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APPROPRIATION AND COLORADO'S GROUND WATER: A CONTINUING DILEMMA?

Underground water in the United States is a significant source of an increasingly precious commodity; nearly one-fifth of the country's withdrawal needs were met from underground supplies in 1963, and the proportion is expected to reach one-half in the foreseeable future. In 1960, six and one-third billion gallons were taken each day from subsurface sources, a consumption double that of a scant fifteen years ago.

In Colorado and other semi-arid western states, the demands of irrigation place an even greater pressure on ground water. While Colorado's surface streams provide roughly sixteen million acre feet of water annually, three of the state's four major ground water reservoirs contain an estimated 177 million acre feet of water. The fourth, underlying the San Luis Valley in south central Colorado, stores two billion acre feet. From these resources, nearly two and one quarter million acre feet of water were drawn in 1959, and utilization is mushrooming. In 1929 less than 810 irrigation pumps were in use in the state's four major basins; in 1959 the total had risen to approximately 8,900, a ten-fold increase. The four year period following 1960 produced a fifty-five percent increase in the number of wells drilled in Colorado, and in 1964 alone, 5,911 wells were completed.

Such statistics are foreboding indicators of the burgeoning rush to board Colorado's underground waterwagon. Even vast underground re-

3. Ibid. 86% of the water consumed on a national basis in 1960 was used for irrigation. Piper, Has the United States Enough Water? 14 (Geological Survey Water-Supply Paper No. 1797, 1963). In Colorado in 1959, 95% of the ground water taken from three of the four primary underground reservoirs was used for agricultural purposes. McGuinness, The Role of Ground Water in the National Water Situation, supra note 1, at 209.
4. Of this amount, only about one-third is available for use in the state. The remaining eleven million acre feet must be delivered to downstream states in compliance with interstate compacts and decrees. Colorado Legislative Council, Water Problems in Colorado 1 (Research Publication No. 93, 1964).
5. The South Platte Basin in north-central and northeastern Colorado; the High Plains of eastern Colorado; the Arkansas River Basin in southeastern Colorado.
sources are not inexhaustible. Surface stream flow rights may be affected, water tables can be depressed to unreachable depths, and the allocation of available supply among claimants may often give rise to economic, legal and administrative conflict. "Our superabundance of water has given us a false sense of security. We take for granted that which is our great necessity. The sooner that we realize water is a commodity, the sooner we will move to protect it."10 Fortunately, events of the past three years demonstrate that Colorado is on the threshold of such a realization. But unfortunately, realization and implementation are not identical; the gap between understanding the problems involved in water resource management and providing workable solutions may be wide. Indeed, "[l]egislation relating to underground water is one of the prickliest thorns with which the legislator is confronted."11 The present material is directed to an examination of several of these hydrologic and legal nettles, together with a discussion of the various legislative and administrative efforts to prune the bramble into a functional system of integrated water regulation.

I. CONTRASTING CONCEPTS OF LAW AND HYDROLOGY

The hydrologist's view of sub-surface water involves two important principles which have been traditionally unacceptable to the courts of this state. The first is a conjunctive definition of underground water without sub-classification according to proximity to surface flow or supposed movement. The second is the role of underground water in relation to the total water resource of the state; engineers insist that the relationship between ground and surface waters makes their separate administration unrealistic. Colorado courts have not wholeheartedly shared these views.

A. The Sub-Definitions of Ground Water

Hydrologists offer unified definitions of ground water. "Ground water includes all of the waters found beneath the surface of the ground."12 Some elaborate. "Ground water is the water of the zone of saturation . . . under hydrostatic pressure in the pores and crevices of the rocks that is free to move under the influence of gravity from places where it enters . . . to places where it is discharged."13 In short, "ground water . . . is all water in the ground."14

COMMENTS

The repository or structural container in which underground water occurs is termed a "ground water reservoir" or "aquifer". In general, each aquifer is filled with permeable material such as sand, gravel or clay, in which the subsurface water is intermixed and relatively confined. As indicated, Colorado is fortunate in having at least four such reservoirs beneath its boundaries.

The Colorado Supreme Court has refused to adopt an integrated definition of ground water. A distinction is made between water which is "tributary" to surface streams and water which is said to "percolate". The result has been application of different legal doctrines to each of these ostensibly different water sources.

According to this distinction, a definite underground stream has the characteristics of a watercourse on the surface—a definite channel with bed and banks, definite stream of water, and definite source or sources of supply—whereas percolating waters comprise all ground waters that do not conform to the definition of a definite underground stream.

Consistently this judicial invention has been rejected. "[A]s a general rule no scientific distinction can be made between the water legally classified as 'percolating' and that in a 'defined underground stream.'" Several states have abolished the disparity. Even the Colorado courts cushion the impact of the misconception with a legal presumption that all ground water is tributary to surface flow, thereby shifting the burden of proof to the claimant who asserts the contrary.

conditions." Id. However, this broad definition is to be distinguished from the more complex concept of "designated ground water" outlined in sub-section (3) of the same statute. Note 24 infra.


