



FOURTH ANNUAL REPORT

**Republican River
Compact
Administration**

For the Year 1963



TOPEKA, KANSAS

April 27, 1964

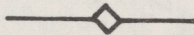
REPUBLICAN RIVER COMPACT ADMINISTRATION

For the Period May 4, 1963 to April 27, 1964

FOURTH ANNUAL REPORT

Republican River Compact Administration

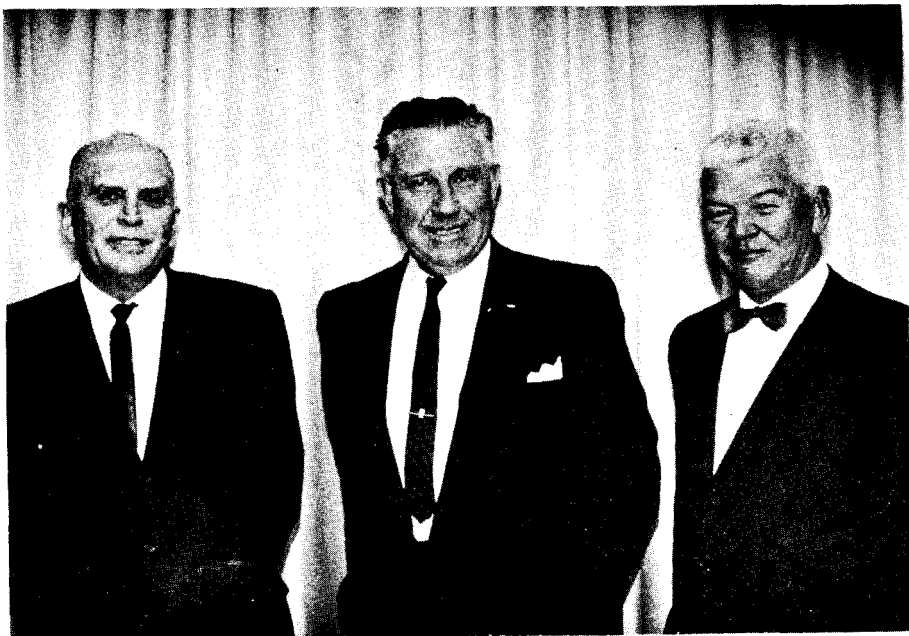
For the Year 1963



TOPEKA, KANSAS

April 27, 1964

OFFICIAL MEMBERS
REPUBLICAN RIVER COMPACT ADMINISTRATION
1963



Left to Right: Dan S. Jones, Jr., Director, Department of Water Resources, Lincoln, Nebraska; J. E. Whitten, State Engineer, Denver, Colorado; R. V. Smrha, Chief Engineer, Division of Water Resources, Board of Agriculture, Topeka, Kansas.

Fourth Annual Report

REPUBLICAN RIVER COMPACT ADMINISTRATION

For the Period May 4, 1963 to April 27, 1964

In conformity with the Rules and Regulations of the Republican River Compact Administration, the Fourth Annual Report of the Administration is submitted, as follows:

1. Pursuant to Rule 12, as amended, this report covers the period from May 4, 1963, to April 27, 1964.
2. Members of the Republican River Compact Administration are the officials of each of the States who are charged with the duty of administering the public water supplies, as follows:


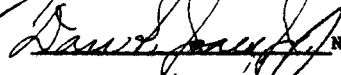
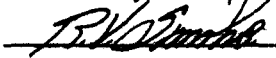
J. E. Whitten, State Engineer of Colorado
Dan S. Jones, Jr., Director, Department of Water
Resources, Nebraska
R. V. Surha, Chief Engineer, Division of Water
Resources, State Board of Agriculture, Kansas

3. The Fifth Annual Meeting of the Administration was held on April 27, 1964, in the State Office Building, Topeka, Kansas. Minutes of that meeting are included elsewhere in this report.
4. During the period covered by this report, three meetings of the Engineering Committee were held. A progress report together with a summary tabulation of the computation of virgin water supply for the 1963 water year, "Formulas for the Computation of Annual Consumptive Use," and summary tabulations of consumptive use for the water years 1959 through 1963, were presented to and accepted by the Administration at the Fifth Annual Meeting. A copy of these presentations is included in this report.
5. On April 27, 1964, Mr. R. V. Surha, Kansas Member of the Administration, was re-elected Chairman to serve until the next meeting of the Administration.

