Engaging Irrigation Organizations in Water Reallocation

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Abstract:

Rising water scarcity in the Western U.S. cannot be well addressed without strong reallocation of agriculturally assigned water rights. Irrigation organizations of the West are necessary participants in this process. The special conditions and problems of improving the reallocative activities of these agencies are examined. Historical background and challenges are reviewed. Policy options are compiled and discussed.

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When urban and environmental water demand groups cannot bargain with irrigators for mutually beneficial water reallocations, all of these parties are denied potential welfare-improving opportunities. This is the situation established by the policies placed upon or pursued within many irrigation organizations. User-to-user bargaining is commonly inoperative in cases where irrigation organizations (IOs), not member farmers, own or restrict agricultural water rights.[1] In the absence of user-to-user bargaining, efficiency in water use is difficult to achieve via alternative policies. Calls for institutional change to improve these conditions have been present for some time,[2] and the driving resource pressures are not subsiding.

The advance of both water and energy scarcities continually lifts the severity of this issue. Not only should modern policy activate an efficient suite of water conservation measures, but the status of agriculture as an energy user, food supplier, and bioenergy supplier asks that irrigators be exposed to a full slate of accurate incentives. Shielding irrigators from water's true value risks skewing cropping selections and production practices in an era where food prices promise to rise in response to climate change and energy costs.[3] Cost-effective production of the right foodstuffs is a matter of rising consequences as is the establishment of efficient energy and water use practices.[4]

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[1] User-to-user bargaining is arguably broken on the urban utility side as well, in that urban authorities contract for water acquisitions on behalf of their customers. Yet, households and most other urban clients use relatively small amounts of water, both in absolute terms and relative to the overall use within the utility, and they are not interested in conducting water right negotiations on their own behalf. Signaling urban clients about the value of water is a comparative advantage for nonmarket policies, especially for the manner in which utilities can factor water value into the rates charged to clients. There is a well developed economic literature indicating that, in lieu of household activity in water markets, efficiency in urban use is achievable by scarcity-inclusive water rates and new connection fees incorporating water right values. See Ronald C. Griffin, *Effective Water Pricing*, 37 JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION 1335-47 (October 2001) and William E. Martin, Helen M. Ingram, Nancy K. Laney, & Adrian H. Griffin, SAVING WATER IN A DESERT CITY Chapter 4 (1984) Resources for the Future. These rate modernization concepts are extendable to irrigation organizations.

[2] Micha Gisser & Ronald N. Johnston. *Institutional Restrictions on the Transfer of Water Rights and the Survival of an Agency*, in WATER RIGHTS: SCARCE RESOURCE ALLOCATION, BUREAUCRACY, AND THE ENVIRONMENT 137-65 (Terry L. Anderson ed.,1983); Rodney T. Smith, *The Economic Determinants and Consequences of Private and Public Ownership of Local Irrigation Facilities*, in WATER RIGHTS: SCARCE RESOURCE ALLOCATION, BUREAUCRACY, AND THE ENVIRONMENT 167-217 (Terry L. Anderson ed., 1983). National Research Council, WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT96-98 (1992).

[3] Gerald C. Nelson, et al., CLIMATE CHANGE: IMPACT ON AGRICULTURE AND COSTS OF ADAPTATION (2009) International Food Policy Research Institute.

[4] Robert H. Abrams & Noah D. Hall, *Framing Water Policy in a Carbon Affected and Carbon Constrained Environment*, 50 NATURAL RESOURCES JOURNAL 3-70 (Winter 2010).

To examine this issue and assess prospects for change, in the coming sections we consider the path to the present conditions, the existing rules bearing upon IO water transfers, the pros and cons of obstructing water trade for IOs, and the available remedial policies for establishing value-signaling contact with the actual irrigators.

The Breadth of Irrigation Organizations

For nonmembers of IOs such as cities and environmental agencies or advocates, one and sometimes two layers of administration impinge on opportunities to contract with irrigators receiving water via shared delivery systems. The first layer is epitomized by the U.S. Bureau of Reclamation (USBR), which is often the legal owner of the agricultural water rights it manages and delivers to irrigation districts. Other regional agencies (e.g. California State Water Project) may serve a similar role in which the agency resembles a wholesaler – typically providing water to retailer IOs. Even though the USBR owns much of the irrigation water it handles, there are many situations where USBR-sponsored irrigation development did not result in federal water right ownership, providing clear evidence of the potential to separate authority for facility operations from water right ownership (e.g. Northern Colorado Water Conservancy District, Truckee-Carson Irrigation District, and nearly all Texas irrigation organizations). Promisingly, districts that complete their repayment obligations to the USBR may subsequently gain ownership of the associated water rights.

The second layer of administrative restraints occurs at the retail level, where local boards and organization managers oversee the collectively managed facilities conveying water to farm gates. Direct ownership of rights by many IOs takes additional water off the table of that transactable by irrigators. It is commonly argued that the IO's power to prevent or limit such transactions is justified by the economies of cooperation and the externalities, such as internally utilized return flows, that link the collective's irrigators.[5] It is sometimes further argued that these externalities extend to the support of local agri-economies. The weight of these considerations warrants reexamination in light of the rising burdens of protectionist policies.

Unfortunately, satisfactory documentation of the evolving role of IOs was derailed after 1978 when the Census of Irrigation Organizations was terminated as part of the regular

[5] Kathleen A. Miller, *The Right to Use Versus the Right to Sell: Spillover Effects and Constraints on the Water Rights of Irrigation Organization Members*, 23 WATER RESOURCES RESEARCH 2166-73 (December 1987).

Census of Agriculture.[6] Whereas the reallocative potential of IOs captured significant academic attention during the 1980's surge of water marketing studies, interest seems to have gone underground, perhaps due in part to deficient statistical information regarding the overall command of water by IOs. Through 1978, the IO Census had been conducted every decade commencing in 1910.[7] Among other contributions, the IO census identified standardized IO types and reported water deliveries and land service acreages according to these types. The Census taxonomy included nine classes of IOs (1982, pp. 135-6):

1. Unincorporated mutual – private "partnership or informal group of two or more farmers"
2. Incorporated mutual – private "legally constituted, cooperative-type corporation"
3. District – public entity with taxation and condemnation powers
4. USBR constructed and operated
5. USBR constructed and user operated (and hence also an IO belonging to another grouping)
6. Bureau of Indian Affairs operated – primarily on reservations
7. State and local governments – distinguished from districts in that districts are water-focused organizations
8. Commercial – not user controlled and usually profit motivated; irrigation water service may be incidental to activities such as electricity supply or municipal water supply
9. Other

Proclivities to transfer water vary across these IO types, but the taxonomy is not fully indicative of willingness to transfer. It is well acknowledged that mutuals have been more receptive of water transfers, by building upon unique traditions in which internal transfers among shareholders were often permitted, especially via ownership shares in the mutual.[8] The two USBR types are distinguished on the basis of facility ownership rather than water ownership, so it is not strictly accurate to say that one of these two classes offers a more conducive platform for conducting water transfers. Still, user-owned facilities are correlated with user-owned water rights. IOs in the commercial category might be regarded as more

[6] U.S. Department of Agriculture, *Economic Research Service, Agricultural Resources and Environmental Indicators, 1994*, in AGRICULTURAL HANDBOOK 705 (1994) .
[7] U.S. Department of Commerce, Bureau of the Census, *1978 Census of Agriculture*, IRRIGATION, U.S. Government Printing Office, 4 (1982), at 134.
[8] Rodney T. Smith, *Water Transfers, Irrigation Districts, and the Compensation Problem,* 8 JOURNAL OF POLICY ANALYSIS AND MANAGEMENT 446-65 (1989).

amenable to water transfers, yet they are few in number and their water supply activities are sometimes secondary to other functions.

Using reassembled IO Census data, Table 1 provides a snapshot of the relative roles of different IO types as of the last survey. Of the 7375 IOs reported to be operating in the U.S. in 1978, 97.5% (7190) were in the 17-state western U.S., and 169 of the 185 nonwestern IOs operated in Louisiana.[9] The number of IOs peaked in the 1950 census with 10,170 in the western U.S. The post-1950 decline was dominated by falls in the two mutual categories, which aggregatively decreased from 9297 to 5988 from 1950 to 1978. However, the 1950-1978 growth in irrigated acreage under mutuals suggests that small mutuals were closing/combining during this period and much of the changes were reorganizational.[10]

Total irrigated acreage served by IOs increased from 14.7 million acres in 1950 to 21.3 million acres in 1978. This was nearly one-half of the western U.S.'s total irrigated acreage (43.6 million acres) with the remainder being self-supplied, largely using ground water. The data of Table 1 suggest that much of the 1950-to-1978 increase was the result of USBR projects coming online, as USBR-sponsored acreage increased by more than 4.3 million acres during this period. USBR acreage rose to over 30% of that served by IOs in 1978, while involving 50% of the water (Table 1).

Of the 167 million acre feet of water noted in Table 1, less than 2% was directly withdrawn from a ground water source by the reporting organization. 67% was directly withdrawn from a surface water source, and 29% was provided by another IO (pp. 139, 152). Setting aside USBR water so as to focus on retail water deliveries, districts handle more water and serve more acreage than any other IO type. Districts deliver more than one-third of the water and serve more than half of the acreage covered by western IOs. In light of their heightened flexibility and potential advantage for transferring water, it is noteworthy that mutuals of both forms handle a large portion of the West's water. Recognizing that some of these data may have changed substantially during the past 30+ years, due to the elevated malleability of mutuals (as evidenced by 1950-to-1978 trends), it is still noteworthy that mutuals served more than nine million irrigated acres in 1978 and delivered more than 40

[9] U.S. Department of Commerce, *supra* note 7, at 146.
[10] U.S. Department of Commerce, *supra* note 7, at 139.

