



SEVENTEENTH ANNUAL REPORT

REPUBLICAN RIVER

COMPACT

ADMINISTRATION

FOR THE YEAR 1976

LINCOLN, NEBRASKA

JUNE 30, 1977

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TABLE OF CONTENTS

Seventeenth Annual Report	3
Minutes of Eighteenth Annual Meeting	4
Report of Engineering Committee	7

Seventeenth Annual Report
REPUBLICAN RIVER COMPACT ADMINISTRATION

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

1. Pursuant to Rule 12, as amended, this report covers the period from July 20, 1976, to June 30, 1977.
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, and are as follows:
 - M. E. Ball, Director, Department of Water Resources, Nebraska
 - C. J. Kuiper, State Engineer of Colorado
 - Guy E. Gibson, Chief Engineer, Division of Water Resources
State Board of Agriculture, Kansas
3. The Eighteenth Annual Meeting of the Administration was held on June 30, 1977, in the offices of the Department of Water Resources, Lincoln, Nebraska. Minutes of the meeting are included in this report.
4. During the period covered by this report, one meeting of the Engineering Committee was held. A report from that Committee together with summary tabulations of the computed annual virgin water supply and the consumptive use for the 1976 water year in the Republican River Basin were presented to and accepted subject to the changes requested by the Administration.
5. On June 30, 1977, M. E. Ball, Nebraska Member of the Administration, was elected Chairman to serve until the next annual meeting of the Administration.

Minutes of the
Eighteenth Annual Meeting
Republican River Compact Administration
Lincoln, Nebraska - June 30, 1977

The meeting was called to order by M. E. Ball, Chairman, at 8:30 A.M. in the Conference Room of the Nebraska Department of Water Resources, 301 Centennial Mall South, Lincoln, Nebraska. The following were in attendance:

<u>Name</u>	<u>Agency</u>	<u>Location</u>
M. E. Ball	Official Member	Lincoln, Nebraska
Guy E. Gibson	Official Member	Topeka, Kansas
C. J. Kuiper	Official Member	Denver, Colorado
Jeris A. Danielson	Division of Water Resources	Denver, Colorado
Fred Zabel	Dept. of Water Resources	Cambridge, Nebraska
Gerald E. Hilmes	Division of Water Resources	Topeka, Kansas
Gayle Lewis	Natural Resources Commission	Lincoln, Nebraska
Bob Prouty	Bureau of Reclamation	McCook, Nebraska
Jerry Wallin	Natural Resources Commission	Lincoln, Nebraska
Bob Kutz	Bureau of Reclamation	McCook, Nebraska
Fred T. Krauss	Reclamation, LM Region	Denver, Colorado
Roger A. Weidelman	Reclamation, LM Region	Denver, Colorado
Eric Lappala	U. S. Geological Survey	Lincoln, Nebraska
Don Thompson	Republican River Cons. Ass'n.	McCook, Nebraska
Michael Jess	Dept. of Water Resources	Lincoln, Nebraska

Approval of the Minutes of the Seventeenth Annual Meeting:

Mr. Kuiper moved that the minutes be accepted as presented in the Sixteenth Annual Report. Mr. Gibson seconded and the Chairman declared the motion passed.

Report of Chairman:

Mr. Ball read a letter from Joe D. Hall, Regional Director of the Bureau of Reclamation, stating that members of his staff would be present to discuss the Republican River Water Management Study.

Mr. Ball reported that Harry Strunk Lake was the only reservoir full.

Report of Official Members:

Mr. Gibson reported that he called a meeting in the Bostwick area regarding Kansas. Both Mr. Gibson and Mr. Ball indicated they felt further study should be carried on in this area.

Michael Jess of the Nebraska Department of Water Resources discussed the Nebraska Ground Water Management Act. Mr. Jess reported on the groundwater control area hearing held in the Upper Republican area under the terms of this act and explained what could be done if a groundwater control area were declared. He stated that at the present rate of depletion there would be times by 1980 when the flow would be zero.