16. Note 5 supra.

17. See, e.g., Whitten v. Coit, 153 Colo. 157, 385 P.2d 131 (1963) (non-tributary ground water is not subject to the doctrine of appropriation).

18. 1 R. Clark, Waters and Water Rights 162 (1967).

19. The distinction has been termed "impractical" in Moulder, Legal and Management Problems Related to Development of An Artesian Ground-Water Reservoir 5 (Colo. Ground Water Cir. No. 6, 1962), and a "delight . . . [to] the nonscientific mind . . . " by Shurtz, Some Thoughts on Ground Water Development in Kansas, 32 Rocky Mt. L. Rev. 515, 517 (1960).


21. Idaho, Kansas, Oregon and Wyoming have eliminated the distinction by statute. Hutchins, Ground Water Legislation, supra note 14, at 416 & n.3.

22. Safranek v. Town of Limon, 123 Colo. 330, 228 P.2d 975 (1951). In most western jurisdictions, the presumption is that waters are percolating. Hutchins, Ground Water Legislation, supra note 14, at 417.
The Colorado legislature has made a curious effort to partially discontinue the percolating-tributary dichotomy and provide uniformity in regulation of competing well users by extending the rule of prior appropriation to all “designated ground water” in the state. By definition, however, the remedy is not total, and remnants of the tributary concept remain woven in the statutory provisions of the Underground Water Management Act. A quasi-acceptance of the hydrologist’s view is thus reflected in the Act, although outright recognition of all subsurface water as a single, unified supply has not yet been achieved. The importance of abandoning any unfounded discord between legal doctrine and geologic reality rests in the urgent need to deal consistently with Colorado’s total water resource.

B. Recognizing the Role of Underground Water

As long as surface water supplies remain adequate to meet the requirements of users, little attention is likely to be given to the correlation between underground water withdrawals and stream behavior. Wells in the vicinity may multiply in number and capacity unnoticed or without objection. Economic development in reliance on irrigation wells is commonplace.

[Integration of surface and ground water doctrines and rights of use has not always kept pace with comprehension of physical conditions. Rival claimants to waters of surface streams have usually litigated their relative rights as between themselves, without intervention of owners of wells who depend on ground water . . . and the reverse holds true with respect to most adjudications of ground water rights.]

However, as these independent demands on apparently independent sources increase, hydrologic realities become more apparent. Surface users, left with reduced stream volume, logically turn to well operators as competing junior appropriators; the call for coordinated judicial or administrative regulation comes late, perhaps, but resolutely. The surface-stream relationship can no longer be ignored.

These problems can be settled only by an adjudication of all water rights, based on full recognition of the physical principles governing the movement of water throughout the hydrologic

24. Excluded under the administrative provisions of the act is ground water required to meet surface priorities (thus “tributary” ground water), and ground water which is adjacent to a surface stream (again, “tributary”). Colo. Rev. Stat. Ann. § 148-18-2(3) (Supp. 1965); In Colo. Rev. Stat. Ann. § 148-11-22(1) (Supp. 1965), enacted in the same legislative session, the “tributary ground water” illusion is asserted with similar vigor. The state engineer is directed to apply the doctrine of appropriation to both surface waters and “underground waters tributary thereto.” Id.
cycle under natural conditions and on determination of the changes that have been effected by development.  

Legislative action to correct this “arbitrary and unscientific classification of all waters into surface and ground waters” did not take place in Colorado until 1965. House Bill 1066 ratified the appropriation doctrine as applied to tributary ground water and brought offending well operations under the administrative control of the state engineer, in order to “prevent such diversions from materially injuring the vested rights of other appropriators.” The result was a long overdue statutory recognition of the interplay of subsurface water in the hydrologic environment. To this extent, the enactment was an essential forward stride in the development of the state’s water assets.

**C. The Other Side of the Coin**

Reaching the point of understanding that “[a] model water law must take this interrelation into account and cover both surface and ground waters under a single legal principle” is plainly a prerequisite to the implementation of a useful framework of laws with which to govern the state’s ground water use. However, this is only a first step. Recognition of a total water resource demanding coordinated administration gives rise to far more troublesome questions concerning the legal formulas most suited to achieving the desired end. These are questions which have not been adequately answered by Colorado’s 1965 ground water legislation.

