UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey

C L McGuinness
11/17/54

Memorandum on ground-water investigations in the Sells area, Papago Indian Reservation, Pima County, Arizona

By

D. R. Coates

Prepared in cooperation with
the Bureau of Indian Affairs

54-51

Tucson, Arizona
September 1954

MEMORANDUM ON GROUND-WATER INVESTIGATIONS IN THE SELLS AREA,
PAPAGO INDIAN RESERVATION
PIMA COUNTY, ARIZONA

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From 1950 to ~~the present~~ date the ~~Ground Water Branch~~, U. S. Geological Survey, has been collecting data about the ground-water supply in the Sells area, at the request of the Bureau of Indian Affairs, Papago Inidan Agency. The purpose of these studies has been to aid in locating and developing additional ground-water supplies for the community of Sells, the agency headquarters. The work has been financed by and has been in cooperation with the Papago Indian Agency. In addition to the author of this memorandum, the following personnel aided in collecting data: D. G. Metzger, H. E. Skibitzke, S. F. Turner, H. N. Wolcott, and C. B. Yost, Jr.

Sells is on the Papago Indian Reservation, Pima County, about 60 miles southwest of Tucson. Most of the ground-water studies have been made in a 6-square-mile area immediately north and east of Sells (pl. 1). The collection of data in this area has included geologic reconnaissance mapping, geophysical probing by electrical resistivity methods, hydrologic studies of wells and test holes, and laboratory ~~analyses~~ study of well cuttings.

The South Comobabi Mountains limit the area on the north, ~~and~~ consist of an igneous complex of volcanic and intrusive rocks. The altitude of the highest peak is 4,551 feet, more than 2,000 feet higher than Sells. The Artesa Mountains, to the south, rise to an altitude of 3,384 feet and are composed of volcanic rocks. West-flowing Sells Wash is the largest stream and it drains a large area east of Sells. Geophysical studies, comparisons of well logs, and laboratory examination of drill cuttings indicate that an

irregular bedrock floor underlies the area, extending southward from the pediment slopes of the South Comobabi Mountains. This relation and the fact that subsurface lava beds in the area are discontinuous due to faulting, make ground-water prospecting and predicting hazardous. The volcanic rocks are intercalated with sand and gravel beds. Individual lava beds may range in thickness up to about 60 feet without noticeable breaks in the formation. The composition of the beds is basaltic to andesitic. The sand and gravel strata range in thickness up to 12 feet but average less than 6 feet. Some of these strata are composed entirely of volcanic materials; others are heterogeneous and contain abundant quartz, feldspar, and diorite fragments.

In the Sells area most of the ground water occurs in the sand and gravel beds. Some water occurs in the fractured zones of the volcanic rocks, but the yield to wells is small to negligible.

The source of the ground water is infiltration mainly along the South Comobabi Mountain front, where recharge occurs from runoff in the coarse alluvium in the washes. Some recharge possibly occurs during times of flow in Sells Wash but the amount is believed to be small. The ground water in the Sells area moves in a general westward direction. The gradient of the water table is 40 to 50 feet per mile, about the same as the gradient of the land surface. The depth to water in the area ranges from 80 to 90 feet. The ground water is under slight hydrostatic pressure in places and may rise as much as 30 feet above the depth at which it was encountered. The ground water in the area can be considered to occur on a subsurface volcanic plateau that is higher than the much larger alluvial valleys on the east and west.

That there is no movement of ground water between the Sells area and Baboquivari Valley is indicated by differences in water-table elevations. The altitude of the water table at (D-17-5)20caa (Deep Test # 2) in the Sells area is 2,374 feet and in well (D-17-5)24ccd (DW-34) in the Baboquivari Valley it is 2,085 feet (table 1). These two wells are approximately 3½ miles apart and the lack of intervening data makes it impractical to locate the ground-water divide other than as a general area (pl. 1). It is possible, however, that some recharge to the Sells area may occur from as far northeast ~~as the area in~~ the vicinity of sec. 14, T. 17 S., R. 5 E.

