PECOS RIVER COMPACT

Report of the River Master

Water Year 2016

Accounting Year 2017

Final Report

Neil S. Grigg
River Master of the Pecos River
749 S. Lemay, Ste. A3, PMB 330
Fort Collins, Colorado 80524

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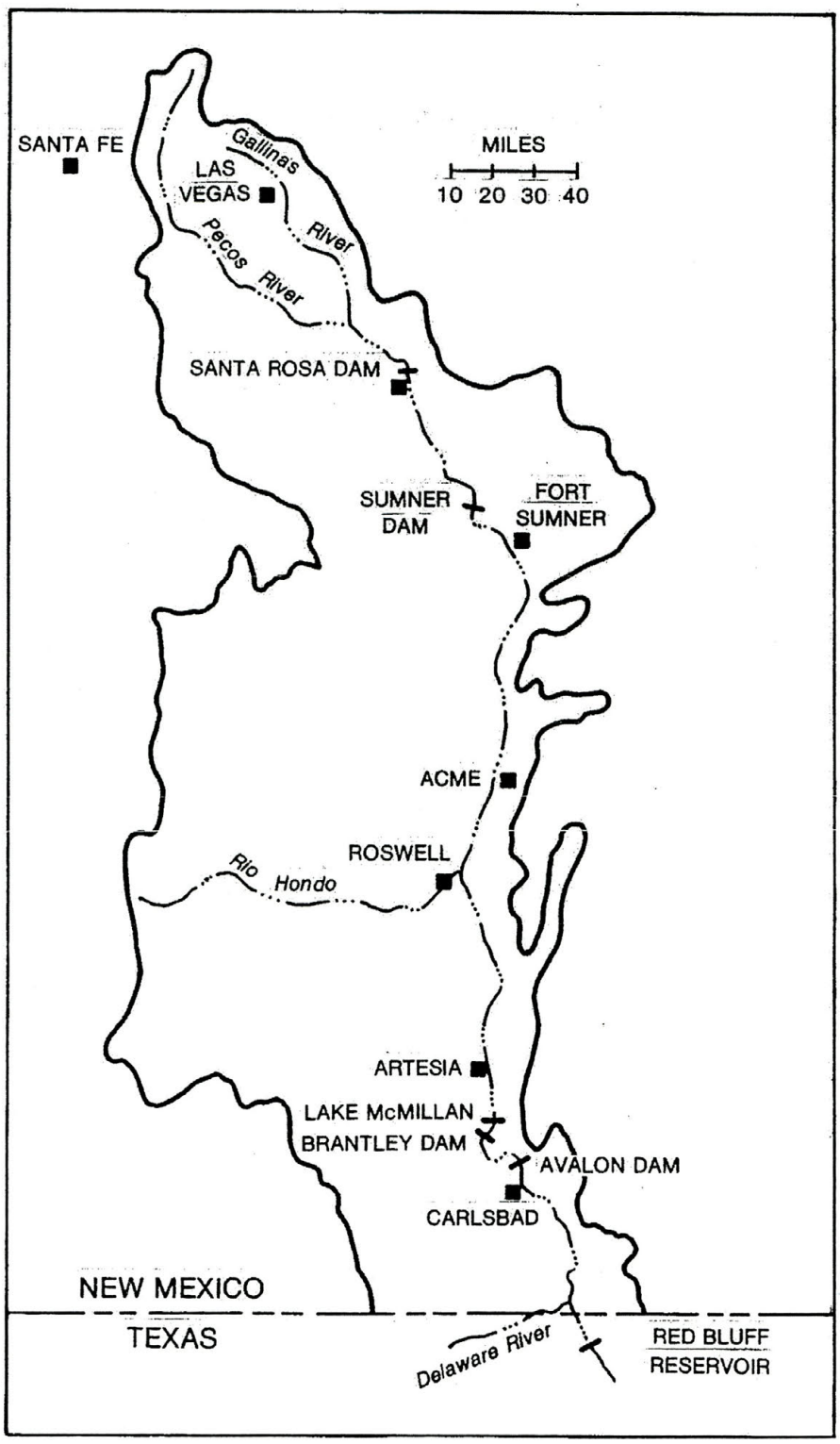

Map of Pecos River Basin Showing Accounting Reaches

PECOS RIVER COMPACT
Supreme Court of the United States
No. 65, Original
Amended Decree

Final Report of the River Master
Water Year 2015 - Accounting Year 2016
June 28, 2017

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." This is the required Final Report with the determination of:

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's delivery in Water Year 2016 was an overage of 28,400 acre-feet. The accumulated overage since the beginning of Water Year 1987 is 137,900 acre-feet.