Table 1. Irrigation Organizations of the Western 17 States

	1978			1950	
IO Type	**Number**	**Irrigated Acres** (1000)	**Acre-feet** (1000)	**Number**	**Irrigated Acres** (1000)
Unincorporated Mutual	3,557	2,031	6,669	6,417	2,114
Incorporated Mutual[1]	2,431	6,979	33,424	2,880	5,636
District[1]	831	10,770	58,385	483	4,962
USBR	86	251	48,699	37	682
USBR/User[2]	307	6,315	35,211	79	1,540
BIA	139	662	3,742	141	506
Commercial	55	220	6,068	131	705
Government	74	253	1,210	81	109
Other	17	202	9,150	0	0
All	7,190	21,340	167,152	10,170	14,714

Source: Tables 1-3 of the *1978 Census of Irrigation Organizations*, U.S. Dept. of Commerce, 1982.

Footnotes

[1]Irrigated acreage and water use for Incorporated Mutuals and Districts may be slightly overstated due to nondisclosure constraints for Louisiana which was previously subtracted to obtain Western-only data.

[2]All data reported in the USBR-built/User-operated category is redundant with data also incorporated for the seven nonUSBR IOs. The sole purpose of this category is to more completely represent the extent of USBR involvement in Western irrigation activity.

million acre-feet of water. Even though the role of mutuals may have moderated during recent decades, these data suggest that mutuals continue to be important forces.

Water Marketing Absent Irrigation Organizations

Population increases have been the primary driving factor for water policy reform in the West and Southeast, but climate change is now a noteworthy force through its several impacts on water supply (e.g. precipitation quantity and reliability, snowpack quantity and melt timing, flood risk effects on reservoir management operations)[11] as well as its evolving influence on energy policy. During recent decades, much has been said about the poor prospects for supplyside solutions via additional water development, due to economic costs, environmental harms, and the physical scarcity of unappropriated water. In response, legal doctrines have been slowly evolving to facilitate the transferability of water rights and thereby mitigate scarcity in advantageous ways, especially in the more arid Western states where a legal platform for trading is already established with the severance of surface water rights from land. Calls for reduced restrictions upon water marketing[12] have been answered throughout the West,[13] and further reforms appear likely. Some of these policy revisions have been complex developments,[14] yet rising scarcity has justified the advances.

A key attribute of the marketing policy instrument is its reliance on voluntary action, thereby elevating chances that results are actually win-win and achievable at low cost. Moreover, the decentralized fashion in which these trades are resolved allows participants to accommodate the particularized attributes of their water demands. Because water's use value varies substantially across agents, even within sectoral classifications, attention to individual conditions is an underappreciated achievement that contributes to social welfare and the efficiency of water use.

Another advantage of water marketing is that it provides an avenue for environmental demands to be better met in spite of the historical underallocation of water rights to *in situ*

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[11] Kathleen Miller & David Yates, CLIMATE CHANGE AND WATER RESOURCES: A PRIMER FOR MUNICIPAL WATER PROVIDERS (2005) AWWA Research Foundation.
[12] J.W. Milliman, *Water Law and Private Decision-Making: A Critique*, 2 THE JOURNAL OF LAW AND ECONOMICS 41-63 (October 1959). Terry L. Anderson, WATER CRISIS: ENDING THE POLICY DROUGHT (1983) The Johns Hopkins University Press.
[13] Gerald Johns, *Where is California Taking Water Transfers?* 129 JOURNAL OF WATER RESOURCES PLANNING AND MANAGEMENT 1-3 (January/February 2003). Thomas C. Brown, *Trends in Water Market Activity and Price in the Western United States*, 42 WATER RESOURCES RESEARCH (2006).
[14] Itay Fischhendler & David Zilberman, *Packaging policies to reform the water sector: The case of the Central Valley Project Improvement Act,* 41 WATER RESOURCES RESEARCH 10.1029/2004WR003786 (2005).

purposes. That is, because of the strong historical tendency to grant rights only to appropriators, the environment tended to become a residual claimant of water rights, possessing only what was left over.[15] While one may protest the fairness of environmental purchases in terms of who is paying and why sufficient protections of environmental water were not built in many decades ago, at least transferability provides a tool for stewardship agencies and environmental groups to rededicate water to the environment, especially during stressed periods which give rise to low flows and high water temperatures, both of which can be perilous for native species. A Californian inventory indicates that environmental water leases in that state has grown to exceed the volume of transacted water to any other sector[16] with the U.S. Fish and Wildlife Service being the major procurer.

Important local and regional water markets now exist in much of the West. Joining the water markets of the western U.S., policy changes have introduced original water markets to other nations.[17] Within the U.S., varied institutional settings have established unique variations of empowerment for water property owners, sometimes forging idiosyncratic marketplaces and site-specific nomenclatures. Differing marketing constraints and administrative approval processes modify the feasibility and conduct of trade and, consequently, the transaction costs of trade. Varying by locale, transfers may occur in different forms, including transactions in permanent rights, temporary leases of rights, and sometimes mere transactions in water access rights. Such is the nature of decentralization. Some markets remain constrained in that leases are permitted but not sales.

Across all of these developments, the increased scarcity of water has fostered policy evolution. Yet, IOs are lagging participants in this process. Consequently, the proportion of western irrigation rights held by IOs must be rising, as are the pressures of scarcity upon these organizations. IOs bring new challenges which have been incompletely addressed by the promarketing reforms of recent decades.

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[15] Bonnie G. Colby, *Enhancing Instream Flow Benefits in an Era of Water Marketing*, 26 WATER RESOURCES RESEARCH 1113-20 (June 1990). Ronald C. Griffin & Shih-Hsun Hsu, *The Potential for Water Market Efficiency When Instream Flows Have Value,* 75 AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS 292-303 (May 1993).

[16] Ellen Hanak, WHO SHOULD BE ALLOWED TO SELL WATER IN CALIFORNIA?: THIRD-PARTY ISSUES AND THE WATER MARKET (2003)Public Policy Institute of California.

[17] K. William Easter, Mark W. Rosegrant & Ariel Dinar, MARKETS FOR WATER: POTENTIAL AND PERFORMANCE (1998) Kluwer Academic Publishers. Lin Crase, ed. WATER POLICY IN AUSTRALIA: THE IMPACT OF CHANGE AND UNCERTAINTY (2008) Resources for the Future. Carl J. Bauer, *Results of Chilean Water Markets* 40 WATER RESOURCES RESEARCH (2004).

Water Reallocation in the Presence of IOs

The propensities and abilities of individual IOs to respond to increasing water demand in nonagricultural sectors depend on several factors. First among these is whether growth-inspired water demand is occurring interior to the legal boundaries of the IO. Second is whether the IO's water rights, if it possesses any, are the transactable property of members of the organization. Prospects for reallocation are improved when reallocation is internal to the IO and/or members own water rights. For external reallocation in cases where neither the IO nor its members hold the pertinent water rights, as in the case of many IOs receiving contract water from the USBR, reallocation is rendered even more difficult.

Internal Transfers

Two lubricating influences assist reallocation in instances of internal reallocation, rendering these situations unique – less problematic in most ways, yet more so in others. First, where urbanization is converting irrigated lands to new activities, IOs are less irrigation-centric about the water under their control. District managers are known to facilitate water availability in these cases, in the interest of community development, organization preservation, and job security.[18] Second, the legal barriers to internal reallocation are often simplified. IO-enabling statutes commonly cite local economic development objectives, thereby reducing the possibility of legal challenges when water supplies are extended to nonagricultural sectors.

Still, problems can arise when IOs favor internal reallocation. Among these are the following matters:

- Satisfaction of urban, domestic, commercial water demands can be achieved via internal reallocation, yet environmental water demands tend to remain shut out because of the immobile and normally external location of these demands. Consequently, environmental sponsors may be forced to compete in smaller and more expensive water markets.
- When IOs exhibit biases favoring internal over external reallocation, they tilt the land development playing field by encouraging the conversion of internal irrigated properties. An outcome can be the urbanization of more productive irrigated lands

[18] Gisser, *supra* note 2.

(internal) rather than external dry land. In addition, fragmentation of irrigated lands within the IO's service area can result, reducing the hydrologic and economic efficiencies of surface water deliveries via canals. Per-acre conveyance losses and canal maintenance costs are lower when irrigated areas remain contiguous and compact. Other farm costs, such as weed and insect control, benefit too.

- Sustained reallocation of both land and water away from agriculture within a given IO sometimes produces tensions between the IO and the local domestic/urban water supplier(s). Alternatively, the IO can morph into a new role by expanding the amount of water processing (e.g. treatment and piped conveyance) it performs for the growing domestic/urban segment of its clients. New roles require continual reformulation of IO policies. For example, morphing organizations typically apply an array of water rates (for different sectors), and it is not uncommon for such rate systems to take on complex designs while arguably embedding subsidies for a favored sector.