Mr. Gibson reported on recent legislation in Kansas, Senate Bill No. 4. He stated that as of January 1, 1978, except for the appropriation of water for domestic use, the production and return of salt water in operation of oil and gas wells and diversion of surface water impounded in any reservoir not exceeding 15 acre-feet per year, it is unlawful for any person to appropriate or threaten to appropriate water without first obtaining a permit. He further explained major provisions of the bill. Mr. Gibson stated there were now five groundwater management districts in Kansas, the boundaries of which are worked out locally but approved by the Chief Engineer, Division of Water Resources. He stated that a moratorium has been declared on the approval of applications for permits to appropriate water in an area adjacent to the Arkansas River in Kearny and Hamilton Counties, southwest Kansas. The moratorium will continue until a study of the relationship of groundwater withdrawals to flows of the Arkansas River can be made. Mr. Gibson stated that approximately 1,000,000 acres have been brought under irrigation during the past three years. He stated that there have been only five years since 1945 when more applications to appropriate water were received than during the first three months in 1977.

Mr. Kuiper reported that there have been no major changes in Colorado water laws. Mr. Kuiper explained the Colorado three-mile basis for determination of number of wells to be permitted. He stated that Colorado could permit the number of wells within a three mile circle so that it will not deplete the aquifer more than 40% in twenty-five years, the period of time required by lending organizations.

Report of Engineering Committee:

Gerald Hilmes presented the report of the Engineering Committee.

Mr. Gibson suggested that Exhibit A should be shown basically as on page 3 of the report so that the table would show both surface and groundwater.

Motion by Mr. Kuiper that the Engineering Committee include groundwater diversions for Nebraska in the various tributaries in the same manner as it was done for Colorado and Kansas. Seconded by Mr. Gibson and passed by the Chairman with his vote in the affirmative.

It was moved by Mr. Kuiper that the Engineering Report be accepted with the amendments to Exhibit A and the addition of the sub-basin groundwater diversions in Nebraska but that the publication be delayed until the Bureau of Reclamation has had a chance to check the diversion records above Lovewell Reservoir. Seconded by Mr. Gibson and passed by the Chairman with his vote in the affirmative.

Assignments:

The assignments of the Engineering Committee will remain the same as last year. It was moved by Mr. Gibson that members of the Compact review the last paragraph on page 8 and make their recommendations to the Chairman six weeks in advance of the next annual meeting. Seconded by Mr. Kuiper with the comment that it is the same motion made last year. Passed by the Chairman with his vote in the affirmative.

Election of Officers:

It was moved by Mr. Gibson that Mr. Ball be the Chairman of the Compact for the coming year. Seconded Mr. Kuiper and passed by the Chairman with his vote in the affirmative.

Mr. Kuiper moved that the Engineering Committee remain the same. Seconded by Mr. Gibson and passed by the Chairman with his vote in the affirmative.

Mr. Gibson moved to recess until after the Bureau of Reclamation presentation. Mr. Fred Krauss, head of the Bureau Planning Team in Colorado, made the presentation of "Water Management Study for the Republican Basin." This presentation was followed by questions and discussion of the proposed study.

Motion by Mr. Kuiper that the Republican Compact Administration annual meeting be adjourned at 12:30 P.M. Seconded by Mr. Gibson and passed by the Chairman with his vote in the affirmative.

Respectfully submitted,

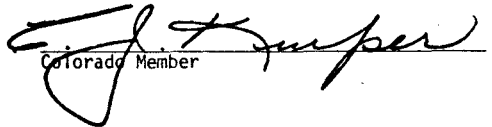
by:



Nebraska Member (Chairman)



Kansas Member



Colorado Member

Report of Engineering Committee

Republican River Compact Administration

June 30, 1977

The Republican River Compact Administration at its 17th annual meeting held July 20, 1976, agreed the assignments to the Engineering Committee would be as follows:

1. Compute annual virgin water supply, 1976 water year;
2. Compute annual consumptive use, 1976 water year;
3. Compute adjusted allocations on annual five-year average and ten-year average basis;
4. Any other special assignment that might be assigned to the Committee by the Compact Administration during the coming year.

The Engineering Committee held one regular meeting during the year, June 7-8, 1977, to study the virgin water supply and consumptive use of the water supply for 1976. Submitted here and made a part of this report are the following:

1. (Exhibit A) Computed annual virgin water supply Republican River Basin, 1976 water year;
2. (Exhibit B) Computed annual consumptive use Republican River Basin, 1976 water year;
3. Computed inflow to Lovewell Reservoir and net evaporation of Republican River water stored in Lovewell, 1976 water year;
4. Computed adjusted allocations on annual five-year average and ten-year average basis.

