

A Report
On Salinity Operations
On the Colorado River Under Minute No. 242
January 1 – December 31, 2003



by
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**A REPORT ON SALINITY OPERATIONS
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This report presents the results of operations from January 1 through December 31, 2003 under the agreement with Mexico entitled, "Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River," incorporated in Minute No. 242 dated August 30, 1973 of the International Boundary and Water Commission, United States and Mexico (IBWC). The operations began on June 25, 1974, immediately following approval of the Enabling Legislation, Public Law 93-320.

This report is based upon records of flows and salinities determined jointly by the United States and Mexican Sections of the IBWC, the United States Bureau of Reclamation (USBR) and the United States Geological Survey (USGS). Locations and features referred to in this report are shown in Exhibit 1.

The records show that the United States operations resulted in compliance with the agreement in Minute No. 242.

The Salinity Differential

Minute No. 242 provides in Point 1 that:

"The United States shall adopt measures to assure that . . . the approximately 1,360,000 acre-feet (1,677,545,000 cubic meters) delivered to Mexico upstream of Morelos Dam, have an annual average salinity of no more than 115 p.p.m. \pm 30 p.p.m. U.S. count (121 p.p.m. \pm 30 p.p.m. Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam . . ."

The records show that during 2003:

- 1) Scheduled deliveries of water from the Colorado River in the quantity of 1,500,001 acre-feet or 1,850,234 thousand cubic meters (tcm) were made to Mexico in accordance with Article 10 of the 1944 Water Treaty consisting of 1,366,956 acre-feet (1,686,127 tcm) at the river bed above Morelos Dam and 132,352 acre-feet (163,255 tcm) across the land boundary near San Luis, Arizona and at the limitrophe section of the river below Morelos Dam. Also, 691 acre-feet (852 tcm) were diverted from the Colorado River at Parker Dam to make emergency deliveries to Tijuana. Other waters delivered to Mexico in the limitrophe section amounted to 61,162 acre-feet (75,443 tcm).
- 2) The annual flow weighted average salinities of the waters of the Colorado River a) upstream of Morelos Dam, b) arriving at Imperial Dam, and the resulting salinity differentials were as follows:

	<u>Waters</u>	<u>U.S. Count*</u> <u>(ppm)</u>	<u>Mexican Count*</u> <u>(ppm)</u>
a)	Upstream of Morelos Dam	842	926
b)	Arriving at Imperial Dam	<u>706</u>	<u>779</u>
	Salinity Differential	136	147

* The difference in the U.S. and Mexican counts is a result of different methods of analysis and of computing the total dissolved solids used by laboratories in each country. The annual flow weighted average salinities resulting from operations under Minute No. 242, since it became effective on June 24, 1974, are shown in Table 1.

The annual flow weighted average salinities of the waters arriving at Imperial Dam since 1951, the first full year of deliveries to Mexico under the 1944 Water Treaty, and of the waters made available to Mexico at the Northerly International Boundary (NIB) since 1958 are graphically shown on Exhibit 2, which shows the effect of operations under Minute No. 242. The interim measure adopted by the United States to effect the agreed upon salinity differential, pending completion and operation of desalting projects, consists of discharging all Wellton-Mohawk drainage waters into a bypass channel to convey them to the Santa Clara Slough on the Gulf of California, and substituting for such waters an equal volume of other waters. The quantities of Wellton-Mohawk drainage waters discharged and substituted for by other waters for the deliveries to Mexico under Minute No. 242, since it became effective on June 24, 1974, are shown in Table 2.

Deliveries on the Land Boundary

Point 1 of Minute No. 242 further provides that:

“The United States will continue to deliver to Mexico on the land boundary at San Luis and in the limitrophe section of the Colorado River downstream from Morelos Dam approximately 140,000 acre-feet (172,689,000 cubic meters) annually with a salinity substantially the same as that of the waters customarily delivered there.”

The annual volumes of water delivered to Mexico on the land boundary at San Luis and in the limitrophe section of the river below Morelos Dam, excluding the Wellton-Mohawk drainage waters under Minute No. 242, since it became effective June 24, 1974 are shown in Table 3.