The physician who diagnoses a serious illness in his patient but prescribes an experimental overdose of medication may only be adding to the patient’s difficulties. The Colorado legislature has prescribed the

29. Prior to this enactment, the doctrine of appropriation was held applicable to tributary underground streams. Safranek v. Town of Limon, 123 Colo. 330, 228 P.2d 975 (1951). However, without clear legislative direction, the state engineer was unwilling to extend his supervision to well operations. Moss & Vranesh, *Colorado’s New Ground Water Laws*, 38 U. Colo. L. Rev. 295, 300 (1966).
32. The 1965 legislation has been recognized as a foundation for subsequent statutory clarification. “In fact, in view of the substantial problems that were allowed to develop over the years, additional legislative action will undoubtedly be necessary in the future based on the effects and experience developed over the next few years.” Colorado Legislative Council, *Implementation of 1965 Water Legislation*, supra note 28, at xxvii.
II. APPROPRIATION IN ACTION

The Colorado system of appropriation was tailored to the conditions of surface stream diversions in an arid western climate. To the extent that underground water and surface water share common characteristics, expanding appropriation concepts to solve ground water problems may be valid. Yet a failure to acknowledge variations can result in unwarranted distortions of the relationship between stream and well. The following comparisons point out several important differences.

<table>
<thead>
<tr>
<th>Environment and the Water Resource</th>
<th>Ground Water</th>
<th>Surface Water</th>
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<tbody>
<tr>
<td>Seasonal Availability</td>
<td>only slightly influenced</td>
<td>varies widely according to climate changes</td>
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33. In brief the doctrine holds that title to all water rests in the state or the “public,” that individuals can appropriate water for beneficial use, that as between appropriators “the first in time is the first in right,” ... but that the right is neither contingent on nor proportional to land ownership. Piper & Thomas, Hydrology and Water Law: What is Their Future Common Ground?, in Water Resources and the Law 7, 19 (Legislative Research Center, Univ. of Michigan Law School, 1958).

The alternative principles of reasonable use, correlative rights and absolute ownership have not gained vitality in Colorado. See Mertz, Who Has the Better Right to Non-Tributary Ground Waters in Colorado—Landowner or Appropriate?, 34 Dicta 20 (1954).


36. Recent remarks of the state engineer indicate the serious effects of absolute enforcement of the terms of House Bill 1066. Minutes of the Meeting, Committee on Water, July 20, 1967.


**COMMENTS**

*Environment and the Water Resource* (Continued)

<table>
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<th>may exceed annual recharge for extended periods</th>
<th>limited to annual supplies (minimum storage)</th>
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<td>Accessibility</td>
<td>only a fraction of the total supply is available from a single location</td>
<td>total supply can be withdrawn from a single point</td>
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<td>Transmission</td>
<td>very slow movement</td>
<td>rapid movement</td>
</tr>
<tr>
<td>Evaporation</td>
<td>negligible</td>
<td>up to 60% loss</td>
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<tr>
<td>Effect of Total Consumption</td>
<td>excess mining may result in aquifer damage</td>
<td>none</td>
</tr>
<tr>
<td>Cost of Diversion</td>
<td>can be substantial</td>
<td>relatively low</td>
</tr>
<tr>
<td>Re-supply</td>
<td>recharge may be minimal</td>
<td>self-renewing</td>
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Undeniably, these fundamental contrasts must be accounted for in order to achieve the desired uniformity and maximum utilization of the fund of water available. One author suggests that consistent results may require adapting different legal principles to accommodate differing hydrologic circumstances. "It is as much an error . . . to apply a water rights doctrine designed for a replenishing resource to a non-replenishing resource as to apply two different doctrines to water which is all part of the same source of supply."39

One of the obstacles in applying appropriation rules to subsurface water is the very slow rate at which ground water moves in an aquifer. Surface stream flow is measured in feet per second; ground water movement may be calculated in feet per year.40 Restricting junior stream diverters in time of shortage brings an immediate increase in volume to meet senior demands. In an underground reservoir, however, the benefit is neither as direct nor as prompt. It is possible that an entire growing season will pass before a senior well or surface right is benefited by regulation of distant junior wells.

In addition, such factors as well size, the transmissibility and saturated thickness of an aquifer, and the spacing of wells did not complicate the century-old problems for which the doctrine was designed. Wells junior in time are frequently scattered at indiscriminate distances and bear random priorities. Although wells closest to a senior diversion frequently will have the greatest impact, appropriation rules look exclusively to seniority, disregarding all-important factors of proximity and actual effect. As a

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result, the first wells called upon to stop pumping must be the most junior wells, even though they may be geographically the most distant and the least offensive to the senior. Strict administration on the basis of seniority would plainly "prevent a full beneficial use of water" in the aquifer.

Because of these complexities, the need for detailed engineering data on well size, location, operation, priority and anticipated effects is essential to an effective application of the appropriation theory to well operations. Wells which number in the thousands cannot be governed by priority where priorities are unknown. Futility calls on distant or even proximate diversions are unavoidable without a precise understanding of the well-surface relationship in each case. And, of course, effective economic planning calls for certainty in supply predictions. Unavailability of, or inattention to, critical information of this type makes it possible to transform well-operators who are located in an overdeveloped aquifer or near surface streams into involuntary dry land operators as they wait for senior rights to come back to life. Much ground water will remain inaccessible to all, sealed from economic productivity by misapprehension of hydrologic fact.