N S. Grigg

Neil S. Grigg
River Master of the Pecos River

Pecos River Compact		
Accumulated Shortfall or Overage		
	June 28, 2017	
Water Year	Annual Overage or Shortfall, AF	Accumulated Overage or Shortfall, AF
1987	15,400	15,400
1988	23,600	39,000
1989	2,700	41,700
1990	-14,100	27,600
1991	-16,500	11,100
1992	10,900	22,000
1993	6,600	28,600
1994	5,900	34,500
1995	-14,100	20,400
1996	-6,700	13,700
1997	6,100	19,800
1998	1,700	21,500
1999	1,400	22,900
2000	-12,300	10,600
2001	-700	9,900
2002	-3,000	6,900
2003	2,000	8,900
2004	8,300	17,200
2005	24,000	41,200
2006	26,100	67,300
2007	25,200	92,500
2008	6,000	98,500
2009	1,600	100,100
2010	-500	99,600
2011	500	100,100
2012	1,900	102,000
2013	-6,300	95,700
2014	1,900	97,600
2015	11,900	109,500
2015	28,400	137,900

Table 1. General Calculation of Annual Departures in TAF (B.1)			
Water Year	2016		
6/28/2017			
	WY 2014	WY 2015	WY 2016
B.1.a. Index Inflows			
(1) Annual flood inflow			
(a) Gaged flow Pecos R bel Alamogordo Dam	120.6	100.7	128.6
(b) Flood Inflow Alamogordo - Artesia (Table 2)	57.3	28.5	-2.6
(c) Flood Inflow Artesia - Carlsbad (Table 3)	42.5	3.2	15.3
(d) Flood Inflow Carlsbad - State Line (Table 4)	122.8	6.2	9.5
Total (annual flood inflow)	343.2	138.6	150.8
(2) Index Inflow (3-year avg)			210.9
B.1.b. 1947 Condition Delivery Obligation			99.4
(Index Outflow)			
B.1.c. Average Historical (Gaged) Outflow			
(1) Annual historical outflow			
(a) Gaged Flow Pecos River at Red Bluff NM	146.6	101.1	75.4
(b) Gaged Flow Delaware River nr Red Bluff NM	48.3	5.4	6.2
(c) Metered diversions Permit 3254 into C-2713	0.2	0.2	0.2
Total Annual Historical Outflow	195.1	106.7	81.8
(2) Average Historical Outflow (3-yr average)			127.9
B.1.d. Annual Departure			28.4
C. Adjustments to Computed Departure			
1. Adjustments for Depletions above Alam Dam			
a. Depletions Due to Irrigation (Table 5)	-0.2	-3.2	1.3
b. Depl fr Operation of Santa Rosa Reservoir (Table 6)	-1.7	16.7	-6.3
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	118.7	114.2	123.6
(b) Flood Inflow Alamogordo - Artesia	57.3	28.5	-2.6
(c) Flood Inflow Artesia - Carlsbad	42.5	3.2	15.3
(d) Flood Inflow Carlsbad - State Line	122.8	6.2	9.5
Total (annual flood inflow)	341.3	152.1	145.8
Recomputed Index Inflow (3-year avg)			213.1
Recomputed 1947 Condition Del Outflow			100.9
(Index Outflow)			
Recomputed Annual Departures			26.9
Credits to New Mexico			
C.2 Depletions Due to McMillan Dike			1.5
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			28.4

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

Water Year	2016												
4/29/2017													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
Flow bel Sumner Dam	1.9	4.1	7.2	10.3	20.5	17.2	20.4	34.6	4.7	6.0	0.5	1.2	128.6
FtSumner Irrig Div	0.0	0.0	5.8	5.0	4.3	5.5	5.4	4.2	4.2	5.4	0.0	0.0	39.7
Ft Sumner ID Return	0.8	0.6	1.5	1.7	2.5	2.5	2.5	2.5	2.3	2.1	1.1	0.8	21.1
Flow past FS IDist	2.8	4.7	2.9	7.0	18.8	14.2	17.6	33.0	2.8	2.7	1.5	2.1	109.9
Channel loss	0.3	0.4	0.7	1.9	3.3	3.1	3.0	4.3	0.9	0.8	0.6	0.2	19.5
Residual Flow	2.5	4.3	2.1	5.1	15.4	11.1	14.5	28.7	2.0	1.8	0.9	1.8	90.4
Base Inflow	2.9	3.0	2.6	2.0	1.7	1.1	0.6	0.2	0.9	1.3	1.1	1.0	18.3
River Pump Divers	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.5
Residual, Artesia	5.4	7.3	4.6	7.1	17.0	12.1	15.0	28.8	2.8	3.1	1.9	2.9	108.1
Pecos Flow Artesia	7.1	6.9	5.2	4.3	17.4	2.4	18.2	18.6	12.5	3.8	5.7	3.5	105.5
Flood Inflow, AD-Art	1.7	-0.4	0.5	-2.8	0.3	-9.7	3.2	-10.3	9.7	0.7	3.8	0.6	-2.6

Note: Whenever the computed flow past the District is less than the return flow, set the flow past the District equal to the return flow (Manual, B.3.d).

