J. E. WHITTEN
State Engineer

A. RALPH OWENS
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DENVER 3, COLORADO

November 27, 1962

Mr. J. E. Whitten
State Engineer
State of Colorado
232 State Services Building
Denver, Colorado

Dear Mr. Whitten:

I submit herewith my report of water investigations conducted in Water Districts 11, 12, 14, 17, and 67, of Irrigation Division No. 2, during the 1962 Irrigation year.

Respectfully submitted,

John W. Patterson
Associate Hydrographic Engineer

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(PREFACE)

Under authorization granted by the State Legislature, I was instructed by the State Engineer to conduct seepage and water investigations in the Arkansas River Basin during the summer of 1962. An unusually high sustained base flow of the Arkansas River and its tributaries prevented the acquisition of a series of measurements which could be used to determine average losses or gains in the river within a close degree of accuracy.

As a result of being unable to conduct a number of physical investigative studies on the River, I undertook a study, as time permitted, of administrative procedures and water rights in Irrigation Division No. 2.

Investigation of seepage and gains in the Arkansas River Basin should be continued for a number of years until a final report can be rendered giving various flow characteristics and patterns of return flow. This data will be invaluable in the administration of direct flow rights and reservoir releases from the mountainous area to the flat lands of the Arkansas River Basin.

(1)

A single series of water flow measurements of water flow patterns in the Arkansas River Basin was conducted during the past summer.

GAINS AND LOSSES IN THE ARKANSAS RIVER FROM THE TWIN LAKES TUNNEL TO THE HEADGATE OF THE BESSEMER CANAL

A single series of water flow measurements were conducted during the past summer of water flow patterns in the Arkansas River Basin. These measurements were conducted under conditions which were far from ideal, due primarily to the unusually high rate of flow in the main Arkansas River. There were only a few locations where the river could be waded until the latter part of the summer. Several series of measurements were commenced, but had to be abandoned before completion, due to either rain or unannounced water releases from upstream reservoirs.

Measurements were made on August 28 and September 24-26, 1962, of water flow in the Arkansas River from the confluence of Lake Creek and the Arkansas River to the headgate of the Bessemer Canal. Although an interval of approximately one month transpired from the commencement of this series until its completion upstream of Panorama Park, it is felt that over-all loss and gain patterns would be quite similar, due to the fact that inflow and outflow conditions would probably still be in a state of equilibrium.

Measurements, for the most part, revealed unobserved* water inflow gains (see ~~Appendix A~~ tabulations following the text of this report) to the Arkansas River from the outlet of the Twin Lakes Tunnel to the headgate of the Bessemer Canal. However, certain exceptions were found, of which the major one was found to be between the old Portland gaging station and a point approximately 11 miles downstream on the Hobson Ranch.

*Unobserved Inflow--that inflow which percolates into the river from seepage and non-measurable sources. The source of gain is generally derived from excess water application to irrigated lands and underground tributary inflow.

A ditch loss of 78.12 c.f.s. was measured between these points. An attempt was made to find an answer for this apparent extreme loss but without any particular success. Additional measurements at a later date will probably provide a logical solution to the problem.

An eventual question to be determined regarding losses and gains in the Arkansas River is whether the unobserved inflow into the Arkansas River is the total inflow or whether it is merely that amount in excess to seepage and conveyance losses. The answer to this question can probably best be determined by either geological investigations, budget type inflow-outflow measurements during a dry year, or a combination of both.

TWIN LAKES RESERVOIR RELEASES

Investigations of seepage and conveyance losses from the Twin Lakes to the headgate of the Colorado Canal were inconclusive so far as actual measurement was concerned, due to the extremely high sustained base flow of the Arkansas River. However, observations of the gaging station at Nepesta tended to confirm previous estimates of a 12% conveyance charge from the Twin Lakes to the Colorado Canal. Charts to support this claim are not included in the tabulations following this appendix of this report, due to their present unavailability, but will be incorporated at a later date.

