THE PECOS RIVER MASTER'S MANUAL

November 30, 1987

TEXAS EXHIBIT NO. 108

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INTRODUCTION

This manual contains the procedures to be used by the River Master to make the calculations provided for in the decree of the United States Supreme Court in Texas vs. New Mexico, No. 65 Original. These calculations include determinations of negative or positive departures from New Mexico's delivery obligation.

The computational procedures and the computer programs required to make the computations are described in detail in Texas Exhibit No. 79.

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MANUAL OF PROCEDURES
TO COMPUTE PECOS RIVER COMPACT COMPLIANCE

A. General

1. The so-called "annual flood inflow" for the Alamogordo Dam[1] to state line reach is defined as the sum of the measured flow of the Pecos River below Alamogordo Dam plus the estimated flood inflows from the Alamogordo Dam to Artesia, Artesia to Carlsbad and Carlsbad to state line reaches. The current year's "annual flood inflow" is averaged with the annual flood inflows for the two prior years. This three-year average quantity is termed the "Index Inflow" and is used as "x" in the equation

$$y = 0.0489892\ (x)^{1.42318}$$

in order to determine the index outflow "y," New Mexico's three- year average 1947 condition delivery obligation at the New Mexico- Texas state line. This index inflow-index outflow equation was approved June 11, 1984 by the U.S. Supreme Court in the Texas vs. New Mexico Pecos River Compact Litigation, No. 65 Original. This equation will be used to determine New Mexico's 1947 condition delivery obligation imposed by the Pecos River Compact. A comparison of the index outflow with the three year average historical outflow will identify any delivery depletions from the 1947 condition which might have occurred.

2. There are several factors which, under terms of the Pecos River Compact, might at times increase or decrease New Mexico's obligation to deliver Pecos River water at state line. When appropriate, the following factors may need to be employed to adjust the computed departures in the Compact compliance computations:

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1 On October 17, 1974, Alamogordo Dam was renamed Sumner Dam by the U.S. Congress under Public law 93-447, but for purposes of this manual, Sumner Dam has been usually referenced as Alamogordo Dam.

a. Adjustments for Depletions above Alamogordo Dam

b. Depletions due to McMillan Dike

c. Salvage Water in New Mexico

d. Unappropriated Flood Waters

e. Texas Water Stored in New Mexico Reservoirs

f. Beneficial Consumptive Use of Waters of Delaware River by Texas

B. Procedures to Compute Departures of State Line Flows of the Pecos River from the 1947 Condition

1. General

a. Compute Index Inflow, Alamogordo Dam to New Mexico-Texas state line as follows:[2]

(1). The annual flood inflow is computed as follows:

(a) Gaged flow of the Pecos River below Alamogordo Dam, plus

(b) Computed flood inflow, Alamogordo Dam to Artesia reach, plus

(c) Computed flood inflow, Artesia to Carlsbad reach, plus

(d) Computed flood inflow, Carlsbad to state line reach.

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2 All computations are to be performed in units of 1,000 acre-feet rounded to the nearest 100 acre-feet.

(2) The Index inflow for one year is the average of the annual flood inflow for that year plus the annual flood inflows for the two prior years.

b. Determine New Mexico's 1947 condition delivery obligation at the New Mexico-Texas state line (Index Outflow). The 1947 condition index outflow is determined by the equation:

$$y = 0.0489892(X)^{1.42318}$$

where (X) is the index inflow and Y is the 1947 condition outflow in units of 1,000 acre-feet.

c. Determine the three-year running average historical outflow at the New Mexico-Texas state line.

(1) The annual historical outflow is computed as follows:

(a) Gaged flow of the Pecos River at Red Bluff, New Mexico.

(b) Gaged flow of the Delaware River near Red Bluff, New Mexico.

(2) The three-year average historical outflow for any year is the average of the annual historical outflow for that year and the two prior years.

d. Compute annual departures of state line flows of the Pecos River from the 1947 condition. Compute each annual departure by subtracting the annual 1947 condition delivery obligation (index outflow) from the corresponding three-year average historical outflow. Add algebraically the adjustments to the computed departures as determined under the provisions in Part C herein. A negative departure indicates an underdelivery at state line and a positive departure indicates an overdelivery.

Figure 1 shows the approximate boundary of the Pecos River Basin from its headwaters in New Mexico to the gaging station of the Pecos River near Girvin, Texas. Figures 2, 3 and 4 are stick diagrams of the main stem of the Pecos River showing important tributaries, gaging stations, diversion facilities and reservoirs in New Mexico and Texas.

