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CHAPTER 7

Water Infrastructure and Water Allocation in California

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One of the major problems in California is that the state's water is concentrated in the north, but the majority of the state's urban population and irrigated agriculture is located in the south. California contains 32 million acre-feet of developed water, of which 84 percent is used to irrigate 9.68 million acres of agricultural land. Because such a large proportion of water resources is used for irrigated agriculture, most water management conflicts involve the movement of water to or from irrigated agriculture. While most of the water is used to irrigate field and fodder crops, the high value vegetable and fruit crops generate the majority of agricultural revenues.

State Water Project and Federal Central Valley Water Project

From the 1950's to 1970's different government agencies at the State and Federal level implemented a massive water development program in California. This program was built upon the traditional supply augmentation approach to water development. Unfortunately this approach to water development is flawed. The main weakness of the traditional supply based method is that it assumes that the demand for water is perfectly inelastic and unchanging over time. An inelastic demand assumes that there is little quantitative response to changes in the price of water. Under this planning approach the quantity of water to be delivered by a water project is fixed, and the only question is how to minimize the costs of supplying it. Economic analysis is then performed to see if the total costs of the water project are less than the total benefits.

Both the State Water Project (SWP) and the Federal Central Valley Water Project (CVP) were developed using the principles of the supply-based approach to water development. The SWP was originally projected to supply an average annual quantity of 4.2 million acre-feet of water in two stages. The first stage of 2.2 million acre-feet was built and put into service in the late 1960's and early 1970's. However, subsequent attempts to build the remaining 2 million acre-feet capacity have met with effective opposition from environmental interests, who want to prevent any further water development, and current contractors, who know that the average cost of water delivered by the system will have to increase by up to 300 percent to finance the completion of the planned project.

In 1994 the SWP project contractors and operators met to renegotiate the conditions for water sales among contractors and the allocation of cuts in water deliveries during drought periods. The resulting Monterey agreement also enabled contractors who overlie a state operated groundwater storage project to exchange the control of the project for surface water entitlements; these entitlements could then be transferred to urban contractors. Finally, the agreement sanctioned the permanent transfer of 130 thousand acre-feet of water from agricultural to urban users.

The CVP parallels the SWP and delivers 4.6 million acre-feet of water to both urban and agricultural contractors. Urban contractors receive 10 percent of total water deliveries while the remaining 90 percent of water is diverted to agricultural contractors. The CVP was operational in 1965, but by 1992 there was considerable political pressure to modify the operation of the project to reduce environmental damage to different fish populations in the Sacramento River Delta. The resulting Central Valley Project Improvement Act (CVPIA) reallocated water to environmental uses by cutting water deliveries by 1 million acre-feet in normal rainfall years and by 804 thousand acre-feet in critical rainfall years. The CVPIA mandated that 800 thousand acre-feet of water be reallocated to instream uses to protect the salmon runs, while 400 thousand acre-feet of water be reallocated to wildlife refuges (Hanak, 2003).

Water markets in the CVP districts are limited to local sales among agricultural contractors. These sales are short in duration and are generated by differences in the water allocations between farm regions and years. Due to institutional constraints, CVP water is still largely used for agricultural irrigation despite a three-fold difference between the value of water in nearby urban sectors and agricultural sectors.

In recent years, State and Federal law have mandated a set of modifications that affect both the state and federal water projects in California. In 1996 and 1997 California developed the 4.4 Plan that aims to reduce diversions from the Colorado River to 4.4 million acre-feet over a period of 15 years. Moreover, in 2000 the Environmental Water Account (EWA) was implemented by the state and federal governments. The purpose of the EWA is to regenerate the fisheries of the San Francisco Bay-Delta system while simultaneously securing water supplies to both urban and agricultural users. Both these developments have encouraged water trading.