RESERVOIR RELEASES FROM LAKE MEREDITH TO THE ARKANSAS RIVER

Measurements and observations were made of conveyance losses in the discharge canal from Lake Meredith to the confluence of the Arkansas River. A seepage flow of water in the canal of an estimated 0.1 c.f.s. was observed to flow approximately one-half the distance of six miles from the outlet works of the reservoir to the river. Earlier in the irrigation season, this flow would almost reach the river. It is quite probable that maximum losses in the canal, based upon 1962 measurements and observations, would not exceed 1.0 c.f.s. during those periods when the canal was transporting flows up to an amount of 300 c.f.s.

WATER DISTRICT NO. 11

A search was conducted in the Chaffee County Court House, located in Salida, Colorado, of all water rights granted in Water District No. 11. This search was deemed necessary due to the fact that some sixty decrees granted in this district were absent from the records of the ~~District Court~~ State Engineer's ~~Office~~ Office and the office of the Dist. Engr.

All decrees granted in the District Court were analyzed and compiled into a priority list. The list was compiled, based upon the fact that a right granted in a supplemental adjudication must be junior to all rights granted in preceding adjudications, irrespective of the appropriation date awarded by the adjudicating court.

Individuals worthy of commendation in the preparation of this priority list are: Mrs. Dorris Harfst, Deputy Clerk of the District Court of Chaffee County, and Mr. Harold Krasomil, Water Commissioner for Water District No. 11. Mrs. Harfst has completely revised and indexed all water proceedings which have transpired in Water District No. 11 to the extent that Water District No. 11 now has, in my personal opinion, one of the most complete and readily available system of water records of any district court in ~~Water~~ Division No. 2.

The adjudicating court in Water District No. 11 has, until 1942, held adjudications of water rights at both the spring and fall terms of court. However, decrees granted in subsequent adjudications have quite often been given priorities senior to those rights granted in previous adjudications. The sole exception to this situation exists with the decrees granted after the original adjudication of June 19, 1890. These decrees carried the expressly implied provision of having to be junior to decrees granted during the original adjudication of 1890.

In the past, a subsequent adjudication in Water District No. 11 has permitted a claimant to assert a claim for a date of appropriation

senior to particular rights adjudicated in prior adjudications. Advertisements and official notices would be delivered to these particular ditch users, and they in turn would be obliged to protest a claim by an individual who had a right to be adjudicated, even though the right to be adjudicated might possibly be in an adjudication proceeding some 20 years after the right over which a prior appropriation date was claimed. *

The next issue raised pertains to the administration of the water rights so granted in Water District No. 11. If the administration of water rights in Water Division No. 2, of which Water District No. 11 is a part, were based solely upon date of appropriation, the rights granted the early dates of appropriation in the later adjudications of Water District No. 11 would be receiving water to which they would not otherwise be entitled. It is estimated that there is a minimum of 150 c.f.s. of water rights granted to ditches in Water District No. 11 from the South Arkansas and Arkansas Rivers alone which would be of this category. However, it has been held that river calls between districts can be made according to date of appropriation. **

* These rights are probably invalid so far as being senior to rights previously adjudicated. A similar case entitled "The Huerfano Valley Ditch and Reservoir Company V Hinderlider" (1927) 81C. 468, 256 P. 305, stated that:

> "A supplemental or additional statutory adjudication which purports to subordinate earlier decreed priorities to priorities awarded in the supplemental decree, is to that extent absolutely void."

** "In an action to secure an award of priority of water right adjudicated in one district, over one adjudicated in another district, where the plaintiff's adjudication was prior, but its decreed water right was subsequent in priority to that of defendant, it was held that the date of priority controlled and not the date of proceeding and entry of decree,....."
HOLBROOK IRR. DIST. V ARKANSAS VALLEY SUGAR BEET & IRR. CO.
(1931) 54 F. 2d 840; Idem (1929) 42 F. 2d 541.

As a result, a situation exists wherein senior downstream rights apparently cannot place a call upon junior upstream rights due to the fact that these particular rights might possibly have a senior date of appropriation; and, to even further complicate the situation within Water District No. 11 itself, rights granted during the first or 1890 adjudication (and which have a later date of appropriation) are being deprived of water by those rights granted during a later adjudication but which have an earlier date of appropriation.

The situation, as herein presented, is not the fault of the present Water Commissioner for Water District No. 11, but rather, it traces back to a series of preceding Water Commissioners and division engineers and their apparent lack of understanding or interpretation of the water statutes of the State of Colorado.