It is the recommendation of the Engineering Committee that the computed annual virgin water supply and computed annual consumptive use for the 1976 water year be published in the 17th annual report of the Republican River Compact Administration.

The detailed computations of the virgin water supply and consumptive use, the adjusted allocations on an annual basis for 1976, and a five-year and ten-year average basis are available for inspection by members of the Compact Administration.

The following exhibits are available to the members of the Compact Administration with the recommendation that they not be published in detail in the Seventeenth Annual Report

- 10A. Computed Annual Virgin Water Supply for the 1976 water year;
- 10B. Adjusted allocations computed on the Basis of Annual Virgin Water Supply, for 1976 water year;
- 10C. Average Annual Virgin Water Supply for Five-year Running Averages for 1972-1976 and Ten-year Running Averages for 1967-1976;
- 10D. Adjusted Allocations by Five-year and Ten-year Running Averages for same years as 10C.
- 10E. Computed Annual Consumptive Use by States for 1976 water year.

The above computations made by the Engineering Committee followed the procedures of previous years.

Municipal and industrial uses are not included in the virgin water supply computations; but, for the record, those available to the Committee are as follows:

		<u>1976 Calendar Year</u>	1977
	City of Norton	832 Ac. Ft.	
(Amoco)	Midwest Oil Co.	329 Ac. Ft.	306
(Ladd)	L.V.O. Oil Co.	63 Ac. Ft.	15

Recorded diversions from the North Fork Republican River by the Haigler Canal for 1976 were:

Colorado	3,740 Ac. Ft.
Nebraska	8,560 Ac. Ft.
Total	<u>12,300 Ac. Ft.</u>

Other recorded diversions from surface water in Colorado with the exception of the Hale Ditch were:

S. Fk. Republican River	3,110 Ac. Ft.
N. Fk. Republican River	4,810 Ac. Ft.
Arikaree River	0 Ac. Ft.
Beaver Creek	0 Ac. Ft.

Colorado diversions from groundwater were based on an average diversion of 169 acre-feet per well producing from valley alluvium and are shown below in acre-feet:

S. Fk. Republican River	1,860
N. Fk. Republican River	510
Arikaree River	4,900
Beaver Creek	0

Nebraska recorded diversions from surface water by other than major canals are given below in acre-feet.

Frenchman Creek	900	Buffalo Creek	1,340
Medicine Creek	1,400	Beaver Creek	350
Red Willow Creek	690	Sappa Creek	2,220
Republican River	23,270		

In other basins in Nebraska, surface water diversions were computed as 1.9 acre-feet per acre intended to be irrigated. Groundwater diversion rate used for 1976 in Nebraska was 2.0 acre-feet per acre irrigated as determined from reports of irrigators for 10% sample of wells pumping from the valley alluvium.

Estimated groundwater diversions by individuals in Nebraska for 1976 by sub-basin are as follows:

Frenchman Creek	58,890	Buffalo Creek	360
Medicine Creek	14,840	Beaver Creek	24,420
Redwillow Creek	5,040	Sappa Creek	15,220
S. Fk. Republican River	1,260	Driftwood Creek	1,190

Diversions by individual irrigators from alluvial wells and streams in Kansas were estimated on the basis of water use reports from 47% of the water users. Average of all reported diversions in the Republican River Basin in Kansas was 2.0 Ac. Ft./Ac. Average rate of diversion from groundwater was 2.0 Ac.Ft./Ac. and from surface water was 1.9 Ac. Ft./Ac.

