

**A REPORT ON
COLORADO RIVER SALINITY OPERATIONS,
UNDER INTETIONAL BOUNDARY AND WATER COMMISSION
MINUTE NO. 242
JANUARY 1 to DECEMBER 31, 2012**



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Acronyms

af - Acre-feet	IBWC – International Boundary and Water Commission
ppm - Parts per million	USIBWC - United States Section of the IBWC
tcm - Thousand cubic meters	MxIBWC - Mexican Section of the IBWC
TDS - Total dissolved solids	NIB - Northerly International Boundary
	SIB - Southerly International Boundary
	ICMA-Intentionally Created Mexican Allocation

Cover Photo: Colorado River, Yuma, Arizona, taken July 2012.

COLORADO RIVER SALINITY OPERATIONS, JANUARY 1, 2012 THROUGH DECEMBER 31, 2012, UNDER IBWC MINUTE NO. 242

This report presents the results of the operations from January 1 through December 31, 2012, under the agreement with the Republic of Mexico (Mexico) titled “*Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River.*” The agreement is incorporated into International Boundary and Water Commission, United States and Mexico (IBWC) Minute No. 242 dated August 30, 1973. Minute No. 242 replaced Minute No. 241 (which replaced Minute No. 218). Operations under Minute 242 first began on June 25, 1974, immediately following approval of Public Law 93-320, *Colorado River Basin Salinity Control Act* (Act of 1974) on June 24, 1974.

This report is based on United States Section of the IBWC (USIBWC) records on water flows and salinity levels determined jointly by the United States and Mexican Sections of the IBWC, as well as flow-monitoring data from the United States Geological Survey and volume and chemical investigations data from the U.S. Bureau of Reclamation. Figure 1 shows the locations referred to in this report. **The 2012 records show that the United States (U.S.) operations of the lower Colorado River resulted in compliance with the agreement in IBWC Minute No. 242.**