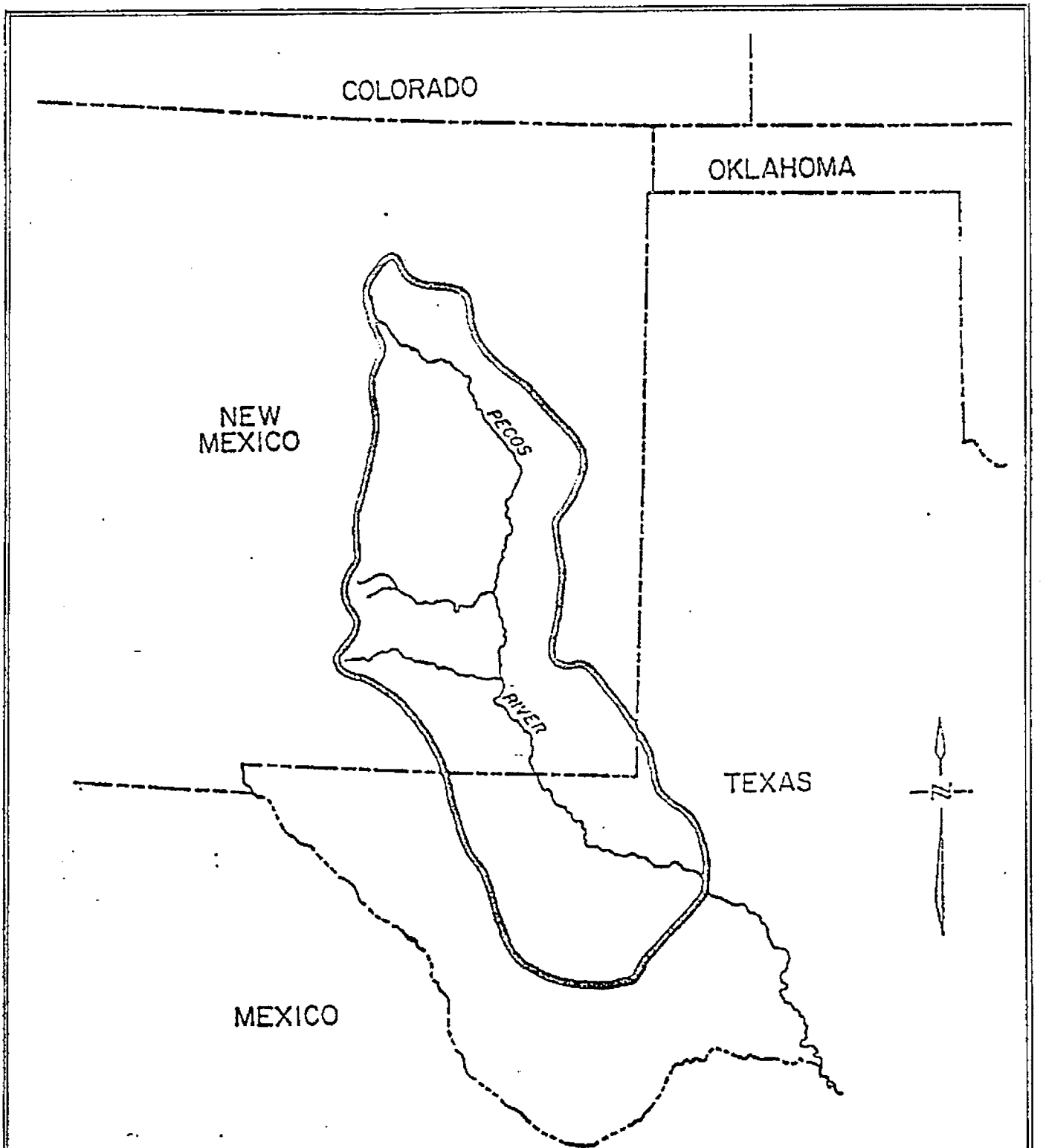

Figure 1
Pecos River Basin
Pecos River Compact
New Mexico-Texas

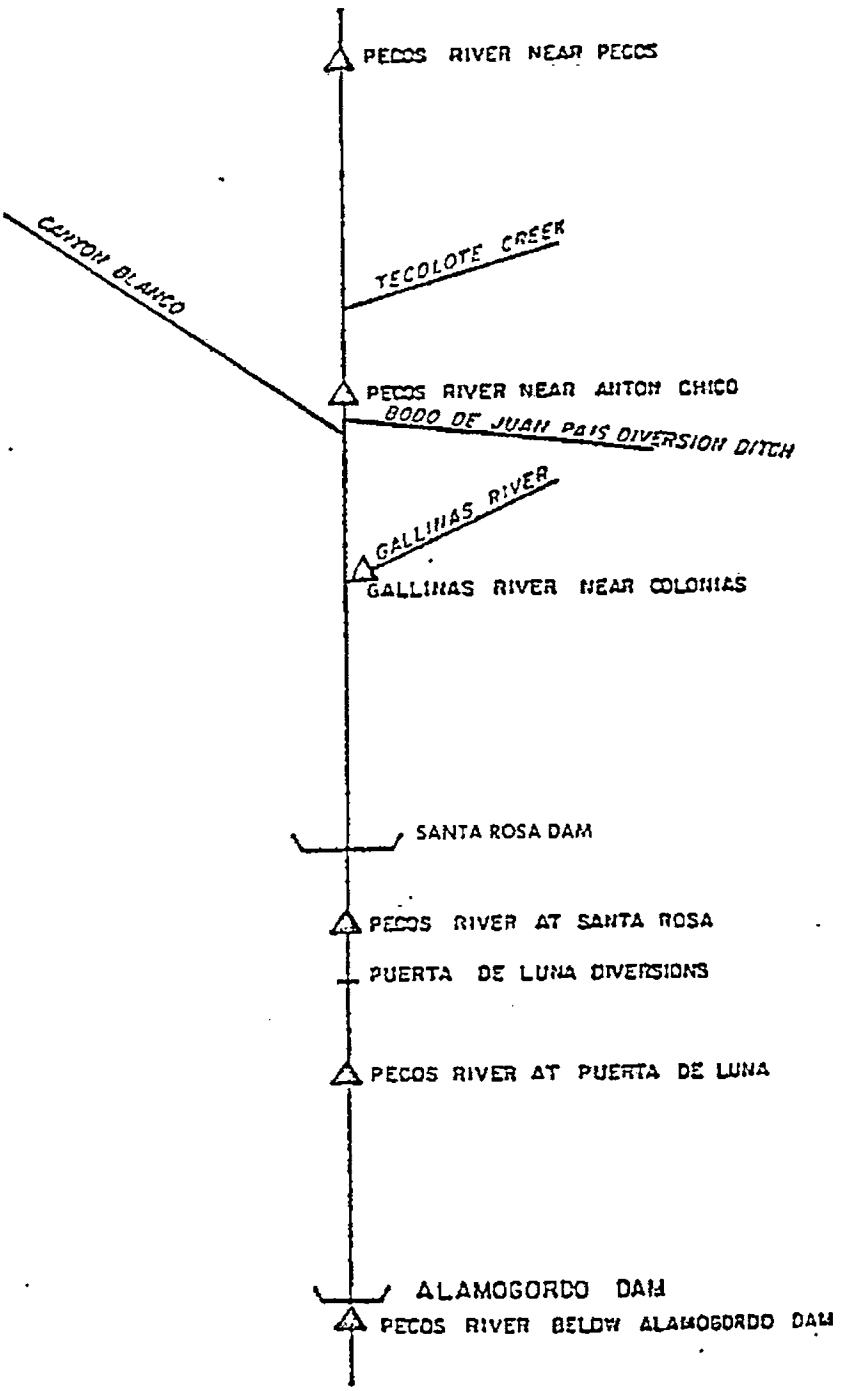

Figure 2
Diagram of Pecos River Near Pecos
to Alamogordo Dam

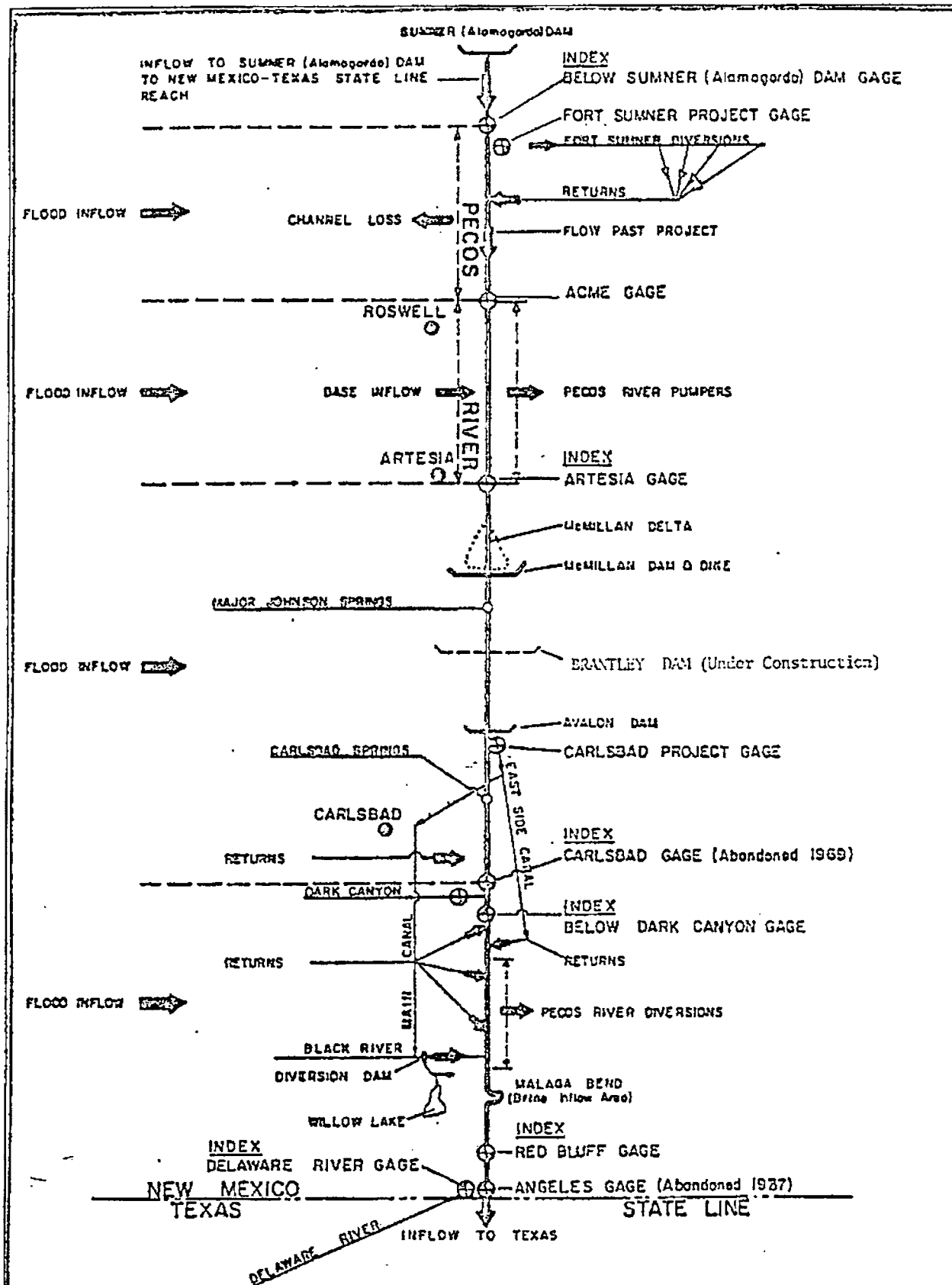

Figure 3

Diagram of Sumner (Alamogordo) Dam to New Mexico-Texas State Line Reach

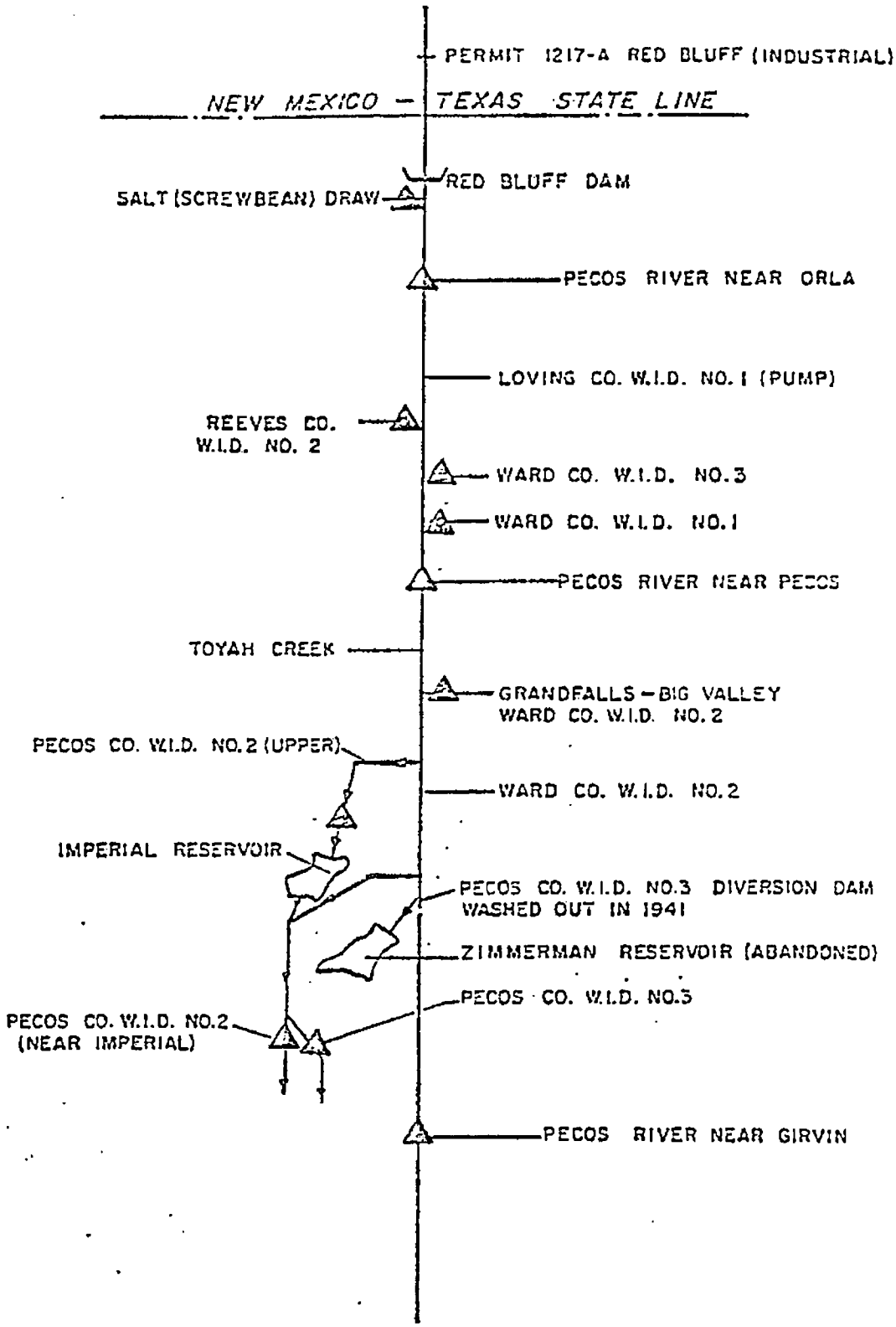

Figure 4

Diagram of Red Bluff-Girvin Area

2. Determination of Alamogordo Reservoir Releases and Spills

Use the monthly United States Geological Survey (USGS) streamflow records for the gaging station, Pecos River below Alamogordo Dam, as the measure of releases and spills from the reservoir.

3. Determination of Flood Inflows, Alamogordo Dam to Artesia

The computational items used to estimate the flood inflows to this 197.8 river mile reach of the Pecos River are listed below, followed by an explanation for each computation to be made. Monthly quantities for each item will be measured or computed, and the annual quantity will be the sum of the monthly quantities.

Streamflow below Alamogordo Dam (see 3.a. below).
Fort Sumner Irrigation District diversion (see 3.b. below)
Fort Sumner Irrigation District return flow (see 3.c. below)
Streamflow past Fort Sumner Irrigation District (see 3.d. below)
Channel loss, Alamogordo Dam to Acme (see 3.e. below)
Computed Residual Flow at Acme (see 3.f. below)
Base inflow, Acme to Artesia (see 3.g. below)
River pump depletions, Acme to Artesia, (see 3.h. below)
Residual Flow at Artesia (see 3.i. below)
Streamflow, Pecos River near Artesia (see 3.j. below)
Flood inflow, Alamogordo Dam to Artesia (see 3.k. below)

a. Streamflow Below Alamogordo Dam

Use the monthly USGS streamflow records for the gaging station, Pecos River below Alamogordo Dam, N.M.

b. Fort Sumner Irrigation District Diversion

Use the monthly USGS discharge records for the gaging station, Fort Sumner Main Canal near Fort Sumner, N.M.

c. Fort Sumner Irrigation District Return Flow

Use 53 percent of the total annual diversion (item b. above) and distribute on a monthly basis as follows:

MONTH	J	F	M	A	M	J	J	A	S	O	N	D
PERCENT	4	3	7	8	12	12	12	12	11	10	5	4

d. Streamflow Past Fort Sumner Irrigation District

From the streamflow below Alamogordo Dam (Item 3.a.), subtract the Fort Sumner Irrigation District diversions (Item 3.b.), and add the Fort Sumner Irrigation District return flows (Item 3.c.). Whenever the computed flow past the District is less than the return flow, set the flow past the District (Item 3.d.) equal to the return flow (Item 3.c.).

e. Channel Loss, Alamogordo Dam to Acme

Compute the monthly river channel losses using the equations below, where X is the flow past the Fort Sumner Irrigation District in units of 1000 acre-feet (Item 3.d.). Whenever the computed loss exceeds the calculated flow past the District, the channel loss (Item 3.e.) is set equal to the flow past the District (Item 3.d.). Any computed negative channel loss is set equal to zero.

Month	Channel Loss "L" by Month in 1000 Acre-Feet
Jan, Feb, Dec	$L = 0.404X - 0.033$
Mar	$L = 0.172X + 0.324$
Apr, May	$L = 0.117X + 1.142$
Jun	$L = 0.173X + 0.998$
Jul	$L = 0.157X - 0.182$
Aug	$L = 0.109X + 1.295$
Sep, Oct	$L = 0.129X + 0.456$
Nov	$L = 0.233X + 0.078$

f. Computed Residual Flow at Acme

Item 3.d. - Item 3.e.

g. Base Inflow, Acme to Artesia

Use the monthly base inflow quantities determined and furnished by the USGS.

h. River Pump Depletion, Acme to Artesia

Use monthly river pump diversion quantities compiled by USGS based upon river pumping from the Pecos River in the Acme to Artesia reach as reported by the New Mexico Pecos River Water Master.

i. Residual Flow at Artesia

Item 3.f. + Item 3.g. - Item 3. h.

j. Steamflow, Pecos River near Artesia

Use the monthly USGS streamflow records for the gaging station, Pecos River near Artesia, N.M.

k. Flood Inflow, Alamogordo Dam to Artesia

Item 3.j. - Item 3.i.

Table 1 shows sample computations for years 1982 and 1983 extracted from Texas Exhibit 79.

4. Determination of Flood Inflows, Artesia to Carlsbad

The computational items used to estimate the flood inflows for this 45.3 river mile reach of the Pecos River are listed below, followed by an explanation of each computation to be made. Monthly quantities for each item will be measured or computed, and the annual quantities will be the sum of the monthly quantities.

Steamflow, Pecos River near Artesia (see 4.a. below)
Major Johnson Springs (new water) (see 4.b. below)
Carlsbad Springs (new water) (see 4.c. below)
Total inflow (see 4.d. below)
Channel losses (see 4.e. below)
Evaporation losses (see 4.f. below)
Change in storage (see 4.g. below)
Net Carlsbad Irrigation District diversions (see 4.h. below)
Other depletions (see 4.i. below)
Steamflow, Pecos River at Carlsbad (see 4.j. below)
Total outflow (see 4.k. below)
Total Flood inflow, Artesia to Carlsbad (see 4.l. below)

TABLE 1
PECOS RIVER COMPACT
ALAMOGORDO DAM TO ARTESIA REACH
PECOS RIVER BASIN, NEW MEXICO
ESTIMATED FLOOD INFLOWS IN 1,000 AC-FT UNITS
1950-1983

YEAR		ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1982	(1)	GAGED FLOW BELOW ALAMOGORDO DAM	.1	.1	5.5	99.6	5.9	8.1	36.3	7.1	36.2	9.1	.0	.0	198.0
	(2)	FT SUMNER DIVERSIONS	.0	.0	9.7	9.7	5.3	9.9	5.1	5.9	5.8	3.6	.2	.0	40.2
	(3)	FT SUMNER RETURN FLOW	.9	.6	1.5	1.7	2.6	2.5	2.5	2.6	2.3	2.1	1.1	.9	21.3
	(4)	FLOW PAST PROJECT	1.0	.7	2.3	91.6	3.2	5.7	33.7	3.8	32.7	2.6	.9	.9	129.1
	(5)	CHANNEL LOSS, FT SUMNER-ACME	.9	.2	.7	6.0	1.5	2.0	5.1	1.7	9.7	.0	.3	.3	23.7
	(6)	COMPUTED RESIDUAL FLOW AT ACME	.6	.5	1.6	35.6	1.7	3.7	20.6	2.1	20.0	1.0	.6	.6	105.9
	(7)	BASE INFLOW ACME-ARTESIA	2.8	2.7	2.2	1.9	1.5	1.1	.8	.8	.9	1.3	1.6	2.9	19.5
	(8)	RIVER PUMP DEPLETION	.0	.2	.9	2.3	1.3	.7	2.9	1.1	1.1	.2	.1	.0	9.8
	(9)	RESIDUAL FLOW AT ARTESIA	3.9	3.0	3.9	38.7	1.9	9.1	27.0	1.8	27.0	2.9	2.1	3.0	115.1
	(10)	PECOS RIVER NEAR ARTESIA	9.2	3.0	2.2	24.5	9.3	.6	29.1	1.2	27.3	7.6	3.2	3.9	116.1
	(11)	FLOOD INFLOW	.0	.0	-1.2	-10.2	7.9	-3.5	2.1	-.6	-.5	9.7	1.1	.9	1.0

