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HYDROLOGIC AND DRILL-HOLE DATA SAN XAVIER INDIAN RESERVATION AND VICINITY, PIMA COUNTY, ARIZONA

BY
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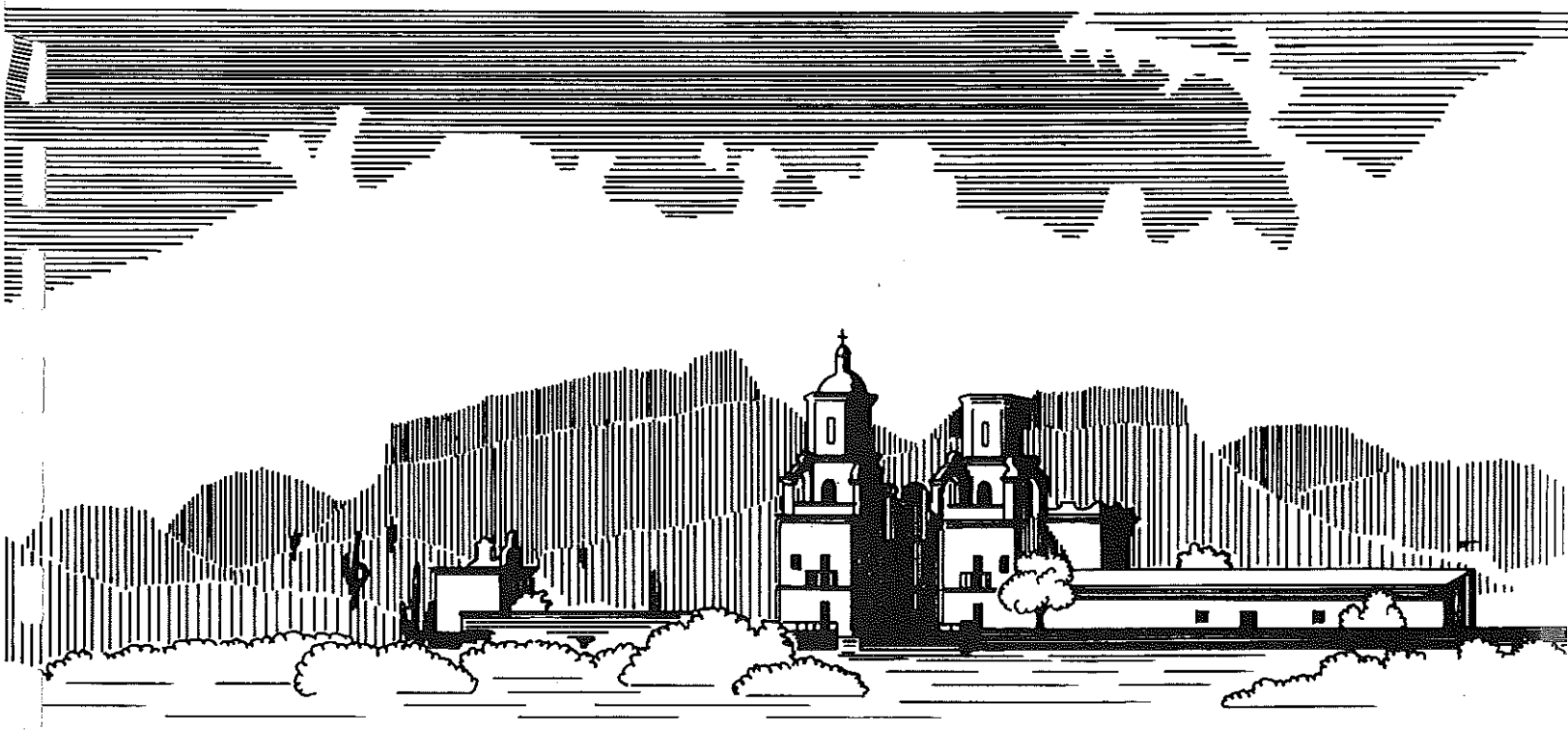

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HYDROLOGIC AND DRILL-HOLE DATA, SAN XAVIER INDIAN RESERVATION AND VICINITY, PIMA COUNTY, ARIZONA

By L. A. Heindl and Natalie D. White

Introduction

The tables in this report present a part of the hydrologic and drill-hole data for the San Xavier Indian Reservation and vicinity, Pima County, Ariz. Most of the information was collected by the U.S. Geological Survey during an investigation of the geology and ground-water resources of the reservation made for the Bureau of Indian Affairs as part of the general rehabilitation program for the Papago Indian Tribe. The tables contain information from an area larger than the San Xavier Indian Reservation because data from the reservation alone were insufficient to explain the principal features of its hydrology (fig. 1).

The tables and accompanying well-location map (fig. 2) were compiled to provide a ready reference to hydrologic information for the San Xavier area. The hydrologic information in the tables will be used in the preparation of geologic and hydrologic maps for the interpretative reports. The tables are issued separately to minimize the size of the interpretative reports, which will include maps and texts showing and discussing geologic and hydrologic relations.

Location and Extent of Area

The San Xavier area, which includes the San Xavier Indian Reservation and the adjacent areas described in this report (fig. 2), is immediately south of Tucson in southeastern Arizona. The San Xavier Indian Reservation is the second largest of three reservations of the Papago Indian Tribe and includes about 110 square miles; in addition, data from 180 square miles surrounding the reservation are included in the tables. In general, the reservation and its immediate vicinity straddle a low part of the divide between Santa Cruz and Avra Valleys and include parts of the Sierrita and Tucson Mountains.

Sources of Information

Most of the information in these tables was collected and compiled by the Geological Survey between 1954 and 1960; however, some data are as recent as 1962. Older data were obtained from the Bureau of Indian Affairs at Sells and Phoenix, the University of Arizona Agricultural Experiment Station, the Geological Survey in Tucson, and the published and unpublished sources listed here. Much of the data in the Geological Survey files for the area surrounding the reservation was collected by the Survey as a part of the statewide ground-water program in cooperation with the Arizona State Land Department.

The ground-water conditions in the San Xavier Indian Reservation and adjacent areas have not

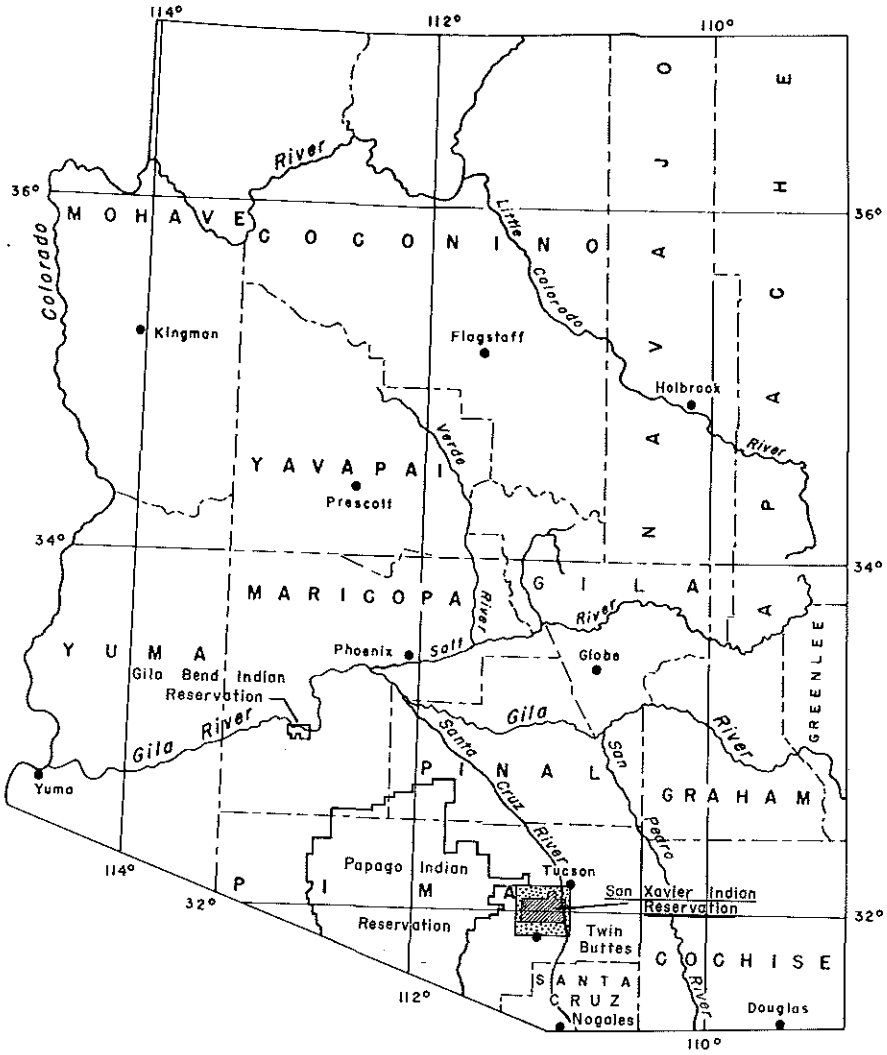


Figure 1.--Map of Arizona showing locations of the San Xavier, Papago, and Gila Bend Indian Reservations. Data in tables are from only the San Xavier Indian Reservation and the stippled area around it.

been discussed in detail, although they have been described in general in regional reports. Pertinent published and unpublished reports are listed below in chronological order. Those followed by annotations contain subsurface information incorporated in the tables in this report.

1912. Hinderlider, M. C., and Odom, V. P., Map of the Allison barrier showing location of test wells and stations for measurement of underflow velocities: The Tucson Farms Co., Inc.

Map and section show locations and logs of test wells across the Allison barrier, which consists of shallow buried bedrock where the Santa Cruz River is constricted between the San Xavier Mission and Sahuarita Butte. (Report provided by Mr. Dan Clarke, Midvale Farms, Tucson.)

1925. Bryan, Kirk, The Papago country, Arizona—a geographic, geologic, and hydrologic

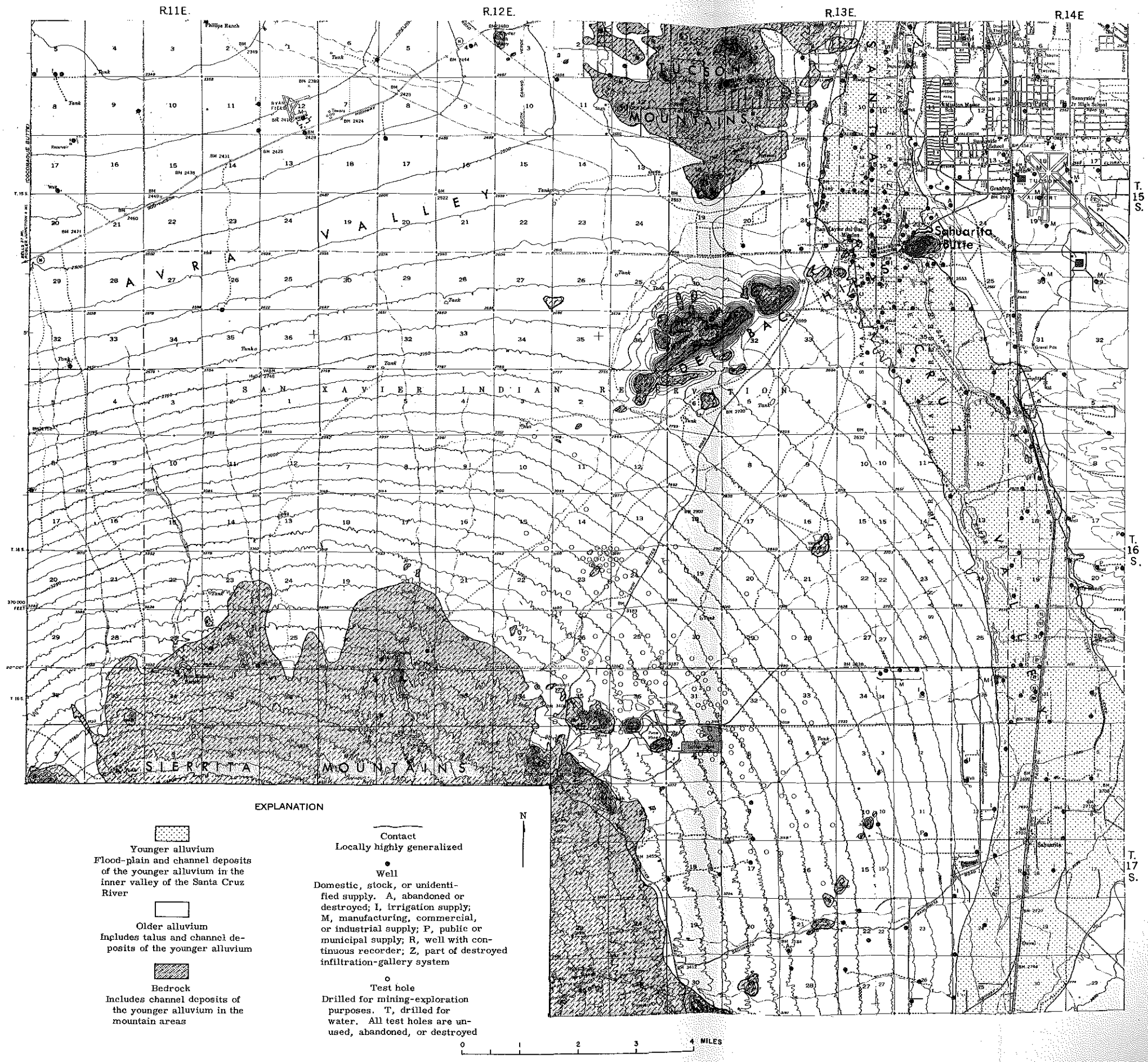


Figure 2.--Map of San Xavier Indian Reservation and adjacent areas showing areal distribution of bedrock and alluvium and location of wells.

reconnaissance with a guide to desert watering places: U. S. Geol. Survey Water-Supply Paper 499, 436 p.

1937. Andrews, D. A., Ground water in Avra-Altar Valley, Arizona: U. S. Geol. Survey Water-Supply Paper 798-E, p. 163-180.

1938. Smith, G. E. P., The physiography of Arizona valleys and the occurrence of groundwater: Univ. Arizona, Agr. Exp. Sta. Tech. Bull. 77, 91 p.

Describes logs of wells near the San Xavier Mission; figure 3 shows a generalized version of the section across the Allison barrier made by Hinderlider and Odom (1912).

1939 to 1955. U. S. Geological Survey, Water levels and artesian pressures in observation wells in the United States, pt. 6, Southwestern States and Territory of Hawaii: U. S. Geol. Survey Water-Supply Papers.

1940. Keesee, G. B., Report on the status of the San Xavier Indian irrigation project at the close of the fiscal year 1940: U. S. Bur. Indian Affairs report (duplicated), 17 p.

Summarizes construction, water-level, and pumpage data from 1915 to 1940.

1943. Turner, S. F., and others, Ground-water resources of the Santa Cruz basin, Arizona: U. S. Geol. Survey open-file report, 84 p.

1947. Turner, S. F., and others, Further investigations of the ground-water resources of the Santa Cruz basin, Arizona: U. S. Geol. Survey open-file report, 45 p.

1952. Johnson, P. W., Upper Santa Cruz basin, Pima and Santa Cruz Counties, in Ground water in the Gila River basin and adjacent areas, Arizona—a summary, by L. C. Halpenny and others: U. S. Geol. Survey open-file report, p. 101-115.

1954. Barnes, J. I., Nolan, M. J., Rupkey, R. H., and Walker, J. C., Appendix, San Xavier Irrigation Project, San Xavier Indian Reservation, Arizona: U. S. Bur. Indian Affairs report (duplicated), 34 p.

1956 to 1964. Annual report on ground water in Arizona: Arizona State Land Dept. Water Resources Reports.

1957. Schwalen, H. C., and Shaw, R. J., Water in the Santa Cruz Valley: Univ. Arizona, Agr. Exp. Sta. Bull. 288, 119 p.

Contains many water-level measurements and a few logs for wells in the area adjacent to the San Xavier Indian Reservation; water-table and decline-of-water-table maps include eastern part of reservation.

1957. Kidwai, Z. V., The relationship of ground water to alluvium in the Tucson area: unpublished master's thesis, Arizona Univ., Tucson, 55 p.

Contains analyses of well-cutting samples and interpretation of hydrologic conditions in the area immediately east of the San Xavier Indian Reservation.

1959. Rillito Creek Hydrologic Research Committee of the University of Arizona and the U. S. Geological Survey, Capturing additional water in the Tucson area: U. S. Geol. Survey open-file report, 59 p.

1961. Schwalen, H. C., and Shaw, R. J., Progress report on study of water in the Santa Cruz Valley, Arizona: Univ. Arizona, Agr. Exp. Sta. Rept. no. 205, 39 p.

Supplements the 1957 report with water-level and pumpage data through the spring of 1961.

1962. Heindl, L. A., Ground-water shadows and buried topography, San Xavier Indian Reservation, Pima County, Arizona, in Geological Survey research 1962: U. S. Geol. Survey Prof. Paper 450-C, p. 120-122.

A preliminary evaluation of the distribution of ground-water availability and its relation to the ridges and valleys cut in bedrock and buried beneath the alluvium of the Santa Cruz Valley.

Principal reports resulting from the present investigation of the Papago and Gila Bend Indian Reservations include the following:

1961. Heindl, L. A., and Cosner, O. J., Hydrologic data and drillers' logs, Papago Indian Reservation, Arizona, with a section on chemical quality of the water by L. R. Kister: Arizona State Land Dept. Water Resources Rept. 9, 116 p.

1962. Heindl, L. A., Cosner, O. J., Page, H. G., Armstrong, C. A., and Kister, L. R., Summary of ground water on the Papago Indian Reservation, Arizona: U. S. Geol. Survey Hydrol. Inv. Atlas HA-55.

1963. Heindl, L. A., and Armstrong, C. A., Geology and ground-water conditions on the Gila Bend Indian Reservation, Maricopa County, Arizona: U. S. Geol. Survey Water-Supply Paper 1647-A, 48 p.

1964. Heindl, L. A., and McClymonds, N. E., Younger Precambrian formations and the Bolsa(?) Quartzite of Cambrian age, Papago Indian Reservation, Arizona, in Geological Survey research 1964: U. S. Geol. Survey Prof. Paper 501-C, p. 43-49.

Personnel

The investigation was made under the supervision of L. C. Halpenny and J. W. Harshbarger, successive supervisors of the Arizona district office of the Geological Survey, Ground Water Branch. L. A. Heindl, project chief, collected much of the hydrologic data on the reservation and made the final compilations; Mrs. Natalie D. White made most of the preliminary compilations. Some well records were collected by O. J. Cosner and E. K. Morse.

Acknowledgments

The collection and compilation of well logs were facilitated by the cooperation of many people working with the Bureau of Indian Affairs, particularly Messrs. M. J. Nolan and B. J. Loucks, successive chiefs of the Land Operations Branch, Papago Indian Agency. The late Mr. L. G. McCray drilled several test holes on the reservation for the Bureau of Indian Affairs during the investigation and cooperated in the collection of data from the holes.

Altitudes of the base of the alluvium (table 7) were provided mainly by the American Smelting and Refining Co., the Banner Mining Co., and, to a lesser extent, by the Heinrichs Geoexploration Co. Thanks

are due these companies for permission to use information from their drill holes, and we are grateful for the cooperation and assistance of their representatives in Tucson. These companies and Mr. G. V. Keller, U. S. Geological Survey Theoretical Geophysics Branch, Denver, Colo., also provided some of the logs and depth-to-water measurements.

Particular thanks are due the University of Arizona Agricultural Experiment Station for providing the altitude measurements for many wells in the tables.

Accuracy of Locations and Altitudes

Most of the locations shown on figure 2 are believed to be accurate to at least the nearest 10 acres; wells that were surveyed during preparation of the original topographic maps are, of course, more accurately located. Altitudes given in the tables to the nearest foot were spirit-leveled; the others, usually followed by the suffix "D," were interpolated from topographic maps, and most are believed to be accurate to within ± 5 feet.

Definition and Hydrologic Significance of Terms Used in Tables 1 and 2

Some of the terms in the "Remarks" column need explanation because they are used here more specifically than is usual or because they are not in common use.

The rocks in the area are divided into two broad categories—bedrock and alluvium. Bedrock, as used in this report, includes the black volcanic flows that cap Black Mountain and all older rocks. Bedrock also includes some sedimentary units that underlie the older alluvium and are known only from drill-hole data; thus, their age and correlation are not certain, and parts of them may be younger than the volcanic flows capping Black Mountain. However, all volcanic, sedimentary, metamorphosed, and intrusive rocks of the bedrock are older than the alluvium. In the "Remarks" column the term "bedrock" has been used in place of the various drillers' terms, which were interpreted by the senior author to be bedrock. Alluvium includes what commonly is called "valley fill"; in this report it is divided into older and younger alluvium. The older alluvium constitutes the bulk of the valley fill; the younger alluvium includes flood-plain deposits and the silt, sand, and gravel that floor the present channels.

The water-bearing characteristics of the bedrock vary considerably. Locally, some of the sedimentary units are known to yield water to wells; in some places—particularly along the base of the bajada (q.v.) on the north and east flanks of the Sierrita Mountains—part of the yield attributed to the older alluvium may come from these units. East of the Santa Cruz River these units locally yield considerable quantities of warm mineralized water.

The buried sedimentary deposits probably are the most important water-bearing units of the bedrock, although nonsedimentary older rocks in mine workings have yielded considerable quantities of water. In general, however, the bedrock yields little water compared to the older alluvium.

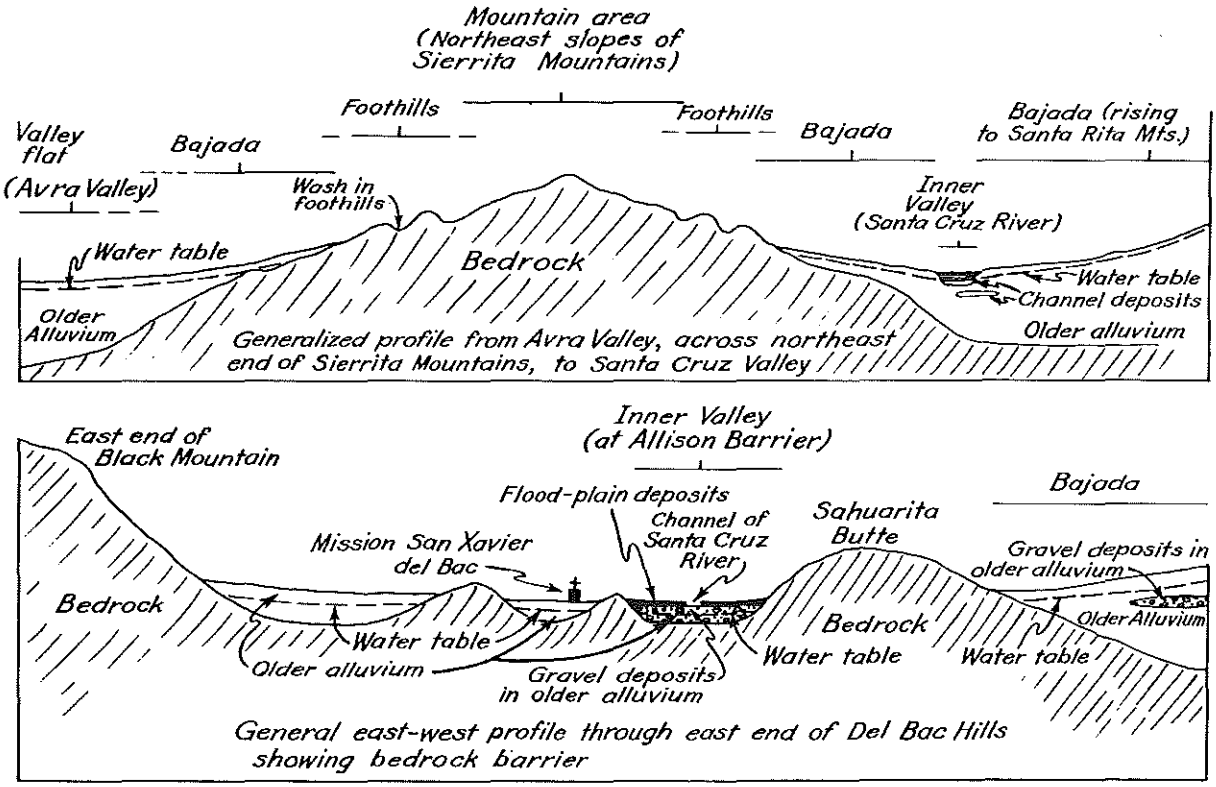
The older alluvium is the principal aquifer in the area. The younger alluvium, except for the channel deposits in the foothills, is not water bearing because it is too fine grained or is above the water table.

