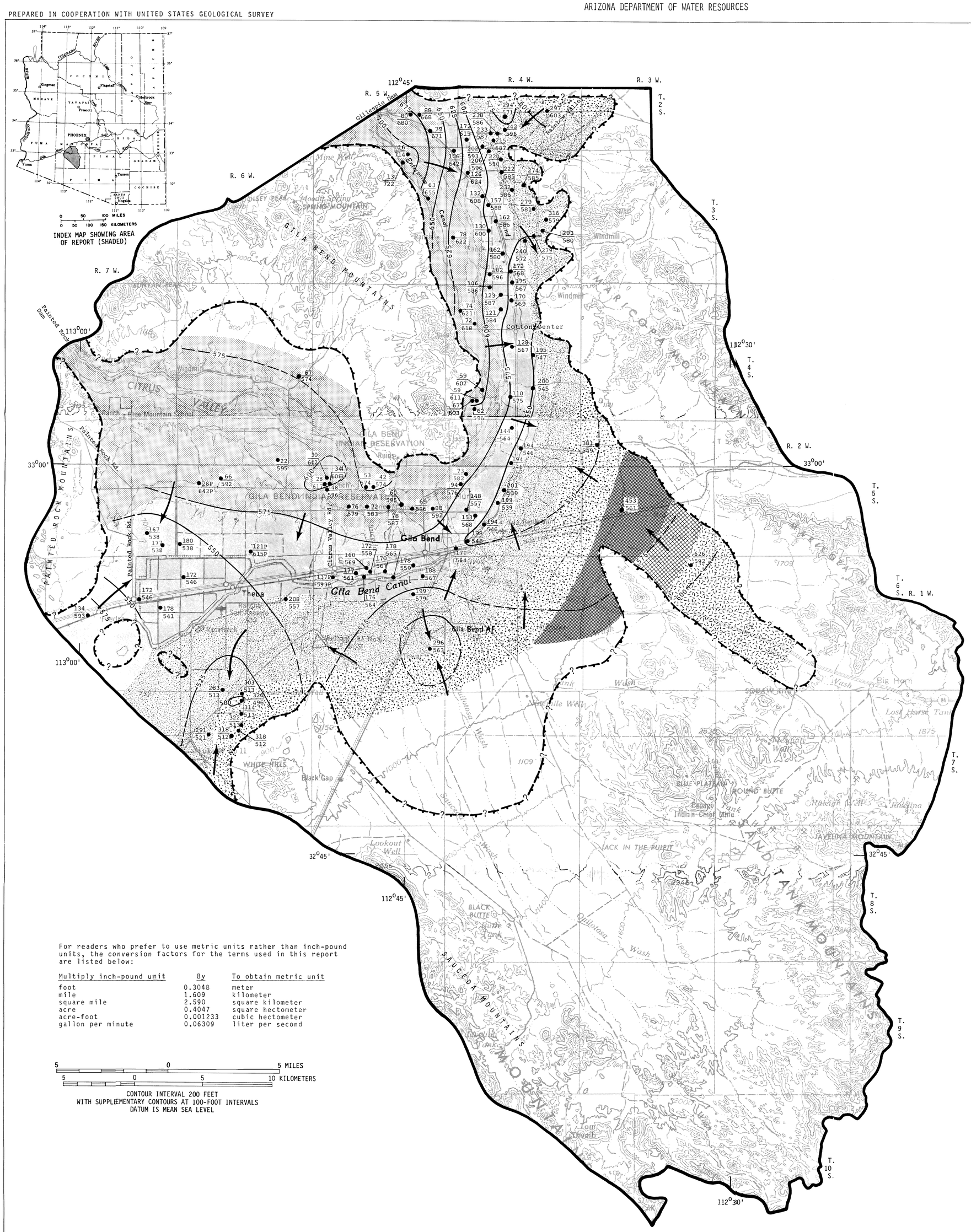


The Gila Bend basin area includes about 1,300 square miles in southwestern Arizona and is a wide desert plain surrounded by mountains composed principally of crystalline rocks. The agriculture in the basin is concentrated primarily along the Gila River floodplain; nearly all of the water resources developed in the basin are used to irrigate crops. The Gila River, an ephemeral stream, enters the northern part of the basin at Gillespie Dam, flows southward then westward to the basin outlet at Painted Rock Dam. Surface water is diverted from the Gila River at Gillespie Dam into two canals, the unlined Enterprise Canal, which transports water to a ranch 6 miles south and the partially lined Gila Bend Canal, which transports water about 45 miles to agricultural lands near Theba. About 50 irrigation wells pump ground water directly into the Gila Bend Canal to supplement the surface-water diversions. Ground water is the principal source of irrigation water in the basin.

