Commentary

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The National Water Policy Review and Western Water Rights Law Reform: An Overview†

I. INTRODUCTION

State and federal water policies have traditionally accepted economic development as a principal objective.[1] Federal transportation, hydro-power generation, and reclamation policies have been perceived as instrumental in helping a developing nation reach its economic potential. Because these economic development objectives have been largely achieved, public concern in recent years has changed from the development of natural resources to a greater emphasis on their protection and preservation.[2] Enactment of federal environmental legislation reflecting these more recent concerns has resulted in inconsistent federal water policies. Implementation of reclamation, flood control, and hydro-power production programs has changed to accommodate environmental objectives, although integration of development and environmental objectives is a continuing controversy. In addition, taxpayer resistance has triggered a greater interest in efficiency in government and reduced public expenditures. Consequently, water de-

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1. B. HOLMES, A HISTORY OF FEDERAL WATER RESOURCES PROGRAMS, 1800-1960 (U.S. Dep't of Agriculture, Misc. Pub. No. 1233 (1972)).
2. B. HOLMES, A HISTORY OF FEDERAL WATER RESOURCES PROGRAMS AND POLICIES (U.S. Dep't of Agriculture, Misc. Pub. No. 1368 (1980)).

velopment programs are being subjected to closer budgetary scrutiny.

The conflict between these shifting objectives is reflected in the recent National Water Policy Review. In his May 23, 1977, environmental policy message, President Carter initiated a review and establishment of "a national water resources management policy."[3] Major objectives of the National Water Policy Review included: (1) giving environmental and water conservation objectives greater emphasis in federal water project planning and evaluation procedures;[4] (2) reducing the federal share in financing water resource development projects by requiring increased state and private financing;[5] and (3) modifying state water law to meet environmental protection and water use efficiency objectives.[6]

Specifically, state water laws were characterized as generally: (1) not reflecting or accommodating environmental values;[7] (2) not addressing interrelationships between surface water and ground water;[8] (3) not facilitating the conjunctive (*i.e.*, integrated) use of surface water and ground water;[9] (4) not requiring or encouraging a high degree of water use efficiency;[10] and (5) being too inflexible to permit effective water management.[11]

The suggestion that federal water policies would force substantive reform in state water rights law raised such a storm of protest in the western states[12] that it was subsequently dropped as an explicit objective in the National Water Policy Review.[13] Nonetheless, the criticisms were and remain valid.[14] Water development

3. Water Resources Policy Study: Issue and Option Papers, 42 Fed. Reg. 36788 (1977).
4. *Id.* at 36788-90.
5. *Id.* at 36790-92.
6. *Id.* at 36792-95.
7. *Id.* at 36793.
8. *Id.*
9. *Id.* at 36795.
10. *Id.* at 36793-95.
11. *Id.* at 36793-94.
12. "The western states" are the seventeen contiguous western states that follow the doctrine of appropriation in allocating surface water resources. These states are: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.
13. For the text of the President's water policy address, see W. VIESMANN, THE WATER RESOURCES POLICY STUDY: AN ASSESSMENT 109-18 (House Comm. on Energy and Natural Resources, Pub. No. 95-108 (1978)). The President proposed to: improve planning and management of federal water resources programs, emphasize water conservation, *enhance federal-state cooperation and improve state water resources planning*, and increase consideration of environmental quality. *Id.* at 109 (emphasis added). *See id.* at 119-36.
14. For a general review of water policy issues, see NATIONAL WATER COMMISSION, WATER POLICY FOR THE FUTURE (1973), and several background legal

projects will continue to be opposed by environmentalists if environmental values are not accommodated. Surface water development projects will encounter difficulties if project water supplies are disrupted by ground water withdrawals. Inefficient use can lead to earlier exhaustion of ground water supplies. Restricting water rights transfers between users can freeze water uses in the pattern of bygone days. These problems will continue to perplex state and federal water policymakers, even though consideration of these issues is no longer part of the National Water Policy Review.

One point obscured in the national water policy deliberations is that law makers and administrators in a few western states have come to grips with some, if not all, of these issues. These more progressive policies may serve as models for state and federal officials in their considerations of water policy alternatives. Existing innovative water policies include: (1) farm-level irrigation water use efficiency programs in Nebraska; (2) ground water mining regulations in Nebraska; (3) minimum streamflow legislation in several western states; (4) procedures for resolving of conflicts between surface and ground water users in Colorado; and (5) policies for conjunctive management of ground and surface water in Washington and California.

This commentary will describe these innovative water laws and evaluate their relevance to other western states. It also explores an appropriate federal role in achieving state water policy reforms.

II. IRRIGATION WATER USE EFFICIENCY

In 1975, eighty-three percent of the fresh water consumed in the United States was used for crop irrigation.[15] In the western states this figure was ninety-one percent.[16] Increasing the efficiency of water use in irrigation may make water available for additional uses, either by prolonging the life of ground water supplies or by making additional surface water available to other users.

