2009 Basin Highlights Report for the Rio Grande Basin

Annual Basin Report for the Rio Grande in Texas May 2009

International Boundary and Water Commission, U.S. Section
Texas Clean Rivers Program

Introduction

The United States Section of the International Boundary and Water Commission (USIBWC) supports and administers the Texas Clean Rivers Program (CRP) in the Rio Grande Basin under the guidance of the Texas Commission on Environmental Quality (TCEQ), providing expert insight into the needs and water quality issues that are unique to an international water boundary. This report summarizes the 2008 to 2009 USIBWC CRP water quality monitoring activities as well as water quality data for the Rio Grande Basin. This report is a supplemental update to the *2008 Regional Water Quality Assessment for the Rio Grande Basin*.

The Rio Grande Basin is divided into the Upper Basin (from the Texas-New Mexico state line to Amistad International Dam), the Middle Basin (from Amistad International Dam to Falcon International Dam), the Lower Basin (from Falcon International Dam to the Gulf of Mexico), and the Pecos Basin (from Red Bluff Reservoir at the Texas-New Mexico state line to the confluence with the Rio Grande).

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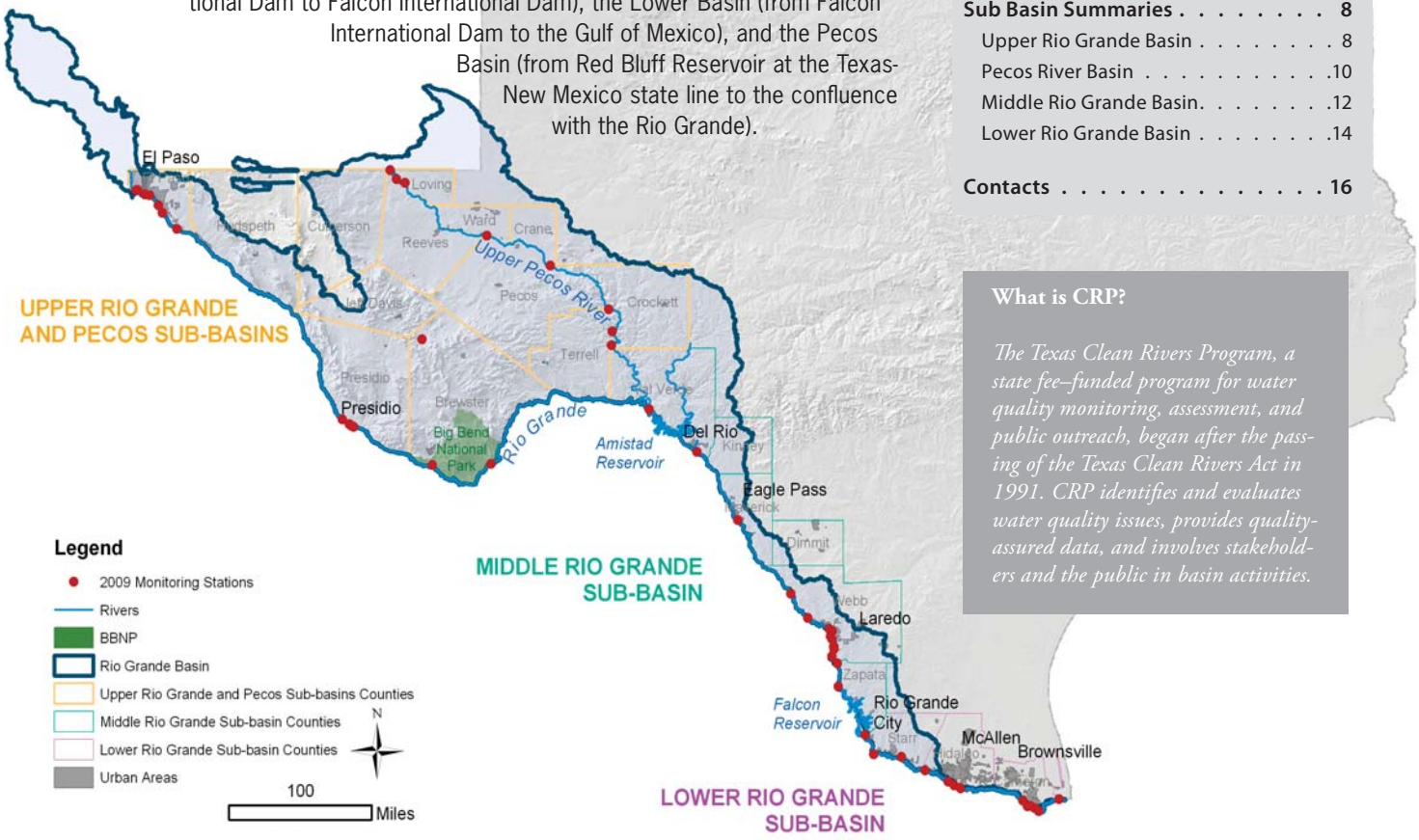


What is CRP?

The Texas Clean Rivers Program, a state fee–funded program for water quality monitoring, assessment, and public outreach, began after the passing of the Texas Clean Rivers Act in 1991. CRP identifies and evaluates water quality issues, provides quality-assured data, and involves stakeholders and the public in basin activities.

Photo Credit: J. Bennett

The Ojinaga wastewater plant lagoons under water in the September 2008 flood.

Photo Credit: E. Verdecchia

DHS constructs the border fence on the Rio Grande levee in El Paso, Texas, November 2008.

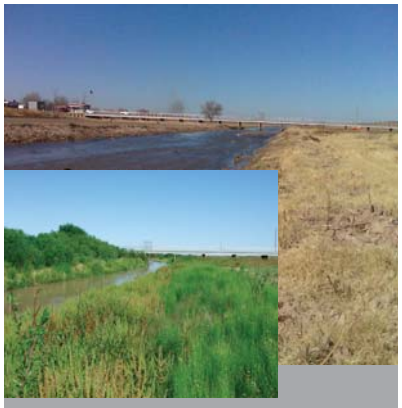


Photo Credits: W. Belzer and H. Balsinger

IBWC Minute 313 allows for maintenance of the floodplain and channel to address flood concerns. These photos show Station 15704 in May 2007 (bottom) and in December 2008 (top).

This Year's Highlights

Presidio Flood

September 2008 brought substantial and memorable floods to the Presidio/Ojinaga area. Heavy rains caused flood conditions on the Rio Conchos in Mexico beginning in late August, and both sections of the IBWC coordinated closely with local officials and Mexican officials regarding flows and dam releases on the Conchos River. Presidio county officials ordered the evacuation of residents on September 14th. Within a few days, the floodwaters overtopped the levees on both sides of the river and inundated the wastewater treatment plant in Ojinaga, Chihuahua, Mexico, sending sewage into the Rio Grande approximately two miles downstream of the international railroad bridge. USIBWC CRP partners collected extra bacteria samples in September, but bacteria levels were not as high as expected due to the large volumes of water in the river. Amistad Dam also began the first stages of flood operations when the International Amistad Reservoir levels began to rise.

