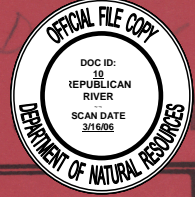


**OFFICIAL**



**TENTH ANNUAL REPORT**

**Republican River  
Compact  
Administration**

**For the Year 1969**

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**TOPEKA, KANSAS**

**May 26, 1970**

**TENTH ANNUAL REPORT**

**Republican River  
Compact  
Administration**

**For the Year 1969**

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**TOPEKA, KANSAS**

**May 26, 1970**

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Tenth Annual Report

REPUBLICAN RIVER COMPACT ADMINISTRATION

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

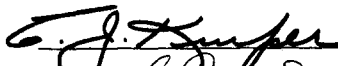
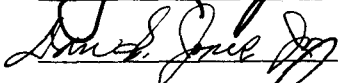

1. Pursuant to Rule 12, as amended, this report covers the period July 1, 1969, to May 26, 1970.
2. Members of the Republican River Compact Administration are the officials of each of the States who are charged with the duty of administering the public water supplies, as follows:
  - C. J. Kuiper, State Engineer of Colorado
  - Dan S. Jones, Jr., Director, Department of Water Resources, Nebraska
  - R. V. Smrha, Chief Engineer, Division of Water Resources, State Board of Agriculture, Kansas
3. The Eleventh Annual Meeting of the Administration was held on May 26, 1970, in the State Office Building, Topeka, Kansas. 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 consumptive use for the 1969 water year in the Republican River Basin were presented to and accepted by the Administration at the Eleventh Annual Meeting. Copies of these presentations are included elsewhere in this report.
5. Revised formulas for the computation of annual virgin water supply, Republican River Basin, and the Computation of annual consumptive use, Republican River Basin, were adopted at the Eleventh Annual Meeting by the Administration. These revised formulas are also included in this report.

6. Rules and Regulations constituting the Republican River Compact Administration, as amended to May 26, 1970, were adopted by the Administration at the Eleventh Annual Meeting. These amended Rules and Regulations are published as a part of this report.
7. On May 26, 1970, Mr. Dan S. Jones, Jr., Nebraska Member of the Administration, was elected Chairman to serve until the next annual meeting of the Administration.

Respectfully submitted,

REPUBLICAN RIVER COMPACT ADMINISTRATION

By:

 Colorado Member  
 Nebraska Member  
 Kansas Member  
(Chairman)

Minutes of the  
Eleventh Annual Meeting  
Republican River Compact Administration  
Topeka, Kansas - May 26, 1970

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

The following were in attendance:

<u>Name</u>	<u>Agency</u>	<u>Location</u>
Dan S. Jones, Jr.	Official Member	Lincoln, Nebraska
R. V. Smrha	Official Member	Topeka, Kansas
Glen E. Brees	Personal Representative of Colorado Member	Denver, Colorado
M. E. Ball	Nebraska Department of Water Resources	Lincoln, Nebraska
M. William Mattern	Colorado Division of Water Resources	Denver, Colorado
Robert D. Gower	Colorado Division of Water Resources	Denver, Colorado
A. A. Fischback, Jr.	U.S. Geological Survey	Denver, Colorado
C. W. Lane	U.S. Geological Survey	Lawrence, Kansas
D. E. Messinger	U.S. Bureau of Reclama- tion	McCook, Nebraska
William O. Brown	U.S. Bureau of Reclama- tion	McCook, Nebraska
W. E. Steps	Kansas Water Resources Board	Topeka, Kansas
H. L. Mackey	Kansas Division of Water Resources	Topeka, Kansas

Recognition of Personal Representative:

A letter from Mr. C. J. Kuiper, Official Member for Colorado, designating Mr. Glen E. Brees as his Personal Representative was presented to and accepted by the Administration. This letter is attached to these minutes on page 12.

Approval of the Minutes of Previous Meeting:

Mr. Jones noted that the minutes of the Tenth Annual Meeting, as published in the Ninth Annual Report, had been previously approved by correspondence and moved confirmation of this approval. The motion was seconded by Mr. Brees and passed unanimously.

Report of the Chairman:

Mr. Smrha stated the Ninth Annual Report had been printed and as Chairman he had sent copies to the President of the United States and to the following Federal agencies:

Regional Director  
U. S. Bureau of Reclamation  
Denver, Colorado

District Chief  
WRD, U. S. Geological Survey  
Lincoln, Nebraska

Project Manager  
Kansas River Projects  
U. S. Bureau of Reclamation  
McCook, Nebraska

River Basin Representative  
U. S. Department of Agriculture  
Lincoln, Nebraska

Regional Hydrologist  
WRD, U. S. Geological Survey  
Denver, Colorado

District Engineer  
U. S. Corps of Engineers  
Kansas City, Missouri

As Official Member from Kansas he had sent copies to the Governor of Kansas, State agencies and interested individuals.

Mr. Jones moved to include the Division Engineer, U. S. Corps of Engineers, Omaha, Nebraska, and District Chiefs, WRD, U. S. Geological Survey in Denver, Colorado, and Lawrence, Kansas, on the Chairman's mailing list. Motion was seconded by Mr. Brees and passed unanimously.

Reports of Official Members or Personal Representatives:

Mr. Jones reported copies of the Ninth Annual Report had been sent to the Governor of Nebraska and Nebraska State agencies. Mr. Brees reported the Ninth Annual Report had been sent to the Governor of Colorado and Colorado State agencies.

