GROUNDWATER LAW IN ARIZONA AND NEIGHBORING STATES

BY

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FOREWORD

The use of groundwater for irrigation has increased rapidly in the past twenty-five years and has reached proportions far greater than could have been foreseen at the beginning of the century. In some important areas the groundwater supply has been fully developed, and as competition for the water becomes keener, a great many problems are arising with regard to the value and security of water rights and with regard to the control and distribution of water. It is not advantageous to the state, from the standpoint of public welfare, when a supply of water already in use in one community is seized upon for use on another area, leaving the people in the first community stranded, with the loss of their investments, and any such transference of water rights should be guarded against.

A thorough understanding of the principles underlying water rights and of court decisions relating to such rights is desirable in order that present water users may protect their rights to water supplies, and also that any remaining justifiable development may proceed with assurance of protection.

The present bulletin discusses the principles of groundwater law and the existing law in this and neighboring states. The bulletin lays the foundation for widespread discussion and, perhaps, further legislation. The author has not made dogmatic and arbitrary recommendations but has suggested the possible lines of procedure for consideration by the many and varied interests involved.

R. S. HAWKINS
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Plate I.—The Roosevelt Dam, built in the period from 1904 to 1910, was the first of four high dams on the Salt River. Despite the remarkably complete utilization of the stream flow of the Salt River, it has been necessary since 1924 to supplement the gravity water supply by extensive pumping of well waters throughout the Salt River Valley.
INTRODUCTION

THE VALUE OF GROUNDWATERS

The value of groundwater supplies is widely recognized. Particularly in the southwestern states of Arizona and New Mexico, and in California, the high economic value of groundwaters can hardly be overemphasized. The census of 1930 showed that 69 percent of the irrigated area in Arizona is watered wholly or partially from wells. Moreover, in this state domestic and municipal water supplies and stock water to a large extent are derived from wells. The 1930 census showed also that of the approximately 5,000,000 acres irrigated in California a little more than one half is supplied wholly or partially from wells. In several other states, from Oregon to Kansas, groundwaters are used extensively for irrigation and for other purposes.

The value of water is bound to increase with time and with growth in population. Aside from such water as may be obtained from the main stem of the Colorado River, elsewhere in the state the competition for the very limited water supplies is becoming constantly more keen.

The welfare of Arizona depends in the highest measure on wise and complete and permanent utilization of the water supplies, both surface waters and underground waters. The degree of such utilization depends, in part, on the laws affecting the development and use of water, especially the laws governing security of titles, and on the public control that may be exercised in the distribution of the water in accordance with the determined water rights.

Great injury is done to an irrigation project if its water supply or a part of its supply is intercepted and is applied to other lands. This has occurred in several instances and certain projects are now feeling acutely the menace of hazards of this kind. Depending upon the hydrologic conditions, a groundwater project may injure another groundwater project or may injure a surface water project close by or farther down in the drainage system of a valley, or a surface water project may injure a groundwater project. Groundwaters are derived from surface waters, and much surface-water stream flow is derived from groundwaters. The effective protection of either one involves some degree of control over the other.
Plate II.—A direct-connected vertical motor, standing over a deep well, with pump house, hoisting tower, and power-line substation. This water supply cares for a large area of citrus orchard northeast of Mesa. The tank supply is for stock water.

The thought has been advanced that groundwater supplies that have been developed by pumping could have been utilized better by means of storage in surface reservoirs. This is a question involving consideration of the physical and other circumstances. Groundwater reservoirs are efficient in some respects, notably freedom from loss by evaporation. In many cases careful analysis shows the greatest advantages on the side of groundwater reservoirs, and in some cases surface storage is not at all possible.

STATUS OF GROUNDWATER LAW

With respect to groundwaters, the law in Arizona as in some other states has been and is uncertain and makeshift. The context of the early statutes on waters indicates that their application was to "running water"; there has been no specific legislation
respecting percolating water. When the state water code was written in 1919, references to groundwater were purposely omitted, with the single exception that the list of waters subject to appropriation included “water flowing in definite underground channels.” It was felt that too little was known regarding groundwaters and that the state water commissioner’s office should concentrate its full attention on the determination of rights in surface waters for some years. Also, there was need for caution. There was then much misconception regarding groundwater as evidenced in many engineering reports and in records of court proceedings. However, knowledge of groundwaters is increasing. It is known now how to investigate groundwater supplies, and in many areas they have been studied quite thoroughly.

With no guidance from the statutes, other than that one reference in the code, the court rulings have been inconclusive. The decision in a recent important case admittedly left much of importance for future decision, though the decision itself contains much dictum pertaining to water law in general.

Because of the reluctance to pass legislation regarding groundwaters, it may be long before groundwater law becomes crystallized.

CLASSES OF GROUNDWATERS

There are two classes of natural underground waters in legal parlance in Arizona, New Mexico, Nevada, and some other states. The two classes are percolating waters and those that flow in definite, underground channels. The distinction may appear to be simple enough, but widely different interpretations have been given to these terms. In many states all groundwaters are treated under the same rule of law.

Percolating waters have been designated “vagrant, wandering drops moving by gravity in any and every direction along the line of least resistance.” A variation of this definition used in a California case is that “percolating waters are vagrant, constantly dropping, moving by gradient in every direction along the line of least resistance and are the surpluses from most surface wells.” The only part of these definitions that should be salvaged is the phrase “moving by gravity.”

All groundwaters percolate, except those flowing in open rock joints and caves and caverns or in driven tunnels. Percolation is relatively very slow, though in unconsolidated, well-sorted river gravel and coarse sand it may have velocities of a few hundred feet per day.

1 The Arizona state water code, passed by the legislature in 1919, was written by the present author after a study of the codes of many other states and of western Canada. The single reference to groundwater followed the previous court decisions in Arizona.

2 Ordinarily, running water in nature is liquid water flowing over but not through sands or other solid substances. The term “flowing” is used in connection with running water and also, more loosely, in connection with underflow and other percolating waters. Running water may “flow” in open channels or in closed channels such as pipes and tunnels.
Plate III.—A water supply derived from wells. This measuring structure on the canal of the Flowing Wells Irrigation District was designed by the Agricultural Engineering Department. The autographic recording instrument in the cabinet at the right stands over a stilling well. The continuous records are of value to the district in the protection of its water rights and to the department in studies of the Santa Cruz River underflow.

What, then, is a definite underground channel? Some jurists have seemed to include only cavern and similar waters; some decisions refer to the need of "bed and banks and current" as requisite, while other decisions indicate that a knowledge of the source of the groundwater is enough; some would accept only the underflow beneath the river bed, while others consider the entire body of groundwater across a wide valley, from mountain to mountain, as flowing in a definite, underground channel. There is a great and immediate need for agreement as to what constitutes a "definite, underground channel."

In a recent case before the Arizona Supreme Court, the court, after trying unsuccessfully to apply the test of "bed and banks and current," devised a new test—namely, that the withdrawal of water from the underflow by pumping must be reflected in a corresponding decrease of the river or creek surface flow—and the court remanded the case with instructions to the lower court to apply the new test. In the case of a small, steady stream flow, unvarying over many days, with heavy withdrawals from near-by wells, the test could be applied, but when the stream flow is out of proportion to the pumpage or is subject to wide natural fluctua-
tions within a few hours and especially in the case of Arizona's ephemeral streams, it cannot be applied.

**DEGREE OF PROTECTION TO GROUNDWATER RIGHTS**

Shall rights of priority of appropriation of groundwater be granted and protected? If so, to what classes of waters and to what extent? Where shall the line be drawn? These are still moot questions for public discussion.

In the discussion of these questions, there are three lines of approach. The first and most obvious is from the natural viewpoint of the water users themselves, both individuals and associations. Groundwater development for irrigation involves considerable outlay of capital, first, for wells and pumping machinery, and second, for ditches and preparation of land and for buildings and equipment. It is natural that the developer or investor should want protection for his continued use of the water supply just as does his brother irrigator who uses water from a surface stream. The history of irrigation is that overdevelopment is the common rule rather than the exception. Overdraft of groundwater supplies has become very serious already, especially so in California and in some parts of Arizona and New Mexico. Overdevelopment has wrecked many otherwise worthy enterprises.

Second, there is the point of view of the public. Surface water supplies in the West belong to the public, or to the state; in some states, all groundwaters do also. It is to the interest of the public, the state, that the waters should be developed and used fully. Therefore, it is to the interest of the public that the developer's investment be accorded protection, for such protection ensures more orderly and prompt development and more economic, continuous, and permanent use of the water. Lack of protection should cause hesitation to make the necessary or adequate investment, but also it may cause a race between rivals with consequent "mining" of the water until there is none for either party within economic pumping lift.

Third, there is the purely legalistic point of view in which the welfare of water users or even of the public is not the issue, but the query is, what is the law? This is the backward view. It is apt to be the attitude of courts. Yet in some cases courts have made broad changes from former decisions because of new concepts of the relation of groundwater supplies to public welfare and to justice.

While some states, including Arizona, attempt to differentiate between different classes of groundwater, in other states little or no distinction is made, and the same degree of protection is granted to all groundwater rights. In all the western states, except Arizona, the present tendency is toward increased protection.

Both the public welfare and justice to those who have developed groundwater supplies seem to dictate that groundwater priorities should be recognized and protected. However, such protection is not so simple as in the case of surface water. There are radical
differences between the regimen of groundwaters and that of surface waters, and the usual water law, statutory or common, should not be applied directly to groundwaters without modification to meet the special and peculiar conditions. Therein lies the reason for difficulties that have arisen in cases where courts have applied the law of surface water supplies rigorously to groundwaters.

BETTER UNDERSTANDING OF GROUNDWATERS

Courts hearing litigation relating to groundwaters suffer the handicap that evidence presented is prejudiced, some facts being mildly distorted and other essential facts being purposely withheld. Expert witnesses give testimony diametrically opposite to that given by other experts. The judges may need unprejudiced amici curiae with knowledge of geology and hydrology much more than they do legal assistance. In some cases an independent, extensive study and report of the geologic and hydrologic conditions under the direction of the court might well be required as a condition precedent to the writing of the decision, even though several years’ delay will be involved.

Plate IV.—A group of well drillers and landowners assembled to study the formations encountered in deep wells at a locality where the formations are exposed on the ground surface. The invitation was extended through the local newspaper to those interested in obtaining groundwater supplies.
The present bulletin discusses groundwater law in Arizona and in neighboring states. Its purpose is threefold: to aid in the proper consideration of any further litigation, to stimulate a widespread discussion such as should precede any new legislation, and to give to groundwater users an understanding of the nature of the water rights to which their investments and their hopes are anchored.

ACKNOWLEDGMENT

The author is deeply indebted to Dr. J. B. McCormick, Professor of Law, for his invaluable assistance in interpreting decisions concerning groundwater and for reviewing the manuscript.
LEGISLATION WITH REGARD TO USE OF WATER IN ARIZONA

There was a paucity of legislation in Arizona regarding water and the rights to water prior to the adoption of the water code in 1919. It seems remarkable that despite the importance of water so little attention was given to it by legislators. However, many law issues, some of great importance, were determined by the courts; special mention should be made of the Kibbey Decision, justly famous, in 1892 and several learned decisions written by Judge Sloan.

