

# Liability Rules as a Solution to the Problem of Waste in Western Water Law: An Economic Analysis

*This Comment addresses the problem of water shortages in the Western United States. The Author notes that potentially vast savings in water use could be achieved by reducing waste in current agricultural and conveyance practices. He evaluates the present system of regulating water waste and concludes that vague legal rules, market failures, and bargaining breakdown have prevented efficient water use in the Western states. Specifically, the Author demonstrates how the beneficial use requirement is inconsistently applied and hence, has failed to deter wasteful water use. The Author rejects the most popular alternative—replacing beneficial use with a pure market system—as naive, because it fails to take into account water's unique properties and resistance to standard market solutions. The Author concludes that market solutions must be combined with some reform of the rules governing liability for water waste. After evaluating the various alternatives, the Author recommends that a negligence standard be adopted to inhibit wasteful water conveyance and application. The Comment concludes with a recommendation for implementing this negligence rule through existing administrative agencies.*

## INTRODUCTION

Environmental groups, scholars, and the media warn of impending water shortages in the Western United States. Population growth in this region continues to increase the demand for water, while existing sources of supply are strained to capacity. The historic solution—building more water projects—soon will no longer be feasible as few unused sources remain. Finding new ways to satisfy the demands of Western water-users is an issue of mounting public concern.

Despite the predicted water crisis in the West, wasteful conveyance and irrigation practices abound. Agricultural uses of water, which account for roughly eighty-three percent of all water consumption in the United States,<sup>1</sup> are especially wasteful, with less than fifty percent of the water diverted to farms actually being used by crops.<sup>2</sup> Conserving this

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1. UNITED STATES SOIL CONSERVATION SERVICE, CROP CONSUMPTIVE IRRIGATION REQUIREMENTS AND IRRIGATION EFFICIENCY COEFFICIENTS FOR THE UNITED STATES 2 (1976); Shupe, *Waste in Western Water Law: A Blueprint for Change*, 61 OR. L. REV. 483, 484 (1982); INTERAGENCY TASK FORCE, UNITED STATES DEPARTMENT OF AGRICULTURE & UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, IRRIGATION WATER USE AND MANAGEMENT 22 (1979).

2. See Pring & Tomb, *License to Waste: Legal Barriers to Conservation and Efficient Use of*

wasted water provides a potential means of satisfying the increased demand for water.<sup>3</sup> In addition to increasing the supply of water to Western cities, more efficient irrigation practices would serve environmental values by preserving in-stream flows, reducing soil erosion, and preventing the runoff of pesticides into other water sources.

Legal restrictions,<sup>4</sup> market imperfection,<sup>5</sup> and bargaining failure,<sup>6</sup> however, discourage the implementation and maintenance of efficient conveyance systems. Vague legal rules inhibit self-imposed conservation by failing to specify who is entitled to "conserved" water.<sup>7</sup> Even absent these legal disincentives, an efficient market for water is unlikely to develop on its own. Because of water's unique physical properties, it is difficult to determine the value of its external benefits or charge downstream appropriators for its use.<sup>8</sup> Since water is an essentially local good with few buyers and sellers in any given area, exchanges will be particularly susceptible to monopolistic control in a market situation. In a bargaining situation, attempted transfers are likely to be characterized by strategic behavior and resulting bargaining failure.

The proposed sale of water from the Imperial Irrigation District

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*Water in the West*, 25 ROCKY MTN. MIN. L. INST. 25-1, -5 (1979) (an average of 41% of water diverted for irrigation is used consumptively by crops).

3. A 7% increase in the efficiency of agricultural water use could support a 100% increase in all nonagricultural water uses. See *To Establish a National Water Policy: Hearings Before the Subcomm. on Water Resources of the Senate Comm. on Environmental and Public Works*, 95th Cong., 2d Sess. (1978) (testimony of M.T. El-Ashry, Co-Chairman, Water and Land Resources Program, Environmental Defense Fund); C. HOWE & K.W. EASTER, *INTERBASIN TRANSFERS OF WATER: ECONOMIC ISSUES AND IMPACTS* 112 (1971).

4. Pring & Tomb, *supra* note 2, at 25-3.

5. See C. MEYERS & R. POSNER, *MARKET TRANSFERS OF WATER RIGHTS: TOWARD AN IMPROVED MARKET IN WATER RESOURCES* (National Water Commission Legal Study No. 4, 1971) (not officially approved by the National Water Commission).

6. Competitive markets are characterized by large numbers of buyers and sellers of a given product. See Cooter, *The Cost of Coase*, 11 J. LEGAL STUD. 1, 10 (1982) ("We assume that there are enough participants in this market for it to be competitive."). Situations in which relatively few buyers and sellers trade a product are referred to as bargaining situations. In the absence of a market for a product, bargaining may facilitate efficient trade. See *Id.* at 16 ("The mechanism for achieving efficiency in the absence of competitive markets is bargaining.").

7. *But see* CAL. WATER CODE §§ 109, 1011, 1012 (West Supp. 1987) (encouraging conservation and transfer, protecting appropriators' right to transfer salvage, and specifically allowing for the retention of rights to conserved water in the Imperial Irrigation District, respectively).

8. For example, one farmer's (Farmer A's) use of water for irrigation will often result in a runoff onto another farmer's (Farmer B's) land. This situation can result in an "external cost" if the runoff causes harm to Farmer B's land that Farmer A does not have to pay for. The situation results in an "external benefit" if Farmer B gets the benefit of applying the water to his crops without having to pay for it. Since the external cost and external benefit operate on Farmer B rather than on Farmer A, they do not influence Farmer A's decision whether to divert water, and are therefore "external" to his calculations. Because Farmer A does not weigh all the costs and benefits to society in deciding whether and how to use his water, he will not always make the socially optimal choice as to how to employ his resources.

("IID") to the Metropolitan Water District ("MWD") in southern California demonstrates how outdated legal rules, external effects, and bargaining failure can prevent the application of wasted water to a socially desirable use.<sup>9</sup> In *Arizona v. California*,<sup>10</sup> the Supreme Court held that the Boulder Canyon Project Act of 1928<sup>11</sup> vested the Secretary of the Interior with the power to apportion Colorado River water among bordering western states in accordance with the terms of the Act. The Court affirmed the apportionment of .3 million acre feet ("MAF") per year to Nevada, 2.8 MAF per year to Arizona, and 4.4 MAF per year to California.<sup>12</sup> Because Nevada and Arizona have not required their entire allotment, California has relied on the surplus and used nearly 5 MAF per year.

A problem will arise with the completion of the Central Arizona Project, a federal reclamation project that involves pumping water from the Colorado River into central Arizona. Once the project is completed, Arizona will begin taking its full allotment, and the Metropolitan Water District, the lowest priority California user, will be forced to reduce its use from its current 1.2 MAF per year to .55 MAF per year<sup>13</sup> in order for California to stay within its 4.4 MAF limitation. With southern California dependent on this water, the Metropolitan Water District must look elsewhere to meet its needs.

One proposed method for the MWD to compensate for the reduction in available water from the Colorado is to purchase water from the Imperial Irrigation District, another California water district. The IID potentially could conserve and sell .438 MAF per year<sup>14</sup> that the Department of Water Resources has determined to be waste.<sup>15</sup> Unfortunately, vague legal rules and bargaining breakdowns complicate the situation and prevent easy resolution. This situation exemplifies the paradox of the entire Western water allocation system: Increasing demand for water resources coexists with huge and surprising losses due to waste.

This Comment discusses the beneficial use requirement in the prior appropriation system, and demonstrates how an ill-defined and unevenly

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9. For a thorough discussion of this situation, see R. STAVINS, *TRADING CONSERVATION INVESTMENTS FOR WATER: A PROPOSAL FOR THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA TO OBTAIN ADDITIONAL COLORADO RIVER WATER BY FINANCING WATER CONSERVATION INVESTMENTS FOR THE IMPERIAL IRRIGATION DISTRICT* (Environmental Defense Fund 1983).

10. 373 U.S. 546 (1963).

11. 43 U.S.C. §§ 617-617(t) (1982).

12. *Arizona v. California*, 373 U.S. at 592.

13. R. STAVINS, *supra* note 9, at 11.

14. *Id.* at 46.

15. *Imperial Irrigation Dist. v. State Water Resources Control Bd.*, 186 Cal. App. 3d 1160, 231 Cal. Rptr. 283 (1986) (recognizing that the Department of Water Resources has adjudicative powers, granted by the legislature, to determine whether waste has occurred).

applied beneficial use standard fails to prevent water waste. A commonly proposed solution to the waste problem is to abrogate legal restrictions on the transfer of water rights. This solution, however, rests on the assumption that water markets can provide proper monetary incentives for conservation. While the movement towards the market is a step in the right direction, the market alone is not enough. This Comment proposes that tort-like liability rules be imposed to compensate for inefficient legal rules, market imperfection, and bargaining failure.

Part I examines the operation of the beneficial use requirement, and describes its many problems. Part II describes the leading proposals for improving the water market and reveals how legal restraints, market failure, and bargaining breakdown undermine these solutions. Part III introduces no-liability, negligence, and strict liability rules, and discusses their potential for curtailing wasteful water conveyance and application practices. Part IV discusses the relative merits of each of the three proposed rules and concludes that the negligence rule, with its ability to absorb miscalculations in the external cost of water loss, will likely provide the best solution. Finally, Part V offers a proposal for implementing the negligence rule through existing administrative agencies.

## I

### THE BENEFICIAL USE REQUIREMENT

Unlike traditional property law, which places few restrictions on how an owner uses his property, water law requires the owner to use water in a way which is "reasonable" or "beneficial." The riparian system of water rights, operating in humid Eastern states, permits owners of property adjacent to a water source "to consume, within the natural watershed, amounts of water 'reasonable' in light of similar reasonable requirements of other riparian owners,"<sup>16</sup> and grants each riparian owner "the right to receive the flow of the watercourse 'undiminished in its natural quantity and quality',"<sup>17</sup> regardless of which riparian began using the water first.

The prior appropriation system, developed according to "first in time, first in right" principles<sup>18</sup> during the 1850 California gold rush,<sup>19</sup>

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16. Oeltjen & Fischer, *Allocation of Rights to Water: Preferences, Priorities, and the Role of the Market*, 57 NEB. L. REV. 245, 249 (1978).

17. *Id.* (quoting *Harvey Realty Co. v. Borough of Wallingford*, 111 Conn. 352, 359, 150 A. 60, 63 (1930)).

18. Priority in the prior appropriation system is determined chronologically; whomever first appropriated the water has first priority to it. The severity of this system in times of drought is somewhat tempered by statutory preferences. See generally Oeltjen & Fischer, *supra* note 16 at 257-59.

19. Scholars usually trace the origin of the appropriative doctrine to the 1855 California Supreme Court decision of *Irwin v. Phillips*, 5 Cal. 140 (1855); see Lay, *The Beneficial Use*

grants a protected right to an appropriator who intentionally diverts a water flow and applies it to a "beneficial use."<sup>20</sup> While beneficial use has been defined as any use that does not constitute waste,<sup>21</sup> the definition of waste is unclear.<sup>22</sup> Nevertheless, judicial and legislative language suggests that states applying the appropriation doctrine have strong policies favoring the conservation of water resources.

There are currently nine Western states that follow a pure prior appropriation system—Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.<sup>23</sup> Eight other Western states have mixed appropriation and riparian systems.<sup>24</sup> Of these, two states, California and Nebraska, grant new rights under both systems.<sup>25</sup> The other six states originally had riparian systems, but have switched to a system of prior appropriation,<sup>26</sup> thus, unlike California and Nebraska, they will only grant *new* rights under the prior appropriation system.<sup>27</sup> Virtually all of the Western states apply a beneficial use requirement and, in theory, are committed to ensuring that water is used in a socially beneficial way.<sup>28</sup>

#### A. Legal Limitations on Nonuse and Misuse

The penalty for wasting water is severe—loss of the right to use that water. The loss of a preexisting appropriative right can come about

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*Requirements of the Appropriative Water Right and the Forfeiture of Rights Through Nonuse*, 37 OKLA. L. REV. 67, 69 (1984). The *Irwin* court founded its decision on the rule of the first taker used in mining law. 5 Cal. at 147 ("[H]owever much the policy of the State . . . has conferred the privilege to work the mines, it has equally conferred the right to divert the streams from their natural channels, and as these two rights stand upon equal footing . . . they must be decided by the fact of priority. . . ."); see Lay, *supra* at 69.

20. Shupe, *supra* note 1, at 486. Whether an instream use qualifies as a diversion is subject to controversy and is resolved differently in different jurisdictions. J. SAX & R. ABRAMS, LEGAL CONTROL OF WATER RESOURCES CASES AND MATERIALS 278, 317-19 (1986); see, State, Dept. of Parks v. Idaho Dept. of Water Administration, 96 Idaho 440, 530 P.2d 924 (1974).

21. Pring & Tomb, *supra* note 2, at 25-17.

22. See *id.* at 25-18.

23. J. SAX & R. ABRAMS, *supra* note 20, at 289.

24. See *id.* at 289-90.

25. *Id.*

26. *Id.* at 290.

27. *Id.*

28. "Whether by statute or constitutional provision, virtually all of the western jurisdictions recognize the appropriative doctrine and the principle that beneficial *use* is the basis, the measure, and the limit of the appropriative right." Lay, *supra* note 19, at 70 (emphasis in original); see also *In re Water Rights of Escalante Valley Drainage Area*, 10 Utah 2d 77, 81, 348 P.2d 679, 681-82 (1960). "It is a settled rule that beneficial use shall be the basis, the measure and the limit of all rights to the use of water in this State."

For constitutional provisions requiring beneficial use see ALASKA CONST. art. VIII, § 13; ARIZ. CONST. art. XVII, § 2; CAL. CONST. art. X, § 2; COLO. CONST. art. XVI, §§ 5,6; IDAHO CONST. art. XV, § 3; MONT. CONST. art. IX, § 3; NEB. CONST. art. XV, §§ 5,6; N.M. CONST. art. XVI, §§ 1-3; UTAH CONST. art. XVII, § 1.

through several different legal mechanisms, two of which are abandonment and forfeiture. Common law abandonment occurs when the holder of a water right relinquishes that right with the *intent* to abandon it.<sup>29</sup> "Intent to abandon must be proved by clear and convincing evidence of unequivocal acts, and mere non-use of a water right, standing alone, is not sufficient for a *per se* abandonment."<sup>30</sup> Because it is difficult to prove that a wasteful appropriator actually intended to abandon the wasted water, abandonment rules provide little protection against waste.

Although forfeiture statutes are similar to common law abandonment rules, they provide that if a water right is not used for a given number of years,<sup>31</sup> the right is lost regardless of the right holder's intent.<sup>32</sup> Forfeiture rules are also ineffective in curtailing water waste, however, because the waste must continue for years before the forfeiture statutes apply. Forfeiture statutes then effectively *protect* waste for the statutory period.

The rule of adverse possession provides another potential protection against waste or nonuse. Many states, however, do not recognize the acquisition of water rights through adverse possession, and, of those states that do, several disfavor the doctrine.<sup>33</sup> Nevertheless, in those states that recognize adverse possession over water claims, the rule is purported to apply in the same way that it applies to conventional property: The adverse possessor, making a use which is open, hostile, exclusive, continuous, and under a claim of right for the prescriptive period of time, will acquire the original owner's interest in the water.<sup>34</sup> Prescription claims in water law, however, are difficult to acquire because of the nature of water rights. A water right is not a possessory right, but is "usufructuary"; that is, the right holder's interest extends only to the *use* of the water.<sup>35</sup> Thus, in order to successfully claim a right by adverse possession, the claimant must not only interfere with the true owner's possession, as in conventional property cases, but must also interfere with the true owner's use of the water. Accordingly, courts have held that the adverse possessor must deprive the prior appropriator of water at times when the prior appropriator actually needed it.<sup>36</sup> In order to support a claim of adverse possession, then, the claimant must overcome

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29. *Jenkins v. State, Dept. of Water Resources*, 103 Idaho 384, 388, 647 P.2d 1256, 1260 (1982).

30. *Id.* at 388-89, 647 P.2d at 1260-61.

31. The statutory period is generally five years. *See, e.g., IDAHO CODE* § 42-222(2) (1977 & Supp. 1987).

32. *See, e.g., id.*; OKLA. STAT. ANN. tit. 82, § 105.17 (West Supp. 1987).

33. Idaho and Montana are two examples. *See J. SAX & R. ABRAMS, supra* note 20, at 406.

34. *See, e.g., Gilbert v. Smith*, 97 Idaho 735, 740, 552 P.2d 1220, 1225 (1976).

35. *See BLACK'S LAW DICTIONARY* 1384 (5th ed. 1979).

36. *See, e.g., Sears v. Berryman*, 101 Idaho 843, 623 P.2d 455 (1981).

the difficult burden of proving that the true owner wanted to use the water; hence, this rule also fails to deter waste.<sup>37</sup>

A final theory<sup>38</sup> under which an inefficient use may be curtailed is the common law waste doctrine. Under the waste doctrine, a water right will be lost to the extent that it is not applied to a beneficial use.<sup>39</sup> To illustrate, picture two appropriators along a river that supplies 180 cubic feet of water per second (cfs). Appropriator *A* has been diverting and beneficially using 100 cfs and thereby has acquired an appropriative right to that quantity of water. When *A* originally appropriated the water, there were no other users in the system, and it was therefore economically efficient to use remedial methods of conveyance and irrigation. In other words, the cost of lining ditches, laying pipes, or installing a trickle irrigation system<sup>40</sup> was greater than the value of the water that would have been saved through the implementation of such technology. Later, during a period when the river was running especially high, Appropriator *B* made a diversion of 100 cfs, applying the water to beneficial use via modern irrigation technology. When the river level drops to its normal 180 cfs, there is a system-wide shortage. Since *A* made the prior appropriation, *A*'s 100 cfs appropriation takes priority over *B*'s 100 cfs appro-

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37. Due to problems of tracing and fungibility, it is difficult to show whose water the claimant was using. Thus, the peculiar nature of water as a resource also makes it difficult to prove openness of possession. This is especially true since a rightful owner might believe that a reduction in flow was attributable to natural causes.

38. Some states also set statutory limits on the amount of water that may be applied to agricultural uses in a given water basin under the "duty of water" concept. *See, e.g.*, NEB. REV. STAT. § 46-231 (1984 & Supp. 1987) ("No allotment from the natural flow of streams for irrigation shall exceed one cubic foot per second of time for each seventy acres of land, nor three acre feet in the aggregate during one calendar year for each acre of land . . ."); S.D. CODIFIED LAWS ANN. § 46-5-6 (1987) ("the amount allowed shall not be in excess of the rate of one cubic foot of water per second for each seventy acres . . . and the volume of water diverted for use shall not exceed two acre-feet per acre, delivered on the land for a specified time each year"). While in theory the duty of water sets a maximum amount of water use per acre of farm land, water boards tend automatically to grant the full amount in the allocation, thus encouraging waste. Pring & Tomb, *supra* note 2, at 25-17 (citing W. HUTCHINS, *WATER RIGHTS LAW IN THE NINETEEN WESTERN STATES* 316 (1971) and Note, *Determining Quantity in Irrigation Appropriations*, 4 *LAND & WATER L. REV.* 501, 502 (1969)).

