	450-1,562	2,196	.....	.....	2,710	.....	9/65	L	C	S.
25ccc	1962	1,490	.....	.....	2,194	441	12/65	.....	.....	.....	.....	.....	
(B-7-10)13cdd	1958	800	20	365- 800	2,110	305 305 343	9/58 10/58 9/65	.....	.....	.....	.....	.....	
14ccc	1965	1,000	18	350-1,000	2,086	320	9/65	.....	.....	.....	L	.....	
14dcd	1965	1,000	18	349-1,000	2,099	.....	.....	.....	.....	.....	.....	.....	
16ddd	.....	325	6	.....	2,071	264 264 275	3/57 10/58 10/65	.....	.....	.....	.....	.....	
21acb	1965	500	18	.....	2,070	274	10/65	.....	.....	.....	.....	.....	
(B-7-11)27abc	1956	340	.....	.....	2,028	227 227 226	10/57 9/58 12/65	.....	.....	.....	.....	.....	WL; stock well.

Table 1.--Records of selected wells in McMullen Valley—Continued

Well location	Date completed (year)	Depth of well (feet)	Diameter of casing (inches)	Perforated interval (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water level		Pumping data			Log	Chemical analysis	Remarks
						Depth below land surface (feet)	Date measured (month, year)	Yield (gpm)	Pumping level (feet below land surface)	Date measured (month, year)			
(B-8-9)26cca	1945	428	8	.....	2,190	379 384	1/57 10/58	.....	.....	.....	.....	.....	
26ccd	.....	.....	.....	.....	2,191	433	12/65	.....	.....	.....	.....	.....	Domestic water supply.
27dcc	.....	.....	.....	.....	2,172	.....	.....	.....	.....	.....	.....	C	Destroyed 1965.
32aaa	1954	1,352	20-12	375- 590 600-1,340	2,166	.....	.....	2,050	.....	9/65	.....	C	
32baa	1955	1,003	20-16	418-1,003	2,166	365 380 428	12/56 4/58 10/65	.....	.....	.....	.....	.....	
33aab	1965	2,100	16	390-	2,164	356 374 447	11/56 4/58 10/65	.....	.....	.....	L	C	Originally drilled to 825 feet in 1956, deepened in 1965.
33ddd	1957	1,650	20-12-8	400-1,650	2,152	348 368 436	2/57 4/58 9/65	.....	.....	.....	.....	C	
(B-8-10)35bbb	1958	1,402	20-12	350-1,402	2,209	419 427	10/58 10/65	.....	.....	.....	L	.....	WL.
36bbb	1958	1,352	20-12	287-1,352	2,198	393 393 414	5/58 10/58 10/65	.....	.....	.....	.....	.....	H, WL.
(B-8-11)36bbb	1952	500	6	420- 500	2,294	492 491	10/57 9/58	.....	.....	.....	.....	.....	

Table 2. --Drillers' logs of selected wells in McMullen Valley

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(B-5-13)2cbb					
Sandy soil	25	25	Small gravel	20	420
Red clay	75	100	Clay and coarse gravel	55	475
Brown clay, little water	60	160	Hard shell, artesian water	25	500
Brown sandy clay, more water	75	235	Blue-gray gravel, lots of water	30	530
Coarse sand and clay	5	240	Gravel and clay	70	600
Brown clay, more water	60	300	Coarse gravel	100	700
Light-brown sandy water	60	360			
Coarse gravel	40	400	TOTAL DEPTH		700
(B-5-13)5cbb					
Top soil	4	4	Conglomerate, loose, with smooth gravel	50	555
Sand and fine gravel	136	140			
Semicemented sand and gravel, with hard streaks, gray-colored binder	365	505	TOTAL DEPTH (before deepening)		555
(B-5-13)10cdb					
Surface silt and sand	40	40	Very good gravel, only finer and lighter	78	918
Boulders ground with streaks of gray clay	200	240			
Gray medium gravel and boulders	260	500	TOTAL DEPTH		918
Very good gravel	340	840			
(B-5-13)15dac					
Surface silt and sand	60	60	Streaks of sand and clay with granite	120	620
Some gravel, streaks of clay	50	110	Tight formation with few boulders and granite	125	745
Clay streaks, some boulders and sand	70	180			
Some sand with red clay	190	370	TOTAL DEPTH		745
Tight hard granite streaks, some clay	130	500			
(B-5-13)21acc					
Sandy valley fill	4	4	Granite wash with clay	42	527
Caliche	63	67	Granite wash with sand and clay, water	18	545
Gravelly clay	43	110	Granite wash	90	635
Sandy clay	15	125	Clay with a little granite wash	10	645
Granite wash with clay	43	168	Hard clay	24	669
Granite wash with clay	47	215	Granite wash with clay	23	692
Granite wash and sand, water	10	225	Caliche	11	703
Granite wash with clay	157	382	Granite wash with clay	14	717
Granite wash, water	3	385	Montmorillonite clay, granite wash	10	727
Granite wash with clay	42	427	Granite wash	73	800
Montmorillonite clay (light pink and white)	13	440			
Granite wash and clay	13	453	TOTAL DEPTH		800
Montmorillonite clay with granite wash	32	485			
(B-6-13)25ccb					
Gravel, surface	100	100	Gravel, water	700	1,400
Gravel, clay	400	500			
Clay gravel, gravel clay	200	700	TOTAL DEPTH		1,400
(B-6-13)35cbb					
Surface silt and sand	40	40	Gray and white sand, gravel, and boulders	480	900
Clay with gravel	140	180			
Clay with streaks of sand	240	420	TOTAL DEPTH		900
(B-6-13)36bcb					
Surface sand	65	65	Gravel with streaks of clay	130	690
Sandy clay	285	350	Good gravel with some clay	207	897
Sand and small gravel	135	485			
Sandy clay with streaks of gravel	75	560	TOTAL DEPTH		897