Table 3. Determination of Flood Inflows, Artesia to Carlsbad (B.4)													
Water Year	2016												
4/29/2017													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
Rio Penasco at Dayton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fourmile Draw nr Lakew	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Seven Rivers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Arroyo at Hwy Br	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Flood Inflow, Art-DS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Pecos R at Dam Site 3	18.3	5.7	5.8	12.8	9.8	10.7	12.6	8.0	3.8	9.7	1.2	1.4	99.8
CB Sprgs New Water (from Table 7)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	4.0
Total Inflow, DS3 - CB	18.6	6.1	6.1	13.2	10.1	11.0	12.9	8.3	4.1	10.1	1.5	1.7	103.7
Evap Loss, Lake Avalon (from Table 10)	0.2	0.3	0.5	0.5	0.5	0.6	0.8	0.2	0.0	0.3	0.1	0.1	4.2
Storage Chg, Lake Avalon (from Table 11)	2.1	-0.6	-2.7	0.8	0.0	-0.3	-0.3	1.2	-1.6	-0.5	0.7	0.7	-0.4
Carls ID diversions	0.0	0.0	6.9	10.6	10.7	10.6	12.6	7.2	3.6	9.3	0.0	0.0	71.4
93% CID diver	0.0	0.0	6.4	9.9	10.0	9.8	11.7	6.6	3.3	8.6	0.0	0.0	66.4
Other depletions	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.4
Dark Canyon at Csbad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1	0.0	0.0	0.0	1.4
Pecos b Dark Canyon	15.2	6.3	2.3	2.4	2.3	2.0	2.0	4.6	2.6	2.5	2.5	2.3	46.7
Pecos R at Carlsbad	15.2	6.3	2.3	2.4	2.3	2.0	2.0	3.2	2.6	2.5	2.5	2.3	45.4
Total Outflow	17.6	6.1	6.6	13.6	12.9	12.2	14.3	11.5	4.4	11.0	3.4	3.2	117.0
Flood Inflow, DS3-CB	-1.0	0.1	0.5	0.5	2.8	1.2	1.5	3.1	0.3	0.9	1.9	1.5	13.3
Flood Inflow, Art-CB	-1.0	0.1	0.5	0.5	2.8	1.2	1.5	3.1	2.3	0.9	1.9	1.5	15.3

Table 4. Summary Table for Computations, Carlsbad to State Line (B.5)						
Water Year		2016				
6/26/2017						
		BCB - RB		Del R	DC	
		RM				
Jan		0.0		0.0	0.0	
Feb		0.0		0.0	0.0	
Mar		0.0		0.0	0.0	
Apr		0.1		0.0	0.0	
May		0.2		0.0	0.0	
Jun		0.5		0.0	0.0	
Jul		0.3		0.0	0.0	
Aug		1.1		3.3	1.3	
Sep		1.7		0.3	0.1	
Oct		0.2		0.0	0.0	
Nov		0.2		0.1	0.0	
Dec		0.1		0.0	0.0	
Total		4.4		3.7	1.4	
Summary of flood inflows, Carlsbad to State Line, TAF						
Red Bluff - Carlsbad + Dark C RM calcs)						5.8
Delaware River						3.7
Total Flood Inflow, Carlsbad to State Line						9.5

Table 5. Depletions Due to Irrigation Above Sumner Dam (C.1.a)								
Water Year	2016							
4/29/2017								
	APR	MAY	JUN	JUL	AUG	SEPT	OCT	TOTAL
Precip Las Vegas FAA AP	1.38	1.69	0.61	0.87	4.86	1.35	0.10	10.86
Eff prec Las Veg FAA AP	1.30	1.57	0.60	0.84	3.73	1.28	0.10	9.42
Precip Pecos Natl Monument*	1.31	1.07	0.92	1.82	4.28	1.49	0.06	10.95
Eff Precip Pecos RS	1.24	1.03	0.89	1.68	3.47	1.40	0.06	9.77
Precip Santa Rosa	0.19	0.84	2.19	1.05	1.63	1.06	0.30	7.26
Eff Precip Santa Ro	0.19	0.82	1.98	1.02	1.52	1.02	0.29	6.84
Average eff precip, ft	0.08	0.10	0.10	0.10	0.24	0.10	0.01	0.72
Consumptive use, ft	0.19	0.36	0.36	0.30	0.27	0.18	0.11	1.77
Unit depletion rate (CU less eff precip), ft	0.11	0.27	0.26	0.20	0.03	0.08	0.10	1.05
Acres (most recent inventory)	11529							
Streamflow depletion (actual use), AF	12070							
1947 depletion, AF	10804							
Difference (actual use - 1947 depletion), TAF	1.3							
Adjustment to Gaged Flow, Pecos River below Sumner Dam, TAF =						1.3		
* See note on Table 12								

Table 6. Depletions Due to Santa Rosa Reservoir Operations (C.1.b)