PEACE BREAKS OUT ON THE COLORADO RIVER

The year 2003 may have marked the end of a different sort of water conflict in California—the long-running battle among districts drawing supplies from the Colorado River. Resolution of this dispute, in particular the long-term transfer of water from the Imperial Irrigation District to the San Diego County Water Authority, was key to California retaining access to the Interim Surplus allocated to the state from the Colorado River. The agreement was outlined in the Quantification Settlement Agreement (QSA) signed in October by IID, SDCWA, Metropolitan Water District and Coachella Valley Water District.

Under the QSA, the IID agreed to cap its annual water use at 3.1 million acre-feet. From that amount, the IID would transfer:

- 104,000 acre-feet yearly to the Metropolitan Water District of Southern California under a 1988 agreement;
- 11,500 acre-feet to miscellaneous holders of present perfected rights;
- 67,700 acre-feet annually from recovered seepage from the All-American Canal to the San Diego County Water Authority for two 55-year terms;
- 200,000 acre-feet annually to the SDCWA at an initial ramp-up of 10,000 acre-feet yearly beginning the first year of the transfer, and at an increased ramp-up beginning in 2017 until the maximum is reached;
- 103,000 acre-feet annually to the Coachella Valley Water District at a ramp-up of 4,000 acre-feet yearly beginning in 2008;
- 1.6 million acre-feet, in two transfers of 800,000 acre-feet, for environmental mitigation during the first 15 years of the transfer, with the first transfer increasing at 5,000 acre-feet yearly beginning the first year of the QSA. The second quantity would ramp-up at 20,000 acre-feet yearly beginning about 2008. The first quantity would be sold for $62.50 an acre-foot, while the second would be sold for $175 per acre-foot. Both quantities would be sold to the California Department of Water Resources, which would then sell them to MWD. The profits from the sale would go to environmental mitigation.

Other provisions of the QSA covered restoration of the Salton Sea, compensation for third party impacts of the transfer, exemption from state environmental regulations, canal lining and other improvements, allocation of surplus water, and "peace treaties" whereby the four parties agree not to challenge each other with respect to certain areas of conflict (i.e., wheeling laws, water rights, etc).

This transfer, while historic, is more like an intergovernmental reallocation than a prototypical water market exchange. The QSA settled a large array of issues regarding use and conveyance of Colorado River water, many of which were unrelated to the transfer itself. There is also some question as to the willingness of IID to enter into the agreement. While it appears that many landowners and the IID itself will benefit substantially from the agreement, local opposition to the transfer remained strong until the Bureau of Reclamation found under a Section 517 proceeding that IID's use of water exceeded "reasonable and beneficial" amounts. This finding raised the possibility that, unless transferred, IID stood to lose a significant share of its annual use with no compensation.

WATER MARKETS IN CALIFORNIA

State sponsored water spot markets developed in 1991 in response to severe droughts and were repeated in 1992 and 1994. Since then, water trades by other agencies have grown, so that by 2000 the total quantity of water traded under non-drought conditions equaled 1991's extreme drought trades (Hanak, 2002). The increase in water trades since 1996 has predominantly been driven by environmental demands.

Table 1. Water Purchase Quantities by Institution (1000 acre-feet)

Year	Private	District	Wholesale	Bank	State	Federal	Total
1996	341	634,364	45,181	0	0	27,055	950,484
1997	39,707	606,441	62,342	62,755	20	545,024	1,316,294
1998	59,998	433,325	48,433	199,839	19	216,423	958,042
1999	27,096	672,392	151,187	256,722	20,309	369,629	1,497,341
2000	9,148	709,584	336,192	175,557	0	509,722	1,740,203
Average	27,258	611,218	128,665	138,973	4,071	382,273	1,292,474
% Average	2.11	47.29	9.96	10.75	0.31	29.58	--

Source McCann & Cutter (2002)