In addition to water conservation, increasing irrigation water use efficiency may improve water quality. Application of excessive amounts of irrigation water can result in leaching of fertilizer and other water soluble agricultural chemicals into ground water supplies, in water soluble agricultural chemicals being carried to

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studies including: C. Meyers & R. Posner, Market Transfers of Water Rights (1971); E. Clyde & D. Jensen, Administrative Allocation of Water (1971); R. Dewsnup, Legal Protection of Instream Values (1971); C. Corker, Ground Water Law, Management and Administration (1971).

15. C. MURRAY & E. REEVES, ESTIMATED WATER USE IN THE UNITED STATES IN 1975, 8 (U.S. Geological Survey, Cir. No. 765 (1977)).

16. *See id.* at 24-25 (*Table 7*).

streams as overland runoff, or in soil erosion and stream sedimentation.[17] Increasing water use efficiency can reduce these nonpoint[18] sources of water pollution.

Finally, increasing irrigation water use efficiency can reduce energy consumption and costs, resulting in decreased peak power requirements during summer months. If energy conservation becomes mandatory, irrigation scheduling may be used to reduce energy consumption for irrigation.

While increasing irrigation water use efficiency can result in water conservation, improved water quality, and energy conservation, state water laws do not require a high degree of irrigation water use efficiency.[19] State water allocation laws typically apply only nominal restrictions on the amount of water which can be used for irrigation. When water is available, irrigators are authorized to withdraw quantities of water which would allow them to irrigate fully without having to irrigate efficiently. In part, this is because these quantities are usually established by statute.[20] Since most state water statutes were enacted in the late nineteenth and early twentieth centuries, the quantities of water established reflect the efficiency of relatively crude irrigation practices. Since World War II, impressive technical innovations increasing the efficiency of irrigation water distribution systems have occurred.[21] The more recent development of irrigation scheduling techniques to schedule irrigations to meet crop water needs more precisely and to use available precipitation more effectively have

17. *See generally* DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES, UNIVERSITY OF CAL.-DAVIS, NATIONAL CONFERENCE ON MANAGEMENT OF NITROGEN IN IRRIGATED AGRICULTURE (1978).
18. Non-point sources of pollution may be defined as any source of water pollution not associated with a descrete conveyance, such as a discharge pipe. W. ROGERS, ENVIRONMENTAL LAW § 4.4 (1977).
19. 1 W. HUTCHINS, WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES 644-50 (completed by H.H. Ellis & J.P. DeBraal, U.S. Dep't Agriculture, Misc. Pub. No. 1206 (1974)).
20. Quantification may be accomplished by statutes fixing the amount of water per acre for irrigation. *E.g.*, NEB. REV. STAT. § 46-231 (1978); IDAHO CODE §§ 42-202 & -220 (1977); OKLA. STAT. ANN. tit. 82, § 185.12 (West Supp. 1979); S.D. COMPILED LAWS ANN. §§ 46-5-6 (Supp. 1979). *See* 1 W. HUTCHINS, *supra* note 19, at 510-11. The other major approach is to establish "beneficial use" as the basis for determining the quantity of water allocated on a case-by-case basis. *E.g.*, ARIZ. REV. STAT. ANN. § 45-101(B) (1956); NEV. REV. STAT. § 533.035 (1973); N. M. STAT. ANN. § 75-1-2 (1953); N.D. CENT. CODE § 61-04-01.2 (Supp. 1979). For a discussion of what contitutes a beneficial use of water, see 1 W. HUTCHINS, *supra* note 19, at 493-503.
21. *See* U.S. DEP'T OF THE INTERIOR, U.S. DEP'T OF AGRICULTURE, U.S. ENVIRONMENTAL PROTECTION AGENCY, IRRIGATION WATER USE AND MANAGEMENT 11-12 (1979) [hereinafter cited as IRRIGATION WATER USE AND MANAGEMENT].

yielded substantial water savings in irrigation.[22] State water rights laws, however, generally have not been modified to reflect these developments in improved irrigation water use efficiency.

Western state water laws are partially responsible for discouraging the adoption of water saving techniques in irrigation. A water right authorizes the holder to use a specific quantity of water on a specific quantity of land.[23] If the irrigator uses his water more efficiently he cannot apply the saved water on additional land: he must acquire an additional water right to do so.[24] Because water in the western states is allocated on the basis of "first in time is first in right," the irrigator is likely to lose the water he has saved to other water users.[25] He therefore has little incentive to increase his water use efficiency.

The rationale for prohibiting the use of water saved through conservation techniques is the protection of downstream users. When water is used for irrigation some is evaporated, and some is transpired by the crop. The rest, at least in theory, finds its way back to the stream as return flows, either as overland runoff or as percolation into a ground water reservoir which may feed the stream.[26] If an irrigator is permitted to increase the number of acres he can irrigate with a fixed quantity of water, the quantity of water transpired in crop production will increase,[27] and return flows will be reduced correspondingly. In other words, the consumptive use of water is increased at the expense of downstream water users.

