WATER ALLOCATION UNDER ADMINISTRATIVE REGULATION: SOME ECONOMIC CONSIDERATIONS*

Clyde Kiker and Gary D. Lynne

Increased competition and conflict among users of water have caused eastern states to investigate alternatives to their common law doctrines dealing with water use, and the legislative trend is toward greater state administration in water management. As a part of this trend, Florida has enacted an administrative water law (Florida Water Resource Act of 1972 [4]) based upon a model water code suggested for eastern states [11]. The economic efficiency implications of the allocation processes allowed by the code and the Florida act are examined herein to indicate how more effective use of basic economic principles could increase efficiency of water allocation under an administrative system. Since the present body-of-water law has evolved over time and any modifications must be consistent with this body of law,[1] eastern surface and groundwater law is reviewed first. Then, water allocation under administrative water law, with a focus on the code and the Florida water act, is discussed. Alternative approaches to water allocation which have potential for improving economic efficiency are discussed last.[2]

EASTERN WATER LAW

The states of the Union have evolved systems of law under which acquisition, use and protection of water rights are controlled and regulated. Humid eastern states[3] evolved common law doctrines, while the arid western ones adopted a prior-appropriation doctrine. In addition, several states chose to recognize both doctrines.[4]

The physically abundant water supplies of the eastern states led to a body of law which viewed water as property—the property of no one to be shared by everyone. These are common law doctrines. Rights to navigable waters were covered in the riparian doctrine. Owners of land adjoining a navigable lake or stream are entitled to the full natural flow. Others are entitled to use the waters for fishing and navigation. Taken literally, the doctrines preclude removing water from, or depositing any foreign substance into, the navigable water. The doctrine has been modified through case law over time, and presently, the user may make "reasonable use" of the water for any purpose not unduly interfering with "reasonable use" of other riparian land owners [5, 12, 16].

The groundwater law of the East also stems from common law doctrines. English common law considered groundwater below an individual's land to be absolutely owned by him. The right to water was based on a rule of capture, with allocation based simply on the amount one could pump. This doctrine

Clyde Kiker and Gary D. Lynne are Assistant Professors, Food and Resource Economics Department, University of Florida.

*Florida Agricultural Journal Series No. 133.

[1] New statutes modify many aspects of existing water law and specific parts will be ultimately tested in the courts. It is not possible to foresee the outcome of these cases, but it is reasonable for economists to attempt to understand the evolved law and make suggestions that are not likely to conflict with this law.

[2] The authors recognize that a substantial body of literature has been developed around the relationship between economics of water allocation and the western prior-appropriation doctrine. Eastern common law water doctrines stem from an entirely different legal basis and this relationship has not been developed.

[3] Eastern states are considered to be all states east of, and including, Minnesota, Iowa, Missouri, Arkansas and Louisiana.

[4] Federal government also had a large influence, through various actions, on water use. It is useful for purposes of this paper, however, to limit the discussion to state laws and their influence on water-use rights.

worked well when there was little use of the groundwater [5, 12].

As greater use (and the resulting competition) of groundwater arose, two other doctrines evolved; namely, the reasonable use and correlative rights doctrines. The reasonable use doctrine allows any reasonable use of groundwater on the land from which it was removed. Water may not be taken and used on lands other than that from which it was pumped. The landowner was given a right to develop groundwater and land without regard to the external effect that might be created [5, 12]. The correlative rights doctrine requires landowners to apportion the common groundwater supply. "Reasonableness," for this case, is the balance of co-equal and co-extensive rights of affected landowners [5, 12].

Conflicts between individuals over available supplies of both surface and groundwater are settled by civil litigation under the common law doctrine. With ample supplies and low usage of water (such as in eastern states until recent time), this approach to allocation facilitated adjustment of conflicts among users in accordance with the demands of each and dictates of general "public interests." There was little interdependence in utility and production function during this time. The doctrines provided each landowner with a degree of flexibility which allowed new uses or expansion of old uses in light of changing conditions of water use and supply.