Some drilled holes are listed as "dry" because they reportedly "don't yield enough water to make a well." This statement means only that the yield of the hole was not up to the owner's or driller's expectations. Some holes planned for irrigation purposes are reported dry because they yielded less than several hundred gallons of water per minute; others planned for stock purposes have not been equipped as wells because they yielded less than 5 gpm (gallons per minute)—the amount set by the Bureau of Indian Affairs as a minimum necessary to maintain reasonably carefree operation of their standard stock-well equipment.

In many instances the topography provides valuable clues to the occurrence of ground water, and, consequently, an abbreviated description of the terrain at many well sites is given in the "Remarks" column. Some of the terms used to describe the terrain are defined here, and the general water-bearing characteristics are discussed. The terrain terms also are shown diagrammatically in figure 3.

Bajada

The broad slope between the foothills and the general valley floor is called the bajada. In the Santa Cruz Valley the bajadas sloping down from the Sierrita and Santa Rita Mountains meet at the inner valley of the Santa Cruz River. (See figure 3 and below.) The bajada on the north side of the Sierrita Mountains slopes into the valley flat of Avra Valley. Generally, the bajada is completely underlain by alluvium, but locally small nubbins of bedrock stand above its slopes.



Not to scale

Figure 3. --Sketches showing terms applied to topographic features and rock units in this report.

The yields of wells on the bajada depend largely on the thickness of the saturated older alluvium, which is determined by the configuration of the buried bedrock. In general, where the saturated alluvium is less than about 50 feet thick, the yields may be adequate for small community, domestic, and stock purposes; where the saturated alluvium is thicker—as much as about 500 feet—the yields may be adequate for irrigation and large industrial supplies. In the valley along the Santa Cruz River, the alluvium generally is about 500 feet thick and yields from 400 to 2,000 gpm to many wells. In Avra Valley, the alluvium thickens to the north and west, and potential yields are high, although the maximum productivity of this part of the aquifer has not been tested. In a broad zone between the Del Bac Hills and the Sierrita Mountains and near the foothills along the east side of the Sierrita Mountains, the older alluvium, although as much as 200 feet thick, commonly is dry or nearly so because it is above the water table. The yield of the older alluvium also differs with its texture. East and southeast of the Tucson Municipal Airport, although its saturated thickness is as great as 500 feet, the alluvium does not yield large quantities of water because it is fine grained.

Bedrock Barrier

A bedrock barrier is made up of bedrock, at or near the surface, that acts as a partial or complete barrier to the movement of ground water. Productivity of the aquifer near the barrier depends on the thickness and permeability of the saturated alluvium. For example, above the barrier where the Santa Cruz River is constricted west of Sahuarita Butte, the saturated alluvium, although only about 40 feet thick, is highly productive because it is unusually permeable. A short distance away, however, about 235 feet of saturated alluvium yields only moderate amounts of water, and drawdowns are large.

Foothills

The foothills—low to moderate in altitude—flank the main parts of the mountain ranges. In the foothills, wells may be either in bedrock or in alluvium between the bedrock exposures. These wells obtain water principally from the shallow alluvium, but some water may be obtained from permeable bedrock. The water levels in shallow wells in the foothills are subject to seasonal fluctuations.

Inner Valley

The inner valleys—which are narrow, nearly flat, and gently to steeply walled—border the major streams and their principal tributaries. The inner valleys were cut into older rocks, usually the older alluvium of the valley fill, and then partly refilled with flood-plain and channel deposits. Such flood-plain and channel deposits constitute the younger alluvium of this report. Along most streams the inner valley supports luxurious vegetation compared with that of the adjacent bajadas, and the boundaries are marked by a sharp contrast in the density of plant growth. In many areas the younger alluvium of the inner valley yields large quantities of water because it is highly permeable and is recharged seasonally by streamflow and floodflow; its yields may be particularly spectacular in contrast to the much lower yields of the underlying, finer grained, older alluvium. Along the Santa

Cruz River, however, the deposits of the inner valley, except for the deposits in the present channels, are not water bearing because they are above the water table. The present channels are cut through, or nearly through, the flood-plain deposits and are in direct contact with the older alluvium in many places (not shown in figure 2). The high yield of the wells in the inner valley of the Santa Cruz River comes from the underlying older alluvium, which contains highly permeable buried channel deposits.

Valley Flat

The central parts of some intermontane valleys, such as Avra Valley, are called valley flats. Commonly, valley flats are broad and nearly flat and merge upward almost imperceptibly into bajadas. The older alluvium in Avra Valley is about 700 feet thick in the northwesternmost corner of the map area (fig. 2) and is reported to yield as much as 2,000 gpm. In most areas the older alluvium beneath the valley flats is capable of yielding sufficient water for irrigation.

Discharge Characteristics—Tables 3 and 4

The discharge characteristics shown in tables 3 and 4 are limited to the specific capacity of individual wells and the coefficient of transmissibility of small parts of the aquifer. As an index to the characteristics of the aquifer, the coefficient of transmissibility is more reliable than the specific capacity because it is obtained under more exacting conditions and is not influenced as directly by the type and condition of the well and its equipment. The coefficients of storage obtained from tests in this area are omitted from the table because their reliability and significance are questionable.

The coefficient of transmissibility is defined as the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 100 percent (Ferris and others, 1962, p. 73). Thus, it is an index of the ability of an aquifer to transmit water to wells. Mathematical analysis of drawdown and recovery data from controlled pumping tests is used to compute a numerical value for this coefficient.

The specific capacity of a well is the relation of yield to drawdown; that is, its yield in gallons per minute per foot of drawdown of the water level measured within the well bore. It is a function not only of the ability of the aquifer to transmit water to the well but also of the construction of the well itself. Obviously, then, the rate at which a well will yield water cannot be greater than the rate at which water is transmitted through the aquifer and will be less than this amount because of frictional and other losses that develop as the water enters the well. In general, as the rate at which a well is pumped increases, the specific capacity decreases. However, the specific capacity of a well also varies, even when the well is pumped at essentially the same rate, mainly due to changes in the thickness of saturated aquifer available to the well and to changes in the type and amount of head loss as the water enters the well. The thickness of saturated aquifer available to the well changes as a direct result of increased drawdown due to increases in pumping rate; but, more significantly, the thickness of saturated aquifer is reduced as the static

water level is lowered with time. Head loss, or well loss, caused by turbulent flow as the water moves into the well bore, varies directly as the square of the entrance velocity. Thus, head loss is affected by the size and shape of the openings, the mineral incrustations of openings either in the casing or in the aquifer material immediately around the casing, the accumulation of sand in the well, and the compaction of fine material around the casing. Other factors remaining constant, particularly the level of the static water table, the highest specific capacity for any given rate of discharge is probably closest to the aquifer's ability to transmit water.

Drillers' Logs—Tables 5 and 6

The rock descriptions in drillers' logs differ, partly because of the complex material penetrated and partly because of the differences among the many drillers in judgment and use of terminology. The drillers' logs in tables 5 and 6 generally are quoted from the available records, except for minor changes in spelling and punctuation; in some instances, the logs have been shortened by abbreviating descriptive material and by combining successive similar descriptions.

A geological interpretation is made of some of the rock zones described in the drillers' logs; those made by the senior author are bracketed. Some logs have no "picks"; these either are presumed to be all in the older alluvium or do not lend themselves to being interpreted at readily definable horizons. Bedrock units usually are not identified by formational names. The principal terms used in the geological interpretations are described below.

Flood-Plain Deposits

Flood-plain deposits are the fine-grained—generally sandy silt and finer—materials that underlie the floor of the flood plain. The flood-plain deposits are part of the younger alluvium.

Gravel Deposits

The term "gravel deposits," as used in the logs, refers specifically to units of the older alluvium that are composed only of sand and gravel; with minor exceptions, a layer of sand and gravel is not identified as forming gravel deposits if its description suggests it includes any clay or clayey material. Some of the gravel deposits close to the surface may include an unknown thickness of channel deposits of the younger alluvium. The gravel deposits probably are the most permeable units in the older alluvium.

Older Alluvium

The older alluvium is composed of alternating zones of alluvial material that rest on the bedrock and underlie the flood-plain deposits where present. The base of the older alluvium is indicated in the logs wherever possible as a means of determining the thickness of the alluvium. Sedimentary deposits below the base of the older alluvium are interpreted to be part of the bedrock. If the base of the older alluvium is not indicated, the well is presumed to bottom in older alluvium.

Depths to Base of Older Alluvium and to Water—Table 7

The data in this table form the basis for maps showing the configurations of the buried bedrock

topography and the water table and the distribution of thicknesses of the saturated older alluvium. A few wells outside the map area (fig. 2) are included because they provide data helpful in the construction of the geologic and hydrologic maps.

Chemical Quality of Ground Water—Table 8

The following description of chemical constituents and other properties is a slight modification of the section on chemical quality of water that was prepared by L. R. Kister for the basic-data report for the Papago Indian Reservation (Heindl and Cosner, 1961, p. 8-12).

Chemical Constituents

Pure water does not occur naturally, and the chemical composition of natural water is variable. Even the purest form of water—rainwater—contains dissolved gases and small amounts of sodium, chloride, and sulfate ions. The presence of dissolved gases, mainly carbon dioxide, helps water to dissolve mineral material from the rocks of the earth. The source and significance of the various minerals often found in water are discussed in the following paragraphs.

Silica (SiO_2).--Silicon usually is found as silica in quartz or as silicates in feldspar and other minerals. Most of the silica in ordinary water is probably in the form of subcolloidal-sized particles or undissociated molecules and does not affect the ionic balance in a water sample. However, at high pH the silica may be present in the ionized state. Colloidal silica is a good carrier of other material that may precipitate from solution. Water high in silica forms an exceedingly hard scale on porcelain fixtures, boilers, or other surfaces with which it may come in contact.

Iron (Fe).--Iron is available from practically all rocks, and ground water may contain several parts per million. Upon exposure to air, the iron in water may settle out as a precipitate of insoluble ferric hydroxide as a result of oxidation. Excessive amounts of iron cause an objectionable taste in water and will stain porcelain fixtures and fabrics washed in the water.

Calcium (Ca) and magnesium (Mg).--Hardness of water is caused chiefly by calcium and magnesium. Calcium is found in all ground water and surface water and is commonly the major cation present. It is present in silicate minerals, nonsilicate minerals—such as gypsum, calcite, limestone, and dolomite—and the cementing material of many sedimentary rocks. The weathering of these calcium-bearing rocks yields calcium to water.

Magnesium is abundant in the carbonate rocks and is a typical constituent of some of the silicate minerals, such as olivine, pyroxene, and mica. Magnesium usually is present in water in smaller amounts than calcium, but once in solution magnesium does not precipitate as readily as calcium. The solubility of calcium and magnesium is increased by the presence of carbon dioxide in the water.

Sodium (Na) and potassium (K).--All natural water contains sodium and potassium, which are derived from the weathering of feldspar and evaporite

deposits or from "base-exchange" reactions between basic ions in water and clay minerals. If large amounts of both are dissolved in the water, sodium normally will be present in much greater quantities than potassium. Potassium usually is not present in large amounts in ground water. Sodium remains in solution when leached from igneous rock minerals, whereas potassium tends to recombine with the products of weathering, especially the clay minerals.

Bicarbonate (HCO_3) and carbonate (CO_3). --Bicarbonate is the principal negative ion (anion) present in most natural water. Water that has come in contact with granitic rocks usually contains less than 50 ppm (parts per million) bicarbonate, whereas water that has come in contact with carbonate rocks or calcareous material may contain as much as 500 ppm.

Carbon is present in relatively few instances in natural water. Theoretically, carbonate may be present only in water with a pH of more than 8.2. Some ground water contains carbonate, and some water that has been treated with lime also contains carbonate.

Alkalinity in water is caused primarily by the presence of bicarbonate and carbonate, although some other anions may also cause alkalinity. The property of alkalinity in water is its ability to neutralize acid.

Sulfate (SO_4). --The sulfate ion is produced during the weathering process when sulfide materials are oxidized, and it is also freed by the weathering of minerals containing sulfate. Sulfate salts of calcium and magnesium in boiler water will cause the formation of hard scale in boilers. The presence of calcium sulfate (gypsum) in irrigation water is desirable because of the favorable reactions with the soil. In fact, gypsum is often added to the irrigation water or the soil to prevent formation of "black alkali" or to reclaim alkali lands. Magnesium salts of sulfate (epsom salts) are objectionable in public supplies because of the laxative effect.

Chloride (Cl). --Chloride is present in all natural water and is the most abundant of the halogen group of elements. Sedimentary rocks, especially evaporite deposits, are an important source of chloride. Sodium usually is associated with large concentrations of chloride in water.

Fluoride (F). --Fluoride is second to chloride as the most abundant of all the halogens and may be present in rocks as a constituent of apatite, fluorite, mica, hornblende, and certain evaporite and clay minerals. Fluoride is resistant to weathering, but its solubility increases in the presence of carbon dioxide. Excessive concentrations of fluoride in drinking water are undesirable. According to the California State Water Pollution Control Board (1952), water containing less than 0.9 to 1.0 ppm of fluoride will seldom cause mottled enamel in the teeth of children, and concentrations of less than 3 or 4 ppm are not likely to cause endemic cumulative fluorosis and skeletal effects in adults.

Nitrate (NO_3). --Part of the nitrogen present in ground water and surface water is removed from rocks by weathering, and part is the product of decay

and oxidation of organic matter. Nitrate nitrogen is the final oxidation product caused by the reaction of bacteria in the decay of plants and animals. The occurrence of nitrate in abundance in evaporite deposits is rare. However, it may form by the action of microorganisms and collect in separate beds in arid regions. The nitrate deposits of Chile are outstanding examples. The presence of large amounts of nitrate in drinking water may be the cause of methemoglobinemia in infants (blue babies). It is recommended that water containing more than 10 to 20 ppm of nitrate, expressed as nitrogen, should not be used in infant feeding (Comly, 1945, p. 112-116). The presence of nitrate also may be an indication of pollution by sewage or by organic decomposition products. Ordinarily, water does not contain more than a few parts per million of nitrate.

Boron (B).--Boron occurs in igneous rocks and also as borate in marine evaporite deposits, evaporite deposits in closed basins, and in evaporite deposits connected with volcanic activity. Marine evaporite deposits contain chiefly magnesium borate, but boron in evaporite deposits in closed basins occurs as calcium borate. Volcanic sublimates contain boron as boric acid and various borates. Boron is necessary for normal plant growth, but the amount required is usually very small. Citrus shows definite injury when irrigated with water containing 1 ppm boron, and 3 ppm boron in the irrigation water will kill the plant. On the other hand, alfalfa grows best when irrigated with water containing 1 to 2 ppm of boron, and date palms seem to require about 5 ppm and will tolerate as much as 100 ppm.

Other Properties

Dissolved solids.--The results reported as dissolved solids represent the total quantity of dissolved mineral matter in the water. The terms "dissolved solids (D. S.)" and "residue on evaporation at 180°C" are used synonymously in describing the amount of dissolved material in a unit volume of water. Ground water usually contains more dissolved solids than surface water. Part of the material reported as dissolved solids in colored water is organic matter, which is not shown in the analyses.

Hardness.--Hardness, sometimes called the soap-consuming property of water, is caused mainly by calcium and magnesium. The hardness caused by the calcium and magnesium equivalent of the bicarbonate in water is called carbonate or temporary hardness. This may be removed by boiling. Other salts of calcium and magnesium cause noncarbonate or permanent hardness. Hardness is a particularly troublesome property, and large sums of money are spent in softening water for domestic and industrial use.

Percent sodium.--The percent sodium in water is the ratio of sodium to the total cations, expressed as a percentage, with all ion concentrations expressed in equivalents per million. Percent sodium is calculated as follows:

$$\text{Percent sodium} = \frac{Na^{+}}{Na^{+} + K^{+} + Ca^{++} + Mg^{++}} \times 100$$

High concentrations of sodium in soil tend to replace calcium and magnesium from the mineral and organic complexes, with the result that the physical

properties of the soil are impaired and the soil becomes relatively impermeable.

Sodium-adsorption-ratio (SAR).--SAR is a ratio for soil extracts and irrigation water used to express the relative activity of sodium ions in exchange reactions with the soil. It is used as an index of the sodium (alkali) hazard of an irrigation water. High SAR values indicate high sodium hazards.

Specific conductance.--The specific conductance of water is a measure of its capacity to conduct an electric current. The conductance varies with the concentration of the ions in solution and is a rough measure of the mineral content of the water.

pH.--The hydrogen-ion concentration of water usually is expressed in pH units. The pH denotes whether a water is basic or acidic. The pH of pure water is 7.0 and the pH of most natural water ranges from about 6.0 to slightly more than 8.0. Water with a pH less than 7.0 is acidic and tends to be corrosive, whereas water with a pH more than 7.0 is basic and may deposit scale in pipes or boilers.

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T A B L E S

Table 1.—Records of wells, San Xavier Indian Reservation, Pima County, Arizona

Type of well: Dg, dug well; Dr, drilled well.
Casing diameter: Size of dug wells not shown.
Type of finish: OH, open hole; P, perforated, method unknown; Pm, perforated by Mills knife.
Type of lift: B, bucket; C, cylinder; S, submersible; T, turbine; E, electric; N, none; W, windmill.
Surface altitude: In feet above mean sea-level datum, rounded to nearest foot if leveled and nearest 5 feet otherwise. Source of data: D, by interpolation from Geological Survey topographic maps or benchmarks; L, spirit leveling by Geological Survey or Bureau of Mines.

Water-level depth: Measured unless otherwise indicated; R, reported.
Water-level altitude: To nearest foot above mean sea-level datum, based on surface altitude given in this table.
Yield: Reported or estimated yields; measured yields, indicated by (M), are rounded.
Use: A, abandoned or not completed; D, domestic; I, irrigation; N, not used; S, stock.
Log, well cuttings, and chemical analysis of water: X, on file at Arizona Bureau of Mines well-sample cuttings library University of Arizona, Tucson, Arizona; Y, driller's log or water analysis in tables 5 and 8.

Location	Well number or name	CONSTRUCTION DATA: Type	Date of completion (year)	Total depth (feet)	Casing record: Diameter (inches)	Casing record: Depth (feet) From	Casing record: Depth (feet) To	Finish: Type	Finish: Depth (feet) From	Finish: Depth (feet) To	Type of lift	HYDROLOGIC DATA: Surface altitude	Water level: Depth below land surface (feet)	Water level: Date measured (mo/yr.)	Water-level altitude	Yield (gpm)	SUPPLEMENTARY DATA: Use	Log	Well cuttings	Chemical analysis of water	Remarks
T. 15 S., R. 11 E.																					
Sec. 35																					
NW¼NE¼NW¼	SX-R-6	Dr			6							2,610D	461.4	10/53	2,149					Y	On bajada.
T. 15 S., R. 13 E.																					
Sec. 16																					
NE¼NW¼NE¼		Dr		30				OH				2,480D					A				Inner valley; reported abandoned in "bedrock" at 30 feet.
NE¼NW¼SE¼		Dr	1958	135	8						S,E	2,485D					D				Inner valley; reported in "clay" at 135 feet.
Sec. 21																					
NE¼NW¼NE¼-1												2,495L	48.7	2/52	2,446		A				Inner valley; at same location as NE¼NW¼NE¼-2; not shown on fig. 2.
NE¼NW¼NE¼-2		Dr	1958	131	8						S,E	2,495D					D				Inner valley; reported in "bedrock" at 131 feet.
SW¼NW¼NE¼		Dr	1958		8						S,E						D				Inner valley.
SE¼NW¼NE¼		Dr	1958		8						S,E						D				Do.
SW¼SE¼SE¼		Dr	1958	130	8						S,E	2,525D	70.R	1/58	2,455	50	D,S				In foothills near inner valley; well reported on "bedrock" at 130 feet; drilled 150 feet north of abandoned 60-foot dug well not shown on fig 2.
Sec. 22																					All sec. 22 wells are in inner valley, except as noted.
SE¼NW¼NE¼		Dg		36								2,500D	30.6 36.7	9/39 1/53	2,469 2,463		A				Now occupied by privy.
NE¼SW¼NE¼		Dg		35								2,500D	34.3 36	9/39 1/53	2,466 2,464		A				Destroyed.
NW¼SW¼NE¼		Dg		37							B	2,505D	37	9/39	2,468		D,S				
NW¼SE¼NE¼-2	Rios well	Dr	1958	130	8						S,E	2,505D					D				Replaces abandoned dug well 30 feet southwest; not shown on fig. 2.
SW¼SE¼NE¼		Dg	1932	44		0	44	concrete			N	2,505D	29.7 35.4	9/39 1/53	2,475 2,470		N			Y	Used as observation well 9/39 to 12/41 and 1/53 to 12/57.
SE¼NW¼SW¼		Dr	1950	150	12												N				Inner valley; not equipped; to replace well in NE¼SW¼SW¼.
NE¼SW¼SW¼		Dr		101	8						T,E	2,510D	60	9/39	2,450		D				Near low foothills near inner valley; not shown on fig. 2.
SE¼SW¼SW¼		Dg	old	20							B	2,515D	18.9	9/39	2,496		D,S				Near low foothills near inner valley; reported to have been dug when San Xavier Mission was built.
SW¼NW¼SE¼-1		Dg		35								2,507L	34.2	1/53	2,473		D				Not shown on fig. 2; replaced by well SW¼NW¼SE¼-2.
SW¼NW¼SE¼-2		Dr	1958	225	8							2,507L	36.3	2/52	2,471		D	Y	X		In inner valley near foothills; 1952 water-level measurement for nearby dug well now abandoned.
SW¼SW¼SE¼-1	Farm well	Dr		45	6							2,513L	29.7 35.4	9/39 9/54	2,483 2,478		A				Used as observation well 9/39 to 12/43; see table 3.
SW¼SW¼SE¼-2	Well E	Dr	1912?	182								2,511L	20R	1912	2,491		A	Y			Destroyed test well; not shown separately on fig. 2; may be same as Farm well.