Table 2.--Drillers' logs of selected wells in McMullen Valley—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(B-7-8)15baa					
Surface sand and soil	275	275	Sand and gravel	375	1,791
Cemented conglomerate	137	412	Shale	21	1,812
Sand and shale	393	805			
Sand, streaks of shale	345	1,150	TOTAL DEPTH		1,812
Hard shale	266	1,416			
(B-7-8)29ddd					
Top soil	25	25	Clay and fine sand	280	1,380
Clay	105	130	Gravel and quartz	160	1,540
Sand and clay	150	280	Dark sand	180	1,720
Cemented sand	260	540			
Sand and gravel	220	760	TOTAL DEPTH		1,720
Coarse sand	340	1,100			
(B-7-8)33add					
Top soil	5	5	Fine sand and clay	268	1,180
Hard sand and boulders	185	190	Hard sand	130	1,310
Sandy clay	97	287	Small gravel and boulders	32	1,342
Coarse sand	212	499	Clay	64	1,406
Clay	77	576	Fine sand and rocks	36	1,442
Fine sand	117	693			
Sand and boulders	95	788	TOTAL DEPTH		1,442
Small gravel and clay	124	912			
(B-7-9)9aaa					
Clay and sand	810	810	Sand and gravel	150	1,410
Sand	25	835	Sand	240	1,650
Coarse sand	205	1,040			
Gravel, fine	220	1,260	TOTAL DEPTH		1,650
(B-7-9)12add					
Top soil	4	4	Sand and gravel with clay binder	30	1,010
Clay and small gravel	16	20	Semicemented sand and gravel	90	1,100
Clay with streaks of gravel	92	112	Cemented sand and gravel	315	1,415
Clay and gravel, some boulders	358	470			
Fine sand	20	490	TOTAL DEPTH		1,415
Sandy clay	490	980			
(B-7-9)16add					
Clay and sand	380	380	Clay and quartz	160	1,420
Clay	290	670	Coarse sand	240	1,660
Shells	165	835			
Coarse sand and gravel	425	1,260	TOTAL DEPTH		1,660
(B-7-9)24aaa					
No data	135	135	Malpais, decomposed granite, and streaks of clay	201	886
Sand and clay	47	182	Malpais and streaks of clay	22	908
Sand, black boulders, and clay	40	222	Sand and clay	22	930
Sand and clay	70	292	Lava and sand	33	963
Sandy clay	37	329	Sand, clay, and boulders	67	1,030
Cemented sand	11	340	Hard sand	12	1,042
Cemented gravel and clay streaks	33	373	Malpais streaks	55	1,097
Tight sand	22	395	Sand	55	1,152
Sand, streaks of clay	11	406	Sand and boulders	149	1,301
Tight sand and streaks of clay	11	417	Sand and malpais	11	1,312
Sand and boulders	70	487	Decomposed granite, sandy quartz	31	1,343
Malpais	11	499	Sand and decomposed granite	148	1,491
Sand	55	553	Streaks of clay	11	1,502
Sand and boulders	11	564	Decomposed granite and clay streaks	32	1,534
Sand	33	597	No data	28	1,562
Sand and boulders	66	663			
Cemented boulders	22	685	TOTAL DEPTH		1,562