Unfinished Business:

Mr. Ball presented for Mr. K. A. MacKichan, District Chief, WRD, U. S. Geological Survey, Lincoln, Nebraska, a report on the continuing series of seepage runs along a 42.5 mile reach of the Republican River in Nebraska that extends from above the mouth of Frenchman Creek downstream to Cambridge.

The report by Mr. MacKichan stated there have been six series of measurements made from November 1967 to April 1970 during periods of nearly constant river flows and no surface runoff from precipitation or irrigation. All visible inflow to the reach was measured and subtracted from the flow of the Republican River at Cambridge to obtain seepage inflow. Since the seepage inflows were generally small in comparison with streamflow and were computed by the difference in inflow and outflow, measuring errors were accumulated and the errors in the seepage flows were large.

The results of the seepage runs, in c.f.s., are summarized below:

<u>Date of Run</u>	<u>Seepage Inflow</u>		<u>Estimated Error</u>
	<u>Gains</u>	<u>Losses</u>	
November 1967	2.88		±3.8
March 1968	2.59		±4.4
November 1968	7.79		±3.1
April 1969	41.51		±3.0
November 1969	40.35		±4.3
April 1970		1.33	±9.0

Seepage inflows were plotted against water levels measured in selected observation wells in the flood plain. These plottings showed considerable scatter of the data with no satisfactory correlation between seepage inflow and water levels in the alluvium. Mr. MacKichan concluded the seepage runs served little purpose and recommended they be discontinued.

Discussion of the report indicated the data from the seepage runs was not of sufficient value to justify their continuation and that the Engineering Committee had not been able to utilize the data in the computations of annual virgin water supply.

Mr. Jones moved the report be accepted by the Administration with an expression of appreciation to Mr. MacKichan and further moved the Administration concur in the recommendation that the seepage runs be discontinued. The motion was seconded by Mr. Brees and passed unanimously.

#### New Business:

Mr. Ball, Chairman, reported that the Engineering Committee held one meeting during the year on April 8-10, 1970, at Lincoln, Nebraska. At that meeting the Engineering Committee made computations of annual virgin water supply and annual consumptive use for water year 1969 in the Republican River Basin. The Committee also prepared drafts of revised formulas for the computation of annual virgin water supply and revised formulas for the computation for annual consumptive use. He stated these revised formulas were being presented for action by the Administration.

Mr. Mackey presented computations of the Engineering Committee for annual virgin water supply and annual consumptive use in the Basin in 1969 together with computations to show what the adjusted allocations to each State would be if adjusted on the basis of annual virgin water supply, 5-year average, annual virgin water supply or 10-year average annual virgin water supply.

Upon the motion of Mr. Jones, the Administration accepted the report of the Engineering Committee and agreed to the publication of the report and the summaries of the computations of annual virgin water supply and annual consumptive use for the 1969 water year.

The report of the Engineering Committee is given on page 13 and the summaries are included on pages 17 and 18.



Mr. Ball discussed a study he had made of the river reach used for the seepage runs. This was a continuation of a study initiated several years before by Mr. La Fever utilizing annual discharges from gaging stations rather than data from seepage runs. He pointed out that the stream was a losing stream prior to the beginning of operations by the irrigation districts but had changed to a gaining stream since that time and that the earlier study had covered the period of change with inconsistent results. On the basis of the present study it appeared there was an average gain of 45.5 percent for the 1960-69 period if estimated depletions by wells in the alluvium were included in the computations and about 31.9 percent for the same period if estimated well depletions were omitted.

Mr. Ball recommended that the assignments to the Engineering Committee include the continuation of these water-budget studies. He further recommended that the assignment to study the proration of net evaporation losses from all reservoirs in the basin be deferred to a later time. The other members of the Engineering Committee, Mr. Brees and Mr. Mackey, concurred in these recommendations.

The Administration gave the following assignments to the Engineering Committee for the coming year:

1. Compute annual virgin water supply, 1970 water year;
2. Compute annual consumptive use, 1970 water year;
3. Compute inflow to Lovewell Reservoir and net evaporation of Republican River water stored in Lovewell, 1970 water year;
4. Compute adjusted allocations on annual, five-year average and ten-year average basis;
5. Continue investigations of depletions by wells in the alluvium;
6. Make a water-budget study, in cooperation with the U. S. Geological Survey, of the Trenton-Palisades to Cambridge reach of the Republican River.

Mr. Mackey discussed the proposed changes in the Formulas for the Computation of Annual Virgin Water Supply, Republican River Basin and the Formulas for the Computation of Annual Consumptive Use, Republican River Basin. He pointed out that the proposed formulas gave the factors and procedures presently used in the annual computations. He stated the Engineering Committee recommended the adoption of the revised formulas with the understanding further revisions could be made in the future.

It was moved by Mr. Brees, seconded by Mr. Jones and passed unanimously that the Administration adopt the revised formulas and that they be published in the Tenth Annual Report. The revised formulas for the Computation of Annual Virgin Water Supply are given on page 19 of this report and for the Computation of Annual Consumptive use on page 33.

Mr. Mackey presented copies of the Rules and Regulations that showed the amendments previously adopted by the Administration. Mr. Smrha stated that the Rules and Regulations had been first adopted on July 15, 1959, and he thought it might be appropriate to publish them again. Mr. Smrha moved that the Rules and Regulations as amended to May 26, 1970, be adopted by the Administration and they be published in the Tenth Annual Report. The motion was seconded by Mr. Jones and passed unanimously. The amended Rules and Regulations are published on page 41 of this report.