EARLY LEGISLATION

The Territory of Arizona was organized in 1863. The first legislature met in September, 1864, at Prescott. It adopted a code of laws, consisting of a bill of rights and sixty-one chapters, officially named the Howell Code. Article 22 of the Bill of Rights is as follows:

All streams, lakes, and ponds of water capable of being used for the purposes of navigation or irrigation, are hereby declared to be public property; and no individual or corporation shall have the right to appropriate them exclusively to their own private use, except under such equitable regulations and restrictions as the legislature shall provide for that purpose.

Chapter LV of the Howell Code was entitled “Of Acequias, or Irrigating Canals” and consisted of twenty-eight sections, which were copied from or similar to laws already in force in New Mexico. The most important sections were:

Section 1. All rivers, creeks and streams of running water in the Territory of Arizona are hereby declared public, and applicable to the purpose of irrigation and mining, as hereinafter provided.

Section 2. All rights in acequias, or irrigating canals, heretofore established shall not be disturbed, nor shall the course of such acequias be changed without the consent of the proprietors of such established rights.

Section 3. All the inhabitants of this Territory, who own or possess arable and irrigable lands, shall have the right to construct public or private acequias, and obtain the necessary water for the same from any convenient river, creek or stream of running water.

Section 16. It shall be the duty of the overseers . . . to distribute and apportion the water in proportion to the quantity to which each one is entitled, according to the land cultivated by him; and, in making such apportionment he shall take into consideration the nature of the seed sown or planted, the crops and plants cultivated . . .

Section 17. During years when a scarcity of water shall exist, owners of fields shall have precedence of the water for irrigation, according to

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5 This provision had much merit. However, it has been changed to a flat acreage basis in the irrigation district act and also in court decrees. The state water code, Section 1, states that beneficial use shall be the basis, measure, and limit to the use of water. A strict interpretation of this phrase would require that the nature of the soil, the crop, and the climate be considered in the distribution of water.
the dates of their respective titles or their occupation of the lands, either by themselves or their grantors. The oldest titles shall have precedence always.

Section 27. Any person owning lands which may include a spring or stream of running water, or owning lands upon a river where there is not population sufficient to form a public acequia, may construct a private acequia for his own uses, subject to his own regulations, provided it does not interfere with the rights of others.

The other sections of Chapter LV dealt with details connected with the water rights and with the operation of the primitive ditches of those days, including the provision that each owner of land must contribute labor under the overseer, whether he used water or not.

Section 17 laid the foundation for the principle of priority of appropriation as opposed to that of correlative rights. Section 27 asserted that springs, like streams of running water, had a public character, but doubtless the framers had in mind natural flowing springs or emergent underflow of volume sufficient for irrigation.

The context of the whole chapter indicates that the application was to streams of running surface water. Underground waters percolating through or existing in sand and gravel and less pervious material were probably considered as of little economic value and were not the subject of legislation. It is true that underflow collecting ditches were in use in some places during the dry months, particularly in years of drouth, but the framers of the law saw the water running in the underflow acequias with no thought of the percolating source stream, and they included such open streams with "streams of running waters."

The legislature of 1887 added the following to the code relating to water: "The common law doctrine of riparian water rights shall not obtain or be of any force or effect in the State."

This provision was later embodied in the State Constitution, adopted in 1911, as Article XVII, Section 1.

The next important legislation was in 1893, as follows:

Section 1. That any person or persons, company or corporation shall have the right to appropriate any of the unappropriated waters or the surplus or flood waters in this Territory for delivery to consumers, rental, milling, irrigation, mechanical, domestic, stock or any other beneficial purpose, and such person or persons, company or corporation for the purpose of making such appropriation of waters as herein specified, shall have the right to construct and maintain reservoirs, dams, canals, ditches, flumes and any and all other necessary water ways. And the person or persons, company or corporation first appropriating water for the purposes herein mentioned shall always have the better right to the same.

Section 2. Every person or persons, company or corporation, who shall desire to appropriate any of the waters of this Territory for the uses and purposes mentioned in Section 1 of this Act, shall first post at the place of diversion on the stream or streams, as the case may be, a notice of his, their or its appropriation of the amount of water by it or them appropriated, and that they intend to build and maintain a dam at a certain place in said notice to be designated, and in case of storage of water by

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4 In court decisions this rule was not followed; precedence has been based on priority of taking the water.
reservoir that they intend to construct and maintain a reservoir at a place
to be in said notice stated, and that they intend to construct and maintain
canal or canals, as the case may be, from the point of diversion of said
water to some terminal point to be mentioned in said notice, a copy of
which shall be filed and recorded in the office of the county recorder in
which said dam, reservoir and canal is contemplated to be con-
structed . . .

The expression “any of the unappropriated waters” might be
interpreted to include groundwaters were it not for the context,
which plainly limits the application of the act to surface waters.

It does not appear that there was any basis of groundwater law
in the statutes in Arizona prior to 1919. In some cases, however,
the courts have attempted to interpret the statutes that were
intended to apply to surface waters only so that their application
could include groundwaters.

THE STATE WATER CODE

The state water code, adopted in 1919, relates to surface waters
except for a clause in Section 1. That section originally was as
follows:

Section 1. The water of all natural streams, or flowing in any canyon,
ravine or other natural channel, or in definite underground channel, and,
of springs and lakes, belongs to the public, and is subject to beneficial
use as herein provided. Beneficial use shall be the basis and the measure
and the limit to the use of water in the State and whenever hereafter
the owner of a perfected and developed right shall cease or fail to use the
water appropriated for a period of five successive years the right to use
shall thereupon cease and revert to the public and become again subject
to appropriation in the manner herein provided . . .

Section 1 has been amended several times and now reads:

The water of all sources, flowing in streams, canyons, ravines or other
natural channels, or in definite underground channels, whether perennial
or intermittent, flood, waste or surplus water, and of lakes, ponds, and
springs on the surface, belongs to the public, and is subject to appropria-
tion and beneficial use, as herein provided. Beneficial use shall be the
basis, measure, and limit to the use of water. Whenever the owner of a
right to the use of water shall cease or fail to use the water appropriated
for five successive years, the right to the use shall cease, and the water
shall revert to the public and be again subject to appropriation.

The state water code was designed to accomplish three purposes:

1. To secure, by surveys and the taking of testimony in the
field, covering all of the water rights of a drainage basin in a single
determination, the complete adjudication of all water rights within
the state, similar to the Wyoming and Oregon systems, so that
water titles might be as secure as land titles.

2. To control the initiation of additional appropriations of
water.

3. To administer the stream system through the agency of the
state water commissioner so that each appropriator should re-
cieve at all times his proper share of the supply (excepting such
canal systems as were already administered by court water com-
missioners), this task being too cumbersome and too onerous to
be left permanently to the judicial branch of the government.
The words “in definite underground channels” as used in Section 1 of the water code have been interpreted in various ways. Some of them are:

1. If such waters were included in early legislation at all, it would appear that they were limited to cavernous waters. There are many springs of great volume in Arizona, and some of them, notably those issuing from limestone rock, such as Fossil Spring and Monkey Spring, must flow for considerable distances as running water before reaching the outlets on the surface. Water flowing in mine tunnels would be included.

2. Underground streams of percolating water having bed and banks and current have been discussed at great length in decisions and in works on water law, but no explicit example of such streams has ever been properly presented in detail in court in this state.

3. Underflow directly beneath the river bed is often discussed, but is inseparable from the moving water beneath the adjacent lands, for river banks, which ordinarily are temporary, do not predicate any side barriers beneath, except in narrow rock canyons. The Los Angeles River canyon described in Los Angeles vs. Pomeroy (57 Pac. 585) is possibly in this class, though the canyon and underflow are much wider than the river bed.

4. The term definite underground channel was applied to the entire body of groundwater beneath the extensive, broad San Fernando Valley in Los Angeles vs. Hunter (105 Pac. 755).

5. In at least one case the court has included the groundwater beneath a plain or delta fan in front of the mouth of a river canyon where the river emerges from a mountain. In such cases the groundwater is shown by the groundwater contours to have its source in the river discharge, and, in truth, ordinarily there appears to be no other possible source, as was said in Miller vs. Bay Cities Water Company (107 Pac. 115). The existence of channels from the region of intake to the locality of the wells is implied, though such channels have not been discovered and mapped.

Section 1, as quoted above, for the first time gives positive statutory authority for the appropriation of water flowing in definite underground channels, and thus it gives a foothold for some public control. Otherwise the code deals with surface running waters and in many parts would apply to groundwaters awkwardly.

Since the words “in definite underground channels” are used in the state water code, it is most desirable that they be given a definite meaning, either by the courts or by legislation. Furthermore, because of the intimate relation between surface waters and the groundwaters within a valley, it appears desirable to give the words such a liberal interpretation as will permit protection to vested rights in the use of surface water and to constructed enterprises based on the use of groundwater.

It may be pertinent to suggest a commission, to be authorized by the legislature, to prepare additions to the code dealing with groundwaters, (see page 86).
It was natural that in the early days of settlement, surface water supplies should be utilized before groundwaters. Surface waters could be seen, and ordinarily they could be diverted and placed upon the land more quickly and at less cost. A deterrent factor in the case of wells was the great uncertainty as to the yield or quantity of water until the well was finished and tested. Not until about 1910 did pumps and wells appear important for irrigation supplies. Even at that time some interested, thinking men still conceived of the groundwater as "inexhaustible," while others denied that groundwater could have any perceptible movement or could be developed in great volume, or that the returns could pay for the cost of pumping. Development of groundwater for irrigation reached a peak in 1913 and another peak about 1920, and development has continued irregularly to the present time. The investment per acre is less than for great storage projects.

The decisions by the Arizona Supreme Court respecting groundwaters will now be discussed. These decisions were influenced, probably, by the stage of development of irrigation pumping in each period.

Howard vs. Perrin: The first case involving groundwater rights that came before the Arizona Supreme Court was that of Howard vs. Perrin (8 Ariz. 347, 76 Pac. 460) in 1904. It involved a couple of wells connected by a discharge tunnel to an arroyo, from which a small flow was conducted by pipe to a tank and watering trough for range stock. The plaintiff, although only a squatter on supposed public land, had gone through the formality of posting his appropriation notice and having it recorded, as required for surface waters under the legislative act of April 13, 1893. He claimed that there was a subterranean stream of water running in a well-defined channel between banks.

In the early decisions, and indeed until modified in the decision in the case of Katz vs. Walkinshaw in 1902, the courts of California and Nevada had differentiated between percolating waters and groundwaters flowing in well-defined channels, and, following the common law of England, percolating water was deemed the property of the owner of the overlying land. Whether the second

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5 A pioneer, a generation ahead of his time, was W. A. Hart, who developed an irrigated ranch at Sahuarita about 1889, using water pumped from a great dug well, sunk as a four-compartment mine shaft and with the best type of machinery of that period. The first notable case of an extensive engineered project for irrigation pumping was the one at the head of the Tempe Canal in 1894. Another noteworthy project was that of the United States Reclamation Service at Santan, acting for the Indian Service in 1909, in which a series of ten wells, concrete caissons with drilled feeders, were developed to a capacity adequate for 10,000 acres of land.

