Chapter 5
Are Lease Water Markets Still Emerging in California?

Richard E. Howitt

Abstract Over the past 15 years water markets in California have evolved, but not as fast as expected, and not between the agents who were initially expected to be active in the market. The chapter reviews the disappointing performance of the state-sponsored groundwater bank in the 2009 drought and advances some hypotheses as to why the trades were not larger. The growth in bilateral trades between urban and agricultural regions and the role of environmental constraints on restricting water trades is summarized and discussed. One source of problems for the emerging water market in California is the multiplicity of ways in which opponents can use valid environmental regulations to delay or block water trades until the window of opportunity for spot trades is no longer open. Two recent examples are analyzed.

The chapter concludes that water markets are still emerging California, but they are not yet fully emerged or formed. A policy conclusion that results from this review is that excessive environmental caution can provide a mechanism to increase transaction costs of short-term spot trades needed for drought management, to a point at which they are no longer viable. Some suggestions for simpler and more robust institutions that would enable short-term spot trades are suggested, and the recent recognition of the role of markets by water industry stakeholders gives rise to cautious optimism for future water markets in California.

Keywords Water markets • California water • Transaction costs • Market institutions • Drought management

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5.1 Introduction

There are several reasons why California should have more active water markets than it currently does. First, there is a wide difference in the value marginal product of water both within the agricultural sector and certainly between agriculture and the urban sector. One glaring case is in the central San Joaquin Valley where, in water scarce years such as 2009, the highest going price in Westlands water district in the latter half of the summer was $500 per acre foot, while 50 miles away the effective cost of water was less than $40 per acre foot. The price and value variation within urban areas is less pronounced, but still enough to overcome reasonable transaction costs.

A second reason why one would anticipate an active spot market in California is the degree of interconnection between alternative locations of water demand. The state and federal water systems namely the California Water Project (CWP) and the Central Valley Project (CVP) have a well-developed canal structure that runs from the north to the south of the state connecting urban and agricultural regions over a 700 mile long linked river and canal system. In addition, many other irrigation districts are connected indirectly by river systems and local control structures. One exception to this interconnectedness is the difficulty in making water transfers from the East side of the San Joaquin valley to the West side. While canal capacity in the north-south conveyance system is often in surplus supply, due to the original planning anticipating more water development in the north than actually occurred, institutional rigidity and obstructionism make the practical implementation of water trades difficult.

There are at least six different types of agency who are responsible for conveying water in California. In Fig. 5.1, federally funded conveyance systems are marked in black, state funded conveyance is orange, joint federal and state are marked as pink, and conveyance that is funded by the many types of local agencies is marked in green. The blue colored lines represent the natural river flows in the Colorado, Sacramento, American, San Joaquin and many other smaller rivers that are an essential part of the supply system, particularly those located on the east side of the San Joaquin and Sacramento valleys.

Since California has Mediterranean climate, water years are predominantly distributed as bimodal wet and dry years. This means that there is a predictable frequency of dry years in which the demand for spot market water transfers is high. In addition, the California economy is perpetually developing and changing. The first change was from an agrarian and extractive economy that was dominant from 1850 to 1910, with a gradual movement of the locally developed water out of gold mining and into irrigated agriculture. The second stage was an agrarian and industrial economy from 1911 to 1980 when large state and federal inter-basin projects were developed for both irrigated agriculture and municipal/industrial water supplies.

The current phase of California's economic development can be characterized as an irrigated agriculture and post-industrial service economy. These past substantial

