



# 2016 Basin Highlights Report

May 2016

**Texas Rio Grande Basin Program Update**

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

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Pictured on left: CRP Station 13177, Rio Grande at El Jardin Pump Station

Pictured on front and back covers: Anzalduas Dam. Front cover is circa 2008, back cover is circa early 1970's.



# *Aspects of the Clean Rivers Program*

The USIBWC is one of 15 partner agencies that collaborate with TCEQ to administer the Texas Clean Rivers Program in the 23 river and coastal basins in Texas. The main goals of CRP from the long-term plan include:

- Maintain a basin-wide routine water quality monitoring program and water quality database.
- Provide quality-assured data to TCEQ for use in water quality decision-making.
- Identify and evaluate water quality issues and summarize in reports.
- Promote cooperative watershed planning (such as conducting Coordinated Monitoring Meetings and collaborating on watershed plans and water quality initiatives).
- Inform and engage stakeholders (for example, conducting Basin Advisory meetings, watershed education activities, maintain an updated website, and print our annual reports).
- Maintain an efficient use of public funds.
- Adapt the program to emerging water quality issues.

## **Rio Grande Basin CRP's New Quality Assurance Officer**

The Rio Grande Basin Clean Rivers Program has a new Quality Assurance Officer. Andres Garcia joined the Texas Clean Rivers Program for the Rio Grande Basin in May 2015. He is a retired Major from the United States Army. He previously worked as a Maneuver Support Integration Team Lead for the Brigade Modernization Command at Fort Bliss, Texas. Mr. Garcia also served with the Joint Operations Unit, United States Forces – Iraq (USF-I), first as a Chief of Assessments and then as a Joint Operations Center Officer (Force Protection). He graduated from the University of Texas at El Paso with a Bachelor of Science in Biological Sciences and earned a Master of Science in Environmental Management at Webster University.



## Introduction

In 1991, the Texas Legislature passed the Texas Clean Rivers Act (Senate Bill 818) to address water resources in an integrated, systematic manner, creating the Texas Clean Rivers Program (CRP). CRP is a state fee-funded program specifically for water quality monitoring, assessment, and public outreach, and aims to improve the quality of water within each river basin in Texas through partnerships with the Texas Commission on Environmental Quality and participating entities. The CRP for the Rio Grande Basin was originally administered by the Border Environment Assessment team of the TCEQ, which at that time was called the Texas Natural Resources Conservation Commission (TNRCC).

In 1998, the State of Texas contracted with the International Boundary and Water Commission, United States Section (USIBWC) to implement the CRP for the Rio Grande Basin, and to monitor and address water quality issues unique to the international water boundary. The USIBWC CRP monitors and assesses the Texas portion of the Rio Grande Basin from the point that it enters the state to its end at the Gulf of Mexico. This action has resulted in better coverage within the basin and more comprehensive information, which is then used to advance the resolution of issues along the border. The USIBWC has expanded the program to include 20 partners and 91 water quality monitoring stations, and provides support for special projects along the border. The partners participate in water quality monitoring, providing advice and suggestions on improving the program and the basin, developing and assisting in special studies, and communicating with and educating the general public.

For the purpose of coordination and planning, the USIBWC CRP has divided the basin in Texas into four sub-regions: the Pecos, Upper, Middle and Lower Rio Grande. This report will focus mainly on the Lower Rio Grande, which extends from International Falcon Reservoir downstream to the Gulf of Mexico (Segments 2303, 2302, 2302A, 2301).

This report will provide a more detailed look at water quality data in this section of the basin, the various factors that have an impact on the water quality and information on activities that have taken place aiming to improve water quality. The summary statistics presented in the watershed characterization portion of the report are compiled from 15 years of water quality data collected by the USIBWC CRP. Where the data and/or information is referring to the TCEQ Integrated Report, it will be so stated. If you have questions on the data or information presented in this report, please contact USIBWC CRP staff.

### **Coordinated Monitoring Meetings and Basin Advisory Committee Meetings**

CRP holds several types of meetings, including an important series of annual meetings called Coordinated Monitoring Meetings. The purpose of the meetings is to plan and coordinate water quality monitoring efforts among different entities and partners. These meetings allow for more efficient use of agency resources, and take into consideration concerns from the public gathered throughout the year. They provide an opportunity for CRP to hear about local water quality interests and problems, and allows attendees to bring up any questions or concerns they may have about their area to CRP staff. Additionally, USIBWC CRP typically hosts trainings for sampling partners in conjunction with these meetings. Basin Advisory Committee meetings are held twice a year, and usually revolve around presenting an annual water quality update to the public, as well as updates about important issues in the area. This might include fish kills, water quality concerns, and projects in the area. Both meetings are open to anyone interested in the CRP's activities and efforts.



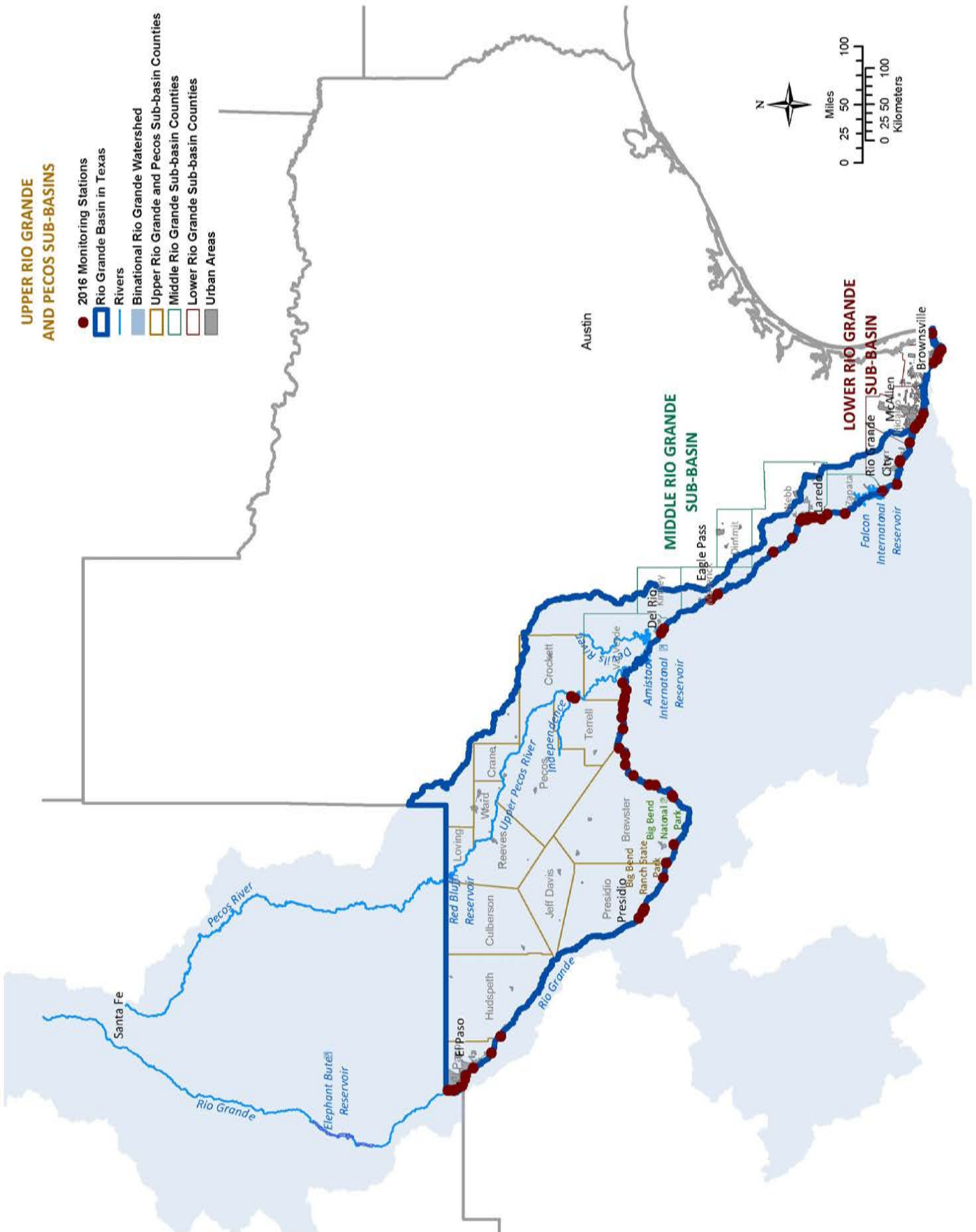
Figure 1

# Rio Grande Watershed and Basin States





**Figure 2. General Map Overview of the Rio Grande Basin in Texas**



# Overview of Water Quality Monitoring

## How do we tell the quality of water?

During the past year, the USIBWC CRP continued to maintain its large network of water quality stations. CRP and TCEQ gain an understanding of the conditions of the water quality through routine monitoring, which is performed at fixed locations at regular intervals throughout the year. Table 1 shows the kinds of data that we analyze during routine monitoring and why.

Routine monitoring helps us understand questions about how the river can be used (Table 3), such as:

- Is it swimmable?
- Is it drinkable?
- Is it fishable?
- Is it healthy for aquatic life?

CRP partners throughout the basin collect water quality and sediment samples at about 70 routine monitoring stations. When these samples are collected for laboratory analysis, personnel also make field observations to record conditions at the time the sample was taken. Field observations include things such as weather conditions at the time of collection, recent rain events in the area, water color, and other general notes related to water quality and stream uses. Important field measurements are made using different pieces of equipment. Measurements include: water and air temperature, water depth, Secchi disk, stream flow and how that flow compares to the normal flow for that water body. Field parameters are described in more detail in Table 4.

The routine collection of field parameters together with laboratory parameters, also described in Table 1, allow us to determine the health of the river ecosystem and what potential human and ecological issues we should focus on. Data is compared with Texas State Water Quality Standards (TSWQS) criteria and screening levels in Tables 1, 2 and 4; these steps are described in the next sections.

When routine monitoring shows a water quality issue or trend, we begin more intensive monitoring and special studies, which are created to gather information to address a specific water quality issue.



Pictures from top: CRP staff with Falcon Dam Field Office Staff, UTB student sampling, and CRP staff with Mercedes Field Office staff sampling



**Table 1. Primary Surface Water Quality Standards for the Rio Grande Basin\***

| 2014 Texas Surface Water Quality Standards for the Rio Grande Basin |                                          |            |              |                       |                        |                                      |            |           |               |                            |                     |
|---------------------------------------------------------------------|------------------------------------------|------------|--------------|-----------------------|------------------------|--------------------------------------|------------|-----------|---------------|----------------------------|---------------------|
| SEGMENT                                                             |                                          | USES       |              |                       | CRITERIA               |                                      |            |           |               |                            |                     |
| Segment                                                             | Segment Name                             | Recreation | Aquatic Life | Domestic Water Supply | Cl <sup>-</sup> (mg/l) | SO <sub>4</sub> <sup>2-</sup> (mg/l) | TDS (mg/l) | DO (mg/l) | pH range (SU) | Bacteria geomean (#/100ml) | Temperature (deg F) |
| 2301                                                                | Rio Grande Tidal                         | PCR1       | E            | -                     | -                      | -                                    | -          | 5.0       | 6.5-9.0       | 35                         | 95                  |
| 2302                                                                | RG Below Falcon Reservoir                | PCR1       | H            | PS**                  | 270                    | 350                                  | 880        | 5.0       | 6.5-9.0       | 126                        | 90                  |
| 2303                                                                | Falcon International Reservoir           | PCR        | H            | PS**                  | 200                    | 300                                  | 1,000      | 5.0       | 6.5-9.0       | 126                        | 93                  |
| 2304                                                                | RG Below Amistad International Reservoir | PCR        | H            | PS**                  | 200                    | 300                                  | 1,000      | 5.0       | 6.5-9.0       | 126                        | 95                  |
| 2305                                                                | International Amistad Reservoir          | PCR        | H            | PS                    | 150                    | 270                                  | 800        | 5.0       | 6.5-9.0       | 126                        | 88                  |
| 2306                                                                | RG Above Amistad International Reservoir | PCR        | H            | PS                    | 200                    | 450                                  | 1,400      | 5.0       | 6.5-9.0       | 126                        | 93                  |
| 2307                                                                | RG Below Riverside Diversion Dam         | PCR        | H            | PS                    | 300                    | 550                                  | 1,500      | 5.0       | 6.5-9.0       | 126                        | 93                  |
| 2308                                                                | RG Below International Dam               | NCR        | L            | -                     | 250                    | 450                                  | 1,400      | 3.0       | 6.5-9.0       | 605                        | 95                  |
| 2309                                                                | Devils River                             | PCR        | E            | PS                    | 50                     | 50                                   | 300        | 6.0       | 6.5-9.0       | 126                        | 90                  |
| 2310                                                                | Lower Pecos River                        | PCR        | H            | PS                    | 1,700                  | 1,000                                | 4,000      | 5.0       | 6.5-9.0       | 126                        | 92                  |
| 2311                                                                | Upper Pecos River                        | PCR        | H            | -                     | 7,000                  | 3,500                                | 15,000     | 5.0       | 6.5-9.0       | 33                         | 92                  |
| 2312                                                                | Red Bluff Reservoir                      | PCR        | H            | -                     | 3,200                  | 2,200                                | 9,400      | 5.0       | 6.5-9.0       | 33                         | 90                  |
| 2313                                                                | San Felipe Creek                         | PCR        | H            | PS                    | 50                     | 50                                   | 400        | 5.0       | 6.5-9.0       | 126                        | 90                  |
| 2314                                                                | RG Above International Dam               | PCR        | H            | PS                    | 340                    | 600                                  | 1,800      | 5.0       | 6.5-9.0       | 126                        | 92                  |
| 2315                                                                | Rio Grande Below Rio Conchos             | PCR        | H            |                       | 450                    | 750                                  | 2100       | 5.0       | 6.5-9.0       | 126                        | 93                  |

PCR - Primary Contact Recreation      ALU - Aquatic Life Use      NCR - Noncontact Recreation      PS - Public Water Supply  
 E - Exceptional Aquatic Life      L - Limited Aquatic Life      H - High Aquatic Life      TDS - Total Dissolved Solids      geomean  
 - geometric mean      Cl<sup>-</sup> - chloride      SO<sub>4</sub><sup>2-</sup> - sulfate      DO - Dissolved Oxygen

The indicator bacteria for freshwater is *E. coli* and Enterococci for saltwater (2301, 2312, 2311).  
 The DO criterion in the upper reach of Segment 2307 (Riverside Diversion Dam to the end of the rectified channel below Fort Quitman) is 3.0 mg/L when head-water flow over the Riverside Diversion Dam is less than 35 cfs.  
 The critical low-flow for Segments 2309 and 2313 is calculated according to §307.8(a)(2)(A) of the TSWQS.  
 A 24-hr minimum dissolved oxygen criterion of 1.0 mg/L applies to Segment 2311.

\* The Standards listed above are the Proposed 2014 Revisions to the Texas Surface Water Quality Standards (TSWQS). The revisions were approved by TCEQ in April 2014 and approved but have not yet been approved by the EPA. More information on primary standards can be found at TCEQ's TSWQS website ([http://www.tceq.texas.gov/permitting/water\\_quality/wq\\_assessment/standards/eq\\_swqs.html](http://www.tceq.texas.gov/permitting/water_quality/wq_assessment/standards/eq_swqs.html)). Major changes from the 2010 Standards include the addition of a new segment and lower TDS standard in Segment 2306.

\*\*Designated in the 2014 TSWQS as a sole-source surface drinking water supply, as provided by the TCEQ Drinking Water Protection Team.

| Table 2. 2010 Texas Nutrient Criteria for the Rio Grande Basin |                     |            |                               |
|----------------------------------------------------------------|---------------------|------------|-------------------------------|
| Segment                                                        | Segment Name        | Station ID | Chlorophyll-a Criteria (µg/L) |
| 2312                                                           | Red Bluff Reservoir | 13267      | 25.14***                      |

\*\*\* Criteria for chlorophyll-a are attained when they are not exceeded by the median of monitoring data results. The nutrient criteria has not changed since the 2010 TSWQS.

# Designated Uses

The State of Texas assigns designated uses to specific water bodies. Table 3 describes the designated uses for the Rio Grande Basin, and Table 1 lists the uses and standards for each segment. Designated uses and water quality standards are defined in the TSWQS. For more info, see TSWQS website.

**Contact recreation (CR)** – Fishing, swimming, wading, boating, and direct water contact. *E. Coli* and Enterococci bacteria are used as indicators. The proposed 2014 revisions to the TSWQS created sub-categories of Primary (PCR) and Secondary Contact Recreation (SCR). PCR refers to activities such as swimming, and SCR refers to non-immersing recreation activities such as canoeing and fishing.

**Public water supply (PS)** – As a drinking water source, the primary concern is total dissolved solids (TDS). The TSWQS include a list of parameters that are screened to ensure domestic water supply use.

**Aquatic life use (ALU)** – To protect aquatic species. This designated use has four levels depending on the ability of a water body to support aquatic life such as fish and benthic macroinvertebrates (aquatic insects). The primary parameter is DO. The four aquatic life use categories are exceptional, high, intermediate, and limited.

**Fish consumption (FC)** – This applies to all water bodies where citizens may collect and consume fish. The TSWQS include a list of parameters that are screened to ensure the fish consumption use is met.

**General use** – To safeguard general water quality rather than for protection of one specific use.

**Table 3. Designated Uses for Freshwater**

| Designated Uses                 |                                                                                     |                                                                                                                      |                                                                                                                                                                                                                                        |
|---------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Designated Use                  | Description                                                                         | Primary Parameter                                                                                                    | Criteria                                                                                                                                                                                                                               |
| <b>Contact Recreation (CR)</b>  | 3 levels depending on the use of the water: Fishing, swimming, wading, boating, etc | Bacteria: <i>E. Coli</i><br><br>Tidal and saline- Enterococcus (Enterococcus)                                        | Primary Contact Recreation (significant possibility of water ingestion, i.e. swimming)<br><br>Geometric mean:<br>126 colony forming units (CFU) for <i>E. Coli</i><br>35 CFU Enterococcus                                              |
|                                 |                                                                                     |                                                                                                                      | Secondary Contact Recreation (limited body contact that poses a less significant risk of ingestion of water, i.e. fishing, boating)<br><br>Geometric mean<br>630 colony forming units (CFU) for <i>E. Coli</i><br>175 CFU Enterococcus |
|                                 |                                                                                     |                                                                                                                      | Non- Contact Recreation: Unsuitable for contact recreation                                                                                                                                                                             |
| <b>Public Water Supply (PS)</b> | Drinking water source                                                               | See full list of Human Health Criteria in Table 3 of the TSWQS                                                       |                                                                                                                                                                                                                                        |
| <b>Aquatic Life Use (ALU)</b>   | 4 levels depending on the ability of water body to support aquatic life             | DO - average values                                                                                                  | (E) Exceptional 6.0 mg/L                                                                                                                                                                                                               |
|                                 |                                                                                     |                                                                                                                      | (H) High 5.0 mg/L                                                                                                                                                                                                                      |
|                                 |                                                                                     |                                                                                                                      | (I) Intermediate 4.0 mg/L                                                                                                                                                                                                              |
|                                 |                                                                                     |                                                                                                                      | (L) Limited 3.0 mg/L                                                                                                                                                                                                                   |
|                                 | Toxics in Water                                                                     | See full list of Aquatic Life Criteria in Table 1 of the TSWQS                                                       |                                                                                                                                                                                                                                        |
| <b>Fish Consumption (FC)</b>    | Prevent contamination to protect human health                                       | See full list of Human Health Criteria in Table 3 of the TSWQS<br><br>Example: Mercury - 0.0122 ug/L in water & fish |                                                                                                                                                                                                                                        |
| <b>General Use (GU)</b>         | General water quality                                                               | Water Temp, High pH, Low pH, Dissolved Solids, Nutrients, and Chlorophyll-a. See Tables 2 and 4.                     |                                                                                                                                                                                                                                        |



Aquatic life studies evaluate the health and diversity of organisms such as fish and insects that live in the water.

