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COMMENTS

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Water markets have special appeal in the western United States where the prior appropriation doctrine favors historic, low-value agricultural water rights over other valuable water rights.[1] Yet, despite the allure of water markets for moving water, especially from agricultural to urban use, the legal, political, and practical obstacles to the operation of such markets have proven far more elusive than market theory would predict.[2] Although water transfers occur on a fairly regular basis in most western states,[3] they do not occur as quickly or as easily as they would likely occur in a free market, even where water supplies are stressed, and the transaction costs associated with many proposed transfers often prove prohibitive.[4] Indeed, the costs, delays, and uncertainties posed by water transfers have combined to discourage many municipal water suppliers from viewing such transfers as a viable option for solving their water supply problems.[5] In short, the story of water transfers in the western United States is largely a story of market failure.[6]

One consequence of the failure of water markets is that many cities continue to turn to engineering solutions to address water supply needs, despite the enormous environmental, political, and economic costs of such proposals,[7]

Author's Note: This Article is an abridged version of an article that will appear in Volume 53, No. 1, of the Natural Resources Journal. *The longer version, titled* Water Transfers for a Changing Climate, *provides an in-depth review of two case studies that are only briefly reviewed in this Article—the Northern Colorado Water Conservancy District's Colorado-Big Thompson Project, and the evolving proposal often described as the "Super Ditch," which would facilitate temporary transfers of agricultural water in the Arkansas Valley of Colorado to urban use. As implied by the title, the long-form article also offers insight into the importance of reforming water transfer regulations in the face of likely diminished water supplies as a result of climate change. This abridged Article was made possible in part by the outstanding assistance of several Colorado students, including Anshul Bagga, Laura Brown, and Lisa Smith.*

1. The consumptive municipal use of water in Denver, Colorado, amounts to 234,000 acre-feet per year, which is equivalent to 2% of all of Colorado's statewide consumptive use. About Us, *Denver Water's Water Use*, Denver Water, *available at* http://www.denverwater.org/AboutUs/KeyFacts/. Metropolitan Denver has a gross municipal product of $152.8 billion, which is approximately 66% of the Colorado State gross domestic product (GDP) of $231.6 billion. U.S. Department of Commerce, Bureau of Economic Analysis, 2011, *available at* http://www.bea.gov/newsreleases/regional/gdp_metro/2011/pdf/gdp_metro0211.pdf. U.S. Department of Commerce, Bureau of Economic Analysis, 2011, *available at* http://www.bea.gov/newsreleases/regional/gdp_state/2011/pdf/gsp0611.pdf. Irrigation in the state of Colorado accounted for 90% of the consumptive use within the state in 2005. Estimated Use of Water in the United States, U.S. Geological Survey, U.S. Department of the Interior (2005), *available at* http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf. Net farm income in Colorado accounted for $745 million or approximately 0.3% of the state GDP in 2009. *State Fact Sheets: Colorado*, U.S. Department of Agriculture (July 11, 2011), *available at* http://www.ers.usda.gov/StateFacts/CO.HTM.
2. *See* A. Dan Tarlock, Law of Water Rights and Resources §2:13 (1988).
3. *See* Bonnie G. Colby et al., *Procedural Aspects of State Water Law: Transferring Water Rights in the Western States, Water Transfer Symposium*, 31 Ariz. L. Rev. 697, 697 (1989) (summarizing the procedural differences in the evaluation of water right change applications across eight western states).
4. *See, e.g.*, Peter D. Nichols & Douglas S. Kenney, *Watering Growth in Colorado: Swept Along by the Current or Choosing a Better Line*, 6 U. Denv. Water L. Rev. 411, 422 (2002-2003).
   > The minimal transaction costs of acquiring existing trans-basin diversions for municipal use are a sharp contrast to the extreme costs associated with newly proposed trans-basin diversions. For example, the American Water Development, Inc. (AWDI) proposal to export water from the San Luis Valley to the Denver Metro area consumed nine years and several million dollars in attorneys' fees and engineering fees associated with expert testimony presented in court. The Colorado Supreme Court ended AWDI's plans when it upheld the District Court's dismissal of AWDI's water rights application.

   American Water Dev., Inc. v. City of Alamosa, 874 P.2d 352, 357, 359, 368 (Colo. 1994).); *see also* Charles W. Howe et al., *Transaction Costs as Determinants of Water Transfers*, 61 U. Colo. L. Rev. 393 (1990).
5. *See, e.g.*, Sarah Klahn, *The Blind Man and the Elephant: Describing Drought in Colorado*, 6 U. Denv. Water L. Rev. 519, 534 (2003) ("As in past droughts, the legislature has determined that one solution is to build more storage projects. . . . The legislature adopted Senate Bill 236, which requested voter approval to float $2 billion in bonds for reservoir construction as a part of a so-called 'drought-package.'").
6. *See, e.g.*, Loyal M. Hartman & Don Seastone, Water Transfers: Economic Efficiency and Alternative Institutions 1 (1970); *see also* James F. Booker et al., *Economics and the Modeling of Water Resources and Policies*, 25(1) Nat. Res. Model. 168, 173 (2012) ("[C]ompetitive markets for water are rare if not absent throughout the world."). *See* Bonnie G. Colby et al., *Procedural Aspects of State Water Law: Transferring Water Rights in the Western States, Water Transfer Symposium*, 31 Ariz. L. Rev. 697, 697 (1989) (summarizing the procedural differences in the evaluation of water right change applications across eight western states); *see also* Charles W. Howe et al., *The Economic Impacts of Agriculture-to-Urban Water Transfers on the Area of Origin: A Case Study of the Arkansas River Valley in Colorado*, 72 Am. J. Agric. Econ. 1200, 1202 (1990) ("A major U.S. Geological Survey-funded study (MacDonnell, et al.) has found frequent water transfers in several western states (Colorado, New Mexico, Utah) but infrequent transfers in other states (e.g., California and Wyoming), the frequency being strongly affected by the institutional structure for effecting transfers and the pressure on water supplies.").
7. *See* Euclid v. Ambler Realty, 272 U.S. 365, 397 (1926); Golblatt v. Town of Hempstead, 369 U.S. 590, 592 (1962); Keystone Bituminous Coal Ass'n

and the relative advantages of water transfers.[8] If the political, legal, and practical problems associated with traditional transfers could be fixed, the demand for new engineering projects would likely disappear.[9] One important aspect of any legal reform then must be to address in a meaningful way the very real problems that transfers have historically created while at the same time finding ways to simplify and streamline the transfer process.

Overcoming the obstacles to water transfers is not just about promoting economic efficiency. It is also about protecting the environment and minimizing impacts on the communities in remote water basins that have often become the target for the seemingly insatiable demands of growing urban centers. The good news is that water transfers can be optimized and made more attractive with relatively modest reforms to current law.

This Article suggests concrete solutions to promote the development of robust water markets. It begins with a review of water transfers in the western United States and historical water use patterns that help illuminate the problem. It then considers opportunities for moving agricultural water to urban use by studying successful water transfer systems. To those who know water allocation law, it will come as no surprise that many of these systems have evolved in the context of special purpose water districts[10] and mutual ditch companies.[11] Since special purpose districts and mutual ditch companies provide well over one-half the water to water users in the West,[12] focusing reform efforts on such agencies could be an efficient way to modernize water transfer law. The Article then derives lessons from these examples and concludes with a series of recommendations for reforming western water law in ways that will promote more sensible water management.

I. Background

From its earliest incarnations, the prior appropriation doctrine that evolved in most western states allowed perfected[13] water rights to be transferred from their original use to some other beneficial use.[14] The interdependent nature of most prior appropriation water rights has persuaded states to authorize such transfers only where they can be carried out without injury to existing users.[15] Such injuries may occur, for example, where they reduce the amount or timing of return flows.[16] Moreover, to avoid burdening existing users with the need to prove injury, many states place the burden of showing "no injury" on the proponent of the transfer.[17]

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v. DeBenedictis, 480 U.S. 470, 488, 17 ELR 20440 (1987); Palazzolo v. Rhode Island, 533 U.S. 606, 631, 32 ELR 20516 (2001).

8. *See, e.g.*, Douglas S. Kenney, *Relative Costs of New Water Supply Options for Front Range Cities*, Phase 1 Report 21 (July 2010) (unpublished draft), *available at* http://www.rlch.org/archive/wp-content/uploads/2010/07/10_RR_Kenneycostofwater1.pdf. ("[O]ur estimates of representative costs (in $/AF) are as follows: new projects, $16,200; water transfers, $14,000; and conservation, $5,200.").
9. *See infra* notes 52-53 and accompanying text.
10. It is difficult to simplify descriptions of these districts, other than to say that they are quasi-governmental agencies organized in accordance with detailed legislation adopted in the various states. John Leshy once aptly noted the
    > practical impossibility of generalizing about modern special water districts. They are, in fact, rather like snowflakes, each with its own unique form. Many of these typically lengthy statutes apply to only one or a handful of districts, and only a few lawyers and district managers may be familiar with their provisions.

    John D. Leshy, *Special Water Districts—The Historical Background*, *in* Special Water Districts: Challenge for the Future (James Corbridge ed., 1983).
11. *See* John H. Davidson, *Mutual Ditch or Water Corporations*, *in* Waters and Water Rights, §26.02 (Robert E. Beck ed., 1991) (explaining that mutual ditch companies are "usually in the form of a non-profit corporation organized for the exclusive benefit of the users in a particular area who became its stockholders," with the goal of "provid[ing] a vehicle for organizing the distribution of water so that the individual water users were relieved of the burden of managing the ditch").
12. *See, e.g.*, Barton H. Thompson Jr., *Institutional Perspectives on Water Policy and Markets*, 81 Cal. L. Rev. 671, 688 (1993). In 1978, public water districts supplied 56.8% of California's water, mutuals supplied 9.0%; public water districts supplied 7.1% of Colorado's water, mutuals supplied 69.9%; public water districts supplied 24.7% of Wyoming's water, mutuals supplied 30.7%. *Id.* tbl. 2.
13. As a general rule, states do not allow parties to transfer unperfected rights, that is, rights that have not been applied to the beneficial use for which they were authorized, in part because of the fear that allowing such transfers would promote speculation. *See, e.g.*, Catherland Reclamation Dist. v. Lower Platte North Natural Resources Dist., 433 N.W.2d 161, 165 (Neb. 1988); Green River Development Co. v. FMC Corp., 660 P.2d 339, 344 (Wyo. 1983).
14. At least one western state, Wyoming, initially prohibited transfers entirely. *See* Wyo. Stat. §41-3-101 (2011), which to this day provides in relevant part that "[w]ater rights for the direct use of the natural unstored flow of any stream cannot be detached from the lands, place or purpose for which they are acquired. . . ." This prohibition has since been superseded by an express provision that allows transfers, but only under strict conditions. Wyo. Stat. §41-3-104 (2011). Other western states have taken a more liberal view of transfers, but generally subject to the no injury standard. For example, Ariz. Rev. Stat. Ann. §45-172 (2011) allows water transfers with some limitations. "A water right may be severed from the land to which it is appurtenant or from the site of its use if for other than irrigation purposes and with the consent and approval of the owner of such right may be transferred. . . ." *Id.*
15. Ariz. Rev. Stat. Ann. §45-172(A)(2) (2011) states in relevant part that, "[v]ested or existing rights to the use of water shall not be affected, infringed upon nor interfered with, and in no event shall the water diverted or used after the transfer of such rights exceed the vested rights existing at the time of such severance and transfer. . . ." Cal. Water Code §1745.07 (2011) states in relevant part that "[n]o transfer of water pursuant to this Article or any other provision of law shall cause a forfeiture, diminution, or impairment of any water rights."
16. *See, e.g.*, Phoenix Water Co. v. Fletcher, 23 Cal. 481, 487 (Cal. 1863); Lawrence J. MacDonnell & Teresa A. Rice, *Moving Agricultural Water to Cities: The Search for Smarter Approaches*, 2 Hastings W.-Nw. J. Envtl. L. & Pol'y 27, 28 (1994-1995):
    > The understanding reached in Colorado is that a proposed transfer should be considered in terms of its net depletive effects on the stream and on the manner in which it would change the timing of flows. A reduction in the historical availability of water to another appropriator, either because of increased depletion by the new use or because the new use changes the timing with which the water is available to other appropriators, will be regarded as an injury to those appropriators and will not be permitted.
17. *See, e.g.*, Santa Fe Trail Ranches Property Owners Ass'n v. Simpson, 990 P.2d 46, 58 (Colo.1999), which held in part:
    > [i]n a change of use and augmentation case, applicant seeking change must demonstrate that the timing of diversions and the

On its face, the no injury rule is simple and sensible. It helps ensure that priorities among water users on a given stream are not upset by changes to the system instigated by an existing user or her successor.[18] Unfortunately, as currently implemented, the no injury rule often imposes extraordinary transaction costs, primarily in the form of legal and expert fees. In particular, uncertainties about the scope and extent of injuries from a proposed transfer encourage parties on both sides to hire experts to predict an outcome that favors the legal position of their clients.[19] In addition to the significant costs associated with proving or disproving injury, all of this also takes considerable time, which means that a transfer applicant may not know for several years whether her application will be approved and, if so, how much water will be authorized for transfer if it is approved.[20]

Arguably, much of the cost and uncertainty associated with water transfers is attributable to the resistance of the agricultural community to any transfers that propose moving water out of agricultural use.[21] This resistance stems, in part, from the threats that water transfers pose to the economic stability of rural communities.[22] Perhaps most obviously, moving water from farms to cities usually means a loss of the economic activity associated with the farmland itself.[23] When cities buy irrigated farmland for the purpose of transferring the water resources, they have often engaged in what some have pejoratively called "buy and dry"[24] practices. Buy and dry refers to the situation where the buyer essentially abandons the land after the water rights are transferred without adequate consideration of the need to restore the land to a stable and productive state.[25] So, instead of reverting to native grasses that might contribute to a bucolic setting, attractive to tourists and new settlers, the land subject to buy and dry practices may become infested with unattractive, opportunistic, non-native weeds, that further diminish the prospects for a vibrant rural economy. Reforms are likely to be viewed skeptically by rural communities if they perceive a streamlined water transfer process as a vehicle for undermining rural economies.