6 See page 76. The trial of the case of Howard vs. Perrin occurred prior to the reversal of the decision by the Supreme Court of California in Katz vs. Walkinshaw.
class was limited to such running waters as springs and the drainage water from mine tunnels, which were the subjects of several suits, is not always clear.

At any rate, the litigants in Howard vs. Perrin, influenced by the California and Nevada decisions, agreed that the division into two classes was, or should be, the law in Arizona. Therefore, the court was faced with making a decision as to the evidence, not as to the law. Although the plaintiff had asserted that the flow from the wells was a subterranean stream in a well-defined channel, no adequate evidence was produced to show that the location of the source stream could be identified or that the stream was detached or distinct from the surrounding groundwaters. The court, in finding for the defendant, said:

The determination of this case depends upon whether the water developed and used by the cross-complainant and claimed to have been appropriated by him constituted a running stream flowing in natural channels between well-defined banks, such as is contemplated by the provisions of our statutes as cited herein, and therefore the subject of appropriation, or whether it was, on the contrary, filtrating or percolating water cozing through the soil beneath the surface in undefined and unknown channels, and therefore a component part of the earth, having no characteristic of ownership distinct from the land itself, and therefore not the subject of appropriation by another, but belonging to the owner of the soil. Throughout the Pacific Coast, where the doctrine of appropriation obtains, the decisions are uniform to the effect that waters percolating generally through the soil beneath the surface are the property of the owner of the soil, but that subterranean streams, flowing in natural channels, between well-defined banks, are subject to appropriation under the same rule as surface streams. The law on this subject has been correctly stated by appellant [Howard] in his brief: "No distinction exists between waters running under the surface in defined channels and those running in distinct channels upon the surface. The distinction is made between all waters running in distinct channels, whether upon the surface or subterranean, and those cozing or percolating through the soil in varying quantities and uncertain directions." Strait v. Brown, 16 Nev. 317, 40 Am. Rep. 497. He claims, however, that the evidence was clear and conclusive that the water in question was "a subterranean stream, with well-defined channel and banks," and that "the court erred in finding that the water in question was not a flowing stream with well-defined channel or banks." This presents solely a question of fact, both parties agreeing as to the law in the premises. The defendant having alleged in the cross-complaint that there was a subterranean stream of water running in a well-defined channel, the burden of proof was upon him to establish that fact by competent evidence ... We have examined the evidence in this case, and do not see how the court could have found, from the evidence in the case, other than it did. We fail to find sufficient evidence in the testimony of the witnesses of the appellant to establish the existence of a "subterranean stream with well-defined channel and banks," even if no consideration were given to the contradictory evidence introduced by the opposite party.

Although the property value in this case was of trifling importance, the case was appealed to the United States Supreme Court. That court, in affirming the judgment, cited paragraphs from the Revised Statutes of Arizona, 1877, and then said:

\footnote{In previous cases in California and Nevada the waters artificially developed by tunnels had been declared appropriable.}
We need not stop to inquire whether these sections apply to subterranean streams, because the finding of fact which is sustained by the testimony, is "that the only water upon said land is percolating water oozing through the soil beneath the surface in an undefined and unknown channel." Of course, this excludes the idea of a "river, creek or stream of running water."

The attitude of Congress and of the Supreme Court was that the western or irrigated part of the country, including the territories, should be left free to develop its own laws relating to water.

Thus it is clear that the division of groundwaters into two classes found its way into Arizona law in 1904 because of its previous wide adoption in the West over a period of about thirty-five years and not because of any specific statutory foundation then existing in the statutes of Arizona. Furthermore, it was not the studied conclusion of the court that such division was in the interest of justice or was best suited to physical and economic conditions in the Territory of Arizona, but since both litigants had agreed to the two-way division of groundwaters as a principle of law, that issue was not before the court for consideration.

However, had the first case involving groundwaters to come before the Arizona Supreme Court been a case involving extensive properties and the welfare of whole communities of people, undoubtedly the court would have given much consideration to the principles of law and their applicability to Arizona conditions. Since the legislature had not dealt specifically with groundwaters, the way was open for the broadest treatment, even the rejection of the English common law relating to groundwater as being unsuited to a country dependent upon its water supplies for irrigation. The early statutes were quite evidently intended to relate to surface waters and could have been considered by the court as being neither inclusive nor exclusive of groundwaters.

McKenzie vs. Moore: The second case involving groundwater to reach the Supreme Court was that of McKenzie vs. Moore (20 Ariz. 1, 176 Pac. 568) in 1919. This case, like that of Howard vs. Perrin, was over a trivial property value. The defendant Moore claimed a water right in a "spring" situated on land which McKenzie had located as a mining claim in the county of Cochise. The suit was for trespass. The evidence shows that the spring when found did not flow naturally but was a seep or underflow which had been made usable by means of a pit or well and that the

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8The common law of England with respect to the use of surface water has been rejected repeatedly by the courts of Arizona. As one instance, in Chandler vs. Austin, the Supreme Court said: "The common law has no application whatever to the use of water with us. . . . So the common law can furnish no aid in the adjustment of water rights in this territory" (4 Ariz. 350). Only two years earlier than the case of Howard vs. Perrin reached the Supreme Court but later than the time of the trial, the California Supreme Court had rejected the English common-law doctrine regarding percolating water as inapplicable to that state. The Arizona court might well have modified the common law rule as evidence of the public interest in and the interdependence of all water supplies. As the common-law doctrine was rejected as to surface streams, so might it have been also with respect to groundwaters.
water level was a few feet below the surface. The notice of appropriation stated that the appropriator, Moore, intended to construct an open canal or ditch from the pit to a wash and thence to a reservoir. Whether he did so or not is not revealed. The trial court determined that the water claim was a valid appropriation. The Supreme Court reversed the judgment. Quoting from the decision:

The manner of appropriating water on public domain is delegated to the states, and in this state the right to appropriate water for any beneficial purpose, and thereby acquire a vested right in the said water, is limited to the appropriation of the waters declared public, by Paragraph 5344, supra, that is to the appropriation of the waters of "rivers, creeks and streams of running water in this state."

Percolating water, unconfined to a definite channel, is not the subject of appropriation, but belongs to the realty.

Quoting further:

Certainly a spring of water, as such, is not one of the sources from which water may be appropriated by notice given. Before the party giving notice . . . can acquire any right thereby, his claimed appropriation must be of waters of a river, creek or stream of running water.

Two months after the decision was rendered, the state water code of 1919, including springs among appropriable waters, was adopted by the legislature. Had the case been postponed a few months the statement as to springs would have been quite different, but always there is a question as to whether the physical conditions are such as to justify calling the water a spring.

The decision attempts to limit the right of appropriation emphatically to running streams, a construction which excludes all groundwaters except those flowing in caves and tunnels. Now the distinction between running water and all percolating waters is far greater than the distinction between water percolating within certain boundaries and water percolating where boundaries are not ascertainable.

Further, the decision asserts as a rule of law that ordinary percolating water "belongs to the realty." In this the court was following the rule which was stipulated by litigants and followed by the court in Howard vs. Perrin.

Proctor vs. Pima Farms Company: After the passage of the state water code act of 1919, the first case concerning groundwaters to come before the state Supreme Court was that of Proctor vs. Pima Farms Company (30 Ariz. 96, 245 Pac. 369) in 1926. The Pima Farms Company acquired practically all of the irrigable land lying along the Santa Cruz River for a distance of about 15 miles. Most of the land was undeveloped and still covered with desert brush. The company developed the groundwater supply to the fullest extent by drilling many deep wells of large diameter and installing pumps of high capacity. It also built a central power plant and an extensive canal system and then sold the land in tracts, with water rights, to incoming farmers. Proctor was one of a few who, prior to the coming of the Pima Farms Company, had developed a water supply for his land by means of wells, two
in number, and who chose not to sell his land to the company. The area sold to settlers by the company, 14,500 acres, was much larger than could be provided with irrigation water continually from the definite, limited water supply, and consequently the heavy, continuous pumping of the many company wells lowered the water table rapidly. This made it necessary for Proctor to lower his pumps, which he did. Further lowering of the water table by the company's pumping operations the next year foretold that he would have to lower his pumps again. He then brought the action, claiming a prior appropriation of the groundwater and claiming that

the senior appropriator of water, by means of wells and pumps, from an independent underground stream of flowing water is entitled, as against subsequent appropriators, to have such stream's level remain so that his means of capture and diversion as originally installed will not be impaired or destroyed for his uses, or in lieu thereof, to have the later appropriators deliver to him his water in such manner as to make it available for his uses.

The defendant company admitted the priority of appropriation but contended that, the supply of groundwater still being ample though at lowered depth, it was the duty of Proctor to lower his pump as need be and at his own expense.

The trial court enjoined the company from lowering the water table but suspended the judgment on the agreement of the company to furnish water from its canal system to Proctor at a price to be fixed by the court. The judgment was affirmed by the Supreme Court. A plan was adopted, under which the company furnished water from their canal system to Proctor, and Proctor's pumps stood idle.

There are a number of features of this case which require comment. At the outset of the litigation, the parties were agreed that the groundwater supply underlying the Santa Cruz Valley is "a known independent subterranean stream," and that classification of the water supply was accepted by the Supreme Court without questioning it. For the first time the court did accept as appropriable a water supply which patently and admittedly is not running water but which percolates through sand and gravel,
a percolating groundwater supply over a mile in width, and
further, accepted it without inquiring as to the facts relating to
"bed and banks" of the underground channel.

Although the subterranean stream was designated as independ-
ent, it was formerly, before the advent of pumping, a dependent
stream throughout the year along that part of its course in the
upstream part of the company's tract and was dependent through-
out the pumped area after great floods and during years of much
rain and runoff. It was rendered independent by excessive pump-
ing during the years 1921 to 1929 but may become dependent again
when such rainfall and floods as occurred in 1914 and 1915 occur
again.

Quoting from the decision:
The source of supply of plaintiff and defendant, as indicated by ex-
plorations at the date of trial, is quite a large body of water and none of
it should be permitted to go to waste if it can be lifted out of the bowels
of the earth and economically applied to a beneficial use.

No thought was expressed as to whether the large body of water
was a large stream or a large reservoir of accumulated water
which, as indicated by the lowering water plane, was being over-
drawn and might be depleted to the point of exhaustion. To be
sure, this question was not before the court. Yet, in case the water
was being "mined" (as much of it was), it was likely that the time
would come when pumping would be unprofitable and delivery
from the canal to Proctor would cease, and no water could be
obtained by Proctor for some years.

Farther on in the same paragraph of the decision:
Under this doctrine of prior appropriation the waters of an under-
ground flowing stream are equally as available to an appropriation by the
owners of arable or irrigable lands as the waters of a surface stream and
the appropriation is governed by the same principles of law.

This sentence is highly important because it was spoken of a
"percolating" groundwater supply of the full width of the inner
valley, in places over a mile in width, and so described in the
transcript and shown by maps of the location of wells. The de-
scription would fit most of the rivers of the state and would include
most of the important groundwater supplies. It would appear,
therefore, that a groundwater supply located elsewhere but shown
to be similar to this one would be accepted also as appropriable.

The decision quotes from Kinney's The Law of Irrigation to the
effect that if groundwater has been appropriated, it "cannot be
interfered with" by others, citing an early Oregon decision as
follows: "... and, so long as the subsequent appropriators
do not injure or impair the rights of those prior to them they may
use as much water as they choose."

