North and Central Watershed Stations

North and Central Watershed Protection Plan Development

Regional Small Cities Conference

July 22, 2025

Grant Overview and Funding

Clean Water Act's (319 Nonpoint Source Pollution Program)

Funding provided by the Texas Commission on Environmental Quality through a Clean Water Act § 319(h) grant from the U.S. Environmental Protection Agency.

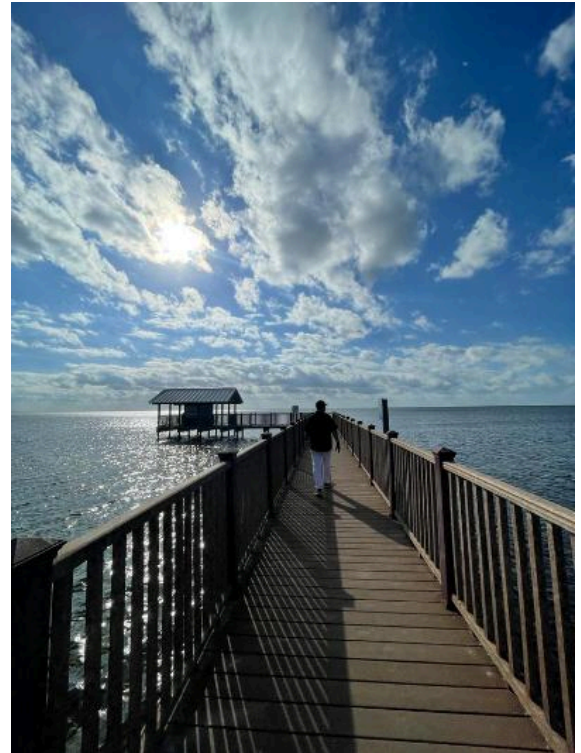This funding is to address non-point source (urban runoff, stormwater runoff) pollution problems.

Project Overview

The Lower Laguna Madre (LLM) is designated as an impaired waterway for high concentrations of bacteria and low dissolved oxygen (DO).

North and Central (NC) primary waterways (Raymondville Drain, Hidalgo Willacy Main Drain, and IBWC North Floodway) in the Lower Rio Grande Valley (LRGV) have not been characterized which can potentially be the flow water carriers of these contaminants into the LLM.

South Padre Island Birding And Nature Center

- Aquatic Life
- Laguna Atascosa Wildlife Refuge: Protects nearly 100k acres of habitat.
- Recreation activities: Fishing and Swimming

Lower Laguna Madre Importance

For more Low- Dissolved Oxygen Information visit: MIT (2014) Dissolved Oxygen

Previous Efforts

- **Watershed Characterization Phase I** (2019-2021) **UTRGV:** Thesis and Research Publication.
- **Lower Laguna Madre - Fresh Water Flows** (2021-2023) - **RATES**

Ongoing Efforts

- **Watershed Characterization Phase II (2022-Present)** - **RATES**
- **WPP Development Phase I (Sep 1, 2024-Present**) - **RATES**
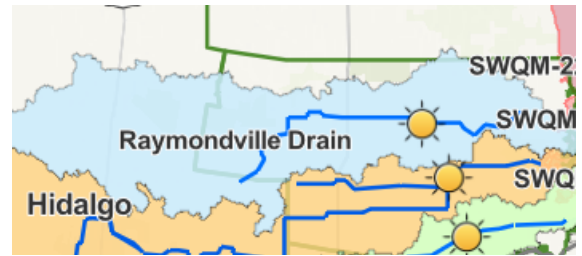
North and Central Watersheds

Waterways Analyzed

- Raymondville Drain
- Hidalgo Willacy Main Drain
- IBWC North Floodway

- **Project Duration:** 24-36 months.