The annual discharge of the Gila River is highly variable (about 1 million acre-feet to nearly zero acre-feet) and mean annual flows generally were declining between 1921 and 1965. However, since 1966 the mean annual discharge has increased steadily. During 1966, 1967, 1973, 1978 and 1979 large volumes of surface water, ranging from 31,000 acre-feet in 1967 to 1,616,000 acre-feet in 1979 were stored temporarily behind Painted Rock Dam, which resulted in the inundation of nearby agricultural lands and provided recharge to the ground-water reservoir.

In the Gila Bend basin area alluvial deposits form the main water-bearing unit and consist mainly of unconsolidated to moderately consolidated clay, silt, sand and gravel. The unit ranges in thickness from a few tens of feet near the mountains to more than 2,000 feet in the central part of the basin. The unit may yield from several hundred to several thousand gallons per minute of water to wells.

In the southwestern part of the basin near Theba, the main water-bearing unit is divided into upper and lower layers by fine-grained deposits that range in thickness from a few feet to about 900 feet. The generalized extent of the fine-grained deposits as mapped by the Bureau of Reclamation (1976, fig. 59) and modified by Ward (1980, figs. 11-14) is shown on Sheet 2. These deposits probably yield no more than a few tens of gallons per minute to wells.

The crystalline, granitic, metamorphic, and volcanic rocks that comprise the mountains that surround the basin may yield small amounts of water to wells in places where the rocks are sufficiently faulted or fractured. Thin alluvial deposits along narrow valleys in the mountains also may yield a few gallons per minute to stock and domestic wells.

Depth to water in the main water-bearing unit ranges from less than 15 feet near Gillespie Dam to more than 600 feet in T. 6 S., R. 3 W. In most places the water in the main water-bearing unit occurs under unconfined (water-table) conditions; however, in some parts of the basin, the water may occur under confined (artesian) conditions; one such area is near Theba. Some of the anomalous water levels in the area northwest of Gila Bend are assumed to be the result of a perched water zone on or in fine-grained deposits in the main water-bearing unit.

The configuration of the 1979 water-level altitude contours is principally the result of the composite effects of ground-water pumpage and recharge from floodflows and reservoir storage. The extensive cone of depression centered along the Gila Bend Canal and extending from Gila Bend northward into the lower part of T. 3 S., R 4 W. has not changed significantly since it was delineated in 1973 by Babcock (1975, p. 21). This cone of depression was first noted in the northern end of the basin by White (1963, p. 21); the cone slowly moved southward as the distribution of pumpage along the Gila Bend Canal moved southward during the early 1960's (Stulik and Moosburner, 1969, p. 8). A second cone of depression has developed about 5 miles south of Theba and a third cone of depression appears to be developing northwest of Theba. An apparent ground-water divide near Gila Bend separates the cones of depression. East of this divide ground water moves northward toward the cone of depression centered north of Gila Bend; west of the divide ground water appears to move southward toward the cone of depression south of Theba. Ground-water movement toward the Painted Rock Dam is not indicated as it was in previous reports but the effect of water impounded behind Painted Rock Dam probably masks the true gradient of ground-water movement in this part of the basin and may have temporarily eliminated the cone developing northwest of Theba.

The hydrologic data on which these maps are based are available, for the most part, in computer-printout form for consultation at the Department of Water Resources, 99 East Virginia, Phoenix, Arizona, 85004 and at the U.S. Geological Survey, Box FB-44, 301 West Congress, Tucson, Arizona, 85701 or Valley Center, Suite 1880, Phoenix, Arizona, 85073. Material from which copies can be made at private expense is available at the Tucson and Phoenix offices of the U.S. Geological Survey.

