

Water Deliveries and Costs

in the San Joaquin Valley cotton area

CHARLES V. MOORE and TRIMBLE R. HEDGES

Most San Joaquin Valley operators of irrigated farms depend on surface water sources to supplement ground water supplies. In years of low rainfall, when ground water levels drop, wells deliver less than normal quantities—some wells go dry—and sources of surface water are of increased importance.

In a study of surface irrigation water supplies and costs in the San Joaquin Valley, 11 irrigation districts in the cotton producing area were chosen because of their geographical distribution in the floor of the valley.

The different combinations of water sources, the variations of supply within the sources, and the many distributing agencies with varying policies within the selected study districts prevented an area analysis. Consequently, the 11 districts were treated individually.

Among the most important surface water distributors are irrigation districts, water storage districts, county water districts, California water districts, mutual water companies, and private water companies. Irrigation districts supply the most extensive San Joaquin Valley surface water service areas.

Stream flow diversions, reservoir storage, and purchase contracts with the United States Bureau of Reclamation provide most of the water that irrigation districts retail to farmers. The reliability and adequacy of stream diversions de-

pend on the nature of the water rights held by the organization or its members, and flow in the stream to which the rights pertain. An irrigation district may hold only a junior appropriative right on a stream, for example, and, therefore, receive water only during wet years, or only during high stream flow seasons of a given year. In contrast, a district may have a senior right on a stream and with it, a dependable supply throughout the irrigation season, except in unusually dry years.

Costs to the district, and hence to farmers, vary widely. Investments in distribution facilities depend upon the type of system used. Completely closed concrete pipe systems with small service areas of 40–80 acres per turnout are expensive; investments may range up to \$300 per acre of cropland in the district. The closed type system is efficient and minimizes losses from seepage and evaporation. Unlined open ditches require lower investments per acre, but seepage and evaporation losses are high.

The age of the system—when installed—also affects its cost and the price that growers must pay for water. Concrete pipeline construction costs in 1960 were 48% higher than they were in 1947. Some of the older districts have repaid the capital cost of their distribution systems, have no funded debt to be repaid, and no need to include fees or charges

to cover such obligations. Newer districts usually have heavy capital obligations.

In addition to capital costs, farmer payments for surface water must cover the cost of all services which may include storage within the season, and also year-to-year carryover to insure more uniform water supplies. Some districts carry on extensive ground water recharge programs requiring large percolation facilities. Also, some districts have developed extensive drainage systems for parts or all of their service area.

For the current study all district costs were charged to the surface water delivered—the only quantifiable service—a procedure that masks the amounts properly chargeable against the other services provided. The boards of directors determine pricing policies for their individual districts, and most of the organizations break down the total price into two components, the assessment portion and the toll portion.

Irrigation districts, as public entities, have the power of taxation. They can levy the assessment portion of the total price as a fixed cost which the district member, the farmer, must pay, usually annually, regardless of the amount of water—if any—the farmer received from the district. Special assessments for improvement or drainage districts within an irrigation district, if levied, cause the fixed

Concluded on next page

Continued from preceding page

them in boxes without ice and ship immediately. Water from melting ice in a shipping box can cause collapse of the box in handling, loosening of the braces, and damage to merchandise.

Although, in all trials, all flowers were salable on arrival at Ithaca, the carnations showed minor signs of thrips injury, chemical injury, and botrytis. Of the three, thrips injury seemed to be the most serious. Petals showing thrips injury on arrival soon exhibited premature

browning and dehydration. If carnations are free of disease, insect injury, and physiologically able to function as cut flowers, shipping success depends little on methods used. However, shipping methods can increase cut flower life.

Standard Chrysanthemums

Standard chrysanthemums in the bud stage shipped well in a box with no ice. Buds opened to salable flower size in 4–5 days when stems were recut and commer-

cial flower preservative added to the water. When stems were recut and plain water used, buds did not open and leaves and flowers did not remain turgid. Recutting of stems and the use of a flower preservative are necessary. Maximum benefits derived from shipping standard chrysanthemums in the bud stage could be savings in transportation, less damage to flowers, and the possibility of stockpiling mums by the wholesaler.

Seward T. Besemer is Farm Advisor, San Diego County, University of California.

WATER

Continued from preceding page

cost per acre to vary within the district on land with equal assessed valuations.

Water tolls are measured quantity rates that most districts use and represent the variable portion of the total price. A farmer incurs water toll costs only if he purchases and receives water. Toll rates per acre foot sometimes vary within a district, due to the added cost of pumping water to areas of higher elevation in the district.

Fixed and variable portions of the total cost of irrigation water for the 11 San Joaquin Valley irrigation districts included in the study vary according to stream runoff conditions. Total stream discharge for the high runoff water year of 1957-1958 was about 125% of long time normal. The low runoff year was for a water year when the total stream discharge was about 75% of normal.

The table indicates that acre feet of water delivered within the district do not always decrease from a wet year to a dry year. The district may have sufficient storage carryover from the previous year to meet needs in a dry year, or, water may be diverted from the normal ground water recharge program, and used to maintain or increase delivery supplies for direct irrigation.

