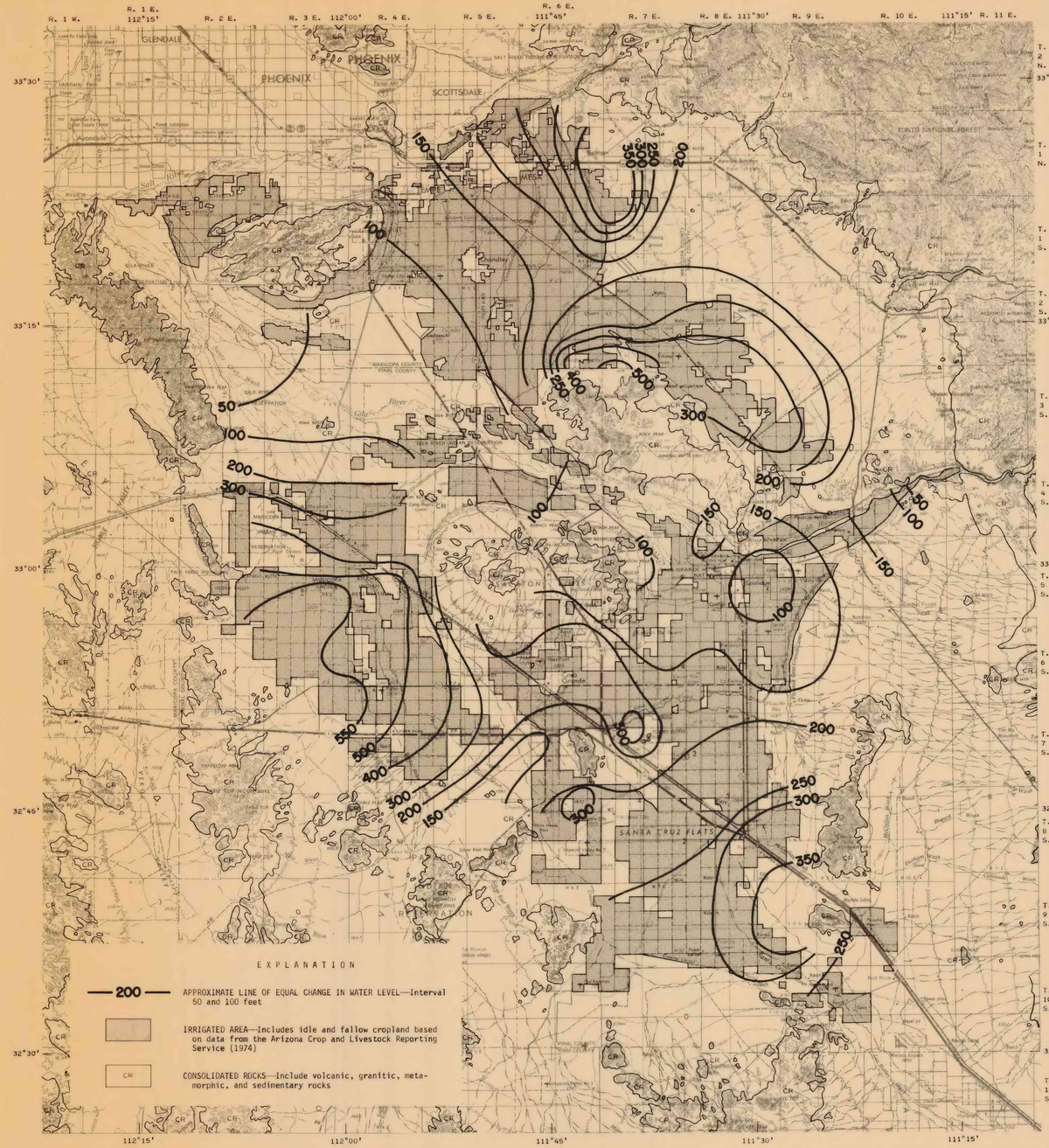
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
U.S. BUREAU OF INDIAN AFFAIRS