YEAR		ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1983	(1)	GAGED FLOW BELOW ALAMOGORDO DAM	.0	.0	3.2	9.2	39.6	11.9	59.6	14.5	27.7	3.0	.0	.0	164.0
	(2)	FT SUMNER DIVERSIONS	.0	.0	2.8	3.7	5.0	5.5	6.9	5.7	4.9	2.0	.0	.0	37.6
	(3)	FT SUMNER RETURN FLOW	.0	.6	1.9	1.6	2.9	2.3	2.9	2.9	2.2	2.0	1.0	.8	19.9
	(4)	FLOW PAST PROJECT	.0	.6	1.0	2.1	36.2	8.2	55.6	11.2	25.0	3.0	1.0	.8	146.3
	(5)	CHANNEL LOSS, FT SUMNER-ACME	.3	.2	.6	1.9	5.9	2.9	0.5	2.5	3.7	.0	.3	.3	26.9
	(6)	COMPUTED RESIDUAL FLOW AT ACME	.5	.9	1.2	.7	30.8	5.8	47.1	8.7	21.3	2.2	.7	.5	119.9
	(7)	BASE INFLOW ACME-ARTESIA	2.6	2.1	1.7	1.2	1.1	.7	.6	.6	.9	1.5	2.0	2.5	17.5
	(8)	RIVER PUMP DEPLETION	.0	.0	.2	.5	2.0	1.2	2.6	1.6	1.9	.2	.0	.0	10.2
	(9)	RESIDUAL FLOW AT ARTESIA	3.1	2.5	2.7	1.9	29.9	5.3	45.1	7.7	20.3	3.5	2.7	3.0	127.2
	(10)	PECOS RIVER NEAR ARTESIA	9.0	3.0	2.1	2.1	20.6	1.5	40.8	2.2	25.9	7.7	9.9	9.2	131.5
	(11)	FLOOD INFLOW	.9	.5	-.6	.7	-1.3	-3.8	-9.3	-5.5	5.1	9.2	7.2	1.2	9.3

EXPLANATION OF ROWS

(1) GAGED STREAMFLOW AT USGS INDEX GAGING STATION PECOS RIVER BELOW ALAMOGORDO DAM
(2) FROM TABLE A-5-3, PAGE 5-16, ROD PRIOR MAR 1950, MEASURED DIVERSIONS THEREAFTER
(3) COMPUTED FROM 53 PERCENT OF ANNUAL QUANTITY ROW(2) TIMES MONTHLY DISTRIBUTION FROM PAGE 5-11, ROD
(4) ROW(1) - ROW(2) + ROW(3);
(5) COMPUTED FROM ROW(4) USING MONTHLY STIPULATED LOSS EQUATIONS OF JULY 3, 1935 (PAGE A-5 OF APPENDIX A)
(6) ROW(4) - ROW(5)
(7) TABLE A-18-1, PAGE 8-5, ROD 1950-56, AND 1957-83 AS DETERMINED BY USGS
(8) TABLE A-7-6, PAGES 7-20 & 21, ROD 1950-56, AND 1957-83 AS TABULATED BY USGS FROM NEW MEXICO DIVERSION RECORDS
(9) ROW(6) + ROW(7) - ROW(8)
(10) REVISED USGS STREAMFLOW RECORDS PECOS RIVER NEAR ARTESIA
(11) ROW(10) - ROW(9)

a. Streamflow, Pecos River near Artesia

Use the monthly USGS streamflow records for the gaging station, Pecos River near Artesia, N.M. (Same as Item 3.j.)

b. Major Johnson Springs (New Water)

(1) Use the equation (X) = 22.737 - 0.1578 (Y) to compute the summer new water discharge rate at Major Johnson Springs, where (X) is the average summer new water discharge rate in cfs and (Y) is the average summer depth in feet below land surface to water level in well 20.26.8.1211 for the months of July, August and September as measured by the USGS.

(2) Compute the monthly new water discharge rates using the following equations:

Months	Rate
Jan, Feb, Mar	X + 5.0 cfs
Apr, May, Jun	X + 2.5 cfs
Jul, Aug, Sep	X
Oct, Nov, Dec	X + 2.5 cfs

wherein X is the new water discharge rate computed in 4.b.(1) above.

Convert the new water discharge rates to units of 1,000 acre-feet each month.

(3) Once Brantley Reservoir begins impounding water, compute the Major Johnson Springs new water by the water balance technique using the following factors in addition to reservoir evaporation, content changes and diversions:

(a) Gaged inflows into and outflows (including spills and releases) from Brantley Reservoir and;

(b) Losses and gains to Brantley Reservoir bank storage by piezometric measurements.

If the above data are not available, the Major Johnson Springs new water shall be assumed to be 8200 acre-feet per year for the water years 1988 and 1989. If the gages and piezometers have not been installed by January 1, 1989, the River Master shall have the gages and piezometers installed and shall bill the expenses of the installation to the states.

c. Carlsbad Springs New Water

(1) use the following procedure to compute the monthly new water discharge quantities rounded to the nearest 100 acre-feet.

(a) Use the annual streamflow records (expressed in cfs) furnished by the USGS for the gaging station, Pecos River below Dark Canyon, at Carlsbad, N.M.

(b) Subtract tributary inflow from Dark Canyon Draw, furnished by USGS at Dark Canyon Draw at Carlsbad gaging station.

(c) Subtract releases and spills from Lake Avalon which are furnished by USGS for gaging station, Pecos River Below Avalon Dam, N.M.

(d) Add 2 cfs for the annual depletions from the Pecos River from the Carlsbad canal flume to the Carlsbad gage. These depletions are caused by the power plant consumptive use, evaporation from Tansill and Bataan Lakes, and all diversions, including the Carlsbad golf course, F. V. Dowling and E. J. Hines.

(e) Subtract the lagged seepage from the main CID canal in cfs which is computed to be 7 percent of the CID diversions measured at Avalon Dam by USGS for gaging station, Carlsbad Main Canal at Head, Carlsbad, N.M. This seepage will have a lagged distribution as follows: one-half in the current quarter; one-third in the following quarter; and one-sixth in the next quarter.

(f) Subtract one cfs to represent the average annual return flow from surface water irrigation between Avalon Dam and the gaging station Pecos River at Carlsbad.

(g) Subtract lagged leakage from Lake Avalon. The leakage from Lake Avalon is estimated by using the mean monthly gage height (H) in feet for Lake Avalon (published by USGS for Lake Avalon Near Carlsbad, N.M.), in the equation: Avalon leakage in cfs = 4.78 (H) - 62.0. One-half of the leakage is assumed to appear at Carlsbad Springs during the current quarter, with one-third to appear during the following quarter and one-sixth during the next quarter.

(h) Subtract 3 cfs to represent the average seepage loss from the Pecos River in the reach between Major Johnson Springs and Dam site No. 3 gage.

(i) The annual new water in cfs is: (a)-(b)-(c)+(d)-(e)-(f)-(g)-(h).

(j) Convert the new water in cfs, item (i), above, to units of 1000 acre-feet, and distribute equally to each month of the year.

B.4.d. Total Inflow

This is the sum of Items B.4.a., B.4.b. and B.4.c.

e. Channel Losses

Compute the monthly river channel losses using the equation (Y) = 0.2165(X)-0.3845, where (Y) is the monthly river channel loss and (X) is the monthly flow of the Pecos River at Artesia in units of 1000 acre-feet (Item 4.a.). Whenever the computed loss exceeds the flow of the Pecos River at Artesia, the calculated loss is set equal to the flow at Artesia. The maximum loss during any one month is limited to 14,300 acre-feet.

f. Evaporation Loss

(1) Compute the total monthly evaporation loss by multiplying the monthly net evaporation rates times the average monthly surface areas for Lake Avalon and Lake McMillan and adding the two quantities.[3]

(2) Use the USGS elevation, area and capacity relationships for Lake Avalon and Lake McMillan Reservoirs to estimate the average monthly surface area for each reservoir.[3] The 1984 area-capacity table for Lake McMillan (Table 2) is to be used until a revised area-capacity table becomes available

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3 When Brantley Reservoir begins impounding water, the evaporation loss and storage change shall be computed for both Brantley and McMillan Reservoirs until the McMillan Dam is breached and no water is stored in McMillan Reservoir after which only Brantley Reservoir will be considered.

Table 2
Lake McMillan

Gage Height-Area-Capacity Relationship
(Based on New Mexico's estimated 1984 sedimentation)

Gage Height (Feet)	Area (Acres)	Capacity (Acre-Feet)
13.1	0	0
14.4	5	2
15.4	50	26
16.4	373	213
17.4	800	786
18.4	1148	1754
19.4	1309	2982
20.4	1663	4464
21.4	2074	6329
22.4	2581	8652
23.4	3183	11529
24.4	3723	14978
25.4	4450	19059
26.1	5550	22551

Note: The gage height of 26.1 feet corresponds to an elevation of 3267.7 feet above the mean sea level with the datum of gage at 3241.6 feet above mean sea level.

Table 3
Lake Avalon

Gage Height-Area-Capacity Relationship

(Based on the USBR 1979 Survey)

Gage Height (Feet)	Area (Acres)	Capacity (Acre-Feet)
4.0	0	0
8.0	1	1
9.0	2	2
10.0	10	7
11.0	28	24
12.0	49	63
13.0	75	123
14.0	170	230
15.0	374	493
16.0	567	975
17.0	682	1608
18.0	754	2327
19.0	822	3115
20.0	892	3972
20.4	920	4334

Note: The gage height of 26.1 feet corresponds to an elevation of 3267.7 feet above the mean sea level with the datum of gage at 3241.6 feet above mean sea level.

and is approved for use. The 1982 area-capacity table based on the 1979 United States Bureau of Reclamation (USBR) sediment survey for Lake Avalon (Table 3) is to be used until a revised area-capacity table based on a new sediment survey performed by the USBR, the U.S. Army Corps of Engineers, USGS, U.S. Soil Conservation Service or a state-registered engineer is available.

Gage height-area-capacity tables for Brantley Reservoir are shown in Appendix A-2 to this Manual.

B.4.f. (3) Use U.S. Weather Bureau evaporation data for Lake Avalon and precipitation data for Artesia and Lake Avalon. Missing evaporation data are to be computed using the following equation:

$$E_L = 2.5 \left[\frac{p}{100} T \frac{(114-H)}{100} - 0.6 \right]$$

where E_L is the lake evaporation rate in inches; "p" is the percentage of daytime hours at the approximate latitude of McMillan and Avalon Reservoirs, as given in the table below; "T" is the mean monthly temperature in °F average of Artesia and Carlsbad; "H" is the average percent humidity for the month computed from the data at 5AM, 11AM, 11PM furnished by U.S. Weather Bureau.

Table of Percentage of Daytime Hours for McMillan & Avalon Reservoirs

Jan.	Feb	Mar	Apr	May	Jun
7.17	6.95	8.36	8.76	9.65	9.62
Jul	Aug	Sep	Oct	Nov	Dec
9.80	9.29	8.34	7.92	7.08	7.02

(a) If Lake Avalon evaporation data are not available, and humidity data at Roswell and other data are not available for estimating evaporation at Lake Avalon and there is not more than one month missing between months for which data are available, estimate the evaporation by interpolation between monthly data. If complete evaporation data are missing for more than two consecutive months and data for all of the above described methods are not

available, find the average daily evaporation that is published for that month and estimate total evaporation by multiplying the average daily evaporation times the number of days in the month.

(b) If precipitation data at Lake Avalon are not available, use Carlsbad precipitation; if Carlsbad precipitation is not available, use the precipitation data at Carlsbad Federal Aeronautic Administration Airport.

(c) Pan evaporation as determined at Lake Avalon is converted to lake surface evaporation by applying a factor of 0.77 and reducing it by the precipitation at Lake Avalon for obtaining the net evaporation rate at Lake Avalon.

For Lake McMillan, the computed lake evaporation rate of Lake Avalon is reduced by the average precipitation at Artesia and Lake Avalon.[4] The computed net evaporation rates are then converted from inches to feet.

g. Change in Storage

Use change in storage data from USGS gage height records for Lake Avalon near Carlsbad, N.M. and for Lake McMillan[5] near Lakewood, N.M. and using gage height-area-capacity data shown in Tables 2 and 3.

h. Net Carlsbad Irrigation District Diversions

Use 93 percent of the USGS published records for the gaging station, Carlsbad Main Canal at Head, Near Carlsbad, N.M.

i. Other Depletions

(1) For other depletions referenced in B.4.c.(1)(d) add 100 acre-feet for all months except July and August and 200 acre-feet for July and August.
(2) Add any depletions as determined by the USGS caused by Brantley Reservoir and due to loss of water to underground aquifers and to the bank storage.

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4 In the future, if pan evaporation data are available at the Brantley Dam site, use these data in estimating the evaporation rates. If data are not available for Brantley Reservoir, use the procedures described in B.4.f.

5 See Footnote 3

j. Streamflow, Pecos River at Carlsbad

Use the USGS gaging station records for Pecos River below Dark Canyon, at Carlsbad, NM, minus the gaged streamflow at the USGS gaging station, Dark Canyon Draw at Carlsbad, NM.

In 1970, the USGS discontinued the gaging station Pecos River at Carlsbad, NM, and moved it to a new site about 0.8 mile downstream. The new "Carlsbad gage" was renamed Pecos River below Dark Canyon Draw and it now measures tributary inflow from Dark Canyon Draw that was not previously measured at the Carlsbad site. The total flow of Dark Canyon must be subtracted from the total flow Pecos River below Dark Canyon Draw in order to arrive at the equivalent total flow at the old location at Carlsbad. This subtracted amount will be added as part of flood inflow in Carlsbad to state line reach.

k. Total Outflow

This is the algebraic sum of Items B.4.e, B.4.f., B.4.g., B.4.h., B.4.i. and B.4.j.

l. Flood Inflow, Artesia to Carlsbad

Determine this quantity by subtracting the total inflow, Item B.4.d., from the total outflow, Item B.4.k.

Table 4 shows sample computations for years 1982 and 1983 extracted from Exhibit No. 79.