Assuming *arguendo* that states have the legal authority to reduce the quantity of water irrigators may use,[28] most of the alter-

22. *Id.* at 68.
23. *See* 1 W. HUTCHINS, *supra* note 19, at 489-91, 454-68.
24. Salt River Valley Waters Users' Ass'n v. Kovacovich, 3 Ariz. App. 28, 411 P.2d 201 (1966). *See* Dickinson, *Installation of Water Saving Devices as a Means of Enlarging an Appropriative Right to Use Water*, 2 NAT. RESOURCES LAW. 272 (1969); 46 ORE. L. REV. 243 (1967).
25. Under the doctrine of priority, between competing water users the earliest user has the superior right. 1 W. HUTCHINS, *supra* note 19, at 396-400. Consequently one who conserves water may lose it to the competing upstream or downstream "junior appropriators," *i.e.*, appropriators with later priority dates. Upstream junior appropriators will be required to allow less water flow to the water conserver. Downstream junior appropriators will be entitled to use the water not diverted because of conservation practices. The only circumstances in which an appropriator can acquire a secure right to use the water he has conserved is if no intervening junior appropriative rights have been established.
26. IRRIGATION WATER USE AND MANAGEMENT, *supra* note 21, at 17-19.
27. Transpiration will increase if more acres are irrigated unless crops using less water are substituted for the original crop or crops.
28. Appropriative water rights are based on the notion of beneficial use, *i.e.*, use without unnecessary waste. *See* 1 W. HUTCHINS, *supra* note 19, at 489-503, 506-

natives facing the irrigator appear economically unattractive, which probably is the major reason western states have not mandated irrigation water use efficiency. If the quantity of water irrigators are authorized to use is reduced, the irrigator has four major alternatives: (1) he may either fully irrigate fewer acres or partially irrigate as many acres as he can at his present level of irrigation efficiency without changing his cropping patterns; (2) he may change his cropping pattern to include crops that require less water; (3) he may increase his irrigation efficiency by, *e.g.*, scheduling his irrigation, or by purchasing more efficient irrigation water distribution equipment; or (4) he may both grow crops requiring less water and increase irrigation efficiency.

These alternatives may reduce an irrigator's net income. If fewer acres are irrigated or acres are partially irrigated and cropping patterns are not changed, crop yields probably will be reduced. If crops using less water are grown, net profits may or may not be affected, depending on the relative crop prices and production costs. Purchase of more efficient irrigation equipment can be expensive. Instituting irrigation scheduling techniques using existing water distribution systems may or may not increase costs, depending on labor, energy, and fertilizer prices.

Because each of these alternatives requires changes in irrigation practices, they are likely to be resisted as unwarranted governmental interference in how a farmer irrigates without regard to the actual economic impacts. For these reasons, proposals to impose irrigation efficiency requirements on existing irrigators are likely to be controversial.

As mentioned earlier, irrigation water conservation can improve water quality. Using more irrigation water than the crop can utilize can result in the leaching of fertilizers into ground water supplies, stream sedimentation from overland runoff, or both. One alternative for dealing with these nonpoint water pollution problems is to reduce percolation to ground water supplies or overland runoff by increasing irrigation water use efficiency. Future water conservation requirements may stem not from a desire to use water more efficiently but rather to meet water quality objec-

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14, 545-46. In practice, however, this permits inefficient use. *Id.* at 514-15. Irrigators are not required to use the most efficient irrigation method. Tulare Irr. Dist. v. Lindsay-Strathmore Irr. Dist., 3 Cal. 2d 489, 45 P.2d 972 (1935). *See* 1 W. HUTCHINS, *supra* note 19, at 644-50.

The interesting legal question is whether the legal concept of what practices are wasteful can be legislatively changed retroactively. Statutes in some western states do authorize the state water administrator to reduce the quantities of water to which an appropriator is entitled in order to achieve more efficient water use. *E.g.*, NEB. REV. STAT. § 46-231 (Reissue 1978).

tives.[29]

Irrigation water use efficiency requirements have been developed for use in the proposed Norden reclamation project in Nebraska to protect ground water quality.[30] A major concern for the proposed irrigation project has been the possibility of ground water contamination from fertilizers being leached into the aquifer from the irrigation of sandy soils. To address this problem irrigators will be required to use irrigation scheduling techniques as part of their water service contracts,[31] even though this is not required by Nebraska water rights law. This in effect establishes irrigation water use efficiency requirements in addition to reducing the leaching of fertilizer into the aquifer.

In addition to achieving water conservation and water quality management objectives, irrigation water use efficiency may be required because of energy shortages. Rising energy prices have increased pumping costs.[32] Irrigation scheduling is one way to reduce these costs. Irrigation scheduling may also be used to reduce peak power demands. Several rural power districts in Nebraska have established voluntary irrigation electricity load management programs where irrigators agree to stop pumping at the request of the power district.[33] The timing of power interruptions are integrated into irrigation scheduling programs so that interruptions do not adversely affect crop yields. Cooperating irrigators enjoy rate reductions of up to one third, in addition to reducing peak power demands for the power district.