WATER-RESOURCES INVESTIGATIONS REPORT 85-4073
SHEET 2 OF 2



EXPLANATION

200 — APPROXIMATE LINE OF EQUAL CHANGE IN WATER LEVEL—Interval 50 and 100 feet

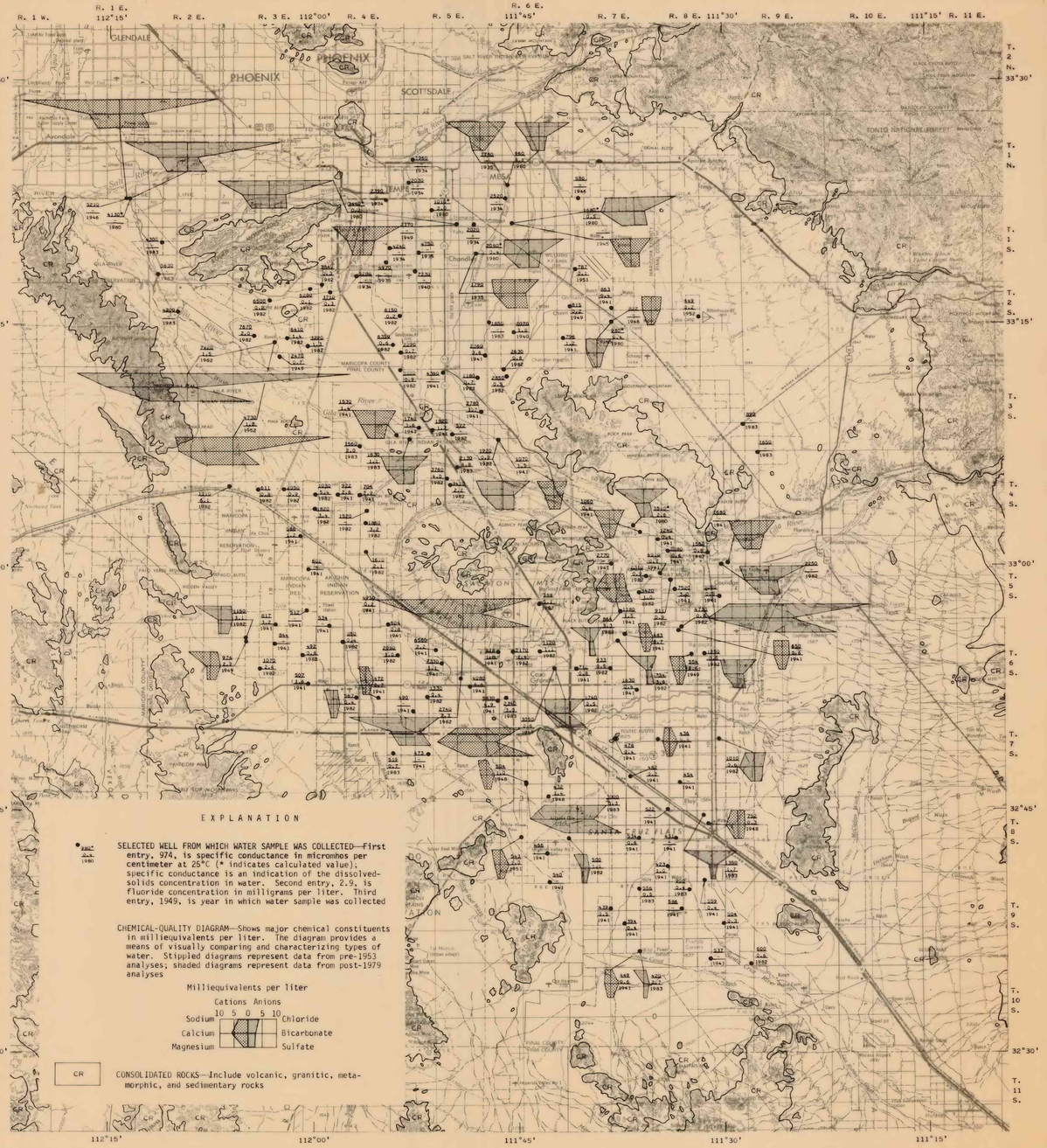
IRRIGATED AREA—Includes idle and fallow cropland based on data from the Arizona Crop and Livestock Reporting Service (1974)