External Transfers

IO leadership teams are less receptive to external reallocations, and it is for this reason that external situations are emphasized in the forthcoming sections. IO administrators, managers, and boards of directors tend to see threats rather than opportunities in external reallocations. Thus, when they have authority over transfer policy, they express reservations, underscore legal issues and other difficulties, and suppress institutional change. For the most part, the problems emphasized by these leaders are real issues, justifying our attentions, even where they may be overstated.

Prospects for external reallocation must often address the combined challenges of organization-held water rights and linked rural economies, both of which stall reallocation even when reallocation may be desirable to end water users – at both ends. There are multiple, reinforcing marketing hurdles in these situations.

A first hurdle occurs when the water-using clients of an IO hold water rights collectively, not individually, giving rise to an original type of common property issue. For typical district-like IOs, water right ownership is said to be "diffused" in that a organization's water rights are jointly owned by all clients of the IO, and some measure of ownership may extend, implicitly or even explicitly, to other local interests such as agribusinesses and the

general community.[19] Even where legal prohibitions on trade are absent, there is a strong reluctance on the part of district boards and managers to approve of out-of-district transfers.[20] Where their concerns are arguably well founded,[21] it may be possible to design contract modifications involving compensation or mitigation of local effects.[22]

Second, in the case of external transfers any reapportionment of irrigation water takes on attributes of an "area of origin" with the additional concerns that accompany this matter.[23] Here, local water "nonusers" contend that continued irrigation to its fullest extent is desirable to support the agriculturally linked interests of a region. IO leaders tend to be supportive of this position when external transfers are proposed, just as these leaders repeat any argument favoring the status quo retention of water rights.

This "district of origin" problem constitutes a mere pecuniary externality, and therefore it is not a bona fide market failure (implying that economic efficiency is not upset). Yet, there is a normative disruption in the axioms of economics that muddies considerations of area-of-origin protections. It is observable that policies protecting areas of origin foul just one of the two available visions of economic efficiency.[24] Given the political sensitivities that arise when water policy portends an economic activity decline for agriculturally dependent locales, it may be crucial to prepare contingencies to address and possibly assuage objections along these lines. Whereas economic theory can be reasoned to be dismissive of pecuniary externalities because such externalities are artifacts of markets performing social good rather

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[19] Brent M. Haddad, RIVERS OF GOLD: DESIGNING MARKETS TO ALLOCATE WATER IN CALIFORNIA (2000) Island Press.
[20] Susanna Eden, Robert Glennon, Alan Ker, Gary Libecap, Sharon Megdal & Taylor Shipman, *Agricultural Water to Municipal Use: The Legal and Institutional Context for Voluntary Transactions in Arizona*, 58 THE WATER REPORT 9-20 (December 2008).
[21] Miller, *supra* note 5.
[22] Gisser & Johnston, *supra* note 2. Smith, *supra* note 2. Eden, *supra* note 20.
[23] Ronald C. Griffin, WATER RESOURCE ECONOMICS: THE ANALYSIS OF SCARCITY, POLICIES, AND PROJECTS (2006) The MIT Press. National Research Council, *supra* note 2.
[24] Under the two available efficiency objectives promulgated by economic doctrines, Pareto optimality and net benefits maximization, protecting areas of origin is admissible under the Pareto criterion, but not the stronger criterion. Net benefits maximization does not respect negative secondary economic effects in areas of origin because of the offsetting positive secondary economic effects to be experienced in the area of water receipt. As a strictly aggregative measure, total net benefits does not weigh any one sector (e.g. agribusiness) more highly than others, so status quo protections for existing beneficiaries are not supported. On the other hand, because of the variable fairness perspectives accommodated by Pareto optimality, it is "neutral" in deciding whether areas of origin merit special protections that might restrict water export. See chapters 2 and 7 of Griffin, *Id*. Thus, many, indeed infinitely many, efficient states of the economy can be envisioned according to Pareto optimality, and the Pareto criterion is indifferent across these. Among Pareto optimal states of the economy are states where irrigation-linked businesses and their local economies enjoy a protected status. Thus, prohibitions of water export from districts of origin cannot be criticized on Pareto grounds even though such restrictions inhibit the total value that a basin gains from its natural water supply. Viewed another way, the Pareto criterion is somewhat anemic in its ability to compare with- and without-policy scenarios, whereas net benefits maximization is a sharper and more insistent objective. Still, the choice between the two efficiency criteria is normative.

than bad, political sensitivities tend to be different.[25] For all of these reasons, it is sound practice to distinguish pecuniary and technological externalities when observing the "third party effects" of water transactions.

Due to the elevated difficulties of the external reallocation problem setting, institutional change may be a required precursor for effective reallocation via water markets, and it is feasible that such change will have to be innovative and even dramatic. Yet, if new approaches are not well conceived, it is possible that the costs of change will overwhelm the prospective gains.

Overall, the stakes are high in that it may be practical to achieve a lot of public good if pressures upon the West's water resource base can be released through improved participation in reallocation by IOs.

A Premarketing Design Meets a New Era

U.S. irrigation organizations were created because infrastructure to deliver water to farmland was in demand, economically and politically. The early irrigation organizations of the 1800s were privately organized cooperatives, often in support of land development schemes. During the latter 1800s, many western states applied novel legislation to initiate and support the formation of public IOs with powers usually reserved for local governments.[26] Further encouragement came with the powerful U.S. Reclamation Act of 1902 which provided technical assistance and substantial subsidies for establishing irrigation infrastructure. Currently, most U.S. irrigation organizations are at least several decades old. They were established when naturally occurring water was too plentiful to have marginal value[27] in its found location. Natural water was typically free for this reason; permits were granted almost for the trouble of applying for them. Permit approval hinged on beneficial use requirements, which meant that users had to install infrastructure to activate and secure their permit quantities. Therefore, infrastructural capacity can be said to bound wet-water permit quantities from above, but infrastructure meant costs; naturally occurring water did not

[25] Randall G. Holcombe & Russell S. Sobel, *Public Policy Toward Pecuniary Externalities*, 29 PUBLIC FINANCE REVIEW 304-25 (July 2001).
[26] Orson Winso Israelsen, *A Discussion of the Irrigation District Movement,* M.S. Thesis, University of California, 1914. Katharine Coman, *Some Unsettled Problems of Irrigation*, 1 AMERICAN ECONOMIC REVIEW 1-19 (1911).
[27] Marginal value, the value of an additional unit at current use levels, is a key point of emphasis for examining the prospective efficiency of alternative policy and for maximizing the net benefits, inclusive of all water uses, that a society obtains from its water endowments.

involve costs. Even in contemporary contractual relations between IOs and agency water wholesalers such as the U.S. Bureau of Reclamation and the California State Water Project, IOs are only responsible for processing costs,[28] experiencing no costs representing the embedded value of natural water. Under these circumstances, many irrigators do not receive a sufficient economic signal in the form of a rate or a market price (offered or billed) that would motivate production activities that are fully respectful of resource values. Rates are founded on infrastructure and operational costs, not water value.

What was strongly valued at the time of each IO's creation was the ability to deliver water to arable lands. What was scarce was infrastructure, which is a form of capital. Most IOs were designed as nonprofit ventures to sponsor construction of this capital, primarily pumping plants and canals and often storage impoundments. IOs such as mutuals and commercial entities had to arrange their own financing, often relying on strictly internal energies or funds. Legislatures granted many IOs the power to issue bonds, and they took on the indebtedness and other duties necessary to get this capital in place. These organizations – at least the ones that survived – developed into effective agencies for managing this capital and collecting money from members and property owners to defray repayment and operation and maintenance costs. Whereas both inputs, natural water and infrastructure, are formally essential[29] in the production of irrigation water, IOs were designed to tackle the infrastructural challenges, given the ready availability of natural water at the time of their birth and for many years thereafter.

One hundred years after the Reclamation Act, the relative scarcities of capital and water have changed. The water marketing evidence is widespread, not only in private transactions but occasionally in deals involving irrigation organizations. In the rare jurisdictions where whole IOs can be bought and sold, they are sometimes purchased for their water right holdings, with the value of their capital taking an obvious backseat.[30] In places where

[28] Processing costs are primarily operation and maintenance costs, but some repayment and debt costs associated with infrastructure may also be included. Forgiveness of interest costs has historically been the prime source of subsidy in Reclamation policy whereas the California program assigned its interest costs to contracting water districts. See Richard W. Wahl, *MARKETS FOR FEDERAL WATER: SUBSIDIES, PROPERTY RIGHTS, AND THE BUREAU OF RECLAMATION* (1989) Resources for the Future.

[29] Formally, an essential input is one for which a zero level of employment implies a zero level of output.

[30] Texas is the lead example for these possibilities. Most notably, the Lower Colorado River Authority (a large quasipublic electricity and water supplier in Texas) has actively expanded its water sales capacity by purchasing irrigation companies. These include multiple purchases over several decades, and IOs serving tens of thousands of irrigated acres. To date the Authority has continued to serve this acreage, but rising rates and a new regime of providing irrigation water on an "interruptible" basis has resulted in greater security for urban water supply activities. See Ronald C. Griffin, *Texas Water*

urbanization is eliminating the traditional tasks of IOs, IOs are attempting to transform into new rolls, but conflicts between the IO and urban government can arise, leaving people to wonder why the IO has not been retired.[31] In places where IOs allow transfers between nonagricultural entities and irrigators owning entitlement shares, the nonagricultural buyers are most interested in obtaining the water (though they also receive storage and delivery services in cases where the buyer is physically linked to the IO). In places where IO management is conducting water trades with external urban interests, it is the organization's water right holdings that are motivating the transactions. Now that water is highly appropriated in the West, these activities indicate that heightened IO participation is a desired part of the solution package for rising scarcity.