Increasing irrigation water use efficiency can result in water conservation, improved water quality, and reduced energy consumption and costs. The programs in Nebraska for integrating irrigation scheduling with water quality management and electricity demand management programs are models for states concerned about these issues to consider.

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29. *See, e.g.*, NEBRASKA NATURAL RESOURCES COMMISSION, SECTION 208 WATER QUALITY MANAGEMENT PLAN FOR THE STATE OF NEBRASKA 15-19 (1979).
30. Memorandum of Understanding Among the United States, North Central Nebraska Reclamation District, and Niobrara Basin Irrigation District Concerning Compliance With Federal Pollution Control Standards for Ground Water (February 15, 1979) (copy on file with the Nebraska Law Review).
31. Project water users will be required to complete an irrigation scheduling training course, use soil moisture measuring equipment, institute and maintain an irrigation scheduling program, and refrain from making fall and winter fertilizer applications. *Id.* ¶ 2(a)-(d).
32. M. SKOLD, FARMER ADJUSTMENTS TO HIGHER ENERGY PRICES: THE CASE OF PUMP IRRIGATORS (U.S. Dep't of Agriculture, Pub. No. ERS-663 (1977)).
33. Stetson & Addink, *Controlling Electrical Peak Demands by Scheduling Irrigation Systems*, 20 AM. SOC. AGRIC. ENGINEERS TRANSACTIONS 754 (1977).

III. GROUND WATER MINING

From 1955 to 1975, the quantity of ground water used annually for irrigation in the seventeen western states increased from eighteen million acre feet[34] to fifty-six million acre feet.[35] This dramatic increase in ground water use has led to the mining of ground water in several western states, notably in the high plains region from Texas to Nebraska, in Arizona, and in southern California.[36] Ground water mining occurs when withdrawals from an aquifer are made at rates greater than net recharge. Ground water mining becomes serious when it continues over time. If restrictions on withdrawals are not established, the aquifer may be prematurely depleted, and local and regional economies dependent on ground water irrigation may wither and die.[37]

Regulation of ground water is not widespread in the West, probably because irrigators assume that restrictions will necessarily adversely affect their income.[38] Economic analyses in the high plains of Texas and Oklahoma, however, conclude that restrictions on ground water withdrawals would result in higher net farm income than would unrestricted pumping.[39] The study assumes that irrigators would use ground water more efficiently if its availability were restricted.

In most western states, ground water use is subject to some degree of state regulation including special restrictions when ground water mining is occurring.[40] In California, Texas, and Nebraska, however, where sixty percent of the ground water withdrawals for irrigation occurred, meaningful restrictions on ground water withdrawals have not been imposed.[41]

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34. An acre foot is enough water to cover an acre of land with one foot of water, or 325,900 gallons.
35. Derived from Table 3 *in* K. MacKichan, Estimated Use of Water in the United States, 1955,6-7 (U.S. Geological Survey, Cir. No. 398, 1957); C. Murray & E. Reeves, *supra* note 15.
36. U.S. Water Resources Council, I The Nation's Water Resources 58 (1978).
37. *See generally* National Water Commission, *supra* note 14, at 238-43.
38. *See* Aiken & Supalla, *Ground Water Mining and Western Water Rights Law: The Nebraska Experience*, 24 S. Dak. L. Rev. 607, 610-17 (1979); G. Sloggett, Mining the Ogallala Aquifer: State and Local Efforts in Ground Water Management (Okla. State Univ. Research Report No. P-761 (1977)).
39. H. Mapp & V. Eidman, An Economic Analysis of Regulating Water Use in the Central Ogallala Formation 58-63 (Okla. State Univ. Tech. Bull. No. T-141, 1976).
40. Aiken & Supalla, *supra* note 38, at 610-17.
41. In 1975, ninety percent of the ground water used for irrigation in the seventeen western states was withdrawn in seven states:

California	18 million acre feet
Texas	10 million acre feet
Nebraska	5.9 million acre feet

This may be changing in Nebraska. Legislation enacted in 1975 gives Natural Resources Districts (NRDs) authority to regulate ground water mining.[42] Regulations in the Upper Republican ground water control area anticipate reductions in ground water withdrawals beginning in 1980.[43] Withdrawal limitations have been delayed to give irrigators time to install water meters on their wells, and also adjust to the prospect of reduced water availability.[44]

Factors which have made ground water controls more acceptable to Nebraska irrigators include: (1) recognition that supplemental water supplies are not readily available to augment diminishing ground water supplies;[45] (2) technological advances in irrigation water distribution systems which permit greater water use efficiency; (3) experience in scheduling irrigation to time water distribution with crop water needs using traditional gravity irrigation water distribution systems as well as sprinkler irrigation systems; and (4) concern that if local districts do not deal directly with ground water mining, the responsibility for developing ground water management programs will be given to the state.[46]

Perhaps the most difficult question related to ground water mining is determining how much water to allocate to irrigators over time. This issue could be approached in a number of ways, but a central question is: what level of economic returns are decision-makers willing to sacrifice to prolong aquifer life? If no sacrifice of current economic returns is desired, the proper allocation level would eliminate waste but meet full irrigation demands. On the other extreme, if decisionmakers were willing to sacrifice any amount of current economic returns in order to prevent further ground water mining, the appropriate allocation would be that

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Kansas	5.2 million acre feet
Arizona	4.7 million acre feet
Idaho	3.9 million acre feet
Colorado	2.8 million acre feet

In 1975, ground water withdrawals in California, Nebraska, and Texas totaled 34 million acre feet, 60% of the 56 million acre feet withdrawn in total. C. MURRAY & E. REEVES, *supra* note 15. For a discussion of ground water law and management in California, Texas, and Nebraska, see Aiken & Supalla, *supra* note 38, at 610-17.

