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Agricultural Water Use and Costs In California

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Agricultural Water Use and Costs In California

by

Allan Highstreet,* Carole Frank Nuckton** and Gerald L. Horner***

Introduction

A satellite photograph of California reveals a land of striking contrasts -- from the forested North Coast to the high desert in the southeast, from the Sierra peaks to the great San Francisco Bay, from the densely populated metropolitan areas to vast agricultural basins. California's agriculture is as diverse as the environment in which it flourishes. Over 240 commodities are produced -- some grow below sea level; others in mountain valleys over a mile high.

The picture of the state's landscape also shows a great network of waterways supporting life in this semi-arid state. Unseen in the photograph are groundwater aquifers with storage capacity of over three times that of all the state's surface water projects. This vast underground resource, however, is in several areas of the state, subject to overdrafting.

About 85 percent of the water put to use in California goes initially to agriculture; the remainder is used by municipalities and industries. Nearly seventy-three percent of California's cropland is irrigated: 7,748,709 acres in 1974, according to the Census of Agriculture. Uncertainty about water supplies, however, and increasing water and energy (for

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pumping) costs have generated concerns about optimum water allocation in times of scarcity and the possibility of conservation, including more efficient irrigation application methods. Changes in cropping patterns may also be involved as changes in water supplies and costs occur.

Objectives of Report

This report is about how water is currently being used in agricultural production. The patterns described here can serve as a basis from which to examine future changes necessitated by competing demands for water, increasing water costs, its decreasing availability and/or diminished quality.

The objectives of this study are:

(1) to determine the predominant regional crops,

(2) to ascertain the water source (groundwater or surface water) and the irrigation methods used for each crop in each region, and

(3) to estimate regional irrigation costs by water source and application method for each crop.

Water-Use Efficiency Considerations

As water costs increase, farmers may be forced to change cropping patterns, reducing water use on low-valued crops. For example, recent reports have indicated that the demand for water for low-valued forage crops will probably be reduced significantly in response to increased water costs (Turner; King, et. al.).

Another possible response to increasing water costs or to diminished supplies is to use more efficient irrigation methods. While application methods are often decided by such factors as soil characteristics and initial investment costs, high water costs in some areas encourage water-use efficiency. Water-scarce Kern County has become an innovator in new, more efficient irrigation technology (Watson, et. al.). Also, high labor

costs involved in furrow and flood methods have led to increased use of sprinkler and drip application methods which not only require less labor but also use less water. Government agencies promoting water conservation in the Southern San Joaquin Valley may also account in part for the expansion of drip irrigation there.

Water Costs by Production Region

In the past, most crop budgets reported water costs as a single item, but now as irrigation costs escalate, farmers must evaluate each water cost component individually. Costs vary widely depending on: (1) water source, (2) irrigation method used and (3) the application rate for the particular crop in the area. In this report water costs are differentiated by source, application rate, and method used for each crop in 13 production regions of California.

The 13 regions were determined by natural boundaries and climatic similarities, closely following the 1971 hydrographic study areas developed by the California Region Framework Committee. Table 1 lists the 13 regions and the counties included within each. The production regions are outlined in Figure 1.

Sources of Data

Using County Agricultural Commissioner reports, crops were selected on a 1975 acreage basis in three categories: field crops, fruits and nuts, and vegetables. The year 1975 was chosen as the base year, thus avoiding drought year cropping patterns (1976 and 1977). Within each of the three categories crops were placed in descending order of total state acreage until 90 percent of the acreage in the category was accounted for. Then, each region was examined to determine which of the selected crops were prevalent there, according to the following criteria: (1) the region was one of the largest three in terms of acreage in the crop or was greater than

Table 1. Production Regions of California

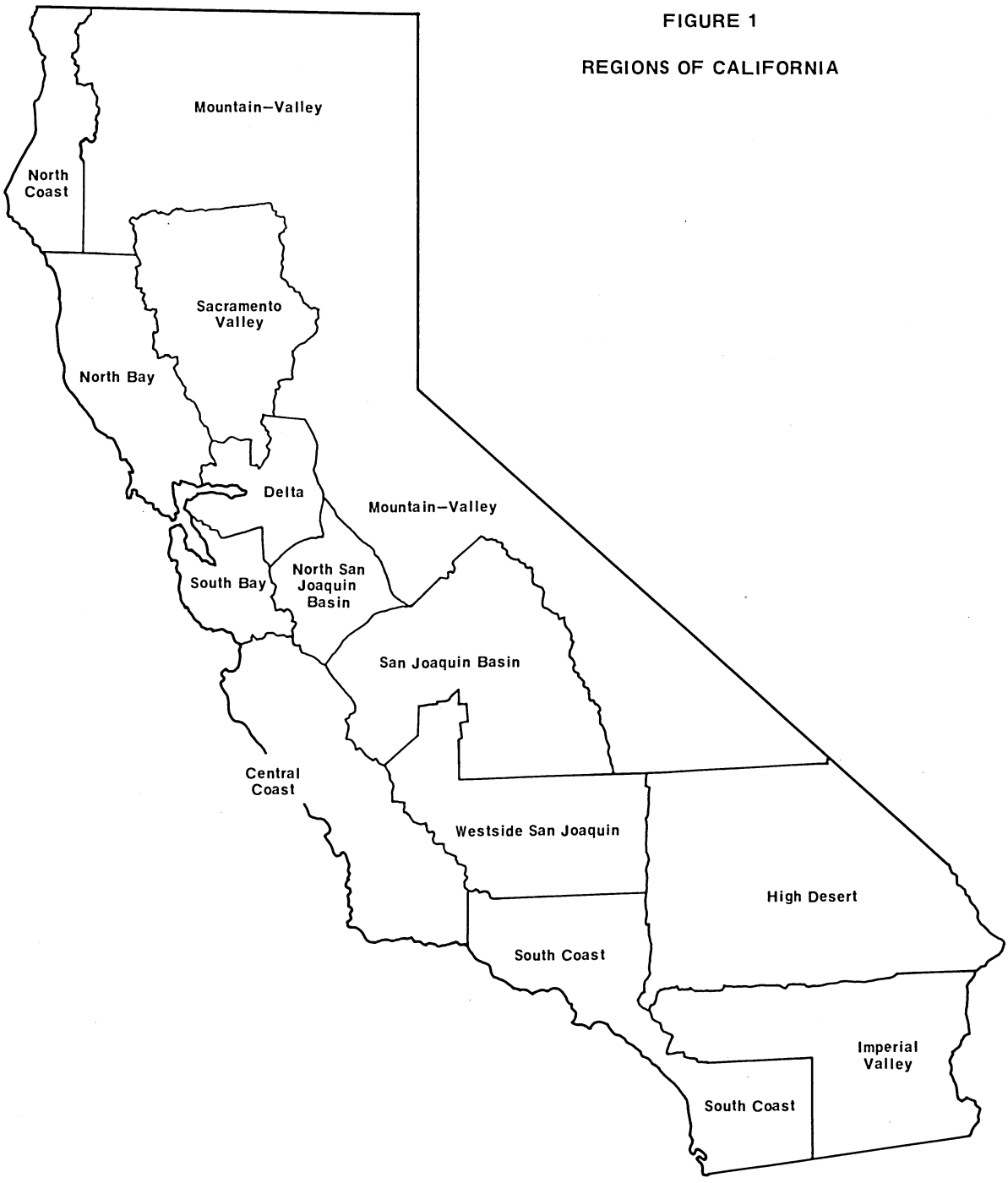
Region	Counties Included
North Coast	Humbolt
	Del Norte
North Bay	Lake
	Marin
	Mendocino
	Napa
	Sonoma
South Bay	Alameda
	San Francisco
	San Mateo
	Santa Clara
	Santa Cruz
Delta	Contra Costa
	Sacramento
	San Joaquin
	Solano
Sacramento Valley	Butte
	Colusa
	Glenn
	Sutter
	Tehema
	Yolo
	Yuba
Mountain-Valley	Alpine
	Amador
	Calaveras
	El Dorado
	Inyo
	Lassen
	Mariposa
	Modoc
	Mono
	Nevada
	Placer
	Plumas
	Shasta
	Sierra
	Siskiyou
	Trinity
	Tuolumne

Table 1.--Continued

Region	Counties Included
North San Joaquin Basin	Stanislaus Merced
Central Coast	Monterey San Benito San Luis Obispo Santa Barbara
San Joaquin Basin	Fresno Madera Tulare
Westside San Joaquin	Kern Kings
South Coast	Los Angeles Orange San Diego Ventura
High Desert	San Bernardino
Imperial Valley	Imperial Riverside

FIGURE 1

REGIONS OF CALIFORNIA



5,000 acres, or (2) the regional crop acreage was over 10,000 acres. Once crops for a production region were chosen, counties with the largest acreage in that crop were selected to have personal interviews conducted there. If relatively large acreages were in the crop in more than one county in the region, the survey was extended to the other counties as well, and regional figures for water source and irrigation method were averaged, weighted by county crop acreage. Interviews with University of California Cooperative Extension county farm advisors in 1979 were the primary source of information on water sources and application methods used in the region. Other local people knowledgeable about irrigation practices were also contacted (see the Acknowledgements).

Production cost data are from the University of California Cooperative Extension Budget Generator (CEBG). CEBG was developed in Stillwater, Oklahoma, in 1970 and is now being used in 25 states and by several government agencies. Cooperative Extension at U.C. Davis purchased the program, adapted it to the Burroughs Computer and modified it to handle the great variety of crops grown and the various types of irrigation methods used in California. CEBG provides consistent uniform data; parameters are adjusted to give a crop budget specific to particular local conditions. A budget for growing wheat in Butte County, for example, would be quite different from one for Kern County because of differences in soil type, growing season, irrigation method, and water costs.

Surface water costs presented in the tables which follow are weighted averages of irrigation district charges within the region or if one district had over 80 percent of the irrigated acreage of the crop, then that district's charge was taken as the regional cost. The costs, then, should be considered as broadly representative rather than a precise estimate of actual irrigation costs for a particular crop in a specific place.

Similarly, groundwater costs were based on the average pumping lift in feet for the crop in the region, according to the Department of Water Resources, using the California Irrigation Cost Program (Horner and Ahmadi).

Appendix and Summary Tables

The compilation of data from three sources -- County Agricultural Commissioner's Reports, personal interviews, and CEBG costs -- is found in Appendix A. For each region, the harvested acreage of each of the prevalent crops, their nonwater production costs, the source of surface water or lift for groundwater, the method of application, the application rate, the corresponding water cost, and the estimated total production cost for each crop are given. From this wealth of information the authors have prepared summary tables which are presented below.