Sec. 23																					
SE¼NE¼NE¼	--------	Dr	1950	------	6	------	------	------	------	------	------	2,528L	52.1	2/52	2,476	------	A	------	------	------	On bajada.
NW¼SW¼NE¼	--------	Dg	------	------	------	------	------	------	------	------	B	2,500L	35.6	2/52	2,464	------	D,S	------	------	------	Along valley on bajada.
SW¼SW¼NE¼	--------	Dg	------	40	------	------	------	------	------	------	B	2,520L	38.9	9/39	2,481	------	A	------	------	------	On bajada; used as garbage pit.
													42.9	2/52	2,477						
SW¼NE¼SW¼	--------	Dr	------	58	12	0	41	------	------	------	T,E	2,500D	12 R	12/42	2,488	550	A	Y	------	------	Channel floor; destroyed; not shown on fig. 2.
SE¼NE¼SW¼	--------	Dg	------	36	------	------	------	------	------	------	B	2,500D	30.8	9/39	2,469	------	D,S	------	------	------	At base of foothill.
NE¼NW¼SW¼	SX-10	Dr	1956	410	10	------	------	------	------	------	T,E	2,510D	72.9	5/56	2,437	500M	I	------	X	Y	Inner valley; see table 3.
													75.6	9/56	2,434						Reported all in alluvium.
SW¼NW¼SW¼	SX-11	Dr	1959	280	20	0	261	Pm	60	220	T,E	2,510D	45 R	7/59	2,465	540M	---	Y	X	------	Inner valley; water temperature reported 74°F; see table 3.
NW¼SW¼SW¼	--------	Dg	------	35	------	------	------	------	------	------	B	2,500D	28.7	9/39	2,471	------	A	------	------	------	Inner valley; used as observation well 9/39 to 12/41.
													37.1	5/56	2,463						
SW¼SW¼SW¼	Infiltration gallery	------	------	------	------	------	------	------	------	------	------	2,502L	------	1941	------	1,800	---	------	------	------	Infiltration gallery is below channel.
													11.2	10/45	2,489	850					
		Dr	1915	239	16?	------	------	------	------	------	------	------	------	------	------	250	A	------	------	------	One of first 3 irrigation wells drilled in reservations; no other location available; abandoned in 1923.
Sec. 25																					
SW¼SE¼SW¼	SX-12	Dr	1959	365	20	0	365	Pm	60	360	------	2,550D	45 R	6/59	2,505	1,000M	I	Y	X	------	In inner valley; see table 3.
Sec. 26																					
SW¼NE¼NE¼	--------	Dg	------	26	------	------	------	------	------	------	B	2,540D	22.4	9/39	2,508	------	D,S	------	------	Y	Inner valley; used as observation well 9/39 to 12/41.
													23.7	2/52	2,516						
NW¼NW¼NE¼	SX-Hosp. Test 1	Dr	1954	115	10	------	------	------	------	------	------	2,530D	32.0	12/54	2,498	10	A	Y	X	------	Inner valley at base of hill; see table 3.
SW¼NW¼NE¼-1	SX-Hosp. 1	Dr	1931	100	16	0	100	P	36	55	T,E	2,530D	22 R	7/31	2,508	150	D,I	Y	------	------	Inner valley; not shown on fig. 2.
SW¼NW¼NE¼-2	SX-Hosp. Test 2	Dr	1955	243	10	0	240	P	167	240	------	2,525D	23.6	12/54	2,501	40	D	Y	X	------	Inner valley near foothills; see table 3.
NW¼SW¼NW¼	SX-1 (PWA-1)	Dr	1934	92 (308)	18	0	92	------	------	------	T,E	2,502L	14.3	1/53	2,488	1,000	I	Y	------	Y	Inner valley; pilot hole, PWA-1, drilled to 308 feet; plugged back to 92 feet; see table 3.
SW¼SW¼NW¼	SX-1A	Dr	1956	400	16	0	378	P	45	370	------	2,528D	28.2	6/56	2,500	1,500M	I	Y	X	------	Inner valley; see table 3.
SE¼SW¼SW¼	SX-6	Dr	1953	260	20	0	260	P	45	208	T,E	2,535D	29 R	1953	2,506	600	I	Y	X	------	Do.
SE¼SE¼SE¼	Old SX-4	Dr	1915	362	12	------	------	------	------	------	------	2,540D	11.0	1915	2,529	450	A	Y	------	------	Inner valley; site of one of first 3 irrigation wells drilled on reservation; "malapais boulders" reported at 342 feet; plugged back to 339 feet after water level dropped to 23 feet when "malapais boulders" were encountered.
													16.6	1917	2,523						
													17.5	1934	2,522						
Sec. 27																					
SW¼NE¼NE¼	SX-8	Dr	1954	380	20	------	------	P	42	364	T,E	2,520D	30 R	8/54	2,490	950	I	Y	X	------	Inner valley.
NW¼NW¼NE¼	SX-5 (PWA-5)	Dr	1934	265	18	0	102	P	30	80	T,E	2,520D	34.5	1/53	2,485	1,200	I	Y	------	------	Inner valley; see table 3.
SW¼NW¼NE¼	Encinas well	Dg	------	40	------	------	------	------	------	------	S,E	2,519L	24.9	9/39	2,494	------	N	------	------	------	Inner valley; used as observation well 9/39 to 12/41.
													33.4	2/52	2,486						
NW¼NE¼NW¼	--------	Dr	1958	------	8	------	------	------	------	------	S,E	------	------	------	------	------	D	------	------	------	In foothills near inner valley.
SE¼NW¼NW¼	--------	Dg	------	------	------	------	------	------	------	------	B	2,525L	33.1	2/52	2,492	------	D,S	------	------	------	Do.
SW¼SE¼NW¼	--------	Dr	------	------	8	------	------	------	------	------	T,E	2,525D	------	------	------	------	D,I	------	------	------	Inner valley.
SE¼SE¼NW¼	--------	Dr	1934	151	6	------	------	------	------	------	------	2,525D	14.3	6/34	------	------	A	Y	------	------	
NE¼NE¼SW¼	--------	Dg	------	------	------	------	------	------	------	------	B	2,527L	29.1	2/52	2,498	------	D,S	------	------	------	Do.
NE¼SW¼SW¼	--------	Dg	------	------	------	------	------	------	------	------	B	2,539L	39.3	2/52	2,500	------	A	------	------	------	In foothills near inner valley.
NE¼NW¼SE¼	Old SX-3	Dr	------	230	16	0	17	P	25	185	------	2,530D	26 R	------	2,514	400	A	Y	------	------	Inner valley; abandoned because of low specific capacity; see table 3.
					12	17	200														
SE¼SE¼SE¼	--------	Dr	1914	239	16	0	100	------	------	------	B	2,534L	17.0	1914	2,517	450	D,S	------	------	------	Inner valley; one of first 3 irrigation wells drilled on reservation; abandoned as irrigation well and converted for domestic and stock use; observation well 9/39 to 12/41; reported in "malapais boulders" from 235 to 239 feet; reported to yield about 400 gpm in 1915.
					12	0	139						23.6	9/39	2,510						
													28.1	2/52	2,506						

Table 1.—*Records of wells, San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Well number or name	CONSTRUCTION DATA: Type	Date of completion (year)	Total depth (feet)	Casing record: Diameter (inches)	Casing record: Depth (feet) From	Casing record: Depth (feet) To	Finish: Type	Finish: Depth (feet) From	Finish: Depth (feet) To	Type of lift	HYDROLOGIC DATA: Surface altitude	Water level: Depth below land surface (feet)	Water level: Date measured (mo./yr.)	Water-level altitude	Yield (gpm)	SUPPLEMENTARY DATA: Use	Log	Well cuttings	Chemical analysis of water	Remarks
T. 15 S., R. 13 E.—Cont.																					
Sec. 34																					
NW¼NE¼NE¼	PWA-4	Dr	1934	55	6	------	------	------	------	------	------	2,540D	19.2	5/34	------	------	A	Y	------	------	
SE¼NW¼NE¼	SX-9	Dr	1954	340	20	0	340	P	37	340	------	2,550D	35.2	8/54	2,515	750	I	Y	X	------	Inner valley; see table 3.
NE¼SE¼NE¼	PWA-6	Dr	1934	100	6	------	------	------	------	------	------	2,550D	24.1	6/34	------	------	A	Y	------	------	
NE¼NW¼SW¼	------	Dr	------	------	6	------	------	------	------	------	C,W	2,570L	59.6	2/52	2,510	------	S	---	------	------	On bajada.
Sec. 35																					
SW¼NW¼SW¼	SX-2 (PWA-2)	Dr	1934-1954	140-238	18	0	140	Pm	30 90	62 127	T,E	2,550	28.2 35 R	1/35 6/52	2,522 2,515	1,500 670	I	Y	X	------	Inner valley; see table 3; well deepened from 140 to 238 feet in 1954; used as observation well 5/34 to 1/35.
SE¼SW¼SW¼	SX-7	Dr	1953	260	20	0	260	P	45	248	T,E	2,560D	34 R	11/53	2,526	900	I	Y	X	------	Inner valley; see table 3.
T. 16 S., R. 11 E.																					
Sec. 13																					
SW¼SE¼NW¼	SX-DT-3	Dr	1954	540	8	0	540	------	------	------	------	3,175D	401.2	9/54	2,774	1.5M	---	Y	X	Y	On bajada; yield insufficient (5-1½ gpm) to make a stock well; see table 5.
Sec. 26																					
SE¼NW¼SW¼	SX-W-7	Dg	1941	------	------	------	------	------	------	------	C,W	3,520D	37.9	10/53	3,482	------	D,S	---	------	------	On bajada in foothill; dug in shallow alluvium above granite.
SE¼SE¼SE¼-1	------	Dg	------	------	------	------	------	------	------	------	------	3,600D	15.9	10/53	3,584	------	D,S	---	------	------	Along wash in foothills; dug in shallow alluvium above granite.
SE¼SE¼SE¼-2	------	Dg	------	------	------	------	------	------	------	------	------	3,605D	28 R	11/41	3,577	------	D,S	---	------	------	Along wash in foothills; dug in shallow alluvium above granite; about 100 feet south of well 1 in SE¼SE¼SE¼ sec. 26; not shown on fig. 2.
T. 16 S., R. 12 E.																					
Sec. 3																					
NE¼SE¼SW¼	SX-DT-2	Dr	1954	405	------	------	------	10-inch OH	------	------	------	2,910D	287.5	10/54	2,622	1	N	Y	X	------	On bajada; reported in bedrock at 175 feet; yield insufficient (1 gpm) to make stock well.
Sec. 24																					
NE¼SE¼NE¼	SX-DT-1A	Dr	1954	300	10	0	20	------	------	------	------	3,025D	288.1	8/54	2,737	------	A	Y	X	------	On bajada; reported in bedrock at 210 feet; yield insufficient to make stock well.
Sec. 26																					
NW¼NW¼NW¼	Old SX-7	Dr	1938	750	6-1/4	------	------	------	------	------	------	3,300D	------	------	------	2	A	Y	------	------	On bajada; reported in bedrock at 185 feet; water occurring at 600 feet was lost below 700 feet.
SW¼NW¼SE¼	SX-DT-1	Dr	1954	250	10	0	10	OH	10	253	------	3,310D	Dry	------	------	------	N	Y	X	Y	On bajada; reported in bedrock at 155 feet.
SW¼SW¼SE¼	------	Dr	1952	210	2	0	210	------	------	------	------	3,330D	182.9	7/54	3,147	------	A	Y	------	------	On bajada; center of 3 holes drilled for mining exploration within 100 feet of each other; reported in bedrock at about 150 feet.
Sec. 29																					
NW¼SW¼SW¼	SX-W-9	Dg	------	------	------	------	------	------	------	------	C,W	3,550D	14.3	10/53	3,536	------	D,S	---	------	Y	Along wash in foothills; dug in shallow alluvium above granite.
SE¼NE¼SE¼	SX-W-6	Dg	1941	------	------	------	------	------	------	------	C,W	3,460D	39.9	10/53	3,420	------	D,S	---	------	------	On bajada near foothills; dug in shallow alluvium above granite.

T. 16 S., R. 13 E.																					
Sec. 1																					
NE¼NW¼NE¼	------	Dr	1935	31	------	------	------	OH	------	------	------	2,570D	29.2	10/39	2,541	------	A	----	------	------	Inner valley.
NE¼SW¼NE¼	AW-4	Dr	1940	97	------	------	------	------	------	------	------	2,555D	Dry	1940	------	------	A	Y	------	------	In channel; part of destroyed infiltration-gallery system.
NW¼SE¼NE¼	AW-3	Dr	1940	81	------	------	------	------	------	------	------	------	Dry	1940	------	------	A	Y	------	------	Do.
SE¼SE¼NE¼	AW-5	Dr	1940	90	------	------	------	------	------	------	------	------	Dry	1940	------	------	A	Y	------	------	Do.
SE¼NW¼NW¼	------	Dg	------	27	------	------	------	------	------	------	C,W	2,555	25.7	9/39	2,529	------	A	---	------	------	Inner valley.
NE¼NE¼SE¼-1	AW-2	Dr	1940	100	12	------	------	------	------	------	------	2,556L	3.1	2/42	2,553	1,300	A	Y	------	------	In channel; part of destroyed infiltration-gallery system; see table 3.
NE¼NE¼SE¼-2	AW-6	Dr	1940	100	12	------	------	P	------	------	------	2,561	5.2	2/42	------	1,200	A	Y	------	------	Do.
SE¼NE¼SE¼	AW-1	Dr	1940	105	12	------	------	P	70	98	------	2,561	------	------	------	1,200M	A	Y	------	------	Do.
Sec. 2																					
SE¼NW¼NW¼-1	Old No. 1	Dr	1914	143	10	0	143	P	------	------	------	2,555D	14 R	6/14	2,541	700	A	Y	------	------	Inner valley; reported to break suction after 3 hours pumping; replaced by SX-3; not shown on fig. 2.
SE¼NW¼NW¼-2	SX-3	Dr	1934	232	10	0	232	------	------	------	T,E	2,556L	27.7 33.8	10/42 1/53	2,528 2,522	800	I	Y	------	------	Inner valley.
SW¼SE¼NW¼	SX-4	Dr	1934	180	18	0	180	------	------	------	T,E	2,570L	37.2 42.5	10/42 1/53	2,533 2,527	460	I	Y	------	------	Do.
Sec. 3																					
NE¼NE¼NE¼	PWA-8	Dr	1934	102	6	------	------	------	------	------	------	2,565D	28.1	6/34	------	------	A	Y	------	------	
NW¼NW¼SE¼	SX-DW-1	Dr	------	------	6	------	------	------	------	------	C,W	2,610L	84.3	2/52	2,526	------	S	---	------	------	On bajada.
Sec. 14																					
NE¼NE¼NE¼	------	Dr	1938	136	6	------	------	------	------	------	C,W	2,613L	26 R 59.8	1/38 2/52	2,587 2,553	------	S	Y	------	------	Inner valley.

Table 2.—*Records of selected wells adjacent to San Xavier Indian Reservation, Pima County, Arizona*

Type of well: Dg, dug well; Dr, drilled well.
Casing diameter: Size of dug wells not shown.
Type of finish: OH, open hole; P, perforated, method unknown; Pm, perforated by Mills knife.
Type of lift: B, bucket; C, cylinder; S, submersible; T, turbine; D, diesel; E, electric; G, gasoline; NG, natural gas; N, none; W, windmill.
Surface altitude: In feet above mean sea-leavel datum, rounded to nearest foot if leveled and nearest 5 feet otherwise. Source of data: Spirit-level altitudes from Schwalen and Shaw (1957) unless followed by D; D, interpolation from Geological Survey topographic maps or benchmarks.
Water-level depth: Measured unless otherwise indicated; R, reported; many water-level depths are from Schwalen and Shaw (1957).
Water-level altitude: To nearest foot above mean sea-leavel datum, based on surface altitude given in this table.
Yield: Reported or estimated yields; measured yields, indicated by (M), are rounded.
Use: A, abandoned or not completed; D, domestic; I, irrigation; In, industrial; M, mining prospect; O, observation well; N, not used; PS, public supply; S, stock.
Log, well cuttings, and chemical analysis of water: X, water analysis on file, U.S. Geological Survey, Tucson, and well cuttings on file at Arizona Bureau of Mines, University of Arizona, Tucson, Arizona; Y, driller's log in table 6.

Location	Well number or name	CONSTRUCTION DATA: Type	Date of completion (year)	Total depth (feet)	Casing record: Diameter (inches)	Casing record: Depth (feet) From	Casing record: Depth (feet) To	Finish: Type	Finish: Depth (feet) From	Finish: Depth (feet) To	HYDROLOGIC DATA: Type of lift	Surface altitude	Water level: Depth below land surface (feet)	Water level: Date measured (mo./yr.)	Water-level altitude	Yield (gpm)	SUPPLEMENTARY DATA: Use	Log	Well cuttings	Chemical analysis of water	Remarks
T. 15 S., R. 11 E.																					
Sec. 5																					
SW¼SW¼SW¼	--------	Dr	1953	712	20	0	712	Pm	240	697	T,NG	2,370	308.6	1/54	2,061	3,000	I	Y	----	------	See table 4.
SE¼SE¼SW¼	--------	Dr	1953	728	20	0	728	Pm	240	662	T,NG	2,365	304.1	9/54	2,061	3,000	I	----	----	------	
SW¼SW¼SE-2	--------	Dr	1943	500	------	------	------	------	------	------	------	2,362	306.3	9/54	2,056	------	S	----	----	------	Reported "last 50 feet in whitish [material] containing bentonite."
Sec. 11																					
SE¼SE¼NE¼	--------	Dr	1953	588	20	0	585	Pm	330	585	T,NG	2,388	345.5	9/54	2,042	2,000	I	Y	----	------	See table 4.
Sec. 12																					
NE¼SW¼SE¼-1	Owner's no.1	Dr	1942	550	8	------	------	P	------	------	T,E	2,416	362 R	6/42	2,054	------	In	----	----	------	
NE¼SW¼SE¼-2	--------	Dr	1942	550	------	------	------	OH	------	------	------	2,415D	--------	----------	----------	------	A	Y	----	------	Thirty feet south of well 1; not shown on fig. 2.
SE¼SW¼SE¼	Owner's no. 2	Dr	1944	502	12	------	------	P	------	------	T,G,E	2,420	363.7	10/48	2,056	------	S	Y	----	------	
Sec. 17																					
NW¼NE¼NE¼	--------	Dr	1954	369 700	6 20	------	------	------	------	------	T,E	2,389	304.8	9/54	2,084	------	D,I	----	----	------	Deepened to 700 feet in 1954.
T. 15 S., R. 12 E.																					
Sec.1																					
NE¼NE¼SW¼	--------	Dr	------	------	------	------	------	------	------	------	------	2,584	108.6	6/53	2,475	------	----	----	----	------	
SE¼NE¼SW¼	--------	Dr	1932	139	8	------	------	------	------	------	------	2,575 D	60.3	3/40	2,515	------	----	----	----	------	
NE¼SW¼SW¼	--------	Dr	--------	215	6	------	------	------	------	------	------	2,570 D	137.6	9/54	2,432	------	----	----	----	------	
Sec. 2																					
SW¼NE¼NE¼	--------	Dr	------	------	------	------	------	------	------	------	------	2,550	89.3	1/54	2,461	------	----	----	----	------	
SE¼SE¼SE¼	--------	Dr	--------	200	------	------	------	------	------	------	------	2,568	103.1	9/54	2,465	------	----	----	----	------	
Sec. 4																					
SW¼SW¼NE¼	--------	Dr	1917	451	6-1/4	------	------	------	------	------	------	2,455	400 R	2/17	2,055	20	In	Y	----	------	Water-bearing gravel reported at 410 to 450 feet; well partly filled in 1948.
Sec. 6																					
SE¼NE¼SE¼	--------	Dr	1936	435	6	------	------	------	------	------	------	2,407	358 R 360.7	3/40 1/54	2,049 2,046	------	----	----	----	------	
Sec. 11																					
NW¼NW¼NW¼	--------	Dr	------	------	------	------	------	------	------	------	------	2,507	184.3 177.5	1/54 9/54	2,323 2,329	------	----	----	----	------	
Sec. 17																					
NW¼NW¼NW¼	--------	Dr	1937	450	6	------	------	------	------	------	------	2,459	402.4	1/54	2,057	------	----	----	----	------	

T. 15 S., R. 13 E.																					
Sec. 1																					
SW¼SW¼NE¼		Dr	1949	250	12	0	250				T,E	2,490D	67 R	3/49	2,423	450	PS	Y			See table 4.
NW¼SW¼NW¼		Dr	1951	300	16						T,E	2,475	70.4	/54	2,405	800	PS				Do.
Sec. 2																					
NE¼NW¼NW¼-2	SS-10 1/	Dr	1931	182	20							2,431	61 R 60.7 50.3	5/51 /54 /56	2,370	1,100	PS	Y			Do.
NW¼NE¼SW¼	SS-23 1/	Dr		310				P	120	300			75 R	11/54		800	PS				Do.
NE¼NW¼SW¼	SS-3 1/	Dr		118	16						T,E		52 R	/51		600	PS				Do.
NE¼SW¼SW¼		Dg,Dr		105	16							2,430	30.7 58.3 72.8	2/40 2/55 6/61	2,399 2,372 2,357		O				Water-level records since 1931.
Sec. 3																					
SW¼SE¼NE¼	Owner's no. 2.	Dr		142	16	0	142	P	34	138	T,E	2,439	57.7	1/52	2,381	1,000	I	Y			See table 4.
Sec. 4																					
NE¼SE¼SE¼		Dr		210								2,455D					N	Y	X		
Sec. 10																					
SW¼SW¼SW¼		Dg,Dr		61	16							2,470D	31 R				A	Y			
SW¼SE¼SW¼		Dr		161								2,462						Y			
NW¼NW¼SE¼		Dr		141	14			P	38	137	T,E	2,463	60.2	/54	2,403	400	I				
SW¼SW¼SE¼-2		Dr		366	12						T,E	2,465D	42 R 56.4	12/48 2/57	2,423 2,409	400	I	Y			Do.
Sec. 11																					
NE¼NW¼SW¼		Dr		281	16						T,E	2,460	58.0	/53	2,402	300	PS	Y			See table 4. Log is for 198-foot well adjacent to this site.
Sec. 14																					
SE¼SW¼SW¼		Dr		465	20						T,E	2,490D					I	Y			
Sec. 15																					
SE¼SE¼NE¼		Dr		240	8			P	0	240	T,E	2,476	43 R 39.6	6/46 2/52	2,433 2,436	650 750	I	Y			Deepened from 164 to 240 feet in 1947; see table 4.
SW¼NE¼SW¼		Dr	1961	252	12	0	52	P	70	242		2,480D					I	Y			
NW¼NW¼SE¼		Dr	1952	263	16	0	170	Pm	50	170	T,NG	2,470D	50 R	11/52	2,420	650	I	Y			
NW¼SW¼SE¼		Dr	1962	350	16	0	350	Pm	70	345		2,480D	76 R	2/62	2,404			Y			
SW¼SW¼SE¼		Dr		200	16	0	200	P	37	200	T,E	2,485D	52.3	1/52	2,433	500	I				See table 4.
SW¼SE¼SE¼		Dr		133	18											500	I				Do.
Sec. 20																					
NW¼SE¼SW¼-1		Dr	1954	168	12						T,E	2,537	77.2	9/54	2,460		D,S				A hundred feet west of abandoned, 100-foot well shown on topographic map. Reported all in alluvium.
Sec. 21																					
NE¼NE¼SW¼		Dr		130								2,509	51.5	2/52	2,457		D				Reported in "rock" at depth of 130 feet.
SW¼SE¼SW¼-1		Dr		116								2,529	67.2	2/52	2,462						Reported in "rock" at depth of 116 feet.
T. 15 S., R. 14 E.																					
Sec. 2																					
NW¼NE¼SE¼	Deep test 2/	Dr	1957?	2,460															X		Only partial set of cuttings (0–1,000 feet) on file; size analysis on file, 0–1,000 feet.
Sec. 3																					
NW¼NW¼NE¼	Well 3 2/	Dr	1957	848	16	0	848	P	280	835			190 R	4/57							Size analysis on file.
SW¼NW¼NE¼	Well 2 2/	Dr	1957	730															X		Do.
NW¼SW¼NE¼		Dr	1956	820	16	0	820	P	280	805			184 R	12/56							
SW¼NE¼NW¼	Well 1	Dr	1956	1,150				P	240	760		2,620D	147 R	12/56	2,473			Y	X		Partial set of cuttings (0–1,115 feet) on file; size analysis on file, 0–1,115 feet.
NW¼NW¼NW¼		Dr	1956	868	20	0	868	P	240	858		2,600D	187 R	11/56	2,413						
Sec. 7																					
SE¼SE¼NE¼-1		Dr		440	10			P	90	440			84 R	3/56		220	PS				See table 4.
SE¼SE¼NE¼-2		Dr		444	10			P	84	440			84 R	9/58		150	PS				Not shown separately on fig. 2, see table 4.

See footnotes at end of table.