Accepting that case as precedent, the court was then faced with
the interpretation of the words "impair the rights." Defendant's
theory as to the meaning was that the prior appropriator's quantity
of water must be preserved available to him, but his means of
diverting the water or of securing it by wells and pumps were his
own responsibility. The court decided otherwise, as stated above.
The judgment was not a serious hardship to the company because of their extensive facilities for pumping and delivering water. But, it might be a hardship under other circumstances. If the subsequent appropriator were another farmer, like Proctor, with limited capital and irrigating only a quarter section of land or less, to require him to pump and furnish water to Proctor or to cease pumping entirely would be unjust and unwise, and yet it is admitted that his pumping would disturb the water plane of the independent subterranean stream. Better it would be if this rule of law were changed, preferably by the court but by statute if need be, to permit lowering the water level a "reasonable" amount but not so as to increase the pumping lift beyond the economic pump lift, and further, the total pump draft should have a relation to the safe average annual yield of the supply so that the water will not be "mined."

Under the rule laid down, if a valley were settled by twenty homesteaders arriving successively, each one drilling a well and installing an irrigation turbine pump, each new arrival would have to assume the burden of all those who had arrived before him, and the last man would require an expensive pumping plant with capacity twenty times as great as his own needs.

The operation of the first appropriator's own well results in some lowering of the water table, and the operation of each subsequent appropriator's well or wells has the effect of lowering the water table. A reasonable amount of lowering of the water table should be expected as inevitable, and incidental to pumping and should be permitted without setting up a system of penalties, which would become more involved as the number of successive appropriations increases. A rule of reasonableness should be substituted for the rigid rule which forbids any lowering of the water plane without severe penalty. The fundamental principle should be that the water supply belongs to the public and the public welfare demands that the supply be used, up to the quantity of safe yield or to the limiting economic pump lift, whichever is reached first. Each appropriator of groundwater should initiate his water right with that understanding.

The Southwest Cotton Company Case: In 1926 there was begun in the Superior Court the case of Southwest Cotton Company et al. vs. Maricopa County Municipal Water Conservation District No. 1 et al. It was appealed, the defendant being the appellant. The decision of the Supreme Court was dated October 22, 1931 (39 Ariz. 65, 4 Fac. 2d 369).

The issues in this case were of tremendous importance, involving directly investments of about $10,000,000, quite evenly divided between the litigants and establishing precedents for appropriations of water throughout the state. Many expert witnesses were employed, including geologists and hydrologists and engineers of high standing, and the cost of the litigation is stated to have been over half a million dollars.

In 1916 the Southwest Cotton Company purchased the Marinette Ranch of about 10,000 acres lying between the Agua Fria and New
rivers. An affiliated company acquired about 12,000 acres on the west side of the Agua Fria River and established the town of Litchfield near the center of that area. The existing groundwater developments were greatly extended, mostly by deep wells, and for some years surface water was taken from the Agua Fria River through the Marinette Canal. Excluding fallow lands, the actual irrigated area of the two ranches has exceeded 13,000 acres.

The Water Conservation District, organized in 1925, included the area formerly owned or controlled by the Beardsley Land and Investment Company, and the district purchased the property and whatever water rights the company possessed. With proceeds of a bond issue the district built a high dam for storage of the waters of the Agua Fria River and a long canal system to cover the Beardsley lands lying to the north and to the west of the Litchfield lands. The storage reservoir intercepted and cut off the river flow, except at such rare times as the reservoir might be filled, when the excess water would escape over the spillway and flow down the Agua Fria channel. The Southwest Cotton Company brought suit against the district to enjoin the latter from storing and using the waters of the Agua Fria, and alleged that such storage and use would cut off the supply to the Marinette Canal and the flow and underflow which had furnished the waters to the wells of the company.

The judgment of the trial court in 1928 in favor of the plaintiff was reversed in 1931 by the Arizona Supreme Court, and the case was remanded with instructions to grant a new trial in accordance with certain specific principles. The decision of the Supreme Court is replete with discussions of public interest, but on account of its great length it is here reviewed in a very incomplete and cursory manner with the author’s comments interposed, thus adding to the discussion.

After remarking on the importance of the case and the probable far-reaching effect of the decision, the court then traced in detail the origin and history of the general water law of Arizona, asserting its derivation from the civil law of Spain and Mexico, particularly the doctrine of appropriation as opposed to that of riparian rights. With regard to percolating waters the court cited the famous Spanish code, Las Siete Partidas, formulated to the effect that the owner of the land owned them to the extent that he could draw them from his land at will, even though by so doing it cut off the subterranean supply previously used by other land owners, with the exception that the government could by grant authorize the appropriation of even these waters, if they ran in definite channels.

The court held, however, that the Territorial Legislature in 1864 adopted the doctrine of appropriation only “so far as the waters named in the bill of rights are concerned.” These waters as stated in the Bill of Rights are “streams, lakes and ponds” but in Howell’s

12 One reference says the code was written in 1256-63 and was published in 1340.
Code of the same year are "rivers, creeks and streams of running water." Subterranean waters other than cavernous waters were thereby excluded. The court said:

At that time (1864) there was little, if any knowledge in regard to subterranean waters, though it was recognized that there were occasional cases in which these waters might be "rivers, lakes or ponds" in the same sense as those of that character above ground. Generally speaking, however, they were presumed to be percolating in their nature.

Thus the distinction was drawn clearly between waters which percolate and waters which run (and ponds). Quoting again,

Obviously the Howell Code left percolating subterranean waters as the property of the owner of the land, subject to the rules of the common law. We should remember, in discussing the law of prior appropriation, its binding authority as general law and a declaration of the field which it covers is primarily statutory . . . .

In an examination of later legislation and of the state constitution, the court held that

the legislature has never specifically made percolating waters subject to appropriation, and, if we apply the usual rule of "expressio unius", has very carefully excluded them therefrom.

The last clause should perhaps be challenged, for, as quoted above, "there was little, if any, knowledge in regard to subterranean waters." The legislators may have thought it more prudent not to deal with the subject at all. There was a decided advantage in leaving subterranean waters to the courts in that when a case arose and the circumstances surrounding it were set forth, a decision based on justice and consonant with the public's interest could be made.

At any rate, the courts of Arizona have departed more or less from the theory that all subterranean waters which percolate are excluded from appropriation, and it has been left to the discretion of the court as to how far this departure should go. Since there has been no reaffirmation of the principle quoted from Las Siete Partidas in all the years since the organization of Arizona as a territory, that principle can hardly be called statutory law at the present time, and it has never been invoked as statutory law by anyone for protection. In the early decisions respecting groundwaters the court, in the absence of any statutory law, has adopted the law of other western states derived from the English common law. (Also, it has repeatedly held that the common law of England as to surface water is not applicable to this state.) Admitting the difficulty in defining the expression "definite underground channels" as used in the state water code, it would appear that, until there is specific legislation respecting groundwaters, the court has a great deal of latitude, at least.

Returning to the decision and again quoting:

Whether percolating waters in Arizona since the adoption of the Howell Code have been governed by the old English common law in its strictest form, or by the American modification known as the rule of correlative rights, as explained in Katz v. Walkinshaw (74 Pac. 786) and the cases
which follow it . . . we need not now decide. When the matter is properly before us, we will determine the rule which applies.

Since this bulletin deals with the whole subject of groundwaters, it is well to remark that the above situation is quite sure to come before the court as the competition for water becomes more acute. For example, it may be that where two or more users of percolating water from the same basin or from beneath the same plain have each made extensive investment, one of them through greatly increased development may deprive the others of their water supply; one user may take more than his proportional share. A somewhat different case will arise in which the development of a percolating water supply will seriously injure an appropriator of a surface stream below. In all such cases the most thorough knowledge of the groundwater regimen will be needed.

To this point the decision has dealt with the water law, particularly groundwater law. Quoting again:

The second question for our determination, therefore, is: what is the nature of the waters in question? Are they percolating in any legal meaning of the term, or are they found running in well-defined channels, with known boundaries?

After remarking that the burden of proof is on the plaintiff, the court stated that the essentials of a surface water course are “a channel, consisting of well-defined bed and banks, and a current of water” and then defined bed and banks and current separately. Asserting that an underground “stream” must have the same characteristics literally, the court next examined the nature of proof required to establish a subterranean bed, banks, and current. The court said:

While surface indications such as trees, shrubs, bushes and grasses growing along the course, and the topographical features of the surface, are the simplest and surest methods of proof, we think they are by no means exclusive. Other methods may be used, such as a series of wells or borings, tunnels, the color and character of the water, the sound of water passing underneath the earth, the interruption of the flowing of other wells on the line of the alleged subterranean stream, geologic formation, and perhaps others. But all of these, when examined, must be such as to afford clear and convincing proof to the satisfaction of a reasonable man, not only that there are subterranean waters, but that such waters have a definite bed, banks and current within the ordinary meaning of the terms as above set forth, and the evidence must establish with reasonable certainty the location of such bed and banks. It is not sufficient that geologic theory or even visible physical facts prove that a stream may exist in a certain place, or probably, or certainly does exist somewhere. There must be certainty of location as well as of existence of the stream before it is subject to appropriation.

Next, with the above “rules of law” as a yardstick, the evidence was examined. The court stated that “the vital finding” of the trial court reads as follows:

. . . at all times there is a surface flow in said river at and for a long distance above a point two or three miles below Camp Dyer, where it sinks in the bed of the river . . . .

All of said waters so sinking into and absorbed by the bed of said river
as aforesaid join the subflow of said river and/or flow into and through known, definite, dependent underground channels extending laterally from various points along and beneath the bed of said river to and under the lands, wells, and pumping plants of the plaintiffs, which said known, definite, dependent underground channels run in a general southerly direction and have their ultimate outlets in the Gila River. All of said known, definite, dependent underground channels are interconnected and in contact with and have their sources in the Agua Fria River and are dependent on the discharge of said river at Camp Dyer for practically all of their waters. Said known, definite, dependent underground channels may hereinafter be designated as underground channels of the Agua Fria River.

Then, with an extended description of the physiography of the entire Salt River Valley, the court continued:

So far as surface indications show, there are no underground channels of running water in the sense defined above, under or near any of the land of plaintiffs except directly beneath the surface bed of the Agua Fria River. . . . there is not a scintilla of evidence in the record from which the ordinary man, or even the trained scientist, could point out definitely a specific place where any one of these so-called subterranean water courses begins, where it ends, or how far its banks extend.

Judging the evidence by the rules set forth above, the court deemed the groundwaters to be percolating waters and not appropriable. In answer to cases in the California Supreme Court, in which the physical conditions were similar to those in the Agua Fria Valley, the court asserted again that Arizona's law relating to groundwater is different, and that in order to be appropriable as underground streams, the stream channels must first be definitely located. (In that discussion the court raised the question as to what would be the effect if one appropriator's land were situated outside the watershed. Apparently that also is a moot question.)

The court next examined the claim that the groundwaters, or a portion of them, are the subflow of the river and hence appropriable and defines subflow as those waters which slowly find their way through the sand and gravel constituting the bed of the stream, or the lands under or immediately adjacent to the stream, and are themselves a part of the surface stream.

