2021

BASIN HIGHLIGHTS REPORT

WATERSHED CHARACTERIZATION OF THE UPPER RIO GRANDE SUB-BASIN

PROGRAM UPDATE

INTERNATIONAL BOUNDARY AND WATER COMMISSION, U.S. SECTION

TEXAS CLEAN RIVERS PROGRAM FOR THE RIO GRANDE BASIN

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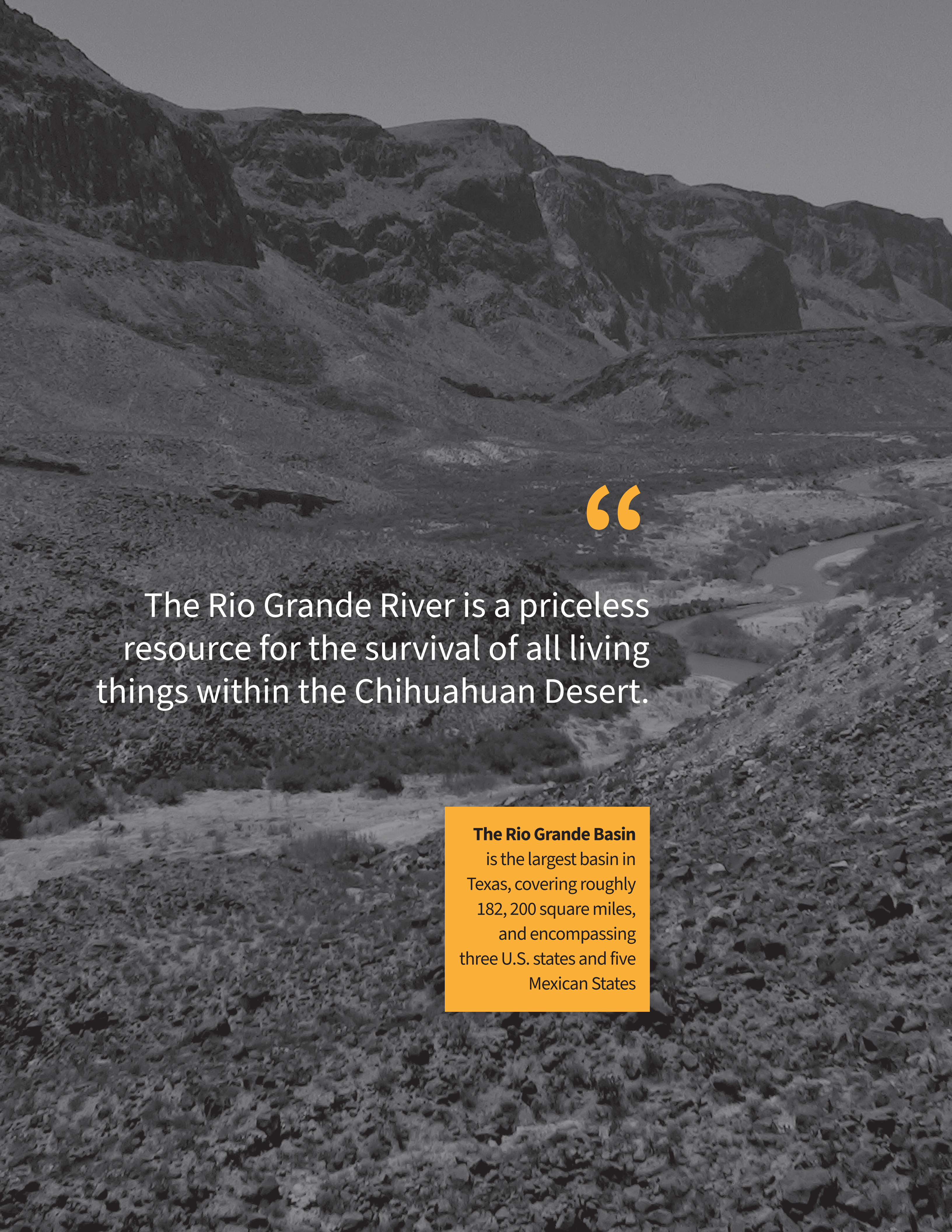


> "The Rio Grande River is a priceless resource for the survival of all living things within the Chihuahuan Desert.

The Rio Grande Basin is the largest basin in Texas, covering roughly 182, 200 square miles, and encompassing three U.S. states and five Mexican States

EXECUTIVE SUMMARY

2021 UPPER RIO GRANDE BASIN HIGHLIGHTS REPORT

The Texas Clean Rivers Program (CRP), born out of the Texas Clean Rivers Act, was created to address water resources in an integrated and systematic manner. The CRP was created specifically to perform water quality monitoring, assessment and public outreach. It aims to improve the quality of water within each river basin in Texas through partnerships with the Texas Commission on Environmental Quality (TCEQ) and participating entities.

The USIBWC CRP has divided the basins in Texas into four sub-regions: the Pecos, Upper, Middle and Lower Rio Grande. This report will focus on the Upper Rio Grande Sub-Basin, which extends from the New Mexico/ Texas state line downstream to International Amistad Reservoir.

This report provides a detailed look at the water quality data collected within this sub-basin, reviews the various factors that have an impact on water quality, and outlines efforts made to improve water quality. The summary statistics presented in the watershed characterization portion of the report are compiled from 10 years of water quality data collected by the TCEQ El Paso and Laredo regional offices and the USIBWC CRP.

2021 UPPER RIO GRANDE BASIN HIGHLIGHTS REPORT

Life is not sustainable without water; it is essential to every living thing on the planet. Water is a crucial part of our every day lives, from the irrigation fields that grow our food to the water that comes out of our faucets at home. In a time when we are facing water shortages worldwide, the quality of the water we do have is even more important. Water quality can affect aquatic life, ecosystems, and even public health, so water quality monitoring is essential to ensure the safety of our water bodies.

The Rio Grande River's headwaters begin in the beautiful San Juan Mountains in the State of Colorado. It flows through Colorado, New Mexico and Texas, a total of 1,896 miles, and empties into the Gulf of Mexico. Once the Rio Grande enters Texas, it forms the 1, 250-mile international border between Texas and five Mexican states.

The binational nature of this river within Texas presents its own unique and complicated challenges regarding how water quality issues are addressed. This, coupled with severe drought, makes managing a manipulated water system all that more complicated. How do we manage a water system where every drop of water is counted? How do we manage a river system where the two countries that share it have different water quality standards, different water quality indicators and different processes? The answer lies in the unique relationship that exists between the U.S. International Boundary and Water Commission (USIBWC) and the Texas Commission on Environmental Quality (TCEQ) through the Clean Rivers Program (CRP) for the Rio Grande Basin.

USIBWC AND CRP

The Texas Clean Rivers Program (CRP), born out of the Texas Clean Rivers Act (Senate Bill 818) passed by the State Legislature in 1991, was created to address water resources in an integrated and systematic manner. The CRP was created specifically to perform 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 (TCEQ) and participating entities. Whereas most of the river systems in Texas had a designated river authority or similar entity charged with its oversight, the Rio Grande was unique in that there was no such entity. Instead, there was the USIBWC, the federal agency charged with overseeing the international treaties with Mexico governing the international border and waters of the Rio Grande River.

In 1998, the State of Texas (through TCEQ) contracted with the 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 of Texas 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 15 partners and 52 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.

PURPOSE AND SCOPE

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 Upper Rio Grande Sub-basin, which extends from the New Mexico/Texas state line downstream and emptying into Amistad Reservoir (Segments 2305, 2306, 2307, 2308, 2309 and 2314).

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 water quality and information on activities performed to improve water quality. The summary statistics presented in the watershed characterization portion of the report is compiled from 10 years (2010- 2020) of water quality data collected by the USIBWC CRP American Dam, Presidio and Amistad field offices, Big Bend National Park, Texas Parks and Wildlife, and the TCEQ Regional El Paso and Laredo field offices. Where the data and/or information refers 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. Contact information is available on the inside cover of this report.

CRP PARTNERS

The USIBWC Clean Rivers Program is proud to be partnered with 15 partners: 3 laboratories, five USIBWC field offices, two universities, two municipalities, one non-profit organization, a national park and a state park. 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.

WATER QUALITY STATUS

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 2018 TSWQS for the Rio Grande Basin and the 2020 Integrated Report can be found at the following links.

https://www.tceq.texas.gov/waterquality/standards/2018-surface-water-quality-standards

https://www.tceq.texas.gov/waterquality/assessment/20twqi

COORDINATED MONITORING

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/

In addition to coordinating with the large network of volunteer partners, the USIBWC CRP also collaborates with the TCEQ regional field offices that work along the Rio Grande, ensuring a complete assessment of the monitoring activities occurring along the watershed.

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. 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 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.

CRP Partners in the Upper Rio Grande Sub-Basin

There are six partners that work collaboratively within the Upper Rio Grande Sub-Basin:

USIBWC American Dam/Carlos Marin Field Office

The USIBWC American Dam/Carlos Marin field office recently welcomed the addition of Alfredo Rojas as the hydrotech. Fred is currently undergoing training with USIBWC CRP staff and collects at water samples at Stations 13272, 15528, 15529, and 14465.

El Paso Water- International Water Quality Laboratory

El Paso Water's (EPW) laboratory provides the laboratory analysis for the stations collected by the USIBWC American Dam/Carlos Marin field office. This is a long-time mutual agreement between the USIBWC and EPW- our staff collect the water samples at these important river sites, and the laboratory provides the laboratory analysis.

USIBWC CRP Staff

The USIBWC CRP staff work out of USIBWC Headquarters in El Paso, TX. Leslie Grijalva and Lisa Torres collect samples at eight water quality stations in the El Paso and surrounding area (Stations 13276, 13275, 13274, 17040, 15089, 15704, 15795, and 22193) while also administering the program.

USIBWC Presidio Field Office

Albert Covos at the USIBWC Presidio Field Office has collected water samples at Stations 17407, 13229, 13230, 17000 and 17001 in the Presidio area for a few years now. Albert is originally from the Presidio, TX area and brings important local knowledge of the area to the program.

Texas Parks and Wildlife Dept., Big Bend Ranch State Park

The TPWD Natural Resources Program staff assist the program by collecting water samples in Big Bend Ranch State Park. Price Rumbelow and Nicolas Havlik collect samples at Stations 16862 and 18441 in the state park, providing the only water quality data within the state park area to the program. They are staffed out of Ft. Davis and make the drive down to the state park quarterly for sampling.

Big Bend National Park

Big Bend National Park recently welcomed new Physical Scientist Dustin Renninger, who will be taking over the water sampling collection at Stations 16730 and 13228. These stations provide important water quality data for the national park, providing a snapshot of water quality in a location used for recreation and before heading into the Rio Grande's Wild and Scenic portion of the river.

Amistad Dam

Amistad Dam (Presa la Amistad) is a major embankment dam across the Rio Grande between Texas, United States, and Coahuila, Mexico. Built to provide irrigation water storage, flood control, and hydropower generation, it is the largest dam along the international boundary reach of the Rio Grande.

OVERVIEW OF WATER QUALITY MONITORING

During the past year, the USIBWC CRP continued to maintain its large network of water quality stations. The CRP and the 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:

- **Are the waters of the Rio Grande swimmable?**
- **Are the waters of the Rio Grande drinkable?**
- **Do the waters of the Rio Grande provide fishing opportunities?**
- **Is the habitat in the Rio Grande Watershed healthy for aquatic life?**

CRP partners throughout the basin collect water quality and sediment samples at about 52 routine monitoring stations. When these samples are collected for laboratory analysis, personnel also make field observations to re¬cord 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 Surface Water Quality Standards (TSWQS) criteria and screening levels in Tables 1, 2 and 4; these steps are described in the next sections.

Routine water quality monitoring is performed at fixed locations at regular intervals throughout the year

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.

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

2018 Texas Surface Water Quality Standards for the Rio Grande Basin												
SEGMENT		USES			CRITERIA							
Segment	Segment Name	Recreation	Aquatic Life	Domestic Water Supply	Cl^- (mg/L)	SO_4^{2-} (mg/L)	TDS (mg/L)	DO (mg/L)	pH Range (SU)	Indicator Bacteria[1] (#/100 mL)	Temperature (F)
2301	Rio Grande Tidal	PCR1	E					5.0	6.5-9.0	35	95
2302	Rio Grande Below Falcon Reservoir	PCR1	H	PS	270	350	880	5.0	6.5-9.0	126	90
2303	International Falcon Reservoir	PCR1	H	PS	200	300	1,000	5.0	6.5-9.0	126	93
2304	Rio Grande Below Amistad Reservoir	PCR1	H	PS	200	300	1,000	5.0	6.5-9.0	126	95
2305	International Amistad Reservoir	PCR1	H	PS	150	270	800	5.0	6.5-9.0	126	88
2306	RG Above Amistad International Reservoir	PCR1	H	PS	200	450	1,400	5.0	6.5-9.0	126	93
2307	RG Below Riverside Diversion Dam	PCR1	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[2]	PCR1	E	PS	50	50	300	6.0	6.5-9.0	126	90
2310	Lower Pecos River	PCR1	H	PS	1,700	1,000	4,000	5.0	6.5-9.0	126	92
2311	Upper Pecos River	PCR1	L		7,000	3,500	15,000	5.0[3]	6.5-9.0	33	92
2312	Red Bluff Reservoir	PCR1	H		3,200	2,200	9,400	5.0	6.5-9.0	33	90
2313	San Felipe Creek[2]	PCR1	H	PS	50	50	400	5.0	6.5-9.0	126	90
2314	Rio Grande Above International Dam	PCR1	H	PS	340	600	1,800	5.0	6.5-9.0	126	92
2315	Rio Grande Below Rio Conchos	PCR1	H		450	750	2,100	5.0	6.5-9.0	126	93

Definitions

PCR1– Primary Contact Recreation H – High Aquatic Life L – Limited Aquatic Life E – Exceptional Aquatic Life
PS – Public Water Supply Cl^- – Chloride SO_4^{2-} – Sulfate TDS – Total Dissolved Solids NCR – Non Contact Recreation

Footnote:
1 - The indicator bacteria for freshwater is *E. coli* and for saltwater is Enterococci. The indicator bacteria for Segments 2311 and 2312 is Enterococci.
2 - The critical low-flow is calculated in accordance with 307.8(a)(2)(A) of this title.
3 - The 24-hour minimum dissolved oxygen criterion is 1.0mg/L.
Source to these standards: https://www.tceq.texas.gov/waterquality/standards/2018-surface-water-quality-standards

Table 2. Designated Uses for Freshwater

Designated Use	Description	Primary Parameter	Criteria
Contact Recreation (CR)	3 levels depending on the use of the water: Fishing, swimming, wading, boating, etc. Note: Secondary contact recreation criteria is not applied in any of the seg-ments in the Rio Grande Basin	Bacteria: *E. Coli* Tidal and saline- Enterococcus (Entero)	Primary Contact Recreation (significant possibility of water ingestion, i.e. swimming). Geometric mean: 126 colony forming units (CFU) for E. Coli 35 CFU Entero
			Secondary Contact Recreation (limited body contact that poses a less significant risk of ingestion of water, i.e. fishing, boating)
			Non- Contact Recreation: Unsuitable for contact recreation
Public Water Supply (PS)	Drinking water source	See full list of Human Health Criteria in Table 2 of the TSWQS	
Aquatic Life Use (ALU)	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	
Fish Consumption (FC)	Prevent contamination to protect human health	See full list of Human Health Criteria in Table 2 of the TSWQS Example: Mercury - 0.0122 ug/L in water & fish	
General Use (GU)	General water quality	Water Temp, High pH, Low pH, Dissolved Solids, Nutrients, and Chlorophyll-a. See Tables 2 and 4 in this document.	

DESIGNATED USES

The State of Texas assigns designated uses to specific water bodies. Table 2 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 by children, boating, and direct water contact. *E. Coli* and Enterococci bacteria are used as indicators. The proposed 2014 revisions to the TSWQS created subcategories 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 includes a list of parameters that are screened to ensure safe domestic water supply use.

Aquatic life use (ALU) – This designated use is designed to protect aquatic species including fish and benthic macroinvertebrates (aquatic insects). This designated use has four levels depending on the ability of a water body to support aquatic life (exceptional, high, intermediate, and limited). The primary parameter used to determine the ALU of a waterbody is DO.

Fish consumption (FC) – This applies to all water bodies where citizens may collect and consume fish. The TSWQS includes 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.

Photo credit: Leslie Grijalva

WATER QUALITY PARAMETERS, IMPAIRMENTS AND CONCERNS

*Table 3. Table of Water Quality Impairments and Concerns from the 2020 305(b) Texas Water Quality Inventory and 303(d) List of Impaired Waterbodies**

Segment	Segment Name	Parameter(s) Impaired	Parameter of Concern
2301	Rio Grande Tidal		Bacteria, Chlorophyll-a, Nitrate, DO[1]
2302	Rio Grande Below Falcon Reservoir	Bacteria	Ammonia, Chlorophyll-a, DO[1]
2302A	Arroyo Los Olmos	Bacteria	Chlorophyll-a, DO[1]
2303	International Falcon Reservoir		Fish Kills, Toxicity in Water
2304	Rio Grande Below Amistad Reservoir	Bacteria	Ammonia, Toxicity in Water
2304B	Manadas Creek		Antimony in Sediment, Bacteria, Nitrate, Total Phosphorus
2305	International Amistad Reservoir		Fish Kills
2306	Rio Grande Above Amistad Reservoir	Sulfate	Chlorophyll-a, Fish Kills, Total Phosphorus
2307	Rio Grande Below Riverside Diversion Dam	Bacteria, Chloride, TDS	Ammonia, Chlorophyll-a, DO[1], Nitrate, Total Phosphorus
2308	Rio Grande Below International Dam	Bacteria	Ammonia, Chlorophyll-a, Total Phosphorus
2310	Lower Pecos	TDS[2]	
2311	Upper Pecos River	DO	Bacteria, Chlorophyll-a
2312	Red Bluff Reservoir		DO[1]
2313	San Felipe Creek	Bacteria	
2314	Rio Grande Above International Dam	Bacteria	Ammonia, Chlorophyll-a, Nitrate, Total Phosphorus

* Information obtained from the 2020 Texas Integrated Report.
[1] Dissolved Oxygen. If DO is listed as a concern, then the mean concentration exceeded the screening level for a grab sample.
[2] Newly Listed Impairment.

