IRRIGATION PUMPING IN THE SAN JOAQUIN

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Continued groundwater use at rates in excess of natural recharge to the groundwater basins has caused significant overdrafts in some areas of the San Joaquin Valley. This study points out the need for careful consideration of pumping unit efficiency and water costs per acre-foot, per foot of lift. Farmers in areas of highly unstable pumping lifts may need to look for supplemental irrigation water or to reorganize their systems of farming.

AVERAGE PUMPING LIFTS, OVERDRAFTS, AND COST OF PUMPING IRRIGATION WATER, SAN JOAQUIN VALLEY, CALIFORNIA, 1960–1964

Area	Input horsepower	Average ft total lift	Overall % efficiency	Gallons per minute	Pumping lift (ft)	Average change in pump lift 1950–54 to 1960–64 (ft)	Estimated cost per acre-foot per foot of lift*
1	45.3	66.8	56.3	1,554	31.9	+ 25.0	$0.048
2	32.8	92.4	56.0	755	72.2	− 7.6	0.047
3	62.0	170.0	60.0	780	135.9	− 22.7	0.044
4	186.9	398.4	62.6	1,178	327.0	− 41.0	0.044
5	332.1	654.0	64.1	1,248	600.7	− 55.3	0.045
6	202.9	402.3	61.5	1,240	365.0	− 52.2	0.045
7	82.1	147.1	60.9	1,309	117.7	− 5.3	0.047
8	16.0	59.3	53.9	562	43.6	+ 0.5	0.051
9	18.3	83.7	48.5	415	59.8	+ 1.2	0.051
10†	15.2	72.6	47.2	458	40.4	+ 10.6	0.058
11	97.8	206.9	59.0	1,109	160.1	− 13.0	0.060
12	101.1	263.7	56.2	785	234.8	− 34.3	0.045
13	120.1	259.5	58.8	1,099	231.5	− 56.5	0.070
14	191.5	408.6	60.4	1,162	392.3	− 70.9	0.046
15	83.9	164.7	60.4	1,258	143.1	− 50.9	0.064
16	68.7	114.5	59.5	1,456	85.2	− 116.3	0.064
17	59.7	173.8	57.3	776	148.9	− 57.4	0.046
18	122.8	304.1	50.0	1,262	251.7	− 61.9	0.046
19	231.3	579.6	59.8	1,049	515.4	− 172.1	0.046
20†	93.7	168.2	59.8	1,281	133.8	− 22.6	0.058
21	40.4	139.4	37.0	813	116.6	+ 33.2	0.044

* *"Some Characteristics of Farm Irrigation Water-Supplies,"* San Joaquin Valley, Giannini Foundation Research Report No. 258, September, 1962.

† Areas 10 and 20 contain service area of another power company which was not sampled, so these data are not complete.

IRRIGATION WATER costs have been estimated for the San Joaquin Valley as a part of an extensive cost study for the cotton-producing areas of the United States. The Pacific Gas and Electric Company furnished microfilms of pump tests in the Valley from 1960 to 1964. Ten per cent of these pumps were observed for the study reported here. Where a single township contained fewer than 50 pumps, at least five were observed. Physical characteristics of the wells were summarized according to township and included: input horsepower, plate horsepower, pump lift, total lift, gallons per minute, and overall plant efficiency.

Groupings

Townships with similar pump lifts were grouped together according to whether they had 50 to 200 ft of lift, from 200 to 300 ft, 300 to 500 ft, or over 500 ft. A total of 21 different areas of similar lifts were mapped in the Valley from Merced south to the Tehachapi Mountains. The smallest area contained only two townships, while the largest area contained 41 townships.

The greatest pump lifts were found in the area abutting on the Coast Range in western Fresno County (see map, area 5). This region is characterized by low annual rainfall, ephemeral streams with small annual runoff, and a slope-elevation complex conducive to rapid surface runoff, as well as rapid surface and subsur-