This introduces another, a third, class of groundwaters in addition to the two classes previously discussed, inasmuch as the criteria of natural bed and banks is waived. The rule or test to be applied to this class is "that there cannot be any abstraction of the water of the underflow without abstracting a corresponding amount from the surface stream." (This test is the one stated by Kinney to be the test for a known, dependent, subterranean stream.) In the ensuing discussion, the expressions "tend to diminish appreciably" and "will appreciably deplete" were used instead of "corresponding amount." In another paragraph the expression "or are actually in the subterranean channel of the river itself" seems to imply that in that case the test of subflow is not required. But the court said:

We think the body of water shown to exist beneath the lands of plaintiffs, and from which they draw by reason of their wells, even within the

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liberal doctrine laid down by the Pomeroy case, does not constitute the subflow of the Agua Fria River, for there is not the slightest evidence that their pumping diminishes directly or appreciably the surface flow, no matter how true may be the converse.

In the discussion of subflow the two cases, Los Angeles vs. Pomeroy and Los Angeles vs. Hunter, concerning the rights of the city to all of the groundwater supply in the Los Angeles River canyon and in the great San Fernando Valley above the canyon were reviewed. The decision in the former case was found to be in accord with the rules relating to subflow, but the decision in the latter case was considered to be, in effect, unsound, since the claim of being an underground lake could not be substantiated by the test that the surface of the "lake" must be "perpendicular to a radius of the earth."

The decision in the Hunter case is in effect a reversal of that in the Pomeroy case as to the distinction between groundwaters appropriable as a stream and those that are not appropriable.

The case was remanded to the trial court for a new trial with the injunction, or at least suggestion, that the plaintiff's wells be divided into two classes—first, those in or immediately adjacent to the bed of the river and second, all the other wells not so situated—and that the test of subflow be applied to the former class.

The decision throughout shows the effort and determination of the court to make it as thorough and exhaustive as was humanly possible. But the difficulties encountered were very great, in fact they were too great.

Comparing the Southwest Cotton Company case with that of Proctor vs. Pima Farms Company (see page 61), it is to be noted that in the Proctor case, the plaintiff alleged the groundwater stream to be independent, while in the former case the judgment of the lower court designated the groundwaters as flowing in dependent underground channels. As a matter of fact, the physical conditions in the two valleys are for all practical purposes the same, and furthermore, the width of the Recent, or inner, valley is about the same, being from a mile to a mile and a half in each case. Further, in both cases, the underflow in its natural condition before the advent of pumping was dependent, but due to the great lowering of the water table by pumping, in both cases the groundwater stream is now independent. In the original condition of these water supplies, the test for subflow might possibly have been made during the most favorable winter flows, but in neither case would it be possible to make the test now.

The test of subflow might be made successfully if the surface flow in the river were quite uniform and constant for many days and if the quantity of water pumped were a considerable percentage of the river flow. In other cases, the allowable, probable error in river flow measurements would be greater than the pumpage, and no conclusions could be drawn. With the ephemeral streams of Arizona the test is entirely impracticable.

Admitting that these underflows have now become independent subterranean streams and that the Kinney subflow test designed
for dependent streams is impracticable for application on most of the water courses in Arizona, and is always impracticable on independent subterranean streams, then there can be no hope of perfecting an appropriation of such waters as subflow, and it is necessary to fall back on the theory of "bed and banks and current."

Fourzan et al. vs. Curtis et al.: A more recent case to come before the Supreme Court was that of Fourzan vs. Curtis (43 Ariz. 140, 29 Pac. 2d 722), decided February 19, 1934. This case dealt with the rival claims to a small seep or spring located in the region of the Vermillion Cliffs north of the Grand Canyon. Although described as having been only a small swampy place originally, it was developed by excavations to a flow of between \( \frac{1}{2} \) gallon and a gallon of water per minute. The court held that the appropriability depended on the original, natural condition, and that so insignificant a water supply was not a spring, but belonged in the category of percolating water.

One feature of the dictum in this decision was the statement that the owner of percolating waters may convey them to other premises than those on which they are originally found, provided no other rights are injured thereby. This shows a definite trend in the thought of the court toward the theory of correlative rights.

There is an unfortunate aspect connected with litigation over trivial quantities of water, besides the high cost to the litigants. If the evolution of groundwater law in all its details is to come about through court decisions, it is better that cases concerning important water supplies should be before the court, so that there may be as a background a knowledge of the groundwater regimen in broad phases and both sides of the case may be thoroughly presented. In important cases, if the details of the picture are not known, it is feasible to make expenditures in the field to ascertain physical conditions. Trivial cases end, as they begin, wrapped in surmise.

Campbell vs. Willard: This case, originating in Yavapai County, was decided March 18, 1935 (42 Pac. 2d 403). The plaintiff, Willard, had a well drilled in 1913 on public land. Water under artesian pressure was encountered and the well flowed 30 gallons a minute. Some seven years later he piped the water about half a mile to a dairy ranch on rented land and used the water for dairy purposes until it was cut off by defendant, who had acquired title to the land by United States patent, January 11, 1932. The plaintiff did not at any time apply to the state water commissioner for a permit to appropriate, and no evidence was submitted to prove that the water came from an underground stream or lake. The plaintiff had won in the trial court.

The decision shows that the court was following closely the statute (Section 3280, Revised Code of Arizona, 1928), which defines the waters subject to appropriation. The court has held consistently that the burden of proof is on the one claiming that the

\[\text{Section 1 of the state water code might well be amended to read: "... and natural springs flowing more than one gallon a minute ..."} \]
groundwater supply is a definite stream or body of water and ruled that, there being no evidence to that effect in this case, the water must be presumed to be percolating water not subject to appropriation but belonging to the overlying landowner, Campbell.

Artesian waters, as such, are not included in the waters subject to appropriation.

Parker et al. vs. McIntyre et al.: The latest case involving groundwater to come before the court was that of Parker vs. McIntyre, decided April 27, 1936 (56 Pac. 2d 1337). The controversy was over two stock-watering springs on the east slope of the Catalina Mountains. C. C. Parker, a cattleman, made applications for the water rights in 1931, in regular order, both locations being on public land, but the permits were not granted by the state water commissioner until 1934. In the meantime stock-raising homesteads were filed, one in each location, and the land was occupied. The defendants claimed lack of diligence (laches) on the part of the applicant and his assignees and that the water was percolating water, and the Superior Court so decided. But the Supreme Court reversed the decision and remanded the case, stating that the delay evidently was in the commissioner's office in a quasi-judicial proceeding, and such delay could not be pleaded, at least not in a later proceeding. The court said further that since the enactment of the water code in 1919, springs capable of beneficial use are appropriable, that stock watering is a beneficial use, that water on the public land is appropriable, that a valid appropriation had been made, and that under the doctrine of relation the statutes provide that the priority date of the appropriation is that of filing the application, and further that the recording of applications and permits "by the water commissioner in a book kept for that purpose" is sufficient notice to all persons, and that it is the duty of homesteaders to search such record.

No evidence was given as to the amount of flow of the springs, except that they flowed throughout the year.

THE GILA RIVER DECREE

Controversies of long standing over the rights to use waters of the Gila River were settled by the decree of June 29, 1935 (Globe Equity No. 59). The United States of America, acting for the Pima tribe of Indians, was the plaintiff and the suit was in the District Court of the United States in and for the District of Arizona before Albert M. Sames, Judge. The entire decree is a stipulation between the many parties involved, arrived at after many years of negotiation. It follows the theory of prior appropriation in the main, the various departures therefrom being due largely to the location of the great Coolidge storage reservoir, which is below the water users of two counties and above the water users of a third county.

In the decree, no distinction in the determination of priorities was made between diverters of surface flow and various enterprises which pump water from the groundwater beneath the bot-
tomland of the Gila River Valley; the underflow to the full width of the bottomland was considered to be a part of the Gila River water supply, and water rights to the well waters were given priorities as of the dates of their first use.

The decree went even further and provided that the stream flow must be so regulated as to maintain the water table at certain pumping plants.

The principles of law followed in this decree cannot be said to be thereby impressed upon the law of the state of Arizona, or that the state courts are bound to follow those principles. In fact, the federal courts follow the state courts in matters relating to water law. It must be assumed that the federal court believed the law of Arizona holds as appropriable the underflow of a river valley to the full width of the bottomland.

It would be unfortunate and unnecessary to have rules of water law in one part of the state different from the rules applied by the courts in other parts of the state.
The following brief review of groundwater law in neighboring states may well be prefaced by a restatement of the various theories as to groundwater rights. There are four theories by which the water may be claimed:

1. The English or common-law doctrine, applicable to percolating water, that the groundwater is owned by the owner of the overlying soil and can be dealt with by him without restraint. In this case there is no assurance or protection as to the future of a water supply, if there are other competitors for the water. The usual court case arises, however, when a great quantity of water is withdrawn by pumps by one overlying owner and is transmitted by pipe line to a considerable distance, either for irrigation or for use by cities. Even in the eastern states, where the common-law doctrine is followed generally, the injustice to local interests has sometimes been so great that the courts in many states have departed from the English common-law rule of unlimited use and have imposed the conditions that the water cannot be used wastefully nor exported to other lands if injury results to neighboring landowners. The modified English rule has been called recently the American rule.\(^{15}\)

2. The doctrine of correlative rights. This has two outstanding features. First, it recognizes the close mutuality of interests and allows each landowner to take a reasonable or a proportional part of the common supply. Its background is recognition of the principle that there is a certain limited quantity of groundwater annually available, that it is one common supply, and each overlying owner is entitled to a reasonable or a proportional use. Second, it gives the better right to use on lands overlying, or riparian to, the groundwater in preference to use on distant lands but recognizes the right of export if injury to others does not result. An overlying landowner may begin at a late date to demand and take his share of the water, even though the water is then fully used. The early users must yield and reduce the quantity pumped by them in order that the new irrigator may get his share.

3. Priority of appropriation, the same as applies to surface waters, based on the principle, “first in time, first in right.” This may be applied to certain classes of groundwaters, or even to all groundwaters. In Idaho, Utah, and Colorado it is applied to all groundwaters; in Washington, Oregon (east of the Cascade Mountains), Nevada, Arizona, and New Mexico it is applied to certain classes of groundwater.

4. The riparian doctrine applicable, in states which follow that

doctrine, to streams flowing in definite underground channels, since the same rules of law apply to them and to surface streams. As modified by courts in California, Oregon, Washington, Nebraska, and Texas, this doctrine permits "reasonable" use by riparian owners without regard to priority, but in theory the doctrine denies any use whatever to nonriparian owners and thus tends to result in nonuse and waste of water. The lateral limits of the tracts riparian to the stream may be the full width of a Spanish land grant or may be restricted to the quarter sections or to even smaller tracts along the stream or overlying the groundwater. In California, by a recent decision (1935), the riparian owner is not only restricted to reasonable use, but his riparian interests are limited strictly to such waters as he actually uses.

It makes little difference which of the four theories is followed, and contests are nearly eliminated where the entire groundwater supply or better still the entire surface and groundwater supply are under one single control and management. Even though the land ownership is in separate parcels, the groundwater may be developed as one co-operative enterprise, and there is much advantage in so doing. Where each landowner has his own individual pumping plant or where there are several independent mutual companies or districts, there can be no planned control of the groundwater supply.