Respectfully submitted,

REPUBLICAN RIVER COMPACT ADMINISTRATION

By:


Colorado Member

Nebraska Member

(Chairman)
Kansas Member

Minutes of the
Fifth Annual Meeting

Republican River Compact Administration

Topeka, Kansas -- April 27, 1964

The meeting was called to order by the Chairman, R. V. Surha, at 10:00 a.m., in Room 1031-S, State Office Building, Topeka, Kansas.

The following were in attendance:

Dan S. Jones, Jr., Official Member, Lincoln, Nebraska
R. V. Surha, Official Member, Topeka, Kansas
M. E. Ball, Ass't. Director, Nebraska Department of
Water Resources, Lincoln, Nebraska
Floyd F. LeFever, District Engineer, U. S. Geological
Survey (S. W.) Lincoln, Nebraska
Ray E. Aldrich, U. S. Bureau of Reclamation, McCook,
Nebraska
Burton C. Filkin, U. S. Bureau of Reclamation, McCook,
Nebraska
E. J. Kennedy, District Engineer, U. S. Geological Survey
(S. W.) Topeka, Kansas
Hal K. Hall, Ass't. District Engineer, U. S. Geological
Survey (S. W.) Topeka, Kansas
A. M. Diaz, U. S. Geological Survey (Q. W.) Topeka, Kansas
S. W. Fader, U. S. Geological Survey (G. W.) Lawrence, Kansas
H. L. Mackey, Kansas Division of Water Resources,
Topeka, Kansas

The Chairman noted that Mr. J. E. Whitten, Official Member, Denver, Colorado, was unable to attend because of injuries received in an accident, and that time did not permit a personal representative to be appointed and attend the meeting for Colorado.

Approval of Minutes of Previous Meeting:

The minutes of the Fourth Annual Meeting had been previously approved by correspondence. Mr. Jones moved that the minutes be confirmed as circulated and that reading of them be dispensed with. The motion was seconded and unanimously passed.

Report of the Chairman:

The Chairman called on Mr. Mackey who reported the Third Annual Report was in the hands of the printer and would be distributed as soon as received.

Reports of Official Members or Representatives:

The Official Member from Nebraska had no report to make.

Unfinished Business:

Mr. F. F. LeFever, District Engineer, U. S. Geological Survey, Lincoln, Nebraska, reported that the report of his studies on return flows between Trenton and Cambridge was under review by the U. S. Geological Survey. Preliminary comments on the report indicated there was a need for financing a system - analysis study to provide needed data. Funds are available for such a study on a cooperative basis with the States but not for an entirely Federal study, since the results might not be applicable to other river basins in the region. When review has been completed, copies will be given the Administration for the files of each Official Member.

Mr. Jones stated that since return flows from irrigation are a large factor in the computation of virgin water supply, an attempt should be made to improve return flow data and that a short-term study probably would not be sufficient.

The Chairman noted that at the previous annual meeting he had been directed to write Mr. S. K. Jackson, Division Hydrologist, U. S. Geological Survey, in regard to this study. However, since the report by Mr. LeFever had not been received by the Administration, Mr. Jackson had not been contacted.

On motion of Mr. Jones the Administration directed the Chairman to arrange a conference with Mr. Jackson to discuss possible return flow studies in the Republican Basin.

New Business:

The Chairman stated that at the last meeting of the Administration the following assignments were made to the Engineering Committee:

1. Virgin Water Supply computations for 1963;
2. Establish formulas and make computations of consumptive use for 1961, 1962 and 1963;
3. In cooperation with representatives of the Bureau of Reclamation and Corps of Engineers, arrive at a method of computing inflow to Lovewell Reservoir from White Rock Creek;
4. Establish a method of proration of evaporation losses from Harlan County Reservoir between Nebraska and Kansas and proration of evaporation losses from Lovewell Reservoir between waters from White Rock Creek and Republican River.