Table 4. Water Quality Parameters

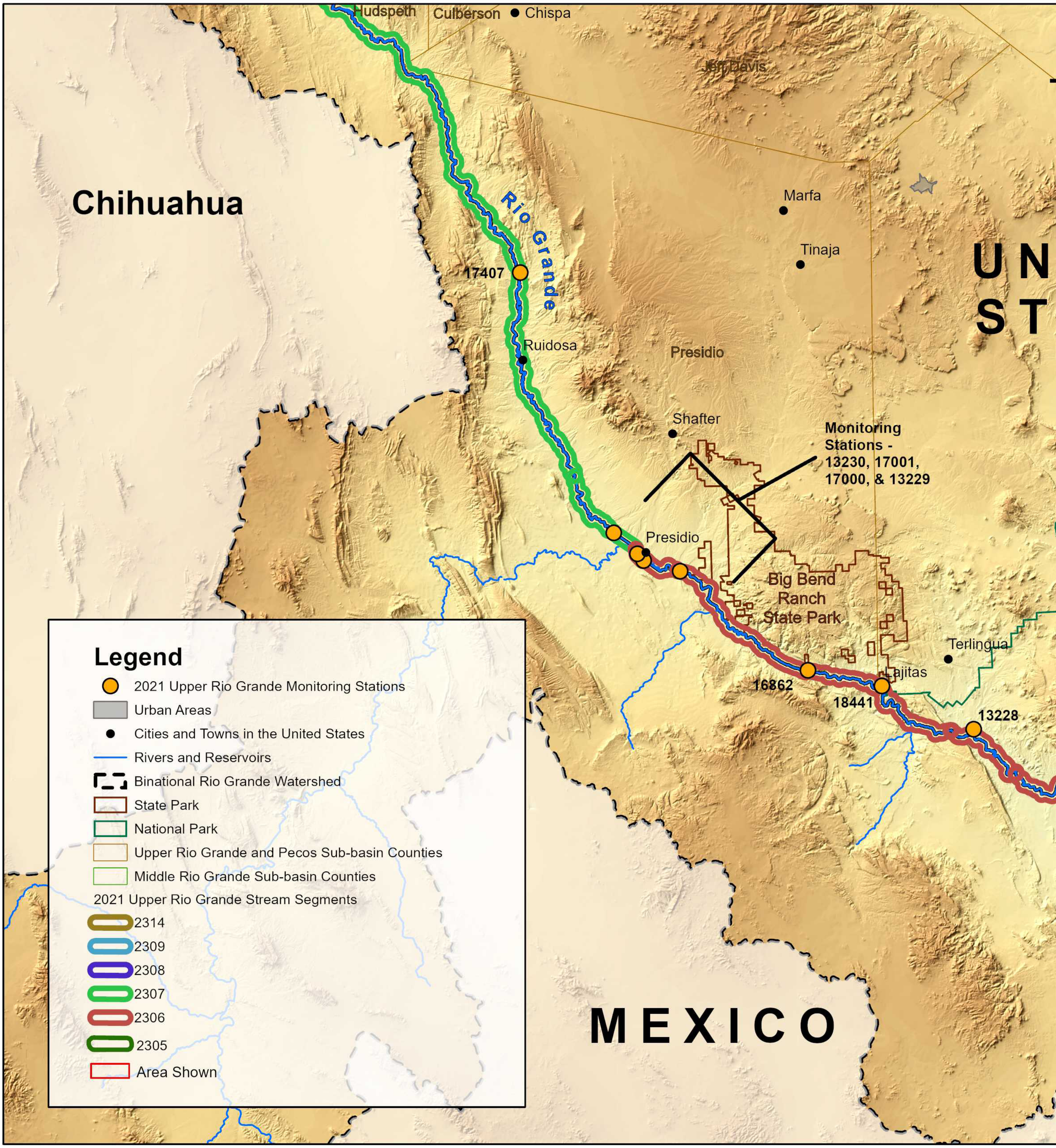
Parameter	Description	Effects to Water Body
Field Parameters		
pH	Measure of how acidic or basic the water is. The values range from 0 to 14, with 7 being neutral. pH values less than 7 indicate acidity, whereas a pH greater than 7 indicates a base.	Values greater than 9.0 and less than 5.0 can have detrimental affects on the health of aquatic life, wildlife, and humans.
Specific Conductance	Indicator of how well the water conducts electricity. Pure water does not conduct electricity; impurities of water are what allow electricity to pass through the water. These impurities are salts and metals. Since total and dissolved metal values are very low, conductivity primarily measures how much salt is in the water. 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. Indirect effects of excess dissolved solids are primarily the elimination of desirable food plants and habitat-forming plant species. Agricultural uses of water for livestock watering are limited by excessive dissolved solids and high dissolved solids can be a problem in water used for irrigation.
Dissolved Oxygen (DO)	Measure of the oxygen in the water.	Low DO values can lead to a reduced abundance and diversity in aquatic communities. Very low levels (<2) can be indicative of higher levels of oxygen-demanding plants that use up DO during the decay process.
Secchi Depth	A measure of the transparency of water - the maximum depth at which a black and white disk is visible.	Higher transparency leads to 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
Stream Flow	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		
Solids	Total and dissolved materials of any kind (calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates).	High total dissolved solids indicate higher amounts of dissolved salts which can reduce the diversity of aquatic life and can render the water unusable for human consumption, industry and agriculture.
Nutrients	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.
Chlorophyll-a	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		
Metals	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.
Organics	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		
Nekton	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.
Benthics	Freshwater macroinvertebrates collected during a five-minute kick net method	Using IBI, this biological aquatic assemblage analysis indicates biodiversity and overall health of river. Healthy macroinvertebrate communities can be excellent indicators of high water quality.

Map of the Upper Rio Grande Sub-Basin

Watershed Characterization of the Upper Rio Grande Sub-Basin

Figure 1. Map of the Upper Rio Grande Sub-Basin in Texas


UNITED STATES
Location Map
Texas
Ward
Crane
Upper Pecos River
Pecos
Crockett
Independence Creek
Terrell
Devils River
Val Verde
Brewster
International Amistad Reservoir
Kinney
Big Bend National Park
Maverick
Coahuila
Dimmit
0 12.5 25 50 75 100 Miles
0 15 30 60 90 120 Kilometers
N
Data courtesy ESRI, USGS, US IBWC, TCEQ, and TNRIS

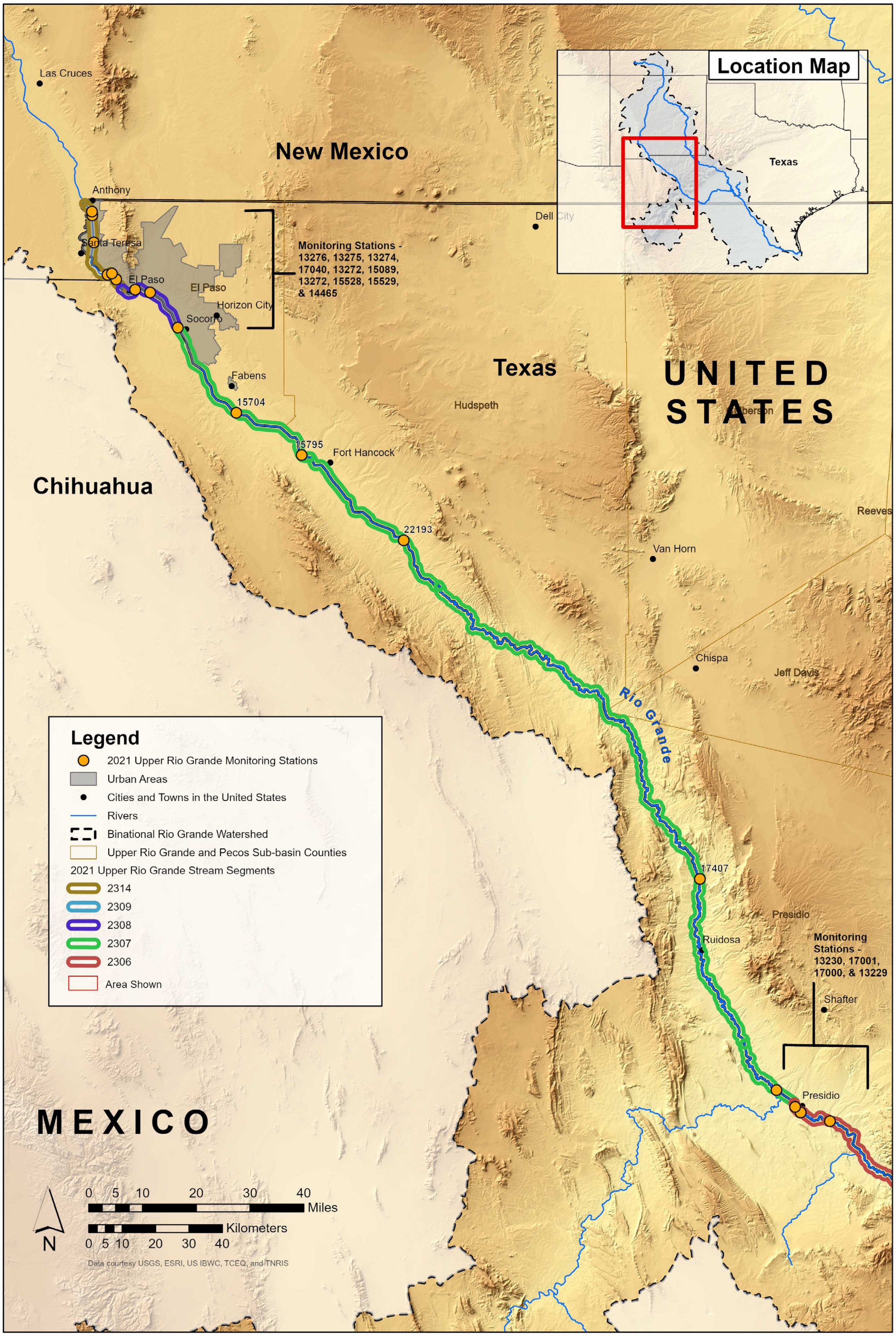


Upper Rio Grande Sub-Basin Stream Segments and Monitoring Locations, Section 2

Watershed Characterization of the Upper Rio Grande Sub-Basin

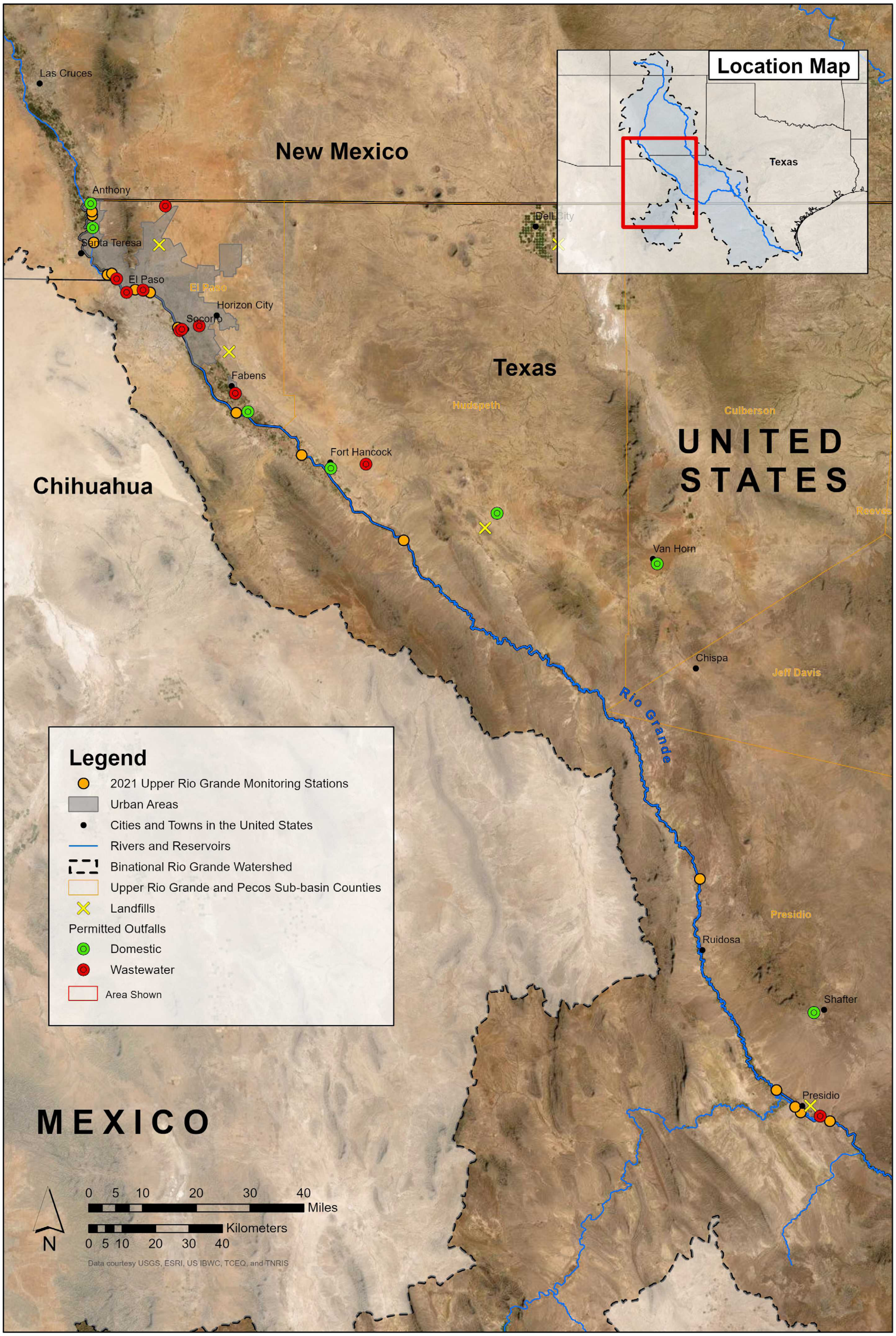
Figure 2. Map of Stream Segments and Monitoring Locations in the Upper Rio Grande Sub-Basin - Section 2


Texas
Pecos
Independence Creek
Crockett
Terrell
Sanderson
ITED
ATES
Pecos River
Devils River
13239
Val Verde
14942
Langtry
13223
Brewster
13237
15892
15893
International Amistad Reservoir
13835
Del Rio
13225
Big Bend National Park
Kinney
16730
Coahuila
Location Map
Texas
0 5 10 20 30 40
Miles
Kilometers
0 5 10 20 30 40
N
Data courtesy USGS, ESRI, US IBWC, TCEQ, and TNRIS



Upper Rio Grande Sub-Basin Stream Segments and Monitoring Locations, Section 1

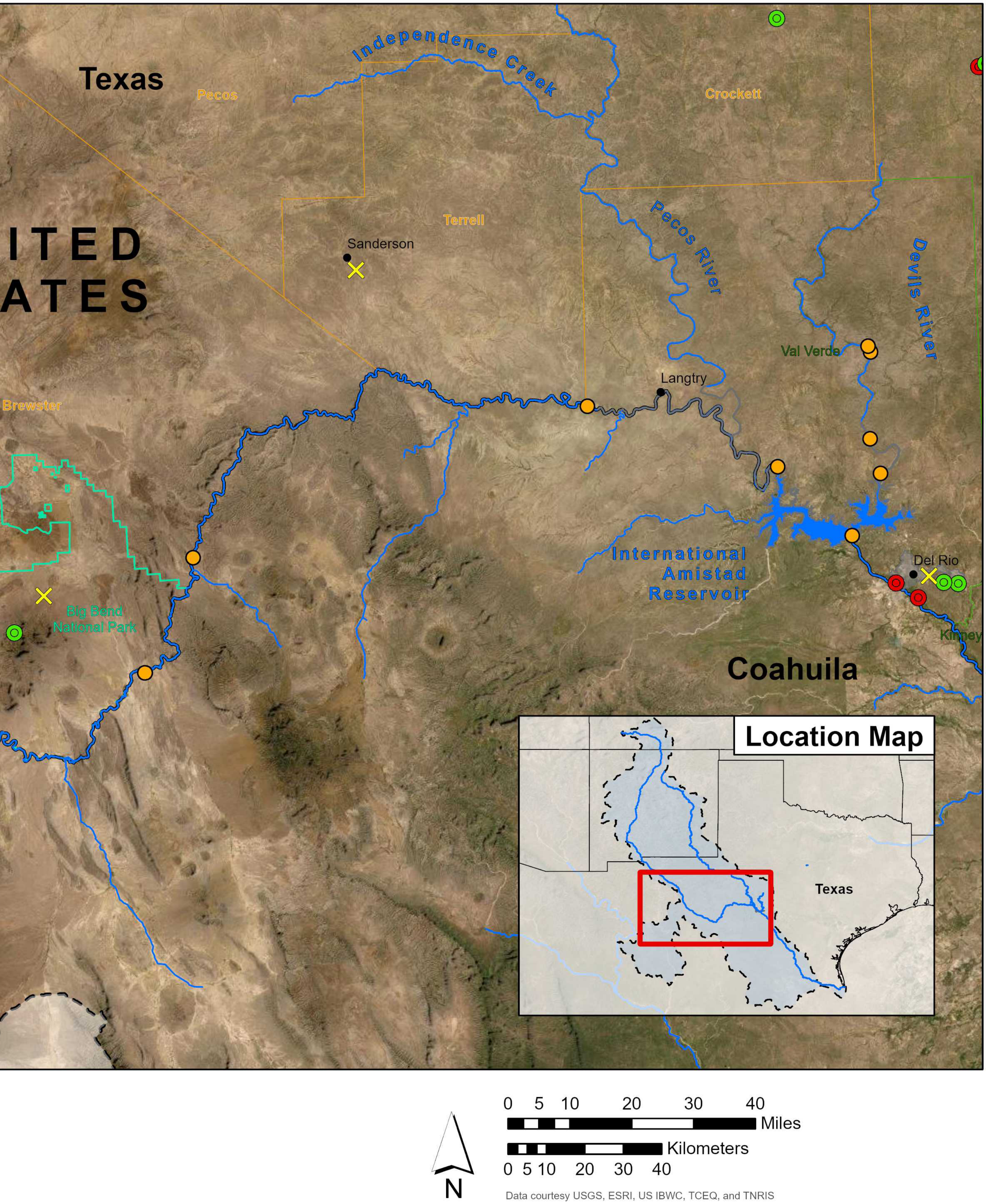
Figure 3. Map of Stream Segments and Monitoring Locations in the Upper Rio Grande Sub-Basin - Section 1