42. NEB. REV. STAT. §§ 46-656 to -674 (Cum Supp. 1979). For a brief discussion of Natural Resource Districts, see Aiken & Supalla, *supra* note 38, at 619-20.

43. *See* Aiken & Supalla, *supra* note 38, at 641-42. Ground water withdrawals may also be limited in the Upper Big Blue ground water control area. *See id.* at 629.

44. *Id.* at 641.

45. The major limitation is the prohibition against interbasin transfers of surface water. *See generally* Oeltjen, Harnsberger & Fisher, *Interbasin Transfers: Nebraska Law and Legend*, 51 NEB. L. REV. 87 (1971).

46. *See* Aiken & Supalla, *supra* note 38, at 620.

amount which prevents ground water mining. An intermediate approach could reduce quantities to a level that would force cropping changes or rotation without preventing ground water mining *per se*.

In practice, the selection of an allocation level is likely to be a continually evolving activity. Political restraints and the lack of economic impact and hydrologic information will probably mean that initial allocation levels will seek to eliminate waste only, and may be followed by gradual reductions over many years. As allocations are gradually reduced, decisionmakers will learn more about the current economic cost of reduced withdrawals and the impact on ground water levels. This will enable them to make better informed, long-term decisions regarding the tradeoffs between prolonged aquifer life and reduction of short-term economic returns.

Reducing ground water withdrawals may be an effective measure to counter the effects of ground water mining. Political resistance to quantity restrictions may be met by integrating irrigation efficiency practices with ground water management policies, as illustrated by the locally-developed ground water regulations in Nebraska.

IV. LEGAL RECOGNITION OF INSTREAM WATER USES

One of the most controversial water policy question in the West is the extent to which instream water uses should be recognized and protected under state law. Instream uses—such as water quality maintenance, ground water recharge, fish and wildlife habitat maintenance, and recreation—have traditionally not been legally recognized or protected. As public attitudes regarding natural resources have changed, the instream flows question has emerged as an important water policy issue.

The problem is political and economic rather than legal. Numerous legal precedents are available to protect instream flows.[47] The controversial issues are: should instream flows be recognized, and if so, how much water should be allocated to instream uses? Two basic approaches have been taken in western states to protect instream flows: reservation of water for instream uses, and authorization of instream flow appropriations. Instream reservations have been authorized in Washington[48] and Oregon,[49] while in-

47. *See* R. DEWSNUP & D. JENSEN, STATE LAWS AND INSTREAM FLOWS (U.S. Fish & Wildlife Service, Office of Biological Services, Pub. No. 77/27, 1977); Comment, *Minimum Streamflows: The Legislative Alternatives*, 57 NEB. L. REV. 704 (1978).

48. WASH. REV. CODE §§ 75.20.010 to .20.060 (1962).

49. OR. REV. STAT. §§ 538.010 to .450 (Supp. 1977).

stream appropriations are authorized in Colorado[50] and Idaho.[51]

A. Instream Reservations

Under the instream reservation approach the state establishes a protected base flow or minimum flow level for a particular stream or portion thereof. This flow is then considered when applications for new withdrawals are considered. When the state issues new water rights it can either deny the permit because of interference with the protected flow, or else condition the permit so that withdrawals are not permitted which would interfere with protected flows. Existing water rights are honored even if they interfere with the protected flow level. One problem with the instream reservation approach is the difficulty in ascertaining what level on streamflow should be maintained. Because many different instream uses may be recognized which have different quantity requirements, a single measure of protected flow would be difficult to establish.

B. Instream Appropriations

Under the instream appropriation approach water rights are issued for particular instream uses. A public or private agency acquires an instream appropriation but water is not withdrawn from the stream; rather, this amount of water is then protected from future appropriation and withdrawal. Again, existing water rights would not be affected under the instream appropriations approach.

An advantage of instream appropriations is that water rights can be granted for a variety of purposes, and each instream flow right request can be evaluated on its own merits. Typically, these instream appropriations are cumulative. If one applies for an instream appropriation of fifty cubic feet per second (cfs)[52] for ground water recharge and a twenty cfs instream flow right has already been established for some other purpose, a new instream appropriation would be issued for thirty cfs.

Establishing protected flows would not affect existing water rights. Western water rights law follows the rule of priority: first in time is first in right.[53] Thus, any protected flows that might be established would be subject to existing water rights. Protected flows would therefore have their greatest impact on water rights not yet granted.

