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IB 439 (1934)

USDA TECHNICAL BULLETINS

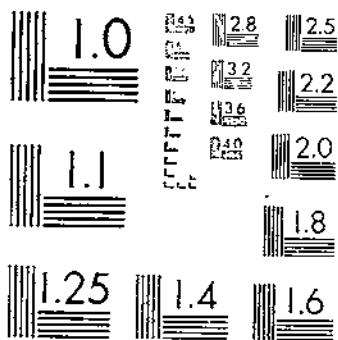
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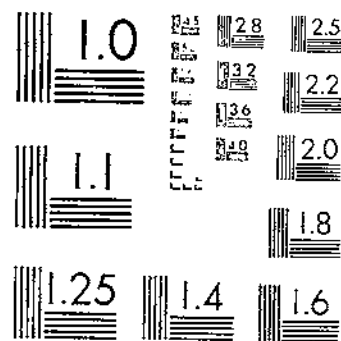
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TK 439 (1934)

TECHNICAL BULLETIN No. 439

OCTOBER 1934

# POLICIES GOVERNING THE OWNERSHIP OF RETURN WATERS FROM IRRIGATION

By

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JAN 29 1935

UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.



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By WELLS A. HUTCHINS, *irrigation economist, Division of Irrigation, Bureau of Agricultural Engineering*

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INTRODUCTION

The ownership of return flow of irrigation water is a matter which has concerned State administrative officials in increasing degree in recent years. It has been much debated at their annual conventions. Return waters from irrigation constitute a large percentage of the total water supply available for further use from many important stream systems; yet the courts have ruled on the question of ownership in only a few States, and only in one State (Colorado) have the decisions been sufficiently numerous to furnish comprehensive precedents for its varying angles. The present inquiry has been undertaken for the purpose of securing information upon the extent of use of return flow for irrigation purposes, the nature of conflicts over the right to its use, its effect upon irrigation development gen-

erally, the character and operation of policies governing its control and reuse, and the necessity, if any, for further formulation or modification of policy.

The study was made in 13 of the Western States—the 11 States farthest west, and Nebraska and Texas—by personal visits to important localities and by consultation with the several State administrative authorities.

#### DEFINITION OF RETURN FLOW

Return flow from irrigation may be defined as that portion of water diverted for purposes of irrigation which eventually finds its way back to the stream from which diverted, or to some other stream, or which would find its way back if not intercepted by some natural or artificial obstacle.

Return flow includes both avoidable and unavoidable losses from the project. Part of the return is water which has escaped from control by means of leakage through and around structures, seepage through canal banks, and penetration below the root zones of plants; and part is water purposely released from the ends of canals and over wasteways.

Return water normally returns to the stream from which diverted. However, if transported to another watershed, in which case it would naturally drain toward a different channel, such water would nevertheless still be properly classed as return water. It is foreign to the stream toward which it now drains, but is nevertheless return water from irrigation. Return flow on its way back to the stream may be intercepted by a subterranean dike; or may be collected in drainage ditches or pumped from underground and reused for irrigation before reaching the stream, without losing its character as return flow.

Visible return flow is that portion of the return water which appears at the surface of the ground before reaching the stream. It collects and is returned to the stream in artificial or natural drains, or appears in small rivulets or waterfalls, and therefore is often directly measurable.

Invisible return flow is that portion which seeps into the river channel through the banks, below the surface of the stream, or which rises through the bottom. Obviously it is seldom directly measurable. For a given stream section, the nearest quantitative approximation that can be made of invisible return flow is a calculation of invisible net gain (or, it may be, net loss) within the section, made by deducting the sum of all measured inflows from the sum of all measured outflows.<sup>1</sup>

However, all accretions to a stream within an irrigated region, even where no surface importations are evident, may not be return water from irrigation. The problem of measuring the quantity of return is often complicated by additions to the underground supply caused by seepage into the basin from surrounding elevations

<sup>1</sup> Formula,  $x = (b + d) - (a + c)$ .

Where  $a$  = flow of stream at upper end of section

$b$  = flow of stream at lower end of section

$c$  = visible return flow to section

$d$  = diversions from section

$x$  = invisible net gain or, if a minus quantity, net loss.

and by rainfall within the basin. Likewise, excessive return flow shown by measurements taken during the falling stages of streams has been attributed partly to the release of water stored in adjacent sands during the rising stages (*11, pp. 96-98; 22, p. 48*).<sup>2</sup>

Western streams commonly lose water by seepage and evaporation after leaving the mountains in which they rise. Return flow from irrigation partly offsets this loss in certain localities and completely overcomes it with resulting net gains in others.

## THE PHENOMENON OF RETURN FLOW

### EARLY RECOGNITION

The earliest observations in the United States, so far as the author is aware, of the relation between seepage from irrigated lands and increases in river flow below the lands were in Colorado. The second State engineer of Colorado (E. S. Nettleton), writing in 1884, commented upon the increase in the autumn discharge of streams in the irrigated area during the preceding 14 years, notwithstanding his reasonable certainty that the rainfall had not increased; and spoke of the subsidence of alarm on the part of residents of lower Cache la Poudre Valley and elsewhere over the scarcity of water, in the face of their declarations 8 years earlier that no new diversions should be made, and in spite of the fact that new appropriations of water had been made in each succeeding year (*18, Rept. 2, pp. 17, 34*). Two years later Nettleton reported the results of a series of measurements to obtain accurate information concerning seepage water in the Cache la Poudre (*18, Rept. 3, pp. 210-214*). It appears that the increase in flow of water in the lower valley of the South Platte had been attracting attention and had led to the construction of new canals for the purpose of taking advantage of it. Seepage studies on the Poudre and South Platte were made in succeeding years by Carpenter and others (*3*), and were continued on the South Platte with considerable regularity by incumbents of the State engineer's office. Parshall (*22*) in 1922 published a comprehensive study on seepage return to the lower South Platte.

In the meantime the phenomenon had been observed and studied elsewhere in the West.<sup>3</sup> Without attempting to list all the references, it may be stated that Fortier (*8*) investigated the matter in Ogden Valley, Utah, in 1894 and concluded that the use of water in the upper valley increased the available supply to certain lower areas during the greater part of the irrigating period. Dr. Fortier reported further studies made in Utah in 1896 (*9, 10*), and in Bitter Root Valley, Mont., in 1903 (*11, pp. 84-93*). In Arizona, on the Gila River, measurements made in 1899 were reported by Newell (*19, pp. 340-347*), and on the Salt River the relation between irrigation and return water was discussed by Code (*4, pp. 103-105*) in 1900. Measurements on the North Platte in Wyoming and Nebraska were made in 1903 in connection with a study of water rights on certain interstate streams (*25, pp. 48-50*). In more recent years the results of many studies of return flow have been published in several of the Western States, principally by State engineer offices.

<sup>2</sup> Italic numbers in parentheses refer to Literature Cited, p. 47.

<sup>3</sup> Carpenter, writing in 1896, also cites instances in India, Italy, and France (*3, pp. 58-60*).

Some of the early works on seepage inflow to streams laid little or no stress upon the fact that all accretions were not necessarily due to return water from irrigated land; while others pointed out carefully the various possible sources of gain.

In the following pages will be found (1), a description of conditions on a number of typical streams with reference to return flow; (2) a discussion of controversial questions which have arisen in connection with the appropriation of return waters and opinions of the courts bearing on these questions; (3) an impartial statement of both sides of the controversy over public versus private ownership of return water; and (4) an analysis of the principles upon which an equitable policy can be formulated. The chief purpose of the publication is to set forth clearly a statement of the equitable principles governing the use of return waters as an aid in the efficient utilization of the streams in the arid and semiarid regions.

#### RETURN FLOW ON IMPORTANT STREAM SYSTEMS

Recognition of the existence of return water from irrigation is now widespread throughout the West. Accretions from this source are to be noted along the portions of practically all streams within irrigated valleys, except in those comparatively rare formations (for example, the Lower Rio Grande Delta in Texas-Mexico) in which the return from irrigation drains away from the stream channel rather than into it, and except in other cases in which the irrigation water is applied beyond the height of land along the watercourse.

The following brief statements are designed to emphasize the widespread existence of this important feature of western stream flow and to point out the various ways in which it has become manifest and the resulting complications in irrigation water rights and development.

##### YAKIMA RIVER, WASH.

The irrigable land of Yakima Basin, Wash., lies in three main areas—Kittitas Valley, which ends a short distance below Thrall, after which the river flows through precipitous country; the Yakima area, with a pronounced constriction at Union Gap; and the extensive area between Union Gap and the mouth of the river at Richland. The Yakima thus lends itself readily to the functioning of return flow, and the fact has been recognized for many years.<sup>4</sup> The amount of return in each of these areas is considerable, but complete return-flow studies in the basin have not been made.

In the area below Union Gap the quantity of return flow from the Wapato and Sunnyside projects has been such that in a season of water shortage it has been possible to dry the river at the Sunnyside diversion and still supply the lower projects.

The river is regulated by officials of the Yakima project of the Bureau of Reclamation. The Bureau has constructed extensive storage and distribution works and has agreements with holders of

<sup>4</sup>Records compiled by a local engineer in 1905 showed that 11 percent of the water diverted in Yakima Basin during that year was taken out while the total diversions exceeded the combined flow of supply streams.

old rights under which storage water is furnished to supplement direct flow.

An important feature of the return-water situation is illustrated by the recovery and reuse of drainage waters on Wapato project of the United States Indian Irrigation Service. The topography is favorable, and the soil "is disintegrated basalt underlaid with gravel susceptible of excellent drainage".<sup>5</sup> Several of the main laterals are paralleled by drainage ditches. The method of diversion is to check up the drain and raise the water level to a point where it can be taken out into an irrigation ditch. In 1930 nearly a fourth of the 82,472 acres irrigated on the project were supplied in this way. A pumping unit of 8,700 acres has since been installed for the utilization of drainage waters as well as natural flow. A subdivision of the Satus unit consisting of 8,800 acres is supplied by gravity from the main Wapato drain, 3,215 acres having been irrigated thus in 1931; and another with 2,929 acres irrigated that year pumps drainage water as the principal part of its supply. More than one-third of the drainage yield of the project was recovered and reused for irrigation in 1930 before reaching the river. When all of the lands served by these additional units are in cultivation, it is anticipated that the net drainage return to the river will be substantially lowered.

#### UMATILLA RIVER, OREG.

Most of the land irrigated from the Umatilla River in Oregon lies along its lower reaches below Echo and along the Columbia below the junction of the Umatilla and Columbia. The Umatilla project of the Bureau of Reclamation covers by far the larger part of the irrigable land. The project is covered by two irrigation districts—Hermiston and West Extension. A large amount of seepage water arises on Hermiston district. The soil is sandy and is underlaid with gravel; large quantities of water are applied in irrigation; and the result is that the main Hermiston drain flows perpetually with a mean monthly discharge which ranged from 24 to 57 second-feet and a run-off which averaged 28,550 acre-feet per annum for the 3 years ended September 1931.<sup>6</sup> The water supply of West Extension Irrigation District during part of the season consists entirely of return flow. Its diversion is some 9 or 10 miles below the Hermiston drain and it receives, in addition, invisible seepage from Hermiston District and return waters from other irrigated lands above.

When the water supply in the Umatilla is only enough to fill the demands of decreed priorities the river is successively dried at four diversion points, all lower rights in turn being satisfied by return water flowing in the channel.

The extent to which diversions from this stream are dependent upon return water from irrigation may be illustrated by the results of gagings made over a 3-year period on the Umatilla (28. *Paper 694*, pp. 16-17, 21; *Paper 709*, pp. 14-15, 19; *Paper 724*, pp. 15-16, 21) and on Butter Creek.<sup>6</sup> The differences in run-off to Umatilla River

<sup>5</sup> CAREBERRY, R. S., PRESTON, P. J., and HOYT, L. M. REPORT ON OPERATION AND MAINTENANCE METHODS AND PRACTICES ON FIFTEEN MAJOR PROJECTS, GOVERNMENT AND PRIVATE, JANUARY 1927, MADE TO THE COMMISSIONER OF RECLAMATION. 1927. (Unpublished manuscript.)

<sup>6</sup> Data furnished by State engineer of Oregon.

above Furnish Reservoir plus the inflow from Butter Creek and the run-off in the river near Umatilla (near its mouth), as compared with actual diversions between the points of measurement, in acre-feet per 12-month (October–September) period, were as shown in table 1.

The actual proportion of the excess due solely to return flow has not been determined. Some of it is due to rainfall and to unmeasured accretions, but return flow unquestionably accounts for a large part.

TABLE 1.—Differences between upper and lower stations of Umatilla River, Oreg., total diversions and excess due largely to return flow

Item	1923-29	1929-30	1930-31
Differences between upper and lower stations, presumably available for diversion	Acre-feet 152,000	Acre-feet 120,370	Acre-feet 131,400
Total actual diversions	235,052	212,778	209,378
Excess, probably due in large measure to return flow from irrigation	73,052	87,406	77,918

#### SACRAMENTO AND SAN JOAQUIN RIVERS, CALIF.

The Sacramento River occupies the trough of a valley about 150 miles long and mainly from 25 to 40 miles wide. Drainage from irrigation diversions returns quickly to the river, principally through troughs in the adjoining basins, and is discharged into the river through well-defined channels at considerable distances downstream from the diversion sources (24, pp. 245–246). Studies of return flow during the period 1924–28, made by the State Division of Water Resources (24, p. 247), show

that the seasonal seepage, ground water return, etc., which can not be directly measured varied from a minimum of 11 per cent of the irrigation draft in 1924 to a maximum of 20 per cent in 1927; that the seasonal return as measured at the definite return channels varied from 22 per cent of the irrigation draft in 1924 to 40 per cent in 1925; and that the total return, including all accretions, varied from 33 per cent of the irrigation draft in 1924 to 59 per cent in 1925 and 1927.

Figure 1, showing the accumulated draft and return flow along a 200-mile section for June to September 1928, is redrawn after the report upon this work. Water known to be derived from sources other than return from Sacramento River diversions was carefully excluded from the amounts used in preparing the chart.

A feature of the return-water situation in Sacramento Valley is the large quantity of river water diverted for rice irrigation and the large proportion of such diversions returned to the river. Records of three typical projects over a period of 7 years showed the consumptive use to be essentially unaffected by the quantities diverted. As the soils were impervious, quantities in excess of evaporation and transpiration requirements returned promptly to the river and became available for reuse by lower projects. Large irrigating "heads" and large rice "checks" were used to reduce labor costs and to effect sufficient circulation of water both to wash out alkali accumulations and to prevent further alkali deposits (26).