EXPLANATION

121P / 615P — WELL IN WHICH DEPTH TO WATER WAS MEASURED IN 1979--Upper number, 121P, is depth to water in feet below land surface. Lower number, 615P, is altitude of the water level in feet above mean sea level. Water levels may represent unconfined (water-table) or confined (artesian) conditions. (P, probable perched water level)

DEPTH TO WATER IN FEET BELOW LAND SURFACE

- Less than 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- Greater than 600
- Insufficient data

575 — WATER-LEVEL CONTOUR--Shows altitude of the water level. Water levels may represent unconfined (water-table) or confined (artesian) conditions. Dashed where approximate. Interval 25 feet. Datum is mean sea level

GENERALIZED DIRECTION OF GROUND-WATER FLOW

APPROXIMATE BOUNDARY OF THE MAIN WATER-BEARING UNIT--The main water-bearing unit is principally alluvial deposits, which consists of clay, silt, sand, and gravel. In part of the area, the unit contains thick fine-grained deposits that probably contribute only small amounts of water to wells. Faulted or fractured crystalline rocks and thin alluvial deposits in narrow valleys may yield small amounts of water to wells outside the boundary of the main water-bearing unit. Queried where uncertain

ARBITRARY BOUNDARY OF GROUND-WATER AREA

For readers who prefer to use metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
acre	0.4047	square hectometer
acre-foot	0.001233	cubic hectometer
gallon per minute	0.06309	liter per second

5 0 5 MILES
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, 1:250,000, 1954-69 AND
AJO, 1:250,000, 1953-69