Water Year	2016												
6/28/2017													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
LS 2001 table (USBR), add 4,200 feet to value shown; LSR 1997 tables used (COE); Add 4,700 feet to value shown													
Lk Sumner ga ht, avg	64.4	64.7	61.0	62.9	58.5	58.9	55.7	54.1	54.9	52.5	53.1	55.9	
LS content, AF, avg	45319	46191	36113	41116	30455	31327	24842	21977	23383	19324	20294	25216	
LS area, acres, avg	2891	2922	2457	2706	2160	2204	1857	1724	1791	1592	1641	1874	
LS evap, inches	2.99	5.73	10.17	10.60	12.84	14.19	15.29	11.17	9.43	10.38	5.29	3.29	111.37
.77 LS Evap	2.30	4.41	7.83	8.16	9.89	10.93	11.77	8.60	7.26	7.99	4.07	2.54	85.76
LS Precip, inches	0.45	0.10	0.00	0.69	0.85	1.54	1.15	1.25	1.60	0.14	4.44	0.35	12.56
Net LS Evap, inches	1.85	4.31	7.83	7.47	9.04	9.39	10.62	7.35	5.66	7.85	-0.37	2.19	73.20
LSum Evaploss, TAF	0.45	1.05	1.60	1.68	1.63	1.72	1.64	1.06	0.84	1.04	-0.05	0.34	13.01
L S Rosa ga ht, avg	44.9	44.9	45.5	46.1	45.9	46.9	41.2	38.0	32.0	31.8	31.8	31.8	
LSR content, AF, avg	96706	96706	98914	101158	100405	104202	83826	73569	56872	56367	56367	56357	
LSR area, acres, avg	3646	3646	3709	3772	3752	3842	3326	3075	2522	2512	2512	2512	
LSR evap, inches	3.72	5.16	8.31	8.06	10.60	12.08	14.76	9.10	8.11	8.72	4.94	3.76	97.32
.77 LSR Evap	2.86	3.97	6.40	6.21	8.16	9.30	11.37	7.01	6.24	6.71	3.80	2.90	74.93
LSR precip, inches	0.45	0.57	0.02	0.19	0.84	2.19	1.05	1.63	1.06	0.30	2.59	0.73	11.62
Net LSR Evap, inches	2.41	3.40	6.38	6.02	7.32	7.11	10.32	5.38	5.18	6.41	1.21	2.17	63.31
LSR Evaploss, TAF	0.73	1.03	1.97	1.89	2.29	2.28	2.86	1.38	1.09	1.34	0.25	0.45	17.57
Total evaploss, TAF	1.18	2.08	3.57	3.58	3.91	4.00	4.50	2.43	1.93	2.38	0.20	0.79	30.58
Sum contents, AF	142025	142897	135027	142274	130860	135529	108668	95546	80255	75691	76661	81573	
1947 area, acres	4600	4600	4600	4600	4600	4600	4021	3679	3237	3146	3162	3277	
1947 evaploss, TAF	0.71	1.65	3.00	2.86	3.46	3.60	3.56	2.25	1.53	2.06	-0.10	0.60	25.19
current-1947evaploss	0.47	0.43	0.57	0.71	0.45	0.40	0.94	0.18	0.41	0.33	0.30	0.20	5.39
						Annual adjustment for excess evaporation =							5.4

ADJUSTMENT FOR EXCESSIVE STORAGE IN SANTA ROSA RESERVOIR

	2015 Gage	2015 Storage	2016 Gage	2016 Storage
EndYear Sumner Sto	4263.90	43887	4256.90	27141
EndYear S R Sto	4745.00	97072	4731.80	56367
Sum		140959		83508
Sto Adjustment, TAF				-11.7
Adjustm Ex Evap, TAF				5.4
Total Adjustment,TAF				-6.3

Storage adjustment
Both equal or less than 129.3 TAF, adjustment is zero
~~Both greater than 129.3 TAF, subtract previous from current year~~
Current year less than 129.3 TAF, previous greater than 129.3 TAF, subtract previous year from 129.3 TAF
Current year greater than 129.3 TAF, previous year less than 129.3 TAF, subtract 129.3 TAF from current year

Table 7. Carlsbad Springs New Water [B.4.c.(2)]					
Water Year	2016				
4/29/2017					
		TAF	AF/day	cfs	Totals
Pecos R bel DC		46.7	127.6	64.3	64.3
Dark Canyon		1.4	3.8	1.9	1.9
Pecos R bel Lake Avalon		17.3	47.3	23.8	23.8
Depletion, cfs					2.0
CID lag seep, cfs (from Table 8)					6.7
Return flow, cfs					1.0
Lake Av lagged seep, cfs (from Table 9)					24.4
PR seepage, cfs					3.0
Carls new water, cfs					5.5
Carls new wat, TAF					4.0
Carls new wat monthly, TAF					0.3

Table 8. Carlsbad Main Canal Seepage Lagged [B.4.c.(2)(e)]													
Water Year	2016												
4/29/2017													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
WY 2016													
CID, TAF	0.0	0.0	6.9	10.6	10.7	10.6	12.6	7.2	3.6	9.3	0.0	0.0	71.4
days/mo	31	29	31	30	31	30	31	31	30	31	30	31	366
cfs	0	0.0	111.7	178.5	174.7	178.0	205.2	116.3	59.7	150.6	0.0	0.0	97.9
cfs, qtr avg			38.1			177.0			127.8			50.7	
WY 2015		1Q	2Q	3Q	4Q								
FLOWS, cfs				138.6	25.6								
SEVEN %				9.7	1.8								
WY 2016 lagged		1Q	2Q	3Q	4Q								
FLOWS, cfs		38.1	177.0	127.8	50.7								
SEVEN %		2.7	12.4	8.9	3.6								
LAG		3.5	7.4	9.0	6.8	Avg =	6.7	cfs					