First, distilled from the detail in Appendix Tables A.1 - A.11 are harvested acreage figures and average application rates for each crop by region where grown (see Table 2). Application rates vary substantially from region to region for the same crop due to differences in climate, soil type, and the availability and cost of water. Also relevant in explaining differences in application rates among regions are substantial differences in the amount of precipitation. In Table 3, the average annual rainfall by region is given.

In Tables 4 and 5 application methods for surface and groundwater, respectively, are summarized. There has been a progressive increase in more efficient water-use methods (drip and sprinkler). In 1972, Stewart conducted a survey similar to the one reported here, obtaining information from Cooperative Extension personnel in all 58 counties. At that time there was hardly enough of the drip method to be counted (0.3 percent of total irrigated acreage). Flood, border, and furrow accounted

for 82 percent of the acreage; sprinkler, 17 percent; and sub-irrigation, one percent. According to our calculations for 1975, the sprinkler method increased considerably -- to over 20 percent. From surface water sources, sprinklers were used on 14.7 percent of the acreage; from groundwater sources, 28.7 percent. Drip methods, however, were still only one-half of one percent.

The 1977 irrigation survey showed an increase in the drip method to two percent. It is likely that the two year drought (1976 and 1977) was a strong incentive toward greater irrigation efficiency and that the memory of the drought may continue to promote more efficient methods in the future.

Table 2. Harvested Acreage[a/] and Average Irrigation Application Rate, by Crop and by Region, 1975

Crop	North Coast		North Bay		South Bay		Delta		Sacramento Valley		Mountain-Valley	
	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet
Field Crops:												
Alfalfa Hay							75,760	4.5			147,246	2.7
Barley							60,600	1.2	91,612	0.8		
Cotton												
Field Corn							138,070	4.0	51,835	3.0		
Grain Hay											36,106	1.3
Irrigated Pasture	23,860	1.4	22,080	2.6			177,400	5.0	163,600	4.6	322,794	3.3
Rice							23,550	7.0	440,214	8.0	12,000	8.0
Sorghum, Grain							20,350	4.0	81,588	2.0		
Sugar Beets							87,116	4.0	53,713	2.9		
Wheat							84,340	1.7	200,864	1.0		
Fruit and Nut Crops:												
Almonds							33,402	3.9	70,160	2.6		
Apricots							7,116	4.0				
Grapes			41,910	1.3			50,038	3.3				
Lemons												
Oranges												
Peaches									21,392	3.5		
Pears			13,513	1.9			10,754	2.4	5,264	3.5		
Prunes					8,503	2.0			49,924	3.5		
Walnuts							31,487	2.1	42,785	2.9		
Vegetable Crops:												
Artichokes												
Asparagus							24,082	2.0				
Broccoli												
Carrots												
Celery												
Lettuce												
Lima Beans												
Melons[c/]												
Onions												
Sweet Corn												
Tomatoes, Fresh							4,313	5.0				
Tomatoes, Processing							66,850	3.8	90,540	5.0		

Continued

Table 2.--Continued

Crop	North San Joaquin Basin		Central Coast		San Joaquin Basin Basin		Westside San Joaquin		South Coast		High Desert		Imperial Valley	
	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet	Acres	Acre-Feet
Field Crops:														
Alfalfa Hay	91,190	4.0	28,780	3.2	229,700	4.5	169,000	4.3	20,360	4.5	16,430	7.0	166,513	8.0
Barley					263,800	1.7	170,000	1.8					30,914	4.7
Cotton	35,540	3.0			382,000	3.3	432,000	3.3					59,400	4.4
Field Corn	19,267	1.7			41,400	2.8	10,285	3,3						
Grain Hay	33,954	0.8							4,555	1.2	10,750	4.7	13,510	4.7
Irrigated Pasture	178,500	4.8	14,887	2.6	95,000	5.1	27,100	5.0						
Rice	16,276	6.8			27,400	7.0	14,250	7.0						
Sorghum, Grain					56,800	2.3	56,200	1.9					25,000	3.7
Sugar Beets	18,666	3.2	28,908	2.5	45,770	3.5	31,670	3.2					70,300	4.3
Wheat	17,447	0.8			233,900	2.2	166,900	1.7					216,650	4.7
Fruit and Nut Crops:														
Almonds	69,566	2.9			30,066	3.1								
Apricots	11,582	2.7												
Grapes	37,759	2.7	24,666	1.8	290,496	3.6	67,209	3.7			12,342	3.7		
Lemons									26,867	2.8				
Oranges					103,870	2.4	18,578	3.4	37,784	2.8	11,241	6.0	23,334	5.6
Peaches	28,770	2.9			15,143	3.5								
Pears														
Prunes					21,913[b]	3.0								
Walnuts	30,652	3.1			26,339	3.0								
Vegetable Crops:														
Artichokes			10,110	2.4										
Asparagus														
Broccoli			40,742	2.8										
Carrots							11,000	2.8					13,717	2.4
Celery			8,539	2.8					10,351	2.1				
Lettuce			80,810	2.8	7,700	2.1							53,247	2.4
Lima Beans	13,338	1.9							11,105	1.3				
Melons[c]	7,479	2.7			29,670	2.2							11,159	4.5
Onions							9,400	2.5					11,454	2.2
Sweet Corn													5,167	3.7
Tomatoes, Fresh														
Tomatoes, Processing	17,807	3.0	19,662[d]	6.0	68,800	3.5	18,324	3.5						

a/ Acreage totals across regions do not necessarily equal the statewide total acreage of the crop since the particular crop may grow elsewhere in the state besides in the regions reported.

b/ Includes plums.

c/ Excluding watermelons.

d/ Not differentiated in the Central Coast Counties Agricultural Commissioners' Reports between fresh and processing acreage.

Table 3. Average Annual Rainfall by Region

Region	Average Annual Rainfall (inches)
North Coast	39 (Eureka) 111 (Crescent City)
North Bay	30
South Bay	22 - range 12 to 40
Delta	18
Sacramento Valley	30
Mountain Valley	22 (north) 8 (south)
North San Joaquin Basin	14
Central Coast	20
San Joaquin Basin	10
Westside San Joaquin	10
South Coast	18 10 (Riverside) 40 (at high altitudes)
High Desert	5
Imperial Valley	5

Source: California Region Framework Study Committee, Comprehensive Framework Study, California Region, Appendix V--Water Resources, June, 1971. Prepared for the Pacific Southwest Inter-Agency Committee, Water Resources Council.

Table 4. Regional Acreage Irrigated by Surface Water, by Application Method

Region	Flood	Border	Furrow	Sprinkler	Sub-irrigation	Drip	Total Acreage Irr. by Surface Water
North Coast				3,579			3,579
North Bay	11,535	5,405		20,955			37,895
South Bay							
Delta		151,688	107,861	29,662	133,500		422,711
Sacramento Valley	16,360	731,545	101,736	18,610			868,251
Mountain-Valley	118,925	9,600		29,449			157,974
North San Joaquin Basin		460,640	111,557	1,158			573,355
Central Coast			168,830	37,207			206,037
San Joaquin Basin		490,658	616,525	28,658			1,135,841
Westside San Joaquin	50,270		380,797	175,805		5,218	612,090
South Coast		1,246	6,465	9,747			17,458
High Desert		1,686	1,124				2,810
Imperial Valley		179,013	181,820	339,532			700,365
TOTALS	197,090	2,031,481	1,676,715	694,362	133,500	5,218	4,738,366

Table 5. Regional Acreage Irrigated by Groundwater, by Application Method

Region	Flood	Border	Furrow	Sprinkler	Drip	Total Acreage Irr. by Groundwater
North Coast				20,281		20,281
North Bay	1,104			38,504		39,608
South Bay				8,503		8,503
Delta		267,555	174,647	30,315		472,517
Sacramento Valley	39,736	279,692	99,253	76,558		495,239
Mountain-Valley	129,118	2,400		228,654		360,172
North San Joaquin Basin		32,846	7,497	14,095		54,438
Central Coast				51,067		51,067
San Joaquin Basin		300,490	358,177	150,689	21,571	830,927
Westside San Joaquin	126,280		271,361	186,038	6,147	589,826
South Coast		7,474	45,246	34,378	6,465	93,563
High Desert		6,745		41,208		47,953
Imperial Valley						
TOTALS	296,238	897,202	956,181	880,290	34,183	3,064,094

Appendix Table A.1. North Coast, North Bay, and South Bay Regions, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
North Coast:											
Irrigated Pasture	23,860	183.48	Surface	Stream Diversion	Sprinkler[a]	15	1.50[b]	1.4	31.75	33.85	217.33
			Ground	35 Feet	Sprinkler[a]	85	26.95	1.4	31.75	69.48	252.96
			Weighted Averages -- All Methods			(100)	23.13	1.4	31.75	69.14	247.62
North Bay:											
Grapes	41,910	1,589.00	Surface	Stream Diversion	Sprinkler[c]	40	12.00	1.3	14.66	30.26	1,619.26
			Surface	Storage Ponds	Sprinkler[c]	10	1.50	1.3	14.66	16.61	1,605.61
			Ground	60 Feet	Sprinkler[c]	15	29.04	1.3	14.66	52.41	1,641.41
			Ground	90 Feet	Sprinkler[c]	30	31.68	1.3	14.66	55.84	1,644.34
			Ground	300 Feet	Sprinkler[c]	5	51.21	1.3	14.66	81.27	1,670.27
			Weighted Averages -- All Methods			(100)	21.37	1.3	14.66	42.44	1,631.44
Irrigated Pasture	22,080	183.48	Surface	Stream Diversion	Flood	40	7.00	2.9	22.62	42.92	226.40
			Ground	80 Feet	Flood	5	16.68	2.9	22.62	70.99	254.47
			Ground	80 Feet	Sprinkler[a]	30	33.12	2.4	54.43	133.92	317.40
			Ground	200 Feet	Sprinkler[a]	25	43.68	2.4	54.43	159.26	342.74
			Weighted Averages -- All Methods			(100)	24.49	2.6	40.12	100.71	284.19
Pears	13,513	1,787.00	Surface	Stream Diversion	Flood	20	7.00	2.0	15.60	29.60	1,816.60
			Surface	Stream Diversion	Border	40	7.00	1.9	15.60	29.60	1,816.60
			Ground	20 Feet	Sprinkler[d]	40	19.32	1.9	18.47	55.18	1,842.18
			Weighted Averages -- All Methods			(100)	11.93	1.9	16.75	39.83	1,826.83
South Bay:											
Prunes	8,503	1,117.89	Ground	Metered Pumps	Sprinkler[d]	100	8.50	2.0	19.44	36.44	1,154.33

a/ Hand move system.
b/ Maintenance on delivery system.
c/ Permanent set sprinklers for frost protection.
d/ Hose drag system.

