PECOS RIVER COMPACT

No. 65, Original

In The Supreme Court of the United States

Amended Decree

Final Report of the River Master

Water Year 1988

Accounting Year 1989

June 15, 1989

Neil S. Grigg

River Master of the Pecos River

P.O. Box 8581

Ft. Collins, Colorado 80524

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Purpose of the Report

In its Amended Decree issued March 28, 1988 the Supreme Court of the United States appointed a River Master of the Pecos River and directed him to "...Deliver to the parties a Preliminary Report setting forth the tentative results of the calculations required by Section III.B.1 of this Decree by May 15 of the accounting year..." and to consider "...any written objections to the Preliminary Report submitted by the parties prior to June 15 of the accounting year..." and to deliver "...to the parties a Final Report setting forth the final results of the calculations required by Section III.B.1 of this Decree by July 1 of the accounting year." The Preliminary Report was delivered as required, and written objections from both states were received and considered. This Final Report provides the results of the required calculations for water year 1988 which determine, according to the Amended Decree (Section III.B.1):

"a. The Article III(a) obligation;
b. Any shortfall or overage, which calculation shall disregard deliveries of water pursuant to an Approved Plan;
c. The net shortfall, if any, after subtracting any overages accumulated in previous years, beginning with water year 1987."

Result of Calculations and Statement of Shortfall or Overage

The results of the calculations in this Final Report show that New Mexico is credited with an overage of 23,600 acre-feet for water year 1988. In Water Year 1987 New Mexico was credited with an overage of 15,400 acre-feet, thus the accumulated overage, beginning in Water Year 1987, is 39,000 acre-feet.

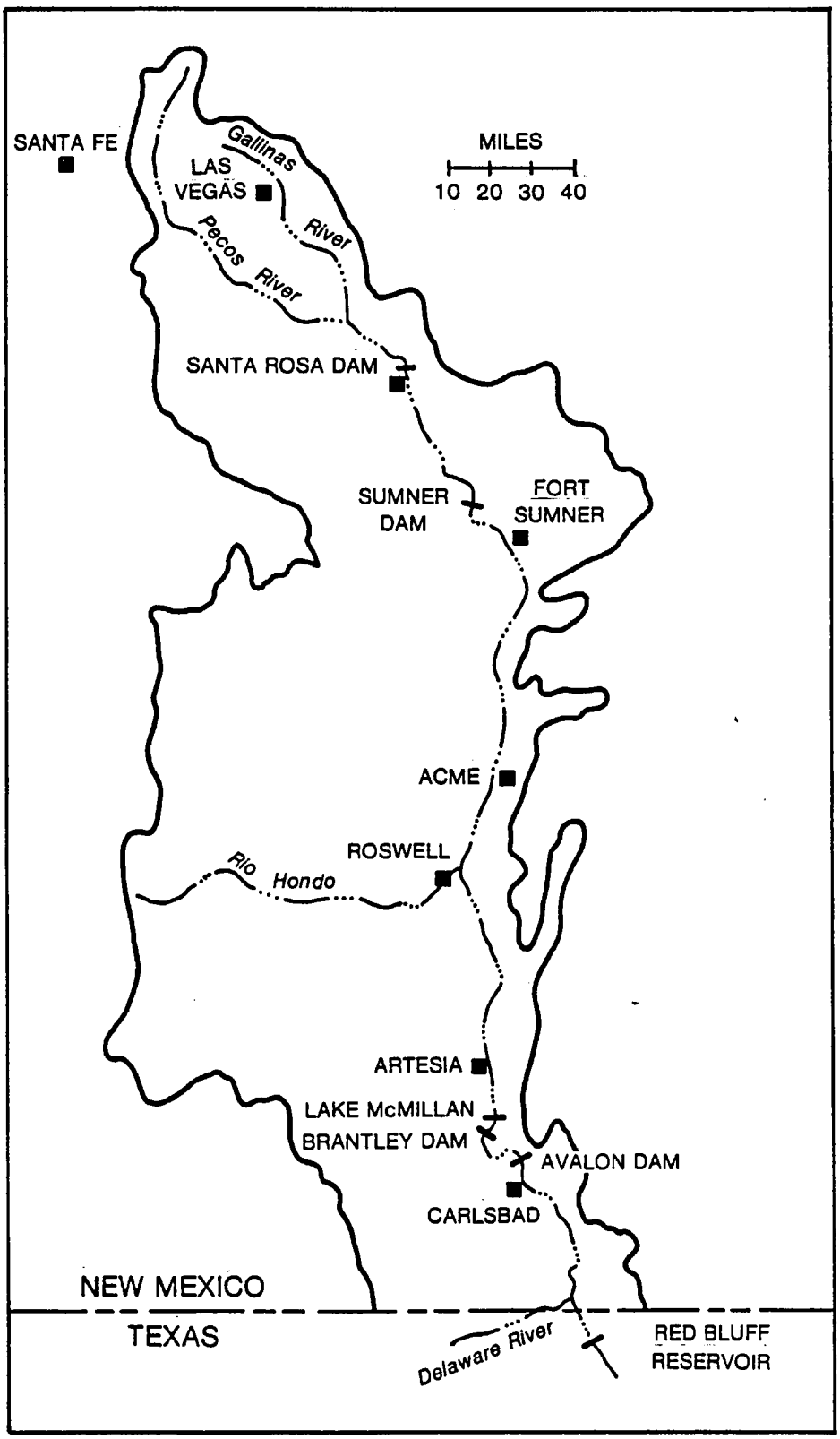

Figure 1. Map of Pecos Basin Showing Accounting Reaches (Adapted from USGS Report: Hydrologic Effects of Phreatophyte Control, 1988)