The Chairman of the Engineering Committee, Mr. M. E. Ball, presented a progress report to the Administration. A copy of the report is attached as Exhibit "A" and made a part of these minutes. Mr. Surha asked that the record show all members of the Engineering Committee subscribed to the report.

On motion of Mr. Jones the Administration accepted the report of the Engineering Committee subject to examination and study by the Official Members.

Accompanying the report of the Engineering Committee was a tabulation of the computed virgin water supply for 1963 water year and revised computations for 1959 through 1962 water years. It was pointed out that any errors in assumed factors for return flow or well diversions could make a considerable difference in total computed annual virgin water supply. On motion of Mr. Smrha the Administration accepted the tabulation of computed virgin water supplies for 1959 through 1963 water years which is made a part of these minutes as Exhibit "B". Detailed computations are in the files of each Official Member.

Formulas to compute annual consumptive use in the Republican River Basin were next presented to the Administration. These formulas were adopted by the Administration and are attached as Exhibit "C".

Mr. Mackey of the Engineering Committee discussed the need for a method whereby the inflow to Lovewell Reservoir from White Rock Creek can be computed. The stream-flow records at the Burr Oak gaging station cannot be used for this since the intervening area below the station is almost one-third of that at Lovewell Dam. The Engineering Committee used, on a monthly basis, records of outflow and change in storage of Lovewell Reservoir, inflow and outflow of the Courtland Canal, precipitation at the dam, and reservoir evaporation as computed by the Corps of Engineers to compute the inflow to Lovewell from White Rock Creek. This information is needed to prorate evaporation losses in Lovewell Reservoir. The Administration accepted the procedure with the understanding that it may be revised in the future.

Mr. Mackey explained that water originating from White Rock Creek is allocated by the Compact to Kansas and the Engineering Committee found it was necessary to keep a separate running account of water in Lovewell derived from White Rock Creek and the Republican River since the evaporation in Lovewell of water from the Republican River would be counted as a part of the consumptive use by Kansas. Results of the operations studies showed little Republican River water was carried over from year to year after the initial filling of Lovewell. The Administration accepted the method of operations subject to possible future revision.

Mr. Ball discussed Item 4 of the Engineering Committee's assignment. It was felt by the Committee that the proration of evaporation in Harlan County Reservoir was a subject for consideration by the Administration. For the present, evaporation in Harlan County Reservoir is being divided between Kansas and Nebraska in the ratio of annual diversions in each state below the reservoir, and recommended this be adopted by the Administration. On motion by Mr. Jones that procedure was accepted by the Administration.

Mr. Ball then presented the results of computations of consumptive use in each state based on the formulas given in Exhibit "C". Mr. Jones moved that the tabulations entitled "Computed Annual Consumptive Use, Republican River Basin, 1959-1963", as submitted by the Engineering Committee, be accepted. The motion was seconded and passed unanimously. The tabulations of consumptive use are included in these minutes as Exhibit "D".

A motion to commend the Engineering Committee for the accomplishment of their assignments was passed unanimously by the Administration.

Mr. Filkin commented that the U. S. Bureau of Reclamation was considering a proposal to take water from Harlan County Reservoir to meet municipal needs in the Phillipsburg-Smith Center area. Since this would export water from the Republican River Basin, he suggested it be discussed. Mr. Filkin also stated that results of the study on Beaver Creek indicated the Nelson Buck Unit would require water in excess of allocation. He requested an opinion as to whether allocation could be transferred upstream since there is about 7,000 acres below Harlan County Dam which will not be developed as planned and for which acreage water is available. The Chairman stated that the extent to which these questions involve interpretation of the Compact would have to be determined later upon the Administration receiving a report setting out the proposals.

The Chairman summarized the future work assignments for the Engineering Committee as:

1. Virgin Water Supply computations for 1964;
2. Consumptive Use computations for 1964;
3. Continue method of computing inflow to Lovewell Reservoir from White Rock Creek;
4. Continue study of proration of evaporation losses.