Table 1 shows the breakdown of water purchases between 1996 and 2000 in California by type of institution. McCann and Cutter (2002) classify water institutions by the controlling agency: "private" denotes private water purchasers; "district" denotes independent local water districts; "wholesale" denotes water trades negotiated by third party water traders; and "bank" denotes water banks run by the state or federal water agencies. It is clear from this data that the California water market was been active over the five years from 1996 to 2000 even though hydrological conditions were favorable, a fact that is also reflected in Figure 1. It is also apparent that two groups have dominated the water purchasing market. Local water districts accounted for 47 percent of water purchases, and federal agencies initiated 30 percent of water

purchases over this five year period. In contrast to purchases, water sales have been more evenly distributed among the different agencies. Between 1998 and 2000 the different institutions accounted for the following percentages of average water sales: "private"—4 percent; "district"—39 percent; "wholesale"—20 percent; "bank"—15 percent; "state"—16 percent; and "federal"—6 percent. Evidently, local water agencies play a dominant role in both water purchases and water sales.

Figure 1 shows that the incidence of water markets has varied considerably over the past 17 years. To detect any systematic trend in the market, the effect of changes in water scarcity and supply, shown in figure 2, needs to be disentangled from market trends.

Figure 1. Total Water Transfers—California

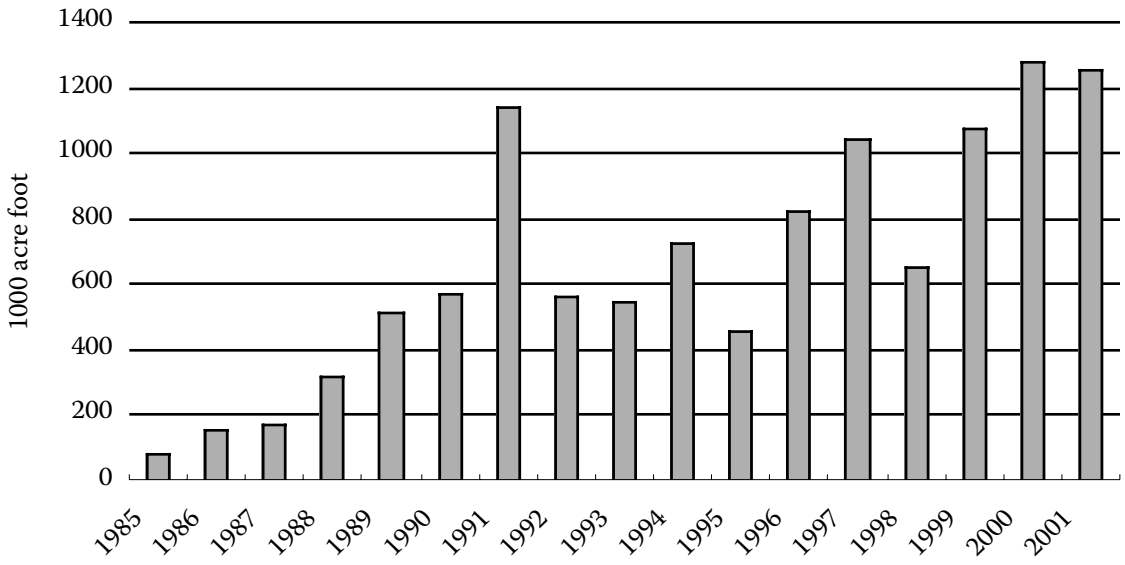


Table 2. Regression Statistics

R Square	0.813			
Adjusted R Square	0.770			
Standard Error	184.369			
Observations	17			
	Degrees of freedom	F statistic	Significance of F statistic	
Regression	3	18.843	0.000051	
	Coefficients	Standard Error	t Statistic	p-Value
Intercept	348.563	133.338	2.614	0.021
Ordinances	5.568	16.376	0.340	0.739
Water Index	-46.046	16.892	-2.726	0.017
Time Trend	69.382	21.944	3.162	0.007