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50. COLO. REV. STAT. § 37-60-106 (Cum. Supp. 1978).
51. IDAHO CODE § 42-1734 (Supp. 1979).
52. Cubic feet per second (cfs) is a measure of how much water flows (or is pumped) past a certain point. A flow of one cfs is equal to a flow of approximately 450 gallons per minute.
53. *See* 1 W. HUTCHINS, *supra* note 19, at 396-400.

Because prior rights must be respected, a system of protected streamflows could not be maintained on streams that are already over appropriated. Under these conditions if greater flows are desired, streamflow would need to be augmented with stored water, water from another source, or through the purchase of existing water rights and converting them to an instream use.[54]

Finally, protected flows may be difficult to maintain over time because of ground water development. As ground water levels decline, streamflow may be affected. Whether instream flows will be protected depends on the effectiveness of a state's laws for resolving conflicts between ground and surface water users.

Western water law is not an insurmountable obstacle to establishment and protection of instream flows. The difficulty comes in persuading legislators and the public that legal changes are necessary and instream flow values worth preserving. Where unappropriated water is not available for instream flows, an additional challenge is persuading the public that obtaining a supplemental water supply for instream flows is worth the cost.

V. RESOLUTION OF CONFLICTS BETWEEN USERS OF SURFACE AND GROUND WATER

In many parts of the West, ground and surface water supplies are physically interrelated. Under these circumstances ground water mining can significantly impact surface supplies, resulting in conflicts between ground water users and surface water users. Generally referred to as the "subflow" problem, the basic issue is whether the subflow, *i.e.*, the ground water flow associated with a stream, is legally treated as surface water or ground water. The general approach followed in the West is the subflow of a stream is part of the stream and subject to the same rights to use.[55]

If prior appropriation is applied to interrelated ground and surface water, ground water users can be placed at a legal disadvantage. Because technological developments in well design, pumps, and irrigation water distribution systems have been relatively recent, ground water users will usually be in a "junior appropriator"

54. *See* R. DEWSNUP & D. JENSEN, *supra* note 47, at 31, 35-41; R. DEWSNUP & D. JENSEN, PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS 8-9, 23-24, 49-63 (U.S. Fish & Wildlife Service, Office of Biological Services, Pub. No. 77/29 1977).

55. Maricopa County Mun. Water Conservation Dist. No. 1 v. Southwest Cotton Co., 39 Ariz. 65, 4 P.2d 369 (1931); Union Central Life Ins. Co. v. Albrethsen, 50 Idaho 196, 294 P. 843 (1930); Smith v. Duff, 39 Mont. 382, 102 P. 984 (1909); CAL. WATER CODE § 1200 (West 1970); KAN. STAT. § 42-306 (1973); TEX. WATER CODE ANN. tit. 2, § 5.021 (Vernon 1970).

status. This can mean that ground water development can be restricted in order to protect senior surface water rights.

The restriction on ground water development may not be extensive if only subflow is regulated as part of the stream. However, additional ground water that normally would reach a stream can be intercepted by wells. If this ground water, sometimes called tributary ground water, is regulated as part of the stream, the impact on ground water development may be greater than if only subflow were regulated.

In Colorado, tributary ground water is regulated as part of the surface water supply.[56] The Colorado law recognizes that such an approach could significantly restrict ground water development and adopts several features to accommodate ground water users. Surface water users are permitted to transfer their priority date to a well, in effect substituting a more reliable ground water supply for a less dependable surface water supply but maintaining the earlier priority date.[57] In addition, ground water users are permitted to provide substitute water to surface water users to compensate for stream depletion by ground water withdrawals.[58] Finally, ground water users are not required to stop withdrawing ground water that depletes streamflow if the increase in streamflow will not occur soon enough to benefit the senior surface water appropriator.[59]

The Colorado approach has aroused considerable controversy, in part because of the cumbersome procedure for acquiring water rights.[60] Administration requires considerable diplomatic ability.[61] This is unavoidable where ground and surface water users are directly competing for the same water. The Colorado approach of applying surface water rules to a stream-aquifer system may be appropriate where surface water is the major source of supply. Where ground water is the major source of supply in a stream-aquifer system, following a rule of ground water law that the available supply is shared by all users may be more appropriate.[62] In

56. COLO. REV. STAT. §§ 37-92-101 to -602 (Cum. Supp. 1978).
57. *Id.* §§ 37-92 -102(1) & -301(3).
58. Kuiper, *Colorado: The Problem of Underground Water*, 6 DEN. J. INT'L L. & POL'Y 455 (1970).
59. COLO. REV. STAT. § 37-92-501(1) (1973).
60. In Colorado appropriative water rights for surface water and tributary ground water are acquired not through an administrative procedure but by a court procedure. *See* 3 W. HUTCHINS, *supra* note 19, at 215, 217-21.
61. *See* Kuiper, *supra* note 58. Mr. Kuiper is the Colorado State Engineer.
62. This is an extension of the California doctrine of correlative rights. For a brief discussion of the correlative rights doctrine, see Aiken & Supalla, *supra* note 38, at 613-15.

any event, the Colorado approach to resolving disputes between users of ground and surface water is an important precedent.