B. 5. Determination of Flood Inflows, Carlsbad to New Mexico-Texas State Line

Because of the lack of sufficient data to accurately compute flood inflow in the Carlsbad to state line reach by the inflow-outflow method, the flood inflow for this reach is to be determined by the hydrograph scalping method. Figure 5 shows the factors to be considered in scalping. flood flows from the hydrographs. The computational items used to estimate flood inflows to this 54 river mile reach of the Pecos River are listed below, followed by an explanation of each computation to be made. Monthly quantities for each item will be computed from daily streamflow quantities. The annual quantities will be the sum of the computed monthly flood inflow quantities.

Flood inflow, Carlsbad to state line not including Delaware River flood inflow (see a. below)

Flood inflow, Delaware River (see b. below)

Total flood inflow, Carlsbad to state line (see c. below)

TABLE 4
PECOS RIVER COMPACT
ARTESIA TO CARLSBAD REACH
PECOS RIVER BASIN, NEW MEXICO
ESTIMATED FLOOD INFLOWS IN 1,000 AC-FT UNITS
1950-1983

YEAR		ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1982	(1)	PECOS RIVER NEAR ARTESIA	4.2	3.0	2.2	24.5	9.3	.6	29.1	1.2	27.3	7.6	3.2	3.9	116.1
	(2)	MAJOR JOHNSON SPRINGS (NEW WATER)	.7	.7	.7	.6	.6	.6	.8	.8	.8	.6	.6	.6	6.9
	(3)	CARLSBAD SPRINGS (NEW WATER)	-.7	-.7	-.8	-.8	-.8	-.8	-.8	-.8	-.8	-.8	-.8	-.8	-9.4
	(4)	TOTAL INFLOW	4.2	3.0	2.1	24.3	9.1	.4	28.7	.8	26.9	7.4	3.0	3.7	113.6
	(5)	CHANNEL LOSSES	.5	.3	.1	4.9	1.6	.0	5.9	.0	5.5	1.3	.3	.5	20.9
	(6)	EVAPORATION LOSSES	.7	.8	1.9	2.3	2.2	2.1	1.6	1.6	1.4	1.2	.7	.1	16.6
	(7)	CHANGE IN STORAGE	1.9	.9	-4.4	-4.0	-1.4	-8.2	-6.5	-6.3	-9.9	-3.7	-2.5	-3.1	-44.6
	(8)	NET CID DIVERSION	.0	.0	4.4	10.9	6.5	10.1	10.0	8.6	7.6	8.9	.1	.0	67.1
	(9)	OTHER DEPLETIONS	.1	.1	.1	.1	.1	.1	.2	.2	.1	.1	.1	.1	1.4
	(10)	PECOS RIVER AT CARLSBAD	1.2	1.1	1.0	.2	.6	.4	.4	.4	.6	.8	.7	1.0	9.2
	(11)	TOTAL OUTFLOW	4.4	3.2	3.9	22.4	9.6	4.5	24.6	4.5	25.1	8.6	4.4	4.8	120.0
	(12)	TOTAL FLOOD INFLOW	.2	.2	1.8	-1.9	.5	4.1	-4.1	3.7	-1.8	1.2	1.4	1.1	6.4

YEAR		ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1983	(1)	PECOS RIVER NEAR ARTESIA	4.0	3.0	2.1	2.1	28.6	1.5	40.8	2.2	25.9	7.7	9.9	4.2	131.5
	(2)	MAJOR JOHNSON SPRINGS (NEW WATER)	.8	.7	.8	.6	.6	.6	.5	.5	.4	.6	.6	.6	7.3
	(3)	CARLSBAD SPRINGS (NEW WATER)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.1	-1.1	-1.1	-1.0	-1.0	-1.0	-12.3
	(4)	TOTAL INFLOW	3.8	2.7	1.9	1.7	28.2	1.1	40.2	1.6	24.7	7.3	9.5	3.8	126.5
	(5)	CHANNEL LOSSES	.5	.3	.1	.1	5.8	.0	8.9	.1	5.1	1.3	1.8	.5	24.0
	(6)	EVAPORATION LOSSES	.5	.8	1.7	.8	1.7	1.8	2.3	2.1	1.0	.5	.5	.4	14.1
	(7)	CHANGE IN STORAGE	2.0	.6	-5.5	-8.0	7.8	-8.6	11.9	-10.5	4.9	3.1	-5.1	1.3	4.1
	(8)	NET CID DIVERSION	.0	.0	4.6	10.6	10.3	10.7	14.2	11.5	12.3	4.0	.0	.0	78.2
	(9)	OTHER DEPLETIONS	.1	.1	.1	.1	.1	.1	.2	.2	.1	.1	.1	.1	1.4
	(10)	PECOS RIVER AT CARLSBAD	1.0	1.5	1.0	.7	.5	.6	.2	.2	.3	.8	.7	.8	8.3
	(11)	TOTAL OUTFLOW	4.1	3.3	2.0	4.3	26.2	4.6	37.2	3.6	23.7	9.8	8.2	3.1	130.1
	(12)	TOTAL FLOOD INFLOW	.3	.6	.1	2.6	-2.0	3.5	-3.0	2.0	-1.0	2.5	-1.3	-.7	3.6

EXPLANATION OF ROWS

(1) REVISED USGS STREAMFLOW RECORDS
(2) AS STIPULATED BY TEXAS AND NEW MEXICO ON JULY 3, 1985 (TABLES B-1 AND B-2 OF APPENDIX B)
(3) AS COMPUTED IN TABLES B-4 AND B-5 OF APPENDIX B
(4) ROW(1) + ROW(2) + ROW(3)
(5) COMPUTED FROM ROW(1) FOR EACH MONTH USING TWO TEXAS LOSS EQUATIONS: 1. Y = 0.212*X - 0.048 FOR 1950-53-(STIP.-IN JULY,85);—
2. Y = 0.2165*X - 0.3845 FOR 1954-83 (EQUATION STIPULATED ON NOV. 18, 1985)
(6) COMPUTED EVAPORATION, LAKE MCMILLAN PLUS LAKE AVALON
(7) COMPUTED VALUES, LAKE MCMILLAN PLUS LAKE AVALON CHANGE IN STORAGE
(8) COMPUTED FROM USGS RECORDS (0.93 * GROSS DIVERSION AT AVALON)
(9) DEPLETIONS FROM TANSILL AND BATAAN LAKES ABOVE CARLSBAD GAGE (TABLE B-3 OF APPENDIX B)
(10) REVISED USGS STREAMFLOW RECORDS
(11) ROW(5) + ROW(6) + ROW(7) + ROW(8) + ROW(9) + ROW(10)
(12) ROW(11) - ROW(4)

a. Flood Inflow, Carlsbad to USGS Gage at Red Bluff, N.M.

Use the following procedure.

(1) Prepare daily hydrographs for the USGS gaging station Pecos River below Dark Canyon, at Carlsbad, New Mexico, and Pecos River at Red Bluff, New Mexico and identify apparent flood inflows by hydrograph scalping techniques.

(2) Compute the flood inflows occurring between the upstream and downstream gaging stations as the difference between the scalped flood flow quantities of the two hydrographs; however, flood inflows are only considered when 0.05 inches or more of precipitation has occurred within the reach. Add the gaged flows of Dark Canyon Draw to the scalped flood inflows.

b. Flood Inflow, Delaware River

Use the daily records furnished by the USGS for the gaging station, Delaware River near Red Bluff, N.M. and select flood inflows by inspection of daily data.

c. Flood Inflow, Carlsbad to state Line

Add the estimated flood inflows from item 5.a. to that quantity determined in item 5.b.

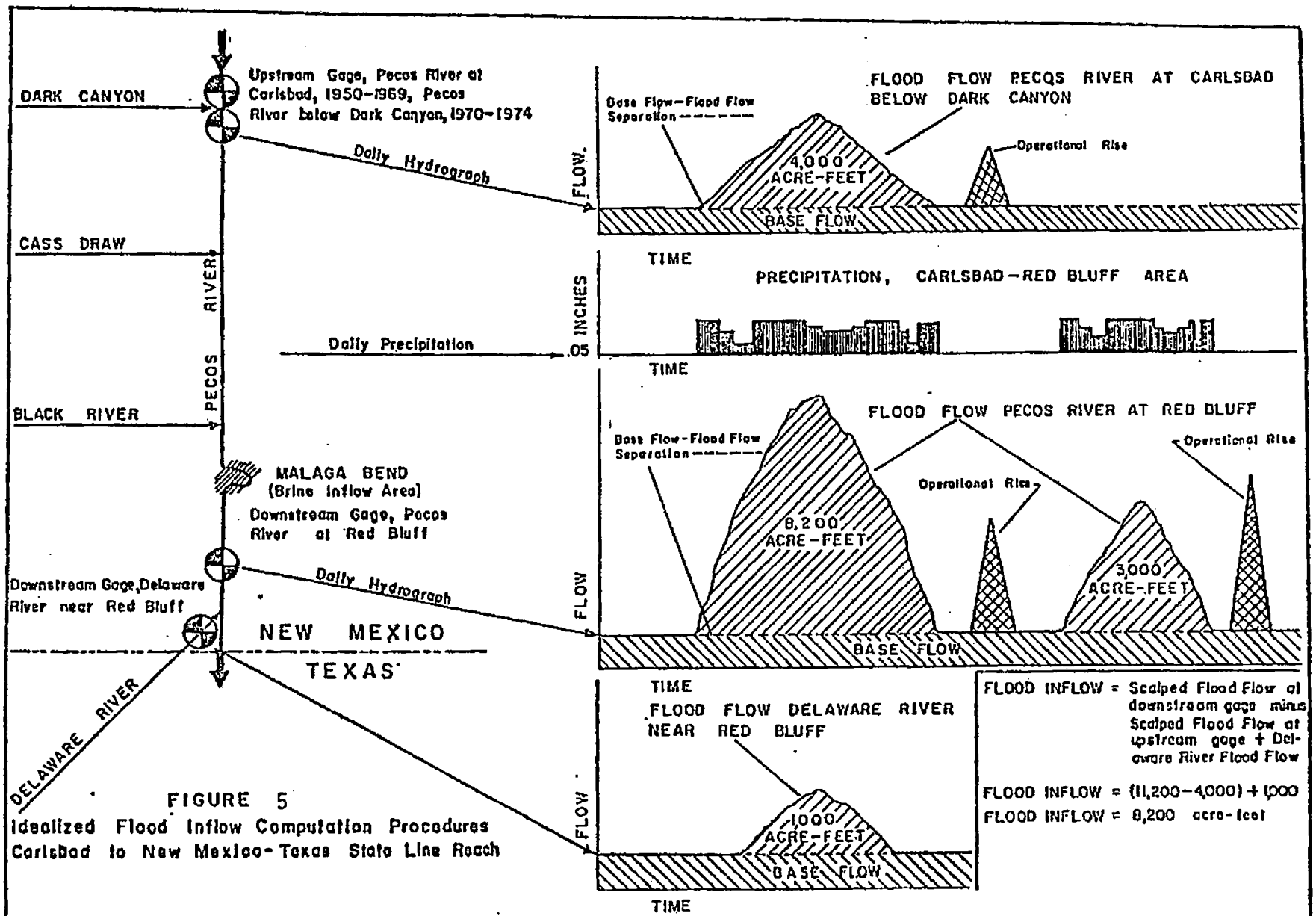

FIGURE 5
Idealized Flood Inflow Computation Procedures
Carlsbad to New Mexico-Texas State Line Reach

C. Adjustments to Computed Departures.

1. Adjustments For Depletions Above Alamogordo Dam

a. Depletions Due to Irrigation

(1) In computing the total irrigated acreage in the Upper Reach, above Alamogordo Dam, to which surface and/or groundwater has been applied during any time of the year, use the irrigated acreage shown on the most recent irrigation inventory as reported by New Mexico. If any water right acreage in the Upper Reach is converted to another use, the depletion will be computed as if the use was irrigation use.

(2) Determine the consumptive use of irrigated acreage by multiplying the irrigated acreage determined in 1.a.(1) by the unit depletion rate for the year in question in acre-feet/acre. The unit depletion rate is determined as follows:

(a) Tabulate the monthly precipitation furnished for the Las Vegas Federal Aviation Administration Airport, Pecos Ranger Station and Santa Rosa for the months April through October. Find the effective precipitation for each station for each month using Figure A-7-2, page 7-11, of Stipulated Exhibit No. 8.

(b) Compute the average effective precipitation of the three stations for each month in inches. Convert the monthly effective precipitation in inches to feet.

(c) Using the following distribution of monthly unit consumptive use of 1.77 acre-feet per acre, subtract the estimated effective precipitation determined in Step 2 from the monthly unit consumptive use.

DISTRIBUTION OF MONTHLY UNIT CONSUMPTIVE USE [6]

(acre-feet per acre)

Apr	May	Jun	Jul	Aug	Sept	Oct	TOTAL
.19	.36	.36	.30	.27	.18	.11	1.77

[6] Monthly distribution of 1.77 acre-feet annual consumptive use calculated from table shown on page 41 of Stipulated Exhibit 11b.

(d) If the monthly effective precipitation estimated in Step 2 equals or exceeds the total monthly consumptive use, set the streamflow depletion equal to zero. If the monthly effective precipitation is less than the consumptive use, the difference is the streamflow depletion. Add the estimated streamflow depletion computed each month April through October to determine the annual streamflow depletion rate to be applied to the historic irrigated acreage for the water year.

(e) Multiply the streamflow depletion rate determined in Step 4 by the irrigated acreage for the water year to determine the total streamflow depletion of the irrigated lands in the upper reach.

(3) Compare the 1947 condition irrigation consumptive use (14,600 acres x 0.74 acre-feet/acre = 10,804 acre-feet per year) with Item (2). If the 1947 condition use exceeds the actual use during the year computed in (2), the gaged streamflow below Alamogordo Dam will be reduced by the difference.

If the actual use computed in (2) exceeds the 1947 condition use, i.e., 10,804 acre-feet per year, then add the difference to the gaged streamflow below Alamogordo Dam.