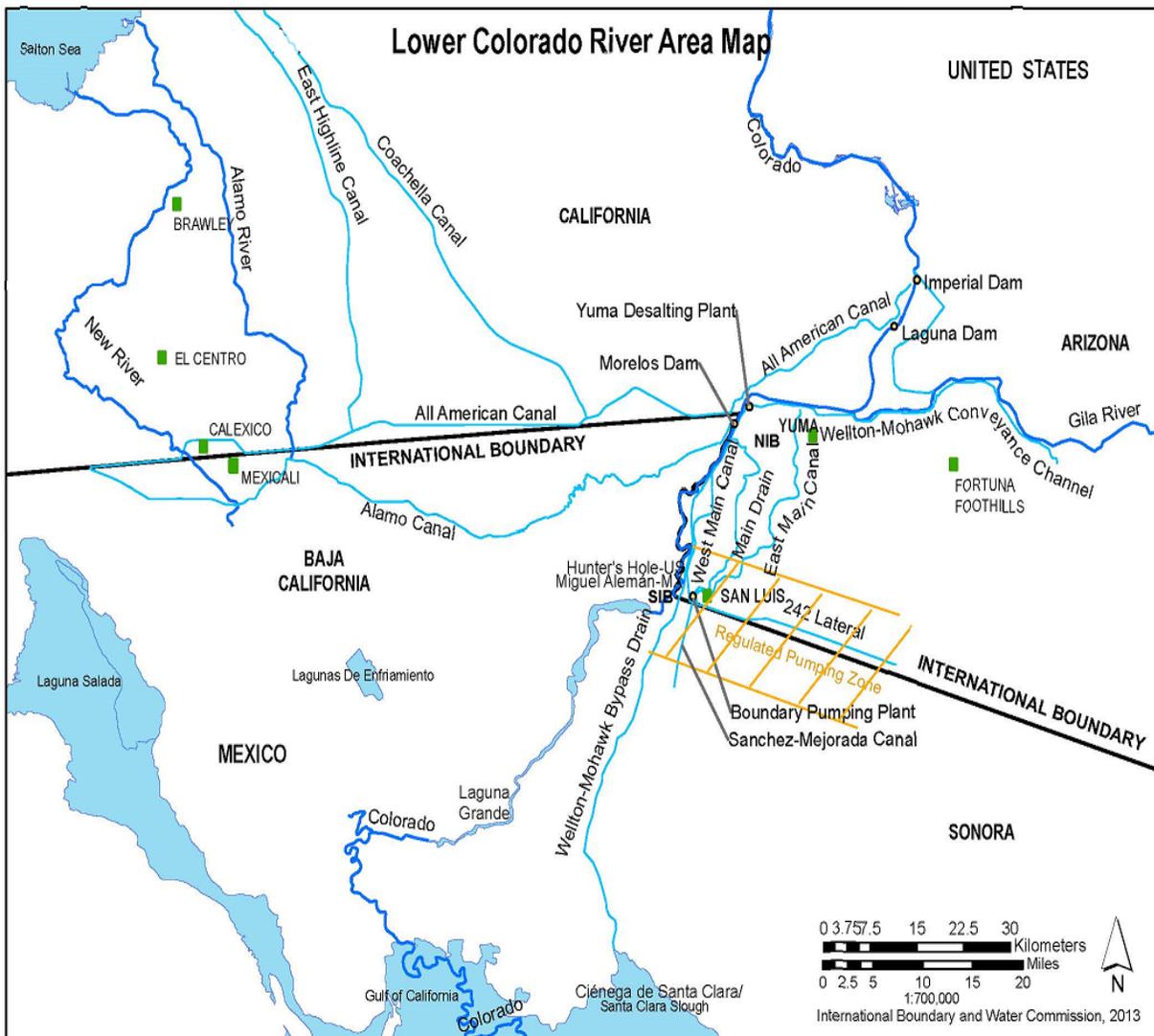


Figure 1: Map of Lower Colorado River Area

WATER DELIVERIES AND SALINITY DIFFERENTIAL

IBWC Minute No. 242 and Water Deliveries

Table 1 is a summary of the scheduled deliveries and actual deliveries made to Mexico and where those deliveries were made in 2012.

Table 1: Summary, Total Deliveries of Colorado River Water to Mexico in 2012

	Scheduled Deliveries	Actual Deliveries Made
NIB (“at the riverbed above Morelos Dam”)	1,514,207.87 tcm (1,227,583.46 af) ¹	1,649,283 tcm (1,337,090.22 af) ²
SIB (“across the land boundary near San Luis, Arizona,” includes the water flows through the limitrophe of the river below Morelos Dam)	172,000 tcm (139,442.12 af) ¹	153,895 tcm (124,764.21 af) ³
Downward Delivery Adjustment (Minute 318)	164,026.13 tcm (132,977.62 af) ¹	
Total	1,850,234 tcm (1,500,003.21 af) ¹	1,803,177.70 tcm (1,461,854.19 af) not including Downward Delivery
Other water delivered [arriving] to Mexico in the Limitrophe Section ⁴		116,970 tcm (94,821.45 af) ⁴

The accumulated volume of Colorado River water recorded at Imperial Dam in 2012 was 7,079,036 tcm (5,739,045 af)⁵. Imperial Dam serves Yuma County, Imperial County and deliveries to Mexico. The quantities requested by Mexico to be delivered for 2012 were in accordance with Article 10 of the 1944 Water Treaty. The quantities requested are for deliveries to be made at the riverbed above Morelos Diversion Dam, also referred to as the Northerly International Boundary (NIB), and across the southern land boundary near San Luis, Arizona, also referred to as the Southerly International Boundary (SIB). Deliveries across the SIB include the water flows through the limitrophe of the river below Morelos Dam.

A delivery of 125.7 tcm⁵ (101.9 af) of Colorado River water was made to Mexico at Tijuana, Baja California, in 2012. Deliveries to Tijuana are diverted at Parker Dam through an existing pipeline at Otay Mesa in San Diego, California, and are calculated into the total deliveries made at NIB. Deliveries made through this diversion are governed by IBWC Minute No. 314 which replaced Minute No. 310 in November 2008. This Minute is intended to address periods of shortages expected to occur in Tijuana, Baja California, over the subsequent five years.

The April 2010 earthquake in the Mexicali Valley, Baja California, Mexico caused damage to Irrigation District 014, Rio Colorado infrastructure in Baja California and Sonora. The earthquake damaged 398 miles of canals in Mexico making it difficult to receive and transport its full allotment of Treaty water. In response to this situation, IBWC Minute No. 318, *Adjustment of Delivery Schedules of Water Allotted to Mexico for the Years 2010 Through 2013 as a Result of Infrastructure Damage in Irrigation District 014, Rio Colorado, Caused by the April 2010 Earthquake in the Mexicali Valley, Baja California*, dated December 17, 2010, was established. This Minute allows for the downward adjustment of Treaty deliveries at Mexico’s request by a maximum of 260,000 af between the remaining portion of 2010 and December 31, 2013, and subsequent delivery of the water when Mexico is able to make beneficial use of it.

¹ Source: 2012 Mexico schedule.

² Source: Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm

³ Sources: Southerly Land Boundary Combined Flow (East Main Canal Wasteway, West Main Canal Wasteway, Main Drain, 242-Lateral) + 11-Mile Wasteway + 21-Mile Wasteway – Diversion

Channel (Diversion Channel is subtracted only for the months of Jan., Oct., Nov., and Dec. when flows are diverted into the Wellton-Mohawk Bypass)

⁴ Source: USIBWC Yuma Field Office calculations. Other water arriving in the limitrophe of the Colorado River not accounted for in scheduled deliveries.

⁵ Source: USIBWC Yuma Field Office calculations

On November 20, 2102, the IBWC signed Minute 319, entitled “ *Interim International Cooperative Measures in the Colorado River Basin through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California,*” authorizes the creation of Intentionally Created Mexican Allocations (ICMA) which allows limited deferment of water deliveries with a 3% reduction for evaporation and a 2% water assessment reserved for environmental purposes and will be reflected in the 2013 Annual Salinity Report.