It was agreed by the Administration that a new assignment to the Engineering Committee would be to adjust allocations as set forth in the Compact for all years since 1959 on an annual and five-year basis and when further records are available on a ten-year basis.

Mr. LeFever stated the Compact gaging station on Driftwood Creek should be moved downstream as it now gives a record that does not include all return flows and wastes from irrigation. He also stated money had been requested to rehabilitate eight Compact stations. He agreed to keep the Engineering Committee informed of any changes in location of the stations as such changes would affect the formulas for virgin water supply and consumptive use.

Mr. Jones and Mr. Sarha thanked the representatives of the Federal agencies for their attendance and cooperation with the Administration and the Engineering Committee. They also agreed that copies of the detailed work sheets of the Engineering Committee would be distributed to those Federal representatives working with the Administration.

Mr. Sarha was re-elected Chairman of the Administration to serve until the next meeting.

Adjournment:

The Fifth Annual Meeting of the Administration adjourned at 3:00 p.m.


R. V. Sarha, Chairman

Progress Report of the Engineering Committee
Republican River Compact Administration
April 27, 1964

The Republican River Compact Administration at its annual meeting held May 3, 1963, assigned the subject committee the following tasks:

- (1) Virgin flow computations for 1963;
- (2) Establish formulas and make computations of consumptive use for 1961, 1962 and 1963;
- (3) In cooperation with representatives of the Bureau of Reclamation and Corps of Engineers arrive at a method of computing inflow to Lovewell Reservoir from White Rock Creek;
- (4) Establish a method of proration of evaporation losses from Harlan County Reservoir between Nebraska and Kansas and proration of evaporation losses from Lovewell Reservoir between White Rock Creek and Republican River waters.

Submitted herewith in accordance with the above assigned tasks are the following:

- (1) Tabulation of the computed annual virgin water supply Republican River Basin for the water years 1959 through 1963, inclusive;
- (2) Tabulation of the formulas for computation of the annual consumptive use - Republican River Basin;
- (3) Computed annual consumptive use by states for the water years 1959 through 1963, inclusive.

The Engineering Committee met on three occasions during the past year. The committee held its eighth meeting on November 5-6, 1963, in Denver, Colorado, at which meeting formulas were developed for the computation of consumptive use of each of the states in the Republican River Basin. The committee held its ninth meeting January 16-17, 1964, with Mr. E. C. Balke of the Corps of Engineers and Mr. R. E. Aldrich and Mr. B. C. Filkin of the U. S. Bureau of Reclamation in attendance, for the primary purpose of discussing the evaporation data for Lovewell Reservoir. As a result of the discussions concerning this subject Mr. Balke agreed to submit a memorandum concerning the method of computation preferred by the Corps of Engineers and such memorandum was transmitted to the department dated

February 7, 1964, and received February 17, 1964. Mr. Balke's memorandum provides a formula for the computation of the inflow to Lovewell Reservoir, which computation is basic in determining the respective quantities of White Rock Creek water and Republican River water in Lovewell Reservoir. The Bureau of Reclamation also summarized its views in a memorandum dated January 29, 1964.

The Engineering Committee met in its tenth meeting March 24-25, 1964, and after review of the Corps and Bureau memorandums, the Engineering Committee agreed on a formula for the computation of inflow to Lovewell Reservoir. The discussions concerning whether to accept the measured inflows to Lovewell Reservoir from White Rock Creek or to compute the inflow cannot be described in detail in this report, but the decision to compute the inflow from White Rock Creek rather than accept the measured inflow data is appropriately summarized by the conclusion in paragraph 5 of Mr. Balke's statement where he states, "fundamentally then because of the many imponderables along with our sometimes seeming inept methods, we must arrive at a reasonable total. We must also always recognize that the cost of getting the final answer each month and year should not get out of hand in comparison with the benefits."

In short, it would be too expensive to obtain sufficient data to correct the measured inflows at the Burr Oak Gaging Station on White Rock Creek to determine actual reservoir inflows.