Table 1. General Calculation of Annual Departures, Thousand Acre-Feet

	1986	1987	1988
B.1.a. Index Inflows			
(1) Annual flood inflow			
(a) Gaged flow Pecos R bel Alamogordo Dam	105.8	196.7	163.2
(b) Flood Inflow Alamogordo - Artesia	100.9	55.9	16.6
(c) Flood Inflow Artesia - Carlsbad	107.3	31.2	-3.2
(d) Flood Inflow Carlsbad - State Line	69.9	7.2	6.8
Total (annual flood inflow)	383.9	291.0	183.4
(2) Index Inflow (3-year avg)			286.1
B.1.b. 1947 Condition Delivery Obligation (Index Outflow)			153.5
B.1.c. Average Historical (Gaged) Outflow			
Gaged Flow Pecos River at Red Bluff NM	268.5	163.5	59.3
Gaged Flow Delaware River nr Red Bluff NM	14.6	6.4	3.2
(1) Total Annual Historical Outflow	283.1	169.9	62.5
(2) Average Historical Outflow (3-yr average)			171.8
B.1.d. Annual Departure			18.3
C. Adjustments to Computed Departure			
1. Adjustments for Depletions above Alam Dam			
a. Depletions Due to Irrigation	-2.5	-2.6	-5.1
b. Depl fr Operation of Santa Rosa Reservoir	35.3	-19.1	-19.6
c. Transfer of Water Use to Upstream of AD	0	0	0
Recomputed Index Inflows			
(1) Annual flood inflow			
(a) Gaged flow Pecos R bel Alamogordo Dam	138.6	175	138.5
(b) Flood Inflow Alamogordo - Artesia	100.9	55.9	16.6
(c) Flood Inflow Artesia - Carlsbad	107.3	31.2	-3.2
(d) Flood Inflow Carlsbad - State Line	69.9	7.2	6.8
Total (annual flood inflow)	416.7	269.3	158.7
Recomputed Index Inflow (3-year avg)			281.6
Recomputed 1947 Condition Del Outflow (Index Outflow)			150.1
Recomputed Annual Departures			21.7
Credits to New Mexico			
C.2 Depletions Due to McMillan Dike			1.9
C.3 Salvage Water Analysis			0
C.4 Unappropriated Flood Waters			0
C.5 Texas Water Stored in NM Reservoirs			0
C.6 Beneficial C.U. Delaware River Water			0
Final Calculated Departure, TAF			23.6

Table 2. Determination of Flood Inflows, Alamogordo Dam to Artesia - 1988 (B.3)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
Flow bel Alamog Dam	.1	3.1	6.0	4.4	33.7	19.4	23.5	18.2	48.7	6.2	.0	.0	163.2
FtSumner Irrig Div	.0	2.7	5.9	4.3	5.2	5.7	5.3	5.5	4.2	5.9	.2	.0	44.8
Ft Sumner ID Return	.9	.7	1.7	1.9	2.8	2.8	2.8	2.8	2.6	2.4	1.2	.9	23.7
Flow past FS IDist	1.1	1.1	1.7	2.0	31.4	16.6	21.0	15.5	47.1	2.7	1.2	1.0	142.1
Channel loss	.4	.4	.6	1.4	4.8	3.9	3.1	3.0	6.5	.8	.4	.4	25.6
Residual Flow	.7	.7	1.1	.6	26.5	12.7	17.9	12.6	40.5	1.9	.8	.6	116.7
Base Inflow	4.7	3.8	3.0	1.8	1.6	1.6	1.8	2.0	2.0	2.3	2.5	2.6	29.7
River Pump Divers	.0	.0	.6	1.1	1.4	1.7	1.5	2.2	1.5	.4	.1	.0	10.5
Residual, Artesia	5.4	4.5	3.5	1.3	26.7	12.6	18.2	12.4	41.0	3.8	3.2	3.2	135.9
Pecos Flow Artesia	6.8	7.3	4.4	2.3	23.2	6.9	25.3	5.2	50.4	12.3	4.3	4.0	152.4
Flood Inflow, AD-Art	1.5	2.8	.9	1.0	-3.5	-5.7	7.2	-7.2	9.3	8.5	1.0	.8	16.6

Table 3. Determination of Flood Inflows, Artesia to Carlsbad - 1988 (B.4)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
Pecos R at Artesia	6.8	7.3	4.4	2.3	23.2	6.9	25.3	5.2	50.4	12.3	4.3	4.0	152.4
Major John Springs	.9	.8	.9	.8	.8	.8	.7	.8	.7	.8	.8	.8	9.6
Carlsbad Springs	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	1.2
Total Inflow	7.8	8.2	5.4	3.2	24.1	7.8	26.1	6.1	51.2	13.2	5.2	4.9	163.2
Channel Losses	1.1	1.2	.6	.1	4.6	1.1	5.1	.7	10.5	2.3	.5	.5	28.4
Evap Loss, Av-McM-Br	.8	1.0	2.9	2.0	1.5	1.8	1.8	.9	.7	1.9	1.5	.8	17.60
Sto Change, Av-McM-Br	3.0	2.7	-5.7	-11.1	6.9	-8.0	8.1	-8.0	22.4	-3.5	.1	1.2	8.10
Carls ID diversions	.0	.8	6.6	13.6	11.3	14.1	10.4	14.3	7.2	9.7	.0	.0	87.8
93% CID diver	.0	.7	6.1	12.7	10.5	13.1	9.7	13.3	6.7	9.0	.0	.0	81.7
Other depletions	.1	.1	.1	.1	.1	.1	.2	.2	.1	.1	.1	.1	1.4
Pecos R at Carlsbad	1.9	1.9	2.2	1.9	1.8	1.6	1.8	2.0	1.7	2.7	1.8	1.5	22.8
Total Outflow	6.9	7.6	6.2	5.7	25.4	9.7	26.6	9.1	42.1	12.4	4.1	4.1	160.0
Flood Inflow	-.9	-.6	.8	2.5	1.3	1.9	.5	3.0	-9.1	-.8	-1.1	-.8	-3.2