The State Division of Water Resources has estimated from its water supply and return water studies that under a condition of ultimate

development about 42.5 percent of all water diverted for irrigation in Sacramento Valley would reach the streams as return water. The division further estimates that 75 percent of the total annual return would reach the streams during the irrigation months of April to October, inclusive; that the highest rate of return per month would be 13 percent from June to August, and the lowest 5 percent from November to March (29, p. 80).

Studies made from 1924 to 1928 by the State Division of Water Resources indicated that the average percentage of diversions occurring as return water in the San Joaquin River was considerably less than for the Sacramento, due probably to the recapture of much of the underground water by drainage pumps and its reuse for

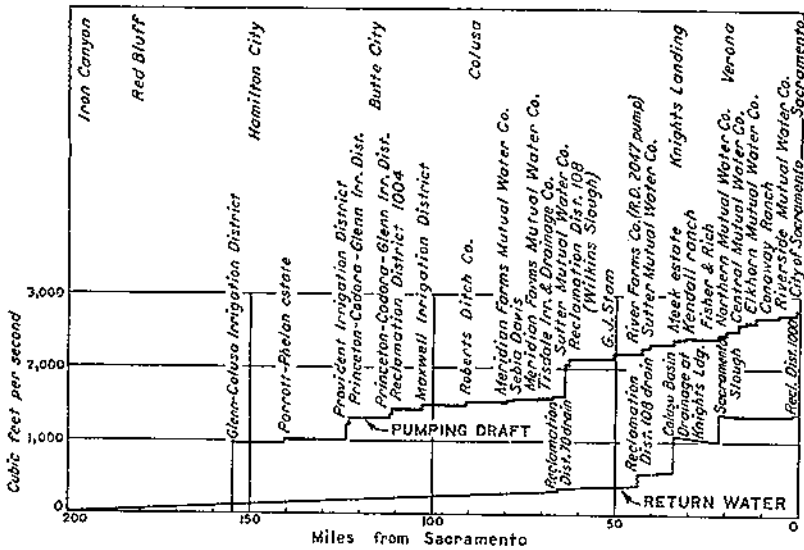


FIGURE 1.—Accumulated draft and return flow, Sacramento River, Calif., Red Bluff to Sacramento, June 1 to Sept. 30, 1928. (Redrawn from California Department of Public Works, Division of Water Resources Bulletin 23 (24, p. 279)). In order to show return water from Sacramento River irrigation only, the discharge to the Sacramento River of the Feather and American Rivers is excluded as is also return through Butte slough, a portion of the return through Sacramento slough derived from Feather River diversions and the return through the back borrow pit of Reclamation District No. 1000.

irrigation before reaching the stream. It was stated, however, that as all waters in the tributary Stanislaus, Tuolumne, and Merced Rivers normally are diverted by July or earlier at the foothills, and those of the San Joaquin are diverted near Mendota and Dos Palos, practically all water in these streams below those diversion points during most of the irrigation season is return water. The division found, on the one hand, some evidence of a considerable "lag" between diversions and return to the San Joaquin; and, on the other hand, evidence pointing to a surprisingly rapid response in the return water to certain diversions considerably remote. The return water average for July, August, and September ranged from 28 to 38 percent of the annual draft during the 5-year period studied (24, pp. 342-345).

## KINGS RIVER, CALIF.

Upon leaving the foothills, canals serving a combined area of some 400,000 acres (irrigated in 1928) divert from Kings River quantities of water which during the 10 years ended with 1931 ranged from 221,000 to 1,058,000 acre-feet per annum. Just below these diversions the river with its connecting sloughs passes through a basin about 6 miles long and 1 to 3 miles wide, known as "Centerville Bottoms", which is irrigated by a number of small riparian ditches. Much of the water diverted by these riparian ditches drains directly back into the river within the basin. Some 13 or 14 miles below the outlet is the Peoples Weir, the first of a number of lower canal diversions, and on each side of the river throughout this distance is an extensive irrigated area.

In all cases for which records are available for the period May to September in the years 1920 to 1928, inclusive (14), an analysis shows gains between the upper entrance to the basin and Peoples Weir. This is considered to be due to return water from irrigation in Centerville Bottoms and in the areas bordering the river lower down. In some cases the monthly gain exceeded the combined monthly diversions in the bottoms.

There were losses, however, in September 1929 and throughout the irrigation season of 1931 (14).<sup>5</sup> This reversal is attributed in part to droughts of recent years, and in part to the extensive increase in pumping which is thought to be intercepting water that previously returned to the river.

## SANTA ANA RIVER, CALIF.

The Santa Ana River Basin (5) is divided into 5 major basins, the river crossing 3 and separating the other 2.<sup>6</sup> These basins, separated by barriers or constrictions, are essentially gravel-filled valleys which act as underground reservoirs and contain "areas of intensive irrigation where water is put to use, partially consumed and partially sinking again as return water to underground storage" (23, p. 38). Underground waters not intercepted by pumping within a basin eventually come to the surface in the river bed above the dike which marks its lower end and flow out to the next lower basin. Irrigation waters, therefore, are reused again and again.

In a number of localities in Santa Ana Basin flood water has been spread over gravels to replenish the underground supply, principally since about 1910 but in some cases as early as 1895 or 1896 (23, pp. 165-179). For example, in the upper basin, which ends at Colton, the Water Conservation Association built spreading works below the canyon for the purpose of recovering the water at and above the outlet, at first principally in the gravity canals of the association members and later in artesian and pumped wells.

An analysis of summer consumptive use in the Santa Ana Basin was made in 1928 by the State division of engineering and irrigation (23, pp. 158-161). Certain values were assumed for transpiration and evaporation and such losses were deducted from assumed water

<sup>5</sup> KAUFKE, C. L. WATER MASTER REPORT FOR YEAR 1931. Kings River Water Association. 61 p. Fresno, Calif. 1932. [Mimeographed.]

<sup>6</sup> A map appears opposite p. 18 in (5).

requirements, the result being estimated as return water or deep penetration from irrigation practice. The net loss or return calculated in this manner for the entire basin amounted to 30 percent of the water applied.

## BOISE RIVER, IDAHO

Most of the irrigable land in Boise Valley, Idaho, south of the river, is included in the Boise project (constructed by the Bureau of Reclamation) and in several large irrigation districts, while the land now irrigated north of the river is served principally by a number of mutual irrigation companies in a comparatively narrow strip along the stream. The total irrigated from Boise River in 1929 was 318,496 acres (27). The river is divided for administrative purposes into three natural sections—the first beginning at the Boise project diversion dam and ending about a mile below Star, the second ending at the Notus bridge, and the third at the confluence with Snake River. The vital part played by return flow in river regulation is exemplified by the situation in 1931—one of the seasons of shortest water supply recorded on the river. During the low-water period of that year—July 1 to September 30—section 1 diverted practically all natural flow in the river, so that section 2 was supplied entirely from return flow; while in section 3 throughout the entire irrigation season all rights were supplied entirely from return flow.<sup>10</sup> The total river run-off for the year was 846,844 acre-feet and the total return flow 171,736 acre-feet.

The waters of Boise River have been adjudicated, except as to the duty of water, and in that regard the water master has followed since 1919 a temporary order made by the District Court of Canyon County and effective "until a further order of this court." Three drainage districts of Ada County (adjoining Canyon County on the east) in 1923 and 1925 secured from the District Court of Ada County orders temporarily apportioning the "developed" or drainage waters for the appropriation of which the districts had secured or were in process of securing permits from the State; prior existing rights on Boise River not to be interfered with. These orders were held later by the Ada County court to have been administrative only, in exercise of powers granted by the drainage district statute. In carrying out the orders, the water master turned into the heads of canals supplying these drained lands the quantities of water—within limits specified in the orders—that he ascertained upon the basis of the best available data as developed by the drainage systems and discharged into the river. In other words, these lands were given additional diversions from Boise River equivalent to the quantities of water determined as being developed by them.

Return flow to the Boise River has been an essential factor in supplying downstream priorities, as above indicated. In time of shortage the delivery of these drainage waters under the temporary orders referred to is considered by some of the Boise River users as cutting into their rights—which would undoubtedly be the case were the waters in question a part of the river flow. However, the questions as to public or private character of these drainage waters, as to

<sup>10</sup> WELSH, W. E. WATER DISTRIBUTION OF BOISE RIVER, DISTRICT NO. 12-A, 1931. Report by water master of Boise River to Commissioner of Reclamation. 21 pp., illus., Boise, Idaho, 1932. [Mimeographed.]

whether they are actually "developed" waters or would reach the river irrespective of the drainage works, and as to their ownership, have never been litigated in a proceeding competent to decide them. Furthermore, no comprehensive physical investigation of these drainage and "developed" waters has yet been made.

Return flow on this stream has been under observation for many years and has been the subject of a number of reports.<sup>11</sup> Controversies have arisen over the diversion of drainage water for irrigation, and the ownership of drainage waters was called into question in a recent case but was not decided because of the nature of the proceeding.<sup>12</sup>

There are other instances of the use of drainage water before reaching Boise River.

#### SNAKE RIVER, WITHIN IDAHO

Several groups of extensive irrigated areas lie along this stream in its course across southern Idaho, and in many sections return flow is an important part of the water supply. The ownership of return flow from the Minidoka project (Bureau of Reclamation) has been in controversy recently, but after being in court for about 5 years, the cause was dismissed without prejudice in 1932, by agreement of the parties, without deciding any of the questions at issue.<sup>13</sup>

The Minidoka project lies a short distance above Milner Dam, at which water is diverted for the Twin Falls tracts. Above the Minidoka lands is Lake Walcott Reservoir, and above this lake in turn is American Falls. The Neeley gaging station is located on the river just above Lake Walcott. The Foster decree, adjudicating the rights of users between American Falls and Milner Dam, entered upon stipulation in 1913, gave Twin Falls Canal Co. a right for 3,000 second-feet and North Side Canal Co. 400 second-feet, immediately prior to the Minidoka right of 1,726 second-feet. This decree also provided that the State engineer or his deputy should determine what part of the water flowing in Snake River at Minidoka and Milner Dams is storage and what part natural flow, "the amount of the natural flow to be determined as such natural flow would be, if unaffected by the diversions or acts of the parties hereto or any or either of them or by the release of stored water, \* \* \*." The water master's affidavit stated that this language had been interpreted both before and after entry of the final decree as excluding the return flow of the Minidoka project from the natural flow to which the Twin Falls Canal Co. was entitled.

The net average daily gain in the river section between Neeley and Milner for the summer seasons of 1919 to 1930, inclusive, ranged from 1 second-foot in 1927 to 272 second-feet in 1929, averaging 111

<sup>11</sup> TULLER, W. H. REPORT TO BOISE PROJECT BOARD OF CONTROL OF THE DEVELOPMENTS TO DATE ON RETURN FLOW AND SEEPAGE STUDIES MADE ON BOISE RIVER. Boise, Idaho 1931. [Typewritten.] 14 pp.

<sup>12</sup> *Nampa & Meridian Irrigation District v. William E. Welsh, Water Master, et al.*, 52 Idaho 279, 15 Pac. (2d) 817. This was a petition for writ of mandate to compel the water master to distribute the waters of Boise River as directed by the Stewart decree. The court held that while the question of ownership of certain drainage waters had been thrown into controversy by the pleadings and evidence, such a matter could not be litigated in a mandamus proceeding.

<sup>13</sup> *Twin Falls Canal Co. v. George N. Carter et al.*, District Court of the United States, District of Idaho, Southern Division.

for the period.<sup>14</sup> Under the interpretation of the Foster decree referred to above, the Minidoka canals were given this gain at such times as they were drawing stored water. In other words, the decree has been administered according to the water stages at Neeley: whatever amount of water belonging to Twin Falls Canal Co., for example, was found at Neeley, that amount was delivered to the company at its Milner diversion. It was to obtain the benefit of this increment during low-water stages of the river—when the flow at Neely is less than enough to satisfy the Twin Falls rights—that this action was brought by the company. Dismissal of the complaint leaves the situation as it was before; the State administrative officers determining storage and direct flow according to the Foster decree.

The drainage discharge from the Twin Falls tracts is likewise considerable. The average discharge of all developed drains on the Twin Falls Canal Co. project, measured in the spring and fall with all water out of the irrigation system, ranged from 129,000 to 176,000 acre-feet per annum during the period 1928-33. This drainage discharge, during the period 1931-33 for which information is available, was less than one-third of the total run-off from the project; and the total run-off in turn, during that 3-year period, constituted 39 percent of the total water diverted.

#### PROVO RIVER, UTAH

The Provo River system in Summit, Wasatch, and Utah Counties serves an upper agricultural area lying mainly in Wasatch County, converges at Provo Canyon, and then serves a lower area in Utah Valley. All drainage from the upper area is through this canyon. Early settlement and use of water were in and around Provo in the lower area. As settlement progressed upstream, demands upon the water supply of the river increased to such an extent that the lower users claimed that their rights—many of them prior in point of time—were being infringed upon. Naturally this led to many conflicts and much litigation. However, subsequent developments seemed to indicate that in the long run upstream use during at least a part of the season was a benefit rather than an injury to lower lands, in that the storage of water in these upper lands and its gradual release tended to prolong the seasonal supply in the lower river. The adjudication of Provo River took account of this situation, and resulted in good rights for both upper and lower appropriators. Return water from irrigation is specifically decreed a part of the stream supply; in order to insure its continuance, none of the upper users (Wasatch and Summit Counties) may extend

the use of the waters awarded to them upon other lands than those now irrigated so as to cause the seepage or drainage therefrom to be diverted away from the channel of said river or from the lands heretofore irrigated thereby.<sup>15</sup>

One of the parties to the adjudication (Esthema Tanner), owning land about 5 miles below the mouth of Provo Canyon, claimed the right to take from the river a quantity of water equal to the quantity of drainage water discharged into the river from such land.

<sup>14</sup> CRANDALL, L. REPORT OF WATER MASTER, DISTRICT NO. 30, IDAHO, FOR 1930. 1931. [Typewritten.]

<sup>15</sup> Findings of Fact and Conclusions of Law, *Provo Reservoir Co. v. Provo City et al.*, Utah County, signed May 2, 1921.