39. It is not entirely clear how the common law waste doctrine interacts with modern forfeiture statutes. One authority, in listing the ways water rights may be lost in Oklahoma, does not even mention waste, *see Lay, supra* note 19, at 77, and later discusses waste only in stating that a wasteful use may never be a defense to a forfeiture action, *id.* at 91. Forfeiture statutes have actually been the basis of claims of waste. *See State v. McLean*, 62 N.M. 264, 308 P.2d 983 (1957); Shupe, *supra* note 1, at 499-501 (forfeiture statutes applicable to "misuse" as well as nonuse). If the common law waste doctrine is absorbed by state forfeiture statutes, a court must not only find that a use is wasteful, but also that it has been wasteful for the statutory period of time, in order to curtail the waste. *See Lay, supra* note 19, at 78, 91 (suggesting that putting water to a non-beneficial use constitutes "nonuse"). Under such a rule of law, a wasteful use could continue for years without consequence.

40. "A trickle . . . irrigation network supplies small amounts of water at frequent intervals directly to the root zone to satisfy the crop's immediate needs." Shupe, *supra* note 1, at 504.

priation. Thus, regardless of whether *B* is upstream or downstream from *A*,<sup>41</sup> *B* must cut its appropriation back to 80 cfs. To combat this reduction, *B* may seek to have *A*'s conveyance losses adjudicated as waste—claiming that *A*'s conveyance system is no longer efficient in light of the increased demand for water in the river basin.<sup>42</sup> If *B* is successful, *A*'s allocation will be reduced by the amount of water it was wasting, say 20 cfs, and *B*, the next appropriator in line of priority, could take the excess water to fill its appropriation. Thus *A* will be forced to reduce the quantity of water it diverts by 20 cfs, and *B* will be able to increase its diversion by that amount.

In theory, the legal doctrines of abandonment, forfeiture, adverse possession, and waste are adequate to deter wasteful practices of water conveyance and application. In practice, however, water loss is common, even in areas where water is in short supply.<sup>43</sup> More than half of the water diverted for agriculture is lost before reaching crops.<sup>44</sup> Even in the arid West, where water is precious, irrigation efficiency is surprisingly low: Only forty-one to forty-six percent of water diverted from a stream is used consumptively.<sup>45</sup> A Bureau of Reclamation study estimates that of all water diverted for irrigation, forty-seven percent is temporarily lost, returning later to the system as recoverable return flows,<sup>46</sup> twelve percent is irretrievably lost, and only forty-one percent is used consumptively by crops.<sup>47</sup>

While the Bureau of Reclamation's statistics suggest that only the quantity irretrievably lost constitutes an actual loss to society, excessive

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41. For simplicity, this illustration ignores the possibility that water used by *A* and *B* will return to the stream to be reused. In reality, however, if *B* is downstream from *A*, even if *A* appropriates all the water on the stream, *B* will likely be able to reuse *A*'s return flow.

42. Such would be the case if the value of the water which could be saved by implementing modern conveyance technologies exceeds the cost of implementation.

43. It is important to distinguish at the outset between water waste and water loss. While the legal standard for water waste is ill-defined, see *infra* notes 52-98 and accompanying text, waste is typically regarded as water loss this is not benefiting society. This parallels the economist's definition of "inefficiency." See J. BAUMOL & A. BLINDER, *ECONOMICS: PRINCIPLES AND POLICY* 46 (1982 2d ed.) ("Economists define *efficiency* as the absence of waste.") (italics in original) (footnote omitted). Water loss, on the other hand, is the total amount of water that is diverted from a stream that is not used consumptively by crops. Pring & Tomb, *supra* note 2 at 25-4 n. 8. Water loss includes evaporation, non-crop evapotranspiration, and non-recoverable groundwater. *Id.* Waste is a subset of loss, and some loss is actually desirable because it serves beneficial purposes. Since it would waste other resources to pipe every diversion system, evaporation loss from some ditches actually serves the beneficial purpose of providing for the conveyance of water from the stream to thirsty crops.

44. Pring & Tomb, *supra* note 2, at 25-5.

45. *Id.* (citing studies by the United States Bureau of Reclamation, the Soil Conservation Service, and the Department of Agriculture).

46. "Return Flows are the portion of the diversions which return to accessible surface or groundwater after irrigation." Pring & Tomb, *supra* note 2, at 25-4 n.8.

47. UNITED STATES BUREAU OF RECLAMATION, *Shut Off the Water—The Root Zone is Full: A Study of Irrigation Water Use* (1973).

irrigation leads to other problems, including crop damage, top soil erosion, increased soil and water salinity, soil waterlogging, pesticide pollution of the water supply, and the flushing of soil nutrients. These losses, comprising physical damage to the environment, may be termed "environmental losses."<sup>48</sup> Furthermore, a wasteful use upstream, which causes water to escape temporarily before it returns to the system much further downstream, prevents valuable use by bypassed downstream users and constitutes an additional loss to society.<sup>49</sup> Such loss, owing to the bypass of potential users, may be referred to as "location loss." Differences between irretrievable loss, location loss, and environmental loss suggest that different legal standards might be applied to handle the different losses to society.<sup>50</sup> Rather than fashioning an intricate legal remedy that requires tracing and netting these various effects, courts could provide an efficient solution by applying a negligence rule to conveyance losses even where the full social harm from water waste is difficult to ascertain.

### B. The Cases

Despite frequent reference to—and support for—states' policies favoring efficient water use, courts have been reluctant to apply the waste doctrine to reduce a right except in extreme cases.<sup>51</sup> According to some

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48. See Pring & Tomb, *supra* note 2, at 25-6.

49. Water's value depends largely on its location. Because water may be reused many times, upstream water presents more opportunities for use than does downstream water. See, e.g., *Fellhauer v. People*, 167 Colo. 320, 335, 447 P.2d 986, 993-94 (1968) ("For nearly a century the waters of the Arkansas River have been used and reused many times over as they proceed from elevations exceeding 12,000 feet to 3,375 feet at the state line.").

Not only does upstream water present opportunity for use by a greater number of people than does downstream water, but also by virtue of its elevation, upstream water contains greater potential energy than downstream water. Hydroelectric plants extract this potential energy by running water through hydroelectric generators. Thus, when users are bypassed there is a significant loss to the system, even if the water eventually returns to the stream.

50. A loss that ends up inuring to the benefit of a third party should, perhaps, be judged according to less critical legal standards than a loss which has no such external benefit. This is illustrated dramatically in the proposed transfer of salvaged water from the Imperial Irrigation District to the Metropolitan Water District, discussed *supra* at notes 9-15 and accompanying text. Although the water to be transferred is "waste" in the IID system because the IID does not put it to a present beneficial use, much of the water later flows into the Salton Sea and thereby is of some benefit to other users. If water use in the Salton Sea is deemed a beneficial use, it is unclear whether the IID's waste may be curtailed. Thus, IID's waste does not represent irretrievable loss of the entire amount because the water, arguably, is going to a beneficial use. Should another's beneficial use be a defense to a claim of waste? Only, it seems, to the extent that the other's use is not wasteful. Since much water is *irretrievably* lost as the water makes its way to the Salton Sea, the method of conveying the water to the Salton Sea is, itself, likely to be wasteful, even if use in the lake is deemed beneficial. Thus, the other's beneficial use should only operate as a partial defense in such situations. To protect *all* IID waste because of the smaller quantity of water used beneficially in the Salton Sea seems counterproductive.

51. "The cases reveal a remarkable judicial tolerance for waste despite rhetoric to the contrary." Pring & Tomb, *supra* note 2, at 25-18. "It should be obvious by now that the courts are

authorities, "the waste concept is poorly defined, hesitantly applied, and rarely enforced."<sup>52</sup> In *Tulare Irrigation District v. Lindsay-Strathmore Irrigation District*,<sup>53</sup> perhaps the seminal case on water conveyance loss, a number of plaintiffs brought suit to quiet title to surface and groundwater in the Kaweah Water District and to enjoin Lindsay-Strathmore Irrigation District from pumping groundwater out of the district.<sup>54</sup> The defendant, Lindsay-Strathmore, conceded that the plaintiffs' appropriative rights were prior to its own, but contended that some of the water allocated to the plaintiffs had not been applied to a beneficial use.<sup>55</sup> After years of litigation,<sup>56</sup> the trial court found that the plaintiffs' uses, including using water to drown rodents, satisfied the beneficial use requirement. Accordingly, the trial court permanently enjoined Lindsay-Strathmore from pumping any groundwater out of the district and from diverting any water from the Kaweah River beyond its riparian needs.<sup>57</sup>

On appeal, the California Supreme Court affirmed the *Tulare* court's holding in part, and remanded the case for quantification of the plaintiff/appropriators' allocations.<sup>58</sup> In deciding the case, the court assessed whether waste had occurred in three different contexts. First, the court applied the beneficial use requirement to an unconventional water use—drowning rodents. Although the trial court had protected the use of water during the winter to drown gophers and squirrels,<sup>59</sup> and although several witnesses had testified that this was a beneficial use,<sup>60</sup> the California Supreme Court summarily reversed the lower court's holding.

It seems quite clear to us that in such an area of need as the Kaweah delta the use of an appreciable quantity of water for such a purpose cannot be held to be a reasonable beneficial use. This seems to us so self-evident that no further discussion of the point is necessary. We, therefore, hold that whatever quantity of water was used by respondents solely

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ambivalent about waste. They condemn it regularly, yet almost as regularly refuse to enforce rules against it." J. SAX & R. ABRAMS, *supra* note 20, at 341.

52. Pring & Tomb, *supra* note 2, at 25-18 (citing Clark, *Background and Trends in Water Salvage Law*, 15 ROCKY MTN. MIN. L. INST. 421, 461 (1969)).

53. 3 Cal. 2d 489, 45 P.2d 972 (1935).

54. *Id.* at 502, 45 P.2d at 975.

55. *Id.* at 504, 45 P.2d at 976.

56. From filing to final decision, the case took more than 18 years. The trial reporter's transcript was 26,936 pages long, and the parties' briefs, which took more than five years to prepare, totaled 1,957 pages. *Id.* at 503, 45 P.2d at 975.

57. *Id.* at 517, 45 P.2d at 982.

58. *Id.* at 529-30, 45 P.2d at 988.

59. *Id.* at 567-68, 45 P.2d at 1007. According to one witness, "the best season of the year to kill gophers is with cold water (sic), irrigate in cold weather and kill them. The same thing with squirrels. You irrigate the squirrels in cold weather, in February, he gets wet and comes out and freezes to death." *Id.* at 568, 45 P.2d at 1007.

60. One witness testified that "the first benefit is you get rid of all your gophers. . . ." *Id.* at 567-68, 45 P.2d at 1007.

for this purpose during the winter period was not devoted to a beneficial use and that, in so far as the finding of the trial court now under discussion is based on such use, it is unsupported by the evidence.<sup>61</sup>

Indeed, the court may have approached the outer bounds of sound appellate review by overturning the trial court's finding of fact on this issue without citing any evidence that extermination of rodents was not beneficial to the farms.<sup>62</sup> What the court appears to have done then, in the context of an unconventional water use, is hold that not every use that brings about benefit qualifies as a "beneficial use." Although there is a benefit in exterminating destructive rodents, such a use might be wasteful as compared with crop irrigation.

The *Tulare* court applied the beneficial use requirement in a second context, analyzing whether the quantity of water applied to a conventional use—crop irrigation—was excessive. In this context the court proved much less vigilant in protecting against waste. While ample evidence existed to support Lindsay-Strathmore's contention that the quantity of water used to irrigate plaintiffs' land was wasteful, the court affirmed the trial court's finding that the use was beneficial. "[Defendant's] attack on this ground, cannot be sustained. Testimony as to damage to the soils of the delta, alleged to have been caused by the excessive use of water, with a resulting high water table, was highly conflicting."<sup>63</sup> The unlikelihood that the plaintiffs would use excessive amounts of water and thereby damage their land persuaded the court to affirm the trial court's finding that the amount of water used for irrigation was not excessive.<sup>64</sup>

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61. *Id.* at 568, 45 P.2d at 1007.

62. The court's assignment of the burden of proof may account for some of this inconsistency. The burden of proof is on the prior appropriator, in such action, to show by a preponderance of the evidence, every element of the right claimed by him. Proof of long continued use of a definite quantity, however, under the proper circumstances, may raise a presumption the use was necessary, for it is not reasonable to suppose that one would destroy or impair the value of his land by the use of an excessive amount.

*Id.* at 548, 45 P.2d at 997.

63. *Id.* at 571, 45 P.2d at 1009.

64. Physical damage to the land could occur simultaneously with a positive marginal utility of the water if the marginal product of the water were greater than the marginal land destruction loss. In other words, destruction of the land is simply a cost of irrigation. Economists tell us that self-interested individuals will undertake a costly activity if the benefits from engaging in the activity outweigh the costs. P. SAMUELSON, *ECONOMICS* 403 (11th ed. 1980) ("The firm increases total profit so long as the extra revenue brought in from the last unit sold is greater than the *extra* cost which the last unit entailed.") (emphasis in original). If the benefit to crops outweighs the damage to the land, rational farmers will continue to irrigate. The court's reasoning however, suggests that it was considering destruction to land that outweighed the marginal product of the water.

[I]t is not at all probable that a number of farmers would use, for many years, for the purpose of irrigation, an amount of water that would destroy or impair the value of their land. Of course, they would not willingly do so; and it is hard to believe that, in these days of intelligent and scientifically directed agriculture, these men, who have located and built up a thriving community, would make such a grievous mistake as to cause deliberately their lands to become water-logged and depreciated for all the purposes of husbandry.

In evaluating the benefits of water use for crop irrigation, the court failed to recognize that the amount of water applied to crops might be excessive without impairing the value of the plaintiffs' land. The first few units of water applied to a crop are likely to be very beneficial. As crops reach saturation, however, the benefit derived from each added unit will decrease. In other words, water applied to crops is characterized by decreasing marginal utility. When crops are overwatered, the last few units applied will provide very little benefit. If even more water is applied to the field, marginal utility—the benefit of the last unit—may drop below zero. When so much water is used as to cause damage to the irrigator's land (without a corresponding marginal benefit) then there is negative marginal utility. The court's standard suggests that only water use which causes damage—or that which has negative marginal utility—is wasteful.<sup>65</sup> However, even where marginal utility is positive, the last few units of water could be of such a small benefit to the irrigator as to be negligible. Thus, even though there is some benefit derived, the overwatering could be wasteful in light of other water needs. Had the court applied an economist's definition of waste, it would have considered whether the value derived from applying the last marginal unit of water to the crops was less than the value that could be derived from applying the water to its next best use.<sup>66</sup> Instead, the court defined waste as a use which is so excessive as to have reached a point of negative marginal utility.

Finally, the court applied the beneficial use requirement in assessing the reasonableness of the plaintiffs' conveyance methods. Even though the plaintiffs had conceded that conveyance in open, unlined ditches through porous soils resulted in a loss of forty to forty-five percent of diverted water, the court affirmed the trial court's finding that no waste had occurred.<sup>67</sup> The court applied a locality (or local custom) standard<sup>68</sup> and noted that other unlined conveyance systems resulted in conveyance losses of over fifty-seven percent.<sup>69</sup> The court concluded that, *as a matter*

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*Id.* at 572, 45 P.2d at 1009 (quoting *Stinson Canal & Irr. Co. v. Lemoore Canal & Irr. Co.*, 45 Cal. App. 241, 252, 188 P. 77, 82 (1920)).

65. *See supra* note 64.

66. Under the economist's definition of waste, the costs of using the water in that activity, including environmental damages and the foregone benefit of the water's next best use, are weighed against the benefits of the water's actual use. If the social benefit of the last incremental unit of water (the marginal benefit) equals the social cost of that last unit (the marginal cost), then there is no waste. *See* R. Cooter & T. Ulen, *Law & Economics*, 46-47 (1986) (discussion of social and private marginal costs).

67. *Tulane Irr. Dist.*, 3 Cal. 2d at 572-73, 45 P.2d at 1009.

68. "He is entitled to make a reasonable use of the water according to the custom of the locality, and, as long as he does so, other persons cannot complain of his acts." *Id.* at 573, 45 P.2d at 1010.

69. *Id.* at 573, 45 P.2d at 1009.

of law, the plaintiffs' had the right to use unlined earthen ditches to convey the water since this did not violate local custom.<sup>70</sup>

Although *Tulare* allowed large conveyance losses, the aptly named Chief Justice Waste employed strong language in the court's opinion condemning wasteful water use practices.

As the pressure of population has led to the attempt to bring under cultivation more and more lands, and as the demands for water to irrigate these lands have become more and more pressing, the decisions have become increasingly emphatic in limiting the appropriator to the quantity reasonably necessary for beneficial uses. . . . [I]t is the policy of the state to require within reasonable limits the highest and greatest duty from the waters of the state.<sup>71</sup>

The court also stressed the Judiciary's role in curtailing wasteful water uses by noting that, unlike the complete ownership of conventional property, water rights are limited by the beneficial use requirement.

If the appropriator uses more than the amount so required, he gains no right thereto. . . . In so far as the diversion exceeds the amount reasonably necessary for beneficial purposes, it is contrary to the policy of the law and is a taking without right and confers no title, no matter for how long continued.<sup>72</sup>

Thus, on a theoretical level, the court expressed willingness to curtail inefficient water use. However, despite its authority to do so, the court declined to hold economically inefficient irrigation or conveyance losses to be wasteful.

The *Tulare* court set out what has become the controlling standard in conveyance loss cases: "An appropriator, as against subsequent appropriators, is entitled to the continued flow to the head of his ditch of the amount of water that he, in the past . . . has diverted for beneficial purposes, plus a reasonable conveyance loss. . . ."<sup>73</sup> The court, however, did little to define the term "beneficial," resulting in a variety of interpretations.

The *Tulare* court's application of the beneficial use doctrine illustrates that standard's malleability. Although the court readily found the practice of drowning gophers wasteful despite testimony to the contrary, it refused to extend its holding to irrigation absent findings of actual physical damage to the land and apparently a negative marginal value for the water's use. Indeed, while the court deferred almost totally to local custom in discussing conveyance loss, and failed even to consider the relative costs and benefits of improving the irrigation systems, it implicitly *rejected* that same locality rule in enjoining the use of water to drown

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70. *Id.*

71. *Id.* at 547, 45 P.2d at 997.

72. *Id.*

73. *Id.* at 546, 45 P.2d at 997.

rodents. Thus, citing a single standard for defining waste, the court produced fundamentally inconsistent results. The court's vague treatment of the terms "beneficial purposes" and "reasonable conveyance loss," has given subsequent courts little guidance in determining whether a particular use constitutes waste.

Although a multitude of possible interpretations for "beneficial use" exist, economic theory recognizes two broad categories of meaning: total benefit and marginal benefit. In assessing a given activity's total benefit, a court would ask whether applying the *total* quantity of water to the activity results in some benefit. In marginal benefit analysis, the court would look to see whether the *last unit* of water applied to the activity is beneficial. These two different methods of analysis can lead to very different results, since water use in a particular activity might be beneficial on the whole, even though the last few units of water applied to the activity are wasteful.