Table 4. Flood Inflows: Carlsbad to New Mexico - Texas State Line

Hydrograph scalping: Pecos River at Red Bluff	+ 7440 AF
Hydrograph scalping: Pecos River Below Dark Canyon	- 888 AF
Hydrograph scalping: Delaware River	+ 93 AF
Gaged Flow: Dark Canyon Draw	+ 160 AF
Total Flood Inflow	6805 AF

Table 5. Depletions Due to Irrigation Above Alamogordo Dam - 1988

	APR	MAY	JUN	JUL	AUG	SEPT	OCT	TOTAL
Precip Las Vegas	1.53	2.48	3.05	6.27	5.32	2.65	.27	
Eff precip Las Vegas	1.43	2.20	2.61	4.08	3.91	2.33	.27	
Precip Pecos RangerS	.97	1.75	2.22	2.43	5.48	2.92	.00	
Eff Precip Pecos RS	.92	1.63	2.01	2.16	3.96	2.52	0	
Precip Santa Rosa	2.32	1.56	2.51	2.75	.82	2.82	.38	
Eff Precip Santa Ro	2.08	1.46	2.23	2.41	.80	2.46	.37	
Average precip, ft	.12	.15	.19	.24	.24	.20	.02	
consumptive use, ft	.19	.36	.36	.30	.27	.18	.11	1.77
CU less eff precip, ft	.07	.21	.17	.06	.03	0	.09	.63

Acres (most recent inventory)	9057
Streamflow depletion, AF	5716
1947 depletion, AF	10804
Difference, AF	5088

Table 6. Depletions Due to Santa Rosa Reservoir Operations - 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
Alamogor ga ht, avg	57.31	58.99	58.49	58.00	51.77	45.92	47.51	47.13	44.29	45.47	46.36	49.44	
Alacontent	41604	45912	44601	43341	29301	19474	21824	21240	17182	18853	20100	24997	
AlaArea	2484	2644	2596	2550	1958	1402	1553	1517	1242	1359	1443	1736	
Alaevap	2.44	3.74	8.36	10.79	12.29	12.51	12.02	9.62	8.78	6.97	7.08	4.41	99.01
.77Evap	1.88	2.88	6.44	8.31	9.46	9.63	9.26	7.41	6.76	5.37	5.45	3.40	
AlaPrecip	.16	.07	.08	1.01	1.65	1.95	5.70	2.00	2.88	.18	.02	.24	15.94
NetEvap	1.72	2.81	6.36	7.30	7.81	7.68	3.56	5.41	3.88	5.19	5.43	3.16	
AlaEvaploss	.36	.62	1.38	1.55	1.27	.90	.46	.68	.40	.59	.65	.46	
L S Rosa ga ht, avg	47.49	47.51	47.60	47.74	47.71	47.53	43.14	44.87	42.05	38.51	38.64	38.90	
SRcontent	111517	111596	111951	112504	112386	111675	95237	101511	91417	79703	80115	80942	
SRarea	3944	3946	3954	3967	3964	3948	3548	3700	3459	3166	3177	3199	
SRevap	3.72	5.22	9.13	6.29	8.39	8.93	9.34	6.96	7.43	5.38	5.78	3.72	80.29
.77Evap	2.86	4.02	7.03	4.84	6.46	6.88	7.19	5.36	5.72	4.14	4.45	2.86	
Lake SR precip	.25	.04	.16	2.39	1.81	3.33	4.07	1.33	4.11	.21	.17	.28	18.15
NetEvap	2.61	3.98	6.87	2.45	4.65	3.55	3.12	4.03	1.61	3.93	4.28	2.58	
SREvaploss	.86	1.31	2.26	.81	1.54	1.17	.92	1.24	.46	1.04	1.13	.69	
totalevaploss	1.22	1.93	3.64	2.36	2.81	2.06	1.38	1.93	.87	1.62	1.79	1.15	
sumcontents	153121	157508	156552	155845	141687	131149	117061	122751	108599	98556	100215	105939	
1947area	4600	4600	4600	4600	4600	4600	4228	4375	4019	3759	3803	3952	
1947loss	.66	1.08	2.44	2.80	3.00	2.95	1.25	1.97	1.30	1.62	1.72	1.04	
current-1947	.56	.85	1.20	-.44	-.18	-.88	.13	-.05	-.43	.00	.07	.11	
									annual	adjustment =		.93	

ADJUSTMENT FOR EXCESS STORAGE IN SANTA ROSA RESERVOIR

	1987	1988
EndYear Sumner Sto	38196	27446
EndYear S R Sto	111675	81454
Sum	149871	108900
Sto Adjustment, AF	29481	-20571
Adjustm Ex Evap, TAF		.93
Total Adjustment,TAF		-19.6

Table 7. Major Johnson Springs New Water - 1988

month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
well	69.3												
Q, cfs	16.8	16.8	16.8	14.3	14.3	14.3	11.8	11.8	11.8	14.3	14.3	14.3	
acre-ft	.9	.8	.9	.8	.8	.8	.7	.8	.7	.8	.8	.8	9.6

Explanation: well is the calculated average July-August-September depth to water in well number 20.26.8.1211. Q is the calculated discharge in cfs using the equations in the RMM. Acre-feet is the monthly quantity converted to acre-feet. If this equation is used for the entire year the result is 10.3 TAF. Since Brantley Reservoir started filling about 9-1-88 the well procedure is determined to be valid only until then. The annual value of 9.6 TAF is arrived at by prorating 8 months at an annual rate of 10.3 TAF and four months at 8.2 TAF.