The Western U.S. is now well into an era when the escalating problem of scarce water management is facing off with organizations originally designed for capital management. In some cases, fortuitous conditions have allowed this to work out well, such as in the Northern Colorado Water Conservancy District where irrigators ended up owning shares of their IO's water, because of repayment responsibilities in a region where some existing irrigators already had water supplies and did not wish to participate at the time of project creation.[32] That is, preexisting irrigators did not wish to be financially responsible for project repayment requirements (in spite of large subsidies), so political and contractual agreements necessary for project approval and construction were obstructed. To overcome this hurdle, it was decided that only project beneficiaries would pay, and this was accomplished by creating shares in the new water supply. Shareholders had to pay annual assessments to the district, and these shares became transferable entitlements to the water supply.

Where IOs were formed as mutuals, with individual farmers owning preset portions of the organization's water rights, there are improved options for achieving efficient allocation.

Marketing and Pricing, in WATER POLICY IN TEXAS: RESPONDING TO THE RISE OF SCARCITY 49-77 (Ronald C. Griffin ed., 2011).

[31] A recent case involves the City of McAllen, Texas, and Hidalgo County Water Improvement District 3. Organized to provide irrigation water in 1921, urbanization of the district now places the city as the district's majority customer, with the district arguably becoming more superfluous each year (http://www.themonitor.com/articles/mcallen-52409-water-step.html). The city successfully got a bill before the 2011 Texas Legislature to allow local voters to dissolve the district, and the bill overwhelmingly passed in both House and Senate (http://www.capitol.state.tx.us/BillLookup/History.aspx?LegSess=82R&Bill=SB978). Governor Perry vetoed the bill on grounds that the local vote would give unfair advantage to the city.

[32] Charles W. Howe, Dennis R. Schurmeier & W. Douglass Shaw, Jr., *Innovative Approaches to Water Allocation: The Potential for Water Markets*, 22 WATER RESOURCES RESEARCH 439-45 (April 1986) . Janis M. Carey & David L. Sunding, *Emerging Markets in Water: A Comparative Institutional Analysis of the Central Valley and Colorado-Big Thompson Projects,* 41 NATURAL RESOURCES JOURNAL 283-328 (Spring 2001).

This achievement stems from a more concentrated ownership of water rights, yet mutuals are a less common form of irrigation organization in most states (e.g. Arizona) and tend to be smaller.

When it comes to optimal water management, many IOs are hamstrung by their authorizing legislation. Rules allowing trade between member-irrigators and external sectors are commonly absent, prohibitions are sometimes explicit, and change is usually opposed for many years after it is initially proposed. These rules have created decision-making processes that prohibit maximization of water's value for the irrigators that IOs were originally intended to serve. Irrigators are not the only potentially harmed parties in circumstances where IOs tightly hold the water rights. A further consequence is that growing urban areas must ration water more carefully or seek out other water sources, often at great expense. Moreover, these urban pursuits place further stress on already pressured environmental water. When environmental organizations and agencies are denied the ability to buy or lease organization-held rights, their options can be quite limited, and litigation can become a favored path. Consequently, IO limitations on water transfers have had negative ramifications in multiple ways.

The USBR: A Unique Institution

As an entrenched, ubiquitous, and powerful water agency, the U.S. Bureau of Reclamation is the elephant in the room when it comes to western water reallocation. Its policies are demonstrably resistant to change, and for this reason there is a great deal of prospective labor to be honestly weighed by prospective reformers. The high level of subsidy brought to western states by the USBR has established strong political alliances on key levels.[33] IOs benefiting from USBR's efforts tend to be content with their long-term contractual relationships. IO leaders prefer stabilization of existing policy in the same way that USBR administrators do. Irrigators receiving USBR-handled water are aware of the low prices and, typically, their lack of strict water right ownership. Intuitive risk-reward assessments by any of these parties makes it difficult for reform efforts to garner internal support. Based on the record, water scarcity needs to reach critical levels before old rules can be modified.

[33] Wahl, *supra* note 28.

Wahl argues that the institutionalized reluctance of the USBR to allow trade is a matter of the agency's customary practices rather than legal prohibitions. Yet, it remains true that trade in USBR-managed water has greater feasibility when the USBR is not the owner of water rights. Wahl's 1989 tabulation shows considerable differences across states and projects in terms of who owns the water storage rights within USBR projects, thereby providing some indication of reallocative potentials. [34] In California and Utah, 94-97% of storage rights were U.S.-owned, yet it is also true that the overall USBR presence is much greater in California than Utah. In Arizona and New Mexico, 65% were U.S.-owned within each state. Yet, only 25% were U.S.-owned in Colorado. These numbers are changing in some regions as IOs complete their repayment obligations to the U.S. under the Reclamation Act and possibly gain more complete title to USBR-held rights. Whether these rights convey to the IOs or to their irrigating members then becomes an important question.

In some places, work to rectify the inflexible assignments of USBR water has already been accomplished. Some degree of transferability may exist in these locations. The Central Valley Project Improvement Act of 1992 established limited transferability among the Californian agricultural districts receiving water within this large USBR project.[35] Also, the USBR is a party to the onerously forged transfer arrangement between the Imperial Irrigation District and (especially) urban buyers in southern California.[36] Elsewhere, there are several basins or districts where the USBR has sanctioned unique transfers or where long histories of leasing or even sales have been feasible.[37] These are platforms that can be extended within the IOs where they are occurring as well as to other USBR-served IOs where transfers have been barred.

While the USBR policy has only weakly responded to criticisms about underpricing and excess irrigation, there are changes to be observed. Conservation plans now are required of most IOs receiving water from the USBR.[38] The agency will not approve or reject submitted plans, but it will offer suggestions.[39] A specific guidance manual has been generated to assist

[34] Wahl, *supra* note 28.
[35] Richard Howitt & Dave Sunding, *Water Infrastructure and Water Allocation in California*, in CALIFORNIA AGRICULTURE: DIMENSIONS AND ISSUES 181-90 (2004).
[36] *Id.*
[37] Wahl, *supra* note 28.
[38] http://www.usbr.gov/recman/pec/pec10-22.pdf
[39] http://www.usbr.gov/recman/wtr/wtr01-01.pdf

in the preparation of these plans.[40] Whereas incentivizing rate structures such as block rates are observed as possible strategies in this document, in actual practice two blocks are customary with the first block being sufficiently wide to encompass the majority of farm settings.[41] Thus, on-the-ground inducements to alter water use practices remain modest, and the pricing problems of subsidized delivery and omitted water value are unabated. Transfers are also an observed strategy within the guidance document, yet emphasis is upon in-district reallocations. Overall, these conservation promotions constitute incremental policy shifts.

Although it has been argued that the USBR is a required participant for future Western transfers[42] and that many USBR policies constitute barriers for achieving efficiency, some groundwork now exists for conducting reallocation in specific districts, as noted above. Outside of these areas, new efforts to foster reallocation with the USBR will require patience. In large basins it may be practical to "work around" the USBR, perhaps by pursuing trades with more flexible IOs, especially those which are not fully dependent on USBR water supplies. Perhaps the annual rate of transfers, as fueled by population growth, will not be so momentous that large reallocations are justified in any single year, making such strategies more practical.

Ownership and Rules

Setting aside wholesalers such as the USBR, for all types of retailing irrigation organizations, system-level capital is communally owned, and for the majority of these IOs water rights are also communally owned. It is the communal ownership of water that is obstructing. Due to the absence of trading, nonagricultural demand groups commonly experience greater marginal water values than is being received for the lowest valued irrigation uses. When marginal values are not equalized, society is not maximizing the rewards received from its water.[43] Economically, water is being wasted.

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[40] Hydrosphere Resource Consultants and U.S. Bureau of Reclamation, ACHIEVING EFFICIENT WATER MANAGEMENT: A GUIDEBOOK FOR PREPARING AGRICULTURAL WATER MANAGEMENT PLANS (2000).

[41] Ari M. Michelsen, R. G. Taylor, Ray G. Huffaker & J. Thomas McGuckin, *Emerging Agricultural Water Conservation Price Incentives*, 24 JOURNAL OF AGRICULTURAL AND RESOURCE ECONOMICS222-38 (July 1999)..

[42] Congressional Budget Office, WATER USE CONFLICTS IN THE WEST: IMPLICATIONS OF REFORMING THE BUREAU OF RECLAMATION'S WATER SUPPLY POLICIES (1997) Congressional Budget Office.

[43] There are well acknowledged considerations that require adjustments to the equal marginal value rule in the case of water, but these are regarded as implicitly understood and manageable here. Examples include transportation costs such as conveyance losses incurred in moving district water to distant cities, as well as return flow disparities and instream flow contributions. See Griffin, *supra* note 23, especially 42-44, 216-20, 366-68.

In Table 2, the notion that marketing tools for improved management hinge on ownership institutions is represented. When the organizational type is an ordinary "District", property rights to water and control over water are held at the district level. In this case control over water is diffused across all water users (and possibly the greater community as well), and a political process involving elected board members and board interaction with a hired manager is used to select policy. Water allocation is then influenced by multiple policies, including the rates established by the board, and is largely managed via nonmarket policies. [Rates set by districts in these cases should not be mistaken as a market activity.]