IBWC Minute No. 242 Salinity Levels and Salinity Differentials

Item 1.a of IBWC Minute No. 242 provides 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 ppm ± 30 ppm U.S. count (121 ppm ± 30 ppm Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam.”

Salinity

Both Mexican and U.S. values are between acceptable ranges as stated in the Minute 242. Table 2 provides a summary of the salinity levels and differentials in the lower Colorado River in 2012.

Table 2: 2012 Colorado River Salinity Levels and Differentials

Waters	U.S. count (ppm)	Mexican count (ppm)
Arriving Upstream of Morelos Diversion Dam at NIB	826	895
Arriving at Imperial Dam	683	749
Salinity Differential	143	146

Table 3 below provides the annual average flow-weighted salinity levels and salinity differentials of the water resulting from operations under IBWC Minute No. 242 for the last ten years. It was first implemented June, 1974. To view the complete record, see Appendix A.

Table 3: Annual Average Flow-Weighted Salinity Levels

Year	Annual Average Salinity (U.S. Count) as TDS (ppm)		Differential (U.S. Count) (ppm)
	At Imperial Dam	Upstream of Morelos Dam	
2003	706	842	136
2004	735	858	123
2005	708	803	95
2006	713	844	131
2007	675	805	130
2008	728	868	140
2009	721	858	137
2010	686	825	139
2011	687	828	141
2012	683	826	143

Figure 2 demonstrates the effects of operations under the Minutes, graphs the annual average salinity levels in the water arriving [delivered] at Imperial Dam since 1951 (the first full year of deliveries to Mexico under the 1944 Water Treaty) and at NIB since 1958.

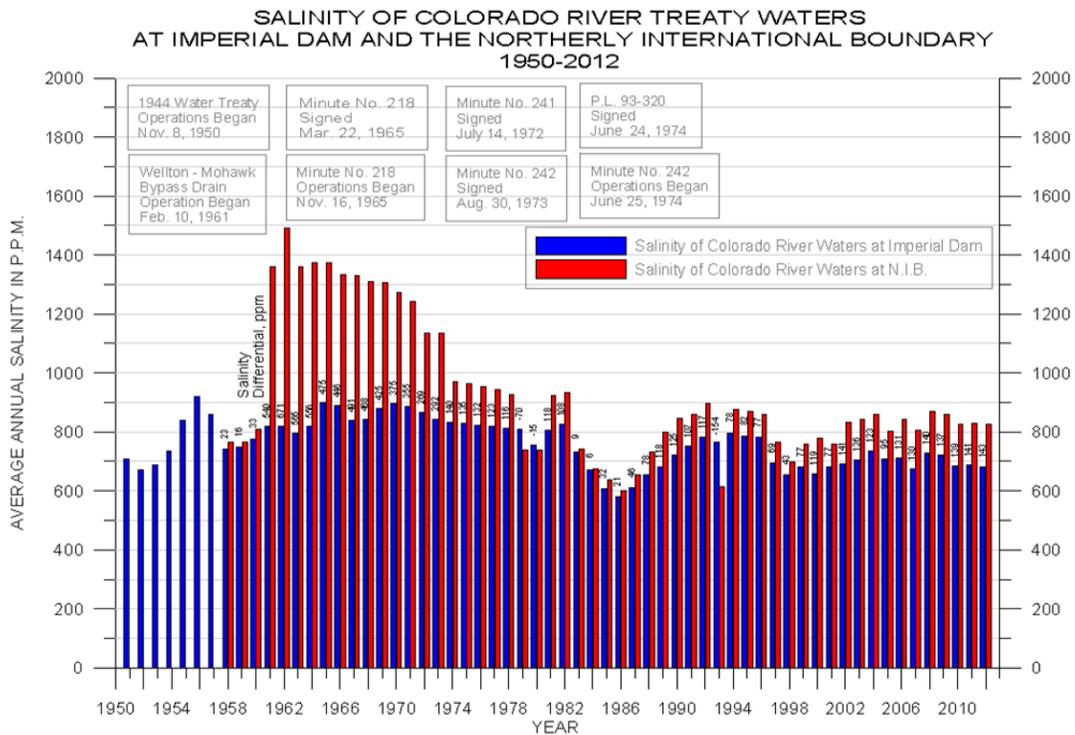


Figure 2: Annual Average Salinity Levels

The IBWC previously conducted a study of the differences in measurements and calculations by the United States and Mexico. A full detail of the study results is presented in a final joint report titled *Binational Study Regarding the Technical Methods and Joint Monitoring of the Salinity in the Colorado River for the fulfillment of International Boundary and Water Commission Minute No. 242 Between the United States and Mexico Conducted from January 2006 to December 2007- Final Report 2011*.