Permitted Outfalls and Landfills in the Upper Rio Grande Sub-Basin, Section 1

Figure 4. Map of Permitted Outfalls and Landfills in the Upper Rio Grande Sub-Basin - Section 1

Figure 5. Map of Permitted Outfalls and Landfills in the Upper Rio Grande Sub-Basin - Section 2


Texas
Pecos
Independence Creek
Crockett
Terrell
Sanderson
ITED
ATES
Pecos River
Devils River
Val Verde
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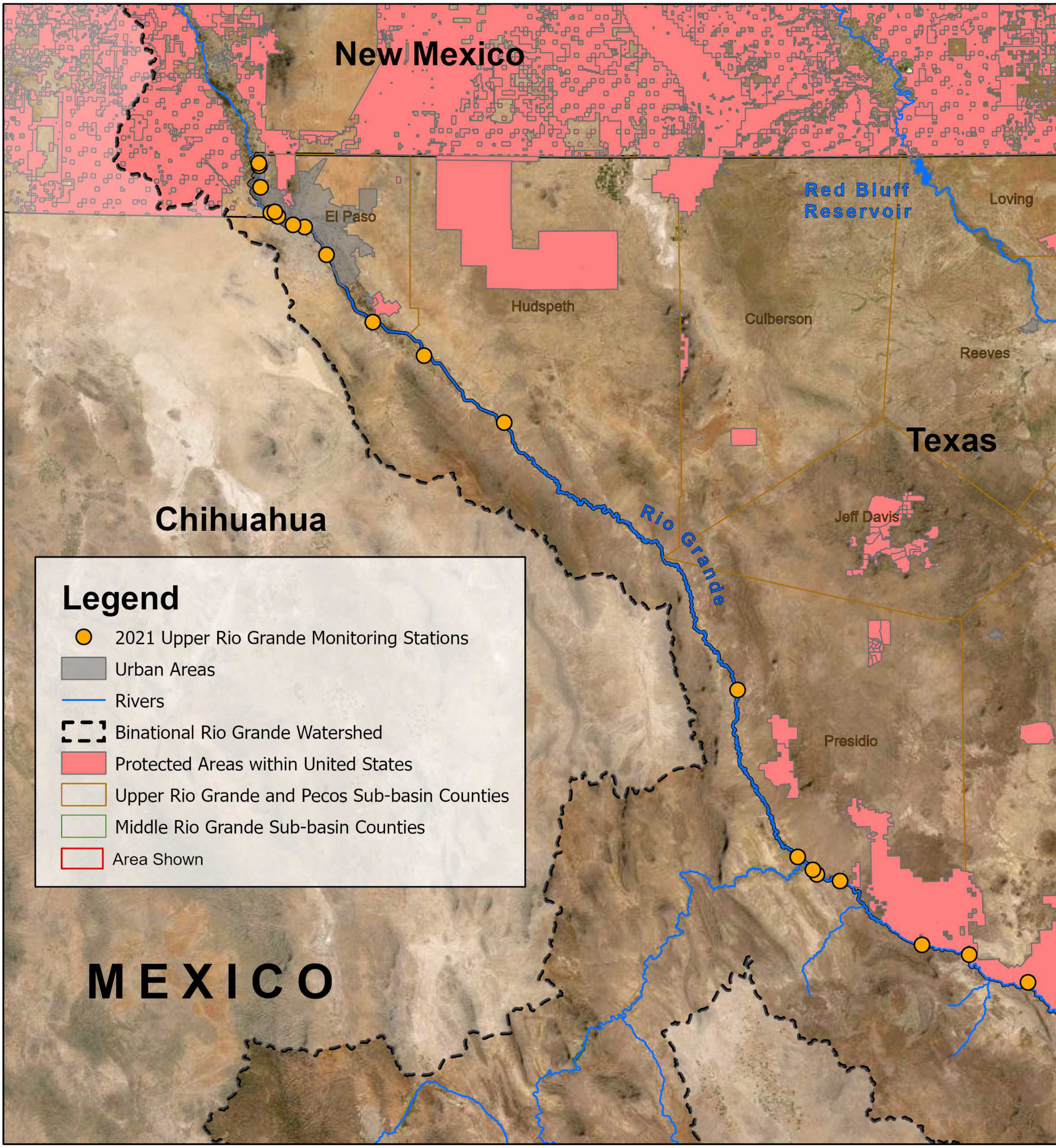
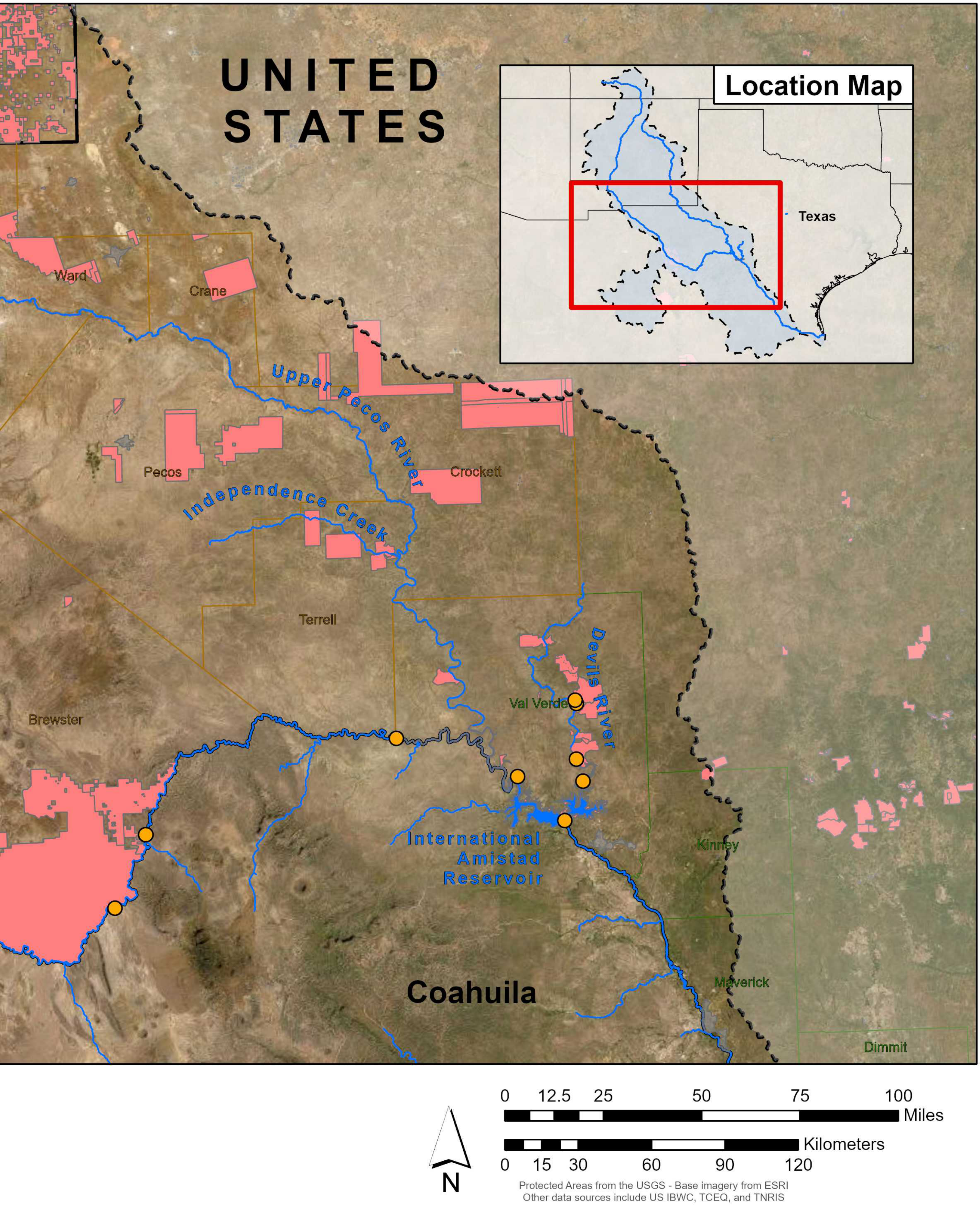
International
Amistad
Reservoir
Del Rio
Big Bend
National Park
Kinney
Coahuila
Location Map
Texas
0 5 10 20 30 40
Miles
Kilometers
0 5 10 20 30 40
N
Data courtesy USGS, ESRI, US IBWC, TCEQ, and TNRIS



Protected Areas within the United States

Watershed Characterization of the Upper Rio Grande Sub-Basin

Figure 6. Map of Protected Areas - Upper Rio Grande Sub-Basin


UNITED STATES
Location Map
Texas
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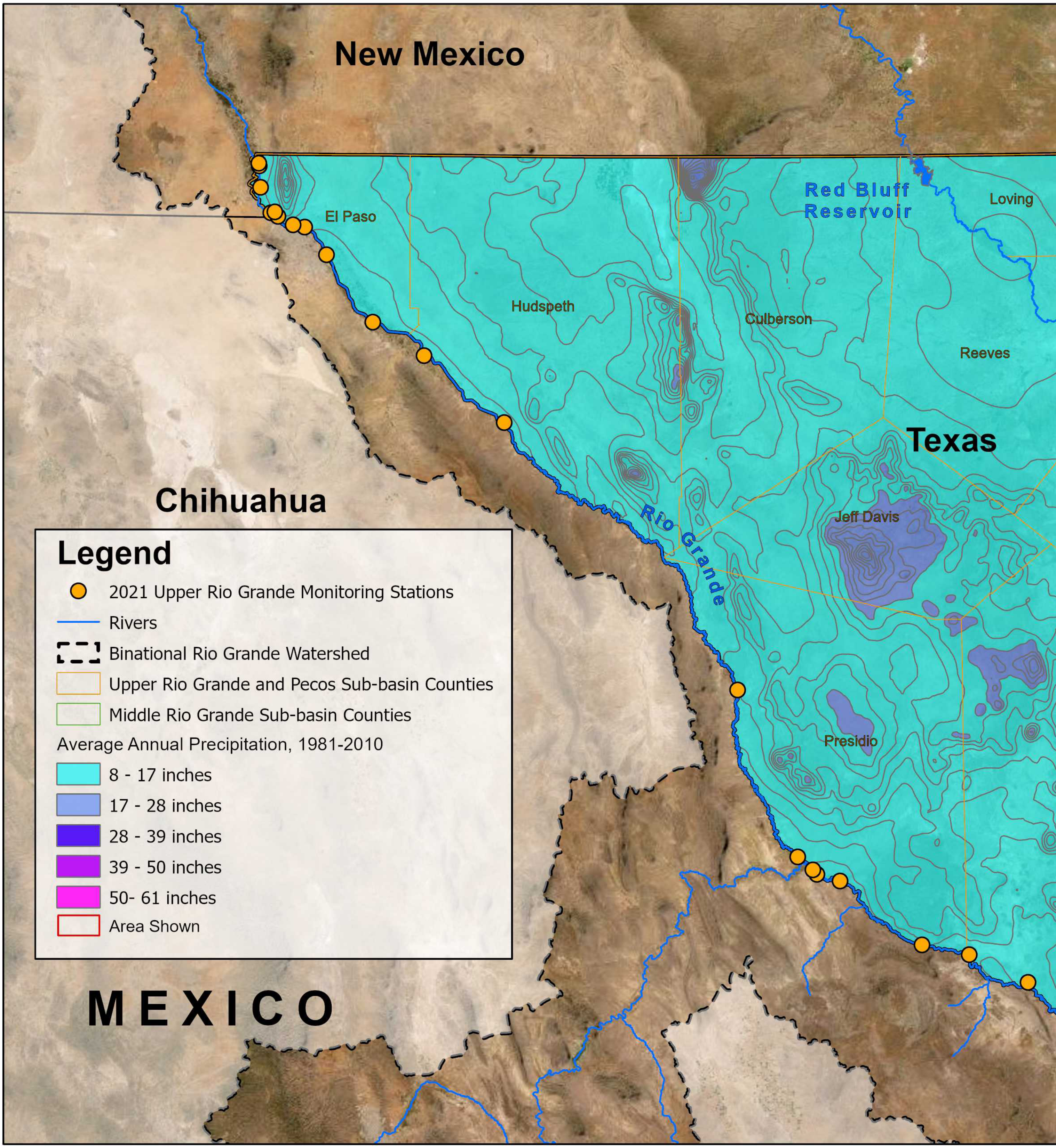
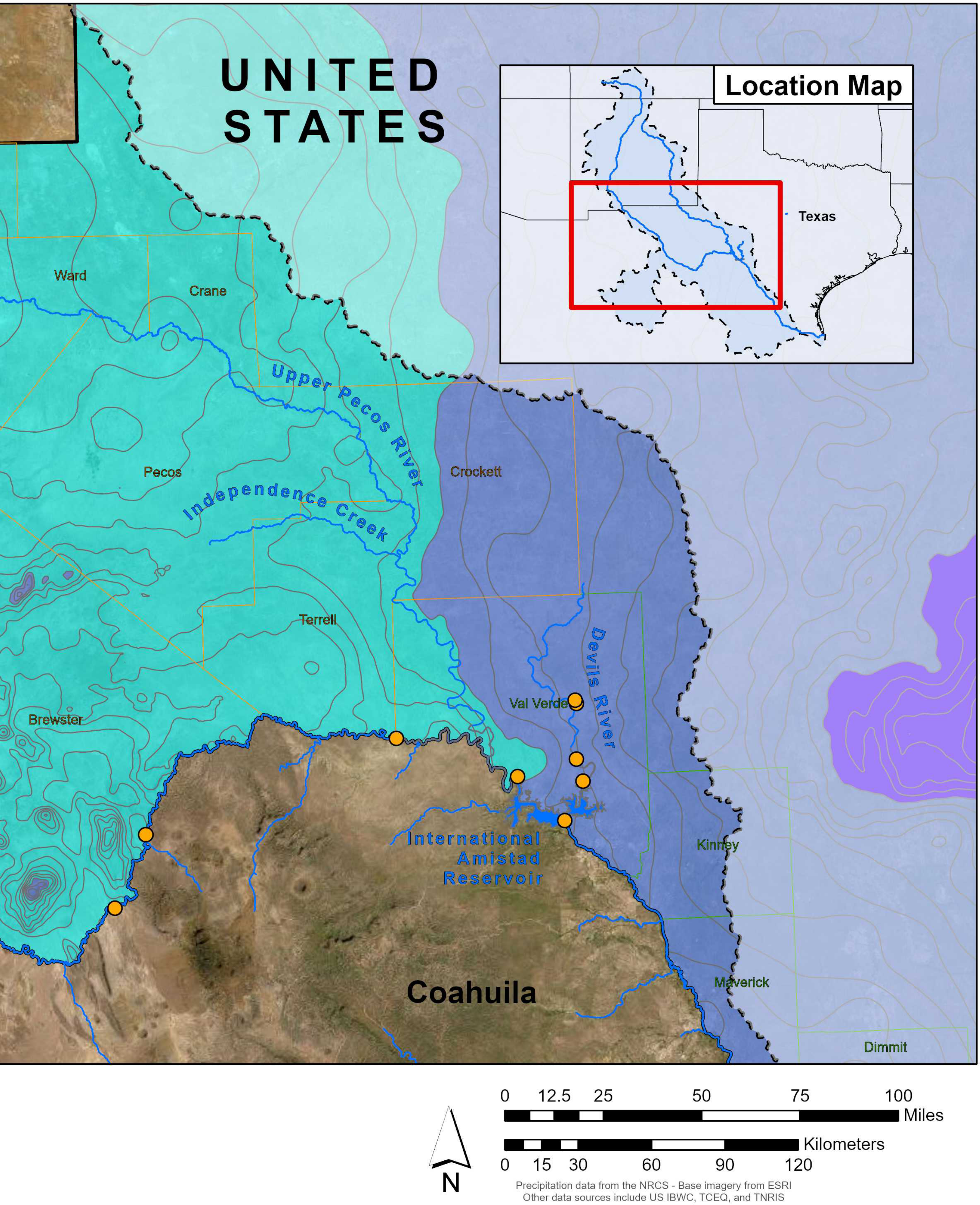
Maverick
Coahuila
Dimmit
0 12.5 25 50 75 100 Miles
0 15 30 60 90 120 Kilometers
N
Protected Areas from the USGS - Base imagery from ESRI
Other data sources include US IBWC, TCEQ, and TNRIS



Average Annual Precipitation in Texas, 1981-2010

Watershed Characterization of the Upper Rio Grande Sub-Basin

Figure 7. Map of Average Annual Precipitation


UNITED STATES
Location Map
Texas
Ward
Crane
Upper Pecos River
Pecos
Crockett
Independence Creek
Terrell
Devils River
Val Verde
Brewster
International Amistad Reservoir
Kinney
Coahuila
Maverick
Dimmit
0 12.5 25 50 75 100 Miles
Kilometers 0 15 30 60 90 120
N
Precipitation data from the NRCS - Base imagery from ESRI
Other data sources include US IBWC, TCEQ, and TNRIS

SEGMENTS IN THE UPPER RIO GRANDE SUB-BASIN

This report focuses mainly on the Upper Sub-Basin, which extends from the New Mexico/ Texas state line downstream to International Amistad Reservoir. The Upper Rio Grande Sub-Basin report includes segments 2305, 2306, 2307, 2308, 2309, and 2314.