Table 8. Carlsbad Springs New Water 198

	1988
Pecos R bel DC, cfs	31.7
Dark Canyon, cfs	.2
Pecos R bel Lake Av, cfs	.1
Depletion, cfs	2.0
CID lag seep, cfs	8.6
Return flow, cfs	1.0
Lake Av seep lag, cfs	19.2
PR seepage, cfs	3.0
Carls new water, cfs	1.6
Carls new wat, AF	1151.1
Carls new wat monthly, AF	95.9

Table 9. Carlsbad Main Canal Seepage lagged - 1988

1987	1Q	2Q	3Q	4Q
FLOWS, cfs			192.60	51.90
SEVEN %			13.48	3.63
LAG				

1988	1Q	2Q	3Q	4Q
FLOWS, cfs	40.90	216.30	174.60	53.00
SEVEN %	2.86	15.14	12.22	3.71
LAG	4.89	9.13	11.64	8.45

Average = 8.55 cfs

Table 10. Lake Avalon leakage lagged - 1988

1987	1Q	2Q	3Q	4Q
gage			17.36	17.60
flows, cfs			20.98	22.13
lag				

1988	1Q	2Q	3Q	4Q
gage	19.34	16.13	16.42	14.27
flows, cfs	30.45	15.10	16.49	6.21
lag	26.10	21.39	18.35	11.12
		Total		76.95

Average = 19.19 cfs

Table 11. Evaporation Loss at Lakes McMillan, Avalon and Brantley - 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
McMillan gage ht, avg	23.92	24.72	25.07	21.89	19.59	20.60	23.01	20.36	21.46	20.87	19.45	19.93	
Avg area McMil	3464	3956	4210	2323	1376	1745	2948	1649	2105	1856	1325	1497	
Avalon gage ht, avg	19.80	19.77	18.44	16.07	16.10	16.21	16.15	16.03	17.09	16.18	13.91	12.72	
Avg area Avalon	878	875	784	578	582	599	590	572	689	595	156	66	
precipBrantley	.05	.38	.01	.59	.52	1.92	3.80	2.88	4.35	0	0	.44	14.94
precipArtesia	.09	.86	.01	.20	2.93	2.03	3.16	1.33	4.03	.04	.04	.44	.00
precipCarlsbad	.02	.48	.01	.42	.82	2.25	2.41	3.74	4.74	.00	.00	.50	15.39
lakeevap *	2.13	3.03	7.08	8.69	10.80	11.50	8.83	7.83	6.88	5.46	5.84	3.24	81.31
netevapMcM **	2.08	2.36	7.07	8.38	8.93	9.36	6.05	5.30	2.50	5.44	5.82	2.77	66.04
lossMcM	599	778	2480	1622	1023	1361	1485	728	438	841	643	346	12344
netevapAvalon	2.11	2.55	7.07	8.27	9.98	9.25	6.42	4.09	2.14	5.46	5.84	2.74	65.92
lossAvalon	154	186	462	398	484	462	316	195	123	271	76	15	3142
Total loss, TAF (AvMc)	.8	1.0	2.9	2.0	1.5	1.8	1.8	.9	.6	1.1	.7	.4	15.49
Brantley gage ht, avg									231.27	244.92	245.38	245.47	
Avg Br area	0	0	0	0	0	0	0	0	482	1654	1702	1712	
netevapBrantley***	2.08	2.65	7.07	8.10	10.28	9.58	5.03	4.95	2.53	5.46	5.84	2.80	
lossBrantley	0	0	0	0	0	0	0	0	102	753	828	399	2082
Totalloss A+M+B,TAF	.8	1.0	2.9	2.0	1.5	1.8	1.8	.9	.7	1.9	1.5	.8	17.57

* Evap was calculated Jan-Mar; Brantley values used Apr - Dec
** Evap reduced by average of Artesia/Carlsbad precipitation; Brantley precip available but not called for in RHM
*** Evap reduced by Brantley precipitation

Table 12. Evaporation Calculations for Lake Avalon and Data for Brantley - 1988
(Humidity at Roswell, Temp avg at Artesia and Carlsbad)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
%Daytime	7.17	6.95	8.36	8.76	9.65	9.62	9.80	9.29	8.34	7.92	7.08	7.02	100
Humidity	61	56	34	36	43	43	57	60	49	50	33	50	47.7
Temperature	38.2	45.0	51.3	59.3	68.9	76.8	78.6	78.3	71.1	62.5	52.4	40.4	60.2
Evap (computed)	2.13	3.03	7.08	8.63	10.30	11.61	9.48	8.32	8.14	6.42	6.01	3.04	84.19
Evap at Brantley				11.29	14.03	14.94	11.47	10.17	8.93	7.09	7.58	4.21	
0.77*Evap/Brantl				8.69	10.80	11.50	8.83	7.83	6.88	5.46	5.84	3.24	

Table 13. Change in storage, Lakes McMillan, Brantley and Avalon 1988
(Gage heights from last day of each month)

