

Tabulation Showing
ORIGIN OF WATER SUPPLY, AREA, AND RUN-OFF OF REPUBLICAN RIVER AND TRIBUTARIES
IN COLORADO, NEBRASKA AND KANSAS

BASIN	COLORADO			NEBRASKA			KANSAS			TOTAL		
	Water Supply Acre-foot	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-foot	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-foot	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-foot	Area Sq. Miles	Run-off per Sq. Mi.
North Fork Republican	43,950	1,474	29.8	750	26	28.8	0	0	-	44,700	1,500	29.8
Arikaree	17,414	1,760	11.0	98	10	9.8	98	10	9.8	17,610	1,780	11.0
Buffalo	5,730	1,040	5.5	2,160	137	15.8	0	0	-	7,890	1,177	6.7
Rock	43,240	2,027	21.3	11,000	145	75.9	0	0	-	11,000	145	75.9
North Fork Republican	0	0	-	200	10	20.0	13,760	658	20.3	57,200	2,595	21.2
Republican to Culbertson	0	1,289	-	12,850	921	14.0	1,950	144	13.5	14,800	1,095	13.3
Frenchman	0	0	-	98,500	1,948	50.7	0	0	-	98,500	3,237	30.4
Blackwood	0	0	-	6,800	377	18.0	0	0	-	6,800	377	18.0
Driftwood	0	0	-	4,100	216	19.0	3,200	191	16.8	7,300	407	17.9
Red Willow	0	0	-	21,900	985	22.2	0	0	-	21,900	985	22.2
Medicine	0	0	-	50,800	1,035	49.1	0	0	-	50,800	1,035	49.1
Beaver - At Mouth	1,530	288	5.3	4,780	509	9.4	10,190	1,329	7.7	16,500	2,126	7.8
Sappa - At Mouth	0	0	-	3,180	149	21.3	18,220	1,507	12.1	21,400	1,656	12.9
Prairie Dog	0	0	-	2,000	64	31.2	25,600	1,116	22.9	27,600	1,180	23.4
Republican, Culbertson to Bloomington	0	0	-	41,090	2,062	19.9	810	45	18.0	41,900	2,107	19.9
Republican, Bloomington to Guide Rock	0	0	-	29,810	1,028	29.0	1,190	66	18.0	31,000	1,094	28.3
TOTAL to Guide Rock	138,924	7,878	17.6	264,258	9,622	27.5	75,018	5,066	14.8	478,900	22,566	21.2
% of Total to Guide Rock	29.0	34.9	-	55.3	42.6	-	15.7	22.5	-	478,900	22,566	21.2
Republican, Guide Rock to Hardy	0	0	-	7,133	281	21.5	1,967	71	27.7	9,100	352	27.6
White Rock	0	0	-	0	0	-	0	0	-	0	0	-
Republican, Hardy to Scandia	0	0	-	13	13	-	0	0	-	13	133	-
Buffalo	0	0	-	0	0	-	0	0	-	0	342	-
Republican, Scandia to Concordia	0	0	-	0	0	-	0	0	-	0	322	-
Republican, Concordia to Junction City	0	0	-	0	0	-	0	0	-	0	1,392	-
Compact Total												

F. B. Shaffer, Technician
 January 4, 1941, Lincoln, Nebraska

A SUMMARY ON INVESTIGATIONS OF THE ORIGINAL
VIRGIN WATER SUPPLY AND ALLOCATIONS
OF THE REPUBLICAN RIVER COMPACT

As requested by the Deputy State Engineer a review of available documents on the Republican River Compact has been conducted. This was done with an eye to determining the basis for the original allocations to each state, and for reviewing the role ground water diversions had in those allocations.

The virginal water supplies and per state allocation from each sub-basin are identical in both the first compact signed on March 19, 1941 and the second compact signed on December 31, 1942. Therefore an investigation into how the allocations were arrived at may rely heavily upon on the history leading up to the first compact.

A search was made of files and libraries for documents, reports, publications, letters, etc. having to do with the compact or persons involved with the compact. Areas searched were: central files and library within the Colorado State Engineers office, Colorado State Archives, Colorado Water Conservation Board library, Denver Public Library, Colorado State Library, and the library of the Colorado Historical Society.

The most useful items found were the following: bound minutes of the eight meetings of the commission leading up to the first compact; minutes of the two subsequent meetings leading to the second compact; unsigned minutes of a meeting between the commissioners conducted on July 15, 1943 after completion of the second compact; "Explanatory Statements" by Colorado commissioner M.C. Hinderlider forwarding initially the first and later the second compacts to the Colorado General Assembly; tables detailing within each sub-basin and state sources of virgin water supplies and allocations by use and type; and four reports from federal agencies addressing water resource development in the Republican River Basin.

The four federal reports found are:

- ✓ "Reconnaissance Report on Republican River Basin", Project Investigations Report #41, by the Bureau of Reclamation, Dept. of the Interior, Dated March 1940 (preliminary)
- ✓ "Water Facilities Area Plan for the Upper Republican Basin in Nebraska, Kansas, and Colorado", by the Bureau of Agricultural Economics, Dept. of Agriculture, Dated June 1941

"Survey of Republican River, Nebraska and Kansas", by the Corps of Engineers, War Department, dated April 10, 1940.

✓ "Agricultural Land and Water Use Recommendations for the Republican River Watershed in Nebraska, Kansas, and Colorado", by the Soil Conservation Service, Dept. of Agriculture, dated January 29, 1940

The reports by the Bureau of Reclamation, the Bureau of Agricultural Economics, and the Corps of Engineers are referred to in the commission's minutes as having been considered during deliberations over the compact. The first two reports were found in central files of the Office of the State Engineer. The Corps' report is on file in the Denver Public Library (U.S. Serial Set Index Vol. 31, Serial 10505; House Document 842 of the 76th Congress 3rd Session). The fourth report by the Soil Conservation Service, while found in the State Engineer's files among other Republican River Compact documents, is not referenced by any meeting minutes.

WATER SUPPLIES AND ALLOCATIONS:

The tables which were found detailing virginial water supplies and allocations by state and sub-basin appear to be the commission's final working basis for the values contained in the compacts. Copies of these tables are attached hereto as Exhibits A & B. The values in these tables match, with rounding to the appropriate 100 acre-feet, those values contained in the compact. These tables were prepared by a Mr. F. B. Shaffer of Lincoln, Nebraska who is identified in the minutes of the third meeting as being an assistant engineer representing Nebraska, and one of the persons who did work compiling such tables. The first table is a tabulation of water supply, area, and run-off per square mile by sub-basin and state. This table is originally dated January 4, 1941, with revisions occurring on March 26, 1941. The second table consists of 5 pages with a revision date of March 19, 1941, being the same date the commissioners concluded consideration of and signed the first compact. The second table reiterates the water supply by sub-basin (being however renamed "run-off"), and then lists the assigned disposal of this virginial supply to each state for four types of use.

As gaged stream flow records for determining virginial water supplies should be one of the basic factors used by the commission, an attempt was made to determine how the commission obtained such flow records. Using figures from the second table the "present usage" of water from each sub-basin was subtracted from that sub-basin's "water supply" to obtain what should be the gaged stream flow records the commission relied on. These resulting stream flows were compared to the gaged average annual stream flows as given in the federal reports. It is noted that each federal report listed different average annual stream flows. There was no direct match between any of the values from the

commission tables and values contained in the reports. While some values computed from the tables were near the report average flows, others varied significantly. In Mr. Hinderlider's explanatory statement forwarding the second compact to the Colorado General Assembly in 1943 he states that the total available water supplies of the basin were "...based upon the preceding eleven years during which period fairly reliable records of stream flow are available". While this eleven year period may have been used, it does not appear that a straight average of 1929-1939 data was employed. It is likely that the commission took the available stream flow data and adjusted that data to come up with what they believed to be true conditions. The minutes of commission meetings 2, 3, 4, and 5 make numerous mention of consideration of revised or reconstituted records of stream flow and water supply.

For purposes of illustrating the stream flow records available to the commission, a summary comparing the average annual flows as given in the federal reports to those derived from the second table is attached hereto as Exhibit C.

The state by state allocation of run-off from each sub-basin as given on the second table is based upon four use types. These are: present usage, present shortage, reservoir loss, and new projects. The top to bottom relative listing of these four uses follows the principles proposed by Mr. Hinderlider in the third commission meeting for controlling the division of the waters of the basin. This proposal provided that past and present uses should be first and fully protected, that next consideration be given to needs for water to supplement existing uses, leaving future proposed uses to be lastly supplied. As there were no reservoirs existing at the time the compact was signed both the reservoir evaporation losses and the new irrigation project E.T. losses would be considered future use.

The federal reports gave various tabulations of the amount of lands which were then being irrigated and which could be irrigated in the future using developed sources of water. They also estimated the quantities of water which were being and would be consumed on such acreages. As with the virgin water supply numbers, no direct match could be established between the values given in these reports and the allotments for present use provided for in the second table. Again it is likely the commission used the reports as a guide but made final computations based upon their own adjustments. See minutes of commission meetings 2, 3, 4, 5, 7, and 8 where reference is made to consideration of allocations, and specifically to the fifth meeting on February 12, 1941 where reference is made to a field trip over portions of the South Fork of the Republican for purposes concerning irrigated areas.

The number of acres of new projects to be irrigated from

each source in each state as assumed by the commission in the second table may be deduced by applying a 2 acre-foot per acre irrigation requirement to all new projects in Colorado, and a 1.5 acre-foot per acre irrigation requirement to all new projects in Kansas and Nebraska. These factors will result in a match between the total new project acreage supplied by each sub-basin and the new project allocation to each state from that basin. The only exception to these factors is in the "Republican bet. Bloomington & Guide Rock" reach on page 4 where a 1.576 acre-foot per acre factor is expressly set out for both Kansas and Nebraska.

The number of acres which were assumed to have present water shortages may also be deduced by computing the irrigation requirement factors needed to match the total of the present shortage acreages to be supplied by each sub-basin and the allocation to each state from that basin. It appears that in all sub-basins except the "Republican bet. State Line & Culbertson" and "Red Willow" a factor of 1 acre-foot per acre was used. The "Republican bet. State Line & Culbertson" and the "Red Willow" basins would require a 0.5 acre-foot per acre factor.

As the total number of acres presently irrigated from each sub-basin supply is not provided, irrigation requirement factors to provide a match between such totals and each state's allocation cannot be calculated. It does appear reasonable however to assume that if presently irrigated lands had a full water supply the commission would have used the same factors as were used for new project lands. Therefore, by adding the present shortage water requirements to the water presently used and applying the new project factors the total number of acres the commission assumed to be presently irrigated may be deduced.