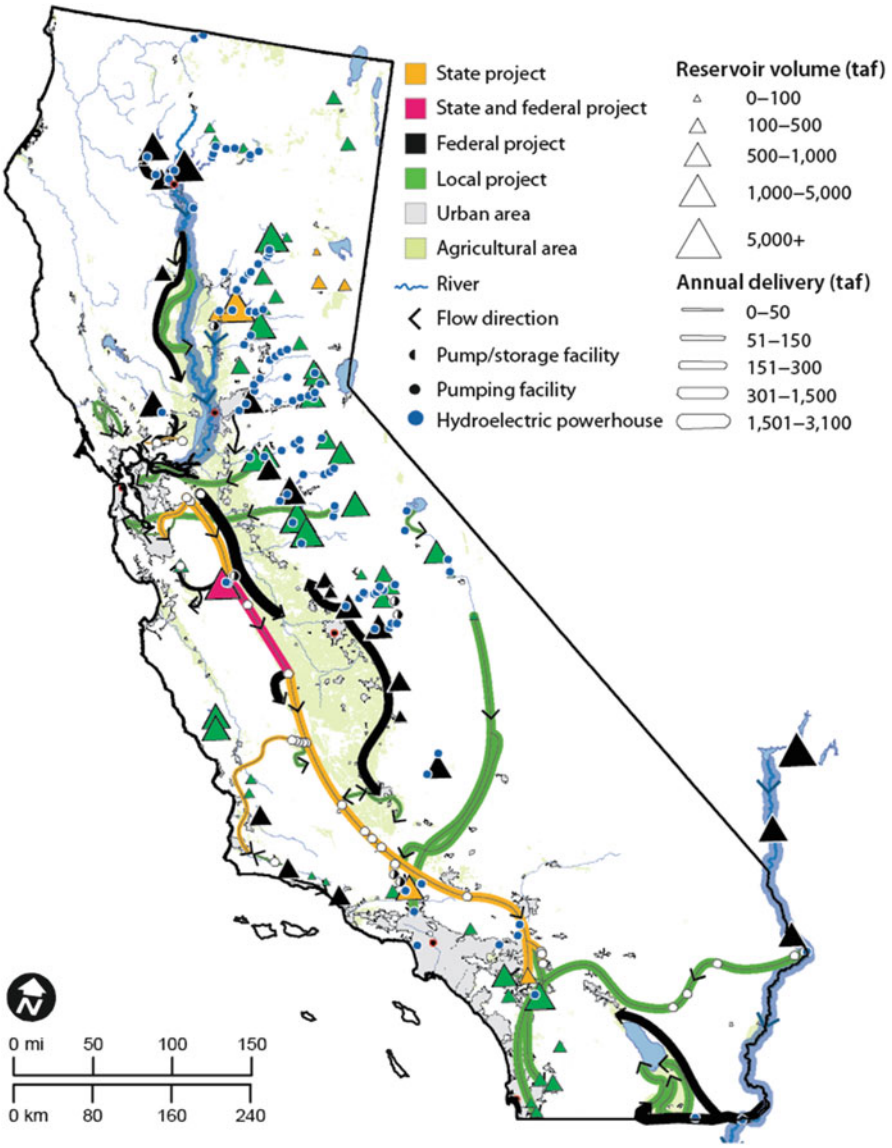

Fig. 5.1 California's interconnected water system (Source: Hanak et al. 2011)

shifts in the economic sectors have required parallel shifts in the development and allocation of natural resources, principally water. With the rapidly increasing economic and environmental cost of developing additional water supplies, the incentive to use water markets to adjust the allocation of the currently developed water supplies to changes in water using sectors of the economy is strong. Despite

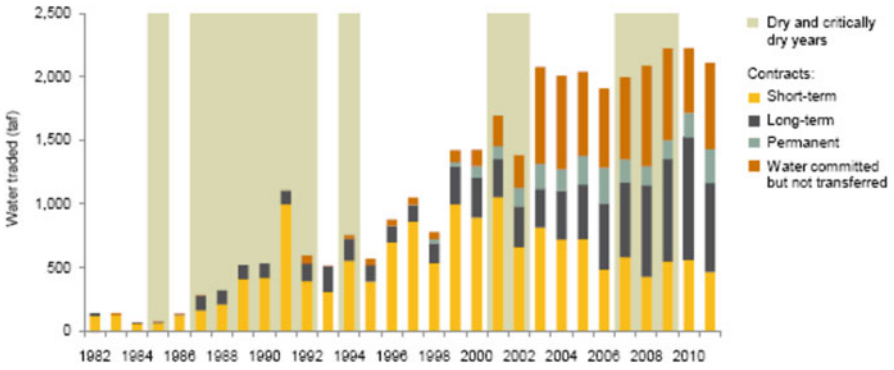

Fig. 5.2 California water markets over 30 years (Source: Hanak and Stryjewski 2012)

these pressures, the market for permanent water rights in California, which should be used to adjust to sectorial changes in demand, is lagging behind the rate of change in the water economy sectors. Hansen et al. (2013) show that state level water markets tend to cluster into states in which either lease or sales markets predominate. This is reflected by the record of water transactions having high or low "lease to sales" ratios. California, with a lease to sale ratio of 21, has clearly developed a growing lease market and a stagnant water rights sale market. Accordingly, this chapter will focus on problems and improvements to the water lease market, and leave the analysis of the reasons for bifurcated water markets in the western US for a later paper.

Parallel to the growth in population, income, and the service-based economy, the demand for environmental goods in California has grown rapidly. Many of these environmental goods involve the use of water, either directly as a consumption input or indirectly through the support of environmental amenities and populations of fauna and flora. The growth in environmental demands and the pressures for water transfers between the agricultural and urban and municipal sectors have contributed to the rapidly increasing scarcity value of water in both economic and political terms. This increased scarcity value should have stimulated significant market activity, but there seems to be little correlation between market activity and drought years based on records of water market sales over the last 30 years as seen in Fig. 5.2.

5.2 Water Market Response to Drought

The water market in California was inconsequential until the severe drought year in 1991. Faced with an extremely dry year in 1991 after a series of dry years, the state and governor were faced with the necessity of allocating the existing water supplies by directives or markets. Governor Deukmejian used emergency powers to suspend

some water ordinances and create a state run emergency water bank. The water bank was not a market in the sense that purchase and sale prices were set at fixed rates that escalated slightly during the irrigation season. In addition, sales of water were initially allocated to users who could demonstrate that they had also taken some conservation actions. However, after late rains slightly improved the supplies, the water bank purchases exceeded the demand and 100,000 acre feet of water was carried over from the 1991 water year to 1992 when it was sold at a discount.

In both economic and political terms the 1991 Drought Water Bank was a success, with an estimated net return to the state of $105 million (1991$), and a total purchase quantity of 821,000 acre feet (Howitt et al. 1992). One of the reasons that this bank was so successful was that the governor gave it the highest priority, and a deputy director of the California Department of water resources was charged with the administration of the water bank. In no small measure, the success of the bank was due to the stellar reputation of the deputy director Bob Potter who had worked in the California Department of Water Resources for many years, and had the trust and respect of both the farmer sellers and urban buyer communities. This trust was an essential component of the 1991 water bank, and in real terms lowered the bank transaction costs which were estimated at 2.5 % of the value of the transactions.

Figure 5.2 shows the trends in the total volume of water sales, how the composition of the sales has changed, and also how dry years did or did not change the water market. Dry years are shown in Fig. 5.2 by tan highlighting. The market in 1991 jump-started with a large volume of spot trades which rapidly declined when the drought broke with a wet year in 1993. Spot trading volume increased slightly with below average precipitation years in 2001–2002, but trended downward from 2003 to 2010. This downward trend in spot trades was not broken by the 2007–2009 droughts. The state sponsored water bank that was reestablished in 2009 was ineffective for several reasons discussed below.