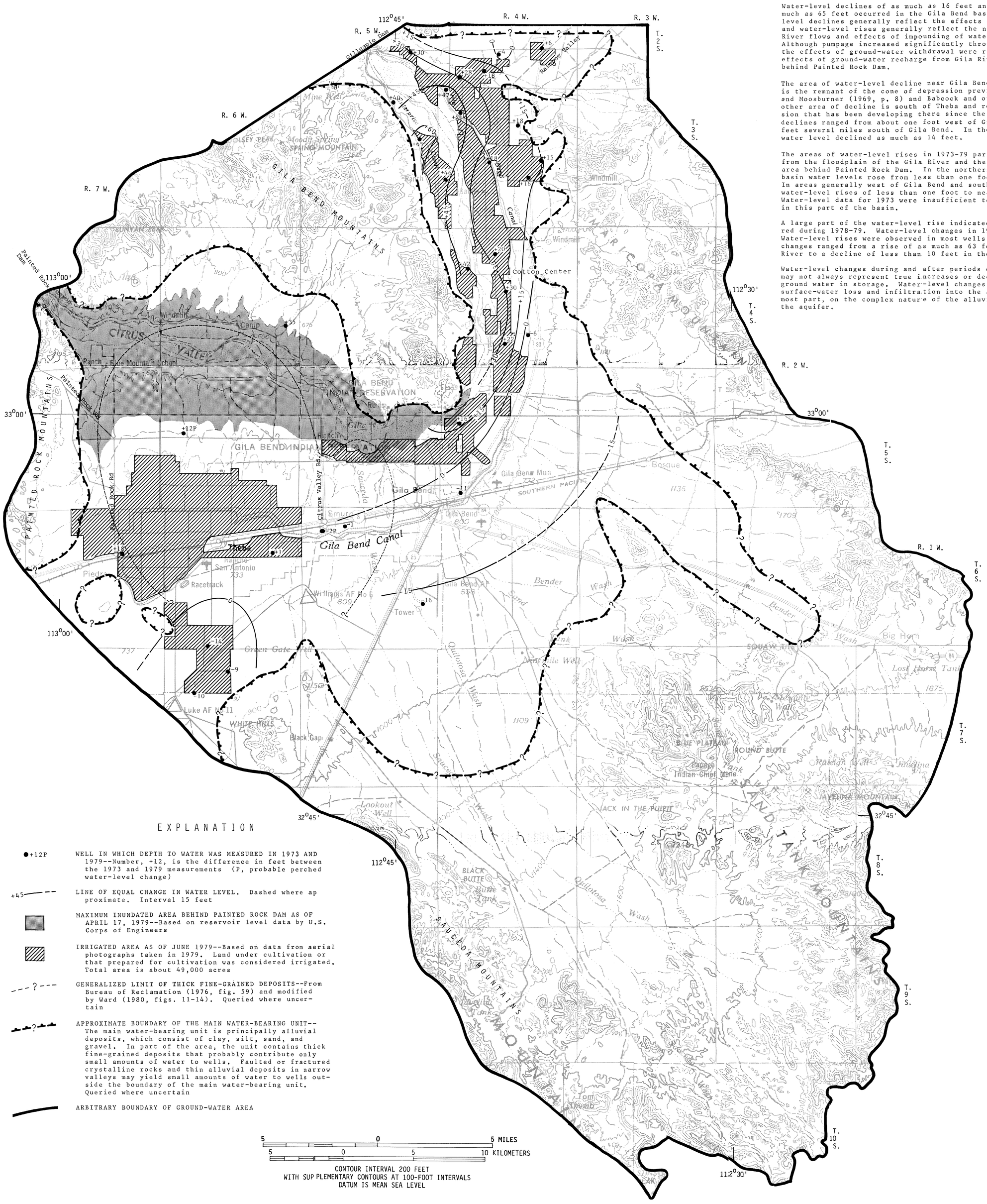
DEPTH TO WATER AND ALTITUDE OF THE WATER LEVEL, 1979

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA BEND BASIN AREA

MARICOPA COUNTY, ARIZONA--1979

by

P.G. SEBENIK



Water-level declines of as much as 16 feet and water-level rises of as much as 65 feet occurred in the Gila Bend basin area in 1973-79. Water-level declines generally reflect the effects of ground-water withdrawal and water-level rises generally reflect the number and magnitude of Gila River flows and effects of impounding of water behind Painted Rock Dam. Although pumpage increased significantly throughout the basin since 1973, the effects of ground-water withdrawal were reduced considerably by the effects of ground-water recharge from Gila River floodflows and storage behind Painted Rock Dam.

The area of water-level decline near Gila Bend and north to Cotton Center is the remnant of the cone of depression previously reported by Stulik and Moosburner (1969, p. 8) and Babcock and others (1975, p. 21). The other area of decline is south of Theba and reflects the cone of depression that has been developing there since the early 1970's. Water-level declines ranged from about one foot west of Gila Bend to as much as 16 feet several miles south of Gila Bend. In the area south of Theba the water level declined as much as 14 feet.

The areas of water-level rises in 1973-79 parallelled and radiated away from the floodplain of the Gila River and the 75 square-mile reservoir area behind Painted Rock Dam. In the northern and eastern parts of the basin water levels rose from less than one foot to more than 60 feet. In areas generally west of Gila Bend and south of Painted Rock Reservoir, water-level rises of less than one foot to nearly 20 feet occurred. Water-level data for 1973 were insufficient to contour water-level changes in this part of the basin.

A large part of the water-level rise indicated in 1973-79 actually occurred during 1978-79. Water-level changes in 1978-79 are shown on Sheet 4. Water-level rises were observed in most wells during this period and changes ranged from a rise of as much as 63 feet in a well near the Gila River to a decline of less than 10 feet in the area south of Theba.

Water-level changes during and after periods of flooding and impoundment may not always represent true increases or decreases in the amount of ground water in storage. Water-level changes and their relation to surface-water loss and infiltration into the aquifer depends, for the most part, on the complex nature of the alluvial deposits that constitute the aquifer.

EXPLANATION

●+12P — WELL IN WHICH DEPTH TO WATER WAS MEASURED IN 1973 AND 1979--Number, +12, is the difference in feet between the 1973 and 1979 measurements (P, probable perched water-level change)

+45 — LINE OF EQUAL CHANGE IN WATER LEVEL. Dashed where approximate. Interval 15 feet

MAXIMUM INUNDATED AREA BEHIND PAINTED ROCK DAM AS OF APRIL 17, 1979--Based on reservoir level data by U.S. Corps of Engineers

IRRIGATED AREA AS OF JUNE 1979--Based on data from aerial photographs taken in 1979. Land under cultivation or that prepared for cultivation was considered irrigated. Total area is about 49,000 acres

GENERALIZED LIMIT OF THICK FINE-GRAINED DEPOSITS--From Bureau of Reclamation (1976, fig. 59) and modified by Ward (1980, figs. 11-14). Queried where uncertain

APPROXIMATE BOUNDARY OF THE MAIN WATER-BEARING UNIT--The main water-bearing unit is principally alluvial deposits, which consist of clay, silt, sand, and gravel. In part of the area, the unit contains thick fine-grained deposits that probably contribute only small amounts of water to wells. Faulted or fractured crystalline rocks and thin alluvial deposits in narrow valleys may yield small amounts of water to wells outside the boundary of the main water-bearing unit. Queried where uncertain