No attempt will be made to analyze in detail the effects of the present method of water administration in Water District No. 11 of Irrigation Division No. 2. However, it is quite probable that a beneficial effect would result to downstream senior rights if water application to these lands which would not otherwise be entitled to such water were to occur during an above-average water yield year. This is due to the fact that excess water applied for irrigation eventually returns to the Arkansas River Basin as return flow and acts to supplement the natural river base flow.

During periods of shortage in the Arkansas River Basin, present administrative procedures in Water District No. 11 would almost certainly deprive senior downstream rights of water to which they should legally be entitled.

RECOMMENDATIONS:

1. Attempt to clarify the status of water rights adjudicated in Water District No. 11 and their relation to ~~Water~~ Irrigation Division No. 2 as a whole. It is quite probable

RECOMMENDATIONS (Continued)

that any clarification will ultimately result in court action by some of the ditch users in the area against the State Engineer's office.

2. A letter of commendation be forwarded by the State Engineer to Mrs. Dorris Harfst, Deputy Clerk of the Chaffee County District Court, commending her for outstanding cooperation and assistance in indexing all decrees and water proceedings which have transpired before the District Court of Chaffee County,

WATER DISTRICT NO. 12

Water District No. 12, Irrigation Division No. 2, is under the supervision of Mr. John S. McDonough, Water Commissioner I. Mr. McDonough's administrative problems are primarily concerned with streams tributary to the Arkansas River, rather than the main stream. These streams are intermittent in nature and can cause considerable difficulty in administration due to rapidly fluctuating conditions.

There are several minor decrees in Water District No. 12 which have an early date of appropriation granted in subsequent adjudications, but which are administered solely by date of appropriation. Inasmuch as little opportunity was available to analyze all of the rights decreed in Water District No. 12, it is difficult to ascertain whether these junior rights would have any material effect upon other ditches in the water district or Division No. 2.

Mr. McDonough is to be commended for his unusual completeness of records of water diversions for Water District No. 12. It would be desirable if all water commissioners in the state would maintain records as complete as Mr. McDonough's, but this seems impossible inasmuch as such completeness is not required by law.

WATER DISTRICT NO. 14

Water District No. 14 is under the nominal supervision of Mr. Joe Russ, Water Commissioner I. ~~Mr. Russ's~~ His duties are generally carried out on a per diem basis, ~~of which~~ with an average total of approximately 286 days ~~are~~ claimed each year. He is generally off duty during the months of December and January and commences work in February. However, in reality, most of the administrative duties of Water District No. 14 are handled by the Division Engineer of ~~Water~~ Irrig. Division No. 2, of which Water District No. 14 is a part.

The changing of ditch recorder charts, which is also a duty of the water commissioner, is rarely handled by the water commissioner himself but by a member of his family. This is due to his partial incapacity ~~from~~ as a result of old age.

A certain legal question arises as to the validity of the priority of certain water rights of the City of Pueblo. The City of Pueblo acquired, during the adjudication of March 23, 1896, a right to 22.66 c.f.s. ~~of water~~ cubic feet of water per second/time for domestic and irrigation purposes. Date of appropriation given to this right was April 22, 1884. In the adjudication of June 22, 1896, the City of Pueblo acquired an additional right for 46.0 c.f.s. ~~of water~~ cubic feet of water per second/time for domestic and irrigation purposes, with a date of appropriation of February 20, 1889. During the minimum year, insufficient water would be available from the Arkansas River to satisfy these priorities.

In the adjudication of October 13, 1932, the City of Pueblo acquired rights for "beneficial uses, other than irrigation." This adjudication, which was an original for non-irrigation purposes, gave the City of Pueblo rights to 45.0 c.f.s. ~~of water~~ cubic feet to water with a date of appropriation of April 1, 1874. The City, in turn, agreed to abandon back to the Arkansas River, the rights

previously mentioned, if the statutory period for objection were to pass without objection. No objections arose.

As a result of the adjudication of 1932, the City of Pueblo is now receiving water to which it would not have been entitled had it been diverting water under its original rights.