Lower appropriators with old-river rights, which were being satisfied during part of the season by seepage from bench lands, feared that the substitution of direct flow for drainage water might interfere with their own right to demand direct flow during periods of deficiency in the seepage accretions, and accordingly protested. In order to safeguard all appropriators below the drainage ditch, the adjudication authorized such substitution only while direct flow is turned down to supply seepage deficiency, and only to the extent of the quantity of drainage water discharged from such tract into the river. In other words, when direct flow is being sent down on demand of the lower users this tract may take a part of such water equivalent to its own drainage discharge, but otherwise cannot demand direct flow in substitution for return flow.

## SALT RIVER, ARIZ.

Recognition of the effect of return flow upon irrigation is of long standing in Salt River Valley, for it is a common occurrence for canals during low-water stages to dry the river, one after another, at their respective head gates. For example, on May 1, 1932, when flood conditions were not prevailing, all water flowing in the river, consisting of 70,000 miners' inches, was being diverted at Granite Reef by the Salt River Valley Water Users Association. More than one-half of this dam rests upon bedrock, and the depth to rock beneath the other portion is shallow; consequently in the opinion of certain local engineers the underflow is small or nonexistent except when the stream bed above has been badly stirred by a flood. It is, therefore, likely that at this time practically all of the subsurface as well as the surface flow was being diverted. As there were no living streams between that point and the junction of the Salt and Gila Rivers, it follows that diversions at that time between those points may be safely attributed principally to return waters from the Salt River project. Joint Head, Peninsula, and Horowitz, and the Indian ditch diversions successively took the entire river flow on May 1 (although there was leakage through the two last-named diversion structures)—with an aggregate of 2,567 miners' inches—yet the Salt River delivered 3,445 inches into the Gila on May 2.

The figures in the foregoing paragraph do not include underflow in the Agua Fria below the Salt-Gila junction or pick-up below that point, which in one or both cases was considerable. Nor, due to the extensive pumping on the Salt River project, do they provide any measure of the total amount of water that otherwise would have returned to the river. Pumping for drainage on that project and reuse of the water for irrigation constitute an important feature of this area (15).

## NORTH PLATTE RIVER, COLO.-WYO.-NEBR.

The North Platte rises in northern Colorado, flows north into Wyoming, and thence southeast and east across Nebraska, being joined in the central part of that State by the South Platte. The area now irrigated from this stream in Colorado is relatively very small, but studies have been made of the possibility of capturing a large part of the tributary inflow in North Park and diverting it to

Cache la Poudre Valley. The most extensive development of this stream in Wyoming and Nebraska has been by the Bureau of Reclamation. In addition, one large and numerous small projects have built diversion and distribution systems, and some have contracted with the United States for storage rights in Pathfinder Reservoir.

Determinations of the amount of river gain have been made from time to time, a systematic series of measurements aimed at determining the amount of return flow having been begun in 1914 (30). With the development of the large projects above Bridgeport and the installation of drainage systems the amounts of both visible and invisible return to the river have become very great. A recent study (7) shows that the total increase in the North Platte, between Whalen Dam and the city of North Platte, for the year ended September 30, 1931, was 1,574,700 acre-feet, of which 540,300 acre-feet occurred during the irrigation season May to September. As a means of approximating the quantity of return flow included in this gain, the annual figures were corrected for flow from all known sources other than irrigation, for rediverted return flow, and for evaporation losses. The result was:

Visible gain:		<i>Acre-feet</i>
Above Bridgeport.....	-----	600,700
Below Bridgeport.....	-----	106,200
Invisible gain:		
Above Bridgeport.....	-----	368,700
Below Bridgeport.....	-----	173,800
Total .....	-----	1,258,400

It was concluded that the greater part of the increase in flow above Bridgeport was return flow from irrigation, and that below Bridgeport a large proportion of the invisible increase was foreign ground water.

The effect of return flow above Bridgeport upon diversions below that point is strikingly brought out by a chart prepared in the office of the Bureau of Irrigation, Water Power, and Drainage of Nebraska and presented in somewhat different form in figure 2. The river flow at each station is taken from (17, pp. 338-345), as of the time when the water released from Guernsey Reservoir at 6 p.m., August 1, 1929, would reach that station if flowing at an average rate of 35 miles per 24 hours. "Pick-up" includes both visible and invisible increase.<sup>10</sup> The quantity flowing in the South Platte (the only important surface tributary to be considered in this connection) at the city of North Platte on August 8 was only 2 second-feet.

Figure 2 shows that during the period considered the quantity of original flow and storage water released from Guernsey Reservoir on the evening of August 1 was sufficient to care for diversions only as far down as Melbeta. From there to Overton, except for a small quantity of storage, all diversions were from "pick-up" which undoubtedly consisted principally of return waters from irrigation. The quantity of water released from Guernsey at that time was 5,750 second-feet; the aggregate quantities diverted in the 10-day procession down the river were 7,964 second-feet.

<sup>10</sup> It should be noted that the Bureau of Irrigation of Nebraska and the Federal Bureau of Reclamation were not at that time in agreement as to the rate of evaporation at which "pick-up" should be computed.

## SOUTH PLATTE RIVER, WITHIN COLORADO

The early recognition of return flow to the South Platte and its largest tributary, the Cache la Poudre, has been shown above. The river flows north and northeast from Denver across the plains in a well-defined valley, the river bottom being confined between bluffs which throughout considerable distances are very sandy. The progressive construction of larger and longer ditches and of reservoirs, which have provided water for expanding areas, have created more and more return flow to the river (22, pp. 4-11).

Parshall reports a total net return flow between Kersey (just below the mouth of the Cache la Poudre) and Julesburg (near the Colorado-Nebraska State line) amounting to 184,510 acre-feet for the approximate period July 1-November 10, 1919, and 474,840 acre-feet for January 1-November 10, 1920 (22, pp. 31-36). The relation borne by return flow to irrigation in the South Platte Valley

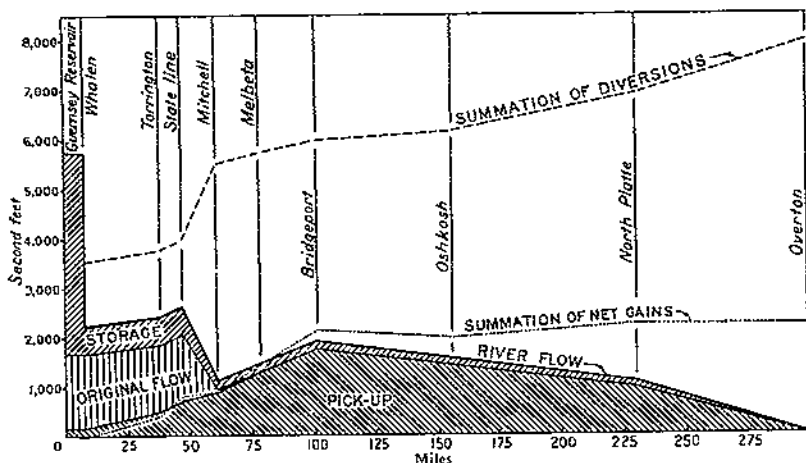


FIGURE 2.—Effect of return water from irrigation upon canal diversions from North Platte and Platte Rivers, Wyo. and Nebr., from Guernsey Reservoir to Overton, August 1, at 6 p. m., to August 10, at 2 a. m., 1929.

may be further illustrated by the statement that during the period in 1920 just referred to, the flow of the South Platte at Kersey totaled 472,632 acre-feet, the inflow of lower tributaries being comparatively small; that 169,630 acres were reported irrigated in districts 1 and 64 with an aggregate application of 457,837 acre-feet, which nearly equalled the flow at Kersey; yet the river flow at Julesburg, below this area, for that period amounted to 259,782 acre-feet, or 55 per cent of the flow at Kersey (22, pp. 31, 36, 66, 67).

The latest published report on seepage and return flow to the South Platte is in the State engineer's biennial report for 1929-30 (13, pp. 45-59). A series of measurements in 1930—Kersey to Julesburg in April, and Waterton to Kersey in May—revealed a total seepage return of 1,467.4 second-feet for the river, which, if representative of the entire year, means an annual return of approximately 1,000,000 acre-feet. Figure 3, reproduced in slightly different form from this report, shows the return flow measured at intervals

over the period 1891-1930. The report concludes that since 1916 the rate of increase of seepage return appears to be approaching the ultimate, although irrigation has been gradually increasing. "This would seem to indicate that the pervious water-carrying strata through which the seepage returns to the river, is nearing its carrying capacity" (13, p. 45).

#### ARKANSAS RIVER, WITHIN COLORADO

The Arkansas River leaves the mountains just west of Pueblo, Colo., and flows in an easterly direction across the State into Kansas. The waters of this river were involved in the noted interstate case of *Kansas v. Colorado*,<sup>17</sup> and at the present time are again being litigated in a suit between those two States. Many irrigation projects dependent upon this stream and its tributaries lie along its

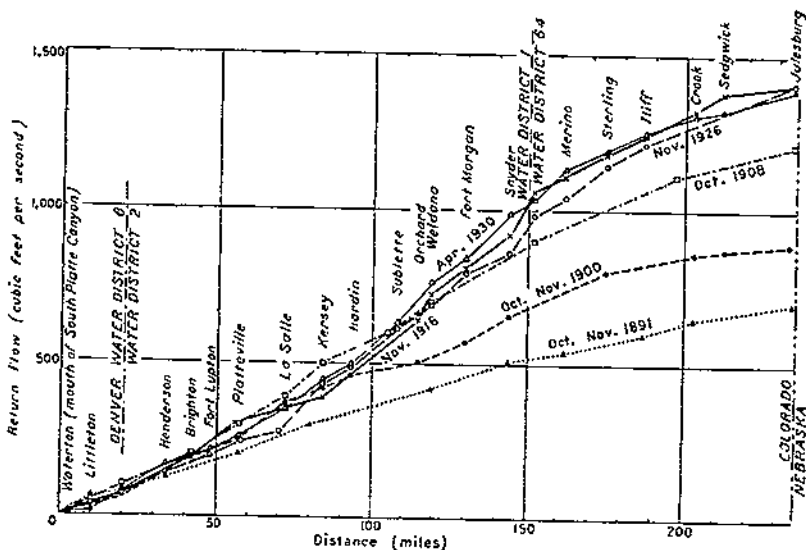


FIGURE 3.—Measured seepage return flow to the South Platte River between Waterton and Julesburg, Colo., 1891 to 1930, inclusive (13, p. 59).

course, the irrigated areas in most cases being not far from the river. Investigations made to the year 1926 by the State engineer of Colorado indicate that the total invisible seepage and return flow along the main stem of the river throughout its length in Colorado amounted to substantially 200,000 acre-feet per year, such amount, however, varying materially from season to season (13, p. 45).

#### RIO GRANDE, COLO.-N.MEX.-TEX.

The Rio Grande rises in southern Colorado, flows south through central New Mexico, and thence continues southeasterly between Texas and Mexico to the Gulf of Mexico.

Rio Grande waters are diverted by a number of irrigation systems in San Luis Valley, Colo. The northern part of this valley com-

<sup>17</sup> *Kansas v. Colorado et al*, 206 U.S. 46.

prises a so-called "dead area" respecting drainage. There is a ridge running roughly parallel to the river on the north; south of this ridge the drainage is toward the river, and north of the ridge the drainage is away from it. On the north drainage water reaches a trough and forms swamps and lakes with no known outlet to the river. Some 240,000 acre-feet per year drain into the dead area as a result of natural run-off, and in addition 300,000 to 400,000 acre-feet are diverted into this area annually from the Rio Grande by canal systems (13, pp. 38-39); therefore, when this area shall have been drained to the river a considerable addition to its water supply will result. The valley ends a short distance south of the State line and the river enters mountainous country, so that the portion of return water from irrigation not trapped north of the ridge or otherwise lost is forced back into the stream channel.

The Middle Rio Grande Conservancy District of New Mexico includes lands lying along the river for a distance of more than 150 miles between Cochiti and San Marcial. Immediately below the district are Elephant Butte Reservoir and the irrigated lands of Rio Grande project of the Bureau of Reclamation. The conservancy district's works are under construction. Its reclamation plan includes the construction of a storage reservoir on the Chama, drainage of water-logged lands and use of the waters, and flood control (1, pp. 109-134). Waters recovered by the drains are partly return waters from irrigation, and partly other waters entering the soil by overflow and seepage from the main river and from tributary streams, which under water-table conditions prevailing prior to the drainage construction had been lost by evaporation and by transpiration by aquatic plants. The reclamation plan contemplates the lowering of the water table to such an extent that water-logged lands can be cultivated, and the supplying of irrigation water to those lands and to other lands which have lacked reliable water supplies. It is estimated that the annual consumptive use in the entire area after construction of reclamation works will average 490,000 acre-feet, whereas the previous losses have averaged 541,000 acre-feet per annum.<sup>18</sup>

The Rio Grande project in New Mexico-Texas consists of successive valleys separated by canyons through which the river passes from one valley to another. The largest sections are Rincon, Mesilla, and El Paso Valleys. The project is provided with extensive drainage systems which return to the river much water that has been used in irrigation. The drainage water, mingled with direct-flow and storage waters, is partly diverted into lower canal systems on the project.

Most of the irrigation along the Rio Grande below the Federal project is in Lower Rio Grande Valley, where 350,000 acres are under cultivation on the American side between Rio Grande City and the Gulf. Here return water does not reach the river. On the contrary, nearly the entire area is a delta formation, in which the characteristic slope of the land is away from the river. The drainage outlets lead to the Gulf, not to the river. Drainage water is recovered and reused for irrigation to some extent, however, several small projects depending upon such water for a substantial part of their irrigation supply.

<sup>18</sup> DEHLER, E. H. FINAL REPORT ON MIDDLE RIO GRANDE INVESTIGATIONS. U. S. Dept. Int., Bur. Reclam., 157 pp. illus. 1932. [Typewriter.]

**ECONOMIC IMPORTANCE OF RETURN FLOW IN STREAM UTILIZATION****CONFLICTS OVER OWNERSHIP AND USE OF RETURN WATERS****NATURE OF CONTROVERSIES**

Conflicts over return waters have arisen in all or nearly all of the irrigation States. In the course of the present study notes were made of more than 40 such cases in 13 States, involving the right to use seepage waters under a wide range of circumstances. Many controversies were settled as a result of court decisions.

Specific questions involved in these disputes were the right of a project to recapture its own seepage waters, or to substitute them for the diversion of direct flow, and the method of substitution; the right of downstream users to take return waters yielded by upper projects; the alteration of drainage outlets, or the capture of drainage water and delivery to a third party, to the injury of lower diverters of such drainage water; diversion of waters to points from which return water could not find its way back to the original stream; intercepting underground waters on their way to the stream; refusal to pay agreed compensation for drainage waters; and the value of return flow. Entire water rights were involved in many of these cases.