Appendix Table A.2. Delta Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Irrigated Pasture	177,400	242.45	Surface	Local ID[a]	Border	40	3.30[b]	5.0	39.00	55.50	297.95
			Ground	20 Feet	Border	20	12.84	5.0	39.00	103.20	345.65
			Ground	125 Feet	Border	40	20.52	5.0	39.00	141.60	384.05
			Weighted Averages -- All Methods			(100)	12.08	5.0	39.00	99.48	341.93
Field Corn	138,070	321.24	Surface	Diverted	Sub-Irrigation[c]	50	1.75[d]	4.0	31.20	38.20	359.44
			Ground	20 Feet	Furrow	25	6.72	4.0	15.36	42.24	363.48
			Ground	125 Feet	Furrow	25	17.40	4.0	15.36	84.96	406.20
			Weighted Averages -- All Methods			(100)	6.91	4.0	23.28	50.90	372.14
Sugar Beets	87,116	518.22	Surface	D-M Canal[e]	Furrow	3	4.75	4.0	15.36	34.36	552.58
			Surface	Local ID	Furrow	2	4.10	4.0	15.36	31.76	549.98
			Surface	Blend	Furrow	20	7.00	4.0	15.36	43.36	361.58
			Ground	20 Feet	Furrow	25	6.72	4.0	15.36	42.24	560.46
			Ground	125 Feet	Furrow	50	17.40	4.0	15.36	84.96	603.18
			Weighted Averages -- All Methods			(100)	12.00	4.0	15.36	63.37	581.57
Wheat	84,340	241.53	Surface	Diverted	Sub-Irrigation[c]	50	4.12	1.7	13.26	20.26	261.79
			Ground	20 Feet	Border	40	9.36	1.7	13.26	29.17	270.70
			Ground	125 Feet	Border	10	20.52	1.7	13.26	48.14	289.67
			Weighted Averages -- All Methods			(100)	7.85	1.7	13.26	26.60	268.13
Alfalfa Hay	75,760	392.11	Surface	D-M Canal	Border	15	4.50[f]	4.5	35.10	55.35	447.46
			Surface	Local ID	Border	30	4.00[f]	4.5	35.10	53.10	445.46
			Surface	Blend [g]	Border	5	11.00	4.5	35.10	84.60	476.71
			Ground	40 Feet	Border	10	12.84	4.5	35.10	92.88	484.99
			Ground	125 Feet	Border	40	20.52	4.5	35.10	127.44	519.55
			Weighted Averages -- All Methods			(100)	11.90	4.5	35.10	88.71	480.81

Continued--

Table A.2--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Tomatoes Processing	66,850	1,164.01	Surface	Local ID	Furrow	15	4.60	4.0	15.36	33.76	1,197.77
			Surface	D-M Canal	Furrow	15	4.75	4.0	15.36	34.36	1,198.37
			Surface	Blend	Furrow	50	4.50	4.0	15.36	33.36	1,197.37
			Ground	10 Feet	Furrow	15	9.72	4.0	38.88	77.76	1,241.77
			Ground	125 Feet	Sprinkler[h/]	5	34.92	3.0	45.36	150.12	1,314.13
			Weighted Averages -- All Methods			(100)	6.86	3.82	20.39	46.07	1,210.08
Barley	60,600	231.58	Surface	Diverted	Sub-Irrigation[c/]	20	6.00[d/]	1.2	9.36	16.56	248.14
			Ground	120 Feet	Border	80	20.04	1.2	9.36	33.41	264.99
			Weighted Averages -- All Methods			(100)	17.23	1.2	9.36	30.04	261.62
Grapes	50,038	1,376.25	Surface	Local ID	Furrow	10	5.50	3.4	13.06	31.76	1,408.01
			Surface	Local ID	Border	15	5.50	3.4	26.52	45.22	1.421.47
			Ground	125 Feet	Furrow	30	17.40	3.4	13.06	72.22	1,448.47
			Ground	125 Feet	Border	30	20.52	3.4	26.52	96.29	1,376.25
			Ground	125 Feet	Sprinkler[i/]	15	34.80	3.0	33.84	138.24	1,376.25
			Weighted Averages -- All Methods			(100)	17.97	3.34	22.23	81.85	1,457.50
Almonds	33,402	728.41	Surface	Local ID	Sprinkler[j/]	35	4.70	3.5	34.02	50.47	778.87
			Surface	Blend	Furrow	35	14.80	4.6	17.66	85.74	814.15
			Ground	125 Feet	Sprinkler[j/]	30	33.24	3.5	34.02	150.36	878.77
			Weighted Averages -- All Methods			(100)	16.79	3.9	28.29	92.76	821.18
Walnuts	31,487	981.54	Surface	D-M Canal	Furrow	10	4.00	2.3	8.83	18.03	999.57
			Surface	D-M Canal	Sprinkler[j/]	15	4.00	2.0	19.44	27.44	1,008.98
			Surface	Local ID	Sprinkler[j/]	15	7.00	2.0	19.44	33.44	1,014.98
			Surface	Blend	Sprinkler[j/]	10	7.00	2.0	19.44	33.44	1,014.98
			Ground	125 Feet	Furrow	5	17.40	2.3	8.83	48.85	1,030.39
			Ground	125 Feet	Border	15	20.52	2.3	17.94	65.14	1,046.68
			Ground	125 Feet	Sprinkler[j/]	30	33.24	2.0	19.44	85.92	1,067.46
			Weighted Averages -- All Methods			(100)	16.66	2.1	18.93	52.25	1,033.51

Continued--

Table A.2--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Asparagus	24,082	2,310.32	Surface	Diverted	Furrow	10	2.00	2.0	7.68	11.68	2,322.00
			Surface	Diverted	Border	80	2.00	2.0	15.60	19.60	2,329.92
			Ground	20 Feet	Furrow	5	6.72	2.0	7.68	21.12	2,331.44
			Ground	125 Feet	Furrow	5	17.40	2.0	7.68	42.48	2,352.80
			Weighted Averages -- All Methods			(100)	3.00	2.0	14.02	20.03	2,330.35
Rice	23,550	539.74	Surface	Local ID	Border	50	2.35[b]	7.0	54.60	71.05	610.79
			Ground	125 Feet	Border	50	20.52	7.0	54.60	198.24	737.98
			Weighted Averages -- All Methods			(100)	11.43	7.0	54.60	134.64	674.38
Sorghum Grain	20,350	229.57	Surface	Diverted	Sub-Irrigation[c]	50	1.75	4.0	31.20	38.20	267.77
			Ground	20 Feet	Furrow	25	6.72	4.0	31.20	58.08	287.65
			Ground	125 Feet	Furrow	25	17.40	4.0	31.20	100.80	330.37
			Weighted Averages -- All Methods			(100)	6.90	4.0	31.20	58.82	288.38
Pears	10,754	1,656.23	Surface	Diverted	Border	40	1.60[k]	2.5	19.50	23.50	1,679.73
			Surface	Diverted	Sprinkler[j]	50	1.60	2.3	22.36	26.04	1.682.27
			Ground	125 Feet	Border	10	20.52	2.5	19.50	70.80	1,656.23
			Weighted Averages -- All Methods			(100)	3.49	2.4	20.93	29.50	1,685.73
Apricots	7,116	1,342.89	Surface	Blend	Furrow	100	14.80	4.0	15.36	74.56	1,417.45
Tomatoes Fresh	4,313	2,716.59	Surface	Local ID	Furrow	75	14.00	5.0	19.20	89.20	2,805.79
			Ground	35 Feet	Furrow	20	9.24	5.0	19.20	65.40	2,781.99
			Ground	125 Feet	Furrow	5	17.40	5.0	19.20	106.20	2,822.79
			Weighted Averages -- All Methods			(100)	13.22	5.0	19.20	85.29	2,801.88

a/ Irrigation district without state or federal affiliation.
b/ Based on a flat charge of $16.50/acre-year.
c/ Sub-irrigation is via a "spud ditch," a canal carrying seepage water.
d/ Based on a charge of $7/acre. Assessments range from $4 to $17/acre with $7, the most typical.
e/ Delta-Mendota Canal, a Bureau of Reclamation project.
f/ The typical charge is $18/acre/season.
g/ Districts blending federal or state water with a local source.
h/ Whell line.
i/ Permanent set system.
j/ Hose drag system.
k/ Based on a reclamation district charge of $4/acre.

Appendix Table A.3. Sacramento Valley Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975.

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Rice	440,214	539.84	Surface	Bureau [a/]	Border	30	3.00	8.0	62.40	86.40	626.24
			Surface	State [a/]	Border	35	2.00	8.0	62.40	78.40	618.24
			Surface	Local ID [b/]	Border	10	3.00	8.0	62.40	86.40	626.24
			Ground	80 Feet	Border	25	16.68	8.0	62.40	195.84	735.68
				Weighted Averages	-- All Methods	(100)	6.07	8.0	62.40	110.96	650.80
Wheat	200,864	323.18	Surface	Bureau	Border	30	6.00	1.0	7.80	13.80	336.98
			Surface	State	Border	30	6.25	1.0	7.80	14.05	337.23
			Surface	Local ID	Border	10	5.00	1.0	7.80	12.80	335.98
			Ground	20 Feet	Sprinkler [c/]	5	20.88	.9	13.61	32.40	355.58
			Ground	70 Feet	Border	20	15.84	1.0	7.80	23.64	346.82
			Ground	70 Feet	Sprinkler [c/]	5	30.00	.9	13.61	40.61	363.79
				Weighted Averages	-- All Methods	(100)	9.89	1.0	8.38	71.01	341.18
Irrigated Pasture	163,600	169.13	Surface	Bureau	Border	15	7.00	4.6	35.88	68.08	237.21
			Surface	Bureau	Flood	5	7.00 [d/]	4.6	35.88	68.08	237.21
			Surface	Diverted	Border	15	5.00 [d/]	4.6	35.88	58.88	228.01
			Surface	Diverted	Flood	5	5.00 [d/]	4.6	35.88	58.88	228.01
			Ground	70 Feet	Border	20	15.84	4.6	35.88	108.74	277.87
			Ground	70 Feet	Flood	10	15.84	4.6	35.88	108.74	277.87
			Ground	130 Feet	Border	20	21.00	4.6	35.88	132.48	301.61
			Ground	130 Feet	Flood	10	21.00	4.6	35.88	132.48	301.61
				Weighted Averages	-- All Methods	(100)	13.45	4.6	35.88	97.76	266.88
Barley	91,612	225.74	Surface	Local ID	Border	5 [g/]	5.00	.8	6.24	10.24	235.98
			Surface	State [e/]	Border	35 [g/]	5.00	.8	6.24	10.24	235.98
			Surface	Bureau [f/]	Border	35 [g/]	4.00	.8	6.24	9.44	235.18
			Ground	70 Feet	Border	15 [g/]	15.84	.8	6.24	18.91	244.65
			Ground	70 Feet	Sprinkler [c/]	10 [g/]	30.00	.6	9.07	27.07	252.74
				Weighted Averages	-- All Methods	(100)	8.78	.8	6.53	12.95	238.67