Although we must recognize that there is a spectrum of organization models in place, leading one writer to liken water districts to snowflakes,[44] the co-op-resembling districts can be juxtaposed to the more corporately styled mutual district (or "ditch company") in which members own distinct shares. Mutuals are not attempting to generate a profit – that's for the share owners to accomplish on their farms – yet they are often permissive about the exchange of shares among members. Mutuals may even allow transfers to outside parties, usually requiring that new owners accept the fiscal responsibilities that accompany shareholdings. It is no coincidence that the Northern Colorado Water Conservancy District, which is arguably the U.S.'s strongest example of an urban-enabling IO (and is a USBR project!), utilizes mutual-like water right shares that are actually possessed by water users, and this district handles most of the irrigation-to-urban transfers conducted in Colorado.[45] In Utah, mutuals are the dominant owners of irrigation water rights.[46]

Western states have a variety of classifications of irrigation organizations, so the distinctions are more complex than what is overviewed within Table 2. Still, it is readily witnessed that the strongest impediment to external purchase or lease of IO rights is the common property ownership of water rights in ordinary districts. The established "common" is centrally composed of the entire water-consuming membership of a district. Moreover, where districts have funded a portion of their capital or operations using revenues other than user fees, such as property taxes, the common may extend to all property owners within

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[44] John D. Leshy, *Special Water Districts - The Historical Background*, in SPECIAL WATER DISTRICTS: CHALLENGE FOR THE FUTURE (James N. Corbridge, Jr., ed., 1983) at 11-30.

[45] Suzanne Lieberman, *Water Organizations in Colorado: A First Look Into Control of Agricultural Water Rights by Water Organizations and their Transfer Potential in the Colorado River Basin in Colorado* (2010) Unpublished memorandum for EDF.

[46] Johanna Hamburger, *Water Organizations and Legal Framework of Water Rights in Utah* (2010) Unpublished memorandum for EDF.

Table 2. District Management Options Mirror Ownership

	Range of Realizations	
Organization Type:	Districts	Mutuals
	⇕	⇕
Water Control:	Diffused (common property)	Concentrated (private property)
	⇕	⇕
Allocation Style:	Nonmarket	Market

district boundaries. Authorizing legislation for individual districts may also include mandates emphasizing irrigation functions. In extreme cases, such as California's Imperial Irrigation District, the general citizenry may be de facto members of the common due to the voting rules used to select board members and the broad-based revenue sources long exercised by the district. When the common is large and diverse in its membership, the inertia associated with district-held water rights is correspondingly large.

Arguments Favoring Status Quo Arrangements

All policies (rules, institutions) have two sides, as they express the *duties* of some group to behave in a particular manner toward others and, simultaneously, the *privileges* of the latter group to expect certain behavior from others.[47] Relaxing transfer restrictions pertaining to district water is an increase in irrigator privileges in water management, which must be reflected by increased duties or lost privileges for other parties. That is, we are contemplating reassignment of the transferability "stick" from the IO's bundle to the bundles of its members. It must be asked if there are private and social interests served by present restrictions on the transferability of district water. As policy revisions are considered, it is important to assess whether continuation of these protections has merit relative to the water use inefficiency that they perpetuate.

The more prominent effects of enhancing district water transferability have to do with impacts on agriculture. Transfers of water from agriculture are likely to reduce food production and increase crop prices, albeit slightly during individual periods. It is expected that these changes will concentrate where water has low "value of marginal product," meaning that units of transferred water contribute little production or the crop type itself is low valued. For example, likely first-tier sources of transacted water would come at the expense of irrigated hay or pasture acreages and on-farm delivery losses. Higher valued crops such as vegetable, fruit, nursery, and wine grapes are unlikely to be affected.

Even slight reductions in agricultural production may inspire complaints from agri-centric interests along the following lines.

1. As a consequence of curtailed production, relatively immobile (either physically or economically) agribusinesses can experience losses, at least in the short run. This includes

[47] Daniel W. Bromley, ECONOMIC INTERESTS AND INSTITUTIONS: THE CONCEPTUAL FOUNDATIONS OF PUBLIC POLICY (1989) Basil Blackwell Inc.

tenant farmers engaged in either cash rent or sharecropping arrangements with landowners. All agribusiness agents may be well acclimated to a regulatory setting where water transferability is restricted, and it is difficult for them to visualize personal gains in relaxations of this regulation. Water export can lead to unemployment for some currently working people. It is conceivable that some of the capital established by these agents could become stranded by reduced crop production and its value lost in advance of full depreciation.[48] For example, a custom harvester who provides a grain harvesting service could experience decreased work and an inability to keep all owned machinery occupied if row crops are affected. Understandable worries over these matters lead these types of agents to object strongly to heightened transferability. Whether the strength of the objections is aligned well with the magnitude of prospective losses is an unanswered question until empirical studies are performed for the area in question. Also, whether these types of losses could be ameliorated sufficiently by phasing in new policies over several years is unknown as well. It is crucial to realize that people who will acquire new work or new gains as a consequence of the money flows into the area of origin are not in a position to anticipate their gains and offer countervailing political support favoring transfers. The same is true of economic development in the "area of water receipt."

2. There may be some loss in the resiliency of food production as a consequence of reduced irrigation. Excess food production capacity, as may be supported by having a class of water rights confined to irrigation by law or policy, provides a measure of insurance against uncertain events affecting either the supply or demand for food. While paying an "insurance premium" in the form of inefficient water use may be sensibly supported by this argument, there is still a balance to be struck, and cost-effective achievement of the goal is warranted. Because the preservation of food production capacity is largely a nonlocal issue, the social values are broadly felt. Consequently, this resiliency value may be better sponsored at higher government levels. A more important efficiency consideration may be that an objective to maintain excess food production will be achieved more cost effectively by directly targeting food output rather than addressing one of many production inputs (i.e., water). Because water's influence on crop production is

[48] Carey & Sunding, *supra* note 31.

nonlinear and nonuniform, food policy will have a comparative advantage over water policy in achieving self-sufficiency or improving the resiliency of food production.

3. County sales tax revenues can decline, affecting local government, when a region serves purely as an area-of-origin for water rights. If buyers of water lie in another region, the region containing the IO may experience a reduction in total economic output upon which sales tax is based. Furthermore, advanced decoupling of water rights from land, as may be necessary to activate water marketing, will lower land value while creating water right value, with the summed value of the two expected to exceed prior land value. If governments apply a property tax upon land values while exempting water right values from similar taxation, a decrease in property tax collections should be anticipated. On the other hand, when areas-of-water-origin are exchanging water for money, they will become areas-of-money-receipt unless the sellers of water live outside the region or are transferring their new money completely out of the region. Studies have indicated how these give-and-take matters have balanced out for recent bodies of water transactions (but it is beyond our scope to assemble these findings here).
4. Empowering irrigators with water right transferability reduces the economic and political power held at the IO management level. Water managers and boards have a harder time seeing gains when control over water is progressively granted to others, first to irrigating producers and subsequently to outside water users via marketing. Thus, leaders tend to be less enthusiastic about new water marketing arrangements than the average irrigator. This is especially true of IO managers, because they often view all irrigation as key to job security.

Efficiency with Food and Water

It is not the goal of market-advancing water policy to improve allocative efficiency for one commodity while fouling that of other commodities. Continued efficiency in food production is a notable goal in any attempt to improve water policy. The IOs of the western U.S. support the production of very significant quantities of food, inferring a high degree of public interest. Fortunately, food and related agricultural products, including inputs, tend to be exchanged in highly competitive markets where price signals induce all kinds of socially significant activity. At field-level irrigation contexts, well known theoretical principles

indicate that efficient water use occurs where marginal costs are balanced against changes in gains.[49] It has been long acknowledged that water transferability among irrigators enhances agricultural output.[50] More broadly, for the array of water use-influencing decisions faced on the farm, it is true that the conjunctive selection of crops, irrigation technologies, land leveling, and other inputs foster the pursuit of profit. All of these choices, except the use of water, are framed in market settings where the level of competition is strong and markets are thought to be performing well. If water policies external or internal to IOs are modified to improve water marketing, relatively efficient adjustments should be anticipated from the host of related agricultural markets. That is, the efficiencies with which these other markets operate generates confidence about the outcomes.

Reform Objectives

A useful thought process for investigating reform options begins with an imaginative exercise. If IOs were hypothetically sunsetted and a clean institutional slate was established, with the current water supply holdings and infrastructural development intact, what would be an optimal design for contemporary IDs? Although a clean slate is politically unrealistic in the near term, it is a clarifying position from which to conceive reformation opportunities. Given that current institutions embodied in irrigation organizations were designed long ago, they may be unsuited to contemporary demands.

There are two functions for a redesigned IO to perform, and arranging for their joint accomplishment is important. The two are the *delivery of water* and the *allocation of water*. These are not independent matters from the IO's perspective though it is primarily allocation that interests contemporary public policy due to rising water scarcity. Effective performance of each function is important. The allocation of focus in this article occurs where IOs interface with the urban and environment sectors, but it is also important that internally used water generates a high level of profitability across farmers.

Acknowledging both delivery and allocation functions, what kind of achievements would be desired of freshly designed IOs?