Monitoring Component:

- **Extend Phase I Lower Rio Grande Valley-North and Central Watershed Characterization (UTRGV).**
- Real-Time Hydrologic System (RTHS): Leverages three RTHS commissioned by TWDB-FWF.
- **Continuous water quality measurements:** Dissolved Oxygen, Water Temperature, Specific Conductivity, and Nitrate.
- **Quarterly water quality and hydrodynamic measurements:** Dissolved Oxygen, Water Temperature, Conductivity, pH, Nitrate/Nitrite, Total Phosphorus, Total Nitrogen (TKN), and E. coli.
- Acoustic Doppler Current Profiler **(ADCP) discharge transects and flow measurements** to develop discharge rating curves as a function of stage height.
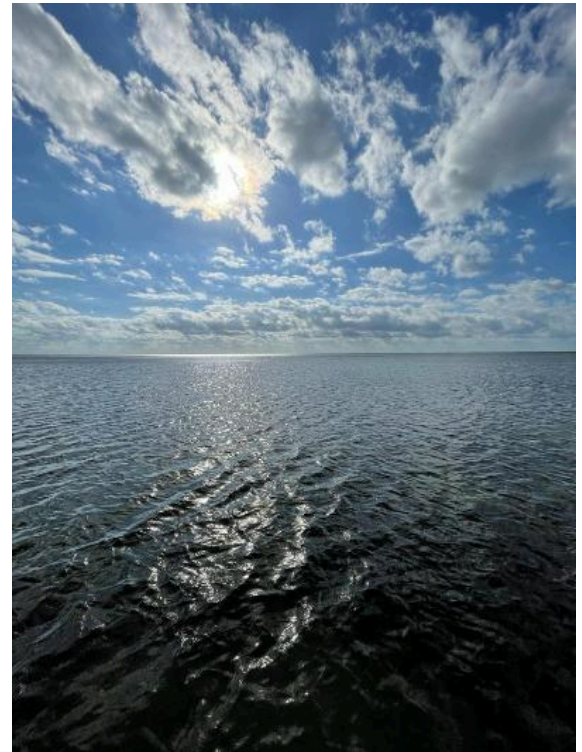
Lower Laguna Madre

Modeling Component:

- **QAPP Approved Fall 2024**

- **Water Quality Analysis:** Bacteria and nutrients concentration along with flow data will be utilized to gather actual discharge loads, the total mass of a nutrient (i.e, TP, TKN, NO_2-NO_3) being transported in the water over a given period.

- **Load Duration Curves:** tool driven by discharge loads and (i.e., high, medium, low) that allows to identify potential sources of pollution, address Total Maximum Daily Loads (TMDLs), and support the development of appropriate Base Management Practices (BMPs).

- **Bacteria Load Characterization:** Implementation of a Spatial Analysis Tool called Spatially Explicit Load Enrichment Calculation Tool (SELECT), that predicts potential E. Coli discharge loads coming from multiple sources (i.e., Wastewater Treatment Facilities, On-Site Sewage Facilities, Wildlife and Stock) per subwatershed. The results help to address in danger areas and support the development of BMPs.