Figure 2. Water Runoff Index—Sacramento Valley

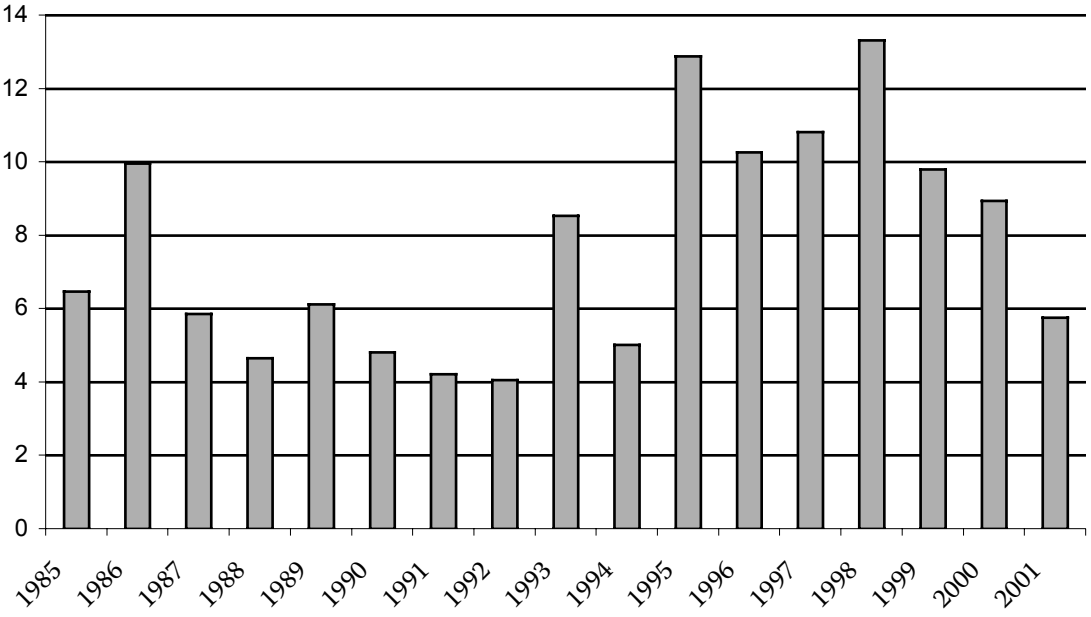
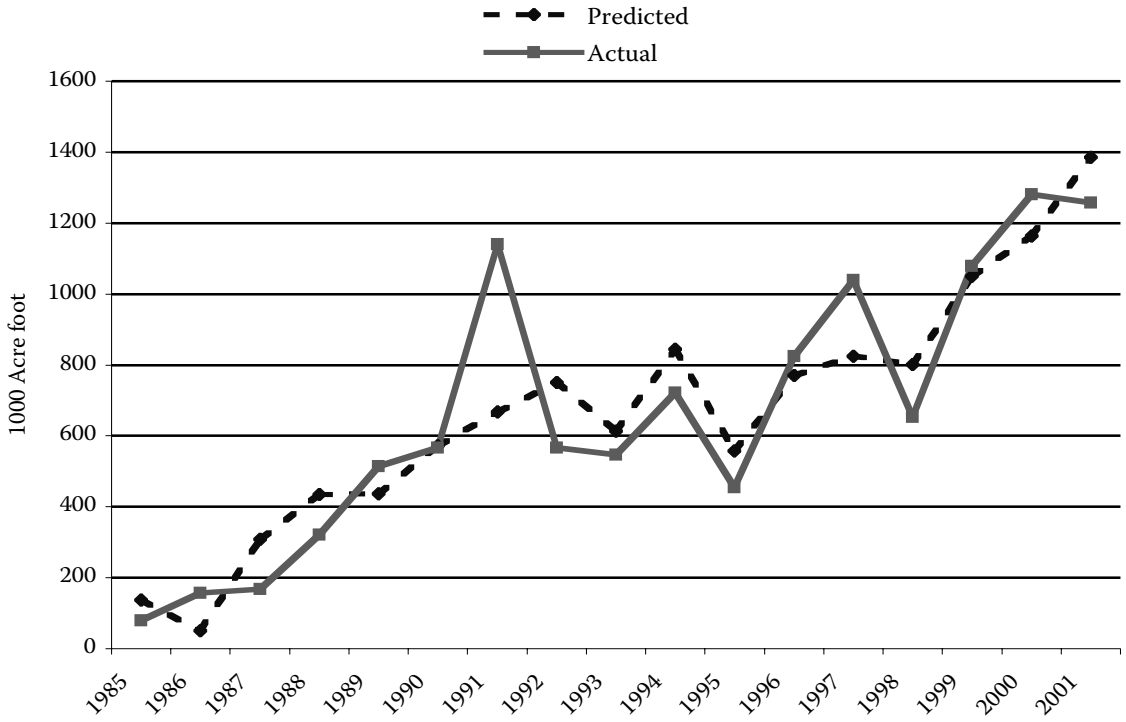