In New Mexico, Arizona, Nevada, Oregon, and Washington a dual system of water law exists. The common-law doctrine is invoked in cases relating to percolating waters and the appropriative doctrine with respect to waters in definite channels or within ascertainable boundaries. California has a triple system of groundwater law, following the correlative rule for percolating water, the riparian doctrine for underground streams, and the appropriation rule by prescription for five years.

The correlative doctrine of groundwater law is compatible with the riparian doctrine of rights to surface stream flow. It is not compatible with the appropriative doctrine.

The groundwater law in neighboring states will now be discussed. It is a fair presumption that the more closely another state resembles Arizona in its physiography, climate, and agriculture, the more valuable is its experience with the legal aspects of the control of groundwater.

NEW MEXICO

Although both New Mexico and Arizona were originally included in the state of Sonora, Mexico, and inherited the doctrine of appropriation, yet the development of law relating to groundwaters has taken quite different courses in the two states.

Arizona, New Mexico, Colorado, Wyoming, Utah, and Idaho rejected the riparian-rights doctrine at the outset, or very early. Nevada abrogated and discarded the doctrine in 1883, Nebraska in 1889 as to public lands, and Montana in 1921. Other western states adopted and have retained the riparian doctrine, at least in part. In Oregon the doctrine is practically extinguished as to nonnavigable streams.
In 1905 the territorial legislature of New Mexico created the office of artesian well supervisor, whose duty was to issue permits for drilling, make pressure and flow measurements, keep records of the logs of wells, and make inspections and file complaints for waste of artesian water. The purpose was to protect the Roswell artesian basin from improperly drilled, leaky wells, to prevent the flow from running to waste, and to control the drilling of new wells. This law was amended from time to time. A law passed in 1925 defined an artesian well, set up regulations for drilling and settling casing and for capping wells, declared waste of water to be a public nuisance with penalties, and provided that county officials could enter property and plug wells, placing a lien on the property for the cost.

A thorough investigation in 1925 and 1926 disclosed that the Roswell basin was overdeveloped; in fact, the area of the flowing wells basin had shrunk from 663 square miles in 1905 to 425 square miles in 1925, and many wells had been abandoned or had been equipped with pumps. In 1927 a law was enacted, applicable to the whole state, declaring underground waters to be public and appropriable under definite state regulations. This law was declared unconstitutional on technical grounds but was passed again in corrected form in 1931 and is now in force.

Under this act the state engineer can declare any area with underground water, the boundaries of which can be reasonably well determined, to be an "underground water basin," and appropriations within the area must be made practically the same as for surface streams. There are now four such areas, the Roswell artesian area, and three shallow-water pumping areas, with other designations being contemplated.

With a state appropriation in 1931 and local money thereafter, about 110 leaking wells have been solidly plugged. It is claimed that 48 cubic feet of water per second, which ten years ago was being wasted and lost, was saved by the plugging of the first sixteen wells alone, and further, the artesian pressure has been slowly improved in the last few years.

When an "underground water basin" is established, not only the broadly diffused percolating water but any underground streams within the area are included, both being considered as parts of the same water supply. Groundwater law in New Mexico may be said to be now based mainly and increasingly on the appropriation doctrine. The administration of the law by the state engineer is giving protection to present water users, preventing waste, and permitting expansion only where it should be permitted.

"In New Mexico, by legislative enactment and by decision of the Supreme Court of the state, that three-century-old rule of 'first in time, first in right', has been held to apply to the ground water with the same force and effect as it applies to water in surface streams. Thus the basis for the state to assume the right to control the ground waters and supervise their use, has reached us through the early customs and usage of the Spanish and Mexican settlements of this country." (From an address by T. M. McClure, State Engineer, before the Association of Western State Engineers, November 14, 1935.)
COLORADO

In Colorado there is little or no distinction in law between underground water and surface water, and the doctrine of appropriation applies throughout. In the case of McClellan vs. Hurdle (33 Pac. 280) in 1893, the court said:

It is probably safe to say that it is a matter of no moment whether water reaches a certain point by percolation through the soil, by a subterranean channel, or by an obvious surface channel. If by any of these natural methods it reaches the point, and is there appropriated in accordance with law, the appropriator has a property in it which cannot be divested by the wrongful diversion by another, nor can there be any substantial diminution.

Under this rule all water users, whatever their source of supply, are protected by the rule of priority, and it is not necessary to inquire whether the groundwater is diffused or is a definite stream with bed and banks. Many supreme court decisions have upheld the principle that surface waters and groundwaters belong to the same supply.

UTAH

The courts of Utah first followed the common-law rule. But in the Utah Oil Refining Co. cases (1921 and 1923) the court adopted a modification of the correlative rights doctrine, holding that each overlying landowner was entitled to his proportion of the groundwater but permitting export of the water to other lands regardless of the effect.

Since that time (1923) the trend in Utah has been toward the appropriative doctrine and the most recent decisions have been based on the doctrine of priority. The 1935 legislature added important provisions to the general water law for the particular purpose of regulating groundwater, requiring all claimants to file notice of their claims on blank forms. Since the passage of that act the state engineer has made special effort to get all claimants to groundwater to file their claims, stationing representatives in several counties to assist claimants in preparing their evidence and executing the blank forms. Over 17,000 claims have been filed to the end of 1936, "claims are being filed daily and in the end all will be claimed."

NEVADA

The growth and development of Nevada was coincident with the early development of California. Both states adopted the common-law doctrine of percolating waters.\textsuperscript{15} Hence, it was necessary to show some characteristics of a flowing, definite stream before rights of appropriation of groundwater could be established. At a

\textsuperscript{15} Also, both states were plagued by the adoption by the courts of the doctrine of riparian rights on streams.
very early date, 1871, the court held that water sufficient to flow out
of the mouth of a mining tunnel driven into the side of a moun-
tain was appropriable under the laws relating to water flowing in
streams. The distinction between underground streams and per-
colating waters was stated as dictum in court decisions, with no
scientific description or demarcation as to the meaning of these
terms.

Under a law passed in 1905 it was required that all new appro-
priations of water must be acquired through application to the
state engineer. In 1913 a more comprehensive water code was
adopted, Section 1 of which states that “the water of all sources of
supply within the boundaries of the state, whether above or be-
neath the surface of the ground, belongs to the public.” In 1915,
however, an amendment was adopted specifically eliminating per-
colating waters from the operations of the law but leaving under-
ground waters in defined channels or bodies within the general
water law. The provision as to percolating water has been nulli-
fied to a great extent by acts relating to artesian waters, stock
watering, and other acts.

In 1915, also, an act relating to artesian wells, to prevent waste
of water and declaring the waters of defined artesian basins to be
appropriable, was passed. This act was amended in 1935 as
follows:

Section 4. The state engineer shall administer this act and shall pre-
scribe all necessary rules and regulations for such administration. The
state engineer shall designate administrative underground areas and
subareas. The state engineer may require periodical statements of
water elevations, water used and acreage on which water was used from
all holders of permits and claimants of vested rights, shall find as to
whether there is unappropriated water in the area affected, and shall
issue permits only if such finding is affirmative. The state engineer at
any time may hold a hearing on his own motion or upon petition signed
by at least one fourth, and not less than fifty users of underground water
in any area or subarea, to determine whether the water supply within
such area or subarea is adequate for the needs of all permittees and
vested right claimants; if the finding is negative, the state engineer shall
order that withdrawals be restricted in [reverse] order of priority during
the period of shortage.

Section 8. It is the intention of the legislature, by the exercise of the
police powers of the state, to prevent the waste of underground waters
and pollution and contamination of the underground water supply, and
provide for the administration of the provisions of this act by the state
engineer, who shall prescribe fees for all services provided herein to
cover the reasonable cost of state services not defrayed by appropriation
or otherwise.

The effect of these amendments is to place the waters of artesian
basins under the administration of the state engineer, who claims
that the law gives his office control over all groundwaters. The
new legislation appears to have been copied from that in force in
New Mexico.
CALIFORNIA

Although California was carved out of former Mexican territory, in which the appropriation theory obtained, the mistake was made of adopting the English common law relating to water; and before needed changes were made to at least partially fit the law to the physical conditions, vested rights were acquired under the common law on a huge scale. Particularly since the decision in the celebrated case of Lux vs. Haggin in 1886, there has been a continuous, hard-fought struggle between the defenders of the common-law doctrine of riparian rights and the advocates of the appropriation theory, with the latter slowly gaining over the former. Finally, in 1928, a constitutional amendment was adopted declaring that waste or unreasonable use or unreasonable method of use of water must be prevented and that riparian rights attach to only as much of the water as can be used reasonably by the riparian owners and not to the whole stream, thus freeing to nonriparian appropriators all of the waters not used by riparian owners.

As to groundwaters not flowing in definite channels, the English common-law doctrine was retained until 1902, when the historic Katz vs. Walkinshaw decision was handed down by the Supreme Court. Until then an overlying landowner could withdraw the groundwater from beneath his own land without any restraint. The court substituted the theory of correlative rights, under which

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19 In this case Lux and others sought to enjoin Haggin from diverting to nonriparian land the waters of Kern River which would naturally flow down Buena Vista Slough to which their lands were riparian. The two-hundred-page decision, adopted by a divided court of four to three, upheld the riparian doctrine and enjoined Haggin, but in its dictum it modified the concepts so much that the riparian doctrine as so modified is spoken of as the California rule. Quoting from the decision, “By our law the riparian proprietors are entitled to a reasonable use of the waters of the stream for the purpose of irrigation. What is such reasonable use is a question of fact, and depends upon the circumstances appearing in each particular case.”

The California rule, of course, applies to definite groundwater streams. The wide uncertainty as to what is reasonable use is unfortunate and has caused much litigation, and of course under this rule the waters must be used on riparian lands. Since California law recognizes appropriation rights also, under certain conditions the greatest confusion has ensued.

20 The Constitution of California, Art. 14, Sec. 3.

21 The litigants and others were landowners over a basin of artesian water to which they had sunk wells. The defendant diverted the water for sale to be used on the lands of others distant from the artesian basin. She contended that the water was percolating water and therefore was her property. The Plaintiff contended that the artesian water was part of an underground stream to which his land was riparian. The court held that the water was percolating water, but, reversing the lower court, it emphasized the difference in the conditions “in a country like southern California, where the relative importance of percolating water and water flowing in definite water courses is greatly changed,” and held that the common-law rule should be upset and a new rule of “reasonable use” should be established.
each overlying owner is entitled to reasonable or proportional use on the overlying land, and only a surplus over what may be required by overlying lands may be conducted to other or distant lands.

In a later supporting decision\(^{22}\) in 1908, those overlying owners who take water from the common source for use on distant lands are spoken of as appropriators. Their rights, however, arise from their ownership of overlying lands.

Comparing the correlative rights doctrine pertaining to percolating waters with the rules applying to appropriations from definite underground streams, the principal difference is that in the former the principle of priority plays no part. Under the correlative doctrine, if an overlying owner who is late in developing his land finally sinks a well and begins pumping when there is no longer any unused surplus, then the other water users are supposed to yield to the newcomer his proportional part and to contract their own irrigated areas and their use of water.