CR — CONSOLIDATED ROCKS—Include volcanic, granitic, metamorphic, and sedimentary rocks

BASE FROM U.S. GEOLOGICAL SURVEY, 1:250,000
AUO, 1953-69; MESA, 1954-69; PHOENIX,
1954-69; AND TUCSON, 1956-62

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

CHANGE IN WATER LEVEL, ABOUT 1900 TO 1983, AND IRRIGATED AREA, 1974



EXPLANATION

•980 2.9 1980 — SELECTED WELL FROM WHICH WATER SAMPLE WAS COLLECTED—First entry, 974, is specific conductance in micromhos per centimeter at 25°C (* indicates calculated value); specific conductance is an indication of the dissolved-solids concentration in water. Second entry, 2.9, is fluoride concentration in milligrams per liter. Third entry, 1949, is year in which water sample was collected

CHEMICAL-QUALITY DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The diagram provides a means of visually comparing and characterizing types of water. Stippled diagrams represent data from pre-1953 analyses; shaded diagrams represent data from post-1979 analyses

Milliequivalents per liter

Cations: Sodium, Calcium, Magnesium — Anions: Chloride, Bicarbonate, Sulfate

10 5 0 5 10

CR — CONSOLIDATED ROCKS—Include volcanic, granitic, metamorphic, and sedimentary rocks

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CHEMICAL QUALITY OF THE GROUND WATER

Change in Water Level, About 1900 to 1983

Since the beginning of ground-water pumping in Arizona, more than 43 million acre-ft of water has been pumped from the lower Santa Cruz area and nearly 80 million acre-ft from the Salt River Valley area (U.S. Geological Survey, 1983). The part of the lower Santa Cruz basin included in this report contains essentially all the irrigated land in that basin. The part of the Salt River Valley in this report contains about 40 to 50 percent of the irrigated land in the valley, but the distribution of ground-water pumpage has not been determined. Most of the ground water pumped in the study area has been used for irrigation. Although surface water is used for irrigation in some areas, ground water has been withdrawn in nearly all areas to supplement or replace surface-water supplies in dry years. Ground-water pumping has been greatest in areas where surface water was not available, namely the Maricopa-Stanfield area. Long-term ground-water withdrawal has resulted in a general decline in water levels in wells throughout the area. The largest declines are in areas of large withdrawals or low aquifer productivity. Water levels in wells declined more than 550 ft near Stanfield, 500 ft near Chandler Heights, 350 ft east of Mesa and southeast of Eloy, about 100 ft or less near Sacaton, and less than 50 ft near Gila Crossing. Most of the decline has occurred since the 1940's when intense ground-water development began. The change in water levels was determined from differences between water-level altitudes in about 1900 and 1983 (sheet 1).

Estimated annual ground-water pumpage in the lower Santa Cruz basin and the Salt River Valley

Chemical Quality

The chemical quality of ground-water samples collected in 1980-83 was compared to that of the samples collected prior to heavy pumping. The comparisons were used to define changes in chemical quality that have occurred as a result of the large ground-water withdrawals, surface diversions, altered recharge patterns, and various farming practices over the past 40 to 50 years. Where possible, comparisons were made from samples from the same well or a nearby well of similar depth and construction. The results are shown in the chemical-quality diagrams. The earliest available analyses that were suitable for constructing chemical-quality diagrams were done in 1935, and the latest analysis used for the period prior to heavy pumping was done in 1952.