VI. CONJUNCTIVE MANAGEMENT OF GROUND AND SURFACE WATER: LEGAL ASPECTS OF STORING WATER UNDERGROUND

Another aspect of the interrelation between surface and ground water is the conjunctive management of ground and surface waters. Conjunctive management is the management of ground and surface water as a single source of supply. This may mean using ground water when surface water is scarce and restricting ground water use when surface water is plentiful.

One method of achieving conjunctive management of ground and surface waters is using the ground water reservoir[63] as a storage reservoir, then managing the use of both ground and surface water resources based on their relative availability. In years when surface water was plentiful less ground water would be withdrawn and ground water supplies recharged. In dry years more ground water would be withdrawn because of reduced surface water availability.

What is meant by "storing water underground?" Water is naturally stored underground as ground water where geological conditions are favorable. Artificial ground water storage occurs when man accelerates this natural process. Water can be artificially stored in ground water reservoirs directly through injection wells, or indirectly through seepage. Examples of indirect storage include the increase in ground water levels resulting from water leaking from irrigation canals and percolation to the ground water aquifer of excess irrigation water.

A. California Law: Ground Water Recharge

Southern California has long been dependent on ground water supplies to support both agricultural and municipal development. Because existing water supplies have been insufficient to sustain this development surface water has been imported to southern California, first from the Colorado River and more recently from

63. One should distinguish between a ground water reservoir and a ground water aquifer. The ground water reservoir is those subsurface materials (*i.e.*, sands and gravels) capable of holding significant amounts of water whether the materials are saturated or not. A ground water acquifer is a subsurface formation of *saturated* water bearing materials capable of yielding significant amounts of water to wells. The important distinction is that a "depleted aquifer" is no longer an aquifer because it is not saturated with water. A "depleted aquifer," is part of the ground water reservoir, whose storage capability can be used to artificially store water underground.

northern California. Some of this water has been used to recharge depleted ground water basins.[64]

For a ground water recharge program to be successful, a method is needed to allocate rights to make ground water withdrawals of recharged as well as naturally occurring ground water. In California this is accomplished by a judicial determination of rights to withdraw ground water. The court, with the assistance of the California Department of Water Resources, determines what the so-called "safe yield" of an aquifer is, and restricts the current withdrawals of all ground water users proportionally so that total withdrawals equal the safe-yield figure.[65]

In several basins where ground water rights have been adjudicated ground water recharge operations are in effect because the ground water allocations are insufficient to meet present demands. One example is the city of Los Angeles. The city began importing surface water in the 1930s to supply its municipal needs and recharge depleted ground water reservoirs. Twice Los Angeles has gone to court to protect its right to control the use of water it recharged into the ground water reservoir. Municipalities and other ground water users were withdrawing water Los Angeles had imported and recharged without bearing any of the associated costs. In both decisions the California Supreme Court recognized rights to use recharged ground water which were different from those to use naturally occurring ground water.[66] The practical effect of these decisions is that anyone who withdraws ground water from a basin recharged by Los Angeles in excess of the amount allocated to every ground water user (through the court adjudication process) must pay Los Angeles for that right. The money allocated can be used to purchase and recharge imported surface water.

A similar arrangement exists where ground water replenishment districts have been established. California statutes permit the establishment of replenishment districts to recharge depleted ground water resevoirs.[67] These districts have the authority to

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64. CALIFORNIA DEP'T OF WATER RESOURCES, CALIFORNIA'S GROUND WATER 119-21 (Bull. No. 18, 1975).

65. For a description of the basin adjudication process, see A. Schneider, Groundwater Rights in California 19-37 (Governor's Comm'n to Review Calif. Water Law Staff Paper No. 2 1977).

66. City of Los Angeles v. City of Glendale, 23 Cal. 2d 68, 142 P.2d 289 (1943); City of Los Angeles v. City of San Fernando, 123 Cal. Rptr. 1, 14 Cal. 3d 199, 537 P.2d 1250 (1975). For analyses of the *Glendale* and *San Fernando* decisions, see respectively Kreiger & Banks, *Groundwater Basin Management*, 50 CAL. L. REV. 56 (1962); Gleason, *Water Projects Go Underground*, 5 ECOLOGY L.Q. 625 (1976).

67. CAL. WATER CODE §§ 60000-60388 (Cum. Supp. 1978). *See* A. Schneider, *supra* note 65, at 39-42.

charge a replenishment assessment, which is a payment levied when ground water users withdraw more than their judicially allocated share. This replenishment assessment permits replenishment districts to purchase imported surface water for recharge purposes.

Where ground water users, such as municipalities, have the ability to use either ground or surface water, the replenishment assessment gives the district effective control over how much ground water is pumped. When surface water is abundant, the replenishment assessment can be raised to the point where it is cheaper to purchase surface water rather than pump ground water (including payment of the replenishment assessment). As recharge operations continue, the amount of ground water in storage will increase during periods of plentiful surface water. When surface water is less plentiful, water stored in the ground water reservoir is available for use.