It is sometimes stated that the correlative doctrine is virtually the riparian doctrine applied to percolating groundwaters. There have been some distinctions, however. Under the correlative rights doctrine, surplus groundwaters may be diverted to distant lands, but under the riparian doctrine they cannot be so diverted; under the riparian doctrine a riparian proprietor could enjoin diversion by an appropriator and in so doing would not be limited by any rule of reasonableness, prior to the constitutional amendment of 1928. The former rule tends to promote use of waters, the latter (riparian) rule tended to promote waste.

Despite the fine-spun theories as to groundwater rights in California courts over a period of thirty-three years, nothing has actually been done to control the withdrawal and use of water from the many great groundwater basins throughout the state. New, late developers among the correlative landowners add their pumping draft when the total is already too great. As a consequence, these water supplies have been slowly but steadily depleted, until in many of them exhaustion has been reached or is in sight. Rather than curtail the use of water by any water user, with reduction of irrigated area, impressive sums of federal money are being expended to import water from other sources, including the project to bring Sacramento River water southward into the San Joaquin Valley and Colorado River water to southern California counties. With no public administrator in charge of distribution and a public attitude of perpetual "boost and build," a hands-off policy has been pursued by the state. A few thoughtful persons have deplored the lack of control of groundwater supplies, pointing out that the cost of pumping over great areas is several times what it was ten to twenty years ago due to the higher lift, and legal means are now being sought for thwarting new claimants for groundwaters that already are completely used.

No other western state is now following California by adopting

\(^{22}\) Burr vs. Maclay Rancho Water Company (154 Cal. 428).
the rule of correlative rights, and in that state the results have been disappointing. When new overlying owners develop their lands and begin to pump, the draft of prior users is supposed to be further reduced if overdraft exists. However, in most cases, all who desired to do so have developed and pumped, ad libitum, as though the supply were inexhaustible, and the water has been mined. The correlative rights doctrine has been tried and appears to have failed, partly perhaps for want of vigorous public administration.

The constitutional amendment of 1928 limiting riparian rights to actual, beneficial, reasonable use on an owner's lands has been interpreted extensively in a recent decision, and some features of the decision relate to groundwater supplies. The points are well shown in headnotes 7, 8, 9, and 10, which are as follows:

7. Overlying landowner may possess right to subsurface stream analogous to riparian rights and is entitled to protection against unreasonable depletion by appropriator.

8. Use of entire flood flow of stream to press small amount of water into adjoining land is unreasonable use, and riparian and overlying landowners could not enjoin appropriation of flood water which served no useful purpose for groundwater replenishment.

9. Mere inconvenience or extra expense to overlying landowner within limits which are not unreasonable will not justify granting injunction against subsequent appropriator of underlying waters.

10. Persons claiming prior water rights as overlying or riparian landowners held not entitled to injunction to restrain impounding of creek waters by city by means of reservoir, since public use had intervened.

Regarding the determination of reasonable use the court said:

The problem in any case is to ascertain what portion of the product of the stream is subject to appropriation after all reasonable beneficial uses on the part of those having paramount rights have been enjoyed or safeguarded. It is suggested that the application of the doctrine of reasonable use of water lays the matter open to too much uncertainty. Conceding that the ascertainment of reasonable use is difficult, it does not follow that it cannot be done. The requirements of public welfare demand that it be done, and the uncertainty ends when a definite application of the rule has been made to the facts in each case.

Since the turn of the century, the California courts have given prominence to the public interest in full conservation and use of the water resources. In the effort to assure continued supplies to water users, new theories and rules of law have been evolved. The questions of the particular body of water, its origin, place and method of diversion, and economic cost have become overshadowed in the struggle to extend the irrigated area.

There is considerable unrest with respect to the status of groundwater law among those best qualified to judge of the adequacy of the present law. This dissatisfaction was expressed recently in the following language:

All principles regarding groundwaters in California are the result of court decisions. Although eventually these precedents may yield to public necessity, there is usually a considerable time lag during which unfavor-

23 Peabody et al. vs. The City of Vallejo, 1935 (40 Pac. 2nd 486).
able conditions continue. The Committee considers that there is need in California for a reconsideration of this subject in the light of present knowledge and conditions.

... It considers that a Constitutional Amendment, perhaps along the lines of the recent Amendment of the California Constitution regarding rights of riparian owners on surface streams, is probably necessary to effect such a change, and believes that efforts to draft and secure its adoption are justified by the present conditions.24

CONCLUSION

In general, the foregoing discussions of the laws of underground waters in the ring of states surrounding Arizona exhibit the uncertain status and the divergent trends in the evolution of groundwater law and the frequent changes25 and modifications of legal principles made in most cases by the courts. These developments have in each case reflected the need of adjusting the law to the physical and, to a less extent, the economic conditions in the respective states. Even now, several states are testing new theories and methods of control, and groundwater law is far from being crystallized.


25 The Supreme Court of Idaho in 1922 in a case involving some artesian wells said, "Mere percolating waters or waters gathered in wells upon the land of owner of fee are not subject to appropriation, either under the constitution or statutes" (211 Pac. 536). But within nine years the court had completely reversed itself. In a case in 1931 (5 Pac. 2d 1049) the court said, "A valid appropriation of percolating subterranean waters, made either by statutory permit or by actual diversion and beneficial use gives priority over a subsequent valid appropriation, however made."
At the annual meeting of the Association of Western State Engineers on December 7, 1934, a committee was authorized and directed to prepare a draft for a uniform underground water law in time for presentation to legislatures meeting early in 1935. The draft of a model law prepared by the committee and published by the association declares practically all groundwaters to be public waters and extends the laws relating to appropriation and adjudication of surface waters to underground waters. It authorizes the state engineer to designate areas and subareas of underground water for administrative purposes and provides that priority in each case shall relate to a definite area. The responsibility is placed on the engineer to determine whether or not there is any unappropriated groundwater in an area before acting upon an application for a new appropriation, and therefore investigations must be carried on continuously and records maintained. If there is found to be a deficiency, the state engineer must order the withdrawals of water by pumping to cease in reverse order of the priorities. Claimants to vested rights must file notice within one year after date of enactment, and evidence of use within the last three years is required. Nonuse for four years constitutes a forfeiture of the priority.

Largely in conformity with the uniform groundwater law, as thus proposed, the legislature of Utah in 1935 enacted a statute requiring all claimants of groundwater to file their claims in the office of the state engineer. Over 17,000 claims have been filed, and the attitude toward the new law is such that the newly elected legislature is to be asked to strengthen it in several particulars. Filing of claims to well waters as a first step assures full protection to all present vested rights.
PRESENT STATUS IN ARIZONA

The general effect of the decision in the Southwest Cotton Company case in 1931 has been to increase the uncertainty concerning water law, but in general the decision has discouraged the application of the doctrine of prior appropriation to groundwaters in the state. This was evidenced in a legal opinion, written in 1935, on the groundwater supply of the valley land in the vicinity of Sahuarita in Pima County. The opinion states that "the subsurface water in the Sahuarita Valley is, beyond a doubt, percolating water" and is owned by the owner of the overlying land. If that were true, then the city of Tucson can have no priority of appropriation for its wells along the Santa Cruz River nor can numerous irrigators between Tucson and Nogales, and the decision in Proctor vs. Pima Farms Company was based on a wrong premise.

The opinion was intended to encourage the customer, a federal agency, to buy land on the theory that none of the other water users along the valley could interfere with the pumping operations on the 200-acre tract to be purchased. Even were the conclusion correct, the advice as rendered was bad, for it overlooked the fact that after the owner of the unprotected percolating water supply pumped the water that came with the land, he would be dependent for new water on such inflow as could get past and under his neighbors' lands. In this instance, since there is more fertile bottomland than there is water supply, a race for water would be likely, and the competition would be to see which of the owners could underpump the others, an especially baneful condition in this case, because the land would be cut into scores of small holdings.

Unless the Southwest Cotton Company case is retried (see page 64), which appears unlikely, it may be necessary to await some other new case before the questions as to just what groundwaters are appropriable and to what extent can be clarified. These questions should be settled. There are today projects proposed and awaiting proper financing, which should not be built, and there are many developed areas in which uncertainty and fear and threatened litigation over groundwater exist.

It is presumable that the Supreme Court will cling to the dual system and will not reverse its judgment as to diffused percolating waters. At any rate, since the decision in Howard vs. Perrin in 1904, one who has developed such waters has had notice that he did so at his own risk. The court may or may not adopt the theory of

26 The author in 1916 induced the Agricultural Products Corporation to locate their operations on the Canoa Land Grant, because, the adjacent foothill slopes being very rough, the groundwater supply for that entire section of the valley would be under one control, with assurance of recharge from the flanking mountains as well as from the main river flow. He has often advised a prospective farmer who wished to farm 100 acres to purchase several hundred or a thousand acres, depending on the conditions and to place his well in or near the center of the tract.
Plate V.—A pumping plant on the desert northwest of Laveen with hoisting tower, weir box and division box, and new type (1936) substation arrangement. The pumping lift is 38 feet, and the well discharge serves 1,080 acres adequately. By means of the weir, the crest of which is 30 inches long, a record of the quantity of water is kept.

correlative (proportional) rights; in practice it is not important which happens, since in either event landowners will probably withdraw such water ad libitum, as in California. The water table in certain areas may recede to low levels, and injury to some sur-
face water supplies downstream may be unavoidable; in areas where use is limited mainly to domestic use and stock watering, the supply will continue to be adequate and satisfactory.

With the growing necessity for protection of water users, however, it is not unlikely that the court may take a more liberal view as to what constitutes a definite underground channel. Of the three criteria—bed, banks, and current—the current, or water movement, presents no difficulty, since wherever the water table has a slope, the groundwater is moving in the direction of the slope. No one will controvert that statement. In many cases banks can be ascertained and established by one trained in physiography. Beds might be ascertained also by extensive drilling operations but only at great expense, and it is here that the court may become lenient in its requirements, and with good reason. While it is necessary to draw lines on the ground surface between the areas to which each rule of law applies, the depth of a water movement is not so vital, since ownership is not in horizontal slices of the earth's crust, and wells are drilled vertically. Banks and current are relatively important, the bed of an underground channel is not. The bed is not a logical or justifiable criterion.

THE THREE ALTERNATIVES

Speaking broadly, it may be asked what is the wisest course to pursue from the standpoint of public policy. There appear to be three alternatives, which should be weighed, and each one should be given due consideration before concentration upon any one as being the most desirable.

First, the present conditions may be continued, with no organized state control over groundwaters, but with unlimited use and new development by overlying landowners except in rare cases when the water users stipulate or attempt to prove a definite underground channel. Each landowner will have an incentive to take as much as he desires and can use and to deepen his wells as the water table recedes, but he may be deterred from new development if he or his financial advisers see a probability that other developers will cut off his apparent supply within a few years. If, however, he feels that his location is advantageous, he may develop his supply rapidly to the detriment of other competing water users or of old established rights below. This is the law of the jungle applied to use of groundwaters, particularly when the use requires the great quantities of water needed in irrigation.