The high flows documented in September 2008 were comparable to the floods of 1978 and 1958, with peak flows just over 51,000 cubic feet per second. Despite the danger and damage caused by the high, fast flows, the large volume of water actually benefits the ecosystem, flushing accumulated sediment, debris, and nonnative species from the channel and banks. Scientists at Big Bend National Park and other entities are studying the effects of the flood on aggressive exotic species, salt cedar (*Tamarix spp.*) and giant river cane (*Arundo donax*).

Hurricanes

Hurricanes Dolly in July, Gustav in August, and Ike in September brought heavy rains and strong winds throughout the Lower Rio Grande Valley. The resulting high flows flushed out large quantities of aggressive exotic aquatic weeds, such as the water hyacinth, that can grow densely enough to impede flow. Students at the University of Texas at Brownsville, one of the CRP sampling partners, conducted a comparative study of erosion on the tidal dunes near the mouth of the river as it empties into the Gulf of Mexico.

Border Wall

This year the Department of Homeland Security (DHS) planned and constructed hundreds of miles of border fences and walls along the Rio Grande. The USIBWC has been working with DHS to make sure that no structures built near the river violate international treaties. In addition, USIBWC Clean Rivers Program is working to ensure that all sampling partners have appropriate access to the river for monitoring.

IBWC Minute 313

In February of 2008, the IBWC Commissioners signed Minute 313, "Maintenance in the Rectified Channel of the Rio Grande." In this formal international agreement, both the U.S. and Mexico agreed on the terms of maintenance of the channel in the reach of the river from El Paso to Fort Quitman. The Commissioners "concluded that failure to remove silt and attend to other basic maintenance tasks presented a risk of municipal flooding and could result in a change in the river course, thus altering the international boundary." Work includes desilting of the channel, restoring levees, vegetation removal in the floodway, and realignment of the river. In 2007, the USIBWC completed work on a Programmatic Environmental Impact Statement to address certain aspects of this work, and the USIBWC will finalize the project-specific Environmental Assessment by the summer of 2009.

Big Bend Workshop

In 2000, Secretaries of the U.S. Department of Interior and Mexico's environmental agency (SEMARNAT) signed a Joint Declaration to enhance cooperation on the protection of ecological integrity of the Rio Grande. The signing was accompanied by a binational symposium to build collaboration in the reach from Fort Quitman to Amistad Reservoir. In November 2008, World Wildlife Fund (WWF) and other partners in the Chihuahuan Desert Ecoregion hosted a binational workshop on environmental and restoration research activities in the Big Bend area of the Rio Grande, a follow up of the 2000 Joint Declaration. At this workshop, researchers from 25 agencies and organizations in both countries came together in Alpine, Texas to share their work on the river's historic and current hydrology and channel morphology, fish assemblages, the status and experience of several riparian rehabiliation efforts, climatic trends in the ecoregion, and the efforts to release the salt cedar leaf beetle and the endangered silvery minnow. USIBWC CRP and TCEQ Surface Water Quality Monitoring (SWQM) presented information about water quality monitoring.

Photo Credit: D. Borunda

Participants from local, state, federal agencies and organizations from both the U.S. and Mexico shared research presentations on the Big Bend reach.

Biological Control of Salt Cedar

USDA Agricultural Research Service (ARS), Texas A&M University, and the Rio Grande Institute are conducting research on the biological control of salt cedar. They have released salt cedar leaf beetles (*Diorhabda elongata*) to control the invasive salt cedar/tamarisk populations in riparian habitats of various water bodies in Texas, including the Rio Grande. In September 2008, both the U.S. and Mexican Sections of the IBWC participated in a site visit to research areas along the Rio Grande in the reach upstream of Presidio, as well as Big Spring, Texas, to see the progress the beetles have made in several stages of release. After a couple of years, the beetles have begun to control hundreds of acres of the aggressive exotic bush. More information on ARS research can be found at http://www.ars.usda.gov.

Photo Credit: D. Borunda

Larvae of a salt cedar leaf beetle devours the leaves of a salt cedar tree at a USDA experimental release site near Candelaria, TX.

Mexico's Clean Basin Program

Various Mexican federal and state agencies have united to form the Clean Basin Program for the Rio Grande/Rio Bravo and Rio Conchos basin in Mexico. This program will synergize various environmental agencies and municipalities in Mexico to share resources, make priorities for the basin, address infrastructure and sanitation needs, and improve the health and environment of the 20 municipalities that will adhere to the program.

Silvery Minnow Release in Big Bend

In December 2008, the Fish and Wildlife Service together with the National Park Service and other assisting organizations released half a million Rio Grande silvery minnows into the river in Big Bend National Park. This experimental population is an important attempt to recover a native fish that has been absent from Texas waters for more than fifty years. More information and photographs can be found at http://www.fws.gov/endangered/home_stories/silvery_minnows.html.

Photo Credit: Raymond Skiles, U.S. Fish and Wildlife Service

Volunteers assist Fish and Wildlife Service and National Park Service staff with the release of silvery minnows into the river, December 2008.

Binational Water Quality Initiative

TCEQ and EPA are leading the effort for a Rio Grande Water Quality Initiative in order to address water quality impairments in the river. This project will focus on the Lower Rio Grande Valley below Falcon International Dam as a pilot project for a binational watershed protection plan. Local, state and federal agencies and organizations from both countries are participating in steering, policy, and technical committees that have discussed existing and necessary resources and have begun creating plans of action in order to address

Highlight of 2008 Publications on Rio Grande Research

Hydrology, Salinity, and Salinity Control Possibilities of the Middle Pecos River: A Reconnaissance Report. Texas Water Resources Institute, May 2008.

Quality of Water and Sediment in Streams Affected by Historical Mining, and Quality of Mine Tailings, in the Rio Grande/Rio Bravo Basin, Big Bend Area of the US and Mexico, August 2002. USGS Scientific Investigations Report 2008-5032.

Forgotten Reach of the Rio Grande, Fort Quitman to Presidio. US Army Corps of Engineers, January 2008.

Assessment of Organochlorine Pesticide Levels in Manadas Creek, an Urban Tributary of the Rio Grande in Laredo, Texas. *Arch Environ Contam Toxicol*, Sept. 2008.

Water Quality model for the Rio Bravo / Grande Basin: Progress Report. University of Texas at Austin, Center for Research in Water Resources. August 2008.

The Rio Grande in Texas comprises 1,255 miles of the Texas/Mexico border, traveling through 15 Texas counties, four Mexican states, six major dams, and several ecoregions.

the water quality issues in the region. The USIBWC CRP is participating in the technical committee, and the data we collect through the program will assist the members of the Initiative to set binational water quality goals and pollutant loads.

The TCEQ Border Initiative

The TCEQ has developed a comprehensive plan that sets priorities for cooperation on the local, state, national and international scales to deal with border issues. Among its priorities for water issues are the Lower Rio Grande Water Quality initiative (above), deploying additional continuous water quality monitoring stations, and assisting with the silvery minnow reintroduction in Big Bend. More information on the plan can be found at http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/gi/gi-392.html.