Continued--

Table A.3--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Tomatoes, Processing	90,540	2,708.65	Surface	Local ID	Furrow	5	14.00	5.0	19.20	89.20	2,297.85
			Ground	40 Feet	Furrow	20	9.72	5.0	19.20	67.80	2,776.45
			Ground	125 Feet	Furrow	60	17.40	5.0	19.20	106.20	2,814.85
			Ground	170 Feet	Furrow	15	21.48	5.0	19.20	126.60	2,837.25
			Weighted Averages -- All Methods			(100)	16.30	5.0	19.20	100.67	2,784.68
Sorghum, Grain	81,588	272.47	Surface	Local ID	Border	5	4.00	2.0	15.60	23.60	296.07
			Surface	Bureau	Border	50	3.05	2.0	15.60	23.60	295.17
			Surface	State	Border	20	4.60 [h/]	2.0	15.60	24.60	297.07
			Surface	Stream Diversion	Furrow	5	5.00	2.0	7.68	17.68	290.15
			Ground	70 Feet	Border	5	15.84	2.0	15.60	47.28	319.75
			Ground	70 Feet	Sprinkler	15	30.00	1.7	25.70	76.70	349.17
			Weighted Averages -- All Methods			(100)	8.19	2.0	16.72	32.65	304.60
Almonds	70,160	657.91	Surface	Bureau	Border	15	4.50	2.7	21.06	33.21	691.12
			Surface	Bureau	Sprinkler [i/]	10	4.50	2.5	24.30	35.55	693.46
			Surface	State	Border	15	5.00	2.7	21.06	34.56	692.47
			Surface	State	Sprinkler [i/]	10	5.00	2.5	24.30	36.80	694.71
			Surface	Local ID	Furrow	5	4.50	2.7	10.37	22.52	680.43
			Surface	Local ID	Sprinkler [i/]	5	4.50	2.5	24.30	35.55	693.46
			Ground	20 Feet	Border	10	19.32	2.7	21.06	73.22	731.13
			Ground	70 Feet	Flood	10	15.36	2.7	21.06	62.63	720.44
			Ground	70 Feet	Sprinkler [i/]	20	28.20	2.5	24.30	94.80	752.71
			Weighted Averages -- All Methods			(100)	11.93	2.6	22.52	52.85	710.74

Continued--

Table A.3--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Sugar Beets	53,713	546.97	Surface	Bureau	Furrow	50	4.50	1.9	7.30	43.03	590.00
			Surface	Bureau	Sprinkler[1/]		4.50	1.0	22.68	43.03	590.00
			Surface	State	Furrow	20	5.00	1.9	7.30	44.48	591.45
			Surface	State	Sprinkler[1/]		5.00	1.0	22.68	44.48	591.45
			Surface	Local ID	Furrow	10	4.50	2.9	11.14	24.19	571.16
			Ground	20 Feet	Furrow	10	6.72	2.9	11.14	30.63	577.60
			Ground	70 Feet	Furrow	5	12.36	2.9	11.14	46.98	593.95
			Ground	70 Feet	Sprinkler[1/]	5	30.00	2.9	65.77	152.77	699.74
				Weighted Averages	-- All Methods	(100)	4.88		16.57	62.45	592.86
Field Corn	51,835	457.59	Surface	T-C Canal[k/]	Furrow	90	5.00	3.0	11.52	26.52	484.11
			Ground	70 Feet	Furrow	10	12.36	3.0	11.52	48.60	506.19
				Weighted Averages	-- All Methods	(100)	5.73	3.0	11.52	28.73	486.32
Prunes	49,924	1,069.23	Surface	Bureau	Border	5	4.50	3.5	27.30	43.05	1,112.28
			Surface	State	Border	15	5.00	3.5	27.30	44.80	1,114.03
			Surface	Local ID	Border	30	4.50	3.5	27.30	43.05	1,112.28
			Ground	20 Feet	Border	20	9.36	3.5	27.30	60.06	1,129.29
			Ground	70 Feet	Border	20	15.84	3.5	27.30	82.74	1,151,97
			Ground	70 Feet	Sprinkler	10	30.00	3.1	30.13	123.13	1,192.36
				Weighted Averages	-- All Methods	(100)	10.37	3.5	27.28	62.60	1,131.88
Walnuts	42,785	1,203.63	Surface	Bureau	Border	20	4.50	3.0	23.40	36.90	1,240.53
			Surface	State	Border	20	5.00	3.0	23.40	38.40	1,242.03
			Surface	Local ID	Border	10	4.50	3.0	23.40	36.90	1,240.53
			Ground	20 Feet	Border	10	9.36	3.0	23.40	51.48	1,255.11
			Ground	20 Feet	Sprinkler[i/]	20	19.32	2.6	25.27	75.50	1,279.13
			Ground	70 Feet	Border	10	15.84	3.0	23.40	70.92	1,274.55
			Ground	70 Feet	Sprinkler[i/]	10	30.00	2.6	25.27	103.27	1,306.90
				Weighted Averages	-- All Methods	(100)	11.73	2.9	23.96	56.42	1,260.04

Continued--

Table A.3--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	----------$/Acre----------		
Peaches	21,392	1,897.31	Surface	Bureau	Border	15	4.50	3.5	27.30	43.05	1,940.36
			Surface	State	Border	30	5.00	3.5	27.30	44.80	1,942.11
			Surface	Local ID	Border	5	4.50	3.5	27.30	43.05	1,940.36
			Surface	Stream Diversion	Border	5	5.00	3.5	27.30	44.80	1,942.11
			Surface	Stream Diversion	Sprinkler i/	5	5.00	3.1	30.13	45.63	1,942.94
			Ground	20 Feet	Border	40	9.36	3.5	27.30	60.06	1,957.37
				Weighted Averages -- All Methods		(100)	6.64	3.5	27.50	50.59	1,947.91
Pears	5,264	1,072.22	Surface	Bureau	Border	10	4.50	3.5	27.30	43.05	1,115.27
			Surface	State	Border	30	5.00	3.5	27.30	41.80	1,114.02
			Surface	Local ID	Border	10	4.50	3.5	27.30	43.05	1,115.27
			Ground	20 Feet	Border	40	9.36	3.5	27.30	60.06	1,132.28
			Ground	20 Feet	Sprinkler j/	10	19.32	3.1	70.31	130.20	1,202.42
				Weighted Averages -- All Methods		(100)	8.07	3.5	31.60	58.19	1,130.42

a/ From a rate of $16/acre/season.
b/ Irrigation district without state or federal affiliation.
c/ Wheel line system.
d/ Maintenance and labor on ditch system.
e/ Feather River, Oroville Dam.
f/ Tehama-Colusa Canal and the Sacramento River, out of Shasta Dam.
g/ Based on most typical cost determined by location of crop.
h/ Based on a charge of $9/acre/season.
i/ Hose drag system.
j/ Hand move system, sprinkler to germinate, then furrow.
k/ Tehama-Colusa Canal.

Appendix Table A.4. Mountain-Valley Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Irrigated Pasture	322,794	183.96	Surface	Stream Diversion	Flood	20	5.00	3.5	27.30	44.80	228.76
			Surface	Local ID [a]	Flood	10	25.00	3.5	27.30	114.80	298.76
			Ground	20 Feet	Flood	40	9.36	3.5	27.30	60.06	244.02
			Ground	20 Feet	Sprinkler[b]	30	22.44	2.7	61.24	121.83	305.79
			Weighted Averages -- All Methods			(100)	13.97	3.3	37.48	81.01	264.98
Alfalfa Hay	147,246	287.52	Surface	Local ID	Sprinkler[c]	20	25.00	2.6	39.31	104.31	391.83
			Surface	Stream Diversion	Flood	15	5.00[d]	3.0	23.40	38.40	325.92
			Ground	100 Feet	Sprinkler[c]	20	17.04[e]	2.6	39.31	83.61	371.13
			Ground	100 Feet	Sprinkler[c]	45	32.76	2.6	39.31	157.25	464.77
			Weighted Averages -- All Methods			(100)	23.90	2.7	36.92	114.10	410.64
Grain Hay	36,106	184.50	Ground	100 Feet	Sprinkler[c]	100	28.04	1.3	19.66	56.11	240.61
Rice	12,000	573.84	Surface	Local	Border	80	6.24	8.0	62.40	112.34	686.18
			Ground	90 Feet	Border	20	16.68	8.0	62.40	195.84	769.68
			Weighted Averages -- All Methods			(100)	8.33	8.0	62.40	129.04	702.88

[a] Irrigation district without state or federal affiliation.
[b] Hand move system.
[c] Wheel line system.
[d] Rural electrification.
[e] Pacific Gas and Electric.