The 2009 Drought Water Bank was established in February 2009 to meet projected demands. Over the 2009 water season, the Drought Bank purchased 82,000 acre feet, falling far short of its initial target, which was, at one point, set at 600,000 acre feet. One of the main reasons for the lack of participation in the bank was the price that was offered to potential farmer sellers. At $275 per acre foot, a water purchase price that was just competitive with growing rice, but offered no real incentive to sell water to the bank, given the inevitable local skepticism about such sales. Additional problems with the 2009 water bank were restrictions on moving water across the Sacramento Delta, and the leadership of the bank which was given to a competent, but unknown, state agency manager rather than a known leader in the water industry as in previous years.

In short, despite the pressing need for an effective drought spot water market in California, far from growing from a promising start, the spot water market has dwindled downward, due the combination of layers of environmental legislation, and successful blocking action by local water trade opponents. More details of these actions are given later.

A small volume of long term trades emerged in 1992, but only started growing in 2000. Since then, the volume of long term and permanent water trades had

grown steadily, and has offset the decline in spot market trading activity. In terms of actual water traded, the California water market volume has been stationary since 2003. Given the predictable periodic need for short term dry spot water markets in California, a detailed examination of the forces restricting spot water markets is used to suggest two potential solutions to the current torpor in water marketing.

5.3 Market Constraints

What went wrong in the development of the California water market? There are several reasons. Effective opposition in potential water exporting regions, increasing environmental restrictions in the Sacramento-San Joaquin Delta restricted conveyance, and a plethora of multiple agency regulations on conveyance capacity and the change of point of diversion, all combined to delay implementation of trades and increase their transaction costs. Timing is a critical factor for California drought spot market water trades. Despite good information on current dam capacity, the capricious nature of California precipitation means that potential market participants do not know if they are facing a drought until February. Since spot market water is mainly supplied from changes in agricultural operations, there is only a 2 month window in which spot market trades can be implemented before farmer crop timing prevents further trades. In the discussion that follows I will focus on the impediments to spot markets rather than long term or permanent transfers because the volume of spot transfers is in decline rather than growing as would be expected from the increasing and cyclical nature of California water scarcity.

Hanak (2003) has thoroughly analyzed the extent and growth of county ordinances on water exports that are designed to prevent or severely limit the export of water from a given county. Figure 5.3 shows the extent and type of ordinance. We conjecture that there are three dominant reasons for enacting these ordinances. The first concern is over the effect on groundwater depletion from water sales, directly by the sale of groundwater, or more commonly, indirectly by the sale of surface water and the substitution of increased groundwater pumping. The second concern is for the reduction in revenues received by local farm related businesses from increased crop fallowing due to water sales. Third, the prevention of environmental externalities from field fallowing, or from changes in river flows, temperature or return flows from crop irrigation.

Groundwater depletion is a valid concern for most potential water export regions, as they completely lack any form of quantified groundwater rights. With few exceptions, California's groundwater is governed by correlative water rights that only restrict overlying groundwater users to pump for beneficial use. The concept of beneficial use in agriculture is a very broad definition. One of the few recorded exceptions to beneficial use of groundwater was its use in gopher control by flooding the entire area that had holes. Groundwater is covered by an extensive "no injury" rule. While this is an equitable concept, there is no statewide criteria of "no injury" to groundwater, thus counties have defined fragmented and varying measures to

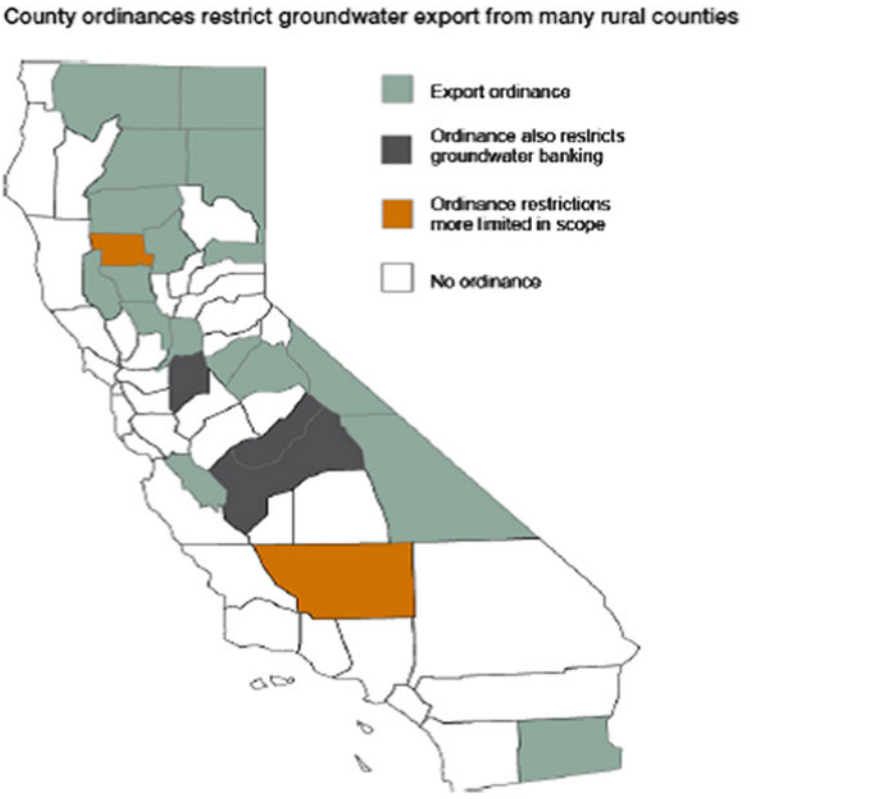

Fig. 5.3 County water ordinances (Note: Figure shows ordinance status as of 2002. To our knowledge, no additional county groundwater ordinances have been adopted since then. Kern County's ordinance is limited to the southeast portion of the county within the South Lahontan hydrologic region. Glenn County's ordinance was updated in 2000 and now relies on basin management objectives that do not automatically restrict groundwater exports. Source: Hanak 2003)

prevent injury. In some counties, any depletion of groundwater is assumed to be injurious to county residents, and water transfers are banned rather than having to compensate those county residents who are directly injured.