Attached as Exhibit D is a tabulation where the acre-foot values of the second table have been reduced to acres irrigated, or to be irrigated, by use of irrigation requirement factors. The reservoir losses have also been reduced to acres of water surface by use of the evaporation rates given in the second table.

GROUND WATER:

There has been some discussion in recent commission meetings as to the role of ground water in the original compact, and what role ground water withdrawals should be given presently. Research indicates that knowledge of interaction between ground water and surface water was with the original commissioners, and that this interaction was most likely meant to be taken into account in both water supply and allocation aspects.

Both the Bureau of Reclamation Report and the Bureau of Agricultural Economics Report contain reference to use of and

development of ground water. In fact the basic recommendation of the Bureau of Agricultural Economics report was agricultural development of the basin by use of ground water. Mr. Harry P. Burleigh, representing the Bureau of Agricultural Economics, appeared before the commission on January 27, 1941 during their fourth meeting to outline the scope of the Bureau's work. This work included analysis of the water supplies within the basin. In reference to these supplies the minutes of the fourth meeting state:

as reflected
"Upon inquiry, Mr. Burleigh advised the Commission that all of the underground waters of the basin above Scandia, Kansas, are included in the total water supplies of the basin, as reflected in measurements of stream flow at Scandia and other points in the basin, and that any underground water development must be considered as reducing to that extent the amount of surface water available for use within the basin."

It appears the implication of the above statement is that the Bureau's analysis was based upon a renewable average annual water supply. The Bureau's written report conveys that surface flows were being supported by ground water feed in turn by precipitation.

That Mr. Hinderlider acknowledged ground water withdrawals must be taken into account is evidenced by his explanatory statement forwarding the second compact to the Colorado General Assembly in 1943 wherein he states that he believes: "...this compact equitably apportions the total available average annual virgin water supplies of the basin, both surface and underground, among the three signatory states".

That all of the commissioners realized ground water supplies affected compact computations is evidenced by the minutes of a commission meeting held on July 15, 1943, after signing of the second compact. To quote from those minutes:

"The matter of obtaining canal diversion records was discussed but no conclusions concerning it were reached.

A lengthy discussion was had concerning the necessity of securing ground water records along with those of surface water at the state line stations. All were agreed that such records would be of value and Mr. Parker was requested to establish observation wells at such stations on streams where proposed irrigation development might warrant it."

Prepared by: Keith Vander Horst
Water Resource Engineer
Colorado Division of Water Resources

December 13, 1989

Tabulation Showing
**ORIGIN OF WATER SUPPLY, AREA, AND RUN-OFF OF REPUBLICAN RIVER AND TRIBUTARIES
 IN COLORADO, NEBRASKA AND KANSAS**

BASIN	COLORADO				NEBRASKA				KANSAS				TOTAL			
	Water Supply Acre-feet	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-feet	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-feet	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-feet	Area Sq. Miles	Run-off per Sq. Mi.	Water Supply Acre-feet	Area Sq. Miles	Run-off per Sq. Mi.	
North Fork Republican	43,950	1,474	29.8	750	26	28.8	0	0	-	44,700	1,500	29.8	44,700	1,500	29.8	
Arikaree	19,414	1,760	11.0	98	10	9.8	98	10	9.8	19,610	1,780	11.0	19,610	1,780	11.0	
Buffalo	5,730	1,040	5.5	2,160	137	15.8	0	0	-	7,890	1,177	6.7	7,890	1,177	6.7	
Rock	0	0	-	11,000	145	75.9	0	0	-	11,000	145	75.9	11,000	145	75.9	
South Fork Republican	43,240	2,027	21.3	200	10	20.0	13,760	658	20.3	57,200	2,695	21.2	57,200	2,695	21.2	
Republican to Culbertson	0	0	-	12,850	921	14.0	1,950	144	13.5	14,800	1,065	13.9	14,800	1,065	13.9	
Frenchman	0	1,289	-	98,500	1,948	50.7	0	0	-	98,500	3,237	30.4	98,500	3,237	30.4	
Blackwood	0	0	-	6,800	377	18.0	0	0	-	6,800	377	18.0	6,800	377	18.0	
Driftwood	0	0	-	4,100	215	13.0	3,200	191	16.8	7,300	407	17.9	7,300	407	17.9	
Red Willow	0	0	-	21,900	985	22.2	0	0	-	21,900	985	22.2	21,900	985	22.2	
Medicine	0	0	-	50,800	1,035	49.1	0	0	-	50,800	1,035	49.1	50,800	1,035	49.1	
Beaver- At Mouth	1,530	288	5.3	4,780	509	9.4	10,190	1,129	7.7	16,500	2,126	7.8	16,500	2,126	7.8	
Sappa- At Mouth	0	0	-	3,180	149	21.3	18,220	1,507	12.1	21,400	1,656	12.9	21,400	1,656	12.9	
Prairie Dog	0	0	-	2,000	64	31.2	25,600	1,116	22.9	27,600	1,180	23.4	27,600	1,180	23.4	
Republican, Culbertson to Bloomington	0	0	-	41,090	2,062	19.9	310	45	18.0	41,900	2,107	19.9	41,900	2,107	19.9	
Republican, Bloomington to Guide Rock	0	0	-	21,810	1,028	23.0	1,130	66	18.0	31,000	1,094	28.3	31,000	1,094	28.3	
TOTAL to Guide Rock	138,924	7,878	17.6	264,958	9,622	27.5	75,018	5,066	14.8	478,900	22,566	21.2	478,900	22,566	21.2	
% of Total to Guide Rock	29.0	34.9	-	55.3	42.6	-	15.7	22.5	-	9,700	352	27.6	9,700	352	27.6	
Republican, Guide Rock to Hardy	0	0	-	7,133	281	21.5	1,967	71	27.7	9,700	352	27.6	9,700	352	27.6	
White Rock	0	0	-	0	0	-	0	0	-	0	0	-	0	0	-	
Republican, Hardy to Scandia	0	0	-	13	13	-	0	120	-	133	133	-	133	133	-	
Buffalo	0	0	-	0	0	-	0	342	-	342	342	-	342	342	-	
Republican, Scandia to Concordia	0	0	-	0	0	-	0	322	-	322	322	-	322	322	-	
Republican, Concordia to Junction City	0	0	-	0	0	-	0	1,392	-	1,392	1,392	-	1,392	1,392	-	

F. B. Shaffer, Technician
 January 4, 1941, Lincoln, Nebraska
 Revised, March 26, 1941

ANALYSIS OF
 REPUBLICAN RIVER BASIN WATER SUPPLY
 AND ITS DISPOSAL
 ABOVE GUIDE ROCK, NEBRASKA

Revised at Denver, Colorado, March 19, 1941

Stream Basin	Colorado		Nebraska		Totals		Cumulative Acres-Feet
	Acres-Feet	Acres-Feet	Acres-Feet	Acres-Feet	Acres-Feet	Acres-Feet	
<u>N. York Republican</u> Run-off					44,700		44,700
Pres. Use	5,500		5,000		10,500		
Pres. Shortage	2,000		2,500		4,500		
Res. Loss	500		500		1,000		
New Projects	2,000		3,000		5,000		
Total	10,000		11,000		-21,000		23,700
<u>Arkaree</u> Run-off					49,610		49,610
Pres. Use	2,210		0		2,210		
Pres. Shortage	880		0		880		
Res. Loss	2,150		885		3,035		
New Projects	10,175		2,170		12,345		
Total	15,415		3,255		-19,610		23,700
<u>Buffalo</u> Run-off					7,890		31,590
Pres. Use	0		790		790		
Pres. Shortage	0		525		525		
Res. Loss	0		1,000		1,000		
New Projects	0		300		300		
Total	0		2,615		- 2,615		28,975

used in

5

Stream Basin Colorado Kansas Moore-ke Totals Cumulative
Acre-Feet Acre-Feet Acre-Feet Acre-Feet Acre-Feet Acre-Feet

Kock Run-off / 11,000 39,976

Pres. Use - 400
 Pres. Shortage 200 ac. 0 200
 New Projects 2500 ac. 0 3,750
 Total 0 4,350

S. Fork Republican / 57,200 92,825

Pres. Use 10,067 ac. at 1.5' 10,200
 Pres. Shortage 7,200 ac. 6,300
 Res. Loss 2,000
 New Projects 5,400
 Total 23,000 43,675

Republican bet. Star Line & Culbertson / 14,300 58,475

Run-off
 Pres. Use - 2,000
 Pres. Shortage 2000 ac. 0 1,000
 New Projects 3000 ac. 0 4,500
 Total 0 7,500 50,975

Frenchman / 98,500 149,475

Pres. Use - 15,000
 Pres. Shortage 0 7,500
 Res. Loss 300 ac. at 6' 0 4,800
 New Projects 0 25,500
 Total 0 52,800 96,675

Blackwood / 6,800 103,475

Run-off

*applicator = 1/2
 applicator = 1/2
 applicator = 1/2*

Stream Basin	Colorado Acre-Feet	Kansas Acre-Feet	Nebraska Acre-Feet	Totals Acre-Feet	Cumulative Acre-Feet
<u>Driftwood</u> Run-off	-	500	-	7,300	110,775
Pres. Use	0	500	1,200	1,700	
New Projects	0	500	1,200	1,700	109,075
Total	0	500	1,200	7,300	110,775
<u>Red Willow</u> Run-off	-	0	0	21,900	130,975
Pres. Use	0	0	800	900	
Pres. Shortage 100 ac.	0	0	400	400	
Res. Loss 500 at 6'	0	0	3,000	3,000	
Total	0	0	4,200	4,200	126,775
<u>Medicine</u> Run-off	-	0	0	50,800	177,575
Pres. Use	0	0	500	500	
Pres. Shortage 250 ac.	0	0	250	250	
Res. Loss 650 ac. at 6'	0	0	3,900	3,900	
Total	0	0	4,650	4,650	172,925
<u>Beaver</u> Run-off	-	0	0	16,500	199,425
Pres. Use	0	0	200	200	
Pres. Shortage 100 ac.	0	0	100	100	
Res. Loss 700 ac. at 4.5'	0	1,575	1,575	3,150	
New Projects 5050 ac.	3,300	4,800	4,800	12,900	
Total	3,300	6,375	6,675	16,500	173,075

Stream Basin

Colorado

Kansas

Nebraska

Totals

Cumulative

<u>Sappa</u>				
Run-off	-			
Pres. Use	-			
Pres. Shortage	200	400	200	
Res. Loss	700	1,000	3,150	
New Projects	9200	6,200	13,800	
Total	0	8,775	176,925	194,475