LIFTS
VALLEY

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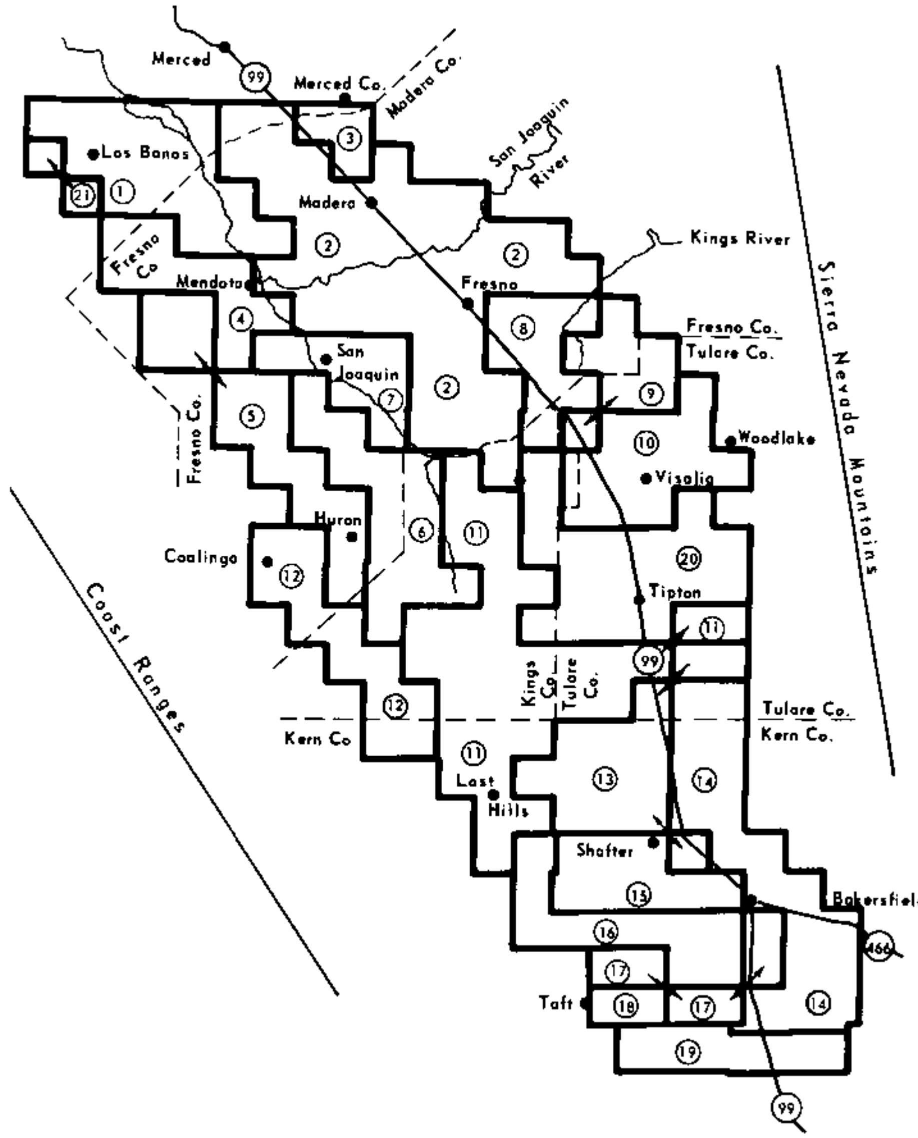
AREAS OF SIMILAR PUMP LIFTS, SAN JOAQUIN VALLEY 1960–64



face drainage and percolation. Some pump lifts in this area are in excess of 1,000 ft, with the pumps being driven by 400 horsepower electric motors. The other high-lift area (area 19), includes the southernmost tier of townships in the Maricopa-Wheeler Ridge area at the extreme southwestern edge of the San Joaquin Valley.

Comparisons

Data for average pump lifts by township in the San Joaquin Valley were obtained from a previous study to provide information for comparison with the period 1950 to 1954—ten years earlier than the present data. Areas with similar pump lifts did not necessarily have equal rates of overdraft. Portions of some areas are served by supplemental water supplies, and some individual townships showed a reduction in the pumping lifts. Areas including the Delta-Mendota Canal, Madera Canal, and all but the southernmost reaches of the Friant-Kern Canal, showed shallower pump lifts at the end of the 10-year period.

Greatest changes in pump lifts occurred in Kern County (see areas 14 to 19 in table). For example, the difference between the 10-year averages for area 19 was 172 ft, or an average increase in pumping lifts of about 17 ft per year. This would mean an increase of about $7.90 per acre-foot in the cost of water in 10 years for a farmer in this area experiencing similar increases in pumping lifts. For the area with the greatest lift (area 5) on the west side of Fresno County, the difference between the two time periods was 55 ft, or an overdraft of 5.5 ft per year. The evidence is insufficient to draw firm conclusions, but it appears that economic forces are causing the reduced rate of overdraft in this area. That is, the cost of water in this area, because of the high pump lifts, is causing the groundwater to be withdrawn at a somewhat slower rate.

Pumping units with overall efficiencies that are less than the average shown in the last column in the table will be more expensive to operate, and water cost per acre-foot per foot of lift will be higher. Farmers in areas with relatively stable groundwater pumping lifts are in a favored economic position from the standpoint of developing long-run farm organization or reorganization plans. On the other hand, farmers in areas of highly unstable pumping lifts may need to look for sources of supplemental irrigation water or to reorganize their systems of farming.

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