The Upper Rio Grande Sub-basin extends from the New Mexico-Texas state line downstream to the Inter¬national Amistad Reservoir, a length of 650 miles. Due to historical changes in the channel, the Rio Grande meanders in and out of Texas and New Mexico with some sections forming the boundary between the two states. Proceeding downstream, the Rio Grande forms the international boundary between the U.S. and Mexico.

The Upper Rio Grande Sub-basin lies entirely in the Trans-Pecos region. The upper portion of the river traverses the mountains of the Chihuahuan desert, flowing through arid mountains, high hills, and rock outcrops as it passes through Big Bend National Park. This region depends largely on groundwater sources for its water supply. Two aquifers, the Edwards-Trinity (Plateau) and Hueco-Mesilla Bolsons, combined with six minor aquifers, contribute to most of the region's water supply.

The USIBWC CRP has 6 partners in the Upper Rio Grande: USIBWC American Dam Field Office, USIBWC Presidio Field Office, USIBWC Amistad Dam Field Office, El Paso Water Laboratory, Big Bend Ranch State Park and Big Bend National Park. These partners monitor 20 stations and TCEQ monitors 15 stations. Combined, the USIBWC CRP and TCEQ provide field, flow, and water quality data for the program in this reach to promote the protection, restoration and wise use of Texas surface water resources.

Segment 2305

From Amistad Dam in Val Verde County to a point 1.8 km downstream of the confluence if Ramsey Canyon on the Rio Grande Arm in Val Verde County and to point 0.7 km downstream of the confluence of Painted Canyon on the Pecos Arm.

Segment 2306

The Rio Grande beginning just downstream of the confluence with the Rio Conchos (in Presidio County) and ending at a point 1.1 miles downstream of the confluence of Ramsey Canyon in Val Verde County and upstream of International Amistad Reservoir.

Segment 2307

Extends from below Riverside Diversion Dam in El Paso County downstream to the confluence with the Rio Conchos (MX) in Presidio County.

Segment 2308

Defined as the river in El Paso County from the Riverside Diversion Dam to the International Dam.

Segment 2309

Defined from a point 0.4 miles downstream of the confluence of Little Satan Creek in Val Verde County to the confluence of Dry Devils River in Sutton County.

Segment 2314

Defined as the Rio Grande from the New Mexico-Texas state line downstream to the International Dam in El paso County.

SEGMENT 2305
INTERNATIONAL AMISTAD RESERVOIR

Segment 2305 is from Amistad Dam to the confluence of Ramsey Canyon on the Rio Grande Arm and to the downstream confluence of Painted Canyon on the Pecos Arm.

Segment 2305 is defined as being from Amistad Dam in Val Verde County to a point 1.8 km (1.1 miles) downstream of the confluence of Ramsey Canyon on the Rio Grande Arm in Val Verde County and to a point 0.7 km (0.4 miles) downstream of the confluence of Painted Canyon on the Pecos Arm. Segment 2305 primarily comprises International Amistad Dam, which was built for flood control, conservation, irrigation, power, and recreation. Segment 2305 is listed for uses of primary contact recreation, high aquatic life use, and public water supply.

International Amistad Reservoir is a popular attraction for boating, fishing, and picnicking. Hydroelectric power is generated at the dam by both the U.S. and Mexico. The deep area nearest the dam acts as a settling basin for the heavy sediment loading entering the shallow upper end resulting in clearer water available for downstream releases. Water stored at the reservoir belongs to both the U.S. and Mexico based on the allocation of waters outlined in the 1944 Water Treaty.

In 2020, Segment 2305 was monitored by four stations, including:

- **Station 13237**: Devils River at Pafford Crossing Near Comstock
- **Station 13835:** Amistad Reservoir at Buoy 1
- **Station 15892:** Amistad Reservoir Rio Grande Arm at Buoy 28
- **Station 15893:** Amistad Reservoir Devils River Arm at Buoy DRP

Segment 2305 has four assessment units (AUs):

- **2305_01**: Rio Grande Arm
- **2305_02:** Devils River Arm
- **2305_03:** Area around International Boundary Buoy (dam)
- **2305_04:** Remainder of reservoir

International Amistad Reservoir is a popular attraction for boating, fishing, and picnicking. Hydroelectric power is generated at the dam by both the U.S. and Mexico. The deep area nearest the dam acts as a settling basin for the heavy sediment loading entering the shallow upper end resulting in clearer water available for downstream releases. Water stored at the reservoir belongs to both the U.S. and Mexico based on the allocation of waters outlined in the 1944 Water Treaty.

Figure 8. Devils River at Paffords Crossing Station 13237

Table 5. Data Analysis of Water Quality Issues Segment 2305 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 126 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 150 mg/L	Data points	Std: 800 mg/L	Data points	Std: 270 mg/L
13237	38	4.6	39	9.41	40	8.19	39	14.29	24	227.96	40	8.13
13835	29	1.5	493	6.70	514	8.08	32	118.78	5	597.60	33	222.30
15892	23	1.6	293	7.49	293	8.18	28	136.00	3	629.33	28	250.32
15893	31	1.7	297	7.19	308	8.12	33	73.86	19	472.89	35	128.74

Hydrologic Characteristics

Amistad Dam is the largest of the storage dams and reservoirs built on the international reach of the Rio Grande River. Most of its water originates either in the Rio Conchos in Mexico or results from rainfall runoff along the river between Presidio and International Amistad Reservoir. Surface flows from the Pecos River enter the Rio Grande upstream of International Amistad Reservoir near Del Rio. The Devils River empties directly into the Devils River Arm on the northern end of the lake. About 90% of the water released from the Amistad Reservoir flows through Falcon Reservoir to be used in the lower Rio Grande Valley.

In 2020, water levels in International Amistad Reservoir were below the median storage capacity from 1990-2020, whereas in 2019 they were consistently above. From June 2020 through September 2020, water levels in the reservoir were around 60% of storage capacity. In August, 2020, the mean water level was at 1,070 feet, which was 47 feet below the conservation pool elevation of 1,117 feet (the conservation pool elevation corresponds to full reservoir capacity). The water level at International Amistad Reservoir is not meant to exceed the conservation pool elevation; if it does, that excess water is spilled downstream to the Lower Rio Grande Valley.

When International Amistad Reservoir is full, the Devil's River runs out into the reservoir near station 13237 at Pafford Crossing.

Precipitation contributes to the flow regime in segment 2305. Most of the precipitation each year at Amistad Dam typically falls during the growing season, from April to October. Evaporation typically exceeds precipitation every month. Extreme storm events can periodically cause flooding in tributaries that flow into Segment 2305. In addition, periods of drought, which are predicted to be more commonplace in the future by the Texas Department of Parks and Wildlife, can lead to decreased stream flows into the reservoir, particularly from the Rio Grande. According to data from the NRCS, from 1981-2010, 15-18 inches of precipitation annually falls in the region around this stream segment.

Impairment - Area of Interest

Segment 2305 is included on the 303(d) list because it contains International Amistad Reservoir, which is an important body of water that is used for conservation, flood control, irrigation, power, and recreation. In the 2020 Integrated Report, this station was not impaired for any water quality parameters, but it does have a concern for fish kills in assessment unit 2305_01. In the 3,911 sampling events done at the four stations described above in segment 2305, none of the mean results exceeded any of the water quality thresholds described for this segment.

Land Use

Based on satellite imagery, many of the lands adjacent to International Amistad Reservoir are undisturbed. Historically, the land around International Amistad Reservoir was used for ranching. In recent years, population growth has seen numerous residential communities develop along the southern edge of the reservoir. A few urban areas are located near segment 2305 to the southeast of the reservoir, including Ciudad Acuña in Mexico and Del Rio in the United States. In addition, various recreational facilities are located along the edges of the reservoir. There are no permitted outfalls or TCEQ permitted facilities in this segment. Segment 2305 consists of EPA Level IV Ecoregion IV "Llano Estacado".

SEGMENT 2305 - Continued
INTERNATIONAL AMISTAD RESERVOIR

Possible Causes of Impairment

Nonpoint sources - Runoff from development around the reservoir is the primary possible source of pollution in the reservoir. Runoff from upstream sources can also possibly affect water quality in this stream segment. Much of this segment exists around relatively undisturbed lands, and the major urban centers adjacent to this reservoir are located downstream of International Amistad dam.

Agricultural - Few if any agricultural lands are found adjacent to Segment 2305. Ranching practices would need to be investigated further in this area to determine if those practices impact water quality.

Wildlife - Since International Amistad Reservoir was created in 1964, it has been stocked with fish to make it a recreational hotspot; the reservoir offers a stark contrast in terms of ecosystem function compared to the relatively slow moving, shallow streams that flow into the reservoir. This stream segment has a concern for fish kill reports from non-point sources, particularly near the upstream end of the reservoir. The wildlife found in the region, including deer and various species of birds, can impact water quality with waste.

Urban Runoff - Most of the urban areas in the vicinity of segment 2305 are located downstream of the International Amistad Reservoir and this segment's boundary. There are a few suburban communities and recreational facilities along the edge of the International Amistad Reservoir

Table 6. Segment 2305 Hydrology and Temperature

Assessment Unit	Stations	Streamflow		Temperature	
		Data points	CFS	Data points	Degrees Celsius
2305_01	13240	Not Analyzed			
	16379	Not Analyzed			
	15892	NA	NA	293	20.63
2305_02	13237	37	236.19	40	22.21
	15893	NA	NA	308	19.04
2305_03	13835	NA	NA	516	18.29
2305_04	None	NA	NA	NA	NA

Table 7. Segment 2305 Parameter of Concern

Assessment Unit	Parameter of Concern	Year First Listed	Assessment Category	Parameter(s) of Concern	Level of Concern
2305_01	Fish Kill	-	5c	Fish Kill	CN

CS- Concern for water quality based on screening levels
CN- Concern for water quality based on non-attainment of water quality standards
NS - Non-supporting

Figure 9. Finnegan Springs

that can impact water quality in this stream segment.

Influences of Flow - The water level in International Amistad Reservoir is jointly and actively managed by the U.S. and Mexico. Fluctuating reservoir levels impact water quality and facilitate the expansion of invasive species, such as the non-native clam, Corbicula, which thrives in the shoreline zone. If droughts become more commonplace in the future, they could contribute to decreased stream flows, lower water levels, and present more acute water quality conditions in this segment.

The spring-fed Devils River flows into this stream segment; it has high water quality and contributes to improved water quality in the reservoir.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service

Recommendations

The TCEQ should continue their routine monitoring of this segment at the current levels. International Amistad Reservoir is impacted by activities further upstream, so care should be taken to minimize use of pesticides and fertilizers directly upstream or around the reservoir. Illegal dumping should be discouraged. Recreation should be done with care to minimize impacts to water quality and surrounding habitat.

Figure 10. Flowers in Big Ben National Park

SEGMENT 2306
ABOVE AMISTAD INTERNATIONAL RESERVOIR

Segment 2306, Rio Grande Above Amistad International Reservoir to downstream of the confluence of Ramsay Canyon in Val Verde County to the confluence of the Rio Conchos (Mexico) in Presidio County

Segment 2306, Rio Grande Above Amistad International Reservoir, is defined as being from a point 1.8 km (1.1 miles) downstream of the confluence of Ramsay Canyon in Val Verde County to the confluence of the Rio Conchos (Mexico) in Presidio County. This segment encompasses Big Bend Ranch State Park and Big Bend National Park, as well as the Wild and Scenic River portion of the Rio Grande. This segment is the longest segment in the Upper Rio Grande Sub-Basin at 313 miles in length. Segment 2306 is listed for uses of primary contact recreation, high aquatic life use, and public water supply.

In 2020, Segment 2306 was monitored by nine active stations, including:

- **Station 13223:** Rio Grande 1.895 km south and 552 m west from the intersection of Unnamed Street and Foster Ranch Road and 10.1021 km south and 4.37 km west from the intersection of US Hwy 90 and Fosters Ranch Road in Val Verde County CAMS 759
- **Station 13225:** Rio Grande at Fm 2627/Gerstacker Bridge Downstream Big Bend
- **Station 16730:** Rio Grande at Boat Ramp at Rio Grande Village in Big Bend National Park
- **Station 13228:** Rio Grande at the mouth of Santa Elena Canyon
- **Station 16862:** Rio Grande River at Colorado Canyon Approx 30km SE of Redford on Rr170 in Presidio County
- **Station 18441:** Rio Grande at Lajitas Resort/Fm 170 Boat Ramp 240 M upstream of Black Hills Creek confluence near Lajitas
- **Station 13229:** Rio Grande 449 Meters West and 121 Meters south from the intersection of Ranch Road 170 and Ranch Road 169 in Presidio County Cams 758
- **Station 17000:** Rio Grande at Presidio Railroad Bridge 3.25km downstream of US67 south of Presidio

Figure 11. Segment 2306, Station 16862; Rio Grande at Colorado Canyon, Big Bend Ranch State Park.

Table 8. Data Analysis of Water Quality Issues Segment 2306 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 126 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 200 mg/L	Data points	Std: 1,400 mg/L	Data points	Std: 450 mg/L
13223	15	39.3	13	8.15	16	8.00	15	86.33	3	960.00	12	299.92
13225	25	53.5	34	8.12	36	8.17	30	123.37	4	1362.50	29	414.24
13228	50	24.1	83	8.78	88	8.05	80	271.94	53	1622.42	81	677.40
13229	77	54.8	110	9.58	113	8.04	108	269.33	80	1698.15	112	710.38
16730	23	13.7	52	8.07	48	7.88	46	210.81	44	1316.34	46	549.33
16862	8	10.5	22	7.65	21	7.95	15	302.48	14	1742.93	14	740.30
17000	47	104.9	80	8.12	78	7.94	0	ND	0	ND	0	ND
17001	45	110.0	80	7.87	78	7.90	0	ND	0	ND	0	ND
18441	8	13.3	23	7.67	20	8.02	15	289.54	16	1498.94	16	674.25

- **Station 17001:** Rio Grande at Presidio/Ojinaga Toll Bridge/International 0.75km downstream of US67 in Presidio

Segment 2306 has eight assessment units (AUs):

- 2306_01 From the lower segment boundary at Ramsay Canyon upstream to the confluence of Panther Gulch
- 2306_02 From the confluence of Panther Gulch upstream to FM 2627
- 2306_03 From FM 2627 upstream to Boquillas Canyon
- 2306_04 From Boquillas Canyon upstream to Mariscal Canyon
- 2306_05 From Mariscal Canyon to a point upstream of the IBWC gage at Johnson Ranch
- 2306_06 From a point upstream of the IBWC gage at Johnson Ranch to the mouth of Santa Elena Canyon at the Terlingua Creek confluence
- 2306_07 From the mouth of Santa Elena Canyon at Terlingua Creek confluence upstream to the Alamito Creek confluence
- 2306_08 From Alamito Creek confluence upstream to the Rio Conchos confluence

Hydrologic Characteristics

Near the beginning of this stream segment, the Rio Conchos flows into the Rio Grande from the southwest in Mexico and that adds a significant amount of stream volume. Historically, the flows of the Rio Grande that passed through this segment varied considerably. With the construction of dams, the average peak spring runoff decreased to a third or less of the historical peak flows and at times the river is no longer capable of transporting sediment from its tributary headwater streams.

Upstream of the Rio Conchos confluence, the Rio Grande frequently runs dry.

In 2020, the mean flow across 9 stations ranged from as low as 6.1 cfs at station 13225 to as high as 650.8 cfs at station 13223. The number sampling events for flow ranged from as few as 4 at station 13225 to as many as 111 at station 13229. All the stations in this stream segment are below the Rio Conchos confluence with the Rio Grande.

Impairment - Area of Interest

In the 2020 Integrated Report, this segment was impaired for sulfate at all active monitoring stations. This segment was first listed for sulfate in 2010. In addition, this segment had concerns for chlorophyll-a, fish kills, and total phosphorus.

Segment 2306 exceeded its threshold for E.coli bacteria at stations 13223, 13225, 13229, 16862, and 17001 in 2020. Stations 13228, 13229, 16730, 16862, and 18441 were impaired for chloride and sulfate in 2020. Stations 13228, 13229, 16862, and 18441 exceeded the threshold for total dissolved solids (TDS).

Land Use

Much of this stream segment includes relatively undisturbed lands; the Rio Grande River flows through areas such as Big Bend Ranch State Park and Big Bend National Park. Many agricultural activities take place in the communities of Presidio, Lajitas, and Benito Juarez, in the top half of the stream segment; urban areas are found in the neighboring towns of Ojinaga and Presidio. Recreation is popular in the parks. Much of segment 2306 exists in EPA Level IV Ecoregion “Low Mountains and Bajadas”; near the communities of Lajitas, Hot Springs, and Sierra Chino, EPA Level IV Ecoregion “Shinnery Sands” is also found.