Binational Water Quality Database

USGS in collaboration with IBWC and Mexico's water agency CONAGUA, have been creating a binational water quality database. This database will build on the Border Environmental Health Initiative and the binational GIS database that USGS has created with IBWC, and will house water quality data from various U.S. and Mexican agencies for the entire international boundary, including the Rio Grande. The University of Texas at Austin has also created a complementary database and is currently using it for modeling contaminants.

Rio Grande Research Database and Website

USIBWC CRP is compiling a database of current and previous water quality and environmental research projects occurring in the Rio Grande Basin. The River Systems Institute and USGS have both made research databases and bibliographies, and the CRP database will be complementary to those projects. In the future, the list of research will be made available on the USIBWC CRP website with links to all online reports.

Public Outreach

Basin Advisory Committee

The Basin Advisory Committee (BAC) is a group of private citizens, government agency representatives, citizen groups, and academia who provide input and information for the CRP program to ensure issues and concerns in the community are addressed. Input from the BAC assists the CRP in determining changes to the monitoring schedule, new monitoring sites, special studies, and dissemination of information. People who are interested in providing input on environmental issues and who would like to be a member of the Rio Grande Basin BAC can contact anyone in the CRP (see the back cover of this report for contact information).

BAC meetings are held once a year in the fall in El Paso and the Lower Rio Grande Valley, in conjunction with the USIBWC Rio Grande Citizens' Forum. These meetings provide the USIBWC CRP with an opportunity to update the committee on recent activities and future plans, as well as a forum for research exchange and input about the program.

Texas Stream Team

The Texas Stream Team, formerly called Texas Watch, is a network of trained volunteers and partners who gather information about Texas natural resources and ensure information is available to the general public. In previous years, the USIBWC CRP has partnered with the Texas Stream Team on Rio Grande projects in Laredo and McAllen. We plan to

continue our partnership with Texas Stream Team in the coming years to bring the program to the U.S.-Mexico border region. To find out more about the Texas Stream Team, go to their website at: http://txstreamteam.rivers.txstate.edu.

Friends of the Rio Grande and 2009 Small Project Funding Opportunities

A 2004 initiative created as a sunset recommendation from the Texas State Legislature mandated TCEQ to create and fund a team called the Friends of the Rio Grande (FORG). The objective of FORG was to promote environmental awareness along the Rio Grande through public outreach and education, organizing volunteer cleanups along the river, water quality monitoring, and recognition of exemplary environmental efforts. In 2004, TCEQ and the USIBWC CRP funded projects at schools, museums, environmental awareness groups, and parks.

In 2009, USIBWC CRP funded additional small projects for water quality and outreach projects affecting the Rio Grande. Projects included water quality data collection on a tributary of the Rio Grande in the Forgotten Stretch, river cleanups, experiments with riparian plants, and bacteria source tracking. These awards will be posted on the Friends of the Rio Grande website, http://www.friendsoftheriogrande.com.

Other Outreach Activities

In the past year, the USIBWC CRP has participated in various outreach activities. The annual El Paso Water Festival brought children and educators to the El Paso Desalination Plant's TecH_2O Center in October 2008 to learn about water conservation in the area. USIBWC displayed its outreach trailer with exhibits on the agency, its history, and activities along the international boundary. In May, USIBWC participated in Village of Vinton's River Cleanup through the Texas Waterway Cleanup Program. USIBWC plans to have additional future river cleanups. USIBWC also presented water quality monitoring at a local elementary school Career Day.

USIBWC CRP Website

The USIBWC CRP website provides the following pages and information:

USIBWC CRP website can be found at http://www.ibwc.gov/CRP/index.htm

Study Area – This page contains a GIS based interactive map of the Rio Grande Basin and provides information on water quality and water quantity stations.

Data – USIBWC CRP Data, our water quality data page where you can acquire an Excel file of the water quality data by station since 1995. You can also find a link to the monitoring schedule website (cms.lcra.org), definition of monitoring parameters, available data on metals analysis in the basin, a spreadsheet of Rio Grande segment uses and water quality standards, and laboratory specifications.

Publications – contains our Basin Highlights Reports and our five-year Basin Summary Reports in PDF format.

Links – contains links to other planning agencies in Texas, the Rio Grande basin partners, and other related links to environmental agencies and groups in the federal government, Mexican government, and public sector.

Contacts – contains contact information for CRP personnel.

Participation – contains information on how the public can become involved with CRP.

Calendar/Current Activities – contains meetings that we will be attending or have attended and updates on current activities in the basin.

How can we tell the quality of water?

During the past year, the USIBWC CRP continued to maintain its large network of water quality stations. We can begin to understand the condition of the water through routine monitoring, which is performed at fixed locations at regular intervals throughout the year. When routine monitoring shows a water quality issue or trend, we can begin more intensive monitoring. CRP partners throughout the basin have been a valuable asset in water quality monitoring and developing and assisting in special studies. Table 1 shows the kinds of data that we analyze for during routine monitoring and why.

Table 1: Water Quality Parameters Analyzed

Field Parameters		
Parameter	Description	Effects to Waterbody
pH	Measure of how acidic or basic the water is. The values range from 0 to 14, with 7 being neutral. pH values less than 7 indicate acidity, whereas a pH greater than 7 indicates a base.	Values greater than 9.0 and less than 5.0 can have detrimental affects on the health of aquatic life, wildlife, and humans.
Specific Conductance	Indicator of how well the water conducts electricity. Pure water does not conduct electricity; impurities of water are what allow electricity to pass through the water. These impurities are salts and metals. Since total and dissolved metal values are very low, conductivity primarily measures how much salt is in the water.	Can cause physiological effects in animals and plants
Dissolved Oxygen (DO)	Measure of the oxygen in the water. DO is one of the most important water quality parameters.	Low DO values can lead to reduced numbers of aquatic life in a water body. Very low levels (<2) can be indicative of higher levels of pollutants that use up DO during the decay process.
Secchi depth	A measure of the transparency of water - the maximum depth at which a black and white disk is visible.	Higher transparency leads to healthier aquatic plant life (particles in water block sunlight for photosynthesis).

Conventional Laboratory Parameters		
Parameter	Description	Effects to Waterbody
Solids	Total and dissolved materials of any kind (calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates)	High total dissolved solids indicate higher amounts of dissolved salts which can reduce the diversity of aquatic life and can render the water unusable for human consumption.
Nutrients	Nitrogen compounds, ammonia, and phosphorus	High levels can cause excessive plant growth, which can lead to reduced dissolved oxygen, reduced stream flow and reduced navigability of the waters. Ammonia is toxic to aquatic life.
Chlorophyll-a	An indicator of excessive plant and algal growth in the water	High levels for long periods indicate low water quality and are indicative of excess nutrient levels.
Alkalinity	A measure of the acid neutralizing ability of the water due to the amount of carbonates, bicarbonates, and hydroxides	Alkaline water is detrimental to agriculture and plant growth.

Non-conventional Laboratory Parameters		
Parameter	Description	Effects to Waterbody
Metals	Aluminum, arsenic, barium, chromium, copper, lead, mercury, nickel, silver, and zinc. Metals can be tested as total or dissolved metals in water or sediment to determine long-term accumulation.	High concentrations can be highly toxic to aquatic life and human health.
Organics	Chemicals containing carbon and hydrogen. Organic compounds analyzed are herbicides, pesticides and industrial organic compounds both in water and in sediment.	Can be toxic to aquatic life and human health

How is the water?