ARBITRARY BOUNDARY OF GROUND-WATER AREA

5 0 5 MILES
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, 1:250,000, 1954-69 AND
AJO, 1:250,000, 1953-69

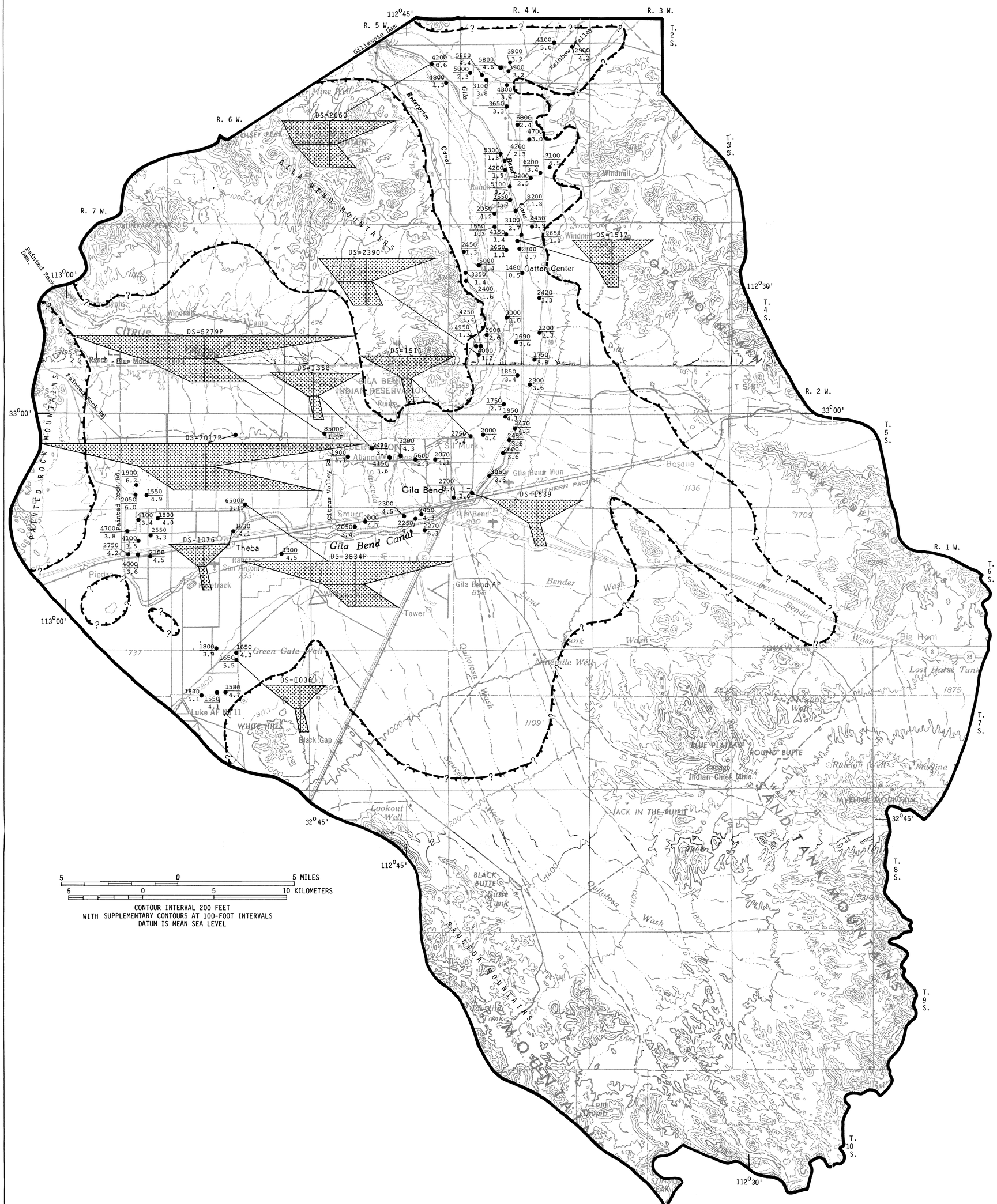
CHANGE IN WATER LEVEL, 1973-79, AND IRRIGATED AREA