Appendix Table A.5. North San Joaquin Basin Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Irrigated Pasture	178,500	164.02	Surface	Local ID[a/]	Border	100	3.00	4.8	37.44	51.84	
Alfalfa Hay	91,190	454.68	Surface	Bureau	Border	60	4.70	4.0	31.20	50.00	504.68
			Surface	Local ID	Border	20	2.50	4.0	31.20	41.20	495.88
			Ground	75 Feet	Border	20	16.32	4.0	31.20	96.48	551.16
			Weighted Averages -- All Methods			(100)	6.58	4.0	31.20	57.54	512.22
Almonds	69,566	1,044.14	Surface	Bureau	Furrow	10	4.70	2.9	11.14	27.77	1,068.91
			Surface	Bureau	Border	30	4.70	2.9	22.62	36.25	1,080.39
			Surface	Local ID	Border	45	3.75	2.9	22.62	33.50	1,077.64
			Ground	40 Feet	Border	5	12.84	2.9	22.62	59.86	1,104.00
			Ground	100 Feet	Border	5	18.36	2.9	22.62	75.86	1,120.00
			Ground	150 Feet	Sprinkler[b/]	5	37.32	2.9	28.20	121.50	1,165.64
			Weighted Averages -- All Methods			(100)	7.00	2.9	21.75	41.60	1,084.40
Grapes	37,759	1,254.02	Surface	Local ID	Border	80	3.75	2.8	31.58	42.08	1,296.10
			Ground	200 Feet	Sprinkler[b/]	20	41.64	2.5	28.20	132.30	1,386.32
			Weighted Averages -- All Methods			(100)	11.33	2.7	30.90	60.12	1,314.14
Cotton	35,540	395.53	Surface	Bureau	Furrow	85	4.70	3.0	11.52	25.62	421.15
			Surface	Local ID	Furrow	10	3.75	3.0	11.52	22.77	418.30
			Ground	75 Feet	Furrow	5	12.84	3.0	11.52	50.04	445.57
			Weighted Averages -- All Methods			(100)	5.01	3.0	11.52	26.56	422.09
Grain Hay	33,954	184.50	Surface	Local ID	Border	85	3.75	.8	6.24	9.24	193.74
			Ground	75 Feet	Border	15	16.32	.8	6.24	19.30	203.80
			Weighted Averages -- All Methods			(100)	5.64	.8	6.24	10.75	195.25

Continued--

Table A.5--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Walnuts	30,652	726.07	Surface	Bureau	Border	50	4.70	3.1	24.18	38.75	764.82
			Surface	Local ID	Border	40	3.75	3.1	24.18	35.81	761.88
			Ground	150 Feet	Sprinkler[b/]	10	37.32	3.1	30.46	131.22	857.29
				Weighted Averages	-- All Methods	(100)	7.58	3.1	24.81	46.82	772.89
Peaches	28,770	2,111.52	Surface	Local ID	Border	100	3.75	2.9	22.62	33.50	2,145.02
Field Corn	19,267	341.15	Surface	Bureau[c/]	Furrow	40	4.70	1.7	6.53	14.52	355.67
			Surface	Local ID	Furrow	40	3.75	1.7	6.53	12.91	354.06
			Ground	75 Feet	Furrow	20	12.84	1.7	6.53	28.36	369.51
				Weighted Averages	-- All Methods	(100)	5.95	1.7	6.53	16.64	457.79
Sugar Beets	18,666	508.09	Surface	Bureau	Furrow	80	4.50	3.2	12.29	26.69	534.78
			Surface	Local ID	Furrow	5	3.75	3.2	12.29	24.29	532.38
			Surface	Blend	Furrow	5	13.00	3.2	12.29	53.89	561.47
			Ground	75 Feet	Furrow	10	12.84	3.2	12.29	53.38	561.47
				Weighted Averages	-- All Methods	(100)	5.72	3.2	12.29	30.58	538.66
Tomatoes Processing	17,807	1,607.83	Surface	Bureau	Furrow	50	4.50	3.0	11.52	25.02	1,632.85
			Surface	Local ID	Furrow	20	3.75	3.0	11.52	22.77	1,630.60
			Surface	Blend	Furrow	30	14.00	3.0	11.52	53.52	1,661.35
				Weighted Averages	-- All Methods	(100)	7.20	3.0	11.52	33.12	1,641.96
Wheat	17,447	238.42	Surface	Bureau	Border	30	5.00	.8	6.24	10.24	248.66
			Surface	Local ID	Border	60	3.75	.8	6.24	9.24	247.66
			Ground	40 Feet	Border	10	12.84	.8	6.24	16.51	254.93
				Weighted Averages	-- All Methods	(100)	5.03	.8	6.24	10.76	248.67

Continued--

Table A.5--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Rice	16,276	539.84	Surface	Bureau	Border	65	4.25	6.8	53.04	81.94	621.78
			Surface	Local ID	Border	30	3.75	6.8	53.04	78.54	618.38
			Ground	50 Feet	Border	5	13.68	6.8	53.04	146.06	685.90
			Weighted Averages -- All Methods			(100)	4.57	6.8	53.04	34.07	623.97
Lima Beans	13,338	515.27	Surface	Bureau	Furrow	35	4.70	1.9	7.30	16.23	531.50
			Surface	Local ID	Furrow	65	3.75	1.9	7.30	14.43	529.70
			Weighted Averages -- All Methods			(100)	4.09	1.9	7.30	15.06	530.34
Apricots	11,582	1,320.01	Surface	Bureau	Border	80	4.70	2.7	21.06	33.75	1,353.76
			Surface	Bureau	Sprinkler[d/]	5	4.70	2.4	23.33	34.61	1,354.62
			Surface	Local ID	Border	10	3.75	2.7	21.06	31.19	1,351.20
			Surface	Local ID	Sprinkler[d/]	5	3.75	2.4	23.33	32.33	1,352.34
			Weighted Averages -- All Methods			(100)	4.56	2.7	21.88	33.47	1,353.48
Melons	7,479	758.00	Surface	Bureau	Furrow	35	3.75	2.7	10.37	20.50	778.50
			Surface	Blend	Furrow	65	14.00[e/]	2.7	10.37	48.17	806.17
			Weighted Averages -- All Methods			(100)	10.41	2.7	10.37	38.49	769.41

a/ Irrigation district without state or federal affiliation.
b/ Permanent set.
c/ Delta-Mendota Canal.
d/ Hose drag system.
e/ This price is higher than either Bureau or local ID prices; districts which blend had problems obtaining enough water to meet their needs.

Appendix Table A.6. Central Coast Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Lettuce	80,810	1,968.51	Surface	Local ID[a/]	Furrow	100	10.00	2.8	10.75	38.75	2,007.26
Brocoli	40,742	953.50	Surface	Local ID	Furrow	100	10.00	2.8	10.75	38.75	992.25
Sugar Beets	28,908	644.25	Surface	Local ID[b/]	Furrow/ Sprinkler[c/]	100	10.00	2.5	20.88	45.88	690.13
Alfalfa Hay	28,780	452.80	Ground	20 Feet	Sprinkler[d/]	20	22.44	3.2	36.10	107.91	560.71
			Ground	150 Feet	Sprinkler[d/]	60	39.36	3.2	36.10	162.05	614.85
			Ground	250 Feet	Sprinkler[d/]	20	49.08	3.2	36.10	193.16	645.96
				Weighted Averages	-- All Methods	(100)	37.93	3.2	36.10	157.44	610.24
Grapes	24,666	1,254.02	Surface	Local ID	Sprinkler[e/]	70	10.00	1.8	20.30	38.30	1,292.32
			Ground	150 Feet	Sprinkler[e/]	20	37.32	1.8	20.30	87.48	1,341.50
			Ground	250 Feet	Sprinkler[e/]	10	45.84	1.8	20.30	102.81	1,356.83
				Weighted Averages	-- All Methods	(100)	19.04	1.8	20.30	54.59	1,308.60
Tomatoes	19,662	2,708.65	Surface	Local ID	Furrow	50	10.00	6.0	23.04	83.04	2,791.69
			Surface	Local ID	Sprinkler[f/]	50	10.00	5.0	75.60	125.60	2,834.25
				Weighted Averages	-- All Methods	(100)	10.00	6.0	49.32	104.32	2,812.97
Irrigated Pasture	14,887	242.45	Ground	20 Feet	Sprinkler[d/]	20	22.44	2.6	29.33	87.67	330.12
			Ground	150 Feet	Sprinkler[d/]	60	39.36	2.6	29.33	131.67	374.12
			Ground	250 Feet	Sprinkler[d/]	20	49.08	2.6	29.33	156.94	399.39
				Weighted Averages	-- All Methods	(100)	37.93	2.6	29.33	127.92	370.37
Artichokes	10,110	1,440.05	Surface	Local ID	Sprinkler[d/]	100	10.00	2.4	54.43	78.43	1,518.48
Celery	8,539	3,503.95	Surface	Local ID	Furrow	100	10.00	2.8	10.75	38.75	3,542.70

a/ Irrigation district without state or Federal affiliation.
b/ From the Monterey Flood Control and Water Conservation District--transportation charge only, no water charge.
c/ Sprinkler to germinate, then furrow.
d/ Hand move system
e/ Permanent set.
f/ Wheel line system.

Appendix Table A.7. San Joaquin Basin Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Cotton	382,000	551.07	Surface	Bureau[a]	Furrow	25	15.80	3.3	12.67	64.81	615.88
			Surface	Ditch Companies	Furrow	35	7.00	3.3	12.67	35.77	586.84
			Ground	150 Feet	Furrow	30	19.56	3.3	12.67	77.22	628.29
			Ground	700 Feet	Furrow	10	70.44	3.3	12.67	245.12	796.19
			Weighted Averages -- All Methods			(100)	19.31	3.3	12.67	76.40	627.47
Grapes	290,496	1,254.02	Surface	Bureau	Furrow	35	11.00	3.7	14.21	54.91	1,308.93
			Surface	Bureau	Border	15	11.00	3.7	28.86	69.56	1,323.58
			Surface	Ditch Companies	Furrow	5	7.00	3.7	14.21	40.11	1,294.13
			Surface	Ditch Companies	Border	10	7.00	3.7	28.86	54.76	1,308.78
			Ground	125 Feet	Furrow	10	17.40	3.7	14.21	78.59	1,332.61
			Ground	125 Feet	Border	10	20.52	3.7	28.86	104.78	1,358.80
			Ground	125 Feet	Sprinkler[b]	10	34.80	3.2	36.10	147.46	1,401.48
			Ground	125 Feet	Drip	5	27.72	3.0	52.56	135.72	1,389.74
			Weighted Averages -- All Methods			(100)	15.21	3.6	23.43	54.10	1,330.74
Barley	263,800	225.52	Surface	Bureau[c]	Furrow	10	15.80[d]	1.7	6.53	33.39	258.91
			Surface	Bureau[c]	Border	45	15.80[d]	1.7	13.26	40.12	265.64
			Surface	Ditch Companies	Furrow	10	6.00[d]	1.7	6.53	16.73	242.25
			Surface	Ditch Companies	Border	10	6.00[d]	1.7	13.26	23.46	248.98
			Ground	150 Feet	Furrow	5	19.56[d]	1.7	6.53	39.78	265.30
			Ground	150 Feet	Border	10	22.96[d]	1.7	13.26	52.29	277.81
			Ground	150 Feet	Sprinkler[e]	10	39.36[d]	1.5	34.02	93.06	318.58
			Weighted Averages -- All Methods			(100)	17.10	1.7	13.65	41.94	267.46
Wheat	233,900	270.41	Surface	Bureau	Furrow	10	11.00	2.2	8.45	32.65	303.06
			Surface	Bureau	Border	45	11.00	2.2	17.16	41.36	311.77
			Surface	Ditch Companies	Furrow	10	7.00	2.2	8.45	23.85	294.26
			Surface	Ditch Companies	Border	10	7.00	2.2	17.16	32.56	302.97
			Ground	150 Feet	Furrow	5	19.56	2.2	8.45	51.48	321.89
			Ground	150 Feet	Border	10	22.92	2.2	17.16	67.58	337.99
			Ground	150 Feet	Sprinkler[d]	10	39.36	2.2	45.36	124.08	394.49
			Weighted Averages -- All Methods			(100)	15.29	2.2	17.77	49.22	319.64