At present the Sells water supply is coming from two wells which have a combined production of about 80 gallons per minute. Much of the ground water now being used is withdrawn from storage. The water level in one of the community wells, (D-17-4)25ad3 (DW-52C), has declined from an original depth of 70 feet in 1940 to 85 feet in 1949 and to 89 feet in 1951. In 1954, the depth to water was 86 feet after the well had been shut off for 2 weeks.

After consideration of all factors involved it is concluded that the most favorable area for future development of a supplemental ground-water supply is in secs. 19 and 20, T. 17 S., R. 5 E. In this area a total of four test holes, (D-17-5)20caa, (D-17-5)19ada, (D-17-5)20bcd, and (D-17-5) 20bdd (Deep Tests 2, 6, 7, and 8), have been drilled with ~~gratifying~~ results. The deepest hole, (D-17-5)20caa, was drilled to a depth of 450 feet. Although several volcanic flows were encountered the hole did not reach bedrock. Preliminary pumping-test data based on pumping periods of less than 90 hours indicate that the specific capacities of the test wells in this area range from about 0.5 to 5 gallons per minute per foot of drawdown. The total quantity of ground water that can be withdrawn in this area

is believed to be greater than is available in the recently developed well-field area north of Sells, (D-17-4)25ad2 and 3.

The ground water of the Sells area contains moderate amounts of dissolved solids consisting largely of calcium and sodium bicarbonate. Concentrations of dissolved solids range from about 250 to about 700 parts per million. Hardness ranges from about 100 to about 350 parts per million. The fluoride content is less than 1.0 part per million and meets Public Health Service standards, which state that satisfactory drinking water should contain less than 1.5 parts per million of fluoride. The water is chemically satisfactory for domestic and municipal use.

On the basis of the hydrologic data presently available, the area in the vicinity of secs. 19 and 20, T. 17 S., R. 5 E., appears favorable for drilling production wells. It is considered desirable, however, in view of the known erratic nature of ground-water occurrence, that the area be more thoroughly proved by making aquifer tests, including velocity logging on the test holes.

If the resulting data are as favorable as the preliminary indications, it is believed that at least the 200 gallons per minute desired could be obtained from four production wells at approximately the sites of the four test holes. For maximum yield the production wells would have to be drilled to depths of at least 250 feet and would have to be at least 10 inches in diameter.

It is believed that there is sufficient ground water in the area investigated to supply the community for many years. In the future it may become necessary to develop one or more additional well-field areas and to pump from them in rotation, using one well field for

several years in order to allow for recovery of the water level in the other fields. Such a plan would be likely to result in the greatest yield of ground water in the long run, as the surrounding less permeable portions of the ground-water reservoir would thereby aid in filling the cones of depression in the standby well fields.

Table 1. Summary of data collected from drilled wells and test holes near Sells, Ariz.