As populations grew and society become more complex, criticism was leveled at the common law doctrines because they often indirectly prevented more efficient use of a state's water resources. Economic efficiency is not necessarily considered in common law, since almost all uses are considered equally valuable. This problem is compounded because the doctrines do not provide for use of water on lands other than from which it originated. A great deal of uncertainty is created for the user as the concept of reasonableness changes over time in response to case law. Indeed, extent of a landowner's right of reasonable use can be determined only by expensive litigation, often of long duration, and then only with respect to the other litigant. Growing concern over adequacy of the common law case-by-case approach has led many states to move toward considering statutory means for dealing with water quantity and quality problems. The Florida act and the Model Water Code, both of which offer an administrative approach to water rights allocation and regulation, are cases in point.[5]

ADMINISTRATIVE REGULATION

The stated, legal intent of statutory regulation of a state's water resources is to enhance public and private water rights by considering hydrologic interrelationships of all types of water, minimizing uncertainty (providing security), and providing flexibility that will allow maximum beneficial use of water and eliminate waste [11]. The question that arises is: What are the implications for economic efficiency and distribution under administrative regulation with these objectives? The administrative structure outlined in the code and implemented in the Florida administrative system will serve as an example in addressing this question.

The Florida Water Resources Act of 1972 declares that " . . . all waters in the state are subject to regulation . . . " [4, Part 1, Sec. 4].[6] To perform this regulation, the act authorizes a state water plan and establishes a two-tiered state and local administrative structure. A state environmental regulation agency exercises a coordinating and planning role, while actual administration at the local level is assigned to five water management disctricts (hereinafter referred to as the districts), established along hydrologic lines. Stated intent of the act is to provide for management of water for efficient use and conservation, as well as for protection of natural resources, fish and wildlife, and public health and welfare [4].

The heart of the water regulation process is a permit system administered by the districts. There are two types of permits, regulatory and consumptive use. Regulatory permits provide control over physical modifications of the water resource system [4, Parts III and IV]. A permit of the consumptive use type must be obtained for removal of water from all sources for all uses except domestic consumption by individuals. Permits may be granted for up to twenty years [4, Part II], but at present are being given for shorter periods. For a permit to be granted, it must be established that the proposed use is a "reasonable-beneficial use,"[7] will not interfere with any presently

[5] Several western states (California, Idaho, Kansas, Nebraska, New Mexico, Oregon, Utah, Texas and Washington) have administrative water control agencies empowered by law to handle the water claims of appropriators, to approve or disapprove transfers and to resolve conflicts; however, these have as their institutional roots western water law [6].

[6] Waters in the state are defined as " . . . any and all water on or beneath the surface of the ground or in the atmosphere . . . as well as all coastal waters within the jurisdiction of the state . . . " [4, Part I, Sec. 2 (9)].

[7] The act defines "reasonable-beneficial use" as " . . . the use of water in such quantities as is necessary for economic and efficient utilization, for a purpose and in a manner which is both reasonable and consistent with the public interest . . . " [4, Part I, Sec. 2, (5)].

existing legal use (a permitted use), and is consistent with the "public interest" [4, Part II, Sec. 3 (1)]. In fact, the act generally emphasizes what it terms public interest considerations. For example, in the case of water shortages (insufficient water to meet permitted quantities, or conditions being such that water use should be reduced to protect water resources from "serious harm"), the Board may impose restrictions in light of the "public interest" [4, Part II, Sec. 10 (3)]. As such, the legislation appears to have greatly enhanced public rights in determining water allocations [10]. The question is: How will private rights fair under the act? The act is not specific as to private rights.[8] The districts have, however, developed criteria for giving permits to private users.