The Texas Water Quality Inventory is done by the TCEQ every two years as required by the Clean Water Act. Any section of a water body that does not meet the primary standards is then placed on the 303(d) list, which contains water quality impairments in the water bodies of the state. Sections of a water body on the 303(d) list are then assessed to determine the course of action to take in identifying the source of the impairment and possible corrective solutions.

Impairments are determined when a section does not meet the primary standards assigned to the segment. Primary parameters are chloride, sulfate, total dissolved solids, dissolved oxygen, pH, temperature, and bacteria. **Concerns** are identified when data is compared to secondary screening levels, and criteria are determined based on the water body type. Information on primary standards can be found at TCEQ's Texas Surface Water Quality Standards website, http://tceq.state.tx.us/nav/eq/eq_swqs.html, and the Surface Water Quality Monitoring website, http://tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html has information on secondary screening levels. Tables 2 and 3 below show which segments of the Rio Grande Basin have been listed on the Texas 2008 impairment list. More information about each Segment can be found in the following sections.

Table 2: Water Quality Impairments in the Rio Grande Basin

Water Quality Impairments in the Rio Grande Basin (303(d) List)		
Segment	Parameter Impaired	Year First Listed
2314	Bacteria	1996
2311	Depressed Dissolved Oxygen	2006
2307	Bacteria Chloride Total Dissolved Solids	1996
2306	Bacteria	1999
2304	Bacteria	1996
2302A	Bacteria	2004
2302	Bacteria	1996

Photo Credit: E. Verdecchia

A student from El Paso Community College (EPCC) collects samples near Station 14465 upstream of Riverside Diversion Canal in El Paso, December 2008. EPCC has been conducting a special study on bacteria with USIBWC CRP for the past 8 years.

Table 3: Water Quality Concerns in the Rio Grande Basin

Water Quality Concerns in the Rio Grande Basin	
Segment	Parameter Impaired
2314	Chlorophyll-a
2312	Harmful algal bloom/golden alga Chlorophyll-a Nitrate Depressed dissolved oxygen orthophosphorus Ammonia
2311	Harmful algal bloom/golden alga Chlorophyll-a Bacteria Depressed dissolved oxygen
2310	Harmful algal bloom/golden alga
2308	Chlorophyll-a Nitrate Total Phosphorus
2307	Nitrate Orthophosphorus Total Phosphorus Ammonia Chlorophyll-a Depressed dissolved oxygen
2306	Chlorophyll-a Total Phosphorus
2305	Nitrate
2304	Depressed dissolved oxygen Bacteria Toxicity in Ambient Water
2303	Toxicity in Ambient Water
2302	Mercury in fish tissue Depressed dissolved oxygen
2301	Bacteria Chlorophyll-a

Upper Rio Grande Sub-Basin

Upper Rio Grande CRP Partners

USIBWC American Dam Field Office

El Paso Water Utilities

El Paso Community College

University of Texas at El Paso

TCEQ El Paso Office

USIBWC Presidio Office

Big Bend National Park

USIBWC Amistad Dam Office

Introduction

The upper Rio Grande sub-basin extends from the Texas-New Mexico state line downstream to the International Amistad Dam, a length of 650 miles (1,045 km). The water in the upper portion of this segment is used for agriculture and as a drinking water supply. Water in the river downstream of El Paso and Juarez is primarily composed of agricultural return flows, wastewater effluent, and raw or partially treated sewage, and is therefore high in salts and bacteria. Further downstream, two major tributaries (the Rio Conchos from Mexico and the Pecos River in Texas) join the Rio Grande, increasing water quality and quantity. Between those tributaries is the wild and scenic Big Bend region. The upper Rio Grande sub-basin ends at the International Amistad Dam, operated by the IBWC. The dam provides flood control, improved water quality, increased water supply, a steady flow in the river below the dam, fishing, recreation, and hydroelectric power on both sides of the border.

2009 Upper Rio Grande Sub-basin Updates and Special Studies

New Mexico Monitoring. The Rio Grande in southern New Mexico below Las Cruces and in Texas upstream of El Paso is impaired for contact recreation. The sources of high bacteria levels in the impaired Segment 2314 in Texas are unknown, although they are believed to be linked to municipal, agricultural and livestock operations along the river, as well as possible groundwater sources. USIBWC CRP is beginning talks with various organizations to start a routine monitoring program in southern New Mexico in order to understand the sources of contamination entering the impaired segment. Routine monitoring would provide valuable baseline information in both New Mexico and Texas. In addition, the Paso del Norte Watershed Council is applying for Federal Clean Water Act Section 319(h) Nonpoint Source Grant to address water quality issues in the lower reach of the Rio Grande in New Mexico.

Table 4: Upper Rio Grande Sub Basin Segments

Segments in the Upper Rio Grande Basin

Segment	Segment Name	Stations	Water Quality Summary
2314	RG Above International Dam	13276, 17040, 13272	Contact recreation impairment due to high bacteria
2308	RG Below International Dam	14465, 15528, 15529	Concrete lined channel to prevent meandering of the international boundary; limited aquatic life use; meeting all primary standards, which are lower than other segments
2307	RG Below Riverside Diversion Dam	16272, 15704, 15795, 13232, 13230	Irrigated agriculture and poorly treated wastewater effluent create high bacteria, TDS, ammonia and phosphorus levels, which lead to high algal content
2306	RG Above Amistad International Reservoir	17001, 17000, 13229, 13228, 16730, 13225, 13223	Bacteria levels are high downstream of Presidio/Ojinaga; Big Bend reach has elevated algal growth; high nutrient levels below Big Bend; high TDS and chloride with the confluence of the Pecos.
2305	International Amistad Reservoir	13835, 15892, 15893	Reservoir has high aquatic life use and contact recreation uses being met; nitrate concern but exact sources are not known
2309	Devils River	14942, 13239, 13237	Exceptional aquatic life and contact recreation uses fully supported; excellent water quality with low salinity

Big Bend Nutrients and Salinity. In the past few years, Big Bend NP, the USGS, TCEQ and the USIBWC have conducted a special study in Big Bend to track the source of nutrient and salinity contamination between Presidio and Amistad Dam. Some portions of the study have concluded and a report is currently being prepared by USGS.

Continuous Water Quality Monitoring in Big Bend. TCEQ installed real-time water quality monitoring stations in the Rio Grande within Big Bend National Park. The continuous data stations were installed to provide information about salinity, but the data is also providing interesting trends about the dissolved oxygen levels in the river. Data can be viewed at the Continuous Water Quality Monitoring website, http://tceq.state.tx.us/assets/public/compliance/monops/water/wqm/tx_realtime_swf.html.