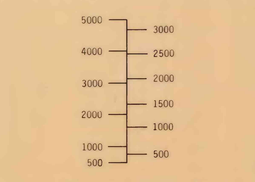
The chemical quality of the ground water in the Gila River Indian Reservation varied areally before the early 1950's. In the eastern and central parts of the reservation, the specific conductance was about 1,000 to 3,000 micromhos; the water was a mixed chloride type. Ground water in the western and northwestern parts of the reservation was also a mixed chloride type, but was characterized by higher conductivities—about 5,000 micromhos—and an increased percentage of calcium ion.

Specific-conductance values for ground water in the areas adjacent to the reservation generally were 1,000 to 2,500 micromhos except in three local areas where specific-conductance values were high. The areas north of the reservation near Chandler, south of the reservation near Coolidge, and west of Casa Grande contained water with specific-conductance values as much as 7,230, 7,520, and 7,330 micromhos, respectively. Specific-conductance values of the water in the Santa Cruz Flats and Stanfield areas were less than 1,000 micromhos. A mixed chloride type ground water was prevalent throughout the study area except for the southeastern part where sodium bicarbonate water was present. Bicarbonate ions were present in the ground water throughout the study area in different but detectable amounts. The concentrations of fluoride in the ground water sampled generally were less than 1.5 mg/L (milligrams per liter) except in areas east of Maricopa, along the southwest edge of the study area, near Coolidge, and west of Casa Grande where specific-conductance values were high; in these areas, fluoride concentrations ranged from about 2 to 5 mg/L.

Chemical analyses from 1980-83 showed some distinct changes in water chemistry from pre-1953 analyses. On the Gila River Indian Reservation, four of the five available comparative analyses showed an increase in specific conductance from about 6 to 80 percent for the post-1979 analyses. The fifth analysis, which showed a decrease in specific conductance, was for water from wells near the northwest corner of the reservation in sec. 35, T. 1 N., R. 1 E. The analyses that showed increases in specific conductance also showed increases in concentrations of sodium, chloride, and sulfate ions. The analyses for the rest of the study area showed increases in the concentrations of sodium, chloride, and sulfate ions except for the area near Santa Cruz Flats and the area south of the Sacaton Mountains. In the Santa Cruz Flats area, water from wells in secs. 14 and 17, T. 8 S., R. 6 E., and sec. 27, T. 9 S., R. 7 E., showed a reduction of calcium and magnesium ions. In the area south of the Sacaton Mountains, comparative analyses of water from wells in sec. 22, T. 6 S., R. 5 E., and sec. 15, T. 6 S., R. 6 E., showed a reduction of calcium, sodium, magnesium, chloride, and sulfate ions. The post-1979 water type for the study area was mixed; the major ions were sodium, calcium, chloride, and sulfate. The concentrations of fluoride in the ground water sampled in 1980-83 were similar to those sampled prior to 1953.

Apparent changes in the chemical quality of the ground water may have resulted from the dewatering of sediments and the deepening of wells. Some differences in chemical quality may have resulted from changes in sampling techniques and methods of analysis.

The maximum contaminant level for fluoride in public water supplies differs according to the annual average maximum daily air temperature (Bureau of Water Quality Control, 1978, p. 6). The amount of water consumed by humans, and therefore the amount of fluoride ingested, depends partly on air temperature. In the Gila River Indian Reservation and adjacent areas, the annual average maximum daily air temperature is about 86°F, and the maximum contaminant level for fluoride is 1.4 mg/L. The fluoride concentration exceeded 1.4 mg/L in a few water samples collected near Coolidge, west of Casa Grande, and west of Stanfield. Fluoride concentrations ranged from 2.0 to 6.8 mg/L in water samples collected from 10 wells in the area near Maricopa and northeastward to the Gila River.



APPROXIMATE RELATION OF SPECIFIC CONDUCTANCE TO DISSOLVED SOLIDS

CONVERSION FACTORS

For use of readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
gallon per minute (gal/min)	0.06309	liter per second (L/s)

GROUND-WATER CONDITIONS IN AND NEAR THE GILA RIVER INDIAN RESERVATION, SOUTH-CENTRAL ARIZONA

BY

B. W. THOMSEN AND S. BALDYS III