**Table 4. Water Quality Parameters**

| Field Parameters                       |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                          |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter                              | Description                                                                                                                                                                                                                                                                                                                                                                                          | Effects to Water body                                                                                                                                                                                                    |
| <b>pH</b>                              | 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 effects on the health of aquatic life, wildlife, and humans.                                                                                              |
| <b>Specific Conductance</b>            | 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. Most naturally-occurring waters have some level of conductivity. | High conductivity can cause physiological effects in animals and plants. It also has negative implications for TDS.                                                                                                      |
| <b>Dissolved Oxygen (DO)</b>           | Measure of the oxygen in the water.                                                                                                                                                                                                                                                                                                                                                                  | Low DO values can lead to a reduced community of aquatic life in a water body. Very low levels (<2) can be indicative of higher levels of oxygen-demanding plants that use up DO during the decay process.               |
| <b>Secchi Depth</b>                    | A measure of the transparency of water - the maximum depth at which a black and white disk is visible.                                                                                                                                                                                                                                                                                               | Higher transparency leads to a more robust aquatic plant life (particles in water block sunlight for photosynthesis). High transparency coupled with high nutrients can lead to negative impacts on DO and aquatic life. |
| <b>Stream Flow</b>                     | Volume of water moving over a location over a period of time. Low flow conditions common in the warm summer months create critical conditions for aquatic organisms.                                                                                                                                                                                                                                 | At low flows, the stream has a lower assimilative capacity for waste inputs from point and nonpoint sources.                                                                                                             |
| Conventional Laboratory Parameters     |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                          |
| Parameter                              | Description                                                                                                                                                                                                                                                                                                                                                                                          | Effects to Water body                                                                                                                                                                                                    |
| <b>Solids</b>                          | 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, industry and agriculture.                 |
| <b>Nutrients</b>                       | Nutrients include nitrogen compounds, ammonia, and phosphorus.                                                                                                                                                                                                                                                                                                                                       | High levels can cause excessive plant growth, which can lead to reduced dissolved oxygen and fish kills, reduced stream flow and reduced navigability of the waters. Elevated ammonia can also be toxic to aquatic life. |
| <b>Chlorophyll-a</b>                   | Chlorophyll-a is used as an indicator of algal growth in water.                                                                                                                                                                                                                                                                                                                                      | High levels for long periods may indicate low water quality and are indicative of excess nutrient levels.                                                                                                                |
| Non-conventional Laboratory Parameters |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                          |
| Parameter                              | Description                                                                                                                                                                                                                                                                                                                                                                                          | Effects to Water body                                                                                                                                                                                                    |
| <b>Metals</b>                          | Aluminum, arsenic, barium, chromium, copper, lead, mercury, nickel, silver, and zinc. Metals can be tested as total or dissolved metals in water or metals in sediment to determine long-term accumulation.                                                                                                                                                                                          | High concentrations can result in long- and short-term effects on aquatic life and human health.                                                                                                                         |
| <b>Organics</b>                        | Chemicals containing carbon and hydrogen. Organic compounds analyzed are herbicides, pesticides and industrial compounds both in water and in sediment.                                                                                                                                                                                                                                              | Organics can result in long- and short-term effects on aquatic life and human health.                                                                                                                                    |
| Biological Parameters                  |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                          |
| Parameter                              | Description                                                                                                                                                                                                                                                                                                                                                                                          | Effects to Water body                                                                                                                                                                                                    |
| <b>Nekton</b>                          | Fish captured in the river during biological surveys using both electrofishing and seining methods                                                                                                                                                                                                                                                                                                   | Using Index of Biological Integrity (IBI), Indicate biodiversity and overall health of river.                                                                                                                            |
| <b>Benthics</b>                        | Freshwater macroinvertebrates collected during a five-minute kick net method                                                                                                                                                                                                                                                                                                                         | Using IBI, this biological aquatic assemblage analysis indicates biodiversity and overall health of river. Excellent indicators of water quality.                                                                        |



# How is the Water Quality?

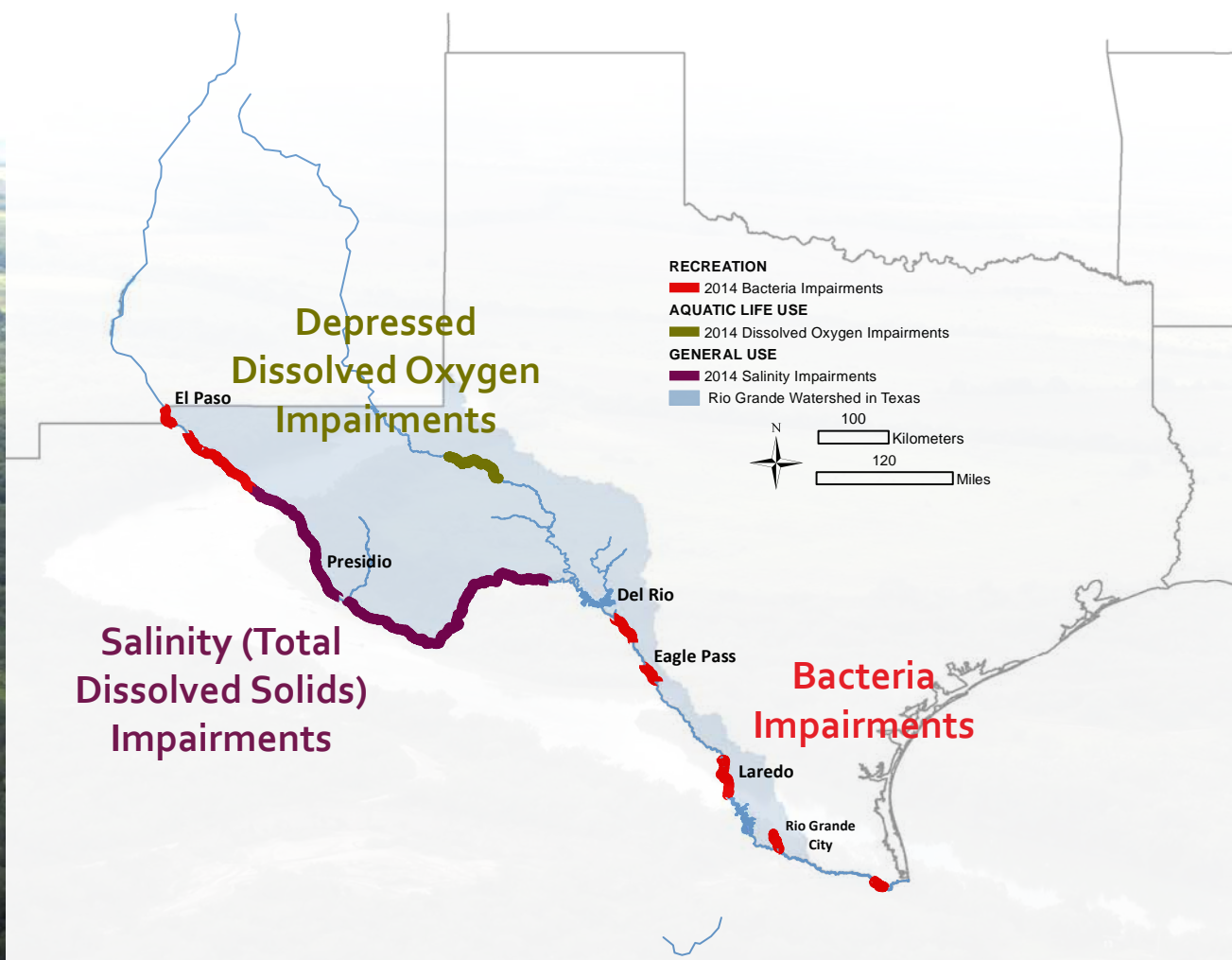
## What are Impaired Waters?

The State of Texas publishes the Texas Surface Water Quality Standards (TSWQS) for each river basin. USIBWC Clean Rivers Program water quality data is used to help determine whether stream segments are meeting the standards. Not every parameter of concern in the Rio Grande Basin has standards associated with it; however, screening levels exist for parameters that have historically led to environmental issues in the area. A water body is listed as "impaired" in the Texas Integrated Report if the data shows the standards are not being met. A water body is described as having a concern if it is near non-attainment to the standard (CN) or is not meeting the screening levels (CS). The EPA approved the 2014 TSWQS for the Rio Grande Basin and the 2014 Integrated Report can be found at the following links.

**TSWQS** <https://www.tceq.texas.gov/waterquality/standards/2014standards.html>

**Integrated Report:** <https://www.tceq.texas.gov/waterquality/assessment/14twqi/14txir>

Figure 3. Impairments in the Rio Grande Basin



**Table 5. Water Quality Impairments and Concerns in the Rio Grande Basin**

| Summary of Water Quality Impairments and Concerns in the Rio Grande Basin |                                          |                                                |                      |                                                                              |                      |
|---------------------------------------------------------------------------|------------------------------------------|------------------------------------------------|----------------------|------------------------------------------------------------------------------|----------------------|
| Segment                                                                   | Segment Name                             | Parameter (s) Impaired                         | Year First Listed    | Parameter(s) of Concern                                                      | Type of Concern      |
| 2301                                                                      | Rio Grande Tidal                         | No Impairment                                  |                      | Bacteria<br>Chlorophyll-a<br>Nitrate                                         | CN<br>CS<br>CS       |
| 2302                                                                      | RG Below Falcon Reservoir                | Bacteria                                       | 1996                 | Ammonia<br>Chlorophyll-a<br>Depressed Dissolved Oxygen                       | CS<br>CS<br>CS       |
| 2302A                                                                     | Los Olmos Arroyo                         | Bacteria                                       | 2004                 | Chlorophyll-a                                                                | CS                   |
| 2303                                                                      | International Falcon Reservoir           | No Impairment                                  |                      | Toxicity in Water<br>Total Phosphorus<br>Ammonia<br>Nitrate                  | CN<br>CS<br>CS<br>CS |
| 2304                                                                      | RG Below Amistad International Reservoir | Bacteria                                       | 1996                 | Toxicity in Water<br>Ammonia                                                 | CN<br>CS             |
| 2304B                                                                     | Manadas Creek                            | No impairment                                  |                      | Bacteria<br>Chlorophyll-a<br>Ammonia                                         | CN<br>CS<br>CS       |
| 2305                                                                      | International Amistad Reservoir          | Chloride<br>Total Dissolved Solids             | 2014<br>2014         | Nitrate                                                                      | CS                   |
| 2306                                                                      | RG Above Amistad International Reservoir | Sulfate<br>Total Dissolved Solids<br>Chloride  | 2010<br>2010<br>2010 | Chlorophyll-a<br>Total Phosphorus<br>Fish Kill Report                        | CS<br>CS<br>CN       |
| 2306A                                                                     | Alamito Creek                            | No impairment                                  |                      | No Concern                                                                   |                      |
| 2307                                                                      | RG Below Riverside Diversion Dam         | Bacteria<br>Chloride<br>Total Dissolved Solids | 2002<br>1996<br>1996 | Nitrate<br>Total Phosphorus<br>Ammonia<br>Chlorophyll-a                      | CS<br>CS<br>CS<br>CS |
| 2308                                                                      | RG Below International Dam               | Bacteria                                       | 2014                 | Chlorophyll-a<br>Total Phosphorus<br>Ammonia                                 | CS<br>CS<br>CS       |
| 2309                                                                      | Devils Rivers                            | No Impairment                                  |                      | No Concern                                                                   |                      |
| 2310                                                                      | Lower Pecos River                        | No Impairment                                  |                      | Harmful algal bloom/golden alga                                              | CN                   |
| 2310A                                                                     | Independence Creek                       | No Impairment                                  |                      | No Concern                                                                   |                      |
| 2311                                                                      | Upper Pecos River                        | Depressed DO                                   | 2006                 | Harmful algal bloom/golden alga<br>Bacteria<br>Chlorophyll-a<br>Depressed DO | CN<br>CS<br>CS       |
| 2312                                                                      | Red Bluff Reservoir                      | No Impairment                                  |                      | Harmful algal bloom/golden alga<br>Chlorophyll-a<br>Depressed DO             | CN<br>CS<br>CS       |
| 2313                                                                      | San Felipe Creek                         | Bacteria                                       | 2014                 | No Concern                                                                   |                      |
| 2314                                                                      | RG Above International Dam               | Bacteria                                       | 2002                 | Chlorophyll-a                                                                | CS                   |
| 2315                                                                      | RG Below Rio Conchos*                    | Not evaluated                                  |                      | Not evaluated                                                                |                      |

CN - Concern for near-nonattainment of the Water Quality Standards

CS - Concern for water quality based on screening levels

\*New segment in 2014 WQS Revision. This segment was previously a part of Segment 2306.

Note: Each Segment is further subdivided into Assessment Units (AU). The entire segment may not be impaired. The complete list of impairments and AUs can be found at the TCEQ 303(d) website.

# How does it work and who monitors what?

The USIBWC Clean Rivers Program is proud to be partnered with 20 partners: 4 laboratories, five USIBWC field offices, three universities, three municipalities, non-profit organizations, and other state and federal agencies. These partners have volunteered to collect water quality data in addition to their own projects and work goals, and the collaboration helps monitor this large watershed. The large collaboration works by making sure that USIBWC CRP staff keeps in constant contact with all the partners via phone calls, emails, and meetings.

All USIBWC CRP partners are trained by USIBWC CRP staff, and all partners use the sampling methods outlined in TCEQ's Surface Water Quality Monitoring Procedures Manual, Volume 1. The stations monitored are agreed upon at annual meetings. Field sheets and chain of custody records are kept by both the partner and the USIBWC CRP staff, so that the integrity of the data can be traced if needed. All partners use the same standard equipment. The water samples are sent to laboratories accredited by the State of Texas under the National Environmental Laboratory Accreditation Program (NELAP). This is a requirement in order for the data collected by the partners to be accepted by the State of Texas for assessment purposes. The reports are then sent to USIBWC CRP staff.

The USIBWC CRP coordinates all the data received from the partners, in the form of field data, and the laboratories, in the form of lab reports. The staff checks the data against rigorous quality assurance criteria, consolidates all the data into usable reports, and sends the data to the TCEQ to be reviewed. Once the TCEQ reviews these reports, the data is uploaded into the state's database, called SWQMIS (Surface Water Quality Monitoring Information System). All data collected by the CRP partners is available to the public on the USIBWC CRP website.

## Coordinated Monitoring Schedule

**All entities that monitor the Rio Grande in Texas gather annually to discuss and coordinate monitoring activities. You can see who is collecting water quality data, where, and how often within the Rio Grande watershed on the Coordinated Monitoring Schedule.**

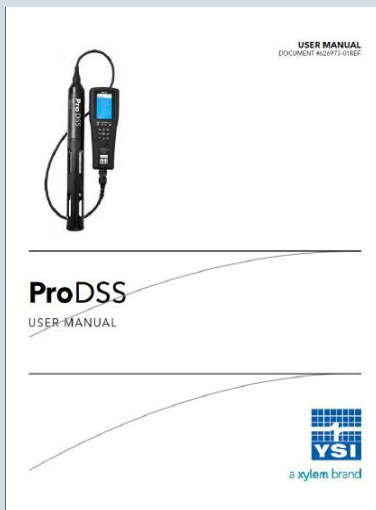
<http://cms.lcra.org/>



RG-415  
Revised August 2012

### Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods

Water Quality Planning Division  
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



### Quality Assurance Project Plan Rio Grande Basin Monitoring Program

4171 N. Mesa St., Ste. C-100  
El Paso, TX 79902

Clean Rivers Program  
Water Quality Planning Division  
Texas Commission on Environmental Quality  
P.O. Box 13087, MC 234  
Austin, Texas 78711-3087  
Effective Period: FY 2016 to FY 2017

Questions concerning this QAPP should be directed to:  
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USIBWC El Paso Headquarters Program Manager  
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(915) 832-4779  
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USIBWC FY16-17 QAPP  
Last Revised on August 15, 2015

Page 1  
USIBWC CRP QAPP FY16-17

Pictured from left: TCEQ's Surface Water Quality Monitoring Procedures manual Volume 1, ProDSS User Manual, 2016/2017 Rio Grande Basin Quality Assurance Project Plan



# This Year's Highlights

## Restoration for Manadas Creek, Laredo, TX



Laredo, TX is home to Manadas Creek, a small tributary to the Rio Grande that is located on the outskirts of the city. Manadas Creek is located near an area that is well known for long-term industrial use, including an antimony smelter. Many years ago, the creek became a major water quality issue when testing showed very high levels of heavy metals and bacteria in the water. Over time the issue has not been resolved, and monitoring continues at this site for total metals in water and sediment, as well as water chemistry, nutrients, and bacteria. Since the area around the creek has been developed in the most recent years, it is now a popular dumping site and has a problem with trash along the waterway.



Recently, the Rio Grande International Study Center, a CRP partner and a non-profit agency, has put in proposals to target Manadas Creek for a wetlands restoration project. The proposal (map pictured at left) includes river cleanups, involving both the public and the school systems, to help with the trash, and water quality sampling. This will also serve as an opportunity to teach the public not only about the environment, local wildlife and vegetation, but also about the river and how everything is interconnected. The USIBWC CRP has offered to support the RGISC by providing training to their sampling volunteers and assisting in the development of a sampling plan.

## Rio Grande International Study Center's Dr. Tom Vaughan Receives Prestigious Award

Dr. Tom Vaughan has been a CRP partner for over 15 years, and between his time in Laredo, TX as a professor at TX A&M International University and member of the board of directors for the Rio Grande International Study Center (RGISC), he finds time to perform monthly sampling on the Rio Grande for CRP, mentors students and brings attention to the issues that plague the Rio Grande. On March 30, 2016, Dr. Tom Vaughan won the 2016 Jefferson Award for Public Service for his outstanding contributions to improving the Rio Grande and the environment in the Laredo area for over 30 years. He goes on to Washington D.C. to compete nationally against 200 other recipients from across the country for this prestigious award established by the late Jacqueline Kennedy Onassis. The CRP is proud to have Dr. Vaughan as a partner, and as an advocate for the Rio Grande and the Laredo area. Congratulations, Dr. Vaughan!





## Binational Surface Water Quality Monitoring Workshop

In early 2015, a group of students from a university in the state of Coahuila, Mexico attended the 2015 TCEQ Environmental Trade and Fair Conference held in Austin, TX. The students were interested in the surface water monitoring programs that existed in the State of Texas. This was the catalyst for what ended up becoming the first-ever Binational Surface Water Quality Monitoring Workshop in the borderland. The university group from Coahuila, along with the states of Coahuila, Nuevo Leon, Monterrey, Tamaulipas and Chihuahua in Mexico, and the IBWC, Mexico Section came together with the TCEQ Border Affairs Division, TCEQ Surface Water Quality Monitoring Program, TCEQ TX Clean Rivers Program, and the USIBWC-CRP to discuss their water bodies. There were 38 people in attendance from multiple U.S. and Mexican agencies and non-profit organizations, and the meeting was held in the binational control room atop Amistad Dam in Del Rio, TX in November 2015.

The workshop discussed what efforts were currently going on in their watershed. Were there established stations? What data was being collected already? What are the data objectives? Are there funding resources? What personnel is there, and what kind of training do they have/require? Both TCEQ and the Mexican Section of the IBWC gave presentations on the water rules and regulations in their respective areas (state and federal level for the U.S., federal for MX). It was a great opportunity for both countries to learn from each other, discuss the issues and outline how we can work together as a truly binational watershed. There was also an equipment demonstration and a field demonstration. Planning for the next phases is currently ongoing.

Pictured: The participants of the first Binational Surface Water Quality Monitoring Workshop, Amistad Dam, Del Rio, TX



Pictured Above: Field demonstrations on the Rio Grande near Amistad Dam.



Pictured right: Presentations during the meeting,

# The Lower Rio Grande Basin

The Lower Rio Grande Sub-basin stretches from just below International Falcon Dam to its confluence with the Gulf of Mexico (see Figure 4). 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. Population centers along the Lower Rio Grande have grown tremendously in the past 10 years. Agriculture, trade, services, manufacturing, and hydrocarbon production are the primary economic activities in this region. Major cities in the sub-basin include McAllen, Harlingen, and Brownsville, Texas, on the U.S. side of the river, and Matamoros and Reynosa, Tamaulipas, on the Mexican side. Drinking water requirements of the Lower Rio Grande Sub-basin depend entirely on the Rio Grande. Anticipated increases in municipal and industrial demands resulting from rapid population growth will only further strain a limited resource already taxed by previous drought conditions and high agricultural use.



Pictured: CRP Station 13184, Rio Grande at Los Ebanos

The Lower Rio Grande Sub-basin occupies the southeastern portion of the South Texas Brush Country region. There are two major aquifers that lie beneath a major portion of this region—the Carrizo-Wilcox and Gulf Coast Aquifers. Groundwater in the area is brackish, requiring construction of a desalinization plant and the possible construction of more plants in the future. Studies are being conducted on the desalinization of groundwater and ocean water to supplement drinking water supplies in the Lower Rio Grande Valley due, in part, to the high salinity in the water in this region. Currently, research is also being done on potential water storage solutions, such as construction of a weir near Brownsville. Most agricultural and urban discharges do not enter the Rio Grande in this reach, as they are diverted to canals that ultimately empty into the Gulf of Mexico; however, excessive flows that exceed the capacity of the canals can be routed to the Rio Grande.

The USIBWC has multiple dams along this stretch of the river: Falcon Dam, Anzalduas Dam, and Retamal Dam. Falcon Dam and Reservoir serve for conservation purposes, and water is released during scheduled water releases to both countries, as well as during severe weather-related occurrences (hurricanes, tropical storms) that require large amounts of water to be carefully released to prevent flooding of the urban areas downstream. Anzalduas and Retamal dams are diversion dams for water accounting purposes, but both can also be used for emergency flooding situations as well. The Lower Rio Grande Valley also has an emergency floodway that is meant to divert flood waters from the Rio Grande to the Gulf of Mexico during flood events, which was last used in 2010 during Hurricane Alex.

The USIBWC CRP has 5 partners in the lower Rio Grande: the USIBWC Falcon Dam field office, USIBWC Mercedes field office, Brownsville Public Utilities Board, University of Texas Rio Grande Valley- Brownsville, and University of Texas Rio Grande Valley- Edinburg. The partners monitor 17 stations in three segments (2303, 2302, 2301), providing field, flow, and water quality data for the program. Each segment will be discussed in more detail.



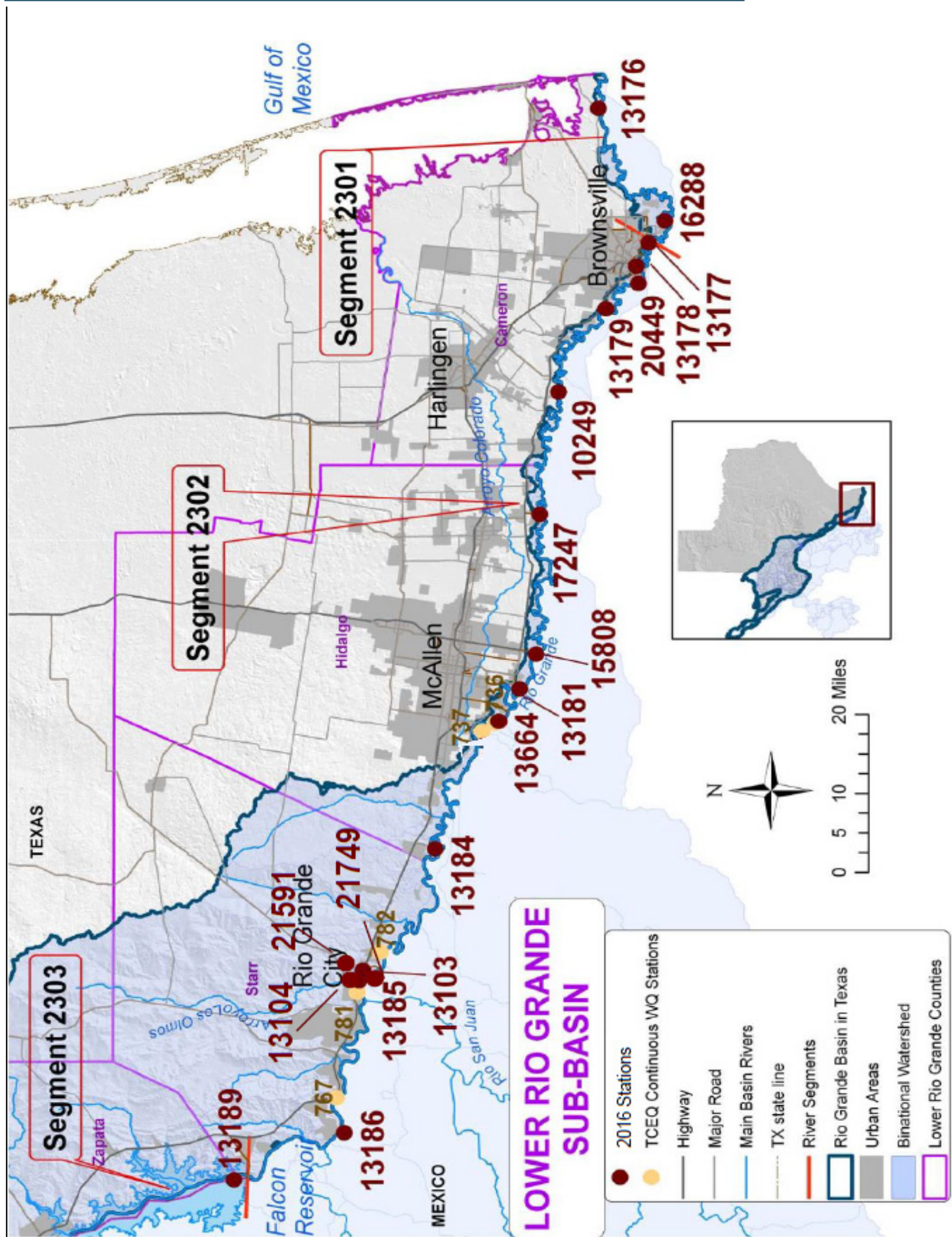
Pictured: CRP Station 13184, Rio Grande at Los Ebanos, looking upstream.