DELIVERIES AT THE SOUTHERLY INTERNATIONAL BOUNDARY

Point 1.b) 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 through the Sanchez Mejorada Canal and in the limitrophe section of the river below Morelos Dam since Minute No. 242 operations began on June 25, 1974 are shown in Table 4. To view the complete record, see Appendix A. These volumes exclude the Wellton-Mohawk drainage water that was bypassed in accordance with Minute No. 242 (discussed above). Delivery volume made in 2012, which totaled 153,895 tcm (124,764 af)⁶, was less than the annual volume of 172,689 tcm (140,001 af) referred to in IBWC Minute No. 242. The quantity of water to make up the difference was delivered in the bed of the Colorado River above Morelos Dam, as stipulated in Point 1 c) of IBWC Minute No. 242, which states: *“Any decrease in deliveries under point 1(b) will be made up by an equal increase in deliveries under point 1(a).”*

⁶Based on volumes from East Main Canal Wasteway + West Main Canal Wasteway + Main Drain + 242-Lateral - Diversion at SIB + 11-Mile Wasteway + 21-Mile Wasteway.

Table 4: Annual Volume of Water Schedule

Year	Annual Volume Delivered	
	(tcm)	(af)
2003	141,523	114,734
2004	160,957	130,488
2005	157,437	127,634
2006	155,992	126,465
2007	168,661	136,735
2008	165,841	134,449
2009	175,567	142,334
2010	154,688	125,407
2011	167,242	135,585
2012	153,895	124,764

Quantities of United States Bypass Drain Water

The Yuma Desalting Plant, which is located four miles west of Yuma, was built to reduce the salinity of pumped drainage water from the Wellton-Mohawk Irrigation and Drainage District before the water is returned to the Colorado River. Pending completion and operation of desalting projects, the U.S. adopted an interim measure to achieve the agreed-upon salinity differential. This measure consisted of discharging all Wellton-Mohawk pumped drainage water into the United States Bypass Drain, which conveys these waters to the Santa Clara Slough (now commonly referred to as the Ciénega de Santa Clara), the largest wetland in the Colorado River Delta. The water diverted to the United States Bypass Drain is then substituted by an equal volume of other water consisting of drainage return flows above the Northerly International Boundary (NIB) and Colorado River water from upstream storage.

Table 5: United States Bypass Drain Water delivered at Southerly International Boundary (SIB)

Year	Annual Volume Discharged	
	(tcm)	(af)
2003	141,523	114,734
2004	121,883	98,812
2005	132,519	107,433
2006	132,617	107,514
2007	131,914	106,944
2008	142,387	115,435
2009	141,567	114,770
2010	144,892	117,465
2011	161,108	130,612
2012	155,697	126,225 ⁶

Table 5 above shows quantities of United States Bypass Drain water delivered, including the 2012 delivery of 155,697 tcm (126,225.80 af)⁷ at SIB and substituted for by other water for deliveries to Mexico under IBWC Minute No. 242 for the last ten years. To view the complete record since implementation of the Minute in 1974, see Appendix A. There was no Bypass Drain water discharged back into the Colorado River above SIB during 2012.

⁷ Source: USIBWC Yuma Field Office calculations.

Annual Average Flow-Weighted Salinity in the Water Delivered to Mexico in 2012 at SIB

The annual average flow-weighted salinity levels of the water delivered to Mexico at SIB near San Luis under IBWC Minute No. 242 for the last ten years are shown in Table 6. The 2012 average salinity of 1,142 ppm was lower than the 38-year average of 1,311 ppm, as well as the average of 1,540 ppm for the 10-year period of 1963-72. To view the complete record since implementation of the Act in 1974, see Appendix A.

Table 6: Annual Average Flow-Weighted Salinity Levels

Year	Annual Average Flow-Weighted Salinity (U.S. Count) as TDS (ppm)
2003	1,094
2004	1,155
2005	1,103
2006	995
2007	984
2008	1,032
2009	1,116
2010	1,103
2011	1,157
2012	1,142

Because of high salinity levels, Mexico requested that all of its 1944 Water Treaty deliveries be made at NIB. This was not feasible because flows would still continue south to San Luis, Arizona, and to SIB resulting in deliveries to Mexico in excess of its annual treaty allotment. As part of the 1944 Treaty, the U.S. deliveries to Mexico are still made at SIB to meet those obligations.

GROUNDWATER – MINUTE NO. 242 WELL FIELD

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 groundwater 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 2012, Mexico pumped 161,360 tcm (130,816.16 af) from its San Luis Mesa Well Field located within five miles (eight kilometers) of the boundary near San Luis. Table 7 below shows the annual quantities pumped by Mexico from its San Luis Mesa field located within five miles (eight kilometers) of the Arizona-Sonora boundary near San Luis. To view the complete record, see Appendix A.

Table 7: Annual Volume Pumped by Mexico

Year	Annual Volume Pumped	
	(tcm)	(af)
2003	174,747	141,669
2004	182,994	148,355
2005	153,762	124,655
2006	174,778	141,693
2007	191,221	155,025
2008	165,113	133,859
2009	194,717	157,859
2010	117,180	94,999
2011	153,515	124,457
2012	161,360	130,816

The U.S. pumped a total of 41,277.1 tcm (33,463.67 af) within five miles of the boundary, including the Minute 242 Well Field. Table 8 provides the annual quantities pumped by the U.S. from the Minute 242 Well Field and the total water pumped within five miles of the boundary near San Luis from 1975 through 2011 (limited to 160,000 acre-feet [197,358,000 cubic meters] for each country pursuant to Minute 242). To view the complete record, see Appendix A.