Irrigated agriculture is far and away the dominant consumptive use of water resources in the West.[26] Thus, it seems inevitable that cities looking for new water supplies will cast their gaze toward agricultural communities. Agricultural water rights are also attractive because they tend to be the most senior rights.[27] While agriculture is an impor-

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quantity of consumption for the changed use will not exceed those of the perfected appropriation, and that return flows of native waters from the decreed use at its place of use—upon which junior appropriators and prospective new appropriators often depend for their supply-will not be diminished.

See also Farmer's High Line Canal & Reservoir Co. v. City of Golden, 975 P.2d 189, 197 (Colo. 1999), which held in relevant part that "[i]t is the water court's duty to hear testimony regarding the alleged injurious effects of the change of use of water and to aid the parties in crafting conditions of water rights decree to prevent such injury." Put differently, "[c]hanging the place of diversion of adjudicated water rights cannot enlarge or expand the water right at the expense of other appropriators or the state." W.S. Ranch Co. v. Kaiser Steel Corp., 439 P.2d 714,718 (N.M. 1968).

18. MacDonnell & Rice, *supra* note 16, at 30-31. **("At one level, such protection** [the no injury rule] makes eminent good sense; transfers ought not to leave other water users in the same system worse off.").
19. Injuries may result not only from the loss of water resources from a particular basin, but also the loss of late season flows that often result from the application of water to upstream agricultural lands. *See* Hall v. Kuiper, 510 P.2d 329 (Colo. 1973); *see also* John H. Davidson, *Reallocation, Transfer, and Change Elements*, *in* Waters And Water Rights §14.04(c) (Robert E. Beck ed., 1991).
20. *See, e.g.*, *supra* note 4, at 420 ("Complex cases can stretch over years and attract dozens of opponents. For example, litigation over Union Park extended from 1984 through 2000, and included over twenty parties." Bd. of County Comm'rs of County of Arapahoe v. Crystal Creek Homeowners Ass'n, 14 P.3d 325, 329 (Colo. 2000)); *id.* at 421:

    > Although engineers can estimate the yield of a water right, adjudication is necessary to determine consumptive use. Thus, purchasers of existing rights for new municipal uses may not know in advance the actual yield of the rights they are purchasing for transfer. The junior protection rule [Colo. Rev. Stat. Ann. §37-902-305(3) (2002)] guarantees in many, perhaps most, situations that not all of a water right can be transferred, and it is not apparent at the time of filing a change case which junior appropriators will be injured and what will be necessary to keep them whole, even with extensive engineering.

    See also Bonny Colby Saliba et al., *Do Water Market Prices Appropriately Measure Water Values*, 27 Nat. Resources J. 617, 621 (1987) (explaining that when individuals are unable to ascertain the legal rights and restrictions of a water purchase, they are unlikely to purchase a water right).
21. *See, e.g.*, In re Application of Howard Sleeper, 760 P.2d 787, 788-89 (N.M. Ct. App. 1988) (responding to protestants challenge that a transfer of water rights to a ski resort harmed the public welfare); MacDonnell & Rice, *supra* note 16 ("Purchases of agricultural lands in the Owens Valley and the associated water rights by the City of Los Angeles earlier in this century, provoked so much controversy that it essentially ended water marketing as a way of meeting urban water demands in California until the last ten years.").
22. Steven J. Shupe et al., *Western Water Rights: The Era of Reallocation*, 29 Nat. Resources J. 413, 428-30 (1989) ("Water right transfers threaten not only county tax bases, but also the overall economic health of rural areas . . . The overall quality and character of life can be undermined in areas where historic irrigation suddenly is terminated.").
23. Studies from California, Colorado, and Oregon confirm "that water availability is a significant determinate of farmland value." Economic Impacts of Climate Change on Agricultural Water Use in California, 15 (2005), *available at* http://www.energy.ca.gov/2005publications/CEC-500-2005-054/CEC-500-2005-054.PDF and http://are.berkeley.edu/~fisher/ClimateChange.pdf; Brian E. Gray, *The Shape of Transfers to Come: A Model Water Transfer Act for California*, 4 Hastings W.-Nw. J. Envtl. L. & Pol'y 23, 40 (1996) (discussing loss of economic activity associated with transfer of water); Charles W. Howe & Christopher Goemans, *Economic Efficiency and Equity Considerations in Regional Water Transfers: A Comparative Analysis of Two Basins in Colorado* 13 (2003).
24. *See, e.g.*, 26th Annual Water Law Conference: *Twenty-First Century Water Supply, Use and Distribution: Do the Rules Still Apply?*, 11 U. Denv. Water L. Rev. 389, 405-06 (2008):

    > "[B]uy and dry" [is] the permanent transfer [of water] from agricultural use to municipal use that can dry the land. . . . [T]he transfer is a one-time deal where municipalities buy shares in a ditch company, often far from the municipality, and the water is permanently removed from irrigation use by the ditch company. The irrigator and the region then can suffer from the limited or lost agricultural productivity resulting from the water transfer.

25. *See id.*
26. For example, an estimated 90% of the total water consumed in Colorado was used for irrigation in 2005. Estimated Use of Water in the United States, *supra* note 1. In Montana, 96% of the total water consumed was used for irrigation. *Id.* In California, irrigation accounted for 74% of total state water use. *Id.*
27. *See, e.g.*, Charles T. DuMars, *Public Policy Considerations in State Water Allocations and Management*, 42 Rocky Mtn. Min. L. Inst. 24, 24-4 (1996) ("While the demand for urban uses is increasing, most senior water rights remain in agricultural uses criticized by some as economically inefficient."); Adam Schempp, *Western Water in the 21st Century: Policies and Programs That Stretch Supplies in a Prior Appropriation World*, 40 ELR 10394, 10411 (Apr. 2010) ("Water rights can remain with lower value uses, such as agriculture (commonly the most senior water rights)."); *see also* Dudley D.

tant component of the economies of these rural areas, it is not a significant part of the overall economy in any western state.[28] Therefore, while the politics of reforming transfer laws will undoubtedly prove daunting, even with proposals that are sensitive to rural impacts, the legal obstacles posed by changing existing water transfer laws are relatively easy to surmount.

II. Water Transfers and the Takings Clause

One of the great myths of western water law is that water rights are property rights that are essentially inviolable. Under this view, the no injury rule for water transfers is effectively compelled by the U.S. Constitution. To be sure, water rights are vested property rights, and unless those rights are abandoned or wasted, they cannot generally be reclaimed by the state without paying just compensation.[29] But this is not to say that the use of these rights cannot be managed or restricted in ways that go beyond the restrictions imposed in the original grant. Such post-acquisition restrictions are common to most forms of property and do not inevitably lead to a valid claim that the property rights have been unconstitutionally "taken."[30]

Moreover, for several reasons, water rights are among the most tenuous forms of property, and as such they have one of the least compelling claims to be free from government restrictions, even where such restrictions are imposed after the rights are perfected. First, in every American state with positive water law, water resources are owned by the state. A water right gives only a right to use the water, and while even use rights can be quite valuable, states have historically given them to water users for free.[31] While this largesse does not license the state to withdraw these rights once they are granted, states have always claimed the power to set rules to regulate, among other things, the allocation of water, abandonment and forfeiture of rights, transfers of water rights, and beneficial use of water resources. And as with forms of real property, states may sometimes add new rules or set new restrictions on existing water rights without compensating the owner. Those new rules are not likely to lead to a valid "takings" claim unless they interfere with the owner's "distinct investment-backed expectations."[32]

To be sure, claims that a state or federal rule gives rise to an unconstitutional taking of a private party's water rights do sometimes arise, and are occasionally successful.[33] One strategy, for example, is to argue that a restriction that curtails the amount of water available to a user amounts to a partial "physical taking" of the water. The U.S. Supreme Court has suggested that a physical taking constitutes a per se taking of property.[34] But unless the state is physically appropriating the water for its own use, the restriction is more likely to be viewed as a regulatory restriction subject to the more forgiving test articulated by the Supreme Court in *Penn Central Transportation Co. v. New York City*.[35] There, the Court held that a regulation that restricts the use of property should be examined to determine "[t]he economic impact of the regulation on the claimant and, particularly, the extent to which the regulation has interfered with distinct investment-backed expectations. . . ."[36] Restrictions that do not interfere with the reasonable, investment-backed expectations of the owner are unlikely to be found to cause a taking. Given the widespread tolerance for minor injuries to water rights that occur under the current prior appropriation system, it seems unlikely that minor injuries to existing users that might result from modest changes in the current water transfers system would interfere with the distinct, investment-backed expectations of the existing user.

III. The Economics of Water Transfers

Understanding why water markets have historically failed to provide for the efficient reallocation of water requires a basic understanding of microeconomic theory. A competitive market typically exhibits the following characteristics: (1) a large numbers of buyers and sellers; (2) products that are fungible, or indistinguishable to consumers; (3) consumers and producers with perfect information about prices and quality; and (4) firms with equal knowledge of and access to relevant technology.[37] Markets lacking one or more of these characteristics may fail to allocate goods efficiently.

At first blush, water rights might seem to fit these characteristics reasonably well. Many people own water rights, and many others are interested in buying those rights.

Johnson, *An Optimal State of Water Law: Fixed Water Rights and Flexible Market Prices*, 57 Va. L. Rev. 345 (1971).

28. *See* Terry L. Anderson, Water Crisis: Ending the Policy Drought (1983); *see also* Harrison C. Dunning, *State Equitable Apportionment of Western Water Resources*, 66 Neb. L. Rev. 76, 78 (1987).
29. *Compare* Tulare Lake Basin Water Storage District v. United States, 49 Fed. Cl. 313 (2001) *with* Klamath Irrigation District v. United States, 67 Fed. Cl. 504 (2005). *See also* Brian E. Gray, *The Property Right in Water*, 9 Hastings W-NW J. Envtl. L. & Pol'y 1 (2002).
30. *See* U.S. Const. amend. V (". . . *nor shall private property be taken for a public use without just compensation*"); *see also* Village of Euclid, Ohio v. Amber Realty Co., 272 U.S. 365 (1926) (upholding post-acquisition restrictions and corresponding diminution of value against a takings challenge). Penn Central Transportation Co. v. City of New York, 438 U.S. 104, 8 ELR 20528 (1978).
31. One notable exception is the state of Montana, which provides for leasing large water rights from the state. Mont. Code Ann. §85-2-407.
32. *See Penn Central, supra* note 30.
33. *See* Hage v. United States, 51 Fed. Cl. 570 (2002).
34. *See* Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, 426, 435-36 (1982) (holding that a permanent physical occupation of private property, however minor, results in a per se taking, regardless of the public interest advanced by the occupation.); *see also* Klamath Irrigation District v. United States, 635 F.3d 505, 41 ELR 20094 (Fed. Cir. 2011); Sacramento Grazing Ass'n, Inc. v. United States, 96 Fed. Cl. 175 (2010). As with any property, the physical taking of a water right requires physical occupation, such as a diversion, in order to implicate the *Penn Central* test.
35. 438 U.S. 104, 124, 8 ELR 20528 (1978).
36. *Id.* (citing Pennsylvania Coal Co. v. Mahon, 260 U.S. 393 (1922)). The Court also considered the "the character of the governmental action," referring specifically to the notion that a physical invasion is more likely to support a takings claim.
37. David Besanko & Ronald R. Braeutigam, Microeconomics 330 (2011). The authors suggest that water markets seem to fail primarily because water rights are not fungible and to a lesser extent because information about price and value is likely imperfect.