Big Bend Lower Canyons Water Quality. National Park Service personnel from Big Bend National Park and the Rio Grande Wild and Scenic River, in cooperation with the USIBWC CRP, TCEQ's Surface Water Quality Monitoring Program, the University of Texas at El Paso and the USGS, have been busy characterizing the water resources and monitoring water quality in the remote Lower Canyons of the Rio Grande. Located in eastern Brewster County and western Terrell County, the Lower Canyons have been referred to as the best wilderness canoe trip in the lower 48 states. Studies have focused on aquatic invertebrates in riffles and springs, and water quality in springs. Besides the flows of the Rio Grande, water in the river comes from numerous limestone springs found throughout the reach. These springs come from the Edwards-Trinity Plateau Aquifer which stretches from Brewster County to Midland and back east to the Hill Country. Future research questions center around determining source information for the spring water. At what elevation did the water enter the aquifer? How long has the water been in the ground? Information like this can be used by communities and landowners to provide appropriate protection.

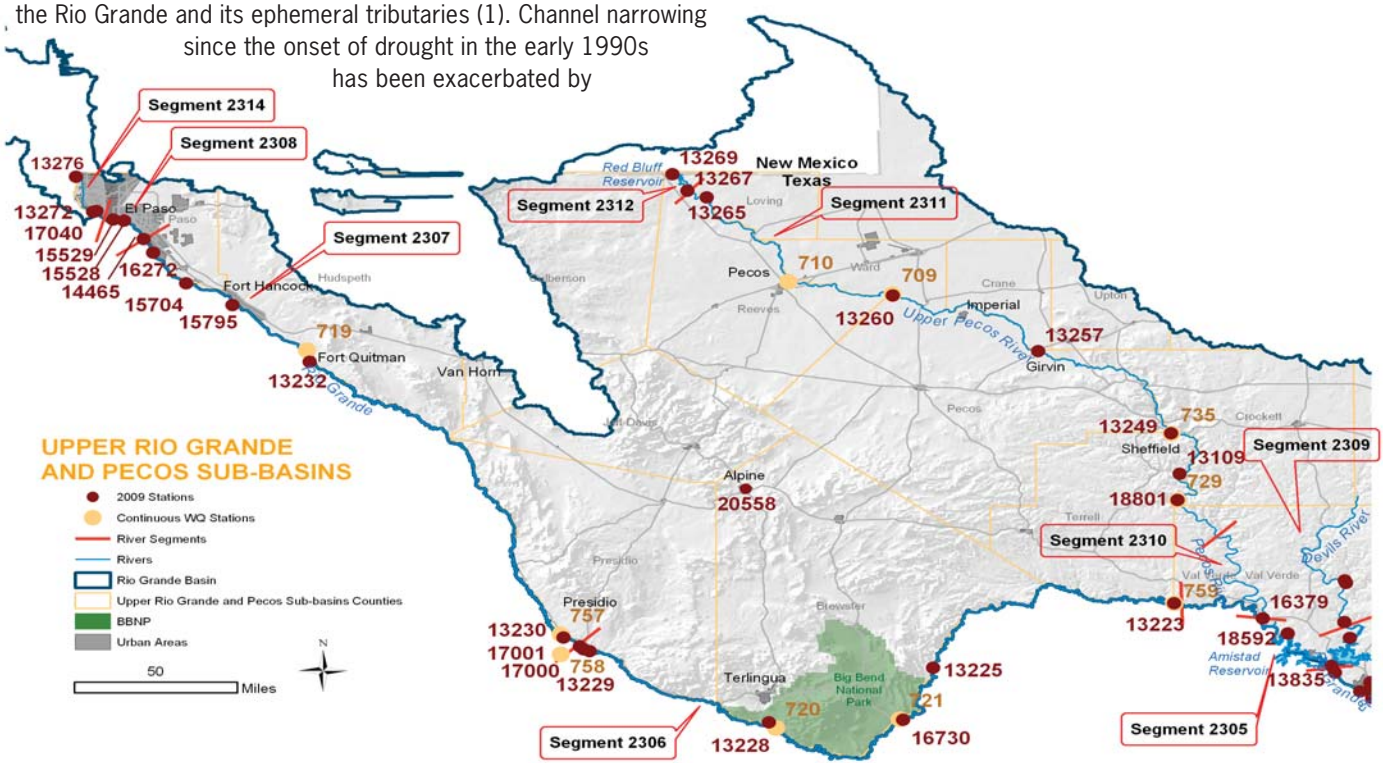
River Restoration in Big Bend. Natural and cultural resource values and park infrastructure along the Big Bend reach of the Rio Grande in the national park are compromised and endangered by increased flooding attributed to changing channel conditions of the Rio Grande and its ephemeral tributaries (1). Channel narrowing since the onset of drought in the early 1990s has been exacerbated by

Photo Credit: USIBWC

Rio Grande near Presidio, Texas before the flood of September.

Photo Credit: USIBWC

Rio Grande levees near Presidio overtopping, September 17, 2008.



(1) Dean, D.J. 2009. A River Transformed: Historic Geomorphic Changes of the Rio Grande in the Big Bend Region of Texas, Chihuahua, and Coahuila. M.S. Thesis. Utah State University

Photo Credit: USIBWC

The river trail in Sunland Park, NM provides access to the river to residents of southern New Mexico as well as El Paso, Texas.

the invasion of non-native salt cedar (*Tamarix spp.*) and giant river cane (*Arundo donax*), which have increased sedimentation along the river margins, resulted in loss of channel flow conveyance, flooding at lower discharges, and continued growth in the elevation of the flood plain even though flood magnitudes have decreased. Additionally, anecdotal observations indicate that floodwaters from tributary flooding are now ponded behind sediments built up at the confluence with the main stem. Over the past six years, a partnership between NPS, World Wildlife Fund, Texas Parks and Wildlife, and counterparts in Mexico, has completed riparian rehabilitation projects on some 35 miles of the river. Focused primarily on removing exotic vegetation, the projects have involved citizens from both sides of the river and opened up the riparian zone to native vegetation.

Organics in the Upper Rio Grande Sub-basin. Since 2007, USIBWC CRP has been collecting data on pesticides and other organics on a semi-annual basis at our routine monitoring sites. Twenty-three chemicals were analyzed in sediment at six stations in the Upper Rio Grande basin. The majority of data did not detect any pesticides in the sediment, with the exception of one sampling event at station 15795, Alamo Control Structure, which detected DDE slightly above the detection limit on February 25, 2008.

Pecos River Sub-Basin

Pecos River CRP Partners

TCEQ Midland Office

Texas AgriLife Extension Service

USIBWC Amistad Dam Office

Sul Ross University

Introduction

The Pecos River in Texas begins at the Texas/New Mexico state line and is then impounded by Red Bluff Reservoir. The river then flows southeast until it empties into the Rio Grande upstream of International Amistad Dam, a journey of 409 miles (658 km). The Pecos River is divided into three segments: 2312, 2311, and 2310 upstream to downstream.

The heavy drought conditions in the southwest have caused the Pecos River to see episodes of discontinuity. Invasive salt cedar plants have also been linked to reduced water levels and increased salinity in the Pecos River basin. Since 1999, the Texas AgriLife Extension Service (formerly the Texas Cooperative Extension) and other parties have been successfully reducing the species along the Pecos River, utilizing multiple sources of funding; to date, these efforts have resulted in the treatment of over 12,000 acres of salt cedar in the Pecos River watershed. Due to the success of the Texas AgriLife Extension, other river basins with the same problem have begun similar programs.