Table 8: Total volume pumped by the United States

Year	Total Volume Pumped		242 Well Field Volume Pumped ¹	
	(tcm)	(af)	(tcm)	(af)
2003	31,589	25,609	18,727	15,182
2004	37,605	30,487	27,797	22,536
2005	53,466	43,345	36,906	29,920
2006	56,710	45,975	40,548	32,872
2007	78,803	63,886	62,864	50,964
2008	81,594	66,149	68,812	55,787
2009	73,299.4	59,424.6	56,385	45,712
2010	61,983.7	50,250.8	41,756	33,852
2011	53,499.5	43,372.7	36,013	29,196
2012	41277.1	33,463.89	26,234	21,268.23

The U.S. Bureau of Reclamation has constructed 21 wells of the original plan to build up to 35 wells that would eventually be required on the U.S. side of the SIB. Construction of the remaining 14 wells has been deferred until additional water supply needs make it necessary. All of the existing wells are located on the mesa within 5 miles (8 kilometers) of the SIB near San Luis. Water captured from these wells is then delivered to Mexico at the SIB in partial satisfaction of the 1944 Water Treaty as substitution for Main Drain water diverted to the United States Bypass Drain. In 2012, 21 wells were pumped.

CONSULTATIONS AND REGIONAL DEVELOPMENTS

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.”

Minute 317

On June 17, 2010, IBWC Minute No. 317, *Conceptual Framework for U.S.-Mexico Discussions on Colorado River Cooperative Actions*, was signed and subsequently approved by the U.S. and Mexican governments. The agreement provides the framework for cooperative comprehensive planning of water management in the Colorado River Basin focusing on the topics of water conservation, identifying new water sources, improving system operations, and identifying water for environmental purposes.

Minute 318

On December 17, 2010, IBWC Minute No. 318, *Adjustment of Delivery Schedules for Water Allotted to Mexico for the Years 2010 Through 2013 as a Result of Infrastructure Damage in Irrigation District 014, Rio Colorado, caused by the April 2010 Earthquake in the Mexicali Valley, Baja California* was signed. It allowed the U.S. and Mexico to bring resources together for mutual benefit after the earthquake that damaged infrastructure in Mexico on Easter Sunday, April 4, 2010.

Minute 319

Introduced above, IBWC Minute 319 *Interim International Cooperative Measures in the Colorado River Basin through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California*, was signed on November 20, 2012. Minute 319 allows for opportunities for future cooperation between the United States and Mexico on water conservation, system operations, environmental restoration, and new water sources projects. It grants both nations to share surpluses and water shortages, allows Mexico to defer some of its allotted water in the United States, allows for U.S. financial support with Mexico's water infrastructure, and restores some flows of the Colorado River for environmental benefits.

Projects contemplated by Minute 319 include:

- Miguel Alemán Site- 50 acre cottonwood and willow vegetation improvement and habitat site in the limitrophe. Site preparation has begun and is ready for planting.
- Intentionally Created Mexican Allocation (ICMA)/Intentionally Created Surplus (ICS) Exchange Pilot Program - The ability for Mexico to adjust deliveries downward and create a surplus for the environment.
- River flows to the Colorado River limitrophe and delta ecosystem - Restoring flows to a former riparian zone.

Lack of steady flows in the Colorado River channel has decreased natural vegetation, wildlife habitat and associated wildlife that naturally persisted. The elimination of this riparian wildlife corridor has instigated a need to improve the existing condition. Water saved from conservation projects will be used to supplement the environmental needs stipulated in Minute 319.

The full text versions of the Minutes referenced are available on-line at:

http://www.ibwc.gov/Treaties_Minutes/Minutes.html.

The Morelos Diversion Dam Sediment Removal Project

The Morelos Diversion Dam Sediment Removal Project and the associated Environmental Mitigation Project were completed in 2012. This project consisted of removing sediment that accumulates around the spillway which prevents the spillway from operating efficiently. The sediment removal was complemented by a 40 acre restoration project designed to substitute the displaced habitat that had encroached into the sediment build-up in the effective portion of the spillway. The site chosen for the mitigation/restoration is entirely in Mexico and the work there has been completed. It is known as the CILA Site. CILA, Sección Mexicana de la Comisión Internacional de Límites y Aguas, also known as MxIBWC, is USIBWC's counterpart in Mexico. This site is part of the larger Laguna Grande site described below.

