BILL WILLIAMS WATERSHED

The Bill Williams watershed is located in the west-central portion of Arizona and has a drainage area of approximately 4,730 square miles. The watershed encompasses the boundaries of the Bill Williams basin, the Big Sandy basin, and a portion of the Sacramento Valley basin.

The watershed is drained by the Bill Williams River and its major tributaries, the Big Sandy and the Santa Maria Rivers. The river system flows toward the southwest and west and drains into the Colorado River. The confluence of the Big Sandy and Santa Maria Rivers is located approximately five miles upstream from Alamo Dam. Downstream from Alamo Dam, the Bill Williams River flows in a westerly direction for about 40 miles before joining the Colorado River.

Streamflow Characteristics

The Bill Williams River was a perennial stream for part of its reach before Alamo Dam was constructed (Wolcott and others, 1956). The river is now ephemeral and flows only in response to precipitation.

The perennial streams in the watershed originate mainly from springs discharging from crystalline rocks and from lateral fissures in exposed rock. Francis Creek, which is tributary to Burro Creek in the eastern portion of the watershed, receives discharge from artesian wells upstream from its confluence with Burro Creek (Rampe, 1984). Most of the public water supply for Bagdad comes from spring flow that discharges into the channel of Francis Creek. In 1968 the flow of Francis Creek was reported to be more than 6,000 gallons per minute (Yost and Gardner Engineers, written commun., 1968). However, in 1983 the Cyprus-Bagdad mining operation removed an estimated 1,000 gallons per minute continually from an impound spring on Francis Creek (Rampe, 1984). In this area, springs commonly discharge along faults at topographic low points (Davidson, 1973). In 1979, U.S. Geological Survey spring flow measurements of ephemeral springs ranged from less than 1 to 27 gallons per minute whereas, flow from perennial springs ranged from 1 to 36 gallons per minute (Sanger and others, 1981). Table 18 lists perennial streams tributary to the Bill Williams River throughout the watershed. Figure 14 displays the location of these reaches.

TABLE 18

PERENNIAL STREAM REACHES IN THE BILL WILLIAMS WATERSHED

Perennial Stream Reaches	Length (miles)
Willow Creek	4
Trout Creek	25
Big Sandy (4 reaches)	25
Burro Creek (2 reaches)	37
Francis Creek	7
Boulder Creek	8
Santa Maria River (3 reaches)	17
Kirkland Creek (2 reaches)	7
Sycamore Creek	12
Cottonwood Canyon	4
Date Creek (2 reaches)	7

Source: Brown and others, 1981

The combined total length of perennial streams in the Bill Williams watershed is approximately 153 miles. The U.S. Geological Survey has operated eight streamgaging stations in the Bill Williams watershed (Figure 14). Annual flows for these stations are presented in Table 19.

TABLE 19

ANNUAL FLOWS FOR USGS STREAMGAGING STATIONS IN THE BILL WILLIAMS WATERSHED

Station Name	Station Number	Period of Record	Mean Annual Flow (ac-ft)	Median Annual Flow (ac-ft)	Record Annual High Flow (ac-ft)	Record Annual Low Flow (ac-ft)
Burro Creek near Bagdad	9424447	1981-1990	43,430	18,750	169,370	4,050
Francis Creek near Bagdad	9424432	1987, 1989-1990	1,740	1,660	2,240	1,300
Big Sandy River near Wikieup	9424450	1967-1990	55,730	26,560	231,620	3,260
Bill Williams below Alamo Dam	9426000	1941-1990	78,170	31,740	642,730	1,520
Santa Maria River near Alamo	9425500	1941-1965	22,440	8,400	184,570	1,740
Bill Williams River at Planet Ranch	9426500	1915, 1929-1946	110,020	60,150	436,450	1,160
Bill Williams near Parker	9426620	1989	6,410	*	*	*
Santa Maria River near Bagdad	9424900	1967-1985 1989-1990	48,490	27,290	167,920	400

* Insufficient data for analysis.
Source: U.S. Geological Survey, 1992, National Water Information System

A hydraulic connection exists between flow in the Bill Williams River and groundwater in the alluvium along the river. Short-term water level rises and declines of as much as 30 feet have been reported by well owners along the Bill Williams River. These fluctuations correlate with the water releases at Alamo Dam (Owen-Joyce, 1987). The water levels in the river below Alamo Dam are occasionally affected by the water levels in Lake Havasu. In 1983 and 1984, the rise in lake elevations at Lake Havasu caused a backwater effect onto the Bill Williams River.

From Alamo Dam to the Colorado River, surface water flow is unmeasured. Average annual runoff from 500 square miles of drainage area between the gage and the mouth was estimated to be 4,000 acre-feet or approximately .2 inches of runoff (Owen-Joyce, 1987).

Reservoirs

Alamo Lake is the only reservoir located in the Bill Williams watershed. Alamo Dam was completed in 1968 and is of earthfill and rockfill construction. Total capacity of the lake is 1,043,000 acre-feet, however, it is maintained at less than full capacity.

Water Quality

Water quality in the Bill Williams River is suitable for irrigation and domestic use, although it is fairly hard and contains moderate quantities of dissolved minerals (Wolcott and others, 1956).

There has been some surface-water contamination in the Boulder Creek area from mining operations. Boulder Creek's waters have been polluted severely by acid, sulfate, and heavy metals in the vicinity of the abandoned Hillside Mine.

Overall water quality in Burro and Francis Creeks above the Boulder Creek confluence is excellent and is well suited for domestic use (Rampe, 1984). Water quality in Burro Creek below Boulder Creek is good, although the sodium and fluoride levels are still rather high for a long-term drinking water supply (Rampe, 1984).