The effect of increased crop fallowing on local businesses is often cited as damage attributed to water exports. Few empirical studies have measured this impact. Howitt (1994) showed that the effect of fallowing and water exports on local businesses in 1991 ranged from a decrease of 4 % of agricultural business sales to 6.5 % of agricultural business profits. While no changes in water use can be free of

these pecuniary externalities, economic theory and public policy does not provide a basis for compensation for the pecuniary effects of public works such as highway changes or zoning. Despite theory and practice, some restrictions on fallowing externalities are reasonable and equitable policy. Such restrictions usually take the form of limits on the proportion of land fallowed in a given area. The informal logic is that businesses associated with agriculture have to have a cost structure that is able to ride out the fluctuations in revenue between seasons and price cycles. If the reduction in business caused by fallowing is within this range, it is reasonable to assume that there will be no structural damage to associated businesses. These area restrictions usually take the form of limiting fallowing to no more than 20 % of the average cropped area. Even with such restrictions, some accounts of negative effects can be compelling. When conducting interviews after the 1991 drought water bank, I vividly remember an aging custom harvest contractor who explained that he had traded in all his combines for new larger models, only to have half of his custom contracts canceled due to water bank fallowing of local corn crops. Situations like this have no answers in economic theory, but do influence local politics.

A complete ban on exports to avoid environmental externalities is often short sighted, since water transfers can generate environmental benefits as well as costs. The "no injury" rule that is the keystone concept in regulating California surface water transfers is open to interpretation but, if taken literally, it sets a bar which would ban almost all economic activity. Clearly, the rule should be no significant injury in which the externalities from a water trade are balanced against the potential for compensation, and the cost of externalities versus the social benefits of the water trade. Given the lack of a statewide definition of a significant injury, the "no injury" rule is widely used as a delaying mechanism by those opposing water trades, and for spot markets the ability to delay a transfer is often the ability to prevent it.

5.4 Blocking Trades

An example of effective blocking of short run water trades is the attempt to trade water during the 2009 drought, between the Glenn Colusa Irrigation District (GCID) in the northern Sacramento Valley, and the Metropolitan Water District (MWD) in the Los Angeles region. Since 2003, GCID and MWD had agreed on a contract for water sales conditional on dry years as measured by the Sacramento River flow index. This type of conditional option contract should be an example of how spot market contracts can be negotiated to respond to drought year demands, and when such year occurs, they should be able to be implemented smoothly. In 2003 the option price was $13 dollars per acre foot, with the option condition being based on the Sacramento River index and a strike price of $102 per acre foot was agreed on in 2003. In 2009 the option condition of the Sacramento River index was clearly met in this drought year, and Glenn Colusa prepared for bids to fallow land and release surface water to fulfill the contract. The fallowing of land in the irrigation district was challenged by local groups on the basis that the fallowed land would

make it difficult for an endangered species of snake, namely the Giant Garter snake, to make the dens in the dry soil. Given the restrictions of the Endangered Species Act, the water district proposed to fulfill the contract without fallowing land, but substituting groundwater irrigation for surface water that was normally used to irrigate the area. The landowners had correlative rights to groundwater which was from a comparatively shallow aquifer and normally recharged by natural recharge and deep percolation from surrounding irrigated fields. This substitution of groundwater was challenged by local organizations that opposed water trades, but the farmer's rights to pump groundwater were upheld. The opposition group then challenged the groundwater pumping on the basis of increased air pollution. They argued that pumping this additional groundwater would involve the use of temporary diesel powered pumps, and that such pumps would contribute toward the regional air pollution and should be prevented. When the district pointed out that many farmers already use diesel pumps to pump groundwater in this region, the ruling from the local air quality control board was that diesel pumps used pumped groundwater that was used for local irrigated agriculture were permissible under existing air pollution regulations, but the diesel pumps used to pump groundwater for irrigated crops when surface water was transferred could contribute to regional air pollution and thus had to be banned. At this stage, the water season was advanced to a time that alternative supply measures had been taken by the MWD, and this conditional, previously contracted; short-term water trade was no longer viable.

The experience of the GCID and MWD in 2009 shows that the ability to raise a sequence of challenges to short-term spot water trades is a very effective method of preventing the implementation of trades in a water spot market. It's not clear from an economic perspective why people would oppose such markets if the effect of environmental and local externality were adequately taken into account, which they were in the case of the conditional option agreement between GCID and MWD. However, it is reasonable to assume that any reallocation of the local natural resource will generate some degree of opposition. Certainly, the evidence is that the economic well-being of the County would show a net benefit. The problem seems to be, not in the existence of environmental constraints which are necessary, but in the presumption that trades have to be prevented until sequential objections are satisfied.

Another example of spot market trades creating problems between exporting growers in another region of the Sacramento Valley called Butte County started in the 1994 drought, and continued in the form of a water export ordinance. The crux of this water transfer problem in Butte County lies in the differences in farm size and profitability. The districts which wanted to transfer their surface water rights and use their legitimate groundwater rights to irrigate crops in 1994, are composed of a group of farmers who grow rice in the valley floor. The litigants were located in an area called the Cherokee Strip composed of small farms that could not grow rice and were dependent on groundwater. The Cherokee Strip is higher than the valley floor, and thus there could be a groundwater gradient and lateral flows between the exporters and the farmers in the strip.