Special Studies

Continuous Water Quality Monitoring (CWQM) on the Pecos. TCEQ and USIBWC have collaborated to install real-time water quality monitoring stations on the Pecos River to enhance data normally collected on a quarterly basis at routine sampling stations. The continuous monitoring sites serve a variety of data needs, including the evaluation of increasing salinity, the effects of salt cedar removal and increased oil and gas production, the quality of water for irrigation, and low dissolved oxygen in the upper Pecos. The stations are collecting DO, pH, conductivity and temperature at 15 minute intervals and the data are transmitted remotely to the TCEQ. The data are then validated and made available on the TCEQ website at the following address:
http://www.tceq.state.tx.us/assets/public/compliance/monops/water/wqm/tx_realtime_swf.html.

The CWQM stations are located at the following sites: Pecos River near Pecos, TX (13261/C710); Pecos River at Coyanosa, TX (13260/C709); Pecos River at Sheffield

(13249/C735); and Pecos River 2.3 miles upstream of the Terrell/Val Verde county lines (18801/C729). The four Pecos River stations have companion USGS gages which separately monitor flow. A fifth TCEQ station was installed at Oasis Ranch on Independence Creek (20338/C764).

Fish kills caused by the golden alga, *Prymnesium parvum*, are a visible result of increased salinity. Fish kills related to *P. parvum* have been documented in the Pecos River since 1985. The real-time data is being used by the Texas Parks and Wildlife Department to evaluate the potential triggers for golden alga blooms. More information on this study can be found at: http://www.tpwd.state.tx.us/landwater/water/environconcerns/hab/ga/.

Salinity Studies. Total Dissolved Solids (TDS) values in the Pecos River enter Texas above 5,000 mg/l and climb to an average value of 20,000 mg/l as the water flows downstream to Girvin. TCEQ, USIBWC and Texas AgriLife Research are conducting a special study in the Pecos River to determine possible sources contributing to the increasing salinity. Currently, TCEQ is collecting monthly samples at six stations along the Pecos between Girvin and Imperial where salinity is highest. This study is evaluating the Bromide/Chloride ratio to help in determining the source of salts entering the river as well as the salt load. More information on this project can be found on the web at: http://pecosbasin.tamu.edu/index.php.

Photo Credit: E. Verdecchia

Pecos River at Coyanosa gage station, September 2008. Some salt cedar has been killed due to salt cedar eradication projects on the Pecos.

Pecos Watershed Protection Plan (WPP). The Texas AgriLife Extension Service, along with the USIBWC, TCEQ, the Texas Water Resources Institute, and the Texas State Soil and Water Conservation Board, is nearing completion of a USEPA funded project to develop a watershed protection plan for the Texas portion of the Pecos River. Project funding has been combined into a watershed protection plan for the Pecos River in Texas that outlines needed management practices that can be voluntarily implemented in identified areas of the watershed to address water quality and other watershed concerns. The watershed protection plan has also identified potential sources of financial and technical assistance that landowners can utilize to offset some costs of voluntary practice implementation, while also setting goals and developing a timeline for trial implementation.

This plan is vital to the future ecosystem of the Pecos River. The Pecos River has experienced lowered water quality and stream flows, and the aquatic community of the Pecos River has been drastically altered, according to fishery biologists and to local users of the river. The greatly reduced aquatic diversity has been negatively affected by changes in river hydrology, riparian community destruction, oil and gas activities, irrigation demands, long and short-term droughts, damming of the river and the desertification of the upland

Photo Credit: USIBWC

Station 13240 (Pecos River at Gaging Station 7.4 miles East of Langtry) in Segment 2310.

Water Quality Review

Table 5: Pecos River Sub Basin Segments

Segments in the Pecos River Sub Basin				
Segment	**Segment Name**	**Stations**	**Uses**	**Water Quality Summary**
2312	Red Bluff Reservoir	13269, 13267	H, GU, FC, CR	Golden alga a concern and high chlorophyll. Salinity values are typically over 6,000 mg/l. Segment has concern for golden alga blooms..
2311	Upper Pecos River	13265, 13264, 13260, 13257, 15114	H, GU, FC, CR	Water is not drinkable due to high salinity from groundwater (TDS standard is 15,000 mg/l). Segment has concern for golden alga blooms.
2310	Lower Pecos River	13109, 13246, 13240, 16379, 18801	H, PS, GU, FC, CR	Waters from Independence Creek have in the past brought salinity values down to drinking water levels, but recent data shows abnormally high values of chloride, sulfate, and TDS. Segment has concern for golden alga blooms

H - High Aquatic Life, PS - Public Drinking Supply, GU - General Use , FC - Fish Consumption , CR - Contact Recreation

watershed due to grazing mismanagement. These factors, both natural and man-made, have allowed introduced plant species, such as salt cedar, to dominate the riparian systems within the watershed. The WPP will address the issue by implementing best management practices.

The Pecos River contributes approximately 11% of the stream inflow into Amistad Lake. However, it also contributes to salt loading into Amistad Lake at an annual rate 29.5% of the total salt loading. Salinity of the waters in Amistad Lake exceeded 1000 ppm for a month in 1988, and has fluctuated since. It is important to control salt loading from the Pecos to Rio Grande if we are to be successful in keeping salinity of the reservoir within drinking water standards.

For more information on the project and to view reports developed from the research conducted by the various partnering agencies, visit the project website at http://pecosbasin.tamu.edu.

Middle Rio Grande Sub-Basin

Middle Rio Grande CRP Partners

USIBWC Amistad Field Office

USIBWC Falcon Field Office

City of Laredo Environmental Services Department

City of Laredo Health Department

Rio Grande International Study Center

TCEQ San Antonio Office

Introduction

The middle Rio Grande sub-basin consists of the portion of the river flowing from just below International Amistad Reservoir to just above International Falcon Reservoir and also includes San Felipe Creek. This 303-mile (487 km) stretch of the river flows past five counties in Texas and the Mexican states of Coahuila, Nuevo Leon, and Tamaulipas. Del Rio, Eagle Pass and Laredo, along with Mexican sister cities Ciudad Acuña, Piedras Negras, and Nuevo Laredo comprise the bulk of the population living along the Rio Grande in this reach. Laredo, in particular, is one of the fastest growing cities in Texas. Increased trade with Mexico, manufacturing growth, and tourism have contributed to population increases in the area.

Overall water quality in the middle Rio Grande sub-basin has been stable or has shown improvement in the last few years. Water impounded behind Amistad Dam slows in velocity, settling much of the suspended solids carried from the upper Rio Grande sub-basin. Water in the middle Rio Grande is used for irrigation and increasingly for municipal use. Most municipalities along the river are dependent on surface water for domestic and industrial use. Del Rio, TX is the only major city that relies on groundwater for its water needs.