The committee agreed further at its tenth meeting that the evaporation losses from Lovewell Reservoir should be prorated between the Republican River water and the White Rock Creek water stored in Lovewell Reservoir, and that it will be necessary to continue a running account by months of the storage of two kinds of water in the reservoir to prorate the evaporation loss. The committee agreed to accept the evaporation loss by months as furnished by the Corps of Engineers.

The Compact Commissioners met with the Bureau of Reclamation in the fall of 1949 at Indianola, Nebraska, and at that time agreed that the consumptive use by evaporation from Harlan County should be divided on the basis of the benefits received. The Engineering Committee, together with the Corps and Bureau representatives, at their ninth meeting considered whether it should be necessary to keep a running account of the Harlan County Reservoir storage in the same manner as for the Lovewell Reservoir, thereby keeping a record of the water stored for Kansas and Nebraska in the reservoir in order to arrive at a proper allocation of the net evaporation between the two states. All parties agreed that it would not be desirable to keep a running account of the division of storage in Harlan County Reservoir between the two states because the inflow to Harlan County Reservoir was primarily all Republican River water, and that the conditions were not similar to those at the Lovewell Reservoir where the White Rock Creek water was a significantly large portion of the total water used from Lovewell Reservoir. It was, therefore, agreed that it would be more appropriate to prorate the evaporation loss in Harlan County Reservoir on some other basis. Kansas presented a study of the Lovewell Reservoir operations

since water was first stored in Lovewell Reservoir. The computed inflow from White Rock Creek was used in this study. This study showed that White Rock Creek water was a major portion of the water storable in Lovewell Reservoir and that at the end of the 1962 irrigation season only White Rock Creek water remained in the reservoir. There was a carry-over of 7,835 acre-feet of Republican River water in Lovewell Reservoir at the end of the 1963 irrigation season.

The Committee agreed, after considerable study, that the best interpretation of the benefits of Harlan County Reservoir to Nebraska and Kansas would be obtained for the past years up to the present time by prorating the net evaporation in Harlan County Reservoir on the ratio of the annual diversions by the Nebraska-Bostwick Irrigation District below Harlan County Reservoir, and the state line flows of the Courtland Canal, plus the diversions by the individual irrigators in Kansas above the Hardy Gaging Station. Since stored water in Harlan County Reservoir is carried over from year to year, it may be desirable in the future to divide the net evaporation on the basis of the acreage in each state for which irrigation service is available. The percent of the net evaporation from Harlan County Reservoir charged to Nebraska and Kansas, based on the diversions as stated above, is as follows for the years 1959 through 1963.

PER CENT OF HARLAN COUNTY NET EVAPORATION

	1959	1960	1961	1962	1963
Kansas	36	41	49	41	57
Nebraska	64	59	51	59	43

The Committee considered that the Compact Administration should make the decision as to the meaning of the words "benefits received" from Harlan County and that the Administration should adopt one of the two formulas for the proration of Harlan County losses. It is the opinion of the Committee that the matter is not critical for past usage of Harlan County Reservoir, and that the method could be changed in the future if the Administration considered the conditions warranted such change.

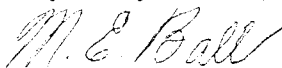
The procedure adopted by the Engineering Committee for the determination of the use of water by small stream pumps and by the ground-water wells was very much the same as adopted in 1962. Kansas based its use on the results of the reported data under Kansas law for the various streams and wells. The average of all diversion rates in the Republican River Basin in Kansas gave 1.9 acre-feet per acre for diversions from ground water alluvium and 0.7 acre-feet per acre from surface water.

Nebraska continued its procedure of obtaining pumping data from wells whose owners reported on a voluntary basis, which procedure was established in 1962. The voluntary response in Nebraska for 780 well users was 24% in the Republican River Valley, indicating a pumping rate of 1.70 acre-feet per acre for 1963, and this rate was applied to all acres irrigated

from wells in Nebraska. Nebraska obtained actual records of diversions from surface water by small pumps on Frenchman, Medicine and Red Willow Creeks. The actual diversion records were used for these streams. No diversion records were obtained for the pumps diverting from the main stem of the Republican River and other small tributaries, and a figure of one acre-foot per acre diversion was adopted for these pumps.