Table A.7--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	----------$/Acre----------		
Alfalfa Hay	229,700	453.25	Surface	Bureau[f]	Border	15	11.00	4.5	35.10	84.60	537.85
			Surface	Ditch Companies	Border	10	7.00	4.5	35.10	66.60	519.85
			Ground	150 Feet	Border	70	22.92	4.5	35.10	138.24	591.49
			Ground	150 Feet	Sprinkler[e]	5	39.36	3.9	88.45	241.95	695.20
			Weighted Averages -- All Methods			(100)	20.36	4.5	37.77	128.22	581.47
Oranges	103,870	639.63	Surface	Bureau	Furrow	25	11.00	2.5	9.60	37.10	676.73
			Surface	Bureau	Sprinkler[g]	15	11.00	2.2	21.38	45.58	685.21
			Surface	Local ID[h]	Furrow	5	7.00	2.5	9.60	27.10	666.73
			Surface	Local ID	Sprinkler[g]	5	7.00	2.2	21.38	36.78	676.41
			Ground	150 Feet	Furrow	30	19.56	2.5	9.60	58.50	698.13
			Ground	150 Feet	Sprinkler[g]	15	35.52	2.2	21.38	99.52	739.15
			Ground	150 Feet	Drip	5	29.88	2.1	36.79	99.54	739.17
			Weighted Averages -- All Methods			(100)	17.79	2.4	15.08	56.78	696.39
Irrigated Pasture	95,000	185.57	Surface	Bureau	Border	10	11.00	5.3	41.34	99.64	285.21
			Surface	Ditch Companies	Border	10	7.00	5.3	41.34	57.44	243.01
			Ground	150 Feet	Border	50	22.92	5.3	41.34	162.82	348.39
			Ground	150 Feet	Sprinkler[e]	30	39.36	4.7	106.60	291.59	477.16
			Weighted Averages -- All Methods			(100)	25.07	5.1	60.92	184.59	370.17
Tomatoes, Processing	62,800	1,051.76	Surface	Bureau	Sprinkler[e]/Furrow	85	15.80	3.5[i]	32.28	87.58	1,139.34
			Ground	250 Feet	Sprinkler[e]/Furrow	15	74.52	3.5[i]	32.28	149.82	1,201.58
			Weighted Averages -- All Methods			(100)	24.61	3.5	32.28	96.93	1,148.68
Sorghum, Grain	56,800	324.20	Surface	Bureau	Furrow	5	15.80	2.3	11.52	47.86	372.06
			Surface	Ditch Companies	Furrow	15	7.00	2.3	11.52	27.62	351.82
			Ground	120 Feet	Furrow	80	16.92	2.3	11.52	50.44	374.64
			Weighted Averages -- All Methods			(100)	15.38	2.3	11.52	46.88	371.08
Sugar Beets	45,770	513.79	Surface	Bureau	Furrow	20	15.80	3.6	13.82	70.70	584.49
			Surface	Bureau	Sprinkler[g]	5	15.80	3.2	72.58	123.14	1,736.93
			Surface	Local ID	Furrow	20	7.00	3.6	13.82	39.02	552.81
			Surface	Local ID	Sprinkler[e]	5	7.00	3.2	72.58	94.98	608.77
			Ground	450 Feet	Furrow	30	46.92	3.6	13.82	182.73	696.52
			Ground	450 Feet	Sprinkler[e]	20	67.08	3.2	72.58	287.24	801.03
			Weighted Averages -- All Methods			(100)	33.50	3.5	31.44	145.12	713.92

Table A.7--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet		$/Acre	
Field Corn	41,400	312.78	Surface	Bureau[1/]	Furrow	20	11.00	2.8	10.75	41.55	354.33
			Ground	120 Feet	Furrow	80	16.92	2.8	10.75	58.13	370.91
			Weighted Averages -- All Methods			(100)	15.74	2.8	10.75	54.81	367.60
Almonds	30,066	1,098.68	Surface	Bureau	Border	50	15.80	3.2	12.29	62.85	1,161.53
			Surface	Bureau	Sprinkler[g/]	5	15.80	2.8	27.22	71.46	1,170.14
			Surface	Local ID	Border	35	7.00	3.2	12.29	34.69	1,133.37
			Surface	Local ID	Sprinkler[g/]	5	7.00	2.8	27.22	46.82	1,145.50
			Ground	80 Feet	Sprinkler[g/]	5	30.96	2.8	27.22	113.91	1,212.59
			Weighted Averages -- All Methods			(100)	13.04	3.1	14.53	55.18	1,153.90
Melons	29,670	758.00	Surface	Bureau	Sprinkler[e/]/Furrow	80	15.80	2.0[1/]	30.36	77.76	835.76
			Ground	250 Feet	Sprinkler[e/]/Furrow	20	74.52	3.0[1/]	30.36	133.56	891.56
			Weighted Averages -- All Methods			(100)	27.54	2.2	30.36	88.92	846.92
Rice	27,400	539.84	Surface	Bureau	Border	50	15.80	7.0	54.60	165.20	705.04
			Surface	Local ID	Border	50	7.00	7.0	54.60	103.60	643.44
			Weighted Averages -- All Methods			(100)	11.40	7.0	54.60	134.40	674.24
Walnuts	26,339	627.94	Surface	Bureau	Furrow	5	15.80	3.0	11.52	58.92	686.86
			Surface	Bureau	Border	20	15.80	3.0	23.40	70.80	698.74
			Surface	Ditch Companies	Furrow	5	6.00	3.0	11.52	29.52	657.46
			Surface	Ditch Companies	Border	20	6.00	3.0	23.40	41.40	669.34
			Ground	100 Feet	Furrow	5	15.24	3.0	11.52	57.24	684.18
			Ground	100 Feet	Border	30	18.36	3.0	23.40	78.48	706.42
			Ground	100 Feet	Sprinkler[g/]	15	30.84	2.7	26.24	109.51	737.45
			Weighted Averages -- All Methods			(100)	16.35	3.0	22.05	69.70	697.59
Plums & Prunes	21,913	1,553.00	Surface	Bureau	Furrow	10	11.00	3.0	11.52	44.52	1,597.52
			Surface	Bureau	Border	10	11.00	3.0	23.40	56.40	1,609.40
			Surface	Ditch Companies	Furrow	10	7.00	3.0	11.52	32.52	1,585.52
			Surface	Ditch Companies	Border	10	7.00	3.0	23.40	44.40	1,597.40
			Ground	100 Feet	Furrow	25	14.88	3.0	11.52	56.16	1,609.16
			Ground	100 Feet	Border	25	18.36	3.0	23.40	78.48	1,631.48
			Ground	100 Feet	Sprinkler[g/]	5	30.84	2.7	26.24	109.51	1,662.51
			Ground	100 Feet	Drip	5	25.20	2.3	40.30	98.26	1,651.26
			Weighted Averages -- All Methods			(100)	14.71	3.0	19.04	61.83	1,614.45

Table A.7--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	----------$/Acre----------		
Peaches	15,143	2,232.00	Surface	Bureau[k]	Furrow	35	11.00	3.5	13.44	51.94	2,283.94
			Surface	Local ID	Furrow	35	7.00	3.5	13.44	37.94	2,269.94
			Ground	100 Feet	Furrow	25	14.88	3.5	13.44	65.52	2,297.52
			Ground	100 Feet	Drip	5	25.20	2.8	49.06	119.62	2,351.62
				Weighted Averages -- All Methods		(100)	11.28	3.5	15.22	53.82	2,285.82
Lettuce	7,700	604.61	Surface	Bureau	Sprinkler[e]/Furrow	50	11.00	2.1[i]	26.90	50.00	654.61
			Surface	Local ID	Sprinkler[e]/Furrow	35	7.00	2.1[i]	26.90	41.60	646.21
			Ground	250 Feet	Sprinkler[e]/Furrow	15	36.85	2.1[i]	26.90	104.29	708.90
				Weighted Averages -- All Methods		(100)	13.48	2.1	26.90	55.20	659.82

a/ Mainly on the west side, from San Luis Canal
b/ Permanent set
c/ From the San Luis Canal, Westlands Water District
d/ In Fresno County, since the annual recharge of groundwater amounts to 26% of the potential water, their water cost studies are based on 26% well water and 74% surface water
e/ Hand move system
f/ Mainly on the east side, Friant-Kern and Madera Canal
g/ Hose drag system
h/ Irrigation district without federal or state affiliation
i/ Sprinkler to germinate, then furrow
j/ From the San Luis, Madera, and Friant-Kern canals
k/ Friant-Kern Canal