Basic information about the sale price of water is reasonably well-known,[38] and interested parties have some sense about the value of water in individual water basins.[39] But a closer look reveals some structural problems that will have to be overcome if the free market in water is ever going to thrive. In particular, under the current legal system, water rights often fail the fungibility test because they are not homogenous. Moreover, information about the price and quality of water may be skewed by the limited number of transfers and the dominant influence of the Colorado-Big Thompson (CBT) market in the transfer picture.[40]

In order to be fungible, a water right must essentially be the same anywhere it is available within a given geographic market. Put another way, if water rights were fungible, a buyer interested in purchasing an acre-foot of water should be able to walk into a marketplace and purchase that acre-foot of water at a negotiated price, and then take that water to the desired point of end use. The location and quality of that acre-foot of water may affect the price, since it will have to be delivered to the point of use, and perhaps treated to bring it to the quality required for that use. But the value of property is commonly dependent on location and quality, and such differences by themselves should not deter water transactions. The real obstacle to the fungibility of water rights seems to be the uncertainty that the no injury rule brings to the transfer.[41] Uncertainty causes significant delays and denies the buyer the ability to know exactly how much water will be available for use after the transfer.[42] Thus, the buyer cannot accurately compare the cost of water available for transfer with water that might be available from a water development project or some other source.[43] Moreover, this uncertainty greatly increases the transaction costs associated with transferring water, and overcoming this uncertainty is too often an expensive, complex, and time-consuming task.[44]

As previously described, the no injury rule allows any existing water user who might be affected by a proposed transfer to block that transfer even for minor injuries that might result from the proposed changes to the water system. Such injuries might include, for example, a change in the timing of return flows.[45] Consequently, a water right taken from one location on a stream is not fungible with a water right taken from another location on that same stream if existing users are in a position to complain about injuries, such as the loss of late-season return flows.

Importantly, this problem does not manifest itself with storage water rights, which is why successful water markets are so often associated with stored water.[46] Stored water in the western United States is typically collected in the spring as snow melts in the mountains, and the owner's priorities are satisfied at the time of storage. Most of the large storage projects are owned and managed by special-purpose water districts and mutual ditch companies, which is one reason that these agencies have proved more capable of transferring water efficiently.[47]

As already noted, one of the chief obstacles to making water rights fungible is the inadequate definition of water as a property right. Western water law has traditionally defined water rights in terms of the amount of water that can be diverted out of a stream.[48] While this may be a necessary requirement for identifying a property right in water, it is hardly sufficient if the goal is to promote a robust water market. This is because the system largely functions on the basis of the amount of water *consumed*, not the amount of water *diverted*.[49] More specifically, the diversion amount tells a prospective buyer very little about the amount of water that might be available for transfer. If water rights were defined both in terms of a diversion amount and a consumptive use amount, the prospects for a free market in water would brighten markedly.[50] In particular, one can easily imagine a thriving market of consump-

38. David S. Brookshire et al., Water Resources Research 1 (2004).
39. Decisions to pursue engineering solutions, for example, are generally weighed against the relative cost of acquiring water through transfers. *See, e.g.*, *Northern Integrated Supply Project DEIS*, *supra* note 5.
40. *See infra* notes 62-64 and accompanying text. The CBT project is discussed in greater detail at Part V.I.A. of the Article. *See also* Besanko & Braeutigam, *supra* note 37, at 330; Bonnie Colby Saliba & David B. Bush, Water Markets 23 (1987).
41. Bonny Colby Saliba et al., *Do Water Market Prices Appropriately Measure Water Values?*, 27 Nat. Resources J. 617, 621 (1987) (explaining that when individuals are unable to ascertain the legal rights and restrictions of a water purchase, they are unlikely to purchase a water right).
42. *Id.* at 645 (1987) (noting that legal, hydrologic, and economic uncertainties are present in water markets and reduce market participation and distort market prices); *see also Transaction Costs as Determinants*, *supra* note 4, at 3 (noting that because water transfers must go through the review of the Water Court or State Engineer, and because the Water Court may impose conditions upon the transfer, Colo. Rev. Stat. Ann. §37-92-305(4)(a), the final transfer is likely to contain terms not found in the original application such as: restrictions on total volume, flow rate, and timing).
43. *See* Saliba et al., *supra* note 41, at 651 (explaining that information regarding the amount and price of water as well as the restrictions that will be placed on the use of said water are essential in the valuation process of a proposed transfer of water).
44. Uncertainties in water transfers lead to buyers and sellers bearing the cost of risks that take the form of brokerage service fees, hydrology studies, and legal representation. *Transaction Costs as Determinants*, *supra* note 4, at 3. These transaction costs become prohibitively large for most prospective parties to a transfer as is evidenced by the proposed American Water Development, Inc. transfer that spent nine years in court and several million dollars in attorneys and engineering fees. *See* American Water Dev., Inc. v. City of Alamosa, 874 P.2d 352, 357, 359 (Colo. 1994); *see also* Nichols & Kenney, *supra* note 4, at 422; *see also* Charles W. Howe et al., *supra* note 6, at 1200 (1990) ("Water sales and subsequent transfers may be negotiated over several years . . . There is no such thing as a clean-cut water transfer.").
45. *See, e.g.*, Colo. Rev. Stat. Ann. §37-92-304(a)(II) (2011).
46. *See, e.g.*, Margaret Bushman LaBianca, *The Arizona Water Bank and the Law of the River*, 40 Ariz. L. Rev. 659, 676 (1998); Morris Israel & Jay R. Lund, *Recent California Water Transfers: Implications for Water Management*, 35 Nat. Resources J. 1, 13 (1995); *see also* Booker et al., *supra* note 6, at 206 ("Economists have long suggested that market institutions such as water rights transfers and water banks have the potential to increase economic efficiency relative to traditional water allocation institutions. . . .").
47. For a discussion of a robust water market and its accompanying storage facilities, see notes 18-21 and accompanying text.
48. Nichols & Kenney, *supra* note 4, at 421.
49. Santa Fe Trail Ranches Property Owners Ass'n v. Simpson, 990 P.2d 46, 52, 59 (Colo. 1999).
50. *See* Lawrence J. MacDonnell, *Public Water-Private Water: Anti-Speculation, Water Reallocation and High Plains A&M*, LLC v. Southeastern Colorado Water Cons District, 10 U. Denv. Water L. Rev. 1, 3 (2006) (suggesting that consumptive use "effectively privatizes the water"); Antony Frank & David Carlson, Colorado's Net Irrigation Requirements for Agriculture, tbl. 1 Colorado Dept. of Agriculture (1995), *available at* http://cospl.coalliance.org/fez/eserv/co:3072/ag92ir71999internet.pdf; Nichols & Kenney, *supra* note 4, at 421.

tive use amounts within a single water basin, and perhaps even among multiple basins.

Of course, even defining water rights in terms of consumptive use would not by itself make transfers any easier. Current law in most jurisdictions explicitly recognizes the right of existing water users to block transfers if they suffer injuries, even where the transfer amount is limited to consumptive use.[51] However, a relatively simple change to the law would require water rights to be defined in terms of their consumptive use and to presumptively allow that amount—perhaps subject to a small discount—to be transferred. Indeed, such a change would be easy to accommodate under the current legal regime, would likely cause no greater injury than is already tolerated under other aspects of the law, and could potentially limit other forms of injury.

For example, in every western state, agricultural water users are free to grow any crop they can successfully cultivate. But the choice of crop greatly affects the amount of water consumed. In Colorado, alfalfa typically consumes nearly two acre-feet of water per acre, whereas sunflowers consume 1.34 acre-feet of water per acre.[52] Yet, an agricultural user may freely switch from sunflower to alfalfa, even if such a change causes a significant injury to existing users. Likewise, in most western states, agricultural users are free to recapture and reuse water, so long as they recapture and reuse the water for the same purpose and on the land for which the rights were appropriated, even if such reuse increases the amount of water consumed.[53] Finally, measuring the amount of water diverted through a ditch is far from an exact science, and measurement errors are routinely tolerated, even if they might cause injury to existing users.[54] Defining water rights in terms of consumptive use would ensure that efforts to recapture and reuse, or to change crops, would not result in the consumption of water resources in excess of the legal allotment.

Furthermore, minor departures from the priority system are common in the prior appropriation system, and are tolerated even where they might harm vested water rights. So, for example, the fact that an inaccurate flume might injure another water user by effectively allowing the diversion of more than one's entitlement[55] or the fact that an appropriator might change crops and thereby consume more water in a manner detrimental to an existing user, will not generally trigger a valid legal claim by an injured water user. Likewise, an existing user may recapture, reuse, and thereby consume more water than was historically consumed, to the detriment of other users, without giving rise to a valid cause of action.[56] Tolerating such vagaries in the priority system is probably sensible and perhaps even necessary to the efficient operation of the system, but it also illustrates how a water right is not the inviolable form of property that some wish to claim for it.

These examples highlight the inconsistent way that water transfers are treated under the law. The smallest injuries could result in the denial of a transfer application, but farmers need no approval to change to crops that could cause far greater injuries to existing users.

Allowing parties to transfer consumptive use amounts, without regard to the relatively minor injuries that such transfers might cause, would help address the definitional problem with water rights that exists under the current system, and could easily be accomplished in accordance with property rights principles. The courts have consistently recognized the power of government agencies to impose modest constraints on the use of property without having to compensate the property owner for any possible loss of value.[57] The ability of government agencies to impose such limits on the use of private water rights should be especially clear in the context of a resource where the property owner has only a use right and where the corpus of the right is held by the state in trust for the people.[58]

The difficulties inherent in transferring water in the West have the unfortunate effect of increasing the price of the limited supplies of water that are readily available for transfer. This can be seen from the ease with which CBT units are traded and the extraordinarily high price that these units command in the marketplace.[59] From 2007-2009, there were 353 permanent transfers in the western United States.[60] Of those transfers, 61% or 216 transfers involved CBT units in Colorado.[61] Put another way, more than 60% of all transfer activity involved a single project that represents a tiny fraction of total allocated water rights in the western states. Prices for CBT units purchased in Colorado from 2007-2009 were also among the highest

51. *See, e.g.*, Colo. Rev. Stat. Ann. §37-92-304 (2011); Wyo. Stat. §41-3-104(a) (2011).
52. Rachel Barta et al., Colorado High Plains Irrigation Practices Guide Water Saving Options for Irrigators in Eastern Colorado, tbl. 1 (2004), *available at* http://www.cwi.colostate.edu/publications/sr/14.pdf. *See also* Save the Poudre Coalition, *A Review of the Likely Agricultural Impacts From the Northern Integrated Supply Project*, app. A (Sept. 7, 2008), *available at* http://www.savethepoudre.org/docs/stp_ag_impacts_analysis.pdf, citing the U.S. Department of Agriculture 2002 Census of Agriculture, *available at* http://www.agcensus.usda.gov/ and U.S. Department of Agriculture, National Agricultural Statistics Service, *available at* http://www.nass.usda.gov/. *See also* Antony Frank & David Carlson, Colorado's Net Irrigation Requirements for Agriculture, tbl. 1 Colorado Dept. of Agriculture (1995).
53. *See, e.g.*, Montana v. Wyoming, 131 S. Ct. 1765, 1779, 41 ELR 20168 (2011); Cleaver v. Judd, 393 P.2d 193, 195-96 (Or. 1964); Bower v. Big Horn Canal Assoc., 307 P.2d 593, 601 (Wyo. 1957).
54. *See* Mark Squillace, *Accounting for Water Rights in the Western United States*, *in* International Water Accounting: Effective Management of a Scarce Resource (2012).
55. *Id.*
56. *See* City of Thornton v. Bijou Irrigation Co., 926 P.2d 1 (Colo. 1996); Binning v. Miller, 102 P.2d 54 (Wyo. 1940); Department of Ecology v. U.S. Bureau of Reclamation, 827 P.2d 275 (Wash. 1992).
57. *See, e.g.*, *supra* note 7.
58. *See, e.g.*, Colo. Const. art. XVI, §5; Idaho Const. art. XV, §1, Cal. Const. art. X, §5; Wyo. Const. art. I, §31.
59. *See* Booker et al., *supra* note 6, at 208 ("Gardner and Miller [1983] . . . found that while most CBT shares at the time were held by agricultural users, prices fully reflected expected values to future municipal and industrial buyers.").
60. There were 135 permanent transfers in the West in 2007. Eighty-seven of these involved CBT units. *2007 Annual Transaction Review*, Water Strategist, Feb. 2008, at 11-15. In 2008, there were 116 permanent transfers; 69 involved CBT units. *2008 Annual Transaction Review*, Water Strategist, Feb. 2009, at 8-12. In 2009, there were 102 permanent transfers in the western states; 60 involved CBT units. *2009 Annual Transaction Review*, Water Strategist, Feb. 2010, at 9-13.
61. *Id.*

recorded for permanent transfers in western states.[62] The relative paucity of these transfers calls into question the adequacy of the public's information about the true price of water.