Applying a total analysis, a court could reach three distinct definitions of "beneficial." First, "beneficial" might mean a water use where, ignoring all associated costs, the total amount of water applied to the activity results in a gross benefit to the appropriator. Such a standard might be termed a "total gross benefit" standard. Second, a court might net out the costs that the water use imposes on the appropriator, while continuing to ignore costs, such as environmental loss, that the appropriator's water use imposes on others. Such a standard could be referred to as a "total net private benefit" standard since it looks only to the appropriator's costs and benefits. Third, while still applying a total, rather than marginal, analysis, the court could take into account *all* benefits and costs associated with the water use to determine whether it is beneficial. Such a standard could be deemed a "total net social benefit" standard.

Applying a marginal analysis for assessing beneficiality, a court could come to still three other definitions of "beneficial." First, paralleling the total-gross-benefit standard, the court might ignore all costs associated with the water use and determine whether the last unit of water applied to the use was of any benefit to the appropriator. This could be called a "marginal gross benefit" standard. Then, subtracting all the costs that the last unit of water might impose on the appropriator, the court might apply a "marginal net private benefit" standard. Finally, if the court takes into account all costs and benefits, both private and social, and applies a marginal analysis, it can be said to have applied a "marginal net social benefit" standard. This final standard is, essentially, the economist's definition of "efficiency." Nevertheless, the apparent feasibility of six different interpretations of "beneficial use" almost ensures that the standard will be applied inconsistently.

Although courts continue to be reluctant to find waste in the context

of conveyance loss, the California Supreme Court has applied a less differential standard for analyzing an appropriator's water use than was used in *Tulare*. In *Joslin v. Marin Municipal Water District*,<sup>74</sup> downstream riparian owners brought suit to recover damages of \$275,000 after the defendant, Marin Municipal Water District, built a dam on the Nicasio Creek above the plaintiffs' land.<sup>75</sup> Plaintiffs claimed that the dam diminished the value of their lands by reducing the quantity of rock and gravel available for them to sell.<sup>76</sup> Stressing the need to use water in a beneficial manner,<sup>77</sup> the *Joslin* court held that "the use of such waters as an agent to expose or to carry and deposit sand, gravel and rock, is as a matter of law unreasonable within the meaning of [the California Constitution]."<sup>78</sup> Since the plaintiffs' use was wasteful, the Water District's action did not constitute a taking of the plaintiffs' property.<sup>79</sup>

The *Joslin* court came much closer to applying an efficiency analysis than did the court in *Tulare*. In finding that the plaintiffs' irrigation methods were not wasteful, the *Tulare* court restricted its analysis entirely to the benefits, and some of the costs, of the plaintiffs' irrigation. The *Joslin* court, by contrast, compared the relative value of *both* parties' water use in determining that the plaintiffs' use was wasteful. Storing water in a reservoir, the court concluded, was much more beneficial than merely using it to carry gravel, even though both uses are beneficial

74. 67 Cal. 2d 132, 429 P.2d 889, 60 Cal. Rptr. 377 (1967).

75. *Id.* at 134-35, 429 P.2d at 889-90, 60 Cal. Rptr. at 378-79.

76. *Id.* at 135, 429 P.2d at 890, 60 Cal. Rptr. at 379.

77. "Paramount among [state-wide considerations of transcendent importance is] the ever increasing need for the conservation of water in this state, an inescapable reality of life. . . . The present and future well-being and prosperity of the state depend upon the conservation of its life-giving waters.'" *Id.* at 140 & n.9, 429 P.2d at 894 & n.9, 60 Cal. Rptr. at 382 & n.9 (quoting *Gin S. Chow v. City of Santa Barbara*, 217 Cal. 673, 22 P.2d 5 (1933)). The court continued by stating that it could not

deem such a use to be in accord with the constitutional mandate that our limited water resources be put only to those beneficial uses "to the fullest of which they are capable," that "waste or unreasonable use" be prevented, and that conservation be exercised "in the interest of the people and for the public welfare."

*Id.* at 141, 429 P.2d at 895, 60 Cal. Rptr. at 383 (quoting CAL. CONST. art. XIV, § 3).

78. *Id.*

79. "[S]ince there was and is no property right in an unreasonable use, there has been no taking or damaging of property by the deprivation of such use and, accordingly, the deprivation is not compensable." *Id.* at 145, 429 P.2d at 898, 60 Cal. Rptr. at 386.

The usufructuary nature of water rights makes for interesting condemnation issues. Since condemnation is only justified when the government has a more efficient use for the water than the private party, if we define "beneficial use" as the *most* efficient use—economic efficiency demands the allocation of scarce resources to their highest valued uses, see W. BAUMOL & A. BLINDER, *ECONOMICS: PRINCIPLES AND POLICY* 430-34 (2d ed. 1982)—the private right in the water disappears whenever the government presents a use that is more socially beneficial than the private use was. Thus, under this strict definition of "beneficial use," condemnations would never be compensated.

under a "total gross benefit" standard, in that they both produce gross utility gains.

The apparent shift from a total benefit analysis to a marginal, or efficiency, analysis has not extended to conveyance loss cases. As the *Tulare* and *Joslin* examples illustrate, most cases holding an appropriation to be wasteful involve disputes over the purpose of a given water use; and crop irrigation, unlike killing rodents or transporting gravel, is seldom held to constitute waste. Where conveyance methods are in question, courts seldom find waste.<sup>80</sup> Even irrigation by flood methods has been held a nonwasteful means of conveying water to crops.<sup>81</sup>

Courts have avoided confronting the wastefulness of specific means of conveyance by applying a locality rule.

[P]rinciples of maximum utilization have never been held to require that appropriators achieve absolute efficiency when they divert water and apply it to beneficial use. . . . In determining whether a diversion system is reasonably efficient, [the courts should consider] whether the earthen ditches . . . conform to the conditions and customs of the locality where the water diversion occurs . . . .<sup>82</sup>

One early case went so far as to say that even *inefficient* methods of conveyance may not be challenged if they conform to local custom.<sup>83</sup> Moreover, because appropriators frequently are not permitted to sell water they save through efficient conveyance, they often have little economic incentive to conserve.<sup>84</sup>

As with medical malpractice cases which apply a locality rule<sup>85</sup> and other early tort cases which relied on custom to define negligence,<sup>86</sup> the

80. Damming a stream in order to convey water for use at a higher elevation has been held not to be a wasteful interference with uses of other (junior) appropriators even when the water level fluctuations produced actual injury. *State ex rel. Crowley v. District Court*, 108 Mont. 89, 88 P.2d 23 (1939).

81. *Joerger v. Pacific Gas & Elec. Co.*, 207 Cal. 8, 276 P. 1017 (1929).

82. *A-B Cattle Co. v. United States*, 196 Colo. 539, 554-57, 589 P.2d 57, 68-69 (1978) (Erickson, J., dissenting).

83. "[W]hen ditches and flumes are the usual and ordinary means of diverting water, parties who have made their appropriations by such means cannot be compelled to substitute iron pipes, though they will be required to prevent unnecessary waste by keeping their ditches and flumes in good repair." *Crowley*, 108 Mont. at 103, 88 P.2d at 30 (quoting J. LONG, A TREATISE ON THE LAW OF IRRIGATION § 116 (2d ed. 1916)).

84. "[T]he salvage having been made, a junior appropriator. . . may claim that the salvaged water 'belongs to the stream' rather than to the salvager." J. SAX & R. ABRAMS, *supra* note 20, at 351.

85. See, e.g., *Murphy v. Dyer*, 409 F.2d 747 (10th Cir. 1969); *Loftus v. Hayden*, 391 A.2d 749 (Del. 1978). But see *Brune v. Belinkoff*, 354 Mass. 102, 235 N.E.2d 793 (1968) (locality rule rejected).

86. See, e.g., *Mayhew v. Sullivan Mining Co.*, 76 Me. 100 (1884); *Titus v. Bradford*, 136 Pa. 618, 20 A. 517 (1890). But see *The T.J. Hooper*, 60 F.2d 737 (2d Cir.), *cert. denied*, 287 U.S. 662 (1932) (opinion of Hand, J.) (holding failure to use modern radio sets on tugboat negligent, despite conformity with industry practice).

locality rule has obvious shortcomings. This rule permits inefficient methods of conveyance notwithstanding the availability of efficient methods that would save enough water to offset the cost of implementation.<sup>87</sup> In the medical malpractice context, the locality rule was justified as a means of protecting rural doctors.<sup>88</sup> Similarly, the locality rule as applied to water conveyance losses might be justified as a subsidy to support rural economies. However, given other, more overt means of supporting farm economies through tax incentives, price controls, government buyouts, and direct monetary subsidies, the desirability of using the locality rule for conveyance systems as a subsidy is questionable. First, the locality rule subsidizes *all* farms, rather than only its supposed beneficiaries—small family farms. Second, since the subsidy is directly tied to water use, it operates more heavily on water intensive crops. Considering the growing water crisis, it is not at all clear that legislators would choose to favor farmers of water-intensive crops over farmers growing crops which are less water intensive. Finally, it seems more appropriate to leave farm policy decisions to state and federal legislators, rather than judicially creating farm subsidies in the guise of a locality rule.

Even absent a locality rule, however, inefficient water conveyance

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87. See Pring & Tomb, *supra* note 2, at 25-18 to 25-19; see also Note, *Water Waste—Ascertainment and Abatement*, 1973 UTAH L. REV. 449, 455-56 (finding only three cases that directly hold a method of conveyance conforming to local practices to be wasteful).

88. J. WALTZ & F. INBAU, *MEDICAL JURISPRUDENCE* 64, 64-65 (1971).

In the last 20 years, the medical malpractice locality rule has come under much fire. "The rule often has been criticized and seldom defended." Pearson, *The Role of Custom in Medical Malpractice Cases*, 51 IND. L.J. 528, 539-40 (1976) (footnotes omitted). "The 'locality' or 'community' rule is becoming a thing of the past as a general national standard is being applied in medical malpractice cases." Simon, *Libel as Malpractice: News Media Ethics and the Standard of Care*, 53 FORDHAM L. REV. 449, 449-50 n.2 (1984) (citing *Sullivan v. Henry*, 160 Ga. App. 791, 800, 287 S.E.2d 652, 659 (1982); *Brune v. Belinkoff*, 354 Mass. 102, 107-09, 235 N.E.2d 793, 797-98 (1968); *King v. Williams*, 276 S.C. 478, 481-82, 279 S.E.2d 618, 619-20 (1981); *Pederson v. Dumouchel*, 72 Wash. 2d 73, 78-79, 431 P.2d 973, 977-78 (1967)); see also Waltz, *The Rise and Gradual Fall of the Locality Rule in Medical Malpractice Litigation*, 18 DE PAUL L. REV. 408, 415-18 (1969); Comment, *Standard of Care for Medical Practitioners—Abandonment of the Locality Rule*, 60 KY. L.J. 209 (1971); Note, *Medical Specialties and the Locality Rule*, 14 STAN. L. REV. 884, 886-91 (1962).

In most jurisdictions the locality rule in medical malpractice is being replaced by a "same or similar community rule," rather than by a single national standard. Professor Robert Byrd comments,

The number of adherents to the locality rule declined as advances in medical science, stricter regulation of the medical profession, and improvements in medical education and practice removed many of the factors that earlier contributed to different levels of quality in practice. The prevailing standard became customary practice in the "same or similar community" and a trend toward a national standard developed. This trend was arrested, if not reversed, by medical malpractice legislation adopted by many states in the mid-1970s in response to the malpractice insurance crisis. Today, a majority of jurisdictions follow the same or similar community rule.

Byrd, *The North Carolina Medical Malpractice Statute*, 62 N.C.L. REV. 711, 724 (1984) (footnote omitted).

methods might still persist due to the failure of courts to consider benefits that are external to the challenged user.<sup>89</sup> By looking only at the net benefits accrued by the inefficient appropriator, the courts ignore the full range of social benefits that could be derived from more efficient conveyance systems.

The courts' reluctance to find waste, despite their rhetorical commitment to preventing it, may also be attributable to judicial deference to state constitutional provisions that guarantee citizens the right to appropriate unappropriated water.<sup>90</sup> While no court has suggested that these constitutional guarantees are absolute or immune to beneficial use requirements, the constitutional inmagnitude of these provisions suggests that appropriations should not be taken away for minor reasons. Such an argument is shortsighted, however, because the constitutional importance of water also suggests that water resources be carefully guarded from waste to ensure full and fair use by all.<sup>91</sup>

To summarize, this Part has outlined the various legal limitations on water use in the prior appropriation system. It also has illustrated that courts have applied their vaguely defined beneficial use standard reluctantly and inconsistently against inefficient users and, as a result, have allowed the loss of precious water resources despite a growing need for water and despite the availability of efficient water saving technologies. Part II introduces the leading solution to the problem of the misallocation of water resources: the market solution. In theory, a market system would provide economic incentives, independent of the judicial system, to induce appropriators to employ the most efficient means of conveyance. Part II concludes, however, that because of transaction costs, the nature of water as a near public good, externalities, traditional notions in water resources law, and the small number of buyers and sellers on a given river system, an efficient market is not likely to develop. Furthermore, due to the risk of bargaining failure, exchanges among small num-

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89. "Courts consider only the economic circumstances of the particular appropriator; they refuse to engage in a cost-benefit analysis whereby the cost of instituting efficiency measures is weighed against the value of the water saved." Pring & Tomb, *supra* note 2, at 25-19.

90. See, e.g., COLO. CONST. art. XVI, § 6 ("The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied."); IDAHO CONST. art. XV, § 3 ("The right to divert and appropriate the unappropriated waters of any natural stream to beneficial uses, shall never be denied, except that the state may regulate and limit the use thereof for power purposes."); NEB. CONST. art. XV, § 6 ("The right to divert unappropriated waters of every natural stream for beneficial use shall never be denied except when such denial is demanded by the public interest."); WYO. CONST. art. VIII, § 3 ("Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests.").

91. Perhaps another reason why courts have been reluctant to find waste is that, by expending time and money to defend a lawsuit, the challenged appropriator illustrates that the use in question has some value to her. A third possibility is that courts rarely find waste because there is no clearly defined standard of what constitutes waste.

bers of buyers and sellers in a nonmarket situation will be unlikely to provide proper incentives necessary to induce appropriators to employ efficient means of water conveyance and application.

## II

### TOWARD AN EASED SYSTEM OF TRANSFERS

Many scholars, recognizing the problem of waste in Western water law, propose a "market solution." This solution contemplates an efficient market for water that will provide appropriators with incentives to use efficient methods of diversion and irrigation. If appropriators are able to sell the water they save at a price that accurately reflects the full social value of water conservation, economic self-interest will compel them to improve their methods of diversion and application. The market advocates argue that this self-policing market solution would allocate water to its most efficient uses without judicial intervention. In this perfect world, the invisible hand of capitalism, as envisioned by Adam Smith,<sup>92</sup> would patch up leaky conveyance systems and lead water naturally to its most socially desirable uses.

This Part briefly outlines some of the leading market proposals, and illustrates how, because of water's unique physical properties, it is unlikely to be traded at an economically efficient price in a market or in a bargaining situation.<sup>93</sup> While the move towards the market is well-directed, the market solution alone is inadequate to eliminate waste and to provide for the efficient allocation of water resources.

#### A. *The Coase Theorem*

Professor Ronald Coase has theorized that, no matter how resources are initially allocated, so long as property rights are clearly defined in an efficient market system, those resources will ultimately be applied where they provide the greatest economic benefit.<sup>94</sup> Given an efficient system of water sales (either through the market or through an efficient bargaining mechanism) and clearly defined property rights, then, this theory predicts that efficient use of water will result regardless of the initial allocation.<sup>95</sup>

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92. See generally ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS (1776).

93. References to "markets" contemplate large numbers of buyers and sellers—so large, usually, that any single individual is unable to influence the market price. References to "bargaining situations" contemplate few or only one buyer and seller.

94. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

95. See C. MEYERS & R. POSNER, *supra* note 5, at 3-4; Burness & Quirk, *Water Law, Water Transfers, and Economic Efficiency: The Colorado River*, 23 J.L. & ECON. 111, 130 ("So long as there are zero transaction costs and no restrictions on the buying and selling of rights, any initial pattern of entitlement is consistent with a pattern of water use that satisfies economic efficiency.").

As applied to waste, the Coase Theorem suggests that, rather than divert water to a nonbeneficial use or needlessly lose water through inefficient conveyance systems, an appropriator will sell the water in the market system or bargain with a buyer who is willing to pay something more than the cost of salvage. In *Tulare*,<sup>96</sup> for example, where the plaintiffs wished to protect their use of water to drown gophers against the defendant's transportation of water for use in another water basin, the Coase Theorem provides a simple solution. If drowning gophers has a smaller benefit than the benefit of selling the water at the efficient market rate or of bargaining with a higher valued user, the gopher drowners would be willing to sell—and the water transporters would be willing to buy—the right to use the water. Thus, water would be allocated to its highest valued and most beneficial use without judicial intervention.

Similarly, the market system would allocate water to the most efficient use in cases of inefficient conveyance loss. Take the example of the earthen ditches in *Tulare* that allowed a forty to forty-five percent loss.<sup>97</sup> If the cost of lining the ditches or of putting in pipes were less than the value of using the water saved, and there were either an efficient market or efficient bargaining, the plaintiffs would institute such measures and the defendant would be willing to pay the plaintiffs more than their costs in order to receive the water.

In sum, where the cost of saving water by improving conveyance methods is less than the benefit of the water saved, the invisible hand<sup>98</sup> (in the case of a perfect market) or a more visible bargaining table (if there is no traditional market), will guide the water to the most efficient use. If, on the other hand, the cost of lining the ditches *exceeds* the benefit of applying the salvaged water to another use, then no conveyance improvements would—or should—be instituted. Wasteful conveyance methods and less obvious inefficiencies, such as those associated with the prior appropriation system,<sup>99</sup> would disappear given a Coasian system of free transfers.<sup>100</sup>

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96. *Tulare Irrigation Dist. v. Lindsay-Strathmore Irrigation Dist.*, 3 Cal. 2d 489, 45 P.2d 972 (1935).

97. *Id.* at 572, 45 P.2d at 1009.

98. See generally A. SMITH, *supra* note 92.

99. See, e.g., Burness & Quirk, *supra* note 95. Under the "first-in-time, first-in-right principle," the prior appropriator has priority to water in a stream in times of shortage. This is so even if the prior appropriator's use is less efficient or valuable than later appropriators'. The authors illustrate how allowing for free trade of water in an efficient market will guide the water to the highest valued use, even in times of shortage. *Id.* at 133.

100. "An application of the Coase theorem provides a straightforward mechanism to effect an equal-sharing allocation. With the establishment of competitive markets in which water rights can be freely bought and sold, the inefficiencies [arising from disparate allocation of priority among otherwise equal firms] can be eliminated." *Id.* at 121.