Miguel Alemán Restoration Site

Pronatura Noroeste, in collaboration with the U.S. Bureau of Reclamation, the National Commission on Natural Protected Areas (CONANP), the National Water Commission (CONAGUA) and the community of Colonia Miguel Alemán in Baja California, has been implementing a riparian restoration project in 90 acres along the limitrophe section of the Colorado River. The restoration site is located on the Mexican side of the river, 3 miles north of the Southerly International Boundary. This project was developed as a sister effort of the Hunter's Hole restoration project in Arizona (just across the river), and is part of the implementation projects under the framework of Minute 319. The completed activities for the project include the completion of the restoration design, installation of 3-mile long, 12" diameter pipeline to deliver water for the project, clearing salt cedar at the site, land contouring and leveling, and the production of 60,000 native trees. The plan is to finalize the irrigation infrastructure in September 2013 and start planting trees in October, 2013. Planting and seeding will continue in the spring in 2014, and this phase is expected to be completed in June 2014. The whole restoration goal for the area is 300 acres, and subsequent phases to reach this goal will be implemented between 2014 and 2016.

Laguna Grande Restoration Site

This area is the largest stand of dense habitat along the Colorado River in Mexico, providing valuable habitat along this corridor. Located near the community of Ejido Doctor Alberto Oviedo Mota (also known as El Indiviso), Baja California, this area consists of 1200 acre cottonwood and willow vegetation and habitat improvement site on the main river channel with 150 acres of restored habitat. Members and volunteers with Sonoran Institute, Pronatura Noroeste and other groups have been removing salt cedar and planting native willow and cottonwood and irrigating with water bought from farmers. The Sonoran Institute and Pronatura have demonstrated the feasibility and success of restoration in this area. The efforts of these groups have enabled the dedication of water to this region. Minute 319 will support these efforts and activities over the next 5 years.

The IBWC continues to participate in addressing aquatic nuisance inhabiting the Lower Colorado River Basin. The Colorado River Aquatic Invasive Species Task Force conducts meetings to discuss the invasive species problem. The Palo Verde Irrigation District, U.S. Bureau of Reclamation and U.S. Fish and Wildlife continued to treat giant salvinia along the irrigation drains with chemical and manual controls; the giant salvinia has been removed from four of the five reaches under treatment. The presence of giant salvinia is also being reduced in Mexico as a result of control efforts.

OTHER LOWER COLORADO RIVER INFRASTRUCTURE: U.S. AND MEXICO

Yuma Desalting Plant

The Yuma Desalting Plant (YDP) has been maintained in ready reserve status since the first part of 1993 when the concrete lining of the United States Bypass Drain was damaged by floodwater from the Gila River and the quantity and quality of flows arriving at NIB made operation of the YDP unnecessary. A 90-day demonstration run of the plant at ten percent of its full capacity was conducted in 2007 by the U.S. Bureau of Reclamation which allowed for the evaluation of the operational condition of the plant and design deficiencies. In 2008, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, and the Central Arizona Water Conservation District initiated discussions with the U.S. Bureau of Reclamation regarding an additional Pilot Run of the YDP consisting of operating the plant at one-third capacity of the original design for 365 operating days during a 12 to 18 month period in order to provide sufficient performance and cost data and to assess seasonal variation on the operation of the plant.

The U.S. Bureau of Reclamation initiated the Pilot Run on October 29, 2009. Ongoing binational consultation resulted in the signing of IBWC Minute No. 316 *Utilization of the Wellton-Mohawk Bypass Drain and Necessary Infrastructure in the United States for the Conveyance of Water by Mexico and Non-Governmental Organizations of Both Countries to the Santa Clara Wetland during the Yuma Desalting Plant Pilot Run* dated April 16, 2010. Under this agreement, the United States, Mexico, and a binational coalition of non-governmental organizations

(NGOs) arranged for the delivery of 30,000 af of water to the Santa Clara Slough wetlands in Mexico to compensate for the reduction in flow and increased salinity from the operation of the YDP, as well as environmental monitoring of the wetland system. The U.S., Mexico, and the NGOs have conveyed their commitments for a total of 30,477 af by July 2011, each in satisfaction of minute 316. No water was conveyed in 2012.

The Pilot Run commenced on May 3, 2010 and ceased on March 26, 2011. Greater than 30,000 AF of irrigation return flow water was included in Treaty deliveries to Mexico, resulting in the conservation of a similar volume of water in Lake Mead (22,666 af treated and mixed with 7830 af untreated to achieve similar salinity levels to NIB). Storage credits for the conserved water were distributed among the water agencies which provided funding for the Pilot Run. Review of the data from the Pilot Run is being conducted by the U.S. Bureau of Reclamation and participating water agencies to evaluate potential long-term operation of the plant. The report is available at:

<http://www.usbr.gov/lc/yuma/facilities/ydp/YDPPilotRunFinal072712.pdf>).