To date, there has been no court test case to determine whether an earlier supplemental irrigation decree has a prior right over a subsequent original adjudication. Eventually this decision will probably have to be determined, whether in Water District No. 14 or elsewhere.

A preliminary study of water uses by the City of Pueblo tends to support a statement that water is being diverted by the City in excess of decreed rights and reservoir releases.

WATER DISTRICT NO. 17

Water District No. 17 is under the supervision of Mr. David Heizer, Water Commissioner II. Mr. Heizer's primary administrative problems result from ditches which receive their supply of water from the main Arkansas River, although a major problem is arising due to illicit water diversions from Horse Creek and its tributaries.

Horse Creek is an intermittently flowing stream whose water sinks and rises due to a rather impervious clay barrier. An upstream section of the stream will be dry, while only a short distance downstream a live channel may exist. This condition repeats itself several times in the length of the stream.

There are some appropriators of water in the Horse Creek area who have, with Federal assistance, built water-impounding and diversion structures, both on Horse Creek and its tributaries. Inasmuch as the majority of flow in Horse Creek, after the spring runoff, is derived from late spring and summer rains, these structures tend to obstruct the natural runoff flow which would eventually reach Horse Creek if unimpeded. On June 28, 1962, a flow of approximately 90 cubic feet of water per second of time was observed to be flowing in Horse Creek after a fairly heavy but localized rain. However, due to the fact that tight diversion dams were placed directly across Horse Creek proper, on the Robert Morin and Hixson Ranches, none of this flow was permitted to flow downstream to appropriators who had senior rights.

Approximately five of the ditch users from Horse Creek, who either have no decreed rights or junior rights, are willfully defying the water commissioner for the area by either ignoring or tearing down posted notices prohibiting diversion except during periods of adequate water availability. They have also defied orders from both the Division Engineer of Water Division No. 2 and the State Engineer requiring the installation of headgates and measuring devices.

A problem which also impedes the natural flow of Horse Creek to senior downstream users is the vast number of water wells in the Horse Creek Basin. These wells are shallow and for the most part draw directly from the underflow of Horse Creek. Further acknowledgment of this situation is confirmed by the well owners themselves, who claimed as their sources of supply during the last adjudication of water rights in Water District No. 17 "the natural underground flow of Horse Creek and its tributaries" or "underground sources located with the watershed of Horse Creek."

Although there is no underground water law per se in the State of Colorado which provides for the administration of wells, the fact that the wells have been adjudicated gives authority to the State Engineer for their administration.

RECOMMENDATIONS:

1. Action should be taken to insure the proper administration of water rights in the Horse Creek area. This will necessitate the installation of lock type headgates and the delegation of sufficient administrative and enforcement authority to the deputy water commissioner for the area. Furthermore, the deputy water commissioner should be instructed to automatically go on duty when sufficient runoff occurs to insure water delivery to downstream senior appropriators, rather than await instructions from the water commissioner, who lives in Rocky Ford, Colorado.

2. Adjudicated wells in the Horse Creek area should be administered according to date of appropriation in the same manner as surface rights. It is almost a certainty that this action will result in litigation by the well owners against the office of the State Engineer, but conditions are ideal for a test case.

WATER DISTRICT NO. 67

Administration of water in Water District No. 67 is under the supervision of Mr. R. J. McGrath, Water Commissioner I. Mr. McGrath's primary duties consist of water administration in the lower reaches of the Arkansas River from John Martin Reservoir downstream to the Kansas state line. The majority of Mr. McGrath's information is obtained from telephone calls, although a physical inspection would often times be of more value. Instances occurred last summer when a ditch user would call in erroneous ditch reports for a number of days in order to apparently further his own particular desires. On other occasions, estimates of flow in the Arkansas River have been made rather than a physical inspection. These estimates have on occasion not borne out the actual flow by several hundred second feet.

Compacts were made during the past summer with Messrs. Ken and Ray Jameson, owners of the XY Canal. The canal is located near Carlton, Colorado, and derives its supply of water from the Arkansas River.

The purpose of the visits with the Jameson Brothers was to attempt to secure their cooperation for the installation of a Parshall flume in the XY Canal as required by provisions of the Arkansas River Compact.