If the only consequence of the market failure in water resources was that municipal residents were forced to pay a higher price for their water, this might be considered an acceptable outcome. But the consequences are far more serious, especially in terms of environmental impacts. When a city decides that it needs to secure additional water resources, it has several options. First, and perhaps most importantly, it can embark on a water conservation program to reduce per capita consumption.[63] Second, it can purchase senior water rights (or farmlands that include senior water rights) and begin the process of transferring that water to municipal use.[64] As previously noted, this can be a long and expensive process with an uncertain outcome. Third, it can look to developing new sources of water, either from groundwater or water storage projects.[65] Groundwater is not always available and may not be a secure, long-term resource.[66] Moreover, much groundwater is hydrologically connected to surface water, and thus often leads to conflicts with senior surface water users.[67]

Water storage, often with water from remote water basins, has historically proved to be a reliable source for new water resources, but it can also be very expensive. To justify construction of new projects, a city typically compares the cost of building and operating the project to other options, including the costs associated with buying, transferring, and delivering water from existing users. If the cost of transferring water is inflated well beyond the true market price, water development looks far more reasonable.[68]

Suppose, for example, that a city decides it needs to secure an additional 10,000 acre-feet of water to satisfy its projected demands. If the price for water in a dysfunctional market is currently $10,000/acre-foot (including delivery costs) then, assuming that operation and maintenance costs are comparable, the city will likely opt to transfer water rights only if the cost of a project to produce that water is more than $100 million—the cost of purchasing and transferring 10,000 acre-feet of water rights. If the true market price for water, however, is $1,000 per acre-foot, then a city would be justified in pursuing the project only if the project could be built for less than $10 million.[69] Perhaps more importantly, if the city is not sure how much water it will get from the proposed transfer, or how long it will take to consummate the transfer, the city might reasonably opt to build the project, even if it is pro-

62. In 2007, CBT units were purchased from $9,215-$10,500/unit ($11,519-$13,125/AF) on average. *2007 Annual Transaction Review*, *supra* note 60, at 18. These prices were significantly higher than recorded prices for permanent transfers in most western states. *Id.* at 11-15. Examples of prices in other western states include purchases of pumping rights to Edwards Aquifer in Texas for $5,000/AF and non-irrigation water rights in Arizona for $1,200-$2,000/AF. *Id.* at 11, 15. In 2008, average CBT prices ranged from $9,215-$9,716/unit ($13,164-$13,880/AF), excluding certain November transactions because their price was negotiated in 2002. *2008 Annual Transaction Report*, *supra* note 60, at 16. In Texas, pumping rights for the Edwards Aquifer again sold for $5,000/AF and non-irrigation water rights in Arizona sold for $1,200-$2,000/AF. *Id.* at 16. Prices ranged from $1,800-$3,650/AF in California in the Mojave River Basin. *Id.* CBT units in 2009 sold for $7,133-$10,000/unit ($8,916-$12,500/AF) on average. *2009 Annual Transaction Review*, *supra* note 60, at 16. In Texas, rights to the Edwards Aquifer sold for $5,400-$6,500/AF. *Id.* at 16. Non-irrigation rights in Arizona sold for $1,000-$2,000/AF. *Id.* Prices in the Mojave River Basin of California ranged from $400-$3,841. *Id.* CBT units are converted to acre-feet using a quota set each year by the NCWCD. The quota was 80% in 2007 and 2009, and 70% in 2008. *See News Releases & Policies*, Northern Colorado Water Conservancy District, *available at* http://www.ncwcd.org/news_information/news_release.asp. In setting the initial quota each October and resetting the following April, the Board takes into account water availability and need in the region. Since CBT water is designed as a supplemental water supply, the Board looks at native water supplies and local storage during the quota setting process. *See* Northern Colorado Water Conservancy District, Water Conservation and Management Plan, 3 (2004) [hereinafter NCWCD Management Plan], *available at* http://www.ncwcd.org/ncwcd_about/pdf/cons_plan.pdf.

63. *See* Kenney, *supra* note 8, at 15-20, comparing costs of conservation programs, water transfers, and water development projects. Study finds that conservation is the cheapest option. *Id.* at 21.

64. *See* notes 22-24 and accompanying text. *See also* Kenney, *supra* note 8, at 11-12 (assessing the relative costs of water transfers to other water supply options).

65. Both groundwater and storage projects have found little success in the past 20 years. *See generally* Nichols & Kenney, *supra* note 4, at 427-28. American Water Development, Inc., was defeated in its attempt to tap and export 200,000 acre-feet of groundwater from beneath land it owned in the San Luis Valley as it was determined to be tributary groundwater. American Water Dev., Inc. v. City of Alamosa, 874 P.2d 352, 358 (Colo. 1994). Additionally, new development of water storage projects is considered by most commentators to be nearly impossible because of environmental and area-of-origin considerations. *See, e.g.*, Nichols & Kenney, *supra* note 4, at 447 (claiming that any new development will be small-scale and "unconventional" reservoirs).

66. Although most groundwater aquifers do have a certain level of recharge or replenishment, the rate is significantly slow, and therefore, groundwater resources are usually considered nonrenewable. *See, e.g.*, World Bank, *Sustainable Groundwater Management: Concepts and Tools*, Briefing Note 11, 1 (2002), *available at* cap-net.org/sites/cap-net.org/files/wtr_mngmnt_tls/38_GWMate11.pdf; *see also* Peter D. Nichols et al., Water and Growth in Colorado: A Review of Legal and Policy Issues 99, 103 (2001) (explaining that in Colorado, tributary groundwater is treated like surface waters under the prior appropriation system and that non-tributary groundwater can only be permanent source of water supply if withdrawals are limited to the recharge rate).

67. *See, e.g.*, American Water Dev., Inc. v. City of Alamosa, 874 P.2d 352, 357, 359, 368 (Colo. 1994); Kobobel v. State, Dept. of Natural Resources, 249 P.3d 1127, 1136 (Colo. 2011); Three Bells Ranch Associates v. Cache La Poudre Water Users Ass'n, 758 P.2d 164, 169-70 (Colo. 1988).

68. Nichols & Kenney, *supra* note 4, at 421-22:

> [M]unicipalities such as Colorado Springs, Pueblo, Pueblo West, and Aurora now own almost all of the water from the Twin Lakes project located south of Leadville, a trans-basin project originally designed to serve irrigation interests. Shares sell for $10,000 to $15,000, a price dramatically higher than the cost of native Arkansas River water. Yet, buying shares of trans-basin water for municipal use makes better economic sense than buying native water since it is generally possible to unilaterally change the use without the uncertainty or risk of water court. CBT shares exhibit a similar trend. Municipal water providers concerned about water court costs to convert native water dramatically bid up the price of CBT units. Weighted CBT prices rose steadily from around $3,600 per acre-foot in June 1996 to nearly $26,000 per acre-foot in April 2000. In contrast, competing native irrigation water sells for $500 to $1,000 per acre-foot, depending on location.

69. *See, e.g.*, U.S. Army Corps of Engineers, Omaha District, *Northern Integrated Supply Project DEIS*, ES-6 (Apr. 2008), *available at* https://www.nwo.usace.army.mil/html/od-tl/eis/nisp.deis.apr08.pdf. No-action alternative, which would involve acquiring the water from CBT, would cost an estimated $830,500,000. This is significantly more than the other proposed alternatives, all of which involve major water development projects.

jected to cost more to ensure that needed water resources are secured.

While water transfers can have adverse environmental impacts,[70] limiting transfers to the existing consumptive use, i.e., the amount that has historically been consumed by the existing user, and restricting transfers to the basin of origin, would largely guarantee that such environmental impacts would be relatively modest. By contrast, water development projects, especially those that draw water from remote water basins, are far more likely to impose serious environmental damage.[71] These damages may be justified by the costs and benefits associated with the projects as compared to the alternatives. But when the water transfer alternative is based upon the significantly inflated costs of a dysfunctional market, environmentalists and economic conservatives alike can fairly question whether a more rational approach to water transfers should be fashioned. Suggestions for reforming current law and practices to overcome the problems identified in this section are set out in a later section of this Article. And, as already noted, relatively minor changes to existing law could correct some of the most troubling flaws in the current system and help to promote a truly free and flourishing water market.

One additional but important advantage of defining water rights in terms of consumptive use is the fundamental way that it changes incentives for farmers. Under current law, a farmer's incentive is to grow the most water-consumptive crop possible, especially if that farmer is even remotely contemplating a possible future transfer of the water right. This is because the transfer amount will likely be limited to the amount of water historically consumed.[72] If however, a water right is defined in terms of its consumptive use, the farmer has the opposite incentive.

Consider, for example, a farmer who has historically grown alfalfa on 100 acres of land. That farmer would typically consume about193 acre-feet of water in northeastern Colorado.[73] If the law defined that farmer's water right as the full 193 acre-feet of water consumed by the alfalfa crop, that farmer would have a powerful incentive to switch to a less water-intensive crop, so as to be able to sell the remaining right. Growing sunflowers, for example, in northeastern Colorado would consume about 134 acre-feet of water.[74] Thus, the farmer could continue to farm, albeit with a different crop, while at the same time realizing a significant profit from selling the water saved as a result of the crop switch.

IV. Water Transfers That Work

The possibilities for and obstacles to water transfers can best be understood by reviewing the circumstances that have facilitated transfers in the past. For several reasons, the opportunities for simple and efficient transfers are particularly good for the many water districts and mutual ditch companies that operate throughout the western United States. First, the water rights for many of these entities were approved for a wide range of uses over a relatively large geographic area. Thus, a "transfer" of water within the district from one approved use to another does not generally require a formal application or approval process. Second, a substantial portion of the water rights for these entities are associated with storage reservoirs, which greatly increases management flexibility. Once water is stored, it is free from the "call of the river,"[75] and it can be quickly and easily sold within the project area for any of the uses for which is was originally approved. Finally, many of these entities have elaborate delivery systems that allow the water to be distributed over a large portion of the project area with only modest infrastructure improvements. Existing projects involving permanent and temporary transfers in the West offer a window into developing more robust water markets.

A. *Permanent Transfers*

The CBT project may be the most studied water project anywhere in the world, in part because of its remarkable success in achieving a robust market for its water resources.[76] In 1929, the Colorado State Engineer, the Platte Valley Water Conservation League, and the U.S. Army Corps of Engineers sponsored a study that found that the water resources in the South Platte Basin were insufficient to

70. *See, e.g.*, Morris Israel & Jay R. Lund, *Recent California Water Transfers: Implications for Water Management*, 35 Nat. Resources J. 1, 13 (1995) (explaining environmental impacts of California's water banks).

71. *See, e.g.*, U.S. Army Corps of Engineers, Omaha District, *Moffat Collection System Project (Moffat Project) Draft EIS* (Oct. 2009), *available at* http://www.nwo.usace.army.mil/html/od-tl/eis/moffat-deis-docs.html; U.S. Fish and Wildlife Service comment to RWSP EIS Public Scoping Summary Report, *available at* http://www.nwo.usace.army.mil/html/od-tl/eis/rwsp.scoping.comment.2009.fed.pdf; *Northern Integrated Supply Project DEIS*, *supra* note 69.

72. *See, e.g.*, Wyo. Stat. §41-3-104(a) (2010); *see also* Orr v. Arapahoe, 753 P.2d 1217, 1224 (Colo. 1988).

73. *A Review of the Likely Agricultural Impacts From the Northern Integrated Supply Project*, n.7. *See also* Antony Frank & David Carlson, Colorado's Net Irrigation Requirements for Agriculture tbl. 1, Colorado Dept. of Agriculture (1995).

74. *Id.*

75. A call of the river allows senior water rights holders to require junior water rights holders upstream to curtail use if senior rights holders are not receiving their entitled portion due to low stream flow. *See* Charles W. Howe, *Water Law and Economics: An Assessment of River Calls and the South Platte Well Shut-Down*, 12 U. Denv. Water L. Rev. 181, 181-82 (2008).

76. *See, e.g.*, Daniel Tyler, *The Last Water Hole in the West: The Colorado-Big Thompson Project and the Northern Colorado Water Conservancy District* (1992); David S. Brookshire et al., *Market Prices for Water in the Semiarid West of the United States*, Water Resources Res. 40 (2004); Janis M. Carey & David L. Sunding, *Emerging Markets in Water: A Comparative Institutional Analysis of the Central Valley and Colorado-Big Thompson Projects*. 41 Nat. Res. J. 283 (2001); Raymond L. Anderson, *Windfall Gains From Transfers of Water Allotments Within the Colorado-Big Thompson Project*, 43 Land Econ. 265 (1989); Charles W. Howe, *Project Benefits and Costs From National and Regional Viewpoints: Methodological Issues and Case Study of the Colorado-Big Thompson Project*, 27 Nat. Resources J. 5 (1987); *Market Activity in Southwestern States*, *in* Saliba & Bush, *supra* note 40, at 116-21 (1987); Charles W. Howe et al., *Innovations in Water Management: Lessons From the Colorado-Big Thompson Project and Northern Colorado Water Conservancy District*, *in* Scarce Water and Institutional Change, 171-200 (1986); Charles W. Howe et al., *Innovative Approaches to Water Allocation: The Potential for Water Markets*, Water Resources Res. 22 (4), 439-45 (1986); *Water Organizations: The Northern Colorado Water Conservancy District*, *in* Hartman & Seastone, *supra* note 6; J.M. Dille, A Brief History of Northern Colorado and the Colorado-Big Thompson Project (1958).

meet the current and future supply demands for northeastern Colorado.[77] However, the study identified a potential surplus of water on the western side of the Continental Divide, within the headwaters of the Colorado River.[78] The U.S. Department of the Interior Appropriation Act of 1937 approved construction of the transmountain water diversion and supply project, known as the CBT.[79]

Approval of the project was contingent upon the formation of a public water district in Colorado to contract with the U.S. government for repayment of the project costs.[80] The Colorado Water Conservancy Act[81] authorized a district court to organize a conservancy district upon petition of a stipulated number of property owners.[82] Landowners subsequently created the Northern Colorado Water Conservancy District (NCWCD) and designated it as a public agency authorized to contract with the United States for the development and management of the CBT system and its water supply.[83] According to the NCWCD *Water Conservation and Management Plan*, "[t]he District's primary purpose is to provide supplemental water for agricultural, municipal, domestic, and industrial uses in northeastern Colorado."[84]