Mr. Gower stated that the present law relating to the administration of water supplies in Colorado has been in effect since 1965 and while it has been accepted by most users of surface water there was more resistance to it from groundwater users. He said closed groundwater basins are under the control of the Colorado Groundwater Commission and that seven groundwater management districts had been organized. Groundwater not in closed basins come under the jurisdiction of the State Engineer and that no wells were being approved within 3 miles either side of the South Fork Republican River or the North Fork Republican River.


Mr. Brown reported on the status of U. S. Bureau of Reclamation projects in the Republican Basin. The Nelson Buck Unit has been shelved after being found infeasible due to the increase in interest rates. A feasibility study on the Arnel Unit has been initiated with the report due in July 1971. The Hale Ditch has been buying Warren Act Water from Bonny. This water will not be available if the Arnel Unit is constructed so negotiations are underway for the Hale Ditch to sign a contract for stored water. A feasibility study on the Scandia Unit is scheduled for completion in December 1971 and a reconnaissance study of the Oberlin Unit in July 1972. The Bureau of Reclamation is making an investigation toward providing interest free money available to the Frenchman-Cambridge District to be used to rehabilitate the system in particular to convert lateral systems to closed conduits in order to reduce losses. A water-use study has been in progress in the Meeker-Driftwood District and another is scheduled to begin in 1971 for a five-year program in the Kansas-Bostwick District. He also reported that a consulting firm in McCook will begin water scheduling for irrigators in the Frenchman-Cambridge Division at a cost of \$3.50 per acre and they believed this would be accepted with a great deal of enthusiasm.

#### Election of Chairman:

Mr. Dan S. Jones, Jr., Official Member from Nebraska, was unanimously elected to serve as Chairman of the Administration until the next annual meeting.

#### Adjournment:

The Eleventh Annual Meeting of the Republican River Compact Administration was adjourned at 2:15 p.m., May 26, 1970.

  
R. V. Smrha, Chairman



Report of Engineering Committee  
Republican River Compact Administration  
May 26, 1970

The Republican River Compact Administration at its 10th annual meeting held June 30, 1969, agreed the assignments to the Engineering Committee would include the following:

1. Compute annual virgin water supply, 1969 water year;
2. Compute annual consumptive use, 1969 water year;
3. Compute inflow to Lovewell Reservoir and net evaporation of Republican River water stored in Lovewell, 1969 water year;
4. Continue study of proration of net evaporation losses from all reservoirs in the basin and possible effect upon consumptive use by each State;
5. Compute adjusted allocations on annual, five-year average and ten-year average basis;
6. Continue investigations of depletions by wells in the alluvium;
7. Bring up to date in form for publication the procedures and formulas used by the Engineering Committee for the computation of annual virgin water supply and annual consumptive use.

The Engineering Committee held one meeting during the year, April 8th to 10th, 1970, the 17th meeting, to study the virgin water supply and consumptive use of the water year 1969 and to revise the formulas for these computations. Submitted herewith and made a part of this report are the following:

1. Computed annual virgin water supply Republican River Basin 1969;
2. Computed annual consumptive use Republican River Basin, 1969;
3. Draft of revisions of formulas for the computation of virgin water supply Republican River Basin;
4. Draft of revisions of the formulas for the computation of annual consumptive use, Republican River Basin.

The following exhibits are presented for discussion without recommendation:

1. Virgin water supply computation, 1969 water year;
2. Computation, annual inflow to Lovewell Reservoir, 1969 water year;
3. Computed operations of Lovewell Reservoir, 1969 water year;
4. Consumptive use computation-Kansas, main stem of the Republican River;
5. Computation of adjusted allocations on an annual basis, 1969 water year;
6. Adjusted allocations on a 5-year average basis, 1962-1969;
7. Adjusted allocations on a 10-year average basis, 1959-1969.

The municipal and industrial uses which have not been included in the virgin water supply or consumptive use formulas are given below:

	<u>1969 Calendar Year</u>
City of Norton	645 Ac. Ft.
Midwest Oil Co.	644 Ac. Ft.
Livingston Oil Co.	336 Ac. Ft.

Recorded division of diversions by the Haigler Canal between Colorado and Nebraska for 1969 were:

Colorado	3,140 Ac. Ft.
Nebraska	<u>8,080 Ac. Ft.</u>
Total	11,220 Ac. Ft.

Diversions by individual irrigators from alluvial wells or streams in Kansas were estimated on the basis of water use reports from 48% of the water users. Average of all reported diversions in the Republican River Basin in Kansas was 1.5 Ac. Ft./Ac. Average of diversions from groundwater alluvium was 1.6 Ac. Ft./Ac. and from surface water was 1.3 Ac. Ft./Ac.

Nebraska records of diversions from surface water by other than major canals were:

Frenchman Creek	3,480 Ac. Ft.
Medicine Creek	780 Ac. Ft.
Red Willow Creek	800 Ac. Ft.

In other basins in Nebraska surface water diversions are computed as 1.3 Ac. Ft./Ac. shown as intended to be irrigated. Groundwater diversion rate used for 1969 was 1.2 Ac. Ft./Ac. as determined from a 14% sample of water use reports.

Recorded diversions from surface water in Colorado were:

S. Fork Republican River	2,330 Ac. Ft.
N. Fork Republican River	3,810 Ac. Ft.
Arikaree River	0 Ac. Ft.
Beaver Creek	0 Ac. Ft.

All groundwater diversions in Colorado were assumed to be from upland wells and are not included in the computations.