Colorado had records of all surface water diversions for 1963, but no information was available on ground water diversions. The ground water diversions in Colorado were assumed to be table land diversions and were considered to have no effect on the flow of the streams. Ground-water diversions from the alluvium along the streams in Colorado are minor in that state and were considered to be zero in the 1963 computations of virgin water supply.

Respectfully submitted,

A handwritten signature in cursive script, reading "M. E. Ball".

M. E. Ball, Chairman
Engineering Committee

1959 - 1963
 Computed Annual Virgin Water Supply
 Republican River Basin

Drainage Basin	Compact Ac. Ft.	1959 W.Y.# Ac. Ft.	1960 W.Y.# Ac. Ft.	1961 W.Y.# Ac. Ft.	1962 W.Y.# Ac. Ft.	1963 W.Y. Ac. Ft.
Prairie Dog Creek	27,600	15,040	41,860	30,740	35,250	28,580
Sappa Creek	21,400	18,700	51,970	31,040	37,740	37,290
Beaver Creek	16,500	16,640	50,970	21,840	42,710	31,120
Medicine Creek	50,800	45,520	80,440	42,620	102,810	64,600
Red Willow Creek	21,900	27,230	47,610	27,230	38,180	19,110
Driftwood Creek	7,300	2,610	16,500	560	11,090	2,090
Frenchman Creek	98,500	116,550	151,450	103,770	143,870	130,680
South Fork of the Republican River	57,200	43,330	44,650	36,470	51,550	40,220
Rock Creek	11,000	10,970	10,540	10,090	10,890	9,750
Buffalo Creek	7,890	6,060	6,540	5,920	6,980	5,030
Arikaree River	19,610	10,800	24,480	10,120	28,930	11,170
North Fork of the Republican River	44,700	61,480	57,250	58,970	53,390	47,380
Main Stem of the Republican plus Blackwood Creek	*94,500	135,740	317,530	171,380	261,080	157,240
Totals	478,900	510,670	901,790	550,750	824,470	584,260
 *Main Stem Blackwood Creek	 87,700 6,800					

#Revised November 6, 1963

R E P O R T
to the
REPUBLICAN RIVER COMPACT ADMINISTRATION

FORMULAS FOR THE COMPUTATION
OF
ANNUAL CONSUMPTIVE USE
REPUBLICAN RIVER BASIN

Engineering Committee

April 27, 1964

FORMULAS FOR THE COMPUTATION
OF
ANNUAL CONSUMPTIVE USE
REPUBLICAN RIVER BASIN

Prairie Dog Creek Drainage Basin

Annual Consumptive Use in Kansas equals
the irrigation diversions in Kansas;
minus, the return flows from those diversions;
plus, the net evaporation from Norton Reservoir.

Sappa Creek Drainage Basin

Annual Consumptive Use in Kansas equals
the irrigation diversions in Kansas;
minus, the return flows from those diversions.
Annual Consumptive Use in Nebraska equals
the irrigation diversions in Nebraska;
minus, the return flows from those diversions.

Beaver Creek Drainage Basin

Annual Consumptive Use in Colorado equals
the irrigation diversions in Colorado;
minus, the return flows from those diversions.
Annual Consumptive Use in Kansas equals
the irrigation diversions in Kansas
minus, the return flows from those diversions.

Beaver Creek Drainage Basin (Concluded)

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows from those diversions.

Medicine Creek Drainage Basin

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows from those diversions including the
return flows to the main stem of the Republican River;

plus, the net evaporation from Harry Strunk Lake.

Red Willow Creek Drainage Basin

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows to Red Willow Creek from those
diversions;

minus, the return flows to the main stem of the Republican
River from the Red Willow Canal;

plus, the net evaporation from Hugh Butler Lake.

Driftwood Creek Drainage Basin

Annual Consumptive Use in Kansas equals

the irrigation diversions in Kansas;

minus, the return flows from those diversions.

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows from those diversions.