Recompute New Mexico's 1947 condition delivery obligation and departures at the state line using the revised streamflow of Pecos River below Alamogordo Dam.

b. Depletions Due to Operation of Santa Rosa Reservoir

(1) Determine the average monthly contents of Santa Rosa and Alamogordo Reservoirs and add these two contents to obtain the sum of contents. Use the gage height-area-capacity tables for each reservoir as shown in Appendices A-1 and A-3 of this Manual.

(a) Use the latest gage height-area-capacity Tables for Alamogordo Reservoir as published by U.S. Bureau of Reclamation and in Appendix A-1 to this Manual until another survey is undertaken and area-capacity Tables are published by the U.S. Bureau of Reclamation.

(b) Use the latest gage height-area-capacity Tables for Santa Rosa Lake (Lake Los Esteros) as published by the U.S. Army Corps of Engineers, Albuquerque District, August 1980, and extracted and shown in Appendix A-3 to this Manual, and currently being used by the USGS until another sediment survey is undertaken and area-capacity Tables published.

(2) Compute the monthly historic evaporation losses from Alamogordo Reservoir using the historic average surface area of Alamogordo Reservoir by multiplying it by the net evaporation rate at Alamogordo Dam. Compute the monthly net evaporation rate at Alamogordo Dam as 0.77 times the monthly pan evaporation rate at Alamogordo Dam minus the monthly precipitation at Alamogordo Dam.

(3) Compute the monthly historic evaporation losses from Lake Santa Rosa using the historic average surface area of Lake Santa Rosa multiplying it by the net monthly evaporation rate at Lake Santa Rosa. Compute the net monthly evaporation rate at Lake Santa Rosa as 0.77 times the monthly pan evaporation rate at Lake Santa Rosa minus the monthly precipitation at Lake Santa Rosa.

New Mexico is to provide the pan evaporation and precipitation data for Lake Santa Rosa and Alamogordo Reservoir.

(4) Add the two net monthly historic evaporation losses from Alamogordo and Santa Rosa Reservoirs computed in (2) & (3) above.

(5) Compute the 1947 condition net monthly evaporation loss from Alamogordo Reservoir by assuming its contents equal to the total historic contents of Lake Santa Rosa and Alamogordo Reservoir determined in (1) above. Use the same net evaporation rate from Alamogordo Reservoir as computed in (2) above. (Use Table 3 of Texas Exhibit 68 for Alamogordo Reservoir.)

(6) Subtract 1947 condition net monthly evaporation loss from Alamogordo Reservoir computed in (5) from the total historic net monthly evaporation loss from Alamogordo and Santa Rosa Reservoirs computed in (4) above. Add the 12 monthly values algebraically to make the annual adjustment for excess evaporation.

(7) Compute the excess water held in these two reservoirs during the year over and above the 1947 condition storage of 129,300 acre-feet by the following procedure:

(a) Determine the end of the year combined contents of Santa Rosa and Alamogordo Reservoirs for the current year and the previous year. If both quantities are equal or less than 129,300 acre-feet then the adjustment for excess storage is zero;

(b) If both end of year combined contents are in excess of 129,300 acre-feet, then subtract algebraically the previous year's combined end of year contents from the current year's combined end of year contents;

(c) If the current year's end of year combined contents are less than 129,300 acre-feet and the previous year's end of year combined contents are in excess of 129,300 acre-feet, then subtract algebraically the previous year's combined end of year contents from 129,300 acre-feet; and

(d) If the current year's end of year combined contents are in excess of 129,300 acre-feet but the previous year's end of year combined contents are less than 129,300 acre-feet, then subtract 129,300 acre-feet from the current year's combined end of year contents.

(8) Add algebraically the adjustment for excess evaporation loss computed in (6) above to the adjustment for excess storage held in these two reservoirs, computed in (7) above.

(9) Add algebraically the adjustment computed in (8) to the annual gaged flow below Alamogordo Dam for computing the index inflows.

(10) Recompute New Mexico's 1947 condition delivery obligation and departures at the state line using the adjusted index inflows.

c. Transfer of Water Use by New Mexico to the Upper Reach Upstream from Alamogordo Dam

Add to the streamflow of Pecos River below Alamogordo Dam, the effect of the amount of water diverted by New

Mexico upstream of Alamogordo Dam transferred from the reach below Alamogordo Dam to the state line as reported by New Mexico. If the amount of the diversions is not furnished by New Mexico by March 1, each year, assume the diversion equals the amount of water authorized for transfer in the permit.

Recompute New Mexico's 1947 condition delivery obligation and departures at the state line using the revised streamflow of Pecos River below Alamogordo Dam.

2. Depletions Due to McMillan Dike

Credit the computed departures in B.1.d. with the quantities of depletions caused by the McMillan Dike.

Compute the depletions caused by the McMillan Dike using the following procedures:

a. Use the Alamogordo Dam to New Mexico-Texas state line index inflow computed in B.1.a(2) for the computation year and compute the 1947 condition outflow with McMillan Dike using the following equation:

$$Y=0.046399\ (X)^{1.430603}$$

Where (X) is the index inflow and Y is the 1947 condition outflow in units of 1000 acre-feet.

b. Subtract the outflow computed in 2.a above from the outflow quantity computed in B.1.b.

c. Credit the departures in state line flows computed in B.1.d by the quantity computed in 2.b above.

3. Salvage Water Analysis Criteria and Procedures

a. The term "water salvaged" means that quantity of water which may be recovered and made available for beneficial use and which quantity of water under the 1947 condition was non-beneficially consumed by natural processes.

b. The water salvaged in New Mexico, measured at or near Avalon Dam, through the construction and operation of a project or projects by the United States or by joint undertakings of Texas and New Mexico is apportioned by the Compact as follows: forty-three percent (43%) to Texas and fifty-seven percent (57%) to New Mexico.

c. Any other water salvaged by New Mexico is apportioned by the Compact to New Mexico but will not have the effect of diminishing the quantity of water available to Texas under the 1947 condition. Therefore, the annual Compact compliance computations are only concerned with the water salvage resulting from projects participated in by the United States or from joint Texas-New Mexico projects.

d. Study each water salvage project participated in by the United States and/or each joint Texas-New Mexico project. Determine the amount of water salvaged, if any, and convert to a three year running average quantity.

e. Route the water salvaged from place of occurrence to Avalon Dam, considering only non-beneficial consumption by natural processes. Forty-three percent (43%) of the routed water salvaged reaching Avalon Dam is apportioned to Texas. Add the total quantity of water salvaged that is apportioned to Texas to the delivery obligation of New Mexico at the New Mexico-Texas state line.

4. Unappropriated Flood Waters Analysis Criteria and Procedures

The River Master shall determine and apportion any unappropriated flood waters using methodologies not inconsistent with applicable provisions of the Compact and this Manual.

5. Texas Water Stored in New Mexico Reservoirs.

If a quantity of the Texas allocation is stored in facilities constructed in New Mexico at the request of Texas, then, to the extent not inconsistent with the conditions imposed pursuant to Article IV(e) of the Compact, this quantity will be reduced by the amount of reservoir losses attributable to its storage, and, when released for delivery to Texas, the quantity released less channel losses is to be delivered by New Mexico at the New Mexico-Texas state line.

6. Beneficial Consumptive Use of Waters of Delaware River by Texas.

Add to the computed departures at the New Mexico-Texas state line the amount of beneficial consumptive use of waters of the Delaware River by Texas. These uses shall be furnished by Texas by March 1 each year.

0327P

APPENDIX A-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
SW REGION

CARLSBAD PROJECT, NEW MEXICO

LAKE SUMNER

AREA AND CAPACITY TABLES

NOVEMBER 1973

TABLE OF CONTENTS

MAX W.S. 4297 FT.

TOP Conservation Pool 4275 FT

Crest Outlet Work Str 4200 FT.

INTRODUCTION

Area-capacity tables for Lake Sumner were generated by means of a program (EACAP) developed at the Engineering and Research Center in Denver, which computed incremental area by linear interpolation between basic (5-foot) data contours up to elevation 4,275. Respective capacity equations and capacities are then obtained by integration of the area curves. Each equation generated is valid over successive intervals until it exceeds the confidence limit (which is Epsilon in program EACAP and was equal to .01 for these tables), whereupon a new equation then controls. The capacity curve thus becomes a series of curves, each fitting a certain range of data. The area equations can then be obtained by differentiation of the capacity equations. Capacity equations are the form $y = A1 + A2X^2 + A3X^3$ where y is capacity and x is incremental unit elevation above the elevation base (where x = 0) up to and including the successive elevation base [where x = (successive elevation base) - (initial elevation base)] . Coefficients for capacity equations for Lake Sumner are shown below.

LAKE SUMNER -- CARLSBAD PROJECT
(NOVEMBER 1973 RESURVEY)

COMPUTED
11/30/77
13.01.33.

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1(INTERCEPT)	COEFFICIENT A2(1ST TERM)	COEFFICIENT A3(2ND TERM)
1	4200.00	0	.0000	-.0000	.1000
2	4205.00	2	2.5000	1.0000	.2000
3	4210.00	12	12.5000	3.0000	6.8900
4	4215.00	199	199.7500	71.9000	16.2600
5	4220.00	965	965.7500	234.5000	11.6200
6	4225.00	2428	2421.7153	357.9069	21.0600
7	4235.00	8099	8172.2191	697.6562	29.2900
8	4245.00	18150	18225.0562	1314.2284	47.5190
9	4270.00	80868	80807.1071	3784.3978	75.2189

Basic data for these tables were obtained by averaging widths of end rangelines at 5-foot elevation intervals up to elevation 4,275 for both the 1940 (base) survey and the 1973 resurvey; obtaining ratios of the 1940 and 1973 averages; applying those ratios to their corresponding areas from the base survey; and, finally, by summation of range areas at respective incremental (5-foot) elevations. Extension of the table to elevation 4,297 was achieved by entering the area for elevation 4,300, which was planimetered on 1966 U.S. Geological Survey quad sheets. Base areas had been planimetered at contours within the reservoir for the 1940 survey.

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE FOOT

ELEV. FEET	0	1	2	3	4	5	6	7	8	9
4200	0	0	0	1	1	1	1	2	2	3
4210	3	17	31	44	58	72	104	137	169	202
4220	235	258	281	304	327	351	400	442	484	526
4230	569	611	653	695	737	779	779	815	873	932
4240	991	1049	1108	1166	1225	1283	1409	1504	1599	1694
4250	1789	1884	1979	2075	2170	2265	2360	2455	2550	2645
4260	2740	2835	2930	3025	3120	3215	3310	3405	3500	3595
4270	3690	3935	4085	4236	4386	4537	4687	4837	4988	5138
4280	5289	5439	5590	5740	5891	6041	6191	6342	6492	6643
4290	6793	6944	7094	7244	7395	7545	7696	7846		

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

CAPACITY TABLE IN ACRE FEET

ELEVATION INCREMENT IS ONE FOOT

ELEV. FEET	0	1	2	3	4	5	6	7	8	9
4200	0	0	0	1	2	2	4	5	7	10
4210	12	22	46	84	135	200	288	409	562	748
4220	966	1212	1481	1774	2090	2429	2801	3222	3685	4190
4230	4738	5327	5959	6633	7349	8107	8899	9685	10529	11431
4240	12393	13413	14491	15628	16824	18078	19587	21044	22595	24242
4250	25984	27821	29753	31780	33902	36119	38431	40839	43341	45938
4260	48630	51418	54300	57277	60350	63517	66780	70137	73590	77137
4270	80780	84667	88677	92837	97148	101610	106221	110984	115896	120959
4280	126173	131537	137051	142716	148532	154497	160614	166880	173297	179865
4290	186583	193451	200470	207639	214959	222429	230049	237820		

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4200	0	0	0	0	0	0	0	0	0	0
4201	0	0	0	0	0	0	0	0	0	0
4202	0	0	0	0	0	0	1	1	1	1
4203	1	1	1	1	1	1	1	1	1	1
4204	1	1	1	1	1	1	1	1	1	1
4205	1	1	1	1	1	1	1	1	1	1
4206	1	1	1	2	2	2	2	2	2	2
4207	2	2	2	2	2	2	2	2	2	2
4208	2	2	2	2	2	2	2	2	3	3
4209	3	3	3	3	3	3	3	3	3	3
4210	3	4	6	7	9	10	11	13	14	15
4211	17	18	20	21	22	24	25	26	28	29
4212	31	32	33	35	36	37	39	40	42	43
4213	44	46	47	48	50	51	53	54	55	57
4214	58	59	61	62	64	65	66	68	69	71
4215	72	75	78	82	85	88	91	95	98	101
4216	104	108	111	114	117	121	124	127	130	134
4217	137	140	143	147	150	153	156	160	163	166
4218	169	173	176	179	182	186	189	192	195	199
4219	202	205	208	212	215	218	221	225	228	231
4220	235	237	239	241	244	246	248	251	253	255
4221	258	260	262	265	267	269	272	274	276	279
4222	281	283	286	288	290	293	295	297	300	302
4223	304	307	309	311	314	316	318	320	323	325
4224	327	330	332	334	337	339	341	344	346	348
4225	351	362	366	371	375	379	383	387	392	396
4226	400	404	408	413	417	421	425	430	434	438
4227	442	446	451	455	459	463	467	472	476	480
4228	484	488	493	497	501	505	510	514	518	522
4229	526	531	535	539	543	547	552	556	560	564