Return flow percentages were computed for the major canals from data by the U.S. Bureau of Reclamation with the following results:

<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	41%	Franklin	56%
Culbertson Ext.	45%	Franklin Pump	41%
Meeker-Driftwood	41%	Naponee	41%
Red Willow	46%	Superior	55%
Cambridge	41%	Courtland-Nebr.	25%
Bartley	39%	Courtland-Kans.	
Almena	36%	above Lovewell	54%
		below Lovewell	47%

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

Hale Ditch	38%	Groundwater diversions	25%
Haigler Canal	38%	Surface water diversions	25%
Champion Canal	41%		
Riverside Canal	41%		

The annual virgin water supply and the consumptive use in each state was computed and the results are shown on the attached exhibits. Based on diversions by canals below Harlan County Reservoir, the net evaporation from Harlan County was divided (55%), 8,750 Ac. Ft. to Kansas and (45%), 7,160 Ac. Ft. to Nebraska.

The committee reviewed and revised the formulas for computation of annual virgin water supply and annual consumptive use. These revised formulas are presented in draft form for action by the Administration at this meeting.

No action was taken on the prorating of the net evaporation from reservoirs other than in the Harlan County Reservoir.


The committee studied a detailed computation of the annual losses and gains in the Trenton-Palisade to Cambridge reach of the Republican River. This study indicates that prior to the operation of Irrigation Districts the reach was a losing stream but return flows from districts have now made a gaining river through the reach. The results of this table explain why the original studies made by Floyd LeFever indicated no definite show of return flow as his studies were made at the time of transition of the river from a losing stream to a gaining stream.

The U.S. Geological Survey has supervised two additional seepage runs during the past year to determine the pickup in the Republican River in this same river section. The U.S. Geological Survey will present the results of these studies at this meeting.

Respectfully submitted,

  
\_\_\_\_\_  
Nebraska

  
\_\_\_\_\_  
Kansas

  
\_\_\_\_\_  
Colorado

Republican River Compact Administration  
 May 26, 1970

Computed Annual Virgin Water Supply  
 Republican River Basin

<u>Drainage Basin</u>	<u>Compact Ac. Ft.</u>	<u>1969 W.Y. Ac. Ft.</u>
Prairie Dog Creek	27,600	24,430
Sappa Creek	21,400	31,180
Beaver Creek	16,500	19,690
Medicine Creek	50,800	61,390
Red Willow Creek	21,900	22,150
Driftwood Creek	7,300	2,260
Frenchman Creek	98,500	113,340
South Fork of the Republican River	57,200	37,970
Rock Creek	11,000	10,570
Buffalo Creek	7,890	5,440
Arikaree River	19,610	12,430
North Fork of the Republican River	44,700	43,550
Main Stem of the Republican plus Blackwood Creek	*94,500	184,080
TOTALS	478,900	568,480
*Main Stem Blackwood Creek	87,700 6,800	



Republican River Compact Administration  
 May 26, 1970

Computed Annual Consumptive Use  
 Republican River Basin

1969 Water Year

<u>Drainage Basin</u>	<u>Colorado</u>	<u>Kansas</u>	<u>Nebraska</u>	<u>Total</u>
Prairie Dog Creek	-	17,500	0	17,500
Sappa Creek	-	4,450	7,770	12,220
Beaver Creek	0	5,640	7,960	13,600
Medicine Creek	-	-	6,960	6,960
Red Willow Creek	-	-	9,690	9,690
Driftwood Creek	-	0	410	410
Frenchman Creek	-	-	53,390	53,390
South Fork of the Republican River	9,670	5,560	160	15,390
Rock Creek	-	-	210	210
Buffalo Creek	-	-	410	410
Arikaree River	0	220	0	220
North Fork of the Republican River	4,810	-	5,010	9,820
Main Stem of the Republican River	-	38,720	128,140	166,860
TOTALS	14,480	72,090	220,110	306,680

FORMULAS FOR THE COMPUTATION  
OF  
ANNUAL VIRGIN WATER SUPPLY  
REPUBLICAN RIVER BASIN

April 4, 1961

Revised and Adopted  
at the  
Eleventh Annual Meeting  
Republican River Compact Administration  
May 26, 1970

Computation of Virgin Water Supply  
Republican River Compact Administration

INTRODUCTION

Article III of the Republican River Compact designates the drainage basins, or parts thereof, from which specific allocations are made to the States of Colorado, Kansas and Nebraska.

The annual virgin water supply for each of those designated drainage basins shall be computed by the formulas given herein.

GAGING STATIONS

The stream-gaging stations necessary to the virgin water supply formulas are described in U. S. Geological Survey Water-Supply Papers, Part 6-B, and are listed below:

<u>Station Number</u>	<u>Station Name</u>
6B-8215.00	Arikaree River at Haigler, Nebr.
6B-8230.00	North Fork Republican River at Colorado-Nebraska State line
6B-8235.00	Buffalo Creek near Haigler, Nebr.
6B-8240.00	Rock Creek at Parks, Nebr.
6B-8275.00	South Fork Republican River near Benkelman, Nebr.
6B-8355.00	Frenchman Creek at Culbertson, Nebr.
6B-8365.00	Driftwood Creek near McCook, Nebr.
6B-8380.00	Red Willow Creek near Red Willow, Nebr.
6B-8425.00	Medicine Creek below Harry Strunk Lake, Nebr.
6B-8470.00	Beaver Creek near Beaver City, Nebr.
6B-8475.00	Sappa Creek near Stamford, Nebr.
6B-8485.00	Prairie Dog Creek near Woodruff, Kans.
6B-8525.00	Courtland Canal at Nebraska-Kansas State line
6B-8535.00	Republican River near Hardy, Nebr.