As a drought year of 1994 progressed, wells in the Cherokee Strip started to go dry and run short of water. Landowners in this area claimed that this was due to additional groundwater pumping by water sellers lower in the valley. An investigation by the California Department of Water Resources found little hydrologic linkage between the aquifers, but landowners in the Cherokee Strip proceeded to court. The Cherokee Strip landowners failed to get an injunction and in 1995 claimed substantial impacts. The outcome of this controversy was that passage of the Butte County Groundwater Protection ordinance of 1996 which requires that permits were needed to export groundwater or to substitute groundwater for surface water exported out of the county. Permission would be refused if the exporters were deemed to cause any of following five types of injury. (1) Increased overdraft. (2) Saltwater intrusion. (3) Exceeding the safe yield of a basin or sub-basin. (4) Uncompensated injury. (5) Subsidence.

5.5 Removing Constraints

The five conditions above are very reasonable and in theory allow transfers to occur where they do not cause long-term damage to the aquifer or users that were not compensated. In practice, the political interpretation at the county level has been such that since 1996, no permits have been approved for the export of groundwater despite several severe drought years. In this case, my sympathies lie with the small farmers in the Cherokee Strip who should have been given the benefit of the doubt, even if for political reasons. At a minimum, they should have had subsidized well improvement to restore their groundwater service. The response in this case contrasts with the Glenn Colusa Irrigation District that has well improvement policy in exporting areas that can be described as "Fix the well first, for free, and ask questions afterwards". This approach by GCID reverses the normal response to complainers of "prove your damages" before talks of compensation can occur. It takes a politically more sophisticated view that recognizes that in dry years, the timeliness of response is critical. Just as transfers should be given the option under certain conditions to transfer without being blocked, compensation for damage to wells from transfers should be dealt with by repairing the well first, and then discussing the degree to which it was damaged by water transfer. It seems to me on a subjective basis, that the political goodwill generated by rapid response to these problems outweighs the cost of the inevitable free riders on the system.

The cost that agencies charge for using their facilities to convey, or wheel, transfers may indeed prove an obstruction to the transfer process. A case that has been litigated and argued over the past 13 years concerns the flat or "postage stamp" rate that the Metropolitan Water District (MWD) charges transferors using their facilities. The California water code in Section 1810 outlines the framework for transferring, or wheeling, water and states that ".. neither the state nor any regional or local public agency may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity of the period of time for which that

capacity is available, if fair compensation is paid from a use". Of course, the whole controversy is over what is fair compensation for that use. The code defines fair compensation as "reasonable charges incurred by the conveyance system including capital, operation, maintenance and replacement costs, increased costs from any necessitated purchase of supplemental power, and including reasonable credit for any offsetting benefits from the use of the conveyance system". Discussions at the time of wording the new water code centered about the problems of pricing decreasing marginal cost systems, and how to approximate the marginal cost of a transfer. MWD interpreted this cost as requiring a full average cost charge for the whole system under a system called "postage stamp" pricing. As the name implies, the charge to wheel water through the system is exactly the same for 3 miles or 100 miles. In addition, the MWD wheeling charged is extremely high at $670 an acre foot just to move water any distance through the system. A recent breakdown of this charge shows costs of $195 per acre foot for facilities and $195 per acre foot in support costs and an additional administrative overhead cost of $279 per acre foot based on the entire cost of billing and meter reading averaged over the whole system. These latter costs seem to have nothing to do with the marginal cost of moving water through the system. This extraordinary high fixed cost, does however, have an effective dampening effect on any outside agencies wanting to make transfers independently of the MWD. The best example of this is the charge to the San Diego County Water Authority for moving 200,000 acre-feet of purchased water from Imperial County through the Metropolitan system. This charge is despite the fact that the San Diego County Water Authority is the largest of the member water agencies in the Metropolitan system.

The ability to make short-term dry year spot market transfers in California is significantly handicapped under current regulatory interpretations and environmental regulations. The cases discussed above all can be categorized under three groups. First, the use of environmental objections to transfers based on a number of area origin regulations on species preservation, air pollution, and land use. Second, restrictions on water exports are often successfully based on the impact on groundwater resources as reflected in the many local county level ordinances which flourish in the absence of a statewide ordinance. Third, the inability and cost of transferring water from areas of origin to areas of demand through the existing conveyance system may be prohibitive, due to excessive transfer charges, or a thicket of time-consuming regulatory inter-agency requirements.

5.6 Policy Options

The following section will outline two policy changes that could lower the transaction costs of dry year water spot markets. First, a generic definition of environmental impacts of water transfers would establish a statewide framework for the assessment of regional and environmental impacts of water transfers. In addition, a uniform Environmental Impact Report (EIR) could be the basis of a change in the legal

presumption, to one of being able to make such transfers if the environmental standards are satisfied. I term this approach a generic transfer environmental impact criterion.

A second policy change would optimize the use of California's water conveyance system both for the current contractors and additional water buyers and sellers. The institutional structure of the new management system would mimic a system successfully used in electric power industry, and often termed an Independent System Operator or ISO for water distribution.

The connection between the doctrine of reasonable use and water markets is still under discussion, and has been so since Gray's seminal work in 1994. Despite the opinions that water markets, in terms of the price based incentives for conservation are entirely consistent with the reasonable use doctrine, many holders of water rights are yet to be convinced that selling some of their water does not put their reasonable use water rights at risk. It is now generally accepted that price signals induce more agricultural conservation actions than threats, or command and control policies, generally termed "best management practices". The conservation of urban uses of water shows opposite tendencies with the price effect on conservation being relatively slight given the inelastic demand for urban water, while the effect of public outreach campaigns designed to raise the consciousness of water conservation have been shown to be statistically significant methods to reduce urban water use by Renwick and Green (2000). Further reassurance on the security of reasonable use property rights in the face of transfers and market allocation can probably only be achieved through a series of test court cases, a long and arduous process.