<u>Prairie Dog</u>				
Run-off	-			
Pres. Use	-			
Pres. Shortage	400	800	400	
Res. Loss	2,000	2,000	2,000	
New Projects	10,000	1,500	11,500	
Total	0	2,100	14,700	189,625

<u>Republican bet. Culbertson & Bloomington</u>				
Run-off	-			
Pres. Use	-			
Pres. Shortage	250	500	250	
New Projects	42,000	63,000	63,000	
Total	0	63,750	63,750	167,775

<u>Republican bet. Bloomington & Guide Rock</u>				
Run-off	-			
Pres. Use	-			
New Projects	108,000	52,000	170,175	
Total	0	52,000	170,175	28,800
Harlan County Res. Loss	20,000	8,800	28,800	0

<u>Recapitulation</u>	<u>Colorado</u>	<u>Kansas</u>	<u>Nebraska</u>	<u>Totals</u>
Pres. Use	17,910	5,500	25,790	49,200
Pres. Shortage	9,680	700	13,025	23,405
Res. Loss	4,650	23,615	26,035	60,300
New Projects	21,875	154,550	169,570	345,995
Total Con. Use	54,115	190,565	234,420	478,900
Per Cent	11.3	39.8	48.9	100.0
Cons. Use excl. Res. Losses	49,465	160,750	208,565	418,600
Per Cent	11.8	38.4	49.8	100.0
Origin of Gross Water	138,924	75,018	264,958	478,900
Supply Above Guide Hook	29.0	15.7	55.3	100.0
Area of Basin in Squares	7,878	5,066	9,622	22,566
Miles above Guide Hook	34.9	22.5	42.6	100.0
Per Cent				

EXHIBIT C

COMPARISON OF STREAM FLOW RECORDS, REPUBLICAN RIVER
(all values in acre-feet per year)

GAGE LOCATION or REACH	FROM SECOND TABLE			BUREAU OF RECLAMATION REPORTED AVG. FLOW	BUREAU OF AG. ECONOMICS REPORTED AVG. FLOW	CORPS OF ENGINEERS REPORTED AVG. FLOW	SOIL CONSERV. SERVICE REPORTED AVG. FLOW
	WATER SUPPLY	PRESENT USE	RESULTING AVG. FLOW				
N.FORK AT CD/NB ST.LN	44700	- 10500	= 34200	25500 (17500)	34940	36300	37210
ARIKAREE	19610	- 2210	= 17400	na	21000	22500	23000
BUFFALO CREEK	7890	- 790	= 7100	8000	na	na	na
ROCK CREEK	11000	- 400	= 10600	na	na	na	na
SOUTH FORK	57200	- 15100	= 42100	49500	39250	40200	38500
REP. NEAR BENKELMAN	--	--	--	na	62360	60000	60000
REP. NEAR MAX	--	--	--	150000 (108600)	143000	149800	160100
"REP. TO CULBERTSON"	14800	- 2000	= 12800	--	--	--	--
COMPACT CUMULATIVE TO CULBERTSON	155200	- 31000	= 124200	--	--	--	--
FRENCHMAN CREEK	98500	- 15000	= 83500	85700	92770	88300	93400
COMPACT CUMULATIVE TO CULBERSON + FRENCHMAN	253700	- 46000	= 207700	--	--	--	--
REP. AT CULBERTSON	--	--	--	‡ 235600 ‡(185600)	147550	194600	217300
BLACKWOOD CREEK	6800	- 0	= 6800	na	na	na	na
DRIFTWOOD CREEK	7300	- 0	= 7300	na	na	na	na
RED WILLOW CREEK	21900	- 800	= 21100	20500 (17900)	22046	24520	na
MEDICINE CREEK	50800	- 500	= 50300	48900	45900	58800	62000
BEAVER CREEK	16500	- 200	= 16300	14415	14415	16320	na
SAPPA CREEK	21400	- 400	= 21000	17220	21120	19250	na
PRAIRIE DOG CREEK	27600	- 800	= 26800	32900	35310	32700	32700
"REP., CULTERSON TO BLOOMINGTON"	41900	- 500	= 41400	--	--	--	--
COMPACT CUMULATIVE TO BLOOMINGTON	447900	- 49200	= 398700	--	--	--	--
REP. AT BLOOMINGTON	--	--	--	467000 (40800)	460200	477700	496200
"REP., BLOOMINGTON TO GUIDE ROCK"	31000	- 0	= 31000	--	--	--	--
COMPACT CUMULATIVE TO GUIDE ROCK	478900	- 49200	= 429700	--	--	--	--
REP. AT HARDY	--	--	--	na	505540	534100	575400
REP. AT SCANDIA	--	--	--	545000 (478000)	548200	552000	561900

() = avg exclusive of 1935 flood
‡ = Includes Frenchman Creek

IRRIGATED AREAS AND RESERVOIR SURFACE AREAS
AS REDUCED FROM ACRE-FEET ALLOCATIONS
(all values in acres)

SUB-BASIN / USE	COLORADO	KANSAS	NEBRASKA	TOTALS <i>acre</i>
NORTH FORK	16	<i>Acres</i>	<i>Ac/ae</i>	
PRES. USE	3750		5000	8750
PRES. SHORTAGE	2000		2500	4500
RES. LOSS	100		100	200
NEW PROJECTS	1000		2000	3000
<hr/>				
ARIKAREE	2810		96	
PRES. USE	1545	0	0	1545
PRES. SHORTAGE	880	0	0	880
RES. LOSS	358	44	148	550
NEW PROJECTS	5088	450	1580	7118
<hr/>				
BUFFALO CREEK			1738	
PRES. USE			877	877
PRES. SHORTAGE			525	525
RES. LOSS			200	200
NEW PROJECTS			200	200
<hr/>				
ROCK CREEK			1800	
PRES. USE			400	400
PRES. SHORTAGE			200	200
RES. LOSS			0	0
NEW PROJECTS			2500	2500
<hr/>				
SOUTH FORK	15	1,49	3700	
PRES. USE	** 6800	3267	0	10067
PRES. SHORTAGE	6800	400	0	7200
RES. LOSS	333	700	0	1033
NEW PROJECTS	3200	9000	500	12700
<hr/>				
REP. BETWEEN ST.LINE AND CULBERTSON				
PRES. USE			2000	2000
PRES. SHORTAGE			* 2000	2000
RES. LOSS			0	0
NEW PROJECTS			3000	3000
<hr/>				
FRENCHMAN CREEK				
PRES. USE			15000	15000
PRES. SHORTAGE			7500	7500
RES. LOSS			800	800
NEW PROJECTS			17000	17000
<hr/>				
DRIFTWOOD CREEK			403	
PRES. USE		0	0	0
PRES. SHORTAGE		0	0	0
RES. LOSS		0	0	0
NEW PROJECTS		333	800	1133

RED WILLOW CREEK			800	800
PRES. USE			* 800	800
PRES. SHORTAGE			500	500
RES. LOSS			0	0
NEW PROJECTS				
			2100	

MEDICINE CREEK			500	500
PRES. USE			250	250
PRES. SHORTAGE			650	650
RES. LOSS			0	0
NEW PROJECTS				
			1700	

BEAVER CREEK			200	200
PRES. USE	0	0	100	100
PRES. SHORTAGE	0	0	350	700
RES. LOSS	0	350	3200	8050
NEW PROJECTS	1650	3200		
			3850	

SAPPA CREEK			200	400
PRES. USE		200	100	200
PRES. SHORTAGE		100	350	700
RES. LOSS		350	4600	9200
NEW PROJECTS		4600		
			5250	

PRAIRIE DOG CREEK			400	800
PRES. USE		400	200	400
PRES. SHORTAGE		200	0	444
RES. LOSS		444	1000	7667
NEW PROJECTS		6667		
			1600	

REP. BETWEEN CULBERSON AND BLOOMINGTON			500	500
PRES. USE			250	250
PRES. SHORTAGE			0	0
RES. LOSS			42000	42000
NEW PROJECTS				
			1600	

REP. BETWEEN BLOOMINGTON AND GUIDE ROCK			0	0
PRES. USE		0	0	0
PRES. SHORTAGE		0	0	0
RES. LOSS		0	0	0
NEW PROJECTS		***74984	***32995	107979

TOTALS			25877	41839
PRES. USE	12095	3867	14425	24805
PRES. SHORTAGE	9680	700	3098	5777
RES. LOSS	791	1888	111375	221547
NEW PROJECTS	10938	99234		

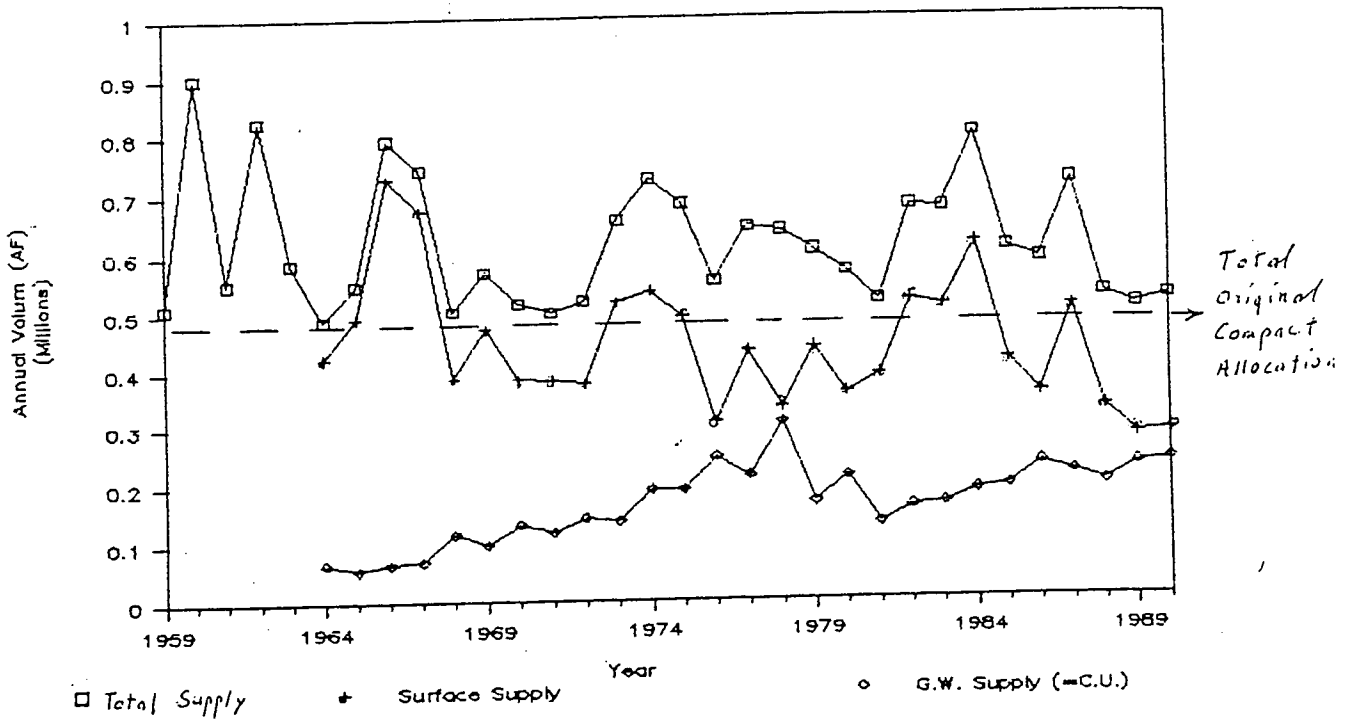
IRRIGATION REQUIREMENT FACTORS USED (af/ac)