DRAINAGE BASINS

The drainage basins designated in Article II, Republican River Compact, are defined for use in the formulas as those drainage areas above the gaging stations at or near the mouths of the streams, with the following exceptions:

Prairie Dog Creek drainage basin is that drainage area above the gaging station near Woodruff;

Sappa Creek drainage basin is that drainage area above the gaging station, Sappa Creek near Stamford, and below the gaging station, Beaver Creek near Beaver City;

Beaver Creek drainage basin is that drainage area above the gaging station near Beaver City;

Medicine Creek drainage basin is that drainage area above the gaging station below Harry Strunk Lake;

The main stem of the Republican River is that area between the junction of the North Fork and the Arikaree River and the gaging station near Hardy and includes (1) those areas below the gaging stations of the designated drainage basins and (2) all of Blackwood Creek drainage basin.

#### BASIC DATA

Basic data for use in the formulas shall be obtained from the following sources:

1. Stream discharges from surface water records as compiled by the U. S. Geological Survey;
2. Total monthly reservoir evaporation records as computed by the U. S. Corps of Engineers;
3. Precipitation records as compiled by the U. S. Weather Bureau;
4. Reservoir elevations, surface areas and storage contents from records as compiled by the operating agency;
5. Irrigation diversions or irrigated acreages from records as furnished by each State.

## GENERAL PROCEDURES

Net reservoir evaporation shall be the total evaporation corrected for the precipitation upon the reservoir surface area.

Average monthly reservoir surface areas shall be computed by applying the average of the daily reservoir elevations to the most recent area table.

Depletions of stream flows due to erosion control practices and stockwater ponds have not been included in the present virgin water supply formulas.

Irrigation diversions from groundwater shall be limited to those by wells pumping from the alluvium along the stream channels. The determination of the effect of pumping by upland wells on the flows of the streams in the Republican River Basin must await considerably more research and data. The wells in the Frenchman Creek drainage basin in Colorado have been considered as upland wells.

Return flows from the lands irrigated by major project developments flowing into two or more designated drainage basins shall be divided in the ratio of the irrigated lands from which the water returns to each drainage basin.

Return flows are considered to be reflected in stream discharge records during the same year the irrigation diversions are made.

## EVALUATION OF FACTORS

Computations of virgin water supply by the formulas are based upon the following factors:

1. The irrigation diversions by canals, stream pumps and wells for which recorded diversions are not available shall be computed by each State based upon the best information available.
2. Return flows from the lands irrigated by small canals, stream pumps and wells shall be computed as 25 percent of the annual diversions.
3. Return flows from the lands irrigated by major project development shall be computed as percent of annual diversions based on data furnished by the U. S. Bureau of Reclamation. Return flows from the lands irrigated by the Hale Ditch and the Haigler Canal shall be computed as 38 percent of annual diversions.

FORMULAS FOR THE COMPUTATION  
OF  
ANNUAL VIRGIN WATER SUPPLY

Prairie Dog Creek Drainage Basin

Annual Virgin Water Supply equals

the recorded discharge near Woodruff;  
plus, the net evaporation from Norton Reservoir;  
plus, or minus, the change in storage in Norton Reservoir;  
plus, the diversions by the Almena Canal;  
plus, the other irrigation diversions of surface water in  
Kansas;  
plus, the irrigation diversions from groundwater in Kansas;  
minus, the return flows from the Almena Irrigation District;  
minus, the return flows from the lands irrigated by other  
diversions from surface water in Kansas;  
minus, the return flows from the lands irrigated by  
diversions from groundwater in Kansas.

Sappa Creek Drainage Basin

Annual Virgin Water Supply equals

the recorded discharge near Stamford;  
minus, the recorded discharge of Beaver Creek near Beaver  
City;  
plus, the irrigation diversions of surface water from Sappa  
Creek in Kansas and Nebraska and from Beaver Creek  
downstream from the gaging station, Beaver Creek near  
Beaver City;  
plus, the irrigation diversions from groundwater along Sappa  
Creek in Kansas and Nebraska and from groundwater along  
Beaver Creek downstream from the gaging station, Beaver  
Creek near Beaver City;  
minus, the return flows from the lands irrigated by diversions  
from surface water;  
minus, the return flows from the lands irrigated by diversions  
from groundwater.

Beaver Creek Drainage Basin

Annual Virgin Water Supply equals

- the recorded discharge near Beaver City;
- plus, the irrigation diversions of surface water in Colorado, Kansas and Nebraska;
- plus, the irrigation diversions from groundwater in Colorado, Kansas and Nebraska;
- minus, the return flows from the lands irrigated by diversions from surface water;
- minus, the return flows from the lands irrigated by diversions from groundwater;

Medicine Creek Drainage Basin

Annual Virgin Water Supply equals

- the recorded discharge below Harry Strunk Lake;
- plus, the net evaporation from Harry Strunk Lake;
- plus, or minus, the change in storage in Harry Strunk Lake;
- plus, the irrigation diversions of surface water;
- plus, the irrigation diversions from groundwater;
- minus, the return flows from the lands irrigated by diversions from surface water;
- minus, the return flows from the lands irrigated by diversions from groundwater.



Red Willow Creek Drainage Basin

Annual Virgin Water Supply equals

the recorded discharge near Red Willow;  
plus, the net evaporation from Red Willow Reservoir;  
plus, or minus, the change in storage in Red Willow Reservoir;  
plus, the diversions by the Red Willow Canal;  
plus, the other irrigation diversions of surface water;  
plus, the irrigation diversions from groundwater;  
minus, the return flows from those lands adjacent to Red Willow Creek and served by the Red Willow Canal;  
minus, the return flows from the lands irrigated by other diversions from surface water;  
minus, the return flows from the lands irrigated by diversions from groundwater.