2009 Middle Rio Grande Sub-basin Updates and Special Studies

Manadas Creek Metals. Texas A&M University - Kingsville (TAMUK) with cooperation from CRP and the Rio Grande International Studies Center (RGISC) in Laredo completed an assessment of nutrients and heavy metals in Manadas Creek, a tributary to the Rio Grande, and its potential impacts to the Rio Grande in Laredo, TX. The study, published in September 2008 in *Archives of Environmental Contamination and Toxicology,* showed that the heavy metals arsenic and antimony exceeded state water quality standards and that phosphorus values were also periodically higher than the water quality standards. Impacts to the river were measured in the Rio Grande relatively far from the confluence. At those river sites, the nutrient and metals contamination observed in Manadas Creek were not present. Future studies will continue studying the metals impacts in Manadas Creek, and TAMUK is currently looking at organochlorinated pesticides in the Rio Grande and tributaries in Laredo. USIBWC CRP continues to analyze for metals from Manadas Creek at Station 13116.

Photo Credit: L. Grijalva

Station 13208, Rio Grande below Amistad Dam, looking upstream, taken July 2007.

Exotic Cane in Laredo. *Arundo donax* (called Carrizo Grande or Giant River Cane) is a significant problem in the Laredo area. The dense cane stands can reach up to 30 feet high and out-compete native plants. The Department of Homeland Security has completed an Environmental Assessment for a pilot project to eradicate cane using a variety of methods, including mechanical, chemical application on monocultures, and a combination

of fire and other methods, and has begun to remove large stands of cane. The Laredo Community College is conducting research on how to use trees and shade to limit the cane growth. In addition, various groups in Cuatro Ciénegas, Coahuila, México, are also conducting studies and creating working groups for the cane management in Mexico.

Organics in the Middle Rio Grande Sub-basin. Since 2007, USIBWC CRP has been collecting data on pesticides and other organics on a semi-annual basis at our routine monitoring sites. Twenty-three chemicals were analyzed in sediment at 10 stations in Segments 2303 and 2304. The majority of data for these segments did not detect any pesticides in the sediment, with the exception of a sampling event at station 13116, Manadas Creek, which detected DDE slightly above the detection limit on March 13, 2008, and at station 18795 on January 29, 2009, where 2,4-D was detected.

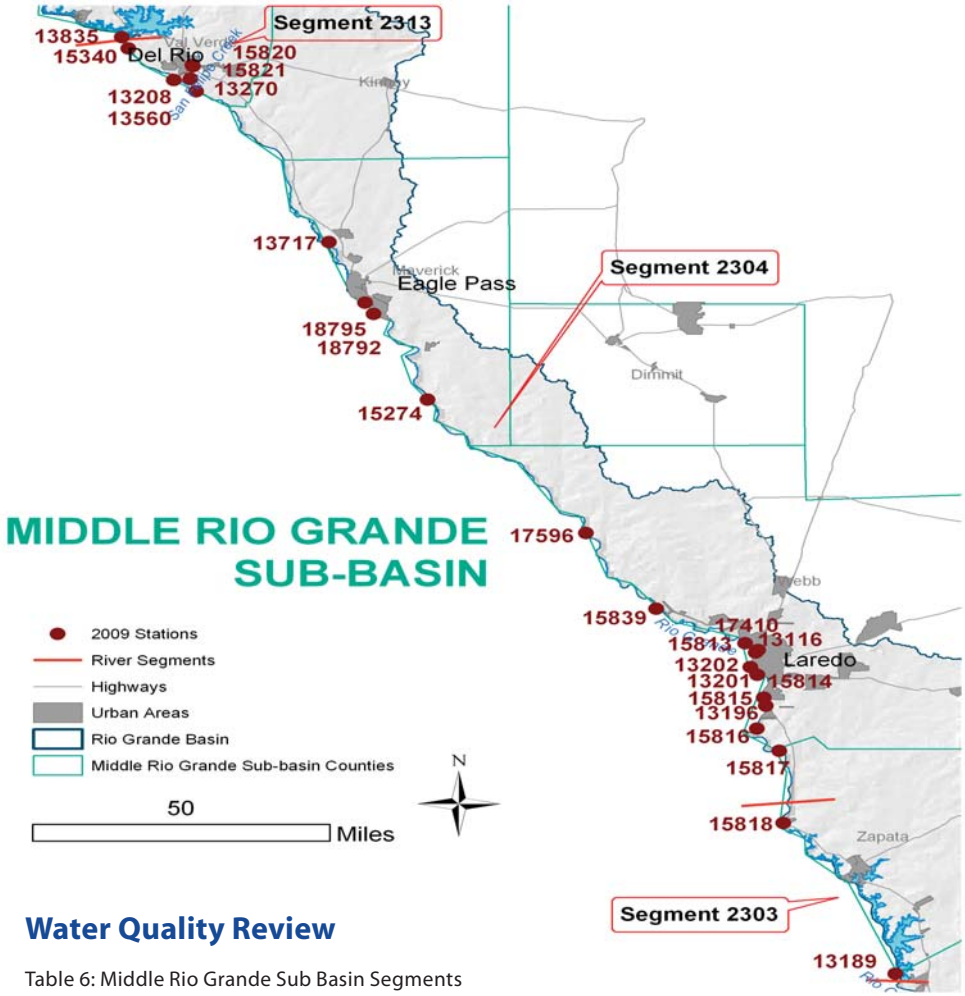


Photo Credit: USIBWC

Station 15821 (San Felipe Creek at Blue Hole Flood Gates) in Segment 2313, looking downstream. Water quality is high in San Felipe Creek.

Photo Credit: USIBWC

The Middle Rio Grande sub-basin begins at Amistad Dam which releases water impounded in Amistad International Reservoir.

Water Quality Review

Table 6: Middle Rio Grande Sub Basin Segments

Segments in the Middle Rio Grande Sub Basin

Segment	Segment Name	Stations	Uses	Water Quality Summary
2304	Rio Grand Below Amistad Reservoir	15340, 13208, 13560, 13206, 13205, 18795, 18792, 15274, 17596, 15839, 17410, 13116, 15813, 13202, 15814, 13201, 15815, 13196, 15816, 15817, 15818	H, PS, GU, FC, CR	Impaired for contact recreation due to high bacteria below Del Rio; concern for nitrate and low DO from below the dam to the confluence with San Felipe Creek; near Laredo, concern for toxicity in ambient water.
2303	International Falcon Reservoir	15818, 13189	H, PS, FC, CR	No impairments, however there is a new concern for toxicity in ambient water. Previous concerns for nitrate and ammonia in the lake have been removed.
2313	San Felipe Creek	15820, 15821, 13270	H, PS, GU, FC, CR	All uses are fully supported.

H - High Aquatic Life, PS - Public Drinking Supply, GU - General Use , FC - Fish Consumption , CR - Contact Recreation

Lower Rio Grande Sub-Basin

Lower Rio Grande CRP Partners

University of Texas at Brownsville

TCEQ Harlingen Field Office

USIBWC Mercedes Field Office

Sabal Palm Audubon Center and Sanctuary

Brownsville Public Utilities Board

Photo Credit: L. Grijalva

Station 13185, Rio Grande at Fort Ringgold below Rio Grande City, shows high flows and high dissolved solids after remnant rains from Hurricane Gustav in August.

Photo Credit: W. Belzer

A green jay sings in the trees at Sabal Palm Audubon Sanctuary in Brownsville, Texas, a great place for bird watchers.