Estimated diversions by individuals in Kansas for 1976 are given below in acre-feet:

<u>Sub-basin</u>	<u>Groundwater</u>	<u>Surface Water</u>
Arikaree River	400	0
S. Fk. Republican River	9,500	170
Beaver Creek	12,080	1,440
Sappa Creek	12,660	220
Prairie Dog Creek	16,750	1,250
Republican River above Hardy	360	1,720

Return flow percentages were computed for the major canals from data provided by the U. S. Bureau of Reclamation as follows:

<u>Canal</u>	<u>Return as Per Cent of Total Diversions</u>	<u>Canal</u>	<u>Return as Per Cent of Total Diversions</u>
Culbertson	42%	Franklin	49%
Culbertson Ext.	50%	Franklin Pump	41%
Meeker-Driftwood	38%	Naponee	43%
Red Willow	39%	Superior	44%
Cambridge	38%	Courtland-Nebr.	24%
Bartley	34%	Courtland-Kansas	
Almena	42%	above Lovewell	39%
		below Lovewell	40%

Return flow percentages for other canals and diversions were estimated as given below

Hale Ditch and Haigler Canal	38%
Champion and Riverside Canals	42%
Groundwater and surface water diversions	25%

Computation of return flow from the Courtland Canal in Nebraska is shown below:

<u>Item</u>	<u>Acre-Feet</u>
Courtland Canal-Headgate	112,160
Courtland Canal-Stateline	-100,030
Total loss in Nebraska	<u>12,130</u>
Direct Supply to Nebraska Lands	-2,890
Courtland Canal Transportation Loss in Nebraska	<u>9,240</u>
Return Flow Percentage	x 75%
Transportation Loss Returned to River	6,930
Direct Supply Returned to River (2,890 x 25%)	+ 720
Total Return Flow in Nebraska	<u>6,210</u>

In Kansas 63% of the irrigable land above Lovewell was irrigated in 1976 with an average diversion rate (based on net supply) of 4.25 acre-feet per acre. From this data it was estimated that 3,040 acre-feet were diverted on 720 acres above Hardy and the return flows were 1,190 acre-feet. On the basis of "Farm Delivery" there was an average application of 2.63 acre-feet per acre.

Division of return flows between tributaries and main stem Republican are given below in acre-feet:

<u>Canal</u>	<u>Diversions</u>	<u>Return Flows</u>		<u>Division of Return Flows</u>	
		<u>%</u>	<u>Ac.Ft.</u>	<u>Frenchman</u>	<u>Main Stem</u>
Champion	3,040	42	1,280	1,280 (100%)	
Riverside	1,830	42	770	770 (100%)	
Culbertson	17,440	42	7,320	6,080 (83%)	1,240 (17%)
Culbertson Ext.	23,680	50	11,840		11,840 (100%)
Totals	45,990		21,210	8,130	13,080
Meeker-Driftwood	42,180	37	15,610	Driftwood 3,750 (24%)	Main Stem 11,860 (76%)
Red Willow	12,040	39	4,700	Red Willow 470 (10%)	Main Stem 4,230 (90%)

The 1976 annual virgin water supply was computed using the above together with streamflow, diversion and reservoir records.

Net evaporation from Harlan County Reservoir was divided (60%) 15,850 acre-feet to Kansas and (40%) 10,560 acre-feet to Nebraska based on total diversions by the canals in each state below Harlan County Reservoir.

Division of consumptive use of the Courtland Canal transportation loss thru Nebraska is given below:

<u>Courtland Canal</u>	<u>Acre-feet</u>
Transportation Loss	9,240
Return flow to river of transportation loss	-6,930
Consumptive use-Transportation Loss	2,310
Kansas Share = $\frac{\text{Stateline Flow}}{\text{Headgate Diversions}} = \frac{100,030}{112,160} = 89\%$	

Kansas Share of Loss C.U. = $2,310 \times 89\% = 2,060$ Ac.Ft.
 Nebraska Share of Loss C.U. = $2,310 - 2,060 = 250$ Ac.Ft.

Consumptive use in Nebraska by the Courtland Canal was computed from the return flow computation rather than using the virgin water supply data, as follows:

<u>Courtland Canal in Nebraska</u>	<u>Acre-feet</u>
Net supply	2,890
Return flow (2,890 x 25%)	- 720
Consumptive use-irrigated lands in Nebraska	2,170
Consumptive use-transportation loss	+ 250
Total consumptive use in Nebraska	2,420

Computations of inflow to Lovewell Reservoir show a 1976 total inflow of 70,320 Ac.Ft. of which 50,090 Ac.Ft. was diverted from the Republican River. Computed operations of Lovewell Reservoir for 1976 gave a net evaporation loss of 2,540 Ac.Ft. from Republican River Water. Storage in Lovewell Reservoir at the beginning of the water year was 36,560 Ac.Ft. of which 4,610 Ac.Ft. was water from the Republican River. At the close of the water year, storage in Lovewell was 27,160 Ac.Ft. of which 4,140 Ac.Ft. was water from the Republican River.