PRES. USE	2	1.5	1.5	(SAME AS NEW PROJECTS)
PRES. SHORTAGE	1	1	1	
NEW PROJECTS	2	1.5	1.5	

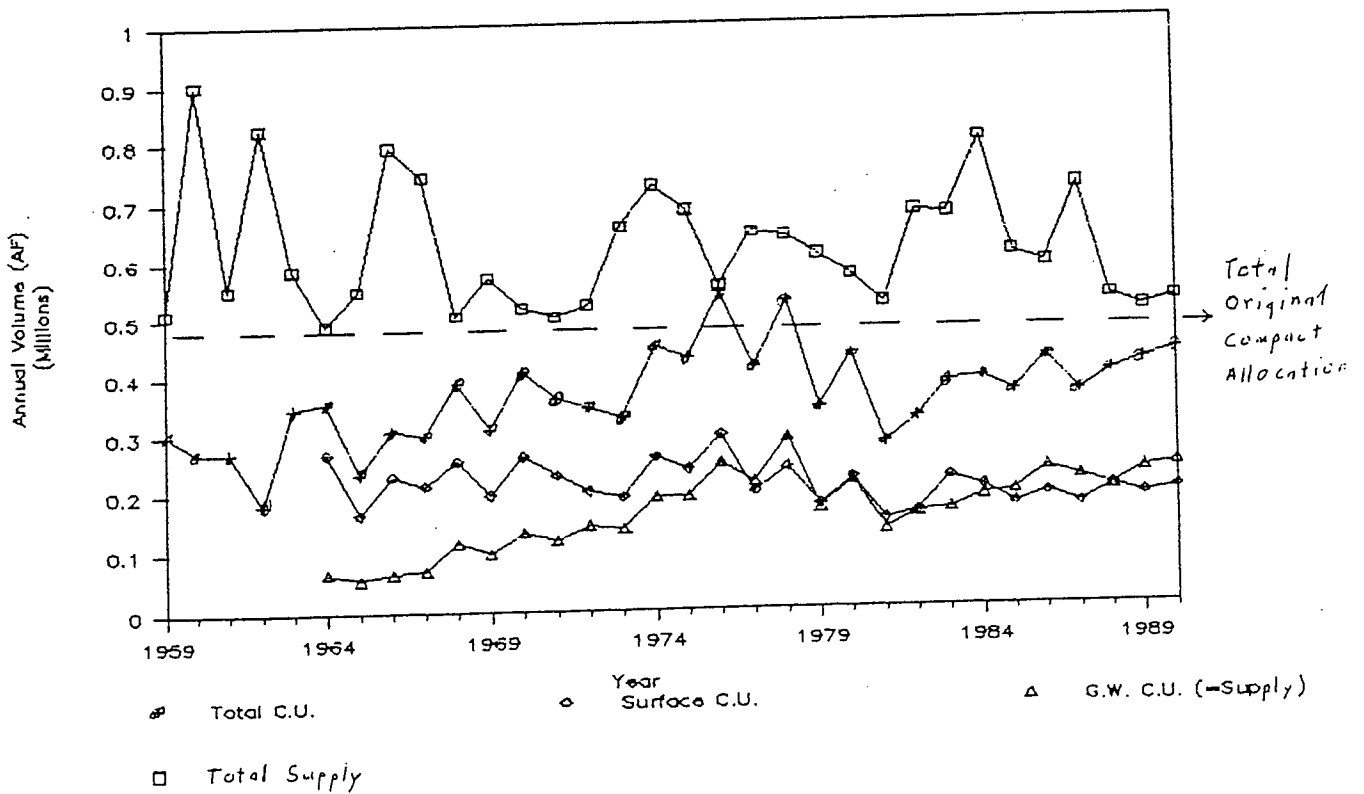
EXCEPTIONS:
 * = 0.5
 ** = 1.5
 *** = 1.576