Introduction

The lower Rio Grande sub-basin stretches from just below Falcon Dam to the mouth of the Rio Grande at its confluence with the Gulf of Mexico. This portion of the river is divided into two segments, 2301 and 2302. This 280-mile (451-km) stretch of the Rio Grande runs through Starr, Hidalgo, and Cameron Counties of Texas and forms the border between those counties and the Mexican State of Tamaulipas. Major cities in the sub-basin include McAllen, Harlingen, and Brownsville on the United States side of the river and Matamoros and Reynosa on the Mexican side. The largest portion of water used in the area is consumed by agriculture. However, the 2000 census shows the lower Rio Grande Valley has the fourth largest increase in population in the country. Increased municipal and industrial demands will only further strain a limited resource already taxed by previous drought conditions and high agricultural use. Groundwater in the area is brackish resulting in the construction of a desalinization plant and possibly more plants in the future.

In 2004, increased rainfall and water deliveries from Mexico have allowed reservoirs to increase storage. Research is also being done to increase storage on the river by constructing a weir near Brownsville and desalinization of groundwater and ocean water to supplement drinking water supplies in the lower valley.

Invasive aquatic weeds such as hydrilla and water hyacinth have been an issue in the lower Rio Grande. These aquatic plants choke portions of the river preventing boat traffic, impeding water flow and increase water loss through consumption and evapotranspiration. Mechanical removal and biological control, using triploid grass carp, reduced the problem significantly.

Heavy rains, such as those in late summer of 2008, also helped push the aquatic plants into saline waters where they cannot survive. At present, the problem is not the serious issue that it was in 2003, but hydrilla is rapidly re-establishing itself in the river.

2009 Lower Rio Grande Sub-basin Updates and Special Studies

Bacteria in Brownsville. The University of Texas at Brownsville is collaborating with USIBWC CRP to conduct a special study to track the source of the bacteria contamination causing the impairment near Station 13177. The special study will consist of intensive monitoring through the 20-mile section of impaired waters as well as a field survey of all drains and discharges emptying into the river and potential nonpoint source pollution. The year-long study will provide information to narrow the geographic extent of the contamination and determine whether the bacteria is coming from a point source.

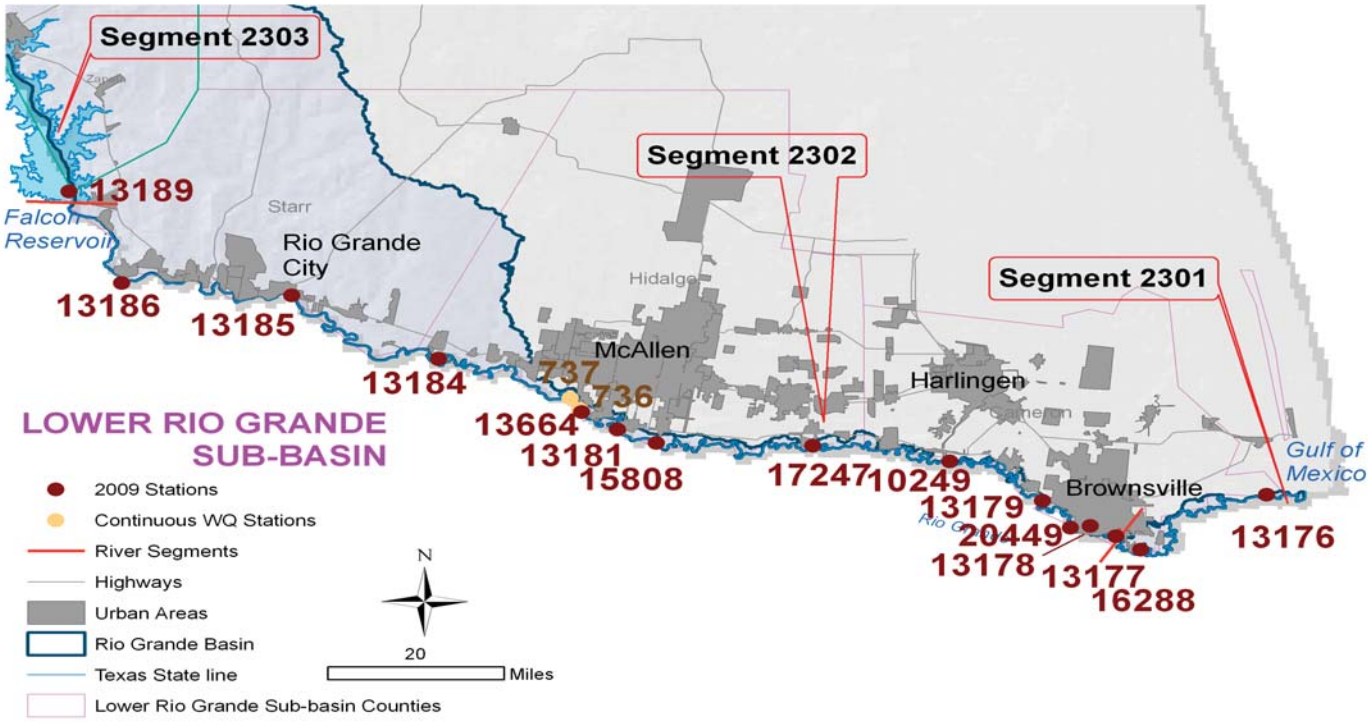
Organics in the Lower Rio Grande Sub-basin. Since 2007, USIBWC CRP has been collecting data on pesticides and other organics on a semi-annual basis at our routine monitoring sites. Twenty-three chemicals were analyzed in sediment at 10 stations in Segments 2302 and 2301. The majority of data for these segments did not detect any pesticides in the sediment, with the exception of two sampling events: Station 13181, Rio Grande at the International Bridge in Hidalgo, which detected DDE slightly above the detection limit on March 18, 2008, and Station 13185, Rio Grande at Fort Ringgold downstream of Rio Grande City, detected DDT and chlordane on September 18, 2008.

Photo Credit: E. Verdecchia

Aquatic weeds flushed through the river from the heavy summer rains and gathered in the tidal waters near the river's mouth. October 2008.

Endangered brown and white pelicans watch a motorcycle in Mexico as the Rio Grande meets the Gulf of Mexico.

Photo Credit: E. Verdecchia



Water Quality Review

Table 7: Lower Rio Grande Sub Basin Segments

Segments in the Lower Rio Grande Sub Basin				
Segment	**Segment Name**	**Stations**	**Uses**	**Water Quality Summary**
2302	Rio Grand Below Falcon Reservoir	13186, 13185, 13184, 13664, 13181, 15808, 13180, 17247, 10249, 13179, 13178, 20449, 13177	H, PS, GU, FC, CR	The majority of this segment has no impairments, but there are consistently high bacterial counts at station 13177 in Brownsville, impairing the entire segment. Increased sulfate levels. The entire segment has a concern for fish consumption due to elevated mercury in fish.
2301	Rio Grande Tidal	16288, 13176	E, GU, FC, CR	Classified as a tidal stream. There are no impairments but closer to the Gulf there are high chlorophyll levels

H - High Aquatic Life, E - Exceptional Aquatic Life, PS - Public Drinking Supply, GU - General Use , FC - Fish Consumption , CR - Contact Recreation

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