A total of nine written notices have been sent to the owners of the XY Canal by either the State Engineer or Division Engineer since 1950. Five of these notices were delivered during 1962, but still with no avail, although the owners of the canal have always assured their complete cooperation. The last notice was sent on October 1, 1962, and requested that the flume be installed as soon as possible, so that it could be checked prior to icing conditions. To the best of my knowledge, no effort has been made as of this date to comply with the provisions of this latest order requiring that a measuring flume be installed.

GENERAL COMMENTS AND RECOMMENDATIONS

1. It is apparent as a result of contacts with water commissioners about the State of Colorado that not all of them are adequately familiar with water administration laws. It is therefore recommended that an individual well versed in water law (possibly from the Attorney General's office) hold a class for all individuals in the State Engineer's office who are primarily concerned with water administration.
2. In several cases, water commissioners are administering water rights with little idea as to how to adequately make a rough estimate of water flow in an open ditch that does not have a Parshall flume. Furthermore, they are unfamiliar with proper procedure in the changing of recorder charts on various streams and irrigation ditches. Uniform instruction should be given to all water commissioners in these phases of administration.
3. Individual members of the Hydrographic Section have been observed making stream flow measurements under extremely hazardous conditions of high water flow. It is recommended that two people always be present for such measurements. The small additional expenditure in time and money is insignificant in relation to the possible saving of a human life. It is further recommended that water safety instruction be given to all hydrographers.

FLOW VARIATIONS IN THE ARKANSAS RIVER FROM THE TWIN LAKES TUNNEL OUTLET TO THE HEADGATE OF THE BESSEMER CANAL

By: John W. Patterson

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STATION	DISTANCE (Miles)	OBSERVED INFLOW (C.F.S.)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
		July 19, 1962			
Twin Lakes Tunnel	0	180.95			
No. Fork of Lake Creek	0.2	67.58			
So. Fork of Lake Creek	2.0	101.64			
THEORETICAL FLOW UPSTREAM OF TWIN LAKES		350.18			
ACTUAL FLOW UPSTREAM OF TWIN LAKES	10.0	451.14		+ 101.26	+ 10.1
		August 28, 1962			
Arkansas River immediately upstream of Lake Creek	0	243.75			
Lake Creek at Confluence with Arkansas River	0.10	72.30			
Low Pass Gulch	1.53	0			
THEORETICAL FLOW OF ARKANSAS RIVER AT GRANITE	2.80	316.05			
ACTUAL FLOW OF ARKANSAS RIVER AT GRANITE	2.80	338.43		+ 22.38	+ 7.99
Cache Creek at Mouth	2.90	2.48			
Clear Creek nr. Mouth	5.30	86.74			
Pine Creek at Mouth	6.90	46.30			
THEORETICAL FLOW OF ARKANSAS RIVER NR. PRINCETON STATION	8.0	473.95			
ACTUAL FLOW OF ARKANSAS RIVER NR. PRINCETON STATION	8.0	433.64		- 40.31	- 7.91

STATION	DISTANCE (MILES)	OBSERVED INFLOW (C.F.S.)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
Langhoff Ditch	8.6		0.25		
Dryfield Ditch	9.5		0.10		
Wapaca Creek at Mouth	10.5	0.25			
Riverside & Allen Ditch	10.9		14.34		
Morris Creek	11.5	0			
Frenchman Crk. at Mouth	12.2	2.55			
Cottonwood Crk. " "	19.2	17.87			
THEORETICAL FLOW OF ARKANSAS RIVER BEHIND BUENA VISTA SMELTER RUINS	19.5	439.62			
ACTUAL FLOW OF ARKANSAS RIVER BEHIND BUENA VISTA SMELTER RUINS	19.5	451.20		+ 11.58	+ 1.06
Helena Ditch	21.3		0.30		
Bray and Allen Ditch	21.3		5.89		
Maxwell Creek at Mouth	22.35	2.0			
Tributary Drainage-Right Side	22.65	1.0			
Thompson Creek	23.60	0.5			
Tributary Drainage-Left Side	24.25	0.2			
THEORETICAL FLOW OF ARKANSAS RIVER AT PANORAMA PARK	24.65	448.71			
ACTUAL FLOW OF ARKANSAS RIVER AT PANORAMA PARK	24.65	566.58		+ 117.87	+ 35.19 ?