*Full sup 10 - 10-50
 5000 + 100
 150 ac*

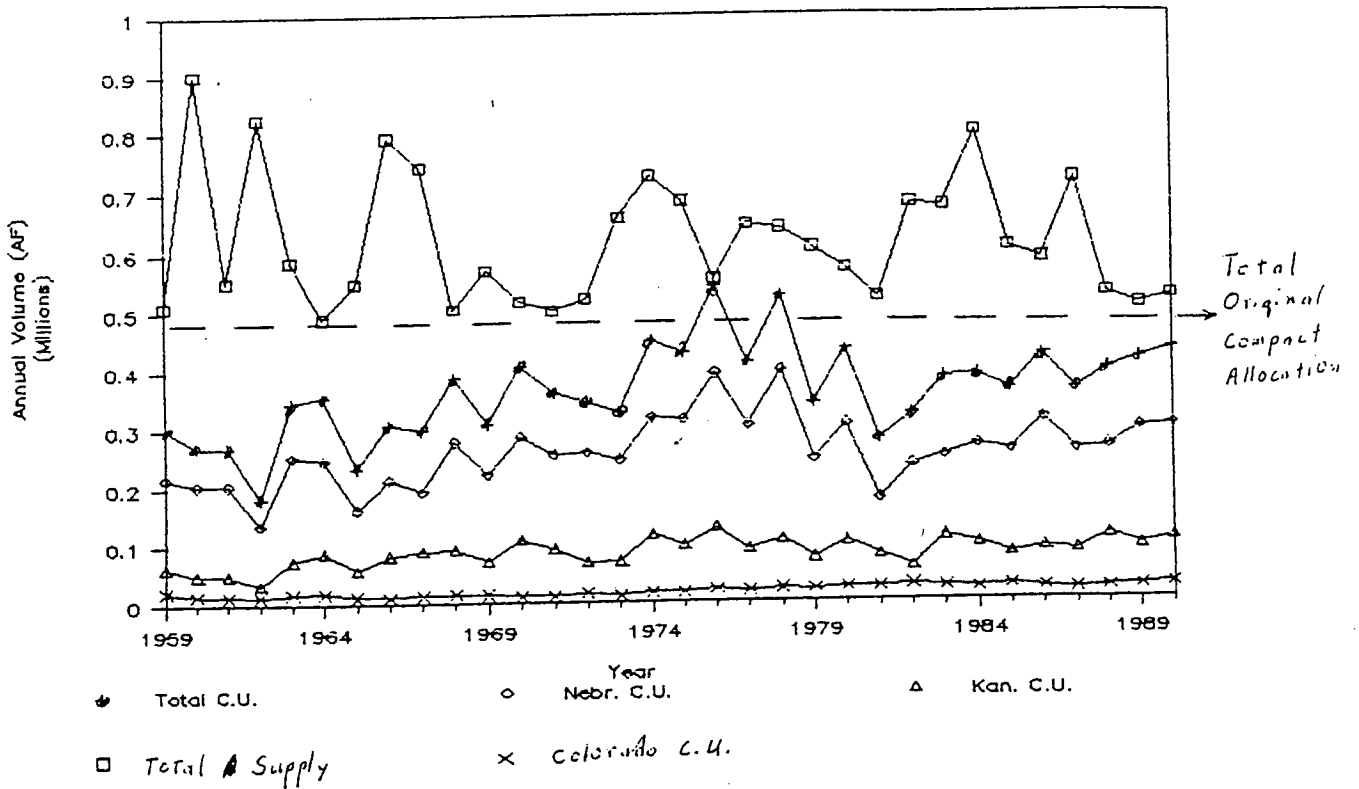
Basin Wide Virginal Water Supply



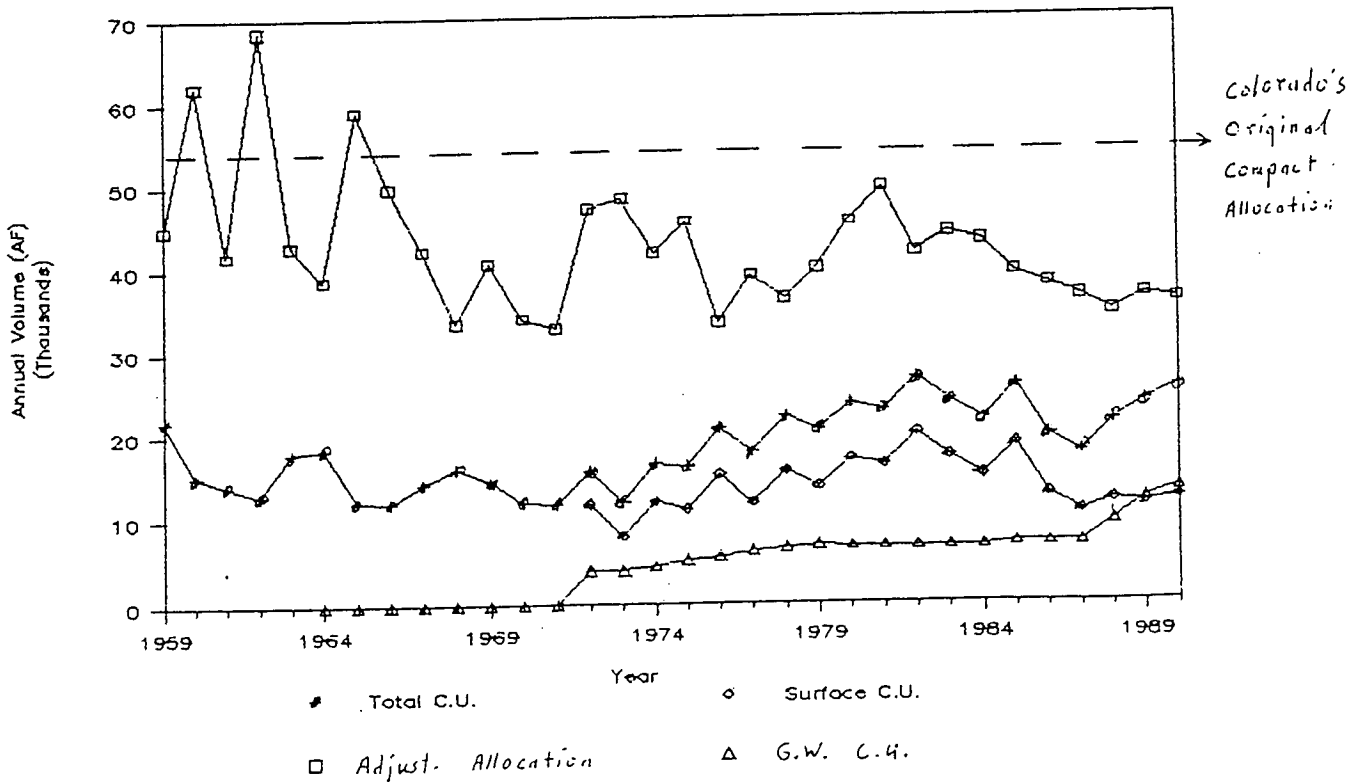
Basin Wide Water Use



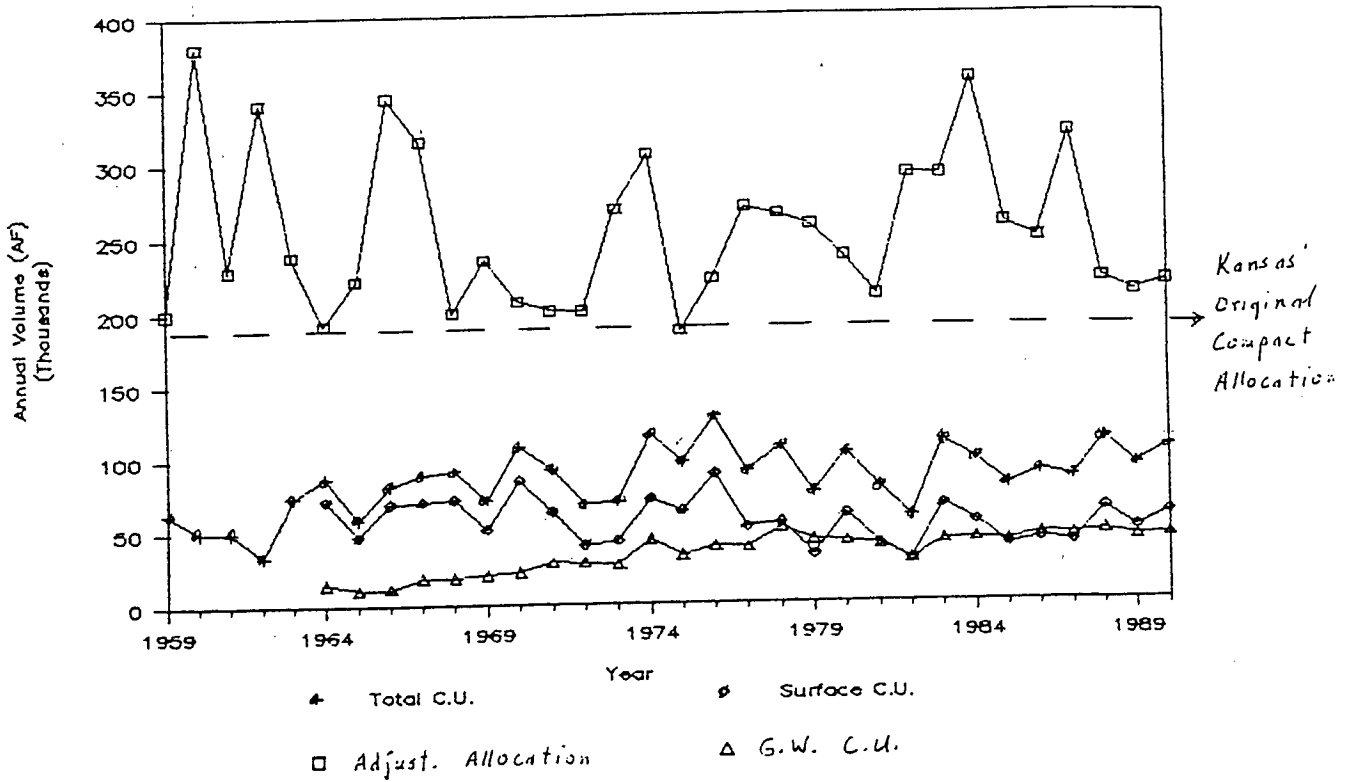
Water Use by States



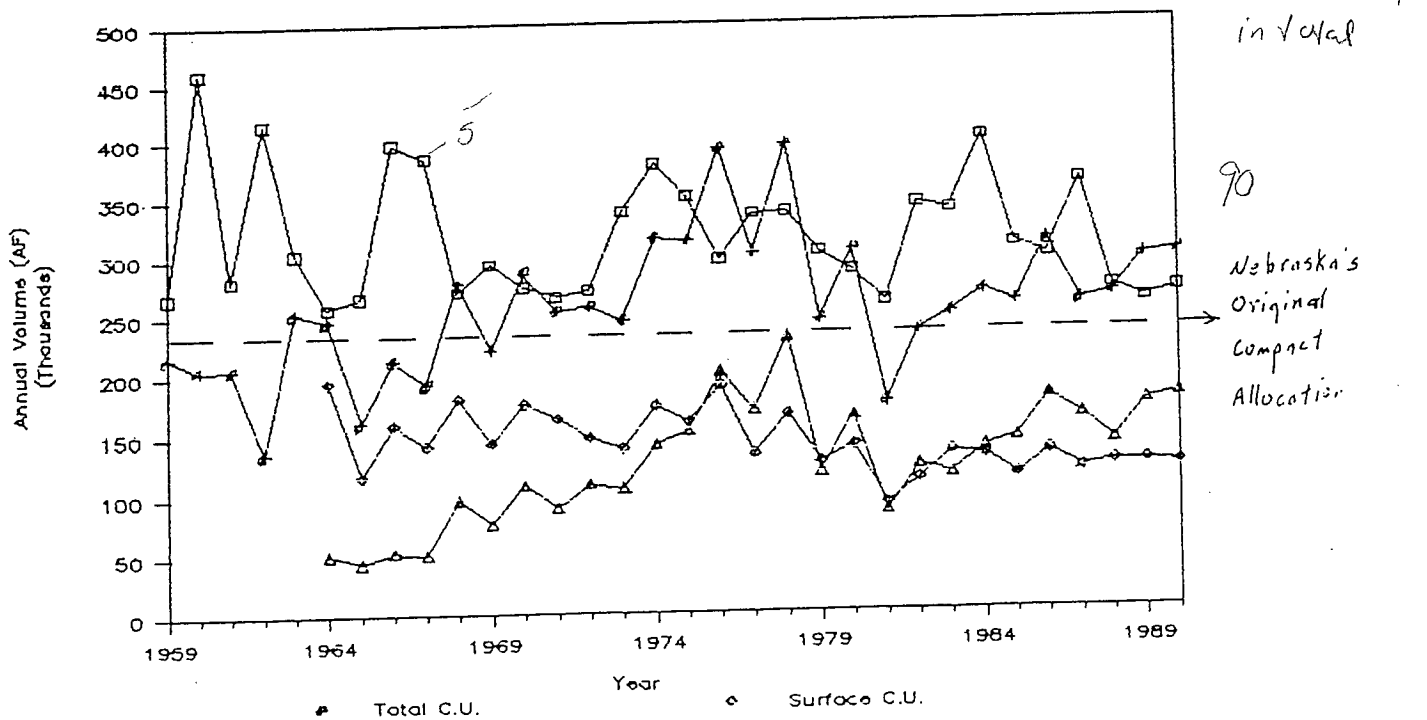
Colorado Water Use



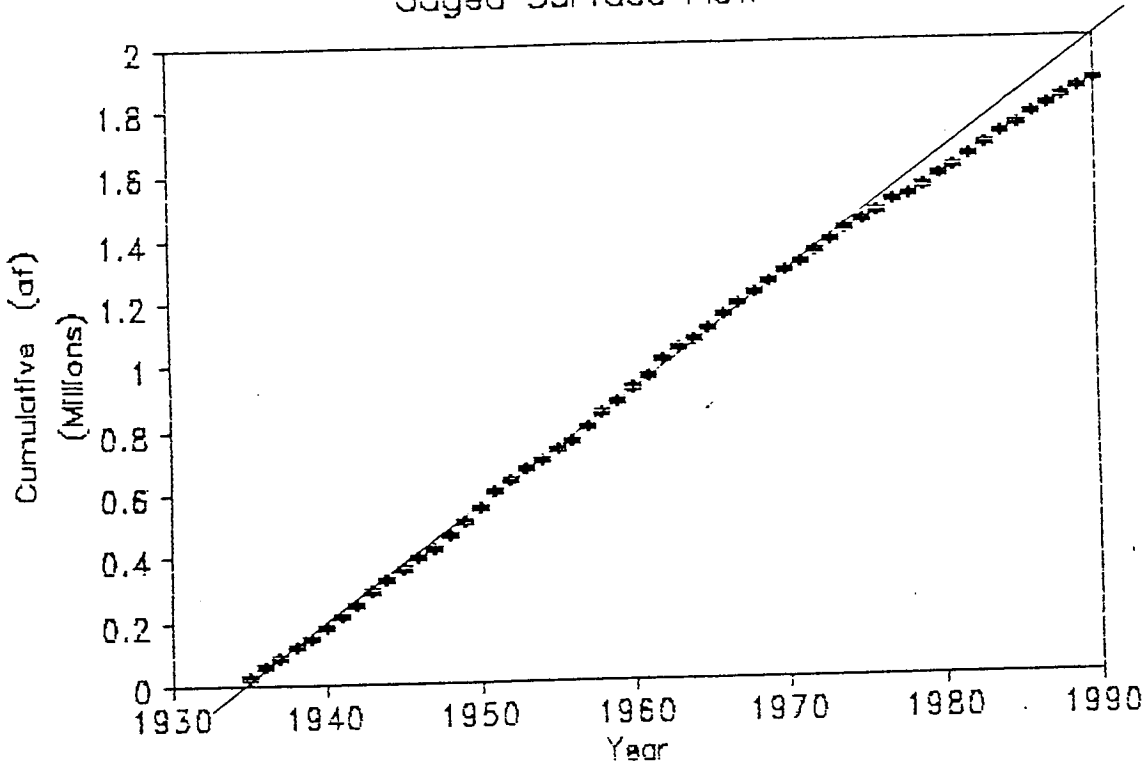
Kansas Water Use