Table 2.—*Records of selected wells adjacent to San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Well number or name	CONSTRUCTION DATA: Type	Date of completion (year)	Total depth (feet)	Casing record: Diameter (inches)	Casing record: Depth (feet) From	Casing record: Depth (feet) To	Finish: Type	Finish: Depth (feet) From	Finish: Depth (feet) To	HYDROLOGIC DATA: Type of lift	Surface altitude	Water level: Depth below land surface (feet)	Water level: Date measured (mo./yr.)	Water-level altitude	Yield (gpm)	SUPPLEMENTARY DATA: Use	Log	Well cuttings	Chemical analysis of water	Remarks
T. 15 S., R. 14 E—Cont.																					
Sec. 18																					
SW¼NE¼SW¼	TMA-1 3/	Dr	1941	250	----	----	----	----	----	----	T,E	2,561	79.6	/53	2,481	750	I	Y	----	----	See table 4.
SW¼NW¼SW¼	TMA-2 3/	Dr	1941	320	16	----	----	P	80	304	T,E	2,551	64 R 73.3	/41 /52	2,487 2,478	1,200	N	Y	----	----	Use discontinued because well was contaminated, reportedly by oil from nearby tank; see table 4.
NE¼NE¼SE¼	TMA-3 3/	Dr	1941	362	14	----	----	P	90	345	T,G	2,570	74 R 78.5	/44 /53	2,496 2,491	200 125	I	----	----	----	Well reported to be in "tight clay" and in "tighter formation" than wells TMA-1 and 2; see table 4.
NE¼SE¼SE¼	TMA-4 3/	Dr	1941	250	14	----	----	P	90	306	----	2,577	78 R 82.6	/44 /53	2,499 2,494	300 110	I	----	----	----	See table 4.
Sec. 19																					
NE¼NE¼NW¼	TMA-5 3/	Dr	1943	310	----	----	----	----	----	----	----	2,573	78.0 83.8 96.3	/48 /53 /63	2,495 2,490 2,477	630	I	----	----	----	Do.
SW¼SW¼SW¼	SC-7 1/	Dr	1954	350	16	0	350	Pm	114	338	T,E	2,565	54.3	5/55	2,511	1,200	PS	Y	----	----	Do.
NW¼NW¼SE¼	TMA-10 3/	Dr	1957	402	12	0	360	----	----	----	----	2,584	80 R	/57	----	500	I	Y	----	----	Do.
Sec. 29																					
SE¼SE¼NW¼	Hughes-4	Dr	----	450	12	0	450	P	150 350	190 410	T,E	2,615D	98 R	2/61	2,517	400	I	Y	----	----	Gamma-ray log on file; see table 4.
Sec. 30																					
SE¼SE¼NE¼	Hughes-2	Dr	1955	504	14	0	501	P	75	480	N	2,602	82.9	/55	2,519	----	A	Y	----	----	Reported all in clay; gamma-ray log available; did not yield enough water to make a well.
Sec. 31																					
NW¼NW¼NW¼	SC-10 1/	Dr	----	550	16	0	550	----	----	----	----	2,580D	73.4	3/61	2,507	----	PS	Y	----	----	
SE¼NW¼SW¼	SC- 6 1/	Dr	1954	350	16	0	350	Pm	110	335	T,E	2,585D	62.4	5/55	2,523	2,000	PS	Y	----	----	See table 4.
T. 16 S., R. 10 E.																					
Sec. 35																					
NW¼SW¼SW¼	----	Dr	1940	830	6	----	----	----	----	----	C,G	3,253	756 R 764.8	/40? 1/62	2,497 2,488	10	D,S	----	----	X	Chief aquifer reported between 756 and 833 feet.
T. 16 S., R. 11 E.																					
Sec. 8																					
SW¼SW¼SW¼	----	Dr	1946	754	6	0	754	P	690	754	C,W	2,906	681.5 676.2 681.3 683.8	5/52 1/53 1/59 1/61	2,224 2,230 2,225 2,222	----	S	Y	----	----	
T. 16 S., R. 12 E.																					
Sec. 25																					
SW¼SW¼NE¼	ASARCO X-204	Dr	1958	1,401	4	0	40	----	----	----	N	3,195	----	----	----	----	M	Y	----	----	Gamma-ray log on file at U.S.G.S., Tucson.
Sec. 33																					
SE¼NW¼SE¼	----	Dr	1960	301	8	0	20	----	----	----	N	3,560D	231.0	9/60	3,329	<1	N	----	----	----	Yielded 30 gpm 8-hour period from "decomposed granite;" yield inadequate to make a well.
T. 16 S., R. 13 E.																					
Sec. 34																					
NW¼NE¼NE¼-1	ASARCO Lab well	Dr	1956	720	8	0	540	Pm	220	500	T,E	2,835D	220 R 223.9 232.3	11/56 12/59 1/60	2,615 2,611 2,603	<460	In	Y	X	----	Water temperature, 90°F.; see table 4.

T. 16 S., R. 13 E.																					
Sec. 34—Cont.																					
NW¼NE¼NE¼-2	ASARCO Mission-5	Dr	1959	500	20	------	------	Pm	--------	-----	T,E	2,830D	221.0	1/60	2,609	1,800	In	------	X	------	Water temperature, 88°F; well is about 350 feet north east of well 1; see table 4.
Sec. 35																					
NE¼NE¼NE¼	----------	Dr	1957	181	8	------	------	------	--------	-----	C,E	2,720D	128 R 139.1	3/57 5/60	2,592 2,581	--------	D	Y	------	------	
SW¼SW¼NE¼	----------	Dr	1952	300	12	------	------	------	--------	-----	T,E	2,765D	139 146.3 155.0	3/52 /55 1/60	2,626 2,619 2,610	840	I	------	------	------	Water temperature is 89°F; see table 4.
NE¼NE¼NW¼	ASARCO Mission-7	Dr	1960	504	20	------	------	Pm	230	485	T,E	2,775D	178.7	4/60	2,596	3,000	In	------	X	------	See table 4.
NW¼NW¼NW¼	ASARCO Mission-6	Dr	1960	500	20	------	------	Pm	--------	-----	T,E	2,790D	202.3	3/60	2,588	2,300	In	------	------	------	Water temperature is 90°F; see table 4.
Sec. 36																					
NW¼NE¼NE¼	Pima-3	Dr	1955	300	21	------	------	P	--------	-----	T,E	2,663	65 R 72.7	3/55 7/56	2,598 2,590	1,400 1,200	In	------	------	------	See table 4.
NE¼SW¼NE¼	Pima-1	Dr	1955 1962	300 900	21	------	------	------	--------	-----	T,E	2,665D	68 R 75.3 80 R	1/55 7/56 2/62	2,597 2,590 2,585	1,200 1,300 1,350	In	------	------	------	Do.
NE¼SE¼NE¼	Pima-2	Dr	1955	300	21	------	------	------	--------	-----	T,E	2,667	64 R 76.9	2/55 7/56	2,603 2,590	1,700 1,250	In	------	------	------	Do.
T. 16 S., R. 14 E.																					
Sec. 7																					
SE¼NE¼NW¼	SC-5 1/	Dr	1954	550	16	0	550	Pm	85	438	T,E	2,596	44 R	8/54	2,552	1,000M	PS	Y	------	------	Do.
Sec. 17																					
SW¼SW¼NW¼	SC-3 1/	Dr	1954	360	16	0	360	Pm	120	348	T,E	2,642	78.0	10/54	2,564	2,000M	PS	Y	------	------	Do.
SE¼NE¼SE¼	SC-2 1/	Dr	1954	350	16	0	350	Pm	160	335	--------	2,675D	108.1	11/54	2,567	250M	N	Y	------	------	Do.
Sec. 20																					
NE¼SE¼NE¼	SC-1 1/	Dr	1954	540	16	0	540	Pm	155	525	T,E	2,701	128.4 126.9	/54 5/55	2,573 2,574	1,200M	PS	Y	------	------	Do.
SW¼NW¼NW¼	SC-8 1/	Dr	1954	380	16	0	380	Pm	90	365	T,E	2,630D	67 R 65.3	9/54 5/55	2,563 2,565	1,500M	PS	Y	------	------	Do.
NE¼SE¼NW¼	SC-4 1/	Dr	1954	350	16	0	350	Pm	150	335	T,E	2,683	112.3 113.7	/54 5/55	2,571 2,569	2,000M	PS	Y	------	------	Do.
Sec. 31																					
NE¼NW¼SW¼	Owner's no.37	Dr	--------	--------	--------	------	--------	------	--------	-----	T,E	2,670D	65 R	/53	2,605	1,200M	I	------	------	------	Do.
SE¼SE¼SE¼	----------	Dr	1914	462	16	0	272	------	--------	-----	T,D	2,673	40.8 72.3	/31 /51	2,632 2,601	700	I	Y	------	------	
Sec. 32																					
SE¼SE¼SW¼	----------	Dr	--------	253	20	0	253	P	55	253	T,D	2,672	50.4 74.9 81.8	/48 /53 /56	2,622 2,597 2,590	2,000	I	------	------	------	Do.
T. 17 S., R. 12 E.																					
Sec. 1																					
NE¼NE¼NW¼	----------	Dr	1954	570	13 to 5	------	------	------	--------	-----	--------	3,317	230 R	8/54	3,087	--------	M,A	------	------	------	Partial log; alluvium, 0–185; residual conglomerate, 185–200; metamorphosed arkose, 200–570; in Pima pit; not shown on fig. 2.
Sec. 12																					
SE¼SW¼NW¼	----------	Dr	1954	1,300	6	------	------	------	--------	-----	N	3,450D	135.2	9/54	3,315	15	M	------	------	------	Started in Cretaceous(?) rocks at surface; hit seep at 135 feet; hit water at 900 that rose to 120 feet. See table 4.
T. 17 S., R. 13 E.																					
Sec. 8																					
SW¼NE¼	----------	Dr	--------	280	------	------	------	------	--------	-----	W	3,180D	230 R 170 R	11/41 /54	2,950 3,010	--------	A	------	------	------	
SW¼SW¼SE¼	----------	Dr	--------	--------	------	------	------	------	--------	-----	C,G,W	3,190D	--------	------	------	--------	---	------	------	------	Well sealed; reported to be a dependable but weak well.

See footnotes at end of table.

Table 2.—*Records of selected wells adjacent to San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Well number or name	CONSTRUCTION DATA: Type	Date of completion (year)	Total depth (feet)	Casing record: Diameter (inches)	Casing record: Depth (feet) From	Casing record: Depth (feet) To	Finish: Type	Finish: Depth (feet) From	Finish: Depth (feet) To	Type of lift	HYDROLOGIC DATA: Surface altitude	Water level: Depth below land surface (feet)	Water level: Date measured (mo./yr.)	Water-level altitude	Yield (gpm)	SUPPLEMENTARY DATA: Use	Log	Well cuttings	Chemical analysis of water	Remarks
T. 17 S., R. 13 E.																					
Sec. 8—Cont.																					
Near center-1		Dr	1932?	263																	Dry hole; partial log: overburden, 0–210; red clay, 210–263; not shown on fig. 2.
Near center-2		Dr	1932?	143																	Dry hole; partial log: overburden, 0–140; red clay, 140–143; not shown on fig. 2.
Sec. 10																					
NW¼SE¼		Dr	1957?	1,150	8	0	450				N	2,950D	305.6	2/58	2,644		M	Y			
													312.1	2/60	2,638						
Sec. 11																					
SW¼SW¼SE¼		Dr	1957	445	12						T,E	2,840D	167.6	10/57	2,692	350	PS				Reported all in alluvium; see table 4.
Sec. 17																					
SE¼SE¼NW¼		Dr	1932?	353	8						C	3,221	200R	4/32							Seep at 200 feet; no water below 200 feet; produces about 70 gpd.
													213R	/47							
													211.3	5/60	3,014	<1	N				
Sec. 18																					
NE¼NE¼SE¼		Dr		220	6						C,W	3,283	168R	3/47							Reported bottomed on rock, goes dry after pumping 4 hours.
													158.0	3/60	3,125	<1					
Sec. 20																					
SW¼NE¼NE¼		Dr		920							N	3,200D	305R?		2,895?		M	Y			Small seep encountered at 420 feet; bailed dry when cleaned; driller attributes water to surface runoff.
SW¼SE¼NE¼		Dr	1937	456	6-5/8						N	3,200D					M	Y			Reported dry.
NW¼NE¼SE¼		Dr	1952?	610							N	3,200D					M	Y			Do.
Sec. 21																					
SE¼NE¼NE¼		Dr		60							N	3,060D					M				Hit "rock" at bottom.
NE¼SW¼SW¼		Dr		465	6 or 8						C,E	3,147	422.7	2/47		<1	D				Total depth 452.5 feet, measured January 1950; reported reliable weak well.
													423.9	2/53	2,723						
													426.5	3/57							
SW¼SW¼SW¼		Dr	1932?	508							C	3,175D	460R	2/47			N	Y			Hit water in "granite" at 500 feet; water rose about 50 feet; well went dry about 1952.
Sec. 22																					
SW¼NE¼NW¼		Dr		320	8							2,993	287.1	1/47			D	Y			Reported to have hit "rock" at 240 feet; deeped to 355 feet in 1957; in crevice from 330–335 and at 355 feet.
													305.3	2/54	2,688						
													320.9	2/59							
SW¼SW¼NW¼		Dr	1931	410	7-5/8							3,047	310R	11/31			D	Y			
													352.4	2/53	2,695						
													370.5	2/58	2,677						
SW¼NW¼SE¼		Dr		370	6							2,932	227.4	1/47			D	Y			
													239.3	2/53	2,693						
													253.6	3/57	2,679						
Sec. 23																					
SE¼SW¼NW¼		Dr	1957	325	6							2,898	222.3	3/57	2,676		D				
Sec. 24																					
SW¼SW¼NE¼		Dr	1948	254	20							2,739	66.9	1/52	2,672	1,200M	I				
													74.3	/56	2,665						
Sec. 25																					
SE¼SE¼NE¼		Dr	1962	500	16	0	305	Pm	35	495		2,750D	35R	8/62	2,715			Y			
					14	300	500														
Sec. 26																					
NE¼SW¼SW¼		Dr	1957	320	6							2,881	196.1	2/58	2,685		D				

T. 17 S., R. 13 E. Cont.																					
Sec. 27																					
NW¼SW¼NW¼	----------	Dr	1950	462	6	------	------	------	------	------	------	3,035	325.3	5/50	2,710	------	------	Y	------	------	
													332.8	2/53	2,702	------	------	------	------	------	
													348.2	3/57	2,687	------	------	------	------	------	
Sec. 28																					
—NW¼NW¼	----------	Dr	1942	467	6	------	------	------	------	------	------	3,150D	420 R	6/42	------	------	------	Y	------	------	Well struck water at 425–430 and 445–452 feet; well dry in January 1950.
T. 17 S., R. 14 E.																					
Sec. 5																					
SE¼SE¼SW¼	----------	Dr	1951	360	20	0	360	P	100	300	T,E	2,707	103.6	/53	2,603	700	I	------	------	------	
Sec. 6																					
SE¼SW¼SE¼	----------	Dr	1914	307	16	0	307	------	------	------	T,E	2,690	44.3	/31	2,646	------	I	------	------	------	
													67.7	/53	2,622	------	------	------	------	------	
													72.9	/55	2,617	------	------	------	------	------	
Sec. 7																					
—SE¼SE¼-1	----------	Dr	--------	905	------	------	------	------	------	------	------	2,705	25.3	/31	2,680	------	------	Y	------	------	
—SE¼SE¼-2	----------	Dr	--------	733	------	------	------	------	------	------	------	2,705	36.5	/47	2,668	------	------	------	------	------	Not shown separately on fig. 2.
													63.7	/55	2,641	------	------	------	------	------	
Sec. 18																					
SW¼SE¼NE¼	----------	Dr	1958	1,220	20	0	607	P	100	1,220	T,E	2,710	104 R	2/58	2,606	2,200	I	Y	------	------	See table 4.
					16	607	1,220	------	------	------	------	------	------	------	------	------	------	------	------	------	
NW¼NE¼SW¼	----------	Dg,Dr	--------	124	------	------	------	------	------	------	N	2,710D	55.5	10/39	2,654	------	0	------	------	------	Water-level records since 1939.
													68.3	5/52	2,642	------	------	------	------	------	
													84.5	3/62	2,625	------	------	------	------	------	

1/ City of Tucson well; SC, Santa Cruz River well field; SS, South side well field.
2/ Tucson Gas, Electric Light, and Power Co. wells.
3/ Tucson Municipal Airport well.

Table 3.—*Discharge characteristics of wells on the San Xavier Indian Reservation, Pima County, Arizona*

[Depth to water: R, reported. Type of Test: Q, quantity of water discharge. Test supervision: U/A, University of Arizona; USGS, U.S. Geological Survey; USIS, U.S. Indian Service.]

Location	Well number or name	CONSTRUCTION DATA			STATIC WATER-LEVEL DATA		PUMPING-TEST DATA								
		Date drilled	Total depth of well (feet)	Diameter of casing (inches)	Depth to water below land surface (feet)	Date measured (mo./yr.)	Date tested (mo./yr.)	Drawdown (feet)	Discharge (gpm)	Specific capacity (gallons per minute per foot of drawdown)	Coefficient of transmissibility (gallons per day per foot)	Duration of test (drawdown only) (hours)	Type of test	Test supervision	Remarks
T. 15 S., R. 13E.															
Sec. 22															
SW¼SW¼SE¼-1	Farm well	------	45	6	35.4	9/54	9/54	3	------	----------	200,000	48	Constant Q	USGS	Coefficient of transmissibility from Farm well when used as observation well during pumping of SX-5.
Sec. 23															
NE¼NW¼SW¼	SX-10	1956	410	10	75.6	9/56	9/56	3	100	33	----------	4	Step draw-down.	USGS	
								5	150	30	----------	----------	----------	------	
								12	300	25	----------	----------	----------	------	
								22	500	23	----------	----------	----------	------	
							9/56	28	500	18	40,000	25	Constant Q	USGS	
SW¼NW¼SW¼	SX-11	1959	280	20	45 R	7/59	1/60	175	540	3-1/2	----------	----------	do	USGS	Broke suction intermittently with bowls set at 220 feet; cascading water precluded measurement of water levels during test.
Sec. 25															
SW¼SE¼SW¼	SX-12	1959	365	20	45 R	6/59	1/60	192	1,000	5	----------	----------	do	USIS	
								235	1,100	4	----------	----------	----------	------	
Sec. 26															
NW¼NW¼NE¼	SX-Hosp Test 1	1954	115	10	32.0	12/54	12/54	83	35	<1	----------	1/4	Bailing	USGS	Bailed dry in 15 minutes at 35 gpm; steady yield at 10 gpm.
SW¼NW¼NE¼-3	SX-Hosp. 2	1955	243	10	23.6	12/54	12/54	72	40	<1	800	4	Bailing	USGS	Average of 3 tests totaling about 4 hours.
NW¼SW¼NW¼	SX-1 (PWA-1)	1934	92	18	7.5	4/34	4/34	42	1,000	23	----------	48	Step draw-down.	USIS	
								22	700	32	----------	----------	----------	------	
								13	500	39	----------	----------	----------	------	
					14 R	6/52	6/52	36	600	16	----------	----------	----------	U/A	Spot measurements.
					14.3	1/53	4/53	12	600	50	----------	24	Constant Q	USGS	Test made before dry icing.
							5/53	12	600	50	----------	24	do	USGS	Test made after dry icing.
SW¼SW¼NW¼	SX-1A	1956	400	16	28.2	6/56	6/56	3	500	167	----------	6-3/4	Step draw-down.	USIS	Well reported to have nearly fully recovered in 10 minutes.
								5	700	140	----------	----------	----------	------	
								25	1,000	40	----------	----------	----------	------	
								35	1,200	34	----------	----------	----------	------	
								57	1,500	26	----------	----------	----------	------	
SE¼SW¼SW¼	SX-6	1953	260	20	29 R	11/53	11/53	135	600	4	----------	48	Production	USIS	
Sec. 27															
SW¼NE¼NE¼	SX-8	1954	380	20	30 R	8/54	8/54	120	1,900	16	----------	30	Step draw-down.	USIS	Water level reported to be 52 feet 5 minutes after completion of test.
								100	1,700	17	----------	----------	----------	------	
								76	1,300	17	----------	----------	----------	------	
								61	1,000	16	----------	----------	----------	------	
								43	700	16	----------	----------	----------	------	
							9/54	1	------	----------	400,000	48	Constant Q	USGS	Coefficient of transmissibility from well SX-8 when used as observation well during pumping of SX-5.
NW¼NW¼NE¼	SX-5 (PWA-5)	1934	265	18	21 R	/35	/35	51	1,000	20	----------	----------	----------	USIS	
							8/38	51	1,100	21	----------	----------	Step draw-down.	USIS	
								40	1,000	25	----------	----------	----------	------	
								36	850	24	----------	----------	----------	------	
								25	700	28	----------	----------	----------	------	
					35 R	6/52	6/52	12	1,000	83	----------	----------	----------	U/A	Spot measurements.
					36.4	4/53	4/53	9	1,000	110	----------	24	Constant Q	USGS	Test made before dry icing.
							5/53	10	1,000	100	----------	24	do	USGS	Test made after dry icing.
					35	9/54	9/54	46	1,200	26	100,000	48	do	USGS	
SW¼NW¼NE¼	Encinas dug well	------	40	108	35	9/54	9/54	1	------	----------	250,000	48	do	USGS	Coefficient of transmissibility from dug well when used as observation well during pumping of SX-5.
NE¼NW¼SE¼	Old SX-3	------	230	16-12	20 R	/33 R	5/33	69	650	10	----------	----------	Unknown	USIS?	
Sec. 34															
SE¼NW¼NE¼	SX-9	1954	340	20	35.2	8/54	8/54	130	750	6	----------	30	Step draw-down.	USIS	Water level reported to be 41 feet 5 minutes after completion of test.
								71	650	9	----------	----------	----------	------	
								32	400	12	----------	----------	----------	------	

Sec. 35															
SW¼NW¼SW¼ ---	SX-2 (PWA-2)	1934	140	18	20 R	5/34	5/34	8	850	106	----------	---------	Step draw-down	USIS	
								12	1,300	108	----------	---------		------	
								21	1,800	86	----------	---------	----------	------	
					35 R	6/52	6/52	27	700	25	----------	---------	----------	U/A	Spot measurements.
							4/53	22	500	23	----------	24	Constant Q	USGS	Test made before dry icing.
					37.5	5/53	5/53	23	450	20	----------	24	---do ----	USGS	Test made after dry icing.
SE¼SW¼SW¼----	SX-7	1953	260	20	34 R	11/53	11/53	74	700	9	----------	48	Step draw-down	USIS	
								86	800	9	----------	---------		------	
								111	900	8	----------	---------	----------	------	
T. 16 S., R. 13 E.															
Sec. 1															
NE¼NE¼SE¼-1--	AW-2	1940	100	12	3.1	2/42	----------	38	1,300	35	----------	---------	----------	USIS	
SE¼NE¼SE¼ ----	AW-1	1940	105	12	----------	----------	----------	20	1,200	60	----------	---------	----------	USIS	
Sec. 2															
SE¼NW¼NW¼ ---	SX-3	1934	232	18	20.7	7/34	8/34	58	900	16	----------	54	Step draw-down	USIS	
								39	700	18	----------	---------		------	
								22	400	18	----------	---------	----------	------	
					34 R	6/52	6/52	16	650	40	----------	---------	----------	U/A	Spot measurements.
					35	4/53	4/53	28	500	18	50,000	24	Constant Q	USGS	Test made before dry icing.
							5/53	28	450	16	----------	24	---do ----	USGS	Test made after dry icing.
SW¼SE¼NW¼ ---	SX-4	1934	180	18	31.5	8/34	8/34	37	900	24	----------	48	Step draw-down	USIS	
								24	700	30	----------	---------		------	
								15	500	33	----------	---------	----------	------	
					43 R	6/52	6/52	27	450	17	----------	---------	----------	U/A	Spot measurements.
					43.6	4/53	4/53	26	350	13	----------	24	Constant Q	USGS	Test made before dry icing.
							5/53	28	400	14	50,000	24	---do ----	USGS	Test made after dry icing with 200 pounds of dry ice.