Ciénega de Santa Clara

The Ciénega de Santa Clara (the Ciénega) is the largest wetland (approximately 15,000 acres with emergent vegetation) on the Mexican portion of the Colorado River Delta that provides critical habitat for several wildlife species. The origins of the Ciénega date back to 1977 with the beginning of the disposal of brackish groundwater from the Wellton-Mohawk Irrigation and Drainage District in Arizona into the region now known as the Ciénega de Santa Clara. The Ciénega is a protected area managed by Mexico's Comisión Nacional de Areas Naturales Protegidas (National Commission on Protected Natural Areas). The Ciénega's vegetation is dominated by cattail (*Typha domingensis*) with some stands of common reed (*Phragmites australis*) and bulrush (*Scirpus americanus*). The Ciénega provides habitat for over 260 species of birds, including marsh birds, shorebirds, waterfowl, and migratory birds, as well as dozens of fish species. Two listed species inhabit the Ciénega: the Yuma Clapper Rail and the Desert Pupfish. Both are listed as endangered in the U.S., while the Pupfish is endangered and the Clapper Rail is threatened in Mexico. The Ciénega is also an important resource for the local economy for fishing, building materials and ecotourism,

The Santa Clara Slough had become popularly known as the Ciénega de Santa Clara as it transitioned from a mud flat to a wetland. It was first labeled Ciénega de Santa Clara in scientific literature by Glenn et al. in 1992.

For 2012 deliveries to the Ciénega, see the section titled “Quantities of United States Bypass Drain Water” above. Deliveries through the Bypass Drain start in 1974 and are listed in Table 4 below. Completion of the Bypass Drain extension to the Santa Clara Slough occurred in 1977 and this data is available at: <http://www.ibwc.gov/wad/DDQWMSIB.HTM>

In 2010, Minute 316 to the 1944 Treaty between Mexico and United States stated the intention of the U.S. Bureau of Reclamation to operate the YDP for a total of 365 days within an 18 month period beginning in May 2010. As a result, the U.S., Mexico and Non-Governmental Organizations each arranged for 10,000 af of water delivered to the Bypass Drain and implemented a monitoring plan during the 2010-2011 pilot run of the YDP.

In preparation for the 2010-2011 pilot run of the YDP, a binational group of scientists from universities, agencies and non-governmental organizations designed a monitoring program. Elements of this monitoring program were funded by a contract with Central Arizona Water Conservation District, Metropolitan Water District of Southern California (MWD) and Southern Nevada Water Authority (SNWA), with additional funding from Mexico's Comisión Nacional de Areas Naturales Protegidas (CONANP) and the Instituto Nacional de Ecología (INE). The monitoring program was facilitated by both the United States and Mexican Sections of the IBWC. This monitoring project was a collaborative effort among the University of Arizona, the Sonoran Institute, Pronatura Noroeste, the Universidad Autónoma de Baja California, and Centro de Investigación en

Alimentación y Desarrollo. The final report, released in June of 2012, may be viewed at: <http://www.geo.arizona.edu/Ciénega/>

The pilot run of the YDP ran from May 3, 2010, to March 26, 2011, and used some of the water that normally flows to the Ciénega and added saline effluent to the canal that supplies water to the Ciénega. Monitoring began in December 2009 and extended to June 2011, from approximately three months before until three months after the pilot operation of the YDP. Data from smaller-scale monitoring efforts that began in August 2006 were also utilized in this study.

Following an extensive fire in March, 2011, satellite imagery and repeat oblique aerial photography showed strong seasonal changes in photosynthetic activity and a strong rebound in photosynthetic activity. The vegetated footprint of the Ciénega itself did not change substantially during the monitoring period and the vegetation recovered quickly.

Environmental events that have occurred include dredging of the Santa Clara-Riito Drain, the nearby magnitude 7.2 El Mayor-Cucapah earthquake of April 4, 2010, the delivery of approximately 30,000 af (37 million cubic meters) of arranged water to the Ciénega de Santa Clara in 2010-11, and the late-March 2011 fire that burned approximately 80% of the Ciénega's vegetation.

The short-term changes associated with the pilot operation of the YDP accompanied by the ~30,000 acre-feet of arranged water, dredging, an earthquake and wildfire did not cause significant changes to the features of the Ciénega de Santa Clara monitored during the period of this study. The Ciénega de Santa Clara appears to be a resilient ecosystem that is capable of withstanding harsh disturbances while providing habitat to a more sensitive wildlife environment.

Yuma Clapper Rail surveys in the Ciénega de Santa Clara

The monitoring efforts for marsh birds in the Ciénega de Santa Clara have been continued in 2012 in 130 survey points, following the Standardized Protocols for Monitoring Marsh Birds in North America. This is an effort implemented by Pronatura Noroeste and the Upper Gulf of California and Colorado River Delta Biosphere Reserve. During 2012, a total of 939 Yuma Clapper Rails were detected, with a population estimated for the whole Ciénega of 6,681 individuals. These surveys have been implemented since 1999, and no significant trend in the population of Clapper Rails in the Ciénega has been detected, although there has been a sustained population increase since 2006.