**RELATION OF PUBLIC OR PRIVATE OWNERSHIP**

The public and private attributes of ownership of return flow will be dealt with later. Suffice it to say that under the public-ownership theory return waters are not the property of the project from which they flow, but become a part of the stream system available to appropriators in order of priority; while under the private-ownership theory they are at the disposal of such project.

Many of the foregoing controversies were settled without specific reference to the broad question of public or private ownership. The peculiarity of the local situation, or injection of other legal points, frequently made a broad decision unnecessary. In some instances it is apparent that the parties purposely avoided bringing the main question to an issue. Consequently, despite the widespread occurrence of controversies, clear-cut court decisions as to the general policy are confined to a few States.

**WATER RIGHTS DEPENDENT UPON CONTINUANCE OF RETURN FLOW**

In many sections of the West extensive development has taken place with water rights predicated wholly or partly upon return flow. This is evident from the examples listed heretofore. In certain cases, such as the Provo in Utah, downstream development occurred first, and return flow from later upstream diversions not only satisfied the demands of earlier appropriators but actually worked to their benefit. Again, as on the South Platte in Colorado, development progressed downstream in step with increasing return flow from upstream projects. The two situations are comparable physically, and in each case junior water rights improved as a result of return flow; but the benefit to holders of junior rights on the Provo is from their own use of water, while on the South Platte

it is from use by others. From a legal standpoint, return flow on the Provo must continue to go to lower users on the ground of priority; upstream users cannot extend their use of water to include their own return flow, for such action would injure the downstream prior appropriators. As long as return flow continues, the earlier users can have no complaint. But the South Platte situation is different, and there the safety of the lower development depends upon some other rule of law—public ownership of return waters, or prescriptive right, or estoppel—which will prevent upstream users from diverting their return waters elsewhere. It is shown herein after that the public-ownership rule is well grounded in Colorado, and so the lower development on the South Platte is protected on that ground at least.

There are other situations in which lower development depends upon continuance of return flow, in jurisdictions in which the character of ownership has not been definitely established beyond argument one way or the other. Boise River in Idaho and Salt River in Arizona are examples of this. The controversy over substitution of direct flow for drainage discharge on the Boise and the fact that there has been no decision in the State courts regarding ownership have been indicated in the discussion of that stream. Administration of Boise River priorities has assumed that return flow (except in case of certain drainage districts) is available for lower diversion. If return flow is increasingly rediverted by projects from which it flows—or direct flow substituted, which amounts to the same thing—the basis of administration must be changed.

Salt River Valley Water Users' Association installed a line of pumping plants, within its boundaries and a few miles from the river, from which water is conveyed to another organization, the Roosevelt Irrigation District; and eventually several lower diverters from the river complained that their water supply was being affected by the pumping. An arrangement was voluntarily made by which these diverters were provided with water to supply deficiencies in their decreed rights. The association had been upheld by the courts in its right, as against a shareholder, to drain lands and dispose of the water for compensation outside the project. The rights of other persons, however, were not involved, and the legal consequences of a possible depletion of their water supply by the diversion of pumped waters elsewhere were thus not passed upon.<sup>19</sup>

#### DIVERSION AND USE OF PERCOLATING WATERS

The right to pump or otherwise divert percolating waters is a correlative right with other overlying landowners in certain States, including California; depends upon compliance with an appropriation statute in one, New Mexico, and in portions of Oregon (not yet passed upon); and goes to the overlying landowner in others. In a Utah controversy it was ruled that percolating return waters on their way to a stream on which appropriation rights had been established could not be intercepted by the owner of land through which they were passing, if such action substantially interfered with prior river rights.<sup>20</sup>

<sup>19</sup> *Brooster et al. v. Salt River Valley Water Users' Association et al.*, 27 Ariz. 23, 229 Pac. 529.

<sup>20</sup> *Eamussen v. Moroni Irrigation Co. et al.*, 56 Utah 140, 189 Pac. 572.

One method of draining irrigated land is to pump the water out. This practice is notable in Salt River Valley (15); several California projects do it on a large scale, and numerous instances could be cited in other States. Drainage water so recovered by an irrigation project is commonly used for irrigation purposes. In most cases that have come to the author's attention the reuse has been on the project doing the pumping and has not been in controversy with users whose stream diversions might be expected to be affected. Diversion of the recovered water to another project is more likely to result in controversy.

#### APPROPRIATION OF WASTE WATER

Avoidable waste of water is contrary to public policy. It tends to deprive a lower user of a supply which he is entitled to receive. However, the statutes and court decisions recognize that some so-called waste is inevitable and may be appropriated to beneficial use.

Several of the State codes provide that ditches for the utilization of waste, seepage, or spring waters shall be governed by the same priority rules as ditches from running streams; also that the person on whose land seepage or spring water arises shall have the first right to its beneficial use on his lands. Colorado, among other States, has such a statute; but the courts there have held that the landowner does not have this first right where seepage waters first come to the surface in the channel of a natural stream<sup>21</sup>; nor where they belong to a stream and would reach it if not intercepted.<sup>22</sup> In New Mexico the first right to seepage from constructed works may be acquired by the owner of the works if he makes filing within 1 year after completion of construction or appearance of the seepage, and thereafter by anybody. Some of the statutes specifically direct an appropriator to turn back to the stream from which he makes his diversion all water in excess of his needs.

Water returned to a stream, after having been used in irrigation and relinquished by the appropriator, becomes a part of the stream again. This is a general rule. If the appropriator does not relinquish control—that is, if his plans include the commingling of such water with that flowing in the river, and its rediversion by himself or others with his consent farther downstream—there is obviously no abandonment. He is simply using the river channel as a carrier, as is commonly done with reservoir water stored upstream. The courts of Colorado do not sanction this practice in case of return flow, but definitely consider water once released from a project (irrespective of the owner's intentions) or seeping from its reservoir as not subject to recapture by that project either before or after reaching a natural channel. Any appropriation of that water is subject to all prior appropriations from the river.<sup>23</sup> Exceptions are noted below under Developed or New Water.

Waste water from irrigated lands may be captured by the first user, except in those jurisdictions (for example, Colorado and probably Utah) in which it is considered tributary to streams. However, the person capturing the waste, although protected against interfer-

<sup>21</sup> *La Jara Creamery and Live Stock Association v. Hansen*, 35 Colo. 105, 83 Pac. 644.

<sup>22</sup> *Neelus et al. v. Smith*, 86 Colo. 178, 279 Pac. 44.

ence by later comers, has no right to compel the continuance of that waste. The project on which the waste originates may make such economical use of its appropriation that but little water will be left over, or can rearrange its distribution so that waste at a given point ceases, or can alter the drainage outlet if advantageous to do so. The only equitable restriction is that it cannot maliciously divert the waste water elsewhere simply to deprive the lower user of a water supply. These matters depend solely upon the facts in the case. Several appropriations of drainage water directly out of drainage ditches have been made in the Lower Rio Grande Valley, Tex., in situations in which the water would not have returned to the river, the appropriator making a contract with the project owning the drainage system which protects him against alteration of the drainage outlet, and securing a permit from the State which gives official sanction to his appropriation. In the administrative practice of the State of Nebraska the location of a diversion headgate on an artificial drain is treated as an optional diversion; the appropriation is considered to be from the stream system, and the headgate location a matter of convenience or efficiency only. The applicant is deemed to be appropriating river water—not waste.

#### THE QUESTION OF A DOUBLE APPROPRIATION

If in addition to its head-gate diversion a project also rediverts its waste water, is it exceeding its appropriation? This point was directly involved in a request by Farmers' Irrigation District, Nebraska, to the State in 1932 for permission to divert a quantity of water equivalent to the discharge of one of its principal drains. The district claimed that the statutory duty of 1 second-foot to 70 acres, measured at the head gate, was insufficient in view of the seepage and evaporation losses from its 80-mile canal, whereas the requirements of a small project with similar soil and crops but with a short canal were capable of being satisfied. The request was denied on the grounds that (1) to add the drainage water to a full head-gate diversion would exceed the statutory duty; and (2) to add the drainage while the head-gate diversion was being cut below its decreed priority would deprive lower appropriators of public water to which they were entitled during periods of shortage. The view of the Nebraska authorities, although not passed upon by the State courts, is that return waters are public property.

The project claimed in the foregoing instance that its diversion was less than needed for beneficial use. If substantiated, there would have been no objection on the part of the State administration to beneficial use of the drainage before it left the project. The criterion was that the right to further use was lost on returning to the North Platte.

#### POINT OF DIVERSION OF RETURN WATERS

The point at which return waters are to be recaptured for irrigation is apparently of considerable moment, from a legal standpoint, at least in some jurisdictions. From a physical standpoint it is of course highly important.

## BEFORE REACHING STREAM CHANNEL.

The right to redivert and reuse drainage entirely within a project is not being seriously questioned, so far as the author is aware, in any of the States. An important precedent was set by the United States Supreme Court in the case of *Ido et al. v. United States*,<sup>24</sup> which arose on the Shoshone project in Wyoming. It was there held that the right of the Government in water appropriated for the reclamation project attached to seepage from the irrigated lands, "affording the Government priority in the enjoyment thereof for further irrigation on the project over strangers who seek to appropriate it for their lands." The court stated that there had never been any purpose to abandon the seepage, but on the contrary the intention to reuse it had been stated in official reports and otherwise made evident many times. The extent to which this ruling and the ruling of the Utah Supreme Court in the earlier case of *Rasmussen v. Moroni Irrigation Co. et al.* conflict is open to some question. In the Rasmussen case it was stated that the person recovering return water from higher lands on its way to a stream could use the water on the lands from which drained, and could "use it, or any part of it, upon lands other than those from which it is drained if such use can be made without interfering with respondents' prior rights."

The right of recapture after water leaves the project from which it drained and before it reaches the stream channel from which it was diverted, or at least before the waters are commingled with those of the original stream, apparently is still a moot question in most of the Western States except Colorado. Conveyance of return waters from one project to another in an artificial conduit, and extension of the area of a project by virtue of the reuse of return waters are other phases of the general question concerning which the law in most States is not definitely settled. These things have all been done in actual practice in various places, sometimes with consent of the State authorities.

## REDIVERSION FROM STREAM CHANNEL INTO WHICH DISCHARGED

Use of the stream channel as a carrier depends upon the right of the project to control its return flow. If it may send this water elsewhere, the stream channel is a convenient and under some circumstances an economical carrier. Legally, of course, this is out of the question in Colorado. It is common practice in New Mexico, particularly along the Pecos; although in these instances the return is largely from irrigation from artesian sources not tributary to the Pecos. A Federal decision arising in Idaho<sup>25</sup> stated that an appropriator, provided he could identify the return flow, "may conduct it through natural channels and may even commingle it or suffer it to commingle with other waters." Incidentally, this language was quoted approvingly by the United States Supreme Court in another case.<sup>24</sup>

<sup>24</sup> *Ido et al. v. United States*, 263 U.S. 497, 68 L. ed. 407.

<sup>25</sup> *United States v. Hays et al.*, 276 Fed. 41.

## SUBSTITUTION OF DIRECT FLOW OR STORAGE WATER FOR RETURN FLOW

The diversion of drainage water and its reapplication to the soil are sometimes so expensive as to be uneconomical. Situations as favorable as that on the Wapato project, Washington, are exceptional. At the other extreme are projects on which the return becomes visible at places so low in elevation or so near the lower end of the area that only by means of pumping can it be redistributed. Substitution of direct flow, to be diverted at the head gate upstream, for the quantities returned to the stream below, has appeared to offer a more satisfactory solution.

Substitution would not be sanctioned under even the private-ownership theory of return waters if it interfered with diversions between the project's head gate and the point of discharge of the drainage water. That is, if the increased diversion, which is practically a transfer of the diversion point upstream, deprived an intervening user of any quantity needed to fill out his priority at his existing head gate, a court decision upholding the transfer is not to be anticipated. If there are no such intervening diversions to be considered, the proposed substitution depends upon the right to redirect drainage from the stream into which discharged. Clearly, if this right exists, transfer of the diversion point upstream does not deprive lower users of any quantity of water to which they are entitled.

Examples of substitution are to be found in several States, and the courts and authorities sanctioning the transaction have taken the position that if a project has the right to reuse its return flow it should be permitted to do so in the most economical manner possible. Several drainage districts along the Boise River have operated under this method of substitution for some years. The section of Snake River opposite the Minidoka project is so regulated that that project is credited with the amount of its drainage discharge. The plans of Middle Rio Grande Conservancy District involve substitution. Talent Irrigation District, Oregon, is permitted to divert upstream a quantity equivalent to its drainage picked up by Medford Irrigation District, which otherwise has the prior right on Bear Creek, the waters in question having been stored and brought across from another drainage area. Vale and Warm Springs Irrigation Districts, Oregon, have a contract under which Warm Springs exchanged a portion of its reservoir space and of its direct-flow rights for equivalent return flow from Vale District available for diversion into Warm Springs canals. The Provo River adjudication in Utah includes one case of limited substitution. Certain adjudications in Washington embody the principle, although a recent decree provided definitely that return seepage waters belonged to the stream.

Only one State supreme court case specifically passing upon this practice has come to the author's attention. In that case, involving the adjudication of Stemilt Creek, Wash.,<sup>27</sup> the decision was to the effect that if the parties have the right to use this seepage water and permit it to flow into the creek,

then it would seem but just and equitable that they should be permitted to take an equal amount of water, less transportation loss, from some point

<sup>27</sup> *The State of Washington v. American Fruit Growers, Inc., et al.*, 135 Wash. 156. 237 Pac. 498.

higher up the creek, from which point it can be conveyed to their land by gravity; provided, of course, that by so doing they do not injure or interfere with the rights of anyone else.

The sole controversy was over the matter of substitution. The right to use the seepage water was not being contested, and the court therefore specifically refrained from passing upon that right.