### B. *Leading Market Proposals*

Advocates of a market solution propose changes in current water law in order to promote the transferability of water rights. These proposed changes fall roughly into three categories: (1) those reducing transaction costs; (2) those vesting water rights more fully in particular individuals; and (3) those abrogating current legal rules that expressly prohibit transfers.<sup>101</sup>

Judicial determinations of water rights involve large and often prohibitive transaction costs because of the time and number of parties involved in adjudicating proposed transfers. Since the court must determine whether the proposed transfer will harm other users, the judicial inquiry is usually extensive. These transaction costs contribute to the inefficient allocation of water by inhibiting transfers that are otherwise socially beneficial.

Meyers and Posner propose three procedural rules in order to reduce transaction costs. First, they recommend that all engineering questions in transfer proceedings be decided by outside experts, subject to judicial review applying a substantial evidence standard. Having such questions decided by an expert, rather than a judge who is unfamiliar with water engineering, will save time and reduce costs. Second, the authors suggest that courts in transfer proceedings ignore possible injuries to other users where a preliminary hearing demonstrates that damages will not be great, or are not ascertainable. The injured parties may reopen the proceeding should damages actually occur. Under the present system, a water right may not be transferred until it is shown that the proposed transfer will not harm other appropriators.<sup>102</sup> The proposed rule would lessen the difficulty of ascertaining in advance what harm will result from changes in a complex water system to other users affected by the transfer. Third, they propose that the burden of production on the issue of injury to other users remain on the proponents of the transfer, but that the burden of persuasion shift to those opposing the transfer to show that the transfer will harm other users.<sup>103</sup> The authors also support

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101. Admittedly, these three categories are not mutually exclusive. For example, the rule prohibiting a transfer of water rights which would harm a downstream user could be included in any or all of the categories. First, the rule could be considered an express prohibition of a transfer under category three. Second, the rule prevents the full vesting of the water right in the initial appropriator and could fit under category two, since it limits the appropriator's ability to transfer water. Finally, the rule could be included in category one as a rule giving rise to excessive transaction costs, because it is frequently necessary, in a complex river system, to extensively adjudicate the issue of whether downstream users might actually be harmed by the transfer.

102. "A change of water right . . . shall be approved if such change . . . will not injuriously affect the owner of or persons entitled to use water. . . ." COLO. REV. STAT. § 37-92-305(3) (1973). "The standard rule is that *A* can only sell his water right to the extent that it will not make *B* worse off." J. SAX & R. ABRAMS *supra* note 20, at 377.

103. C. MEYERS & R. POSNER, *supra* note 5, at 32-34.

substantive developments designed to reduce costs. Since a single large mutual water company could avoid many of the transaction costs and potentials for bargaining failure that are unavoidable in a transaction involving numerous individual sellers, Meyers and Posner support legislation to facilitate the formation of mutual water companies. Such legislation would allow those who use a majority of the water to compel the other users to join the company.<sup>104</sup>

The second category—rules designed to vest water rights in a particular individual—derives from the Coase Theorem discussed earlier: In order for a solution to be efficient, property rights must be clearly defined. “[P]roperty rights which are uncertain or ill-defined are of little value; only rights which are clear and stable can be enjoyed and used up to their fullest extent.”<sup>105</sup>

Some jurisdictions explicitly hold that appropriators may *not* use or sell water that they conserve and that the water conserved “goes back to the stream.”<sup>106</sup> These jurisdictions note that an increase in the efficiency of a diversion merely indicates that prior conveyance methods were wasteful.<sup>107</sup> Since no one can acquire a right to waste water,<sup>108</sup> they conclude, the appropriator never had a valid appropriation for the wasted water. Appropriators in these jurisdictions have diminished incentive to improve their method of diversion because they cannot sell the water that they conserve.

Meyers and Posner recommend that the return flow created by a transfer be recognized as the property of the owner so that the owner can sell the return flow and internalize the benefits to downstream users.<sup>109</sup>

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104. *Id.* at 38.

105. Oeltjen & Fischer, *supra* note 16, at 246.

106. *See, e.g.*, Giffen v. State, 690 P.2d 1244 (Colo. 1984); R.J.A., Inc. v. Water Users Ass'n of Dist. No. 6, 690 P.2d 823 (Colo. 1984); Southeastern Colo. Water Conservancy Dist. v. Shelton Farms, Inc., 187 Colo. 181, 529 P.2d 1321 (1974); Morrison v. Higbee, 204 Mont. 501, 668 P.2d 1029 (1983). *See also* Salt River Valley Water User's Ass'n v. Kovacovich, 3 Ariz. App. 28, 411 P.2d 201 (1966) (Water salvaged by appropriator from his diversion works may not be retained and applied to adjacent plot of land.); Tudor v. Jaca, 178 Or. 126, 164 P.2d 680 (1946); Fuss v. Franks, 610 P.2d 17 (Wyo. 1980). *Contra* CAL. WATER CODE §§ 1010(b), 1011(b) (West Supp. 1985) (granting rights to salvaged water to the salvaging appropriator); Pomona Land & Water Co. v. San Antonio Water Co., 152 Cal. 618, 93 P. 881 (1908); Basiuger v. Taylor, 36 Idaho 591, 211 P. 1085 (1922); Reno v. Richards, 32 Idaho 1, 178 P. 81 (1918); East Bench Irr. Co. v. Deseret Irr. Co., 2 Utah 2d 170, 271 P.2d 449 (1954); Big Cottonwood Tanner Ditch Co. v. Shurtliff, 56 Utah 196, 189 P. 587 (1919).

107. This reasoning is analogous to the use of a manufacturer's subsequent design improvements to prove prior negligence. Evidentiary rules in most jurisdictions go far in excluding such testimony. *See, e.g.*, FED. R. EVID. 407; CAL. EVID. CODE § 1151 (West 1986).

108. Appropriations may be made for “beneficial uses” only. *See supra* note 28 and accompanying text. “There is no dispute *in theory* about the basic rule. . . . [O]ne can acquire only the right to make a non-wasteful use and . . . all wasteful uses must be discontinued.” J. SAX & R. ABRAMS, *supra* note 20, at 334.

109. C. MEYERS & R. POSNER, *supra* note 5, at 28.

Under the present system of entitlement, an appropriator may not transfer water rights if doing so would disadvantage a return flow appropriator.<sup>110</sup> To this extent, return flow appropriators have a vested right in return flow.<sup>111</sup> Accordingly, parties considering the purchase of water rights only consider the benefit to themselves of making a diversion; any benefit to return flow or seepage appropriators is external to their calculation. Appropriators consequently forego efficient diversions because they have no reason to take into account the external benefits to potential users. Conversely, granting the purchaser of water rights the right to the return flow generated by his use would allow the purchaser to charge return flow users and thereby internalize this external benefit.<sup>112</sup>

Another legal restriction that prevents the vesting of property rights is the beneficial use requirement. This requirement causes inefficiency to the extent that "use" contemplates a *present* use. Because an appropriation is only valid if the water is put to a present beneficial use, persons who anticipate an increased demand for water are induced to set up straw uses.<sup>113</sup> For example, farmers might divert unappropriated water through an irrigation system that costs more than the value of the water applied to the crops.<sup>114</sup> Even if there is no value in applying the water to the crops, "farmers will still be willing to make some investment in irrigation works if that is the only way they can obtain a property right . . . that they can sell for a high price in a few years."<sup>115</sup> In order to satisfy the beneficial use requirement and obtain a valid appropriation, the farmer has wasted valuable resources on an inefficient diversion. Thus, the beneficial use requirement—a rule purporting to prevent waste and speculation—can actually provide an incentive for an appropriator to undertake inefficient diversions in order to disguise speculation.<sup>116</sup> In response, Meyers and Posner propose the abrogation of the requirement of present use.<sup>117</sup> Interested parties could speculate in water by acquir-

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110. See *Weibert v. Rothe Bros., Inc.*, 200 Colo. 310, 618 P.2d 1367 (1980).

111. The appropriator may, however, reduce his return flow by applying the water to his own use rather than transferring it. *Stevens v. Oakdale Irrigation Dist.*, 13 Cal. 2d 343, 90 P.2d 58 (1939).

112. C. MEYERS & R. POSNER, *supra* note 5, at 29.

113. "The principal impediment to full efficiency in the development of unappropriated water lies in the doctrine of beneficial use, which is . . . regularly interpreted to preclude an appropriation where no immediate use of the water is contemplated—an appropriation for future, and *a fortiori* for frankly speculative, purposes." *Id.* at 40; see also Williams, *The Requirement of Beneficial Use as a Cause of Waste in Water Resource Development*, 23 NAT. RESOURCES J. 7, 7-11 (1983) (recommending anticipatory water rights as a solution to the inefficiency caused by the beneficial use requirement).

114. C. MEYERS & R. POSNER, *supra* note 5, at 41. Research has revealed no actual examples of straw uses designed to cover up appropriations for future use.

115. *Id.*

116. *Id.*

117. *Id.* at 42.

ing appropriations for future use without having to set up straw diversions. In order to equitably allocate these appropriations, they recommend establishing a state auction system.<sup>118</sup>

The final category of proposals seeks to change legal rules which expressly prohibit transfers. Scholars advocating the market solution are overtly critical of rules that prohibit transfers, such as the appurtenance requirement which prohibits water rights from being sold separately from land.<sup>119</sup> Other direct prohibitions include "area of origin" restrictions which prohibit water sales from one basin to another, or from one state to another.<sup>120</sup> Market theorists condemn these rules and the rule prohibiting transfers of water rights which harm other appropriators because such rules inhibit beneficial transfers of water rights.

Meyers and Posner, for example, propose restricting federal reclamation laws that prohibit transfers to instances where the Bureau of Reclamation has a financial interest in the project and, even then, they suggest that transfers be permitted if the transferee agrees to pay its share of Bureau loans and organizational and management costs.<sup>121</sup> In addition, they propose abolishing state law restrictions in the form of appurtenance requirements and area of origin limitations.<sup>122</sup>

### C. *Inherent Market Failure*

Although market-solution proposals go far in providing a structure of incentives which will inhibit waste and promote the allocation of water to its highest valued uses, the problem of water waste is not so easily solved. Scholars who advocate the market solution skirt over water's unique properties. These differences—perhaps the reason water law developed independently of traditional property law—render water less susceptible to efficient market distribution.<sup>123</sup> Moreover, strong traditions in the water law militate against purely economic solutions to the problem of water waste. This Section identifies six inherent problems with the proposed market solution.

First, water transfers involve prohibitive transaction costs. While,

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118. *Id.* at 43; see also Williams, *supra* note 113, at 11-20.

119. The riparian system is, of course, grounded in the appurtenance requirement. In prior appropriation jurisdictions, however, the strict appurtenance requirement is virtually inoperative today.

120. These interstate restrictions have been routinely upheld despite obvious commerce clause problems. See, e.g., *Sporhase v. Nebraska*, 458 U.S. 941 (1982).

121. C. MEYERS & R. POSNER, *supra* note 5, at 24.

122. *Id.* at 25-27.

123. "The usufructory nature of the right necessarily exposes all water rights to diminution by the wrongful acts of others. This potential for injury can only be prevented by the constant supervision or administration of every water right in a given basin." Martz & Raley, *Administering Colorado's Water: A Critique of the Present Approach*, in TRADITION, INNOVATION AND CONFLICT: PERSPECTIVES ON COLORADO WATER LAW 41, 41 (L. MacDonnell ed. 1986).

as discussed in the previous Part,<sup>124</sup> some market advocates propose to reduce those costs, certain transaction costs are inevitable because of water's unique properties. Such transaction costs cause inefficiency by inhibiting exchanges that otherwise would be socially beneficial.

Water is very difficult to trace. For example, it is impossible to identify upstream the specific water that belongs to a downstream appropriator. Similarly, it is difficult to ascertain whether any water in a given stream is available for appropriation or sale. The cost of obtaining information about buyers or sellers in an intricate river system might, at the margin, preclude otherwise beneficial sales.

Transporting water is very costly. Because water is heavy and has a low value-to-bulk ratio, out-of-basin transfers may be prohibitively expensive. The Central Arizona Project, which will lift water vertically 2,000 feet from the Colorado River in order to deliver it to central Arizona, will cost taxpayers at least \$5.4 billion.<sup>125</sup> The exorbitant cost of transportation represents a transaction cost which may prohibit transfers and cause inefficiency.

The high cost of transportation and information suggests something about the likely characteristics of the hoped for water market. Prohibitive transportation costs make water a localized good; hence, a traditional market scenario, involving large numbers of buyers and sellers, is not likely to apply. Rather, small local markets and bargaining situations will emerge. In sum, the development of an efficient water market with many buyers and sellers is, in many river basins, untenable.

A second inherent flaw in the market theorists' proposal follows directly from the likelihood of small localized water markets and even smaller bargaining situations: monopoly pricing. Imagine a single river owner situated at the top of a flow charging monopoly prices for water and cutting off all users that do not pay.<sup>126</sup> Because of the importance of location in the value of water, hundreds of monopolies could coexist on different streams without the chance of competition. Monopoly is inefficient because it allows firms to provide an inefficiently small quantity at an inflated price.

Meyers and Posner's proposal to vest all return flows in the purchaser of a water right would increase the chance of monopoly. Vesting the entire amount, including use and reuse and re-reuse, etc., in the first appropriator affords a single individual greater control over a larger

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124. See *supra* notes 102-03 and accompanying text.

125. T. POWER, AN ECONOMIC ANALYSIS OF THE CENTRAL ARIZONA PROJECT 1 (1978). Unfortunately, the cost is not justified by the benefit of the project. Its benefit-cost ratio is less than 0.35. *Id.*

126. As will be explained later, it is very difficult for an appropriator to prohibit downstream appropriators from using his water. See *infra* notes 136-37 and accompanying text. Because water is only partially nonexcludable, exclusion is very costly but not impossible.

quantity of water and substantially reduces the number of water sellers in a local market. The more control a single appropriator has over a given river system, the greater are the chances of monopoly.

The proposal advanced by Meyers and Posner, and later by Judge Stephen Williams, that the beneficial use requirement be abrogated to the extent that it requires a *present* beneficial use is subject to the same criticism. A public auction of unappropriated water could lead to the domination of a river system by a large monopolist. The chance of vesting water rights in the hands of a few monopolists is particularly troublesome, given that water is an essential good upon which basic human needs depend.<sup>127</sup>

The third obstacle to the market solution is bargaining failure.<sup>128</sup> This problem is particularly important since potential water transfers are more likely to arise in bargaining, rather than market, situations. Assume, for example, that the value of an in-basin transfer to the transferee, *T*, is \$100. Assume also that the value of the transfer to potential downstream appropriators *A*, *B*, and *C* is \$50, \$30, and \$15 respectively. Assume, finally, that *S* is willing to sell his water for no less than \$150.<sup>129</sup> Under the present system, *T* will not buy the water because, comparing \$100 and \$150, his benefit from the transaction is less than the cost. Under Meyers and Posner's system, however, *T* would behave differently because he would obtain the right of the return flow and thus *T* could sell whatever he purchased regardless of the effect it would have on *A*, *B*, and *C*.

A problem arises when we look closely at the transactions that will occur between *S*, *T*, and the purchasers of *T*'s return flow under Meyers and Posner's system. *T* will bargain with each downstream appropriator. *A* will be willing to pay up to \$50, *B* up to \$30, and *C* up to \$15. *T* will be willing to sell the rights for any amount exceeding the difference between *S*'s selling price (something greater than \$150) and \$100 (the benefit of the water to *T*). Thus, the total potential benefits from the sale equal \$195 while the cost of taking the water away from *S*'s use is \$150; that leaves a surplus of \$45 to be gained from the exchange.

The desire to capture the \$45 surplus, however, will cause all five of the actors to distort their spending preferences. *S* will want to sell the

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127. Judge Williams suggests that the monopoly problem could be avoided by limiting each appropriator to a small percentage of the total future rights available. Williams, *supra* note 113, at 20. Such a limitation would have to be implemented on a basin-by-basin basis to prevent any appropriator from acquiring a monopoly power in any given locality.

128. The Hobbes Theorem, "the polar opposite of the Coase Theorem" states that "[p]rivate bargaining to redistribute external costs will not achieve efficiency unless there is an institutional mechanism to dictate the terms of the contract." Cooter, *The Cost of Coase*, 11 J. LEGAL STUD. 1, 18 (1982). Thus, the Hobbes Theorem presumes bargaining failure.

129. His benefit from the water is something less than \$150.

right for \$195. *T* will try to buy the right for \$150 and sell the return flows to *A*, *B*, and *C* for a total of \$95. Because *A* wishes to enjoy the entire \$45 surplus, *A* may attempt to free ride by offering to purchase the right to return flow for only \$5. Similarly, *B* and *C*, with potential benefits less than the \$45 surplus, will try to free ride and not pay anything.<sup>130</sup> Thus, with each actor attempting to increase his expected return, the bargaining system may collapse as parties hold out for a lower price. Moreover, since this is not a perfect market characterized by very large numbers of buyers and sellers,<sup>131</sup> holding out may in fact be the *rational* choice.

Even if all other externalities are internalized, the sheer number of players vying for the bargaining surplus in each transaction may make bargaining failure inevitable. For example, consider the above hypothetical. Not only will *S*, *T*, *A*, *B*, and *C* all vie for the surplus and engage in many separate negotiations to bring about a sale, there are also likely to be other users dependent on *S*'s return flow who will have to be bought out before a transfer can be made. This would hold true even under the rule proposed by Meyers and Posner that return flow appropriators receive no inherent right to the return flow. Under the proposed system, the external benefit of the return flow would be incorporated into the transfer price by requiring the return flow appropriators to purchase rights to the water. Thus, under either system, the return flow appropriators would have to be bought out before any further water transfer. The transaction costs and risk of bargaining failure involved in such a transfer may often be prohibitive.

The fourth flaw in the market (or bargaining table) solution arises because water is, to some extent, a "public good." While private goods can be allocated efficiently in a free market, public goods, because of the properties of "nonrivalness" and "nonexcludability," are doomed to market failure.<sup>132</sup> These properties ensure that, if the good is provided at all in a society, some consumers will be able to "free ride," or enjoy the good without paying for it. If many consumers attempt to free ride, sellers have little incentive to provide the good. Therefore, the good will be underprovided, or not provided at all, by the private sector. Water,

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130. The benefit to *T* and *A* alone is just enough to cover the cost of not putting the water to *S*'s use.

131. Once again we see the locality effect making water which is valuable to parties within the water district utterly useless to those outside the district. Thus, markets for water tend to be very localized. However, exceptions to this proposition exist. For example, water transfers over tremendous distances are made from Northern California to Los Angeles in the south. For a discussion of these water plans in California see J. SAX & R. ABRAMS, *supra* note 20, at 431-44.

132. "[P]ublic goods are not likely to be provided at all by the market, or if they are privately provided, [they are] provided in less than socially optimal amounts." R. COOTER & T. ULEN, *LAW AND ECONOMICS* 46 (1988).

while not a *pure* public good, has properties economists call "partial nonrivalness" and "partial nonexcludability," and is, therefore, subject to some inefficiency in its allocation.

A good is "nonrival" if one individual's use does not prevent use by another. For example, parks and movies exhibit some degree of nonrivalness because those goods are not used up by one consumer's enjoyment of them.<sup>133</sup> Similarly, water is reusable insofar as agricultural water uses involve return flows<sup>134</sup> or appropriable seepage.<sup>135</sup> Since appropriator *A*'s use of 100 AF of water does not prevent reuse by a downstream appropriator, water is partially nonrival.