Esri, CGIAR, USGS | Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmi…   10 km   Powered by Esri
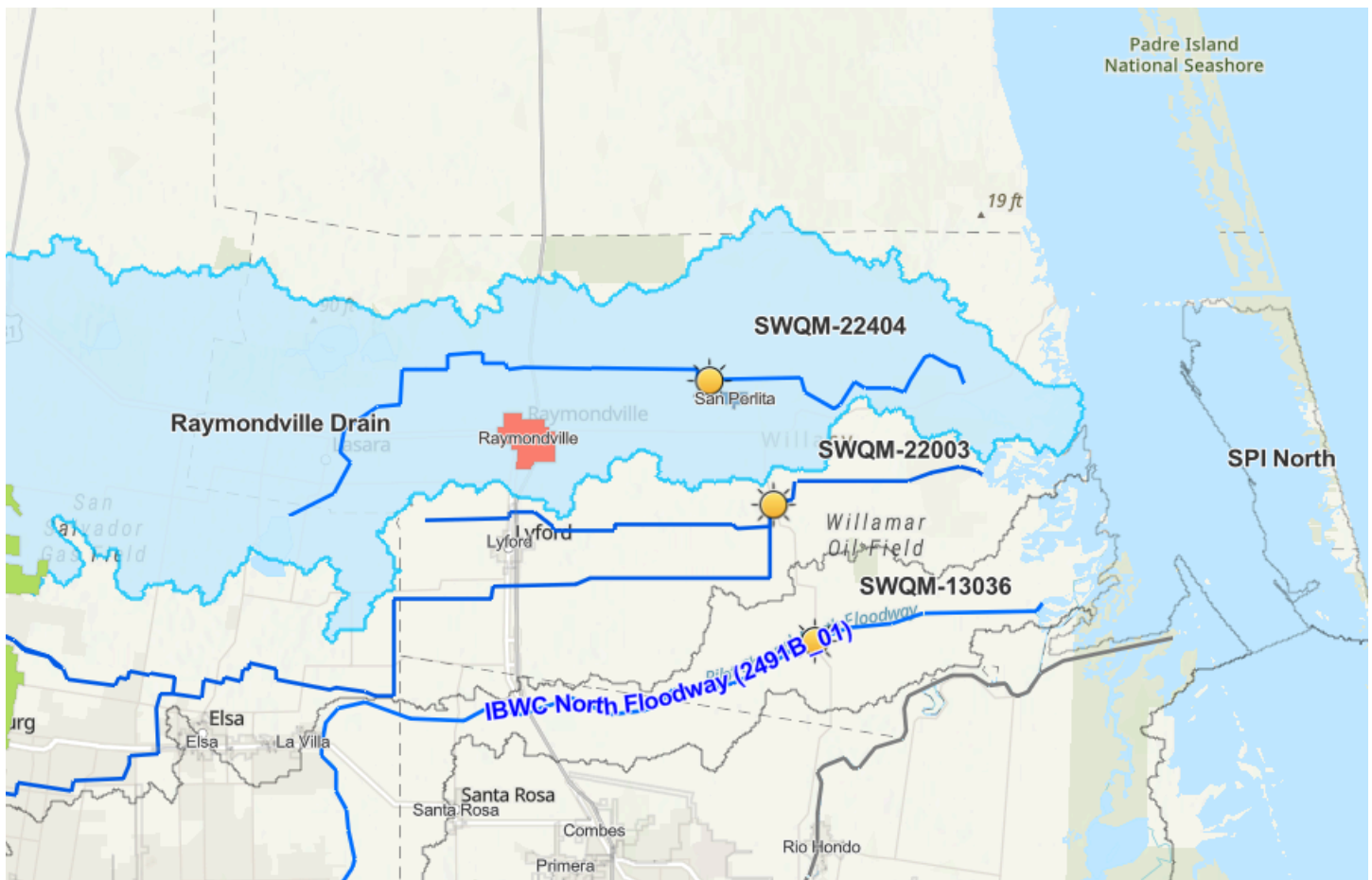
Raymondville Drain (RVD)
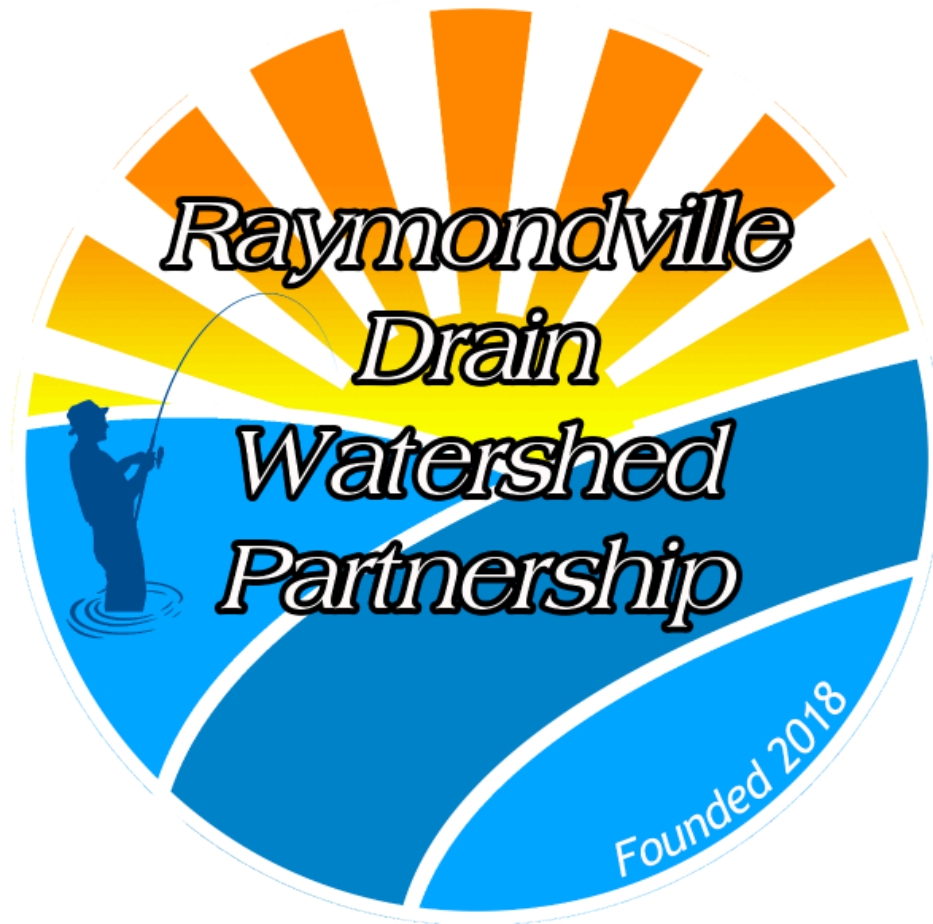