Table 4.—*Discharge characteristics of selected wells adjacent to the San Xavier Indian Reservation, Pima County, Arizona*

[Depth to water: R, reported. Coefficient of transmissibility: E, estimated. Type of test: Q, quantity of water discharged. Test supervision by drillers, except as indicated; USGS, U. S. Geological Survey. Remarks: All wells are in Santa Cruz Valley, except as specified]

Location	Well number or name	CONSTRUCTION DATA			STATIC WATER-LEVEL DATA		PUMPING-TEST DATA								
		Date drilled	Total depth of well (feet)	Diameter of casing (inches)	Depth to water below land surface (feet)	Date measured (mo./yr.)	Date tested (mo./yr.)	Drawdown (feet)	Discharge (gpm)	Specific capacity (gallons per minute per foot of drawdown)	Coefficient of transmissibility (gallons per day per foot of drawdown)	Duration of test (drawdown period) (hours)	Type of test	Test supervision	Remarks
T. 15 S., R. 11 E.															
Sec. 5															
SW¼SW¼SW¼	---------	1953	712	20	308.6	1/54	---------	40	3,000	75	---------	---------	---------	------	In Avra Valley.
SE¼SE¼SW¼	---------	1953	728	20	304.1	9/54	---------	40	3,000	75	---------	---------	---------	------	Do.
Sec. 11															
SE¼SE¼NE¼	---------	------	588	--------	345.2	9/54	/54	85	2,700	32	---------	---------	---------	------	In Avra Valley; coefficient of storage calculated to be about 0.1.
							/58?	73	2,000	28	130,000	240	Constant Q	Univ. of Arizona.	
T. 15 S., R. 13 E.															
Sec. 1															
SW¼SW¼NE¼	---------	1949	250	12	67 R	8/49	---------	25	450	18	---------	---------	---------	------	
NW¼SW¼NW¼	---------	------	300	16	79 R	---------	---------	8	800	100	---------	---------	---------	------	
Sec. 2															
NE¼NW¼NW¼-2	SS-10 1/	1931	182	20	61 R	5/51	5/51	36	1,100	30	---------	---------	---------	------	
NE¼NE¼SW¼	SS-23 1/	------	310	--------	75 R	11/54	---------	16	800	50	---------	10	---------	------	
							2/60	18	1,100	62	---------	---------	---------	------	
NE¼NW¼SW¼	---------	------	118	16	52 R	5/51	---------	32	600	19	---------	---------	---------	------	
Sec. 3															
SW¼SE¼NE¼	---------	------	142	16	58.5	1/52	---------	20	1,000	50	---------	---------	---------	------	
Sec. 10															
NW¼NW¼SE¼	---------	------	141	14	---------	---------	6/46	36	600	17	---------	---------	---------	------	
					52.0	3/52	7/51	34	430	13	---------	---------	---------	------	
					60.2	/54	---------	40	400	10	---------	---------	---------	------	
Sec. 11															
NE¼NW¼SW¼	---------	------	281	16	58.0	/53	5/51	40	300	7	---------	---------	---------	------	
Sec. 15															
SE¼SE¼NE¼	---------	------	240	8	39.6	7/52	6/46	70	650	9	---------	---------	---------	------	
							5/47	67	750	11	---------	---------	---------	------	
SW¼SW¼SE¼	---------	------	200	16	37 R	5/47	5/77	83	500	6	---------	---------	---------	------	
SW¼SE¼SE¼	---------	------	133	18	---------	---------	---------	40	500	12	---------	---------	---------	------	
T. 15 S., R. 14 E.															
Sec. 7															
SE¼SE¼NE¼-1	---------	------	440	10	84 R	3/56	---------	110	220	2	---------	---------	---------	------	
SE¼SE¼NE¼-2	---------	------	444	10	84 R	9/58	---------	86	150	2	---------	---------	---------	------	
Sec. 18															
SW¼NE¼SW¼	TMA-1 2/	1941	250	--------	79.6	/53	/62	25	750	30	---------	---------	---------	------	
SW¼NW¼SW¼	TMA-2 2/	1941	320	16	64 R	/41	/44	38	1,200	32	---------	---------	---------	------	
NE¼NE¼SE¼	TMA-3 2/	1941	362	14	74 R	/44	/44	56	200	4	---------	---------	---------	------	
NE¼SE¼SE¼	TMA-4 2/	1941	250	14	78 R	/44	/44	129	300	3	---------	---------	---------	------	
					82.6	/53	/62	18	110	6	---------	---------	---------	------	
Sec. 19															
NW¼NW¼NE¼	TMA-10 2/	1957	402	12	80 R	/57	/57	54	500	9	---------	11	Step draw-down.	------	
NE¼NE¼NW¼	TMA-5 2/	1943	310	--------	78.0	/48	/48?	70	630	9	---------	6	do	------	
SW¼SW¼SW¼	SC-7 1/	1954	350	16	57 R	9/54	9/54	40	1,200	30	---------	9	---------	------	
Sec. 29															
SE¼SE¼NW¼	Hughes-4	-----	450	12	98 R	2/61	2/61	102	400	4	---------	102	---------	------	
Sec. 31															
SE¼NW¼SW¼	SC-6 1/	1954	350	16	63 R	10/54	10/54	40	2,200	55	---------	12	---------	------	
T. 16 S., R. 13 E.															
Sec. 34															
NW¼NE¼NE¼-1	ASARCO Lab. well	1956	720	8	232.3	1/60	12/56	10	460	46	150,000E	2	Step draw-down.	------	Almost total recovery in 15 minutes.
NW¼NE¼NE¼-2	ASARCO Mission-5	1959	500	20	221.0	1/60	1/60	51	1,800	35	---------	24	Constant Q	USGS	

Sec. 35															
SW¼SW¼NE¼ ---	---------	1952	300	12	155.0	1/60	---------	42	840	20	---------	---------	---------	---------	
NE¼NE¼NW¼ --	ASARCO Mission-7	1960	504	20	178.7	4/60	---------	95	3,000	32	---------	24	---------	---------	
NW¼NW¼NW¼ --	ASARCO Mission-6	1960	500	20	202.3	3/60	---------	60	2,300	38	---------	24	---------	---------	
Sec. 36															
NW¼NE¼NE¼ --	Pima-3	1955	300	21	65 R	3/55	3/55	71	1,400	20	---------	24	---------	---------	
					72.7	7/56	7/56	31	1,200	39	---------	---------	---------	---------	
NE¼SW¼NE¼ ---	Pima-1	1955	300	21	68 R	1/55	1/55	250	1,200	5	---------	24	---------	---------	
					75.3	7/56	7/56	27	1,300	48	---------	---------	---------	---------	
		1962	900	---------	80 R	2/62	2/62	33	1,350	40	---------	---------	---------	---------	Test in 1962 after well was deepened to 900 feet.
NE¼SE¼NE¼ ---	Pima-2	1955	300	21	64 R	2/55	2/55	109	1,700	15	---------	24	---------	---------	
					76.9	7/56	7/56	30	1,250	43	---------	---------	---------	---------	
T. 16 S., R. 14 E.															
Sec. 7															
SE¼NE¼NW¼ ---	SC-5 1/	1954	550	16	42.7	2/55	8/54	50	1,000	20	---------	21	---------	---------	Tested after 9 hours of development.
Sec. 17															
SW¼SW¼NW¼ --	SC-3 1/	1954	360	16	78.0	10/54	9/54	25	2,300	80	---------	6	---------	---------	Specific capacity based on data collected during 14 hours of development.
SE¼NE¼SE¼ ---	SC-2 1/	1954	350	16	112.1	11/54	10/54	80	240	3	---------	3	---------	---------	Specific capacity based on data collected during 14 hours of development.
Sec. 20															
NE¼SE¼NE¼ ---	SC-1 1/	1954	540	16	126.9	5/55	8/54	20	1,200	60	---------	14	---------	---------	Tested after 9 hours of development.
SW¼NW¼NW¼ --	SC-8 1/	1954	380	16	65.3	5/55	9/54	15	1,500	100	---------	11	---------	---------	Specific capacity based on data collected during 11 hours of development.
NE¼SE¼NW¼ ---	SC-4 1/	1954	350	16	113.7	5/55	10/54	33	2,000	60	---------	8	---------	---------	Specific capacity based on data collected during 30 hours of development.
Sec. 31															
NE¼NW¼SW¼ --	Owner's no. 37	------	------	---------	65 R	/53	---------	20	1,200	60	---------	---------	---------	---------	
Sec. 32															
SE¼SE¼NW¼ ---	---------	------	253	20	50.4	/48	---------	20	2,000	100	---------	---------	---------	---------	
T. 17 S., R. 12 E.															
Sec. 12															
SE¼SW¼NW¼ ---	---------	1954	1,300	6	135.2	9/54	---------	22	15	<1	---------	---------	Bailing	---------	
T. 17 S., R. 13 E.															
Sec. 11															
SW¼SW¼SE¼ ---	---------	1957	445	12	167.6	10/57	---------	42	350	8	---------	---------	---------	---------	
T. 17 S., R. 14 E.															
Sec. 18															
SW¼SE¼NE¼ ---	---------	1958	1,220	20–16	104 R	2/58	---------	80	2,200	27	---------	---------	---------	---------	

1/City of Tucson well; SC, Santa Cruz River well field; SS, South side well field.
2/Tucson Municipal Airport well.

Table 5.—*Selected drillers' logs of wells and test holes on the San Xavier Indian Reservation*

Drillers' logs are quoted except for minor changes in spelling and punctuation; in some instances the logs have been shortened by abbreviating descriptive material and combining successive similar zones.

Altitudes are about at ground level and are spirit leveled unless followed by D; D, interpolated from topographic maps. Comments within brackets ([ ]) are by L. A. Heindl.

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 13 E.		
Sec. 22		
SW¼NW¼SE¼-2		
2,507 feet		
Soil	38	38
[Flood-plain deposits, 0–38]		
Sandy, mixed with clay	10	48
Light colored clay	62	110
White caliche-like material	10	120
Yellow clay	75	195
[Base of older alluvium]		
Rock, malpais(?)	30	225
[Rock identified as porphyritic andesite]		
TOTAL DEPTH		225
SW¼SW¼SE¼-2		
2,511 feet		
[Condensed log of well E shown on map and section of Henderlider and Odom, 1912. (See p. 5)]		
Dark soil, sand and clay	20	20
Sand	10	30
Clay and sandy clay	9	39
[Flood-plain deposits, 0–39]		
Sand and gravel	9	48
[Gravel deposits, 39–48] [Base of older alluvium]		
Sandy red clay	134	182
TOTAL DEPTH		182
Sec. 23		
SW¼NE¼SW¼		
2,500 feet D		
Cement pit	10	10
[Dug through flood-plain deposits?]		
Sand, gravel, and boulders	28	38
[Gravel deposits, 10–38]		
Cemented gravel and boulders	16	54
[Base of older alluvium]		
Bedrock	4	58
TOTAL DEPTH		58
SW¼NW¼SW¼		
2,510 feet D		
Well SX-11		
Top soil	12	12
[Flood-plain deposits, 0–12]		
Sand and gravel	3	15
Sandy gravel and boulders	45	60
[Gravel deposits, 12–60]		
Broken clay	52	112
Sand and gravel	4	116
[Gravel deposits, 112–116]		
Sandy clay	40	156
Yellow clay and gravel	64	220
Yellow clay and conglomerate	32	252
Red clay—sticky	22	280
TOTAL DEPTH		280
Sec. 25		
SW¼SE¼SW¼		
2,550 feet D?		
Well SX-12		
Top soil	50	50
[Flood-plain deposits, 0–50]		
Sand	2	52
Clay	32	84
Cemented conglomerate	7	91
Sand and gravel	6	97
[Gravel deposits, 91–97]		
Sandy clay	13	110
Clay	112	222
Cemented sand	2	224
Clay	11	235
Hard clay, gravel and boulders (conglomerate)	130	365
[Base of older alluvium is presumed at below depth of 365 feet.]		
TOTAL DEPTH		365
Sec. 26		
NW¼NW¼NE¼		
2,530 feet D		
Well SX-Hosp. Test 1		
Soft clay, white	25	25
Sand and water	1	26
Red clay	29	55
Red clay, a little sand at 65 feet	10	65
White clay, trace sand at 85 feet	20	85
White clay, with trace of sand	10	95
Caliche, cemented	10	105
Talus(?)	10	115
[Base of older alluvium presumed to be slightly below depth of 115 feet.]		
TOTAL DEPTH		115
SW¼NW¼NE¼-1		
2,530 feet D		
Well SX-Hosp. 1		
Black soil	14	14
Black sandy soil	6	20
Brown sandy soil	13	33
[Flood-plain deposits, 0–33]		
Fine sand, some coarse water gravel	9	42
[Gravel deposits, 33–42]		
Fine clay or fine silt	58	100
TOTAL DEPTH		100
SW¼NW¼NE¼-2		
2,525 feet D		
Well SX-Hosp. 2		
Black surface soil	20	20
[Flood-plain deposits, 0–20]		
Rock, sand, and gravel; little water	5	25
[Gravel deposits 20–25]		
Red clay, soft	20	45
Very soft, possible water	5	50
A little sand	10	60
[Gravel deposits, 50–60]		

Table 5.—*Selected drillers' logs of wells and test holes on the San Xavier Indian Reservation* —Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 13 E.		
Sec. 26 Continued		
Red clay	5	65
Trace of sand	5	70
Caliche, very soft	5	75
Red clay	5	80
Little sand	5	85
Sand, a little pea gravel	5	90
[Gravel deposits, 80–90]		
White clay, soft	10	100
Red clay, soft, with some sand	15	115
Caliche, clay soft	20	135
Clay with trace of sand	25	160
Sand	5	165
Sand and gravel	10	175
[Gravel deposits, 160–175]		
Sand and a little clay	5	180
Sand and gravel, 2-foot bed of clay at 196 feet	20	200
[Gravel deposits, 180–200]		
Clay, a little gravel, 3-foot bed of sand at 208 feet	38	238
Gravel, very hard drilling	4	242
Fine to medium sand, very clean	1	243
[Gravel deposits, 238–243]		
TOTAL DEPTH		243
NW¼SW¼NW¼		
2,502 feet		
Well SX-1 (PWA-1)		
Sandy loam, top soil	9	9
Silt and fine sand	4	13
[Flood-plain deposits, 0–13]		
Clean sand, gravels, and large boulders	16	29
[Gravel deposits, 13–29]		
Yellow clay with fine sand and gravel	91	120
Buff clay with coarse sand and gravel	9	129
Streak of buff clay with boulders and gravel, harder	2	131
Formation darker, color reddish, no gravel	19	150
Light-buff clay with gravel and sand	65	215
Water-bearing gravel	2	217
[Gravel deposits, 215–217]		
Light-buff clay with coarse sand and gravel	13	230
Light-buff clay with fine sand, getting harder, a change coming	6	236
Gravel and rock packed in yellow clay	4	240
Gravel and rocks packed in yellow clay, possibly some water since 236 feet	25	265
Gravel and rocks packed in yellow clay	17	282
Hard-packed boulders and decomposed porphyry	8	290
Hard rocks, decomposed porphyry, and gravel (less rounded); yellow clay from rotten porphyry; evidently much water	5	295
Rocks and gravel conglomerate filled with clay and caliche; probably moderately water bearing; slush shows 25 percent sand	13	308
TOTAL DEPTH		308
SW¼SW¼NW¼		
2,528 feet		
Well SX-1A		
Soil	10	10
Fine sand	15	25
[Flood-plain deposits, 0–25]		
Sand and gravel, water at 35 feet	45	70
[Gravel deposits, 25–70]		
Sand, red clay	25	95
Clay, little sticky	15	110
Clay and gravel, coarse	20	130
Clay, very little gravel	35	165
Red clay and gravel, hard	75	240
Red clay, very little gravel, some sticky	98	338
Cemented boulders, very hard	62	400
[Buried talus deposit (?), 338–400]		
TOTAL DEPTH		400
SE¼SW¼SW¼		
2,535 feet D		
Well SX-6		
Black clay	23	23
[Flood-plain deposits, 0–23]		
Sand	49	72
[Gravel deposits, 23–72]		
Yellow clay and gravel	188	260
TOTAL DEPTH		260
SE¼SE¼SE¼		
2,540 feet D		
Well old SX-4		
Soil	20	20
Blue clay, struck water	3	23
[Flood-plain deposits, 0–23]		
Gravel, boulders, water raised to 16 feet	17	40
Dirty gravel and boulders	8	48
[Gravel deposits, 23–48]		
Clay and sand	7	55
Yellow clay	40	95
Gravel and boulders, water raised to 11 feet	10	105
[Gravel deposits, 95–105]		
Red Clay	17	122
Caliche	16	138
Dark sand and clay	6	144
Red clay	26	170
Caliche	5	175
Red clay and sand	20	195
Red clay and gravel	60	255
Dark clay and gravel	10	265
Red clay and gravel	15	280
Cemented gravel	5	285
Clay, gravel, and boulders	20	305
Caliche	10	315
Malpais boulders	23	338
Red clay	4	342
Malpais boulders, water dropped to 23 feet, well plugged up to 339 feet	20	362
[Bottom 47 feet interpreted as talus; base of other alluvium presumed at slightly below depth of 362 feet]		
TOTAL DEPTH		362
Sec. 27		
SW¼NE¼NE¼		
2,520 feet D		
Well SX-8		
Black clay	7	7
Fine sand	35	42
[Flood-plain deposits, 0–42]		
Sand and gravel up to three-fourths of an inch	6	48
[Gravel deposits, 42–48]		
Yellow clay and gravel	19	67
Sand, yellow clay	100	167
Sand, gravel, and yellow clay	209	376
Yellow clay	4	380
TOTAL DEPTH		380
NW¼NW¼NE¼		
2,520 feet D		
Well SX-5		
Top soil	28	28
[Flood-plain deposits, 0–28]		
Good gravel	24	52
[Gravel deposits, 28–52]		
Sandy clay	50	102
Red clay and conglomerate	163	265
TOTAL DEPTH		265

Table 5.—*Selected drillers' logs of wells and test holes on the San Xavier Indian Reservation*—Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 13 E.		
Sec. 27—Continued		
SE¼SE¼NW¼		
2,525 feet D		
Well PWA-5		
Black top soil	3	3
Black sticky clay	7	10
Gray-colored sandy clay; water seep at 22-foot level	24	34
Buff sandy clay	2	36
[Flood-plain deposits, 0–36]		
Clean volcanic sand and gravel, good water material	5	41
[Gravel deposits, 36–41]		
Buff clay with quartz sand	10	51
Coarse quartz sand, water-bearing	3	54
[Gravel deposits, 51–54]		
Buff clay with sand	46	100
Buff clay with sand, water	51	151
TOTAL DEPTH		151
NE¼NW¼SE¼		
2,530 feet D		
Well old SX-3		
Soil	21	21
[Flood-plain deposits, 0–21]		
Clay and gravel, struck water at 28 feet	7	28
Small gravel, little clay	22	50
Clay	40	90
Clay and fine gravel	15	105
Coarse sharp sand, water raised 2 feet	9	114
Dirty gravel and sand	4	118
[Gravel deposits, 105–118]		
Clay and gravel	12	130
Clay, sand, and gravel	40	170
Dirty gravel	5	175
[Gravel deposits, 170–175]		
Hard clay and boulders	55	230
TOTAL DEPTH		230
Sec. 34		
NW¼NE¼NE¼		
2,540 feet D		
Well PWA-4		
Top soil	3	3
Black sticky clay	12	15
Brown sandy clay, seep of water about 22 feet	8	23
[Flood-plain deposits, 0–23]		
Yellow sandy clay, coarse grains	12	35
Red sandy shale (water gone); at 1 p.m. seep reappeared at 50 feet, enough to mix the material; the red formation is medium hard; at 3 p.m. a red material with quartz sand (possibly a baked shale); water seeping in	18	53
At 4:30 p.m. a dark-brown rock, probably quartz fallen from above (from nearby hills in olden times?)	2	55
Hole abandoned as not promising		
[Possible ancient talus below depth of 53 feet.]		
TOTAL DEPTH		55
SE¼NW¼NE¼		
2,550 feet D		
Well SX-9		
Black clay	2	2
Yellow sandy clay	20	22
[Flood-plain deposits, 0–22]		
Sand	21	43
[Gravel deposits, 22–43]		
Yellow sandy clay and gravel up to three-fourths of an inch	49	92
Red sandy clay and gravel up to 1 inch	168	260
Hard conglomerate	80	340
[Compare with log of NW¼NE¼NE¼ sec. 34 drilled about 1/8-mile to NE.]		
TOTAL DEPTH		340

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
NE¼SE¼NE¼		
2,550 feet D		
Well PWA-6		
Top soil	2	2
Black sticky clay (large boulder or obstruction 13 feet to 15 feet)	13	15
Gray sandy clay, 50 percent sand (water at 32 feet)	25	40
Gray sandy clay	8	48
[Flood-plain deposits, 0–48]		
Water-bearing sand with ¼-inch gravels	4	52
[Gravel deposits, 48–52]		
Yellow sand clay, 30 percent coarse sand	48	100
TOTAL DEPTH		100
Sec. 35		
SW¼NW¼SW¼		
2,550 feet		
Well SX-2 (PWA-2)		
Surface soil, sandy loam clay, etc.	20	20
[Flood-plain deposits, 0–20]		
Yellow sandy clay, struck water at 26 feet	6	26
Sand, boulders, and gravel	28	54
[Gravel deposits, 26–54]		
Streak of light-brown clay with imbedded boulders and gravel	1	55
Sand, gravel, and boulders	11	66
[Gravel deposits, 55–66]		
Yellow sandy clay, not water-bearing	20	86
Yellow sandy clay	4	90
Coarse gravel and a few rocks, water-bearing	5	95
[Gravel deposits, 90–95]		
Yellow semipacked sand and gravel in formation with streaks of clay, some water	45	140
TOTAL DEPTH		140
SE¼SW¼SW¼		
2,560 feet D		
Well SX-7		
Black clay	12	12
Sandy clay	6	18
[Flood-plain deposits, 0–18]		
Sand	43	61
[Gravel deposits, 18–61]		
Yellow clay and gravel	57	118
Brown sandy clay and gravel	92	210
Red sandy clay and gravel	50	260
TOTAL DEPTH		260
T. 16 S., R. 11 E.		
Sec. 13		
SW¼SE¼NW¼		
3,175 feet D		
Well SX-DT-3		
Granite wash	410	410
Loose sand and gravel, water bailed at 5 gpm	20	430
Granite wash with clay	70	500
[Base of older alluvium(?)]		
Broken granite, lost some water	20	520
Caliche conglomerate, bailed at 1-½ gpm	20	540
TOTAL DEPTH		540
T. 16 S., R. 12 E.		
Sec. 3		
NE¼SE¼SW¼		
2,910 feet D		
Well SX-DT-2		
Valley fill, granitic gravel	90	90
Granite wash	85	175
[Base of older alluvium]		
Red rock, medium hard	35	210
Hard rock, red, small (1 gpm) flow of water at 305 feet	95	305
Hard red rock	20	325
Hard red rock getting harder	80	405
[Porphyritic andesite of the Helmet Fanglomerate of Miocene(?) age below 175 feet.]		
TOTAL DEPTH		405