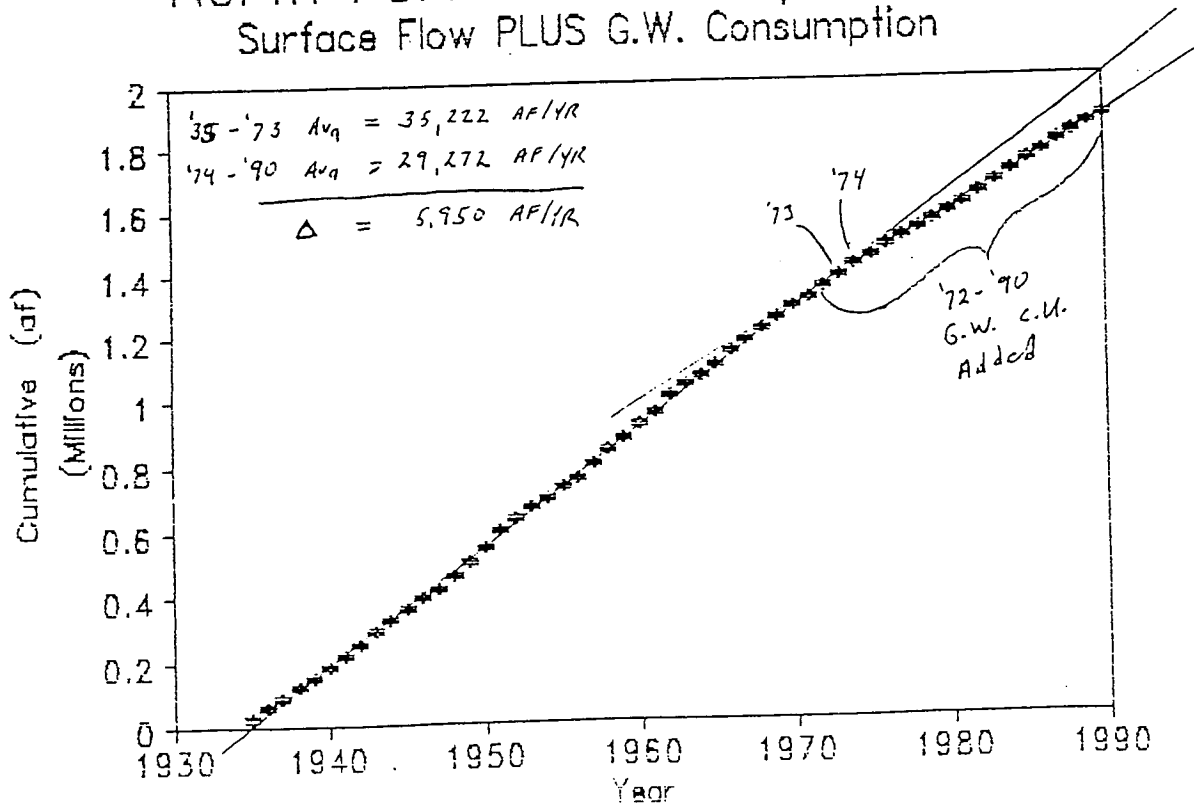
Nebraska Water Use



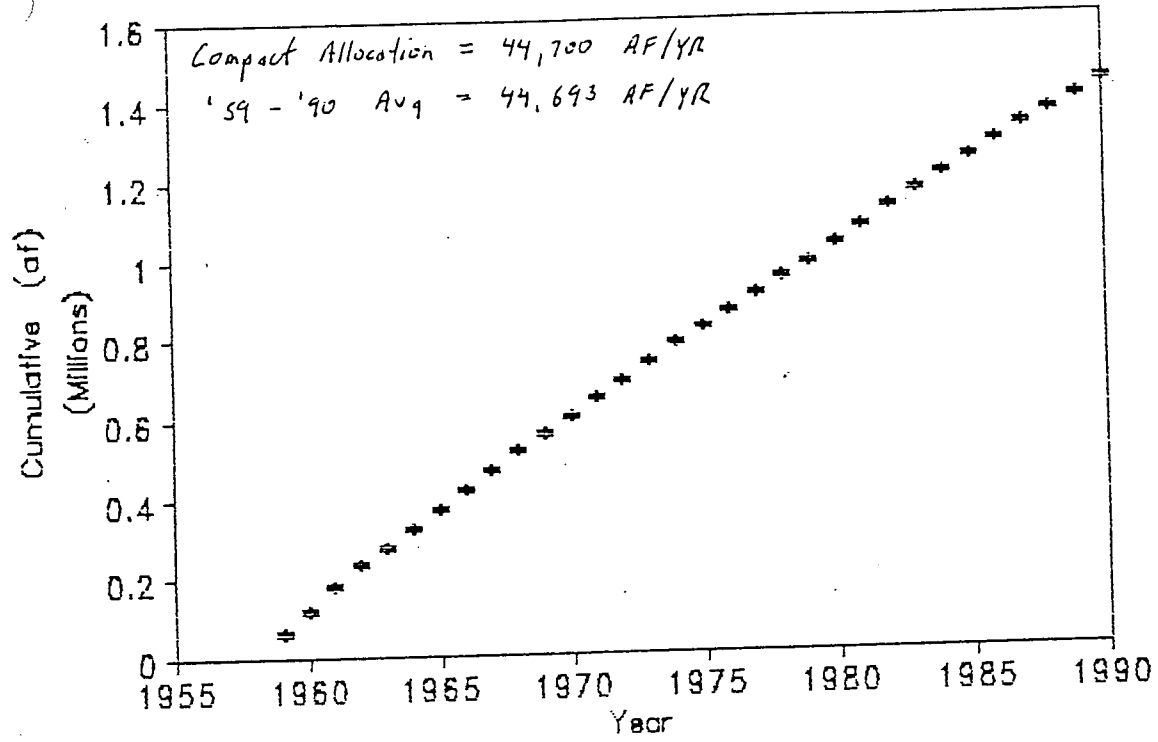
North Fork of the Republican Gaged Surface Flow



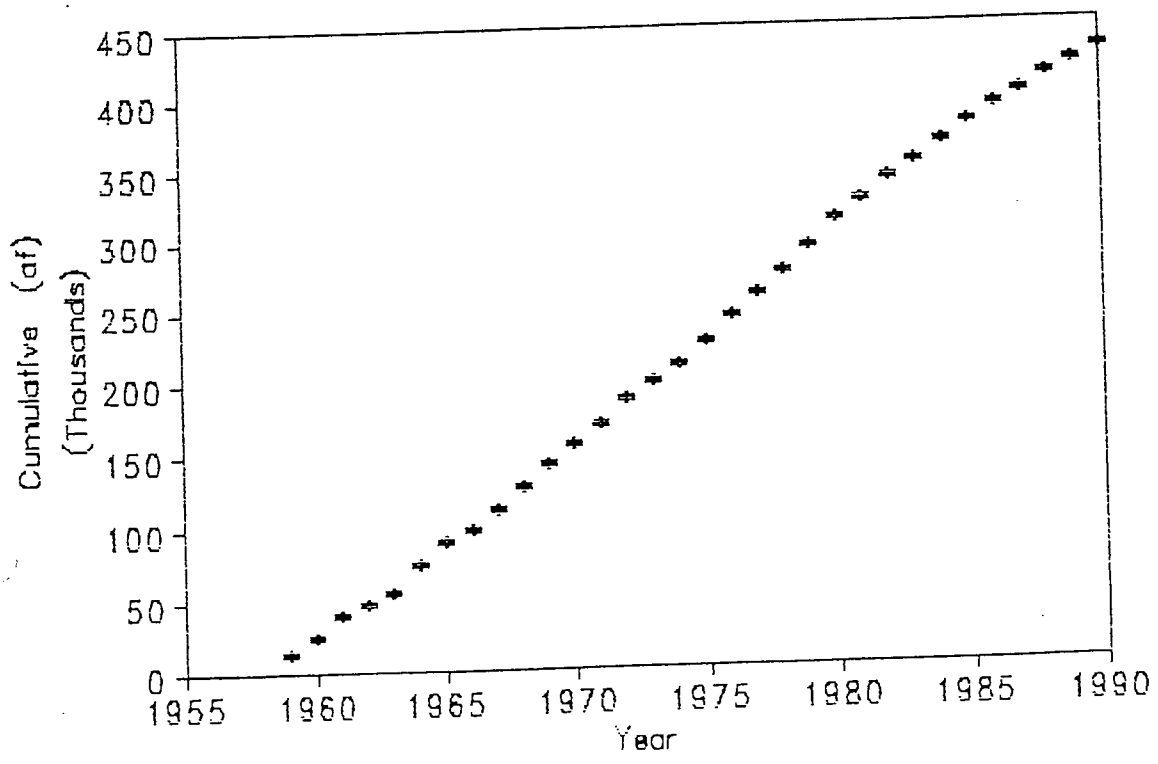
North Fork of the Republican Surface Flow PLUS G.W. Consumption



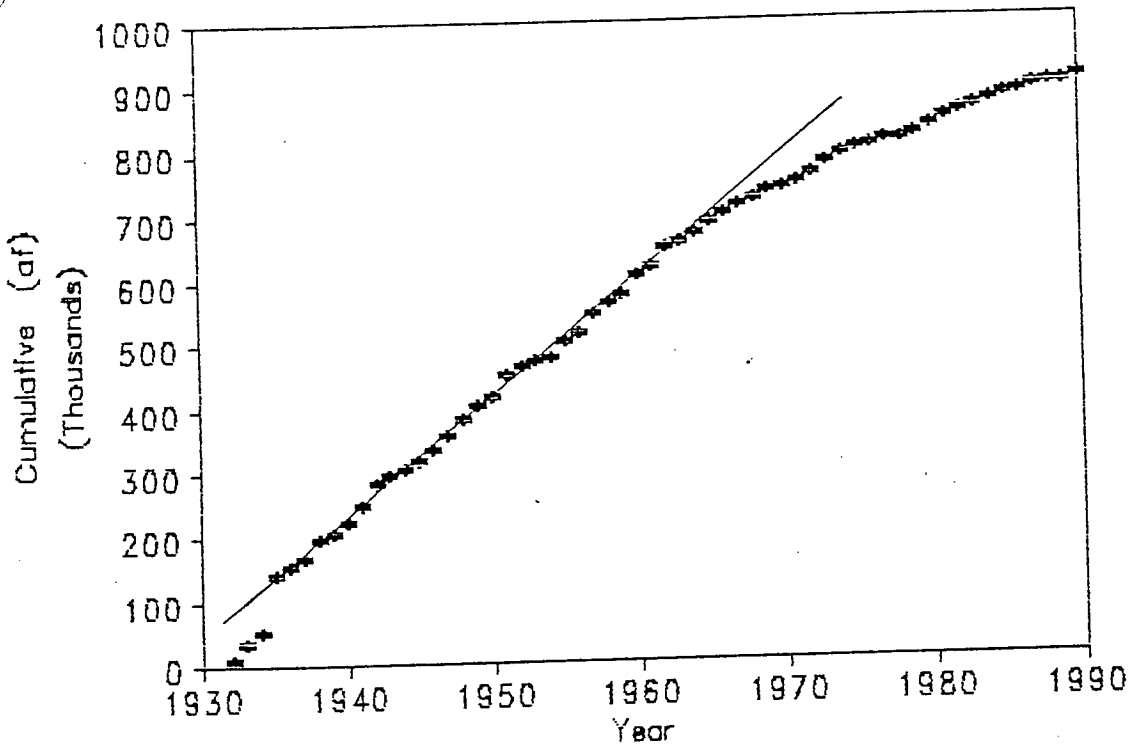
North Fork of the Republican Computed Virgin Supply