Pictured: Station 13664, below Anzalduas Dam

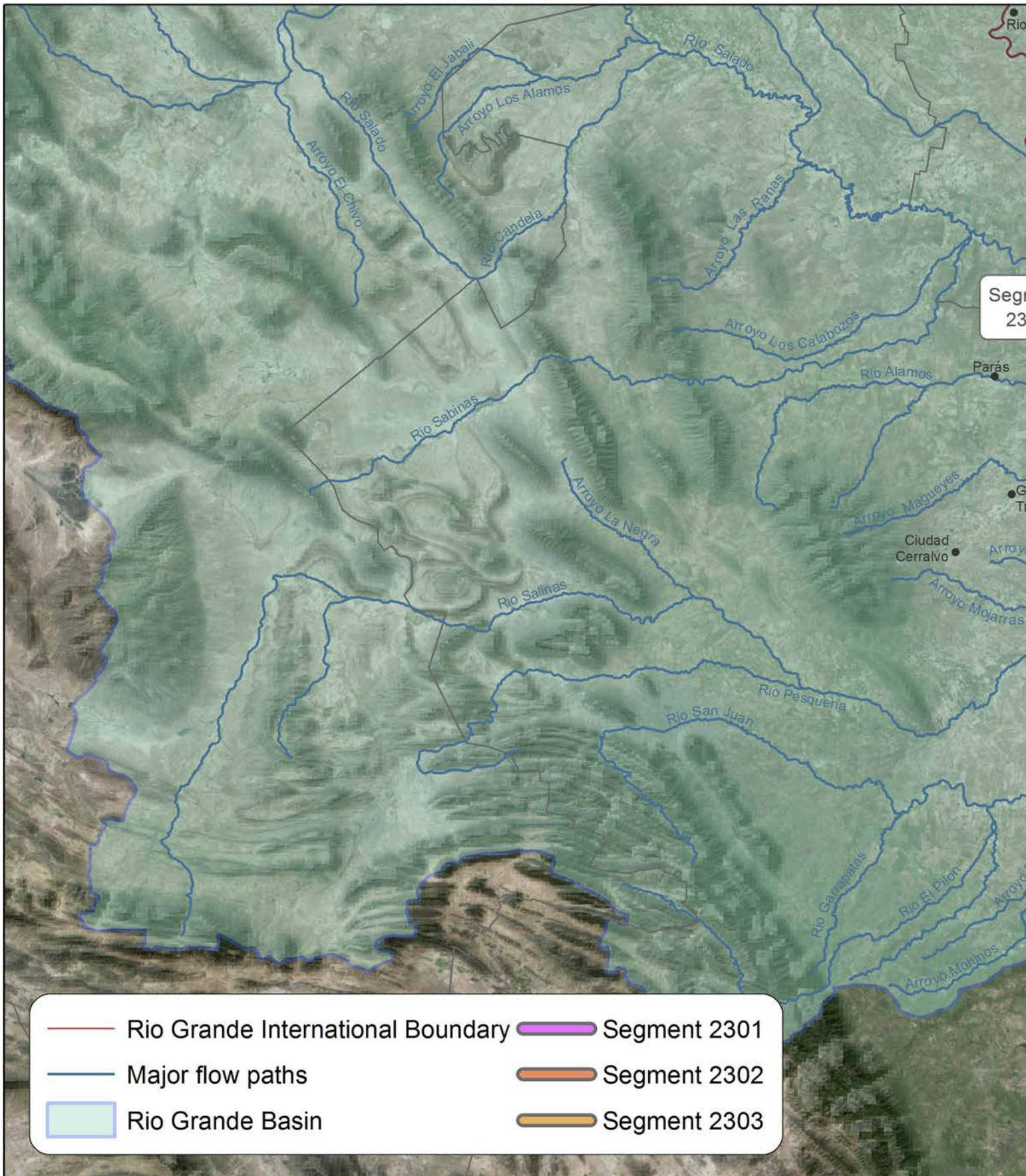


Figure 4. Map of the Lower Rio Grande Basin in Texas





# TCEQ Segments, General Topography, Major Flowpaths



Basin delineation and major flow paths downloaded from the USGS  
Segment boundaries downloaded from the TCEQ  
City locations downloaded from the USGS  
Imagery provided by Google Earth



# Basins, and Basin Delineation for the Lower Rio Grande River



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

University of Texas Center for Research in Water Resources.  
Texas Commission on Environmental Quality.  
Border Environmental Health Initiative.  
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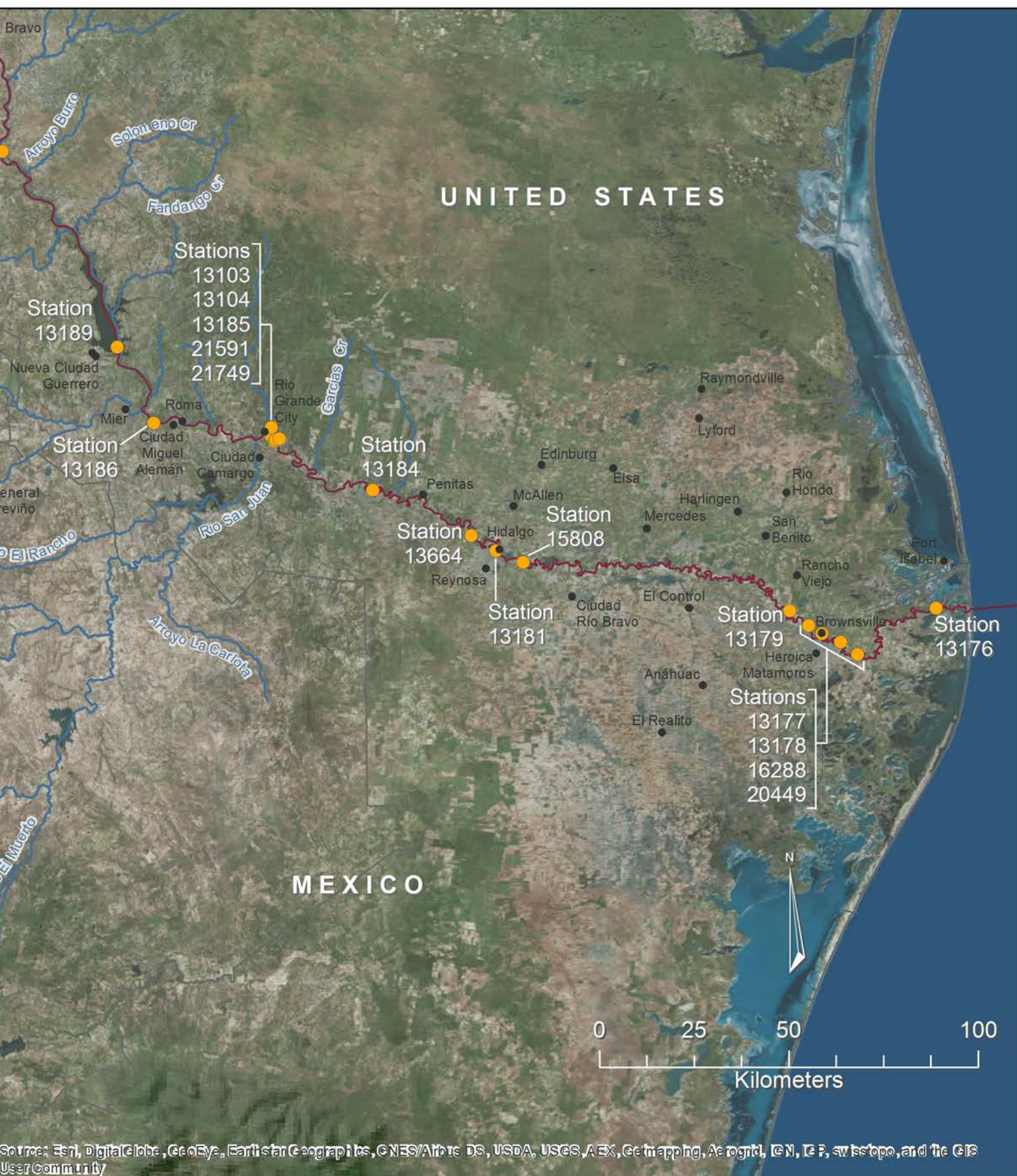
# TCEQ Monitoring Stations in



Major flow paths downloaded from the University of  
TCEQ station locations provided by the Intern  
City locations downloaded from the USGS  
Imagery provid



# the Lower Rio Grande Valley

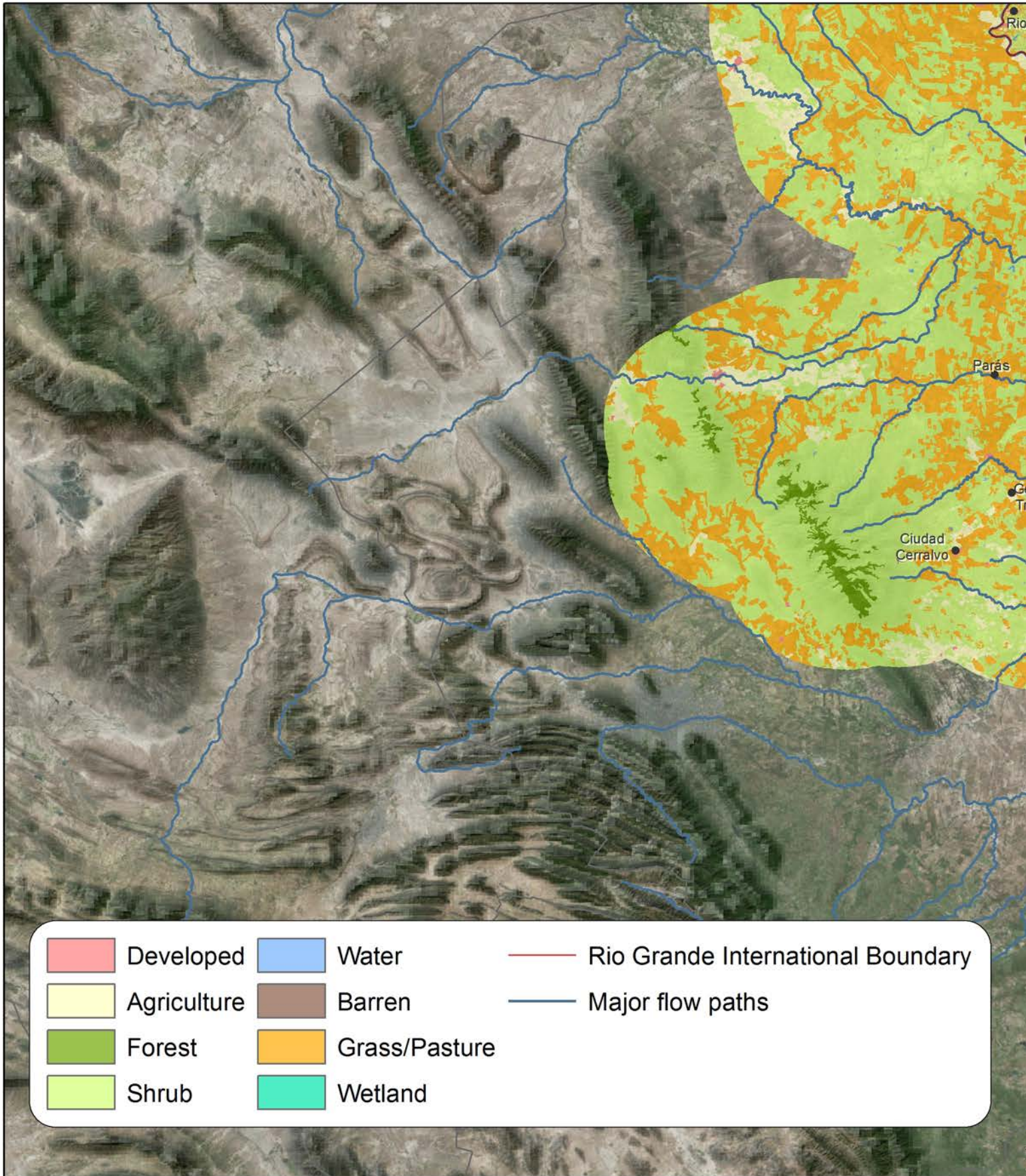


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Texas Center for Research in Water Resources.  
 International Boundary and Water Commission  
 Border Environmental Health Initiative.  
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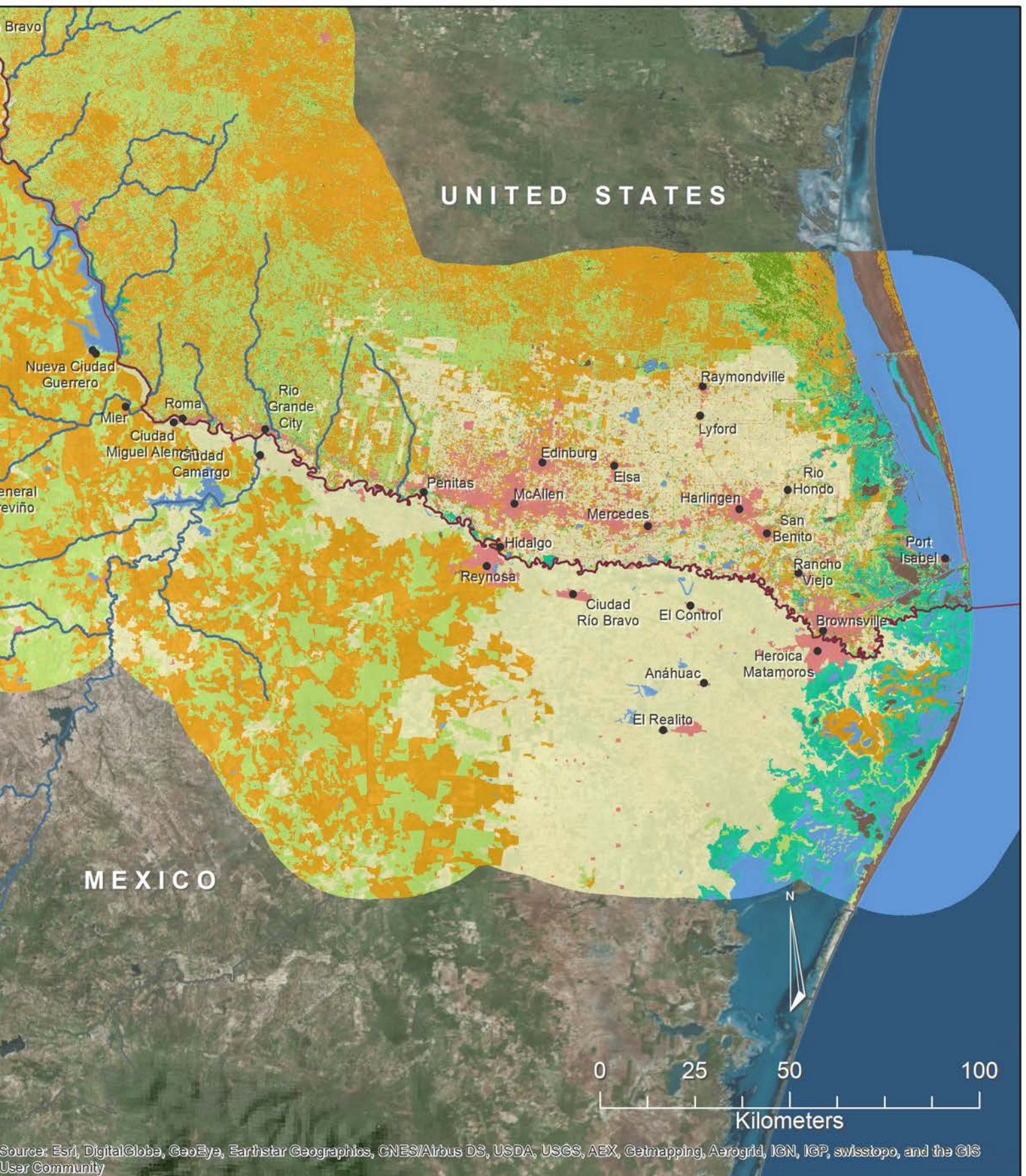








# Annual Landcover



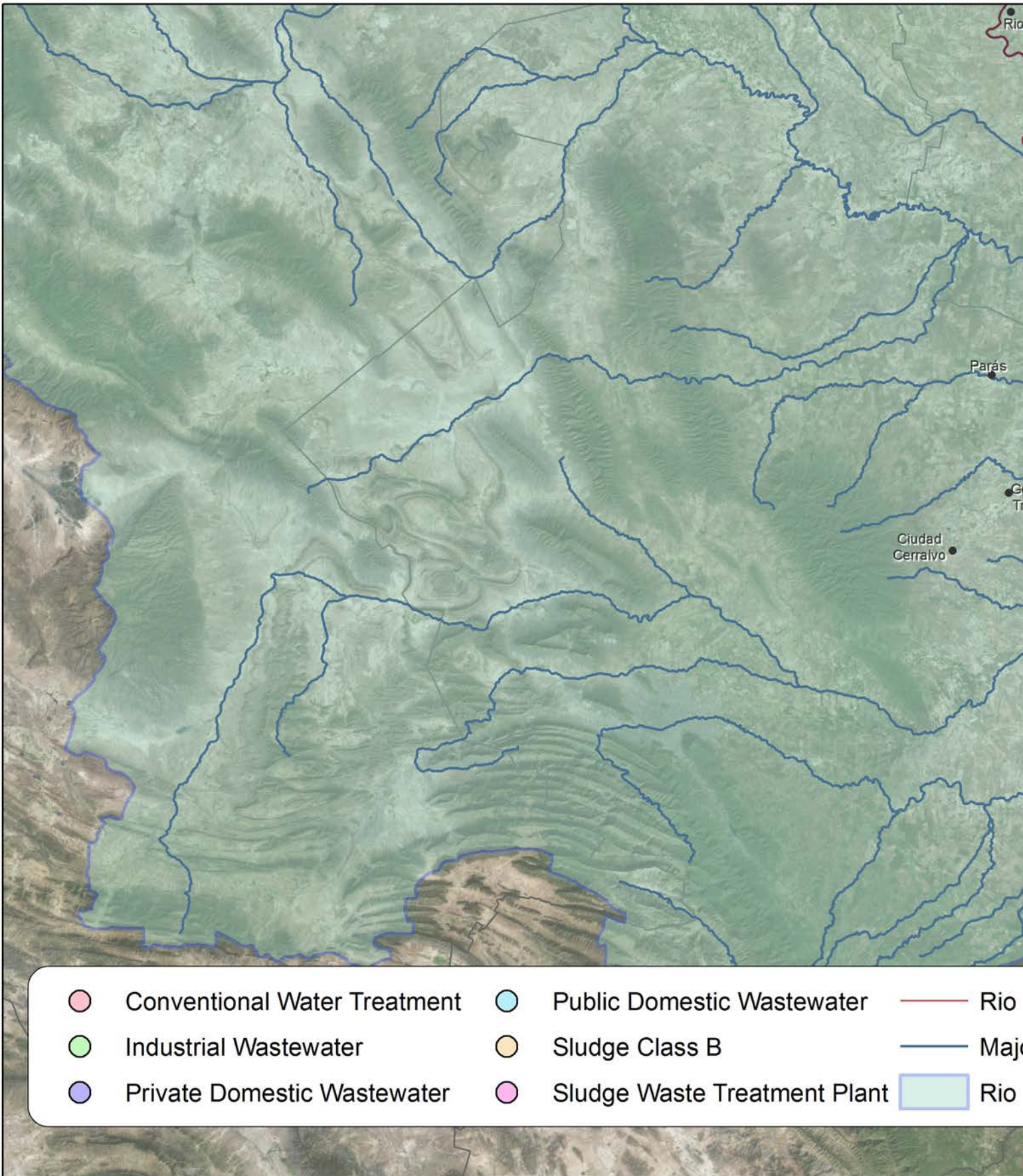
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

from the USGS Border Environmental Health Initiative.  
Texas Center for Research in Water Resources.  
led by Esri.