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[49] E.O. Heady & J. L. Dillon, AGRICULTURAL PRODUCTION FUNCTIONS (1961) The Iowa State University Press. Roger W. Hexem & Earl O. Heady, WATER PRODUCTION FUNCTIONS FOR IRRIGATED AGRICULTURE (1987) The Iowa State University Press.

[50] Ray P. Teele, THE ECONOMICS OF LAND RECLAMATION IN THE UNITED STATES, (1927) A.W. Shaw Company.

Within the IO:

1. The IO should be fiscally sound in the sense of generating revenue sufficient to offset all ordinary operational and maintenance costs including all appropriate planning and administrative functions.
2. Facilities should be in an economical state of repair with any unaddressed maintenance or projects not (yet) justified economically.
3. Irrigator clients of the IO should be making production and water conservation decisions that approximately exhaust their opportunities to profit. Among many other things these decisions include matters of crop selection, fallowing, technology choices, and water application.

Outside the IO, yet influenced by the IO:

4. A balance should be achieved among urban, agricultural, and environmental water values at the margin. [From an aggregative social perspective, it is unsatisfactory to have urban interests spending 3x dollars per unit of added water supply when marginal irrigation value is x.][51]
5. Efficient levels of housing and commercial growth are being supported. Economically advantageous growth is occurring and is receiving the water supply it merits. Economically inefficient levels of growth are not being supported.

Although this listing is abbreviated, it includes unmet challenges. Currently, it is unlikely that items 3-5 are being satisfied within the boundaries of water-scarce regions containing IOs. Not all irrigators are achieving their profit potentials, because they are being denied opportunities to conserve water in return for money. Nonagricultural growth is not being well managed due to deficient opportunities to obtain water inexpensively. Environmental water is weakly procurable even when it might have a sufficiently high value to justify the exchange of water.

Reform Options

To gain an open-minded vision of the changing role of IOs, recognizing the long-term reciprocal relationship that exists between institutions and resource value is helpful.

[51] Summarizing findings of prior studies, Carey and Sunding observe that due to restrictive transfer institutions in California "The marginal value of water in municipal and industrial uses is typically three to four times greater than the marginal value in agriculture" (p. 287). See Carey & Sunding, *supra* note 32, at 283-328.

Institutions – the rules of human interaction – impact value importantly. This is quite evident in water settings. For example, when a majority of a basin's water is employed by a single sector and rules prohibit changes in this arrangement, then water's marginal value to the agents using it is lowered. The consequent subsidy for that sector's production results in lower prices for its outputs. By the same token, product prices for excluded sectors are consequently increased.

Simultaneously however, changes in the social importance of a resource, as might be caused by population growth or technological change or drought, establish a feedback loop whereby force is applied to institutions, urging them to evolve. Resource values are among the forces that induce changes in institutions.[52] Clearly, trends toward improving transferability in water provide an important example of institutional reform being generated by the changing social value of water. Thirty years ago, water marketing occurred in few places, because it was not allowed. That has changed – the institutions have changed – due to the rising pressures that scarcity has placed on these rules. Water policy has been advancing and is continuing to do so. At the current juncture, there is rising pressure on IOs to evolve to the next stage. Hence, arguments that "we don't do it that way" do not infer that we will not be doing it that way in the future.

Two broad categories are readily identifiable for increasing the access of nonagricultural sectors to IO-held water. The extent to which these options may advance or detract from the objectives noted above will be important to investigate in future research. The two general options are: (A) IOs can negotiate water transfers with nonagricultural buyers and pursue various measures for freeing this water within their service areas, and (B) IOs can assign water rights to their clients and allow these right holders to transfer their water to other parties as deemed appropriate by irrigators. Recall that our focus upon "districts of origin" means that growth-fueled demand is occurring outside the IO and desired reallocation would have less water being used within the IO in order to enable greater out-of-IO use. Thus, an option set aside here is having IOs evolve into utilities as growth takes place.

In the following subsections, variants within these two categories are distinguished. Subsequently, more momentous transitions are considered.

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[52] Douglass C. North, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE (1990) Cambridge University Press.

IOs Negotiating with Demand Sectors

Water marketing provides important avenues for weighing the relative value of water in different uses and making corresponding consumption adjustments on a continual basis. Although water transfer agreements between IOs and external, nonagricultural entities have occurred, there are approaches for improving both their results (mindful of the five objectives noted previously) and the extent of transfer activity.

The understandable tendency of IOs is to bargain with what they actually control. Thus, their most common transactions have involved water conserved via refurbishment of facilities, often in the form of canal hardening to reduce permeability. Major projects have been pursued whereby municipal utilities fund irrigation rehabilitation projects in exchange for the conserved water.[53] Besides dealing with choices that are feasible at the IO level, an advantageous characteristic of refurbishment, from IOs' perspective, is that the received money is expended on projects, so there is no need to deliberate and implement new mechanisms for distributing new funds. The major oversight in these refurbishment arrangements has been the perpetuation of low-valued irrigation at values less than those paid for rehabilitation water. Indeed, when refurbishment lowers future operation and maintenance costs, because of reductions in pumping to achieve equivalent deliveries of water at farm gates, and, thereby, lowers future water rates, it is reasonable to expect future inefficiency to be worsened at the basinwide level. That is, irrigators will employ more water when it is cheaper. A better approach is to design transfer packages that engage *all* low-cost alternatives to the benefit of both buyers and sellers. To do otherwise is wasteful by not maximizing the value of water and delivering this value to water users. For this to be accomplished at the local level, the IO must use incentives that cause irrigators to conserve water using on-farm strategies.

If least-cost actions are to be motivated, regulatory approaches will not be successful. For example, prohibiting a particular crop type or cropping practice is not usually an attractive path. Nor is subsidizing specific on-farm production practices. Differences among farmers and among farms (e.g., slope, soil type, elevation) mean that efficient activities vary by farm, with farmers best positioned to make management choices. Policies or modeling activities which do not recognize this variety will not achieve the objectives listed previously.

[53] Haddad, *supra* note 19.

There are at least two paths by which IOs can work with heterogeneous farmers to encourage a given amount of water conservation at least cost. In the first, the IO charges for water on a volumetric basis. Many already apply volumetric pricing, but contemporary rate making seeks cost recovery rather efficient water use. Hence, the norm is that water's value is omitted from rates.[54] The problem is enlarged by the level of subsidy implicit to calculated delivery costs. "The main reason why federally supplied water in the arid West is not always managed efficiently is that it is sold far below the cost of providing it, a characteristic that does not engender wise husbandry."[55] To spur an appropriate amount of water conservation, it will be necessary to raise rates to incorporate, minimally, the omitted value of naturally occurring water. This method is termed full pricing. For any announced rate, we can have confidence that any water conserved by a full pricing policy will have a productive value that is less than the applied volumetric rate. There is some trickiness to development of an approximate charge that will consistently generate a targeted amount of conserved water, so a second policy path would normally be applied.

In the second approach the IO contracts with farmers for fixed amounts of water, or the IO contracts for farming practices such as fallowing that are expected to conserve a computable amount of water. Contracts can be negotiated individually, but fairness and efficiency will be improved with publicly transparent and level programs. Among the quantity-targeting possibilities are reverse auction processes in which the IO asks farmers to submit bids, then accepting the lowest bids[56] sufficient to fulfill a desired total amount of water conservation which is then available to the IO to satisfy external contracts. Smith discusses the general idea of employing corporately styled "tender offers" whereby irrigators contract with the IO to reduce their water use for a price set by the IO.[57] Imperial Irrigation District's fallowing program during recent years resembles this strategy. The District announces a per acre-foot price and invites irrigators to submit applications to fallow their lands.[58] Imperial's 2010 program had a stated price of $75 per acre foot and resulted in over

[54] Michelsen, *supra* note 41.
[55] Wahl, *supra* note 28.
[56] Of course, IOs can use whatever criteria they wish for selecting from alternative bids. For example, bids from tail irrigators could be given preference on the basis of reduced conveyance losses, or bids from particular crop retirements might be preferable on a reduced secondary economic effects basis. Also, all accepted bids could be paid on terms set by the highest accepted bid, and there are other means of improving the gains received by irrigators.
[57] Smith, *supra* note 8.
[58] http://www.iid.com/Water_Index.php?build=view&idr=4348&pid=267.

50,000 acre feet of water savings.[59] [Before presenting the Imperial program as a success story, however, it should be acknowledged that the fallowing policy is merely the currently stable outcome of a frustrating and expensive deliberation involving years of contention and litigation and large expenditures of public monies by the district, California, the U.S. Bureau of Reclamation, and even Arizona and Mexico.][60]

In both full pricing and quantity-target approaches, an economic incentive is employed to generate water that can be transacted to external parties. Auctioning and tender offers involve new incentives that will apply only to farmers who are participating in reallocation, and both possess the positive quality of addressing a water quantity target. There can be transaction cost advantages of having the IO negotiate with outside buyers, and irrigator-sellers may reap better terms when the IO is acting on their collective behalf.[61] Yet, only participating producers will receive benefits in these cases unless the district applies some "markup" in its dealings with external parties, which is to be expected and likely warranted for various reasons. Among these are the desirability of mitigating third-party effects that would qualify as market failures. There are also supportive equity arguments.[62]

IO Members Negotiating with Demand Sectors

As noted earlier, some IOs were formed under an ownership style in which members hold shares to delivered water. Historically, transfers of these shares may have been limited to transactions associated with land purchases, but IOs are often permissive regarding internal swapping of shares among members. In the case of transferring shares to external parties, there are more hurdles to overcome.