Driftwood Creek Drainage Basin

Annual Virgin Water Supply equals

the recorded discharge near McCook;  
plus, the irrigation diversions of surface water in Kansas and Nebraska;  
plus, the irrigation diversions from groundwater in Kansas and Nebraska;  
minus, the return flows from the lands irrigated by diversions from surface water;  
minus, the return flows from the lands irrigated by diversions from groundwater;  
minus, the return flows from the lands upstream from the gaging station that are adjacent to Driftwood Creek and served by the Meeker-Driftwood Canal.

Frenchman Creek Drainage Basin in Nebraska

Annual Virgin Water Supply equals

the recorded discharge at Culbertson;  
plus, the net evaporation from Enders Reservoir;  
plus, or minus, the change in storage in Enders Reservoir;  
plus, the diversions by the Culbertson Canal;  
plus, the diversions by the champion and Riverside Canals;  
plus, the other irrigation diversions of surface water in  
Nebraska;  
plus, the irrigation diversions from groundwater in Nebraska;  
minus, the return flows from the lands within the Frenchman  
Creek drainage basin served by the Culbertson Canal;  
minus, the return flows from the lands irrigated by the  
Champion and Riverside Canals;  
minus, the return flows from the lands irrigated by other  
diversions from surface water in Nebraska;  
minus, the return flows from the lands irrigated by ground-  
water diversions in Nebraska.

South Fork of the Republican River Drainage Basin

Annual Virgin Water Supply equals

the recorded discharge near Benkelman;  
plus, the net evaporation from Bonny Reservoir;  
plus, or minus, the change in storage in Bonny Reservoir;  
plus, the diversions by the Hale Ditch;  
plus, the other irrigation diversions of surface water in  
Colorado, Kansas and Nebraska;  
plus, the irrigation diversions from groundwater in Colorado,  
Kansas and Nebraska;  
minus, the return flows from the lands irrigated by the Hale  
Ditch;  
minus, the return flows from the lands irrigated by other  
diversions from surface water;  
minus, the return flows from the lands irrigated by diversions  
from groundwater.

Rock Creek Drainage Basin

Annual Virgin Water Supply equals

- the recorded discharge at Parks;
- plus, the irrigation diversions of surface water;
- plus, the irrigation diversions from groundwater;
- minus, the return flows from the lands irrigated by diversions from surface water;
- minus, the return flows from the lands irrigated by diversions from groundwater.

Buffalo Creek Drainage Basin

Annual Virgin Water Supply equals

- the recorded discharge near Haigler;
- plus, the irrigation diversions of surface water;
- plus, the irrigation diversions from groundwater;
- minus, the return flows from the lands irrigated by diversions from surface water;
- minus, the return flows from the lands irrigated by diversions from groundwater.

Arikaree River Drainage Basin

Annual Virgin Water Supply equals

- the recorded discharge at Haigler;
- plus, the irrigation diversions of surface water in Colorado, Kansas and Nebraska;
- plus, the diversions from groundwater in Colorado, Kansas and Nebraska;
- minus, the return flows from the lands irrigated by diversions from surface water;
- minus, the return flows from the lands irrigated by the diversions from groundwater.

North Fork of the Republican River Drainage Basin  
in Colorado

Annual Virgin Water Supply equals

- the recorded discharge at the Colorado-Nebraska state line;
- plus, the diversions by the Haigler Canal;
- plus, the other irrigation diversions of surface water in Colorado;
- plus, the irrigation diversions from groundwater in Colorado;
- minus, the return flows from the lands within the North Fork of the Republican River drainage basin in Colorado that are irrigated by the Haigler Canal;
- minus, the return flows from the lands irrigated by other diversions from surface water in Colorado;
- minus, the return flows from the lands irrigated by diversions from groundwater in Colorado.

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 Virgin Water Supply equals

- the recorded discharge of the Republican River near Hardy;
- plus, the diversions by the Courtland Canal;
- minus, the return flows from the lands in Kansas above Hardy irrigated by the Courtland Canal;
- minus, the return flows from the lands in Nebraska irrigated by the Courtland Canal;
- plus, the diversions by the Superior Canal;
- minus, the return flows from the lands irrigated by the Superior Canal;

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

plus, the diversions by the Franklin Pump Canal;  
minus, the return flows from the lands irrigated by the  
Franklin Pump Canal;  
plus, the diversions by the Franklin Canal;  
minus, the return flows from the lands irrigated by the  
Franklin Canal;  
plus, the diversions by the Naponee Canal;  
minus, the return flows from the lands irrigated by the  
Naponee Canal;  
plus, the net evaporation from Harlan County Reservoir;  
plus, or minus, the change in storage in Harlan County  
Reservoir;  
minus, the recorded discharge of Prairie Dog Creek near  
Woodruff;  
plus, the irrigation diversions of surface water from Prairie  
Dog Creek in Nebraska;  
minus, the return flows from the lands irrigated from surface  
water of Prairie Dog Creek in Nebraska;  
plus, the irrigation diversions from groundwater along  
Prairie Dog Creek in Nebraska;  
minus, the return flows from the lands irrigated from ground-  
water along Prairie Dog Creek in Nebraska;  
minus, the recorded discharge of Sappa Creek near Stamford;  
plus, the irrigation diversions of surface water from Sappa  
Creek downstream from the gaging station near Stamford;  
minus, the return flows from the lands irrigated from surface  
water downstream from the gaging station near Stamford;  
plus, the irrigation diversions from groundwater along Sappa  
Creek downstream from the gaging station near Stamford;  
minus, the return flows from the lands irrigated from ground-  
water along Sappa Creek downstream from the gaging  
station near Stamford;  
plus, the diversions by the Cambridge Canal;

