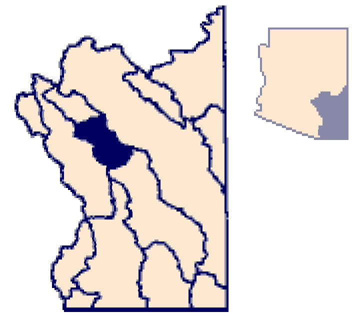
ARAVAIPA CANYON BASIN



Aravaipa Canyon basin occupies 537 square miles in southeastern Arizona (Figure 17). The basin is in the Basin and Range physiographic province and consists of a northwest-trending alluvial valley surrounded by fault-block mountains. The basin's boundaries are the Galiuro Mountains to the southwest, the Santa Teresa and Pinaleno Mountains to the northeast, and the Turnbull Mountains to the north. A topographic high to the southeast serves as a surface water divide between Aravaipa Valley and the northern Sulphur Springs Valley.

Aravaipa Creek is tributary to the San Pedro River and flows through Aravaipa Valley from the southeast to the northwest. The creek, ephemeral in its upper reaches, becomes perennial in Aravaipa Canyon where impermeable bedrock forces groundwater into the creekbed. Aravaipa Creek maintains its perennial flow through the canyon before becoming ephemeral again west of the canyon. Major tributaries to Aravaipa Creek are Stowe Gulch, Deer Creek, Laurel Canyon, Squaw Creek, and Turkey Creek. Mean annual flow of Aravaipa Creek, measured at the western end of Aravaipa Canyon, is 26,059 acre-feet (EarthInfo, 1991).

Elevations on the basin's valley floor range from 4,300 feet above mean sea level at its southeastern end to 3,100 feet above mean sea level at the entrance to Aravaipa Canyon. The surrounding mountains have elevations of up to 7,500 feet above mean sea level.

There are two aquifers in Aravaipa Canyon basin: a water-table aquifer in the streambed alluvium and a confined aquifer in the basin-fill alluvium (Neuman and Adar, 1983). The upper streambed aquifer is the main source of water in the basin. The lower basin-fill aquifer is a dependable, secondary aquifer; however, well yields from it tend to be small. The Hell Hole Conglomerate and the surrounding bedrock complex provide only minor amounts of water, mostly from springs, ephemeral seeps, and a few low-yield stock wells. Total estimated recoverable groundwater in storage in the basin-fill sediments to 1,200 feet below land surface is 5.0 million acre-feet (Freethey and Anderson, 1986).

In the upper reach of Aravaipa Creek the streambed alluvium is 0.5 to 1.0 miles wide. The streambed alluvium thickness ranges from several tens of feet to as much as 300 feet in deeper sections (Ellingson, 1980; Neuman and Adar, 1983). The streambed alluvium is very permeable and several irrigation wells yield up to 1,500 gallons per minute. The streambed aquifer extends into the basin-fill alluvium along the margins of the streambed alluvium. Where this happens, well yields are low due to the lower permeability of the basin-fill. Water levels in the streambed alluvium range from less than 10 feet to 100 feet below surface level (Ellingson, 1980; Gould and Wilson, 1976; Neuman and Adar, 1983).

Water in the basin-fill alluvium is confined due to fine-grained lake bed sediments in the upper sections of the basin-fill. The uppermost confining layer is continuous across the entire valley, whereas deeper layers only are continuous along the eastern and northern portions of the valley. Increased consolidation with depth produce small well yields from the basin-fill. Water levels in the basin-fill range from 26 feet to 500 feet below land surface. Upward leakage from the lower aquifer into the upper water-table aquifer has been reported by Ellingson (1980), and Neuman and Adar (1983).

Water found in the surrounding mountains and Hell Hole Conglomerate comes mostly from springs, seeps, and a few low-yield stock wells. Most springs and seeps are located along faults that drain fracture zones of consolidated rocks, or that drain small, localized perched water tables (Ellingson, 1980). Several springs support perennial flow in streams tributary to Aravaipa Creek; flows of 100 to 150 gallons per minute have been reported for some springs. The few wells located in the mountains and conglomerate are low-yield stock wells. These produce from localized perched zones or from small alluvial deposits (Neuman and Adar, 1983).