The second property of a public good, "nonexcludability," is present when a seller is unable to exclude nonpaying consumers from using the good. National defense (if it is a "good" at all) is a nonexcludable good because provision of it to one individual necessarily makes it available to all.<sup>136</sup> A movie, by contrast, is an excludable good since a theatre owner may close the doors on anyone who refuses to pay the admission fee. Even a park may be fenced in to keep out free-riders.

Water exhibits characteristics of nonexcludability because it is costly and difficult for an appropriator to prevent downstream appropriators from using its return flow. A speculator with an appropriation for future use, an appropriator with vested rights in his return flow, or any other appropriator with excess water that he wishes to sell to downstream users would, if possible, attempt to exclude potential buyers from using the water without paying for it. If the appropriator cannot prevent free use of the downstream flow, buyers certainly will not choose to pay for the water. The potential seller in turn will either (1) let people free ride, or (2) devote considerable resources to the attempt to exclude other users. In either case, society suffers loss. If the potential seller allows free riding, he loses his monetary incentive to conserve water. If the potential seller builds a reservoir to store the water or employs straw uses, society suffers unproductive and exorbitant exclusion costs.

A fifth source of market failure stems from a different form of externality: "environmental loss." Applying water to soil through irrigation

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133. An apple, on the other hand, is a rival good in that *A*'s consumption of the apple prevents its consumption by anyone else.

134. A "return flow" is defined as "[a]ny flow which returns to a stream channel after diversion for use. In irrigation, [a return flow is all] water applied to an area which is not consumed in evaporation or transpiration, and returns to a surface stream or ground-water aquifer." J. SAX & R. ABRAMS, *supra* note 20, at 293.

135. "Seepage" is water lost from a diversion system that has not found its way back to the stream or to an aquifer and is, therefore, not considered a return flow. See J. SAX & R. ABRAMS, *supra* note 20, at 362 (describing a "seepage appropriator" as one who captures runoff in its vagrant form); *Id.* at 293 (defining "return flow").

136. Notice that national defense is also a nonrival good, in that one person's consumption does not diminish the quantity of the good left for others to consume.

causes erosion, the dramatic consequences of which were demonstrated by the midwest dust bowls of the 1940s. Irrigation also leaches nutritious minerals from the soil; it adds salt, pesticides, and other pollutants to streams, ground water supplies, and soil, and it causes soil waterlogging.<sup>137</sup> Because the market price does not take environmental losses into account, inefficiency is, perhaps, inevitable.<sup>138</sup> Appropriators do not pay for environmental externalities, and thus they do not take these losses into account when deciding what quantity of water to apply to crops or what methods of conveyance and irrigation to employ. Since the damage caused by irrigation is external to their decision, they will tend to use too much water on a given crop and expend too few resources on implementing effective conveyance and application systems.

Finally, a sixth factor militates against the market solution: politics. Long tradition has shaped current water law, and it is unlikely that its legacy will be discarded for a market solution. First, the idea that water should only be applied to its *highest* valued use is inimical to the interests of those with the most at stake. Likewise, the establishment of complete ownership rights in water, the encouragement of speculation, and the abrogation of the beneficial use requirement all may be unpalatable to the political forces most concerned with water rights. A market solution is consequently unlikely to provide a complete solution. Rather, political expediency demands a standard that compensates for the various economic impediments discussed earlier without directly interfering with the right, guaranteed by state constitutions,<sup>139</sup> to use water for *any* beneficial purpose. What is needed is a standard capable of operating in conjunction with current legal rules, and which only minimally interferes with traditional notions of water law.

While advocates of the market solution have confronted inefficiencies in water allocation caused by archaic legal rules, they have failed to address other inefficiencies inherent in water's unique properties. This Part has summarized the market solution and has identified six inherent flaws in its application. Because of the large transaction costs associated with water transfers, water cannot be sold in a large national market.

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137. U.S. COMPTROLLER GENERAL, BETTER FEDERAL COORDINATION NEEDED TO PROMOTE MORE EFFICIENT IRRIGATION (1976); *Proposed Amendments to the Federal Water Pollution Control Act: Hearings Before the Subcomm. on Environmental Pollution of the Senate Comm. on Environment and Public Works*, 95th Cong., 1st Sess. 63 (1977) (testimony of M.T. El-Ashry, Co-Chairman, Water and Land Resources Program, Environmental Defense Fund).

138. It is possible, of course, that the external benefit inuring to return-flow and seepage appropriators would exactly offset the external harm called "environmental loss," thereby leading to an efficient amount of water conservation.

139. "The duty of the state to administer water rights in an efficient manner, which rests on [the Colorado Constitution] must be interpreted in light of the constitutional protection given to the rights of appropriation in Section 6, § XVI of the Colorado Constitution. Martz & Raley, *supra* note 123, at 42.

Small submarkets create the risk of monopoly pricing; in the nonmarket situation, the likelihood of bargaining failure is acute. Water also exhibits characteristics of a "public good," and thus a market may not provide proper incentives for conservation. In addition, water use inherently produces uncaptured environmental losses such as pollution and erosion. Finally, even if the physical properties of water that impede establishment of an efficient market could be overcome, the legal and political obstacles appear insurmountable.<sup>140</sup>

Part III discusses the use of tort liability rules to compensate for inefficiencies inherent in water conveyance and irrigation systems and shows the tendency of the strict liability and negligence rules to bring about an efficient solution.

### III LIABILITY RULES PROPOSED

The failure of a market solution does not mean that economic analysis cannot provide insights for improvements in the present system. Economic analysis can help fashion rules that will increase efficiency, while at the same time accommodating traditional allocational policy decisions.

Tort liability rules have received much discussion in the literature of law and economics.<sup>141</sup> Without liability rules, people would often not consider the effect of their behavior on others and would allocate too few resources to the prevention of accidents.<sup>142</sup> Through liability rules, the external costs of accidents can be internalized so that the actors involved are induced to conduct themselves in a socially desirable manner.

140. See generally Pring & Tomb, *supra* note 2 (discussing the legal obstacles to the efficient allocation of water resources).

141. See, e.g., G. CALABRESI, *THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS* (1970); R. COOTER & T. ULEN, *supra* note 132, at 326-71; R. POSNER, *ECONOMIC ANALYSIS OF LAW* (3d ed. 1986); W. PROSSER, *A HANDBOOK OF THE LAW OF TORTS* (4th ed. 1971); S. SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* (1987); *Symposium: Alternative Compensation Schemes and Tort Theory*, 73 CALIF. L. REV. 548 (1985); Brown, *Toward an Economic Theory of Liability*, 2 J. LEGAL STUD. 323 (1973); Calabresi & Hirschhoff, *Toward a Test for Strict Liability in Torts*, 81 YALE L.J. 1055 (1972); Calabresi & Melamed, *Property Rules, Liability Rules and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972); Epstein, *A Theory of Strict Liability*, 2 J. LEGAL STUD. 151 (1973); Fletcher, *Fairness and Utility in Tort Law*, 85 HARV. L. REV. 537 (1972); Grady, *A New Positive Economic Theory of Negligence*, 92 YALE L.J. 799 (1983); Hansmann, *The Current State of Law and Economics Scholarship*, 33 J. LEGAL EDUC. 217, 220; Polinsky, *Strict Liability vs. Negligence in a Market Setting*, 70 AM. ECON. REV. 363 (1980); Polinsky, *Economic Analysis as a Potentially Defective Product: A Buyer's Guide to Posner's Economic Analysis of Law*, 87 HARV. L. REV. 1655 (1974); Posner, *A Theory of Negligence*, 1 J. LEGAL STUD. 29 (1972); Posner, *Strict Liability: A Comment*, 2 J. LEGAL STUD. 205 (1973); Rubinfeld, *The Efficiency of Comparative Negligence*, 16 J. LEGAL STUD. 375 (1987); Wittman, *The Price of Negligence Under Differing Liability Rules*, 29 J. LAW & ECON. 151 (1986).

142. Transaction costs prohibit potential injurers and potential victims from deciding in advance who will bear the cost of an accident. R. COOTER & T. ULEN, *supra* note 132, at 340-43.

There are three basic forms of liability rules. The no-liability rule leaves the risk of loss on the victim. The negligence rule shifts the risk of loss to the tortfeasor who failed to act with due care. Finally, the strict liability rule shifts all risk onto the injurer, regardless of how much care she employed. Part III applies standards of no liability, negligence, and strict liability to irrigation conveyance losses.

### A. *The No-Liability Rule*

The no-liability rule is essentially the mirror image of the strict liability rule.<sup>143</sup> While strict liability requires the injurer to bear the cost of the injury she produces regardless of the level of care exercised by either party, no liability places the full cost entirely on the victim. The no-liability rule operates implicitly whenever the law permits one person to cause another person harm, discomfort, or any type of utility loss without forcing her to compensate the person she has harmed. For example, up to a certain point, people may make distasteful noises, emit unpleasant odors, or, through their appearance, cause others visual discomfort, without suffering legal consequences. These no-liability rules reflect the implicit policy decision that it is unfair to penalize people for being noisy, smelly, or ugly; or, these rules involve the implicit economic decision that it is best, in such situations, to let the risk fall on the victim, who is able to avoid the harm more easily than is the injurer, by plugging her ears, donning a nose-gay, or averting her gaze.

As applied to water conveyance loss, the no-liability rule provides that an appropriator is not liable for such loss,<sup>144</sup> even if caused by her own negligence. Thus, unless the appropriator is able to sell or use the salvaged water, she will let the water be lost with impunity. Unfortunately, as previously demonstrated, the necessary market incentives are often absent. In any event, the no-liability rule is inefficient insofar as the salvaged water is less valuable to the appropriator than to society.<sup>145</sup>

Figure 1 presents a graphical illustration of the no-liability rule. The y-axis represents cost in dollars. The x-axis represents the level of water conservation employed by the appropriator. The curve labeled

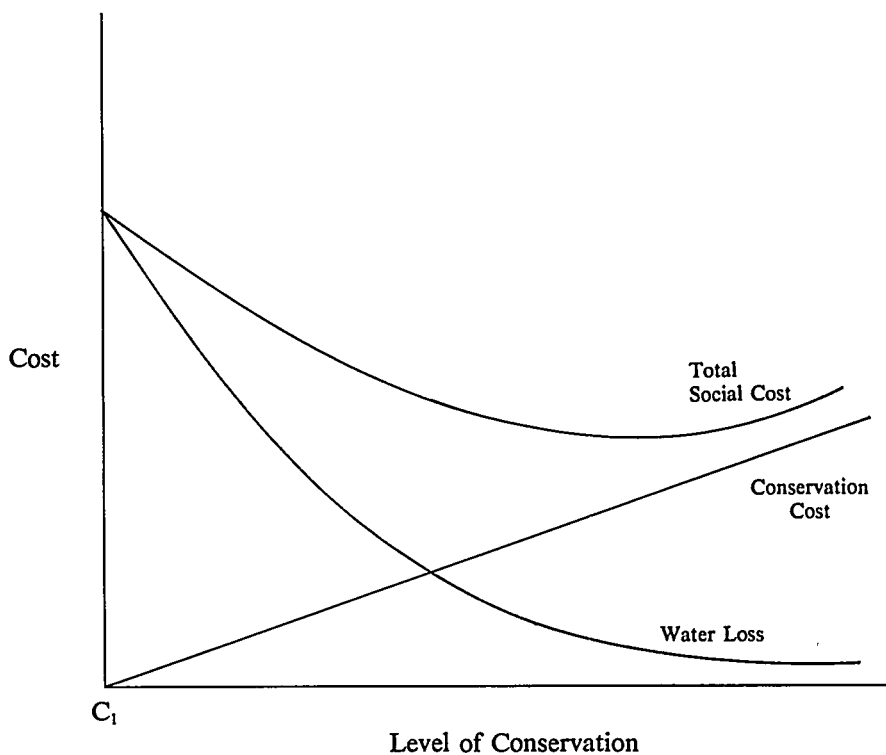
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143. *Id.* at 366.

144. The economic model of tort liability rules usually considers two types of actors in its analysis: injurers and victims. *See, e.g.,* S. SHAVELL, *supra* note 141, at 5; Shavell, *Strict Liability Versus Negligence*, 9 J. LEGAL STUD. 1, 1 (1980). In the case of a water conveyance loss, we consider the wasteful appropriator to be the injurer. However, the victim's identity is less apparent. Because lost water might have gone to another use, we may consider the victim to be either a subsequent appropriator who is not receiving his full allocation, a potential appropriator, or society as a whole.

145. Even so, the inefficient no-liability rule has an advantage over the beneficial use standard as currently applied in states that allow a subsequent improvement to evidence prior waste. *See supra* notes 106-09 and accompanying text.

Figure 1: No Liability



“Conservation Cost” depicts the total cost to the appropriator of implementing water conservation methods, at each level of conservation. The “Conservation Cost” Curve begins at the origin and has a positive slope because the cost of no conservation is zero and the marginal cost of conservation is positive. The curve labeled “Water Loss” measures the social cost of water loss at each level of conservation. This cost represents the value that the wasted water would have in an alternative use plus the loss to society represented by erosion, pollution, and the reduction of in-stream flows. When the appropriator employs no conservation methods, the conveyance system results in a high amount of water loss.<sup>146</sup> As the appropriator increases his level of conservation, water loss decreases. The curve labeled “Total Social Cost” (“TSC”) includes all costs to society—the cost of conservation and costs associated with lost water. Thus, the TSC curve simply reflects the vertical summation of the Conservation Cost and the Water Loss curves.

Under a no-liability rule, an appropriator need only consider the

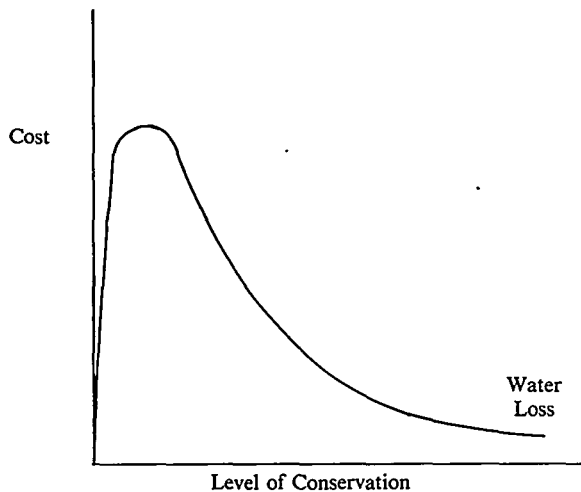
146. In the abstract, zero conservation might constitute building no ditch at all. In that case, since no water is diverted, there is no loss from the system. Thus, the curve could be depicted as below:

Conservation Cost Curve in deciding what level of conservation to employ. Given the likelihood of market or bargaining failure, appropriators may have few private incentives to conserve water. Assuming, for the moment, that there are *no* private incentives,<sup>147</sup> the no-liability rule would encourage the appropriator to minimize his costs by employing no conservation systems (conservation level  $C_1$ ) and thus his behavior would result in maximum water waste.<sup>148</sup>

### B. The Negligence Rule

The negligence rule places the risk of loss on the injurer who has failed to act with the requisite level of care. If the injurer has acted with due care, then the victim bears the cost of any loss. As a general proposition, if the standard of care is set at a level that minimizes social cost (the "efficient level"), then the offending party, acting out of rational self-interest, will pursue the socially optimal level of water conservation.<sup>149</sup>

How we define the standard of care is crucial to the efficacy of the



However, this complication adds little to the analysis. For the sake of simplicity, we will assume that an irrigation system already exists and will use the cost curve in Figure 1 throughout this discussion.

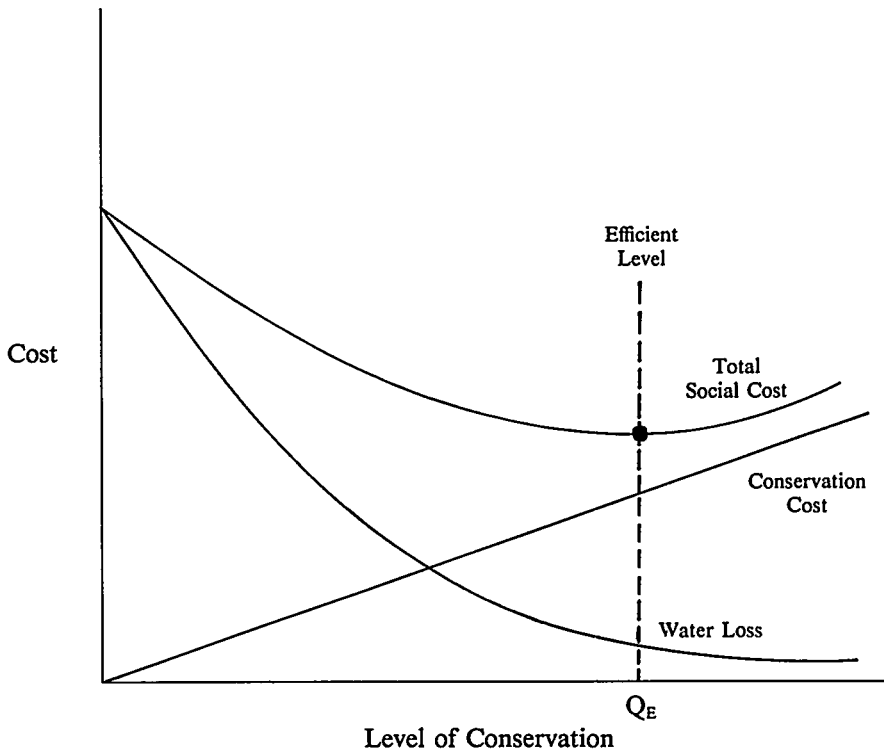
147. Such is the case if the waste does not cause any damage to the appropriator's own land, if the appropriator is not liable for any damage the water runoff and seepage causes to others, and if the appropriator cannot use or sell the conserved water.

148. Again, this extreme case assumes that the additional water saved is of no value to the appropriator. As will be shown later, when the salvaged water is of some value to the appropriator, he considers that value and the cost of conservation in deciding what level of care to employ. See *infra* IV. B. Even so, unless the appropriator's personal (internal) incentive equals the net social cost of water loss, the appropriator will employ an inefficient level of conservation.

149. The negligence rule is applied in three basic forms: simple negligence, negligence with a defense of contributory negligence, and comparative negligence. Because the victim's level of care is not particularly relevant in the context of water law, this Comment will discuss only simple

negligence rule. Efficiency occurs where the marginal cost of conservation is equal to the marginal cost of water loss, that is, where the TSC is minimized. If the appropriator invests in more than this amount of conservation, then the marginal cost of the conservation exceeds its marginal social benefit. Likewise, where the appropriator exercises less care, the cost of additional conservation is less than the benefit derived. The broken vertical line  $Q_E$  in Figure 2 represents the efficient level of conservation; the line intersects the TSC Curve at its minimum.