September 24, 1962

Arkansas River at Panorama	24.65	357.03			
Chalk Creek	26.80	30.18			
THEORETICAL FLOW OF ARKANSAS RIVER UPSTREAM OF GAS CRK.	29.05	387.21			
ACTUAL FLOW OF ARKANSAS RIVER UPSTREAM OF GAS CREEK	29.05	405.60		+ 18.39	+ 4.17

STATION	DISTANCE (MILES)	OBSERVED INFLOW (C.F.S.)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
Gas Creek at Mouth	29.10	4.60			
Brown's Creek at Mouth	30.40	9.00			
Tributary Drainage	33.55	0.70			
Salida Ditch	36.05		21.20		
Kraft Ditch	36.05		1.50		
Sunnyside Park Ditch	36.85		13.60		
Williams and Hamm Ditch			9.30		
THEORETICAL FLOW OF ARKANSAS RIVER AT SALIDA	41.65	374.30			
MEASURED FLOW OF ARKANSAS RIVER AT SALIDA	41.65	474.68		+100.38	+ 8.00
		September 25, 1962			
Arkansas River at Salida	41.65	415.82			
So. Arkansas River	44.45	26.56			
Waste Ditch	44.47	1.50			
Waste Ditch	44.72	0.50			
Salida Sewage	44.75	1.20			
Bear Creek	46.30	2.00			
Pickett Ditch	49.15		0		
Tributary Drainage	53.30	2.00			
Pleasant Valley Ditch	55.05		5.40		
THEORETICAL FLOW OF ARKANSAS RIVER AT HOWARD	55.65	444.18			
MEASURED FLOW OF ARKANSAS RIVER AT HOWARD	55.65	406.49		- 37.69	+ 2.81
Howard Creek	55.68	0.5			
West Creek	56.50	0.1			
Cherry Creek	57.40	0.1			
Stout Creek	57.75	0.5			
Rodgers Ditch	60.45		0		
THEORETICAL FLOW OF ARKANSAS RIVER NEAR VALLIE	61.35	407.69			
ACTUAL FLOW OF ARKANSAS RIVER NEAR VALLIE	61.35	446.65		+ 38.96	+ 6.87

STATION	DISTANCE (MILES)	OBSERVED INFLOW (C.F.S.)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
Seepage	62.85	0.5			
Seepage	62.88	0.3			
Hayden Creek at Mouth	62.95	1.0			
E. Fork of Hayden Crk.	63.15	1.0			
Seepage	63.35	0.5			
Tributary	63.62	0.5			
THEORETICAL FLOW OF ARKANSAS RIVER UPSTREAM OF FOX CANYON CREEK	63.95	450.45			
ACTUAL FLOW OF ARKANSAS RIVER UPSTREAM OF FOX CANYON CREEK	63.95	450.19		- 0.26	
Fox Canyon Creek	63.96	2.0			
Cottonwood Creek	64.55	8.0			
Oak Creek	67.35	0.2			
Clayborne Ext. Ditch			0		
THEORETICAL FLOW OF ARKANSAS RIVER NEAR MOLLIE'S CAFE - 2 MILES FROM TEXAS CRK.	72.60	460.39			
ACTUAL FLOW OF ARKANSAS RIVER NEAR MOLLIE'S CAFE	72.60	485.80		+ 25.41	+ 2.94
Texas Creek	74.60	3.0			
THEORETICAL FLOW OF ARKANSAS RIVER AT ENTRANCE TO ROYAL GORGE	89.40	488.80			
ACTUAL FLOW OF ARKANSAS RIVER AT ENTRANCE TO ROYAL GORGE	89.40	507.73		+ 18.93	+ 1.27