Figure 3 plots both actual transfers and regression predictions of water transfers in California between 1985 and 2001. The regression fitted to water transfer data confirms that rainfall levels have a significant effect on annual water transfers (Table 2). The data also confirms a positive correlation between the time trend and water transfers. When expressed as a percentage of the mean (1993) level of water transfers, the regression time trend shows an annual growth rate of 1.26 percent over the period. We can conclude that the current data shows a steady growth in water markets despite the recent predominance of relatively wet years.

In spite of the active and growing water market, Hanak (2003) points out that California's water market only accounts for 3 percent of total annual water use. Hanak estimates that Central Valley farmers have accounted for approximately three-quarters of all water sales, while the rest of the water has been supplied from Imperial and Riverside Counties. According to Hanak, environmental regulations, rather than urban agencies, have been the major sources of the increased demand for water. Direct purchases for instream uses and wildlife reserves constituted over one third of increased water trades since 1995, while agricultural activities in the San Joaquin valley accounted for over half of the increase in water purchases. This increase in agricultural demand for water stems from the reduction in contractual water deliveries under environmental regulations. However, municipal agencies are the principal purchasers of long-term and permanent water contracts, which constitute approximately 20 percent of total water trades. The 2001 legislation that requires that local governments ensure adequate water supplies for development is likely to increase the urban demand for long-term water transfers.

Figure 3. Total Water Transfers—California



RESISTANCE TO WATER TRADING

Within California there is considerable resistance to water trading which stems from communities in the source regions. These communities are concerned that water sales will generate significant "third-party" effects; i.e. trades may have an adverse impact on both local groundwater users and the local economy. These concerns have arisen from communities' perception of the impacts of short-term water transfers in the early 1990's, which involved the implementation of fallowing contracts by the state to purchase water for the 1991 drought water bank. Water transfers, which were accompanied by land fallowing, slightly reduced the demand for labor and other farm inputs and also decreased the supply of raw materials to local processors. Howitt (1994) estimated that losses in county income in two counties that transferred water ranged between 3.2 percent in Solano County, where 8 percent of the acreage was fallowed for transfers, to 5 percent in Yolo County, where 13 percent of the irrigated acres were fallowed.