What makes this project so important for the study of water transfers is that the 310,000 CBT shares that represent water rights are freely marketable over the entire District—a vast geographic area that includes all of the urban areas along the Front Range of Colorado from Broomfield to Fort Collins.[85] The project also includes a large collection and distribution system that encompasses 12 reservoirs, 35 miles of tunnels, and 95 miles of canals.[86] A series of pumps move water up from Lake Granby to Shadow Mountain Reservoir, which then flows into Grand Lake, all on the western slope of Colorado.[87] From there, the 13.1-mile-long Alva B. Adams Tunnel carries Colorado River water under the Continental Divide to tunnels, canals, and pipelines that divert and disperse the water to users throughout northeastern Colorado.[88] A number of reservoirs store the CBT flows on the eastern slope, and the system forks to the north and south, tying distribution into South Platte River tributaries from the Cache la Poudre River to Boulder Creek.[89] The CBT system has a total storage capacity of 925,456 acre-feet, with the majority of its western slope capacity held within Lake Granby (539,758 acre-feet), and the Front Range capacity primarily coming from Horsetooth Reservoir (156,735 acre-feet) and Carter Lake (112,230 acre-feet).[90] With 75,000 acre-feet of dead storage, Lake Granby can hold over two years of CBT water in active storage.[91]

A hallmark of the CBT project is the ease with which shares are bought and sold and the variety of uses for which they are approved. Transactions occur wholly within the NCWCD, so approval by the Colorado water court is not required.[92] CBT transfers are relatively straightforward, inexpensive, and require little time (two-three months) in comparison to typical water transfers.[93] Therefore, it is easy to acquire CBT rights quickly.[94] The CBT project illustrates generally the enormous value of a free and open market for water. If water rights can be defined not merely as an amount available for withdrawal, but also in terms of the amount of water consumed by the current use, and if that consumptive use can be converted to a presumptively marketable quantity of water, then the prospect exists for a truly open and robust water market that has the potential to reduce the price of water and make water shortages a thing of the past.

A less obvious but additional lesson that can be gleaned from the CBT experience is the importance of access by water buyers and sellers to the elaborate distribution systems that typically characterize publicly financed water projects. Municipal and industrial usage has gradually increased since 1958, and 66% of CBT units are now owned by municipal and industrial users.[95] However, approximately 60% of the actual deliveries are still used by

77. U.S. Bureau of Reclamation, *Project Details—Colorado-Big Thompson Project—Development—History* 9, *available at* http://www.usbr.gov/projects/Project.jsp?proj_Name=Colorado-Big+Thompson+Project.
78. *Id.*
79. Robert Autobee, Colorado-Big Thompson Project, Bureau of Reclamation History Program, Research on Historic Reclamation Projects 3, 10,(1996), *available at* http://www.usbr.gov/projects//ImageServer?imgName=Doc_1303159857902.pdf.
80. *Id.* at 11.
81. Colo. Rev. Stat. Ann. §§37-45-101 et seq. (2010).
82. *Id.* §§108-09.
83. *Id.*; *see also* NCWCD Management Plan, *supra* note 62.
84. NCWCD Management Plan, *supra* note 62, at 3 ("The water is used to alleviate the critical shortages that have hampered and restricted the cultivation of fertile lands in the South Platte River Valley."); *see* U.S. Bureau of Reclamation, *Project Details—Colorado-Big Thompson Project—Benefits—Municipal and Industrial*, http://www.usbr.gov/projects/Project.jsp?proj_Name=Colorado-Big+Thompson+Project (11 communities now receive full or supplemental use from the project); *see also* Autobee, *supra* note 79, at 12 ("[The project] provide[s] water to existing farmlands and was not designed to reclaim uncultivated land.").
85. The NCWCD serves a population of approximately 750,000 and delivers an average of 220,000 acre-feet per year to more than 100 ditch, reservoir, and irrigation companies, and 32 municipalities. For a description of the geographic area encompassed by the District, see NCWCD Management Plan, *supra* note 62, at 3.
86. Northern Colorado Water Conservancy District, *Colorado-Big Thompson Project*, http://www.ncwcd.org/project_features/cbt_main.asp.
87. *Id.*
88. *Id.*
89. *See* U.S. Bureau of Reclamation, *Project Details—Colorado Big-Thompson Project—Facility Descriptions*, http://www.usbr.gov/projects/Project.jsp?proj_Name=Colorado-Big+Thompson+Project (last visited July 26, 2012).
90. Northern Colorado Water Conservation District, *Colorado-Big Thompson Project: Interpretive Area*, *available at* http://www.ncwcd.org/news_information/web_news/Publications/Interpretive%20area.pdf.
91. *See* U.S. Geological Survey, *09018500 LAKE GRANBY NEAR GRANBY, CO*, http://pubs.usgs.gov/wdr/wdr-co-03-1/vol2/html/09018500.2003.sw.html; *see also* Interview with Don Carlson and Brian Werner, NCWCD, in Berthoud, Colo. (July 17, 2009) ("Dead Storage" is defined as water storage space below the level of the spillway.).
92. NCWCD Management Plan, *supra* note 62.
93. W.L. Nieuwoudt, *Water Market Institutions in Colorado With Possible Lessons for South Africa*, 26 Water SA 27, 30 (2000).
94. Interview with Don Carlson and Brian Werner, NCWCD, in Berthoud, Colo. (July 17, 2009). In December 2008, CBT units sold at a price of $9,300/unit, when the quota set at that time yielded 0.6 acre-feet per unit, *Transactions: Colorado*, 23 Water Strategist 1, Jan. 2009. From 2002 to 2008, CBT unit prices have fluctuated between approximately $9,300-10,600/unit, *Water Market Indicators: Colorado-Big Thompson Units*, 23 Water Strategist 11, 12 Nov., Dec. 2009.
95. Telephone Interview with Sherri Rasmussen, Allotment Contract Specialist, N. Colo. Water Conservancy Dist. (July 6, 2012).

agriculture,[96] which lease water from municipal shareholders, especially during the drier months of the later summer.[97] As noted above, the NCWCD has built an elaborate distribution system that could potentially facilitate transfers of non-NCWCD water if others had fair access to the NCWCD system. California requires water utilities to provide access to other water distributors when the utility has excess capacity,[98] and such legislation should be encouraged throughout the West.

Despite the success of the CBT market, the high price paid for CBT water points to the failure of water markets. CBT water represents only a small fraction of the water used in northeastern Colorado,[99] and the limited supply of this easily transferable water resource has pushed up its price. The policies of the NCWCD have also contributed to the supply problem by limiting municipal purchases to 80% of CBT shares.[100] If other water resources within the CBT service area were more easily bought and sold, and if access to the NCWCD's distribution system was more readily available at a fair price to other water buyers and sellers, one could imagine a far more robust market with the ability to buy and sell water at much lower prices.

B. Temporary Transfers

Temporary water transfers or water-leasing programs also hold promise for moving more water to urban communities while protecting rural areas that may otherwise face the prospect of losing water rights permanently. In particular, excellent opportunities exist to support rotational fallowing programs, water banking, and interruptible supply agreements, or "dry year options."[101] The advantage of these programs is that they allow agricultural sellers to retain ownership and control over water rights, even as the water is made available for municipal use.[102]

The rotational fallowing program that was pioneered by the Palo Verde Irrigation District (PVID) of southern California in its agreement with the Metropolitan Water District (MWD) offers a particularly useful model for studying temporary transfers. In 1991, the MWD initiated a two-year pilot program with the PVID to reduce the area's use of the Colorado River while promoting a sustainable rural economy.[103] Under the test program, 20,215 acres were voluntarily fallowed by farmers for annual payments of $620 per acre. The payments totaled $25 million over the two-year period, with approximately 93,000 acre-feet of water stored in Lake Mead and made available to the U.S. Bureau of Reclamation. While the region suffered a modest job loss of 1.3%, property and sales taxes were not affected. The success of the pilot program led to a more permanent arrangement. Farmers must make a long-term commitment to the program, but they are paid for each acre of land fallowed.[104] Currently, PVID growers fallow between 7% and 35% of their land annually,[105] providing between 25,000 and 111,000 acre-feet of water to the MWD each year, which uses existing infrastructure to deliver the water to urban customers.[106]

The success of the MWD/PVID program stirred interest among several mutual ditch companies in the Lower Arkansas River Basin of Colorado.[107] In November 2002, voters in the Arkansas Valley agreed to form the Lower Arkansas Valley Water Conservancy District (LAVWCD).[108] Although most conservancy districts are organized to develop water resources, the LAVWCD's mission is to ensure the continued availability of water resources and the long-term economic viability of the

96. NCWCD Delivery Database, *CBT Project Deliveries* (June 16, 2009) (on file with author).

97. *See* NCWCD Carryover Capacity Transferability Program, *Rules* 3 (Aug. 2004), *available at* http://www.ncwcd.org/news_information/web_news/LatestNews/CCTP.pdf.

98. Cal. Water Code §§1810-1814 (2011); While these water wheeling statutes are helpful, they have been criticized recently for inadequately defining (1) what "unused capacity" means and how it is determined under the statute, (2) what "fair compensation" is, and (3) the rights of parties attempting to wheel water of a substantially different quality than the agency's water. *See* Gray, *supra* note 23, at 33.

99. CBT water use accounts for approximately 260,000 acre-feet annually, while groundwater use alone in northeastern Colorado is estimated at 880,000 acre-feet. *See* United States Bureau of Reclamation, *Project Details—Colorado-Big Thompson Project—Plan*, *available at* http://www.usbr.gov/projects/Project.jsp?proj_Name=Colorado-Big+Thompson+Project; *see also* Colorado Dept. of Natural Resources, *Interim Water Supply and Needs Report for the South Platte Basin and Denver/South Metro Counties*, *available at* http://cwcb.state.co.us/water-management/basin-roundtables/Documents/SouthPlatte/MetroSPInterimBasinWaterSupplyNeedsReport.pdf.

100. Interview with Don Carlson and Brian Werner, NCWCD, in Berthoud, Colo. (July 17, 2009).

101. Rotational fallowing programs give farmers the option to fallow a portion of their land. The unused water from the fallowed land can then be leased to municipalities. Colo. Water Conservation Bd., Alternative Agricultural Transfer Methods Grant Program Study 5 (May 2011), *available at* http://cwcb.state.co.us/water-management/water-supply-planning/Pages/main.aspx. Interruptible water supply agreements or dry year options allow municipalities to contract with farmers for water during dry years, thereby allowing municipalities to avoid more costly permanent water supply agreements. *See generally* Michael O'Donnell, & Bonnie Colby, *Dry-Year Water Supply Reliability Contracts: A Tool for Water Managers*, Univ. of Arizona Dept. of Agricultural and Resource Economics (Oct. 2009), *available at* http://ag.arizona.edu/arec/pubs/facultypubs/ewsr-dyo-Final-5-12-10.pdf. Water banking involves the selling of stored water or storage capacity to parties interested in purchasing that water, often for use at a more convenient time and place. *Analysis of Water Banks in the Western States*, Washington Dept. of Ecology (2004) [hereinafter *Analysis of Water Banks*], *available at* http://www.ecy.wa.gov/pubs/0411011.pdf. This excellent report offers a detailed discussion of the various approaches to water banking, along with a comprehensive survey of water banks in the western United States.

102. The Super Ditch Company's Articles of Incorporation provide that its irrigators can participate in water banking, interruptible supply agreements, and water banking. *See* Articles of Incorporation of the Lower Arkansas Super Ditch Company ¶ 3.2(a) (May 7, 2008) [hereinafter Articles of Incorporation], §2.1.

103. Field Hearing at LaQuinta, California, on the Implementation of the California Plan for the Colorado River—Opportunities and Challenges Before the Subcommittee on Water and Power of the House Resources Committee on Natural Resources, 107th Cong. 1-2 (2002) (Addendum to the testimony of Phillip J. Pace, Chairman, Metro. Water Dist. of S. Cal.).

104. Colo. Water Conservation Bd., Dep't of Natural Res., The Statewide Water Supply Initiative: Phase 2 (SWSI) 3-22 (2007) [hereinafter SWSI 2007].

105. *Id.*

106. *Id.*

107. Jay Winner & Mary Lou Smith, *Colorado's "Super Ditch": Can Farmers Cooperate to Make Lemonade Out of Lemons?*, Report to the U.S. Committee on Irrigation and Drainage 6 (Mar. 30, 2008) [hereinafter Winner].

108. *See* The Lower Arkansas Valley Water Conservation Dist. History, http://www.lavwcd.org/history.html.