Figure 2: The Efficient Level



Under the negligence rule as it applies to water waste, the negligent appropriator is assessed for all water lost from his system in an amount equal to the social cost of the water waste. This cost includes the value of the water in its next best use, plus environmental losses caused by exces-

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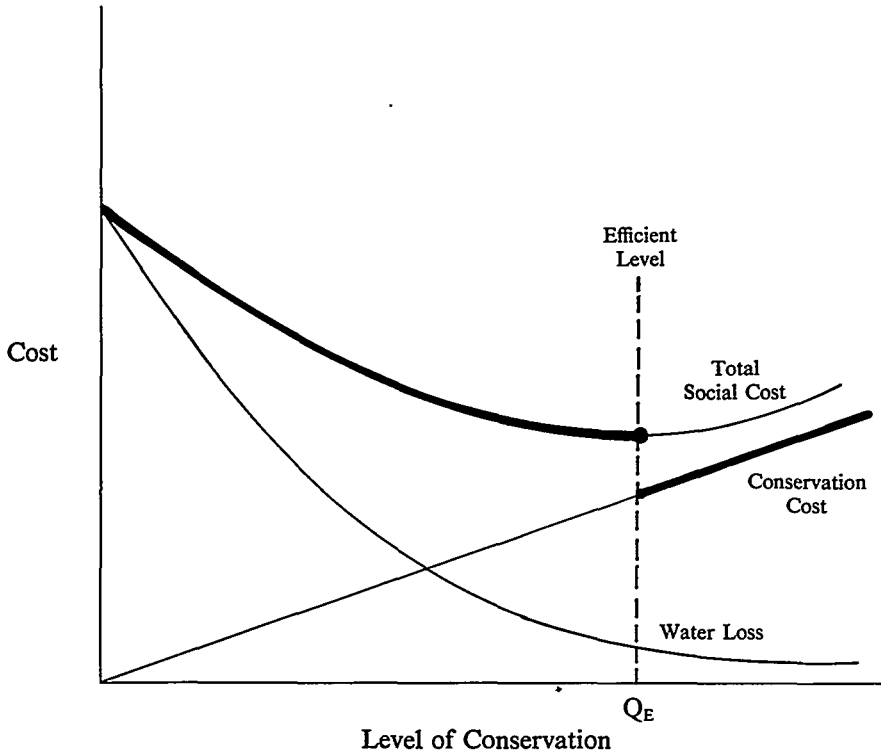
negligence. Even so, the addition of contributory or comparative negligence principles would not materially alter this analysis.

Economists . . . reached the somewhat surprising conclusion that when the legal standard is set at the efficient level of precaution, every one of the negligence rules creates incentives for efficient precaution by potential victims and potential injurers. The reason for this is that rationally self-interested decisionmakers are led by considerations of self-interest to choose the legal standard of care under any of the negligence rules.

R. COOTER & T. ULEN, *supra* note 132, at 357-58 (emphasis omitted).

sive runoff, seepage, or return flows. Thus, under the negligence rule, a negligent appropriator is assessed an amount that brings his private, internal cost in line with the TSC Curve.

Figure 3: Negligence



Under the negligence rule depicted in Figure 3, the appropriator's individual cost curve follows the TSC Curve to the left of the negligence standard ( $Q_E$ ), but drops to the Conservation Cost Curve to the right of  $Q_E$ . The appropriator minimizes his costs by exercising that level of conservation which complies precisely with the negligence standard. Since negligence is set, by hypothesis, at the efficient level, the appropriator will use an efficient level of conservation.<sup>150</sup>

### C. The Strict Liability Rule

The strict liability rule imposes liability on the injurer for any harm he causes, regardless of the level of care he has employed. This rule has found its greatest application in the area of products liability. In general,

150. Judicial interpretations of negligence have defined the negligence threshold in terms suggesting economic efficiency as the standard of care. See, e.g., *United States v. Carroll Towing Co.*, 159 F.2d 169 (2d Cir. 1947).

when only the injurer's level of care is important, strict-liability will bring about an efficient result.<sup>151</sup> A strict liability rule in water law would make an appropriator liable for *any* loss from his conveyance system, whether or not the loss was caused by his negligent failure to use efficient conveyance methods.

Figure 4: Strict Liability

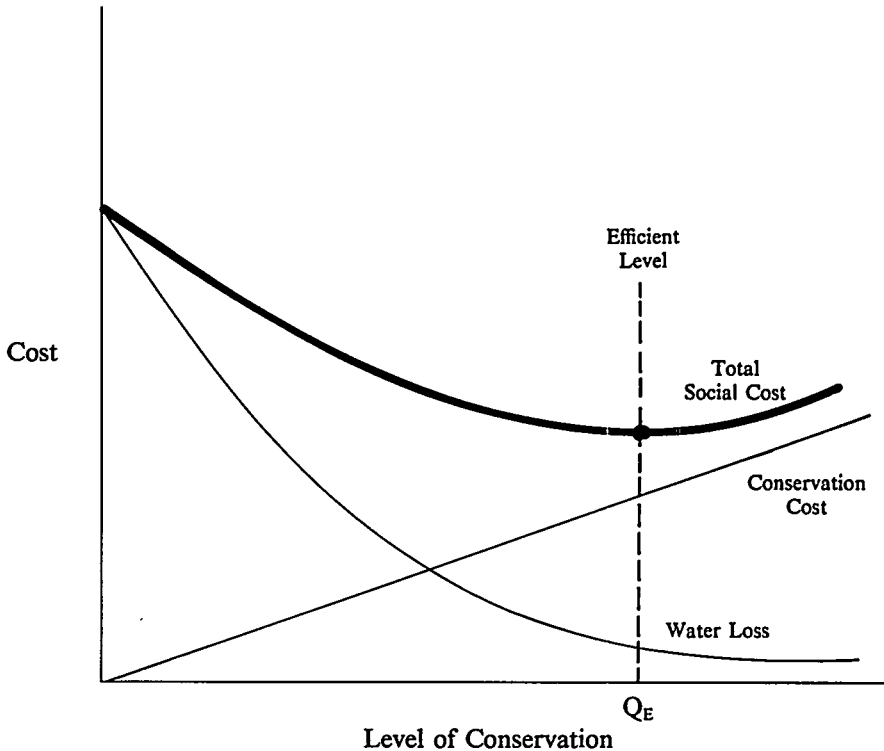


Figure 4 illustrates the strict liability rule. Since the appropriator is penalized for all water loss in his conveyance system, and has to pay for the measures of conservation he employs, his cost curve is the sum of the Conservation Cost and Water Loss Curves.<sup>152</sup> By definition, then, an appropriator's cost curve under a rule of strict liability equals the TSC Curve at *every* level of conservation, rather than only partly mirroring it under a negligence regime. To minimize costs, the appropriator operates at  $Q_E$ —the level of care corresponding to the lowest point on his cost curve.

Since the strict liability rule forces appropriators to internalize all costs, appropriators automatically adopt the efficient level of conserva-

151. R. COOTER & T. ULEN, *supra* note 132, at 365.

152. *See id.* at 364, fig. 8.8.

tion. An appropriator simply considers his costs and chooses the lowest cost solution.<sup>153</sup> The strict liability rule, then, obviates the need for determining a standard of care to which appropriators should be held and eliminates the litigation costs associated with determinations of negligence.

Part III introduced three tort liability rules and applied them to water loss in conveyance and irrigation systems. It concluded that, while the no-liability rule would place the risk of loss on society, the negligence and strict liability rules would potentially compensate for inherent failures in the water market by internalizing the social cost of water loss. Part IV discusses the relative benefits and burdens of each rule.

#### IV CHOICE OF RULES

Both negligence and strict liability rules could compensate for the legal inefficiencies in a nonmarket system and adjust for the inherent market inefficiencies detailed in Part II. Despite the paucity of existing water markets, their high transaction costs, and the risk of monopoly pricing or bargaining failure, the proposed liability rules are nevertheless viable because their ability to promote efficiency does not depend upon the occurrence of exchanges. Likewise, these rules would capture pollution, erosion, and other environmental losses in the calculation of water-loss penalties. Furthermore, as this Part will demonstrate, the proposed liability rules may be less of an affront to traditional notions of water law than is a pure market solution.

This Part compares and contrasts the negligence and strict liability rules. Section A addresses the theoretical differences between these rules and notes that, while the efficiency of the strict liability rule depends upon how accurately the TSC Curve is estimated, the negligence rule is relatively unaffected by miscalculations of the TSC Curve. Section B discusses the diverse incentives that affect an individual appropriator's decisions, and then examines the importance of the theoretical differences of Section A with respect to those decisions. Section B demonstrates the negligence rule's tolerance for an inaccurate assessment of the multiple internal and external incentives that comprise the TSC Curve. Section C discusses the compatibility of each rule with likely changes in the law affecting the transferability of water rights. Finally, Section D briefly discusses the compatibility of strict liability and negligence with traditional notions of water law.

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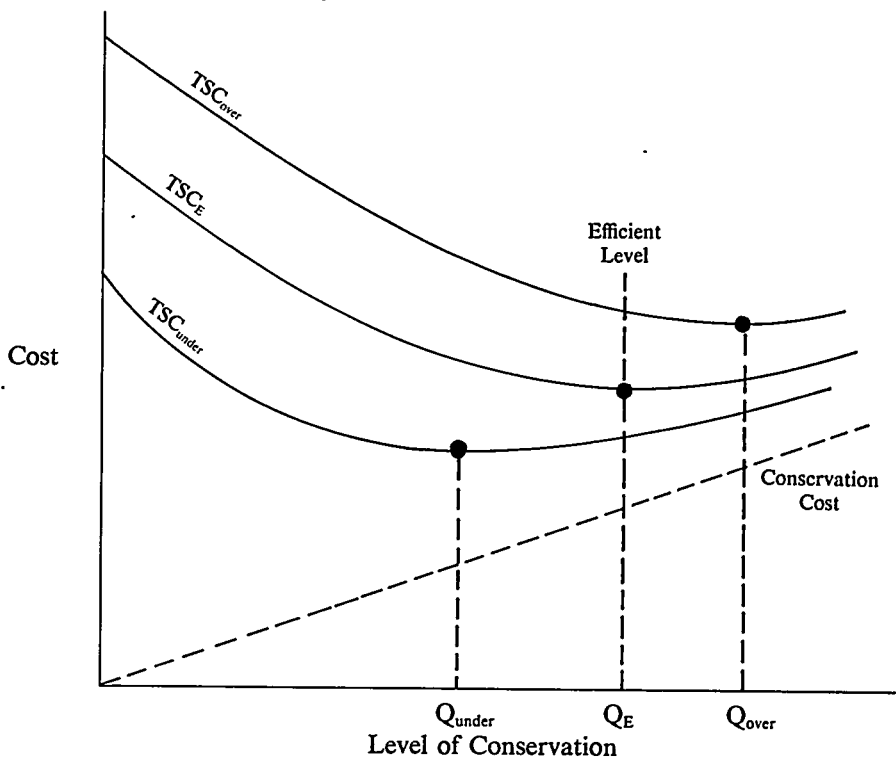
153. A negligence standard does not usually take into account what the efficient level of research and development would be. The strict liability standard, by contrast, provides incentive to develop new technology because the appropriator can lower the entire cost curve by improving technology. *See id.* at 367.

### A. Negligence and Strict Liability—Theoretical Differences

A principal difference between the negligence and strict liability rules is that the negligence rule requires the governing agency to approximate the social cost of water loss, as well as the efficient level of water conservation. The strict liability rule dispenses with the determination of a legal duty of care and only requires the board to ascertain the social cost of water loss.

One disadvantage of the strict liability rule is that “any amount of damages different from those that perfectly compensate the victim creates an inefficient incentive for the potential injurer and, thus, leads to inefficient levels of precaution.”<sup>154</sup> As Figure 5 illustrates, the level of conservation taken by the appropriator under a strict liability rule varies

Figure 5: Strict Liability with Water Loss Over- and Underestimated



with the cost assigned to water loss. Underestimating the TSC Curve induces appropriators to expend too few resources on water conservation, whereas overestimating the curve will induce appropriators to overconserve.

154. R. COOTER & T. ULEN, *supra* note 132, at 363 (emphasis omitted).

In Figure 5 we randomly miscalculate the social cost of water loss and apply the strict liability rule. Although the Water Loss Curve is not depicted in the graph, it is reflected in the TSC Curve, because the TSC Curve represents the sum of the Water Loss and Conservation Cost Curves. The curve labeled  $TSC_{\text{under}}$  underestimates the social cost of water loss. The appropriator minimizes her costs by operating at the level of conservation corresponding to the lowest point on  $TSC_{\text{under}}$ ,  $Q_{\text{under}}$ . Since  $Q_{\text{under}}$  is below the efficient level of conservation,  $Q_E$ , this is an inefficient result. The  $TSC_{\text{over}}$  Curve overestimates the social cost of water loss. The appropriator under a strict liability rule minimizes her costs by operating at  $Q_{\text{over}}$  and thus devotes too many resources to conservation. Only when the social cost of water loss is correctly estimated at  $TSC_E$  does the appropriator employ the efficient level of conservation.

Thus, under the strict liability rule, if the governing agency miscalculates the value of the lost water or the external social cost from pollution and erosion, the strict liability rule will not bring about the efficient solution. Similarly, inaccurate measurement of the *quantity* of water lost from diversion works will prevent an efficient solution. A consistent underestimate will induce too little conservation, while a consistent overestimate will lead to too much conservation.<sup>155</sup> Thus, the strict liability rule will not tolerate inaccuracy in the assessment of the value of water, the cost of environmental loss, or the quantity of water lost from diversion works.<sup>156</sup>

In contrast, the negligence rule is structured to cushion the effect of inaccurate assessments of the TSC Curve; this is illustrated by the gap in Figure 3<sup>157</sup> on the appropriator's cost curve. The cost curve follows the TSC Curve, then drops to the Conservation Cost Curve at the negligence level.<sup>158</sup> This gap allows a large margin for error in determining the

155. Even if measurements are randomly inaccurate and tend to net out, an efficient outcome is not guaranteed because risk-averse appropriators will take extra care and risk-seeking ones will take less than the efficient level of care. See Rubinfeld, *supra* note 141, at 386-87.

156. An additional problem with the strict liability rule in the traditional tort situation is that, unless coupled with an assumption of the risk or contributory negligence defense, it does not provide an incentive for the victim to take the efficient amount of precaution. "[S]trict liability cannot provide efficient incentives for both the injurer and the victim to take precaution; it creates efficient incentives only where precaution is unilateral to the injurer." R. COOTER & T. ULEN, *supra* note 132, at 370. Because the victim in the case of water conveyance losses is in no position to take any precaution, this problem does not hamper our application of the rule.

157. See *supra* text immediately following note 150.

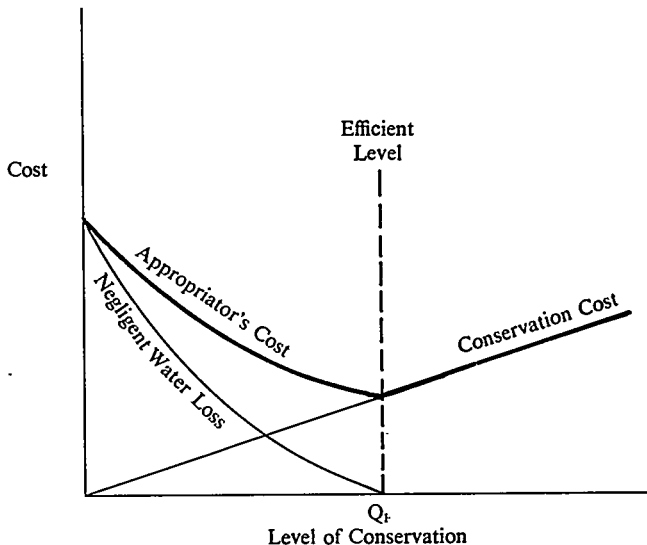
158. Cooter and Ulen explain this gap by noting that the defendant's failure to comply with the negligence standard renders her liable for all harm caused to the plaintiff, even if such harm would have occurred had defendant not acted negligently. R. COOTER & T. ULEN, *supra* note 132, at 353 n.23. This negligence rule forces the injurer to compensate the victim if the injurer has acted below the requisite level of care, whether or not her *negligence* actually caused the harm. Such a rule might be called a "strict-negligence standard." This formulation of the negligence rule was referred to as the "full-liability" rule in Grady, *A New Positive Theory of Negligence*, 92 YALE L.J. 799, 804

social cost of water loss.

In Figure 6 we again miscalculate the social cost of water loss in order to test whether efficiency under the negligence rule will be distorted by inaccurate assessment of the TSC curve. As was true under the previous analysis, the undervaluation and overvaluation of the TSC Curve can reflect a miscalculation of the quantity of water lost, the social cost of environmental loss, or the value of the wasted water in its next best use. Because of the difficulty of accurately measuring any of the four losses, a miscalculation of the Water Loss Curve, and thus of the TSC Curve, is likely. In any event, the miscalculation shifts the TSC Curve up or down, depending on the direction of the miscalculation. The curve labeled  $TSC_{over}$  depicts an overestimate of the social cost of water loss. Under the negligence rule, appropriators consider the TSC curve below

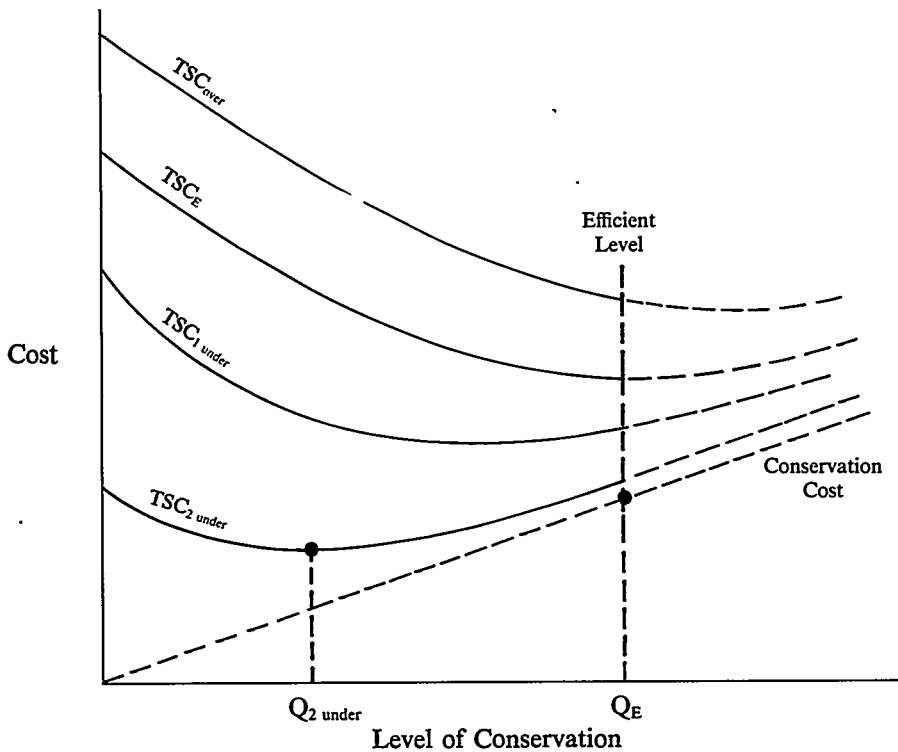
(1983). Applied to our case, an appropriator utilizing inefficient conveyance methods would be liable for all water loss whether caused by her negligence or not.