Table 9. Lake Avalon Leakage Lagged [B.4.c.(2)(g)]													
Water Year	2016												
4/29/2017													
WY 2016	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
Elev NM rept	77.21	77.54	75.58	74.38	74.30	74.17	73.98	74.33	75.67	73.31	73.20	74.28	
ga ht, avg*	20.21	20.54	18.58	17.38	17.30	17.17	16.98	17.33	18.67	16.31	16.20	17.28	
cfs	34.62	36.19	26.82	21.09	20.71	20.06	19.17	20.85	27.26	15.96	15.44	20.62	
days	31	29	31	30	31	30	31	31	30	31	30	31	366
cfs avg	32.8			20.6			22.4			17.4			23.3
WY 2015		1Q	2Q	3Q	4Q								
cfs				33.7	22.8								
WY 2016 lagged		1Q	2Q	3Q	4Q								
cfs		32.8	20.6	22.4	17.4								
lag cfs		29.6	25.1	23.5	19.6	Avg =	24.4	cfs					
* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)													

Table 10. Evaporation Loss at Lake Avalon [B.4.d.(1)]														
Water Year	2016													
4/29/2017														
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT	
Av WS NM Rept	77.21	77.54	75.58	74.38	74.30	74.17	73.98	74.33	75.67	73.31	73.20	74.28		
Avalon ga ht, avg, ft*	20.21	20.54	18.58	17.38	17.30	17.17	16.98	17.33	18.67	16.31	16.20	17.28		
Avg area Avalon, ac**	895.00	921.00	776.00	697.00	691.00	683.00	671.00	693.00	784.00	631.00	624.00	690.00		
Panevap Brantley, in.	4.44	5.60	9.66	11.04	13.39	14.16	17.74	10.32	6.64	7.51	4.18	3.59	108.27	
Lakeevap Brantley, in.	3.42	4.31	7.44	8.50	10.31	10.90	13.66	7.95	5.11	5.78	3.22	2.76	83.37	
Precip Brantley, in.	0.21	0.20	0.00	0.31	1.08	0.33	0.06	4.22	4.82	0.15	0.62	0.75	12.75	
Netevap, inches	3.21	4.11	7.44	8.19	9.23	10.57	13.60	3.73	0.29	5.63	2.60	2.01	70.62	
Evaploss Av, TAF	0.24	0.32	0.48	0.48	0.53	0.60	0.76	0.22	0.02	0.30	0.14	0.12	4.19	
* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)														
** Based on USBR Area and Capacity Table in effect January 1, 1997														

Table 11. Change in Storage, Lake Avalon [B.4.d.(2)]														
(Gage heights are end of month)														
Water Year	2016													
4/29/2017														
	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
	2015.0	2016.0												
WS NM Rept	75.3	77.8	77.2	73.7	74.9	74.9	74.5	74.0	75.6	73.4	72.6	73.8	74.8	
Gage EOM, ft*	18.3	20.8	20.2	16.7	17.9	17.9	17.5	17.0	18.6	16.4	15.6	16.8	17.8	
Storage, AF**	2718.0	4836.0	4286.0	1590.0	2420.0	2420.0	2133.0	1789.0	2948.0	1397.0	907.0	1656.0	2347.0	
Change sto, TAF		2.1	-0.6	-2.7	0.8	0.0	-0.3	-0.3	1.2	-1.6	-0.5	0.7	0.7	-0.4
* Computed as WS elev by NM Report minus Gage datum at 3157.0 (USBR datum)														
** Based on USBR Area and Capacity Table in effect January 1, 1997														

