

COMPARISON BETWEEN HISTORIC OBSERVATIONS OF SAN PEDRO RIVER STREAM CONDITIONS AND HJALMARSON'S ESTIMATES OF PREDEVELOPMENT FLOWS

SAN PEDRO RIVER LOCATION ^a	DATE ^a	OBSERVER ^a	RECORDED STREAM CONDITIONS ^a			CALCULATED Q (ft ³ /s) ^b	TIME Q OR D EQUALED OR EXCEEDED ^c	HJALMARSON ESTIMATED Q (ft ³ /s) ^d	POTENTIAL HUMAN-CAUSED STREAM DIVERSIONS AT DATE (ft ³ /s)		
			W (ft)	D (ft)	V (ft/s)				Mines ^e	Irrigation	Cattle ^h
near Benson	February 1854	Parke	12	1.5	---	18 to 54	33%	75	0	0 ^f	≤ 1
above the Narrows	March and April 1858	Hutton	12	1	---	12 to 36	36% to 47%	45 to 65		0 ^g	
	September 1858	Leach	Dry			0	47%	65		0 ^f	≤ 2
at or above Aravaipa Creek	late September 1858	Tevis	6	1	2.2	6 to 18	66%	30			
near Gila River confluence	November 5, 1846	Emory	6 ("a few yards wide)	1	---	6 to 18	66%	30			≤ 1

Notes

- ^a See Table 1 of March 2013 Burtell Declaration for further details; stream width (W) and depth (D) in feet and velocity (V) in feet per second.
- ^b Discharge (Q) in cubic feet per second (cfs) was calculated by multiplying the recorded stream width and depth by a velocity of 1 to 3 feet per second. This velocity range covers the range of most USGS measurements of San Pedro stream velocities, as presented in Appendix E of Fuller (2004).
- ^c Determined using the median discharge recorded at USGS Gage 9471550 for the given month or day of the historic observation and Hjalmarson's flow duration curve for that gage (see Slide 94 of his presentation).
- ^d Determined using Hjalmarson's predevelopment flow- and depth-duration curves for the San Pedro River (see Slides 150 and 151, respectively, of his presentation).
- ^e The mines at Cananea, Bisbee, Tombstone, and Mammoth were developed after 1858.
- ^f Unlikely much, if any, irrigation occurred in February before the planting season; in September during the harvest; and, after the harvest in November.
- ^g According to Fuller (2004, pp.3-10 and 3-12), Apache raids were an obstacle to colonization of the San Pedro Valley throughout the Mexican Period and, from 1846 through 1859, the United States military expeditions and parties of forty-niners found the area filled with ruins of abandoned ranches and large herds of wild cattle.
- ^h Hjalmarson assumes that historically up to 60,000 cows in the San Pedro Valley could consume "nearly 2 cfs" on a "hot summer day". To have this effect on San Pedro River flows, all of these cows would have to be drinking upstream of a given stream location which is unlikely. Water needs for cattle are expected to decrease during non-summer months. ADWR recommends assuming 12 gallons per cow per day when applying to appropriate surface water. For 60,000 cows, this would equate to 1.1 cfs.