SEGMENT 2306 - Continued

ABOVE AMISTAD INTERNATIONAL RESERVOIR

A domestic outfall is found in the town of Lajitas, in addition to a wastewater outfall northeast of Lajitas in the town of Terlingua. Lajitas also has a private domestic wastewater facility. Terlingua is host to an industrial wastewater facility and is near both a public domestic wastewater facility and a reverse osmosis water treatment facility. Segment 2306 is near an additional three public domestic wastewater facilities found between or near the towns of Sierra Chino and Hot Springs. One landfill exists in the town of Presidio, adjacent to the river. Another is found in Big Bend National Park 20 miles north of the Rio Grande. All of the described TCEQ permitted facilities, permitted outfalls, and landfills could impact water quality in this stream segment.

Possible Causes of Impairment or Interest

Nonpoint sources - The Rio Conchos flows through a large watershed with both urban areas and agricultural areas existing throughout it. Additional non-point sources of possible water pollution are found in the neighboring towns of Presidio and Ojinaga, as well as the small community of Lajitas. Ranches exist on both sides of the border throughout this stream segment and those can contribute to non-point source pollution.

Agricultural - Most of the agriculture that takes place along the Rio Grande in Segment 2306 occurs at the start of the stream segment near the towns of Ojinaga and Presidio.

Upstream of those towns, in segment 2307, additional agricultural activities adjacent to the Rio Grande take place.

Wildlife - This segment flows through Big Bend National Park and Big Bend Ranch State Park, which boast wide-ranging ecosystems and many types of habitat for a diverse array of wildlife. The wildlife found living along this segment and in those protect parks can contribute bacterial issues to the Rio Grande.

Urban Runoff - Urban runoff in this stream segment is limited to the urban area found between the neighboring towns of Presidio and Ojinaga, near the start of the stream segment. The Ojinaga-Presidio Port of Entry sees substantial numbers personal vehicles and pedestrians each year.

Influences of Flow - Segment 2306 receives water from two major tributaries near the start of the segment: the Rio Conchos and Alamito Creek. Alamito Creek is a perennial freshwater stream with few water quality concerns. The Rio Conchos adds a substantial volume of water to the Rio Grande in this stream segment. Even though this segment is in a dry climate that averages 10-15 inches of precipitation each year, based on data from the NRCS collected from 198-2010, it is still subject to intermittent, high volume precipitation events that can significantly impact the water quality in the region. The town of Presidio was damaged in a 2008 flood that saw flows in the adjacent Rio Grande peak at 53,000 cfs .

The 2008 flood caused public health concerns because a wastewater treatment plant in Ojinaga spilled into the river.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service

Recommendations

The USIBWC CRP and TCEQ should continue routine monitoring at current levels in this area of the Rio Grande. 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. This segment is heavily influenced by drought conditions and water releases from upstream and from Mexico. The use of pesticides and fertilizers should be minimized and discouraged from use by local landowners along the river. Burns are also frequently performed by local landowners along the bank; care should be taken to avoid erosion.

Table 9. Segment 2306 Parameter Impairment

Assessment Unit	Parameter(s) Impaired	Year First Listed	Assessment Category
2306_01	Sulfate	2010	5b
2306_02			
2306_03			
2306_04			
2306_05			
2306_06			
2306_07			
2306_08			

Table 10. Segment 2306 Parameter of Concern

Assessment Unit	Parameter of Concern	Level of Concern
2306_01	Total Phosphorus	CS
2306_04	Fish Kill	CN
2306_05	Fish Kill	CN
2306_06	Chlorophyll-a	CS
	Fish Kill	CN
2306_07	Chlorophyll-a	CS
	Fish Kill	CN
2306_08	Chlorophyll-a	CS
	Fish Kill	CN

CS- Concern for water quality based on screening levels
CN- Concern for water quality based on non-attainment of water quality standards
NS - Non-supporting

Table 11. Segment 2306 Hydrology and Temperature

Assessment Unit	Stations	Streamflow		Temperature	
		Data points	CFS	Data points	Degrees Celsius
2306_01	13223	17	650.76	15	23.2
	20631	Not Analyzed			
2306_02	20623	Not Analyzed			
	20625	Not Analyzed			
2306_03	13225	4	6.1	36	21.78
2306_04	16730	62	485.56	56	22.11
	20619	Not Analyzed			
2306_05	None	NA	NA	NA	NA
2306_06	13228	57	485.56	93	19.87
2306_07	16862	4	364.5	27	21.3
	18441	4	364.5	27	21.9
2306_08	13229	111	370.25	119	20.76
	17000	93	366.81	84	18.98
	17001	94	365.93	84	18.77

SEGMENT 2307

RIO GRANDE BELOW RIVERSIDE DIVERSION DAM

Segment 2307, Rio Grande Below Riverside Diversion Dam from the confluence of the Rio Conchos (Mexico) in Presidio County to Riverside Diversion Dam in El Paso County

Segment 2307, Rio Grande Below Riverside Diversion Dam, is defined as being from the confluence of the Rio Conchos (Mexico) in Presidio County to Riverside Diversion Dam in El Paso County.

In 2020, Segment 2307 was monitored by five stations, including:

- **Station 14465**: Rio Grande at Riverside Canal 1.8 km downstream of Zaragosa International Bridge
- **Station 15704:** Rio Grande at Guadalupe Point of Entry Bridge at FM 1109 west of Tornillo
- **Station 15795:** Rio Grande at Alamo Control Structure 9.7 km upstream of Ft. Hancock Port of Entry
- **Station 17407:** Rio Grande upstream of Candelaria 0.5 km upstream of Capote Creek confluence
- **Station 13230:** Rio Grande 3.38 kilometers upstream from the confluence with the Rio Conchos 6.72 kilometers west and 2.445 kilometers north from the intersection of Ranch Road 170 and Rodriquez Road in Presidio County CAMS 757

Segment 2307 has five assessment units (AUs):

- **2307_01** From immediately upstream of the Rio Conchos confluence to a point 40.2 km (25 mi) upstream
- **2307_02** From a point 40.2 km (25 mi) upstream of the Rio Conchos confluence to Little Box Canyon
- **2307_03** From Litle Box Canyon upstream to the Alamo Grade Control Structure
- **2307_04** From the Alamo Grade Control Structure upstream to the Guadalupe Bridge
- **2307_05** From the Guadalupe Bridge to downstream of th Riverside Diversion Dam

Hydrologic Characteristics

The upper portion of this segment receives flow from irrigated agriculture and wastewater treatment plant effluent from both countries. Prior to upstream dam construction, the Rio

Figure 12. Segment 2307, Station 13230; Looking upstream from the Above the Rio Conchos station.

Table 12. Data Analysis of Water Quality Issues Segment 2307 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 126 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 300 mg/L	Data points	Std: 1,500 mg/L	Data points	Std: 550 mg/L
13230	75	125.7	111	8.07	111	8.13	106	410.82	75	1908.08	109	603.93
14465	10	620.5	14	9.42	14	8.01	0	ND	0	ND	0	ND
15704	26	449.8	31	8.42	32	7.99	34	275.73	20	1065.10	34	293.65
15795	24	642.0	24	9.16	17	8.12	26	932.04	28	2639.00	27	0.29
17407	9	68.6	18	7.04	16	8.01	16	594.55	18	2070.00	19	20.73

Grande would transport sediment downstream during the monsoon season through this stream segment on a biannual basis, but in recent years, because of decreased stream flows, it does not do that as often. This portion of the Rio Grande frequently runs dry until it confluences with the Rio Conchos near Presidio, Texas and Ojinaga, Mexico. There are over 150 arroyos that can flash flood into this stream segment. Most of the stream flows in the Rio Grande in this stream segment come from irrigation canal returns and some groundwater.

The mean flow across the four stations looked at in 2020 in this steam segment ranged from as low as 5.5 cfs at station 14465 to as high as 153 cfs at station 17407.

Impairment - Area of Interest

In the 2020 Integrated Report, Segment 2307 was impaired for bacteria, chloride, and total dissolved solids. Ammonia, chlorophyll-a, dissolved oxygen, nitrate, and total phosphorus were also listed as parameters of concern, though not in every assessment unit. This segment was first listed for bacteria in water (recreation use) in 2002; it was first listed for chloride in 1996; and finally, it was first listed for total dissolved solids in 1996. This segment exceeded its threshold for bacteria at all five stations in 2020. In addition, stations 13230, 15795, and 17407 exceeded their thresholds for chloride and total dissolved solids. Station 13230 was impaired for sulfate across 109 sampling events at that station.

Land Use

The lands around the Rio Grande in stream segment 2307 are largely remote, with limited access to the river and its surrounding areas, with exception to the most upstream portion of this segment near El Paso/ Ciudad Juarez. This stream segment includes the so-called "Forgotten Stretch" of the Rio Grande River. Near the confluence with the Rio Conchos at the tail end of this segment, agricultural lands start to appear adjacent to the river. Much of this steam segment is confined to a relatively narrow river corridor. Scattered ranches and farms are found adjacent to the river between Ft. Hancock and Presidio. The community of Ojinaga, Chihuahua, is much larger than Presidio; Texas; communities are surrounded by numerous agricultural fields that border the Rio Grande and the Rio Conchos.

Upstream of Ft. Hancock to the upper reaches of this stream segment, the river is less confined and has more farms and ranches adjacent to the river than anywhere else in the stream segment. The combined El Paso and Ciudad Juarez metropolitan area has grown substantially in recent years and is the largest urban area in the Upper Rio Grande subbasin.

Possible Causes of Impairment

Nonpoint sources - The municipalities of Ciudad Juarez and El Paso, along with their surrounding communities, dominate the upper portion of this stream segment. Downstream of Ft. Hancock, the Rio Grande does not flow through as many potential sources of non point source pollution.

SEGMENT 2307 - Continued

RIO GRANDE BELOW RIVERSIDE DIVERSION DAM

Eight wastewater outfalls and two landfills are found near stream segment 2307 between El Paso and Ft. Hancock. Six wastewater outfalls in Texas are found along this stream segment, in addition to one landfill.

Agricultural - The agricultural industry is a major source of business in the upper reach of this segment. Numerous farms and ranches exist on both sides of the Rio Grande; little land around the Rio Grande in this region is not developed for some agricultural or urban use. In the 2020 Integrated Report, crop production was listed as a nonpoint source for many of the parameters of concern or impairment in listed in this stream segment, including total phosphorus, chlorophyll-a, and total dissolved solids. Runoff from agriculture can cause water pollution due to the use of fertilizers, pesticides and irrigation. Runoff from irrigation that flows through agricultural fields is oftentimes highly saline. Excess fertilizers cause algal blooms.

Wildlife - The upper most portion of this stream segment is heavily urbanized or developed, with few opportunities for substantial numbers of wildlife to be found. In the more rural areas of this stream segment, increased numbers of wildlife are present and they can contribute to bacterial issues to the water quality. In addition, livestock from cattle ranches and industrial agricultural facilities can contribute bacterial problems to this stream segment.

Urban Runoff - The combined municipalities of Ciudad Juarez and El Paso contain an estimated 2.7 million people. The infrastructure in place to house those people is high susceptible to contributing runoff pollution to the Rio Grande in this steam segment and upstream stream segments.

Influences of Flow - This stream segment contains a portion of the Rio Grande that is highly manipulated; the Rio Grande doesn't resemble much of a river until Ft. Quitman, downstream of Ft. Hancock. When no irrigation releases are scheduled, portions of this stream segment frequently run dry.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Irrigation Districts
- Municipalities

Recommendations

The USIBWC CRP and TCEQ should continue routine monitoring at current levels in this area of the Rio Grande. 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. This segment is heavily influenced by drought conditions and water releases from upstream reservoirs. The use of pesticides and fertilizers should be minimized and discouraged from use by local landowners along the river. The re-establishment of the station at Ft. Quitman is filling the need for data in the Forgotten Stretch, but more stations in this area would be greatly beneficial.

Figure 13. Segment 2307, Station 15704; River during irrigation.

Table 13. Segment 2307 Parameter Impairment

Assessment Unit	Parameter(s) Impaired	Year First Listed	Assessment Category
2307_01	Chloride	1996	5b
	Total Dissolved Solids		
2307_02	Chloride	1996	5b
	Total Dissolved Solids		
2307_03	Bacteria (Rec. Use)	2002	5c
	Chloride	1996	5b
	Total Dissolved Solids		
2307_04	Bacteria (Rec. Use)	2002	5c
	Chloride	1996	5b
	Total Dissolved Solids		
2307_05	Bacteria (Rec. Use)	2002	5c
	Chloride	1996	5b
	Total Dissolved Solids		

Table 14. Segment 2307 Parameter of Concern

Assessment Unit	Parameter of Concern	Level of Concern
2307_01	Chlorophyll-a	CS
2307_02	Chlorophyll-a	CS
2307_03	Ammonia	CS
	Chlorophyll-a	
	Total Phosphorus	
2307_04	Ammonia	CS
	Chlorophyll-a	
	Nitrate	
	Total Phosphorus	
2307_05	Ammonia	CS
	Chlorophyll-a	
	Depressed Dissolved Oxygen	
	Nitrate	
	Total Phosphorus	

CS- Concern for water quality based on screening levels
CN- Concern for water quality based on non-attainment of water quality standards
NS - Non-supporting

Table 15. Segment 2307 Hydrology and Temperature

Assessment Unit	Stations	Streamflow		Temperature	
		Data points	CFS	Data points	Degrees Celsius
2307_01	13230	109	47.32	119	18.88
2307_02	17407	20	153.46	18	17.78
	20648	Not Analyzed			
2307_03	13232	Not Analyzed			
	22193	Not Analyzed			
2307_04	15795	1	90	23	15.32
2307_05	14465	13	5.94	13	15.95
	15704	11	38.22	35	16.79

SEGMENT 2308
RIO GRANDE BELOW INTERNATIONAL DAM

Segment 2308, Rio Grande Below International Dam from the Riverside Diversion Dam in El Paso County to International Dam in El Paso County

Segment 2308, Rio Grande Below International Dam, is defined as being from the Riverside Diversion Dam in El Paso County to International Dam in El Paso County. These stations are monitored by the USIBWC CRP program. This segment is the channelized portion of the river that runs for 12 miles through downtown El Paso.

In 2020, Segment 2308 was monitored by two stations, including:

- **Station 15528**: Rio Grande 1.3 km downstream from Haskell St WWTP Outfall
- **Station 15529:** Rio Grande 2.4 km upstream from Haskell St WWTP Outfall south of Bowie High School Football Stadium in El Paso

Segment 2308 has one assessment unit (AU):

- **2308_01** From the Riverside Diversion Dam to the International Dam in El Paso County

Hydrologic Characteristics

Due to upstream diversions in stream segment 2314, this portion of the Rio Grande River rarely contains much water. In recent years, it has been suggested that this stream segment be reclassified as intermittent rather than perennial.

The mean flow at station 15528 was 0.1 cfs while the mean flow at station 15529 upstream of 15529 was 37.8 cfs. For many portions of the year, this stream segment is susceptible to drying out due to diversions and low stream flows.

Impairment - Area of Interest

In the 2020 Integrated Report, Segment 2308 was impaired for bacteria. The segment also has a water quality concerns for ammonia, chlorophyll-a, and total phosphorus. Segment 2308 was first listed for bacteria in water (recreation use) in 2014.

No data was collected for assessment purposes in this stream segment across both stations.

Land Use

The combined municipalities of Ciudad Juarez-El Paso dominate the area around this stream segment. This stream segment is a concrete lined channel that is blocked by fencing. Three wastewater outfalls are located adjacent to the Rio Grande in this

Figure 14. Segment 2308, Station 15528; Rio Grande Downstream of Haskell Street WWTP Effluent.

Table 16. Data Analysis of Water Quality Issues Segment 2308 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 605 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 250 mg/L	Data points	Std: 1,400 mg/L	Data points	Std: 450 mg/L
15528	11	1967.7	7	8.00	9	8.16	0	ND	0	ND	0	ND
15529	6	1724.2	5	9.06	6	8.23	0	ND	0	ND	0	ND

Table 17. Hydrology and Temperature

Station	Streamflow		Temperature	
	Data points	CFS	Data points	Degrees Celsius
15528	22	0.03	9	17.82
15529	23	0	6	19.19

Table 18. Segment 2308 Parameter Impairment

Assessment Unit	Parameter(s) Impaired	Year First Listed	Assessment Category
2308_01	Bacteria (Recreation Use)	2014	5c

Table 19. Segment 2308 Parameter of Concern

Assessment Unit	Parameter of Concern	Level of Concern
2308_01	Ammonia	CS
	Chlorophyll-a	
	Total Phosphorus	

CS- Concern for water quality based on screening levels
CN- Concern for water quality based on non-attainment of water quality standards
NS - Non-supporting

stream segment. Most of this stream segment is within or adjacent to urban land. This stream segment is the most urbanized stream segment in the Upper Rio Grande subbasin and hardly resembles a river.

Possible Causes of Impairment or Interest

Nonpoint sources -This section of the Rio Grande rarely carries water; when it does, it carries mostly wastewater effluent, storm flows, and seepage from the upstream diversion dam.

Agricultural - The majority of agricultural activities take place upstream and downstream of this stream segment. The flow returns from those upstream fields are captured in the Riverside Diversion Dam located in stream segment 2307. Scattered agricultural activities are found adjacent to the Rio Grande in segment 2308 within the urban composition of the area.

Wildlife - Due to the heavily urbanized nature of the area around this stream segment, the impacts of wildlife on the water quality of the Rio Grande in this stream segment are likely to be low in comparison to other potential nonpoint sources of water contamination.

Urban Runoff - This channelized, concreted lined portion of the Rio Grande serves primarily as a stormwater runoff drain between the Riverside Diversion Dam and the International Dam. Urban runoff can carry contaminants from lawns, wastewater outfalls, and roads, and transport those contaminants downstream into stream segment 2307.