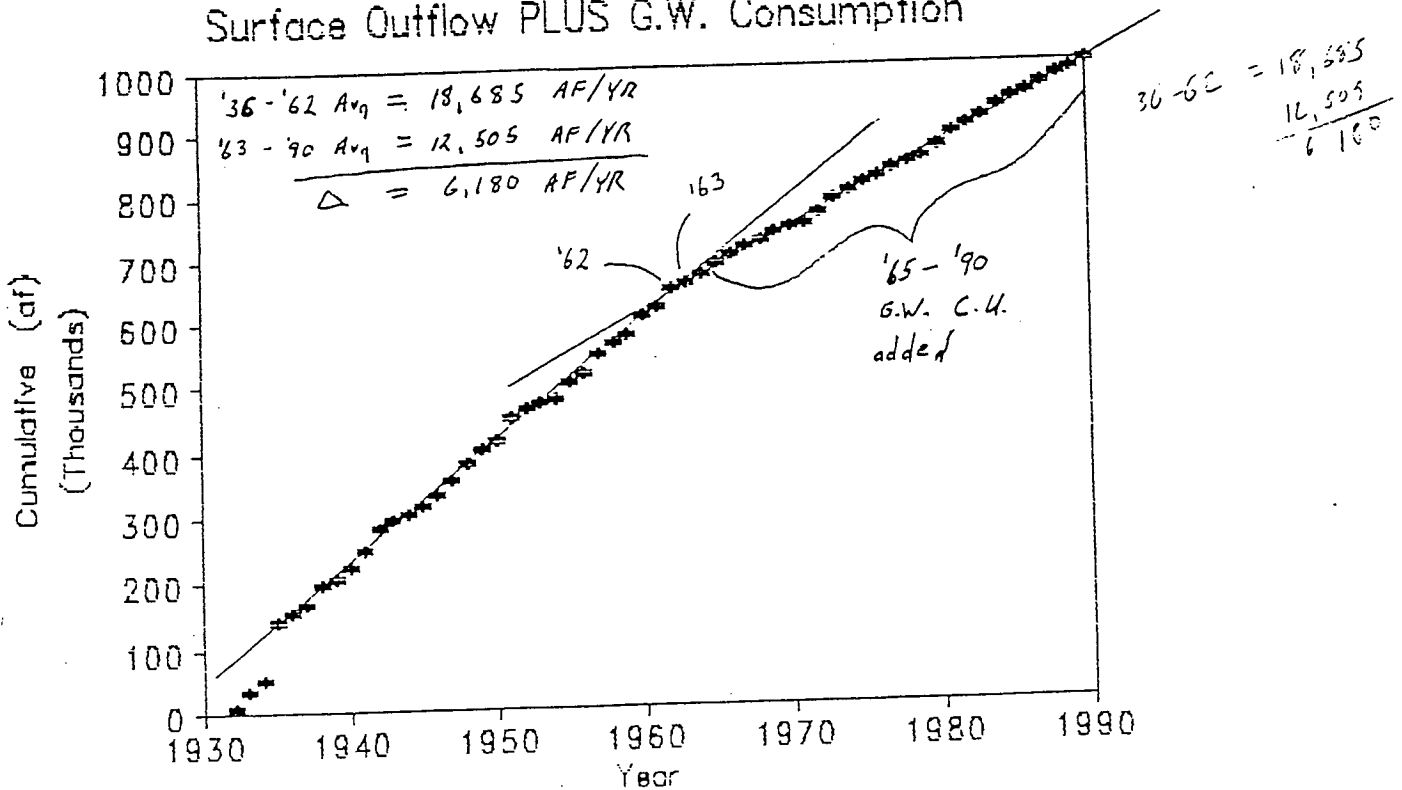
North Fork of the Republican Total Ditch Diversions



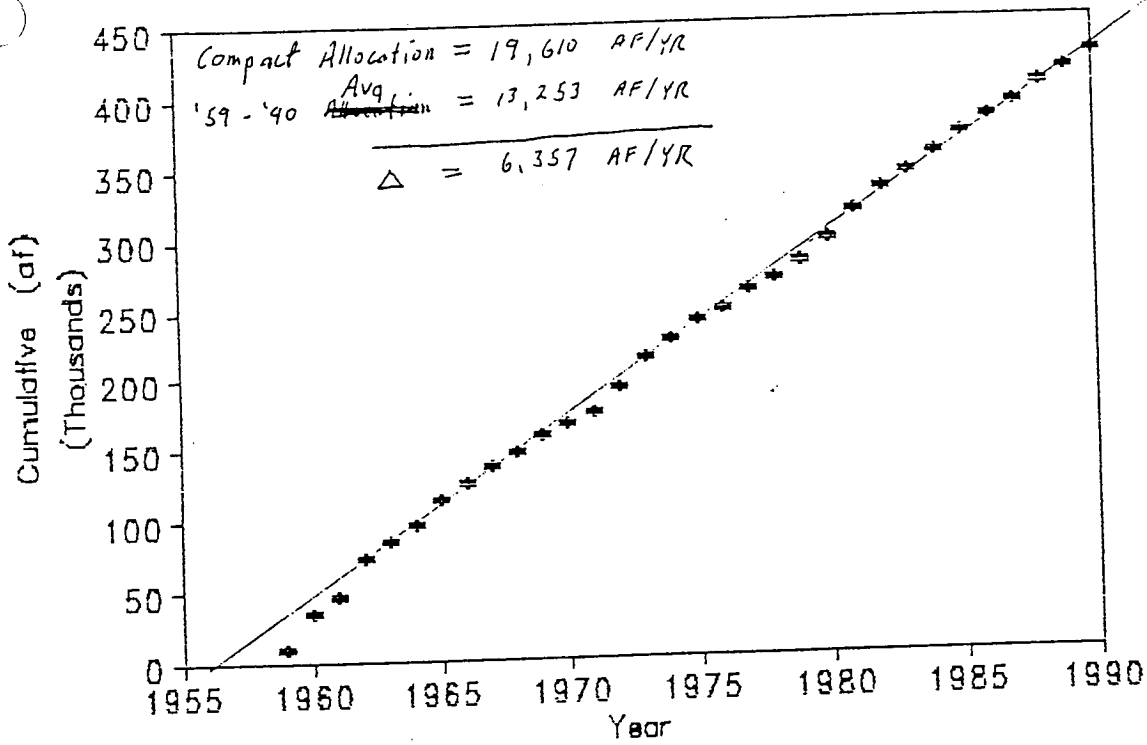
Arikaree Basin Gaged Surface Outflow



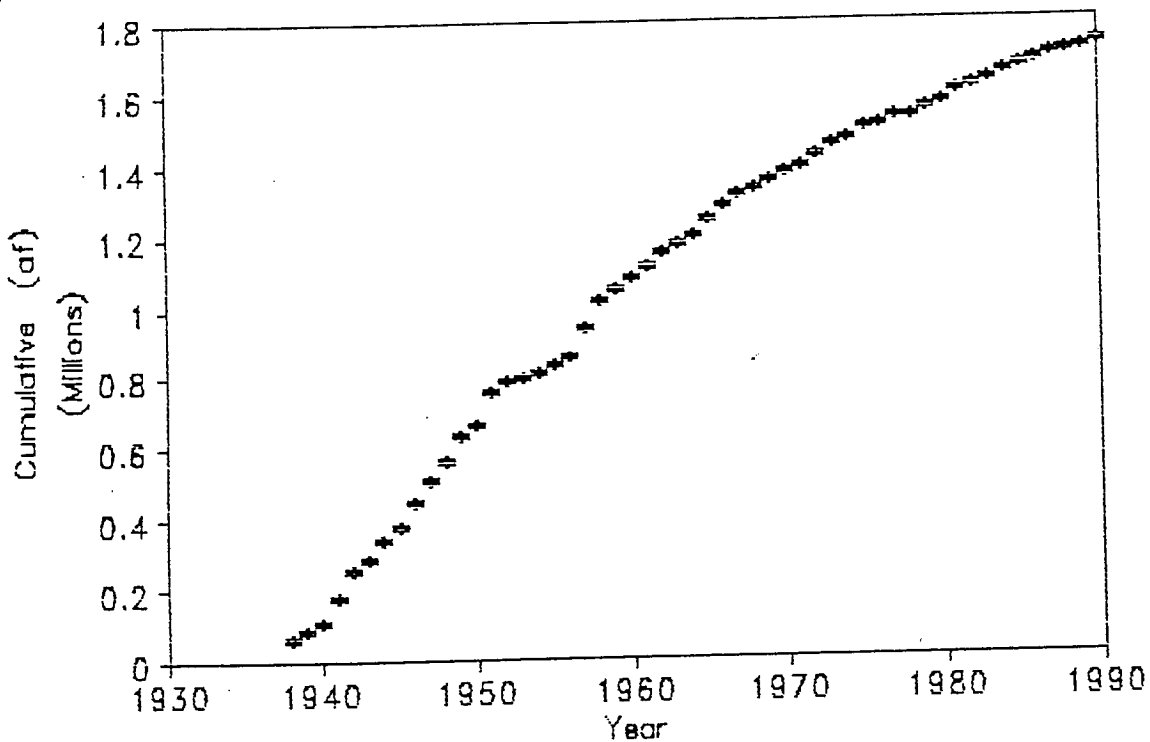
Arikaree Basin Surface Outflow PLUS G.W. Consumption