Such a result could likely occur where it is difficult to distinguish specific injuries caused by defendant's negligence from plaintiff's total injuries. A negligence rule which holds the appropriator liable only for harm which her negligence *causes* could also suit our application. Professor Grady called such a formulation of the negligence rule the "P\*-cutoff" rule. *Id.* Another article denies that such a rule applies to negligence actions, but then discusses such a rule outside the context of torts under the label of the "incremental damages" rule. Calfee & Craswell, *Some Effects of Uncertainty on Compliance with Legal Standards*, 70 VA. L. REV. 965, 989-94 (1984). In such a case, the gap disappears.



The curve labeled "Negligent Water Loss" depicts only that amount of water loss which is due to the appropriator's negligence. By definition, this is zero at the negligence level. The curve labeled "Appropriator's Cost" is the vertical sum of the Water-Loss and Conservation Cost Curves, because, under a negligence rule, the appropriator has to pay the cost of conservation that she employs plus the penalty for the social value of water lost through her negligence. Since (negligent) water loss is zero at the efficient level, there is no gap in the appropriator's cost curve.

Figure 6: Negligence with Water Loss Over- and Underestimated



the negligence level, then consider only the Conservation Cost Curve after meeting the requisite level of care at  $Q_E$ . If the water board overestimates the loss to society and imposes an unduly heavy penalty on negligent water wasters, appropriators will consider  $TSC_{over}$  below the negligence level (i.e., to the left of  $Q_E$ ) and will consider the Conservation Cost Curve after meeting the requisite level of care (to the right of  $Q_E$ ). The appropriator, seeking to minimize costs, will operate at the lowest point on the relevant cost curve. Even though  $TSC_{over}$  is overestimated, the minimum still falls at the bottom of the gap. Thus, the appropriator will choose to operate at the socially efficient level, despite the board's inaccurate assessment of the cost of water waste to society.<sup>159</sup>

159. This analysis is subject to one caveat: If an appropriator is severely overfined, she might allocate too many resources to water conservation and, if the cost is excessive, might drop out of the activity altogether. This occurs in the traditional tort situation because standards of negligence, as applied by juries, are uncertain. To avoid this uncertainty, a potential defendant might employ more care than the negligence standard requires. In our application of the negligence rule, an appropriator will overcomply with the negligence standard if she thinks the water board could mistakenly penalize her when she is not negligent. Since this Comment proposes that water boards prepare and publish in advance the level of care required in each river basin, the effect of uncertainty, so relevant in traditional tort situations, all but disappears.

The curves in Figure 6 labeled "TSC<sub>1 under</sub>" and "TSC<sub>2 under</sub>" depict the governing agency's underestimation of the social cost of water waste. Again, the appropriator will consider these curves to the left of Q<sub>E</sub> and will consider only the Conservation Cost Curve to the right of Q<sub>E</sub>. If the agency estimates total social cost to be TSC<sub>1 under</sub>, the appropriator's minimum still occurs at Q<sub>E</sub>, and the cost minimizing appropriator will employ the efficient level of conservation.

Only when TSC is so grossly underestimated that the minimum of the TSC Curve is lower than the bottom of the gap on the Conservation Cost Curve, is the appropriator induced to take an inefficiently low level of conservation. Applying TSC<sub>2 under</sub>, the appropriator considers this curve up to the negligence level and considers the Conservation Cost Curve to the right of the negligence level. Seeking to minimize his costs, the appropriator will choose to operate at Q<sub>2 under</sub> and expend an inefficiently small amount of resources on water conservation.

Thus, Figure 6 illustrates that an efficient result is likely to occur even where the value of water conservation is determined rather randomly. An inefficient solution results only when the water board grossly underestimates the social cost of water loss. Because the efficiency losses associated with water waste are extremely difficult to quantify, the flexibility of the negligence rule is particularly appealing.

### *B. Negligence and Strict Liability—Functional Differences*

Having discussed the strict liability rule's sensitivity to inaccurate measurement of the social cost or quantity of water loss, and, by contrast, the negligence rule's tolerance in dealing with miscalculations of the Water Loss Curve, we now add an additional consideration to our analysis. We have assumed that, in the absence of liability rules, the only internal cost faced by an appropriator is the cost of conservation. In some instances, this may be true. For example, our simplistic graph is probably accurate in situations where an appropriator may neither use nor sell his conserved water and where water loss causes no harm to his own land. Appropriators, however, typically face numerous other internal costs and benefits. For example, water waste may damage the appropriator's own land.<sup>160</sup> Likewise, an appropriator may be able to sell salvaged water, albeit at an inefficient price, or use the salvaged water for his own benefit.<sup>161</sup> Finally, the appropriator may face legal incentives

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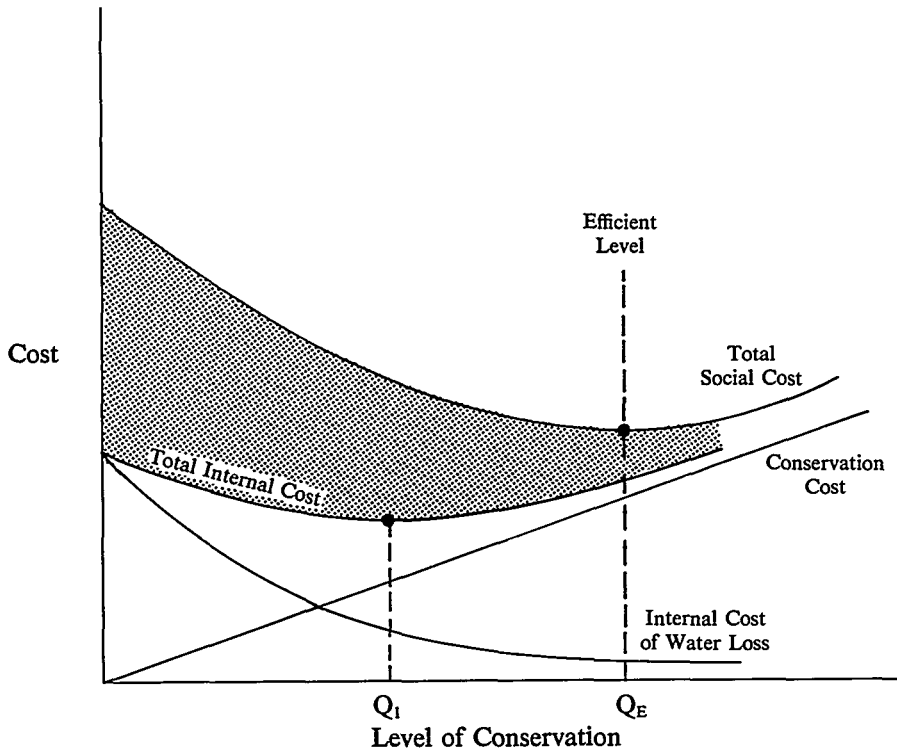
160. *But cf.* Tulare Irrigation Dist. v. Lindsay-Strathmore Irrigation Dist., 3 Cal. 2d 489, 571-72, 45 P.2d 972, 1009 (1935) (quoting Stinson Canal & Irrigation Co. v. Lemoore Canal & Irrigation Co., 45 Cal. App. 241, 252, 188 P. 77, 82 (1919)), in which the court refused to adjudge application of water to crops wasteful, because it doubted that an appropriator would use so much water as to damage his own land.

161. Monopolists would sell at inefficiently high prices, while monopsony or bargaining failure might force appropriators to sell for inefficiently low prices.

not to cause pollution or erosion on neighbors' lands.

Our analysis in Figure 1<sup>162</sup> assumed that the only factor affecting the appropriator's decision was the cost of conservation. We now relax that assumption and recognize that harms that are internal to the appropriator are included in the TSC Curve. In Figure 7, the appropriator's internal costs are shown separately by the "Internal Cost of Water Loss"

Figure 7: Total Internal Cost



Curve. Since the appropriator must pay for conservation at whatever level of care he employs, we add the Conservation Cost and Internal Cost of Water Loss Curves to form the Total Internal Cost ("TIC") Curve. Above the TIC Curve is the TSC Curve. The distance between these curves is the external cost of water loss, or, the costs that the water loss imposes on society for which the appropriator does not have to pay. Under a no-liability rule, the appropriator will consider the vertical sum of the Conservation Cost and Internal Cost of Water Loss Curves, as represented by the Total Internal Cost Curve. Minimizing the total internal cost, the appropriator will operate at  $Q_I$ , an inefficiently low level of conservation.

162. See *supra* text following note 148.

When we previously set the penalty on water loss equal to the social value of water loss, we assumed that only two factors influenced the appropriator. We now recognize that the appropriator will also face many other incentives when choosing what method of conveyance to employ. Accordingly, the penalty no longer should be set equal to the full value of the Water Loss Curve, but rather the penalty on water loss should be set just high enough to raise the appropriator's TIC Curve to match the TSC Curve. Once the external costs are internalized, the appropriator will consider all the social costs and benefits of his behavior and will be induced to operate at the efficient level. Thus, in Figure 7, the appropriate level for the penalty would be, as shown by the shaded area, the distance between the TSC and TIC Curves.

To illustrate numerically, we will assign certain random values to the appropriator's (*A*) internal cost of water loss. Table 1 assigns values to the costs that water waste causes *A* ("internal costs") at several levels

Table 1  
Appropriator's Internal Cost of Water Loss

Level of Conservation	Erosion Costs	Pollution Fines	Opportunity Costs	Cost of Conservation	TIC
1	12	16	64	15	107
2	9	8	32	30	79
3	6	4	16	45	71
4	3	2	8	60	73
5	1	0	4	75	80
6	0	0	2	90	92
7	0	0	1	105	106

of conservation. We assume that the appropriator faces four internal costs: (1) the damage that lost water causes to the appropriator's own land in the form of erosion, waterlogging, and leaching; (2) pollution fines that are assessed for the runoff of the appropriator's pesticides into the stream; (3) the cost of the benefit that is foregone when the appropriator lets the water be lost, rather than using or selling it ("opportunity cost"); and (4) the cost of employing the given level of conservation. Since these values represent costs that inure to *A* personally, they are termed *A*'s "Internal Cost of Water Loss." Table 2 gives the total social cost for each level of conservation. These social costs include the cost of the water loss to the appropriator as well as to the rest of society.

Under a no-liability rule, the appropriator considers only the internal costs of her activity. Minimizing these costs, the appropriator in Table 1 chooses to operate where TIC is the lowest, at conservation level

Table 2  
Total Social Costs

Level of Conservation	Erosion Costs	Pollution Damage	Opportunity Costs	Cost of Conservation	Net TSC	External Cost
1	28	16	104	15	163	56
2	17	8	52	30	107	28
3	10	4	26	45	85	14
4	5	2	13	60	80	7
5	1	0	7	75	83	3
6	0	0	3	90	93	1
7	0	0	2	105	107	1

3. At this level, water loss causes \$6 worth of erosion, waterlogging, and leaching damage to Appropriator *A*'s own land. The water loss at this level also costs *A* \$4 in pollution fines. *A*'s failure to sell or use the water that is wasted produces \$16 in opportunity costs. Finally, the cost of conservation is \$45.

If the social cost of water loss were considered, as in Table 2, TSC would be minimized at conservation level 4. Thus *A*'s internal incentives induce an inefficiently low level of conservation. At conservation level 4, social erosion damage includes \$3 of damage to *A*'s land, plus \$2 damage to other land for a total of \$5. The "Pollution Damage" column assumes that the \$2 of pollution fine exactly reflects \$2 of pollution damage. Under Social Opportunity Costs, the value to society of the water in its next best use is \$13, which is \$5 more than *A* was able to receive in an inefficient market. Finally, the cost of conservation is \$60. Summing these figures to obtain the social cost of water loss at conservation level 4, we have \$80.

Appropriator *A* operates at an inefficient level of conservation because she does not have to bear all the costs and benefits of her actions.<sup>163</sup> Thus, in order to induce her to employ the socially optimal level of conservation (inove from level 3 to level 4) we must penalize her

163. Depending upon how we manipulate these figures, two other results might occur. First, the internal cost and the social cost might be equal. This could occur if there are no externalities—for example, if there is no damage to land other than damage to *A*'s land and *A* is able to receive the full social opportunity cost of the water in an efficient market. In such a case, the internal cost and the social cost would be equal at all levels of conservation. The figures could also be equal, if external benefits netted out external costs. For example, seepage could confer a benefit on another farmer by irrigating his crops. If such benefit exactly offset the external costs of *A*'s activity, then an efficient result would obtain despite the existence of externalities.

Second, if the external benefits are larger than external costs, or if the pollution fine overestimates the social cost of pollution, *A*'s marginal internal cost could be higher than the marginal social cost of water loss. In such a case, absent liability rules, *A* would be induced to employ too high, rather than too low, a level of conservation.

an amount that raises her TIC to equal the TSC, or the net external cost. Under the simplistic analysis presented in Part III, we would assess *A* an amount equal to the full social cost of the water loss. Now, recognizing the internal benefits that act on *A*, we set our penalty to approximate the external cost. Thus, the column labeled "Net External Cost" represents the proper amount the appropriator should be assessed at each level of conservation. Since *A* is operating at level 3 with a TIC of \$71, fining her \$14 raises the cost she must bear to \$85; since the penalty at level 4 is only \$7, *A* will choose to improve her means of conveyance and irrigation to reduce the combined total of her TIC and Penalty to \$80. Thus, a combination of internal costs and benefits and a correctly measured penalty under the proposed liability rules would induce the appropriator to institute exactly the efficient level of conservation.

In our simple diagram we have little trouble netting out internal costs and assessing *A* an amount equal to the external costs. However, the internal costs and benefits that affect individual appropriators will vary drastically, even within the same river basin. For example, while appropriator *A* may be able to get a \$6 benefit by applying one salvaged AF of water to another unused field, appropriator *B* may have no comparable alternative. On the other hand, wasted water may cause severe erosion damage to *A*'s land, while *B*'s waste produces no immediate negative effects. Thus, it will be almost impossible for the agency administering the system to assess exactly the amount of penalty that it should impose upon each appropriator in order to induce efficient behavior.

Internal incentives are particularly likely to vary from case to case because of the local nature of water. An AF of water in one area might sell for \$5.00 and have a social value of \$15.00, and in another area the figures might be \$17.50 and \$20.00 respectively; even within the same area, the benefit of salvaged water is likely to vary greatly depending on the nature of its use. Where there is no chance to sell salvaged water, an appropriator who is allowed to keep salvaged water still may have incentives to use the salvaged water profitably. It would be burdensome, if not impossible, to exactly determine the social cost of water loss and the individual internal incentives in order to impose the proper penalty.

The difficulties of assessing the proper penalty are an important factor in choosing between the negligence and strict liability rules. As discussed previously, the strict liability rule results in an efficient solution only if the social cost is measured correctly. A penalty that overestimates the external cost will result in too large an expenditure on water conservation, while a penalty that underestimates the external cost will induce too low a level of conservation. The negligence rule, on the other hand, can absorb miscalculations of the external cost because the inaccuracies, for the most part, are absorbed in the gap.

### C. Liability and Changing Legal Rules

When choosing between the negligence and the strict liability rules, it is important to assess their relative compatibility with likely changes in current water law. Throughout the field of water law, scholars advocate change. The suggested changes often take the form of legal rules designed to facilitate water transfers.<sup>164</sup> Some authorities suggest radical changes from existing water law.<sup>165</sup> Others suggest smaller changes, such as providing that an appropriator be allowed to sell water that he salvages without losing it under the waste doctrine.<sup>166</sup> Most, but not all, authorities suggest that appropriators' ownership control over their appropriations be increased and that they be allowed to sell their excess water.<sup>167</sup> Because of the increasing scarcity of water, it appears that change is likely, if not imminent. The viability of any proposed liability rule will depend partially upon how well it can be synthesized with other changes in the law.

As legal rules concerning the transfer of water rights liberalize, appropriators face growing internal incentives. Thus, potential changes in water law call for a liability rule capable of absorbing variations in the appropriator's Internal Cost Curve. Under a negligence rule, where the standard of care is set at the efficient level, the added market incentives will be of little consequence. If the appropriator fails to take sufficient water conservation measures, then he is liable for the resulting water loss, and loses profits he might have realized by selling the water. The appropriator thus has a double incentive to raise his level of conservation to the efficient level. Once the appropriator operates at the efficient level, he no longer faces judicial liability and will act based strictly upon market incentives.

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164. I. FOX, WATER-SUPPLY, DEMAND, AND THE LAW (1960); C. MEYERS & R. POSNER, *supra* note 5; G. WEATHERFORD, WATER AND AGRICULTURE IN THE WESTERN UNITED STATES: CONSERVATION, REALLOCATION AND MARKETS 216-219; STUDIES IN WATER POLICY AND MANAGEMENT (1982); Burness & Quirk, *Appropriative Water Rights and the Efficient Allocation of Resources*, 69 AM. ECON. REV. 25 (1979); Burness & Quirk, *supra* note 95; Fox & Herfindahl, *Efficiency in the Use of Natural Resources: Attainment of Efficiency in Satisfying Demands for Water Resources*, AM. ECON. REV., May 1964, at 198; Kerr, *A Market Approach to Water Resource Allocation—A System Unique to the West or a Blueprint for Future Water Allocation in the East?*, 1 COOLEY L. REV. 337 (1983); Oeltjen & Fischer, *supra* note 16; Pring & Tomb, *supra* note 2; Williams, *supra* note 10; Comment, *Marketing of Surplus Water for Federal Reservoirs*, 13 LAND & WATER L. REV. 835 (1978).

165. See C. MEYERS & R. POSNER, *supra* note 5, at 29, 34-38, 40-43 suggesting, respectively, that water companies be formed where a majority of the rights holders agrees; that return flow appropriators not be protected; and that the beneficial use requirement be abrogated.

166. See CAL. WATER CODE §§ 1010(b), 1011(b) (West Supp. 1987), which, unlike the Colorado rule as enunciated in *Southeastern Colorado Water Conservancy Dist. v. Shelton Farms, Inc.*, 187 Colo. 181, 529 P.2d 1321 (1974), provides that an appropriator is entitled to keep water that he salvages. See also note 106 and accompanying text.

167. See, e.g., C. MEYERS & R. POSNER, *supra* note 5, at 27-32.

The strict liability rule, by contrast, is intolerant of pricing errors, and therefore interacts less easily with the change in legal rules that are likely to occur as water demand increases in the arid West. Since the appropriator's cost curve is the same as the social cost curve for every level of conservation, the appropriator considers both legal and market incentives, whether operating above or below the efficient level of care. If the appropriator operates below the efficient level, he has a double incentive to increase his investment in conservation. Unfortunately, this double incentive continues to operate *above* the efficient level under a strict liability rule, and thus the appropriator is induced to allocate too many resources to water conservation. Accordingly, the negligence rule is better suited to likely directions in the water law system.

#### D. *Compatibility with Traditional Water Law*

While the previous Section discussed the negligence and strict liability rules' compatibility with likely changes in water law, a final consideration in choosing between the proposed liability rules is their compatibility with traditional notions in water law that are *unlikely* to change. Although both rules are radical departures from the traditional *enforcement* of water law rules, they signal less of a departure from *substantive* water law than the market solution. The negligence rule, in particular, serves to enforce the beneficial use requirement, albeit through a system of penalties rather than through loss of water rights. In that regard, the negligence rule is consistent with traditional water law.