Table 5.—*Selected drillers' logs of wells and test holes on the San Xavier Indian Reservation*—Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 16 S., R. 12 E.—Continued		
Sec. 24		
NE¼SE¼NE¼		
3,025 feet D		
Well SX-DT-1A		
Alluvium, white, sand, and gravel	160	160
Alluvium, silty, soft	10	170
Yellow-brown alluvium with fragments of arkose, feldspar, and quartz	10	180
Gray alluvium, fine sand to fine gravel	30	210
[Base of older alluvium]		
Crushed arkose(?)	10	220
Crushed arkose	10	230
Arkose, with some quartzite, also some pyrite, magnetite	70	300
[Altered Cretaceous(?) arkose below 210 feet]		
TOTAL DEPTH		300
Sec. 26		
NW¼NW¼NW¼		
3,300 feet D		
Well old SX-7		
Red clay boulders	4	4
Granite	61	65
Conglomerate	15	80
Brown igneous rock	70	150
Conglomerate showing some white quartz boulders	35	185
[Base of older alluvium]		
Red igneous rock	40	225
Green copper-stained rock	20	245
Blue igneous rock	15	260
Green igneous rock showing some limestone	60	320
Red igneous rock	30	350
Black igneous rock mixed with volcanic ash	50	400
Green copper-stained rock	30	430
Red igneous rock	100	530
Green copper-stained rock, white quartz, with little water	40	570
Blue rock formation	30	600
Broken rock crevasse, 2 gpm water production	50	650
Broken igneous crevasse	50	700
Green igneous rock	20	720
Lime quartz formation	30	750
Dry and abandoned		
TOTAL DEPTH		750
SW¼NW¼SE¼		
3,310 feet D		
Well SX-DT-1		
Granite fill or wash	100	100
Granite wash and red clay	55	155
[Base of older alluvium]		
Rotten blue granite, shear or crush	65	220
Red clay with granite wash	30	250
TOTAL DEPTH		250
SW¼SW¼SE¼		
3,330 feet D		
Alluvium	148	148
[Base of older alluvium]		
Decomposed bedrock, brown metamorphosed material, arkose or limestone	9	157
Gray-green siliceous material, brown and wet	4	161
Cored: gray, fractured, vuggy, calcite-veined, hematite-rich andesite	7	168
Brown volcanic, with calcite stringers, fluorite	14	182
Same gray-green volcanic rock, much fresher and less weathered	28	210
[Volcanic lava flows below 157 feet]		
TOTAL DEPTH		210
T. 16 S., R. 13 E.		
Sec. 1		
NE¼SW¼NE¼		
2,555 feet D		
Well AW-4		
Sand and gravel	28	28
[Recent channel deposits and gravel deposits of older alluvium, 0–28]		
Clay	28	56
Sand and gravel	4	60
[Gravel deposits, 56–60]		
Hard clay	37	97
TOTAL DEPTH		97
NE¼NE¼SE¼-1		
2,558 feet		
Well AW-2		
Sand and gravel	30	30
[Recent channel deposits and gravel deposits of older alluvium, 0–30]		
Clay	35	65
Gravel, water-bearing	22	87
[Gravel deposits, 65–87]		
Clay	13	100
TOTAL DEPTH		100
NE¼NE¼SE¼-2		
2,561 feet		
Well AW-6		
Sand and gravel	30	30
[Recent channel deposits and gravel deposits of older alluvium, 0–30]		
Clay	35	65
Sand and gravel, water-bearing	20	85
[Gravel deposits, 65–85]		
Clay	15	100
TOTAL DEPTH		100
SE¼NE¼SE¼		
2,561 feet		
Well AW-1		
Sand and gravel	18	18
Gravel and boulders	12	30
[Recent channel deposits and gravel deposits of older alluvium, 0–30]		
Clay	43	73
Gravel, water-bearing	25	98
[Gravel deposits, 73–98]		
Heavy clay	7	105
TOTAL DEPTH		105
Sec. 2		
SE¼NW¼NW¼		
2,556 feet		
Well SX-3		
Windblown sand	2	2
Light sandy top soil	4	6
Black clay (lake mud)	10	16
Dark sandy clay, water at 23 feet	7	23
[Flood-plain deposits, 0–23]		
Coarse sand and gravel to one-half inch diameter, water	1	24
[Gravel deposits, 23–24]		
Yellow sandy clay and gravel to 1-inch diameter	4	28
Stream rocks, cobblestones, and boulders filled with gravel, occasional narrow streak of clay but whole can be classed as water bearing	19	47
Stream rocks and gravel	2	49
Streak of whitish clay	2	51

Table 5.—*Selected drillers' logs of wells and test holes on the San Xavier Indian Reservation*—Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 16 S., R. 13 E.		
Sec. 2—Continued		
Cobblestones, gravel, and coarse sand	10	61
[Gravel deposits, 28–61]		
Soft brown sandy clay	10	71
Brown clay (decomposed granite) hard streaks with water seep, no gravel	21	92
Yellow clay material, some water seeping in	16	108
Buff clay with variable amounts of sand and occasional small rocks	15	123
Buff clay with fine sand, packed	3	126
Strata of sand, gravel, and small rocks up to 1 inch in diameter with clay, probably water bearing; formation is hard, has consolidated streaks; sandstone gravel conglomerate	3	129
Buff-colored sandy clay	12	141
Sandstone conglomerate	1	142
Rotten conglomerate (clay gravel) probably decomposed sandstone	1	143
Small strata of gravel to ½-inch in diameter, evidently water bearing	2	145
Variations of foregoing formations without well-defined strata; clay gravel and occasional 1-inch rock noted; water coming in to maintain level	10	155
Strata of ½-inch gravel and coarse sand, water-bearing	2	157
Rotten formation with ¼-inch quartz gravel	3	160
Mixed rotten stone, sand, gravel, and few cobblestones, none thick enough to identify strata, probably water bearing	7	167
Rotten caving material, ¼-inch gravel, and coarse sand, some clay	8	175
Hard strata; 1-inch rocks, gravel, and coarse sand, water bearing	1	176
Rotten conglomerate	9	185
Streak of coarser gravels and rocks	1	186
Clay, sand, and gravel	20	206
Gravel, sand, and 2-inch rocks	2	208
Formation resembling rotten sandstone	8	216
Rotten brecciated sandstone, water bearing in the seams and small brecciated streaks	4	220
Red sandy clay with quartz sand and some ½-inch gravel, not water bearing	12	232
TOTAL DEPTH		232
SW¼SE¼NW¼		
2,570 feet		
Well SX-4		
Buff clay with quartz sand and gravel; water came in hole at 31 feet	31	31
[Flood-plain deposits, 0–31]		
Sand, gravel, and rocks, water-bearing	9	40
Sand, gravel, and rocks, water-bearing; sand is dark brown	3	43
Sand, gravel, and rocks, water-bearing, somewhat dirty	11	54
Strata of medium river sand	2	56
[Gravel deposits, 31–56]		
Gray sandy clay, water cut off	2	58
Coarse sand, gravel, and rocks, water-bearing	4	62
Gravel, cobblestones, and boulders, water-bearing	9	71
[Gravel deposits, 58–71]		
Buff sandy clay, water shut off	5	76
Buff sandy clay	20	96
Coarse packed sand and fine gravel, some clay, water at 96 feet	39	135
Sandy clay, buff colored	5	140
Hard sandstone, water under it	3	143
Light-buff sandy clay, medium hard	7	150
Same, but lighter, more clay in mixture	20	170
Cemented material, gravel and sand	10	180
TOTAL DEPTH		180
Sec. 3		
NE¼NE¼NE¼		
2,565 feet D		
Well PWA-8		
Red sandy top soil	4	4
[Flood-plain deposits, 0–4]		
Cemented formation, caliche and sand; water at 34 feet	30	34
Boulders and sand, water-bearing	4	38
Boulders and sand, water-bearing	7	45
[Gravel deposits, 34–45]		
Sand, boulders, and clay streaks, moderately water-bearing, partly cemented	13	58
Light-brown clay	16	74
Light-brown clay, sand, and rocks to 2 inches in diameter, possibly small water-bearing strata	16	90
Light-brown clay with some gravel and sand	12	102
TOTAL DEPTH		102
Sec. 14		
NE¼NE¼NE¼		
2,613 feet		
Loose fine sand	5	5
Light clay and fine sand	10	15
Rock, clay, and sand	2	17
[Flood-plain deposits, 0–17]		
Light-yellow clay and sand	17	34
Gravel, first water found	----------	34
Sandy clay, water cut off	4	38
Water-bearing gravel and sand; water still 34 feet	2	40
Quicksand with a few gravels	3	43
Hard-packed sand, gravel, and clay, very little water	6	49
Water-bearing coarse sand; water up to 29½ feet	3	52
Light sandy clay	4	56
Coarse water-bearing sand	1	57
Clay and coarse sand, scanty water	6	63
Hard sandy clay	5	68
Soft sandy clay, water cut off	5	73
Coarse sand, water-bearing	7	80
Light-yellow sandy clay	20	100
Mixed material; sand, clay, and gravel; water up to 27 feet	6	106
Yellow sandy clay, thin water strata	23	129
Heavy clay with imbedded rocks	2	131
Light sandy clay, water-bearing streaks; water up to 26 feet	5	136
TOTAL DEPTH		136

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation*

Drillers' logs are quoted except for minor changes in spelling and punctuation; in some instances the logs have been shortened by abbreviating descriptive material and combining successive similar zones.

Altitudes are about at ground level and are spirit leveled unless followed by D; D, interpolated from topographic maps. Comments within brackets ([ ]) are by L. A. Heindl.

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 11 E.		
Sec. 5		
SW¼SW¼SW¼		
2,370 feet		
Clay, boulders	40	40
Fine sand	60	100
Sand and boulders	200	300
Streaks of shale and boulders	45	345
Sand, probably water sand	155	500
Hard sand	118	618
Coarse gravel	79	697
Hard sand	15	712
TOTAL DEPTH		712
Sec. 11		
SE¼SE¼NE¼		
2,389 feet		
Soil	10	10
Sandy clay	96	106
Clay with streaks of sand	29	135
Sticky clay	47	182
Sandy clay	16	198
Soft sandy shale	53	251
Hard clay	8	259
Sandy clay	6	265
Clayey gravel	75	340
Hard clay	6	346
Sand, gravel, water	27	373
Sandy clay	9	382
Sand, coarse gravel, water	26	408
Conglomerate	24	432
Clayey gravel, water	43	475
Sandy clay	10	485
Rocky conglomerate	10	495
Muddy sand, gravel, and water	3	498
Hard rocky conglomerate	23	521
Muddy gravel, water	11	532
Rocky conglomerate	56	588
TOTAL DEPTH		588
Sec. 12		
NE¼SW¼SE¼-2		
2,415 feet D		
Soil	2	2
Hard red clay and sand	28	30
Sandy clay, hard-soft streaks, cemented	60	90
Brown hard clay and sand	50	140
Hard yellow clay	30	170
Yellow clay, hard with soft streaks	190	360
Clay with little sand	120	480
Andesite seams of red, yellow and whitish clay or ash	70	550
[Andesite reportedly identified by E. D. Wilson, Director, Arizona Bureau of Mines]		
TOTAL DEPTH		550
SE¼SW¼SE¼		
2,420 feet		
Sandy red clay	5	5
Hard red clay	215	220
Sandy brown clay, cavey	24	244
Hard brown clay-gravel	34	278
Brown clay-cemented gravel	82	360
Sandy brown clay, cavey	27	387
Cemented sand and boulders, porous, hard	115	502
TOTAL DEPTH		502

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 12 E.		
Sec. 4		
SW¼SW¼NE¼		
2,455 feet		
Yellow clay loam	10	10
Slightly varied gritty clay, occasional gravels	400	410
Water-bearing gravel and sand	41	451
TOTAL DEPTH		451
T. 15 S., R. 13 E.		
Sec. 1		
SW¼SW¼NE¼		
2,490 feet D		
Soil	4	4
Caliche	22	26
Sandy red clay	18	44
Caliche and boulders	21	65
Sandy clay, water at 67 feet	8	73
Sand	19	92
Red clay and gravel	128	210
Hard red clay and gravel	40	250
[Base of older alluvium presumed to be below depth of 250 feet, although it may be at 210 feet, at the top of the "hard red clay."]		
TOTAL DEPTH		250
Sec. 2		
NE¼NW¼NW¼-2		
2,431 feet		
City of Tucson SS-10		
Black soil-adobe	15	15
Clay	10	25
[Flood-plain deposits, 0–25]		
Sand and gravel	15	40
[Gravel deposits, 25–40]		
Yellow clay, sand and gravel	24	64
Clay, sand, and gravel	21	85
Porous cemented sand and gravel	4	89
Sand, gravel and clay	89	182
TOTAL DEPTH		182
Sec. 3		
SE¼SE¼NE¼		
2,439 feet		
Black soil	18	18
Pack sand	6	24
[Flood-plain deposits, 0–24]		
Gravel and sand	22	46
[Gravel deposits, 24–46]		
Clay and gravel	92	138
Red clay	4	142
TOTAL DEPTH		142
Sec. 4		
NE¼SE¼SE¼		
2,455 feet D		
Brown caliche and sand	50	50
Yellow conglomerate	95	145
[Base of older alluvium]		

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation* —Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 13 E.		
Sec. 4—Continued		
Quartzite conglomerate	65	210
[This rock is further identified as "conglomerate (that) outcrops (sic) about 1,000 feet northeast of this test hole." This outcrop is Tertiary Cat Mountain Rhyolite of Brown (1939)[1]. However, binocular examination of 1 set of well cuttings from depth of 210 feet suggests rock may be Helmet(?) Fanglomerate of Miocene(?) age]		
TOTAL DEPTH		210
Sec. 10		
SW¼SW¼SW¼		
2,470 feet D		
Soil	31	31
Clay and sand	3	34
[Flood-plain deposits, 0–34]		
Sand and gravel	15	49
[Gravel deposits, 34–49]		
Hard cemented sand, gravel, clay	9	58
[Base of older alluvium]		
Hard rock	3	61
TOTAL DEPTH		61
SW¼SE¼SW¼		
2,462 feet		
Soil (pit)	31	31
[Flood-plain deposits, 0–31]		
Coarse sand and gravel	11	42
Large gravel and boulders	2½	44½
[Gravel deposits, 31–44½]		
Clay cemented gravel	53½	98
White hard cemented gravel	2	100
Broken-cemented boulders	3	103
Fine sand	2	105
[Base of older alluvium]		
Hard rock	56	161
TOTAL DEPTH		161
SW¼SW¼SE¼-2		
2,465 feet D		
Top soil	8	8
[Flood plain deposits, 0–8]		
Red clay, shale	28	36
Muddy sand, water	14	50
Red conglomerate and water	105	155
Hard yellow conglomerate	211	366
[Base of older alluvium presumed to be below depth of 366 feet, although it may be at 155, at the top of the "hard yellow conglomerate."]		
TOTAL DEPTH		366
Sec. 11		
NE¼NW¼SW¼		
2,460 feet		
Caliche	15	15
Yellow clay	3	18
Coarse sand, gravel and boulders-dry	13	31
[Gravel deposits, 18–31]		
Sand, clay, boulders—water	6	37
Clay, sand and gravel	40	77
Red clay, gravel and sand	48	125
Caliche	5	130
Sand shell	4	134
Red clay, gravel, packed sand	8	142
Clay, gravel, little water	6	148
Loose dirty sand	5	153
[Gravel deposits, 148–153]		
Clay, gravel and packed sand	45	198
TOTAL DEPTH		198
Sec. 14		
SE¼SW¼SW¼		
2,490 feet D		
Soil	4	4
Gravel	46	50
[Gravel deposits, 4–50]		
Clay, gravel	130	180
Yellow clay, gravel	40	220
Gravel and clay	8	228
Yellow clay and gravel	202	430
[Base of older alluvium]		
Red clay	28	458
Hard rock	7	465
TOTAL DEPTH		465
Sec. 15		
SE¼SE¼NE¼		
2,476 feet		
(Composite of logs of original and deepened holes)		
Black clay	12	12
Sandy soil	10	22
[Flood-plain deposits, 0–22]		
Boulders and gravel	28	50
[Gravel deposits, 22–50]		
Clay, sandy clay, some gravel	111	161
Red clay	3	164
[Bottom of original hole]		
Soft clay conglomerate	63	227
Hard pan	1	228
Very soft—water	4	232
Hard yellow conglomerate	8	240
TOTAL DEPTH		240
SW¼NE¼SW¼		
2,480 feet D		
Black soil	6	6
Sandy soil	14	20
Sandy clay	10	30
[Flood-plain deposits, 0–30]		
Dry sand and gravel	20	50
[Gravel deposits, 30–50]		
Soft clay conglomerate	25	75
Soft sandy clay-water	15	90
Soft clay conglomerate	20	110
Sandy clay conglomerate	40	150
Sandy conglomerate	20	170
Soft sticky clay	50	220
Sandy clay conglomerate	20	240
Gray clay conglomerate	6	246
Yellow clay	6	252
TOTAL DEPTH		252
NW¼NW¼SE¼		
2,470 feet D		
Top soil	7	7
[Flood-plain deposits, 0–7]		
Sandy red clay	18	25
Sand and gravel	20	45
[Gravel deposits, 25–45]		
Red clay, sand and water	10	55
Sandy red clay	60	115
Hard cemented boulders	148	263
TOTAL DEPTH		263
NW¼SW¼SE¼		
2,480 feet D		
Soil	15	15
[Flood-plain deposits, 0–15]		
Dry sand and gravel	30	45
[Gravel deposits, 15–45]		
Sandy clay and gravel	35	70

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation* —Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 13 E.		
Sec. 15—Continued		
Muddy sand—water	10	80
Sandy clay with gravel—water	70	150
Clay	45	195
Sandy clay with gravel—water	20	215
Clay	5	220
Sandy clay with gravel—water	30	250
Clay	20	270
Sandy clay with gravel—water	25	295
Sand and gravel—water	10	305
[Gravel deposits, 295–305]		
Sandy clay—possible water	15	320
Clay	30	350
TOTAL DEPTH		350
T. 15 S., R. 14 E.		
Sec. 3		
SW¼NE¼NW¼ 2/		
(Schwalen and Shaw, 1957, p. 110 report location in NW¼SW¼ sec. 3.)		
2,620 feet D		
Buff clay with sand layers	115	115
Clay sand and gravel	20	135
Clay with sand layers	130	265
Sand, gravel and clay	20	285
Clay with sand layers	10	295
Sand, gravel and clay	50	345
Clay with sand layers	20	365
Sand, gravel and clay	40	405
Clay with sand layers	30	435
Sand, gravel and clay	10	445
Clay and sand	20	465
Sand, clay and gravel	10	475
Clay and sand	40	525
Clay and fine sand, very sticky	40	565
[Schwalen and Shaw, 1957, p. 22, report well " *** encountered material, which has been tentatively identified as Pantano formation, at a depth of 550 feet ***"]		
Clay and sand in layers	50	615
Clay and sand	60	675
Sand and clay	20	695
Clay and sand	20	715
Sand and clay	30	745
Clay and sand	10	755
Sand, little clay	10	765
Mostly clay, some fine sand	350	1,115
[Schwalen and Shaw, 1957, photograph 10 and p. 22, report "A sample of the formation at 810 feet cut off by the casing shoe ***(shows the) dip of the beds ***"]		
Log unavailable	35	1,150
TOTAL DEPTH		1,150
Sec. 18		
SW¼NE¼SW¼		
2,561 feet		
Tucson Municipal Airport-1		
Loose caliche	3	3
Caliche and boulders	18	21
Loose gravel	29	50
[Gravel deposits, 21–50]		
Caliche	20	70
Loose gravel, water	6	76
[Gravel deposits, 70–76]		
Brown sandy clay	24	100
Brown sticky clay	16	116
Brown sandy clay	26	142
Clay, little gravel	78	220
Sticky clay	10	230
Sticky clay, little sand	20	250
TOTAL DEPTH		250
SW¼NW¼SW¼		
2,551 feet		
Tucson Municipal Airport-2		
Tough compact caliche	50	50
Hard sandy clay	10	60
Sandy clay to stiff caliche	70	130
Caliche and clay	20	150
Hard caliche	10	160
Loose dirty sand	10	170
[Gravel deposits, 160–170]		
Hard tight clay	40	210
Tight sandy clay	10	220
Soft sandy clay	6	226
Gravel	3	229
Tight clay and gravel	3	232
Loose gravel	2	234
Clay and gravel	4	238
Gravel	4	242
[Gravel deposits(?), 229–242]		
Silt and clay	18	260
Stiff clay, shale-like	30	290
Fine-grained sand	8	298
Caliche	6	304
Fine-grained sandy clay	16	320
TOTAL DEPTH		320
Sec. 19		
NW¼NW¼NE¼		
2,584 feet		
Tucson Municipal Airport-10		
Top soil	12	12
Red caliche	8	20
Red clay	5	25
White caliche	10	35
Sandy red clay	5	40
White caliche	8	48
Red clay	21	69
Red sand, clay, water at 75 feet	36	105
Fine sand, red	140	245
Red silty clay	35	280
Red sticky clay	70	350
Red silty clay	52	402
TOTAL DEPTH		402
SW¼SW¼SW¼		
2,565 feet		
City of Tucson SC-7		
Caliche	15	15
Sand	17	32
[Gravel deposits, 15–32]		
Brown sandy clay—water at 57 feet	82	114
Sand and gravel	24	138
Yellow sandy clay	18	156
Brown sandy clay	194	350
TOTAL DEPTH		350
Sec. 29		
SE¼SE¼NW¼		
2,615 feet D		
Hughes-4		
Clay	45	45
Sandy clay	15	60
Sandy clay with rocks	30	90
Sand, small gravel	5	95
[Gravel deposits, 90–95]		
Sandy clay, sand and gravel	30	125
Sand and gravel	25	150
[Gravel deposits, 125–150]		
Sand, gravel and some clay	10	160
Sand, small gravel	20	180
[Gravel deposits, 160–180]		

See footnotes at end of table

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation*—Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 15 S., R. 14 E.		
Sec. 29—Continued		
Sandy clay	15	195
Fine sand	10	205
Clay	40	245
Sandy clay	30	275
Clay	10	285
Sandy clay	10	295
Clay	12	307
Fine sand	8	315
Clay	10	325
Sandy clay, some gravel	15	340
Clay	5	345
Sandy clay, fine sand	10	355
Very fine sand	25	380
Clay	5	385
Sandy clay, some gravel	20	405
Clay	5	410
Sandy clay, small gravel	5	415
Clay, sticky	10	425
Fine sand	20	445
Sticky clay	5	450
TOTAL DEPTH		450
Sec. 30		
SE¼SE¼NE¼		
2,602 feet		
Hughes-2		
Reported all in clay	504	504
TOTAL DEPTH		504
Sec. 31		
NW¼NW¼NW¼		
2,580 feet D		
City of Tucson SC-10		
Soil	4	4
White caliche	30	34
Red clay	39	73
Sandy brown clay—water at 80 feet	41	114
Red sticky clay	8	122
Cemented gravel	51	173
[Gravel deposits(?), 122–173]		
Red clay and gravel	32	205
Red clay and fine sand, loose	10	215
Sticky red clay	295	510
[Possible base of older alluvium]		
Red clay-sand and gravel	40	550
TOTAL DEPTH		550
SE¼NW¼SW¼		
2,585 feet D		
City of Tucson SC-6		
Caliche	4	4
Sand	14	18
Brown sandy clay	22	40
Red sandy clay	7	47
Brown sandy clay	31	78
Sand	4	82
Brown sandy clay	42	126
Tight sand and gravel	16	142
Loose sand, gravel, boulders	22	164
[Gravel deposits, 142–164]		
Brown sandy clay and gravel	186	350
TOTAL DEPTH		350
T. 16 S., R. 11 E.		
Sec. 8		
SW¼SW¼SW¼		
2,908 feet		
Cemented sand	690	690
Sand, gravel and water	60	750
Sandy clay	4	754
TOTAL DEPTH		754