The Colorado Supreme Court has expanded appropriation concepts

41. Colorado Legislative Council, *Water Problems in Colorado* 38 (Research Publication No. 93, 1964) (containing an expanded example of this hypothetical situation).

42. "Extensive hydrologic records and investigations are prerequisite to monitoring the behavior of a ground water body under use. For a few areas and for no state as a whole are such records and results of investigations available." Piper & Thomas, *Hydrology and Water Law: What is Their Future Common Ground? in Water Resources and the Law* 7, 21 (Legislative Research Center, Univ. of Michigan Law School, 1958). However, Colorado State University has undertaken a number of studies on the application of the digital computer to an understanding and prediction of ground water situations. The U.S. Geological Survey has completed an analog model of the Arkansas system and is in the process of assembling data to construct a model of the Platte. The Colorado Water Conservation Board has completed several joint studies with the U.S. Geological Survey in addition to its own continuing research. These are printed in a continuing series of Colorado Ground Water Circulars.

43. For example, on July 20, 1967, the state engineer reported at a meeting of the Committee on Water, that "All in all, along the Platte, there is an ample amount of water to supply current and anticipated needs, with some carry over reservoir water..." Minutes of the Meeting, Committee on Water, July 20, 1967. But on July 31 a total of 16 wells had been shut down on the Platte; on August 1 an additional 56 wells were stopped. See Ft. Morgan Times, Aug. 2, 1967, at 1, col. 3.

44. It is not always certain that well utilization is the major cause of surface shortages.

A water-budget analysis indicates that consumptive use of water in the area has increased concurrently with the development of ground water. Although this suggests a relationship, increase in irrigator-vegetation and changes in agricultural practices also could have caused an increase in consumptive use. Data are insufficient to distinguish the effects of each. Moulder, Jenkins, Moore & Coffin, *Effects of Water Management on a Reach of the Arkansas Valley, La Junta to Les Animas, Colorado* 1 (Colo. Ground Water Cir. No. 10, 1952).
with an eye toward a number of these difficulties. Even so, establishing sophisticated engineering facts might better be committed to properly equipped specialists of a central administration rather than to the courtroom, where private access to such facts is costly and the expense must be borne by the individual litigants. At least a practical barrier, if not a legal obstacle, is created by appropriation rules under these circumstances.

A. Appropriation and Competing Wells

The irregular depth of the saturated zone in each aquifer provides a further example of the difficulties of utilizing appropriation principles to govern well operations. A junior well, situated above a deep portion of an underground reservoir, can be prevented from calling upon the lower storage component of the aquifer where a senior diversion extends to the unproductive bottom of a shallow area. Full development of the resource in storage is blocked by the rights of a user whose efficient but limited location allows him to insist on an economically unrealistic water level throughout the aquifer.

Perhaps more important is the total effect of the appropriation doctrine on planned development and conservation of ground water reserves. Legal theory places no time limit on the usufructuary right secured by diversion of water and application to a beneficial use. But in practice, it is evident that "the airy abstractions of 'rights in perpetuity' in a mined ground water basin have no meaning." For example, underground reserves such as the Ogallala formation of Colorado’s High Plains are in approximate balance if no withdrawals are made. Wells which draw from the system create a depletion of the available total and mark a step closer to exhaustion. Lack of central management under appropriation rules hastens this result in a race for the basin floor. Each user is motivated to draw maximum value from the reservoir, the sooner the better. Delay to

45. "[J]unior appropriators may be shut off if necessary to supply the priorities of senior appropriators, except where juniors who [sic] are so situated that shutting them down would not result in improving the water supply of senior appropriators." City of Colorado Springs v. Bender, 148 Colo. 458, 463, 366 P.2d 552, 555-56 (1961).

46. The illustration assumes that the senior's diversion extends efficiently to the lowest level of the aquifer at his location. If it does not,

[A]ppropriation does not give a right to an inefficient means of diversion, such as a well which reaches to such a shallow depth into the available water supply that a shortage would occur to such senior even though diversion by others did not deplete the stream below, where there would be an adequate supply for the senior's lawful demand. City of Colorado Springs v. Bender, 148 Colo. 458, 462, 366 P.2d 552, 555 (1961).

47. Clark, Ground Water Legislation in the Light of Experience in the Western States, 22 Mont. L. Rev. 42, 52 (1960).

48. When average annual recharge is roughly equal to the average annual discharge, the aquifer is in “dynamic balance.” McGovern and Coffin, Potential Ground-Water Development in the Northern Part of the Colorado High Plains 5 (Colo. Ground Water Cir. No. 8, 1963).
the individual user means going deeper to reach water, at higher pumping costs and increasing uncertainty due to diminishing supply.