The deliveries to Mexico on the land boundary at San Luis and in the limitrophe section below Morelos Dam in 2003 were less than the annual volume of 172,689,000 cubic meters (140,000 acre-feet) referred to in Minute No. 242. The United States made up the difference by delivering to Mexico a volume of water equal to the difference. This volume was delivered in the bed of the river above Morelos Dam, as stipulated in Point 1 of Minute No. 242.

The average flow weighted annual salinities of the waters delivered to Mexico on the land boundary at San Luis under Minute No. 242, since it became effective on June 24, 1974 are shown in Table 4.

The data in Table 4 shows that the salinity in 2003 was lower than that of the water customarily

delivered on the land boundary, which averaged about 1,540 ppm for the 10-year period 1963-1972.

Beginning in late 1995, Mexico raised objections to peaks in salinity at the NIB and to the salinity levels and variability of flows in waters delivered at the land boundary. The IBWC is addressing these matters through an International Task Force arrangement involving the federal water agencies of each country. The effort is for adjustments in operational practices at those periods where high salinity is a significant problem for Mexico.

Mexico utilizes the Treaty waters diverted at Morelos Dam for irrigation and domestic uses in the Mexicali Valley and conveys some of these waters via aqueduct to Tecate and Tijuana. Mexico's concern with an occasional salinity peak comes at those times when Mexico's water delivery demands are low. Beginning in early 1995, the International Task Force exchanged information regarding operations in the United States and Mexico. Salinity readings during 2003 indicate insignificant peaks at this delivery point.

Mexico utilizes some of the NIB delivered waters along with water from wells near San Luis, Sonora for mixing the drainage waters that the United States continues to deliver at the Southerly Land Boundary (SLB). Mexico uses this combination of waters to irrigate 93,860 acres (38,013 hectares) in the area of the Mexicali Valley in Sonora known as the Left Bank unit. Mexico is concerned over reduced crop yields and deteriorating soil quality and increased ground water salinity. In this case also, the International Task Force met several times to exchange information on United States operations and Mexico's management of the delivered waters. Mexico, in this respect, requested that all its Treaty deliveries be made at the NIB. This proposal was not practical to the United States in that the United States is not able to prevent all these drainage waters from discharge to Mexico at the SLB and continues to have the right to make these deliveries as part of the Treaty volume. Further, this would require release of stored water in the United States that is fully appropriated. Finally, there is the need to better understand the problem in the Mexican irrigation system and all the factors that influence increasing soil and groundwater salinity and lower crop yields.

As a matter of cooperation in the near term, the International Task Force has narrowed the perceived effects to a period of four months of the year and examined scenarios of actions in each country that may be carried out to ameliorate salinity peaks during those periods at the SLB. In addition, the International Task Force recommended operational and structural modifications to the water delivery system at the SLB to reduce salinity levels and lessen the variability of flows delivered to Mexico. The operational changes consist of diverting up to a maximum of 8,000 acre-feet per year of Yuma Valley drainage into the Wellton Mohawk Bypass Drain during the four critical months. Structural modifications to the SLB Pumping Plant included the replacement of one pump with a variable speed pump; construction of a bifurcation structure with three sluice gates; a 7,000-foot concrete-lined diversion channel from the Pumping Plant to the Wellton-Mohawk Bypass Drain; and a control panel for the operation of all pumps and sluice gates. All recommendations have been completed with the exception of a remotely operated salinity monitoring system scheduled for implementation by January 2005. The United States shall continue to meet its legal obligations as described in Minute No. 242 by continuing to make the land boundary deliveries with the salinity in the waters customarily delivered at that point.

The Yuma Desalting Plant (YDP) has been off-line since the first part of 1993, when the concrete lining of the Wellton-Mohawk drainage canal was damaged by floodwaters from the Gila River. The damages were repaired.

During 2003, the YDP continued to be on standby status while the USBR reviewed alternatives for complying with the salinity differential.

Groundwater

Point 5 of Minute No. 242 provides that:

“Pending the conclusion by the Governments of the United States and Mexico of a comprehensive agreement on groundwater in the border areas, each country shall limit pumping of ground waters in its territory within five miles (eight kilometers) of the Arizona-Sonora boundary near San Luis to 160,000 acre-feet (197,358,000 cubic meters) annually.”

In 2003, Mexico pumped 174,747,000 cubic meters from its San Luis Mesa well field located within five miles (eight kilometers) of the boundary near San Luis. The annual volumes pumped from these well fields from 1975 through 2003 are shown in Table 5.