When farmers satisfy their irrigation demands using personally owned shares of a cooperative's water supply, the possession of water rights is turned over to individual agents

[59] http://www.iid.com/Media/2010-2011-FP-Summary-by-gate.pdf.
[60] Howitt and Sunding observe that the "transaction" underlying this program bears only a loose resemblance to water marketing. See Howitt & Sunding, *supra* note 35, at 183-4. Water conserved with this fallowing program is committed to external urban and environmental applications, yet IID's participation was obtained via a threatened decrease in their water right holdings.
[61] See page 43 of Michael D. Rosen & Richard J. Sexton, *Irrigation Districts and Water Markets: An Application of Cooperative Decision-Making Theory*, 69 LAND ECONOMICS39-53 (February 1993)..
[62] Auction procedures tend to discover least-cost and least-price sources of water when simple auctioning mechanisms are applied. Least-cost is desirable yet least-price may be objectionable as it may imply small net gains to participating farmers in comparison to the rewards being generated for the external water buyers. Trades from low-valued to high-valued water uses are socially attractive because they generate a net gain, and it is arguable that this gain should be shared. Thus, there may be strong equity arguments for markups conducted at the IO level. Distribution of the markup-generated profit may be conducted in various ways by IOs.

and the common property issue of water ownership is theoretically averted unless IO policies are prohibitive. Absent prohibitions, irrigators are able to evaluate the appropriateness of their production activities in relation to the market-expressed value of water. This may motivate various, modified production activities over time, including more careful water management, altered crop selections, field leveling, fallowing and alternative rotations that incorporate more fallowing, as well as the cessation of irrigation. The idiosyncrasies of soils, topography, farm specializations, and other farm features will lead to a diversity of reactions. Absent strict share ownership, IO policy can be created to allow irrigators to participate in forbearance contracts with external parties. Under this instrument the farmer agrees to suspend irrigation for a season, and the buyer receives a computed amount of water.

It is useful to anticipate that, because the market price of water will be resolved continuously by both supply and demand factors, aggregate effects at the IO level are unlikely to be dramatic in any given year,[63] but changes will accumulate over time in concert with the magnitude of urban growth. Moreover, it is quite conceivable that a variety of market instruments will be utilized by traders according to their combined preferences. Because urban entities are engaged in planning for projected growth *and* insuring themselves against drought, they are likely to investigate all permissible contracting avenues. This includes purchases, leases, and options. In the case of purchases, urban buyers sometimes buy in advance of growth and may engage in leasing excess water in the near term, sometimes back to the seller.

Environmental buyers can have sporadic, specialized demands for water, because they may be targeting specific stream segments or times of year in which flows are especially low. This places more emphasis on short-term market actions, spatially dispersed portfolios of water rights, high altitude water rights, and stored water with the potential to be released on-call. These preferences modify the nature of potential trades with environmental stewards.

A notable yet manageable problem for IOs, as their members engage in water marketing, is keeping the "lights on" as water is rededicated to external users. Accommodations have to be made for preserving the water delivery mission and financial integrity of IOs, even as individual shareholders pursue self-interests with their water shares.

[63] The first year may be an exception due to the accrued effects of pent-up supply and demand disequilibria. If considerable pressure has accumulated due to mounting external scarcity before a district liberalizes its transfer prohibitions, the periods following relaxation can involve quick changes.

As natural monopolies operating in a declining average cost industry, IOs are susceptible to financial failure when revenue declines. When an IO's water deliveries are reduced, its total costs do not rise, but the average costs of a delivered acre-foot do rise for all remaining members. Because rates are acting to distribute commonly caused costs (especially one or more pumping plants, canals, and administration) across a broad acreage and a large number of producers, the loss of served acreage can be financially damaging. It is important for new water management instruments to operate without harming the well developed capital management strategies present in IOs. Therefore, as a foundational precept, external buyers should acquire exactly what irrigators have to sell. In particular, irrigators commonly have a longstanding obligation to make contributions in the form of payments to their IOs. It is sensible for these obligations to convey to buyers as water rights are transacted,[64] or there should be a substitute mechanism agreed upon by the three involved parties (irrigator, buyer, district). For example, a buyer could negotiate a one-time payment to the IO.

Paralleling the financial problem of preserving IO functionality, there is a water supply consideration too. Although 100% of an IO's water may be owned as shares by its members, the hydrological reality is that some of the water consumption occurring in-district happens before the water ever reaches field gates. Evaporation from the open water surfaces of impoundments and canals is one type of consumption. Seepage through canals and impoundments is another. A third is so-called "dead water" remaining in conveyance facilities at the conclusion of an irrigation season, with potential off-season fates as evaporation, transpiration, or seepage prior to the onset of the next irrigation season. The sum of this off-farm water use is not proportionately decreased as external water transfers reduce in-district water use.[65] Thus, just like the operation and maintenance costs of running an IO, accommodations must be designed to prevent harms as water is transferred to the outside.[66] In cases where 100% of water shares are held by members and transferred water will no longer pass through the shared network, it will be appropriate for the IO to retain some portion of the seller's transacted shares. The challenge here is to compute a suitable "tradable proportion."

[64] Gisser & Johnston, *supra* note 2, at 137-65.
[65] Miller, *supra* note 5.
[66] Ronald C. Griffin, *Achieving Water Use Efficiency in Irrigation Districts,* 132 JOURNAL OF WATER RESOURCES PLANNING AND MANAGEMENT 434-42 (November/December 2006)..

The idea is not to be punitive to traders but to accommodate a legitimate efficiency concern and to accurately account for conveyance losses based on hydrologic knowledge.

Extensions to More Aggressive Strategies

The value that is embedded in the aggregate water holdings of today's irrigation IOs may motivate more aggressive measures than the ones just noted. For example, in a many-IO water basin, it is conceivable that a few IOs could be induced to restructure themselves so as to take advantage of new water marketing options. Interestingly, it may only take the transition of a single irrigation IO to satisfy the urban growth of a basin for many years.

At a base level of $75/acre foot/year such as is employed by the Imperial Irrigation District fallowing program, an irrigated acre using 3.0 acre feet annually would involve an implicit water right having a capitalized value of $5,850.[67] Urban areas may be willing to pay much more. This becomes a motivating amount of money when a number of acres are involved. A fully irrigated 160-acre farm could be associated with more than $0.9 million in water value for a permanent transfer of 480 acre feet, without selling any land. These values are sufficient to raise questions about what institutional options might exist for transforming an IO so that these values may be realized by irrigators.

What nonincremental reorganizations are possible whereby IO operations could become highly responsive to attractive urban or environmental water offers?

IO Takeover

It is feasible in some states for an IO to be voluntarily subsumed by another water district. When one inspects the history of IOs throughout the West, many examples of modified ownership and mergers can be found. In some places, affirmation of such modifications may require legislative approval. When ownership of an IO was originally in private hands, the previous owner may have been motivated by financial gain in shedding ownership, such as has occurred in Texas.[68] Subsequent to the takeover, the new management

[67] At a 4% rate of discount and *no* CPI-beating appreciation in the value of water over the future, 75•3•1.04/0.04=5850. If appreciation in water value outpaces the CPI as has generally occurred for multiple decades, the capitalized value will be higher. In the case of Imperial, the average amount of transferable water credited to a fallowed acre is approximately 5.4 acre feet, raising this value to more than $10,000 (http://www.iid.com/Water/2010-2011FallowingProgram).

[68] The Lower Colorado River Authority (LCRA) purchased Gulf Coast Water Company in 1960, Lakeside Irrigation Company in 1983, and Garwood Irrigation Company in 1998. See L.S. Coplin, Fred Liscum, Jeffery W. East & Lee B. Goldstein, *Measurement of Flows for Two Irrigation Districts in the Lower Colorado River Basin, Texas* (1996). http://www.twdb.state.tx.us/rwpg/rpgm_rpts/95483103.pdf. U.S. Geological Society Water Resources Investigations Report

continues to operate the newly acquired IO, so a high level of irrigation service is continued, at least initially. As a result of ownership, the new administration has the ability to transfer irrigation water to other sectors in its client base over time.

Takeover may be disappointing in terms of its ability to coax economic efficiency out of either on-farm activities or intersectoral transfers (now internal) of water. Newly structured incentives are not automatically established by this change. Unless rate systems are revised or another form of scarcity signaling is substituted, efficient allocation will continue to be elusive. If the acquiring IO operates under diffused ownership of water rights and is charged with serving multiple sectors, it becomes possible for future reallocation to be achieved "in house." Yet, the political, nonmarket style of administration necessarily conducted by such IOs provides no guarantee that these reallocations will be efficient, either in result or process. Furthermore, the diffusion of water right ownership is actually aggravated in this situation, given the enlarged clientele of the buyer. Should the expenses or debt accompanying acquisitions be large, cost recovery objectives may motivate the organization to revise rates upwards, potentially developing new pricing signals for all customers. This can be helpful. Yet, it is also possible for the rewards of better water allocation to be cannibalized by the organization if it operates at high cost. The objective of efficient water allocation is to maximize the rewards received from water in a basin, not to foster expensive authorities that prevent water's rewards from reaching consumers.