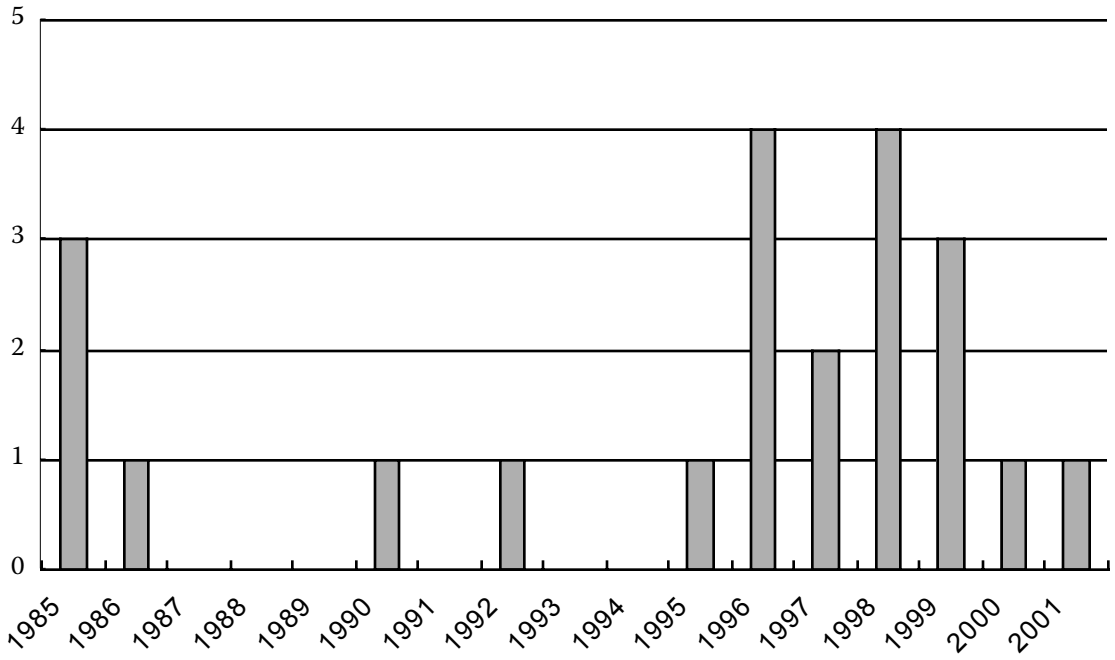
Those farmers who replaced the surface water they had sold by pumping additional groundwater were accused of reducing both the quantity and quality of water available to other users. Because groundwater resources are not regulated by the state, the implementation of the Californian water market has sparked concerns that aquifers will be subject to uncontrolled mining. The experience of the 1990's has exacerbated another source of anxiety: local officials fear that once water has been

transferred elsewhere, local communities will have insufficient money and political influence to retrieve these water entitlements (Hanak, 2003).

Currently, state approval is only required for water transfers pertaining to surface water entitlements that were acquired since 1914, certain types of groundwater banking and any water that is conveyed through a publicly owned facility. The state only actively safeguards against negative economic impacts on source counties when water is conveyed through these publicly owned facilities. In the other two cases, traders are obligated not to harm other surface water rights-holders, fish and wildlife.

Rural counties have attempted to protect their water interests by implementing local restrictions on water marketing in the form of local ordinances (Figure 4). By late 2002, 22 of the state's 58 counties had put ordinances into effect (Hanak, 2003). These ordinances mandate the acquisition of a permit before exporting groundwater or extracting groundwater to substitute for exported surface water. Individuals who wish to obtain a permit have to undergo an environmental review process. According to Hanak, the very low number of permit applications indicates that this process acts as a deterrent to water trades, rather than as a screening mechanism. Statistics for 1990 to 2001 suggest that the implementation of groundwater export restrictions reduced a county's water trades by 14,300 acre-feet and transferred 2,640 acre-feet of water purchases to in-county buyers. Since 1996 total groundwater exports were reduced by 932,000 acre-feet or 19 percent and total water sales were reduced by 787,000 acre-feet or 14 percent (Hanak, 2003).

Figure 4. County Ordinances Passed



While the 1994 appellate court decision favoring Tehama County sanctioned the implementation of groundwater ordinances, counties do not have the legal authority to ban crop fallowing, although several counties have implemented such policies. According to Hanak, these counties tend to have boards that are elected by the general community, as opposed to boards that only permit landowners to vote. In general, landowners are more likely to fallow land for the water market, especially when crop prices are low.

Section 1745.05 of the Water Code mandates that any fallowing proposal that exceeds 20 percent of the local water supply must undergo a public review. Hanak found that water districts that implement fallowing programs tend to include restrictions in these programs that ensure that the viability of idled land is maintained and that landowners who engage in land idling are not solely engaged in selling water.

In summary, a well functioning water market is seen as essential to California's ability to adapt its restricted developed water supplies to changing demands for water. Over the past seventeen years the water market has evolved different forms and has shown steady growth despite relatively good water years. However in recent years, local resistance to water markets has taken the form of local ordinances. These ordinances need to reflect both the interests of local communities and state water users to enable the development of effective markets without imposing undue costs on local communities.

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