	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
Lake Avalon gage, ft	19.70	19.85	19.30	15.65	16.60	16.35	17.15	15.80	15.70	18.80	14.60	12.90	12.80	12.80
Avalon storage, AF	3715	3843	3372	806	1355	1197	1716	879	830	2957	388	117	111	
Av change stor, AF		128	-471	-2566	549	-158	519	-837	-49	2127	-2569	-271	-6	-3604
Lake McMill gage, ft	23.48	24.30	25.10	24.31	19.40	22.87	18.10	23.02	18.10	22.85	19.28	19.58	20.42	20.40
Lake McMill stor, AF	11805	14633	17835	14668	2982	10005	1464	10436	1464	9947	2834	3248	4501	
McMill change stor, AF		2828	3202	-3167	-11686	7023	-8541	8972	-8972	8483	-7113	414	1253	-7304
(A+M) change stor, AF		2956	2731	-5733	-11137	6865	-8022	8135	-9021	10610	-9682	143	1247	-10908
Brantley gage, feet									219.20	241.20	245.40	245.40	245.40	
Brantley storage, AF	0	0	0	0	0	0	0	0	937	12826	19051	19051	19051	
Brant change stor, AF		0	0	0	0	0	0	0	937	11889	6225	0	0	19051
Total change stor, AF		2956	2731	-5733	-11137	6865	-8022	8135	-8084	22499	-3457	143	1247	8143

Table 14a. Hydrograph Scalping: Pecos River Below Dark Canyon 1988

DAY	DISCH	BASEFL	DIFF
2.05	35	31.5	3.5
4.14	33	31.5	1.5
4.15	34	31.5	2.5
4.16	36	31.5	4.5
4.17	35	31.5	3.5
4.18	32	31.5	.5
4.19	35	31.5	3.5
4.20	32	31.5	.5
4.28	29	28	1
4.29	34	28	6
4.30	31	28	3
5.01	32	28	4
5.02	32	28	4
5.03	30	28	2
5.04	29	28	1
5.18	31	27	4
5.19	33	27	6
5.20	28	27	1
5.27	28	27	1
5.28	30	27	3
5.29	27	27	0
5.30	29	27	2
5.31	29	27	2
6.01	29	27	2
6.02	29	27	2
6.11	26	25	1
6.12	36	25	11
6.25	39	26	13
6.26	27	26	1
6.27	31	26	5
6.28	26	26	0
6.29	27	26	1
6.30	28	26	2
7.01	29	26	3
7.15	43	27	16
7.16	31	27	4
7.17	28	27	1
CFS-DAYS	447.7		
ACRE-FT	888		

DAY	DISCH	BASEFL	DIFF
7.19	27	27	0
7.20	46	27	19
7.21	28	27	1
7.22	28	27	1
7.23	29	27	2
7.24	30	27	3
7.25	27	27	0
7.26	27	27	0
7.27	29	27	2
7.28	28	27	1
8.03	54	26	28
8.04	61	26.6	34.4
8.05	42	27.2	14.8
8.06	29	27.8	1.2
8.07	30	28.4	1.6
8.08	31	29	2
8.09	32	29.6	2.4
8.10	40	30.2	9.8
8.11	45	30.8	14.2
8.12	33	31.4	1.6
8.13	32	32	0
8.25	30	29	1
8.26	29	28.7	.3
8.27	30	28.4	1.6
8.28	32	28.1	3.9
8.29	31	27.7	
8.30	30	27.4	2.6
8.31	28	27.1	.9
9.01	32	26.8	5.2
9.02	32	26.5	5.5
9.03	30	26.2	3.8
9.04	28	25.8	2.2
9.05	28	25.5	2.5
9.06	27	25.2	1.8
9.07	27	24.9	2.1
9.08	27	24.6	2.4
9.09	27	24.3	2.7
9.10	26	23.9	2.1
9.11	26	23.6	2.4
9.12	25	23.3	1.7
9.13	23	23	0
9.14	33	23	10
9.15	25	23	2
9.20	54	23	31
9.21	81	24	57
9.22	44	25	19
9.23	48	26	22
9.24	28	27	1

