Border Crossings

Water and Wastewater at the International Boundary

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Pollution ignores borders. These words are especially applicable to the international border that runs between Mexico and the states of California and Arizona, which, surveyed arrow-straight by the U.S.-Mexican Boundary Survey from 1849 to 1855, respects neither watershed nor mountain range. The phrase highlights the frustration scientists and engineers experience in trying to solve water supply and quality problems in the transboundary region. Solutions are difficult to achieve due to exploding population growth combined with cross-border discontinuities in water supply and demand, water and wastewater infrastructure, governmental and institutional mechanisms, social and cultural perspectives, and economic means.

Yet, progress is being made in addressing water quality and wastewater infrastructure problems along the Mexican border with California and Arizona, as described below for seven key population centers.

Tijuana, Baja California / Greater San Diego, California

These border metropolises are impacted by contaminated flows from the Tijuana River and from ocean currents that transport beach discharges. The Tijuana River flows north to Tijuana in a concrete-lined flood control channel before crossing into California, where it flows west for five miles through the Tijuana Estuary and into the Pacific Ocean just north of the border. At least 2 million gallons per day (mgd) of uncaptured raw sewage run into the river in Tijuana.

During dry weather, the flow in the Tijuana River is diverted and pumped to the South Bay International Wastewater Treatment Plant in California for treatment, then discharged into the ocean through the South Bay Ocean Outfall. During wet weather, most of the contaminated water remains in the river and flows directly into the Pacific Ocean through the Tijuana Estuary.

Tijuana cannot treat all of the sewage it manages to collect. It bypasses 6 mgd around the San Antonio de los Buenos Treatment Plant into the surf zone at Punta Banderas, six miles south of the border. This sewage is quickly mixed by wave action but remains near shore where it usually is transported southward by the California Current. At times, though, a near-shore eddy carries the contaminated water northward across the border. Total coliform levels are regularly as high as 1,500 colony forming units per 100 milliliters (cfu/100ml) in the surf zone at the border. The California level for beach closure is 1,000 cfu/100 ml.

Numerous transboundary mitigation projects are in development, including collection system improvements and completion of four wastewater treatment plants in Tijuana funded by low-interest loans from Japan. In addition, the U.S. Congress authorized construction of a secondary treatment plant, tentatively sited in Mexico, to treat an anticipated 59 mgd of Mexican wastewater.

Tecate, Baja California / Tecate, California

After it crosses the border into the United States, Tecate Creek flows four miles through mountainous, sparsely developed terrain before crossing back into Mexico where it enters the Rio Alamar, a tributary to the Tijuana River. In Tecate, Baja California, a 4-mgd

trickling filter treats most of the community's domestic waste. However, about 10,000 people still lack sewer connections, and the sewage from those homes flows untreated to Tecate Creek. The quality of the water at the border is severely degraded, with a biochemical oxygen demand (BOD) of 100-236 mg/l (treated domestic sewage has a BOD of 20-60 mg/l) and zero dissolved oxygen, substantially owing to discharges from the Tecate Brewery and raw sewage. Heavy metal contamination also is in evidence. The wastewater treatment plant is now being upgraded, and planning is underway to bring currently unconnected residences into the system.

Mexicali, Baja California / Calexico and the Salton Sea, California

Contaminated flow in the New River is the principal transboundary water-related concern for Calexico and the Imperial Valley. The New River originates 20 miles south of the border and flows another 65 miles north through Imperial Valley to the Salton Sea. Roughly 14 mgd of raw sewage plus unchecked effluent from hog farms, dairies, slaughterhouses, plastics manufacturers, and chemical plants pollute the New River as it flows northward through Mexicali. At the border, the river's flow averages 129 mgd, with low dissolved oxygen, a BOD of 23 mg/l, and a fecal coliform level of 550,000 cfu/100 ml, plus high loads of sediment, volatile and halogenated volatile organic compounds (VOCs and HVOCs), phosphate, total nitrogen, and selenium. On the U.S. side, the river takes on nutrients, pesticides, and almost 500 mgd of agricultural tail water before entering the Salton Sea.

Mexico has done much to mitigate New River contamination. The Mexicali I wastewater treatment plant at Zaragoza reliably treats 27 mgd in aerated lagoons before discharge. Construction of the Mexicali II plant is underway at Las Arenitas, where another 20 mgd will be treated and discharged southward to the Colorado River Delta.