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4230	569	573	577	581	585	590	594	598	602	606
4231	611	615	619	623	627	632	636	640	644	649
4232	653	657	661	665	670	674	678	682	686	691
4233	695	699	703	708	712	716	720	724	729	733
4234	737	741	745	750	754	758	762	766	771	775
4235	779	779	779	779	779	779	779	779	779	779
4236	779	779	779	779	780	786	791	797	803	809
4237	815	821	827	832	838	844	850	856	862	868
4238	873	879	885	891	897	903	909	914	920	926
4239	932	938	944	950	955	961	967	973	979	985
4240	991	996	1002	1008	1014	1020	1026	1032	1037	1043
4241	1049	1055	1061	1067	1073	1078	1084	1090	1096	1102
4242	1108	1114	1119	1125	1131	1137	1143	1149	1155	1160
4243	1166	1172	1178	1184	1190	1196	1201	1207	1213	1219
4244	1225	1231	1237	1242	1248	1254	1260	1266	1272	1278
4245	1283	1324	1333	1343	1352	1362	1371	1381	1390	1400
4246	1409	1419	1428	1438	1447	1457	1466	1476	1485	1495
4247	1504	1514	1523	1533	1542	1552	1561	1571	1580	1590
4248	1599	1609	1618	1628	1637	1647	1656	1666	1675	1685
4249	1694	1704	1713	1723	1732	1742	1751	1761	1770	1780
4250	1789	1799	1808	1818	1827	1837	1846	1856	1865	1875
4251	1884	1894	1903	1913	1922	1932	1941	1951	1960	1970
4252	1979	1989	1999	2008	2018	2027	2037	2046	2056	2065
4253	2075	2084	2094	2103	2113	2122	2132	2141	2151	2160
4254	2170	2179	2189	2198	2208	2217	2227	2236	2246	2255
4255	2265	2274	2284	2293	2303	2312	2322	2331	2341	2350
4256	2360	2369	2379	2388	2398	2407	2417	2426	2436	2445
4257	2455	2464	2474	2483	2493	2502	2512	2521	2531	2540
4258	2550	2559	2569	2578	2588	2597	2607	2616	2626	2635
4259	2645	2654	2664	2673	2683	2692	2702	2711	2721	2730

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4260	2740	2749	2759	2768	2778	2787	2797	2806	2816	2825
4261	2835	2844	2854	2863	2873	2882	2892	2901	2911	2920
4262	2930	2939	2949	2958	2968	2977	2987	2996	3006	3015
4263	3025	3034	3044	3053	3063	3072	3082	3091	3101	3110
4264	3120	3129	3139	3148	3158	3167	3177	3186	3196	3205
4265	3215	3224	3234	3243	3253	3263	3272	3282	3291	3301
4266	3310	3320	3329	3339	3348	3358	3367	3377	3386	3396
4267	3405	3415	3424	3434	3443	3453	3462	3472	3481	3491
4268	3500	3510	3519	3529	3538	3548	3557	3567	3576	3586
4269	3595	3605	3614	3624	3633	3643	3652	3662	3671	3681
4270	3690	3799	3814	3830	3845	3860	3875	3890	3905	3920
4271	3935	3950	3965	3980	3995	4010	4025	4040	4055	4070
4272	4085	4100	4115	4130	4145	4160	4176	4191	4206	4221
4273	4236	4251	4266	4281	4296	4311	4326	4341	4356	4371
4274	4386	4401	4416	4431	4446	4461	4476	4491	4506	4522
4275	4537	4552	4567	4582	4597	4612	4627	4642	4657	4672
4276	4687	4702	4717	4732	4747	4762	4777	4792	4807	4822
4277	4837	4853	4868	4883	4898	4913	4928	4943	4958	4973
4278	4988	5003	5018	5033	5048	5063	5078	5093	5108	5123
4279	5138	5153	5168	5183	5199	5214	5229	5244	5259	5274
4280	5289	5304	5319	5334	5349	5364	5379	5394	5409	5424
4281	5439	5454	5469	5484	5499	5514	5529	5545	5560	5575
4282	5590	5605	5620	5635	5650	5665	5680	5695	5710	5725
4283	5740	5755	5770	5785	5800	5815	5830	5845	5860	5875
4284	5891	5906	5921	5936	5951	5966	5981	5996	6011	6026
4285	6041	6056	6071	6086	6101	6116	6131	6146	6161	6176
4286	6191	6206	6221	6237	6252	6267	6282	6297	6312	6327
4287	6342	6357	6372	6387	6402	6417	6432	6447	6462	6477
4288	6492	6507	6522	6537	6552	6567	6583	6598	6613	6628
4289	6643	6658	6673	6688	6703	6718	6733	6748	6763	6778

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4290	6793	6808	6823	6838	6853	6868	6883	6898	6914	6929
4291	6944	6959	6974	6989	7004	7019	7034	7049	7064	7079
4292	7094	7109	7124	7139	7154	7169	7184	7199	7214	7229
4293	7244	7260	7275	7290	7305	7320	7335	7350	7365	7380
4294	7395	7410	7425	7440	7455	7470	7485	7500	7515	7530
4295	7545	7560	7575	7590	7606	7621	7636	7651	7666	7681
4296	7696	7711	7726	7741	7756	7771	7786	7801	7816	7831
4297	7846									

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

CAPACITY TABLE IN ACRE FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4200	0	0	0	0	0	0	0	0	0	0
4201	0	0	0	0	0	0	0	0	0	0
4202	0	0	0	1	1	1	1	1	1	1
4203	1	1	1	1	1	1	1	1	1	2
4204	2	2	2	2	2	2	2	2	2	2
4205	2	3	3	3	3	3	3	3	3	4
4206	4	4	4	4	4	4	5	5	5	5
4207	5	5	6	6	6	6	6	7	7	7
4208	7	8	8	8	8	8	9	9	9	9
4209	10	10	10	10	11	11	11	12	12	12
4210	12	13	13	14	15	16	17	18	19	21
4211	22	24	26	28	30	33	35	38	40	43
4212	46	49	52	56	59	63	67	71	75	79
4213	84	88	93	97	102	107	113	118	123	129
4214	135	141	147	153	159	166	172	179	186	193
4215	200	207	215	223	231	240	249	258	268	278
4216	288	299	309	321	332	344	356	369	382	395
4217	409	422	437	451	466	481	497	512	529	545
4218	562	579	596	614	632	651	669	688	708	727
4219	748	768	789	810	831	853	875	897	920	942
4220	966	989	1013	1037	1061	1086	1111	1136	1161	1186
4221	1212	1238	1264	1290	1317	1344	1371	1398	1425	1453
4222	1481	1509	1538	1567	1595	1625	1654	1684	1713	1744
4223	1774	1804	1835	1866	1897	1929	1961	1992	2025	2057
4224	2090	2123	2156	2189	2223	2256	2290	2325	2359	2394
4225	2429	2458	2494	2531	2568	2606	2644	2683	2722	2761
4226	2801	2841	2882	2923	2964	3006	3048	3091	3134	3178
4227	3222	3266	3311	3356	3402	3448	3495	3542	3589	3637
4228	3685	3734	3783	3832	3882	3932	3983	4034	4086	4138
4229	4190	4243	4296	4350	4404	4459	4514	4569	4625	4681

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

CAPACITY TABLE IN ACRE FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4230	4738	4795	4852	4910	4969	5027	5086	5146	5206	5266
4231	5327	5389	5450	5512	5575	5638	5701	5765	5829	5894
4232	5959	6024	6090	6157	6223	6291	6358	6426	6495	6564
4233	6633	6703	6773	6843	6914	6986	7057	7130	7202	7275
4234	7349	7423	7497	7572	7647	7722	7799	7875	7952	8029
4235	8107	8242	8313	8364	8456	8528	8601	8675	8749	8824
4236	8899	8975	9052	9129	9206	9285	9363	9443	9523	9604
4237	9685	9766	9849	9932	10015	10099	10184	10269	10355	10442
4238	10529	10616	10705	10793	10883	10973	11063	11155	11246	11339
4239	11431	11525	11619	11714	11809	11905	12001	12098	12196	12294
4240	12393	12492	12592	12693	12794	12895	12998	13100	13204	13308
4241	13413	13518	13624	13730	13837	13944	14053	14161	14271	14381
4242	14491	14602	14714	14826	14939	15052	15166	15281	15396	15512
4243	15628	15745	15862	15981	16099	16218	16338	16459	16580	16701
4244	16824	16946	17070	17194	17318	17443	17569	17695	17822	17950
4245	18078	18357	18490	18624	18758	18894	19031	19168	19307	19446
4246	19587	19728	19871	20014	20158	20303	20449	20597	20745	20894
4247	21044	21194	21346	21499	21653	21808	21963	22120	22277	22436
4248	22595	22756	22917	23079	23243	23407	23572	23738	23905	24073
4249	24242	24412	24583	24755	24928	25101	25276	25452	25628	25806
4250	25984	26164	26344	26525	26708	26891	27075	27260	27446	27633
4251	27821	28010	28200	28391	28582	28775	28969	29164	29359	29556
4252	29753	29952	30151	30351	30552	30755	30958	31162	31367	31573
4253	31780	31988	32197	32407	32618	32829	33042	33256	33470	33686
4254	33902	34120	34338	34557	34778	34999	35221	35444	35668	35893
4255	36119	36346	36574	36803	37033	37263	37495	37728	37961	38196
4256	38431	38668	38905	39144	39383	39623	39864	40106	40349	40594
4257	40839	41084	41331	41579	41828	42078	42328	42580	42833	43086
4258	43341	43596	43853	44110	44368	44627	44888	45149	45411	45674
4259	45938	46203	46469	46736	47003	47272	47542	47813	48084	48357

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

CAPACITY TABLE IN ACRE FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4260	48630	48905	49180	49456	49734	50012	50291	50571	50852	51135
4261	51418	51702	51986	52272	52559	52847	53136	53425	53716	54007
4262	54300	54593	54888	55183	55479	55777	56075	56374	56674	56975
4263	57277	57580	57884	58189	58495	58802	59109	59418	59728	60038
4264	60350	60662	60976	61290	61605	61922	62239	62557	62876	63196
4265	63517	63839	64162	64486	64811	65137	65463	65791	66120	66449
4266	66780	67111	67444	67777	68111	68447	68783	69120	69458	69797
4267	70137	70478	70820	71163	71507	71852	72197	72544	72892	73240
4268	73590	73940	74292	74644	74997	75352	75707	76063	76420	76778
4269	77137	77497	77858	78220	78583	78947	79312	79677	80044	80412
4270	80780	81186	81567	81949	82333	82718	83105	83493	83883	84274
4271	84667	85061	85457	85854	86253	86653	87055	87458	87863	88269
4272	88677	89086	89497	89909	90323	90738	91155	91573	91993	92414
4273	92837	93262	93687	94115	94544	94974	95406	95839	96274	96710
4274	97148	97588	98028	98471	98915	99360	99807	100255	100705	101157
4275	101610	102064	102520	102977	103436	103897	104359	104822	105287	105753
4276	106221	106691	107162	107634	108108	108584	109061	109539	110019	110501
4277	110984	111468	111954	112442	112931	113421	113913	114407	114902	115398
4278	115896	116396	116897	117399	117903	118409	118916	119425	119935	120446
4279	120959	121474	121990	122508	123027	123547	124069	124593	125118	125645
4280	126173	126703	127234	127766	128301	128836	129373	129912	130452	130994
4281	131537	132082	132628	133175	133725	134275	134828	135381	135936	136493
4282	137051	137611	138172	138735	139299	139865	140432	141001	141571	142143
4283	142716	143291	143867	144445	145024	145605	146187	146771	147356	147943
4284	148532	149121	149713	150306	150900	151496	152093	152692	153292	153894
4285	154497	155102	155709	156316	156926	157537	158149	158763	159378	159995
4286	160614	161233	161855	162478	163102	163728	164355	164984	165615	166247
4287	166880	167515	168151	168789	169429	170070	170712	171356	172002	172649
4288	173297	173947	174599	175252	175906	176562	177220	177879	178539	179201
4289	179865	180530	181196	181864	182534	183205	183877	184551	185227	185904

LAKE SUMNER -- CARLSBAD PROJECT

(NOVEMBER 1973 RESURVEY)

CAPACITY TABLE IN ACRE FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4290	186583	187263	187944	188627	189312	189998	190686	191375	192065	192757
4291	193451	194146	194843	195541	196240	196942	197644	198348	199054	199761
4292	200470	201180	201892	202605	203319	204036	204753	205472	206193	206915
4293	207639	208364	209091	209819	210549	211280	212013	212747	213483	214220
4294	214959	215699	216441	217184	217929	218675	219423	220172	220923	221675
4295	222429	223184	223941	224699	225459	226220	226983	227747	228513	229281
4296	230049	230820	231592	232365	233140	233916	234694	235473	236254	237037
4297	237820									

APPENDIX A-2

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

CAPACITY TABLE IN ACRE FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3202	0	0	0	0	0	0	1	1	1	1
3203	2	2	3	3	4	4	5	5	6	7
3204	7	8	9	10	10	11	12	13	14	15
3205	16	17	19	20	21	22	23	25	26	28
3206	29	30	32	34	35	37	38	40	42	44
3207	45	47	49	51	53	55	57	59	61	63
3208	65	67	70	72	74	77	79	81	84	86
3209	89	91	94	97	99	102	105	107	110	113
3210	116	119	122	125	129	132	136	140	143	147
3211	152	156	160	165	169	174	179	184	189	195
3212	200	206	212	217	223	229	236	242	249	255
3213	262	269	276	283	290	298	305	313	321	329
3214	337	345	353	362	370	379	388	397	406	415
3215	425	434	444	454	464	474	484	494	505	515
3216	526	537	548	559	570	581	593	604	616	628
3217	640	652	664	677	689	702	715	728	741	754
3218	767	781	794	808	822	836	850	864	878	893
3219	908	922	937	952	967	983	998	1014	1029	1045
3220	1061	1077	1098	1110	1127	1144	1161	1179	1196	1214
3221	1232	1251	1269	1288	1307	1327	1346	1366	1386	1406
3222	1426	1447	1468	1489	1510	1532	1554	1576	1598	1620
3223	1643	1666	1689	1713	1736	1760	1784	1808	1833	1858
3224	1883	1908	1933	1959	1985	2011	2037	2064	2091	2118
3225	2145	2172	2200	2228	2256	2284	2313	2342	2371	2400
3226	2430	2459	2489	2519	2550	2581	2611	2643	2674	2705
3227	2737	2769	2801	2834	2867	2899	2933	2966	3000	3033
3228	3067	3102	3136	3171	3206	3241	3276	3312	3348	3384
3229	3420	3457	3494	3531	3568	3605	3643	3681	3719	3757