Lower Arkansas Valley.[109] The District hired an engineering firm to conduct a feasibility study on a water-leasing program in the Arkansas Basin.[110] The study made preliminary estimates of the quantity of water available for leasing and identified potential ditch companies to participate in the program.[111] The seven ditch companies that fit the qualities necessary for the program included Bessemer Ditch, Rocky Ford Highline Canal, Oxford Farmers Ditch, Otero Canal, Catlin Canal, Holbrook Canal, Fort Lyon Storage Canal, and Fort Lyon Canal.[112] The still evolving proposal in the Lower Arkansas Valley, often described as the "Super Ditch," highlights the potential complexity of a temporary transfer program. The Super Ditch proposal is essentially a Super Ditch Company established by the LAVWCD to facilitate the pooling of the water resources of these seven ditch companies and the leasing of these pooled resources to municipal water suppliers, primarily through a system of rotational fallowing.[113]

The MWD/PVID program, however, has a distinct advantage over the Super Ditch proposal, because it pairs a single owner (PVID) of significant senior water rights with the needs of a single large water consumer.[114] By contrast, the fallowing program proposed by the Super Ditch Company would involve seven ditch companies and a multitude of water rights, supplying water to as yet unknown municipalities.[115] This would allow the LAVWCD to create an open market to lease water to anyone with needs in the Basin, but it requires the seller to aggregate multiple water rights, possibly with multiple buyers, thereby greatly increasing the complexity of the transfers and other terms of any agreement among the relevant parties.[116] This is of particular concern, given the problem of high transaction costs that have long been associated with water transfers.[117]

Given the complicated nature of the Super Ditch proposal, it is unsurprising that the LAVWCD has encountered a variety of legal, logistical, and political difficulties.[118] Among these was persuading irrigators to participate before the basic details of the program, including the price per acre-foot of water and the length of leases, were decided.[119] For now, interested parties have simply been asked to pledge a willingness to participate contingent upon the final details.[120]

The legal problems are potentially even more daunting. Most importantly, the Company will have to seek judicial approval for each of its leases prior to changing the point of diversion and new use of the water right. For purposes of transferring water rights, Colorado law historically does not differentiate between temporary or long-term transfers or between leases and permanent transfers.[121] The process for gaining water court approval will significantly increase transaction costs and could compromise the success of the Super Ditch proposal.

Assuming these complications can be addressed to the satisfaction of the parties, opportunities for rotational fallowing, as well as water banking and interruptible supply agreements, or "dry year options," do hold promise.[122] Rotational fallowing seems to be driving the Super Ditch proposal, perhaps because it is viewed as offering the greatest potential for amassing a substantial amount of water that could be made available on a relatively permanent basis. However, the opportunities for banking and dry year options should not be overlooked.

Water banking in particular could hold promise, given the substantial storage capacity in the Arkansas Basin.[123] One could imagine, for example, an arrangement comparable to that between Arizona and the Southern Nevada

109. *See* The Lower Arkansas Valley Water Conservation Dist., Mission, http://www.lavwcd.org/mission.html. (The LAVWCD's Mission Statement declares that its purpose is:

> To acquire, retain and conserve water flowing in the Arkansas River and its tributaries; to insure that all water will remain in the Valley for the socio-economic benefit of the District citizens; and to participate in water-related projects that will embody thoughtful conservation, responsible growth, and beneficial water usage within the Lower Arkansas Valley. To further its mission, the District may, among other methods, accept conservation easements, with or without water attached, that will further the mission of the District and its interests.

110. *Id.* at 5; *see also* HDR Engineering, Inc., Lower Arkansas Valley Water Leasing Potential Preliminary Feasibility Investigation, Report to Lower Arkansas Valley Water Conservation District (2006) [hereinafter HDR Engineering].
111. *Id.* HDR Engineering, The study analyzed natural stream flow data from 1956 through 2004.
112. *Id.* at 2.
113. Alternative Agricultural Transfer Methods Grant Program Study 5, *supra* note 101.
114. Winner, *supra* note 107, at 6; Telephone Interview with Jay Winner, Executive Director of the LAVWCD, in Boulder, Colo. (Aug. 13, 2009).
115. *Id.*
116. HDR Engineering, *supra* note 110, at 84-85.
117. For a discussion of transaction costs, see notes 60-63 and accompanying text.
118. For example, historically, the ditch companies involved in the Super Ditch Company have had trouble working together. HDR Engineering, *supra* note 110, at 109. There are logistical hurdles in determining how shares in the company will be distributed to irrigators because different ditches have different yields and quality of water. *See* Articles of Incorporation, *supra* note 102, at 3.2(b) (describing that the amount of shares disbursed will vary depending on the particular ditch and its historic yield and water quality). Additionally, some of the ditch companies' bylaws do not allow the ditch's water to be used on lands not served by the ditch. *See* Winner, *supra* note 107, at 7.
119. Chris Woodka, *Roundtable Supports Study of Super Ditch*, The Pueblo Chieftain (Sept. 13, 2007).
120. Winner, *supra* note 107, at 7. Additionally, the LAVWCD had to address the practice among ditch companies of including in their bylaws clauses restricting the use of water to lands served directly by the ditch.
121. Colo. Rev. Stat. Ann. §37-92-304(3.5). *See also* Fort Lyon Canal Co. v. Catlin Canal Co., 642 P.2d 501, 506 (Colo. 1982).
122. The Super Ditch Company's Articles of Incorporation provide that its irrigators can participate in water banking, interruptible supply agreements, and water banking. *See* Articles of Incorporation, *supra* note 102, §2.1.
123. The Colorado Water Conservation Board has listed the major storage facilities or projects in the Arkansas River Basin as: John Martin Reservoir (618,600 acre-feet); Pueblo Reservoir (357,678 acre-feet); Great Plains Reservoir (265,552 acre-feet); Twin Lakes (141,000 acre-feet); Turquoise Reservoir (129,440 acre-feet); Trinidad Reservoir (119,887 acre-feet); Adobe Creek Reservoir (71,000 acre-feet); Cuchara Valley Reservoir (40,960 acre-feet); Lake Meredith (39,804 acre-feet); Horse Creek Reservoir (28,000 acre-feet); Mt. Elbert Forebay (11,530 acre-feet); Clear Creek Reservoir (11,500 acre-feet); Lake Henry (9,500 acre-feet); St. Charles Reservoir No. 3 (8.638 acre-feet); Dye Reservoir (5,640 acre-feet); Holbrook Reservoir (4,500 acre-feet); Brush Hollow Reservoir (3,933 acre-feet); Mt. Pisgah Reservoir (2,471 acre-feet); and Deweese-Dye Reservoir (1,772 acre-feet). Colo. Water Conservation Bd., Dep't of Natural Res., The Statewide Supply Initiative: Fact Sheet for the Arkansas Basin 1 (2006).

Water Authority (SNWA) whereby the SNWA sends surplus water to Arizona for storage and later use in Arizona. In exchange, the SNWA receives credits that will allow it to withdraw an equivalent amount of water from Lake Mead.[124] Similarly, a southern Front Range city could allow its surplus water supplies to pass by its diversion point for storage in an Arkansas Basin reservoir, where it could be made available for downstream users. The city would then have the opportunity to use that water in a dry year when it needs additional supplies.

Dry year options could also be constructed creatively to allow cities to take a fixed amount of agricultural water in dry years, either from a willing individual user or perhaps from an entire ditch company that might be willing to forego a certain percentage of its supply in a dry year. The remaining water could be allocated proportionally among mutual shareholders, or farmers could opt for more or less water with the payment of appropriate fees.

V. Reforming Water Transfer Law

While it can be argued persuasively that the basic structure of prior appropriation law requires reform,[125] fundamental changes to that law are neither politically tenable nor necessary to address the most pressing problems facing water resources management in the West. But modest reforms and new ways of thinking about western water law are necessary if the West is going to meet the challenges posed by growing urban demand for water. Set forth below are several recommendations that could, if implemented, provide water resources to meet the future water needs of the western United States.

A. *Define Water Rights by Consumptive Use and Allow Presumptive Transfers of the Consumptive Use Amount*

Western water rights have historically been defined in terms of the amount of water diverted for a particular use on a particular tract of land. The amount of water consumed can vary, so long as the location and type of use does not change. Under current state water law, consumptive use becomes relevant only when a water user decides to sell the water right. At that point, the amount available for transfer will generally be limited to the amount of water historically consumed.[126] State water law further prohibits the transfer of the consumptive amount of a water right if such a transfer would cause even the tiniest injury.[127] For opponents of a transfer, the no injury rule provides an opportunity to drag out the transfer process for many years at great expense to everyone involved. These high transaction costs stand as one of the biggest disincentives to water transfers.

As previously suggested, the absolute nature of the no injury rule as applied to water transfers is entirely at odds with the more flexible approaches in a raft of other areas of water law, such as measuring the accuracy of the diversion amount or allowing water users to change to crops that consume more water.[128] A similar flexibility should be embraced for water transfers, since water transfers may very well hold the key to addressing the water scarcity issues expected to arise in the future.[129]

Redefining western water rights in terms of both the diversion amount and consumptive use amount would be relatively simple and would not disrupt the historic operation of state water law. It would, of course, impose a modest administrative burden on the state, particularly during the time that the state is establishing consumptive use amounts for existing water rights. But if the state defined all water rights within a basin in terms of both the diversion amount and consumptive use amount, the state would be in the position to presumptively allow the transfer of that consumptive use amount, at least within the same water basin, subject to minimal procedure. The processes for defining consumptive use rights and for allowing the transfer of these rights require elaboration.

First, defining all water rights in a state in terms of both the diversion amount and consumptive use will take time, but it can be accomplished deliberately over a period of years. This will allow states to gain experience carrying out the task fairly and efficiently. States might begin with a rulemaking process to help define terms, but should probably resist trying to do much with rules in favor of learning through case-by-case adjudication, at least until the process is reasonably well-understood. In terms of actually adjudicating consumptive use amounts, there are a number of options. States could initially focus on the most water-stressed basins, and gradually work toward covering all basins. Starting in the most water-stressed basins would

124. *See* The Storage and Interstate Release Agreement among the Secretary of the Interior; the Arizona Water Banking Authority; the Southern Nevada Water Authority; and the Colorado River Commission of Nevada, Contract No. 02-XX-30-W0406 (June 12, 2001), *available at* http://www.usbr.gov/lc/region/g4000/SIRA/finagmt.pdf; *see also* Patricia Mulroy, *Beyond the Division: A Compact That Unites*, 28 J. Land Resources & Envtl. L. 105, 109 (2008).

125. Charles F. Wilkinson, *Western Water Law in Transition*, 56 Colo. L. Rev. 317, 344 (1985); Charles F. Wilkinson, Crossing the Next Meridian: Land, Water, and the Future of the West 21-22 (1992); Charles F. Wilkinson, *Prior Appropriation 1848-1991*, 21 Envtl. L. xxix (1991); Leila C. Behnampour, *Reforming a Western Water Institution: How Expanding the Productivity of Water Rights Could Lessen Our Water Woes*, 41 Envtl. L. 201, 204 (2011) (explaining that the prior appropriation doctrine hinders water conservation); Mark Honhart, *Carrots for Conservation: Oregon's Water Conservation Statute Offers Incentives to Invest in Efficiency*, 66 U. Colo. L. Rev. 827, 828 (1995) (describing how the prior appropriation doctrine has become an obstacle to dealing with the problem of inefficient water use in the West).

126. *See, e.g.*, Cal. Water Code §1725 (2011); Idaho Code §42-222 (2011); Wyo. Stat. Ann. §41-3-104(a) (West 2010).

127. *See, e.g.*, Colo. Rev. Stat. Ann. §37-92-305(3) (West 2011); Nev. Rev. Stat. §533.370 (2010); Utah Code Ann. §73-3-3 (West 2011); Wyo. Stat. Ann. §41-3-104 (West 2010).

128. *See* Squillace, *Accounting for Water Rights in the Western United States*, *supra* note 54.

129. The focus on precision in water transfers most likely reflects the suspicions of early legislators about water transfers. By making it difficult to transfer water, the law minimized the concerns that early water applicants were hoping to sell excess water that they might be able to acquire. *See, e.g.*, Elwood Mead, Irrigation Institutions 264 (1903).

facilitate water transfers in the basins that would benefit the most from them. Alternatively, a state might choose to begin with a small basin that is not facing any particular water shortage in order to obtain a better understanding of possible challenges it might face when tackling a more complex basin. A third, and perhaps the most practical option, would be to begin with one or more water districts or mutual ditch companies in a given basin, since these entities generally hold large water rights that could be adjudicated more efficiently. Moreover, they might be in the best position to pool a significant amount of water for sale to a municipal supplier.[130]

The initial consumptive decisions should be made in draft form by the appropriate state official, such as the State Engineer, who could work in cooperation with a state agricultural school. Many of these schools have already done the pioneering work in determining water consumption by crops in different water basins.[131] This work focuses on different types of basins throughout western states.[132]

Unlike traditional water rights, which are often defined in terms of a flow right, consumptive use rights would always be defined in terms of volume of water, probably acre-feet. The owner of the water right and other interested members of the public should be afforded an opportunity to comment on the draft consumptive use decisions. States could minimize the opportunities for objections by authorizing the state agency to treat crop and soil-types somewhat generically. This would allow states to cover large tracts of land fairly quickly, especially where scientific data is already available.

Challenges to these consumptive use determinations could be limited to: (1) whether the agency used the best scientific information in making its judgment; (2) whether a particular tract of land fits the soil profile used to make the decision; and (3) whether the crop chosen to estimate historic consumptive use accurately reflects that land's historical cropping pattern. Regarding this last point, the legislation might place the burden on the agricultural user of demonstrating to the appropriate state official the historic farming practices on the particular tract of land. The legislation might also clarify the meaning of historic practices, perhaps by setting out the historic period subject to review, and the number of years necessary to show historic use for growing a particular crop. Alternatively, the appropriate state agency could adopt rules describing how it will determine historic practices and other issues that might be raised in the proceeding.