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA BEND BASIN AREA

MARICOPA COUNTY, ARIZONA--1979

by

P.G. SEBENIK



In the Gila Bend basin area, the dissolved-solids concentrations in ground water ranged from 900 to 5,000 mg/L (milligrams per liter) in 1979. Specific conductance, as shown on the map, is an indication of the dissolved-solids concentration in the water; the dissolved-solids values may be estimated by multiplying the specific conductance by 0.6. The maximum contaminant level for dissolved solids in public supplies is 500 mg/L, as proposed in the secondary drinking-water regulations of the U.S. Environmental Protection Agency (1977b, p. 17146). The U.S. Environmental Protection Agency (1977a, b) has established national regulations and guidelines for the quality of water provided by public water systems. The regulations are either primary or secondary. Primary drinking-water regulations govern contaminants in drinking water that have been shown to affect human health. Secondary drinking-water regulations apply to contaminants that affect esthetic quality. The primary regulations are enforceable either by the Environmental Protection Agency or by the States; in contrast, the secondary regulations are not Federally enforceable. The secondary regulations are intended as guidelines for the States. The regulations express limits as "maximum contaminant levels," where contaminant means any physical, chemical, biological, or radiological substance or matter in water.

The following guidelines for dissolved-solids and specific-conductance values for irrigation water are modified from the National Academy of Sciences and National Academy of Engineering (1973, p. 335).

Classification	Dissolved solids (milligrams per liter)	Specific conductance (micromhos)
Water for which no detrimental effects are usually noticed...	Less than 500	Less than 850
Water than can have detrimental effects on sensitive crops....	500-1,000	850-1,670
Water that can have adverse effects on many crops; requires careful management practices.....	1,000-2,000	1,670-3,350
Water that can be used for tolerant plants on permeable soils with careful management practices.	2,000 5,000	3,350-8,350

The highest specific conductance values in water from irrigation wells occurred in an area east of the Gila River floodplain that extended from Gillespie Dam nearly to Cotton Center. The specific conductance values in this part of the basin ranged from about 2,000 to 8,200 micromhos. South of Cotton Center ground water for which the specific conductance was less than 2,500 micromhos occurred mainly within the cone of depression north of Gila Bend. South of Theba specific conductance values were less than 2,000 micromhos. In the area west and north of Gila Bend specific conductance values ranged from about 1,500 to 8,500 micromhos; two specific conductance values of 8,500 and 6,500 micromhos, respectively, probably represent water from the perched water zone.

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 Bend basin area, the annual average maximum daily air temperature is about 85°F, and the maximum contaminant level for fluoride is 1.4 mg/L.

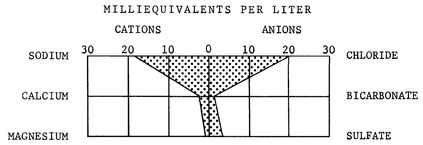
Fluoride content in ground water generally exceeded the maximum contaminant level in the entire Gila Bend basin area except along the Gila River floodplain from Gillespie Dam to about three miles south of Cotton Center. Fluoride concentration throughout the remainder of the basin ranged from 1.5 to 6.0 mg/L and averaged 4.0 mg/L. The highest fluoride concentrations generally were found in the water from deeper wells in the western end of the basin.

Analysis of water samples collected in the Gila Bend basin area show that sodium and chloride are the major ions contained in the ground water. Analysis of samples from wells open to the perched water zones show that large increases in the concentration of the two major ions were also accompanied by increases in calcium, magnesium, and sulfate ions. The poor quality of water in the perched water zone is probably influenced by percolation of excess irrigation water and possibly by evaporite deposits which reportedly may be found in the western part of the basin (Bureau of Reclamation, 1976, p. 71).

EXPLANATION

● 6500P / 3.1P — WELL FROM WHICH WATER SAMPLE WAS COLLECTED IN SUMMER OF 1979--Upper number, 6500, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Lower number, 3.1, is fluoride concentration in milligrams per liter. (P, water sample from probable perched water zone)

CHEMICAL-QUALITY DIAGRAM--Shows major chemical constituents in milliequivalents per liter. The diagrams are in a variety of shapes and sizes, which provides a means of comparing, correlating, and characterizing types of water



DS=3834P — DISSOLVED SOLIDS--Number, 3834, is dissolved-solids concentration in milligrams per liter (P, water sample from probable perched water zone)