Table 14b. Hydrograph Scalping: Pecos River at Red Bluff 1988

DAY	DISCH	BASEFL	DIFF	DAY	DISCH	BASEFL	DIFF	DAY	DISCH	BASEFL	DIFF
4.14	67	61	6	7.07	65	44.5	20.5	8.30	98	50.8	47.2
4.15	65	61	4	7.08	82	44.7	37.3	8.31	103	50.9	52.1
4.16	61	61	0	7.09	81	44.9	36.1	9.01	92	51.1	40.9
4.17	68	61	7	7.10	97	45.1	51.9	9.02	87	51.2	35.8
4.18	78	61	17	7.11	111	45.3	65.7	9.03	132	51.4	80.6
4.19	78	61	17	7.12	115	45.5	69.5	9.04	85	51.5	33.5
4.20	73	61	12	7.13	94	45.7	48.3	9.05	86	51.7	34.3
4.21	82	61	21	7.14	86	45.9	40.1	9.06	72	51.8	20.2
4.22	81	61	20	7.15	101	46.2	54.8	9.07	65	52.0	13.0
4.23	71	61	10	7.16	94	46.4	47.6	9.08	62	52.2	9.8
4.24	66	61	5	7.17	121	46.6	74.4	9.09	58	52.3	5.7
4.25	63	61	2	7.18	126	46.8	79.2	9.10	60	52.5	7.5
4.26	68	61	7	7.19	94	47.0	47.0	9.11	56	52.6	3.4
4.27	64	61	3	7.20	78	47.2	30.8	9.12	58	52.8	5.2
4.28	65	61	4	7.21	249	47.4	201.6	9.13	58	52.9	5.1
4.29	70	61	9	7.22	187	47.6	139.4	9.14	55	53.1	1.9
4.30	72	61	11	7.23	97	47.8	49.2	9.15	64	53.2	10.8
5.01	71	61	10	7.24	70	48.0	22.0	9.16	72	53.4	18.6
				7.25	67	48.2	18.8	9.17	71	53.5	17.5
5.19	46	45	1	7.26	57	48.4	8.6	9.18	69	53.7	15.3
5.20	62	45	17	7.27	53	48.6	4.4	9.19	60	53.8	6.2
5.21	81	45	36	7.28	50	48.8	1.2	9.20	54	54	0
5.22	72	45	27	7.29	49	49	0	9.21	69	54	
5.23	64	45	19					9.21	229	57.6	171.4
5.24	61	45	16	8.03	49	49	0	9.22	308	61.1	246.9
5.25	79	45	34	8.04	50	50	0	9.23	271	64.7	206.3
5.26	70	45	25	8.05	65	50.7	14.3	9.24	170	68.2	101.8
5.27	69	45	24	8.06	105	51.4	53.6	9.25	113	71.8	41.2
5.28	65	45	20	8.07	79	52.1	26.9	9.26	97	75.3	21.7
5.29	59	45	14	8.08	65	52.9	12.1	9.27	94	78.9	15.1
5.30	60	45	15	8.09	63	53.6	9.4	9.28	89	82.4	6.6
5.31	59	45	14	8.10	61	54.3	6.7	9.29	86	86	0
6.01	53	45	8	8.11	60	55.0	5.0				
6.02	48	45	3	8.12	132	55.7	76.3	10.09	66	66	0
				8.13	112	56.4	55.6	10.10	74	66	8
6.11	43	42	1	8.14	68	57.1	10.9	10.11	69	66	3
6.12	53	42	11	8.15	63	57.9	5.1				
6.13	51	42	9	8.16	72	58.6	13.4	11.25	57	57	0
6.14	59	42	17	8.17	74	59.3	14.7	11.26	63	62	1
6.15	51	42	9	8.18	70	60	10	11.27	75	67	8
								11.28	79	72	7
6.25	46	42	4	8.25	69	50	19	11.29	77	77	0
6.26	50	42.2	7.8	8.26	67	50.2	16.8				
6.27	102	42.4	59.6	8.27	59	50.3	8.7	12.08	96	96	0
6.28	142	42.6	99.4	8.28	66	50.5	15.5	12.09	99	96	3
6.29	97	42.8	54.2	8.29	66	50.6	15.4	12.10	101	96	5
6.30	81	43.0	38.0					12.11	96	96	0
7.01	67	43.2	23.8								
7.02	72	43.4	28.6							CFS-DAYS	3750.7
7.03	70	43.6	26.4							ACRE FT	7440
7.04	66	43.9	22.1								
7.05	68	44.1	23.9								
7.06	74	44.3	29.7								

Table 14c. Hydrograph Scalping: Delaware River 1988

DAY	DISCH	BASEFL	DIFF
7.20	2.7	2.7	.0
7.21	21.0	2.6	18.4
7.22	5.4	2.5	2.9
8.05	2.9	2.9	.0
8.06	15.0	2.9	12.1
8.07	3.2	2.9	.3
8.10	5.2	2.9	2.3
8.11	5.3	2.9	2.4
8.12	5.1	2.9	2.2
8.13	3.2	2.9	.3
8.14	3.1	2.9	.2
8.15	2.9	2.9	.0
8.27	2.7	2.7	.0
8.28	3.0	2.7	.3
8.29	3.0	2.7	
8.30	3.2	2.7	.5
8.31	3.0	2.7	.3
9.01	4.1	2.7	1.4
9.02	4.3	2.7	1.6
9.03	3.2	2.7	.5
9.04	2.8	2.7	.1
9.21	2.8	2.6	.2
9.22	2.8	2.6	.2
9.23	3.1	2.6	.5
9.24	2.7	2.6	.1