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 16 S., R. 12 E.		
Sec. 25		
SW¼SW¼NE¼ 3/		
3,196 feet		
ASARCO X-204		
Alluvium	200	200
Basalt (Black Mountain-type)	223	423
"San Xavier" conglomerate beds—upper beds	352	775
Basalt porphyry, "turkey-track andesite"	432	1,207
"San Xavier" conglomerate beds—lower beds	195	1,402
TOTAL DEPTH		1,402
T. 16 S., R. 13 E.		
Sec. 34		
NW¼NE¼NE¼-1 3/		
2,835 feet D		
ASARCO lab. well		
Valley gravels	500	500
[Base of older alluvium(?)]		
"San Xavier" conglomerate beds(?)	220	720
[Helmet(?) Fanglomerate of Miocene(?) age]		
TOTAL DEPTH		720
Sec. 35		
NE¼NE¼NE¼		
2,720 feet D		
Top soil, sandy	3	3
Clay	15	18
Sandy clay	112	130
Sand and gravel	5	135
[Gravel deposits(?), 130–135]		
Red sandy clay	46	181
TOTAL DEPTH		181
T. 16 S., R. 14 E.		
Sec. 7		
SE¼NE¼NW¼		
2,596 feet		
City of Tucson SC-5		
Clay	12	12
Sandy clay	32	44
Sandy clay and large rock	136	180
Clay–very little sand	20	200
Brown sandy clay and ½-inch gravel	75	275
Sandy clay–some gravel	45	320
Sand, gravel and clay	60	380
Large gravel and clay	60	440
[Base of older alluvium(?)]		
Clay–little sand	90	550
TOTAL DEPTH		550
Sec. 17		
SE¼NE¼SE¼		
2,675 feet D		
City of Tucson SC-2		
Caliche and gravel	5	5
Clay	15	20
Caliche	15	35
Sandy clay	15	50
Sand and gravel–little clay	10	60
[Gravel deposits, 50–60]		
Clay	40	100
Very sandy clay	155	255
Sand and gravel	15	270
[Gravel deposits, 255–270]		
Sandy clay	80	350
TOTAL DEPTH		350

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation* —Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 16 S., R. 14 E.		
Sec. 17—Continued		
SW¼SW¼NW¼		
2,642 feet		
City of Tucson SC-3		
Caliche	20	20
Sandy clay and gravel	30	50
Sandy clay	10	60
Sandy gravel–little clay	15	75
Sandy clay and gravel	45	120
Sand, gravel and clay	30	150
Sand and gravel	15	165
[Gravel deposits, 150–165]		
Sand and gravel, little clay	20	185
Sandy clay and gravel	15	200
Sandy clay–little gravel	25	225
Sandy clay	50	275
Clay–very little sand	85	360
TOTAL DEPTH		360
Sec. 20		
NE¼SE¼NE¼		
2,701 feet		
City of Tucson SC-1		
Sand and gravel–little clay	45	45
Clay and gravel	35	80
Sandy clay and gravel	25	105
Sandy clay and caliche	30	135
Sandy clay	45	180
Sand and gravel	25	205
[Gravel deposits, 180–205]		
Sandy clay and gravel	15	220
Sandy clay	280	500
[Kidwai, 1957, p. 40, suggests that the base of the older alluvium is at the top of "sticky clay" at depth of 500 feet]		
Sticky clay and little sand	30	530
Sticky clay and little gravel	10	540
TOTAL DEPTH		540
SW¼NW¼NW¼		
2,630 feet D		
City of Tucson SC-8		
Sand	10	10
Sand and gravel	5	15
[Gravel deposits(?), 0–15]		
Sandy clay	20	35
Sand and gravel	35	70
[Gravel deposits(?), 35–70]		
Sandy clay	10	80
Sand and gravel	20	100
[Gravel deposits(?), 80–100]		
Sandy clay	10	110
Sand and gravel	20	130
[Gravel deposits(?) 110–130]		
Sandy clay and gravel	10	140
Sandy clay	195	335
Sand and gravel, little clay	20	355
Sand and gravel	10	365
[Gravel deposits(?), 355–365]		
Sandy clay	15	380
TOTAL DEPTH		380
NE¼SE¼NW¼		
2,683 feet		
City of Tucson SC-4		
Sand, gravel, little caliche	20	20
Sand, gravel, little clay	20	40
Sandy clay	25	65
Sand, gravel, little clay	25	90
Sandy clay and gravel	10	100
Sandy clay	45	145
Sandy clay and gravel	10	155
Sandy clay, less gravel	10	165
[No entry]	15	180
Sand and gravel	180	225
[Gravel deposits, 180–225]		
Sandy clay	40	265
Sand and gravel	25	290
[Gravel deposits, 265–290]		
Sandy clay	60	350
TOTAL DEPTH		350
Sec. 31		
SE¼SW¼SE¼		
2,673 feet		
Surface soil	22	22
[Flood-plain deposits, 0–22]		
Boulders and gravel, dry	23	45
[Gravel deposits, 22–45]		
Gravel and clay	12	57
Clay, sandy clay, sand	66	123
Water-worn gravel in clay	3	126
[Gravel deposits(?), 123–126]		
Clay	47	173
Water-worn gravel in clay	2	175
[Gravel deposits(?), 173–175]		
Clay	41	216
Clean gravel and sand	19	235
[Gravel deposits, 216–235]		
Clay	75	310
Sand, gravel, dirty	6	316
[Gravel deposits, 310–316]		
Sand and clay	14	330
Coarse sand and gravel	11	341
[Gravel deposits, 330–341]		
Clay	20	361
Coarse sand and gravel	2	363
[Gravel deposits, 361–363]		
Sandy red clay	9	374
Coarse sand and gravel	12	386
[Gravel deposits, 374-386]		
Sandy clay	13	399
Gravel	4	403
[Gravel deposits, 399–403]		
Clay	59	462
TOTAL DEPTH		462
T. 17 S., R. 13 E		
Sec. 10		
——NW¼SE¼		
Approx. 2,950 feet D		
Valley fill	430	430
[Base of older alluvium(?)]		
Conglomerate	470	900
Hard rock	250	1,150
TOTAL DEPTH		1,150
Sec. 20		
SW¼NE¼NE¼		
3,200 feet D		
Sand, top soil, and clay	10	10
Cemented conglomerate	215	225
Boulders and conglomerate	70	295
Hard-rock ledges, boulders	40	335
Conglomerate, gravel, sand, hard-rock shells	150	485
Granite [boulders(?)]	5	490
[Base of older alluvium(?)]		
Red rock	5	495
Blue shale	20	515
Brown gouge and streaks of red shale	7	522
[No entry; according to notes in the Geological Survey files, mining geologists have interpreted cuttings below 500 feet as follows: Andesite porphyry (Helmet Fanglomerate of Miocene(?) age), 500-510 feet Arkose (Helmet(?) Fanglomerate of Miocene(?) age), 500-920 feet]	398	920
TOTAL DEPTH		920
SW¼SE¼NE¼		
3,200 feet D		
Sand, gravel, and boulders	235	235
Sand, shale	65	300
Sand, blue lime	25	325
Brown sandy clay	15	340
Hard granite [cemented conglomerate(?)]	20	360

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation*—Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 17 S., R. 13 E.		
Sec. 20—Continued		
Sand and clay	10	370
Hard granite [cemented conglomerate(?)]	50	420
Sand and brown shale	10	430
Sand, gray	10	440
Sand	10	450
[Base of older alluvium]		
Broken formation	6	456
TOTAL DEPTH		456
NW¼NE¼SE¼		
3,200 feet D		
Sandy soil	3	3
Hard rock, brown sandy clay	7	10
Yellow sandy clay	73	83
Boulders and clay	19	104
Yellow sandy clay	176	280
Boulders and clay	40	320
[Base of older alluvium(?)]		
Cemented boulders and gravel	60	380
Cemented boulders	70	450
Conglomerate	57	507
Cemented boulders	15	522
Conglomerate	88	610
[Material on bailing dump derived from conglomerate with fragments of Cretaceous(?) arkose, volcanic rocks, and granite; conglomerate presumed to be Helmet Fanglomerate of Miocene(?) age]		
TOTAL DEPTH		610
Sec. 21		
SW¼SW¼SW¼		
3,175 feet D		
Soil, cemented outwash of clay, sand and gravel	350	350
[Base of older alluvium(?)]		
Cemented material with rock and boulders up to 8-inch diameter. Had to case because boulders break loose	110	460
Limey sandstone or shale—porous, could carry water (driller thinks this formation stands on edge). Hit water at bottom of this station	40	500
Granite of syenite; went into it far enough to make sure it was solid rock	8	508
TOTAL DEPTH		508
Sec. 22		
SW¼SW¼NW¼		
3,047 feet		
Brown clay, gravel and sand	55	55
Clay, sand, and gravel	132	187
[Base of older alluvium]		
White talc and blue lime rock	93	280
Red talc	5	285
White talc and blue limestone	15	300
Yellow talc	7	307
Red talc	15	322
White talc and blue limestone	28	350
Red talc and blue limestone	12	362
White talc and blue limestone	8	370
Red quartz with little red talc	40	410
TOTAL DEPTH		410
SW¼NW¼SE¼		
2,932 feet		
Red clay and gravel	2	2
Soft sandy yellow clay conglomerate	78	80
Gravelly clay conglomerate	15	95
Soft yellow clay conglomerate	30	125
Gravelly conglomerate	15	140
Soft sandy clay conglomerate	100	240
Sand and gravel—water	45	285
Soft silty sand	55	340
Sand and gravel	10	350
Soft sandy conglomerate	10	360
Yellow clay conglomerate, carries gravel	10	370
TOTAL DEPTH		370
Sec. 25		
SE¼SE¼NE¼		
2,750 feet D		
Sand and gravel, dry	35	35
Sand and gravel, water	2	37
[Gravel deposits, 0–37]		
Clay	28	65
Conglomerate	35	100
Gravel	5	105
[Gravel deposits, 100–105]		
Clay	45	150
Conglomerate	60	210
Clay	25	235
Conglomerate	15	250
Clay	25	275
Muddy sand and gravel	15	290
[Gravel deposits, 275–290]		
Clay	15	305
Conglomerate	65	370
Clay	40	410
Conglomerate	90	500
TOTAL DEPTH		500
Sec. 27		
NW¼SW¼NW¼		
3,035 feet		
No record	2	2
Sandy conglomerate	43	45
Brown sandy clay	70	115
Sandy brown conglomerate	115	330
Sand and gravel—water	5	335
Very sandy conglomerate	10	345
Sand and gravel—water	40	385
Rocky clay conglomerate	5	390
Cemented clay conglomerate	15	405
Brown clay conglomerate	20	425
Sand and gravel—water	10	435
Hard gray clay conglomerate	27	462
TOTAL DEPTH		462
Sec. 28		
____NW¼NW¼		
Approx. 3,150 feet D		
Red clay	3	3
Sandy gravelly conglomerate	362	365
No log	60	425
Loose sand and gravel—water	5	430
Hard cemented conglomerate	15	445
Sand and gravel—water	7	452
Hard quartz and limestone	10	462
Yellow clay	4	466
[Base of older alluvium(?)]		
Hard blue-white limestone (bedrock)	1	467
TOTAL DEPTH		467

Table 6.—*Selected drillers' logs of wells in areas adjacent to San Xavier Indian Reservation* —Continued

Well location, altitude, and rock description	Thickness (feet)	Depth (feet)
T. 17 S., R. 14 E.		
Sec. 7		
SE¼SE¼-1 2/		
2,705 feet		
Soil-silt and sand	3	3
Gravel and boulders	40	43
[Gravel deposits, 3–43]		
Clay and gravel	20	63
Clay with sandy streaks	95	148
Sand and gravel	5	153
[Gravel deposits, 148–153]		
Clay, sand and gravel	120	273
Sand and gravel, loose	17	290
[Gravel deposits, 273–290]		
Clay and gravel	107	397
Gravel, sand and boulders	16	413
[Gravel deposits, 397–413]		
Mostly clay, some sand and gravel	54	467
Clay, sand and gravel	48	515
Sand and gravel	5	520
Tough and hard clay	20	540
Clay and gravel, hard	4	544
[Base of older alluvium(?)]		
Hard brown clay	21	565
Clay, tough, soft and hard	76	641
Hard brown clay, tight	23	664
Soft clay-sand mixed	5	669
Tough red clay	54	723
Soft clay-brown sand streaks—water seepage	18	741
Clay	57	798
Hard clay shale	6	804
Soft clay	8	812
Hard brown clay shale	18	830
Tough clay (gravel mixed)	42	872
Soft brown clay	8	880
Hard brown clay	23	903
Rock-orders to quit	2	905
TOTAL DEPTH		905
Sec. 18		
SW¼SE¼NE¼		
2,710 feet		
Gravel	80	80
Shale	60	140
Shale with streaks of sand	75	215
Sand	25	240
Sand and shale	20	260
Shale	46	306
Sand	26	332
Sand and shale	98	430
Gravel	15	445
Shale	9	456
Sand and shale	62	518
Sand and gravel	31	549
Sand	32	581
Sand and shale	72	653
Shale	22	675
Sand and shale	31	706
Sand	94	800
Sand and shale	130	930
Shale	152	1,082
Sand	32	1,114
Shale	62	1,176
Sand	31	1,207
Shale	13	1,220
TOTAL DEPTH		1,220

1/ Brown, W. H., 1939, Tucson Mountains, an Arizona basin-range type: Geol. Soc. America Bull., v. 50, no. 5, p. 729-731.

2/ Considerably condensed from Schwalen and Shaw, 1957, p. 62 and 111-113.

3/ Formation identifications by mining company geologists.

Table 7.—*Altitudes of base of older alluvium and water levels in wells and drill holes in and near the San Xavier Indian Reservation, Pima County, Arizona*

Land-surface or collar altitudes: Spirit-leveled, unless followed by D; D, interpolated from topographic maps.
Altitudes of base of older alluvium: Altitudes preceded by a < indicate that base of older alluvium is below the altitude of the bottom of the hole, which is shown.
Source of information and remarks: Data, except as indicated, are from open-files of the Geological Survey, Ground-Water Branch, Tucson, Arizona; other sources—ASARCO, American Smelting and Refining Co.; Banner, Banner Mining Co.; HGC, Heinrichs Geoexploration Co.; SS 1957, Schwalen and Shaw (1957), TG, G.V. Keller, Geological Survey Theoretical Geophysics Branch. Geological Survey open-file data supplements information from other sources wherever possible. T-5 and T-6 indicate drillers' log is in table 5 or 6, respectively.

Location	Land-surface or collar altitude	Altitude of base of older alluvium	Water level		Source of information and remarks
			Altitude	Date	
T. 15 S., R. 11 E.					
Sec. 2					
NW¼NW¼NW¼	2,330	<1,965	2,040	9/54	
Sec. 5					
SW¼SW¼SW¼	2,370	<1,658*	2,061	1/54	T-6
SE¼SE¼SW¼	2,365	<1,637	2,061*	9/54	
SW¼SW¼SE¼-2	2,362	<1,862*	2,056	9/54	
Sec. 9					
NE¼NE¼SE¼	2,373	<2,068	2,068	1/51	
Sec. 11					
SE¼SE¼NE¼	2,388	<1,800	2,042	9/54	T-6
SE¼SE¼SE¼	2,409	<1,930	2,053	5/54	
Sec. 12					
NE¼SW¼SE¼-2	2,415 D	1,935	------	------	T-6
SE¼SW¼SE¼	2,420	<1,918	2,056	10/48	T-6
Sec. 17					
NW¼NE¼NE¼	2,389	<1,689	2,084	9/54	
SE¼SE¼SW¼	2,426	----------	2,108	9/54	
Sec. 32					
SW¼SE¼SE¼	2,629	<2,139	2,201	1/53	
Sec. 35					
NW¼NE¼NW¼	2,610 D	<2,149	2,149	10/53	
T. 15 S., R. 12 E.					
Sec. 1					
NE¼NE¼SW¼	2,584	----------	2,475	6/53	
NE¼SW¼SW¼	2,570 D	2,535	2,432	9/54	
Sec. 2					
SW¼NE¼NE¼	2,550	----------	2,461	1/54	
SE¼SE¼SE¼	2,568	----------	2,465	9/54	
Sec. 4					
SW¼SW¼NE¼	2,455	<2,004	2,055	2/17	
Sec. 6					
SE¼NE¼SE¼	2,407	<1,972	2,046	1/54	
Sec. 11					
NW¼NW¼NW¼	2,507	----------	2,323	1/54	
Sec. 17					
NW¼NW¼NW¼	2,459	<2,009	2,057	1/54	
T. 15 S., R. 13 E.					
Sec. 1					
SW¼SW¼NE¼	2,490 D	<2,240	------	------	T-6
NW¼SW¼NW¼	2,475	<2,175	2,405	/54	SS, 1957
Sec. 2					
NE¼SW¼SW¼	2,430 D	<2,325	2,372	2/55	
Sec. 3					
SW¼SE¼SE¼	2,450 D	<2,220	------	------	
Sec. 4					
SW¼NE¼SW¼	2,488	----------	2,401	/51	SS, 1957
NE¼SE¼SE¼	2,455 D	2,310	------	------	T-6
Sec. 10					
SW¼SW¼SW¼	2,470 D	2,412	------	------	T-6
SW¼SE¼SW¼	2,462	2,357	------	------	T-6
SW¼SW¼SE¼-2	2,465 D	<2,099	2,409	2/57	T-6
Sec. 12					
-NE¼NE¼	2,521	----------	2,452	/53	SS, 1957
Sec. 13					
NW¼SE¼NE¼	2,548	<2,418	2,476	/53	SS, 1957
SW¼NW¼SW¼	2,510 D	<2,258	2,465	7/59	
Sec. 14					
NW¼NE¼NW¼	2,470	<2,205	2,415	/52	SS, 1957
SE¼SW¼SW¼	2,490 D	2,060	------	------	T-6
— SW¼SE¼	2,505	----------	2,449	7/52	SS, 1957
— SE¼SE¼	2,520	<2,392	2,459	7/52	Do.
Sec. 15					
SE¼SE¼NE¼	2,476	<2,236	2,436	2/52	T-6
SE¼NW¼NW¼	2,477	----------	2,419	2/52	
SW¼SW¼SW¼	2,490	<2,368*	2,438	/52	SS, 1957
SE¼SW¼SW¼	2,490	----------	2,448	2/52	
SE¼SE¼SW¼	2,490 D	----------	2,434	1/53	
NW¼SW¼SE¼	2,480 D	<2,130	------	------	T-6
Sec. 16					
NE¼NW¼NE¼	2,480 D	2,450	------	------	
NE¼NW¼SE¼	2,485 D	<2,350	------	------	
Sec. 17					
SE¼SW¼SE¼	2,520	----------	2,456	2/52	
Sec. 20					
NW¼SE¼SW¼-1	2,537	<2,369	2,460	9/54	
Sec. 21					
NE¼NW¼NE¼-2	2,495 D	2,364	------	------	
NE¼NE¼SW¼	2,509	2,379	2,457	2/52	
SW¼SE¼SW¼-1	2,529	2,413	2,462	2/52	
SW¼SE¼SE¼	2,525 D	2,395	2,455	1/58	
Sec. 22					
SW¼SE¼NE¼-2	2,505 D	<2,375	------	------	
SW¼NW¼SE¼-2	2,507	2,312	2,471	2/52	T-5
SW¼SW¼SE¼-1	2,513	2,468	2,478	9/54	
SW¼SW¼SE¼-2	2,511	2,463	------	------	Do.
Sec. 23					
SE¼NE¼NE¼	2,528	----------	2,476	2/52	
NW¼SW¼NE¼	2,500	----------	2,464	2/52	
SW¼SW¼NE¼	2,520	2,480	2,477	2/52	
SW¼NE¼SW¼	2,500 D	2,446	------	------	Do.
NE¼NW¼SW¼	2,510 D	<2,100	2,437	5/56	
Sec. 25					
SW¼SE¼SW¼	2,550 D	<2,185	2,505	6/59	Do.
Sec. 26					
SW¼NE¼NE¼	2,540 D	<2,514	2,516	2/52	
NW¼NW¼NE¼	2,530 D	<2,415	2,498	12/54	Do.
SW¼NW¼NE¼-2	2,525 D	<2,282	2,501	12/54	Do.
NW¼SW¼NW¼	2,502	<2,194	2,488	1/53	
SW¼SW¼NW¼	2,528 D	<2,128	2,500	6/56	Do.
SE¼SW¼SW¼	2,535 D	<2,275*	2,506	/53	Do.
SE¼SE¼SE¼	2,540 D	<2,178	------	------	Do.
Sec. 27					
SW¼NE¼NE¼	2,520 D	<2,140	2,490	8/54	Do.
NW¼NW¼NE¼	2,520 D	<2,255	2,485	1/53	
SW¼NW¼NE¼	2,519	<2,479	2,486	2/52	
SE¼NW¼NW¼	2,525	----------	2,492	2/52	
SE¼SE¼NW¼	2,525 D	<2,374	------	------	Do.
NE¼NE¼SW¼	2,527	----------	2,498	2/52	
NE¼SW¼SW¼	2,539	----------	2,500	2/52	
Sec. 34					
NW¼NE¼NE¼	2,540 D	<2,485*	------	------	Do.
SE¼NW¼NE¼	2,550 D	<2,210	2,515	8/54	
NE¼NW¼SW¼	2,570	----------	2,510	2/52	

See footnote at end of table.