The traditional tenet of use or lose in the appropriation doctrine stimulates early depletion... Early use is favored over holding for a later use... If there are numerous rights, collective decision-making relative to when to use the water appears to be the only way to remove this bias in favor of premature depletion.\(^{49}\)

Planned management of available water can hypothetically double the total value of affected farmland if the temptation to seek immediate maximum withdrawal is abandoned in favor of a carefully apportioned consumption.\(^{50}\) Nevertheless, strict appropriation does not include provision for abrogation of individual rights in favor of a comprehensive program and the resulting maximization of stored reserves. It is accurate to conclude that "[e]fficient and equitable management of the groundwater resources of an artesian basin appears impossible under rigid adherence to the doctrine of prior appropriation."\(^{51}\)

At least with respect to the "designated ground waters" of the state, it appears that strict appropriation and its associated rigors will no longer be felt in Colorado. The Colorado Ground Water Management Act extends appropriation rules to defined ground waters, but further provides that "such doctrine should be modified to permit the full economic development of designated ground water resources."\(^ {52}\) Water tables may be allowed to drop below "historic water levels" but a lower limit is set at "reasonable ground water pumping levels."\(^ {53}\) The statute recognizes the need for flexible, local administration\(^ {54}\) of a designated basin, in contrast


\(^{53}\) Id. Unless artificial recharge and waste control activities of an underground water management commission are comprehensive, this latter term may present some ambiguity. Natural recharge does not necessarily improve the water level in an aquifer where pumping pressures are relieved. When recharge and outflow are about equal as in the high plains area, any withdrawal causes a reduction in pumping levels. Total exhaustion of the aquifer is inferentially precluded so presumably withdrawals will be curtailed when "reasonable pumping levels" are exceeded. However, Colo. Rev. Stat. Ann. § 148-18-10(b) (Supp. 1965) hints that any level at which water can be economically extracted, considering the total economic pattern of the area, is "reasonable". Near exhaustion is inferentially included here. The term "reasonable" seems unreasonably elusive. Concern for both individual property rights and the often conflicting community interest in the water resource may underlie this broad phraseology and motivate its chameleon construction.

COMMENTS

the lack of coordination and the “survival of the fittest” attitude inherent in uncontrolled development.\textsuperscript{55}

[T]he act seems straightforward enough, and should not be unduly burdensome to administer. It seems to combine reasonable parts of local control and state supervision into a palatable whole, and should go far to conserve our ground water and implement its efficient utilization.\textsuperscript{56}

B. Appropriation in the Ground Water-Surface Water Conflict

The combination of well and surface priorities is an explosive mixture. Besides the difficulties suggested in inter-well management (which are present and frequently amplified in dealing with surface rights), the point at which well diversions must yield in favor of stream priorities is uncertain.

Colorado’s irrigation wells are almost exclusively junior to surface rights.\textsuperscript{57} It is convenient, but perhaps unsound, to conclude that each well in the vicinity of a surface stream must defer to senior priorities in keeping with appropriation rules. The legislative committee on water had indicated that “[g]round water in aquifers under and adjacent to effluent streams is hydraulically related to the stream flow.”\textsuperscript{58} Recasting this observation in more general terms, a surface appropriator draws not only upon visible surface water to fill his needs, but also relies on the total hydrologic structure to support his diversion. If the stream and adjacent underflow through the ground water reservoir are viewed as a single resource, each surface right necessarily demands both adequate surface volume and favorable underground water levels. On this basis, efficiency in perfecting a diversion of water at the surface alone is arguably only partial efficiency. “[T]he appropriator is not entitled, to command the whole or a substantial flow of the stream merely to facilitate his taking the fraction of the whole flow to which he is entitled.”\textsuperscript{59}

The question is thus raised whether a storage reservoir of more than two million acre feet in the Arkansas Valley or twenty-five million acre feet in the South Platte Basin should be maintained to facilitate surface withdrawals which amount to a small fraction of these totals annually. In view of the hydrologic interrelationship of stream and reservoir, a diversion is not obviously “efficient” if it draws from only a small segment of the total system.

\textsuperscript{55} Moulder, Legal and Management Problems Related to Development of an Artesian Ground-Water Reservoir, supra note 38, at 6.


\textsuperscript{57} Colorado Legislative Council, Water Problems in Colorado, supra note 41, at 36.

\textsuperscript{58} Id.

Moreover,

If . . . [a user] is forced to make changes in his method of diversion because of the effects of a later appropriation, whether surface or ground water, he must do so if he can at reasonable cost; if the cost is unreasonable, the later appropriator may be required to pay for such changes to the extent that their cost is unreasonable.60

Where reliance is placed upon both the surface and the underflow, as it normally is in a river basin system, a "reasonable cost" of diversion might well be extended to include an efficient mechanical call upon the total supply and not merely upon the visible surface portion of the system. Appropriation principles demand that senior rights be protected but also require that senior diversions not be ineffective. Adequacy of diversion facilities cannot rationally be measured in terms of surface supplies alone, in disregard of the total entity of the resource while at the same time demands are being placed upon sub-surface reserves to which the diversion does not reach.