Table 12. Data Required for River Master Manual Calculations													
Water Year 2016													
6/28/2017	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
STREAMFLOW GAGING RECORDS, TAF													
Pecos R b Sumner Dam	1.9	4.1	7.2	10.3	20.5	17.2	20.4	34.6	4.7	6.0	0.5	1.2	128.6
Fort Sumner Main C	0.0	0.0	5.8	5.0	4.3	5.5	5.4	4.2	4.2	5.4	0.0	0.0	39.7
Pecos R nr Artesia	7.1	6.9	5.2	4.3	17.4	2.4	18.2	18.6	12.5	3.8	5.7	3.5	105.5
Rio Penasco at Dayton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fourmile Draw nr Lakewood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Seven Rivers nr Lkwd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Arroyo at Hwy Br nr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
Pecos R at Dam Site 3	18.3	5.7	5.8	12.8	9.8	10.7	12.6	8.0	3.8	9.7	1.2	1.4	99.8
Pecos bel Avalon Dam	13.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.3
Carlsbad Main Canal	0.0	0.0	6.9	10.6	10.7	10.6	12.6	7.2	3.6	9.3	0.0	0.0	71.4
Dark Canyon at Carlsbad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1	0.0	0.0	0.0	1.4
Pecos below Dark Canyon	15.2	6.3	2.3	2.4	2.3	2.0	2.0	4.6	2.6	2.5	2.5	2.3	46.7
Pecos R at Red Bluff	15.7	9.8	4.6	4.4	3.9	3.8	3.7	7.9	6.3	5.0	5.3	5.2	75.4
Delaware R nr Red Bluff	0.4	0.3	0.3	0.2	0.2	0.1	0.0	3.5	0.7	0.2	0.3	0.2	6.2
GAGE HEIGHTS													
Avalon gage ht, end mo	77.8	77.2	73.7	74.9	74.9	74.5	74.0	75.6	73.4	72.6	73.8	74.8	
Avalon gage ht, avg	77.2	77.5	75.6	74.4	74.3	74.2	74.0	74.3	75.7	73.3	73.2	74.3	
Sumner Lake ga ht, end mo	64.8	64.8	63.5	61.7	58.1	57.6	55.0	54.5	54.6	51.4	54.2	56.9	
Sumner Lake gage ht, avg*	64.4	64.7	61.0	62.9	58.5	58.9	55.7	54.1	54.9	52.5	53.1	55.9	
Lake S Rosa ga ht, end mo	44.9	45.1	45.7	46.9	47.1	44.9	40.9	31.5	32.0	31.7	31.8	31.8	
Lake S Rosa ga ht, avg	44.9	44.9	45.5	46.1	45.9	46.9	41.2	38.0	32.0	31.8	31.8	31.8	
PRECIPITATION, INCHES													
Brantley Lake	0.21	0.20	0.00	0.31	1.08	0.33	0.06	4.22	4.82	0.15	0.62	0.75	12.75
Las Vegas FAA AP	0.21	0.29	0.19	1.38	1.69	0.61	0.87	4.86	1.35	0.10	1.35	0.46	13.36
Pecos National Monument**	0.68	0.33	0.00	1.31	1.07	0.92	1.82	4.28	1.49	0.06	1.79	0.24	13.99
Santa Rosa	0.45	0.57	0.02	0.19	0.84	2.19	1.05	1.63	1.06	0.30	2.59	0.73	11.62
Lake Santa Rosa	0.45	0.57	0.02	0.19	0.84	2.19	1.05	1.63	1.06	0.30	2.59	0.73	11.62
Sumner Lake	0.45	0.10	0.00	0.69	0.85	1.54	1.15	1.25	1.60	0.14	4.44	0.35	12.56
PAN EVAPORATION, INCHES													
Lake Santa Rosa	3.72	5.16	8.31	8.06	10.60	12.08	14.76	9.10	8.11	8.72	4.94	3.76	97.3
Lake Sumner	2.99	5.73	10.17	10.60	12.84	14.19	15.29	11.17	9.43	10.38	5.29	3.29	111.4
Brantley Lake	4.44	5.60	9.66	11.04	13.39	14.16	17.74	10.32	6.64	7.51	4.18	3.59	108.3
OTHER REPORTS													
Base Acme-Art, TAF (USGS)	2.9	3.0	2.6	2.0	1.7	1.1	0.6	0.2	0.9	1.3	1.1	1.0	18.3
Pump depl Ac-Artesia, TAF	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.5
Pumping, C-2713, Malaga B													0.2
NM irrig inv, acres (3/9/2000)													11529
NM Transfer water use, TAF													
NM salvaged water, TAF													0.00
Texas, water stored NM, TAF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Texas, use Del water, TAF													
* Apparent error corrected for Lake Sumner average gage height in March													
** Villanueva gage data replaces Pecos National Monument for CY 2016, see NM letter dated March 23, 2017													

APPENDIX

RESPONSE TO STATES' OBJECTIONS

RESPONSE TO STATES' OBJECTIONS

Final Report, Accounting Year 2017

NEW MEXICO OBJECTIONS

1. Table 4. Determination of Flood Inflows, Artesia to Carlsbad.

New Mexico discovered an error in Table 4 where total Delaware River flow was recorded rather than the required scalped flow. The objection is accepted and the Delaware River scalped flow is set at 3.7 TAF to replace the value of 6.2 TAF that was in the Preliminary Report. See also the first part of the response to Texas objection 2.

2. Table 6. Evaporation loss at Lake Avalon.

New Mexico noted that the surface area of Avalon Reservoir was calculated using the USBR Table from 1997 instead of the updated 2006 area and capacity tables. The River Master searched his files and found no record of having received the updated reservoir tables. A separate request is being sent to New Mexico to provide the tables.

3. Table RM 12. End of month and average elevations for WY 2016

New Mexico reported that data furnished by the NMISC for Sumner Reservoir average elevation, March 2016, was incorrect. The correct value is 4,260.96 feet. Tables 1, 6 and 12 were modified accordingly.

TEXAS OBJECTIONS

1. Table 4. Summary Table for Computations, Carlsbad to State Line [B.5], WY 2016;

Scalped Delaware River Flood Inflows.

Texas noted an incorrect value for Delaware River scalped flows. This is accepted, see NM Objection 1. Texas made an independent analysis of the flows and determined that rainfall in November would increase the flow to 3.8 TAF from 3.7 TAF. Although this is an insignificant increase, as noted by Texas, the River Master notes Texas' position that future rainfalls could add significant amounts to Delaware river flood inflows.

Scalped Flood Flows for Carlsbad to Red Bluff.

Texas made an independent analysis of several periods where additional rain, beyond that measured by the three gages reported by NM, might have been in the area. The following replies are by the bullet points in Texas' compilation.

Texas noted how the computations are to be rounded to the nearest 1 acre-foot. This was done and the 0.035 TAF noted was included in the River Master's total report, although the rounded value does indicate zero. When the change from handling computations was made by joint motion in 2002 to shift from rounding to 100 acre-feet to 1 acre-foot, the intent was to use more computer-aided precision in the computations but not to add more decimal points to the reporting and summaries.