Location of well or hole	Designation of well or hole	Purpose or use	Total depth (feet)	Depth to water (feet)	Depth to water: Date measured	Water table elevation (feet)	Pumping data: Gallons per minute	Pumping data: Drawdown	Pumping data: Length of test (min)	Pumping data: Date of test	Log on file	Well cuttings examination	Chemical analyses of water	Remarks
(D-17-4)														
24aab	WT#3	E	102	-	-	-	-	-	-	-	X	X	-	No water at depth of 102 feet. Abandoned in hard black rock. (one (Dale)
24dac	DT#1	E	110	-	-	-	-	-	-	-	-	X	-	No water at depth of 110 feet. Abandoned.
25ad1*	DW-52B	U	110	-	-	-	9 R	-	-	-	X	-	-	Abandoned in malpais..
25ad2	DW-52A	P	117	82 R	-	-	55 R	-	-	3-15-54	X	-	X	-
25ad3	DW-52C	P	118	85.5M	4- 5-54	2295	25 R	-	-	3-15-54	X	-	X	Mostly malpais 27 - 250'.
25bd1*	Hwy#1	U	60	Dry	-	-	-	-	-	-	X	-	-	Abandoned in malpais..
25bd2	Hwy#2	U	100	-	-	-	-	-	-	-	X	-	-	No water at depth of 100 feet. Abandoned in malpais.
25bd3	Hwy#3	U	111	81.9M	5-21-53	2278	20 R	-	-	-	X	-	X	-
25daa	DW-52D	D,S	250	-	-	-	-	-	-	-	X	-	X	-
34abd	DW-41	S	201	145.9M	6- 1-54	2157	-	-	-	-	X	-	X	Originally drilled to 330 feet. Well tested at 60 gpm in 1943.
(D-17-5)														
19ada	DT#6	E	215	86.5M	5-17-54	2362	60 M	101	360	6-30-53	X	-	X	-
19cad	WT#2	E	105	-	-	-	-	-	-	-	X	X	-	No water at depth of 105 feet. Abandoned in diorite.
20bcd	USIS DT#7	E	256	80.5M	5-17-54	2372	30 M	8.5	40	2-18-54	X	-	X	-
20bdd	USIS DT#8	E	130	88.2M	5-17-54	2373	36 M	5	50	4- 1-54	X	-	X	-
20caa	DT#2	E	450	85.5M	5-17-54	2374	39 M	4.5	2760	2-27-52	X	X	X	-

D, domestic; S, stock; P, public; E, exploratory hole; U, unused.
M, measured; R, reported.
DW, Drilled well; DT, deep test hole; WT, water table test.
* Not shown on map because of proximity to nearby wells.

Table 1.—Summary of data collected from drilled wells and test holes near Selle, Ariz.—continued

Location of well or hole	Designation of well or hole	Purpose or use	Total depth (feet)	Depth to water (feet)	Depth to water Date measured	Water table elevation (feet)	Pumping data Gallons per minute	Pumping data Drawdown	Pumping data Length of test (min.)	Pumping data Date of test	Log on file	Well cuttings examination	Chemical analyses of water	Remarks
(D-17-5)														
20cbc	DT#4	E	65	-	-	-	-	-	-	-	X	-	-	Abandoned due to crooked hole.
20ccb	DT#5	E	152	-	-	-	-	-	-	-	X	-	-	Can be bailed dry in a few minutes.
20dbc	DT#3	E	102	86.5M	5-17-54	2377	-	-	-	-	X	-	X	Abandoned in red lava.
21ccd	DW-34	D,S	654	515 R	-	2085	-	-	-	-	X	-	X	-
30aba	WT#1	E	142	85 R	-	2325	30 R	-	-	-	X	-	-	-
31abb	DW-60	D,S	120	70.8M	6-9-54	2314	7 R	-	-	-	X	-	X	Mostly in porphyry and basalt.
35aac	Ali Chukson	D,S	825	395.1M	11-13-53	2195	1 R	-	-	-	X	-	X	-
(D-17-6)														
7ddc	DW-1	S	700	593.3M	4-8-54	2087	-	-	-	-	-	-	X	-
31ccd	DW-14	D,S	855	594.3M	11-10-53	2083	-	-	-	-	X	-	X	Reported to yield 12 gpm in 1943.