# TCEQ Permitted Facilities in



Conventional Water Treatment



Public Domestic Wastewater

Rio



Industrial Wastewater



Sludge Class B

Major



Private Domestic Wastewater



Sludge Waste Treatment Plant

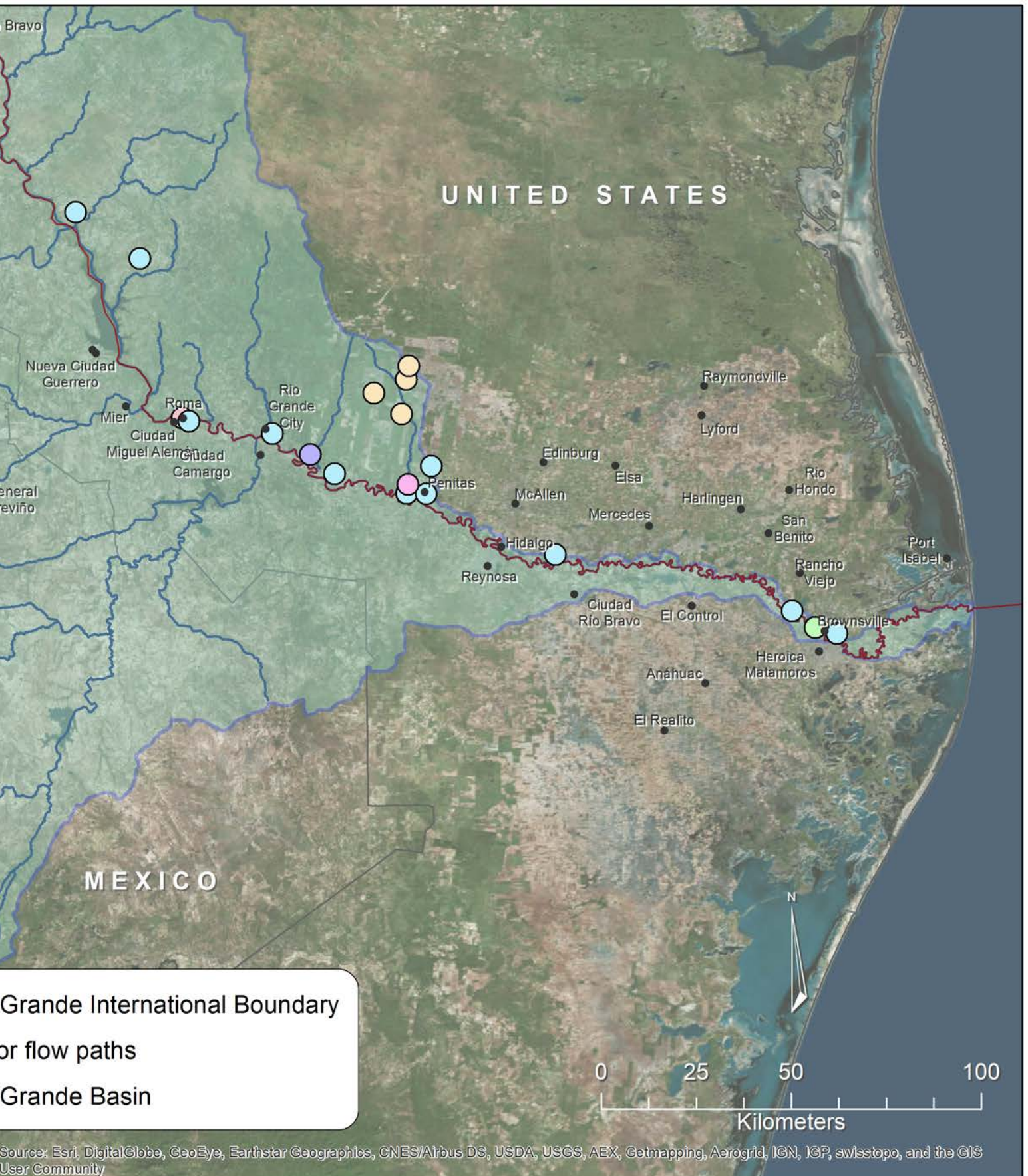
Rio



Major flow paths and basin limit downloaded from the University of Texas at Austin  
City locations downloaded from the USGS  
Permit locations provided by TCEQ  
Imagery provided by Google Earth



# Lower Rio Grande Valley



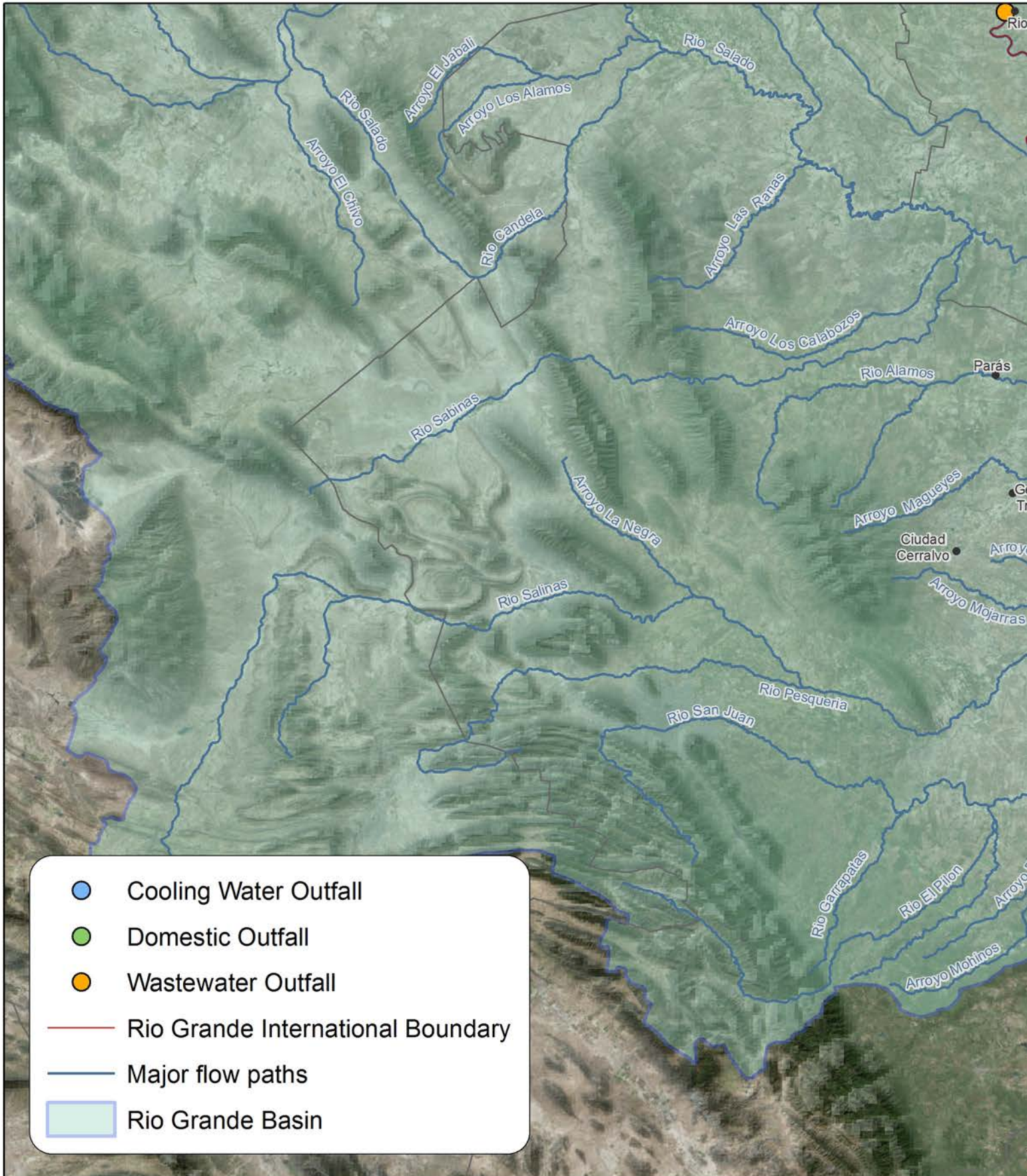
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, ICP, swisstopo, and the GIS User Community

University of Texas Center for Research in Water Resources.  
Border Environmental Health Initiative.  
Provided by TCEQ.  
Led by Esri.





# Permitted Outfalls in the Lower P



Major flow paths downloaded from the University of  
Wastewater outfall data downloaded from the T  
City locations downloaded from the USGS  
Imagery provide



# Rio Grande Valley, United States



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

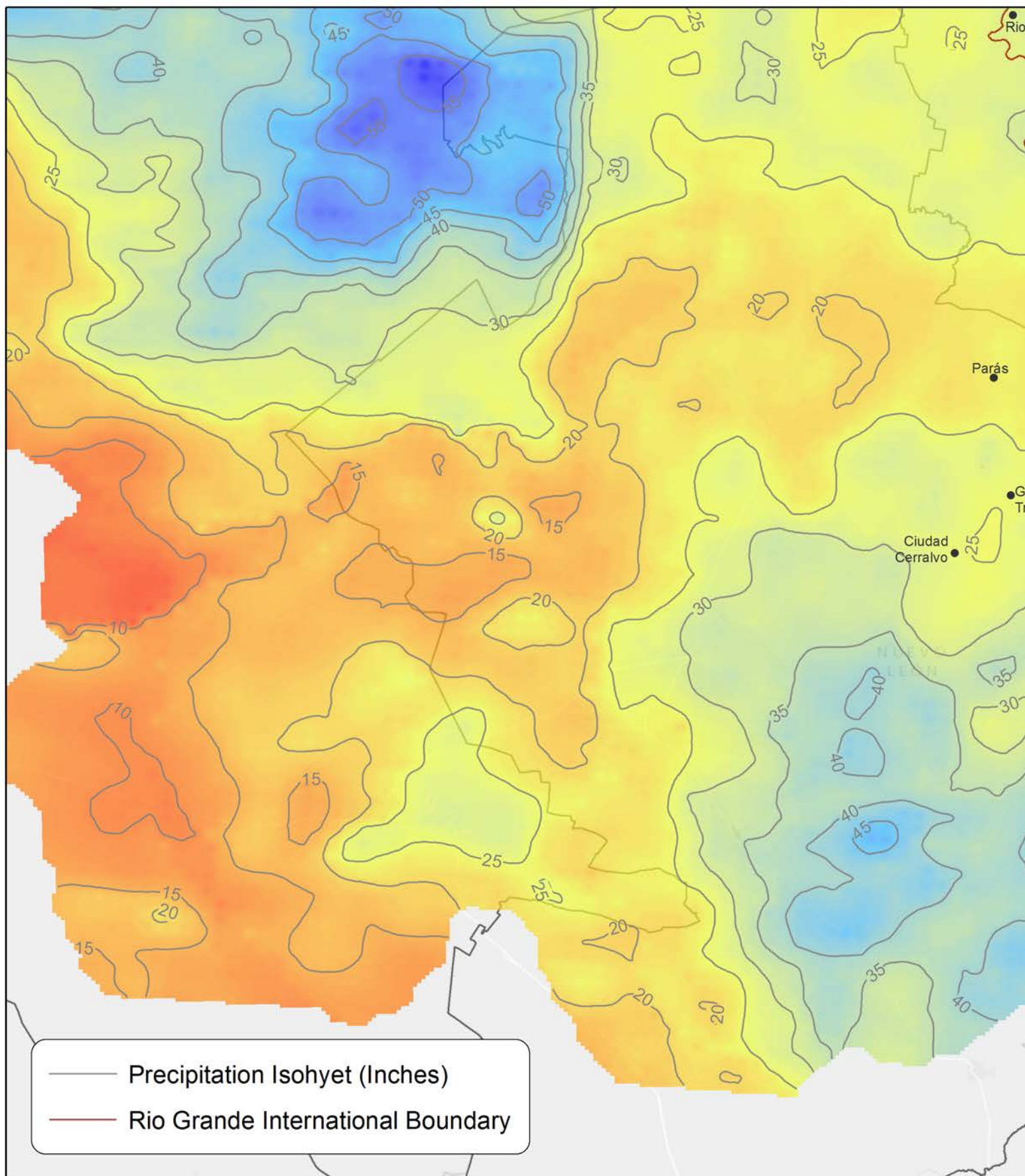
Texas Center for Research in Water Resources.  
Texas Commission on Environmental Quality.  
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# 2015 Precipitation within the Rio Grande

(Areas in gray indicate areas with no data)

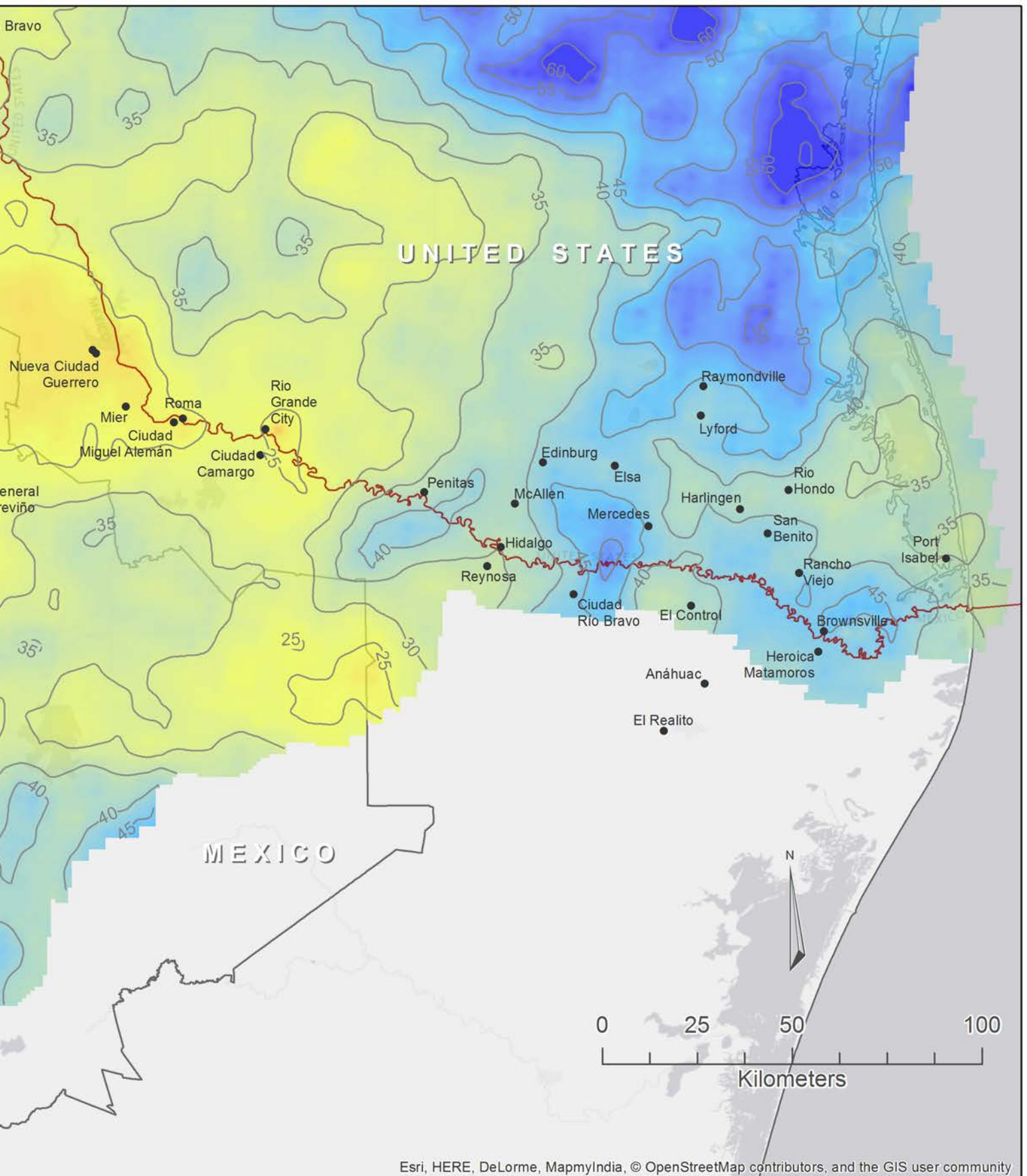


Precipitation values interpolated from data downloaded from the USGS  
City locations downloaded from the USGS  
Basemap provided by the USGS



# The Lower Rio Grande Valley

(Areas with no available data.)



Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Downloaded from the National Weather Service.  
Border Environmental Health Initiative.  
Sponsored by Esri.





# RIO GRANDE WATER QUALITY UPDATE

As previously stated, because of the Rio Grande Basin’s size, the program has found a need to split it into four sub-basins. A table is provided for the lower sub-basin that characterizes which segments are associated with it, what active stations are in those segments, and other general information. For questions on this table, or historical or currently inactive stations, please contact USIBWC CRP staff.

**Table 6. Water Quality Review for the Lower Rio Grande Sub-Basin**

| Water Quality Review for the Lower Rio Grande Sub-Basin |                    |                                                                                                         |        |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Segment                                                 | *Uses              | Stations                                                                                                | Length | Segment Characteristics                                                                                                                                                                         | Water Quality Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2303- International Falcon Reservoir                    | H, PS, FC, PCR     | 15818, 13189                                                                                            | 131 mi | Falcon reservoir is used for recreation, water supply, and hydroelectric power generation.                                                                                                      | No impairments; however, there is a concern for toxicity in water near Zapata, likely from municipal effluent.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2302 - Rio Grande Below Falcon Reservoir                | H, PS, GU, FC, PCR | 13186, 13185, 13184, 13664, 13181, 15808, 17247, 10249, 13179, 13178, 20449, 13177, 21012, 21749, 21591 | 231 mi | Classified as a freshwater stream. Extends from Falcon Dam to below Brownsville and includes Anzalduas Dam and most of the Lower Rio Grande Valley (LRGV).                                      | The majority of this segment has no impairments, but there are consistently <b>high bacteria</b> counts around urban areas such as Brownsville, Rio Grande City, and McAllen/Hidalgo, impairing the segment for contact recreation. Increased sulfate levels, indicating potential wastewater influences that can adversely affect the public water supply. The entire segment has a concern for fish consumption due to elevated <b>mercury</b> in fish. Colonias without wastewater infrastructure as well as urban runoff may contribute to the bacteria and DO issues. |
| 2302A - Arroyo Los Olmos                                | L                  | 13103, 13104                                                                                            | 25 mi  | Unclassified water body. Intermittent stream with pools, and limited aquatic life.                                                                                                              | Impaired for <b>bacteria</b> , with exact source unknown but might be due to urban runoff and other nonpoint source pollution during rain events.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 2301 - Rio Grande Tidal                                 | E, GU, FC, PCR     | 16288, 13176                                                                                            | 49 mi  | Classified as a tidal stream. Extends from the confluence of the Rio Grande with the Gulf of Mexico to a point 6.7 miles downstream of the International Bridge in Brownsville, Cameron County. | Classified as a tidal stream. There are no impairments but closer to the Gulf there are high <b>chlorophyll-a</b> levels. The bacteria indicator is Enterococcus, and data shows a concern for <b>bacteria</b> .                                                                                                                                                                                                                                                                                                                                                           |

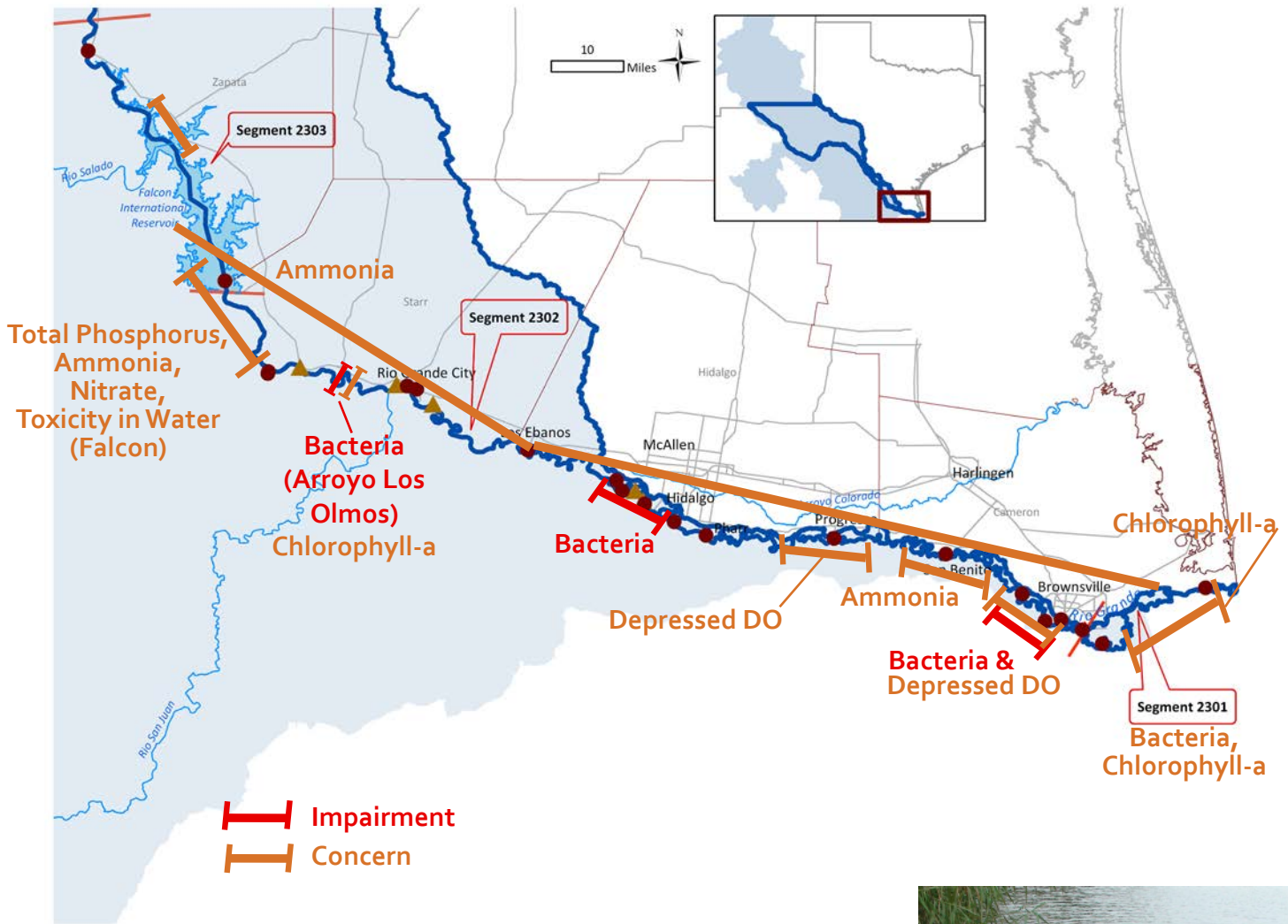
\*For an explanation of the uses, please refer to Table 3, Designated Uses for Freshwater on page 14



This map, made on 2/11/2016, shows the water of the Rio Grande reaching the mouth and flowing into the Gulf of Mexico



# Figure 11. Water Quality Impairments and Concerns in the Lower Rio Grande Basin



Some examples of water quality issues in the Lower Rio Grande: Pictured above, Station 13103, which has high bacteria. Pictured at right, Station 13181, trash is a big problem all along the Rio Grande.



# Segment 2303, International Falcon Reservoir

Segment 2303 begins at Falcon Dam in Starr County to the confluence of the Arroyo Salado (Mexico) in Zapata County, up to normal pool elevation of 301.1 feet (impounds Rio Grande). It includes the length of International Falcon Reservoir and is approximately 131 square miles in area. There are currently three sites being monitored within this segment, Stations 15817 (Rio Grande at Webb/Zapata County Line), 15818 (Falcon reservoir at San Ygnacio WTP Intake West of US 83 Intersection with FM3169) and 13189 (Falcon Lake at International Boundary Monument 1). The segment has four assessment units, or AUs:

2303\_01, Area around International Monument XIV

2301\_02, Area around Zapata WTP Intake

2301\_03, Area around International Monument 1

2301\_04, Remainder of Segment

There are currently no impairments in this segment, but there are numerous concerns for near non-attainment of water quality standards and/or based on screening levels; please see table below.