Second, following the trend in other states, legislation may be enacted defining groundwater rights and providing for adjudication of all rights and then for state control and administration. In such legislation, springs and underground channels and other terms should be adequately defined. Well drillers may be licensed and required to report promptly the logs of new wells. All groundwaters, or limited types of groundwaters, may be claimed as public. The degree of protection to prior users should be set forth.
It is difficult to establish in the statutes fixed rules to fit a multiplicity of conditions, and legislators will need to be well advised, else the laws enacted may do injustice or may add to the confusion. One difficulty easily foreseen will arise from the varied claims of vested rights based on principles of law as previously interpreted by the court.

One suggestion that may be pertinent is that the legislature appoint a commission to study groundwater law in all its aspects and to prepare a code for submission at the next session, having in mind the conservation and greatest possible use of all the water supplies of the state. Problems that should be studied by a commission include:

Shall the dual system of groundwater law be upheld and continued, or a change made to the full appropriative doctrine?

If the dual system is continued, what classes of groundwater shall be appropriable?

1. Underflow beneath a stream bed?
2. Underflow beneath an entire bottomland?
3. Underflow in wider range where it is proved by wells to be available in "commercial" quantity—that is, adequate for extensive irrigation, for much more than kitchen gardens?
4. Artesian waters?

Shall the test be "banks" or the quantity and importance and homogeneity of the groundwater movement?

Shall the determination be made by the water commissioner or by evidence submitted in court or by experts selected by the court?

Shall groundwater developments which affect or reduce surface stream flow be restricted, and to what extent?

Shall storage projects which affect or reduce groundwater supplies be restricted, and to what extent?

Shall protection be absolute, or shall some minor injury to senior appropriators be permitted in order to secure full utilization and prevent waste?

Shall a prior appropriator be protected to the extent that the water plane at his pumping plant shall not be lowered by junior appropriators? Shall reasonable lowering be based on economic considerations or on the annual recharge and total supply in storage?

As the upstream use of water increases to the point of exhaustion of the natural flow, shall the prior appropriators downstream be forced to accept as a substitute inferior waters carrying harmful quantities of white or black alkali; and if not, should the protection as to degree of alkalinity of water be the subject of legislation or left to the state administrative agency?

Shall exchanges of groundwater supply for surface waters require mutual consent or only the authority of the commissioner or merely the taking?

Shall well drillers be licensed and required to

1. Obtain permit before drilling a well?
2. Report an accurate log of the formations to the water commissioner?
3. Thoroughly case an artesian well and equip the top of the casing with a gate valve?
   Shall the permit to drill a new well be required of the landowner or the driller or both?
   Shall all present claimants to use of well waters be required to file their claims, and shall failure to file such claims be considered as “prima facie evidence of intent to abandon such claimed right” so that in the distribution of the underground waters the water commissioner “may disregard any claim not so filed,” as now practiced in the state of Utah?
   Shall the common-law rule or the American rule or the California rule be adopted as applying to diffused percolating water?
   Shall all present users of groundwater for domestic water supply be confirmed in their rights?
   Shall the future additional use of groundwater for domestic service be legalized as a preferred use, even in areas in which the groundwater is now fully utilized for irrigation or other purposes?
   Shall stock watering have rights as a preferred use?
   Shall springs on privately owned land be limited as to appropriability to those flowing more than 3 (or 10 or 25) gallons a minute?
   Shall a spring on public land be defined as a natural flow in a clear stream of not less than ½ gallon per minute in order to differentiate springs from seeps?
   As the third alternative to be considered, it may not be too much to hope that the common law of Arizona respecting groundwater may be wisely, fully, and speedily developed to a conclusion in the courts, after which the main principles of groundwater law can be enacted into legislation, and administrative machinery can be set up to control such waters as are declared to be public. This procedure has the advantage of preventing the numerous and diverse claims of vested rights which would inevitably follow early legislation, if the new legislation is in conflict with the prior statutory law as interpreted by the court. If a reinterpretation shall have been placed upon the old statutes by the court prior to the enactment of the new legislation and this new legislation is in harmony with that interpretation of the old statute then the claim of being deprived of vested rights would be of no force.
   A great deal of the common law as stated in decisions of the Supreme Court (see previous chapter), having been based on inadequate and contradictory evidence and testimony and on misconception of the nature of groundwaters should not be considered as binding on the court. When an important case next comes before the court, it should be considered completely in all its phases and implications, and the decision should be rendered in accordance with justice and the public welfare. Aside from the one dubious clause “definite underground channels” in the code, there are no fetters on the court. Most certainly the early decisions given when the use of groundwaters was limited to house service and stock watering should not be allowed to congeal.
   It is further suggested that in future litigation, in which there
is great conflict in the evidence submitted, that the court appoint and employ a competent physiographer and hydrologist to make a field examination and study and a report thereon to the court at the expense of litigants. And in an extremely doubtful case, the wisest course may be a temporary decree, postponing a final decision until the effects of new diversions are established by continued pumping of some or all of the wells for several years.

27 The laws of Nevada provide: "For further information on any subject in controversy the court may employ one or more qualified persons to investigate and report thereon, under oath, subject to examination by any party in interest as to his competency, to give expert testimony thereon" (Statutes of 1931, Chap. 223, Sec. 36). Also in California, under Section 1871 of the Code of Civil Procedure, the court may call expert witnesses on his own motion as well as on motion of the parties, and either party can call and examine the court's expert, or the court can call and either party can cross-examine. In Arizona in an insanity case the court is required to call in a physician.
SPECIAL RULES OF LAW FOR GROUNDWATER RIGHTS

Attention has been called several times to the difficulties encountered in trying to bring groundwater rights under the same rules of law as surface water rights. For example, each pumped well has an effect on the water table of the surrounding area, the amount of lowering and the permanency of the effect depending upon the physical conditions. To deny a junior appropriator of groundwater the privilege of lowering the water table over the surrounding area without being required to pay damages to one or several senior appropriators tends to give the older appropriators a monopoly, though they may use only a small fraction of the available water supply. The prior appropriators should anticipate the greater lift and should bear some increased cost of pumping.

The most important distinction between surface and groundwater supplies in Arizona lies in the fact that in many cases the groundwater in a valley or a part of a valley if not used in that locality would be consumed by the native plants and by the cottonwoods, mesquites, and other vegetation bordering the stream courses, so that it could never be of value to irrigation projects at a considerable distance downstream. There are exceptions to this statement, and in some cases there would be damage to the lower diversions, though it might be inconsequential in comparison with the value of the water supply derived from the wells. To illustrate, the San Pedro River when not in flood has a small varying flow throughout most of its length, an insignificant flow compared with the great loss of water by evaporation from the river bed and transpiration from vegetation. The slender flow is merely an equalizer. There is very little irrigation by pumping in that valley. If it should be developed to a considerable extent, the injury to the Casa Grande and other downstream projects would be trivial. The Santa Cruz Valley is so far isolated from its outlets in the Gila River that the effect of pumping in the region of Tucson on the water supply at the head of the Buckeye Canal is trivial, perhaps a fraction of 1 per cent.

Another feature of groundwater development in many areas is that the water table must be drawn down during the irrigating season to make room—storage capacity—for recharge during the winter months and for recharge from floods whenever they occur. This is a case of parallelism rather than of distinction, for surface water reservoirs must be drawn upon to make room for more inflow. It is and will be a public necessity in Arizona that such groundwater reservoirs be utilized by alternate draft and refilling at least annually and in some cases twice a year, and with longer, secular fluctuations of stored supply. If pumps have to be lowered at seasons of greatest lowering of the water table, then it is just a necessary incident.

But it may be said, since part of the recharge comes from floods,
if the water table has been drawn down lower than the stream bed, a greater quantity of water will be absorbed from floods. This is true, but normally the floods are large and most of the water runs past the pumped areas and the effect on the final disposition of the water is thus minimized. The value of the continuous pumped supply far outweighs that of the erratic, undependable, occasional increment of flow which might be available at some point downstream.

Because of the necessity of evaluating many hydrologic factors, state administrative officers in other states are given more latitude with respect to groundwaters than with surface streams. In several states, for example, the officer designates areas and sub-areas within each of which the water supply is treated as a unit instead of treating the entire drainage basin as a unit.

In the distribution of surface water supplies, it is the water commissioner's responsibility to see that each water right is definitely understood and protected. He must know just when a junior right must be suppressed to protect another right located perhaps 8 miles away. As an administrator he must know his problems in great detail and must keep and study continuous records. It is a position of trust, and he must be trusted. Likewise, in the administration of groundwaters the state water commissioner must have latitude in the application of the general principles of law.

An analogy with pumping is found in the mutual interference of "underflow ditches," those ditches excavated in or close to the river bed, employed by the people in Sonora and the early settlers in Arizona to provide ditch water after the surface flow failed. Some of the early underflow ditches are still in use, a notable group of them being located in the Rillito River near Fort Lowell ruins.

Such underflow ditches, or gravity collecting ditches as they might be called, are much more sensitive to interference with each other than are wells, since they obtain their water from the top stratum and in effect merely skim the top of it.

After a study of the Rillito underflow ditches, the author published an article on the "Application of the Doctrine of Priority to Underflow Ditches," in which it is stated:

. . . yet the movement or rate of flow per day is in all cases exceedingly slow; and the draft made by ditches or pumps is met in part by the reservoir of stored water in the sand, which reservoir is replenished from time to time by new floods or by periods of rainfall; and, whatever the effects of mutual interference of underflow ditches may be, such effects are all wiped out by every good flood period, and some time must elapse before interference can begin again. A defined underflow stream, therefore, is by nature intermediate between a surface stream flow and an

28 In some cases bottomless flumes of boards or planks, preferably of redwood, were laid in the trench and the trench was then backfilled. If the portion of such collecting flume in the river bed was below the scour line during floods, the flumes endured for many years.

29 Twenty-second Annual Report (University of Arizona College of Agriculture) 1911, p. 570.
indefinite underground flow by percolation. While the doctrine of priority is in a measure applicable to defined underflow streams, such application should be carefully limited.

... interference between ditch heads widely separated is often imputed, when such interference is impossible. In the case of surface water, priority applies all the way from the ditch head to the source of the stream. In the case of underflow, this would be unreasonable. New or additional underflow waters can often be diverted upstream without any injury to the prior rights.

If a man diverts a new ditch of water from a surface stream, all of which has been previously appropriated, then the prior appropriators further downstream are injured to the extent of just as many miner's inches as are carried in the new ditch. But in the case of an underflow stream, perhaps the injury to prior appropriators will be less than five or ten percent of the total amount developed. The community is interested in having the development go on, and where the injury is trivial the state can reasonably expect the prior appropriator to develop his own ditch head a little to get more water. Any one, or all, of the ditches can be improved by deepening the heads or by extending them upstream...

Priority in an underflow appropriation, then, ought not to be positive as it is in the case of surface streams, but should be subject to limitations as follows:

1. Any injury or interference must be proven clearly.
2. The injury must be considerable. Trivial injury, or slight injury at infrequent or short periods should not be cause for action.
3. A ditch owner must be reasonably willing to cooperate with his neighbors in the general development of the underflow.
4. A ditch owner must maintain his collecting head or flume in good condition as an efficient agent for taking and carrying water.

The above discussion is pertinent to all appropriative rights in groundwater, and the four rules as stated may be taken as a starting point in the formulation of rules for groundwaters developed by wells.