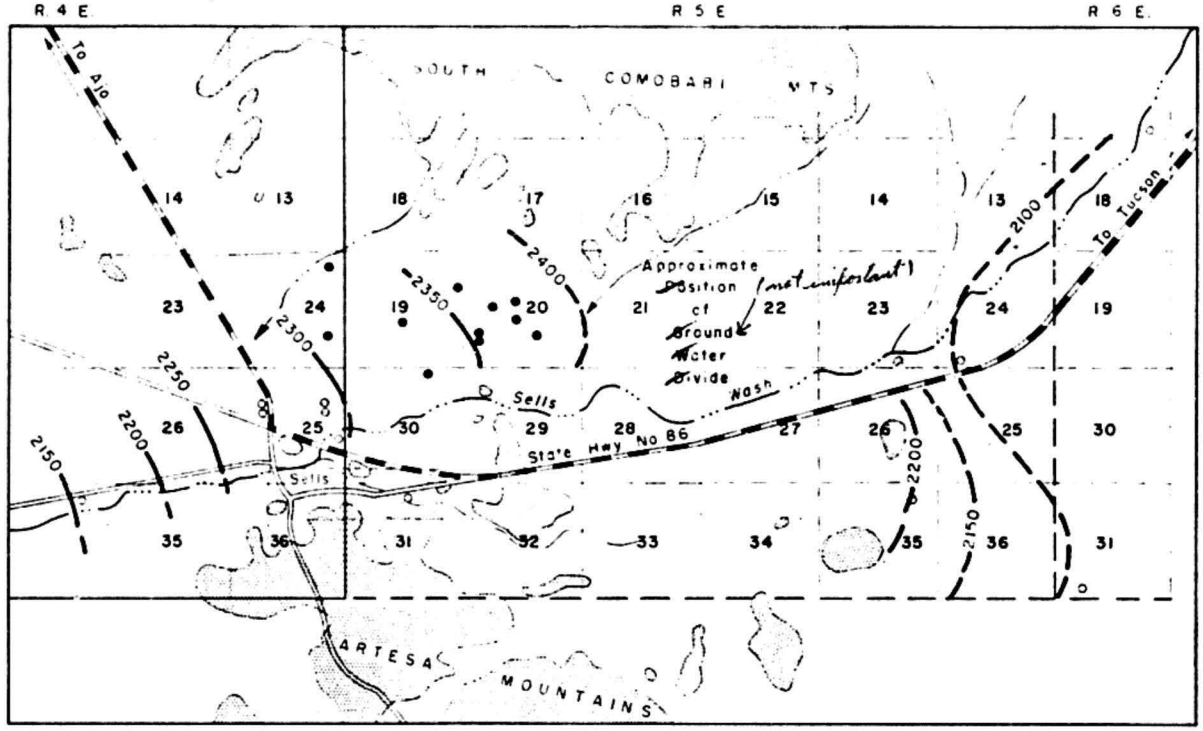
Table 2—Analyses of water from representative wells in the Sells area, Papago Indian Reservation, Pima County, Ariz.
(Parts per million except specific conductance and percent sodium)

Well no.	Date of collection	Depth of well (feet)	Temperature (°F)	Parts per million: Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium & potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance ($K \times 10^5$ at 25°C.)
(D-17-4)																
23[illegible]3	7-13-54	111	-	11	91	26	51	235	91	108	.2	5.5	500	334	35	873
31abd	5-20-54	201	77	40	64	20	48	312	14	44	.4	15	398	242	30	652
(D-17-5)																
2dcd	6- 9-54	654	-	33	49	22	40	276	12	33	.5	16	342	213	29	565
31abb	6-10-54	120	-	58	51	37	51	422	14	19	.6	1.4	440	279	28	682
35aac	7-15-54	825	-	27	24	20	221	557*	56	76	.2	0.0	698	142	77	1,130
(D-17-6)																
7ddc	7-15-54	700	78	31	24	7.6	57	237	5.4	5	.2	8.6	256	91	57	397

* Includes 14 ppm carbonate.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PLATE



MAP OF SELLS AREA, PAPAGO INDIAN RESERVATION, ARIZONA

SHOWING LOCATION OF WELLS AND WATER-TABLE ELEVATIONS

EXPLANATION

- Test hole
- Unused well
- Well with turbine pump
- Areas of exposed hard rock
- Well with windmill or small power pump
- 2400 — Elevation of contour of water table, contour interval 50 feet. Dashed where inferred

1 0 3 miles