Table 7

| Segment | Segment Name                   | Parameter(s) Impaired | Year First Listed | Assessment Category | Parameter (s) of Concern                                    | Level of Concern <sup>2</sup> |
|---------|--------------------------------|-----------------------|-------------------|---------------------|-------------------------------------------------------------|-------------------------------|
| 2303    | International Falcon Reservoir | No Impairments        | --                | --                  | Ammonia<br>Nitrate<br>Total Phosphorus<br>Toxicity in Water | CS<br>CS<br>CS<br>CN          |

CS- Concern for water quality based on screening levels

CN- Concern for water quality based on near non-attainment of water quality standards

## Hydrologic Characteristics

The median instantaneous flow during the historical record of sampling at Station 15817 is 1517 cfs, and for Station 15818 it is 2,993 cfs. Station 13189 is a Falcon reservoir station, and does not record flow, but it does maintain an conservation stage of 2,067 million cubic meters for its period of record. The Rio Grande in the Rio Grande Valley always carries water, but it is still affected by the drought, though the effects are not as severe as in other parts of the basin. The flow at Station 15818, which is just above the entry to Falcon reservoir, fluctuates seasonally. During monsoon season, which tends to be in the summer months of July and August, flows are higher due to heavy rainfall in the areas. Season occurrences, such as tropical storms or hurricanes, also impact rainfall in the area and result is high flows.

## Data Analysis of Water Quality Issues

Segment 2303 has no impairments, but there are multiple water quality concerns for the area. Over the years, routine monitoring has shown concerns for Ammonia, Nitrate, Total Phosphorus, and Toxicity in water.

For Station 15817, the mean of 141 bacteria samples of *E.coli* bacteria that were analyzed from the water quality data was 241 MPN (most probable number). The site shows an increasing trend for high bacteria counts, which is likely due to the increasing population in the area. The water quality data indicated that dissolved oxygen levels had an average of 9.2 mg/L, but is showing a slightly decreasing trend. Data for specific conductance shows a mean specific conductance reading of 936 uS/cm (micro Siemens), and the average for pH at this station during the period of record is 8.0. Ammonia data for this station shows an average of 0.38 mg/L and shows an increasing trend. Total Phosphorus is .25 mg/L, and the data shows a decreasing trend. The concern for toxicity in water has been car-



Station 15818, Falcon Reservoir at San Ygnacio WTP Intake West of US 83 Intersection with FM3169



ried forward in the last TCEQ Integrated Report, and more studies would need to be done to determine if this is still an issue.

For Station 15818, the mean of 31 bacteria samples of *E.coli* bacteria that were analyzed was 268 MPN. The site shows an increasing trend for high bacteria counts, which is likely due to the increasing population and recreation in the area. The data indicated that dissolved oxygen levels showed an average of 7.8 mg/L, but is showing a slightly decreasing trend. The water quality data for specific conductance shows a mean specific conductance reading of 928 uS/cm, and the average for pH at this station during the period of record is 8.0. Ammonia data for this station is an average of 0.25 mg/L and shows an increasing trend. Total Phosphorus is .36 mg/L, and this data shows a decreasing trend. The concern for toxicity in water has been carried forward in the last TCEQ Integrated Report, and more studies would need to be done to determine if this is still an issue.

For Station 13189, the mean of 46 bacteria samples of *E.coli* bacteria that were accessed from the water quality data was 23 MPN. The trend for this site is sharply decreasing, indicating an improvement in the water quality in reference to bacteria. The water quality data indicates that dissolved oxygen levels had a mean of 8.1 mg/L. Data for pH shows a mean of 8.2. Analysis of specific conductance shows a mean of 901 uS/cm and a slightly increasing trend over the period of record. Ammonia data shows an average of 0.33 mg/L and shows a slightly increasing trend. Total Phosphorus is 0.19 mg/L, and this data shows a decreasing trend. The concern for toxicity in water has been carried forward in the last TCEQ Integrated Report, and more studies would need to be done to determine if this is still an issue.

### Land Use

Based on satellite imagery, Station 15818 is located near the San Ygnacio Water Treatment Plant in San Ygnacio, Texas, along the Rio Grande about a mile upstream from the Rio Grande confluence with Falcon Reservoir. Station 15817 is located upstream of Station 15818, along the river on land that is largely unpopulated and undisturbed. There are small urban developments on both sides of the border in this area, and the rest of the surrounding land is undeveloped.

Based on satellite imagery, the land around Station 13189 is a combination of unpopulated rural land and urban developments. The area in and immediately around the reservoir is popular for recreational activities (boating, fishing, swimming), with large settlements of homes on or near the shorelines. The land use of areas past the urban settlements, in the surrounding territory, is rural and largely consists of uninhabited ranchland.

There are two permitted dischargers into Segment 2303, Zapata County Water Works Wastewater Treatment



Small town of San Ygnacio on the right hand side, near Station 15818. MX side on the left side shows no development.



Plant and Zapata County Chihuahua Wastewater Treatment Plant. Zapata County Water Works Wastewater Treatment Plant is located approximately 1600 feet east of the intersection of state Highway 83 and FM 2687, in Zapata, County, Texas. The point of discharge is located approximately 500 feet north of FM 2687. The permit is for the discharge of treated public domestic wastewater, and they are allowed to discharge up to 0.0175 million gallons per day (MGP) into Arroyo Miguel, which goes into International Falcon Reservoir.

Zapata County Chihuahua Wastewater Treatment Plant has a permit for the discharge of treated public domestic wastewater. It is located approximately 0.5 miles west of U.S. Highway 83 on Sewer Plant Road in the City of Zapata, Texas. It discharges 0.8 MGD of treated wastewater from the Zapata County Wastewater Treatment Facility directly to International Falcon Reservoir.

### **Possible negative impacts on water quality**

*Nonpoint sources-* Segment 2303 consists of the water of the Rio Grande in Falcon Reservoir and contributing flows from the Rio Salado in Mexico. However, the section of the river that flows into Falcon reservoir is flowing downstream from the Laredo/Nuevo Laredo area, which has serious bacteria impairments. There are several small urban developments located all the way around the reservoir, which may contribute to bacteria introduction into the reservoir. The reservoir, being an impounded water source, does not flow, and this could contribute to lack of aeration and the buildup and break down of organic materials. Water fowl and horses and cattle from nearby ranchlands may further contribute to bacteria in the water, but the extent of any impact on the reservoir from wildlife is currently unknown.

*Agricultural-* There are some private ranchlands in the surrounding areas, but farming takes place downstream of the reservoir and has little to no impact here. The ranchlands have goats, cattle and horses, as these are frequently seen grazing along the river near San Ygnacio. Farming practices would need to be investigated further in this area to determine if it exists, and what impact it has on water quality.

*Wildlife-* The field crew for Station 15818 have good access to the Rio Grande, but the area sees moderate bird activity, which may contribute to the bacteria issues in this area. There are also horses and cattle grazing in and around the river, and the area has problems with feral hogs. Javalinas and other small wildlife are also common and could be small contributors to bacteria problems. The reservoir sees water fowl year-round, and some cattle and horses may come to graze and drink in the remote edges of the water line.

### **Urban Runoff**

Station 15818 is located about a mile downstream of the small town of San Ysidro, Texas. Google Earth maps show that the main town road goes directly to the river, and many of the town's small recreation areas (parks, popular fishing spots) are along the river and directly accessible by the main road. Falcon Reservoir is impacted by runoff from the multiple communities around the shorelines, as well as by boat ramps and roads coming off the main highways.

### **Influences of Flow**

Segment 2303 mainly encompasses Falcon reservoir, which has no flow. However, Station 15818, located just as the river is entering the Reservoir, is influenced by flows coming from upstream. Directly upstream of San Ysidro is Laredo, Rio Bravo, and El Cenizo, all of which have documented severely elevated bacteria counts. This may be influencing the bacteria counts at the station, contributing to the increasing trend for high bacteria counts, and may be negatively impacting the quality of the water going into the Reservoir.





## Potential Stakeholders

|                                    |                                                             |
|------------------------------------|-------------------------------------------------------------|
| Landowners                         | TCEQ Watermaster Office                                     |
| US Fish & Wildlife Service         | TCEQ Regional Offices                                       |
| TX Parks and Wildlife              | City of Laredo, TX                                          |
| Webb and Zapata Counties           | Towns of Rio Bravo, El Cenizo, San Ygnacio, TX on U.S. side |
| Border cities and towns on MX side | Nuevo Laredo, MX                                            |

## Recommendations

The USIBWC CRP will continue the routine monitoring for a full assessment in 2016. The program will continue to monitor and look at increasing or decreasing trends for parameters to identify water quality issues and needs in this area.

## Segment 2302, Rio Grande Below Falcon Reservoir and 2302A, Arroyo los Olmos

Segment 2302 is described from a point 10.8 km (6.7 miles) downstream of the International Bridge in Cameron County to Falcon Dam in Starr County. It is the segment located just below International Falcon Reservoir, stretching to the tidal segment of the Rio Grande and is approximately 231.5 miles long. The segment has seven assessment units, or AUs, and one unclassified water body:

### Segment 2302, Rio Grande Below Falcon Reservoir

- 2302\_01, From El Jardin Pump Station upstream to the Rancho Viejo Floodway
- 2302\_02, From the Rancho Viejo Floodway upstream to the Progreso Int'l Bridge (FM 1015)
- 2302\_03, From the Progreso Int'l Bridge (FM 1015) upstream to the McAllen Int'l Bridge (US Hwy 281)
- 2302\_04, From the McAllen Int'l Bridge (US Hwy 281) upstream to Anzalduas Dam
- 2302\_05, From Anzalduas Dam upstream to the Los Ebanos Ferry Crossing
- 2302\_06, From the Los Ebanos Ferry Crossing upstream to the Arroyo los Olmos confluence
- 2302\_07, From the Arroyo los Olmos confluence upstream to the Falcon Dam

### Segment 2302A, Arroyo los Olmos

- 2302A\_01 From Rio Grande confluence at Rio Grande City to El Sauz in Starr County

There are 17 active stations within these segments:

- 10249, Rio Grande River 285 meters South and 30 meters West from the intersection of FM Road 813/ Cantu Road and Avilia Road 6.3 KM downstream from San Benito pumping station
- 17247, Rio Grande River 100 M upstream of FM 1015 at Progreso, Texas
- 21012, Rio Grande River off Sherbach RD/Airfield RD 1.05 KM South and 340 meters East from the intersection of Shuerbach RD and Military RD South of Mission Cams 792
- 13186, Rio Grande River 4.1 km Downstream of the Confluence with Rio Alamo near Fronton, TX
- 13185, Rio Grande River at Fort Ringgold 1.6 km Downstream of Rio Grande City
- 13104, Arroyo los Olmos at SH 755 NW of Rio Grande City
- 21749, Rio Grande Approx 380 meters Downstream of Confluence with Los Olmos Creek
- 13103, Los Olmos Creek at US 83/East 2<sup>nd</sup> Street South of Rio Grande City
- 21591, Arroyo Los Olmos 400 m Upstream of Confluence with Rio Grande near Rio Grande City
- 13184, Rio Grande River at FM 886 Near Los Ebanos
- 13664, Rio Grande River 0.8 km Downstream of Anzalduas Dam and 16.4 km Upstream from Hidalgo, TX



13181, Rio Grande River at Hwy 281/International Blvd in Hidalgo

15808, Rio Grande River 300m Upstream of the Pharr International Bridge/US 281 East of Hidalgo, TX

13179, Rio Grande River at River Bend Golf Course Boat Ramp West of Brownsville

20449, Rio Grande River at Brownsville PUB Water Treatment Plant Number 1 Intake Between WTP Reservoir and Rio Grande Levee 910 m and 335 m South to the Intersection of West Elizabeth Street and South Military Road

13177, Rio Grande River at El Jardin Pump Station Located 350m West of Intersection of Monsees Road and Calle Milpa Verde

Both Segment 2302 and 2302A are currently impaired for bacteria, each in one assessment unit; only three stations are within these two AUs and will be discussed below. Segment 2302\_07 was first listed on the Texas Integrated Report as impaired for bacteria in 1996, and 2302A\_01 was listed in 2004. There are numerous concerns for near non-attainment of water quality standards and/or based on screening levels in this area as well; please see table below.

Table 8

| Segment | Segment Name                         | Parameter(s) Impaired | Year First Listed | Parameter (s) of Concern | Level of Concern <sup>2</sup> |
|---------|--------------------------------------|-----------------------|-------------------|--------------------------|-------------------------------|
| 2302    | Below International Falcon Reservoir | <i>E. coli</i>        | 1996              | Ammonia                  | CS                            |
|         |                                      |                       |                   | Chlorophyll- <i>a</i>    | CS                            |
|         |                                      |                       |                   | Depressed DO             | CS                            |
| 2302A   | Los Olmos Arroyo                     | <i>E. coli</i>        | 2004              | Chlorophyll- <i>a</i>    | CS                            |

CS- Concern for water quality based on screening levels

CN- Concern for water quality based on non-attainment of water quality standards

## Hydrologic Characteristics



AU 2302\_07 includes stations 13185 and 13186, and AU 2302A\_01 includes station 13103. The mean flow for Station 13185 is 2,633 cfs, and for Station 13186 the mean flow is 1820 cfs. The median instantaneous flow at Station 13103 (AU 2302A\_01) for the period of record is 3 cfs, so the flow that contributes to the river is minimal. The flows at these stations fluctuate seasonally. During monsoon season, which tends to be in the summer months of July and August, flows are higher due to heavy rainfall in the areas. Season occurrences, such as tropical storms or hurricanes, also impact rainfall in the area and result in high flows. Irrigation also impacts flow, and flows will be higher when they are releasing water from Falcon Reservoir.

Station 13185, Rio Grande River at Fort Ringgold 1.6 km downstream of Rio Grande City

## Data Analysis of Water Quality Issues

Assessment unit 2302\_07 has an impairment for bacteria, as well as other water quality concerns for the area. Over the years, routine monitoring has shown concerns for Ammonia, chlorophyll-a and depressed dissolved oxygen. This AU includes stations 13185 and 13186. AU 2302A\_01 is impaired for bacteria as well, and also has a concern for chlorophyll-a.

For Station 13186, the mean of 96 bacteria samples of *E.coli* bacteria that were analyzed was 75 MPN. The trend analysis for bacteria water quality data at this station is steadily increasing, indicating that activities in this region are having a negative impact on water quality. The water quality data indicated that dissolved oxygen had a mean of 7.6 mg/L and the data shows an increasing trend toward higher values. Analysis of water



Station 13103, Arroyo Los Olmos

quality data for pH shows a mean of 7.9. Data for specific conductance shows a mean of 920 uS/cm and a slightly increasing trend over the period of record. The chlorophyll-a data shows an average of 8.6 ug/L and shows a slightly increasing trend.

For Station 13185, the mean of 134 bacteria samples of *E.coli* bacteria that were analyzed was 495 MPN. The trend for this site is steadily decreasing, indicating an improvement of water quality around this station. The water quality data indicated that dissolved oxygen levels had a mean of 7.8 mg/L and the data shows an increasing trend for higher values. Data for pH shows a mean of 7.9. Specific conductance data shows a mean of 1036 uS/cm and a slightly increasing trend over the period of record. The chlorophyll-a data shows an average of 10.6 ug/L and a slightly increasing trend.

For Station 13103, the mean of 19 bacteria samples of *E.coli* bacteria that were analyzed was 1464 MPN. The site shows an increasing trend for high bacteria counts, which is likely due to the increasing population in the area, aging infrastructure and agricultural return flow. The water quality data indicated that dissolved oxygen levels were 7.2 mg/L, but is showing a decreasing trend. This could be due to no or very low flows, coupled with stagnant water, when there is no water released. This station has not flowed consistently since the drought began in 2010. Specific conductance data shows a mean of 7381 uS/cm, which is high, and the average for pH at this station during the period of record is 8.1. The chlorophyll-a data shows an average of 97.7 ug/L.

Based on statistical analysis of 15 years of water quality data for the two stations in Segment 2302 and the station in Segment 2302A, water quality is being negatively affected as we proceed downstream. The bacteria



counts and other data are within standard limits at station 13186, but in the area surrounding station 13103, which is the furthest downstream of the three stations, the bacteria problems are a serious concern. This segment also has issues with salinity, and farmers and irrigators have concerns that the water is not suitable for irrigation use. Although the area is not yet impaired for Total Dissolved Solids (TDS), the salinity over time has been increasing steadily. Possible sources of this salinity are described further in this report.

It is important to note that in the last TCEQ Integrated Report assessment period (2014 Integrated Report),



Top Map shows a large industrial area on the Mexican side of the river, no U.S. city across.

Bottom Map shows the City of Roma on the upper side of the Rio Grande, and the city of Miguel Aleman in Mexico on the underside of the river





Map shows Rio Grande City, TX on the upper side of the Rio Grande. Under side is undeveloped rural land or farmland in MX.

an AU in Segment 2302 was delisted. 2302\_01 (From El Jardin Pump Station upstream to the Rancho Viejo Floodway) was delisted for bacteria. This indicates that water quality in this area improved enough that the data collected during the assessment period fully supported the water quality standards for bacteria. This is a major improvement for this area. Part of the improvement is attributed to the Matamoros Wastewater Treatment Plant that went online in 2008; we have been monitoring a steady decrease since 2008.

### Land Use

Based on satellite imagery, there is land at the beginning of the segment that is undeveloped, but proceeding downstream there are small and large urban developments on both sides of the border in this area. There are very small developments dotting the land that follows the river throughout the entire segment on both sides of the border, and may presumably be *colonias*, or very poor communities with access to little or no wastewater infrastructure and poor sanitary conditions.

The Lower Rio Grande Valley is heavily influenced by agriculture, and a large part of the lands near the river are agricultural crop lands. There are several large industrial buildings on the Mexican side of the border. This area has ports of entry as well, which see heavy traffic, commercial and private, on a daily basis.

There are 16 permitted dischargers that discharge into Segment 2302. The permits include one for conventional water treatment, one permit for industrial wastewater treatment, two permits for private domestic wastewater treatment, 8 permits for public domestic wastewater treatment.





Map shows McAllen, TX on the upper right side of the river, and the city of Reynosa in Mexico on the lower left.

### **Possible negative impacts on water quality**

*Nonpoint sources-* The Rio Grande is heavily impacted not only by small and large urban developments on both sides of the border, but also by the lower-income communities that have limited or no access to sewer systems. These areas are more likely to have inadequate sewer hookups, leaky septic tanks or no infrastructure at all, which can contribute to the bacteria problems in the area. Water fowl and livestock from nearby ranchlands may further contribute to bacteria in the water, but the extent of any impact on the water quality from wildlife is currently unknown.

*Agricultural-* This segment is heavily impacted by the agricultural industry, and the majority of the land is crop land. This can easily be verified through satellite imagery. There are some private ranchlands in the surrounding areas that have livestock. Agricultural return flows may contribute to high salinity in the water being returned to the river, and may also have a negative impact on the bacteria counts. It is important to note that return flows are received from both the U.S. and Mexico, and both may be contributing to the problem. Agricultural return flows are also high in nutrients, which can contribute to algal blooms. Livestock that are allowed to graze near the river can also be a contributing source of bacteria.

*Wildlife-* Access to the river at the stations in this segment is relatively easy, though the landscape was drastically changed by the flooding caused by Hurricane Alex in 2010. The area is a popular stop for migratory birds, which may contribute to the bacteria issues in this area. There is also livestock grazing around the river due to private ranches. Other small wildlife are also common and could be small contributors to bacteria problems.

*Urban Runoff-* There are multiple communities along the river in this span of the basin. Roma, Rio Grande City, Mercedes, McAllen, Weslaco, La Joya, Harlingen and many other cities border the river until it reaches the Gulf on the U.S. side, while numerous towns and cities border the river on the Mexican side as well.

Google Earth maps show multiple roads in every one of these cities that go directly to the river. Many of the town's small recreation areas (parks, popular fishing spots) are along the river and directly accessible by boat ramps off of main roads. This segment is impacted by runoff from the multiple communities around the shorelines, as well as by boat ramps and roads coming off the main highways. Ports of Entry at each city are also a major contributor of pollution to the Rio Grande water quality, especially during heavy rain events, as these see heavy pedestrian, private vehicle and commercial vehicle traffic on a daily basis.

*Influences of Flow* - Segment 2302 is heavily influenced by releases from Falcon Reservoir, but this area also sees several rain events throughout the year. Since the first station below Falcon Reservoir, 13186, does not have any immediate water quality issues (though the assessment unit itself is impaired), it appears that the impacts to the water quality are coming from other sources as the water flows downstream.

### **Potential Stakeholders**

|                            |                                           |
|----------------------------|-------------------------------------------|
| Landowners                 | TCEQ Watermaster Office                   |
| US Fish & Wildlife Service | TCEQ Regional Offices                     |
| TX Parks and Wildlife      | TX A&M Kingsville                         |
| UTRGV- Edinburg            | Starr, Willacy, Hidalgo, Cameron Counties |

Cities of Zapata, Roma, McAllen, La Feria, Pharr, Mercedes, Weslaco, Edinburg, Mission, Rio Grande City  
Cameron County Water Improvement District No. 10 and 16  
Cameron County irrigation District No. 2 and 6  
Donna irrigation District- Hidalgo County No. 1  
Hidalgo and Cameron County Irrigation District No. 9  
Hidalgo County Irrigation District No. 1, 2, 6, 13, 16, 19  
Hidalgo County Water Control and Improvement District No. 18  
Hidalgo County Water Improvement District No. 3, 5  
Hidalgo County Municipal Utility District No. 1  
La Feria Irrigation District- Cameron County No. 3  
Santa Maria Irrigation District- Cameron County No. 4  
United Irrigation District of Hidalgo County  
Valley Acres Water District  
Valley Municipal Utility District No. 2

### **Recommendations**

The USIBWC CRP will continue the routine monitoring for a full assessment in 2016. The program is currently a participant in the Lower Rio Grande Water Quality Initiative, a pilot binational project that aims to look at bacteria and salinity in the Lower Rio Grande Basin and establish protocols to try and implement a binational watershed protection plan. More information on this project can be found later in the report.