Influences of Flow - This stream segment is heavily influenced by flow, as most of the water that flows through it is the result stormwater runoff that can carry wastewater effluent. Seepage flows from the dam are also found in this stream segment.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Irrigation Districts
- Municipalities

Recommendations

The USIBWC CRP and TCEQ should continue routine monitoring at current levels in this area of the Rio Grande. 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. The USIBWC CRP recommend a reclassification of Segment 2308 to be characterized by intermittent flows, since the segment is not carrying water regularly (any water is storm runoff, seepage or WWTP effluent), and is concrete- lined (not the river in its natural state). There is also no contact recreation in this portion of the river. A reclassification would affect three stations in this seg-ment (15528, 15529, and 14465).

SEGMENT 2309
DEVILS RIVER

Segment 2309, Devils River from downstream of the confluence of Little Satan Creek in Val Verde County to the confluence of Dry Devils River in Sutton County

Segment 2309, Devils River, is defined as from a point 0.6 km (0.4 miles) downstream of the confluence of Little Satan Creek in Val Verde County to the confluence of Dry Devils River in Sutton County. The segment is 67 miles long, and empties into Amistad International Reservoir. This area of the basin is still mostly undisturbed and remains in pristine condition, with excellent water quality and low salinity content. Aside from the tidal segment of the Rio Grande, this is the only other segment with a classification of exceptional aquatic life use. Segment 2309A is Dolan Creek, an unclassified freshwater creek. It is 29 miles long, encompassing Dolan Springs from Yellow Bluff to Sonora, TX.

In 2020, Segment 2309 and 2309A were monitored by two stations, including:

- **Station 13239:** Devils River on Devils River State Natural Area 1.7 km upstream of Dolan Creek
- **Station 14942:** Dolan Springs 100 yds upstream of confluence with Devils River immediately upstream of road crossing

Segment 2309 has three Assessment Units and 2309A has one:

- **2309_01:** From the Devils River Arm of Amistad Reservoir upstream to Falls Canyon just below the Dolan Creek confluence
- **2309_02:** From Falls Canyon just below the Dolan Creek confluence upstream to Wallace Canyon
- **2309_03:** From Wallace Canyon to the upper segment boundary at the Dry Devils River confluence
- **2309A_01:** From the Rio Grande confluence to 46.7 km (29 mi) south of Sonora and 4.8 km (3 mi) west of US 277 in Val Verde County

Hydrologic Characteristics

The Devils River is a relatively small tributary of the Rio Grande that flows into Amistad International Reservoir from the north. The Devils River is primarily spring-fed. Perennial streamflow occurs in the main channel of the Devils River south of Juno because of ground-water discharge from several springs in the lower part of the watershed (source). Average monthly discharges at the Pafford Crossing gaging station range from 7.3 m3 /s in February to 20.4 m3 /s in September. Major floods occasionally transport large quantities of gravel and rock in the stream channel. From 1981-2010, the Devils River watershed averaged 19-21 inches of precipitation per year. When water levels in International Amistad Reservoir are low, the length of Devils River can extend by 4-5 miles past 13237. In 2020, the mean flow in stream volume across 34 sampling events was 86.7 cfs

Figure 15. Segment 2309 - Dolan Creek looking toward confluence with Devils Station 14942

Table 20. Data Analysis of Water Quality Issues Segment 2309 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 126 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 50 mg/L	Data points	Std: 300 mg/L	Data points	Std: 50 mg/L
13239	33	16.9	35	8.57	34	7.90	34	15.60	26	266.04	35	8.86
14942	34	20.6	36	8.16	35	7.91	35	15.15	23	279.43	36	7.61

at station 13239, which is below the confluence with Dolan Creek. On Dolan Creek at station 14942, the mean flow across 33 sampling events was 17.21 cfs.

Impairment - Area of Interest

In the 2020 Integrated Report, Segment 2309 was not listed for any water quality impairments or concerns. Segment 2309A also has no water quality impairments or concerns. Across all sampling events in segment 2309, at both stations, none of the results exceeded any of the water quality standards for the segment. The Devils River provides excellent water quality to International Amistad Reservoir.

Land Use

The land use in this stream segment, which includes much of Devils River, is largely undisturbed. The Devils River exists in the Chihuahan Desert ecoregion, which is composed of extensive arid grasslands and thorny shrubs. Much of the land in the Devils River watershed is privately owned. Cattle ranches are found throughout this stream segment's region. The Devil's River Natural Area, which is located near Dolan Creek and stations 13239 and 14942, provides habitat for many endangered and/or endemic species of fish and birds.

Possible Causes of Impairment

Nonpoint sources - There are few likely sources of nonpoint pollution in this watershed. The largest threats to water contamination come from the scattered cattle ranches adjacent to the stream segment and the oil and gas fields located in the northernmost portion of the Devil's River watershed. The community of Sonora, Texas - population 3,027 at the 2010 census- has four wastewater outfalls located near it.

Agricultural - The Devil's River has few agricultural fields near it. Most of the privately owned lands in the Devil's River watershed is used for cattle ranching. Cattle can have an impact on water quality by way of bacteria getting into the river, but the effects of cattle on this watershed have not been assessed or have not shown up in water quality testing results from previous years of monitoring yet.

Wildlife - The Devil's River watershed is largely remote and undisturbed; like cattle ranching, it's possible that wildlife can negatively impact the water quality of the Devil's River through bacterial contamination.

Urban Runoff - There are few if any urban areas located near this stream segment, and therefore, urban runoff impacts on water quality in this stream segment are very limited.

Influences of Flow - Occasional flooding in the Devil's River has the capacity to transport major quantities of silt, sediment, and debris, which as a process can significantly alter the color of the river. The Devil's River is primarily spring-fed, particularly in the lower half of the watershed, and as such, is not as subject to flow altering the water quality of this stream segment as other stream segments in the Upper Rio Grande River subbasin.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service

Recommendations

The TCEQ should continue their routine monitoring of this segment at the current levels. As one of the only remaining pristine bodies of water in the basin, the Devils River should be carefully monitored for any impacts detrimental to water quality and habitat. Recreation should be done with care to minimize impacts to water quality and surrounding habitat.

Table 21. Hydrology and Temperature

Assessment Unit	Station	Streamflow		Temperature	
		Data points	CFS	Data points	Degrees Celsius
2309_01	13237	37	236.19	40	22.21
2309_02	13239	33	85.7	35	21.71
2309_03	None	NA	NA	NA	NA
2309A_01	14942	34	17.21	36	21.27
2309A_02	None	NA	NA	NA	NA

SEGMENT 2314
RIO GRANDE ABOVE INTERNATIONAL DAM

Segment 2314, Rio Grande Above International Dam from International Dam in El Paso County to the New Mexico State Line, El Paso County

Segment 2314, Rio Grande Above International Dam, is 21 miles long and is defined as from International Dam in El Paso County to the New Mexico State Line in El Paso County.

In 2020, Segment 2314 was monitored by six stations, including:

- **Station 13272:** Rio Grande at Courchesne Bridge 1.7mi upstream from American Dam CAMS 718
- **Station 13274:** Rio Grande at Borderland Rd NW of El Paso
- **Station 13275:** Rio Grande 40 m south of Vinton Bridge approximately 4 km south of Anthony
- **Station 13276:** Rio Grande immediately upstream of the confluence with Anthony Drain west of La Tuna Prison near the state line
- **Station 15089:** Rio Grande River at American Eagle Brick Factory Bridge abandoned RR 0.1 mi downstream from Southern Pacific RR at Smeltertown
- **Station 17040:** Rio Grande at Anapra Bridge on Sunland Park Drive 4.2 KM upstream of American Dam in New Mexico.

Segment 2314 has two assessment units (AU).

- **2314_01:** From the International Dam upstream to the Anthony Drain confluence
- **2314_02:** From the Anthony Drain confluence upstream to the New Mexico/Texas state line

Hydrologic Characteristics

This stream segment is affected by drought and water diversions. It is in one of the driest portions of the Upper Rio Grande Subbasin in Texas. Much of the Rio Grande in this stream segment runs dry when water is not being diverted for irrigation or drinking water for use by the city of El Paso. The amount of water available in the Rio Grande in stream segment 2314 depends largely on the needs of water rights holders, as most of the water is contractually obligated to the States of New Mexico and Texas, irrigation districts, water rights holders, and Mexico. Water diversion for irrigation in the U.S. is diverted at American Dam into the Rio Grande American Canal Extension.

Figure 16. Segment 2314, Station 13272; Rio Grande at Courchesne Bridge, during drought.

Table 22. Data Analysis of Water Quality Issues Segment 2314 (Mean values)

Station	*E.Coli* (#/100 mL)		DO (mg/L)		pH (standard units)		Chloride (mg/L)		TDS (mg/L)		Sulfate (mg/L)	
	Data points	Std: 126 /100 ml	Data points	Std: 5.0 mg/L	Data points	Std: 6.5-9.0 SU	Data points	Std: 340 mg/L	Data points	Std: 1,800 mg/L	Data points	Std: 600 mg/L
13272	93	312.4	129	9.10	142	7.99	33	364.73	6	1006.00	36	475.88
13274	13	286.9	19	8.17	15	8.45	18	76.76	19	492.42	19	119.58
13275	15	131.1	23	7.77	18	8.42	25	89.96	26	512.38	25	126.58
13276	38	96.1	51	7.92	46	8.33	47	85.62	34	544.47	48	128.76
15089	37	489.4	45	8.80	35	8.04	34	299.09	35	1234.00	35	354.09
17040	34	350.6	59	8.04	45	8.02	44	182.77	45	816.78	47	217.55

Approximately 2 miles downstream, water in the river is diverted into Mexico by the International Dam.

The water that does flow in the Rio Grande in stream segment 2314 during the non-irrigation season is mainly wastewater effluent, stormwater runoff, or agricultural return flows, which contribute to salinity issues.

The mean flow at station 13272 was 331.58 cfs across 125 data points, while the mean flow at stations 132724, 13275, and 15089 ranged from as low as 35 cfs across one data point to 259.76 cfs across 9 data points. Station 17040 and 13276 averaged 958.10 cfs and 544.25 cfs, respectively.

Impairment - Area of Interest

In the 2020 Integrated Report, this segment was impaired for bacteria. Segment 2314 was first listed for bacteria in water (recreation use) in 2002.

In 2020, segment 2314 exceeded the threshold for chloride at station 13272. In addition, all of the stations in the segment exceeded the threshold for E. coli bacteria, with mean sampling events ranging from 159. 6 (MPN/ 100ml) at station 13276 to as high as 1967.2 (MPN/ 100ml) at station 15089.

Land Use

Based on satellite imagery, Segment 2314 features sparse undeveloped or non-irrigated lands adjacent to the Rio Grande river. This stream segment is surrounded by highly urbanized areas and agricultural fields. The cities of Ciudad Juarez and El Paso and their smaller, outlying communities control the landscape – they are the largest population centers in the region by far.

Possible Causes of Impairment

Nonpoint sources - There are numerous potential sources of water quality impairments near this stream segment. In general, those sources are related to the large population centers of El Paso and Ciudad Juarez on both sides of the Rio Grande, along with their smaller upstream and downstream communities.

For example, multiple small communities on the Mexican side exist with no city sewage services and they contribute to the bacteria issues in the river. In addition, there are many small wastewater treatment plants in surrounding local communities that are frequently operating over capacity.

Figure 17. Segment 2314, Station 17040; Rio Grande at Anapra.

SEGMENT 2314 - Continued
RIO GRANDE ABOVE INTERNATIONAL DAM

Historically, this stream segment has been subjected to discharges of wastewater bypassing into the river on both sides of the border.

Agricultural - Agricultural fields, ranchlands, and livestock are found in greater frequency in this stream segment than in segment 2308, which is more urbanized. Runoff from agricultural land pollutes the Rio Grande with the use of fertilizers and pesticides. The return flows from agricultural lands tend to be highly saline and high in nutrients. Nutrients can lead to algal blooms and are a likely source of E. coli bacteria contamination in this stream segment.

Wildlife - The Rio Bosque and Keystone Heritage Park, which are wildlife refuges located near this stream segment, attract a significant number of birds to the area. There are watering holes where livestock from nearby ranches may also contribute to bacterial problems. The river itself is a watering area for nearby livestock, which may also contribute to bacteria problems. There are small man-made lakes and ponds in El Paso and surrounding communities that are plagued by algal blooms, which can make their way to the Rio Grande if people are not careful about cleaning boats, fishing equipment and other things used for recreating in these algae-prone water bodies.

Urban Runoff -The heavily urbanized nature of this stream segment means that urban runoff contributes greatly to the water quality of this stream segment. Runoff from communities such as of Las Cruces, New Mexico flows into the Rio Grande upstream of stream segment 2314.

Stormwater is funneled into the Rio Grande in the cities of El Paso-Ciudad Juarez to a significant degree. Pedestrian and vehicle traffic at the El Paso port of entry on its asphalt bridge and road can lead to water contamination from the kick-up of dust created by the traffic. The El Paso port of entry is the second most used port of entry along the entire U.S./Mexico border.

Influences of Flow -Though this stream segment is heavily controlled by numerous dams and diversions, it is still subject to periodic, potentially catastrophic flooding. For example, in 2006, the city of El Paso was subject to 50 year flood event caused by a severe thunderstorm that caused significant damage.

Potential Stakeholders

- AgriLife Extension
- Landowners
- Natural Resource Conservation Service
- Texas Department of Agriculture
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- US Fish and Wildlife Service
- Irrigation Districts
- Municipalities

Figure 18. Segment 2314, Station 13274; Rio Grande at Vinton Bridge, after water deliveries

Recommendations

The USIBWC CRP and TCEQ should continue routine monitoring at current levels in this area of the Rio Grande. 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. This segment is heavily influenced by drought conditions and water releases from upstream reservoirs, as well as water diversions for drinking water and irrigation. The use of pesticides and fertilizers should be minimized and discouraged from use by local landowners along the river due to issues with high nutrients and chlorophyll-a. The bacteria counts in the upper portion of Segment 2314 remain high; monitoring does an effective job of capturing this, but more needs to be done to correct the issues with the wastewater treatment plants in lower New Mexico. Repairs and upgrades are needed to improve the water quality of the water entering Texas. There will still be bacteria issues in this area because of the communities across the border, but it would still improve the water quality.

Table 23. Segment 2314 Parameter of Concern

Assessment Unit	Parameter of Concern	Level of Concern
2314_01	Ammonia,	CS
	Chlorophyll-a	CS
	Nitrate	CS
	Total Phosphorus	CS
2314_02	Chlorophyll-a	CS

CS- Concern for water quality based on screening levels
CN- Concern for water quality based on non-attainment of water quality standards
NS - Non-supporting

Table 24. Segment 2314 Parameter Impairment

Assessment Unit	Parameter(s) Impaired	Year First Listed	Assessment Category
2314_01	Bacteria (Recreational Use)	2002	5c

Table 25. Segment 2314 Hydrology and Temperature

Assessment Unit	Station	Streamflow		Temperature	
		Data points	CFS	Data points	Degrees Celsius
2314_01	13272	125	311.58	149	17.31
	13274	1	35	19	20.96
	13275	2	240	24	21.48
	15089	9	259.76	47	20.69
	17040	8	958.1	61	19.06
2314_02	13276	4	544.25	56	20.91

STATISTICAL ANALYSIS / SUMMARY AND TRENDS

Statistical Analysis for Segments 2305, 2306, 2307, 2308, 2309, and 2314.

This table describes analytical means for parameters with established water quality standards. Values in cells represent means or geomeans (bacteria). A minus sign indicates a statistically significant decreasing trend ($p < 0.1$) and a plus sign indicates a statistically significant increasing trend ($p < 0.1$), and a yellow cell indicates that more than 10% of the data exceeds the standard. Blue text indicates the mean of the parameter over the period of record is above the Texas State Water Quality Standard, with the exception of dissolved oxygen, where falling below 5 mg/L would indicate impairment.