Computation of consumptive use in Kansas of water diverted from the main stem Republican River, including prorated shares of net evaporation from Harlan County Reservoir and Courtland Canal transportation loss thru Nebraska was 81,200 acre-feet in the 1976 water year.

Consumptive use to mouths of tributaries in Nebraska were computed. The results are shown below:

Consumptive Use in Nebraska - 1976

	<u>By Formula</u> <u>Ac. Ft.</u>	<u>Above Mouth</u> <u>Ac. Ft.</u>
Prairie Dog Creek	0	1,350
Beaver Creek	18,580	23,200
Sappa Creek	13,080	12,870
Medicine Creek	15,040	16,030
S. Fk. Republican River	940	940
Buffalo Creek	1,270	1,270

The Committee discussed the matter of modifying Annual Virgin Water Supply and Consumptive Use Formulae to include municipal and industrial diversions from Ground and surface water. It was noted that this assignment was given the Engineering Committee at the 8th Annual Meeting which was held on June 19, 1967 (7th Annual Report). The Report of Engineering Committee dated June 3, 1967 (8th Annual Report) shows the Committee decided that since such diversions were relatively small they would not be included in the 1967 computations. No further action was taken on the assignment. The Engineering Committee at this 24th meeting unanimously agreed to refer said matter to the Administration for their consideration.

The meeting was adjourned at 12 o'clock noon on June 8, 1977.

Respectfully submitted,

Robert F. Bisby 6-23-77
Nebraska Date

Ernest R. Brown 6-29-77
Kansas Date

12 *Janis A. Claveline* 28 JUN 77
Colorado Date

Exhibit A

Computed Annual Virgin Water Supply
Republican River Basin

<u>Drainage Basin</u>	<u>Compact Ac. Ft.</u>	<u>Ground</u>	<u>1976 W.Y. Ac. Ft.</u>	
			<u>Surface</u>	<u>Total</u>
Prairie Dog Creek	27,600	12,560	4,220	16,780
Sappa Creek	21,400	20,920	4,090	25,010
Beaver Creek	16,500	27,380	2,020	29,400
Medicine Creek	50,800	11,130	37,460	48,590
Red Willow Creek	21,900	3,780	20,620	24,400
Driftwood Creek	7,300	890	2,760	3,650
Frenchman Creek	98,500	44,170	78,890	123,060
South Fork of the Republican River	57,200	9,460	16,690	26,150
Rock Creek	11,000	0	8,870	8,870
Buffalo Creek	7,890	270	4,740	5,010
Arikaree River	19,610	3,980	4,920	8,900
North Fork of the Republican River	44,700	380	39,320	39,700
Main Stem of the Republican plus Blackwood Creek	*94,500	11,530	81,210	191,740
TOTALS	478,900	245,450	305,810	551,260
*Main Stem Blackwood Creek	87,700 6,800			

Handwritten notes:
 4 error
 21,400
 11,530

Computed Annual Consumptive Use (Exhibit B)
 Republican River Basin

1976 Water Year

<u>Drainage Basin</u>	<u>Colorado</u>	<u>Kansas</u>	<u>Nebraska</u>	<u>Total</u>
Prairie Dog Creek	-	18,690	1,350	20,040
Sappa Creek	-	9,660	12,870	22,530
Beaver Creek	0	10,140	23,200	33,340
Medicine Creek	-	-	16,030	16,030
Red Willow	-	-	14,520	14,520
Driftwood	-	0	890	890
Frenchman Creek	-	-	72,200	72,200
South Fork of the Republican River	10,680	7,250	940	18,870
Rock Creek	-	-	0	0
Buffalo Creek	-	-	1,270	1,270
Arikaree River	3,680	300	0	3,980
North Fork of the Republican River	6,310	-	5,040	11,350
Main Stem of the Republican River	-	81,200	242,380	323,580
TOTALS	20,670	127,240	390,690	538,600