The USBR has completed 21 of the allowed 35 wells on the United States side, all located within eight kilometers (five miles) of the Arizona-Sonora boundary near San Luis, for protective and regulatory pumping. Construction of the remaining 14 allowed wells has been deferred until additional water supply needs make it necessary. Of the 21 completed wells, 13 were pumped during 2003 for municipal and irrigation uses. The annual volumes pumped from 1975 to 2003 are shown in Table 6.

Under Minute No. 242, the Commission is continuing its program for exchange of groundwater data for the major groundwater basins lying partly in the United States and partly in Mexico, including the Colorado River delta area. The objective of the exchange is to make available hydrologic, geologic and water quality data in either country to both Sections of the Commission to enable evaluation of the conditions of the international groundwater basins.

Consultations and New Developments in the Region

Point 6 of Minute No. 242 provides that:

“. . . . the United States and Mexico shall consult with each other prior to undertaking any new development of either the surface or the groundwater resources, or undertaking substantial modifications of present developments, in its own territory in the border area that might adversely affect the other country.”

The United States and Mexico began informal IBWC talks related to conveyance of a portion of Mexican Treaty water in a lined All-American Canal.

Similarly, binational technical work groups of the IBWC continued to develop joint cooperation options concerning salinity peaks in the southern boundary deliveries and removal of sediment in the international reach of the Colorado River.

Acknowledgment

The full cooperation of the United States Department of the Interior and the USBR, which enabled compliance with the 1944 Water Treaty and the salinity agreement with Mexico, as reported herein, is acknowledged with appreciation.

Arturo Q. Duran
United States Commissioner

TABLE 1

YEAR	ANNUAL AVERAGE SALINITY (U.S. COUNT) AS TOTAL DISSOLVED SOLIDS (PPM)		DIFFERENTIAL (PPM)
	AT IMPERIAL DAM	UPSTREAM OF MORELOS DAM	
1974 (Jun 25 - Dec 31)	832	972	140
1975	829	964	135
1976	823	955	132
1977	820	943	123
1978	812	928	116
1979	809	739	-70
1980	755	740	-15
1981	806	924	118
1982	825	933	108
1983	733	742	9
1984	670	676	6
1985	607	639	32
1986	579	600	21
1987	610	656	46
1988	655	733	78
1989	682	800	118
1990	721	846	125
1991	751	858	107
1992	781	898	117
1993	767	613	-154
1994	797	875	78
1995	787	869	82
1996	782	859	77
1997	695	764	69
1998	655	698	43
1999	681	758	77
2000	659	778	119
2001	681	820	139
2002	691	832	141
2003	706	842	136

TABLE 2

YEAR	ANNUAL VOLUME DISCHARGED	
	(THOUSAND CUBIC METERS)	(ACRE-FEET)
1974 (June 25 - Dec 31)	140,180	113,645
1975	264,866	214,729
1976	253,353	205,395
1977	255,113	206,822
1978	224,540	182,036
1979	219,472	177,928
1980	190,735	154,630
1981	183,082	148,426
1982	184,651	149,698
1983	220,988 *	179,157 *
1984	154,944 **	125,615 **
1985	159,987	129,704
1986	135,747	110,052
1987	120,562	97,741
1988	158,103	128,176
1989	170,990	138,624
1990	164,900	133,690
1991	173,583	140,726
1992	124,716	101,109
1993	75,784 ***	61,439 ***
1994	156,477	124,435
1995	154,772	125,475
1996	138,632	112,390
1997	109,971	89,155
1998	140,332	113,769
1999	97,044	78,675
2000	132,530	107,443
2001	127,969	103,746
2002	150,176	121,749
2003	141,523	114,734

* This includes an undetermined amount of flood waters due to breaks in a bypass canal levee in the United States.

** Includes Gila River water.

*** The low flows are due to damage on the drainage canal caused by Gila River flood waters. Drainage waters entered the Gila River from 02/21/93 to 01/18/94 and were diluted by the high flows.