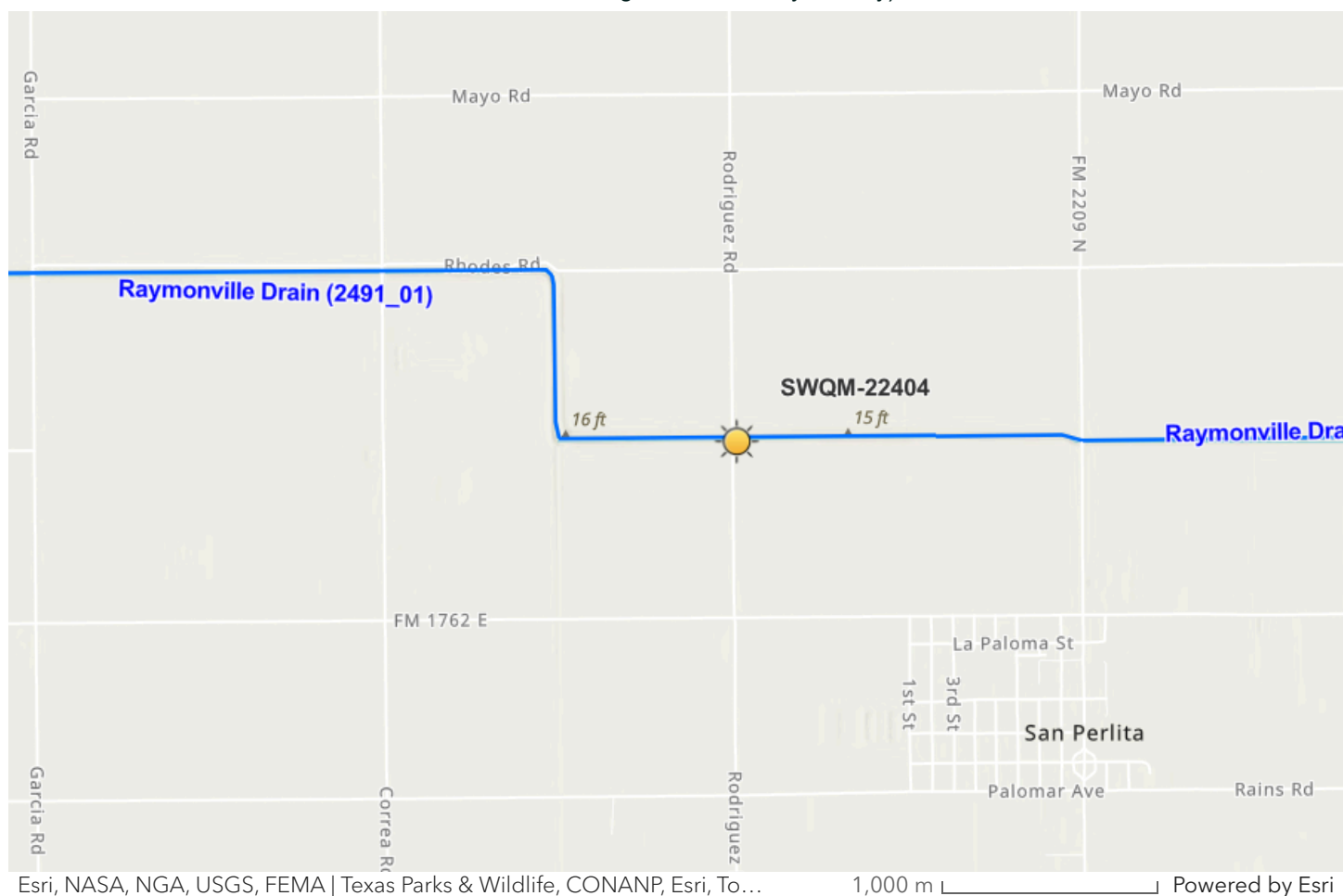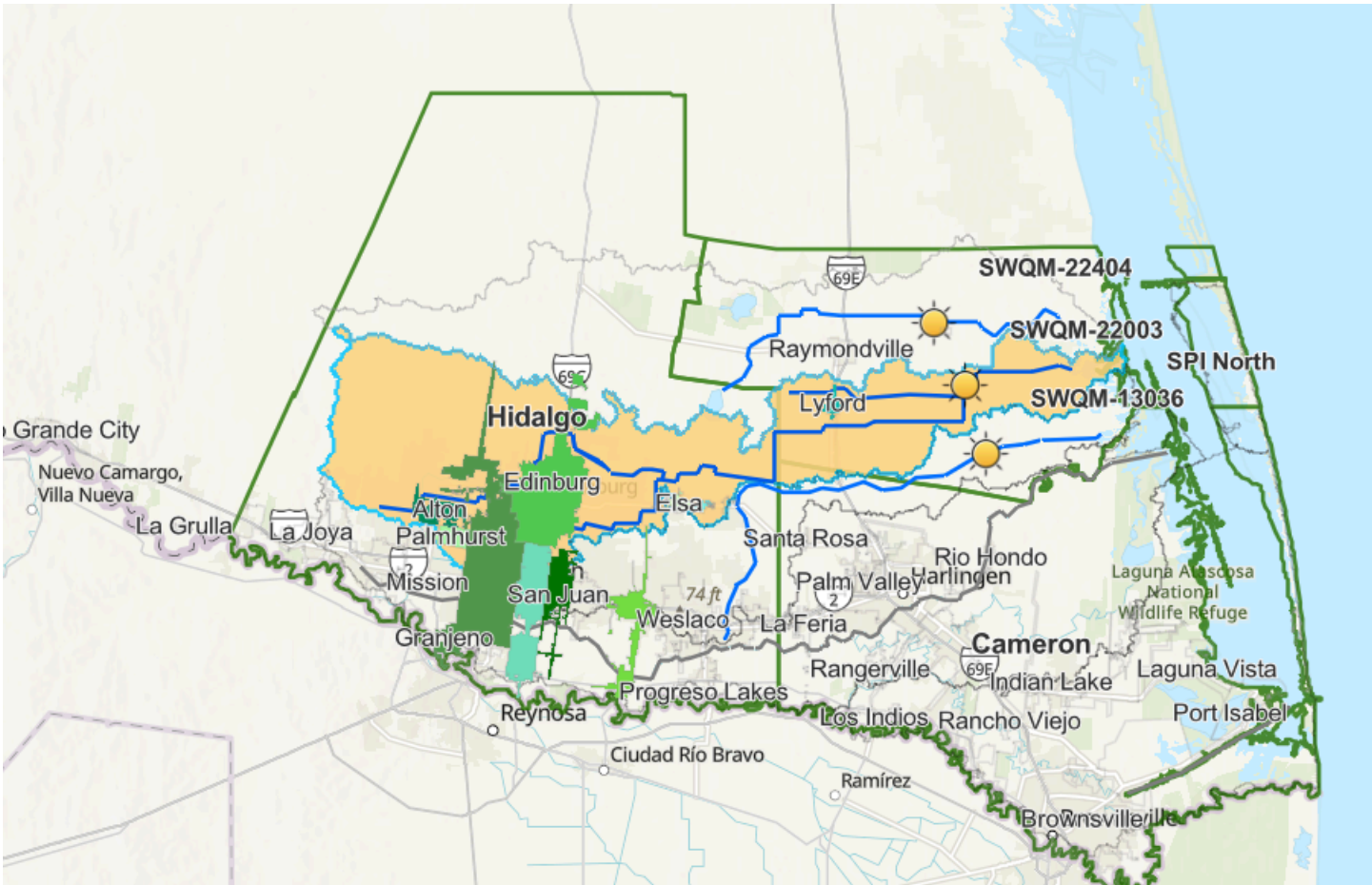
- Edinburg