#### RIVER CONSUMPTIVE USE IN RELATION TO SUBSTITUTION

Many streams in the West have very little water unappropriated; in such cases further development of any consequence is possible only through consumptive use of the relatively small remainder.<sup>28</sup> This involves the control of return flow from the project, which is legally possible only in certain jurisdictions. That is, if an average annual run-off of 25,000 acre-feet is determined as available, and the farm use is estimated as 2.5 acre-feet per acre but the river consumptive use as 1.25 acre-feet per acre, then 20,000 acres of irrigated land will be the maximum area on which water charges can be safely based, and plans must provide for the utmost conservation and careful use of this available remainder. Ordinarily, assuming that the available supply continues to be 25,000 acre-feet, at no time is the project diversion held to 1.25 acre-feet per acre. That is the river use, not the farm use. In the early stages of development the river supply plus rainfall is sufficient to fill the farm requirement of 2.5 acre-feet per acre; and as more and more lands are brought under cultivation and return flow becomes evident, a substitution at the head gate of the equivalent of this return flow leaves all lower rights undisturbed and at the same time fills the new project requirements.

An arrangement such as the above, involving a substitution of return flow for direct flow, but in a situation in which storage facilities are out of the question, presumably would not be feasible in a jurisdiction in which return flow automatically becomes public water. That is, the project could divert whatever excess of direct flow there might be above the requirements of earlier lower projects; but after, say, July 1, when there is no excess, diversions must cease, for the lower users could demand that the return flow come down to them as their lawful heritage. In such event the late project, if it cannot redirect the return flow advantageously within its own borders, cannot predicate its requirements upon consumptive use, but only upon early-season direct-flow supplies, as long as they are available. Therefore the project area must be held to considerably less than 20,000 acres, and the crops must be confined to those benefited by early irrigation. Instead of leaving the river as it was before, as far as lower rights are concerned, the late project is adding to the value of these lower rights by giving them a longer season of full supply than they enjoyed previously.

Middle Rio Grande Conservancy District plans include the redirection or substitution of developed drainage waters in addition to storage development. Storage in the district's El Vado Reservoir would reduce the supplies available for storage in the Rio Grande project's Elephant Butte Reservoir if it were not for return flow

<sup>28</sup> "Consumptive use" has been defined by R. I. Meeker as "The permanent water loss incident to irrigation of large tracts of land \* \* \* the difference between the amount of water diverted and the amount returning to a stream" (12, p. 1450).

and drainage waters developed by the district. In other words, the district's drainage-water development is intended to make good the depletion of the total river supply occasioned by additional diversions of water for irrigating the conservancy-district lands now unirrigated or inadequately supplied with water. Engineers of the Bureau of Reclamation, after a thorough study of the situation under a cooperative agreement with the conservancy district, "concluded that from the standpoint of water supply, the proposed development of the Middle Rio Grande Conservancy District will not injure the Rio Grande project."<sup>29</sup> The New Mexico laws provide that where a conservancy district "conserves, develops, or reclaims water, it shall have the rights which go with the appropriation and beneficial use thereof" (21). The district extends many miles along the river, and apparently there are no other users whose rights are interfered with.

#### DEVELOPED OR NEW WATER

Water brought to the surface in artificial drains is occasionally referred to as "developed" water. A more careful use of the term would exclude water tributary to a stream and which, while facilitated in its passage by the drains, would reach the stream eventually irrespective of them. Such water is not new water; the time of its arrival is simply hastened.

Water which, except for drainage installations, would not reach the river at all is more properly termed "developed" water. For example, the drainage plans of Middle Rio Grande Conservancy District "will lower the water table a sufficient distance below the surface to reduce greatly the present loss of water, thus effecting an actual development of water now lost to all beneficial use" (1, p. 95). Again, in Idaho the Ada County drainage districts are delivering to the Boise River waters which are actually saved from evaporation in swamps, as well as water which would reach the river in any event. The water master on the Boise applies a factor in calculating the portion of drainage which should be considered developed water and which under temporary court orders he credits to the irrigated lands in those districts. It is rather generally considered that the person or project responsible for such artificial increase in flow is entitled to its use or disposal.

Return from foreign water—for example, brought in from another watershed—is similar to developed water in that it is not considered tributary to the stream into which it is being made to flow by reason of the irrigation and drainage works. As far as lower users are concerned it also is new water. Even in Colorado, which appears so thoroughly committed to the public-ownership theory, water diverted from the Rio Grande, applied in the "dead area" from which it could not return naturally to the river, and brought back into the Rio Grande watershed in an artificial drain, was held subject to appropriation by the first taker over the protest of earlier appropriators from the river who claimed that it belonged to them.<sup>30</sup> To the same effect are Washington and Idaho cases in

<sup>29</sup> DEHLER, E. B. See footnote 18.

<sup>30</sup> *San Luis Valley Irrigation District, et al. v. Prairie Ditch Co. and Rio Grande Drainage District, et al.*, 84 Colo. 99, 268 Pac. 533.

which waters were brought in from other watersheds.<sup>41</sup> In the adjudication of Pecos River, N.Mex., which was in progress when the area was visited in 1932, stipulations were being taken providing for the discharge into the river and the subsequent recovery of drainage waters originating from artesian sources and therefore not a part of the original river supply. The administrative practice of the State of New Mexico has been to approve applications to appropriate drainage water discharged into a stream (minus carriage losses) where filed by the owner of lands or the project on which the drainage originates, or by a second party who has contracted with the first for the acquisition of those waters. Many of these contracts are in existence. Most or all of such cases are on the Pecos and have involved return waters from foreign artesian sources, but in a few instances there was included some return from springs which formerly flowed into the Pecos.

A different but somewhat allied question was presented when Waterford Irrigation District, California, applied for a permit to appropriate waste waters from storage reservoirs and power plants of the city of San Francisco. The application was based upon sections of the California statute authorizing temporary appropriations of water already appropriated for municipal use but as yet in excess of municipal needs, and authorizing the appropriation of water after it has been appropriated or used and returned to a stream. Modesto and Turlock districts claimed prior rights to these waters and protested the granting of the application. The permit was issued, subject to the city's prior rights on completion of the works and beneficial use of the water. The principal ground was that these released storage waters were foreign in point of time to the direct flow of the river during the irrigation season. Prior storage rights of the protesting districts were considered amply cared for.

#### CONTRACTS FOR DISPOSAL OF RETURN WATER

Agreements transferring the use of return waters from one enterprise to another are in effect in a number of States. Several have been cited heretofore in this discussion. Some involve water which, if not intercepted, would return to the stream from which diverted, and others deal with so-called "foreign water."

The Warren Act contracts in connection with the North Platte project provide that the United States will store water in Pathfinder Reservoir or elsewhere and release the same into the river, and will supply water from other sources for the use of the contracting enterprise, with the right to deliver drainage or seepage waters as a part of the total delivery. This provision for substitution of seepage for storage and direct flow is not in line with the practice of the Nebraska State Bureau of Irrigation in so administering the North Platte that seepage accretions from the Federal project and elsewhere are treated as public waters. There has been no court decision interpreting the substitution clause as against an objecting

<sup>41</sup> *Phillip Miller et al. v. Peter Wheeler et al.*, 54 Wash. 429, 103 Pac. 641; *Edward J. Breyer v. Andrew J. Baker*, 31 Idaho 387, 171 Pac. 1135.

holder of a valid appropriation.<sup>32</sup> The North Platte project management delivers water for Nebraska contractors at the Wyoming-Nebraska State line; the contracts are filed with the State water authorities of Nebraska, and the quantities of water called for by the contracts have been delivered at the contractors' head gates by such authorities without the development of a specific issue as to whether the water in any case was storage, direct flow, or return flow. Default of one of the contracting districts in making payments to the United States, and its claim that storage water was no longer needed in view of the large increase in return flow to the river, threatened to bring the matter of interpretation to a head several years ago, but the case was decided on another point.<sup>33</sup>

Contracts purporting to dispose of return flow discharged into a stream have been held ineffectual for that purpose in Colorado and Wyoming, on the ground that waters returned to the stream after having been used for irrigation or domestic purposes are public waters no longer subject to disposal by the original diverter.<sup>34</sup>

Contracts attempting to dispose of return flow which the project has actually abandoned, or which has been released from control without intention to recapture, are of no effect.<sup>35</sup> The question as to validity of such contracts has been decided in various cases with reference to the intention of the management of the project from which the return waters flowed at the time the return developed. When the waters flowed away there was no intention to recapture. The controlling feature in the Colorado and Wyoming cases cited in the previous paragraph, on the other hand, was that all private ownership in the return waters had ceased; the intention of the parties was therefore of no consequence.

#### QUALITY AND VALUE OF THE WATER

Drainage water may carry salts in solution of such character and concentration as to make it unfit for irrigation, or at least suitable for crops of high tolerance only. This has proved to be the case on some projects relying largely upon undiluted drainage water. Mixture with water taken directly from the river, on the other hand, has overcome the difficulty. The requirement of the Texas Board of Water Engineers that Lower Rio Grande Valley projects seeking to appropriate drainage water shall also acquire rights to river-flood water gives the project not only a supplemental direct-flow supply.

<sup>32</sup> Drainage waters which were being substituted under the terms of a Warren Act contract were involved in *United States v. Ramshorn Ditch Co. et al.*, 254 Fed. 842 and in *Ramshorn Ditch Co. v. United States*, 269 Fed. 80. It was there held that the Ramshorn Co. had attempted to establish an appropriation which under the Nebraska statutes was ineffectual; consequently as against this company the United States had the right "to be unmolested in the possession of its ditch, the right-of-way thereto and the diversion structures thereon, and to use or dispose of the flow in such a way as it may desire."

<sup>33</sup> *Bridgeport Irr. Dist. v. United States*, 40 Fed. (2d) 827.

<sup>34</sup> *Comstock, State Engineer, et al. v. Ramsey*, 55 Colo. 244, 133 Pac. 1107; *Wyoming Horeford Ranch v. Hammond Packing Co. et al.*, 33 Wyo. 14, 236 Pac. 764.

<sup>35</sup> A contract purporting to dispose of waste was held invalid in Nevada on the ground that the water had been abandoned, there having been no intention to recapture when the water was turned from control and allowed to find its way to a stream. (*Olto T. Schultz v. John P. Scovely*, 19 Nev. 359, 11 Pac. 253.) In Oregon, where the city of Baker had released surplus water from its reservoir and allowed it to find the general level of the country "with no intention of recapturing or enjoying it", the city had no further interest in the water and could confer no right upon anyone to its use. The court carefully refrained from calling this water "abandoned", in order to avoid confusion with abandonment of a water right, but referred to it as released or waste water. (*P. C. Vaughn v. Adam Kolb et al.*, 130 Oreg. 500, 280 Pac. 518.)

but an opportunity to improve the quality of its drainage-water supply. The quality of river water itself may be seriously impaired by the addition of large quantities of drainage water carrying harmful salts in solution. Whether the problem is serious in a given case depends entirely upon local conditions, such as the extent of reuse of the stream, character of the lands irrigated, and availability of flood flows to freshen the main channel.

The value of return flow, in the last analysis, depends primarily upon its effect in accomplishing the production of marketable farm produce. That is a variable quantity from place to place and from season to season. Values arrived at in various ways, however, have been expressed concretely in contracts for disposal of return waters, and elsewhere, and some of these should be noted. For example, in several of the Pecos River contracts compensation was based upon a modification of the neighboring Hagerman Irrigation Co. values. The market value of a Hagerman right at the time in question was \$50 to \$55 per acre; as the drainage water was required to be pumped from either a drainage ditch or from the river, the capitalized cost of pumping was deducted with a resulting price in several instances of \$15 per acre. In other cases in the same general area the price was solely a matter of bargaining. Based upon quantities measured in 1927, several purchases ranged from \$250 to more than \$1,000 per second-foot.

Where a substitute supply is available, a measure of value is the cost of such substitute supply. In this connection, the value in the Ramshorn case in Nebraska<sup>30</sup> was the subject of court comment; it being stated that the Warren Act contract provided for a price of \$5 per acre-foot, "which appears by the evidence to be about \$1,000 per second-foot." Similarly, the value of drainage water recovered so extensively on the Wapato project, Washington, may be taken as the value of an equal quantity of stored water which otherwise would have to be purchased (if available) from the Yakima project. The cost of stored water already purchased by the Wapato was estimated—but not yet fixed—in 1931 as \$6.50 per acre-foot. The value of a small quantity of seepage return to Stemilt Creek, Wash., exchanged for direct flow, was locally estimated in 1931 as \$500 per miner's inch, or \$375 per acre, based upon the commercial value of a class 1 water right, the direct effect of irrigation on apple production having given it this value at that time.

Parshall (22, pp. 19-20), writing of conditions in 1920, estimated the value of return flow to the lower South Platte as around \$3,000 per second-foot. On this basis the return from Kersey to Julesburg, Colo., for the 10 months January to October, was estimated to be worth \$2,250,000 to the farmers of that area.

#### IDENTIFICATION OF RETURN

Identification of the waters returning from a given project, and accurate ascertainment of their quantity, may be difficult or impossible. Visible inflow can be measured, but it does not necessarily consist entirely of return flow from irrigation. Invisible accretions must be ascertained indirectly. Again, granting that 75 percent of

<sup>30</sup> *Ramshorn Ditch Co. v. United States*. See footnote 32.

the inflow is due to irrigation, what part of that proportion is the result of direct flow and what part is from storage waters? This distinction may be important if the ultimate origin of return waters is held to have a bearing upon their ownership. The distinction, if made, will involve a determination of the rate of passage of water through the soil from the time of its application to its appearance as drainage recovery.

Exact determinations may be impossible, but segregations nevertheless may be made which will do substantial justice to all interested parties. The Federal court, in an Idaho case,<sup>37</sup> in determining that a user was entitled to the return waters from certain lands only, adopted a calculation of the amounts based upon drainage areas and a consideration of the natural flow. The practice of stipulating these matters as the result of careful, unbiased studies has been carried out satisfactorily and should serve as a valuable precedent.

It is considerably easier to arrive at satisfactory results where river conditions as they existed prior to the irrigation and drainage development are definitely known. For example, an organization in Idaho which proposed to install a drainage system carefully measured the increment to the stream for a year before the drains were dug, measured it again after construction, and filed on the difference as developed water. This project should occupy a strong position in the event of contest by other rights. The factor used by the Boise watermaster to segregate the quantity of drainage water actually developed by the Ada County districts is admittedly arbitrary, in the absence of satisfactory basic data, and is not acceptable to all parties. Administration of the Snake River between Neeley and Milner Dam, which credits the Minidoka project with its return flow, has been based upon an assumption that under preconstruction conditions the tributary inflow between those points approximately balanced the losses, and that now it is proper to use the flow at Neeley as a basis for dividing waters at Milner. The careful studies of the middle Rio Grande afford a satisfactory basis for future determinations of quantities of water developed there.