On this basis, added costs of perfecting diversion methods of surface users are in the offing; who will bear the expense, as between surface and well operators, may turn on court interpretation of what is a reasonable cost of an efficient diversion. But the expense must be borne by someone, soon, to avert economic retrogression in areas of the state which rely upon wells for agricultural and municipal sustenance. It is one thing for an economy to readjust itself on the basis of necessarily increased unit costs of water in the search for more profitable applications; it is another matter to throttle development by refusing access to water supplies through inconsistent application of stated appropriation principles.

III. MISGIVINGS SINCE 1965?

Colorado's Ground Water Management Act61 has survived its inception62 with minor difficulties63 and some modification,64 but the ap-

60. McGuinness, Water Law With Special Reference to Ground Water 8 (Geological Survey Cir. No. 117, 1951).
62. Six designated ground water areas have been approved by the ground water commission thus far; a seventh is under consideration.
63. Who is responsible to whom in the administrative hierarchy is a curiosity. The 1965 Act declares, "The state engineer shall . . . carry out and enforce the decisions and orders of the [ground water] commission." Colo. Rev. Stat. Ann. § 148-18-3(6) (Supp. 1965). However, an earlier statute places the state engineer at the head of the agencies within the division of natural resources. "The division of natural resources shall consist of . . . the division of water resources, the head of which shall be the state engineer. The division shall consist of . . . the ground water commission." Colo. Rev. Stat. Ann. § 3-15-4(1), (9)(a), (9)(f) (1963). Mr. George Colburn, senior engineer of the ground water section, indicates that the ground water commission functions in a policy making capacity and the state engineer serves an enforcement role.
64. Delays in issuance of well permits have also caused some difficulty under
propiation features of the statute have remained generally undisturbed.

House Bill 1066, on the other hand, has not been so graciously received. The Colorado Supreme Court has not had an opportunity to deal with the legislation, but other sources of evaluation have been plentiful. "An effort made by the last legislature to solve at least part of the ground water problem doesn't seem to have worked out." Already decades late, the law also proved far too little to handle the serious problems spawned in years of uncontrolled drilling and pumping."

Public dissatisfaction may rest partly on misunderstanding, but equally as probable, the ire comes from understanding too well:

"[I]n the absence of any other specific statutory language prior to 1965, individual farmers in Colorado invested thousands of dollars in developing underground water as a source of supply for their crops. It is no wonder, then, that . . . House Bill No. 1066 . . . was considered as a threat to their personal livelihood and a taking of their property without due process of law. . . .

"[I]t is not surprising that many persons view the . . . action in 1965 with deepfelt bitterness and resentment, when the main

the act; an entire growing season may elapse between the time of application for a permit and ultimate well installation. The lag stems from a thirty day statutory notice requirement, Colo. Rev. Stat. Ann. § 148-18-6(2) (Supp. 1965), the ensuing commission evaluation and hearing, Colo. Rev. Stat. Ann. § 148-18-6(4) (Supp. 1965), which may be hampered by a lack of complete data and adequate mapping, and the budget limitations which permit only quarterly meetings of the commission at which final disposition is made. An increased use of computer programming and analysis will hopefully provide some future relief.

Interview with George Colburn in Denver, July 18, 1967.

64. The natural resources coordinator was substituted for the governor as a voting member of the commission, Colo. Laws 1967, ch. 37, § 1, at 52; a 600 foot well spacing limitation was offered by the legislature as a condition to new permits, subject to the discretion of the state engineer following a hearing, Colo. Laws 1967, ch. 188, § 10, at 277; a provision allowing pre-May 17, 1965, wells to be recorded with the state engineer until December 31, 1968, was added, id. § 11, at 278; and a streamlined procedure for altering the boundaries of a ground water management district was provided, id.


66. An appeal in the case of People v. Fallhauer, Civ. No. 53065, decided in the District Court of Pueblo County in January, 1967, is presently before the court.


69. A 1957 survey of 74 farm operators in Morgan County, Colorado, demonstrated an interesting attitude toward ground water, pumping rights and regulation. 76% of the responses opposed any restriction on new wells; 82% opposed pumping restrictions in reverse order of drilling; 70% preferred a legal right to do anything with ground water. Davis & Farmer, "Surveys Point Up Ground Water Problem," Colo. Farm & Home Research 6, 9 (1957). Attitudes such as these facilitate an appreciation of the political and legislative problems in attempting to implement farsighted water conservation or management programs. This survey and the effect of public opinion on ground water legislation are considered in Hutchins, "Ground Water Legislation," 30 Rocky Mt. L. Rev. 416, 423 (1958).
thing wrong with this legislation is that it was enacted some 20
or 30 years later than it should have been.\textsuperscript{70}

It is obviously difficult to serve a palatable menu of administrative pro-
scription to a combination of private and public interests which previously
have been fed a diet of legislative laxity and private permissiveness at
substantial economic cost.