Once the consumptive use judgments are final, the owners of those rights would be free to sell all or any portion of the consumptive use amount. It might be wise, however, to build into the legislation a provision that subjects each transfer to a 10% reduction to protect stream flows and to help account for any errors in the system. To satisfy due process concerns, the proposed transfer should still include a notification and decision process, but objectors should not be allowed to complain about the original consumptive use judgment that was made during the basin review process.

While at first blush, farmers might be suspicious of a streamlined water transfer process, it potentially offers them a way to profit from their substantial agricultural water rights while continuing to farm. Returning to an earlier example, if a farmer in northeastern Colorado receives a consumptive use declaration of 193 acre-feet of water for 100 acres of land on which the farmer historically grew alfalfa,[133] that farmer might be willing to switch to a crop such as soybeans, which consumes only 122 acre-feet of water.[134] This would allow the farmer to sell the remaining 71 acre-feet, even while continuing to farm. The state would have to verify the change in crop, and ensure that the farmer does not revert to a more water-consumptive crop in the future. Eventually, advances in satellite imaging technology should make it possible to monitor the type of crop being grown by farmers at a relatively low cost.[135]

130. As suggested below, water supply organizations are probably in the best position to mimic the success of the CBT water market. They will be in a better position to do this if the law makes it easier to transfer consumptive use amounts. *See infra* notes 141-43 and accompanying text.

131. *See, e.g.*, José Luis Chávez et al., *Remote Sensing ET of Alfalfa Using a Surface Aerodynamic Temperature Model*, 5th National Decennial Irrigation Conference Proceedings (2010); Bruce A. Lytle et al., *A Win-Win Scenario for Urban-Rural Water Supplies*, The Water Report, Feb. 2008, *available at* http://www.lytlewater.com/waterreport0208.pdf. *See also* Save the Poudre Coalition, *A Review of the Likely Agricultural Impacts From the Northern Integrated Supply Project*, app. A (Sept. 7, 2008), *available at* http://www.savethepoudre.org/docs/stp_ag_impacts_analysis.pdf, citing the U.S. Department of Agriculture 2002 Census of Agriculture, *available at* http://www.agcensus.usda.gov/ and U.S. Department of Agriculture, National Agricultural Statistics Service, *available at* http://www.nass.usda.gov/. *See also* New Mexico Water Use by Categories, 2005 (describing the Blaney-Criddle Method and the Modified Blaney-Criddle Method for determining consumptive irrigation requirements), *available at* http://www.ose.state.nm.us/PDF/Publications/Library/TechnicalReports/TechReport-052.pdf.

132. *See, e.g.*, Ahmed E. Al-Juaidi, *Water Allocation for Agricultural Use Considering Treated Wastewater, Public Health Risk, and Economic Issues*, 33 Utah State Univ. (2009), *available at* http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1250&context=etd&sei-redir=1#search=%22crops%20water%20consumption%22 (*Discussing Utah's Bear River Valley Basin*); *see also* Colo. Water Conservation Bd., *Alternative Agricultural Water Transfer Methods Grant Program Summary*, 8 tbl. 1 (2011); *see, e.g.*, Timothy K. Gates et al., *Toward Optimal Water Management in Colorado's Lower Arkansas River Valley*, Colorado Water Resources Research Institute Completion Report No. 205 (2006), *available at* http://www.cwi.colostate.edu/publications/cr/205.pdf; *see, e.g.*, Amber Kirkpatrick et al., *A Practical Guide to Choosing Crops Well-Suited to Limited Irrigation*, Irrigating With Limited Water Supplies (2006), *available at* http://region8water.colostate.edu/PDFs/Irrigating%20with%20Limited%20Water%20Supplies.pdf (estimating water consumptive use of select crops in Montana, Colorado, and Utah).

133. Antony Frank & David Carlson, Colorado's Net Irrigation Requirements for Agriculture tbl. 1, Colorado Dept. of Agriculture (1995) (figures for Weld County), *available at* http://cospl.coalliance.org/fez/eserv/co:3072/ag92ir71999internet.pdf.

134. *Id.*

135. *See, e.g., A Guide to the Practical Use of Aerial Color-Infrared Photography in Agriculture Agricultural Applications of Color-Infrared Film*, Univ. of Nebraska-Lincoln, Virtual Nebraska, Education Module, *available at* http://www.casde.unl.edu/activities/cir-uses/applications/crop-inventory.php. See also Ping Zhang et al., Potential Monitoring of Crop Production Using a Satellite-Based Climate-Variability Impact Index, Agric. & Forest Meteorology 132 (2005), *available at* http://cybele.bu.edu/download/manuscripts/zhping02.pdf (detailing the potential agricultural capabilities of different types of imaging satellites and noting that currently, historical data and visual inspection are necessary to supplement satellite data.). *See also* Stephan

Even greater savings might be realized if the farmer were to limit an alfalfa crop to one or perhaps two cuttings each year, rather than the more typical three cuttings. Indeed, with climate change, Colorado farmers may be in a position to take a fourth cutting, thereby consuming more water than they have historically consumed. While many agricultural rights are defined as "seasonal," the length of the season is not typically specified in the water rights decree.

A similar scenario could play out with a dry year option. Our farmer could sell an option on 71 acre-feet for use by a city during dry years, grow alfalfa in high water years, and shift to a low water-consumption crop in dry years when the city would receive the optioned water.

Importantly, none of this is possible under the current legal regime. The farmer who shifts from alfalfa to soybeans receives no credit for the water saved, and pays no penalty for shifting from soybeans to alfalfa, even if soybeans had been grown on the site for 100 years. While the prospect of selling water sometime in the future may not be the driving force behind decisions that farmers make about the types of crops to grow, it is surely an important factor in any cropping decision. And the incentives under the current system are all in favor of consuming more water. The proposed reforms would give farmers the incentive to consume less water and, in the process, potentially solve water scarcity issues for many years to come.

B. *Demand Conservation and Reclamation Before Agricultural to Urban Transfers Are Approved*

Residents of rural areas are understandably unhappy about the prospect of watching more of the water resources that have historically supported their local economies transferred from agricultural to urban use. While a free market in water could accelerate this trend, states can and should provide rural communities with some assurance that water transfers will not be approved unless and until the buyer first demonstrates a clear need for additional water resources, and takes responsibility for restoring the land from which the water will be transferred to an appropriate condition adequate to promote and sustain its value and future uses.[136]

Municipal suppliers might demonstrate need by using all reasonable conservation measures in the communities they serve. "Reasonable conservation measures" could be defined either by statute or regulation as measures that bring per capita water use below a certain threshold, or perhaps through more prescriptive standards, such as requiring that cities employ aggressive block-rate pricing policies,[137] or requiring that states recycle gray water.[138]

Restoration of the land might simply entail a commitment, backed by a bond, requiring the city to establish a healthy, self-regenerating community of native grasses on the dry lands, or it might involve some long-term commitment to engage in dry land farming[139] or some other use that will ensure that the land does not become a burden to the host community.

While rural areas may continue to harbor some antipathy toward cities for their ever-increasing demands for water, farmers are far more likely to accept water transfers if they can see that the cities have made an aggressive commitment to conservation as a precondition to having agricultural water transfers approved, and if they are assured that lands that are dried up as a result of an agricultural-to-urban water transfer are restored to some productive use.

C. *Encourage Private and Public Agencies With Substantial Storage Capacity and a Large Service Area to Mimic the Success of the CBT Project*

The CBT project is unique. Not only does it have the benefit of substantial storage in the system, it holds water rights that are approved for a broad range of uses, operates an elaborate delivery system in the most populous areas of the northern Front Range of Colorado, and covers a substantial portion of the northeastern part of that state.[140] Under these circumstances, it is not surprising that the limited supply of CBT shares attracts many buyers and sellers. While it may be unlikely that other water organizations will have all of the advantages of the CBT project, many water entities will likely share some of the characteristics of the CBT project, and some water entities could conceivably establish marketable shares, similar to CBT shares, especially if states establish a system to facilitate the transfer of consumptive use amounts, as suggested above.[141]

Most ditch companies hold legal title to the water rights used by their shareholders, but shares can be purchased by cities for urban use.[142] However, most ditch companies'

J. Maas & Nithya Rajan, Agron. J. 100(2): 320-27, 327 (estimating ground cover of field crops using medium-resolution multispectral satellite imagery. And observing that automation of satellite technology to monitor the vegetation canopy and bare soil line could be possible in the future, but currently has to be coupled with visual inspection).

136. *See, e.g.*, Colo. Rev. Stat. Ann. §37-92-305(4.5), which generally requires "reasonable provisions designed to accomplish the revegetation and noxious weed management of lands from which irrigation water is removed."

137. Douglas S. Kenney et al., *Residential Demand Management: Lessons From Aurora, Colorado*, 44 J. Am. Water Res. Ass'n 192 (2008).

138. Yoram Cohen, *Gray Water: A Potential Source of Water*, Southern California Environmental Report Card (Fall 2009), *available at* http://www.environment.ucla.edu/reportcard/article.asp?parentid=4870.

139. Randy Creswell & Franklin W. Martin, Dryland Farming: Crops and Techniques for Arid Regions (1993, revised, 1998), *available at* http://www.echonet.org/repositories/download/30/Dryland%20Farming.pdf.

140. *See id.* Part IV.B.

141. *See id.* Part IV E.

142. *See id.* Part IV B; *see also* Jacobucci v. Dist. Court of Jefferson Cty., 189 Colo. 380, 388 (Colo. 1975):

> Because the right seeking to be condemned, the right to make beneficial application of the water, does not belong to the corporation, but to the shareholders, the mutual ditch corporation cannot be the only proper representative of the shareholders' interests. . . . Mutual ditch companies like Farmers were formed expressly for the purpose of furnishing water to shareholders, not for profit or hire. . . . These companies are not organized under the general Colorado corporation statutes, but under special legislation for ditch and reservoir companies.

water rights were granted strictly for agricultural use over a relatively small geographic area that may not include significant urban centers.[143] Under these circumstances, changing the use and the place of use will require the parties to go through the cumbersome statutory transfer process.

States should recognize the natural advantages that these organizations share with the CBT project and the opportunities that would arise if they had more flexibility to transfer water rights outside the current transfer system. As previously argued, granting water organizations an easier path toward transfers would, at a minimum, require that their consumptive rights be clearly defined. But once that is done, states could use a streamlined transfer process to allow mutual ditch companies and water districts to transfer consumptive rights outside their districts and for new uses.[144] This would open up these entities to more robust marketing opportunities that could resolve many of our current urban water needs.

D. Promote Temporary Transfers

In recent years, much attention has been paid to the potential for temporary transfers to solve long-term water needs. While such transfers could be short-term or long-term, they are all distinguished by the fact that the party holding the water right does not relinquish her ownership interest.

For farmers concerned about the long-term health of their rural communities, this is a very attractive feature. As previously described, successful real-world examples of temporary transfers already exist, including the PVID's rotational fallowing program that provides water to the MWD,[145] and the Arizona Water Bank, which allows Las Vegas to bank groundwater in southern Arizona.[146] But widespread use of temporary transfers is unlikely to occur unless states adopt legislative reforms designed to promote their use.[147] The three primary temporary transfer mechanisms—rotational fallowing, dry year options, and water banking—are described briefly below, along with policy reforms that could lead to their expanded use.

1. Rotational Fallowing

As a tool for moving more water from agricultural to urban use, rotational fallowing has much to recommend it. Farmers who participate in the program agree to fallow a portion of their land, and can thus continue to farm on the remaining land, focusing their efforts on the most productive lands, or rotating the fallowed land from year to year.[148] The unused water made available by fallowing is then leased to a municipality.[149] The MWD/PVID rotational fallowing program is usually cited as a model for such programs, and for good reason. Despite the fact that the program moves a substantial volume of water from agricultural to urban use, it is remarkably simple, with one large buyer and one large seller who happen to have very senior water rights.[150] The Super Ditch proposal may suggest the more typical model, but it remains to be seen whether that proposal will ever come to fruition. Several legal reforms, however, could help make rotational fallowing programs like the Super Ditch more practical.

First and foremost, some progress must be made to streamline the normal water transfer process. The effort needed to design a program like the Super Ditch Company, with its many potential sellers and multiple buyers, is substantial and expensive, yet the parties have no assurance that their efforts to transfer the relevant water rights will make it through the formal transfer process within a reasonable length of time. Moreover, it seems possible, perhaps even likely, that objections to the transfer will be filed and may succeed in limiting the amount of water available under the program, even if the transfer is ultimately approved.

Even if a state is not ready to embrace a wholesale shift to defining water rights in terms of consumptive use, it might consider doing so in the case of temporary transfers. For example, the state could authorize the prospective seller to apply to the appropriate agency official for a consumptive use determination. The seller might even be asked to bear the cost of the determination. Once the determination is made following a process such as that suggested above,[151] the state could authorize the temporary transfer of the consumptive right. As suggested previously, such temporary transfers might further be conditioned to reduce the transfer by 10% to protect stream flows and to account for potential calculation errors, but they would follow a minimal process, as proposed more generally for consumptive use transfers.[152] The law might also provide for minor adjustments to the consumptive use allocation to reflect actual experience once the program has been operating for several years.