TOTALS	
CFS-DAYS	46.8
ACRE-FT	93

Table 15. Data Required for River Master Manual Calculations, Water Year 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
Streamflow gage records													
Pecos R b Sumner Dam, TAF	.1	3.1	6.0	4.4	33.7	19.4	23.5	18.2	48.7	6.2	.0	.0	163.2
Fort Sumner Main C, TAF	.0	2.7	5.9	4.3	5.2	5.7	5.3	5.5	4.2	5.9	.2	.0	44.8
Pecos R nr Artesia, TAF	6.8	7.3	4.4	2.3	23.2	6.9	25.3	5.2	50.4	12.3	4.3	4.0	152.4
Pecos b Dark Canyon, TAF	1.9	1.9	2.2	1.9	1.8	1.6	1.8	2.1	1.8	2.7	1.8	1.5	23.0
Dark Canyon at Csbad, TAF	.0	.0	.0	.0	.0	.0	.0	.1	.1	.0	.0	.0	.2
Pecos bel Avalon Dam, TAF	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.1
Carlsbad Main Canl, TAF	.0	.8	6.6	13.6	11.3	14.1	10.4	14.3	7.2	9.7	.0	.0	87.8
Pecos R at Red Bluff, TAF	6.1	5.7	4.3	4.2	4.0	3.2	5.5	4.3	5.8	5.1	5.7	5.5	59.3
Delaware R nr Red B, TAF	.4	.4	.4	.4	.3	.2	.2	.2	.2	.2	.2	.2	3.2
Gage heights													
Avalon gage ht, end mo	19.85	19.30	15.65	16.60	16.35	17.15	15.80	15.70	18.80	14.60	12.90	12.80	
Avalon gage ht, avg	19.80	19.77	18.44	16.07	16.10	16.21	16.15	16.03	17.09	16.18	13.91	12.72	
McMillan gage ht, end mo	24.30	25.10	24.31	19.40	22.87	18.10	23.02	18.10	22.85	19.28	19.58	20.42	
McMillan gage ht, avg	23.92	24.72	25.07	21.89	19.59	20.60	23.01	20.36	21.46	20.87	19.45	19.93	
Brantley gage ht, end mo								219.20	241.20	245.40	245.40	245.40	
Brantley gage ht, avg									232.31	244.92	245.38	245.47	
Alamogordo gage ht, avg	57.31	58.99	58.49	58.00	51.77	45.92	47.51	47.13	44.29	45.47	46.36	49.44	
Lake St Rosa ga ht, avg	47.49	47.51	47.60	47.74	47.71	47.53	43.14	44.87	42.05	38.51	38.64	38.90	
Precipitation													
Precip Carlsbad, inches	.02	.48	.01	.42	.82	2.25	2.41	3.74	4.74	.00	.00	.50	15.39
Precip Artesia, inches	.09	.86	.01	.20	2.93	2.03	3.16	1.33	4.03	.04	.04	.44	15.16
Precip Brantley, inches	.05	.38	.01	.59	.52	1.92	3.80	2.88	4.35	.00	.00	.44	14.94
Precip LV FAAA AP, inches	.21	.08	.32	1.53	2.48	3.05	6.27	5.32	2.65	.27	.16	.19	22.53
Precip Pecos Rang, inches	1.20	.30	.50	.97	1.75	2.22	2.43	5.48	2.92	.00	.25	.10	18.12
Precip Santa Rosa, inches	.23	.06	.13	2.32	1.56	2.51	2.75	.82	2.82	.38	.19	.36	11.57
Precip Sumnr lake, inches	.16	.07	.08	1.01	1.65	1.95	5.70	2.00	2.88	.18	.02	.24	15.94
Precip Lake SRosa, inches	.25	.04	.16	2.39	1.81	3.33	4.07	1.33	4.11	.21	.17	.28	18.15
Evaporation, temp, humidity													
PanEvap Lake Sumn, inches	2.44	3.74	8.36	10.79	12.29	12.51	12.02	9.62	8.78	6.97	7.08	4.41	99.01
PanEvap Lk SRosa, inches	3.72	5.22	9.13	6.29	8.39	8.93	9.34	6.96	7.43	5.38	5.78	3.72	80.29
Pan Evap, Brantley, inches				11.29	14.03	14.94	11.47	10.17	8.93	7.09	7.58	4.21	
Humidity avg Roswell, %	61	56	34	36	43	43	57	60	49	50	33	50	
Temp avg Art/Carl, deg F	38.2	45.0	51.3	59.3	68.9	76.8	78.6	78.3	71.1	62.5	52.4	40.4	
Other reports													
Base Acme-Artesia, TAF	4.7	3.8	3	1.8	1.5	1.6	1.8	2	2	2.3	2.5	2.6	29.6
Pump depl Ac-Artesia, TAF	0	.0	.6	1.1	1.4	1.7	1.5	2.2	1.5	.4	.1	.0	10.5
Well 20.26.8.1211, ft	62.8	62.6	76.4	77.4	81.1	79.1	69.5	70.3	64.7	52.5	49.3	45.5	
NM irrigation inv, acres													9057.
NM Transfer water use, TAF													0
NM salvaged water, TAF													0
Texas, water stored NM, TAF													0
Texas, use Del water, TAF													0

NEW MEXICO'S OBJECTIONS

General response concerning base flow computation.

New Mexico's main objection to the Preliminary Report is presented on pages 1 and 2 of their submittal. New Mexico calculates an average annual base inflow for the Acme to Artesia reach of 42,700 acre-feet, a quantity that is 10,500 acre-feet higher than the USGS figure of 32,200 acre-feet. As the calculation of this base inflow is the subject of New Mexico's Amended First Motion to Modify the Manual, which is currently being evaluated, I am unable to accept the objection as a basis for change in the Preliminary Report. The Amended Decree states that "A modification of the Manual by motion shall be first applicable to the water year in which the modification becomes effective." The base inflow figures to be retained for the Final Report are those furnished by USGS in accordance with current procedures in the Manual.

Responses to New Mexico's Specific Objections.

A.1. Statements about base inflow are addressed above; other items are addressed later.

A.2. Statements about base inflow are addressed above.

A.3. Objection accepted. July precipitation for Santa Rosa has been corrected. Some of the effective precipitation values read from Stipulated Exhibit No. 8 have been adjusted slightly to respond to this objection.

A.4. Objection accepted. Data values have been corrected.

A.5. No action. Value was checked and found to be correct, but does not enter into computation.

A.6. No action. Computations were checked and verified. New Mexico did not furnish her calculation for comparison. Slight differences may arise according to whether quarterly values are determined by averaging monthly values using weighting factors derived according to the number of days per month, or whether such weighting factors are not used.

A.7. Objection accepted and change made.

A.8. Objection accepted and change made.

A.9. Objection accepted and change made.