APPROXIMATE BOUNDARY OF THE MAIN WATER-BEARING UNIT--The main water-bearing unit is principally alluvial deposits, which consist of clay, silt, sand, and gravel. In part of the area, the unit contains thick fine-grained deposits that probably contribute only small amounts of water to wells. Faulted or fractured crystalline rocks and thin alluvial deposits in narrow valleys may yield small amounts of water to wells outside the boundary of the main water-bearing unit. Queried where uncertain

ARBITRARY BOUNDARY OF GROUND-WATER AREA

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, 1:250,000, 1954-69 AND
AJO, 1:250,000, 1953-69

SPECIFIC CONDUCTANCE, FLUORIDE CONCENTRATION, AND CHEMICAL-QUALITY DIAGRAMS

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA BEND BASIN AREA

MARICOPA COUNTY, ARIZONA-- 1979

by

P.G. SEBENIK

ESTIMATED GROUND-WATER PUMPAGE
IN THE GILA BEND BASIN

(Numbers rounded to nearest thousand acre-feet)

Year	Pumpage, in thousands of acre-feet	Year	Pumpage, in thousands of acre-feet
1935	2	1959	250
1936	2	1960	250
1937	2	1961	200
1938	2	1962	170
1939	2	1963	130
1940	19	1964	130
1941	19	1965	115
1942	19	1966	145
1943	20	1967	198
1944	20	1968	153
1945	20	1969	166
1946	33	1970	162
1947	40	1971	212
1948	61	1972	238
1949	67	1973	198
1950	59	1974	249
1951	104	1975	288
1952	120	1976	287
1953	145	1977	300
1954	139	1978	292
1955	140	1979	218
1956	180		
1957	180		
1958	200	TOTAL	5,946

EXPLANATION

+5 LINE OF EQUAL CHANGE IN WATER LEVEL, 1978-1979--Dashed where approximate. Interval 10 feet

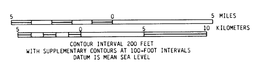
Ⓐ WELL FOR WHICH HYDROGRAPH IS SHOWN

MAXIMUM INUNDATED AREA BEHIND PAINTED ROCK DAM AS OF APRIL 17, 1979--Based on reservoir level data by U.S. Corps of Engineers

GENERALIZED LIMIT OF THICK FINE-GRAINED DEPOSITS--From Bureau of Reclamation (1976, fig. 59) and modified by Ward (1980, figs. 11-14). Queried where uncertain

APPROXIMATE BOUNDARY OF THE MAIN WATER-BEARING UNIT--The main water-bearing unit is principally alluvial deposits, which consist of clay, silt, sand, and gravel. In part of the area, the unit contains thick fine-grained deposits that probably contribute only small amounts of water to wells. Faulted or fractured crystalline rocks and thin alluvial deposits in narrow valleys may yield small amounts of water to wells outside the boundary of the main water-bearing unit. Queried where uncertain