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APPENDIX A
History (1974/5 -2012) for Tables 3 through 8

Table 3. Annual Average Flow-Weighted Salinities of the water of the Colorado River delivered upstream of Morelos Diversion Dam [at Northerly International Boundary] and at Imperial Dam [Resulting from Operations under IBWC Minute No. 242, since the Colorado River Salinity Control Act, as amended, became effective on June 24, 1974]

Year	Annual Average Salinity (U.S. Count) as TDS (ppm)		Differential (U.S. Count) (ppm)
	At Imperial Dam	Upstream of Morelos Dam	
1974 (6/25-12/31)	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
2004	735	858	123
2005	708	803	95
2006	713	844	131
2007	675	805	130
2008	728	868	140
2009	721	858	137
2010	686	825	139
2011	687	828	141
2012	683	826	143

Table 4. Annual Volumes of Water scheduled (and/or actually delivered) to the Sanchez Mejorada Canal, at the Southerly International Boundary near San Luis, Arizona, and in the Limitrophe Section of the Colorado River below Morelos Dam (Under IBWC Minute No. 242, since the Colorado River Salinity Control Act, as Amended, became effective on June 24,

Year	Annual Volume Delivered	
	(tcm)	(af)
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
2004	160,957	130,488
2005	157,437	127,634
2006	155,992	126,465
2007	168,661	136,735
2008	165,841	134,449
2009	175,567	142,334
2010	154,688	125,407
2011	167,242	135,585
2012	153,895	124,764

Table 5. United States Bypass Drain Water delivered at Southerly International Boundary (SIB)
(Extension from the Bypass Drain to the Santa Clara Slough was not complete until 1977)

Year	Annual Volume Discharged	
	(tcm)	(af)
1974 (6/25 – 12/31)	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	2,209,881 ⁸	1,791,571 ⁸
1984	1,549,442 ⁹	1,256,152 ⁹
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	757,843 ¹⁰	614,393 ³
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
2004	121,883	98,812
2005	132,519	107,433
2006	132,617	107,514
2007	131,914	106,944
2008	142,387	115,435
2009	141,567	114,770
2010	144,892	117,465
2011	161,108	130,612
2012	155,697	126,225

⁸ Includes undetermined # floodwater from bypass canal levee breaks in U.S.

⁹ Includes Gila River water.

¹⁰ Low flows due to damage on drainage canal by Gila River floodwater. Drainage water entered the Gila River, Feb. 21, 1993 - Jan. 18, 1994 and was diluted by high flows.

Table 6. Annual Average Flow-Weighted Salinities of the water delivered to Mexico at the Southerly International Boundary (Under IBWC Minute No. 242, since the Colorado River Basin Salinity Control Act, as amended, became effective on June 24, 1974)

Year	Annual Average Flow-Weighted Salinity (U.S. Count) as TDS (ppm)
1974 (6/25 – 12/31)	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	1,166
2003	1,094
2004	1,155
2005	1,103
2006	995
2007	984
2008	1,032
2009	1,116
2010	1,103
2011	1,157
2012	1,142

Table 7. Mexico pumping from its San Luis Mesa Well Field located within five miles (Eight Kilometers) of the Arizona-Sonora boundary near San Luis

Year	Annual Volume Pumped	
	(tcm)	(af)
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 ¹¹	5,867 ¹¹
1994	76,281	61,841
1995	48,830	39,587
1996	81,039	65,699
1997	36,576	29,653
1998	0 ¹²	0 ¹²
1998	0 ¹²	0 ¹²
1999	0 ¹²	0 ¹²
2000	0 ¹²	0 ¹²
2001	67,173	54,458
2002	135,687	110,003
2003	174,747	141,669
2004	182,994	148,355
2005	153,762	124,655
2006	174,778	141,693
2007	191,221	155,025
2008	165,113	133,859
2009	194,717	157,859
2010	117,180	94,999
2011	153,515	124,457
2012	161,360	130,816

¹¹ The reduced pumping was due to excess delivery from the Gila River flood flows.

¹² No Pumping required due to sufficient flows in the Colorado River.

Table 8. Total volume pumped by the United States and volume pumped at the Minute 242 Well Field (Limited to 160,000 acre-feet for each country as per Minute 242)

Year	Total Volume Pumped		242 Well Field Volume Pumped ¹³	
	(tcm)	(af)	(tcm)	(af)
1975	33,401	26,787	n/a	n/a
1976	28,047	22,738	n/a	n/a
1977	28,358	22,990	n/a	n/a
1978 ¹	22,079	17,900	106	86
1979	31,353	25,418	201	163
1980	35,188	28,527	2,244	1,819
1981	47,443	38,463	23,361	18,939
1982	50,516	40,954	29,036	23,540
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	3,358	2,723
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	23,738	19,245
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
2004	37,605	30,487	27,797	22,536
2005	53,466	43,345	36,906	29,920
2006	56,710	45,975	40,548	32,872
2007	78,803	63,886	62,864	50,964
2008	81,594	66,149	68,812	55,787
2009	73,299.4	59,424.6	56,385	45,712
2010	61,983.7	50,250.8	41,756	33,852
2011	53,499.5	43,372.7	36,013	29,196
2012	41,277.1	33,463.89	26,234	21,268.23

¹³Minute No. 242 Well Field was constructed and put into operation in 1978.