Other aspects of the act have been questioned. Statutory guidance
in reasserting the appropriation doctrine to protect surface rights has been
a source of challenge.\textsuperscript{71} House Bill 1066 authorizes the state engineer
to apply for an injunction "to enjoin any person . . . when necessary to
prevent such diversion from materially injuring the vested rights of other
appropriators."\textsuperscript{72} This measure is not discordant with traditional ap-
propriation theory. Where the state engineer is able to marshal evidence
that an offending well is depleting vested rights, material injury must
necessarily be found to exist.

A precise definition of material injury has not been formulated by
the ground water commission; the commission is guided, however, by
such factors as well size, elapsed time between well withdrawal and a
measurable effect on the stream, and well priority dates in assessing pos-
sible well effects on surface shortages.\textsuperscript{73} Injunctions, when needed, must
issue from the state’s courts, which are not unfamiliar with evaluating in-
jury to senior appropriators.\textsuperscript{74}

A significant indication of dissatisfaction with the 1965 legislative
effort has come from the Colorado legislature itself. Senate Bill 407,
passed during the most recent legislative session, provides 50,000 dollars
to be used for a two year investigation of relationships between surface
and ground water and for an evaluation of the need for additional legis-

\textsuperscript{70} Colorado Legislative Council, Implementation of 1965 Water Legislation

\textsuperscript{71} For example, see the objections of a local landowner raised at an August
1, 1967, meeting with the state engineer in Ft. Morgan, Colorado, following a shut-
down of irrigation wells on the South Platte. "How do you determine material
damage? How can you prove that a well far back from the river is not materially
affecting the river? Without this proof, how can you justify ignoring the prior

\textsuperscript{72} A discussion of the limits of administrative discretion and the constitutionality
of legislative delegation is not included in this material. Such matters are
not unimportant, however, and have already been raised in the Pueblo District
Court in the case of People v. Fellhauer, Civ. No. 53065. The court concluded
in part that the state engineer is merely delegated authority to administer the laws
(Supp. 1965) is not unconstitutional.


\textsuperscript{74} "[A] junior appropriator may not divert the water to which he is entitled
by any method or means the result of which will be to diminish or interfere
with the right of a senior appropriator to full use of his appropriation." City of
lation to "provide for integrated administration of all diversions and uses of water within the state." The natural resources coordinator is directed:

To review existing water laws of the state of Colorado to determine their sufficiency and the need for any modifications or supplementations thereto in order to provide an effective system for administration, development, and control of water use in Colorado, and to achieve maximum utilization of water resources compatible with the requirements of the state constitution.76

The experience of other states having conditions similar to Colorado's is to be evaluated. Well permits in surface-ground water areas are to be denied unless the state engineer makes an affirmative finding that "the proposed well will have no material effect upon the vested water rights of existing water users. . . ."77 Court adjudication of well priorities is authorized, but not required.78

Continued confidence in the doctrine of appropriation, plain in the 1965 enactments, is conspicuously absent in the provisions of Senate Bill 407. In its place, a concern for "full" or "maximum" utilization of the state's water resources is evident. In 1967, careful study and long range re-evaluation of the state's water laws is "in", and the 1965 stopgap approach in reliance upon prior surface doctrines seems to have fallen into disfavor. Appropriately, Senate Bill 407 has been labeled by some, the "Moratorium Act."

IV. SEARCHING FOR A COORDINATED SOLUTION

While appropriation rules are subject to justifiable criticism in both theory and application,79 the doctrine receives frequent approval as the most effective basis upon which to build a workable scheme of water regulation.

The principle of prior appropriation may prove to be that capable of promoting the fullest and most efficient development of water resources. . . . [b]ut the strict application of the principle

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75. Colo. Laws 1967, ch. 175, § 1(1)(b), at 249. More than 30% of the available appropriation has been committed to a management study of the policies, purposes and functions of each state agency dealing with water resources. See Minutes of the Meeting, Committee on Water, app. A, May 23, 1967.

76. Colo. Laws 1967, ch. 175, § 2(1)(d), at 249.

77. Colo. Laws 1967, ch. 175, § 1(1)(c), at 249. In the past, this point was unsettled. [T]here is a difference of opinion among judges as to whether courts can adjudicate wells. Some courts maintain the law is not specific on this point while others say jurisdiction can be implied from the court's jurisdiction over natural streams." Minutes of the Meeting, Committee on Water 4, May 23, 1967.

78. See, e.g., Danielson, Water Administration in Colorado—Higher-Order or Priority?, 30 Rocky Mt. L. Rev. 293 (1958) (outlining political and administrative obstacles and the complexities inherent in "statutory cutting and patching and court decisions over the past eighty years").
of priority . . . should be modified . . . to promote the highest beneficial use, the most efficient methods of use, and the full yet safe development of the water resources of each area.89

The general appeal of such a recommendation is plain, but constitutional barriers in tailoring priorities to maximum public benefit are significant.