TABLE 3

YEAR	ANNUAL VOLUME DELIVERED	
	(THOUSAND CUBIC METERS)	(ACRE-FEET)
1974 (June 25 - Dec 31)	70,377	57,055
1975	133,377	107,916
1976	133,328	108,090
1977	115,034	93,259
1978	99,409	80,592
1979	108,263	87,770
1980	126,058	102,196
1981	143,077	115,994
1982	134,843	107,697
1983	120,616	97,784
1984	138,007	111,884
1985	138,091	111,952
1986	153,974	124,829
1987	145,581	118,025
1988	138,832	112,553
1989	167,355	135,677
1990	165,169	133,905
1991	166,289	134,813
1992	157,069	127,338
1993	139,929	113,442
1994	155,091	125,734
1995	144,663	117,279
1996	144,331	117,010
1997	142,013	115,131
1998	159,782	129,537
1999	164,643	133,477
2000	169,577	137,478
2001	164,736	133,553
2002	151,919	123,162
2003	141,523	114,734

TABLE 4

YEAR	AVERAGE ANNUAL SALINITY (U.S. COUNT) AS TOTAL DISSOLVED SOLIDS (PPM)
1974 (June 25 - Dec 31)	1,515
1975	1,500
1976	1,480
1977	1,510
1978	1,470
1979	1,538
1980	1,582
1981	1,572
1982	1,470
1983	1,434
1984	1,487
1985	1,513
1986	1,496
1987	1,431
1988	1,488
1989	1,300
1990	1,333
1991	1,223
1992	1,312
1993	1,306
1994	1,299
1995	1,313
1996	1,358
1997	1,341
1998	1,214
1999	1,242
2000	1,173
2001	1,192
2002	1166
2003	1094

TABLE 5

YEAR	ANNUAL VOLUME PUMPED	
	(THOUSAND CUBIC METERS)	(ACRE-FEET)
1975	131,030	106,227
1976	120,722	97,870
1977	159,905	129,636
1978	121,172	98,235
1979	29,063	23,562
1980	17,735	14,378
1981	148,742	120,586
1982	162,498	131,738
1983	22,437	18,190
1984	8,963	7,266
1985	37,373	30,299
1986	13,308	10,789
1987	64,453	52,253
1988	157,374	127,585
1989	173,551	140,700
1990	167,848	136,077
1991	153,227	124,223
1992	81,374	65,971
1993	7,237 *	5,867 *
1994	76,281	61,841
1995	48,830	39,587
1996	81,039	65,699
1997	36,576	29,653
1998	0.00**	0.00**
1999	0.00**	0.00**
2000	0.00**	0.00**
2001	67,173	54,458
2002	135,687	110,003
2003	174,747	141,669

* The reduced pumping was due to excess delivery from the Gila River flood flows.

** No Pumpage required due to excess flows in the Colorado River.

TABLE 6

YEAR	TOTAL VOLUME PUMPED		242 WELL FIELD VOLUME PUMPED	
	(THOUSAND CUBIC METERS)	(ACRE-FEET)	(THOUSAND CUBIC METERS)	(ACRE-FEET)
1975	33,401	26,787		
1976	28,047	22,738		
1977	28,358	22,990		
1978 *	22,079	17,900		
1979	31,353	25,418	201	163
1980	35,188	28,527	2,244	1,819
1981	47,443	38,463	23,394	18,966
1982	50,516	40,954	29,068	23,566
1983	20,608	16,707	4,856	3,937
1984	19,078	15,467	3,721	3,017
1985	16,818	13,635	2,531	2,952
1986	32,497	26,346	3,367	2,730
1987	33,213	26,926	4,215	3,417
1988	29,512	23,096	3,073	2,491
1989	63,020	51,091	35,430	28,724
1990	71,721	58,145	38,050	30,848
1991	53,000	42,968	38,461	31,181
1992	38,696	31,371	28,319	22,958
1993	18,473	14,976	8,001	6,486
1994	40,478	32,816	20,735	16,810
1995	38,879	31,520	15,354	12,448
1996	21,546	17,468	8,055	6,530
1997	9,776	7,926	550	446
1998	20,592	16,694	6,337	5,138
1999	14,107	11,437	4,884	3,960
2000	14,311	11,602	5,240	4,248
2001	13,329	10,806	2,788	2,260
2002	17,576	14,249	4,402	3,569
2003	31,589	25,609	18,727	15,182

* Minute No. 242 Well Field was constructed in 1978.