A (^) indicates that a seasonal trend exists within the data. A (~) indicates a statistically significant positive correlation to the volume of streamflow, and a ~neg indicates a statistically significant negative correlation to the volume of streamflow. A blue box indicates that the sample size for the streamflow correlation test was insufficient, and a black rectangle indicates the sample size for the seasonality test was insufficient. An asterisk (*) indicates that the station had a sample size (n) for that parameter that is less than the samples size required for trend analysis ($n \geq 10$). The following types of analyses were run for the table below:

1. Mean of Data Exceeding Standard: Permutation Test
2. 10 % Exceedance Levels: Quantile Test
3. Trend Tests : Mann-Kendall
4. Seasonal Variation between means: Wilcox and ANOVA
5. Parameter concentrations correlated to flow: Kendall correlation test

Continuous Monitoring Network

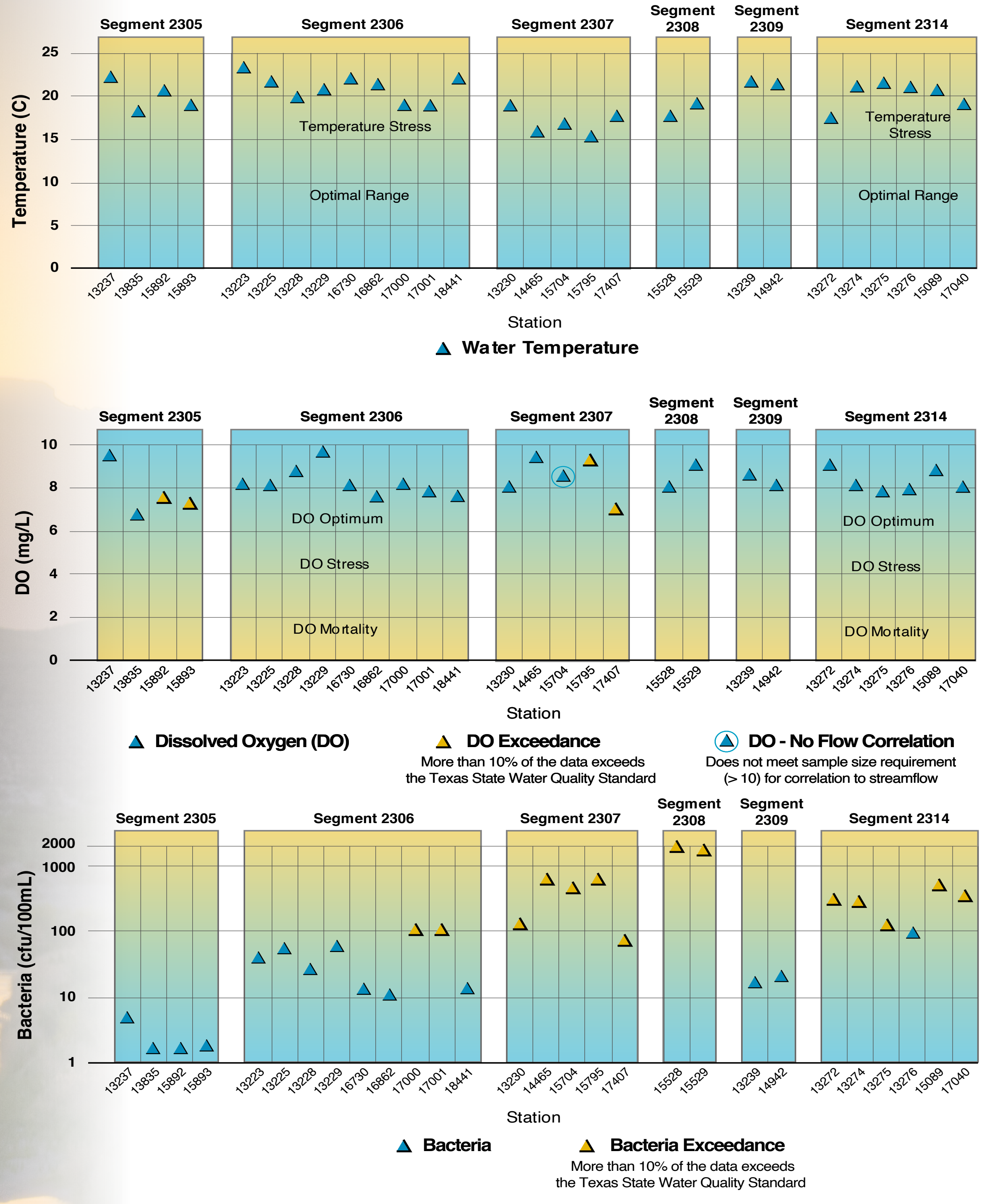
TCEQ continuously monitors water quality parameters in different watersheds within Texas. The Pecos River has ten continuous water quality monitoring gaging stations along the length of the river that monitor water temperature, discharge, specific conductance, dissolved oxygen and pH 24 hours a day. These stations are funded by the TCEQ and are maintained, typically on a monthly basis, by the USGS. Current and historical instantaneous data is available for these stations, although the period of record and data availability varies by station. The data is transmitted via satellite and is available in “near real time.” The data are received, processed and validated by staff before it is available to the public on the webpage. In an area where there is limited routine monitoring, these stations provide important water quality data and help establish and maintain a baseline for the area. If you would like to learn more about the CWQM network, please contact CRP staff or you can visit the TCEQ webpage at https://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html.

Table 26. Statistical Analysis of all Stations

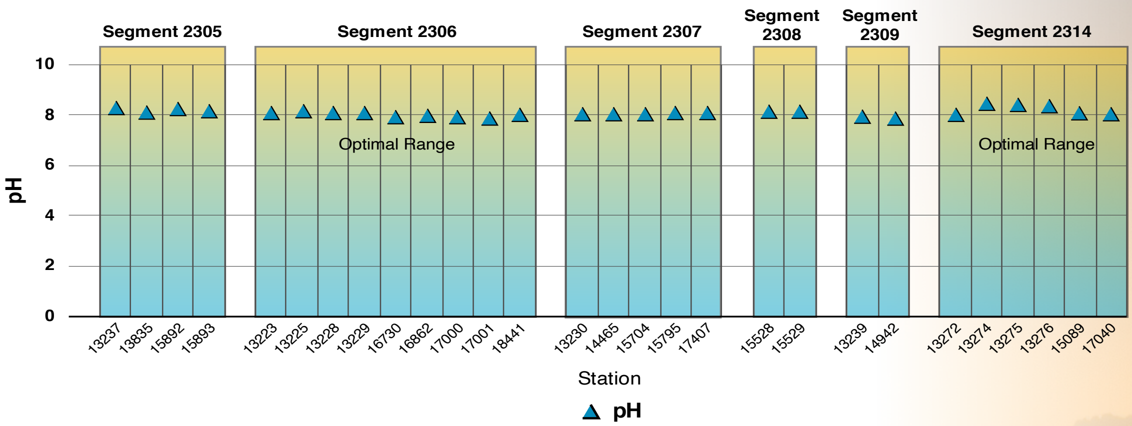
Segment/Station	Water Temperature	Dissolved Oxygen	pH	Chloride	Sulfate	Total Dissolved Solids	Bacteria
Segment 2305	**Amistad International Reservoir**						
13237	22.2	9.4	8.2-	14.3-~neg	8.1-	228.0-	4.6
13835	18.3+^	6.7-^	8.1-^	118.8+	222.3+	597.6-*	1.5
15892	20.6+^	7.5-^	8.2^	136.0	250.3	629.3*	1.6
15893	19.0+^	7.2-^	8.1-^	73.9	128.7	472.9	1.7
Segment 2306	**Above Amistad International Reservoir**						
13223	23.2	8.2	8.0	86.3	299.9	960*	39.3~
13225	21.8	8.1	8.2	123.4	414.2	1362.5*	53.5+
13228	19.9^	8.8^	8.1+~^	271.9- ~neg^	677.4	1622.4 ~neg	24.1 ~neg
13229	20.8^	9.6	8.0~^	269.3-~neg^	710.4-~neg^	1698.2-~neg^	54.8+~
16730	22.1~neg^	8.1~^	7.9+~	210.8~neg	549.3~neg	1316.3	13.7
16862	21.3	7.7	7.9	302.5	740.3	1742.9+	10.5*
17000	19.0^	8.115^	7.9~^	ND	ND	ND	104.9~
17001	18.8^	7.9^	7.9^	ND	ND	ND	110.0~
18441	21.9	7.7	8.0	289.5	674.3	1498.9	13.3*
Segment 2307	**Rio Grande Below Riverside Diversion Dam**						
13230	18.9^	8.1^	8.1~^	410.8~neg^	603.9~neg^	1908.1~neg	125.7+
14465	16.0	9.4	8.0+	ND	ND	ND	620.5+
15704	16.8-	8.4	8.0	275.7	293.6	1065.1	449.8
15795	15.3	9.2	8.1	932.0+	597.5	2639.0+	642.0
17407	17.8~neg	7.0~	8.0	594.6~neg	495.1~neg	2070.0	68.6*
Segment 2308	**Rio Grande Below International Dam**						
15528	17.8*	8*	8.2*	ND	ND	ND	1967.7
15529	19.2*	9.1*	8.2*	ND	ND	ND	1724.2*
Segment 2309	**Devil's River**						
13239	21.7	8.6	7.9	15.6	8.9-~	266.0+	16.9~neg
14942	21.3	8.2	7.9~neg	15.2	7.6-	279.4	20.6~
Segment 2314	**Rio Grande Above International Dam**						
13272	17.3~^	9.1~neg^	8.0+~	364.7~neg	463.0~neg	1006*	312.4~neg^
13274	21.0	8.2	8.5	76.8-	119.6-	492.4-	286.9
13275	21.5	7.8	8.4	90.0-	126.6-	512.4-	131.1+
13276	20.9	7.9	8.3+	85.6-	128.8-	544.5-	96.1+
15089	20.7	8.8	8.0	299.1	354.1	1234.0	489.4
17040	19.1^	8.0^	8.0	182.8	217.6	816.8	350.6

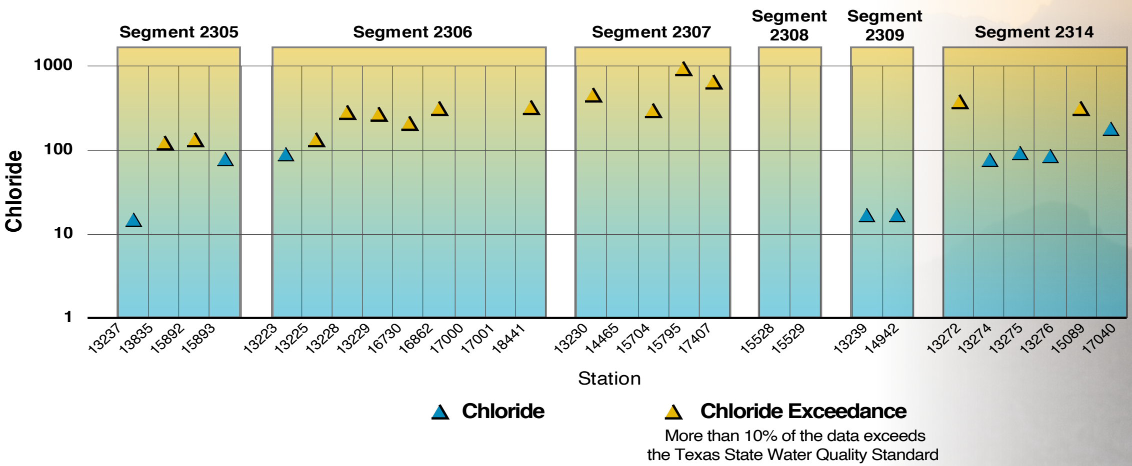
Key	
*	Does not meet sample size requirement (greater than 10)
Blue #	Mean of the parameter over the period of record is above the Texas State Water Quality Standard
(gold shading)	More than 10% of the data exceeds the Texas State Water Quality Standard
"-"	Statistically significant decreasing trend (p ≤ 0.1)
"+"	Statistically significant increasing trend (p ≤ 0.1)
~	Statistically significant positive correlation to streamflow
~neg	Statistically significant negative correlation to streamflow
(blue shading)	Does not meet sample size requirement (greater than 10) for correlation to streamflow
(boxed)	Does not meet sample size requirement (greater than 10) for seasonal effect test
^	Statistically significant difference in sample data grouped by season

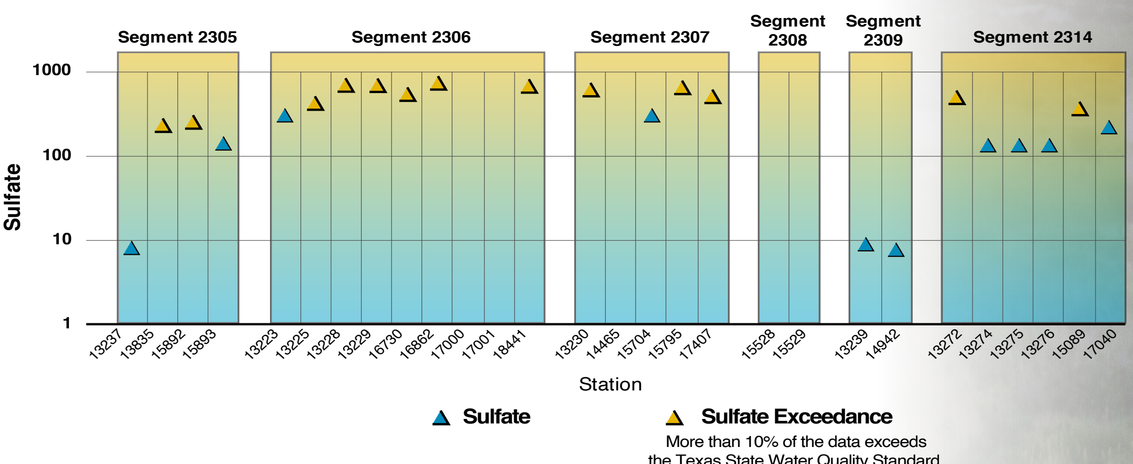
Figures 19-22. Graphs Representing Statistical Analysis of all Stations

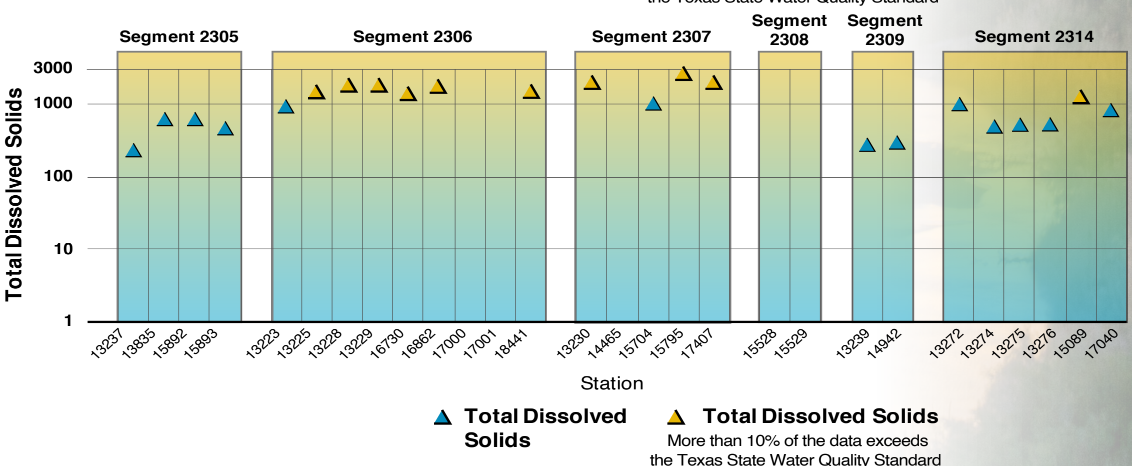


Figures 23-25. Graphs Representing Statistical Analysis of all Stations









INVASIVE SPECIES

Saltcedar (Tamarix spp.) is an invasive species of greater concern.

The Chihuahuan Desert (and Trans-Pecos region by TPWD standards) is one of the most complex and diverse regions in Texas. The region includes mountains, desert valleys and plateaus, and ranges in elevation from 2,500 feet to more than 8,749 feet at Guadalupe Peak. However, this same diversity is also severely affected by prolonged drought, low flows, high temperatures and urbanization in some areas (other areas are remote and relatively pristine). While there are many non-native and/or invasive species, TPWD has a list of species that are considered of higher concern. Below we discuss some of the invasive species that TPWD lists as top concerns for this region.

There are two invasive species that are of greater concern in this area- saltcedar (*Tamarix spp.*) and giant cane or carrizo cane (*Arundo donax*). Both are enormous water consumers, placing additional hardships on an area already struggling with low water availability, and both outcompete native vegetation, thereby reducing the local ecosystem's biodiversity. They also increase the risk for flooding due to their rapid, expansive growth into waterways.

Recently, both plants have been the subject of studies aimed at reducing their spread through biological control. In 2009 and 2012, two different insects- the arundo wasp (*Tetramesa romana Walker*) and the arundo scale (*Rhizaspidiotus donacis (Leonardi*)) were released in Texas and Mexico. These insects only feed on Arundo donax. The wasp lays eggs in the arundo cane side shoots, which results in the formation of abnormal plant growths that the larvae feed on. This damages the stems and shoots of the cane, which leads to the death of the stalk.

As of 2016, the wasp was responsible for an average decrease by 32% of cane along the Rio Grande. The impact of the release of the Arundo scale is still under investigation. Both of these biological controls are still active and are still being investigated, while a third, the arundo leaf miner, has been recently approved for study.

The saltcedar beetle released in the Rio Grande and Trans-Pecos region (subtropical tamarisk beetle, *Diorhabda sublineata*) is one of 4 species of beetles that feed only on saltcedar. It was released into these regions of Texas in 2009. Adult saltcedar beetles and larvae both feed on tender bark and saltcedar leaves; larvae do more damage. The larvae will eat the entire leaf or chew only on the surface tissue of the bark, which will cause the rest of the foliage to die. As the leaves are destroyed, the tree needs to use energy reserves from the extensive root system to regrow leaves, and the cycle repeats itself. Over time, this cycle depletes the plant's energy reserves and the plant starves to death. After five years in one particular area where the beetle was released, Big Springs, TX, it was estimated that the saltcedar canopy was reduced by 85-95 percent and about 20 percent of the trees were dead. The subject of biological control has always been one of extreme caution- while we can expect a certain result or behavior, we can never be truly sure of what will happen once in the wild. Ultimately, in these two instances, this method proved much safer and more effective than mechanical or chemical means, although it does take more time to see full results. Research is still ongoing for both insects.

