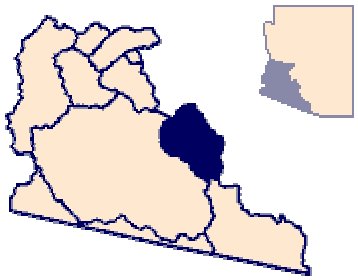
GILA BEND BASIN



The Gila Bend basin is located in southwestern Arizona and contains 1,280 square miles (Figure 15). The basin contains a wide, gently sloping alluvial plain surrounded by low, fault-block mountains. Elevations on the basin's alluvial plain range from about 700 feet to 1,400 feet above mean sea level. The mountains surrounding the basin have elevations of 2,100 feet to 3,200 feet above sea level. The basin is bounded by the Gila Bend Mountains and Buckeye Hills on the north, the Maricopa and Sand Tank Mountains on the east, the Sauceda Mountains on the south, and the Painted Rock Mountains on the west.

The basin's main surface drainage is the Gila River and its tributaries. The Gila enters the basin at its northern end near Gillespie Dam, flows south to the City of Gila Bend, then turns west and exits the basin at Painted Rock Dam. The total length of the river within the basin from Gillespie Dam to Painted Rock Dam is 36 miles. The Gila River is ephemeral in the Gila Bend basin and flows only in response to precipitation events or water releases from upstream dams. Upstream of Gillespie Dam, most of the low flow in the river is sewage effluent and irrigation return flow. As a result, the mean annual discharge of the river is highly variable, and ranges from zero to over a million acre-feet per year (Sebenik, 1981).

The main water-bearing unit in the Gila Bend basin is the alluvial valley-fill material which is divided into a younger and older alluvial unit. Both units yield water to wells and can be considered as one aquifer because of their hydrologic connection (Heindl and Armstrong, 1963). In the mountains, thin alluvial deposits provide water to low-yield stock and domestic wells. Groundwater in the alluvial aquifer is usually unconfined, but several areas exist where fine-grained layers in the alluvium cause confined conditions. Northwest of the Town of Gila Bend, fine-grained layers in the alluvium also cause some perched water-table conditions (Sebenik, 1981). The perched water is caused by downward percolation of irrigation water (Sebenik, 1981).

In the alluvium, depth to water is usually shallowest near the Gila River and deepest near the mountain fronts. In 1979, depth to water varied from about 15 feet below land surface in the Gila River's floodplain near Gillespie Dam to more than 600 feet below surface level in the southern part of the basin in Township 6 South, Range 3 West (Sebenik, 1981). Well yields from the alluvial aquifer vary widely. Sand and gravel beds in the alluvium provide the highest well yields, and fine-grained layers have lower well yields. Measured yields from wells in the alluvial aquifer range from several hundred gallons per minute to over 2,000 gallons per minute (Sebenik, 1981).

Most of the groundwater pumped in the Gila Bend basin is used for irrigation. The groundwater supplements surface water diverted from the Gila River into two canals at Gillespie Dam. Major groundwater development began in 1935 when several wells were drilled for water to supplement surface water diversions. By 1947, 17 irrigation wells had been drilled and 40,000 acre-feet of water had been pumped for crop irrigation (Babcock and Kendall, 1948). In 1965, 50 wells were pumping groundwater and about 35,000 acres of land was in cultivation (Stulik and Moosburner, 1969). Since groundwater development began in 1935, an estimated 7,239,000 acre-feet of water have been withdrawn from the Gila Bend basin through 1984 (U.S. Geological Survey, 1986). The Arizona Department of Water Resources (1988) estimates that there are 27.6 million acre-feet of recoverable groundwater to 1,200 feet below land surface in the Gila Bend basin.

Groundwater pumpage has created several cones of depression in the basin. The largest cone roughly parallels the Gila River from Gila Bend to just north of Cotton Center. Smaller cones of depression occur south of Gila Bend, and south and northwest of Theba (Sebenik, 1981). The largest cone of depression, between Gila Bend and Cotton Center, began near Cotton Center in the 1950's. As agricultural development moved south and west into the Gila Bend-Theba areas in the 1960's and 1970's, the large cone expanded and the smaller cones of depression formed (Sebenik, 1981).

Changes in water levels in the basin are caused by the combined effects of groundwater withdrawals and recharge to the aquifer. Between 1973 and 1979, Sebenik (1981) reported water level declines of 16 feet and rises of as much as 65 feet.

However, it should be noted that in 1973, 1978, and 1979, the Gila River had above normal water flows (Sebenik, 1981). These large flood flows caused unusually large amounts of recharge and corresponding large water level rises in wells near the Gila River's floodplain.

There are four sources of recharge in the Gila Bend basin: Gila River flow events and water impounded behind Painted Rock Dam, infiltration of irrigation and canal water, underflow from the Gila River and its tributaries, and direct precipitation (Heindl and Armstrong, 1963). Gila River flood events and dam storage are the largest source of recharge in the basin. The other sources of recharge are either very small or negligible. Recharge from Gila River flow events helps to offset the effect of groundwater withdrawals in wells near the Gila River floodplain (Stulik and Moosburner, 1969). Recharge from the river has the additional effect of altering the direction of groundwater movement and the long-term change in the amount of groundwater in storage in the aquifer near the river. This effect can be seen northwest of Theba when floodwaters impounded by Painted Rock Dam occasionally create a groundwater mound that masks a small cone of depression in the area (Sebenik, 1981).

Due to the variability of Gila River flows, annual recharge for the Gila River basin is difficult to estimate. Johnson and Cahill (1955) estimated that between 1947 and 1953, annual recharge was between 40,000 and 50,000 acre-feet per year. This matches closely with Freethey and Anderson's (1986) predevelopment estimate of 37,000 acre-feet of recharge per year. However, since 1921, mean annual flows in the Gila River have declined (Stulik and Moosburner, 1969). This decline is the result of increased upstream water use and the expansion of upstream storage facilities. If this trend continues then recharge into the basin will also decline.

The chemical quality of groundwater in the Gila Bend basin is very poor throughout most of the basin. Fluoride and total dissolved solids (TDS) concentrations in numerous wells sampled in the basin exceed the maximum contaminant levels established by the U.S. Environmental Protection Agency.

Groundwater from all wells sampled in the basin exceeded the recommended secondary maximum contaminant level for TDS of 500 milligrams per liter (mg/l). Total dissolved solids concentrations estimated from specific conductance values ranged from 900 mg/l to about 5,000 mg/l in 1979 (Sebenik, 1981). The highest concentrations are in the northeastern part of the basin between Gillespie Dam and Cotton Center. Total dissolved solids values from this area ranged from 1,200 mg/l to 4,290 mg/l (Sebenik, 1981). The U.S. Bureau of Reclamation (1976a) reported a perched-water zone of poor quality northwest of Gila Bend. This perched zone of high sodium and chloride concentrations probably is influenced by percolation of irrigation water and presence of evaporite deposits found in the western part of the basin.

Fluoride concentrations in the basin ranged from 0.5 to 6.2 mg/l, with the highest concentrations found in water from deeper wells in the western end of the basin (Sebenik, 1981). The maximum contaminant level for fluoride is 4.0 mg/l.