Generally speaking, the water permitting-allocation procedure is currently based on technical criteria. The recognized "entitlement" to water is related to the long-run availability of water from the specific source (the physical supply), as compared to the amount of water "required" by the proposed "reasonable" use. The following example, representative of the approach for an agricultural use permit, will serve to clarify.

A producer applies for a groundwater permit to irrigate a 160-acre citrus grove. The district determines maximum evapotranspiration requirement for the crop (i.e., the optimum, maximum plant growth water requirement). His "entitlement" becomes either (1) the quantity of water annually recharged to the aquifer from all his owned land (which may be more than 160 acres), or (2) the quantity of water required to make up the difference between evapotranspiration and average precipitation. The producer is given a permit for the smaller of these two quantities, as long as he does not significantly affect surrounding users of water with his pumping (externalities are banned). Obviously, there are no economic efficiency principles being utilized in this technical criterion.[9]

The act is also unclear with regard to how use is to be shifted from "old" to "new." Current practice by the districts ties the water right to land ownership for a certain period of time (up to 20 years), or until the land is transferred to another owner, whichever is shorter. The right is extinguished if an attempted transfer occurs [16, p. 18]. Under this system, shifts from "old" to "new" uses can occur only when the permit terminates. As a result, as soon as physical supplies are all allocated (all rights assigned), economic activities having higher valued uses (if any exist) will be excluded.

The act also provides little information on how water is to be divided in a water shortage or emergency. A water shortage plan is to be developed by each district [4]; the plan is to include classification of permits according to source, method and use. In periods of water shortage, the Board may order temporary reduction in total water use, impose restrictions on one or more classes of permits, make changes in conditions of an individual's permit, place restrictions on his use of water or suspend his permit [4, Part II, Sec. 10 (6)]. And, in the case of an emergency they may apportion, rotate, limit or prohibit the use of the district's water resources [4, Part II, Sec. 10 (7)].

There is, then, a great deal of uncertainty associated with an individual's right to water. Whether his right will be enhanced or diminished will depend upon administrative discretion. This has caused Trelease [15] to conclude that the code has substituted administrative uncertainty for the legal uncertainties of common law doctrines. His comment is also apropos to the Florida Water Act.

ALTERNATIVE WATER ALLOCATION APPROACHES

Water, as a source of service flows to private uses, does not lend itself readily to open market allocation, because (in part) of the substantial public service flows it also provides. In fact, under the common law doctrines, many of these public uses precede the rights of private users. While the Florida administrative system places public interest foremost, it uses a technical, and potentially inefficient (economically), water right allocation approach. However, there are ways to modify eastern water law to improve allocative efficiency.

Assume the administrative authority, through some type of broad benefit-cost calculus, has established that a given, fixed flow of water in a watershed or groundwater basin shall be allocated in a certain

[8] Wadley [16, p. 13], in a legal interpretation of the act, has stated that although riparian rights remain, "... Any consumptive use or extraction is now regulated by statute." He further stated that, "Few, if any, common law rights to groundwater remain unaffected by the recent statute."

[9] As a side note, present value of a 10-year permit for the 160-acre citrus grove (using a discount rate of 10 percent) is $106,000 (based on net returns to irrigation water of $108.19 per acre per year as estimated by Renolds, *et al*, [13]). Current practice involves giving this permit for the cost of an application fee.

manner such as to satisfy public interest.[10] The question faced by the authority is how to efficiently and practically allocate remaining water rights among private users. Harl [5] and Trelease [15] have addressed this question. Their viewpoints representing basic approaches typically suggested by economists and lawyers are discussed below, along with a third approach we feel has merit.

Harl [5] has recommended an approach for Iowa, which has a permit system [7] similar to the one suggested in the code. Iowa's permit system does not allow free transfer of permits and thus precludes allocation of water rights in a market. Harl noted that optimal allocation of a fixed supply among independent productive uses occurs at the point where value of the marginal product of water in all uses is equal [5, p. 32a]. He suggested a system of ad valorem taxation could have an allocative effect similar to a market system.