Table 27. Invasive Species

Scientific Name	Common Name	Habitat Characteristics	Regions Observed
Arundo donax	Carrizo cane	Along rivers, streams, ponds, lakes, irrigation canals, and drainage ditches.	
Tamarix spp.	Saltcedar	Along broad floodplains, permanent and intermittent streams, and around lakes and reservoirs.	
Nicotiana glauca	Tree tobacco	In open and disturbed habitats including roadsides and lakeshores.	Big Bend Ranch State Park and Big Bend National Park
Peganum harmala	African rue	Grasslands and shrublands	
Pennisetum ciliare	Buffelgrass	Grasslands and shrublands	

THREATENED AND ENDANGERED

Table 27. Threatended and Endangered Species

Common Name	Scientific Name	Group	State Status	Federal Status	County	Habitat & Phenology
Sheep Frog	*Hypopachus variolosus*	Amphibian	Threatened		Brewster	Terrestrial and aquatic: Predominantly grassland and savanna; largely fossorial in areas with moist microclimates.
white-faced ibis	*Plegadis chihi*	Bird	Threatened		El Paso, Hudspeth, Jeff Davis, Presidio,	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.
common black-hawk	*Buteogallus anthracinus*	Bird	Threatened		Presidio, Brewster	Cottonwood-lined rivers and streams; willow tree groves on the lower Rio Grande floodplain; formerly bred in south Texas
zone-tailed hawk	*Buteo albonotatus*	Bird	Threatened		Presidio, Terrell, Hudspeth, Jeff Davis, Brewster	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
gray hawk	*Buteo plagiatus*	Bird	Threatened		Presidio, Brewster, El Paso, Jeff Davis	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
northern aplomado falcon	*Falco femoralis septentrionalis*	Bird	Threatened	Limited Endangered	Presidio, Jeff Davis,	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
American peregrine falcon	*Falco peregrinus anatum*	Bird	Threatened		Hudspeth, Presidio, Terrell, El Paso, Brewster, Jeff Davis	Year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Bird		Limited Endangered	Presidio, Terrell, Jeff Davis, El Paso, Hudspeth, Brewster	Status applies only to western population beyond the Pecos River Drainage; breeds in riparian habitat and associated drainages; springs, developed wells, and earthen ponds supporting mesic vegetation; deciduous woodlands with cottonwoods and willows; dense understory foliage is important for nest site selection; nests in willow, mesquite, cottonwood, and hackberry; forages in similar riparian woodlands; breeding season mid-May-late Sept.
owl	*lucida*	Bird	Threatened	Threatened	Paso	
northern beardless-tyrannulet	*Camptostoma imberbe*	Bird	Threatened		Presidio	Mesquite woodlands; also cottonwood, willow, elm, and tepeguaje near the Rio Grande. Breeding April to July
southwestern willow flycatcher	*Empidonax traillii extimus*	Bird	Endangered	Limited Endangered	Jeff Davis, Hudspeth, El Paso, Presidio, Brewster	Thickets of willow, cottonwood, mesquite, and other species along desert streams
rose-throated becard	*Pachyramphus aglaiae*	Bird	Threatened		Jeff Davis	Riparian corridors; trees, woodlands, open forest, scrub, and mangroves; breeding April to July.
tropical parula	*Setophaga pitiayumi*	Bird	Threatened		Jeff Davis	Semi-tropical evergreen woodland along rivers and resacas. Texas ebony, anacua and other trees with epiphytic plants hanging from them. Dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.
Arizona Botteri's sparrow	*Peucaea botterii arizonae*	Bird	Threatened		Presidio	Only one single accidental nesting record, heavily monitored in following years, but never documented a second occurrence - open pine woods with scattered bushes or understory, brushy or overgrown hillsides, overgrown fields with thickets and brambles, grassy orchards; nests on ground against grass tuft or under low shrub
Mexican stoneroller	*Campostoma ornatum*	Fish	Threatened		Presidio, Brewster	Occurs primarily in Mexico and ranges into Texas in Rio Grande tributaries in Brewster and Presidio counties (Big Bend region; Hubbs 1940; Hubbs 1954; Hubbs et al. 1991). Occurs in riffles, chutes, and pools of rivers and creeks, in warm, clear (sometimes slightly turbid) water over sand, pebble, gravel, rock, and bedrock substrates, at depths of 10 cm to 1 meter; prefers headwaters.
roundnose minnow	*Dionda episcopa*	Fish	Threatened		Jeff Davis, Brewster	Pecos River and Limpia Creek. Restricted to clear, spring-fed waters having little temperature variation.
Rio Grande chub	*Gila pandora*	Fish	Threatened		Jeff Davis	Formerly widespread in creeks of upper Rio Grande and Pecos watersheds; isolated population found in Little Aguja Creek in the Davis Mountains of Trans-Pecos Texas. Pools of small to moderate-sized tributaries, often near inflow of riffles and in association with cover such as undercut banks and plant debris.
Tamaulipas shiner	*Notropis braytoni*	Fish	Threatened		Presidio, Brewster, Terrell	Restricted to the Rio Grande basin in Texas including the lower Pecos River. Typically found in large rivers and creeks associated with a variety of flowng-water habitats such as runs and riffles over gravel, cobble, and sand.
Chihuahua shiner	*Notropis chihuahua*	Fish	Threatened		Presidio	
Rio Grande shiner	*Notropis jemezanus*	Fish	Threatened		Brewster, Terrell, Presidio	Rio Grande drainage. Occurs over substrate of rubble, gravel and sand, often overlain with silt
proserpine shiner	*Cyprinella proserpina*	Fish	Threatened		Terrell	Limited range includes Devils and lower Pecos rivers, Las Moras, Pinto, and San Felipe creeks, and Independence Creek in the Rio Grande watershed in western Texas. Associated with spring-fed tributaries and spring-runs. May be found in flowing pools, swift runs and riffles.
speckled chub	*Macrhybopsis aestivalis*	Fish	Threatened		El Paso, Presidio, Terrell, Brewster	Found throughout the Rio Grande and lower Pecos River but occurs most frequently between the Río Conchos confluence and the Pecos River. Flowing water over coarse sand and fine gravel substrates in streams; typically found in raceways and runs.

Table 27 (continued). Threatended and Endangered Species

Common Name	Scientific Name	Group	State Status	Federal Status	County	Habitat & Phenology
headwater catfish	*Ictalurus lupus*	Fish	Threatened		Presidio, Terrell, Jeff Davis, Brewster	Originally throughout streams of the Edwards Plateau and the Rio Grande basin, currently limited to Rio Grande drainage, including Pecos River basin; springs, and sandy and rocky riffles, runs, and pools of clear creeks and small rivers.
Comanche Springs pupfish	*Cyprinodon elegans*	Fish	Endangered	Limited Endangered	Jeff Davis	Restricted to small series of springs and their outflows, and man-made irrigation canals in the area of Balmorhea, Texas, including Phantom Springs (Jeff Davis County), San Solomon Springs, Giffin Springs and Toyah Creek (Reeves County). Native range: Comanche, Phantom Cave, San Solomon springs (Pecos and Reeves counties). Prefers fast-flowing water. Originally in Comanche Springs, San Solomon, and Phanton Cave, presently restricted to San Solomon and Phantom Cave and associated springs, and downstream irrigation canals; found in constantly discharging springs and in swift-flowing water of canals and earthen ditches
Conchos pupfish	*Cyprinodon eximius*	Fish	Threatened		Jeff Davis, Brewster, Presidio	Devils River and Alamito Creek. The Devils River and Alamito Creek populations are morphologically and biochemically distinct from the Rio Conchos (Mexico) populations. Shallow water (<25 cm) on bedrock shelves and in coves, sloughs, and backwaters over soft bottoms, all where current is negligible and bottom generally devoid of aquatic macrophytes.
Pecos pupfish	*Cyprinodon pecosensis*	Fish	Threatened		Terrell	Originally Pecos River basin, presently restricted to upper basin only; shallow margins of clear, vegetated spring waters high in calcium carbonate, as well as in sinkhole habitats
Big Bend gambusia	*Gambusia gaigei*	Fish	Endangered	Limited Endangered	Brewster	Constant temperature environments; clear, shallow water fed by warm springs, or shallow margins of deeper water among dense aquatic vegetation. Presently restricted to one artificial springfed pool in Big Bend National Park close to the Rio Grande; type locality described as a marshy cattail slough fed by springs.
Pecos gambusia	*Gambusia nobilis*	Fish	Endangered	Limited Endangered	Jeff Davis	Endemic to the Pecos River basin in southeastern New Mexico and western Texas. Restricted to two locations in Texas (Balmorhea springs complex and Diamond Y Draw). Stenothermal springs, runs, ciénegas and irrigation canals carrying spring waters.
Rio Grande darter	*Etheostoma grahami*	Fish	Threatened		Terrell	Essentially restricted to the mainstream and spring-fed tributaries of the Rio Grande and the lower Pecos River downstream to the Devils River and Dolan, San Felipe and Sycamore creeks. Gravel and rubble riffles
Mexican long-	*Leptonycteris nivalis*	Mammal	Endangered	Limited	Presidio,	
spotted bat	*Euderma maculatum*	Mammal	Threatened		Brewster	Ponderosa pine forests to desert scrub; habitat requirement appears to be limited to presence of broken canyon country or cliffs for roosting sites; in Texas, Big Bend region; preferred habitat not fully understood, but species reported from pine forests at high elevations to open, desert scrub; reproduction data sparse, but single offspring born June-July
tawny-bellied cotton rat	*Sigmodon fulviventer*	Mammal	Threatened		Jeff Davis	Known in Texas from a single location in the Trans-Pecos. Insufficient information to determine habitat preferences.
black bear	*Ursus americanus*	Mammal	Threatened		Terrell, Brewster, Hudspeth, Jeff Davis, Presidio	Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.
white-nosed coati	*Nasua narica*	Mammal	Threatened		Brewster, Terrell, Presidio	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
turtle		Reptile	Threatened		Brewster	Aquatic: Cattle tanks, stock ponds, and pools on intermittent creeks.
Texas horned lizard	*Phrynosoma cornutum*	Reptile	Threatened		Terrell, Presidio, Hudspeth, Jeff Davis, El Paso, Brewster	Terrestrial: Open habitats with sparse vegetation, including grass, prairie, 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. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.
mountain short-horned lizard	*Phrynosoma hernandesi*	Reptile	Threatened		Jeff Davis, Hudspeth, El Paso	Terrestrial: Generally restricted to high elevation grasslands and forested areas with open ground; soil may vary from rocky to sandy; burrows into soil or occupies rodent burrow when inactive.
Trans-Pecos black-headed snake	*Tantilla cucullata*	Reptile	Threatened		Terrell, Presidio, Jeff Davis, Brewster	Terrestrial: Found rocky canyons or hillsides in mesquite-creosote and pinyon-juniper-oak forests, as well as grasslands.
diminutive amphipod	*Gammarus hyalelloides*	Crustacean	Endangered	Limited Endangered	Jeff Davis	Known only from Phantom Lake Spring; omnivorous; amphipods are active mostly at night and spend daylight hours hiding under vegetation and other cover; vulnerable to reduction of springflow resulting from declining levels of groundwater
Texas Hornshell	*Popenaias popeii*	Mollusk	Endangered	Limited Endangered	Brewster, Presidio, Terrell	Occurs in small streams to large rivers in slow to moderate current, often residing in rock crevices, travertine shelves, and under large boulders, where small-grained material, such as clay, silt, or sand gathers. Can also occur in riffles that are clean swept of soft silt; not known from reservoirs (Carman 2007; Inoue et al. 2014; Randklev et al. 2017b; Randklev et al. forthcoming). [Mussels of Texas 2019]
Salina Mucket	*Potamilus metnecktayi*	Mollusk	Threatened		Terrell, Brewster, Presidio	Occurs in medium to large rivers, where it may be found in substrates composed of various combinations of mud, sand, gravel, and cobble, as well as under rocks. It occurs in areas with slow to moderate current, most often in stable littoral habitats dominated by boulder or bedrock habitat; not known from reservoirs (Randklev et al. 2017b; Randklev et al. forthcoming). [Mussels of Texas 2019]
Mexican Fawnsfoot	*Truncilla cognata*	Mollusk	Threatened		Presidio, Terrell, Brewster	Occurs in large rivers but may also be found in medium-sized streams. Is commonly found in habitats with some flowing water, often in protected near shore areas such as banks and backwaters but also at the head of riffles; the latter more often supporting both sub-adults and adults. Typically occurs in substrates of mixed sand and gravel as well as soft unconsolidated sediments. Considered intolerant of reservoirs (Randklev et al. 2017b; Randklev et al. forthcoming). [Mussels of Texas 2019]

Table 27 (continued). Threatended and Endangered Species

Common Name	Scientific Name	Group	State Status	Federal Status	County	Habitat & Phenology
Phantom springsnail	*Pyrgulopsis texana*	Mollusk	Endangered	Limited Endangered	Jeff Davis	Endemic aquatic snail; known only from three spring systems and associated outflows in Jeff Davis and Reeves counties; vulnerable to reduction of springflow resulting from declining levels of groundwater
phantom tryonia	*Tryonia cheatumi*	Mollusk	Endangered	Limited Endangered	Jeff Davis	Endemic aquatic snail; known only from three spring systems and associated outflows in Jeff Davis and Reeves counties; vulnerable to reduction of springflow resulting from declining levels of groundwater
Gonzales tryonia	*Tryonia circumstriata*	Mollusk	Endangered	Limited Endangered	Terrell	Endemic; aquatic snail only known from a spring system and associated outflows in Pecos County; mud substrates on the margins of small springs and seeps, and marshes in flowing water associated with sedges and cattails; presumed to be fine particle feeders of detritus and periphyton within substrate
Carolinae tryonia	*Tryonia oasiensis*	Mollusk	Threatened		Terrell	Endemic to a single site in the lower Pecos River basin. Found in a complex of large springs, which is also known as T5 Springs, and discharges into two large ponds. Found in low aboundance in silt along the edges of a short (ca. 5 m) reach of the outflow of the lower pond.
Metcalf's tryonia	*Tryonia metcalfi*	Mollusk	Threatened		Presidio	
Livermore sweet-cicely	*Osmorhiza bipatriata*	Plant	Threatened		Jeff Davis	Moist igneous-derived soils of shaded rocky slopes around springs in high mountain canyons; occurs in shade of a mesic canyon forest; flowering June-August
gypsum scalebroom	*Lepidospartum burgessii*	Plant	Threatened		Hudspeth	Gypsum dune system in the salt basin west of the Guadalupe Mountains, east of Dell City; sparsely vegetated areas; some plants on and around shifting, unstabilized dunes; others in stabilized gypseous soils with a well-developed microbiotic crust; flowering late April- early October, peaking late July-early September
Terlingua Creek cat's-eye	*Cryptantha crassipes*	Plant	Endangered	Limited Endangered	Brewster	On low, seemingly barren, xeric hills of gypseous clay and chalky shales of the Boquillas Formation; flowering late March-early June; fruiting April-July
bunched cory cactus	*Coryphantha ramillosa*	Plant	Threatened	Limited Threatened	Terrell, Brewster	Rocky slopes, ledges, and flats in the Chihuahuan Desert, most frequently on exposures of Santa Elena or Buda limestones or the Boquillas Formation between 400-1070 m (1300-3500 ft) in elevation; flowering August-November, perhaps as early as April in response to rainfall.
Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	Plant		Limited Endangered	El Paso	Habitat description is not available at this time.
Davis' green pitaya	*Echinocereus davisii*	Plant	Endangered	Limited Endangered	Brewster	Novaculite outcrops in full sun among sparse Chihuahuan Desert scrub usually hidden in mats of Selaginella; flowering (February-) March-April
Chisos Mountains hedgehog cactus	*Echinocereus chisosensis*	Plant	Threatened	Limited Threatened	Brewster	Degraded desert grasslands or open shrublands on unconsolidated gravelly fan and terrace deposits on desert flats and low hills at moderate elevations of about 600-800 m (1950-2600 ft) in the Chihuahuan Desert, almost always found under the shelter of a nursery plant; flowering March-April, perhaps July, fruit maturing May-June, perhaps as late as August
Lloyd's mariposa cactus	*Sclerocactus mariposensis*	Plant	Threatened	Limited Threatened	Brewster, Presidio	Among low shrubs and rosette-forming perennials in gravelly or rocky soils on arid limestone slopes in the Chihuahuan Desert, mostly on Boquillas Formation; elevation 750-1,050 m (2,450-3,450 ft); flowering February-mid March, fruit maturing 1-2 months later
Nellie's cory cactus	*Escobaria minima*	Plant	Endangered	Limited Endangered	Brewster	Novaculite outcrops in full sun among Chihuahuan Desert scrub, usually in cracks or chips of novaculite or in mats of Selaginella; flowering March-June, probably most consistently from mid April - mid May; fruiting within one month or less of flowering
Sneed's pincushion cactus	*Escobaria sneedii var. sneedii*	Plant	Endangered	Limited Endangered	El Paso	Xeric limestone outcrops on rocky, usually steep slopes in desert mountains, in the Chihuahuan Desert succulent shrublands or grasslands; flowering April-September (peak usually in April, sometimes opportunistically after summer rains; fruiting August - November
brush-pea	*Genistidium dumosum*	Plant	Threatened		Brewster	Chihuahuan Desert scrub on rocky limestone hills at lower elevations; in Coahuila, also found on volcanic tuff and sandstone; flowering June-October
Hinckley's oak	*Quercus hinckleyi*	Plant	Threatened	Limited Threatened	Brewster, Presidio	Creosote bush-mariola or lechuguilla-sotol shrublands on arid limestone slopes at mid-elevations in Chihuahuan Desert; flowering in spring, produces acorns late August-early September
Leoncita false-foxglove	*Agalinis calycina*	Plant	Threatened		Brewster	Grasslands on perennially moist, heavy, alkaline/saline, calcareous silty clays and loams in and around cienegas (desert springs) and seeps; Annual; Flowering September-October
Guadalupe fescue	*Festuca ligulata*	Plant	Endangered	Limited	Brewster	
Little Aguja pondweed	*Potamogeton clystocarpus*	Plant	Endangered	Limited Endangered	Jeff Davis	Submersed in still or slowly flowing water of pools in intermittent creeks and rooted in sand and gravel derived from igneous rock of surrounding mountain slopes; fruiting May-October, and possibly later

2021

BASIN HIGHLIGHTS REPORT

WATERSHED CHARACTERIZATION OF THE UPPER RIO GRANDE SUB-BASIN

PROGRAM UPDATE

INTERNATIONAL BOUNDARY AND WATER COMMISSION, U.S. SECTION

TEXAS CLEAN RIVERS PROGRAM FOR THE RIO GRANDE BASIN