Variations in water deliveries, when they occur, react sharply on both the total cost per acre foot and the relative importance of the fixed cost components. Typical assessments per acre within the 11 districts varied from \$1.50 to \$9.80, with most of them in the \$2.51 to \$5.00 range. Measured tolls per acre foot varied from zero to \$5.50, with most, again, in the \$2.51 to \$5.00 interval. Considering the amounts of water delivered per acre, and the fact that three districts charge no toll rate—variable cost—seven

districts charge more per acre foot for assessments than for the measured toll charge; thus the fixed cost represents the major part of total water costs to farmers in those districts. The relationship holds for both wet and dry years, reflecting the extent that those districts rely on assessments to obtain necessary revenues. Total costs, ranging in the wet year from \$1.14 to \$8.40, and in the dry year from \$2.35 to \$9.33 per acre foot vary inversely with the amount delivered. All districts made

year volume of water that the streams carry, and 2, instances in which two or more low-stream-flow seasons occur consecutively. Tule River variations ranged between 263% of normal in the 1951-52 season, and 40% in 1958-59. Most of the other streams varied in the same direction—except for minor differences from 1952-53 to 1953-54—and the degree of change was similar. During the nine seasons, the streams showed five flows well below normal and three flows that ex-

Seasonal Flow for Major Streams in the Southern San Joaquin Valley as Percent of Normal, 1950-51 to 1958-59

Stream	Year								
	58-59	57-58	56-57	55-56	54-55	53-54	52-53	51-52	50-51
	Percent								
San Joaquin	64	119	76	173	66	72	67	164	173
Kaweah	49	126	73	176	68	75	75	203	103
Tule	40	149	53	169	49	76	83	263	68
Kern	76	113	63	103	54	72	84	235	90
Kings	60	127	75	141	68	75	69	170	97

Source: Water Conditions Report, California Department of Water Resources.

per acre assessments which remained the same each year, regardless of delivery amounts, although assessments may vary from year to year, depending upon district policies. Total cost per acre foot doubled for one district between the wet and the dry year, increasing from \$2.24 to \$4.88 with all charges representing assessments.

Irrigation districts depend on stream flow—and in turn, on rain and snow—for water supplies. They rely on relatively nearby watersheds and catchment areas, except for those districts that draw upon more distant sources through United States Bureau of Reclamation contracts.

Season's total stream flow data in percentages of normal, for five San Joaquin Valley streams shown in the above table demonstrate two important characteristics: 1, wide variations in the year-to-

ceeded normal sharply in 1951-52. Three rivers were below normal and two well above normal in the level of water flow during the other season. Four weather stations in the mountain watersheds of the five streams showed season-to-season variations in precipitation that agreed closely in direction and degree with the stream flow changes.

Year-to-year variations in amounts of surface water available for irrigation may be sharp, in districts depending on stream diversions and holding junior appropriative rights. Variations, in deliveries, services, and prices charged require study of individual districts.

Charles V. Moore is Assistant Research Agricultural Economist, University of California, Davis.

Trimble R. Hedges is Professor of Agricultural Economics, University of California, Davis.

Quantity and Cost of Surface Irrigation Water Delivered in Wet and Dry Years for 11 Irrigation Districts; San Joaquin Valley Cotton Area

District	Type distribution system	Approx. year system built	Assessment per \$100 valuation	Typical valuation per acre	Assessment per acre	Average delivery per irr. acre		Average assessment per acre foot (fixed cost)		Typical toll rate per ac. ft. (variable cost)	Total cost per ac. ft.	
						wet year	dry year	wet year	dry year		wet year	dry year
				Dollars	Acre feet				Dollars			
1	Open	1900	4.25	100.00	4.25	1.90	0.87	2.24	4.88	0.00	2.24	4.88
2	Open	1927	4.00	100.00	4.00	3.50	1.51	1.14	2.65	0.00	1.14	2.65
3	Open	1918	1.50	100.00	1.50	1.23	1.29	1.22	1.16	5.50	6.72	6.66
4	Closed	1957	7.00	140.00	9.80	3.08	2.82	3.18	3.48	2.00	5.18	5.48
5	Open	1920	3.25	50.00	1.62	2.39	3.80	0.68	0.43	4.50	5.18	4.93
6	Open	1925	5.00	100.00	5.00	2.47	2.13	2.02	2.35	0.00	2.02	2.35
7	Closed	1956	3.16	200.00	6.32	1.86	2.16	3.40	2.92	5.00	8.40	7.92
8	O & C	1900	5.70	110.00	6.27	1.39	1.25	4.51	5.02	3.00	7.51	8.02
9	Open	1956	3.86	115.00	4.44	1.00	0.66	4.44	6.73	2.60	7.04	9.33
10	Closed	1920	3.50	100.00	3.50	1.36	1.56	2.57	2.24	4.50	7.07	6.74
11	Open	1910	6.50	100.00	6.50	2.04	1.54	3.19	4.22	2.00	5.19	6.22

Source: Report on Irrigation in Water Storage Districts in California, California Department of Water Resources, Bulletin 21 and Survey of Irrigation Districts.