STATION	DISTANCE (MILES)	OBSERVED INFLOW (C.F.S.)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
Canon City Water Wks.	92.60		19.0		
Canon City Hydraulic Ditch	96.10		57.5		
South Canon Ditch	96.40		20.0		
Grape Creek	96.63	0			
Fruitland Ditch	96.70	1.0			
THEORETICAL FLOW OF ARKANSAS RIVER AT CANON CITY	96.75	412.23			
ACTUAL FLOW OF ARKANSAS RIVER AT CANON CITY	96.75	367.18		- 45.05	- 10.85
Canon City Power Plant	97.15		0.5		
Tributary Inflow	97.18	0.5			
Canon City and Oil Creek	97.65		32.9		
Canon Mill Ditch	97.80		NON-CONSUMPTIVE		
Phelps Ditch	98.20				
Canon City Sewer	98.60	7.0			
Four Mile Creek	101.10	1.5			
Fremont County Ditch	101.25		13.5		
Minnequa Canal	102.75		141.0		
Waste Ditch	103.25	3.0			
Hannenkrat Ditch	103.25		2.57		
Florence Sewer	105.45	2.0			
Lester & Atterbury Ditch	105.55		0		
Hardscrabble Creek	107.75	1.0			
THEORETICAL FLOW OF ARKANSAS RIVER AT PORTLAND	108.76	191.71			
ACTUAL FLOW OF ARKANSAS RIVER AT PORTLAND	108.76	326.68		+134.97	+ 11.62

STATION	DISTANCE (MILES)	OBSERVED INFLOW (C.F.S)	OBSERVED OUTFLOW (C.F.S.)	UNOBSERVED CHANGE (C.F.S.)	UNOBSERVED CHANGE PER MILE (C.F.S.)
		September 26, 1962			
Arkansas River at Portland	108.76	328.46			
Bear Creek	113.86	2.0			
Tributary Inflow	115.76	0.5			
K. P. Creek	115.91	0.5			
Tributary Inflow	117.00	1.0			
Beaver Creek	117.30	0.5			
Hobson Ditch	118.00		2.0		
THEORETICAL FLOW OF ARKANSAS RIVER AT HOBSON RANCH	119.76	330.96			
ACTUAL FLOW OF ARKANSAS RIVER AT HOBSON RANCH	119.76	330.96		+ 2.43	+ 0.26
Turkey Creek	124.86	0.2			
THEORETICAL FLOW OF ARKANSAS RIVER AT BESSEMER HEADGATE	131.90	333.41			
ACTUAL FLOW OF ARKANSAS RIVER AT BESSEMER HEADGATE	131.90	255.29		- 78.12	- 11.10

SUMMARY
OF
UNOBSERVED INFLOW* INTO THE ARKANSAS RIVER BETWEEN SPECIFIED STATIONS
* * * * * *

Date	Station	Distance Between Stations (Miles)	Unobserved * Inflow (C.F.S.)	Change Per Mile (C.F.S.)
August 28, 1962	Granite to Princeton Station	5.20	- 40.31	- 7.75
" " "	Princeton Station to Buena Vista	11.50	11.58	1.01
" " "	Buena Vista to Panorama Park	5.15	117.87	22.88
Sept. 24, 1962	Panorama Park to Gas Creek	4.40	18.39	4.18
" 25, 1962	Gas Crk. to Salida	12.60	100.38	7.97
" 25, 1962	Salida to Howard	14.00	- 37.69	- 2.69
" 25, 1962	Howard to Vallie	5.70	38.96	6.84
" 25, 1962	Vallie to Fox Canyon Creek	2.60	- 0.26	0.00
" 25, 1962	Fox Canyon Creek to Mollie's Cafe	8.65	25.41	2.94
" 25, 1962	Mollie's Cafe to Entrance to Royal Gorge	16.80	18.93	1.13
" 25, 1962	Entrance to Royal Gorge to Canon City	7.35	- 45.05	6.13
" 26, 1962	Canon City to Portland	12.01	134.97	11.24
" 26, 1962	Portland to Hobson Ranch	11.00	2.43	0.22
" 26, 1962	Hobson Ranch to Bessemer Headgate	12.15	- 78.12	- 6.43
	TOTAL:	129.11 Miles	267.51 c.f.s.	2.07 c.f.s.

*Unobserved Inflow -- That inflow which percolates into the river from seepage and non-measurable sources. The source of gain is generally derived from excess water application to irrigated lands and underground tributary inflows. Loss is probably due to geologic faults.