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

- minus, the return flows from the lands irrigated by the Cambridge Canal;
- minus, the recorded discharge of Medicine Creek below Harry Strunk Lake;
- plus, the irrigation diversions of surface water from Medicine Creek downstream from Harry Strunk Lake;
- minus, the return flows from the lands irrigated from surface water downstream from Harry Strunk Lake;
- plus, the irrigation diversions from groundwater along Medicine Creek downstream from Harry Strunk Lake;
- minus, the return flows from the lands irrigated from groundwater along Medicine Creek downstream from Harry Strunk Lake;
- plus, the diversions by the Bartley Canal;
- minus, the return flows from the lands irrigated by the Bartley Canal;
- minus, the return flows to the Republican River from the lands irrigated by the Red Willow Canal;
- minus, the recorded discharge of Red Willow Creek near Red Willow;
- minus, the recorded discharge of Driftwood Creek near McCook;
- plus, the diversions by the Meeker-Driftwood Canal;
- minus, the return flows to the Republican River from the lands irrigated by the Meeker-Driftwood Canal;
- minus, the return flows to the Republican River from the lands irrigated by the Culbertson Canal;
- minus, the recorded discharge of Frenchman Creek at Culbertson;
- plus, the net evaporation from Swanson Lake;
- plus, or minus, the change in storage in Swanson Lake;

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

- minus, the recorded discharge of the South Fork of the Republican River near Benkelman;
- minus, the recorded discharge of Rock Creek at Parks;
- minus, the recorded discharge of Buffalo Creek near Haigler;
- minus, the recorded discharge of the Arikaree River at Haigler;
- minus, the return flows to the North Fork of the Republican River in Nebraska from the lands irrigated by the Haigler Canal;
- minus, the recorded discharge of the North Fork of the Republican River at the Colorado-Nebraska state line;
- plus, the other irrigation diversions of surface water in Nebraska and Kansas above the gaging station near Hardy;
- minus, the return flows from the lands irrigated by other diversions from surface water in Nebraska and Kansas above the gaging station near Hardy;
- plus, the irrigation diversions from groundwater in Nebraska and Kansas above the gaging station near Hardy;
- minus, the return flows from the lands irrigated by diversions from groundwater in Nebraska and Kansas above the gaging station near Hardy.

FORMULAS FOR THE COMPUTATION  
OF  
ANNUAL CONSUMPTIVE USE  
REPUBLICAN RIVER BASIN  
April 27, 1964

Revised and Adopted  
at the  
Eleventh Annual Meeting  
Republican River Compact Administration  
May 26, 1970



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

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 from the main stem of the Republican River by irrigation districts in Nebraska;

plus, the irrigation diversions from surface water by others in Nebraska;

plus, the irrigation diversions from groundwater in Nebraska;

minus, the return flows from the diversions from the main stem of the Republican River by the irrigation districts in Nebraska including return flows to Driftwood Creek;

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 groundwater in Nebraska;

plus, the net evaporation from Swanson Lake;

plus, that part of the net evaporation from Harlan County Reservoir charged to Nebraska;

plus, a prorated share of the transportation loss of the Courtland Canal through 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, a prorated share of the transportation  
loss of the Courtland Canal through Nebraska;

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 groundwater  
in Kansas above the gaging station near Hardy;

minus, the return flows from those groundwater  
diversions in Kansas above the gaging station  
near Hardy.

REPUBLICAN RIVER COMPACT

Rules and Regulations  
As Amended to May 26, 1970

constituting

The Republican River Compact Administration

Adopted at the  
Eleventh Annual Meeting  
Republican River Compact Administration  
May 26, 1970

## The Republican River Compact

After negotiations by Commissioners appointed by Governors of the States of Kansas, Nebraska and Colorado, and participated in by a duly appointed Representative of the United States of America, the Commissioners signed, and the Representative of the United States of America approved, the Republican River Compact on December 31, 1942. It was ratified by the State of Colorado by an Act effective on March 15, 1943; by the State of Kansas by an Act effective on June 28, 1943; and by the State of Nebraska by an Act effective on February 24, 1943. The Compact was approved by the Congress of the United States in an Act effective on May 26, 1943. (Public Law 60, 78th Congress, Chapter 104, 1st Session).

### Administration of the Compact

Article IX of the Republican River Compact provides for its administration as follows:

#### Article IX.

It shall be the duty of the three States to administer this compact through the official in each State who is now or may hereafter be charged with the duty of administering the public water supplies, and to collect and correlate through such officials the data necessary for the proper administration of the provisions of this compact. Such officials may, by unanimous action, adopt rules and regulations consistent with the provisions of this compact.

The United States Geological Survey, or whatever federal agency may succeed to the functions and duties of that agency, in so far as this compact is concerned, shall collaborate with the officials of the States charged with the administration of this compact in the execution of the duty of such officials in the collection, correlation, and publication of water facts necessary for the proper administration of this compact.