A.10. Objection partially accepted. Material submitted to me by the Bureau only included totalled evaporation values from August 1988, but I added the Weather Service reported values, which are from the Bureau gage, beginning in April. The November and December values are from the Bureau report since the NWS did not include evaporation reports in these months. As I

did not have observations available from the Bureau for January - March the calculated values were used. Next year I intend to use Brantley measurements for the full year. The Bureau report showed 4.21 inches as presented in the Preliminary Report. The source of New Mexico's report of 3.17 inches for December is unknown. The River Master and the states need a systematic method to collect Brantley evaporation data. I suggest that New Mexico compile and submit the data as she does for Lake Santa Rosa and Alamogordo Reservoir, as called for by the Manual at C.1.b.(3).

A.11. Objection accepted and change made.

B.1. Statements about base inflow are addressed above.

B.2. As New Mexico notes, last year I accepted Texas' position that the surface area of Alamogordo Reservoir for the calculation of the 1947 condition evaporation should be limited to 4600 acres, the maximum figure shown on Table 3 of Texas Exhibit 68. Use of this table is required by the Manual at C.1.b.(5). New Mexico is correct, there is sufficient data in Appendix A-1 of the Manual to develop procedures for extropolating the surface acreage beyond 4600 acres. However, since there is a difference in opinion between the states, and since Table 3 does not extend beyond 4600 acres, it is my judgement that any change in the procedure used in the 1988 Final Report would have to be established through action on a motion with review and comment by both states, thus the 4600 acre limitation is retained.

B.3. Typographical error corrected.

B.4. For statements about Brantley evaporation, see A.10. above. Brantley precipitation values were used to compute net evaporation for Brantley reservoir, but for McMillan the Manual statement is retained pending written agreement by the states to modify the Manual.

B.5. I accept the principle advocated by New Mexico that the strict procedures called for by the Manual should be retained until they are changed in the motion process. However, since the 3 humidity values rather than 4 are so obviously an error of omission, and since they will not be used in the future when Brantley evaporation values are available, the computation using four values is retained for this year. My reason for this position is that the River Master's Manual has been written by different persons at different times, and the result is a lack of clarity or precision in a number of places where judgement must be applied to determine how to make calculations. For the most part the procedures in use are understood in the same way by each state's Technical Representatives and the River Master. However, the River Master must make some adjustments due to the lack of clarity in the Manual, especially when the consequencies are not major, as in the case of this calculation.

II. Major Johnson Springs New Water. Since Brantley Reservoir began impounding water at the end of August, 1988 was a transitional year. The Springs would not have been affected by Brantley Reservoir prior to the initiation of impoundment. The procedure for calculating the discharge of the Springs relies on depth of water in a well, which could be affected by the impoundment. However, I examined the pattern of water levels in the well for 1985, 86, 87, and 88 and concluded that the water level had not been materially affected in the July - September period in 1988, and determined that the procedure in use prior to the impoundment had general validity for the period up to impoundment, and that the agreed-upon compromise of 8200 acre-feet should be used thereafter, until a water balance technique can be developed. Objection rejected.

III. This objection cannot be accepted this year but it needs to be acted upon as soon as the technical knowledge is available to determine how much water is lost to underground storage caverns and aquifers. Texas's suggestion that the calculated negative flood inflow should be set to zero and allocated to bank storage needs to be substantiated by a technical study. New Mexico is entitled to comment on the proposal. I note that at our March 20-21 meeting the issue of developing procedures for these calculations was discussed briefly, but not resolved. USGS has presented a proposal for monitoring of water levels and discharges in the Brantley area. From the minutes of the meeting of the Engineering Advisory Committee of the Pecos River Commission I note that the USGS proposal has gone to the Bureau of Reclamation and that the Bureau also reported that they are "...evaluating the loss of water to the bank storage..." However, procedures for calculating bank storage and for dealing with the "other depletions" provision of the Manual at B.4.i(2) need to be developed through the motion process. These must be supported by sufficient data and technical studies. B.4.i(2) presently instructs the River Master to include any other depletions "...as determined by USGS..." USGS apparently did not determine such depletions this year. Since USGS' proposal for a gaging program is to the Bureau, the States will apparently not control the scope of work or the pace of the study process. I consider that since the Bureau is evaluating water loss to bank storage through a program of measurement that the gages and piezometers called for under paragraph B.4.b.(3) of the Manual are in place, and no action is called for by the River Master at this time. I do not consider that the present Manual provisions in B.4.b(3) and B.4.i(2) are adequate to enable me to include loss of water to bank storage or underground aquifers in this year's accounting.

IV. Some of the hydrograph scalping results of Texas are accepted and some not. Differences were more the result of perceptions of lag time of runoff after rainfall than from not considering the Red Bluff rainfall, which has been incorporated into the analysis. Comments refer to Attachment 2 of Texas' objections:

6-1 to 6-24: no change, no real difference

6-25 to 7-29: I accept Texas' analysis for this period

7-30 to 8-2: I reject Texas' analysis for this period since I believe that runoff on July 30, some five days after the last minor rainfall event, is probably not flood runoff.

8-3 to 8-24: I have adjusted the base flow to a value of 60 cfs on 8-18; this is based on my assessment that the runoff occurring in the period 8-19 to 8-24 comes too long after the last rain on 8-13 to be flood runoff.

8-25 to 9-20: I accept Texas' analysis for this period.

9-21 to 10-8: I consider the runoff occurring in the period 10-1 to 10-8 not to be flood runoff; therefore the base flow of 86 cfs on 9-30 is retained.

The result of these adjustments is a new total scalped runoff for Pecos River at Red Bluff of 7440 acre-feet.

By considering rainfall at Red Bluff a slight change in the scalped runoff at Pecos River below Dark Canyon also resulted. The new total is 888 acre-feet.