ARBITRARY BOUNDARY OF GROUND-WATER AREA



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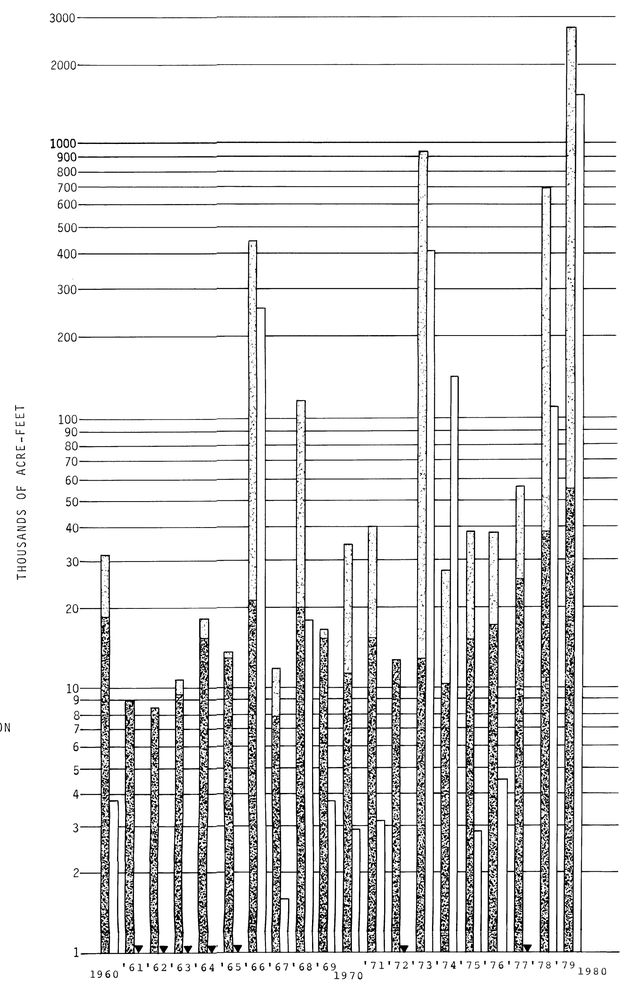
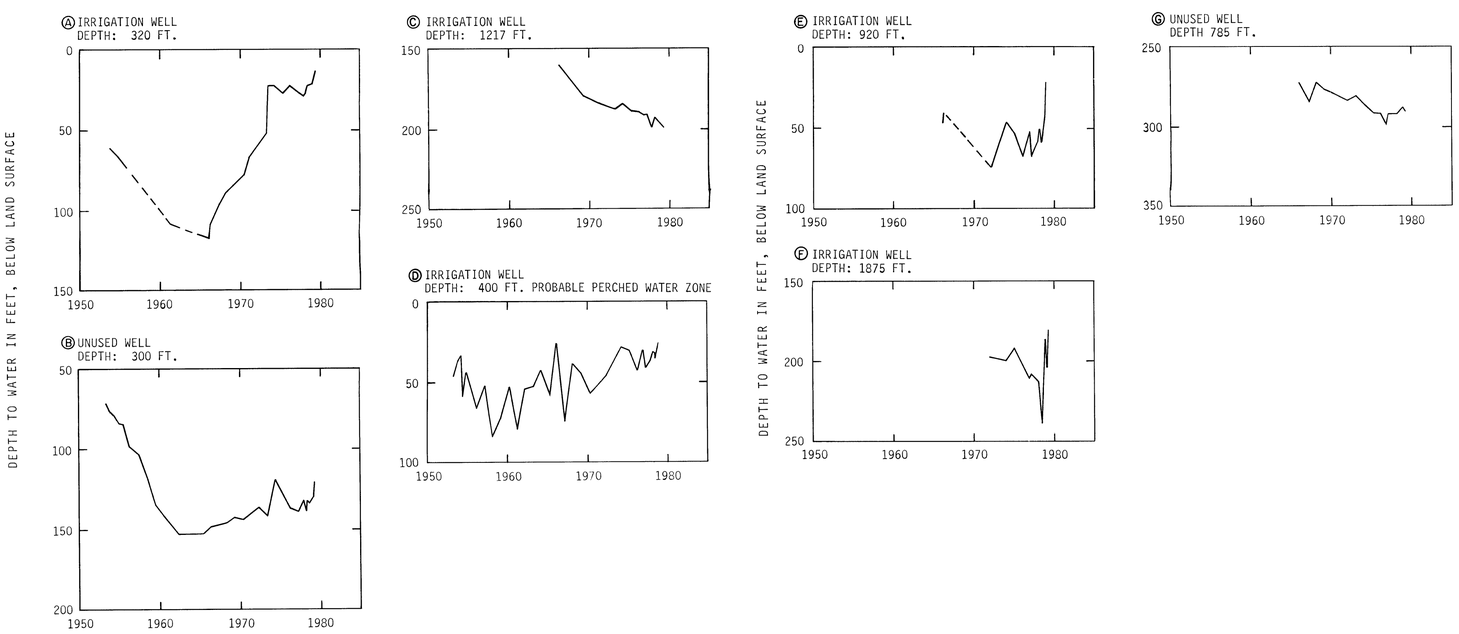
FLOW OF GILA RIVER BELOW GILLESPIE DAM AND BELOW PAINTED ROCK DAM,
1960 THRU 1979



HYDROGRAPHS OF THE WATER LEVEL IN SELECTED WELLS SHOWN ON THE MAP
(dashed lines indicate an inferred water level)



BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, 1:250,000, 1954-69 AND
AJO, 1:250,000, 1953-69

CHANGE IN WATER LEVEL, 1978-79, HYDROGRAPHS OF THE WATER LEVEL IN SELECTED WELLS

MAPS SHOWING GROUND-WATER CONDITIONS IN THE GILA BEND BASIN AREA

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