Deregulatory Division

As has occurred in the electricity industry, it is technically feasible to deregulate IOs by introducing a new administrative entity and assigning to it the water rights held by an IO, effectively dividing the entity into two houses. The prior IO will continue to exist, managing water infrastructure and performing water delivery functions as it always has. Referring here to the new entity as the "water company," this organization will be expected to pursue profit and will distribute its earnings to its share owners. Presumably, irrigators are the strongest

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96-4225. Also see Griffin, *supra* note 30, at 49-77. Based on irrigated acreage at the time of these three transactions, LCRA would be in a position to supply irrigation water for 86,000 acres, much of it originally committed to rice production and therefore involving a substantial amount of water. Subsequently, rate contracts with irrigators transitioned to an "interruptible" basis. This means that irrigators face lower volumetric charges than do municipalities but deliveries can be suspended during dry weather conditions.

candidates for being the shareholders of the created water company.[69] The water company will contract with external sectors for water right exchanges (temporary or permanent), and it will sell water to the IO as well. The water company will not be involved in IO management.

Irrigators will pay higher rates for their water use than they do prior to deregulation, and these rates will incorporate water value (for the first time!). The great majority of irrigators should experience gains under this arrangement, provided that the initially endowed shares are largely allocated to irrigators and the administrative costs of the company are kept in check. That is, ownership of water company shares implicitly entitles each irrigator to a share of water, while the higher rate paid for irrigation water invites conservation. When each irrigator's implicit share is larger than the irrigator's revised water use, there is a potential for gain.

Faced with the possibility of deregulatory division, IO leaders may be provoked to adopt an improved management style, so as to improve water-based income via external transfers. The several other policies inventoried here offer options. Irrigators can be readily placated by such actions and the motivation for division should subside.

Self-Dissolution

One tactic available to the members of an IO may be to exit the irrigation business and sell off the assets of the IO. Similarly, they could shut down all infrastructure, cease irrigation operations, and continue to manage their water right holdings on a for-profit basis through leases and options. While appearing rather extreme for an IO serving tens of thousands of acres, this may be a compelling path for small districts or ditch companies as well the water buyers that they might do business with. Making such chunks of water rights available to urban areas and environmental contractors may serve to alleviate regional demand stress substantially and thereby limit reform pressure on the region's remaining IOs. Another advantage is that the water conserved by eliminating conveyance losses is also marketable under a dissolution strategy.

[69] Other interesting candidates for receiving partial shares include local government, if there is desire to compensate secondary and tax effects of irrigation reductions, and the IO if there is uncertainty about the effects of this policy.

The Policy Opportunity Set

Table 3 lists the various strategies discussed above and compiles brief responses to basic questions about their character. Seven possibilities are included. The first three are approaches that rely on organization-level negotiation with outside interests. The final "Self-Dissolution" strategy can also be regarded as a type of IO Negotiation. The various columns of the table collect some informal observations of relevance when contemplating preferred paths.

Because it may be objectionable to impose change upon irrigators, a crucial feature of any policy option can be whether it is beneficial to irrigators. Two columns of the table pertain to this matter.

The final two columns are of interest in cases where political support from nonirrigators is needed to gain approval of a policy modification. When the impact upon agribusinesses and food production is negative, there could be impetus for two reactions on the part of those championing greater trading. The first is confronting, at least in the process of deliberations, the idea of prospective gains in the area of receipt vis-à-vis the likely losses in the area of origin. After all, for a large accounting stance (e.g. a state or basin) the net effects on economically connected businesses and people will ordinarily be positive, because gains in the area of receipt will more than offset, and arguably "dwarf,"[70] losses in the area of origin.

The second reaction to the issue of reduced agricultural production is to search for policy designs that add mechanisms for mitigating secondary economic effects on agribusinesses and local governments in the areas of origin. Indeed, one of the tasks that may be advisable for future research in this area is to compile and analyze methods for accomplishing such mitigation. Although legislatures have tended to adopt regulatory protections, there may be an array of contractual modifications which are both practical and capable of alleviating concerns over this problem.

Conclusions and Extensions

The tenures of IOs have been filled with many trials, yet they have enabled considerable social good in producing food and generating economic development. Now they are being pressured to relax their hold on a hard-earned resource they regard as critical. Many IOs are

[70] Robert A. Young, *Local and Regional Economic Impacts* in *WATER SCARCITY: IMPACTS ON WESTERN AGRICULTURE* 244-65 (Ernest A. Engelbert & Ann Foley Scheuring, eds., 1984).

Table 3. Properties of Alternative Transfer Strategies

Transfer Strategy	Has Occurred	Establishes New Incentives	Gains to Irrigators	Gains to Nonparticipating Irrigators[1]	Gains to Local Nonirrigating Agribusiness[2]	Impact on Value of Ag Production
A. *IO Negotiation*						
Refurbishment projects	✓	X	modest and in the future		modest and declining once completed	↑
Repricing	?	✓	variable across farms		negative	↓
Contracts with members	✓	✓	yes; amount depends on contract design	maybe; depends on contract design	negative	↓
B. *Member Negotiation*	✓	✓	modest	variable; depends on policy	negative	↓
C. *IO Takeover*	✓	X	unlikely		negative	↓
D. *Deregulatory Division*	X	✓	high if irrigators own sufficient shares		negative	↓
E. *Self-Dissolution*	X	✓	variable		highly negative	↓↓

[1]Some of the identified strategies affect all clients of the IO, so a separate entry is not provided within this column.
[2]It is assumed here that agribusinesses receive no compensation as part of the transfer strategy.

very reluctant to respond, but as their memberships witness wider opportunities for their managed assets than merely food production, the urge to evolve can emerge from within. Some feel that change will be imposed on IOs if they fail to respond. There are many legal, policy, and contractual options for accomplishing this change. In choosing from the available options, a single strategy will not suit all situations. The solutions compiled here represent an initial itemization, and further adjustments to these options via blending and refinements are possible, even probable. Market participants can be especially creative.

The amount of water administered by western U.S. irrigation organizations is too vast to be threatened, and it is too important to fully transfer out of agriculture. Hence, responsible reallocation can easily pursue the low-hanging fruit in whatever dimensions are practical. Of particular concern can be reallocative possibilities where

1. there is considerable separation between the marginal value of in-district and out-of-district water, and/or
2. transaction costs for achieving transfers are low.

Dimension 1 suggests targeting situations of high urban growth, high environmental demand, and low agricultural productivity. For example, cities embarking on expensive water developments, including desalination, as part of their portfolio of management instruments (both supplyside and demandside of course) should periodically reevaluate the use of newly designed deals with IOs. Some environmental demands might be well addressed through trades in higher elevation locales where irrigation tends to be devoted to low-valued activities due to shortened seasons and smaller irrigable land parcels. For such transactions, previous irrigation water can be left instream and may remain in the watercourse for a long distance downstream. Environmental stewards can readily leverage their water operations because of their interest in relatively nonconsumptive uses. For example, they can collaborate with downstream urban demand centers, with upstream water acquisitions capable of fulfilling both environmental demand during its passage and urban demand upon it arrival at downstream diversion points. Joint possibilities such as these imply that the purchased value of water rights is the sum of the separate values.

Dimension 2 is illuminated by the studies of IOs conducted to date. Among other observations, the costs of getting transfer deals done is lower in some circumstances than others. Overall, a maxim of the fewer the transactors, the better applies. Diffused

responsibilities and common property arrangements for water right ownership in many IOs limit transfer opportunities because of the number of parties that have to be paid or convinced. Thus, smaller IOs can be better business partners. Also, the mutual/ditch company form of IO is a clearly preferred partner due to the concentrated ownership that is fostered by their institutions. The possibility of embarking on land transactions should not be overlooked in this context. Where upper basin ranches or farms own shares of small, water delivery companies, the possibility of acquiring agricultural land properties and reallocating both land and water use may be a cost-effective tactic.

When investigating potential IO traders, it becomes sensible to research their past funding mechanisms to discover how diffused ownership may be. Where property owners and not merely irrigators have been paying IO bills, ownership of rights may be more diffused than is immediately apparent. The organization's voting mechanisms (per farm vs. per acre vs. per citizen) for selecting board members is also evidence of differentially diffused ownership and uneven capacities for responding to marketing offers.[71]

Many irrigation developments were federally assisted, and for some organizations it remains true that federal control continues over some aspect(s) of their water. This is especially true in California and Arizona IOs,[72] but it may also be true for other regions, including the upper basin districts of the Colorado River basin. In most cases external buyers should therefore avoid approaching IOs that have not achieved separation from federal authority over water unless other options are quite limited.

Finally, all mechanisms for sponsoring greater flexibility within IOs should nurture sensitivity for the mission of these entities and the problems they face. As observed previously, reductions in water deliveries can detract from a district's viability. There are both economic and hydrologic effects upon the IO. Both require accommodations, but these can be built into new policy frameworks without great difficulty. As a related issue, it may be politically important to acknowledge the sensitivities that surround prospective local declines in agricultural production, especially as they may influence agribusinesses and tax revenues.

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[71] Richard J. McCann & David Zilberman, *Governance Rules and Management Decisions in California's Irrigation Districts*, in THE POLITICAL ECONOMY OF WATER PRICING REFORMS 79-103 (Ariel Dinar ed., 2000).
[72] Dean Price, *The Legal and Historical Obstacles to Out-of-District Transfers from Arizona Irrigation Districts on the Mainstream Colorado River*, (2010) Unpublished memorandum for EDF.

Yet, there are policy accommodations available for mitigating some of these effects, and it is wise not to over-restrict transfer activity in light of the rising resource pressures.