Frenchman Creek Drainage Basin in Nebraska

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows to Frenchman Creek from those diversions;

minus, the return flows to the main stem of the Republican River from the Culbertson Canal;

plus, the net evaporation from Enders Reservoir.

South Fork of the Republican River Drainage Basin

Annual Consumptive Use in Colorado equals

the irrigation diversions in Colorado;

minus, the return flows from those diversions;

plus, the net evaporation from Bonny Reservoir.

Annual Consumptive Use in Kansas equals

the irrigation diversions in Kansas;

minus, the return flows from those diversions.

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows from those diversions.

Rock Creek Drainage Basin

Annual Consumptive Use in Nebraska equals

the irrigation diversions in Nebraska;

minus, the return flows from those diversions.

Buffalo Creek Drainage Basin

Annual Consumptive Use in Nebraska equals
the irrigation diversions in Nebraska;
minus, the return flows from those diversions.

Arikaree River Drainage Basin

Annual Consumptive Use in Colorado equals
the irrigation diversions in Colorado;
minus, the return flows from those diversions.

Annual Consumptive Use in Kansas equals
the irrigation diversions in Kansas;
minus, the return flows from those diversions.

Annual Consumptive Use in Nebraska equals
the irrigation diversions in Nebraska;
minus, the return flows from those diversions.

North Fork of the Republican River Drainage Basin

in Colorado

Annual Consumptive Use in Colorado equals
the irrigation diversions in Colorado;
minus, the return flows from those diversions.

Annual Consumptive Use in Nebraska equals
the irrigation diversions in Nebraska from the Haigler Canal;
minus, the return flows to the main stem of the Republican
River from the Haigler Canal in Nebraska.

The North Fork of the Republican River in Nebraska and the main stem of the Republican River between the junction of the North Fork and the Arikaree River and the lowest crossing of the river at the Nebraska-Kansas state line and the small tributaries thereof.

Annual Consumptive Use in Nebraska equals

the irrigation diversions by irrigation districts in Nebraska;
plus, the irrigation diversions from surface water by others in Nebraska;
plus, the irrigation diversions from ground water in Nebraska;
minus, the return flows from the diversions by the irrigation districts in Nebraska excluding the return flows to the main stem of the Republican River from the Haigler, Culbertson and Red Willow Canals;
minus, the return flows from the irrigation diversions from surface water by others in Nebraska excluding the return flows to the main stem of the Republican River from tributary diversions;
minus, the return flows from the irrigation diversions from ground water in Nebraska;
plus, the net evaporation from Swanson Lake;
plus, that part of the net evaporation from Harlan County Reservoir charged to Nebraska.

Annual Consumptive Use in Kansas equals

the recorded discharge of the Courtland Canal at the Nebraska-Kansas state line;
minus, the deliveries of Republican River water to Lovewell Reservoir by the Courtland Canal;
minus, the return flows to the Republican River from the Courtland Canal above Lovewell Reservoir;

The North Fork of the Republican River in Nebraska
and the main stem of the Republican River
(concluded)

- plus, the diversions of Republican River water from Lovewell Reservoir by the Courtland Canal;
- minus, the return flows from Republican River water diverted by the Courtland Canal below Lovewell Reservoir;
- plus, that part of the net evaporation from Harlan County Reservoir charged to Kansas;
- plus, the prorated share of the net evaporation from Lovewell Reservoir chargeable to Republican River water;
- plus, the other irrigation diversions of surface water in Kansas above the gaging station near Hardy;
- minus, the return flows from those diversions of surface water in Kansas above the gaging station near Hardy;
- plus, the irrigation diversions from ground water in Kansas above the gaging station near Hardy;
- minus, the return flows from those ground water diversions in Kansas above the gaging station near Hardy.