## Rules and Regulations

Pursuant to the responsibility and authority conferred upon them by the Republican River Compact, and for the purpose of implementing its administration, J. E. Whitten, State Engineer of the State of Colorado; Dan S. Jones, Jr., Director of Water Resources of the State of Nebraska; and R. V. Smrha, Chief Engineer, Division of Water Resources, State Board of Agriculture of the State of Kansas, being the officials in their respective states charged with the duty of administering public water supplies, assembled in meeting at Denver, Colorado, on July 15, 1959, and unanimously approved and adopted as being effective from that date, rules and regulations as follows:

1. The State Engineer of the State of Colorado; the Director of Water Resources of the State of Nebraska; and the Chief Engineer, Division of Water Resources, State Board of Agriculture of the State of Kansas, being the officials in their respective states charged with the duty of administering public water supplies, shall be the official members of and together they shall constitute an administrative body hereby designated, "The Republican River Compact Administration".
2. The Republican River Compact, hereinafter referred to as the "Compact", shall be administered by the Republican River Compact Administration, hereinafter referred to as the "Administration".
3. The terms of office of official members of the Administration shall be concurrent with their respective terms of office as officials of each state charged with the duty of administering the public water supplies.

4. Each official member of the Administration shall be recognized in that capacity upon furnishing to the other official members satisfactory evidence that he is the official in his state charged with the duty of administering the public water supplies.
5. If an official member shall be unable to serve personally at any meeting of the Administration, he may appoint a personal representative, other than another official member of the Administration, to serve in his place at said meeting. Such personal representative shall be recognized in that capacity upon furnishing to the official members from the other states or their personal representatives a certificate showing that he has been duly appointed by the official member whom he is to represent. All actions taken in the transaction of business of the Administration by any such duly appointed representative shall be made in the name of the official member whom he represents and shall be binding on such official member.
6. The Chairman of the Administration shall be an official member of the Administration and shall be elected at the annual meeting for a term of office continuing to the close of the annual meeting the following year. In the absence of the Chairman at any meeting, the official members of the Administration and any duly appointed and acting personal representatives present at that time shall select one of them to serve as temporary Chairman. In the event of a vacancy in the office of the Chairman, his successor as the official member from his state shall be temporary Chairman until the next meeting of the Administration at which time, as the first order of business, the vacancy shall be filled by election of an official member of the Administration who shall thereupon be Chairman for the unexpired term.

7. The Chairman shall preside at all meetings of the Administration and may initiate or second motions and vote on all matters coming before the Administration. He shall issue notice of meeting to all official members as to time, place, and purpose in advance of each meeting of the Administration. The Chairman shall keep a record of the proceedings of all meetings and of all transactions of the Administration during his term of office and shall furnish copies thereof concurrently to the other official members to the end that each official member shall have and preserve a complete file of the records of the Administration.
8. The Administration may, from time to time, create committees composed of such official members of the Administration and others as it may determine and assign to such committees such tasks as the Administration may designate.
9. A regular annual meeting of the Administration shall be held upon the call of the Chairman prior to July 1 each year. Other meetings of the Administration shall be held as may be agreed upon at any meeting; or upon call of the Chairman; or upon written request to the Chairman by any official member of the Administration.
10. A quorum for the purpose of transacting official business at any meeting of the Administration shall be at least two official members of the Administration or their duly appointed representatives. In all matters coming before the Administration any action shall be determined by vote. Each State shall have one vote and every decision, authorization or other action shall require a unanimous vote of the official members or their duly appointed and acting personal representatives present at a meeting.

11. At each meeting of the Administration, the order of business, except as provided by rule No. 6 herein, shall be as follows:

Reading, correction, and approval of minutes of last meeting

Report of Chairman

Reports of official members or representatives

Unfinished business

New business

Adjournment

12. The Administration following each annual meeting shall adopt and enter upon its records a report covering a summary of its transactions and proceedings for the preceding year, the current status of its affairs and including such other matters as may be deemed appropriate by the official members. Copies of the report may be furnished to the President of the United States; the Governors of the States of Colorado, Nebraska and Kansas; officials of State and Federal agencies and others as determined by the Administration.
13. Amendments, revisions, deletions or additions to these Rules and Regulations may be made at any meeting of the Administration, provided that official members or duly appointed and acting personal representatives from all three states are present. Such changes may be made also at any meeting at which a quorum is present, provided that a statement of the proposed changes is sent by the Chairman to all official members of the Administration by ordinary mail at least fifteen (15) days in advance of the meeting at which they are to be considered.

Approval and Adoption

The foregoing Rules and Regulations, deemed to be consistent with provisions of the Republican River Compact and considered necessary for its administration, are hereby approved and adopted.

Done in the City of Denver in the State of Colorado on the 15th day of July, in the year of our Lord, one thousand nine hundred fifty-nine.

For the State of Colorado /s/ J. E. Whitten  
J. E. Whitten, State Engineer

For the State of Nebraska /s/ Dan S. Jones, Jr.  
Dan S. Jones, Jr.  
Director of Water Resources

For the State of Kansas /s/ R. V. Smrha  
R. V. Smrha, Chief Engineer  
Division of Water Resources  
State Board of Agriculture

STATE OF Colorado, Denver COUNTY, ss.

BE IT REMEMBERED, That on this 15th day of July, A. D. 1959, before me the undersigned, a notary public in and for said County and State, came J. E. Whitten, State Engineer of the State of Colorado; Dan S. Jones, Jr., Director of Water Resources of the State of Nebraska, and R. V. Smrha, Chief Engineer, Division of Water Resources, State Board of Agriculture of the State of Kansas, who are personally known to me to be such duly appointed qualified and acting officials, and who are personally known to me to be the same persons who executed the within instrument of writing as such officials and such persons duly acknowledged the execution of the same as such officials.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

(SEAL)

Signature: /s/ Janice A. Stewart  
Notary Public

My commission expires My Commission expires January 24, 1962