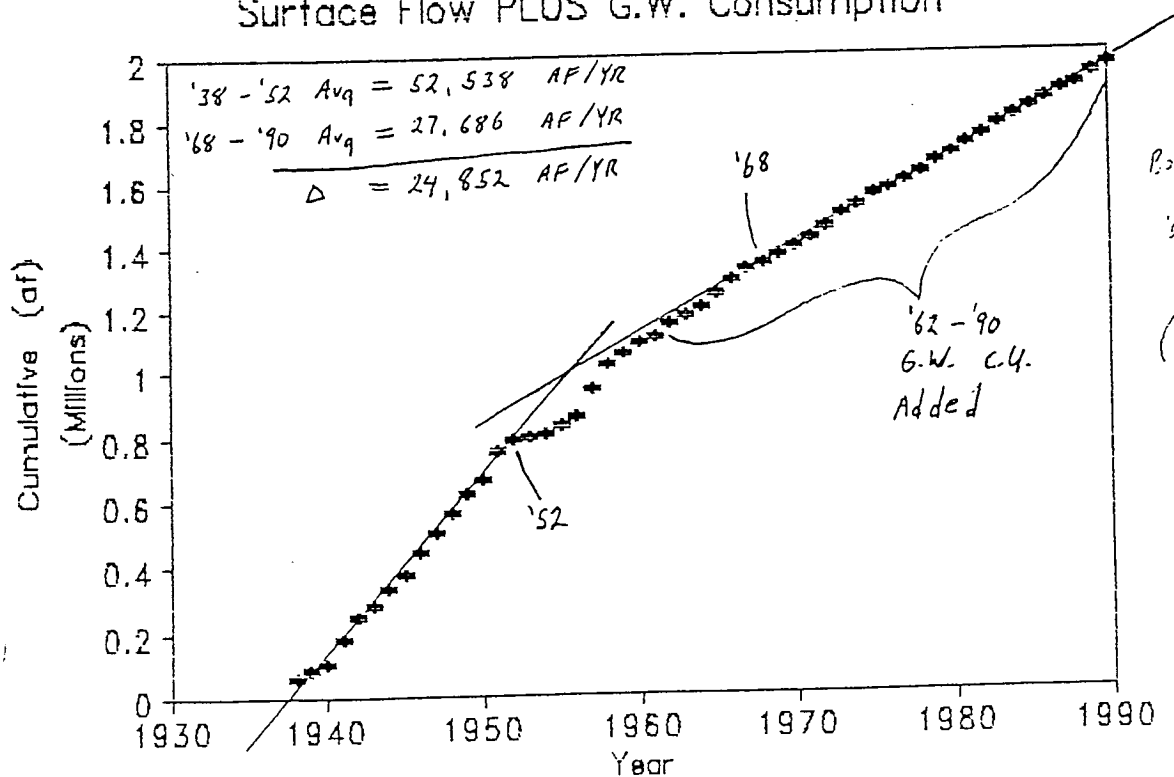
Arikaree Basin Computed Virgin Supply



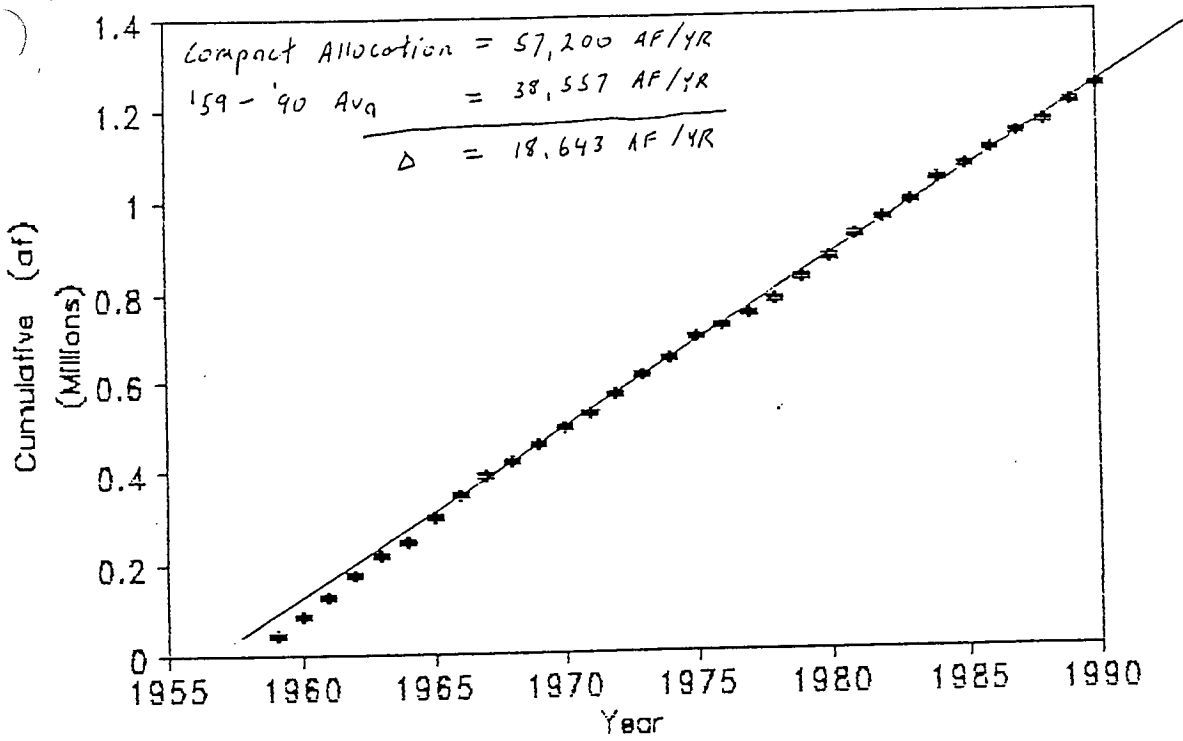
South Fork of the Republican Gaged Surface Flow



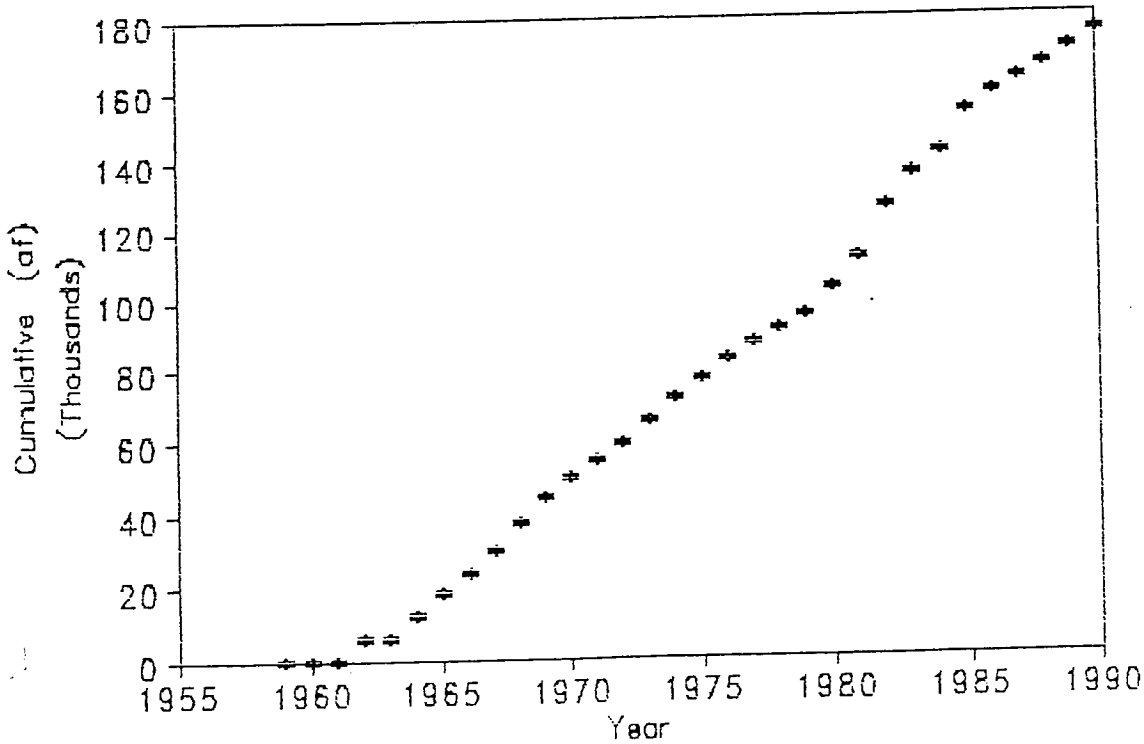
South Fork of the Republican Surface Flow PLUS G.W. Consumption



South Fork of the Republican Computed Virgin Supply



South Fork of the Republican Total Ditch Diversions



MONTHLY AND ANNUAL DISCHARGE, OF NORTH FORK OF REPUBLICAN
RIVER AT COLORADO--NEBRASKA LINE

Unrecorded diversion for Irrigation

From U.S.G.S.-Nebraska Report

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
1924	#2,662	3,200	3,800	4,673	4,372	4,145	3,570	3,074	1,388	615	1,142	893	33,534
1925	1,090	2,082	1,307	738	4,887	5,423	4,403	2,828	952	*2,978	1,335	2,083	30,106
1926	4,243	5,058	5,226	#3,823	#3,749	4,314	3,411	1,277	892	1,967	2,864	1,758	38,582
1927	3,197	4,046	#4,056	3,094	3,532	4,488	4,700	2,169	773	936	1,291	1,368	33,450
1928	3,689	4,700	4,238	4,611	3,049	3,955	2,797	2,828	4,463	2,204	430	2,172	39,136
1929	3,013	4,403	5,395	3,812	3,221	5,095	4,314	4,243	2,519	984	827	1,844	39,670
1930	2,479	3,719	4,120	5,226	3,396	4,568	3,511	3,340	4,245	3,124	2,422	1,963	42,113
1931	*2,644	*2,003	*2,338	*1,947	*2,919	*2,943	*5,900	*4,327	*3,350	0	0	0	28,371
1932	1,730	3,080	4,610	4,920	4,890	6,520	3,820	1,940	1,480	2,190	3,690	2,180	41,050
1933	2,640	4,290	4,930	4,670	3,670	4,000	2,730	4,050	541	17,000	2,130	3,230	53,881
1934	2,570	3,170	4,610	4,490	4,400	4,430	2,570	732	3,060	327	593	1,060	32,012
1935	1,990	2,120	4,040	3,870	3,100	4,650	2,490	3,450	5,160	428	1,760	2,550	35,588
TOTAL	31,947	41,871	48,670	45,874	44,985	54,531	44,216	34,238	28,823	32,753	18,484	21,101	447,493
MEAN	2,662	3,489	4,056	3,823	3,749	4,544	3,685	2,853	2,402	2,729	1,540	1,759	37,291

Mean substituted
* Estimated