Water levels in Aravaipa Valley indicate groundwater movement is from the surrounding mountains to the valley floor and then northwest through the valley towards Aravaipa Canyon. As groundwater moves towards Aravaipa Canyon, the valley narrows and impermeable bedrock forces groundwater into the streambed forming Aravaipa Spring. The spring is located about 0.5 mile downstream from the canyon's entrance (Neuman and Adar, 1983). Aravaipa Creek maintains a perennial reach through the canyon before becoming ephemeral again west of the canyon. In the southeastern part of Aravaipa Valley, a bedrock high serves as a groundwater divide separating Aravaipa Valley from the Sulfur Springs Valley. Gravity surveys indicate the groundwater divide is located just south of the topographic high that separates the two valleys (Robinson, 1976).

Major components of recharge in the basin are: mountain-front recharge, streambed infiltration of runoff, and direct infiltration of rainfall. The relative importance of each recharge component is different for the upper streambed aquifer and the lower confined basin-fill aquifer (Neuman and Adar, 1983). Estimates of total recharge in the basin range from 7,000 acre-feet annually to 16,700 acre-feet annually (Arizona Department of Water Resources, 1991; Ellingson, 1980; Freethey and Anderson, 1986; Neuman and Adar, 1983).

Streambed infiltration and mountain-front recharge are the primary recharge components for the streambed aquifer. Direct infiltration of rainfall is insignificant due to the streambed alluvium's small outcrop area (Neuman and Adar, 1983). Only a small area of streambed alluvium directly overlies mountain bedrock; therefore, most mountain-front recharge infiltrates into the streambed aquifer through upper layers in the older basin-fill alluvium. Streambed infiltration directly occurs through the streambed alluvium of Aravaipa Creek and its ephemeral tributaries. It indirectly occurs from floodflows infiltrating through alluvial fans at the confluence of major mountain washes. An additional source of recharge to the streambed aquifer is water leaking upwards from the confined basin-fill aquifer (Neuman and Adar, 1983).

Mountain-front recharge and deep percolation of rainfall are the primary sources of recharge to the basin-fill aquifer (Neuman and Adar, 1983). As mentioned previously, some of the mountain-front recharge infiltrating into upper layers of the basin-fill also recharges the streambed aquifer. Streambed infiltration into the basin-fill is small because of the lack of major tributaries crossing the basin-fill outcrop (Neuman and Adar, 1983).

Water is discharged from the aquifers as groundwater pumpage and as base flow in Aravaipa Creek. The Arizona Department of Water Resources (1990) estimates total discharge from the basin to be 16,700 acre-feet per year. Water discharged by pumping is estimated to be 3,100 acre-feet annually, and base flow from the basin via Aravaipa Creek averages 11,000 acre-feet per year (Arizona Department of Water Resources, 1990; Ellingson, 1980). Surface water diversions and evapotranspiration make up the remaining water discharges from the basin.

Groundwater development began in Aravaipa Valley with its settlement in the late 1800's. Early water use was to support cattle ranching in the valley and mining in the surrounding mountains. Currently, most groundwater is used for irrigating small fields located along Aravaipa Creek. Since 1957, water use has been fairly steady at about 3,100 acre-feet per year, with 3,000 acre-feet used for irrigation, 45 acre-feet for stock use, and 15 acre-feet for domestic use (Ellingson, 1980; Neuman and Adar, 1983). Of the total annual pumpage, 2,400 acre-feet are withdrawn from the streambed aquifer and 700 acre-feet are withdrawn from the basin-fill aquifer (Neuman and Adar, 1983). In addition to pumped groundwater, up to 97 acre-feet a year of surface water are diverted for irrigation from Aravaipa Creek.

The chemical quality of water in Aravaipa Canyon basin is suitable for most uses. Detailed analysis of water from over 90 wells and springs in the basin was done in 1981-1982 by Neuman and Adar (1983). Total dissolved solids concentrations ranged from 64 to 496 milligrams per liter (mg/l) and averaged 232 mg/l. The recommended secondary maximum contaminant level for total dissolved solids is 500 mg/l (U.S. Environmental Protection Agency, 1988). Fluoride concentrations in the basin range from 0.2 mg/l to 5.7 mg/l and averaged 0.7 mg/l. The maximum contaminant level for fluoride is 4.0 mg/l.