The authors find Harl's recommendations a step in the right direction, but have reservations about their applicability in a rapidly changing state (like Florida). The approach of allocating permits at the value of the marginal product, for example, does not deal with the problem of time dynamics of water allocation. Even if this rule is used to give out initial permits, the resulting resource allocation would be optimal over the life of the permit only if there is very little change in production systems and in communities' water use. In a growth situation, the burden is placed on the water authority to project growth in water use and to establish the value in various uses over time. This "solution by directive" [3] would be extremely costly, even if value in use remained constant over time. Costs of discovering all such use functions (especially if they change over time) are exorbitant. Costs of such knowledge could exceed the benefits gained in economic efficiency.

Trelease [15] has suggested that eastern states use the administrative structure presented in the code in conjunction with the appropriation doctrine used in western states. He points out that the administrative structure in the code will adequately protect the resource, the environment and public interest. His criticism deals with provisions for private rights to water. Essentially, he is arguing for greater security and flexibility in private rights to water, which he believes the appropriation doctrine[11] provides.

There are, however, several aspects of the appropriative doctrine which can be viewed as objectionable. First, if water is interpreted to be public property, there is an obvious windfall gain to the superior appropriators when a right-to-water is granted in perpetuity [11]. As demonstrated in the citrus grove example, this windfall gain can be quite large. The situation is further aggravated if it is necessary for the administrative agency to recover water rights to protect the public's interest; they must purchase back the rights to water which were granted initially for no charge. Second, groundwater has also given the western states problems [9], and is likely to do so in the East. The question is: Who is appropriating what water? There is no clearly defined flow of groundwater as there is with streams; groundwater is diffused and availability can change with pumping patterns. Many western states have statutorily modified these groundwater doctrines to protect public interest [9, 14]. Other authors [2, 6] have pointed out economic shortcomings of the allocation systems used in appropriation doctrine states and California.

As an alternative, the authors feel some features of a competitive market can and should be adopted in order to solve the water allocation problem over time and space.[12] A "pseudo-market" could be developed with the administrative authority serving as a clearing

[10] The authors do not wish to relegate the decision that must be made regarding the choice between private and public interest to the unworthy position of noneconomic importance; i.e., economic principles could (and should) also be applied in allocation decisions between public and private uses and within (and among) public uses. We are also practical, however: public interest, in many cases, involves dealing with the Samuelson type of "public good," problems of measurability, and, certainly, involves the consideration of a multiple objective function. We see some currently insurmountable problems in allocating the water rights needed to satisfy public interest in a market system. At best, transactions costs would only be higher. At worst, a market could not and would not operate at all. This is not to say that economic principles should not be used in the public sector. We simply see less hope for establishing a market, clearing house operation. Therefore, at least as a starting point, it seems public interest should be satisfied through a somewhat arbitrary (but based on "educated guesses" and contingencies) decision process regarding the water "needed."

[11] The prior appropriation doctrine, as used in western states, has evolved with state administration to keep the private rights to water orderly. Essentially, the doctrine (1) gives exclusive right to the first appropriator, and rights of later appropriators are conditional upon these prior rights; (2) makes all rights conditional upon beneficial use; (3) permits water to be used on nonriparian lands as well as on riparian lands; (4) permits diversion of water regardless of the diminution of the stream; and (5) allows loss of the right due to nonuse [8].

[12] Bain, *et al.* [2, p. 666] have recognized the need for marketable water rights in California. They state, "Throughout our study, we have noted that a striking attribute of the California water industry is its consistent failure to develop continuous markets for water and water rights. And this failure, we have stressed, is in a significant part responsible for failure of agencies in the industry to correct historical misallocations of water among uses, users, and sites of use or to reallocate water when changing economic conditions made such reallocation desirable."

house or "arena" within which the market could operate. The administrative authority would allow for sale of transferable "water certificates," where each represented an entitlement to a water flow that could be pumped from a particular sub-region of a district. Each certificate would give property right to water for some particular period of time. During the time period, certificates would be transferable between water users under supervision of the water authority. At the end of the period, the certificates would revert to the water authority and could be offered for sale again.