Appendix Table A.8. Westside San Joaquin Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Cotton	432,000	537.85	Surface	CVP[a]	Furrow	10	24.00	3.5	13.44	97.44	635.29
			Surface	SWP[b]	Furrow	30	55.00	3.5	13.44	205.94	743.79
			Surface	SWP[b]	Sprinkler[c]	10	55.00	2.8	42.34	196.34	734.19
			Surface	Kern River	Furrow	5	15.00	3.5	13.44	65.94	603.79
			Ground	225 Feet	Furrow	30	26.40	3.5	13.44	105.84	643.69
			Ground	225 Feet	Sprinkler[c]	15	43.80	2.8	42.34	164.98	702.83
				Weighted Averages --	All Methods	(100)	39.64	3.3	20.67	150.95	688.81
Barley	170,000	249.46	Surface	CVP	Furrow	3	8.00	2.0	7.68	23.68	273.14
			Surface	CVP	Sprinkler[c]	2	8.00	1.5	22.68	34.68	284.14
			Surface	SWP	Furrow	25	44.00	2.0	7.68	95.68	345.14
			Surface	SWP	Sprinkler[c]	17	44.00	1.5	22.68	88.68	338.14
			Surface	Kern River	Furrow	3	15.00	2.0	7.68	37.68	287.14
			Ground	180 Feet	Furrow	30	22.32	2.0	7.68	52.32	301.78
			Ground	180 Feet	Sprinkler[c]	20	40.08	1.5	22.68	82.80	332.26
				Weighted Averages --	All Methods	(100)	34.05	1.8	13.53	73.79	323.23
Alfalfa Hay	169,000	506.85	Surface	CVP	Sprinkler[c]	10	24.00	3.5	52.92	136.92	643.77
			Surface	SWP	Sprinkler[c]	5	12.00	3.5	52.92	94.92	601.77
			Surface	SWP	Flood	15	12.00	4.5	35.10	89.10	595.95
			Surface	Kern River	Flood	5	15.00	4.5	35.10	102.60	609.45
			Ground	225 Feet	Sprinkler[c]	5	43.80	3.5	52.92	206.22	713.07
			Ground	225 Feet	Flood	60	29.52	4.5	35.10	167.94	674.79
				Weighted Averages --	All Methods	(100)	25.45	4.3	38.66	148.01	654.85
Wheat	166,900	310.23	Surface	CVP	Furrow	10	24.00	2.0	7.68	55.68	365.91
			Surface	CVP	Sprinkler[c]	5	24.00	1.4	21.17	54.77	365.00
			Surface	SWP	Furrow	15	55.00	2.0	7.68	117.68	427.91
			Surface	SWP	Sprinkler[c]	20	55.00	1.4	21.17	98.17	408.40
			Surface	Kern River	Furrow	5	15.00	2.0	7.68	37.68	347.91
			Ground	350 Feet	Furrow	20	37.68	2.0	7.68	83.04	310.23
			Ground	350 Feet	Sprinkler[c]	25	51.36	1.4	21.17	93.07	403.30
				Weighted Averages --	All Methods	(100)	47.93	1.7	14.43	89.35	380.99

Table A.8—Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Grapes	67,209	1,254.02	Surface	CVP	Furrow	20	24.00	4.0	15.36	111.36	1,365.38
			Surface	SWP	Furrow	15	55.00	4.0	15.36	236.36	1,490.38
			Surface	SWP	Sprinkler[d]	10	55.00	2.5	28.20	165.70	1,419.72
			Surface	SWP	Drip	5	55.00	2.1	36.79	152.29	1,407.31
			Surface	Kern River	Furrow	10	15.00	4.0	15.36	75.36	1,329.38
			Ground	250 Feet	Furrow	20	28.68	4.0	15.26	130.08	1,384.10
			Ground	250 Feet	Sprinkler[d]	15	45.84	2.5	28.20	142.80	1,396.82
			Ground	250 Feet	Drip	5	39.60	2.1	47.63	130.79	1,384.81
			Weighted Averages — All Methods			(100)	41.40	3.7	21.25	143.40	1,397.50
Sorghum, Grain	56,200	324.20	Surface	CVP	Furrow	10	8.00	2.0	7.68	23.68	347.88
			Surface	SWP	Furrow	20	12.00	2.0	7.68	31.68	355.88
			Surface	SWP	Sprinkler[e]	5	12.00	1.4	31.75	48.55	372.75
			Surface	Kern River	Furrow	10	15.00	2.0	7.68	37.68	361.88
			Ground	200 Feet	Furrow	40	24.00	2.0	7.68	55.68	379.88
			Ground	200 Feet	Sprinkler[e]	15	43.68	1.4	31.75	92.90	417.10
			Weighted Averages -- All Methods			(100)	21.45	1.9	12.49	51.12	375.32
Sugar Beets	31,670	501.52	Surface	CVP	Furrow	10	24.00	3.5	13.44	97.44	598.96
			Surface	SWP	Furrow	25	55.00	3.5	13.44	205.94	707.46
			Surface	SWP	Sprinkler[c]	10	55.00	2.4	36.29	168.29	669.81
			Surface	Kern River	Furrow	10	15.00	3.5	13.44	65.94	567.46
			Ground	250 Feet	Furrow	30	28.68	3.5	13.44	113.82	615.34
			Ground	250 Feet	Sprinkler[c]	15	45.84	2.4	36.29	146.31	647.83
			Weighted Averages -- All Methods			(100)	44.13	3.2	19.15	140.77	642.25
Irrigated Pasture	27,100	185.57	Surface	CVP	Flood	5	24.00	5.0	39.00	159.00	344.57
			Surface	SWP	Flood	15	12.00	5.0	39.00	99.00	284.57
			Surface	Kern River	Flood	25	15.00	5.0	39.00	114.00	299.57
			Ground	200 Feet	Flood	55	24.96	5.0	39.00	163.80	349.37
			Weighted Averages -- All Methods			(100)	20.48	5.0	39.00	141.39	326.97
Oranges	18,578	630.96	Surface	CVP	Sprinkler[d]	20	24.00	3.5	39.48	123.48	754.55
			Surface	SWP	Sprinkler[d]	15	85.00	3.5	39.48	336.98	967.94
			Surface	SWP	Drip	10	85.00	3.0	33.84	288.84	919.80
			Ground	225 Feet	Sprinkler[d]	40	43.80	3.5	39.48	192.78	823.74
			Ground	225 Feet	Drip	15	43.80	3.0	33.84	165.24	796.20
			Weighted Averages -- All Methods			(100)	50.14	3.4	38.07	206.03	836.99

Table A.8--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Tomatoes, Processing	18,324	1,051.76	Surface	CVP	Furrow	20	24.00	3.5	13.44	97.44	1,149.20
			Surface	SWP	Furrow	40	15.00	3.5	13.44	65.94	1,117.70
			Ground	400 Feet	Furrow	40	42.48	3.5	13.44	162.14	1,213.90
			Weighted Averages -- All Methods			(100)	27.79	3.5	13.44	110.73	1,162.48
Rice	14,250	539.84	Surface	SWP	Flood	30	12.00	7.0	54.60	138.60	678.44
			Ground	200 Feet	Flood	70	24.96	7.0	54.60	229.32	769.16
			Weighted Averages -- All Methods			(100)	21.07	7.0	54.60	202.10	741.94
Carrots	11,000	2,195.26	Surface	CVP	Sprinkler[e/]	15	24.00	2.8	63.50	130.70	2,195.26
			Surface	SWP	Sprinkler[e/]	55	55.00	2.8	63.50	217.50	2,412.76
			Surface	Kern River	Sprinkler[e/]	2	15.00	2.8	63.50	105.50	2,300.76
			Ground	440 Feet	Sprinkler[e/]	28	66.12	2.8	63.50	248.64	2,443.90
			Weighted Averages -- All Methods			(100)	15.66	2.8	63.50	210.97	2,386.62
Field Corn	10,285	378.94	Surface	CVP	Furrow	40	24.00	3.3	12.67	91.87	470.81
			Surface	SWP	Furrow	15	55.00	3.3	12.67	194.17	573.11
			Ground	400 Feet	Furrow	45	42.48	3.3	12.67	152.85	531.79
			Weighted Averages -- All Methods			(100)	36.97	3.3	12.67	134.66	513.60
Onions	9,400	690.08	Surface	CVP	Sprinkler[e/]	15	24.00	2.5	56.70	116.70	806.78
			Surface	SWP	Sprinkler[e/]	45	55.00	2.5	56.70	194.20	884.28
			Surface	Kern River	Sprinkler[e/]	5	15.00	2.5	56.70	94.20	784.28
			Ground	400 Feet	Sprinkler[e/]	35	62.52	2.5	56.70	213.00	903.08
			Weighted Averages -- All Methods			(100)	50.98	2.5	56.70	184.16	874.24

a/ Central Valley Project, Bureau of Reclamation
b/ State Water Project
c/ Wheel line system
d/ Permanent set
e/ Hand move system

Appendix Table A.9. South Coast Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Oranges	37,784	798.00	**Surface**	**State**[a]	**Furrow**	5	40.00	3.0	11.52	131.52	929.52
			Surface	State[a]	Sprinkler[b]	5	40.00	2.7	26.24	134.24	932.24
			Surface	Local ID[c]	Furrow	5	62.00	3.0	11.52	197.52	995.52
			Surface	Local ID	Sprinkler[b]	5	62.00	2.7	26.24	193.64	991.64
			Ground	90 Feet	Furrow	40	14.28	3.0	11.52	54.36	852.36
			Ground	90 Feet	Sprinkler[b]	30	30.00	2.7	26.24	107.24	905.24
			Ground	90 Feet	Drip	10	24.24	2.3	40.30	96.05	894.05
			Weighted Averages — All Methods			(100)	27.33	2.8	20.29	96.37	894.37
Lemons	26,867	593.46	**Surface**	**State**[a]	**Furrow**	5	40.00	3.0	11.52	131.52	724.98
			Surface	State[a]	Sprinkler[b]	5	40.00	2.7	26.24	134.24	727.70
			Surface	Local ID	Furrow	5	62.00	3.0	11.52	197.52	790.98
			Surface	Local ID	Sprinkler[b]	5	62.00	2.7	26.24	193.64	787.10
			Ground	90 Feet	Furrow	40	14.28	3.0	11.52	54.36	647.82
			Ground	90 Feet	Sprinkler[b]	30	30.00	2.7	26.24	107.24	700.70
			Ground	90 Feet	Drip	10	24.24	2.3	40.30	96.05	689.51
			Weighted Averages -- All Methods			(100)	27.33	2.8	20.29	96.37	689.84
Alfalfa Hay	20,360	459.00	**Surface**	**State**[d]	**Border**	5	40.00	4.9	38.22	234.22	693.22
			Surface	State[d]	Sprinkler[e]	10	40.00	4.3	65.02	237.02	696.02
			Surface	Local ID	Sprinkler[e]	5	50.00	4.3	65.02	280.02	739.02
			Ground	100 Feet	Border	20	18.36	4.9	38.22	128.18	587.18
			Ground	100 Feet	Sprinkler[e]	30	32.76	4.3	65.02	205.89	664.89
			Ground	200 Feet	Border	10	27.12	4.9	38.22	171.11	630.11
			Ground	200 Feet	Sprinkler[e]	20	41.76	4.3	65.02	244.59	703.59
			Weighted Averages -- All Methods			(100)	33.06	4.5	55.64	202.85	661.85
Lima Beans	11,105	473.19	Ground	90 Feet	Furrow	100	14.28	1.3	4.99	23.55	496.74
Celery	10,351	3,715.30	Ground	90 Feet	Furrow	80	14.28	2.1	8.06	38.05	3,753.35
			Ground	90 Feet	Sprinkler[f]	20	31.80	2.0	45.36	108.96	3,824.26
			Weighted Averages -- All Methods			(100)	17.78	2.1	15.52	52.23	3,767.53