The costs and complications of the environmental review of water transfers were characterized in the three cases discussed above. While long-term transfers are subject to review by the State Water Resources Control Board (SWRCB), short-term transfers of 1 year or less are exempt from review by the SWRCB. However, many transfers are not subject to review by the board, and thus not exempt from the EIR process which is often used to delay or disqualify short-term dry year transfers.

The key legislation that governs conditions under which water transfers can occur is the "no injury" rule that protects against damage from changes in place or purpose of use of surface water that is subject to regulation by the State Water Resources Control Board. The extent of injury covers all other water users and fish and wildlife associated with the water resource. One glaring omission is that since there is no state law governing groundwater use, the "no injury" rule cannot apply to groundwater, even when it is substituted for surface water to implement a trade. Another omission in the "no injury" rule is that it does not take account of the effects on both local economies and/or environmental amenities from fallowing land to generate tradable water, since this is not technically a change in place or use of water but merely an absence of using water. Even where there is a change in place or use of surface water injuries categorized under the "no injury" rule does not include third-party economic impacts on the local economy, unemployment or loss of tax revenues. This is not surprising as no public compensation system exists for this type of damage. All of these shortfalls mean that on a statewide basis the regulatory

basis for mitigating the effects of water transfers is largely absent. Given this gap in the legislation it's not surprising that local regions concerned about the impact of water transfers have enacted local ordinances which are often used as methods to block transfers rather than to mitigate any injuries. In Section 1745 the California water code calls for public review of transfers involving more than 20 % of local water supplies. While this is a reasonable rule of thumb to limit pecuniary third-party impacts, it does not guarantee that any mitigation payments will be made. Despite this absence of legislation, just about every long-term transfer and many short-term transfers are accompanied by payments to local economies designed to offset any deleterious impacts. In the initial 1991 Emergency Drought Water Bank, payments to Yolo County to compensate for increased unemployment and public support were negotiated between the County and the contractors purchasing Water bank water. The amount that was agreed upon was $65,000. However, due to technical problems of one state agency paying another, the actual payment was never implemented. Later conditional transfers from Imperial County and the Palo Verde Irrigation district have regional economic mitigation payments incorporated as part of the agreement.

There is no question that water transfers should be subject to environmental constraints, but the problem is that many of them are based on the California Environmental Quality Act (CEQA) which is subject to local regional interpretation. Again, social values should be taken into account when assessing the environmental impact of water transfers, however the analysis should be done using a consistent statewide set of principles, and in a way that allows preparation for a potential case for transfers before the dry year in question occurs. There are several state programs where statewide impact preparation manuals exist which local agencies are required to use to prepare the EIR for a subsidy or program. For example, applicants for public assistance for water quality control projects have to follow a uniform set of guidelines in preparation of the case for public funding. While the preparation of a transfer case should reflect local priorities, infrastructure, and water availability, the approach and criteria for granting water quality control financial assistance are uniform across different agencies and regions. This statewide template for a generic EIR for water transfers should be applicable to all types of water rights which are currently covered by local regulations. Prior analysis for the EIR should be done over a range of different hydrologic scenarios so that it is applicable to a wide range of dry year situations with different levels of dam capacity, river flows, previous droughts, and groundwater stocks.

5.7 Key EIR Topics

Essential topics to be covered by an EIR can be grouped under four headings. First the effect of transfers on surface water. The first effect would be that the transfers do not diminish the legitimate uses by other service water users. For example, the California rule that only consumptive use of water can be transferred prevents

most third party effects from surface runoff or deep percolation. One exception to this is if the transfer is achieved by fallowing in an area where the runoff goes in a different direction than the area being supplied surface water, then parties relying on the surface runoff would be deprived of some of the surface water supply. The effect of transfers on surface water quality must also be addressed, in particular with contaminants, timing, or river temperature. One case of the transfer of groundwater out of Yolo County to Kern County was denied because the quality of the groundwater had a higher salinity level than the Sacramento River into which it was discharged, and thus the use of the river to convey the transfers would have degraded the quality by increasing the aggregate salt load. The volume of stream flows is usually not a problem for most transfers which are made from upstream sources to downstream sources, and thus increase the flows in the river. This assumes that the timing and the quality of the flows are not degraded.

Second the effects on groundwater supplies. The set of impacts that could occur due to transfers on groundwater supplies are fully listed in the Butte County groundwater ordinance discussed above, and cover both quantity and quality aspects. The mitigation of adverse effects to groundwater should be required to regulate groundwater supplies on an equal basis with surface water supplies. However this raises an interesting question over the use of groundwater to supplement the surface water that was sold. This is essentially the core of the Butte County problem, since the farmers down-slope of the Cherokee Strip were using their groundwater supplies in a perfectly legal manner, even though they would not normally use them in the absence of water sales. There is no question that this additional pumping would have an effect on surrounding groundwater users, the problem is whether this effect can be categorized as damage due to water transfers if the additional groundwater pumping is within the normal safe yield criteria for the area from which water is being sold. A strict property rights interpretation of the law would conclude that while there was an impact due to transfers, it was not an injury outside current property rights to groundwater held by the farmers who decided to sell their surface water. In this case I would have to conclude that while it was a detrimental impact on other groundwater pumpers, it should not be classified as an injurious impact since the exporting farmers were exercising their groundwater rights in a responsible and balanced manner.

Third the effects of crop fallowing on the environment. The simplest mechanism to release transferable water from agricultural production is to fallow crops and sell the released consumptive water. Even when deep percolation and surface return flows are unchanged, the process of fallowing can have detrimental environmental impacts on the local fauna and Flora. One well-documented case is that of the giant garter snake discussed above. Other environmental impacts can result from changes in the riparian vegetation growing along the distribution canals and laterals. The degree to which farmers are responsible for these externalities is uncertain, as it is clear that in the normal course of farm income optimization, farmers have the right to switch crops and fallow without restriction. Again, like the problems associated with increased legal groundwater pumping, it seems that the current interpretation

of California law is that water transfers are not viewed as normal farm operations, but are in a special class in which any externalities resulting from have to be fully mitigated.