The Salton Sea is noted for avian biodiversity and is an integral stopover along the Pacific Flyway. The sea is extremely saline—with total dissolved solids (TDS) of 44 parts per thousand and rising—and eutrophic, with recurrent fish and bird die-offs. Completion of the Mexicali II plant will eliminate its contributions of BOD, total suspended solids (TSS), and phosphate, thereby reducing nutrient load to the sea. However, the sea could be detrimentally impacted by flow reduction from the loss of Mexicali II flow and another 15 mgd of Mexicali I effluent siphoned off for cooling two new power plants.

San Luis Río Colorado, Sonora / San Luis, Arizona

These agricultural communities, located near the Colorado River, derive their potable supplies from groundwater. The groundwater is highly mineralized, with a TDS of about 1,500 mg/l and a manganese content six to 10 times higher than the secondary maximum contaminant level.

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	UNITED STATES	MEXICO
CA	**San Diego**	**Tijuana**
Pop. 2000	2,856,300 (County)	1,210,820
Pop. 2020	3,528,600 (County)	3,800,000
Key Concerns	6 mgd raw sewage bypasses MX WWTP into surf zone; MX collection system fails to capture 2 mgd of raw sewage, which enters Tijuana River and other drainages.	
Infrastructure Projects	South Bay IWTP & Ocean Outfall, Tijuana River Diversion Structure	San Antonio de los Buenos WWTP; 4 Japanese Credit WWTPs (under construction); U.S.- funded WWTP to treat MX sewage (in development)
CA	**Tecate**	**Tecate**
Pop. 2000	350	77,400
Pop. 2020	NA	246,738
Key Concerns	Inadequate sewage collection system and industrial discharge controls result in high organic loads, toxics, and heavy metals in Tecate Creek that ultimately reach California.	
Infrastructure Projects		Tecate WWTP upgrades; expand domestic sewage connections
CA	**Calexico**	**Mexicali**
Pop. 2000	27,109	738,200
Pop. 2020	60,000	1,234,000
Key Concerns	Raw sewage and other contaminants in the New River impacts Imperial Valley communities and the Salton Sea; flow reductions due to MX WWTP projects may affect Salton Sea.	
Infrastructure Projects		Mexicali I WWTP at Zaragoza; Mexicali II WWTP at Las Arenitas (under construction)
AZ	**San Luis**	**San Luis Rio Colorado**
Pop. 2000	15,332	180,000
Pop. 2020	30,000	420,000 (2018)
Key Concerns	Highly mineralized groundwater causes water distribution system problems; growth is outstripping wastewater treatment capabilities.	
Infrastructure Projects	Second expansion to WWTP just finished, new capacity still needed.	Greatly expanded wastewater treatment lagoons completed.
AZ	**Nogales**	**Nogales**
Pop. 2000	20,878	180,000
Pop. 2020	27,400	300,000
Key Concerns	Frequent raw sewage releases into Nogales Wash; sewage conveyed to Nogales International Wastewater Treatment Plant exceeds treaty limits and taxes the plant capacity; inadequate MX industrial pretreatment; flood events cause AZ sewer overflows and TSS peaks at NIWTP.	
Infrastructure Projects	Rehabilitation of the IOI, NIWTP, and the Nogales, AZ, collection system in design.	Upgrade to sewage subcollectors in development; new Los Alisos WWTP under discussion.
AZ	**Bisbee/Naco**	**Naco**
Pop. 2000	6090 / 833	>10,000
Pop. 2020	6700 / NA	NA
Key Concerns	Frequent sewage releases from antiquated Bisbee collection and treatment system; inadequate treatment capacity in Mexico.	
Infrastructure Projects	Bisbee sewage collection system rehabilitation, San Jose WTP at Bisbee (under construction)	Naco WWTP completed in 2003, but growth will soon outstrip capacity.
AZ	**Douglas**	**Agua Prieta**
Pop. 2000	14,312	110,000
Pop. 2020	16,500	198,400
Key Concerns	New power generation developments in MX may exacerbate groundwater depletion; U.S.population growth may force upgrades to Douglas, AZ, WWTP.	
Infrastructure Projects	Rehabilitation of Douglas wastewater collection system.	New industrial developments may require Agua Prieta wastewater and potable water capacity increases.

Population figures are from federal census, state government, and university sources. NA = not available

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The manganese stains laundry and causes depositions that clog water lines. Mineralization costs San Luis, Arizona, about $120,000 per year in operation and maintenance costs. A study by Arizona's Water Infrastructure Finance Authority concluded that new wells, treatment, and operational changes are needed.

Due to rapid population growth, providing adequate wastewater treatment is a continuing challenge on both sides of the border. In Arizona, treatment capacity expansion is underway. Mineralization limits the reuse value of the treated wastewater. Wastewater discharges from Arizona enter the drain that flows to the Santa Clara wetlands in Mexico's Colorado River Delta.