## **Segment 2301, Rio Grande Tidal**

Segment 2301 is from the confluence with the Gulf of Mexico in Cameron County to a point 10.8 km (6.7 miles) downstream of the International Bridge in Cameron County and is approximately 48.31 miles long. The segment has two assessment units, or AUs:

2301\_01, From the mouth of the Rio Grande (lower segment boundary) to a point 71.7 km (44.6 mi) upstream

2301\_02, From a point 71.7 km (44.6 mi) upstream of the mouth of the Rio Grande to the upper segment boundary 10.8 km (6.7 mi) downstream of the International Bridge

There are 2 stations currently being monitored within this segment:



16288, Rio Grande River at Sabal Palm Sanctuary 370 meters south and 310 meters east from the Intersection of Dakota Ave and Sabal Palm Grove Road

13176, Rio Grande River Tidal at the end of Quicksilver Ave 375 meters south from the Intersection of Boca Chica Blvd and Quicksilver Ave

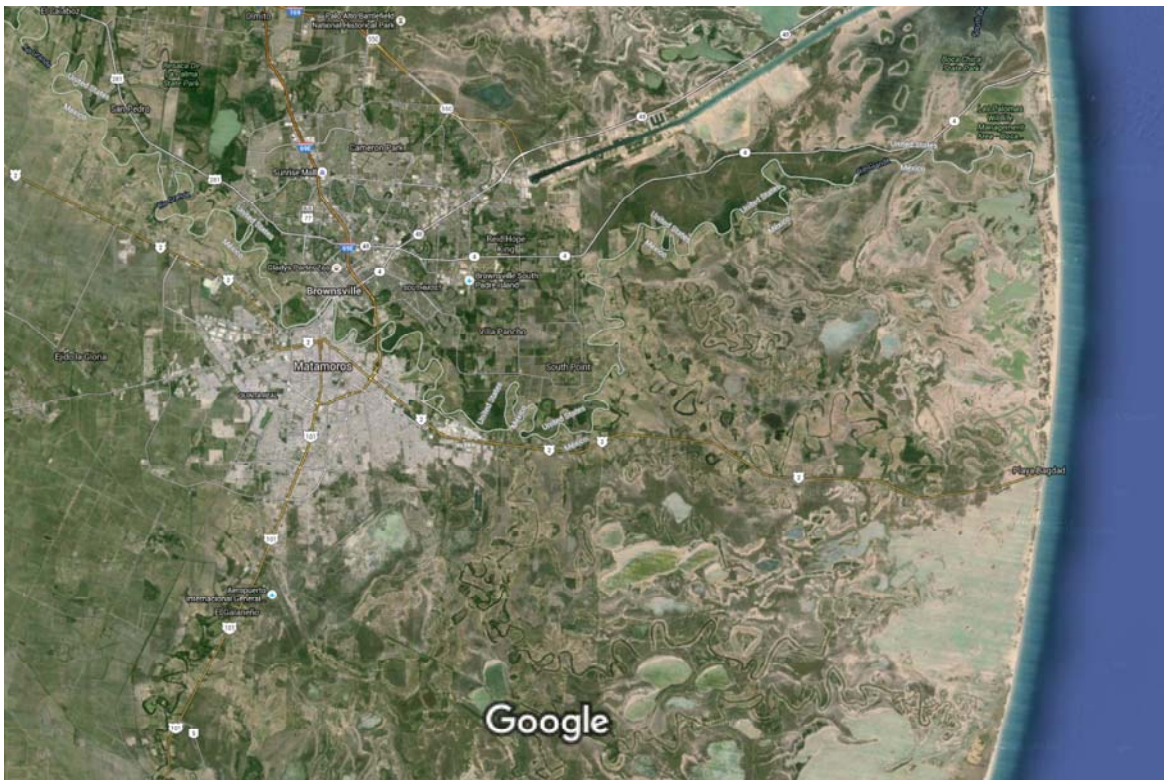
In the 2014 Intergrated Report, Segment 2301 does not have any impairments at this time, but does have concerns for bacteria, chlorophyll-a, and nitrate; please see table below.

Table 9

| Segment | Segment Name     | Parameter(s) Impaired | Year First Listed | Assessment Category <sup>1</sup> | Parameter (s) of Concern                               | Level of Concern <sup>2</sup> |
|---------|------------------|-----------------------|-------------------|----------------------------------|--------------------------------------------------------|-------------------------------|
| 2301    | Rio Grande Tidal | No Impairments        | --                | --                               | <i>Enterococci</i><br>Chlorophyll- <i>a</i><br>nitrate | CN<br>CS<br>CS                |

CS- Concern for water quality based on screening levels

CN- Concern for water quality based on non-attainment of water quality standards



Map shows Brownsville, TX on the upper side of the map, above the river. The large urban area south of the river, to the bottom left, is Matamoros, Tamaulipas, Mexico. To the far right is the Gulf of Mexico.

### Hydrologic Characteristics

AU 2301\_01 includes station 13176, and AU 2302A\_02 includes station 16288. The mean flow for Station 16288 is 767 cfs, and for Station 13176 the mean flow is 588 cfs. The flows at these stations fluctuate seasonally. During monsoon season, which tends to be in the summer months of July and August, flows are higher due to heavy rainfall in the areas. Season occurrences, such as tropical storms or hurricanes, also impact rainfall in the area and result is high flows. Because this segment is so close to the Gulf of Mexico, there may also be tidal influences from high tides and storm surges. Irrigation also impacts flow, and flows will be higher when they are releasing water from Falcon Reservoir and drop when irrigation ceases.

## Data Analysis of Water Quality Issues

Segment 2301 has no impairments, but does have concerns for bacteria, chlorophyll-a and nitrate. AU 2301\_01, which includes Station 13176, has a concern for chlorophyll-a. AU 2301\_02, which includes Station 16288, has concerns for bacteria and nitrate.

For Station 16288, the mean of 23 water quality samples analyzed over the period of record of 15 years was 764 MPN for *Enterococcus*. The data at this station indicates a steadily decreasing trend, which points to an improvement of water quality in this region. The water quality data indicates that dissolved oxygen levels had a mean of 8.1 mg/L and the trend remains constant (no increase/decrease). Data for pH shows a mean of 8.0. Specific conductance shows a mean of 1699 uS/cm and a slightly decreasing trend over the period of record. The nitrate data shows an average of 1.5 mg/L and a decreasing trend.

For Station 13176, the mean of 17 bacteria samples that were analyzed was 53 MPN for *Enterococcus*. The trend for this site is steadily increasing, indicating activities in this area are having a negative impact of water quality around this station. The analysis showed that dissolved oxygen had a mean of 8.9 mg/L. Water quality data for pH shows a mean of 8.2. Specific conductance shows a mean of 4121 uS/cm and a slightly decreasing trend over the period of analysis. The chlorophyll-a data shows an average of 20.5 ug/L and a slightly decreasing trend.

## Land Use

Based on satellite imagery, there are small and large urban developments on both sides of the border in this area. There are very small developments dotting the land that follows the river throughout the entire segment on both sides of the border, and may presumably be *colonias*, or communities with access to little or no wastewater infrastructure and poor sanitary conditions. A large portion of the lands near the river on both sides of the border are wetlands, with agricultural lands right before that (see Binational Landcover map on p. 35-36).

There are 1 permitted discharger that discharges into Segment 2301. The permit belongs to the Brownsville Public Utilities Board (BPUB), which discharges treated public domestic wastewater. The BPUB facility, the Southside Wastewater Treatment Facility, is located at 2800 East University Boulevard, in southeast Brownsville, in Cameron County, Texas. It discharges 12.8 MGD of treated wastewater from Southside Wastewater Treatment Facility directly to Rio Grande Tidal in Segment 2301.

## Possible negative impacts on water quality

*Nonpoint sources*- The Rio Grande is heavily impacted not only by small and large urban developments on both sides of the border, but also by the lower-income communities that have limited or no access to sewer systems. The population in the McAllen, Harlingen and Brownsville areas have doubled in the past ten years, and this places a heavy strain on the treatment facilities in these communities. These areas are more likely to have leaky and/or old septic tanks, aging infrastructure, and facilities that are too small for the communities they serve, which can contribute to the bacteria problems in the area. Water fowl and livestock from nearby ranchlands may further contribute to bacteria in the water, but the extent of any impact on the reservoir from wildlife is currently unknown.

*Agricultural*- This segment is heavily impacted by the agricultural industry, and the majority of the land is crop land. This can be verified through satellite imagery. There are some private ranchlands in the surrounding areas that have livestock. Agricultural return flows may contribute to salinity in the water being returned to the river, and may also have a negative impact on the bacteria counts. It is important to note that return flows are received from both the U.S. and Mexico, and both may be contributing to the problem. Agricultural return flows are also high in nutrients, which can contribute to algal blooms. Livestock that are allowed to graze near the river can also be a contributing source of bacteria.

*Wildlife*- Access to the river at the stations in this segment is relatively easy, though the landscape was drastically changed by the flooding caused by Hurricane Alex in 2010. Some stations are also behind the border fence, so access at these sites requires prior coordination with U.S. Border Patrol. The area is a popular stop for migratory birds, which may contribute to the bacteria issues in this area. There is also livestock grazing around the river due to private ranches. Other small wildlife are also common and could be small contributors to bacteria problems. The area has wildlife refuges and preserves, and several protected areas.



*Urban Runoff*- There are multiple communities along the river in this span of the basin. La Joya, Harlingen, Brownsville and the many cities across the international border are all located along the river. Google Earth maps show multiple roads in every one of these cities that go directly to the river. Many of the town's small recreation areas (parks, popular fishing spots) are along the river and directly accessible by boat ramps off of main roads. Pollution related to trash from recreation are also problems. This segment is impacted by runoff from the multiple communities around the shorelines, as well as by boat ramps and roads coming off the main highways. Ports of Entry at each city are also a major contributor of pollution to the Rio Grande water quality, especially during heavy rain events, as these see heavy pedestrian, private vehicle and commercial vehicle traffic on a daily basis.

*Influences of Flow* - Segment 2301 is heavily influenced by weather in the Gulf region, and the region sees several rain events throughout the year. This is the furthest downstream segment of the basin, and is receiving water from the upstream segments that are impaired. Because the segment is so close to the Gulf, the area is affected by tidal influences, from the tide back flowing and mixing with the river water, and well as by storm surges from tropical storms and hurricanes. These factors, combined with the increasing salinity of the water as it flows downstream from further up the river basin, all contribute to the salinity in this area. The agricultural return flows may also have an impact on the water quality, although there are currently no impairments or concerns for high salinity.

**Potential Stakeholders**

|                                                     |                                               |
|-----------------------------------------------------|-----------------------------------------------|
| Landowners                                          | TCEQ Watermaster Office                       |
| US Fish & Wildlife Service                          | TCEQ Regional Offices                         |
| TX Parks and Wildlife                               | Cities of Harlingen, La Joya, Brownsville, TX |
| Matamoros and other cities in Tamaulipas, MX        | UTRGV- Brownsville                            |
| Adams Garden Irrigation District No. 19             | Brownsville irrigation District               |
| Harlingen Irrigation District- Cameron County No. 1 |                                               |

**Recommendations**

The USIBWC CRP will continue the routine monitoring for a full assessment in 2016. The program is currently a participant in the Lower Rio Grande Water Quality Initiative, a pilot binational project that aims to look at bacteria and salinity in the Lower Rio Grande Basin and establish protocols to deal with them. More information on this project can be found later in the report.



Pictured: Station 20449, monitored by BPUB.



Pictured: Station 13178, Rio Grande near the Brownsville International Port of Entry.

# Lower Rio Grande Valley Flood Control



Pictured: Major highway in the Lower Rio Grande Valley near McAllen, TX, shortly after Hurricane Alex in 2010.

Dams are a major point of discussion among water quality experts, as we know them to be detrimental to the ecosystem of a river. Dams, weirs and other types of control structures can negatively affect mussel populations, fish populations, macroinvertebrates and many other types of wildlife. However, these structures also save people and their communities from the devastating effects of floods in their waterways. Such is the case in the Lower Rio Grande Valley, which is home to several dams and flood control structures. The flood control levees, dams and drainage and irrigation structures stretch over 180 miles from Peñitas, Texas to the Gulf of Mexico. There is also an emergency floodway in place, which is opened and operated only when high flows warrant a need to relieve the pressure on the Rio Grande and flood control structures; the emergency floodway runs almost parallel to the river and discharges the flow directly into the Laguna Madre in the Gulf of Mexico. These measures were put into place, or re-designed, after Hurricane Beulah devastated the Valley in 1967. They were used once again in 2010, during Hurricane Alex.

There are two types of dams along the Lower Rio Grande River: storage dams, which hold vast amounts of water for conservation, downstream distribution and power generation, and diversion dams, which regulate irrigation and flood waters. The Lower Rio Grande Valley is home to three dams: Falcon Dam, Anzalduas Dam, and Retamal Dam. Falcon Dam is a storage dam, while the other two are diversion dams. Each dam will be highlighted separately in the following pages. Please see the final pages of the report for historical pictures of the Rio Grande Valley.

The Rio Grande is unique in that it is largely a manipulated water flow. The area always has water flowing in the river, but the water is subject to impoundment in one of the dams, storage in the reservoir for conservation, irrigation, or diversion to Mexico. This presents unique issues in dealing with water quality: exactly how does this affect the river ecosystem and its water quality? In order to answer these questions, the CRP has multiple routine stations above and below the dams to monitor the water quality. In the case of Falcon Dam (Segment 2303), coming downstream from the Laredo area, Station 15818 is the furthest downstream station before entering Falcon International Reservoir. There is also a station on the reservoir, 13189, and Station 13186 is located downstream of the dam. These stations are monitored on a monthly basis for things such as bacteria, field parameters (pH, dissolved oxygen, water temperature, specific conductance, flow), nutrients, and metals.



Pictured: Bentsen-Rio Grande Valley State Park, which is near the Rio Grande in mission, TX, shortly after Hurricane Alex in 2010. The flood walls kept the water from spilling over into an RV retirement village on the other side.



Pictured: Street sign along a major highway in Mercedes, TX shortly after Hurricane Alex in 2010.



## Historical Pictures of Floods in the Lower Rio Grande Valley prior to the flood control structures.

Many of these are saved newspaper clippings from that time that are housed in the IBWC's Records department.



September 14, 1948: Looking west over the Mission Branch and Hackney Lake Branch floodways at their junction with the Main Floodway, with the Pharr south highway crossing the Main Floodway in the foreground. River overflow in the floodways, near maximum for this this flood at the time of the photograph, reached 6,040 second feet in the Mission Branch and 11,735 second feet in the Hackney Lake Branch.



September 16, 1948: Looking south over the upstream end of the North Floodway from a point north of the highway and railroad bridges at Mercedes, TX. The junction of the floodway with the Main and Arroyo Colorado Floodways in visible in the background. Flow in the North Floodway during the mid-September flood reached a maximum at this point of 13,000 second feet the day before and was near maximum at the time of this photo.





1967, Harlingen, TX

Flooding from Hurricane Beulah devastated the Lower Rio Grande Valley that year, and resulted in repair, upgrading, or construction of many of the flood control structures we have in the Valley today. Newspaper clipping from that time frame.

Top Picture: 1967, La Feria, TX

La Feria's South Main Street in the aftermath of Hurricane Beulah. Newspaper clipping.



LaFeria's South Main Street showed the touch of Beulah and looked like this shortly after the storm passed.

Raymondville's downtown streets were flooded by Beulah's torrents and boats were the order of the day for shopping and other travel. (Gene Smith Photo)

Bottom Picture: 1967, Raymondville, TX, photo by Gene Smith

Raymondville's downtown streets flooded after Hurricane Beulah. Picture shows people doing their shopping via boat. Newspaper clipping.





# Falcon Dam and Falcon International Reservoir

## Falcon Dam

Falcon Dam is the lowermost major multipurpose international dam and reservoir (Falcon Dam International Reservoir) on the Rio Grande. As an organizational unit of the IBWC, the function is to control and regulate the flow of international waters and to provide a means of contributing to the mutual welfare of Mexico and the United States, in compliance with various existing treaties. In conjunction with irrigation, domestic and flood releases, the project generates electricity through the hydroelectric generating plant. The project also provides support and maintenance for a small village. The items below portray all the important functions of this major structure, and the highlighted bullets show the important role it plays within the CRP.

### Some of the Major Functions include:

- Control flood water in such a way as to maximize waters available to the two nations for agricultural, private and industrial use and minimize flood damage.
- Coordinates U.S. Section operations with other U.S. and Mexican Section counterparts.
- Serves as the control point for flood releases of internationally owned waters.
- Coordinates the local state and government agencies; public and private organizations; and the general public on matters relating to the operation and maintenance of the project.
- Operation and maintenance of river gaging stations.
- Participates in and collects samples for the river water quality program.



Pictured: Falcon Dam in Falcon Heights, Texas. CRP Station 15818 is the furthest downstream station before entering the Reservoir. This station is monitored by the Rio Grande International Study Center, located in Laredo, TX. Station 13189 is located on the Reservoir, near the Spillway, and Station 13186 is the first station located downstream of the dam. Both of these stations are monitored by the USIBWC Falcon Dam Field Office on a monthly basis.

# Anzalduas Dam, McAllen, Texas

## Anzalduas Dam

Anzalduas Dam is located near McAllen, Texas in Hidalgo County, about 11 miles upstream of the Hidalgo-Reynosa International Bridge. It's main purpose is to ensure the diversion of the U.S. share of irrigation and floodwaters to the interior floodway, enable diversion of water to Mexico's main irrigation canal, and to effect releases for downstream water users in both countries. Station 13184 (Rio Grande at SH 886 near Los Ebanos) is upstream of this diversion dam, and Station 13664 (Rio Grande 0.5 miles downstream of Anzalduas Dam), is downstream of the dam. Station 13181 (Rio Grande at International Bridge at US281 at Hidalgo) is also located downstream of Anzalduas Dam. These stations are monitored by the USIBWC Mercedes Field Office.



Pictured: Anzalduas Dam, near McAllen, TX



Pictured: Station 13664, Rio Grande 0.5 miles Downstream of Anzalduas Dam



# Retamal Dam, Hidalgo County, Texas

## Retamal Dam

Retamal Dam is located 38 miles downstream of Anzalduas Dam and 16 miles southeast of McAllen, Texas in Hidalgo County. This dam serves two main flood control purposes: to limit flood flows at Brownsville-Matamoros and to enable Mexico to divert its share of the Rio Grande floodwaters to its interior emergency floodway. Station 13184 (Rio Grande at SH 886 near Los Ebanos) is upstream of this diversion dam, and Station 15808 (Rio Grande 200 meters Upstream of Pharr international Bridge), is upstream of the dam and is monitored by the USIBWC Mercedes field office.



Pictured: Retamal Dam, upstream



Pictured: Station 15808, Rio Grande 200 meters upstream of Pharr International Bridge, downstream of Retamal Dam

# Who are the CRP Partners in the Lower Rio Grande Valley?

The Texas Clean Rivers Program relies heavily on volunteer partners to collect the water quality samples in their areas of the basin. Without these partners, the scope of the program would be very limited. We would like to take this opportunity to highlight the CRP partners in the Lower Rio Grande Valley.

## USIBWC Falcon Dam Field Office

The USIBWC Falcon Dam Field Office monitors five routine monitoring stations in the Valley: Stations 13189, 13186, 13185, 17596, and 13103. They have been a CRP partner since the program began in 1998, and they bring a wealth of knowledge and experience to the program not only through their sample collection, but also in their knowledge of the region. Mr. Eli Mendoza, pictured at right in the brown shirt, has been taking samples for many years.



Pictured left and right: Falcon Field Office hydrotechs Eli Mendoza and Lauro Cantu collecting field samples and calibrating.



## USIBWC Mercedes Field Office

The USIBWC Mercedes Field Office collects samples at routine monitoring stations in the Valley: Stations 13664, 13177, 13181, 15808, and 13184. They have been a CRP partner since the program began in 1998, and they also bring a wealth of knowledge and experience to the program through their sample collection and knowledge of the region. Mr. Joe Bazaldua (right) continues collecting the samples for the program.



Pictured Above: Joe Bazaldua, Hydrotechnician



Pictured Left: Franklin Lazo and Larry Peña, Hydrotechnicians with Mercedes FO for many years.



# Who are the CRP Partners in the Lower Rio Grande Valley?

## UTRGV- Brownsville

Formerly UT-Brownsville, UTRGV-Brownsville has been a CRP partner since 1998. Dr. Elizabeth Heise and her students collect samples at Stations 13176, 16288, 13178, and 13179. Her monitoring includes the only two tidal stations of the Rio Grande in the program, 16288 and 13176. Station 16288 is located within Sabal Palm Audubon Sanctuary which used to be monitored by the sanctuary. Dr. Heise incorporates the CRP sampling into her curriculum, allowing her students to gain experience and have the data they collect put to use.



## Brownsville Public Utilities Board (BPUB)



BPUB joined the CRP in 2008. They had been attending the annual Coordinated Monitoring Meetings for some years and decided they wanted to join the program as a partner. They voluntarily provide the data they take for the City of Brownsville at the Brownsville water intake, Station 20449, which is a great source of information for the program. They also provide analysis of *Enterococcus* bacteria for the tidal stations, which are collected by UTRGV-Brownsville.

## UTRGV- Edinburg

UTRGV-Edinburg is a new partner with the CRP, having come aboard in 2016. They have been an integral part of the Lower Rio Grande Water Quality Initiative and decided they wanted to continue collecting water quality data long-term. The CRP program is excited to have them aboard!





# Los Ebanos Port of Entry

The Los Ebanos Port of Entry is a ferry-crossing port of entry on the Rio Grande in Sullivan City, TX, which is near La Joya, TX. The first picture below is around the time the port of entry was first constructed, in 1950. The middle picture is around 1970, and even though it is 20 years later, the ferry looks relatively unchanged. The last picture was taken by CRP staff in 2011. This is an active port of entry and is the only remaining international ferry operation along the U.S./Mexico border. Passengers and vehicles may cross to and from both countries on the ferry, which is hand-pulled to this day. CRP Station 13184 (Rio Grande at Los Ebanos) is about 1.5 miles downstream of the Port of Entry.



Pictured: Los Ebanos Port of Entry, circa 1950



Pictured: Los Ebanos Port of Entry, circa 1970



Pictured: Los Ebanos Port of Entry, 2011



Pictured: Aerial view, Los Ebanos Port of Entry, U.S. side on the bottom, MX on the top



## Lower Rio Grande Water Quality Initiative

The Lower Rio Grande, from Falcon International Reservoir to the reach where the river enters the Gulf of Mexico (here-after termed Lower Rio Grande/Rio Bravo) has experienced persistently high bacteria and increasing salinity levels. The goal of the Lower Rio Grande Water Quality Initiative is to identify feasible options for the prevention and control of pollution. These measures will result in the restoration, conservation, and improvement of water quality in the Lower Rio Grande/Rio Bravo River through a bi-national facilitated process that includes Federal, State, and local agencies on both sides of the border. The information gathered during the project will be used to populate a hydrologic model of the Lower Rio Grande/Rio Bravo, which will be coordinated on both sides of the border through multiple agencies and participants. This model can then be used to optimize pollution prevention solutions so the most efficient course of action can be taken, and may even be used to do similar projects in other parts of the basin. The ultimate goal of this project is to establish a model and strategy that can be applied throughout the rest of the basin.