#### PUBLIC VERSUS PRIVATE OWNERSHIP

Academic discussions of the merits of one form or another of the ownership of return waters have appeared from time to time. The matter was considered at several successive meetings of the Association of Western State Engineers, culminating in two committee reports in support of the public-ownership theory and general discussions preponderantly favoring that view.<sup>38</sup> Probably the foremost exponent of private ownership is the United States Bureau of Reclamation, which for some 20 years or more has been carefully asserting the claim of the United States to all seepage and return waters arising on the Federal projects. Considerable additional support is to be found in the West for private ownership, or for at least some modification of the rigid application of the public-ownership theory.<sup>39</sup>

<sup>37</sup> *United States v. Hays et al.* See footnote 25.

<sup>38</sup> ASSOCIATION OF WESTERN STATE ENGINEERS. PROCEEDINGS OF FIRST ANNUAL CONFERENCE. Salt Lake City, Utah, pp. 120-134, 1928; SECOND ANNUAL CONFERENCE, BEND, NEV., pp. 79-104, 1929; THIRD ANNUAL CONFERENCE, DENVER, COLO., pp. 17-41, 1930. [Minicographed.]

<sup>39</sup> For other discussions pro and con, see (2, 6, 16, 31, 32, 33).

## CONSIDERATIONS FAVORING PUBLIC OWNERSHIP

The arguments of advocates may be summarized as follows:

## REUSE WITHIN PROJECT

It is conceded by many advocates that reuse of return waters within the project on which they arise has legislative and court sanction and is not subject to debate, provided the lands on which the return flow is to be used have the same date of priority as the lands on which the original flow was used. Objection is taken to interception and recovery of these waters after they have left the project.

## PUBLIC INTEREST

Development will be retarded if return water may be bartered and sold. It could be held entirely out of reach of someone who needed it and could use it. With growing scarcity of water the fullest development of the supply is needed.

Under public ownership as now generally practiced, return waters generally supply lower river rights and thereby release natural river flow for up-river development and use, which results in the greatest use and reuse of existing water supplies.

To allow new projects all the benefit of their return flow now is to give them a preferential status. Every ditch contributes some return flow; if one is entitled to its reuse, each one should be. This is impossible without upsetting present water supplies and attendant property values.

## RIGHTS OF APPROPRIATION

The view of many westerners is that the State (or the public) owns and controls the water. The water user does not own the corpus of the water; he has a right to its beneficial use. The State cannot part with the ownership of the water, but merely grants a right to its use. The appropriator of natural flow has had use of the water prior to the appearance of return flow, which is all that the State ever gave him or had a right to give him. He cannot claim title to the residue and demand tribute for its use from the lower appropriator. On the contrary, when the needs of an original appropriation are satisfied, the excess should return to the stream to be appropriated for use on other lands. This excess water is simply a vehicle for the water used consumptively, and diversion is permitted by the State for that purpose only. An old appropriator with rights continuing only part of the season should benefit by accretions to the stream.

Beneficial use is the basis, measure, and limit of right to the use of water. This does not include sale, trade, or barter of return flow. One who constructs works and diverts water is entitled to its use once; if he has made beneficial use, his right has ceased, for he has received in full what is intended under the law.

To allow drainage projects to use the drained water works an injury to lower appropriators. The reclaimed land needs water during the growing season; and the drainage discharge may be foreign in time and quantity to the natural flow and therefore if

the drainage yield is exchanged for natural flow it may impose a greater burden on the river flow during the irrigation season than existed prior to the drainage.

An appropriator who specifies the point of diversion, place of use, and area to be irrigated, and then attempts to extend the use to other lands, should go through the necessary statutory procedure for an additional appropriation, the priority of which would be that of the application for additional use.

#### DETAILS OF ADMINISTRATION

Sales of return flow will complicate and hamper the public administration of water supplies. The practice would require identification and determination of quantities from time to time (as return flow is not static) in order that delivery to specific ditches should not injure direct-flow diverters. It would impose a burden of continuous investigational studies upon water officials, and would be fruitful ground for water disputes.

Under public ownership and control, on the contrary, return waters automatically revert to the public supply upon entry to stream channels and are administered as part of the common water supply. It all goes "into the pool." This procedure simplifies distribution of river flow.

#### CONSIDERATIONS FAVORING PRIVATE OWNERSHIP

The reasons advanced by those favoring this theory are as follows:

##### EQUITIES INVOLVED

A project providing and recapturing water at great expense is in equity entitled to its use. The portion of water yielded by drains which have cost a great deal of money—and especially that portion reclaimed from evaporation, actually developed—belongs in equity to the agency making the development.

Vested rights to water prior to upstream drainage construction are not deprived of any water they have been receiving if the drained water—particularly the developed drainage—inures to those incurring the cost of drainage. They are therefore not injured.

Lower river users under the public-ownership theory get something for nothing. They pay no part of the cost of upper basin development, but fall heir to an increased water supply as the result of it.

##### PUBLIC INTEREST

Revenue from disposal of return flow is a legitimate source from which to decrease per acre project costs, and project extension is possible through the use of return flow. New projects should be allowed to predicate their needs upon consumption of return flow as well as upon the original diversion; otherwise their possibilities will be substantially curtailed.

An added incentive to expenditure of money for drainage construction would be the continued control of the drainage yields and the right to make beneficial use of them, through whatever means of diversion may be most practicable.

## RIGHTS OF APPROPRIATION

The right of an appropriator is not exhausted by one use of the water. His right includes reuse, provided it is beneficial and does not deprive an earlier priority of any water to which it has been entitled.

The right of an appropriator should be determined by his intention at the time of making the appropriation. If his plans include the recapture and reuse of return waters, that should govern.

The State's duty is to maintain the same conditions on the river as obtained at the time the appropriation was made. To require drainage discharge to go down the stream to benefit an earlier appropriator at a time when he would not have had water under pre-drainage conditions is to favor him at the expense of someone else.

If return water must be allowed to augment natural flow, it will work to the benefit of riparian-right claimants in riparian States.

## DETAILS OF ADMINISTRATION

Losses from storage and direct flow are not matters of direct determination and need not be, for satisfactory compromise loss-programs can be worked out by the supervising State officials.

## POLICIES SO FAR ESTABLISHED

The policies of the water administration offices of the several States may be segregated into two groups—those holding strictly to the public-ownership theory, and those recognizing exceptions or deviations in greater or less degree. Some of these policies and their supporting authority have been referred to from time to time, but they are all summarized below for the sake of completeness.

## POLICIES FAVORING STRICT PUBLIC OWNERSHIP

The State engineers of Colorado, Wyoming, Nebraska, Nevada, and Utah regard return flow as the property of the public, and their traditional policies have been opposed to contracts purporting to transfer drainage water from one project to another to the detriment of other appropriators.

The Colorado policy is well grounded in a line of State supreme court decisions that are definite and comprehensive. It is considered that after water has been used for the purpose for which it was appropriated and decreed, any unused portion is abandoned to the natural stream into which it would flow if not intercepted, for the enjoyment of all junior appropriators. A different rule applies in case of foreign waters not naturally tributary to the stream toward which they now drain—that is, waters brought from another watershed, or from an enclosed basin in the same watershed.

The Wyoming State engineer considers return-flow water subject to reuse by other appropriators immediately upon its return to the stream, and not subject to appropriation by others before it has returned to the stream. The basis of this policy is a decision of the State supreme court in a case in which the return (sewage) had been discharged into the stream from which diverted.<sup>40</sup> There is no

<sup>40</sup> *Wyoming Horseford Ranch v. Hammond Packing Co. et al.* See footnote 34.

decision as far as could be ascertained, concerning the status of return waters en route from the project boundary to the stream. The right of a Federal project to recapture and reuse its own return flow within its boundaries has been upheld by the United States Supreme Court.<sup>41</sup>

The Nebraska Bureau of Irrigation, Water Power and Drainage considers return waters as public waters on leaving the project for which the original appropriation was made. There are no Nebraska State Supreme Court decisions on this matter. A Federal circuit court decision<sup>42</sup> upholding the right of a Federal project—as against a company which was attempting to establish an ineffectual appropriation—to recapture seepage water on its way to the North Platte and to deliver it to a Warren Act contractor in lieu of storage or direct flow, is not regarded by the State officials as setting a final precedent for State administrative policy in regard to the general question (17, pp. 301-304).

The Nevada and Utah policies have developed without court decisions concerning the right of a project to dispose of return flow which it had not abandoned. The streams of both States (with one exception noted in the adjudication of Provo River, Utah) have been administered without reference to the origin of return flow and apparently with few or no resulting controversies.

#### POLICIES RECOGNIZING SOME RIGHTS OF RECAPTURE

The administrative policies of the other States are generally to consider return flow in a stream as a part of the public waters of that stream, but some of them have given official recognition to cases of recapture or substitution of return waters or of disposal before reaching a stream channel.

The New Mexico State engineer approves applications to appropriate drainage waters turned into a stream with the intention of subsequent appropriation and recapture. The application may be made by the project yielding the drainage water, or by another who has contracted for the use of that water. A statute authorizes the appropriation of seepage from constructed works. Water flowing in an artificial drain is not subject to appropriation by others, but the creator of the flow has control until it has been deposited in a natural stream.<sup>43</sup> Most of the drainage water involved in applications to appropriate has originated in artesian sources not naturally tributary to the flow of the stream into which the drainage has been diverted. Conservation districts developing or reclaiming water are given statutory authority to make beneficial use of it.

The Texas Board of Water Engineers regards drainage waters accumulated in artificial channels as under the control of the person or corporation responsible for the accumulation, and authorizes appropriations of such waters by others only if they have made contracts for its diversion and use with the one who accumulated the waters. All such cases to date have been in a delta region in which the water would not have returned naturally to the stream from which diverted. Drainage waters that have found their way into a

<sup>41</sup> *Ido et al. v. United States*. See footnote 24.

<sup>42</sup> *Renshorn Ditch Co. v. United States*. See footnote 32.

<sup>43</sup> *Hagerman Irr. Co. v. East Grand Plains Drainage District*, 25 N. Mex. 649, 187 Pac. 656.

natural channel are considered as being on the same basis as other waters in that channel.

The Washington Department of Conservation and Development until recently recognized the right of the owner of a tract, on which measurable drainage or return seepage from irrigation arose, to divert from the stream into which discharged a quantity of water equivalent to the quantity released. The authority was a case in which the decision approved this method of substitution, but in which the right to make use of the seepage water was not in controversy.<sup>44</sup> Substitution was allowed in addition to the original diversion only to the extent of beneficial use; that is, where the original priority was not such as to afford an adequate water supply. Recently, however, the department has reversed its policy, owing to abuses of the privilege and resulting confusion and protests from lower users. Exchanges not previously authorized are not now being permitted. The present policy is to consider return seepage as a part of the stream supply.

The Oregon State engineer considers in general that seepage waters in a stream are public water. However, the State engineer on the authority of an Idaho decision<sup>45</sup> (there being no Oregon decisions in point) authorized the upstream diversion of water equivalent to the amount of drainage discharge in preference to its use by a lower prior appropriator in a case in which the waters had been stored and brought from another drainage area, and in which the upstream right was inadequate. In another instance a contract was recognized in which one project exchanged reservoir space and direct-flow rights for equivalent return flow from another project. Reuse of water on a project on which originally applied may be made without permit from the State, as it is covered by the original appropriation. Permits to appropriate seepage water within the boundaries of an irrigation district, made by others than the district itself, will not be granted without a release by the board of directors of such district.

The Idaho Department of Reclamation grants permits to appropriate the unappropriated waters of the State, without authority to place limitations or restrictions upon the applicant, but does not issue permits upon drainage or waste water as such. However, permits are issued under the authority of a specific statute to drainage districts for the use of the drainage water appearing in their ditches. In some cases these waters are diverted directly from drainage ditches into irrigation channels; in others mingled with the river waters and rediverted; and in still others discharged into the river and an equivalent amount diverted above the point of discharge.

The California State Division of Water Resources regards return waters from power use, after having been stored, as foreign in time to the natural stream flow and, therefore, not water which inures to the benefit of prior appropriators or riparian owners.

In Arizona a project has the right, at least as against a shareholder, to dispose of its drainage waters for compensation outside the project.<sup>46</sup> In the case establishing this point, the rights of lower diverters, whose water supplies might be affected by the interception

<sup>44</sup> *The State of Washington v. American Fruit Growers, Incorporated et al.* See footnote 27.

<sup>45</sup> *Breyer v. Baker.* See footnote 31.

<sup>46</sup> *Breicester v. Salt River Valley Water Users Association.* See footnote 19.

of return flow, were not involved. Drainage waters captured by a drainage district may be disposed of by sale or contract and are not subject to appropriation by others.<sup>47</sup>

There is no administrative authority in Montana over the acquisition of water rights and the distribution of water. Waste waters may be appropriated,<sup>48</sup> but no cases are known passing upon the right of a project to dispose of its waste waters for compensation. In fact, a Federal case<sup>49</sup> denied the right of an appropriator to exceed his decreed right on the justification that the resulting seepage benefited lower prior appropriators, who were held to be entitled to the natural flow plus the seepage from his lands.

#### GENERAL ABSENCE OF JUDICIAL PRECEDENTS

In very few States are there court decisions clearly and specifically defining the right to recapture return flow after it has commingled with the direct flow of a stream, where such action involves no question of abandonment but is part of a definite plan of development; or the project's right to dispose of its drainage waters to others where lower appropriators otherwise would make use of it. Colorado is the outstanding exception: there the question has been comprehensively litigated. Except in Colorado the court decisions, where any have been rendered, have usually involved one or two points only and have left other phases of the question unsettled. The courts ordinarily do not pass upon matters not necessary to be decided in settling the main points at issue in a suit. Where they do comment on questions which need not be decided, their remarks are not necessarily controlling as precedents in later actions.

Likewise, there is very little statutory direction to the State administrative officers in distributing return flow. In most of the States the general principle has been accepted—either tacitly or directly in decisions on controverted points—that return waters are a part of the natural river flow. Nevertheless in some jurisdictions it has seemed best to modify the principle where there is no question of abandonment of waste water.

#### IMPORTANCE OF A WELL-SUPPORTED POLICY

The lack of judicial precedent and support in so many States leaves doubt as to the stability of some of the prevailing administrative policies, and as to the status of return waters now being distributed in accordance with them. Vested rights will have protection, naturally; but just what are vested rights to return waters? Does the appropriator of water have a vested right to the return flow from all upstream diversions, or do the upstream projects have vested rights to their own return flow? And what of return flow that has not yet become evident, but which in the light of past experience may be expected to appear in a given locality sooner or later? Who may claim that? These questions cannot now be answered with certainty in several of the western jurisdictions; but controversies over them in various localities can be predicted with reasonable certainty.