Fourth the effects of fallowing transfers on the local economy. The inclusion of mitigation payments to offset economic costs to local government and even associated local industries should be included as part of the generic EIR. While the theoretical economic efficiency argument for such transfer payments is very weak, political expediency and equity considerations push strongly for such payments as part of the process of implementing water transfers.

A statewide template for a generic EIR as outlined above will provide the basis for reassurance to exporters of water of economic and environmental controls on the extent of transfers and mitigation of any significant damage that occurs. Water importers will also benefit since the conditions and costs of making water transfers will be more transparent, and more importantly, predictable in advance. Once these criteria are established in a consistent statewide formula this generic EIR can be satisfied in advance, thus allowing the rapid response that is necessary in order to implement a dry year spot water market under California hydrologic conditions.

5.8 Managing Water Distribution

At the start of this chapter we noted the extensive water transfer grid that links many water supplies and users in California. What was also obvious from Fig. 5.1 was the wide range of federal, state, and local agencies that had developed different parts of this network system and control its access, pricing, and maintenance. The classic approach to traditional water development in California has been one of vertical integration in the full supply chain. Ownership or control is normally established for the storage source, the canal or river linkages, and the end use by local water agencies. The older water districts on the East side of the San Joaquin Valley and parts of the Sacramento Valley have supplies based on local river systems and dams or on old established pre-1914 riparian water rights. This model of vertical development usually has the cost of storage, transfer, and distribution in a single charge based on cost recovery for the entire system. The structure was very successful in developing the current network of individual systems. The normal way to refer to a particular system including the dam, supply canal and distribution is to categorize it as state, federal or local. The state and federal systems were developed later in the previous century and are based on inter-basin transfers through large long-distance canal systems and pumping plants. Despite the federal and state basis of financing the systems, access to the systems by non state or federal contractors is jealously guarded. In recent years there has been a coordinated operating agreement in effect between the State Water Project and the federal Central Valley project. This agreement has significantly improved the efficiency of the system, particularly with respect to the operation of the shared Sacramento San Joaquin Delta and the San Luis dam. It could be regarded as a

preliminary test of the advantages that an Independent System Operator (ISO) like structure could bring to the entire water distribution system. A shift to water markets can be envisaged as move from vertically integrated supply and delivery systems to horizontally integrated networks that enable the efficient reallocation between sectors and locations. A necessary condition for market transactions is to lower the transaction costs of water movement. I propose that an ISO structure that manages water transfers can achieve the same efficiency savings in water that have been demonstrated in the energy sector. A Water-ISO would likely be opposed by some interests, but if implemented in politically acceptable stages, it would open potential markets for water that are currently hamstrung by the lack of predictable access to water transfers.

In proposing an alternative system in which the ability to implement water transfers and sales without the standard thicket of regulations or exorbitant charges designed to discourage trade, is based on an institution developed in the electric power industry called an Independent System Operator (ISO). With the partial deregulation of electrical energy it became clear that the distribution grid can be operated more effectively if there is equal access to all parts of the grid by those wishing to move power across it. The ISO structure is based on the principle of horizontal integration rather than vertical integration. It has several key and critical characteristics. First, it does not own any of the facilities but does have the control of flows and operations conveying them. Second, the ISO is a public agency, but run on a nonprofit basis by a staff that are not civil servants and thus subject to both the benefits and costs of private market employment. The governing board of the ISO is appointed on a rotating basis by the governors in states in which it has jurisdiction. While an ideal system would be designed to be fully integrated, the shifts in ownership and control needed to do this are unrealistic in the California water sector. The advantage of the ISO institution is that it is designed to be grafted on top of existing institutions without changing the fundamental ownership structure. This design characteristic is a significant advantage from both the political and operational perspective. In addition, an ISO is not beholden of any one water wholesaler or environmental interest, and this increases the likelihood of an impartial allocation of an increasingly scarce resource between competing interests. A clear motivation and operating method for the electric power ISO system is that it uses market prices to provide an incentive for effective supply management of this network commodity. CAISO (2013).

The ISO system was installed to operate in an electrical market in which generation, transmission, and retailing of power were separated into horizontal layers of function rather than the previously vertically integrated utility-based system. It is clear to us that the water sector in California has very similar efficiency gains to be obtained by a shift from vertically integrated utilities to horizontally integrated functions. In the water industry the horizontal integration should be by storage, transmission and wheeling, and wholesaling through irrigation and water districts. Integration of the transmission system would greatly facilitate the ability to move water between regions of different scarcity. Under the ISO implementing legislation individual retail water districts would lose their exclusive franchise on the

operation, but not the ownership, of certain canals and sources of water. Districts and agencies would also be liable for transfer charges on their own system, and might feel that the charges in the ISO market exceeded the current value of the water to them. However, since the water districts retained ownership of these canals and dams, they would be compensated by a gain in revenue from ISO operations, and thus could lower their retail rates from the higher charges rebated by the ISO for their share of the distribution network.

A Water-ISO, like the current electricity ISO, would be a nonprofit public benefit corporation with an independent board appointed by the governor and similar mechanisms to ensure stakeholders have input into the operation. It is important to stress that the Water-ISO would not own any canals, conveyance, or dam facilities. It would be important however that the ISO control sufficient proportion of the water market to form stable prices. Fortunately, the two major arterial water conveyances from north to south of the state are owned by the State Water Project and the federal Central Valley Project. If these two systems were exclusively operated by the Water-ISO, the majority of north-south water movement and East-west water movement in the San Joaquin Valley will be facilitated by a Water-ISO. Independent water districts and systems on the East side of the San Joaquin Valley and in the Sacramento Valley would have to use the Water-ISO for any trades outside their immediate district, and hopefully would see the benefits of combining with the larger system. Since they are still the full owners of dams and canals, the state and federal contractors will be responsible for the maintenance development and investment in the facilities. If the same efficiency gains from combined operation that have been realized in the electricity sector emerge from a Water-ISO, the additional revenues would justify further investment and development of the existing agency systems.