This group has held several bi-national meetings over the course of five years to discuss the scope and focus of this project. The study included a detailed reconnaissance survey of four areas of the river to identify all potential discharges in December 2013. Baseline data was collected in 2014. Planning continued throughout 2015, which included 3 binational sampling events in March, August and November of 2015. For more information on this project, please contact Clean Rivers Program staff at the IBWC. A map of the project sites is provided on the next page for reference.

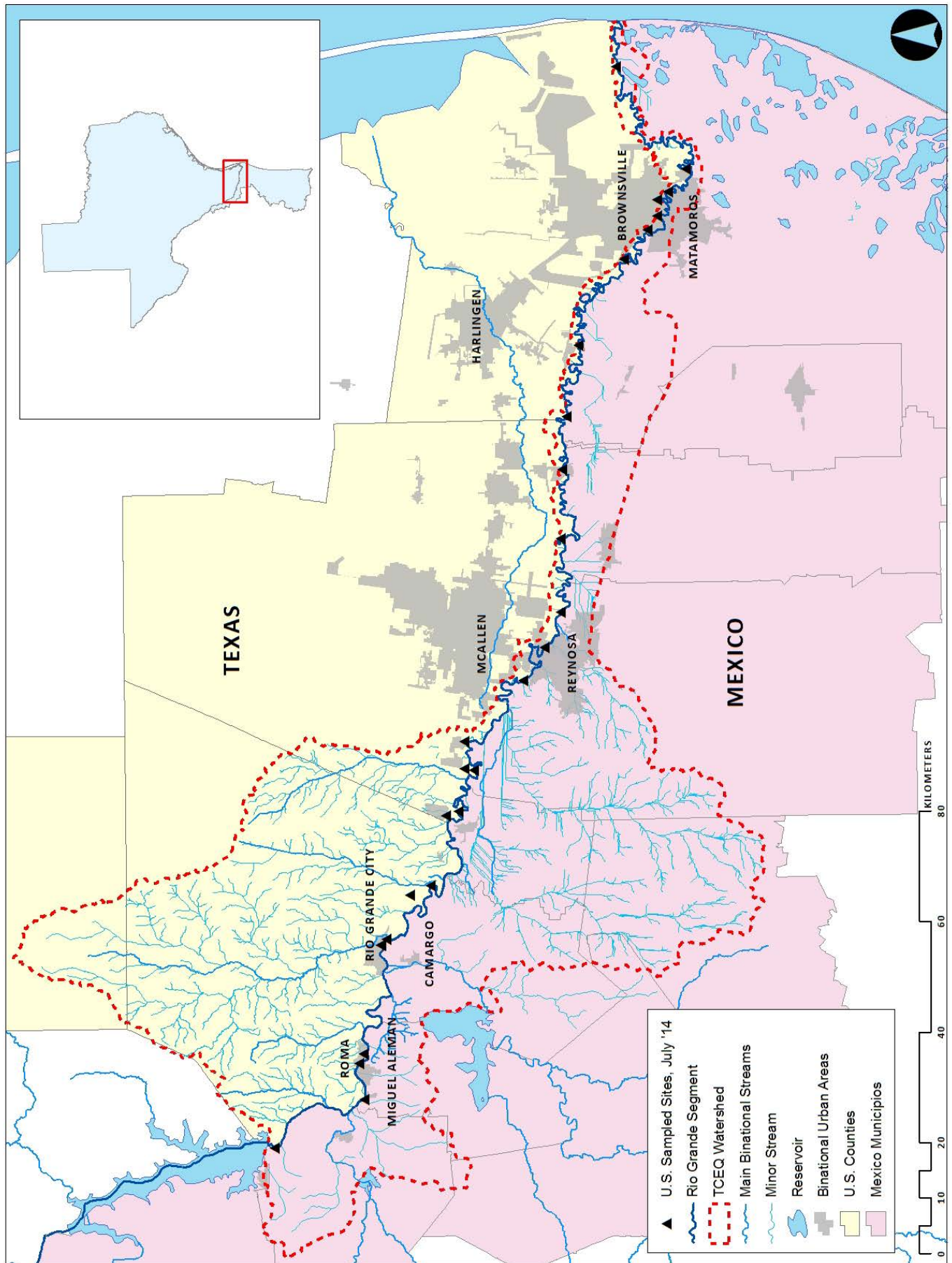


Top Picture and left pictures: Team of students from UTRGV-Edinburg collecting samples at their assigned sites, November 2015.

Top Picture: One of the sampling teams, November 2015.  
Bottom Picture: Salinity profile team, August 2015.



Figure 12. Lower Rio Grande Water Quality Initiative Sampling Sites



Map provided by Roger Miranda, TCEQ TMDL Program



## Invasive and Exotic species

Infestations of invasive aquatic weeds such as hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipe*) and giant cane have been problematic in the Lower Rio Grande Sub-basin. These aquatic plants obstruct sections of the river, prevent boat navigation, impede water flow, and increase water loss through consumption and evapotranspiration. However, control methods including mechanical removal and biological control using triploid grass carp have helped to reduce the problem.

Control of invasive species is important, both for the native vegetation and habitat and the native wildlife. Many of these plants did not start off as invasive species, but were introduced for such things such as erosion control or for aesthetic purposes. However, since that time they have escaped into the habitat and become a threat to the natural environment of the region. They are difficult to control since they spread by natural means (wind, water, and animal movement), and the main method of spreading is by human and vehicle use.

There are currently multiple efforts to control invasive and exotic species by TX Parks and Wildlife, the U.S. Department of Agriculture, and the Lower Rio Grande Valley National Wildlife Refuge of the U.S. Fish & Wildlife Service. Eradication efforts are chosen by investigating what is most useful against the targeted vegetation or wildlife, and what is least detrimental to the environment. This requires the employment of many different methods, including pest management, mechanical removal, prescribed burns, and the application of herbicides. The Lower Rio Grande Valley has a number of invasive plants: hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipe*), Eurasian watermilfoil (*Myriophyllum spicatum*), parrotfeather (*Myriophyllum aquaticum*), elephant ear (*Colocasia esculenta*), giant cane (*Arundo donax*), and salt cedar (*Tamarix spp*). The region also has problems with feral hogs and Nilgail Antelope, and the Lower Rio Grande National Wildlife Refuge has permitted professional trapping programs and permitted hunting to control these animals.

Giant cane and salt cedar bush are problems in other parts of the Rio Grande basin, and recently the State Legislature passed Senate Bill 1734, the Carrizo Cane Eradication Effort, which tasks the Texas State Soil and Water Conservation Board to create a plan to eradicate giant cane from the river banks and flood plains.



Pictured: Aquatic weeds, possibly hydrilla, completely covering a canal in the Lower Rio Grande Valley.



Pictured: Feral hog



Pictured: Aquatic weeds and young giant cane at Station 13176, Rio Grande at Boca Chica

## Federally Listed, State Listed, and Candidate Species in Texas: Nongame and Rare Species Program, Texas Parks and Wildlife Department

The Lower Rio Grande Basin, in Starr, Hidalgo, and Cameron counties, extends along the Rio Grande from Falcon Dam to the Gulf of Mexico. Along the stretch of the river basin, it is home to a variety of animal, invertebrates, and plants. Amongst the wildlife that occupy the basin are endangered and threatened species categorized by both state and federal agencies. Endangered mammals include the ocelot and jaguarundi. Endangered and threatened birds include the common black hawk and the wood stork. Endangered plants include star cactus and *Frankenia johnstonii*. The USIBWC CRP has worked with TX Parks and Wildlife Department to compile a table with the endangered species in this region. The tables are broken up by category (amphibians, birds, etc.), followed by pictures of some of the species in the preceding table. For questions on these tables, please contact USIBWC CRP staff.

**Table 10. Amphibians**

| Common Name                    | Scientific Name                   | Group     | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                       |
|--------------------------------|-----------------------------------|-----------|--------------|----------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Black-spotted Newt             | <i>Notophthalmus meridionalis</i> | Amphibian | Threatened   |                | Starr, Hidalgo, Cameron         | can be found in wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods; Gulf Coastal Plain south of the San Antonio River                                                 |
| Mexican Burrowing Toad         | <i>Rhinophrynus dorsalis</i>      | Amphibian | Threatened   |                | Zapata, Starr                   | roadside ditches, temporary ponds, arroyos, or wherever loose friable soils are present in which to burrow; generally underground emerging only to breed or during rainy periods                                                                          |
| Mexican Treefrog               | <i>Smilisca baudinii</i>          | Amphibian | Threatened   |                | Starr, Hidalgo, Cameron         | subtropical region of extreme southern Texas; breeds May-October coinciding with rainfall, eggs laid in temporary rain pools                                                                                                                              |
| Sheep Frog                     | <i>Hypopachus variolosus</i>      | Amphibian | Threatened   |                | Starr, Hidalgo, Cameron         | predominantly grassland and savanna; moist sites in arid areas                                                                                                                                                                                            |
| South Texas Siren (large form) | <i>Siren</i> sp. 1                | Amphibian | Threatened   |                | Starr, Hidalgo, Cameron         | wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods, but does require some moisture to remain; southern Texas south of Balcones Escarpment; breeds February-June       |
| White-lipped Frog              | <i>Leptodactylus fragilis</i>     | Amphibian | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | grasslands, cultivated fields, roadside ditches, and a wide variety of other habitats; often hides under rocks or in burrows under clumps of grass; species requirements incompatible with widespread habitat alteration and pesticide use in south Texas |



**Mexican Burrowing Toad**



BJ2196 [RM] © www.visualphotos.com

**South Texas Siren**



© KENNETH P. WRAY

**Sheep Frog**



**Black Spotted Newt**



**Mexican Treefrog**



**White-lipped Frog**



**Table 11. Birds**

| Common Name                   | Scientific Name                        | Group | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------|----------------------------------------|-------|--------------|----------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cactus Ferruginous Pygmy-owl  | <i>Glaucidium brasilianum cactorum</i> | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | riparian trees, brush, palm, and mesquite thickets; during day also roosts in small caves and recesses on slopes of low hills; breeding April to June                                                                                                                                                                                                                                                                                                        |
| Common Black Hawk             | <i>Buteogallus anthracinus</i>         | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | cottonwood-lined rivers and streams; willow tree groves on the lower Rio Grande floodplain; formerly bred in south Texas                                                                                                                                                                                                                                                                                                                                     |
| Eskimo Curlew                 | <i>Numenius borealis</i>               | Bird  | Endangered   | Endangered     | Cameron                         | historic; nonbreeding: grasslands, pastures, plowed fields, and less frequently, marshes and mudflats                                                                                                                                                                                                                                                                                                                                                        |
| Gray Hawk                     | <i>Buteo plagiatus</i>                 | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | locally and irregularly along U.S.-Mexico border; mature riparian woodlands and nearby semiarid mesquite and scrub grasslands; breeding range formerly extended north to southernmost Rio Grande floodplain of Texas                                                                                                                                                                                                                                         |
| Interior Least Tern           | <i>Sterna antillarum athalassos</i>    | Bird  | Endangered   | Endangered     | Zapata, Starr, Hidalgo, Cameron | subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony                                                                                                          |
| Northern Aplomado Falcon      | <i>Falco femoralis septentrionalis</i> | Bird  | Endangered   | Endangered     | Hidalgo, Cameron                | open country, especially savanna and open woodland, and sometimes in very barren areas; grassy plains and valleys with scattered mesquite, yucca, and cactus; nests in old stick nests of other bird species                                                                                                                                                                                                                                                 |
| Northern Beardless-tyrannulet | <i>Camptostoma imberbe</i>             | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | mesquite woodlands; near Rio Grande frequents cottonwood, willow, elm, and great leadtree; breeding April to July                                                                                                                                                                                                                                                                                                                                            |
| Peregrine Falcon              | <i>Falco peregrinus anatum</i>         | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat |
| Piping Plover                 | <i>Charadrius melodus</i>              | Bird  | Threatened   | Threatened     | Cameron                         | wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats                                                                                                                                                                                                                                                                                                                                                                          |



**Table 11, cont. Birds**

| Common Name             | Scientific Name                  | Group | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|----------------------------------|-------|--------------|----------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reddish Egret           | <i>Egretta rufescens</i>         | Bird  | Threatened   |                | Hidalgo, Cameron                | resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Rose-throated Becard    | <i>Pachyramphus aglaiae</i>      | Bird  | Threatened   |                | Starr, Hidalgo, Cameron         | riparian trees, woodlands, open forest, scrub, and mangroves; breeding April to July                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Rufa Red Knot           | <i>Calidris canutus rufa</i>     | Bird  |              | Threatened     | Cameron                         | Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. A small plump-bodied, short-necked shorebird that in breeding plumage, typically held from May through August, is a distinctive and unique pottery orange color. Its bill is dark, straight and, relative to other shorebirds, short-to-medium in length. After molting in late summer, this species is in a drab gray-and-white non-breeding plumage, typically held from September through April. In the non-breeding plumage, the knot might be confused with the omnipresent Sanderling. During this plumage, look for the knot's prominent pale eyebrow and whitish flanks with dark barring. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primary prey items include coquina clam ( <i>Donax</i> spp.) on beaches and dwarf surf clam ( <i>Mulinia lateralis</i> ) in bays, at least in the Laguna Madre. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. |
| Sooty Tern              | <i>Sterna fuscata</i>            | Bird  | Threatened   |                | Cameron                         | predominately 'on the wing'; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Sprague's Pipit         | <i>Anthus spragueii</i>          | Bird  |              | Candidate      | Zapata, Starr, Hidalgo, Cameron | only in Texas during migration and winter, mid-September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Texas Botteri's Sparrow | <i>Aimophila botterii texana</i> | Bird  | Threatened   |                | Hidalgo, Cameron                | grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Table 11, cont. Birds**

| Common Name       | Scientific Name           | Group | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------|-------|--------------|----------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tropical Parula   | <i>Parula pitiayumi</i>   | Bird  | Threatened   |                | Starr, Hidalgo, Cameron         | dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July                                                                                                                                                                                                                                                                                                                                  |
| White-faced Ibis  | <i>Plegadis chihi</i>     | Bird  | Threatened   |                | Hidalgo, Cameron                | prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats                                                                                                                                                                                                                                     |
| White-tailed Hawk | <i>Buteo albicaudatus</i> | Bird  | Threatened   |                | Starr, Hidalgo, Cameron         | near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May                                                                                                                                                                                                                                                                           |
| Wood Stork        | <i>Mycteria americana</i> | Bird  | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960 |
| Zone-tailed Hawk  | <i>Buteo albonotatus</i>  | Bird  | Threatened   |                | Starr, Hidalgo, Cameron         | arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions                                                                         |

**Eskimo Curlew**



**Texas Botteri's Sparrow**



**Interior Least Tern**



**Piping Plover**





**Sooty Tern**



**Northern Aplomado Falcon**



**Sprague's Pipit**



**Gray Hawk**



**White-faced Ibis**



**Zone-tailed Hawk**



**White-tailed Hawk**



**Wood Stork**



**Table 12. Fish**

| Common Name               | Scientific Name              | Group | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------|------------------------------|-------|--------------|----------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mexican Goby              | <i>Ctenogobius claytonii</i> | Fish  | Threatened   |                | Cameron                         | Southern coastal area; brackish and freshwater coastal streams                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Opossum Pipefish          | <i>Microphis brachyurus</i>  | Fish  | Threatened   |                | Cameron                         | brooding adults found in fresh or low salinity waters and young move or are carried into more saline waters after birth; southern coastal areas                                                                                                                                                                                                                                                                                                                                            |
| Rio Grande Silvery Minnow | <i>Hybognathus amarus</i>    | Fish  | Endangered   | Endangered     | Zapata, Starr, Hidalgo, Cameron | extirpated; historically Rio Grande and Pecos River systems and canals; reintroduced in Big Bend area; pools and backwaters of medium to large streams with low or moderate gradient in mud, sand, or gravel bottom; ingests mud and bottom ooze for algae and other organic matter; probably spawns on silt substrates of quiet coves                                                                                                                                                     |
| River Goby                | <i>Awaous banana</i>         | Fish  | Threatened   |                | Hidalgo, Cameron                | Southern coastal waters; clear water with slow to moderate current, sandy or hard bottom, and little or no vegetation; also enters brackish and ocean waters                                                                                                                                                                                                                                                                                                                               |
| Smalltooth Sawfish        | <i>Pristis pectinata</i>     | Fish  | Endangered   | Endangered     | Cameron                         | different life history stages have different patterns of habitat use; young found very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 32 ft (10 m); in sheltered bays, on shallow banks, and in estuaries or river mouths; adult sawfish are encountered in various habitat types (mangrove, reef, seagrass, and coral), in varying salinity regimes and temperatures, and at various water depths, feed on a variety of fish species and crustaceans |

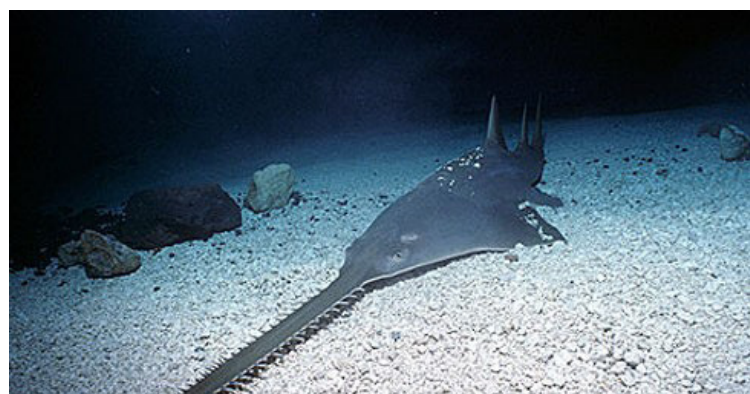
**Opossum Pipefish**



**Rio Grande Silvery Minnow**



**Smalltooth Sawfish**





**Table 13. Invertebrate**

| Common Name     | Scientific Name              | Group        | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                    |
|-----------------|------------------------------|--------------|--------------|----------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| False Spike     | <i>Quadrula mitchelli</i>    | Invertebrate | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins |
| Salina Mucket   | <i>Potamilus metnecktayi</i> | Invertebrate | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | lotic waters; submerged soft sediment (clay and silt) along river bank; other habitat requirements are poorly understood; Rio Grande Basin                                                                                                                             |
| Texas Hornshell | <i>Popenaias popeii</i>      | Invertebrate | Threatened   | Candidate      | Zapata, Starr, Hidalgo, Cameron | both ends of narrow shallow runs over bedrock, in areas where small-grained materials collect in crevices, along river banks, and at the base of boulders; not known from impoundments; Rio Grande Basin and several rivers in Mexico                                  |

**False Spike**



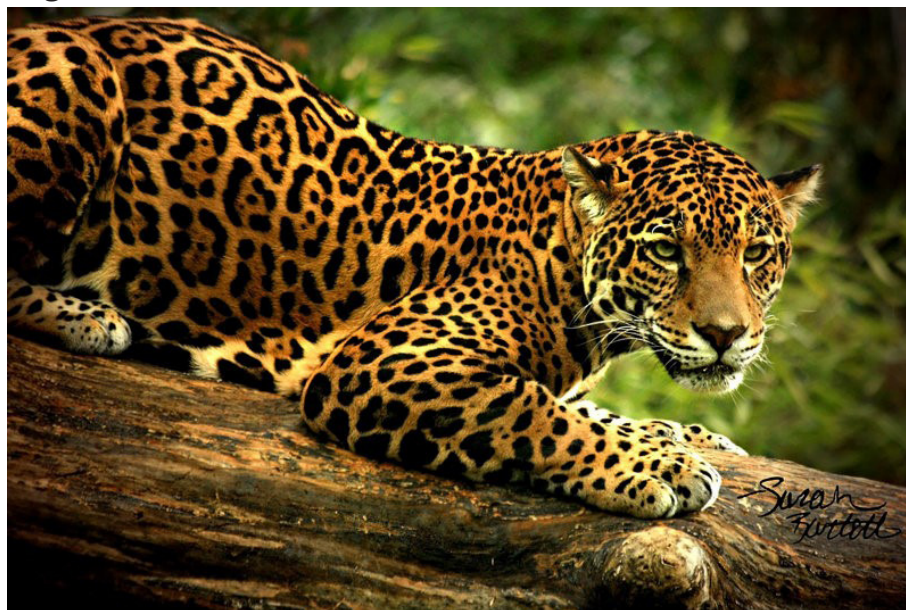
**Texas Hornshell**



**Table 14. Mammals**

| Common Name         | Scientific Name               | Group  | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                              |
|---------------------|-------------------------------|--------|--------------|----------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coues' Rice Rat     | <i>Oryzomys couesi</i>        | Mammal | Threatened   |                | Starr, Hidalgo, Cameron         | cattail-bulrush marsh with shallower zone of aquatic grasses near the shoreline; shade trees around the shoreline are important features; prefers salt and freshwater, as well as grassy areas near water; breeds April-August                   |
| Jaguar              | <i>Panthera onca</i>          | Mammal | Endangered   | Endangered     | Hidalgo, Cameron                | extirpated; dense chaparral; no reliable TX sightings since 1952                                                                                                                                                                                 |
| Jaguarundi          | <i>Herpailurus yaguarondi</i> | Mammal | Endangered   | Endangered     | Zapata, Starr, Hidalgo, Cameron | thick brushlands, near water favored; 60 to 75 day gestation, young born sometimes twice per year in March and August, elsewhere the beginning of the rainy season and end of the dry season                                                     |
| Ocelot              | <i>Leopardus pardalis</i>     | Mammal | Endangered   | Endangered     | Zapata, Starr, Hidalgo, Cameron | dense chaparral thickets; mesquite-thorn scrub and live oak mottes; avoids open areas; breeds and raises young June-November                                                                                                                     |
| Southern Yellow Bat | <i>Lasiurus ega</i>           | Mammal | Threatened   |                | Hidalgo, Cameron                | associated with trees, such as palm trees ( <i>Sabal mexicana</i> ) in Brownsville, which provide them with daytime roosts; insectivorous; breeding in late winter                                                                               |
| West Indian Manatee | <i>Trichechus manatus</i>     | Mammal | Endangered   | Endangered     | Cameron                         | Gulf and bay system; opportunistic, aquatic herbivore                                                                                                                                                                                            |
| White-nosed Coati   | <i>Nasua narica</i>           | Mammal | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | woodlands, riparian corridors and canyons; most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade |

**Jaguar**





Ocelot



Jaguarundi



White-nosed Coati



Coues' Rice Rat



Southern Yellow Bat



**Table 15. Plant**

| Common Name          | Scientific Name                 | Group | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|---------------------------------|-------|--------------|----------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ashy Dogweed         | <i>Thymophylla tephroleuca</i>  | Plant | Endangered   | Endangered     | Zapata, Starr                   | Texas endemic; grasslands with scattered shrubs; most sites on sands or sandy loams on level or very gently rolling topography over Eocene strata of the Laredo Formation; flowering March-May depending to some extent on rainfall                                                                                                                                                                                                                                                                                                                       |
| Johnston's Frankenia | <i>Frankenia johnstonii</i>     | Plant | Endangered   | Endangered     | Zapata, Starr                   | dwarf shrublands on strongly saline, highly alkaline, calcareous or gypseous, clayey to sandy soils of valley flats or rocky slopes; mapped soils at many sites are of the Catarina and/or Maverick Series, other mapped soils include Copita, Brennan, Zapata, and Montell series; most sites are underlain by Eocene sandstones and clays of the Jackson Group or the Yegua and Laredo formations; a few are underlain by El Pico clay or the Catahoula and Frio formations shrublands; flowering throughout the growing season depending upon rainfall |
| South Texas Ambrosia | <i>Ambrosia cheiranthifolia</i> | Plant | Endangered   | Endangered     | Cameron                         | grasslands and mesquite-dominated shrublands on various soils ranging from heavy clays to lighter textured sandy loams, mostly over the Beaumont Formation on the Coastal Plain; in modified unplowed sites such as railroad and highway right-of-ways, cemeteries, mowed fields, erosional areas along small creeks; flowering July-November                                                                                                                                                                                                             |
| Star Cactus          | <i>Astrophytum asterias</i>     | Plant | Endangered   | Endangered     | Zapata, Starr, Hidalgo, Cameron | gravelly clays or loams, possibly of the Catarina Series (deep, droughty, saline clays), over the Catahoula and Frio formations, on gentle slopes and flats in sparsely vegetated openings between shrub thickets within mesquite grasslands or mesquite-blackbrush thorn shrublands; plants sink into or below ground during dry periods; flowering from mid March-May, may also flower in warmer months after sufficient rainfall, flowers most reliably in early April; fruiting mid April-June                                                        |
| Texas Ayenia         | <i>Ayenia limitaris</i>         | Plant | Endangered   | Endangered     | Hidalgo, Cameron                | Subtropical thorn woodland or tall shrubland on loamy soils of the Rio Grande Delta; known site soils include well-drained, calcareous, sandy clay loam (Hidalgo Series) and neutral to moderately alkaline, fine sandy loam (Willacy Series); also under or among taller shrubs in thorn woodland/thorn shrubland; flowering throughout the year with sufficient rainfall                                                                                                                                                                                |
| Walker's Manioc      | <i>Manihot walkerae</i>         | Plant | Endangered   | Endangered     | Starr, Hidalgo                  | periphery of native brush in sandy loam; rare on caliche cuestras; flowering April-September, possibly following rains                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Zapata Bladder-pod   | <i>Physaria thamnophila</i>     | Plant | Endangered   | Endangered     | Zapata, Starr                   | open, thorn shrublands on shallow, well-drained sandy loams and sandstone outcrops of Eocene origin, including the Jackson Group and Yegua and Laredo formations; the known sites' soils are mapped as Zapata, Maverick, Catarina, or Copita Series; flowering usually February-April, but also summer or fall depending on rainfall                                                                                                                                                                                                                      |



**Ashy Dogweed**



**Johnston's Frankenia**



**South Texas Ambrosia**



**Star Cactus**



**Texas Ayenia**



**Zapata Bladderpod**



**Walker's Manioc**



**Table 16. Reptile**

| Common Name                | Scientific Name                   | Group   | State Status | Federal Status | County                  | Habitat & Phenology                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|-----------------------------------|---------|--------------|----------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Black-striped Snake        | <i>Coniophanes imperialis</i>     | Reptile | Threatened   |                | Hidalgo, Cameron        | extreme south Texas; semi-arid coastal plain, warm, moist microhabitats and sandy soils; proficient burrower; eggs laid April-June                                                                                                                                                                                                                                                     |
| Green Sea Turtle           | <i>Chelonia mydas</i>             | Reptile | Threatened   | Threatened     | Cameron                 | Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches; adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds; nesting behavior extends from March to October, with peak activity in May and June |
| Hawksbill Sea Turtle       | <i>Eretmochelys imbricata</i>     | Reptile | Endangered   | Endangered     | Cameron                 | Gulf and bay system, warm shallow waters especially in rocky marine environments, such as coral reefs and jetties, juveniles found in floating mats of sea plants; feed on sponges, jellyfish, sea urchins, molluscs, and crustaceans, nests April through November                                                                                                                    |
| Kemp's Ridley Sea Turtle   | <i>Lepidochelys kempii</i>        | Reptile | Endangered   | Endangered     | Cameron                 | Gulf and bay system, adults stay within the shallow waters of the Gulf of Mexico; feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August                                                                                                                                      |
| Leatherback Sea Turtle     | <i>Dermochelys coriacea</i>       | Reptile | Endangered   | Endangered     | Cameron                 | Gulf and bay systems, and widest ranging open water reptile; omnivorous, shows a preference for jellyfish; in the US portion of their western Atlantic nesting territories, nesting season ranges from March to August                                                                                                                                                                 |
| Loggerhead Sea Turtle      | <i>Caretta caretta</i>            | Reptile | Threatened   | Threatened     | Cameron                 | Gulf and bay system primarily for juveniles, adults are most pelagic of the sea turtles; omnivorous, shows a preference for mollusks, crustaceans, and coral; nests from April through November                                                                                                                                                                                        |
| Northern Cat-eyed Snake    | <i>Leptodeira septentrionalis</i> | Reptile | Threatened   |                | Starr, Hidalgo, Cameron | Gulf Coastal Plain south of the Nueces River; thorn brush woodland; dense thickets bordering ponds and streams; semi-arboreal; nocturnal                                                                                                                                                                                                                                               |
| Reticulate Collared Lizard | <i>Crotaphytus reticulatus</i>    | Reptile | Threatened   |                | Zapata, Starr, Hidalgo  | requires open brush-grasslands; thorn-scrub vegetation, usually on well-drained rolling terrain of shallow gravel, caliche, or sandy soils; often on scattered flat rocks below escarpments or isolated rock outcrops among scattered clumps of prickly pear and mesquite                                                                                                              |
| Speckled Racer             | <i>Drymobius margaritiferus</i>   | Reptile | Threatened   |                | Hidalgo, Cameron        | extreme south Texas; dense thickets near water, Texas palm groves, riparian woodlands; often in areas with much vegetation litter on ground; breeds April-August                                                                                                                                                                                                                       |



**Table 16, cont. Reptile**

| Common Name         | Scientific Name                       | Group   | State Status | Federal Status | County                          | Habitat & Phenology                                                                                                                                                                                                                                                                                         |
|---------------------|---------------------------------------|---------|--------------|----------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Texas Horned Lizard | <i>Phrynosoma cornutum</i>            | Reptile | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September                                       |
| Texas Indigo Snake  | <i>Drymarchon melanurus erebennus</i> | Reptile | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | Texas south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated croplands if not molested or indirectly poisoned; requires moist microhabitats, such as rodent burrows, for shelter |
| Texas Scarlet Snake | <i>Cemophora coccinea lineri</i>      | Reptile | Threatened   |                | Cameron                         | mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September                                                                                                                                                                                                          |
| Texas Tortoise      | <i>Gopherus berlandieri</i>           | Reptile | Threatened   |                | Zapata, Starr, Hidalgo, Cameron | open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November             |

**Texas Horned Lizard**



**Texas Tortoise**





**Leatherback Sea Turtle**



**Texas Scarlet Snake**



**Texas Indigo Snake**



**Reticulate Collared Lizard**



**Northern Cat-eyed Snake**



**Black-striped Snake**



**Kemp's Ridley Sea Turtle**

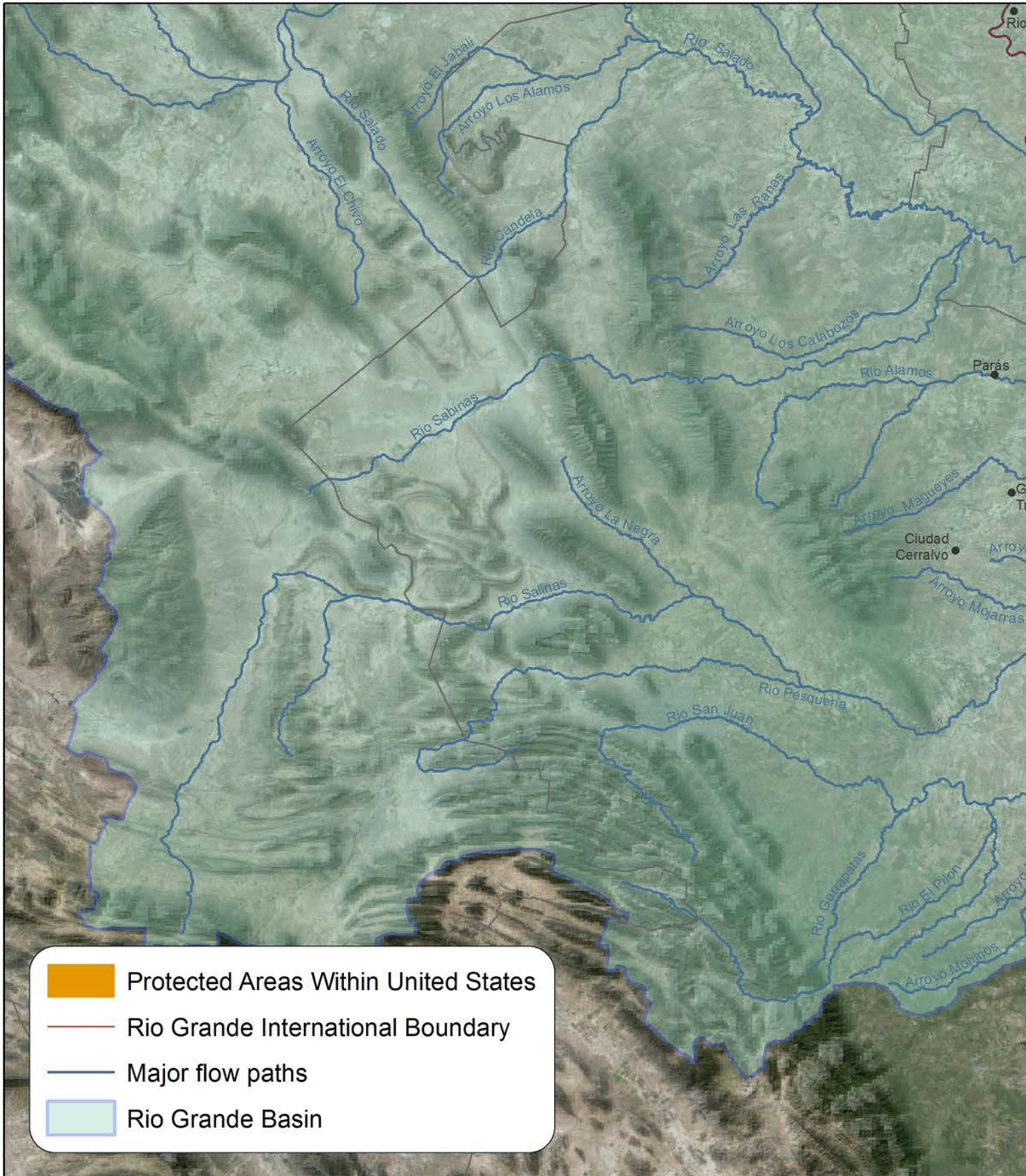





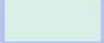
**Speckled Racer**





# Protected Areas Within the United States



-  Protected Areas Within United States
-  Rio Grande International Boundary
-  Major flow paths
-  Rio Grande Basin



Protected areas within United States downloaded from USGS National Gap Analysis  
Basin delineation and major flow paths download from the USGS  
City locations downloaded from the USGS  
Imagery provided by DigitalGlobe



# States in the Lower Rio Grande Valley



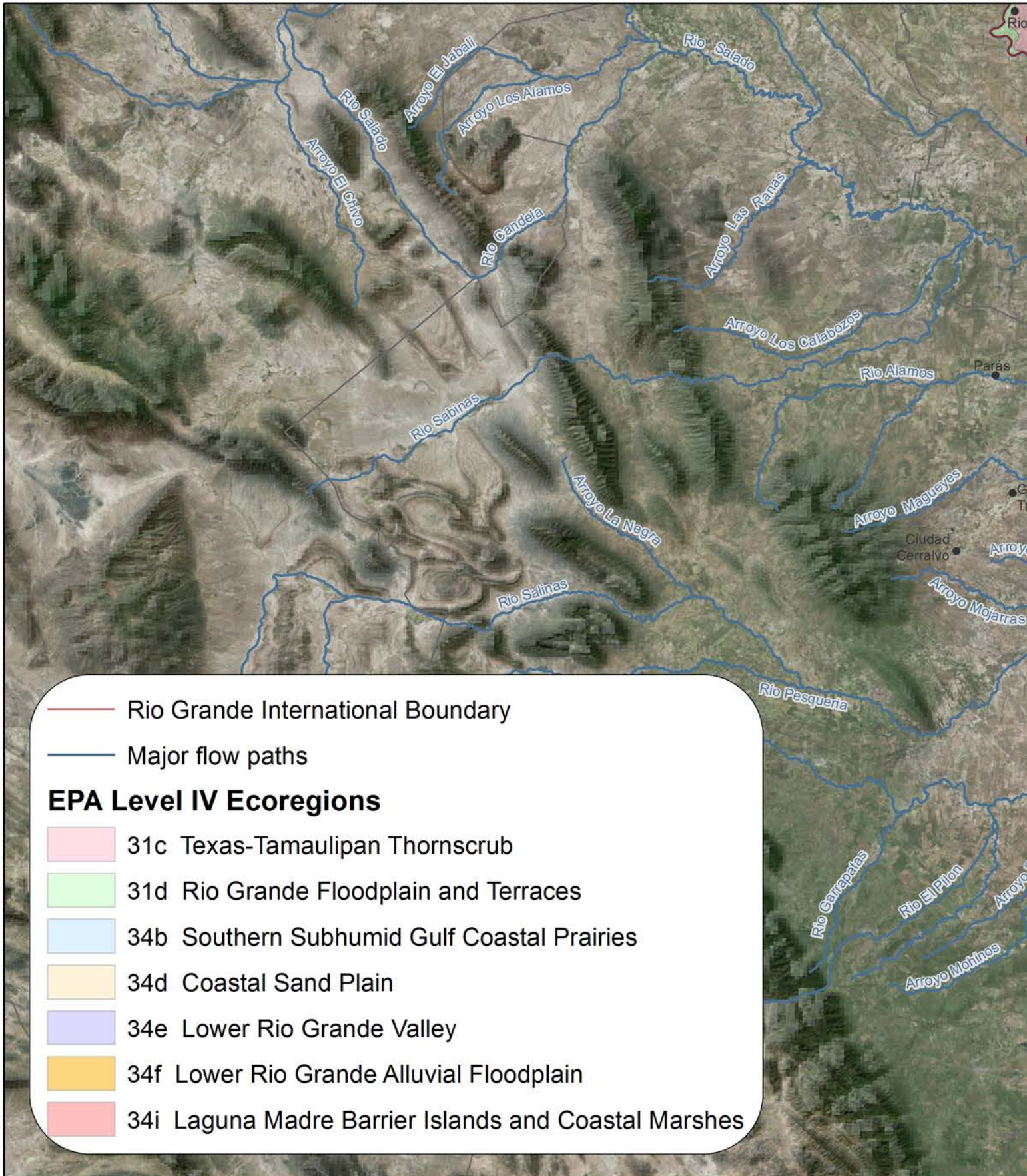
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Program, Protected Areas Database of the United States 1.3, Published in 2012.  
University of Texas Center for Research in Water Resources.  
Border Environmental Health Initiative.  
led by Esri.





# EPA Level IV Ecoregions Within the United



Basin delineation and major flow paths download from the USGS  
City locations downloaded from the USGS  
Level IV ecoregions download from the EPA  
Imagery provided by Google Earth



# United States in the Lower Rio Grande Valley



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

University of Texas Center for Research in Water Resources.  
Border Environmental Health Initiative.  
Downloaded from the EPA.  
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# CRP Website and References

## Watershed Characterization Report

The goal of the USIBWC CRP is to ensure that the public and stakeholders are informed of the water quality related activities occurring throughout the basin. The intent of the basin reports is to disseminate that information and also demonstrate the effective use of program data. The Watershed Characterization Report is an in-depth look at a river basin. Future basin reports from the USIBWC CRP will be in similar format for the Middle and Upper Rio Grande Basin. We invite partners, stakeholders and members of the public to submit small summaries of projects occurring in the basin. We seek people/issues/projects that should be highlighted that we could include in these reports, or any other issues pertinent to our river basin. We ask the public to submit pictures of the river, recreational activities, natural scenery and wildlife.

### The USIBWC CRP maintains a website with a wealth of information for the public:

- **About CRP:** An introduction to the Rio Grande Basin
- **Contact Information:** Contacts for the USIBWC CRP and program information
- **Study Area:** Contains maps of the Rio Grande Basin and of the monitoring locations
- **Monitoring Station Data:** USIBWC CRP and TCEQ water quality data in Excel files by station; information about quality assurance, parameters, and standards.
- **Other Information:** A calendar provides information on upcoming meetings and activities. There are links to studies and publications about the Rio Grande Watershed and the USIBWC Adopt-a-River program. Partner links provide resources for monitoring partners, links to other planning agencies, and links to environmental groups and resources for the Rio Grande.
- **Media Gallery:** Photo albums and videos about monitoring, research, geography, wildlife, and outreach. Our video gallery now includes a number of videos, the most recent being about water quality in the Rio Grande.

### Additional Resources and Links:

TSWQS: <https://www.tceq.texas.gov/waterquality/standards/2014standards.html>

SWQM: <http://www.tceq.texas.gov/waterquality/monitoring>

Integrated Report: [https://www.tceq.texas.gov/waterquality/assessment/public\\_comment](https://www.tceq.texas.gov/waterquality/assessment/public_comment)

Coordinated Monitoring Schedule: <http://cms.lcra.org/>

EPA Recreational WQ Criteria: <http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/>

The Disappearing Rio Grande <http://riogrande.texastribune.org/>

TPWD Kills and Spills team: [https://tpwd.texas.gov/landwater/water/environconcerns/kills\\_and\\_spills/](https://tpwd.texas.gov/landwater/water/environconcerns/kills_and_spills/)

Water Resources: <http://www.twdb.texas.gov/waterplanning>

RGISC: <http://rgisc.org/>

USIBWC website: <http://www.ibwc.gov/home.html>

U.S. Army Core of Engineers, A Survey of the Invasive Aquatic and Riparian Plants of the Lower Rio Grande

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USIBWC CRP Website

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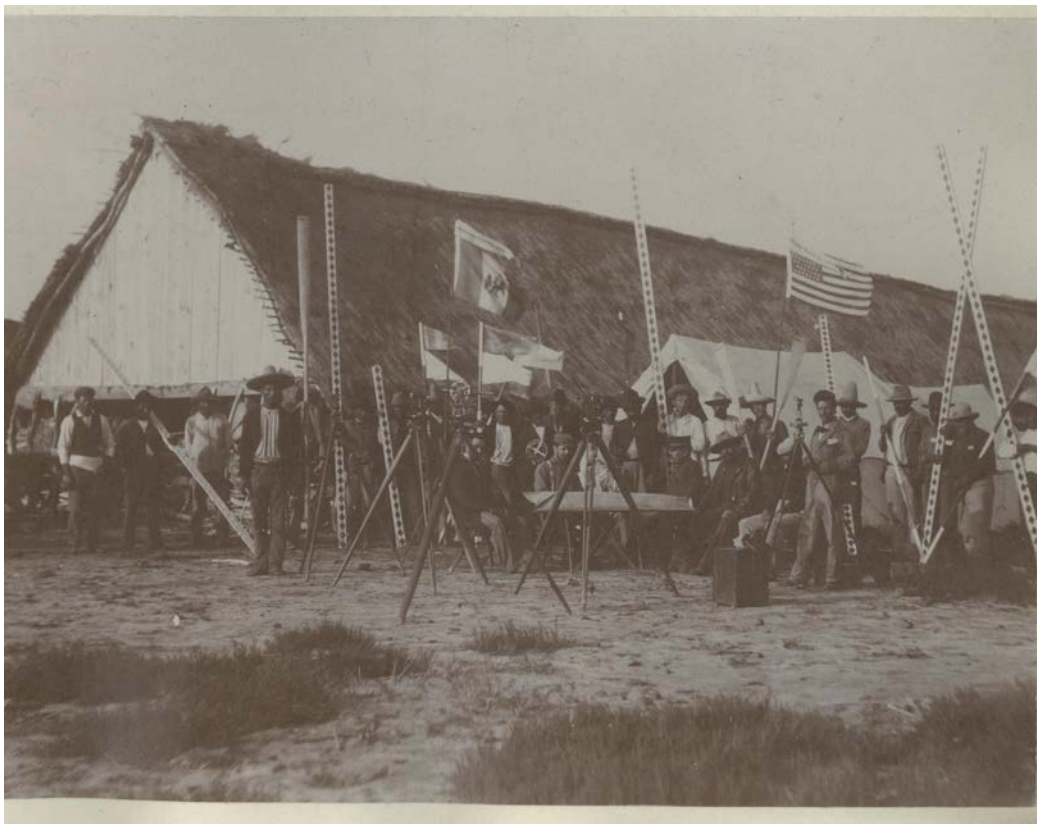
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## Additional historical photos of the Lower Rio Grande Valley



Early Aerial Photograph of Anzalduas Diversion Dam near Mission, Texas on the Rio Grande showing the U.S. off-river “Banker” Floodway, which, as a principle part of the International Project for control of floods of the Lower Rio Grande, serves to divert floodwaters from the river to the U.S. floodways. This photo also shows Mexico’s intake structure to its Anzalduas Irrigation Canal.



April 20, 1898: Staff of the IBWC, Mexican Section in Bagdad, Tamaulipas on the final day of surveying. Both the U.S. and Mexican flags are seen in the picture, signifying the boundary. Bagdad, Tamaulipas was established in 1848 on the south bank of the mouth of the Rio Grande. Presently it is known as the Port of Matamoros, in Matamoros, Tamaulipas.



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