While some scholars view traditional rules of water law, such as the beneficial use requirement, as "defects" in water resource allocation,<sup>168</sup> others believe that the unique properties of water justify special rules to govern its allocation.<sup>169</sup> Whether these rules are propagated through blind adherence to tradition, sensible policy considerations, or merely constitutional fiat, rules such as the beneficial use requirement are likely to remain for years to come. Innovations in water resource allocation, no matter how efficient, will only be palatable if they comport, to some degree, with traditional water law notions.

Although decisions concerning the use to which water will be put have significant efficiency consequences,<sup>170</sup> basic water law policies coun-

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168. See, e.g., Williams, *supra* note 113, at 7.

169. See, e.g., Dunning, *Reflections on the Transfer of Water Rights*, 4 J. CONTEMP. L. 109, 112 (1977) ("When water is compared with [a traditional good such as] coffee, it becomes apparent why water rights law has already had more of a public resource flavor to it than has coffee law.").

170. [T]he value of water in agricultural uses has fallen in relation to its value in municipal, industrial, and recreation uses, and it is increasingly clear that further reallocation of water from agricultural to domestic and industrial uses will be necessary if the water resources of the West are to be used efficiently. Indeed, in some areas of the West the price of water in domestic or industrial uses is now as much as 10 to 20 times as great as the price of the same water used for irrigation. . . .

sel against direct interference with individual use decisions. Some Western state constitutions grant the right to apply unappropriated water to *any* beneficial use.<sup>171</sup> Direct interference with this right in the form of a tax or penalty for less efficient water uses might therefore be unconstitutional. Here economics must bow to allocation decisions embodied in state constitutions. As Harrison Dunning points out “[t]he notion that the economically most productive *uses* of water resources are necessarily the best ones is a difficult one to accept.”<sup>172</sup>

For this reason, this Comment does not propose direct interference with the decision of how to *use* water, provided that there is some benefit associated with the use. The liability rules only relate to inefficiencies in the way water is conveyed and applied to a given use. For example, an appropriator would not be penalized for using water to grow an economically inefficient crop, but would face liability if she used leaky ditches or wasteful sprinklers to irrigate that crop. Allocation among different uses must come about indirectly through an eased system of transfers as suggested by Meyers and Posner<sup>173</sup> and others.<sup>174</sup> Since state constitutions protect every beneficial use but do not protect every beneficial means of getting water to those uses,<sup>175</sup> there is more room to sanction inefficient conveyance methods.

If the penalty for employing an inefficient means of water conveyance were the termination of the water right, then, even though our rules operate only on conveyance losses, the rules would have a direct effect on an appropriator's use. Thus, while the proposed rules penalize an appropriator for wasting water, they do not take the water away from him; rather, the penalties operate more like a charge for use or a tax.<sup>176</sup> In this sense, the proposed liability rules are less severe to appropriators

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C. MEYERS & R. POSNER, *supra* note 5, at 7.

171. See, e.g., ARIZ. CONST. art. XVII, § 2; COLO. CONST. art. XVI, §§ 5,6; IDAHO CONST. art. XV, § 3.

172. Dunning, *supra* note 169, at 110 (emphasis added).

173. See C. MEYERS & R. POSNER, *supra* note 5.

174. See, e.g., Williams, *supra* note 118.

175. See Arizona, California, Colorado, and Idaho, constitutional provisions, cited *supra* in note 28.

176. This would be especially desirable in the IID/MWD case discussed *supra* at notes 9-15 and accompanying text. The water flowing into the Salton Sea could be deemed waste, but the IID would still be entitled to this amount in its appropriation. The penalty to IID would amount to a charge for the water wasted. After the plaintiff showed a negligent loss from the district's conveyance system, the district could then assert the affirmative defense that the water served a useful purpose in the Salton Sea. To the extent that the water reached the Salton Sea, it would be subtracted from the loss from the district's conveyance system.

Whether the Salton Sea is entitled to the waste flow, or whether the district could cut off the supply to the Sea, is a very important question in determining the feasibility of selling the water to the MWD. It does not, however, affect the result.

than existing enforcement methods because they do not limit or terminate existing water rights.

Even though liability rules apply only to means of conveyance and methods of application, and do not involve the termination of water rights or specific uses, they indirectly affect appropriators' use decisions. A final consideration in evaluating the negligence and strict liability rules is the magnitude of their indirect effect on choice of use.

If there are no conveyance losses in a system, the liability rules will not affect the use decision. For example, in-stream uses do not require conveyance and therefore involve no conveyance losses. Implementation of liability rules, then, would have no effect on these uses. Water used for wildlife purposes in-stream,<sup>177</sup> or water appropriated for future use<sup>178</sup> and left in the stream, would not be subject to liability. Uses that are further from the point of diversion, however, potentially involve greater water loss, which would result in increased penalties. Liability rules, therefore, increase incentives to use water close to the point of diversion.

In deciding whether to put water to a particular use, the appropriator will consider the influence of the liability rules upon their conveyance costs. Strict liability is more costly to the appropriator than the negligence rule and therefore it creates a greater disincentive to engage in a new appropriation. Thus, the strict liability rule has a greater secondary effect in allocating water to the highest valued *uses* than does the negligence rule, even though both induce appropriators to use the most efficient method of conveyance.

Law and economics literature that has compared the effect of negligence and strict liability on activity levels has concluded that the two rules bring about different results.<sup>179</sup> In the context of a traditional tort such as an automobile accident, "a negligence rule can create incentives for efficient *precaution*, such as safe driving, but not incentives for an efficient *activity level*, such as the number of miles driven."<sup>180</sup> The strict liability rule, on the other hand, "can induce both efficient precaution and an efficient activity level by potential injurers."<sup>181</sup> Under a negligence rule, once the driver has complied with the standard of care, the threat of liability does not inhibit him from making additional trips even

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177. See *Dep't of Parks v. Idaho Dep't of Water Admin.*, 96 Idaho 440, 530 P.2d 924 (1974) (holding that appropriations for scenic beauty and recreational purposes are "beneficial uses" for which a valid appropriative right can be created even though there is not actual diversion of water).

178. As proposed by C. MEYERS AND R. POSNER, *supra* note 5, at 40-43 and later by Williams, *supra* note 118, at 11-20.

179. R. COOTER & T. ULEN, *supra* note 132, at 368-69; see also Shavell, *Strict Liability Versus Negligence*, 9 J. LEGAL STUD. 1 (1980) (discussing the effect of strict liability and negligence on an injurer's activity level under assumptions of unilateral and bilateral precaution).

180. R. COOTER & T. ULEN, *supra* note 132, at 368 (emphasis in original).

181. *Id.* at 369.

when the risk of accident loss is greater than the potential benefit of the trip.<sup>182</sup>

The "level of activity" consideration introduces another variable into the analysis.<sup>183</sup> This consideration causes us to assess not only the marginal benefit of precautionary measures, but also whether the risk of each automobile trip is justified by the benefit of the trip. As applied to water conveyance losses, the negligence rule induces appropriators to pursue the efficient level of precaution against conveyance losses, but it does not force them to consider the marginal benefit of applying the water to a given use. The negligence standard in the automobile context is inefficient because it does not take into account whether any given trip is justified by the potential benefits of making such a trip. Similarly, as applied to water conveyance losses, the negligence rule has no effect on the quantity of water that is diverted through an efficient ditch, nor on the use to which the water is applied.

Because the strict liability rule makes the injurer liable for all injuries, the driver considers this potential cost each time he decides whether to take a trip. He considers both the type and volume of activity. As applied to water conveyance loss, the strict liability rule affects the appropriator's decision about the amount and purpose of his water diversion more than the negligence rule. Just as strict liability inhibits automobile trips in which the expected benefit barely exceeds the expected cost, strict liability in the water law context will be likely to inhibit lower valued water uses. Just as the negligence rule will not affect the non-negligent driver's decision as to how often to drive, but only how safely to drive, the negligence standard, with a lower cost to the appropriator, is less likely to inhibit the appropriator from applying water to a lower valued use.

In evaluating the negligence and strict liability rules, legislators should consider the degree to which they wish to interfere with the private citizen's right to apply water to lower valued uses. Since the right to use water for *any* beneficial use is deeply rooted in the policies of Western water law, the negligence standard is more politically viable even if it is slightly less efficient. This is especially true considering that the right to

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182. *Id.* at 368.

183. "Activity level" can be broken down into 1) the type of activity and 2) the volume of that activity. See Shavell, *Strict Liability Versus Negligence*, 9 J. LEGAL STUD. 1, 2 (1980) (The nonnegligent injurer under the negligence rule will not consider accident losses in choosing (1) whether to engage in his activity or (2) the level at which to engage in that activity. An efficient system of incentives would cause a driver to assess the benefit of each individual trip by considering how beneficial each activity is compared to the chance of an accident. For example, cruising main street may be less beneficial than driving to one's place of employment. The efficient system would also cause the driver to consider how often to undertake each activity. As applied to water law this breaks down into 1) what use to apply the water to, and 2) how much water to divert for that use.

beneficial use is, in many states, constitutionally guaranteed. A strict liability rule might infringe constitutional rights by weighing too heavily on the appropriator's choice of water use. After all, it is the policy of water law to promote "beneficial use," not the "most beneficial use."

## V

### IMPLEMENTATION

While tort liability rules are generally administered judicially, this Comment proposes that liability for water loss be implemented administratively. An administrative system is better equipped to handle the problem of water waste for three reasons. First, existing administrative agencies, in the form of state water boards and quasi-governmental irrigation and conservancy districts, presently have the capacity to administer such a system.<sup>184</sup> Since these agencies have expert knowledge of irrigation techniques and water needs within specific river basins, it is more practical to leave the administration to them, rather than to the judiciary.

Second, administrative implementation of the liability rules would permit the publication of water conveyance guidelines. Since water demand varies among water districts, an irrigation technique that is efficient in one river basin may not be efficient in another. Judicial precedent would therefore be limited in its capacity to announce firm irrigation rules applicable to different river basins. Existing administrative agencies, on the other hand, could publish guidelines in advance that outline permissible conveyance techniques or quantities of loss. Such guidelines could be drafted specifically for each river basin. The guidelines would provide the needed certainty often lacking in other tort situations.

Although establishing guidelines is not feasible in the traditional tort situation, it would prove quite practical in the case of water conveyance loss. The ways in which a traditional tort defendant may have failed to comply with the requisite level of care, or the ways in which his product may be defective, are almost limitless and thus require the common sense ability of the fact-finder to determine liability. When methods of water diversion and application are in question, there are few ways in which an appropriator can fail to comply. The chain of causation is so limited in the context of water loss that liability rules avail themselves more readily to specific, predetermined guidelines. A categorical approach could therefore be adopted, and minimum levels of diversion and application could be established for each river basin. These standards would govern

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184. "[T]he statutes of Utah, Wyoming, New Mexico, Washington, and California confer broad powers on the water officials to take affirmative action to conserve water and eliminate waste in the application of water to beneficial use." Martz & Raley, *supra* note 123, at 59 (footnotes omitted).

minimum acceptable quantities of water loss per acre foot of water diverted over a given distance. Alternatively, the agency could establish minimum acceptable methods of diversion and application.

Third, administrative determination would reduce transaction costs, such as delay and attorneys fees, that plague the judicial system. As with any continuing tort, the concern over delay is particularly salient in water waste situations because waste continues while the parties await trial. The concern over litigation costs is especially relevant in water rights cases since such cases frequently involve large numbers of appropriators along a given river system.

### A. Agencies

Western appropriation states employ permit systems to allocate appropriative rights.<sup>185</sup> These permit systems provide public record of water rights, approve and disapprove applications for new water rights, and regulate the use of existing water rights.<sup>186</sup> State water boards provide a mechanism through which the proposed liability rules may be implemented.<sup>187</sup>

The extent to which water boards conduct on-site inspections of diversions varies from state to state.<sup>188</sup> Some state boards make only occasional inspections to determine whether unauthorized land is being irrigated.<sup>189</sup> Other states conduct almost daily inspection of the quantity of water being diverted by each irrigator.<sup>190</sup> In addition to on-site inspection, aerial surveillance and mechanical measuring devices are sometimes employed to assess both the quantity of water appropriated and the use to which the water is applied.<sup>191</sup>

In addition, private or quasi-governmental water distribution organizations provide a further mechanism for the implementation of the pro-

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185. Colorado, although the only Western appropriation state not to employ a permit system, employs the equivalent of a permit system under the Water Right Determination and Adjudication Act of 1969, COLO. REV. STAT. § 37-92-101 to 602 (1973 & Supp. 1987). J. SAX & R. ABRAMS, *supra* note 20, at 573; Pring & Tomb, *supra* note 2, at 25-10.

186. Even in Colorado, the only state to still employ the judicial method of determination and enforcement of water rights, "[d]ivision engineers and their assistants (referred to as 'water commissioners') make daily determinations of river flows at various measurement points, determine the priority dates of appropriations that may take water, and regulate headgate diversions to meet downstream calls." Martz & Raley, *supra* note 123, at 44, 53.

187. For an example of a state statute creating a water board to implement the permit system, see CAL. WATER CODE § 174 (West 1971).

188. For a telling example of the varying degree of regulation employed by two states (Colorado and New Mexico) see J. SAX & R. ABRAMS, *supra* note 20, at 575-77 (quoting Colorado v. New Mexico, No. 80, October term 1977, United States Supreme Court, Additional Factual Findings of the Special Master, May 31, 1983).

189. *Id.* at 575.

190. *Id.* at 576.

191. *Id.* at 577.

posed liability rules.<sup>192</sup> In general, irrigation laws permit a majority of the landowners within a river basin to form irrigation districts or conservancy districts to implement extensive water projects and distribution systems. These quasi-governmental entities have the power to force unwilling landowners into the district, impose taxes, exercise eminent domain, issue bonds, and enter into government contracts.<sup>193</sup> Thus, as a condition of its establishment, a conservancy district could be charged with taking regular measurements and inspections of diversions and reporting the results to the state water board. The board would then make the determination whether the diversions complied with the negligence standard. The board would also oversee the diversion of water into the district through ditches common to the entire system.

### B. Determinations

As noted, the penalty for water loss or waste would be designed to raise the appropriator's Total Internal Cost Curve (TIC) to the TSC Curve, so that the appropriator would be forced to consider the full cost of his irrigation activities. Thus, the penalty would equal, at each level of conservation, the net external cost of the waste or water loss. The external cost would include net external environmental losses, as well as the difference between the value the water wasted would have had in its next best use and the amount of benefit the appropriator could have realized by selling or using the salvaged water.

In applying the negligence rule to a given case, the board would have to decide (1) whether the appropriator was negligent in terms of the amount of water lost or the type of conveyance methods employed; and (2) if so, how large were the social costs of this water waste. In determining whether the appropriator was negligent, the board would simply inspect the appropriator's irrigation system and compare it, in terms of quantity of water lost per distance conveyed and the methods of conveyance and irrigation, to the published guidelines. The board would have more difficulty determining the amount of penalty per quantity of water wasted because it would need to approximate the external cost of the waste. The board would assign prices for erosion, pollution, and other environmental losses and would net out external benefits. Then the board would determine the difference between the value of the water in its next best use and the appropriator's internal incentive to sell or use the salvaged water. While this determination would be extremely difficult to make, because internal costs are likely to vary drastically from

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192. See generally J. CORBRIDGE, SPECIAL WATER DISTRICTS: CHALLENGE FOR THE FUTURE (Natural Resources Law Center, Univ. of Colo. Law School, 1983); Special Project, *Irrigation Districts*, 1982 ARIZ. ST. L.J. 345.

193. J. SAX & R. ABRAMS, *supra* note 20, at 611.

case to case, the negligence rule is capable of absorbing inaccuracies in this, as well as the previous determination. Under the negligence rule, the exact amount of the penalty could be determined on a case by case basis, since appropriators would initially be reacting to the published negligence guidelines.

The strict liability rule would require that the board make two determinations in applying the guidelines to a given case: (1) the amount of water lost; and (2) the external cost of the water loss. As with the determination of negligence under the negligence rule, determining the amount of loss would require that the water district take measurements at the point of diversion and at the point of use and ascertain the total amount of water lost from the system. The external cost of the water loss would be determined in the same way that it is for the negligence rule, except, since the appropriator reacts directly to the penalty, problems of uncertainty<sup>194</sup> would be reduced by publishing the penalty amount in advance. The strict liability rule, however, poses a problem because it does not have the ability to absorb inaccuracies in assessment of the external cost or in the measurement of the quantity of water lost. Therefore, a vague general penalty would lead to overconservation and underconservation. A likely solution would be to set a specific general penalty per quantity of water loss which would be reduced or increased at the administrative proceeding if special circumstances, such as excessive or minimal external costs or benefits, exist.

#### CONCLUSION

The growth of Western cities ensures an ever-increasing demand for water in agricultural, industrial, and domestic uses. Because the most efficient (or least inefficient) of reclamation projects have already been built,<sup>195</sup> additional water must come from another source. Given the huge conveyance losses in agricultural irrigation, theory dictates that the market would induce appropriators to improve their methods of conveyance and sell the water saved. However, legal barriers to these transfers and the likelihood of market and bargaining failure inhibit such exchanges. As a "near public good" exhibiting problems of practical nonexcludability and partial nonrivalness, water is likely to be undersupplied by a market. Because of the expense of transporting water to a different basin, markets are often very localized. With a small number of players in each transaction, the potential for bargaining breakdown is

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194. For a discussion of the effect of uncertainty on the operation of tort liability rules, see Calfee & Craswell, *Some Effects of Uncertainty on Compliance with Legal Standards*, 70 VA. L. REV. 965 (1984); Cooter, Kornhauser & Lane, *Liability Rules, Limited Information, and the Role of Precedent*, 10 BELL J. ECON. 366 (1979).

195. San Francisco Chron., Oct. 2, 1987, at A11, col. 1.

high. Furthermore, irrigation uses can cause pollution, erosion, leaching, and drainage problems that would not be accounted for by the market and which, therefore, would not be considered by the appropriator in deciding how much water to apply to crops or which method of irrigation and conveyance to use.

Because of the many problems inherent in the market solution, we realize the need for a nonmarket solution capable of implementation in conjunction with more traditional free market suggestions. Liability rules borrowed from tort law provide likely models upon which to base our rules. While the negligence rule and the strict liability rule have different advantages and disadvantages, each, as applied through existing state water boards and irrigation districts, has the potential to bring about an efficient, market-approximating solution. The strict liability rule would provide incentives not only to implement efficient methods of conveyance, but also to apply the most efficient quantity of water to the most efficient uses. The negligence rule, however, directly affects only the choice of conveyance method. Since the negligence rule involves a smaller degree of interference with the right to appropriate and use water and conforms more closely with traditional notions of water law, it may be a more palatable solution than the strict liability rule. Finally, because the negligence rule is more adaptable to variations in internal costs and benefits, miscalculation of the social cost of water waste, and changes in the legal rules governing water use, it may well be the best solution to the problem of wasteful diversions of scarce water resources.

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