Texas reported computation of an additional 0.278 TAF by examining a wet period from February 22-27 (see Texas Exhibits D and E). However, there is an apparent error in this report as Texas Exhibit D shows a computation of 0.028 TAF instead of 0.278 TAF. The River Master examined this period again and did not compute any additional significant flood runoff. This objection is rejected.

Texas described periods when radar images indicate rain that is not evident on the three gages reported by NM and performed an independent scalping of the hydrographs for those periods. However, as shown by Table 1, the River Master could not verify rain in most of these periods from the radar. Texas also presented an Exhibit C, which includes three gages not actually in the tributary sub-basin but close (Hope, Elk, and WIIP). However, these gages indicated only a very few periods of rain that were not detected by the three gages reported by NM, and in those periods no significant flood runoff was occurring in the tributaries.

Table 1 illustrates the periods when Texas accounted for scalped runoff at time that the River Master did not. Otherwise, Texas' computations are for the same periods as the River Master. As indicated in Table 1, There is little if any indication of rain during the periods indicated, so the main difference in Texas' computation and that of the River Master is in the common time periods of analysis, and the computations are not significantly different in those periods.

Table 1. Texas' scalping periods where River Master did not include flood runoff

Texas scalping dates (1)	Radar? (2)	Show rain? (3)	Rain Gages (4)	Dark Canyon? (5)	Delaware River? (5)	Black River? (5)
1-1 to 1-4	no		no rain	no	No	no
2-22 to 2-27	no		no rain	no	No	no
3-19 to 3.27	no		no rain	no	No	no
4-16 to 4-20	yes	Only 4- 17	no rain	no	No	no
4-30 to 5-9	no		no rain	no	No	no
5-12 to 5-16	no		no rain	no	No	no
6-5 to 6-8	yes	Only 6-6	no rain	no	No	no
7-17 to 7-29	yes	Only 7-18	no rain	no	No	no
10-16 to 10-20	yes		no rain	no	No	no
10-23 to 10-27	yes		no rain	no	No	no
10-29 to 11-4	no		no to 11-2	no	No	no

Explanation of columns: (1) Dates where Texas scalped runoff but the River Master did not; (2) Radar provided by Texas; (3) Radar shows storms; (4) Indication by three rain gages reported by NM of any rain over 0.05-inches; (5) Indication of flood rises on tributaries.

Table 2 compares the computations of Texas and the River Master (same data as Texas Exhibit D). Texas' presentation of decimal places is retained for clarity. With its assumptions, Texas computed 8.95 TAF for flood inflow, Carlsbad to Red Bluff, compared to the River Master's computation of 4.4 TAF. The main difference is in August, where Texas indicates 4.12 TAF versus the River Master's 1.1 TAF. There is an apparent error in Texas' entry on Exhibit D (page 9 of 13), which indicates 1.545 TAF instead of 4.12 TAF. The River Master was unable to check the cause of that error. Even if the large negative value shown for August 31 is deleted, the total is still not 4.12 TAF.

Table 2. River Master and Texas flood inflow computations, Carlsbad to Red Bluff.

	River Master	Texas
Jan	0.0	.047
Feb	0.0	.03
Mar	0.0	.10
Apr	0.1	.14
May	0.2	.42
Jun	0.5	.67
Jul	0.3	.53
Aug	1.1	4.12
Sep	1.7	1.97
Oct	0.2	.46
Nov	0.2	.35
Dec	0.1	.12
Total (TAF)	4.4	8.95

As is apparent from the two tables, most of the difference in the flood inflow estimates is in August, with only small differences in the other months which mainly result from slight differences in scalping the hydrographs. Data from radar or other gages did not make a material difference in the estimates. The one event that has significant rainfall and has been reevaluated is during the late-August rains, which coincided with large flows at the Carlsbad Below Dark Canyon gage.

The River Master reexamined the scalping for the period August 20 – September 13 where there was a significant difference in his estimate and that of Texas. The difference is in the base flow for the Red Bluff gage, as indicated on Figure 1 below. The question to be decided is whether the low point of Red Bluff flow on August 28 is controlled by operational rise or runoff. That is, whether the Red Bluff flow on August 28 has returned to base flow or is still experiencing flood runoff. The tributaries (Black River, Dark Canyon, Delaware) show no rise. There is rain in the area at Hope, but outside the sub-basin. The River Master's conclusion is that, in the absence of any rain or tributary rises, the Red Bluff flow on August 28 is controlled by an operational rise, which is about the same magnitude as other operational rises, about 20 – 30 cfs.