See Colo. Rev. Stat. Ann. §7-42-101 (2011).

143. NCWCD Management Plan, *supra* note 62, app. F.

144. *Compare, e.g.*, Ariz. Rev. Stat. §9-432 (2011); Cal. Water Code §§10505-10505.5, 11460; Colo. Rev. Stat. Ann. §37-45-118(1)(b)(II) (2011); Neb. Rev. Stat. §46-290 (2011); Nev. Rev. Stat. Ann. §533.438(5) (2011); N.M. Stat. Ann. §72-5-29 (2011); Okla. Stat. tit. 82 §§105.12, 1086.1 (2011); Texas Water Code §11.085 (2011); Wyo. Stat. §41-3-104 (2011).

145. As noted in the Super Ditch discussion, the PVID's fallowing program was instrumental in inspiring proponents of the Super Ditch concept. *See* notes 107-14 and accompanying text.

146. *See* Winner, *supra* note 107.

147. *See, e.g.*, Colo. Water Conservation Bd., Alternative Agricultural Transfer Methods Grant Program Study 45-46 (May 2011), *available at* http://cwcb.state.co.us/water-management/water-supply-planning/Pages/main.aspx (explaining that legislative changes may be necessary to remove the barriers to water transfers in Colorado).

148. *Id.* at 5.

149. *Id.*

150. The LAVWCD established the Super Ditch Company to act as a facilitator for the collective leasing of water rights between municipalities in southeastern Colorado and individual shareholders of different ditch companies, *see* Peter D. Nichols, *Memorandum to Water Tables Regarding the Super Ditch: A Temporary Water Leasing Alternative to Historical Permanent "Buy and Dry" or Irrigated Land in the Lower Arkansas Valley* ¶ B (July 7, 2008) [hereinafter *Memorandum to Water Tables*]; *see also* Teresa A. Rice & Lawrence J. MacDonnell, *Agricultural to Urban Water Transfers in Colorado: An Assessment of the Issues and Options*, Colorado Water Resources Research Inst., at 71 (1993).

151. *See* note 114 and accompanying text.

152. *Id.*

Second, state law must allow these rotational fallowing programs to operate over a long period of time consistent with the planning needs of municipal water suppliers. Without some assurance that these programs will offer long-term water security (at least 30-40 years with provisions for renewal), cities are unlikely to find rotational fallowing an attractive option.[153]

2. Dry Year Options

Dry year options, or interruptible water supply agreements, operate much like an emergency water supply.[154] A city may contract with a farmer to take that farmer's water during dry years that meet certain criteria spelled out in legislation, or preferably in the option contract. This allows the city to avoid acquiring a much more costly permanent water supply where the water resources might be needed only once every 10 years. As with rotational fallowing agreements, this strategy will be viable for municipal suppliers only if the parties are willing and able to enter into long-term contracts of at least 30-40 years with some assurance of an opportunity for renewal. If a city cannot secure a long-term commitment of access to water resources in dry years, it lacks an incentive to negotiate the option contract.

The Colorado interruptible water supply agreement statute[155] offers a useful example of how *not* to establish a dry year option program. Under that law, a water owner may agree to forego her use of a water right during a dry year as provided under the terms of the agreement, and the State Engineer may approve and administer such agreements without the need for the formal adjudication that would otherwise be required for a water transfer.[156] The State Engineer must, however, ensure that existing water rights would not be injured when the option is exercised, and furthermore must: (1) quantify the historical consumptive use of the water right, which then forms the basis for the option amount; (2) describe the land where the water is decreed for use; and (3) approve a plan for proper management of the land during the period when it is fallowed.[157] Although strict adherence to the no injury rule could prove problematic, for reasons already discussed, these are generally sensible requirements that could promote more streamlined decisions on these agreements.

Unfortunately, the statute goes on to limit the length of time for any agreement to 10 years, which can be renewed only once, and then only if the option has never been exercised.[158] For a city seeking a secure water supply, this limitation makes the Colorado interruptible water supply agreement statute unworkable.[159]

Fixing the Colorado statute would not be especially difficult, and it suggests the contours of the law that might be adopted in other states. At a minimum, states should make clear that de minimis injuries that might result from exercising a dry year option are not actionable in court. Actionable injuries should specifically be defined to exclude a change in the timing of return flows. Even more explicitly, the statute could simply provide that where the state approves the transfer of the historic consumptive use of a water right, perhaps less 10%, no injury to existing users shall be found. Without some provision like this, the parties to any such agreement face the prospect of transaction costs that are essentially as high as those for regular water transfers.

States should also allow option agreements to last for at least 30 years, perhaps longer, with the possibility of renewal for additional 30-year terms. Municipal water suppliers cannot plan for future water needs unless they have some certainty about the availability of future supplies. A well-defined option right can provide that assurance. Guaranteeing the availability of an option right over a 10-year period, as authorized by the Colorado statute, is simply not adequate to incentivize municipal suppliers to negotiate an agreement.

3. Water Banks

Water banks have been described broadly to encompass "an institutionalized process . . . to facilitate the transfer of developed water to new uses."[160] This definition, however, could be viewed as encompassing many other types of water transfers, including rotational fallowing and dry year options. Moreover, the definition fails to convey the sense that water banks typically involve only temporary water transfers. A more nuanced definition that better reflects the term "water bank" might describe it as a program that establishes a repository or "bank" where parties can store water, together with a program for other parties to withdraw water from the bank.

Water banks have been around for many years, dating back to the early 1930s in Idaho.[161] The earliest legislation, also from Idaho, was enacted in 1979.[162] Since then, many other states have adopted some form of water banking.[163] Like other forms of temporary water transfers, water banks can help make water supplies available to meet critical

153. Alternative Agricultural Transfers, *supra* note 147, at 5 (explaining that if a rotational fallowing agreement were used to provide water for a growing municipal demand, the agreement would need to be ". . . long-term, renewable, or even perpetual. . . .").
154. *See generally Dry-Year Water Supply Reliability Contracts: A Tool for Water Managers*, *supra* note 101.
155. Colo. Rev. Stat. Ann. §37-92-309 (2011).
156. *Id.*
157. *Id.* at 309(3)(b).
158. *Id.* at 309(3)(c). The statute also provides that the option may not be exercised in more than three of the 10 years of the agreement. While this could be a limiting factor in the utility of these agreements, it is understandable that the state would want to avoid having parties use this provision to accomplish something that looks more like a permanent transfer of the water.
159. Two minor applications were currently pending before the State Engineer, but at the time of this writing, no interruptible supply agreements have yet been approved under this provision. Telephone Interview with Joanna Williams, Water Resource Engineer, Colo. Div. Water Res. (July 6, 2012).
160. Lawrence MacDonnell, *Water Banks: Untangling the Gordian Knot of Western Water*, 41 Rocky Mtn. Min. L. Inst. 22-1 (1995).
161. MacDonnell et al., *Using Water Banks to Promote More Flexible Water Use*, Final Report, U.S. Geological Survey Award: 1434-92-2253 (1994).
162. Idaho Code §42-1761-1766 (2011).
163. *Analysis of Water Banks*, *supra* note 101.

needs, especially during dry years. They can also help promote conservation by providing water owners with a venue to market water supplies that they are able to conserve,[164] and by providing conservation groups and states a source for water needed to protect stream flows and fisheries.

Water banks can simply involve a paper transaction where, for example, water sellers answer a call from a buyer to forego the use of water to which the sellers are entitled.[165] This might happen where a party interested in protecting stream flows purchases natural flow rights from a seller for a period of one or more years. More commonly, water banks involve physical storage, either in a reservoir or underground. Water banking in this situation might typically involve a water district with excess storage capacity, willing to sell that capacity to parties with excess water rights. The district might then help facilitate a sale of the water to a third party, or perhaps issue credit to the original owner that allows that original owner to take the water at some later time, probably at some more convenient location on the stream. A good example of this latter arrangement is the Arizona Water Bank, which involves the state of Arizona and the Southern Nevada Water Authority (SNWA).[166] Under this program, the SNWA pays the state of Arizona to store Colorado River water in its groundwater aquifer. When the SNWA needs the water, it takes its entitlement from its regular diversion point on Lake Mead, well above the storage aquifers.[167] Despite the apparent advantages of water banks, there have been a surprising dearth of successful banks,[168] and, with limited exceptions, they do not currently seem to offer a reliable solution to municipal water shortage problems.

As with virtually every other recommendation set forth in this Article, promoting water banks begins with better defining the water rights that are banked, so that they can be readily withdrawn by interested buyers, even if those buyers live outside the water district's service area. While the SNWA arrangement with Arizona is somewhat unusual, it illustrates the high potential for water banks to address municipal water needs. For example, the cities along the Front Range of Colorado are all near major streams that flow out of the mountains. Some of that water is used for municipal purposes; most is dedicated to farmers on the plains, who hold the most senior rights and who are often part of large water districts or mutual ditch companies with significant capacity to store water. If these cities could purchase some storage capacity in the existing reservoirs and solicit willing sellers in the service area of the reservoir to dedicate some their water rights for use by the city, the city could then be issued credits that would allow it to divert that same amount of water at an outtake near the city. Unfortunately, in Colorado, this transaction would almost certainly have to be adjudicated in a state water court, where it could be tied up for years. While the process might be somewhat less cumbersome in other states, the predominant no injury rule would still pose a significant obstacle to completing any such transaction. A streamlined transfer process for water bank transactions that would allow a simple transfer of the consumptive use amount less 10% could go a long way toward reinvigorating the water bank concept.

E. Take Advantage of Existing Distribution Systems to Move Water

As described in the NCWCD case study,[169] that District has a huge advantage in moving water efficiently because of the elaborate distribution system it has built, much of it funded by taxpayers. Indeed, the District could not continue to operate without the one mill tax that it assesses every year on all property within the District's massive service area. The NCWCD and the many other publicly supported water districts throughout the West most likely own and operate the very best water distribution systems in the country, and they are able to do so in large part because they are taxpayer-supported. As quasi-public entities, it seems appropriate that they share the use of distribution systems with excess capacity when third parties might be in a position to use that system to transfer water and thereby help address water supply needs for urban and other uses.

Making excess distribution capacity available to third parties would help promote efficient water transfers by affording at least some water sellers a simple way to move water from the location of its current use to the point of new use. It could also generate revenues for the water district, although a process for setting reasonable prices for wheeling water will have to be devised.

In 1986, California enacted a "water wheeling statute" that essentially adopts the policy suggested here.[170] That law simply provides that "neither the state, nor any regional or local public agency may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity, for the period of time for which that capacity is available, if fair compensation is paid."[171] The law goes on to define such key terms as "fair compensation" and "unused capacity." While evidence of the statute's use is anecdotal, the courts have thus far construed the statute broadly to encompass not only large systems such as aqueducts and canals, but also local distribution systems.[172]

164. *Id.* at 3.
165. *Id.* at 4. The Washington Department of Ecology describes this as "institutional banking."
166. *Id.*
167. Storage and Interstate Release Agreement, *supra* note 124.
168. *Analysis of Water Banks*, *supra* note 101, at 16-18, tbl. 3. This report indicates that the only banks with high levels of activity are in California and Idaho. In the case of Idaho, the water values are so low ($3-10.50/acre foot) as to suggest that they are not serving municipal needs.
169. The District charges a delivery fee for each unit delivered, which can be modified on an annual basis. *See supra* note 62.
170. Cal. Water Code §§1810-1814 (2011).
171. *Id.* §1810.
172. San Luis Coastal Unified School Dist. v. City of Morro Bay, 81 Cal. App. 4th 1044, 97 Cal. Rptr. 2d 323 (2000). *See also* Metropolitan Water Dist. of Southern California v. Imperial Irr. Dist., 80 Cal. App. 4th 1403, 96 Cal. Rptr. 2d 314 (2000), where the court of appeal held that the wheeling

VI. Conclusion

Water markets have long been viewed as a promising option for addressing water shortages, and as a tool for meeting burgeoning urban water demand in the western United States. But the traditional water laws of western states make it difficult and in some cases even impossible to operate efficient water markets. As a result, water transfers and water marketing have thus far proved to be tools of limited utility for addressing the West's future water needs. As drought, climate change, and ever-increasing populations put more pressure on the West's limited water supplies, some additional movement of water from agricultural to urban use seems inevitable. But water marketing offers the possibility of much more. With modest reforms to current law, water marketing could be an efficient and effective solution for most of the West's future water resource challenges. And it could displace the need for destructive water development projects that continue to plague water resource management.

The reforms proposed here are politically challenging but relatively simple to describe and implement. Most fundamentally, water rights must be redefined in terms of their consumptive use amount, and states must streamline the process for transferring the consumptive use amount without undue obeisance to the no injury rule. Such a change would no doubt be controversial, but it could be implemented strategically, either with pilot programs or by adopting special legislation that would streamline transfers for particular projects that are proposing innovative approaches to moving water. Water marketing has long been a favorite topic of academics. The time for moving it into the field is long overdue.

statutes did not preclude the MWD from including systemwide costs in calculating its wheeling rate, and furthermore that the statute did not require the MWD to set its wheeling rates on a case-by-case basis as transactions were proposed.