<sup>47</sup> *Watson et al. v. United States*, 260 Fed. 500.

<sup>48</sup> *Popham v. Holloran*, 84 Mont. 442, 275 Pac. 1099; *Newton v. Weller*, 87 Mont. 104, 288 Pac. 133.

<sup>49</sup> *Marks v. Hilder*, 262 Fed. 302.

## THE SITUATION WITH REFERENCE TO FEDERAL PROJECTS

A member of the staff of the Department of Justice who has been engaged in numerous water-right cases has worked up considerable material to support the thesis that "the United States is the owner of the unappropriated waters in the nonnavigable streams in the public land States of the arid West."<sup>60</sup> This is what is known as the "reservation theory"—that the United States has never granted the waters to any of those States, and that the unappropriated waters still belong to the United States, consequently that so much of the unappropriated waters as may be needed for irrigation uses upon an Indian reservation or a Federal reclamation project may be reserved from further appropriation.

Opponents of this thesis point to the Reclamation Act of 1902—which directs the Secretary of the Interior in carrying out the provisions of the act to proceed in conformity with State and Territorial laws relating to the appropriation and use of water—as settling whatever doubt might otherwise have existed that the United States must secure its appropriations of water for Federal reclamation projects from the States.

Claims to reuse of seepage waters on Federal projects have been upheld in several Federal court decisions, one by the United States Supreme Court;<sup>61</sup> but these decisions have not been based upon outright ownership on the part of the United States. There has been nothing yet in the Federal decisions concerning return waters, so far as ascertained, that definitely distinguishes the right to their use by the United States from the right of a private appropriator from whose project return waters flow. In no case which has come to the author's attention has the right of a Federal project to divert its return waters from the main stream channel and to deliver them to an independent user for compensation been brought up for determination.

In conformity with the Reclamation Act, applications have been made consistently to the several State authorities covering appropriations of water for Federal projects. Many of the projects cover large areas, and the appropriations have been extensive. The original application for an appropriation to the Nebraska authorities in connection with the North Platte project, for example, was made for the irrigation of "all the irrigable lands on the north side of the North Platte River." This was held in the *Ramshorn case*<sup>62</sup> to cover the lands of Farmers' Irrigation District, so that the reclamation project in delivering drainage waters to the district was entitled to the benefits of a statute then in force authorizing the owner of an irrigation canal to collect seepage water thereunder to apply to the irrigation of land covered by the original appropriation. The significance of this is that the Farmers' District appropriation is prior to that of the Federal project, yet the latter appropriation was held to embrace the Farmers' lands so far as this particular statute was concerned.

<sup>60</sup> WARD, E. MEMORANDUM, FEDERAL IRRIGATION WATER RIGHTS. 17 p. Denver, Colo. 1930. [Manuscript.]

<sup>61</sup> *Ramshorn Ditch Co. v. United States; United States v. Hays et al.; and Idc et al. v. United States.* See footnotes 32, 25, and 24, respectively.

<sup>62</sup> *Ramshorn Ditch Co. v. United States.* See footnote 32.

Various State statutes have been passed to facilitate Federal reclamation, definitely providing for the use of water on Federal projects and giving them certain privileges not granted generally in case of initiation of private appropriations. For example, New Mexico, North Dakota, Oklahoma, Oregon, and Washington provided for the withdrawal of waters from appropriation for periods of years for the benefit of the United States in connection with projects under consideration; Montana provided that appropriations by the United States should be held valid for 3 years without commencement of construction; Nebraska authorized the execution of contracts for rental or sale of "developed, stored, flood, or unused water" in excess of project requirements, from the United States to persons holding permits to appropriate normal flow which shall have proven insufficient for their needs.

The assertion of claim of the United States to all return waters arising on Federal reclamation projects is of long standing. It appeared in the annual report of the Reclamation Service for 1912-13 (20) in connection with the statement of the irrigation plan of each of the reclamation projects, and was consistently reasserted in subsequent reports year after year. The wording in the majority of cases was: "The United States claims all waste, seepage, spring, and percolating water arising within the project and proposes to use such water in connection therewith." The published maps of the projects bear the same wording. The claim of the reclamation projects to their return waters has been asserted in several court actions.

It appears, then, that the Bureau of Reclamation has been diligent in asserting and maintaining the right of the Federal projects to recapture and reuse return waters arising on such projects. The Federal decisions leave no doubt as to the view of the courts that there has been no abandonment of these waters by the United States; and the right to recapture and reuse these waters on project lands before they have escaped from the project is apparently well established. The right of a Federal project in Idaho to mingle return waters with the direct flow of a stream and later to redirect them was stated in a Federal decision in that State, the case not having gone to the United States Supreme Court. It further appears that neither Federal nor State courts have ruled specifically that return waters from Federal projects are subject to different rules of law from those governing the return from private projects.

#### AN EQUITABLE POLICY LEADING TO EFFICIENT STREAM UTILIZATION

In stating what in effect are the conclusions reached from this study, it is appreciated that laws and court decisions differ and that a policy which may have sound legal foundation in one State may be out of the question in another. No criticism is intended of any established policy or of the legal authority on which it rests. These decisions invariably have been carefully considered. The purpose of this section is to state what appear to be equitable principles concerning rights to the use of return flow in jurisdictions in which the constitutions and laws are such that the principles may be applied.

Specifically, the law in certain jurisdictions is such that return water immediately upon entering the stream from which diverted

becomes public water, regardless of human intentions. Every appropriator is on notice that that is the law; for one to recapture return flow to which he has no title is not only illegal but is inequitable, for the use belongs to others and the fact is known. That, however, is not the established law everywhere. Where it has not become established, principles which do involve the recapture of return flow under certain circumstances may be entirely equitable.

It is generally considered that return flow may be recaptured before it leaves a project and reused upon the lands of that project, regardless of possible uses elsewhere. If this is equitable, it follows that a user elsewhere is being deprived of water to no greater extent if this return flow, instead of being recaptured before it reaches an arbitrary boundary, is allowed to cross that boundary or even to mingle with the stream waters. The sticking point in certain jurisdictions is a matter of law, and not necessarily a consideration of equity to possible users elsewhere.

#### RETURN FLOW IN RELATION TO BENEFICIAL USE

Beneficial use, unless the statutes and court decisions require it, is not necessarily exhausted by one application of irrigation water. Recapture and reapplication of the same water may satisfy all requirements of beneficial and economical use from a physical standpoint. The process of picking up and reusing one's own waste water is one form of distribution of the original supply. Whether water is allowed to escape from an earthen ditch by seepage and later recovered and taken into another irrigation ditch, or is carried across a project in a cement conduit, is a matter of management, so long as lands which are not concerned with the project plans are not injuriously affected. If beneficial use results in the long run, the rights of the public are satisfied. And in a case in which the project lands respond readily to drainage, the question as to whether the canals shall be lined or a drainage recovery system installed may be a matter of internal economics for the management of the project to decide, rather than a question of beneficial use under the original appropriation.

Some so-called waste is unavoidable. It is impracticable, except possibly in a few extreme instances, for a project to deliver to the farms 100 percent of the water diverted, and impossible for the plants to consume 100 percent of the water applied. If the irrigation practice is reasonable, there appears to be no reason why a project should not be permitted to reuse its waste waters where it can do so to advantage, and where there is no resulting injury to other appropriators. A different question is presented—and one which is outside the scope of the present discussion—where use is wasteful and the excess is lost by evaporation or otherwise and there is consequently no return flow to compensate other appropriators.

#### RETURN FLOW IN RELATION TO RIGHTS OF OTHER APPROPRIATORS

The doctrine of prior appropriation governs the use of water on most of the irrigated land in the West. Public policy is served by protecting appropriators of water in their right to continued use of the water appropriated, so far as it is available, in the order of their

priorities. This is a fundamental principle. Each intending appropriator when he goes upon a stream initiates his right subject to all existing appropriations, whether already perfected by application to beneficial use or in process of being perfected. He takes things as he then finds them. His potential right attaches to a portion of the water then unappropriated, at such times as it may become available in the stream. And the right that he then initiates and perfects is prior to that of every later or junior appropriator, who in turn takes his place in line just as his predecessors did.

The right to make use of water is a relative right. An appropriator is under obligations to all other users from the same source of supply. His right must be exercised with respect to all appropriations both senior and junior to his own.

It would appear, in regulating the diversion of a project from which return water is flowing, at a time when the natural river flow is not enough to supply all priorities, that:

(1) There is no material injury to an appropriator with priority earlier than that of the project in question, if the stream conditions affecting the earlier diversion are maintained substantially as they were when the earlier appropriation was made; in other words, before any junior rights had been initiated. There is no injury if the quantity of water at this earlier appropriator's head gate is just what it would have been had there appeared no subsequent appropriators.

(2) There is no material injury to an appropriator with priority junior to that of the project in question, if the utmost beneficial use is being made of a senior appropriation on the lands covered thereby, according to the terms of such senior appropriation at the time the junior appropriation was made.

#### EFFECT UPON EARLIER APPROPRIATOR

If the first principle is equitable, it follows that a junior appropriator who can so manage his junior diversion as to reuse the return water on his own lands, or even on other lands, without depriving the lower senior appropriator of whatever quantity of water would have flowed down to his head gate but for the junior diversion, is working no injury to the senior appropriator. He is diverting water under his appropriation only when there is enough for both the senior appropriator and himself, and whether he applies the water carefully or lavishly, the rate of his diversion at such time does not deprive the senior of any water to which the latter is entitled at that time. When the river supply falls, the junior diversion is promptly cut in favor of the senior.

Specifically, if A has a right to divert 25 second-feet, and B, with head gate next above on the stream, has a later right, and at the time of A's appropriation there was neither gain nor loss between diversion points B and A—then, when the stream at B drops to 20 second-feet, A's water supply is short by 5 second-feet as the result of natural forces. If in the meantime, as the result of B's use of early season water, local stream conditions are so changed that there is a flow of 5 second-feet from B's lands above A's diversion point, which would give A his full appropriation right if he were to divert it, but which B can redivert and put to beneficial use, the conditions affecting A's appropriation at the time he initiated it are in no way altered if B

does recapture this water. A would have only 20 second-feet—not 25—if B had never appeared. Furthermore, so far as injury to A's appropriation is concerned, it makes no difference whether the 5 second-feet is intercepted by B before it reaches the stream, or is substituted at B's head gate, or is rediverted by B from the stream either above or below A's head gate. Unquestionably the point of diversion makes a great difference legally in some States; but in jurisdictions in which there is no legal injury to A, it is difficult to see wherein the physical injury lies, provided, of course, the return flow has been recaptured immediately by B before giving A reason to rely upon its use. A practical difficulty in regulating the diversions lies in the necessary measurements of flow; but such measurements have been made and can continue to be made. Stream distribution is not a simple proceeding under even the happiest circumstances.

#### EFFECT UPON THE JUNIOR APPROPRIATOR

The junior appropriator is entitled in law and in equity to have the stream conditions maintained as they were when he initiated his appropriation, and to suffer no enlargement of prior rights which will adversely affect his own. The junior appropriator, upon initiating his right, is charged with notice of all rights prior to his own, and of the areas of land covered by such rights in jurisdictions in which water is appurtenant to land, and (at least theoretically) predicates his development upon the use of a portion of what is left of the river supply after the quantities allocated to prior rights have been put to beneficial use upon those lands. As long as prior rights, as they existed when the junior appropriation was made, are not enlarged by excessive diversions of water or by inclusion of additional lands, the junior appropriator is not injured.

If the previous specific example is altered by making A the junior appropriator, and B the senior upstream appropriator with a right to use 25 second-feet on a given tract of, say, 1,750 acres, A is not injured if B recaptures and reuses beneficially his return flow of 5 second-feet on that tract of 1,750 acres, or on an equivalent area to which the appropriation has been properly transferred. No enlargement of B's right is taking place. The stream conditions above B's head gate are unchanged, and he is taking no more than his allotted 25 second-feet of the water reaching his head gate and is using it on only that 1,750-acre tract or its equivalent. B's use is within his appropriation, and if it is beneficial, A is not being deprived of any water which was unappropriated at the time he initiated his own right. Furthermore, so far as injury to A is concerned, the point at which B diverts the return flow is immaterial. This is on the assumption that B recaptures his return flow promptly, before A has reason to start building a development upon its use.

It follows from this that A is materially injured if B uses his 5 second-feet of return flow on lands in addition to the area covered by his prior appropriation, in jurisdictions in which the appropriation is tied to a specific tract or area of land or to a project with designated boundaries. This is an enlargement of B's right as it existed when A's right was initiated. It is an alteration of the terms of A's contract with prior appropriators, without his consent. Whether B's proposed use of the return flow on the additional

lands is beneficial or not is beside the point. B contracted to make beneficial use of 25 second-feet of river flow on 1,750 acres; and any part of that 25 second-feet not required for that purpose is outside of his contract and inures to the benefit of junior appropriators who need it. Delivery of the 5 second-feet of return flow, arising on the 1,750 acres, to additional land is essentially the delivery of part of the original 25 second-feet to additional land, insofar as the junior appropriator is concerned; for if the requirements of the original tract are satisfied by this original 25 second-feet alone, the return flow can be reapplied, if convenient, to the 1,750-acre tract and an equivalent quantity released at the head gate for the junior appropriator, or else the return flow itself allowed to go down.

It also follows that in jurisdictions in which water is not appurtenant to land by law and an appropriation is not limited to a definite tract or area of land, A is not injured by B's use of his own return flow on lands other than those on which the return arises. Here the limitation upon the appropriation of 25 second-feet is beneficial use upon land. It is the quantity of river flow which B may take at his head gate that A looks to when he initiates his own right. If B can so distribute his 25 second-feet as to cover 2,500 acres beneficially, instead of 1,750 as his neighbors may be doing, A cannot complain. Likewise, if B may intercept his own return flow and reapply it beneficially, or redivert it from the river, A is not being deprived of any water which was in the contract when he initiated his own subsequent appropriation.

#### EFFECT UPON INTERVENING DIVERTER

An appropriator is entitled to have his just share of the water supply delivered at his head gate, regardless of the convenience of earlier or later appropriators. This means that the substitution of water at one's head gate, if allowed at all, must be made so that the intervening diverter is not deprived of any part of his supply. To take 5 second-feet of water at one's head gate in place of an equivalent quantity of return flow discharged into the stream below another's head gate is inequitable and illegal if the intervenor needs that 5 second-feet to fill out his quota.