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

CAPACITY TABLE IN ACRE FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3230	3796	3835	3875	3915	3957	3999	4042	4085	4129	4174
3231	4220	4267	4314	4362	4411	4460	4511	4562	4613	4666
3232	4719	4773	4828	4883	4939	4996	5054	5112	5172	5232
3233	5292	5354	5416	5479	5542	5607	5672	5738	5804	5872
3234	5940	6009	6078	6149	6220	6292	6364	6438	6512	6587
3235	6662	6739	6816	6893	6972	7051	7131	7212	7294	7376
3236	7459	7543	7627	7713	7799	7885	7973	8061	8150	8240
3237	8330	8421	8513	8606	8700	8794	8889	8984	9081	9178
3238	9276	9375	9474	9574	9675	9777	9879	9982	10086	10191
3239	10296	10402	10509	10617	10725	10834	10944	11055	11166	11278
3240	11391	11505	11620	11735	11852	11970	12089	12209	12331	12453
3241	12576	12700	12826	12952	13080	13208	13338	13469	13600	13733
3242	13867	14002	14138	14275	14413	14553	14693	14834	14977	15120
3243	15264	15410	15557	15704	15853	16003	16154	16306	16459	16613
3244	16768	16924	17081	17239	17399	17559	17721	17883	18047	18212
3245	18377	18544	18712	18881	19051	19222	19394	19567	19741	19916
3246	20093	20270	20449	20628	20809	20990	21173	21357	21542	21728
3247	21914	22102	22292	22482	22673	22865	23058	23253	23448	23645
3248	23842	24041	24240	24441	24643	24846	25050	25255	25461	25668
3249	25876	26085	26296	26507	26719	26933	27147	27363	27580	27797
3250	28016	28236	28458	28681	28906	29133	29362	29592	29823	30057
3251	30292	30529	30767	31007	31249	31492	31737	31984	32232	32482
3252	32734	32987	33242	33498	33757	34017	34278	34541	34806	35073
3253	35341	35611	35882	36156	36431	36707	36985	37265	37546	37830
3254	38114	38401	38689	38979	39270	39563	39858	40154	40452	40752
3255	41054	41357	41661	41968	42276	42585	42896	43207	43520	43832
3256	44145	44459	44774	45090	45406	45723	46041	46360	46680	47000
3257	47321	47644	47967	48291	48616	48942	49269	49598	49927	50257
3258	50588	50921	51254	51592	51937	52290	52652	53020	53397	53782
3259	54175	54575	54983	55400	55824	56256	56695	57143	57598	58062

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

CAPACITY TABLE IN ACRE FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3260	58533	59011	59496	59986	60483	60986	61495	62010	62531	63058
3261	63591	64131	64676	65228	65785	66349	66919	67495	68077	68665
3262	69260	69860	70467	71079	71698	72323	72954	73591	74234	74883
3263	75539	76200	76868	77542	78221	78907	79599	80297	81001	81712
3264	82428	83151	83879	84614	85355	86102	86855	87614	88379	89151
3265	89928	90712	91501	92297	93099	93907	94721	95541	96367	97200
3266	98038	98883	99733	100590	101453	102322	103197	104079	104966	105859
3267	106759	107664	108576	109494	110418	111348	112284	113226	114175	115129
3268	116090	117064	118061	119080	120121	121184	122258	123334	124412	125490
3269	126570	127654	128744	129840	130942	132050	133164	134285	135411	136544
3270	137682	138828	139981	141141	142308	143483	144665	145854	147051	148254
3271	149466	150684	151910	153144	154384	155632	156887	158150	159420	160697
3272	161981	163273	164573	165879	167193	168514	169843	171178	172522	173872
3273	175230	176595	177968	179347	180735	182129	183531	184940	186356	187780
3274	189211	190650	192095	193549	195009	196477	197952	199434	200924	202421
3275	203925	205437	206956	208482	210016	211557	213105	214661	216224	217794
3276	219372	220957	222549	224149	225756	227370	228992	230621	232257	233901
3277	235552	237210	238875	240548	242229	243916	245611	247313	249023	250740
3278	252464	254195	255934	257681	259434	261195	262963	264739	266521	268312
3279	270109	271914	273726	275545	277372	279206	281048	282897	284753	286616
3280	288487	290365	292253	294148	296052	297965	299886	301816	303754	305701
3281	307656	309619	311592	313572	315561	317559	319565	321580	323603	325635
3282	327675	329724	331781	333846	335921	338003	340094	342194	344302	346419
3283	348544	350678	352820	354971	357130	359298	361474	363658	365852	368053
3284	370264	372482	374709	376945	379189	381442	383703	385973	388251	390538
3285	392833	395137	397449	399770	402099	404437	406783	409137	411501	413872
3286	416253	418641	421038	423444	425858	428281	430712	433152	435600	438057
3287	440522	442996	445478	447969	450468	452976	455492	458017	460550	463092
3288	465642	468201	470768	473344	475928	478521	481122	483732	486350	488977
3289	491612	494256	496908	499569	502238	504916	507602	510297	513000	515712

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

CAPACITY TABLE IN ACRE FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3290	518432	521161	523898	526645	529400	532164	534936	537717	540508	543306
3291	546114	548930	551755	554589	557432	560283	563143	566012	568889	571776
3292	574671	577574	580487	583408	586338	589277	592224	595180	598145	601119
3293	604102	607093	610093	613101	616119	619145	622180	625224	628276	631337
3294	634407	637486	640573	643669	646774	649888	653010	656141	659281	662429
3295	665587	668753	671928	675111	678304	681505	684714	687933	691160	694396
3296	697641	700894	704157	707428	710707	713996	717293	720599	723914	727237
3297	730570	733911	737260	740619	743986	747362	750746	754140	757542	760953
3298	764373	767801	771238	774684	778139	781602	785074	788555	792045	795543
3299	799050	802566	806090	809624	813166	816717	820276	823844	827421	831007
3300	834602	838205	841818	845441	849073	852715	856366	860026	863696	867375
3301	871064	874762	878470	882187	885914	889650	893396	897151	900915	904689
3302	908473	912265	916068	919880	923701	927532	931372	935222	939081	942949
3303	946828	950715	954612	958519	962435	966360	970295	974239	978193	982156
3304	986129	990111	994103	998104	1002115	1006135	1010164	1014203	1018251	1022309
3305	1026377	1030454	1034540	1038636	1042741	1046856	1050980	1055113	1059256	1063409
3306	1067571	1071742	1075923	1080114	1084314	1088523	1092742	1096970	1101208	1105455
3307	1109712	1113978	1118253	1122538	1126833	1131137	1135450	1139773	1144105	1148447
3308	1152799	1157159	1161530	1165909	1170298	1174697	1179105	1183523	1187950	1192386
3309	1196832	1201287	1205752	1210227	1214710	1219204	1223706	1228218	1232740	1237271
3310	1241812	1246361	1250918	1255483	1260056	1264636	1269225	1273821	1278425	1283037
3311	1287657	1292285	1296920	1301564	1306215	1310874	1315541	1320216	1324899	1329589
3312	1334288	1338994	1343708	1348430	1353159	1357897	1362643	1367396	1372157	1376926
3313	1381703	1386487	1391280	1396080	1400889	1405705	1410529	1415360	1420200	1425048
3314	1429903	1434766	1439637	1444516	1449403	1454297	1459200	1464110	1469028	1473954
3315	1478888	1483830	1488779	1493737	1498702	1503675	1508656	1513645	1518641	1523646
3316	1528658	1533678	1538706	1543742	1548786	1553837	1558897	1563964	1569039	1574122
3317	1579213	1584311	1589418	1594532	1599655	1604785	1609922	1615068	1620222	1625383
3318	1630553	1635730	1640915	1646108	1651308	1656517	1661733	1666957	1672189	1677429
3319	1682677	1687933	1693196	1698468	1703747	1709034	1714329	1719631	1724942	1730260

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

CAPACITY TABLE IN ACRE FEET ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3320	1735587									

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM
1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

EQUATION NUMBER	ELEVATION BASE	CAPACITY BASE	COEFFICIENT A1(INTERCEPT)	COEFFICIENT A2(1ST TERM)	COEFFICIENT A3(2ND TERM)
1	3202.00	0	.0000	-.0000	1.8125
2	3210.00	116	116.0000	29.0000	6.5500
3	3220.00	1060	1061.0000	160.0000	11.3500
4	3230.00	3795	3796.0000	387.0000	37.2500
5	3240.00	11390	11391.0000	1132.0000	53.0500
6	3250.00	28015	28016.0022	2192.9956	82.9008
7	3255.50	42585	42585.2500	3105.0000	31.0000
8	3256.00	44145	44145.5000	3136.0000	40.0000
9	3257.00	47321	47321.5000	3216.0000	50.8333
10	3258.20	51253	51254.1957	3336.0046	393.1948
11	3260.00	58533	58533.0315	4752.9904	305.2002
12	3268.00	116089	116089.7000	9636.0000	1104.0001
13	3268.50	121183	121183.7000	10740.0000	67.0000
14	3269.00	126570	126570.4500	10807.0000	305.0000
15	3270.00	137682	137682.7553	11416.5976	366.3815
16	3280.00	288486	288486.7499	18744.0000	425.0500
17	3290.00	518431	518431.7499	27245.0000	437.2000
18	3300.00	834601	834601.7499	35989.0000	473.2000
19	3310.00	1241811	1241811.7498	45453.0000	392.4500

```
CONTRL   320200    332000    320200         0    320200    332000    0    0 20.0000   02
                  BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM
          1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001
ARDATA 3202.00       0.00
ARDATA 3210.00      29.00
ARDATA 3220.00     160.00
ARDATA 3230.00     387.00
ARDATA 3240.00    1132.00
ARDATA 3250.00    2193.00
ARDATA 3255.00    3022.00
ARDATA 3255.50    3105.00
ARDATA 3256.00    3136.00
ARDATA 3257.00    3216.00
ARDATA 3258.20    3338.00
ARDATA 3259.00    3964.00
ARDATA 3260.00    4753.00
ARDATA 3261.00    5363.00
ARDATA 3262.00    5974.00
ARDATA 3263.00    6584.00
ARDATA 3264.00    7195.00
ARDATA 3265.00    7805.00
ARDATA 3266.00    8415.00
ARDATA 3267.00    9026.00
ARDATA 3268.00    9636.00
ARDATA 3268.50   10740.00
ARDATA 3269.00   10807.00
ARDATA 3269.50   11112.00
ARDATA 3270.00   11417.00
ARDATA 3275.00   15080.00
ARDATA 3275.10   15154.00
ARDATA 3280.00   18744.00
ARDATA 3290.00   27245.00
ARDATA 3300.00   35989.00
ARDATA 3310.00   45453.00
ARDATA 3320.00   53302.00
ENDATA
ENDRUN
READY.
```

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3202	0	0	1	1	1	2	2	3	3	3
3203	4	4	4	5	5	5	6	6	7	7
3204	7	8	8	8	9	9	9	10	10	11
3205	11	11	12	12	12	13	13	13	14	14
3206	14	15	15	16	16	16	17	17	17	18
3207	18	18	19	19	20	20	20	21	21	21
3208	22	22	22	23	23	24	24	24	25	25
3209	25	26	26	26	27	27	28	28	28	29
3210	29	30	32	33	34	36	37	38	39	41
3211	42	43	45	46	47	49	50	51	53	54
3212	55	57	58	59	60	62	63	64	66	67
3213	68	70	71	72	74	75	76	77	79	80
3214	81	83	84	85	87	88	89	91	92	93
3215	94	96	97	98	100	101	102	104	105	106
3216	108	109	110	112	113	114	115	117	118	119
3217	121	122	123	125	126	127	129	130	131	132
3218	134	135	136	138	139	140	142	143	144	146
3219	147	148	150	151	152	153	155	156	157	159
3220	160	162	165	167	169	171	174	176	178	180
3221	183	185	187	190	192	194	196	199	201	203
3222	205	208	210	212	214	217	219	221	224	226
3223	228	230	233	235	237	239	242	244	246	249
3224	251	253	255	258	260	262	264	267	269	271
3225	273	276	278	280	283	285	287	289	292	294
3226	296	298	301	303	305	308	310	312	314	317
3227	319	321	323	326	328	330	333	335	337	339
3228	342	344	346	348	351	353	355	357	360	362
3229	364	367	369	371	373	376	378	380	382	385