Computed Annual Consumptive Use
Republican River Basin

Drainage Basin	1959 Water Year			Total
	Colorado	Kansas	Nebraska	
Prairie Dog Creek	-	6,920	0	6,920
Sappa Creek	-	2,300	9,280	11,580
Beaver Creek	-	4,210	4,930	9,140
Medicine Creek	-	-	7,340	7,340
Red Willow Creek	-	-	2,790	2,790
Driftwood Creek	-	0	180	180
Frenchman Creek	-	-	30,500	30,500
South Fork of the Republican River	9,910	3,500	100	13,510
Rock Creek	-	-	180	180
Buffalo Creek	-	-	610	610
Arikaree River	0	0	0	0
North Fork of the Republican River	11,750	-	8,730	20,480
Main Stem of the Republican River	-	46,290	152,070	198,360
TOTALS	21,660	63,220	216,710	301,590

Computed Annual Consumptive Use
Republican River Basin

1960 Water Year				
Drainage Basin	Colorado	Kansas	Nebraska	Total
Prairie Dog Creek	-	7,050	0	7,050
Sappa Creek	-	2,720	7,540	10,260
Beaver Creek	-	4,540	4,660	9,200
Medicine Creek	-	-	6,250	6,250
Red Willow Creek	-	-	2,510	2,510
Driftwood Creek	-	0	600	600
Frenchman Creek	-	-	28,720	28,720
South Fork of the Republican River	8,730	3,050	0	11,780
Rock Creek	-	-	170	170
Buffalo Creek	-	-	800	800
Arikaree River	130	0	0	130
North Fork of the Republican River	6,240	-	7,800	14,040
Main Stem of the Republican River	-	32,730	145,760	178,490
TOTALS	15,100	50,090	204,810	270,000

Computed Annual Consumptive Use
Republican River Basin

1961 Water Year				
Drainage Basin	Colorado	Kansas	Nebraska	Total
Prairie Dog Creek	-	4,960	0	4,960
Sappa Creek	-	2,140	8,860	11,000
Beaver Creek	-	3,030	4,390	7,420
Medicine Creek	-	-	6,110	6,110
Red Willow Creek	-	-	2,790	2,790
Driftwood Creek	-	0	390	390
Frenchman Creek	-	-	37,150	37,150
South Fork of the Republican River	8,120	1,770	0	9,890
Rock Creek	-	-	170	170
Buffalo Creek	-	-	890	890
Arikaree River	0	0	0	0
North Fork of the Republican River	5,960	-	8,780	14,740
Main Stem of the Republican River	-	38,330	135,680	174,010
TOTALS	14,080	50,230	205,210	269,520

Computed Annual Consumptive Use
Republican River Basin

Drainage Basin	1962 Water Year			Total
	Colorado	Kansas	Nebraska	
Prairie Dog Creek	-	4,470	0	4,470
Sappa Creek	-	2,830	2,970	5,800
Beaver Creek	-	3,100	2,410	5,510
Medicine Creek	-	-	3,430	3,430
Red Willow Creek	-	-	2,180	2,180
Driftwood Creek	-	0	170	170
Frenchman Creek	-	-	29,800	29,800
South Fork of the Republican River	9,270	2,510	0	11,780
Rock Creek	-	-	170	170
Buffalo Creek	-	-	700	700
Arikaree River	90	0	0	90
North Fork of the Republican River	3,500	-	2,390	5,890
Main Stem of the Republican River	-	20,710	91,490	112,200
TOTALS	12,860	33,620	135,710	182,190

Computed Annual Consumptive Use
Republican River Basin

Drainage Basin	1963 Water Year			Total
	Colorado	Kansas	Nebraska	
Prairie Dog Creek	-	7,050	0	7,050
Sappa Creek	-	2,570	9,540	12,110
Beaver Creek	-	5,160	8,320	13,480
Medicine Creek	-	-	8,310	8,310
Red Willow Creek	-	-	7,960	7,960
Driftwood Creek	-	0	630	630
Frenchman Creek	-	-	52,170	52,170
South Fork of the Republican River	11,190	2,520	230	13,940
Rock Creek	-	-	160	160
Buffalo Creek	-	-	460	460
Arikaree River	0	0	0	0
North Fork of the Republican River	6,770	-	4,030	10,800
Main Stem of the Republican River	-	56,790	161,140	217,930
TOTALS	17,960	74,090	252,950	345,000