More specifically, the pseudo-market system could operate in the following way. The authority would issue certificates (on a bid basis) the first year, having varying time periods, with a maximum of t years (and others with lesser periods). All rights to water available for private use in a particular area (X_t, the total supply) would be offered for sale.[13] To start the process, t different types of permits would be issued, each having a different time duration (measured in years) specified by t—1, t—2, ..., 1. The proportion to be issued for each time duration should be 1/t. The actual amount of water represented by a certificate would be some common, known measure X_a. The total number of permits available the first year is given by:

$$N_t = \frac{X_t}{X_a}$$

where

N_t = number of permits available for sale
X_t = total available supply of water
X_a = quantity of water represented in a particular permit.

The number of certificates in each time duration class (N_c) is represented by:

$$N_c = \frac{1}{t} N_t$$

That is, the authority could sell N_c certificates in each of the time duration classes the first year. Every year thereafter, N_c certificates would expire and N_c certificates could be sold—the latter having an effective life of t years. Each certificate would provide an entitlement to a flow of water, X_a, in normal hydrologic periods. In periods of water supply shortages, the entitlement X_a would be reduced in proportion to the reduction in overall supply, X_t.

During the life of these certificates, individuals could buy and/or lease certificates from other individuals at any price they could negotiate.[14] Water users would deal with water in much the same way they deal with other factors of production. This would increase water use efficiency among uses and users. Also, requiring N_c permits to expire each year gives flexibility to the administrative authority. In any particular year, it could choose, for example, to retain N_r certificates in a particular area for "public interest" or some other use. The maximum number of certificates that would be circulating in the "market" at any point in time would be N_t. The authority could cause the number to be reduced to (N_t—N_r) in any one year, by not reissuing N_r certificates, or by buying certificates in the "market." The authority could protect "public interest," then, by being an active participant in the market as well as by retaining N_r certificates in any given year.

Revenues from the sale of certificates could provide funding for normal water management functions. Presently, these funds usually come from general revenues. The water authority could also use revenues to enhance the value of water certificates by reducing hydrologic uncertainty (e.g., by stabilizing supplies through construction of water conservation facilities and/or transfer of water from water-rich basins to water-deficient areas).[15]

There are, of course, many problems that would have to be resolved in implementing the proposed system. Selecting the time duration, t, for certificates is of particular interest. Optimum life for certificates will depend on types of use and capital investment problems associated with these uses. Defining available supply, X_t, in a particular area is also a difficult problem, but one with which all allocative systems must deal. There is, also, the problem of individuals attempting to control large quantities of certificates and manipulate the market price of certificates to

[13] The problem of determining X_t is not a simple one. Because of the large number of nonmoney valued benefits (and costs) flowing from the water resource, it seems a realistic starting point would be to define X_t as the total quantity of water available for use to the private sector; i.e., X_t is the water supply remaining after the many "public uses" (like minimum stream flows, pollution abatement, salt water intrusion prevention, wildlife preservation, etc.) are subtracted from the total quantity available (see footnote 10).

[14] Administratively controlled irrigation water rental markets similar to this exist in some western states using the appropriation doctrine and are described in Anderson [1].

[15] It should be noted, however, that the act allows water to be used on land other than riparian or overlying land, as long as the physical transfer is in the "public interest."

their advantage. This could possibly be minimized by requiring the water authority to monitor certificate transfer. The authors feel, however, gains in economic efficiency should exceed costs. Enforcement costs (ensuring holders of certificates do not withdraw more water than the purchased entitlement) may be high; however, these costs would also exist for the current Florida (technical) allocation system as well as for the Harl and Trelease approaches. Further research needs to be undertaken to determine costs and, in general, to better evaluate the proposal.