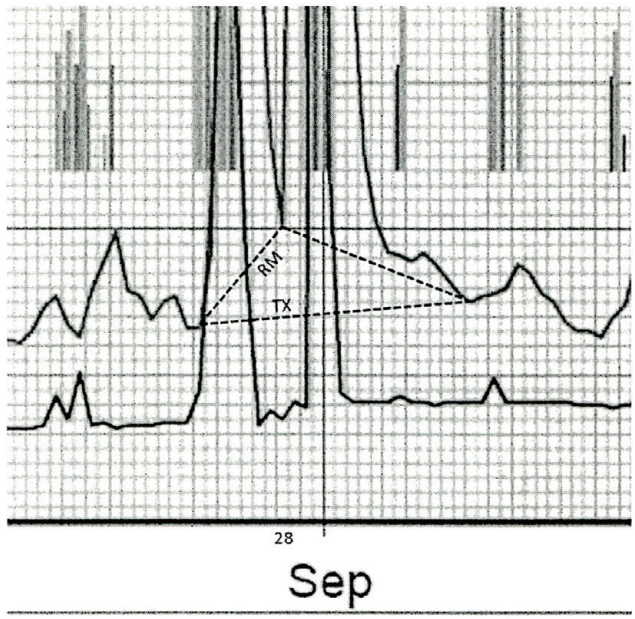

Figure 1. Screen capture of event (note difference in base flow lines)

Per this reanalysis, it is apparent that the differences between the River Master estimates in the Preliminary Report and those of Texas are mostly due to small differences in scalping assumptions and there is no basis to increase the 4.4 TAF for runoff in the reach.

Texas noted that during periods of Dark Canyon Draw flows some negative flood inflows were created, thus triggering RMM Section B.5.a.(3) that requires a separate analysis by deducting DCD flows from the Below Dark Canyon gaged flows and reevaluating the scalped hydrograph for that period. Texas is correct in asking for this reevaluation and presented Exhibit G with its calculation. This calculation shows 3.7 TAF in August and 1.7 TAF in September. There is an error at August 24, which transposes 238cfs to 283 cfs. The River Master recomputed the scalped hydrographs for the event period (assumed to be from August 20-September 13) and found no difference in the outcomes, so no change in the original scalping results was made. The calculations are shown in the spreadsheet just following this page.

The reason for selecting the August 20-September 13 period for analysis is based on the reason for considering negative scalped flows when DCD is flowing. It stems from the relocation of the gage from above DCD (where it was when the 1947 condition was set) to below DCD, where it is presently located. The need to reevaluate these cases is based on the possibility that a hydrograph could become altered during an event and distort the results. For discussion, this change in the RMM was made as a result of NM's Sixth Motion to Modify the Manual, decided on November 4, 1991.

FINAL CALCULATED DEPARTURE

The Preliminary Report's Final Calculated Departure was an overage of 27.9 TAF. After considering the states' objections, the Final Determination is an overage of 28.4 TAF.

Comparison of scalping with and without deducting DCD flows

			PR AT RED BLUFF				PR BELOW DC AT CBD		
	Day	Yr Day	Q	Base	Diff		Q	Base	Diff
AUG									
*****	20	233	66	66	0		34	34	0
	21	234	66	70	-4		45	34	11
	22	235	92	75	17		111	34	77
	23	236	263	79	184		225	34	192
	24	237	483	84	400		194	33	161
	25	238	314	88	226		85	33	52
	26	239	208	92	116		33	33	0
	27	240	131	97	34		38		
*****	28	241	101	101	0		35		
	29	242	350	99	251		41		
	30	243	342	98	244		39	39	0
	31	244	226	96	130		773	40	734
SEP	1	245	347	95	253		123	40	83
	2	246	436	93	343		44	41	4
	3	247	188	91	97		41	41	0
	4	248	125	90	35		41		
	5	249	102	88	14		41		
	6	250	92	86	6		41		
	7	251	91	85	6		43		
	8	252	89	83	6		41		
	9	253	92	82	11		41		
	10	254	88	80	8		40		
	11	255	83	78	5		41		
	12	256	78	77	1		41		
*****	13	257	75	75	0		41		
					2382				1313
			Event difference						1069
	DCD flows deducted					DCD	Q* (less DCD)		
AUG									
*****	20	233	66	66	0		34	34	0
	21	234	66	70	-4	54	-9	34	-43
	22	235	92	75	17	28	83	34	49
	23	236	263	79	184		225	34	192
	24	237	483	84	400	45	149	33	116
	25	238	314	88	226		85	33	52
	26	239	208	92	116		33	33	0
	27	240	131	97	34		38		
*****	28	241	101	101	0		35		
	29	242	350	99	251		41		
	30	243	342	98	244		39	39	0
	31	244	226	96	130	542	231	40	192
SEP	1	245	347	95	253	29	94	40	54
	2	246	436	93	343	0.9	43.1	41	3
	3	247	188	91	97		41	41	0
	4	248	125	90	35		41		
	5	249	102	88	14		41		
	6	250	92	86	6		41		
	7	251	91	85	6		43		
	8	252	89	83	6		41		
	9	253	92	82	11		41		
	10	254	88	80	8		40		
	11	255	83	78	5		41		
	12	256	78	77	1		41		
*****	13	257	75	75	0		41		
					2382				614
			Event difference						1768
	Diff (w and wo/DCD flows_ =								699
		DCD total							700 cfs-days

For the Aug 20- Sep 13 period the event total is 1,069 cfs-days

In the bottom computation, the DCD draw flows are deducted. The event total is 1,768 cfs-days. The difference between this and the upper computation is 699 cfs-days. The DCD total is 700 cfs-days, which is basically identical. So there is no meaningful difference in the two computations.