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3230	387	394	402	409	417	424	432	439	447	454
3231	461	469	476	484	491	499	506	514	521	529
3232	536	543	551	558	566	573	581	588	596	603
3233	610	618	625	633	640	648	655	663	670	678
3234	685	692	700	707	715	722	730	737	745	752
3235	759	767	774	782	789	797	804	812	819	827
3236	834	841	849	856	864	871	879	886	894	901
3237	909	916	923	931	938	946	953	961	968	976
3238	983	990	998	1005	1013	1020	1028	1035	1043	1050
3239	1058	1065	1072	1080	1087	1095	1102	1110	1117	1125
3240	1132	1143	1153	1164	1174	1185	1196	1206	1217	1227
3241	1238	1249	1259	1270	1281	1291	1302	1312	1323	1334
3242	1344	1355	1365	1376	1387	1397	1408	1418	1429	1440
3243	1450	1461	1472	1482	1493	1503	1514	1525	1535	1546
3244	1556	1567	1578	1588	1599	1609	1620	1631	1641	1652
3245	1662	1673	1684	1694	1705	1716	1726	1737	1747	1758
3246	1769	1779	1790	1800	1811	1822	1832	1843	1853	1864
3247	1875	1885	1896	1907	1917	1928	1938	1949	1960	1970
3248	1981	1991	2002	2013	2023	2034	2044	2055	2066	2076
3249	2087	2098	2108	2119	2129	2140	2151	2161	2172	2182
3250	2193	2210	2226	2243	2259	2276	2292	2309	2326	2342
3251	2359	2375	2392	2409	2425	2442	2458	2475	2491	2508
3252	2525	2541	2558	2574	2591	2608	2624	2641	2657	2674
3253	2690	2707	2724	2740	2757	2773	2790	2806	2823	2840
3254	2856	2873	2889	2906	2923	2939	2956	2972	2989	3005
3255	3022	3039	3055	3072	3088	3105	3111	3117	3124	3130
3256	3136	3144	3152	3160	3168	3176	3184	3192	3200	3208
3257	3216	3226	3236	3246	3257	3267	3277	3287	3297	3308
3258	3318	3328	3338	3415	3493	3572	3651	3729	3808	3886
3259	3965	4044	4122	4201	4280	4358	4437	4516	4594	4673

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3260	4752	4814	4875	4936	4997	5058	5119	5180	5241	5302
3261	5363	5424	5485	5547	5608	5669	5730	5791	5852	5913
3262	5974	6035	6096	6157	6218	6279	6340	6401	6462	6523
3263	6584	6645	6706	6767	6828	6889	6950	7011	7073	7134
3264	7195	7256	7317	7378	7439	7500	7561	7622	7683	7744
3265	7805	7866	7927	7988	8049	8110	8171	8232	8293	8354
3266	8415	8476	8537	8599	8660	8721	8782	8843	8904	8965
3267	9026	9087	9148	9209	9270	9331	9392	9453	9514	9575
3268	9636	9857	10078	10298	10519	10740	10753	10767	10780	10794
3269	10807	10868	10929	10990	11051	11112	11173	11234	11295	11356
3270	11417	11490	11563	11636	11710	11783	11856	11930	12003	12076
3271	12149	12223	12296	12369	12442	12516	12589	12662	12736	12809
3272	12882	12955	13029	13102	13175	13249	13322	13395	13468	13542
3273	13615	13688	13761	13835	13908	13981	14055	14128	14201	14274
3274	14348	14421	14494	14567	14641	14714	14787	14861	14934	15007
3275	15080	15154	15227	15300	15374	15447	15520	15593	15667	15740
3276	15813	15886	15960	16033	16106	16180	16253	16326	16399	16473
3277	16546	16619	16692	16766	16839	16912	16986	17059	17132	17205
3278	17279	17352	17425	17499	17572	17645	17718	17792	17865	17938
3279	18011	18085	18158	18231	18305	18378	18451	18524	18598	18671
3280	18744	18829	18914	18999	19084	19169	19254	19339	19424	19509
3281	19594	19679	19764	19849	19934	20019	20104	20189	20274	20359
3282	20444	20529	20614	20699	20784	20869	20954	21039	21124	21209
3283	21294	21379	21464	21549	21634	21719	21804	21889	21974	22059
3284	22144	22229	22314	22399	22484	22569	22654	22739	22824	22909
3285	22994	23080	23165	23250	23335	23420	23505	23590	23675	23760
3286	23845	23930	24015	24100	24185	24270	24355	24440	24525	24610
3287	24695	24780	24865	24950	25035	25120	25205	25290	25375	25460
3288	25545	25630	25715	25800	25885	25970	26055	26140	26225	26310
3289	26395	26480	26565	26650	26735	26820	26905	26990	27075	27160

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

COMPUTED
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1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3290	27245	27332	27420	27507	27595	27682	27770	27857	27945	28032
3291	28119	28207	28294	28382	28469	28557	28644	28731	28819	28906
3292	28994	29081	29169	29256	29344	29431	29518	29606	29693	29781
3293	29868	29956	30043	30131	30218	30305	30393	30480	30568	30655
3294	30743	30830	30917	31005	31092	31180	31267	31355	31442	31530
3295	31617	31704	31792	31879	31967	32054	32142	32229	32317	32404
3296	32491	32579	32666	32754	32841	32929	33016	33103	33191	33278
3297	33366	33453	33541	33628	33716	33803	33890	33978	34065	34153
3298	34240	34328	34415	34503	34590	34677	34765	34852	34940	35027
3299	35115	35202	35289	35377	35464	35552	35639	35727	35814	35902
3300	35989	36084	36178	36273	36368	36462	36557	36651	36746	36841
3301	36935	37030	37125	37219	37314	37409	37503	37598	37693	37787
3302	37882	37976	38071	38166	38260	38355	38450	38544	38639	38734
3303	38828	38923	39017	39112	39207	39301	39396	39491	39585	39680
3304	39775	39869	39964	40059	40153	40248	40342	40437	40532	40626
3305	40721	40816	40910	41005	41100	41194	41289	41383	41478	41573
3306	41667	41762	41857	41951	42046	42141	42235	42330	42425	42519
3307	42614	42708	42803	42898	42992	43087	43182	43276	43371	43466
3308	43560	43655	43749	43844	43939	44033	44128	44223	44317	44412
3309	44507	44601	44696	44791	44885	44980	45074	45169	45264	45358
3310	45453	45531	45610	45688	45767	45845	45924	46002	46081	46159
3311	46238	46316	46395	46473	46552	46630	46709	46787	46866	46944
3312	47023	47101	47180	47258	47337	47415	47494	47572	47651	47729
3313	47808	47886	47965	48043	48122	48200	48279	48357	48436	48514
3314	48593	48671	48750	48828	48907	48985	49064	49142	49221	49299
3315	49377	49456	49534	49613	49691	49770	49848	49927	50005	50084
3316	50162	50241	50319	50398	50476	50555	50633	50712	50790	50869
3317	50947	51026	51104	51183	51261	51340	51418	51497	51575	51654
3318	51732	51811	51889	51968	52046	52125	52203	52282	52360	52439
3319	52517	52596	52674	52753	52831	52910	52988	53067	53145	53224

BRANTLEY RESERVOIR--1981 DAMSITE--USGS DATUM

1981 SEDIMENT CONDITION--CARCAP PROCEDURE--EPSILON = .00001

COMPUTED
08/24/81
11.20.28.

AREA TABLE IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV, FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3320	53302									

APPENDIX A-3

APPENDIX A-3 *

SANTA ROSA LAKE
(Los Esteros)
August 1980

AREA CAPACITY TABLE

Elevation (Feet M.S.L.)	Area (Acres)	Capacity (Acre-Feet)	Elevation (Feet M.S.L.)	Area (Acres)	Capacity (Acre-Feet)
4616.0	0.	0.	4671.0	117.	2398.
4617.0	1.	0.	4672.0	122.	2520.
4618.0	1.	1.	4673.0	127.	2646.
4619.0	2.	2.	4674.0	133.	2776.
4620.0	3.	4.	4675.0	139.	2910.
4621.0	4.	7.	4676.0	145.	3051.
4622.0	5.	11.	4677.0	151.	3198.
4623.0	7.	16.	4678.0	157.	3352.
4624.0	8.	22.	4679.0	165.	3515.
4625.0	9.	30.	4680.0	174.	3696.
4626.0	10.	39.	4681.0	185.	3868.
4627.0	11.	49.	4682.0	199.	4061.
4628.0	12.	61.	4683.0	214.	4270.
4629.0	13.	74.	4684.0	232.	4494.
4630.0	15.	88.	4685.0	251.	4737.
4631.0	16.	104.	4686.0	272.	4999.
4632.0	18.	121.	4687.0	294.	5283.
4633.0	20.	139.	4688.0	317.	5588.
4634.0	22.	160.	4689.0	340.	5916.
4635.0	24.	182.	4690.0	364.	6268.
4636.0	26.	206.	4691.0	388.	6644.
4637.0	28.	233.	4692.0	413.	~~7255.~~ 7045.
4638.0	31.	262.	4693.0	439.	7472.
4639.0	33.	294.	4694.0	468.	7927.
4640.0	35.	327.	4695.0	500.	8414.
4641.0	37.	362.	4696.0	536.	8937.
4642.0	39.	399.	4697.0	578.	9498.
4643.0	41.	439.	4698.0	623.	10099.
4644.0	43.	481.	4699.0	670.	10742.
4645.0	46.	526.	4700.0	716.	11429.
4646.0	49.	573.	4701.0	759	12161.
4647.0	52.	624.	4702.0	800.	12936.
4648.0	55.	677.	4703.0	839.	13752.
4649.0	58.	733.	4704.0	877.	14608.
4650.0	60.	~~821.~~ 791.	4705.0	914.	15501.
4651.0	51.	851.	4706.0	951.	16433.
4652.0	63.	913.	4707.0	989.	17405.
4653.0	64.	976.	4708.0	1031.	18418.
4654.0	66.	1041.	4709.0	1077.	19475.
4655.0	67.	1108.	4710.0	1126.	20578.
4656.0	69.	1178.	4711.0	1177.	21729.
4657.0	72.	1251.	4712.0	1230.	22932.
4658.0	74.	1326.	4713.0	1284.	24189.
4659.0	77.	1401.	4714.0	1340.	25503.
4660.0	80.	1475.	4715.0	1401.	26879.
4661.0	82.	1547.	4716.0	1467.	28320.
4662.0	84.	1617.	4717.0	1540.	29829.
4663.0	86.	1686.	4718.0	1618.	31407.
4664.0	88.	1756.	4719.0	1696.	33056.
4665.0	91.	1827.	4720.0	1770.	34777.
4666.0	95. ~~93.~~	1902.	4721.0	1838.	36569.
4667.0	99. ~~95.~~	1983.	4722.0	1903.	38433.
4668.0	103. ~~98.~~	2073.	4723.0	1965.	40365.
4669.0	107. ~~103.~~	2173.	4724.0	2029. ~~2020.~~	42364.
4670.0	112. ~~107.~~	2282.	4725.0	2096.	44429.

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* Extracted from Area Capacity Tables published by U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico August 1980.

SANTA ROSA LAKE
(Los Esteros)
August 1980

AREA CAPACITY TABLE CONT'D

Elevation (Feet M.S.L.)	Area (Acres)	Capacity (Acre-Feet)
4726.0	2167.	46562.
4727.0	2240.	48766.
4728.0	2314.	51041.
4729.0	2389.	53391.
4730.0	2465.	55816.
4731.0	2543.	58319.
4732.0	2621.	60900.
4733.0	2701.	63561.
4734.0	2782.	66302.
4735.0	2865.	69126.
4736.0	2950.	72033.
4737.0	3036.	75025.
4738.0	3122.	78102.
4739.0	3208.	81262.
4740.0	3292.	84506.
4741.0	3374.	87833.
4742.0	3455.	91244.
4743.0	3537.	94740.
4744.0	3622.	98323.
4745.0	3712.	101993.
4746.0	3805.	105751.
4747.0	3898.	109599.
4748.0	3991.	113537.
4749.0	4081.	117566.
4750.0	4168.	121685.
4751.0	4253.	125892.
4752.0	4338.	130184.
4753.0	4423.	134561.
4754.0	4508.	139023.
4755.0	4594.	143571.
4756.0	4682.	~~140408.~~ 148208.
4757.0	4772.	152934.
4758.0	4864.	157752.
4759.0	4959.	162665.
4760.0	5057.	167674.
4761.0	5159.	172783.
4761.0	5264.	177992.
4763.0	5369.	183304.
4764.0	5473.	188719.
4765.0	5575.	194239.
4766.0	5678.	199866.
4767.0	5785.	205602.
4768.0	5899.	211449.
4769.0	6022.	217411.
4770.0	6153.	223497.
4771.0	6290.	229718.
4772.0	6430.	236082.
4773.0	6572.	242598.
4774.0	6716.	249263.
4775.0	6864.	256078.
4776.0	7015.	263012.
4777.0	7171.	270087.
4778.0	7330.	277305.
4779.0	7493.	284680.
4780.0	7659.	292224.
4781.0	7827.	~~299349.~~ 299949.
4782.0	7995.	307852.
4783.0	8164.	315931.
4784.0	8332.	324180.
4785.0	8499.	332596.
4786.0	8666.	341178.

Elevation (Feet M.S.L.)	Area (Acres)	Capacity (Acre-Feet)
4787.0	8836.	349925.
4788.0	9009.	358836.
4789.0	9188.	367912.
4790.0	9370.	377160.
4791.0	9553.	386590.
4792.0	9736.	396212.
4793.0	9916.	406032.
4794.0	10097.	416041.
4795.0	10283.	426227.
4796.0	10478.	436577.
4797.0	10685.	447087.
4798.0	10901.	457783.
4799.0	11124.	468698.
4800.0	11351.	479864.
4801.0	11579.	491306.
4802.0	11808.	503016.
4803.0	12039.	514974.
4804.0	12271.	527164.
4805.0	12505.	539572.
4806.0	12741.	552202.
4807.0	12976.	~~565063.~~ 565063.
4808.0	13211.	578164.
4809.0	13444.	591510.
4810.0	13674.	605097.
4811.0	13903.	618917.
4812.0	14131.	632964.
4813.0	14358.	647232.
4814.0	14586.	661721.
4815.0	14816.	676431.
4816.0	15051.	691364.
4817.0	15292.	~~706525.~~ 706525.
4818.0	15537.	721930.
4819.0	15784.	737603.
4820.0	16031.	753564.
4821.0	16276.	769818.
4822.0	16520.	786304.
4823.0	16762.	802945.