SUMMARY AND CONCLUSIONS

Change is likely to occur in the water allocative systems of most eastern states. In the past, little conflict arose among water users, as water was not a scarce resource. Presently, uses and users of water are many (public and private), and competition for the supplies is increasing. States are looking to statutory modification of their water institutions to resolve the conflict among uses and users. The trend is toward greater administrative control.

In the past, economic principles have played almost no role in water allocation in the East.[16] Economic principles can, however, be used in allocating water, at least among some uses. The authors believe, especially, that economic principles can be incorporated into water allocation among private uses, thereby improving economic efficiency, and still be compatible with the broader "public interest." The authors further believe economists cannot stand by while allocative institutions are restructured; technical criteria for water allocation are not sufficient for the task. Economists must put forward practical approaches and make decision bodies aware of possibilities for improving the water allocation process. Of the three allocative approaches discussed, it is not clear which is economically superior. Each has its conceptual strengths and weaknesses. Empirical research over time will help identify the best system. The approach recommended by the authors is but one step toward a practical approach.

REFERENCES

[1] Anderson, R. L. "The Irrigation Water Rental Market: A Case Study," *Agricultural Economics Research*, April 1961.

[2] Bain, J. S., R. E. Caves and J. Margolis. *Northern California Water Industry*, Baltimore: The Johns Hopkins Press, 1966.

[3] Davis, O. A. and M. I. Kamien. "Externalities, Information and Alternative Collective Action," in *The Analysis and Evaluation of Public Expenditures: The PPB System*, U.S. Government Printing Office, 1969.

[4] Florida Water Resources Act of 1972, Florida Statutes 373.013, *et seq.*

[5] Harl, N. E., R. A. Baldwin and D. W. Hubly. *An Analysis of the Economic Implications of the Permit System of Water Allocation*, Iowa State Water Resources Research Institute Report, ISWRRI-43, November 1971.

[6] Hartman, L. M. and D. Seastone. *Water Transfers*, Baltimore: The John Hopkins Press, 1970.

[7] Hines, N. W. "A Decade of Experience Under the Iowa Water Permit System—Parts 1 and 2," *Natural Resources Journal*, 7:499-554, October 1967, and 8:23-71, January 1968.

[8] Huffman, R. E. *Irrigation Development and Public Water Policy*, New York: The Roland Press, 1953.

[9] Hutchins, Wells A. "Groundwater Legislation," in *Economics and Public Policy in Water Resource Development*, S. C. Smith and E. N. Castle, Eds., Iowa State University Press, 1964.

[10] Kiker, C. F. "Public and Private Rights Related to Water Use," in *Water Resources: Utilization and Conservation in the Environment*, M. C. Bount, Ed., Georgia: Fort Valley State College, 1975.

[11] Maloney, F. E., R. C. Ausness and J. S. Morris. *A Model Water Code*, University of Florida Press, 1972.

[12] Maloney, F. E., S. J. Plager and F. N. Baldwin. *Water Law and Administration*, University of Florida Press, 1968.

[13] Reynolds, J. E., J. R. Conner, K. C. Gibbs and C. F. Kiker. *Water Allocation Models Based on an Analysis for the Kissimmee River Basin*, Florida Water Resources Research Center Publication No. 26, December 1973.

[14] Smith, Stephen C. "Problems in the Use of the Public District for Ground Water Management," *Land Economics*, August 1956.

[16] Economic principles have, of course, been used in benefit-cost analyses of public investments in large scale water control systems. Few have been used in water allocation among private users.

[15] Trelease, F. J. "The Model Water Code, the Wise Administrator and the Goddam Bureaucrat," *Natural Resources Journal*, 14:207-229, April 1974.

[16] Wadley, J. B. *A Summary Guide to Florida's Water Rights*, Extension Service Circular 412, Institute of Food and Agricultural Sciences, University of Florida, 1976.