B. Washington Law: Management of "Project Ground Water"

Washington water law also permits management of water stored underground. Washington statutes define ground water in two separate categories: naturally occurring ground water and artificially stored ground water.[68] Any person who has artificially stored water underground can file a claim with the Washington Department of Ecology. If the Department accepts the claim of stored ground water, special rights to use that ground water are granted to the storing entity.[69]

The Department has recognized a claim of artifically stored ground water by the Federal Water and Power Resources Service (formerly the Bureau of Reclamation). The Service operates the Columbia River Basin Project in northern Washington. For over forty years seepage from project surface irrigation has slowly moved as ground water from the upper toward the lower part of the project area. This ground water is captured in a surface reservoir for project reuse. In this process ground water levels have risen dramatically since the 1950s. The Service has claimed that this ground water is artificially stored ground water subject to Service control.

The Department has recognized these claims. Before a state permit can be obtained to drill a well within the area of the Service artificially stored ground water, one must first contract with the Service to purchase artifically stored ground water. In effect, the Service is selling ground water just as it sells surface water. In

68. WASH. REV. CODE ANN. § 90.44.035 (Supp. 1978).
69. *Id.* § 90.44.130 (1962).

addition, the Service can, through its contracts to sell ground water, insure that ground water withdrawals do not intefere with reservoir operations.[70]

Integrating the use of ground water can result in more efficient water use and avoid some of the costs and controversies of surface water development. Whether the objective is to recharge depleted ground water reservoirs, as in California, or to integrate the management of water incidentally stored underground as part of a total irrigation project water supply, as in Washington, taking advantage of conjunctive management opportunities can be a significant tool for managing scarce water supplies more effectively.

VII. THE FEDERAL ROLE IN WESTERN WATER LAW REFORM

How can the federal government influence state water law reform? One way is through federal water planning grants to states. The federal government has provided water planning funding to the states to insure that federal water development projects are consistent with state water plans.[71] Federal guidelines for use of these funds could require the states to focus on policy issues such as irrigation water use efficiency, ground water mining, protection of instream flows, resolution of conflicts between users of ground and surface water, and conjunctive management of ground and surface water instead of simply planning for water development projects. Federal agencies, such as the U.S. Geological Survey, the U.S. Fish and Wildlife Service, the Environmental Protection Agency and the Water and Power Resources Service could assist by providing technical information for these policy studies.

In addition to using the state water planning process to analyze policy alternatives, the federal government could consider water policy reform objectives as it plans and manages water development projects.[72] Irrigation water use efficiency, energy conservation, water quality protection, integrated ground and surface water use, and instream flow protection could all be integrated into pro-

70. *See* Thorson, *Storing Water Underground: What's the Aqui-Fer?*, 57 NEB. L. REV. 581, 606-09 (1978). One potential problem in managing ground water as part of a federal reclamation project is that the 160 acre limitation may be violated. *See* Taylor, *Excess Land Law: Calculated Circumvention*, 52 CAL. L. REV. 978 (1964); Comment, *Recapture of Reclamation Project Ground Water*, 53 CAL. L. REV. 541 (1965); Comment, *Project Ground Water: Problems and Possible Solutions in Application of the Federal Reclamation Act to a Disputed Resource*, 44 WASH. L. REV. 259 (1968).
71. 42 U.S.C.A. § 1962c (West Supp. 1979).
72. Revised procedures for evaluating federal water projects are part of President Carter's 1978 water policy proposals. *See* W. VIESMANN, *supra* note 13, at 125-27, 17-20.

ject planning, evaluation, and design. Federal rescue efforts to provide a supplemental water supply to areas experiencing ground water mining could be conditioned on *bona fide* local efforts to better manage ground water supplies. In evaluating surface water supplies for a water development project, reduction in streamflow caused by ground water withdrawals could be evaluated.

Perhaps the most important water policy contribution the federal government could make would be to better integrate its own water programs.[73] Federal environmental and fish and wildlife officials are often at odds with federal reclamation officials regarding a proposed federal project. Until these and other in-house conflicts are resolved, the federal government is not in a strong position to criticize state water rights laws.

VIII. CONCLUSION

For years critics have assailed western water law as being archaic, inflexible, and inefficient. While these criticisms are largely justified they tend to ignore the historical setting in which western water laws developed. As public values have changed, technical innovations occurred, and knowledge of physical and environmental systems increased, the appropriateness of features of western water law can legitimately be questioned. As this commentary illustrates, western water laws can be reformed to accommodate these changes. The primary obstacle to these reforms is not the absence of legal models to obtain reform objectives, but social, economic, and political objections to those objectives. Critics could more constructively determine why defenders of the status quo resist change, and develop alternatives which accommodate development as well as reform objectives. The state water laws described in this commentary indicate that such accommodations are possible, and are being used to address water law reform objectives.

73. Improved planning and management of federal water resources programs are one of President Carter's 1978 water policy proposals. *See id.* at 125-28, 17-26.