#### RETURN FLOW UPON WHICH OTHER USERS HAVE DEPENDED

Regardless of the equitable right of a user to recapture his own return flow, a difficult question is presented where the return has been allowed to find its way back to the stream and other appropriators have been expending money and labor in the development of land and putting this water to beneficial use on the assumption that the supply would continue.

A water user is under no obligation to continue wasting water, and can so alter his irrigation practice that there shall be a minimum of waste. This is a well-established principle. Beneficiaries of the waste take on sufferance only. An interception and beneficial reuse of the return flow on the lands for which the original appropriation was made is essentially within this principle. If the user for this purpose may intercept his return water before it reaches the stream,

there is no equitable reason why he should not recapture it after it is in the stream (in those jurisdictions in which the legal right to do this is sound), provided the quantity and quality of the stream water remain substantially unaltered.

The equitable rights of others who in the meantime have been making beneficial use of this return water, and who are deprived of a valuable supply by the original user's recapture, would seem to depend upon the matter of diligence of the original user in perfecting his appropriation. If he has been diligent in putting his original supply and the return-water supply to beneficial use according to the terms of his original appropriation, other users then have full notice of the situation, and they are proceeding at their own risk if they build development upon the assumption that the discharge of return waters will continue. If, on the contrary, the original user is not diligent, the State is justified in canceling through statutory procedure that part of the appropriation that has not been put to beneficial use according to the terms on which it was initiated. Other appropriators who themselves have been making use of the return water will automatically benefit.

Extension of the area covered by the original appropriation, as a result of recapture of return water which others have been using beneficially, deprives these others of a supply to which they have become equitably entitled. Whether they have made new appropriations based upon the increased stream supply, or whether the water simply fills out their existing appropriations, does not affect the situation. As appropriators they are entitled to have other appropriations held to the terms on which initiated.

A different situation is presented where for years and decades numerous rights have been established upon a stream and the return waters have been distributed as a part of the common supply without question. A custom has been built up, the stream characteristics have been changed substantially as a result of the established practice, and all comers take with knowledge of such conditions. Here, to introduce the right of appropriators generally to recapture return flow which invariably and completely has been going into the general supply would be to disrupt the physical situation and to lead to impairment or destruction of rights predicated upon an established custom, and therefore would not be in the public interest.

However, existing equities on such a stream would not be disturbed in any manner by allowing a new appropriator, from whose lands there has yet been no return flow, to plan his development upon complete utilization of his late appropriation and of all return waters realized from it. No one, in such case, is injured, and no one is being misled. Nor need the custom established upon this stream control the distribution upon another stream where rights have not become similarly established, if it proves that a different custom may result in the greatest beneficial use.

#### UTILIZATION OF RETURN FLOW IN RELATION TO PLANS OF DEVELOPMENT

##### WHERE NOT PART OF ORIGINAL PLAN

The original plans of probably most projects on which return flow in substantial quantities has appeared did not contemplate its reuse. There was apparently no general appreciation on the part of or-

ganizers that this would be an important result of development, although problems of drainage disposal were constantly arising. When these waters do appear in sufficient volume to attract attention, it is probably natural that the project on which they arise should seek to benefit from them, either by making direct use or by securing revenue from other users, particularly in view of the growing scarcity of available water supplies and resulting higher costs of irrigation development. Consequently many controversies over this question have arisen as the result of subsequent rather than original plans of utilization, and they are correspondingly difficult to settle with equity to all concerned.

Where the return waters have been allowed to go down the stream season after season and others have been making use of them and have built development on the assumption that they were a part of the natural stream flow, and the upper project has done nothing to prevent, then to allow it as an afterthought to demand compensation from such users or to contract these waters elsewhere to third parties appears inequitable.

On the other hand, even if the waters have been going down the stream for long periods, but before anyone else has made use of them, the upper project makes its plans to use the waters elsewhere and takes the necessary legal and physical steps to carry out such plans, then it would seem to make no difference whether the waters are used on new project lands or contracted to other projects or diverted by the original project at its own head gate. No other appropriator is being deprived of a water supply which existed when he made his appropriation, or is being deprived of a supplemental supply of which he has been making beneficial use. The first use of these return waters then becomes a matter of new appropriation, if applied on lands other than those on which the original appropriation was made. In such case, if made by B (a lower user) rather than by A on whose lands the return arises, any contract between A and B is simply an assurance to B that A will not reuse these waters on lands covered by A's original appropriation. Whether B makes an appropriation of the water after it is in the stream, without regard to A's possible plans, and before A has taken steps to appropriate it himself for use on additional lands, or whether B at the same time protects himself against A and all others by making a contract with A, would seem to be a matter entirely between these two. The interest of the State is in seeing that the first appropriator gets the water.

#### WHERE PART OF ORIGINAL PLAN

Inclusion of plans for utilization of waste waters as part of the original scheme of development simplifies matters considerably. No one is misled or has any excuse for being misled. No existing development is impaired; no one is deprived of water which, under the stream conditions as they existed when he made his appropriation, he would have been entitled to use but for the present plan; and interposition of subsequent uses is not involved. This is on the assumption that the terms of the appropriation are clear and that the plans of development are carried out diligently.

The appropriation is made for a specific quantity (or flow) of water from the natural flow of the stream, which, together with all

return waters resulting from its use, will be applied on a given area of land or on so much of that area as can be beneficially and economically irrigated. It should make no difference to prior appropriators whether that area is a contiguous body of land or consists of two or more parcels many miles apart, as long as the stream conditions are maintained as they would have been had the new development not taken place. And all subsequent appropriators are apprised of the extent of use which is proposed to be made of the appropriation in point.

#### RETURN FLOW IN RELATION TO EFFICIENT STREAM UTILIZATION

Any policy governing the ownership of return waters which encourages wasteful irrigation practice is, of course, contrary to the public interest. A wasteful practice is essentially one which involves unnecessary diversion of water which others could and would use if it were available. It involves the squandering or destruction of a resource. Diversion and application, however lavish, of an ample stream of water which others do not need and which cannot be stored in reservoirs for later use is not wasteful where it does not deplete any of the State's natural resources or injure good lands unnecessarily through excessive seepage. An appropriator who follows the practice of storing large quantities of water in his soil when the river is in flood, with a view to recovery and reuse of the drainage waters when the river stage is such that he has no right to divert directly, may be making the highest beneficial use of his water supply. This is on the assumption that his action does not result in injury to valuable farm lands, whether owned by himself or by others.

A head-gate diversion at a time when junior appropriators are in need, that permits an application of water so lavish as to yield a substantial return flow, is not equitable to the junior appropriators, even if the recorded rights of the senior are not exceeded. Proper utilization of the stream would require a reduction of the head-gate diversion to an amount which would give this senior diverter what he needs, with due regard to soil and crop conditions, and with the least practicable waste, so that during this period of shortage other lower users could be supplied directly from the stream without the lag occasioned by transportation of excessive quantities of water through the soil. If the return flow in question has been appropriated by the original diverter for use on other lands with the same priority, then the question as to whether he reduces his head-gate diversion and takes out the difference below, or leaves the head gate open at the maximum point and recaptures the return flow later, is a matter of local management for him to decide, provided, of course, whatever practice he adopts results in beneficial use and does not affect the diversions at intermediate head gates.

Plans of a late appropriator to recapture and reuse the resulting return flow would seem to be in line with efficient stream utilization. In fact, that is the only way in which further development can take place on many streams. It is a common occurrence to find the usual summer flows of streams fully appropriated, sometimes several times over, yet to find these same streams yielding spring-flood flows beyond the requirements of existing appropriators. To take a modi-

cum of spring flow, store part of it in a reservoir if possible, apply it to the soil and recapture the drainage for further application, and construct a project on the basis of complete utilization of that modicum, requires a degree of care in plan and execution that leaves no room for wasteful practice at any point. The incentive is to use that water carefully and efficiently.

Whether the best use of present unappropriated flood flows of a given stream would be served by permitting the reuse of return waters as above outlined, or by requiring the return to go down the stream to enrich existing priorities and improve the character of development already in existence, depends upon the local circumstances in each case. Diversion of flood flows for new early season use and larger later season flows for existing projects as a result of the upstream diversion may be the better economics on some streams. In other cases it may prove best to restrict existing areas and concentrate on the new areas. Granted that in a given case the new development is desirable, either in addition to or in substitution for an existing project, efficient use of the spring flood involves the careful reuse of return waters.

#### CONCLUSIONS AS TO EQUITABLE POLICY

Where the law has been settled to the effect that return waters, upon leaving the project on which they arise, or upon reentering the stream from which diverted, are immediately transformed into public waters, it is not only illegal but is inequitable to other appropriators for a project to recapture its return flow after such transformation of character has taken place. On the contrary, in jurisdictions in which the law has not become established to such effect, it is not inequitable to allow a project the beneficial reuse of its return waters, provided all other appropriators are fully protected in all rights theretofore acquired. In such jurisdictions a lower user who has acquired neither legal nor equitable title to the use of return flow arising on an upper project is being deprived of water to no greater extent if the return is recaptured after leaving the upper project than he is where the return is recaptured before leaving the upper project boundaries.

It is inequitable for a project to intercept or recapture its return flow to the injury of other appropriators, either senior or junior. Senior appropriators are entitled to have the stream conditions maintained as they were when their appropriations were initiated, and are injured to whatever extent reuse of return flow by others interferes with this right. Junior appropriators are injured if reuse of return flow by an earlier appropriator works an enlargement of the earlier appropriation. Appropriators whose head gates are located between the point of original diversion of another project and the point at which its return waters reenter the stream are injured by any redirection at the other project's head gate, in substitution for an equivalent of return flow, that cuts short the quantity they are entitled to receive.

Beneficial use of water is achieved by a project which plans and carries out diligently a complete utilization of both its original diversion and its return flow, where this can be accomplished (1) without depriving prior appropriators of any water supply which would

have been available to them but for the later use, (2) without enlarging upon its appropriation to the detriment of later appropriators, and (3) without depriving others of a return water supply which they have been allowed or encouraged to use and which they have had reason to think would continue. This is accomplished most satisfactorily if the reuse of return flow is indicated in the original appropriation; but it can be covered effectively by a later supplemental appropriation, provided the rights of others who in the meantime have initiated appropriations are properly safeguarded.

Introduction of a policy of permitting users to recapture return flow which they have always allowed to escape, and which for years has been consistently administered as public water, and on the strength of which development has taken place, would completely upset existing equitable rights so built up and would be contrary to the public interest. However, new development upon even such a stream, predicated upon consumptive use and involving the beneficial use of return waters which have not yet appeared but which may be reasonably expected to appear, would not disturb existing rights; and if the new development is justified, would be in the interest of efficient stream utilization.

#### SUMMARY

Return flow from irrigation includes both avoidable and unavoidable losses from the irrigation project. Normally, but not necessarily, it returns to the stream from which diverted. Visible return flow is that portion of the return water which appears at the ground surface before reaching the stream, whereas invisible return flow enters the stream channel below the water surface. Visible return flow is often directly measurable.

Observations concerning the relation between seepage from irrigated lands and increases in river flow were made by the State engineer of Colorado 50 years ago. In following years the phenomenon aroused interest and study in a number of Western States; recognition is now widespread throughout the West. Accretions to water supplies from this source, which are to be noted along most streams within or below irrigated valleys, make it possible to irrigate much larger areas from many streams than was formerly thought practicable. It is not uncommon to find the entire flow of a stream diverted at a certain head gate throughout a period during which return flow into the stream below the head gate is supplying the needs of extensive irrigated areas.

Numerous conflicts have arisen over the possession of return waters, with the cleavage principally between public and private ownership. Under the public-ownership theory, return waters are not the property of the project from which they flow, but become a part of the stream system available to appropriators in order of priority; under the private-ownership theory, they are at the disposal of the project on which they arise. The courts in certain States have ruled as to whether return waters are public or private property, while in others the general question has not yet been settled; and, except in Colorado, the many angles to the return-flow question have not been comprehensively litigated. In many sections of the West extensive development has taken place with water rights

predicated wholly or partly upon return flow. There is no uniformity among western jurisdictions as to the right to recapture or appropriate return waters from irrigation, or as to the point at which they may be recaptured; and prevailing practices in various important places are as yet without judicial sanction.

The policies of the water administration offices of the several States may be divided into two groups: (1) The State engineers of Colorado, Wyoming, Nebraska, Nevada, and Utah regard return flow as the property of the public, and their traditional policies have been opposed to contracts purporting to transfer drainage water from one project to another to the detriment of other appropriators. (2) The other State engineers generally consider return flow in a stream as a part of the public waters of that stream, but some of them have given official recognition to cases of recapture or substitution of return waters or of disposal of the same before reaching a stream channel. There is very little statutory direction to the State engineers in distributing return flow. Furthermore, the lack of judicial precedent and support in so many States leaves doubt as to the stability of some of the prevailing administrative policies and as to the status of return waters now being distributed in accordance with them.

There has been considerable controversy as to the right of the United States to recapture and reuse the waste and seepage waters arising on Federal projects. The Federal decisions leave no doubt as to the view of the courts that there has been no abandonment of these waters by the United States; and the right to recapture and reuse these waters on project lands before they have escaped from the project is apparently well established. Neither Federal nor State courts have ruled specifically that return waters from Federal projects are subject to different rules of law from those governing the return from private projects.

Equitable principles concerning rights to the use of return flow, in jurisdictions in which the constitutions and laws are such that the principles may be applied, are as follows: (1) Where the law has been settled that return waters become transformed into public waters, it is not only illegal but is inequitable to other appropriators for a project to recapture its return flow after such transformation of character has taken place. Where the law has not been so established it is not inequitable to allow a project the beneficial reuse of its return waters, provided all other appropriators are fully protected in all rights theretofore acquired. (2) It is inequitable for a project to intercept or recapture its return flow to the injury of other appropriators, either senior or junior. (3) Beneficial use of water is achieved by a project which plans and carries out diligently a complete utilization of both its original diversion and its return flow, where this can be accomplished without injuring either prior or later appropriators and without depriving others of a return water supply which they have been allowed or encouraged to use and which they have had reason to think would continue. (4) Innovations which would upset long-established practices on a stream, on the strength of which development has taken place and that would injure equitable rights predicated upon such practices, would be contrary to the public interest. New development upon such a

stream, based upon consumptive use and involving the beneficial use of return waters yet to appear, should not disturb existing rights; and if the new development is justified, would be in the interest of efficient stream utilization.

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