Table A.9--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Grain Hay	4,555	164.33	Surface	State[a]	Border	5	40.00	1.3	10.14	62.14	226.47
			Surface	Local ID	Sprinkler[f]	5	62.00	1.1	24.95	93.15	257.48
			Ground	150 Feet	Border	30	20.52	1.3	10.14	36.82	201.15
			Ground	150 Feet	Sprinkler[f]	60	39.36	1.1	24.95	68.25	232.58
			Weighted Averages -- All Methods			(100)	34.88	1.2	19.77	59.77	224.09

a/ Southern California Metropolitan Water District
b/ Hose drag system
c/ Irrigation district without state or federal affiliation
d/ Southern California Metropolitan Water District via California Aqueduct
e/ Wheel line system
f/ Hand move system

Appendix Table A.10. High Desert Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Alfalfa Hay	16,430	459.00	Ground	150 Feet	Sprinkler[a/]	100	37.56	7.0	105.84	368.76	827.76
Grapes	12,342	2,467.99	Ground	150 Feet	Sprinkler[b/]	100	39.36	3.7	83.92	229.55	2,697.54
Oranges	11,241	806.86	Surface	Stream Diversion	Border	15	15.00	6.2	48.36	141.36	948.22
			Surface	Stream Diversion	Sprinkler[c/]	10	15.00	5.4	60.91	141.91	948.77
			Ground	150 Feet	Border	60	19.56	6.2	48.36	169.63	976.49
			Ground	150 Feet	Sprinkler[c/]	15	37.32	5.4	60.91	262.44	1,069.30
			Weighted Averages -- All Methods			(100)	21.09	6.0	51.50	176.54	983.40
Grain Hay	10,750	164.33	Ground	150 Feet	Sprinkler[a/]	100	37.56	4.7	71.06	247.59	411.92

a/ Wheel line system
b/ Hand move system
c/ Permanent set

Appendix Table A.11. Imperial Valley Region, California: Water Sources, Application Methods and Irrigation Costs for Principal Crops, 1975

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Wheat	216,650	334.56	Surface	Bureau[a]	Sprinkler[b]	75	4.75	4.7	106.60	128.93	463.49
			Surface	SCMWD[c]	Sprinkler[b]	25	40.00	4.7	106.60	294.60	629.16
			Weighted Averages -- All Methods			(100)	13.56	4.7	106.60	170.35	504.91
Alfalfa Hay	166,513	463.72	Surface	Bureau	Border	75	4.75	8.0	62.40	100.40	564.12
			Surface	SCMWD	Border	25	40.00	8.0	62.40	382.40	846.12
			Weighted Averages -- All Methods			(100)	13.56	8.0	62.40	184.46	634.62
Sugar Beets	70,300	434.79	Surface	Bureau	Furrow	45	4.75	4.3	16.51	36.94	471.73
			Surface	Bureau	Sprinkler[b]	45	4.75	4.3	97.52	117.95	552.74
			Surface	SCMWD	Furrow	5	40.00	4.3	16.51	188.51	623.30
			Surface	SCMWD	Sprinkler[b]	5	40.00	4.3	97.52	269.52	704.31
			Weighted Averages -- All Methods			(100)	8.28	4.3	57.02	92.61	527.40
Cotton	59,400	751.21	Surface	Bureau	Furrow	100	4.75	4.4	16.90	37.80	789.01
Lettuce	53,247	971.83	Surface	Bureau	Furrow	80	4.75	2.4	9.22	20.62	992.45
			Surface	SCMWD	Furrow	20	40.00	2.4	9.22	105.22	1,077.05
			Weighted Averages -- All Methods			(100)	11.80	2.4	9.22	37.54	1,009.77
Barley	30,914	326.52	Surface	SCMWD	Sprinkler[b]	80	40.00	4.7	106.60	294.60	621.12
			Surface	Local ID[d]	Sprinkler[b]	20	20.00	4.7	106.60	200.60	527.12
			Weighted Averages -- All Methods			(100)	36.00	4.7	106.60	275.80	602.32
Sorghum Grain	25,000	337.67	Surface	Bureau	Furrow	45	4.75	3.7	14.21	31.79	369.46
			Surface	Bureau	Border	45	4.75	3.7	28.86	46.44	384.11
			Surface	SCMWD	Furrow	5	40.00	3.7	14.21	162.21	499.88
			Surface	SCMWD	Border	5	40.00	3.7	28.86	176.86	514.53
			Weighted Averages -- All Methods			(100)	8.28	3.7	21.54	52.16	389.83

Table A.11—Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	$/Acre		
Oranges	23,335	1,008.19	Surface	Bureau	Furrow [e/]	10	4.75	6.2	23.81	53.26	1,061.45
			Surface	Bureau	Sprinkler [e/]	85	4.75	5.5	62.04	88.17	1,096.36
			Surface	SCMWD	Sprinkler [e/]	5	40.00	5.5	62.04	282.04	1,290.23
			Weighted Averages -- All Methods			(100)	6.51	5.6	58.22	94.36	1,102.57
Onions	11,454	2,072.85	Surface	Bureau	Furrow [b/]	10	4.75	2.4	9.22	20.62	2,093.47
			Surface	Bureau	Sprinkler [b/]	30	4.75	2.1	47.63	57.61	2,130.46
			Surface	SCMWD	Furrow [b/]	10	40.00	2.4	9.22	105.22	2,178.07
			Surface	SCMWD	Sprinkler [b/]	35	40.00	2.1	47.63	131.63	2,204.48
			Surface	Local ID	Furrow [b/]	5	20.00	2.4	9.22	57.22	2,130.07
			Surface	Local ID	Sprinkler [b/]	10	20.00	2.1	47.63	89.63	2,162.48
			Weighted Averages -- All Methods			(100)	22.90	2.2	38.03	87.75	2,160.62
Melons	11,159	1,103.97	Surface	Bureau	Furrow	80	4.75	4.5	17.28	38.66	1,142.63
			Surface	SCMWD	Furrow	20	40.00	4.5	17.28	197.28	2,301.25
			Weighted Averages -- All Methods			(100)	11.80	4.5	17.28	70.39	1,374.35
Carrots	13,717	3,045.16	Surface	Bureau	Sprinkler [b/]	40	4.75	2.4	54.43	65.83	3,110.99
			Surface	SCMWD	Sprinkler [b/]	60	40.00	2.4	54.43	150.43	3,195.59
			Weighted Averages -- All Methods			(100)	25.90	2.4	54.43	116.59	3,161.94
Grain Hay	13,510	164.33	Surface	SCMWD	Sprinkler [b/]	90	40.00	4.7	106.60	294.60	458.93
			Surface	Local ID	Sprinkler [b/]	10	20.00	4.7	106.60	200.60	364.93
			Weighted Averages -- All Methods			(100)	38.00	4.7	106.60	285.20	449.53
Sweet Corn	5,167	378.96	Surface	SCMWD	Furrow	90	40.00	3.7	14.21	162.21	541.17
			Surface	Local ID	Furrow	10	20.00	3.7	14.21	88.21	467.17
			Weighted Averages -- All Methods			(100)	38.00	3.7	14.21	154.81	533.77

a/ All-American Canal
b/ Hand move system
c/ Colorado River water, transported by Southern California Metropolitan Water District
d/ Irrigation district without state or federal affiliation
e/ Permanent set

Table A.11--Continued

Crop	Harvested Acreage	Nonwater Production Costs	Irrigation Method			Percent of Irrigated Crop Acres	Water Cost	Application Rate	Application Cost	Total Irrigation Cost	Total Production Cost
			Surface/Ground	Source/Lift	Application Method						
		$/Acre				Percent	$/Acre-Feet	Acre-Feet	----------	$/Acre	----------
Oranges	23,335	1,008.19	Surface	Bureau	Furrow [a/]	10	4.75	6.2	23.81	53.26	1,061.45
			Surface	Bureau	Sprinkler [a/]	85	4.75	5.5	62.04	88.17	1,096.36
			Surface	SCMWD	Sprinkler [a/]	5	40.00	5.5	62.04	282.04	1,290.23
			Weighted Averages -- All Methods			(100)	6.51	5.6	58.22	94.36	1,102.57
Onions	11,454	2,072.85	Surface	Bureau	Furrow [b/]	10	4.75	2.4	9.22	20.62	2,093.47
			Surface	Bureau	Sprinkler [b/]	30	4.75	2.1	47.63	57.61	2,130.46
			Surface	SCMWD	Furrow [b/]	10	40.00	2.4	9.22	105.22	2,178.07
			Surface	SCMWD	Sprinkler [b/]	35	40.00	2.1	47.63	131.63	2,204.48
			Surface	Local ID	Furrow [b/]	5	20.00	2.4	9.22	57.22	2,130.07
			Surface	Local ID	Sprinkler [b/]	10	20.00	2.1	47.63	89.63	2,162.48
			Weighted Averages -- All Methods			(100)	22.90	2.2	38.03	87.75	2,160.62
Melons	11,159	1,103.97	Surface	Bureau	Furrow	80	4.75	4.5	17.28	38.66	1,142.63
			Surface	SCMWD	Furrow	20	40.00	4.5	17.28	197.28	2,301.25
			Weighted Averages -- All Methods			(100)	11.80	4.5	17.28	70.39	1,374.35
Carrots	13,717	3,045.16	Surface	Bureau	Sprinkler [b/]	40	4.75	2.4	54.43	65.83	3,110.99
			Surface	SCMWD	Sprinkler [b/]	60	40.00	2.4	54.43	150.43	3,195.59
			Weighted Averages -- All Methods			(100)	25.90	2.4	54.43	116.59	3,161.94
Grain Hay	13,510	164.33	Surface	SCMWD	Sprinkler [b/]	90	40.00	4.7	106.60	294.60	458.93
			Surface	Local ID	Sprinkler [b/]	10	20.00	4.7	106.60	200.60	364.93
			Weighted Averages -- All Methods			(100)	38.00	4.7	106.60	285.20	449.53
Sweet Corn	5,167	378.96	Surface	SCMWD	Furrow	90	40.00	3.7	14.21	162.21	541.17
			Surface	Local ID	Furrow	10	20.00	3.7	14.21	88.21	467.17
			Weighted Averages -- All Methods			(100)	38.00	3.7	14.21	154.81	533.77

a/ All-American Canal
b/ Hand move system
c/ Colorado River water, transported by Southern California Metropolitan Water District
d/ Irrigation district without state or federal affiliation
e/ Permanent set

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