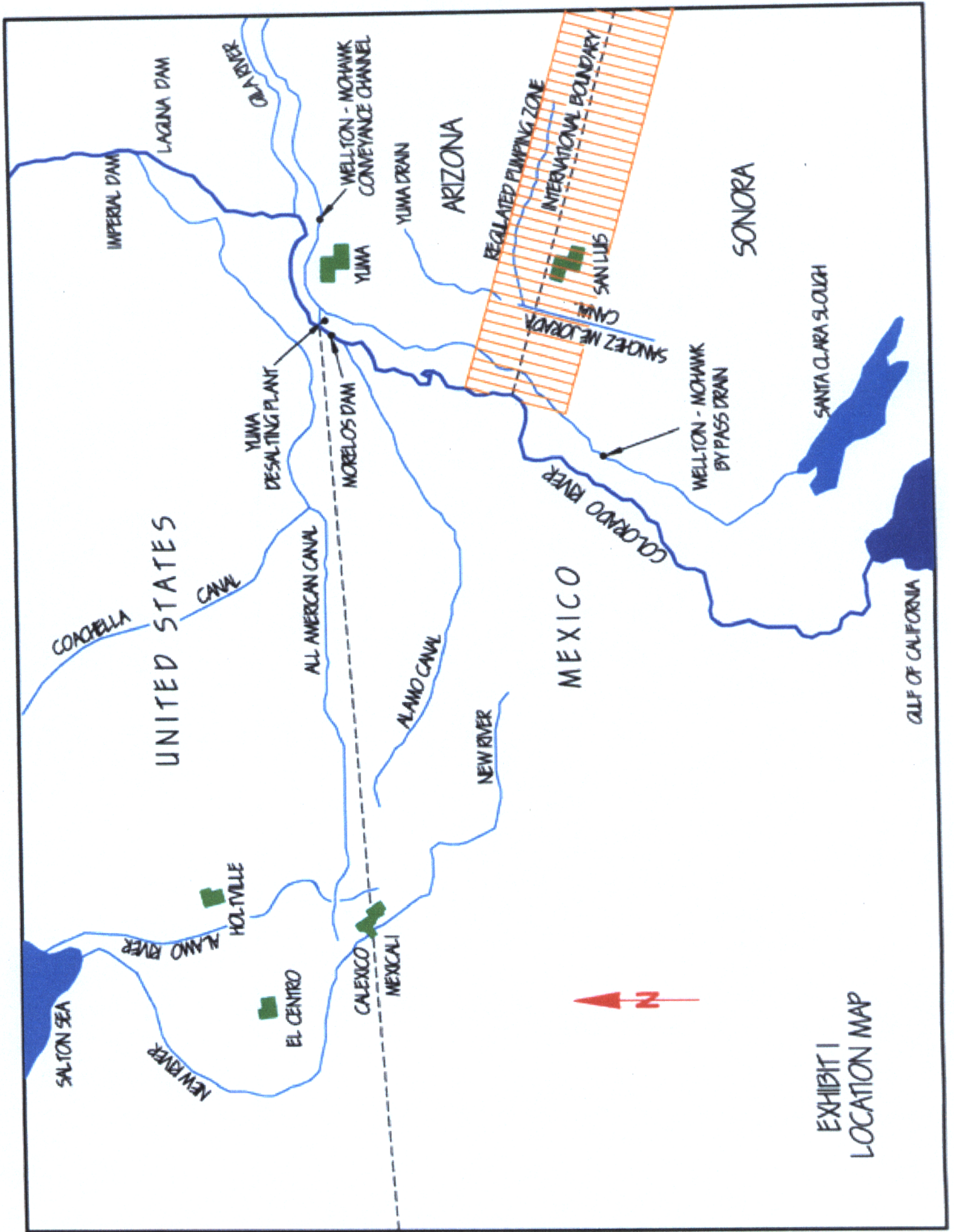
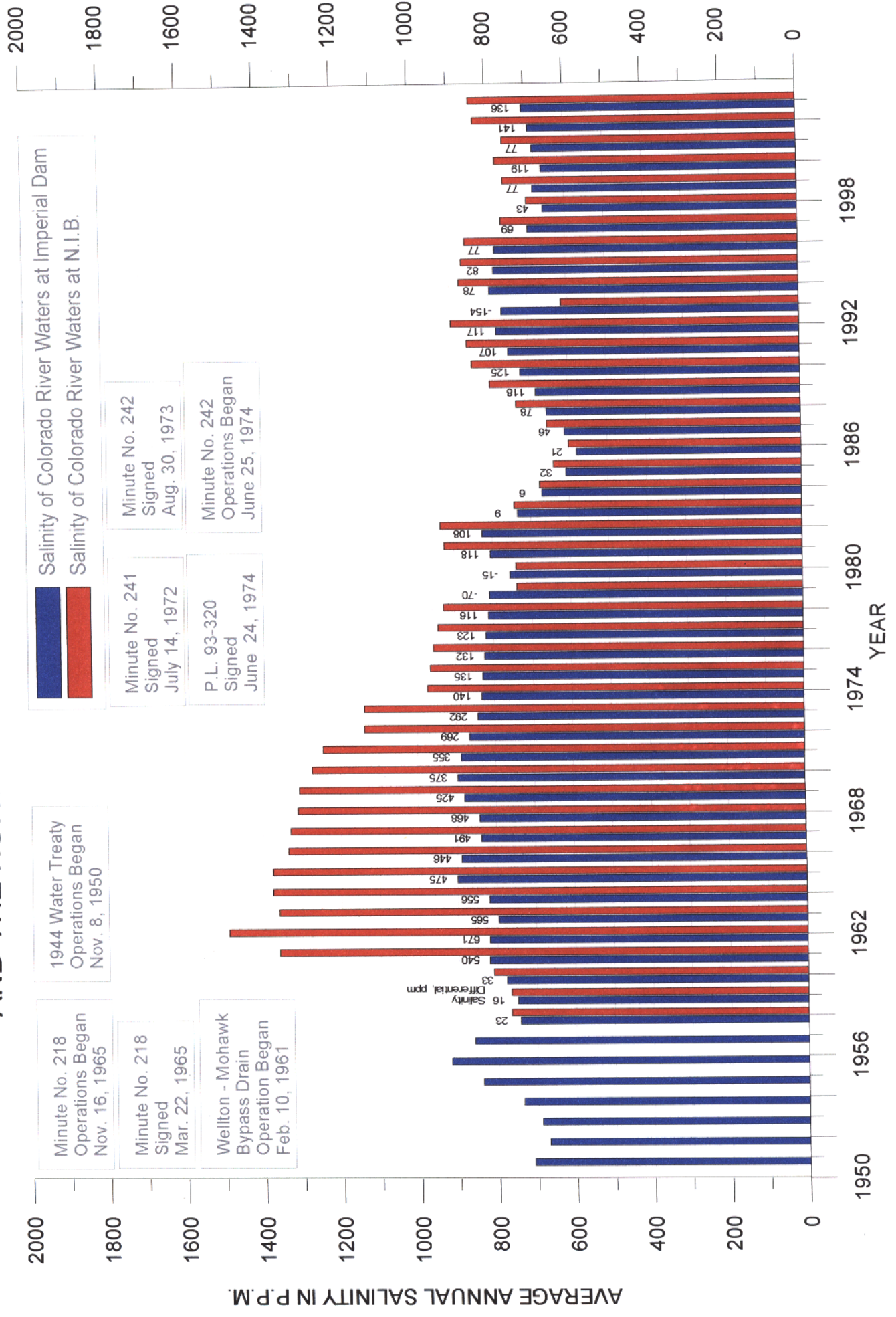


EXHIBIT 1
LOCATION MAP

EXHIBIT 2 SALINITY OF COLORADO RIVER TREATY WATERS AT IMPERIAL DAM AND THE NORTHERLY INTERNATIONAL BOUNDARY



Minute No. 218 Operations Began Nov. 16, 1965

Minute No. 218 Signed Mar. 22, 1965

Wellton - Mohawk Bypass Drain Operation Began Feb. 10, 1961

1944 Water Treaty Operations Began Nov. 8, 1950

Minute No. 241 Signed July 14, 1972

P.L. 93-320 Signed June 24, 1974

Minute No. 242 Signed Aug. 30, 1973

Minute No. 242 Operations Began June 25, 1974

Salinity of Colorado River Waters at Imperial Dam

Salinity of Colorado River Waters at N.I.B.

AVERAGE ANNUAL SALINITY IN P.P.M.