Table 2.--Drillers' logs of selected wells in McMullen Valley—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(B-7-10)14ccc					
Silt and caliche	20	20	Very good coarse gravel	300	1,000
Gravel with streaks of clay	120	140			
Sand and boulders with good streaks of gravel	200	340	TOTAL DEPTH		1,000
Sand and boulders with streaks of clay	360	700			
(B-8-9)33aab					
Top soil	4	4	Clay with cemented rock	170	825
Clay, caliche	66	70			
Clay, sandstone in streaks	328	398	TOTAL DEPTH (before deepening)		825
Clay, rocks 3- to 7-inch diameter	257	655			
(B-8-10)35bbb					
Top soil	30	30	Cemented sand	330	1,170
Sand and clay	160	190	Sandy clay	190	1,360
Clay and small gravel	180	370	Conglomerate	42	1,402
Sand and gravel	210	580			
Boulders and hard sand	260	840	TOTAL DEPTH		1,402

Table 3.--Chemical analyses of water from selected wells in McMullen Valley

[Analytical results in milligrams per liter except as indicated. Dissolved solids: Dissolved-solids computed as sum of determined constituents using the carbonate equivalent of the bicarbonate ion. Source of data: U of A, University of Arizona; USGS, U. S. Geological Survey]

Well location	Date of collection	Temperature (°C)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K) 1/	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$		Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	Source of data
															Total	Noncarbonate			
Salome-Wenden area																			
(B-5-12)31aaa .	7/24/58	26	...	.....	....	.....	255	0	.....	66	.....	...	....	.....	132	0	.....	790	USGS.
	9/27/63	25	...	.....	....	.....	255	0	100	60	3.2	...	....	.....	122	0	.....	759	USGS.
(B-6-12)13ddd .	7/24/58	37	...	.....	....	.....	156	0	.....	58	.....	...	....	.....	20	0	.....	593	USGS.
	9/22/60	37	...	.....	....	.....	158	0	.....	62	.....	...	....	.....	22	0	.....	601	USGS.
	9/27/63	36	...	.....	....	.....	164	0	55	64	4.0	...	....	.....	24	0	.....	603	USGS.
Aguila area																			
(B-7-8)1daa. . .	11/ 8/52	...	...	15	4	63	171	0	10	28	5.0	...	....	209	53	0	3.8	.....	U of A.
1dac. . .	5/25/53	...	...	.....	....	.....	154	.....	80	20	.....	...	....	.....	48	0	.....	435	U of A.
(B-7-9)4bbb. . .	9/27/61	...	...	5	8	91	108	7	63	48	3.4	13	.09	291	46	0	5.8	520	U of A.
4cbb. . .	9/27/61	...	...	7	8	85	139	4	51	37	2.8	11	.07	274	51	0	5.2	460	U of A.
9aaa. . .	9/27/61	...	...	12	10	77	158	2	51	32	2.8	9	.09	274	70	0	4.0	480	U of A.
16add. .	9/27/61	...	...	7	14	63	152	2	45	24	2.8	4	.07	237	75	0	3.2	440	U of A.
17dcd. .	9/27/61	...	...	14	14	74	150	3	77	30	2.2	4	.05	292	92	0	3.4	470	U of A.
24aaa. .	6/27/58	28	27	19	8.8	59	153	0	35	28	2.8	4.4	....	259	84	0	2.8	417	USGS.
(B-8-9)27dcc. .	9/27/61	...	...	14	15	58	146	2	54	30	1.8	3	.04	250	96	0	2.6	450	U of A.
32aaa. .	9/27/61	...	...	2	2	127	83	3	86	79	3	18	.12	361	13	0	15	520	U of A.
33aab. .	9/27/61	...	...	12	12	101	141	2	84	63	3.2	5	.40	351	79	0	4.9	620	U of A.
33ddd. .	9/27/61	...	...	12	10	100	138	2	70	63	2.6	13	.40	341	71	0	5.2	580	U of A.

1/ Reported as sodium.

Table 4.--Field determinations of temperature and specific conductance of water from selected wells in McMullen Valley

Well location	Date of collection (month, year)	Temperature (°C)	Specific conductance (micromhos at 25°C)
(B-7-8)15baa	8/65	35	450
29ddd	7/63	31	500
	9/65	31	510
30daa	7/63	30	480
32add	7/63	31	500
	8/65	31	520
32ddd	7/63	31	700
	8/65	31	700
(B-7-9)4bbb	7/63	34	490
4cbb	7/63	32	450
10aaa	7/63	29	475
	9/65	29	425
11aaa	7/63	29	450
	9/65	29	460
11add	9/65	29	400
11baa	9/65	29	460
12aaa	9/65	29	450
16add	9/65	29	600
17dcd	7/63	29	450
24aaa	9/65	28	400
(B-8-9)32aaa	9/65	34	600