Nogales, Sonora / Nogales, Arizona

Nogales Wash begins about seven miles south of the border and flows north through both cities, conveying base flow (about 0.5 mgd), sporadic stormwater flow (averaging about 18 mgd annually), and fugitive wastewater discharges. Paralleling the wash is the International Outfall Interceptor (IOI), which begins at the border and runs nine miles north to the Nogales International Wastewater Treatment Plant (NIWTP). The IOI carries wastewater flows averaging more than 10 mgd from Mexico and about 4 mgd from the United States.

Persistent wastewater contamination of Nogales Wash is attributable to unsewered growth and sewer system overflows in Sonora. The U.S. Section of the IBWC supplies dry chlorine to Mexican utilities to disinfect dry-weather flows before they cross into the United States. Two Nogales, Sonora projects recently received grants from EPA's Border Environment Infrastructure Fund (BEIF): one to upgrade the potable water distribution system and the other to improve the wastewater collection system. Both projects contain incentives for improving industrial wastewater pretreatment.

In Arizona, BEIF is supporting projects to rehabilitate the IOI and upgrade the NIWTP. Discharge into the Santa Cruz River from NIWTP does not meet water quality standards for ammonia and frequently does not meet standards for metals and other constituents. Extreme hydraulic and TSS peaks from Mexico during rainfall events and a lack of adequate industrial pretreatment in Mexico hinder effective operation of NIWTP. Design of an NIWTP upgrade is now beginning with an innovative conceptual alternatives analysis that will consider the atypical flow characteristics to which NIWTP is subject.

Groundwater is the potable water source for the twin cities border area, "Ambos Nogales." Nogales Wash contamination and discharges from the stressed NIWTP threaten this resource, especially for Arizona communities tapping groundwater near the Santa Cruz River downstream of NIWTP. In addition, groundwater in central Nogales, Sonora, has widespread tetrachloroethylene (PCE) contamination. The Arizona Department of Environmental Quality (ADEQ) monitors wells at the border for transboundary migration of this contaminant plume, but no PCE level exceeding regulatory standards has been detected in recent years. Cleaning up Nogales Wash and providing high-quality wastewater treatment at NIWTP are keys to protecting the groundwater and the Santa Cruz River riparian corridor on the U.S. side.

Naco, Sonora / Bisbee-Naco, Arizona

The twin cities of "Ambos Nacos" and Bisbee rely on groundwater pumped from a small alluvial basin that straddles the border. At the border, groundwater flowing southwest from Bisbee turns northwest to flow into the main San Pedro River Basin. Greenbush Draw, an ephemeral stream, flows west through Naco, Arizona, to the San Pedro River about 10 miles away. The Bisbee and Naco wellfields pump from the aquifer near the border, just downgradient from a sulfate plume from historic mining operations at Bisbee.

Wastewater treatment lagoons for Naco, Sonora, lie just south of the border. Releases of raw sewage and partially treated wastewater often crossed into Arizona before projects funded by BEIF tightened the collection system and expanded treatment lagoons, which greatly reduced fugitive transboundary flows. However, population growth in Mexico could again overwhelm treatment capacity.

In Bisbee, BEIF-funded projects are underway to rehabilitate an antiquated collection system and construct a new sewage treatment plant. The treated wastewater will be discharged into Greenbush Draw upstream from the Naco well fields. Eventually, the treated wastewater may figure significantly in achieving conservation goals for the Upper San Pedro River.

Agua Prieta, Sonora / Douglas, Arizona

These sister cities lie at the southern end of the Sulphur Springs Valley alluvial basin and are drained by Whitewater Draw, an ephemeral stream crossing from the United States into Mexico (becoming the Río Agua Prieta in Mexico). Groundwater also flows from north to south across the border. The Arizona Department of Water Resources manages the Douglas Irrigation Non-Expansion Area, established in 1980, to prevent excessive aquifer level declines in this agricultural area. VOC contamination exists in some Agua Prieta municipal wells, but the extent of contamination is poorly defined. Competition for groundwater at the border will increase with planned expansion of power plants in Mexico. Wastewater is increasingly eyed as another potential supply.

Douglas wastewater is treated at the border and discharged across the border fence into Mexico, where it is reused for irrigation. The wastewater meets ADEQ Class C standards (suitable for fodder and fiber crop irrigation), but if the plant is expanded, ADEQ Aquifer Protection Permit rules will require upgraded treatment. In Mexico, the Río Agua Prieta is degraded by local wastewater sources, solid waste, and algae that clog the watercourse.

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