Table 7.—*Altitudes of base of older alluvium and water levels in wells and drill holes in and near the San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Land-surface or collar altitude	Altitude of base of older alluvium	Water level		Source of information and remarks
			Altitude	Date	
T. 15 S., R. 13 E.—Cont.					
Sec. 35					
SW¼NW¼SW¼	2,550	<2,312*	2,515	/52	T-5
T. 15 S., R. 14 E.					
Sec. 3					
SW¼NE¼NW¼	2,620 D	2,070*	-------	-----	SS, 1957; T-6
Sec. 5					
NW¼NW¼NE¼	2,555	<2,404	2,456	/54	SS, 1957
Sec. 6					
SE¼SE¼SW¼	2,525	----------	2,454	/53	Do.
Sec. 7					
NE¼NW¼SW¼	2,531	<2,251	2,463	/54	Do.
Sec. 9					
—SW¼SW¼	2,613	----------	2,501*	/53	Do.
Sec. 17					
NE¼NW¼NE¼	2,601	----------	2,496	/52	Do.
NE¼NE¼SW¼	2,582	----------	2,500	/52	Do.
Sec. 18					
SE¼NW¼NE¼	2,554	----------	2,484	/53	Do.
SW¼NE¼SW¼	2,561	----------	2,484	/53	Do.
SW¼NW¼SW¼	2,551	<2,231	2,478	/52	Do.
NE¼NE¼SE¼	2,570	----------	2,492	/52	Do.
NE¼SE¼SE¼	2,577	----------	2,495	/52	Do.
Sec. 19					
NW¼NW¼NE¼	2,584	<2,182	-------	-----	T-6
SW¼SW¼SW¼	2,565	<2,215	2,511	5/55	T-6
Sec. 29					
SE¼SE¼NW¼	2,615 D	<2,165	2,517*	2/61	T-6
Sec. 30					
SE¼SE¼NE¼	2,692	<2,098	2,519	/55	T-6
Sec. 31					
NW¼NW¼NW¼	2,580 D	2,070?	2,507*	3/61	T-6
SE¼NW¼SW¼	2,585 D	<2,235*	2,523	5/55	T-6
T. 16 S., R. 10 E.					
Sec. 35					
NW¼SW¼SW¼	3,253	<2,423*	2,488*	1/62	
T. 16 S., R. 11 E.					
Sec. 8					
SW¼SW¼SW¼	2,906	<2,152	2,230	1/53	T-6
Sec. 13					
SW¼SE¼NW¼	3,175 D	2,675?	2,774	9/54	T-5
Sec. 26					
SE¼NW¼SW¼	3,520 D	----------	3,482	10/53	
SE¼SE¼SE¼-1	3,600 D	----------	3,584	10/53	
Sec. 34					
NW¼NW¼NE¼	3,600 D	----------	3,570	10/53	
T. 16 S., R. 12 E.					
Sec. 3					
NE¼SE¼SW¼	2,910 D	2,735	2,622	10/54	T-5
Sec. 10					
NE¼NW¼NE¼	2,938	2,769	-------	-----	ASARCO
Sec. 11					
NW¼SE¼NW¼	2,949	2,812	-------	-----	Do.
Sec. 13					
SE¼SW¼SW¼	3,079	2,944	-------	-----	Do.
SE¼SW¼SW¼	3,072	2,919*	-------	-----	Do.
SW¼SE¼SW¼	3,061	2,912*	-------	-----	Do.
SE¼SE¼SW¼	3,054	2,912*	-------	-----	Do.
SW¼SW¼SE¼	3,042	2,901	-------	-----	ASARCO
SE¼SW¼SE¼	3,036	2,877	-------	-----	Do.
Sec. 14					
NW¼SW¼NE¼	3,042	2,904	-------	-----	Do.
SW¼SE¼SW¼	3,136	3,008	-------	-----	Do.
SE¼SW¼SE¼	3,104	3,023	-------	-----	Do.
SW¼SE¼SE¼	3,093	3,027	-------	-----	Do.
SE¼SE¼SE¼	3,086	2,971	-------	-----	Do.
Sec. 15					
SW¼NW¼SE¼	3,146	3,007	-------	-----	Do.
SE¼SE¼SE¼	3,168	2,974	-------	-----	Do.
Sec. 22					
SW¼NE¼SE¼	3,263	3,173	-------	-----	Do.
Sec. 23					
NE¼NE¼NE¼-1	3,101	3,075	-------	-----	Do.
NE¼NE¼NE¼-2	3,107	3,033	-------	-----	Do.
NW¼NE¼NE¼-1	3,111	3,103	-------	-----	Do.
NW¼NE¼NE¼-2	3,118	3,068	-------	-----	Do.
SW¼NE¼NE¼	3,132	3,117	-------	-----	Do.
SE¼NE¼NE¼	3,124	3,006	-------	-----	Do.
NE¼NW¼NE¼	3,127	3,087	-------	-----	Do.
NW¼NW¼NE¼-1	3,145	3,044	-------	-----	Do.
NW¼NW¼NE¼-2	3,135	3,083	-------	-----	Do.
SE¼NW¼NE¼	3,145	3,091	-------	-----	Do.
NE¼SW¼NE¼-1	3,172	3,172*	-------	-----	Do.
NW¼SW¼NE¼-2	3,167	3,128	-------	-----	Do.
NE¼SE¼NE¼	3,130	2,991	-------	-----	Do.
NW¼SE¼NE¼	3,140	3,120	-------	-----	Do.
NW¼SW¼NW¼	3,196	3,092	-------	-----	Do.
SW¼NE¼SW¼	3,232	3,106	-------	-----	Do.
NE¼NE¼SE¼-1	3,155	3,026	-------	-----	Do.
NE¼NE¼SE¼-2	3,167	3,030	-------	-----	Do.
SE¼NW¼SE¼	3,188	3,059	-------	-----	Do.
Sec. 24					
NE¼SE¼NE¼-1	3,025 D	2,815	2,737	3/54	T-5
NE¼SE¼NE¼-2	3,061	2,906	-------	-----	ASARCO
NW¼NW¼NW¼	3,094	2,984	-------	-----	Do.
SW¼NW¼NW¼-1	3,103	2,978*	-------	-----	Do.
SW¼NW¼NW¼-2	3,116	2,981	-------	-----	Do.
SE¼NW¼NW¼	3,093	2,956	-------	-----	Do.
SW¼SW¼NW¼	3,140	3,033	-------	-----	Do.
SE¼SW¼NW¼	3,125	2,975	-------	-----	Do.
NE¼SE¼NW¼	3,101	3,015	-------	-----	Do.
SE¼NW¼SW¼	3,155	3,015	-------	-----	Do.
SE¼NW¼SE¼	3,122	2,977	-------	-----	Do.
Sec. 25					
SW¼SW¼NE¼	3,195	2,995	-------	-----	ASARCO; T-6
NE¼NE¼NW¼	3,184	2,999	-------	-----	ASARCO
SE¼SW¼NW¼	3,241	3,066	-------	-----	Do.
SE¼SW¼SW¼	3,276	3,086	-------	-----	Do.
NW¼SE¼SW¼	3,256	3,046	-------	-----	Do.
SE¼SE¼SW¼	3,251	3,037*	-------	-----	Do.
SW¼NE¼SE¼	3,183	2,988	-------	-----	Do.
SW¼NW¼SE¼	3,230	3,024	-------	-----	Do.
NW¼SW¼SE¼	3,226	3,011*	-------	-----	Do.
SW¼SW¼SE¼	3,236	3,037*	-------	-----	Do.
SE¼SW¼SE¼-1	3,224	3,041*	-------	-----	Do.
SE¼SW¼SE¼-2	3,218	3,028	-------	-----	Do.
NE¼SE¼SE¼-1	3,181	2,970*	-------	-----	Do.
NE¼SE¼SE¼-2	3,191	2,988*	-------	-----	Do.
NW¼SE¼SE¼	3,199	2,987	-------	-----	Do.
SW¼SE¼SE¼	3,194	2,988	-------	-----	Do.
SE¼SE¼SE¼	3,195	2,995*	-------	-----	Do.
Sec. 26					
NE¼NE¼NE¼	3,214	3,083	-------	-----	Do.
NW¼NW¼NE¼	3,245	3,190	-------	-----	Do.
SE¼SW¼NE¼	3,271	3,154	-------	-----	Do.
NW¼NW¼NW¼	3,300 D	3,115	-------	-----	T-5
SW¼SE¼NW¼	3,314	3,234	-------	-----	ASARCO
NE¼SW¼SW¼	3,358	3,228	-------	-----	Do.
SW¼NW¼SE¼	3,310 D	3,155	Dry at 3,060	-----	

See footnote at end table.

Table 7.—*Altitudes of base of older alluvium and water levels in wells and drill holes in and near the San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Land-surface or collar altitude	Altitude of base of older alluvium	Water level		Source of information and remarks
			Altitude	Date	
T. 16 S., R. 12 E.					
Sec. 26—Cont.					
NW¼SW¼SE¼	3,334	3,180	-------	-----	
SW¼SW¼SE¼	3,330 D	3,180	3,147	7/54	
NE¼SE¼SE¼	3,295	3,120	-------	-----	
SE¼SE¼SE¼	3,304	3,108	-------	-----	
Sec. 29					
NW¼SW¼SW¼	3,550 D	----------	3,536	10/53	
SE¼NE¼SE¼	3,460 D	----------	3,420	10/53	
Sec. 31					
SE¼NE¼NE¼	3,600 D	----------	3,590	10/53	
Sec. 32					
NW¼NW¼SW¼	3,745 D	----------	3,723	10/53	
Sec. 35					
NE¼NE¼NE¼	3,310	3,108	-------	-----	Banner
SE¼NE¼NE¼	3,320	3,073	-------	-----	Do.
NW¼NE¼NW¼	3,403	3,372	-------	-----	Do.
NW¼NW¼NW¼	3,395	3,322	-------	-----	Do.
NE¼SE¼NW¼	3,375 D	3,277	-------	-----	Do.
SW¼SW¼SW¼	3,443	3,433*	-------	-----	Do.
Sec. 36					
NE¼NE¼NE¼	3,196	2,996	-------	-----	Do.
SW¼NE¼NE¼	3,229	3,029	2,864	-----	Do.
SE¼NE¼NE¼	3,211	3,027	-------	-----	Do.
NW¼NW¼NE¼	3,221	3,036	-------	-----	Do.
SW¼NW¼NE¼	3,242	3,036	2,927	-----	Do.
SE¼NW¼NE¼	3,238	3,032	-------	-----	Do.
NE¼NE¼NW¼	3,245	3,050	-------	-----	Do.
SE¼NE¼NW¼-1	3,248	3,070*	-------	-----	Do.
SE¼NE¼NW¼-2	3,251	3,054	-------	-----	Do.
NE¼NW¼NW¼	3,268	3,083	-------	-----	Do.
SE¼NW¼NW¼	3,275	3,115	-------	-----	Do.
SE¼SW¼NW¼	3,271	3,102	-------	-----	Do.
NE¼NW¼SW¼	3,297	3,124	-------	-----	Do.
SE¼NW¼SW¼	3,307	3,167	-------	-----	Do.
T. 16 S., R. 13 E.					
Sec. 2					
SE¼NW¼NW¼	2,556	<2,324	2,522	/53	T-5
SW¼SE¼NW¼	2,570	<2,390	2,527	1/53	T-5
Sec. 3					
NW¼NW¼SE¼	2,610	2,494	2,526	2/52	
Sec. 14					
NE¼NE¼NE¼	2,613	<2,477	2,553	2/52	T-5
Sec. 19					
NW¼NW¼NW¼	2,996	2,831	-------	-----	ASARCO
SW¼SE¼NW¼	3,007	2,856	-------	-----	Do.
Sec. 20					
SE¼NE¼SW¼	2,944	2,753	-------	-----	Do.
Sec. 28					
SE¼SW¼NW¼	2,923	2,638	-------	-----	Do.
Sec. 29					
SW¼SW¼NE¼	2,989	2,736	-------	-----	Do.
NE¼SW¼SW¼	3,056	2,771	-------	-----	Do.
Sec. 30					
SW¼SW¼NW¼	3,149	2,947	-------	-----	Do.
NE¼SW¼SW¼	3,167	2,949	-------	-----	Do.
SW¼SW¼SW¼	3,191	2,971	-------	-----	Do.
NE¼SE¼SW¼	3,141	3,006	-------	-----	Do.
NE¼SW¼SE¼	3,105	2,873	-------	-----	Do.
Sec. 31					
SE¼NE¼NE¼	3,100 D	2,863	-------	-----	Do.
NE¼NW¼NE¼	3,130 D	2,912	-------	-----	Do.
NW¼NW¼NE¼	3,145 D	2,935	-------	-----	Do.
SE¼NW¼NE¼	3,135 D	2,931	-------	-----	Do.
NE¼SW¼NE¼	3,145 D	2,929*	-------	-----	Do.
NW¼SW¼NE¼	3,165 D	3,036	-------	-----	Do.
NE¼SE¼NE¼	3,120 D	2,879	-------	-----	Do.
NW¼SE¼NE¼-1	3,135 D	2,910	-------	-----	ASARCO
NW¼SE¼NE¼-2	3,125 D	2,910*	-------	-----	Do.
NW¼NE¼NW¼	3,155 D	2,941	-------	-----	Do.
NE¼NE¼SE¼	3,140	2,920	-------	-----	Do.
NW¼NE¼SE¼-1	3,140 D	2,911*	-------	-----	Do.
NW¼NE¼SE¼-2	3,150 D	3,001	-------	-----	Do.
SE¼NE¼SE¼	3,135 D	2,909	-------	-----	Do.
NE¼NW¼SE¼	3,160 D	2,945	-------	-----	Do.
SW¼NW¼SE¼	3,180 D	2,962	-------	-----	Do.
SE¼NW¼SE¼	3,175 D	2,950	-------	-----	Do.
SE¼SW¼SE¼	3,180 D	2,993	-------	-----	Do.
NE¼SE¼SE¼	3,100 D	2,948	-------	-----	Do.
Sec. 32					
SW¼SW¼NW¼	3,105 D	2,863	-------	-----	Do.
NW¼NW¼SW¼	3,120 D	2,871	-------	-----	Do.
Sec. 33					
NW¼NW¼NW¼	2,980 D	2,540	-------	-----	Banner
NE¼NE¼SW¼	2,980 D	2,529	-------	-----	Do.
SW¼NW¼SW¼	3,030 D	2,734	-------	-----	Do.
SW¼SW¼SE¼	2,990 D	2,582	-------	-----	Do.
Sec. 34					
NW¼NE¼NE¼-1	2,835 D	2,335	2,603	1/60	ASARCO; T-6
NW¼NE¼NE¼-2	2,830 D	<2,330*	2,609	1/60	ASARCO.
Sec. 35					
NE¼NE¼NE¼	2,720 D	----------	2,581	5/60	
SW¼SW¼NE¼	2,765 D	----------	2,610	1/60	
NE¼NE¼NW¼	2,775 D	<2,271?	2,596	4/60	Do.
NW¼NW¼NW¼	2,790 D	<2,290?	2,588	3/60	Do.
Sec. 36					
NW¼NE¼NE¼	2,663	<2,363	2,590	7/56	
T. 16 S., R. 14 E.					
Sec. 5					
SE¼SW¼SE¼	2,671	<2,417*	2,560	/53	SS, 1957
Sec. 6					
NE¼NE¼NE¼	2,612	<2,492*	2,542	/53	Do.
SW¼SE¼SW¼	2,604	----------	2,552	/54	Do.
Sec. 7					
SE¼NE¼NW¼	2,596	2,156?	2,553	/55	SS, 1957; T-6
NW¼SW¼SE¼	2,606	----------	2,560	/53	SS, 1957
Sec. 17					
SE¼NE¼SE¼	2,675 D	<2,325	2,567	11/54	T-6
Sec. 18					
NW¼SE¼NW¼	2,619	----------	2,564	/53	SS, 1957
Sec. 20					
NE¼SE¼NE¼	2,701	2,201	2,574	5/55	SS, 1957; T-6
SW¼NW¼NW¼	2,630 D	<2,250	2,565	5/55	T-6
Sec. 30					
SW¼SW¼SE¼	2,665 D	----------	2,593	11/50	
Sec. 31					
SE¼SE¼NW¼	2,670 D	----------	2,610	-----	
SW¼SW¼SW¼	2,670 D	<2,436	2,630	-----	
SE¼SE¼SE¼	2,673	<2,211	2,601	/51	SS, 1957; T-6
Sec. 32					
SE¼SE¼NW¼	2,673	----------	2,597	/53	SS, 1957
SE¼SE¼SW¼	2,672	----------	2,590	/54	Do.
T. 17 S., R. 12 E.					
Sec. 1					
NE¼NE¼NW¼	3,317	2,747*	3,087*	8/54	
NW¼NE¼NW¼	3,336	2,838?	3,046*	-----	HGC
NE¼NW¼NW¼	3,345	3,282	-------	-----	Banner
SE¼NW¼NW¼	3,345	3,282*	-------	-----	Do.

See footnote at end of table.

Table 7.—*Altitudes of base of older alluvium and water levels in wells and drill holes in and near the San Xavier Indian Reservation, Pima County, Arizona*—Continued

Location	Land-surface or collar altitude	Altitude of base of older alluvium	Water level		Source of information and remarks
			Altitude	Date	
T. 17 S., R. 12 E—Cont.					
Sec. 12					
SE¼SW¼NW¼	3,450 D	----------	3,315*	9/54	
T. 17 S., R. 13 E.					
Sec. 1					
SE¼SE¼NE¼	2,680 D	----------	2,629	-----	
NW¼NE¼SW¼	2,734	<2,428	2,625	/53	SS,1957
SW¼SE¼SW¼	2,743	<2,432	2,633	/53	Do.
Sec. 4					
SE¼NE¼NW¼	3,020 D	2,596	-------	-----	Banner
SE¼NW¼NW¼	3,050 D	2,715	2,711	-----	Do.
NE¼NE¼SW¼	3,030 D	2,707	-------	-----	Do.
NW¼SW¼SW¼	3,085 D	2,731	2,793	-----	Do.
SW¼SW¼SW¼	3,100 D	2,744	-------	-----	Do.
SE¼SE¼SE¼	2,990 D	2,515	-------	-----	Do.
Sec. 5					
NW¼NE¼NE¼	3,080 D	2,840	-------	-----	Do.
NW¼NW¼NE¼	3,105 D	2,855	2,665	-----	Do.
NW¼NE¼NW¼-1	3,125 D	2,946	-------	-----	ASARCO
NW¼NE¼NW¼-2	3,145 D	2,954	-------	-----	Do.
SE¼NE¼NW¼	3,145 D	2,942	-------	-----	Do.
NE¼NW¼NW¼	3,145 D	2,940	-------	-----	Do.
NE¼SW¼NW¼-1	3,155 D	2,967*	-------	-----	Do.
NE¼SW¼NW¼-2	3,170 D	2,979	-------	-----	Do.
SE¼SW¼NW¼	3,175 D	3,007	-------	-----	Do.
NE¼SE¼NW¼	3,150 D	2,956	-------	-----	Do.
SW¼SE¼NW¼	3,155 D	2,958*	-------	-----	Do.
NE¼NE¼SW¼	3,150 D	2,932	-------	-----	Do.
SW¼NE¼SW¼	3,170 D	2,972	-------	-----	Do.
NE¼NW¼SW¼	3,185 D	3,010*	-------	-----	Do.
SE¼NW¼SW¼	3,195 D	3,006*	-------	-----	Do.
NE¼SW¼SW¼	3,200 D	3,025	-------	-----	Do.
SE¼SW¼SW¼	3,195 D	3,020*	-------	-----	Do.
SW¼SE¼SW¼	3,180 D	2,989	-------	-----	Do.
NW¼NE¼SE¼	3,105 D	2,790	-------	-----	Banner, ASARCO
NW¼SW¼SE¼	3,155 D	2,941	-------	-----	
Sec. 6					
NE¼NE¼NE¼	3,165 D	3,006	-------	-----	Do.
NW¼NE¼NE¼	3,185 D	3,068	-------	-----	Do.
SW¼NE¼NE¼	3,195 D	3,023	-------	-----	Do.
SE¼NW¼NE¼	3,205 D	3,021	-------	-----	Do.
NW¼SW¼NE¼	3,230 D	3,068	-------	-----	Do.
SW¼SW¼NE¼	3,235 D	2,997	-------	-----	Do.
SE¼SW¼NE¼	3,220 D	3,070	-------	-----	Do.
SW¼SE¼NE¼	3,210 D	3,030	-------	-----	Do.
SE¼SE¼NE¼	3,205 D	3,027	-------	-----	Do.
NW¼NE¼SE¼	3,220 D	3,067	-------	-----	Do.
NW¼NW¼SE¼	3,245 D	3,002	-------	-----	Do.
Sec. 7					
SW¼NE¼NE¼	3,260 D	3,048	3,138*	-----	Banner
NE¼SW¼SE¼	3,300 D	3,006	-------	-----	Do.
Sec. 8					
NE¼NW¼NE¼	3,145 D	2,853	-------	-----	Do.
NE¼NE¼NW¼	3,200 D	2,963	-------	-----	Do.
SE¼SE¼NW¼	3,180 D	----------	3,009	-----	
SE¼SW¼SW¼	3,250 D	----------	3,100	3/60	HGC
SW¼SW¼SE¼	3,190 D	----------	2,950?	?	Do.
Sec. 9					
SW¼NW¼NW¼	3,095 D	----------	2,816	3/60	Banner; TG
NE¼SW¼NW¼	3,089	2,733	2,810	3/60	Banner; HGC
SE¼NE¼SW¼	3,080 D	2,702	-------	-----	Banner
SE¼NW¼SW¼-1	3,111	2,775	2,749*	-----	
SE¼NW¼SW¼-2	3,111	2,775	2,815	3/60	Banner; HGC
SE¼NE¼SE¼	3,145 D	2,595	-------	-----	Banner
Sec. 10					
—NW¼SE¼	2,950 D	2,520?	-------	-----	T-6
Sec. 12					
SW¼SE¼NE¼	2,709	<2,389	2,629	/53	SS, 1957
Sec. 13					
NE¼SW¼NE¼	2,728	----------	2,640	/53	Do.
SE¼NE¼NW¼	2,733	<2,623	2,639	/53	Do.
SE¼SE¼SE¼	2,721	<2,546	2,653	/53	Do.
Sec. 16					
SW¼NW¼NW¼	3,150 D	2,854	2,848	3/60	Banner; HGC
SW¼SW¼SW¼	3,165 D	2,873	-------	-----	Banner
SE¼NW¼SE¼	3,070 D	2,944	-------	-----	Do.
Sec. 17					
SW¼NE¼NE¼	3,189	----------	2,930	3/60	HGC
SW¼NW¼NE¼	3,206	----------	2,985	3/60	Do.
SW¼SW¼NE¼	3,220 D	2,927	-------	-----	Banner
SE¼SE¼NW¼	3,221	----------	3,010	5/60	HGC
Sec. 18					
SE¼NE¼NE¼	3,280 D	----------	3,138	-----	
SW¼SE¼NE¼	3,300	----------	3,195	3/60	HGC
SW¼NW¼SW¼	3,402	----------	3,360	3/60	Do.
NE¼NE¼SE¼	3,283	3,063?	3,125	3/60	Do.
Sec. 20					
SW¼NE¼NE¼	3,200 D	2,710?*	2,780	-----	T-6
SW¼SE¼NE¼	3,200 D	2,750?*	Dry at 2,750	-----	Do.
NW¼NE¼SE¼	3,200 D	2,880?	Dry at 2,590	-----	Do.
Sec. 21					
SE¼NE¼NE¼	3,060 D	3,000*	-------	-----	
NE¼SW¼NW¼	3,147	----------	2,723	2/53	
SW¼SW¼SW¼	3,175 D	2,825?	-------	-----	HGC; T-6
Sec. 22					
SW¼NE¼NW¼	2,993	<2,673	2,688*	2/54	SS, 1957
SW¼SW¼NW¼	3,047	2,860	2,695	2/53	T-6
SW¼NW¼SE¼	2,932	<2,562	2,693*	/53	SS, 1957; HGC; T-6
Sec. 23					
SE¼SW¼NW¼	2,898	<2,573	2,676	3/57	HGC
Sec. 24					
SW¼SW¼SW¼	2,777	----------	2,678*	/53	SS, 1957
Sec. 25					
SE¼SE¼NE¼	2,750	<2,250	-------	-----	T-6
Sec. 27					
NW¼SW¼NW¼	3,035	<2,573	2,702*	/53	SS, 1957
Sec. 28					
—NW¼NW¼	3,150 D	2,684?*	-------	-----	HGC; T-6
T. 17 S., R. 14 E.					
Sec. 6					
SW¼NW¼NW¼	2,682	----------	2,614	/53	SS, 1957
SW¼SW¼SW¼	2,691	----------	2,622	/53	Do.
SE¼SE¼SE¼	2,692	----------	2,610	/53	Do.
Sec. 7					
—SE¼SE¼	2,705	2,161?*	-------	-----	SS, 1957; T-6

*Corollary data—not plotted on contour maps but used to supplement or substantiate control data; some data are from wells outside the San Xavier area.

Table 8.—*Analyses of ground water, San Xavier Indian Reservation, Pima County, Arizona*

[Analyses in parts per million, except as indicated]

Location	Well number	Date of collection	Depth (feet)	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Parts per million	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos at 25°C)	pH
T. 15 S., R. 11 E.																									
Sec. 35																									
NW¼NE¼NW¼	SX-R-6	10/28/53	461+	----	59	----	26	12		46	217	0	13	14	0.6	3.8	----	281	0.38	114	0	47	1.9	403	
		9/18/54	----	81	40	----	26	12		27	177	0	8.2	10	.6	5.6	----	216	.29	114	0	34	1.1	336	
T. 15 S., R. 13 E.																									
Sec. 22																									
SW¼SE¼NE¼-1	----	9/8/39	44	----	----	0	62	12		48	236	0	95	11	.0	----	----	344	.47	204	10	34	1.5	580	
Sec. 23																									
NE¼NW¼SW¼	SX-10	5/23/56	410	75	37	.02	46	14		57	213	0	94	14	1.0	1.8	0.89	371	.50	172	0	42	1.9	560	7.5
Sec. 26																									
SW¼NE¼NE¼	----	9/8/40	26	----	----	----	154	42		63	306	0	404	16	----	----	----	830	1.13	557	306	20	1.2	1,230	
NW¼SW¼NW¼	SX-1 (PWA-1)	6/19/34	92	----	----	----	37	7	53	----	204	0	45	14	----	----	----	360	.49	122	0	49	2.1	----	
T. 16 S., R. 11 E.																									
Sec. 13																									
SW¼SE¼NW¼	SX-DT-3	9/18/54	540	----	55	----	44	20		49	194	0	18	82	.6	5.6	----	369	.50	192	33	36	1.5	614	
T. 16 S., R. 12 E.																									
Sec. 26																									
SW¼NW¼SE¼	SX-DT-1	9/17/54	250	74	34	----	44	20		46	234	0	40	40	1.0	.3	----	340	.46	192	0	34	1.4	555	
Sec. 29																									
NW¼SW¼SW¼	SX-W-9	10/27/53	14+	69	62	----	92	28		88	496	0	22	47	1.4	45	----	629	.86	344	0	36	2.1	997	
		9/18/54		74	51	----	122	39		71	394	0	48	80	.8	162	----	768	1.04	465	142	25	1.4	1,270	