Ideally, the Water-ISO would be established with sufficient scale to form an effective market by requiring that all water conveyed through the federal and state systems is subject to operational control by the ISO. If the political will to do this is lacking, a phased in system could also act as a test of the ISO concept. A phased-in system would have two components, one would be an extension of the existing coordinated operating agreement between the state and federal systems to ensure consistency and some efficiency gains in the operation of the combined system. Current state and federal contractors would have priority and compose the majority of the water moved in the combined system, but excess capacity would be quickly identified and made available for those trades which can be agreed on between private or agency parties. Rather than directly make a market with different types of water contract over different periods of time, the phased-in Water-ISO would act as an efficient conveyor, and a market facilitator between independent parties. Under this phased-in system efficiency gains will be more muted, but the market value of water would be more transparent, and the ability to move it would be faster and more efficient than the current system.

There have been increased restrictions on moving water through the Sacramento San Joaquin Delta which were further enforced in 2009. These restrictions are in response to several suits under the Endangered Species Act in which fish species

such as the Delta Smelt and winter run Salmon, which are listed species, could be harmed by excessive exports of water from the Delta. These seasonal restrictions, which also depend on the severity of the water year, significantly reduce the normal contracted exports from the Delta under the federal and state water systems. For example, districts with the most junior rights in the federal system had their allocations for 2012 cut to 40 %, and 2013 which is another dry year, resulted in an additional cut to 20 % of the contracted quantity. There is no question that the endangered species fish populations are at an extremely low levels, and that under the Endangered Species Act actions have to be taken. One problem is that the hierarchal nature of water rights, and the unwillingness of agricultural contractors in the San Joaquin Valley to trade with each other, exacerbate the problem and concentrate cutbacks in areas with the most junior rights, which paradoxically, are those with high production and high water use efficiency. These restrictions on contracted exports from the Delta make the opportunity to use the Delta facilities for water trades increasingly difficult and reduce the ability to move water and have water trades from the lower water value part of the state in the Sacramento Valley to the high water value parts in the southern San Joaquin Valley or the Los Angeles basin.

One recent development that is spurred by this cutback is a reassessment of the value of water trades by agricultural and other contractors. Water trades are now being seen as a required part of the adjustment process. As of writing in 2013, some typical responses have been as follows. “With a long-term average water supply of about 45 % for agricultural service contractors, there will always be a need for supplemental water supplies to meet demands,” said Frances Mizuno of the San Luis-Delta Mendota Water Authority. She continued, saying that “Groundwater pumping and water transfers are the primary sources of supplemental supplies. We need to have in place long-term, programmatic environmental documents that include a cumulative effects analysis for water transfers.”

The 2013 water crisis has resulted in an encouraging response from the California Governor. In May 2013, Governor Brown issued an executive order to streamline approvals for voluntary water transfers. The order directs the state Water Resources Control Board and Department of Water Resources to expedite review and processing of voluntary water transfers and water rights, consistent with current law. The State Water Resources Control Board currently has water transfer petitions totaling about 260,000 acre-feet, with 194,000 acre-feet included in petitions to transfer water between state and federal water projects. George Kostyrko, a State Board spokesman said that in normal years, the water board expects to process three or four water transfer petitions. In drought years, or when there is an executive order, the number of petitions processed increases to 15 on average and can go as high as 30. The water board currently lists 11 pending petitions to transfer water to entities south of the delta. “In terms of time, it depends on the type of transfer,” Kostyrko said, reaffirming that. “It depends on the circumstances of the transfer and whether or not there are protests or comments. The Division of Water Rights has made the processing of a transfer petition its highest priority over other water-right permitting activities.”

California Farm Bureau Federation reported that their President Paul Wenger thanked Governor Brown for recognizing the need to streamline California water transfer rules. “In a year like this, voluntary transfers of water from areas that have a surplus give our system more flexibility so that farmers facing water supply cutbacks, especially those with permanent crops, may find alternative sources,” Wenger said.

5.9 Conclusion

While these very recent statements are encouraging for the reemergence of California water market from its current position of stasis and decline in short-term spot water market trades, many problems still remain. The lack of criteria for groundwater and its connection to surface water transfer remains a major problem, as does the fragmentation of environmental regulation of groundwater use in areas with several types of surface water rights, which in turn, leads to local ordinances that are often used to prevent water trades. The organization of the water wheeling network between federal state and many local agencies is also a major impediment to actually moving traded water, once the terms have been agreed. Adding to this is the current impasse over environmental standards in the Sacramento San Joaquin Delta. This chapter has suggested two principle institutional corrections for these problems. First a statewide adoption of standards and environmental criteria to pre-approve trades that can be rapidly implemented in drought periods. It is encouraging to see that water contractor’s organizations are calling for this innovation. The second suggestion is more radical and involves significant reorganization and shift in power over the ability to wheel transferred water between places of diversion and use. The second innovation, namely, the concept of establishing a Water-ISO will take longer than a generic environmental impact report, but should greatly facilitate trades if it occurs. There is no doubt that California water markets have not fully emerged from an initially promising start, however the pressures of water scarcity and the wide discrepancies in its value of use between different locations in uses will stimulate change. We envisage that some version of the market reforms suggested here will evolve in the future, and recent statements by water leaders are encouraging along these lines.

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