A priority is considered to be private real property in the nature of an easement in the public waters. As such, it is entitled to the due process protection of the Colorado and United States Constitutions. This due process protection must be kept firmly in mind when considering changes in the system or its administration.81

Thus, the road to modification of the “rugged individualist” philosophy of appropriation82 to better accord with objective resource management, conservation programs, and scientific principles of hydrology may be a narrow route cluttered with constitutional detours, rather than a multi-lane legislative expressway. Resort to the police powers of the state is a suggested method of implementing a conservation-oriented water coordination program without legal damage to existing water rights.83 However, the cost as well as the effect of this form of governmental interference are factors which could make this an unattractive alternative, depending on the extent of the police power exercise and the ultimate disposition of the rights acquired.

On the other hand, a solution based on the voluntary participation of water users could theoretically achieve the desired recognition of vested rights, conservation policies and coordinated management, together with the added features of group cooperation and natural economic adjustment of the value of water uses. A program of this type has been suggested in broad outline by Richard T. Eckles, Colorado coordinator of natural resources, for the state’s river basins where surface decrees and well operations draw from the same total water source.84

The proposal is aimed at eliminating several significant defects peculiar to Colorado’s water administration and use. Among them are:

1. Transportation losses in meeting downstream surface priorities due to evaporation, phreatophyte consumption and well operat-

81. Danielson, Water Administration in Colorado—Higher-Ority or Priority?, supra note 78, at 293 (footnotes omitted).
83. The possibility is discussed in Piper, Requirements of a Model Water Law, supra note 80, at 1215.
84. See Minutes of the Meeting, Committee on Water, July 20, 1967.
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2. Winter flooding as a wasteful, defensive measure in anticipation of a shortage of summer supplies.
3. Municipal and private well operations which affect senior stream rights.
4. Sale of senior surface rights and immediate resort to wells as a replacement source. This practice offers a handsome profit at the expense of other basin water users.
5. Hoarding or retention of relatively junior surface decrees which are unlikely to be filled except in years of abundant supply. These priorities are of small economic value, but remain an obstacle to well operation.

The scheme presupposes that enough water is in fact available, provided the present offensive practices are curtailed and distribution is effectively engineered with reference to all available sources. Each user remits his priorities to a central basin "cash register" administered by a locally elected committee of agricultural, industrial and municipal water users. Through central planning, each consumer's water needs are delivered to his headgate or ditch from one of three sources: well, reservoir or stream.

The delivery method is selected with regard to the user's location, the volume required and the location of available supplies. A downstream irrigator who has previously relied on surface diversion may be supplied from underground reserves to avoid severe transportation losses. Well diversions immediately adjacent to a stream or ditch might be replaced with surface flow if pumping costs were excessive in the past. Water previously committed to winter flooding would be available for reservoir storage to meet demands during the growing season.

The costs of delivery and development of new diversions and storage facilities is borne by the basin organization's funds from assessments levied on each user according to a progressive scale. Junior users pay the greatest assessment; valuable early rights would pay a minimum charge in recognition of their seniority.

In theory the proposal offers several appealing features. Well operators could forego the needless expense of adjudication and be insured of a uniform supply without the present risk of regulation in favor of senior rights. Senior appropriations would benefit from an increased certainty of quotas as well as an acknowledgement of their priorities. The plan envisions an integrated administration of the river basin resources; water use and not water rights is made the object of concern.

86. Note 36 supra and associated text.
The proposal is presently in the planning stage; engineering, administrative and legislative details are not yet formulated. Presumably the attractiveness of local administration and the prospect of a realistic allocation of limited resources, contrasted with the likelihood of litigation and the uncertainties attending the present state of Colorado water use will offer some incentive for approval. Unless operative details, especially the progressive assessment and other costs, alter the complexion of the plan, Colorado may have its first practicable, integrated water management program at its disposal. "The plan is going to take a lot of selling, but it looks like a real breakthrough toward water use progress."

V. LOOKING AHEAD

Principles which are applicable to the relative abundance of the state’s 1875 water resource are not necessarily the key to solving today’s water problems. New conflicts and demands have emerged, calling for serious reappraisal of past policies in the light of the public welfare and the future economic needs of Colorado.

The penalties of inaction are litigation, public and private expense, ineffective use of water and eventual short supply. The reward for enlightened administration and use is an adequate water supply for the future. Colorado has yet to select this latter alternative.

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87. The plan was explained in an interview with the coordinator of natural resources in Denver, Sept. On the basis of scientific study and recommendations, Mr. Eckles intends to submit the engineering necessities of implementation to a statutory drafting committee, which would be in the unique position of framing a law to conform to existing natural conditions. A special legislative session is anticipated as the final step, so that the program can receive exclusive attention without the pressures of time and competing causes which attend a regular session.


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