- Raymondville

- San Perlita

Photo taken at station SWQM 22404 (Raymondville
Drain and Rodriguez Rd, Willacy County).

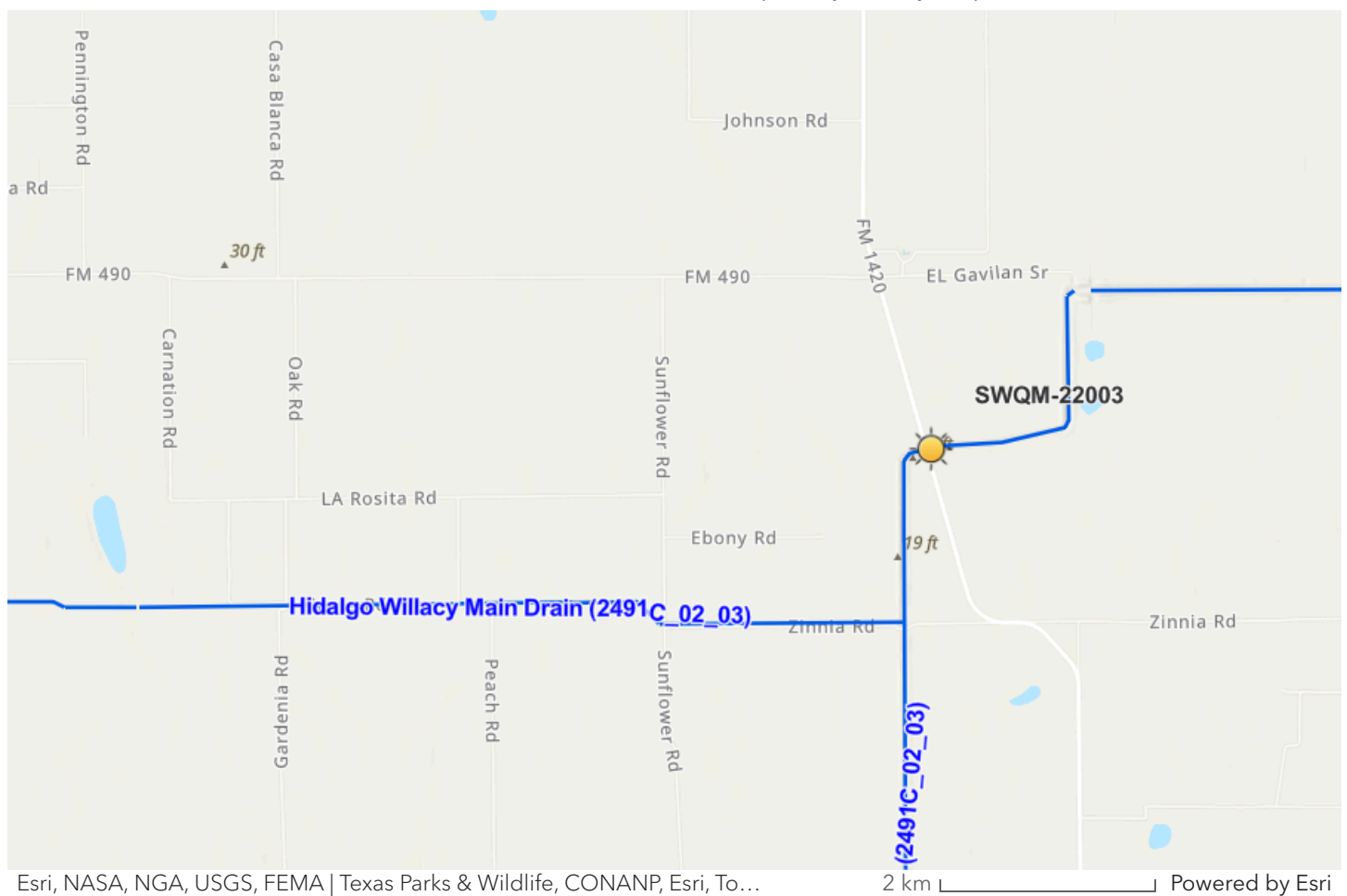## Raymondville Drain Monitoring Station

Rodriguez Road

Hidalgo Willacy Main Drain (HWMD)

- Alton

- Palmhurst

- Mission

- McAllen

- Pharr

- Edinburg

- Elsa

- Edcouch

- La Villa

- Lyford

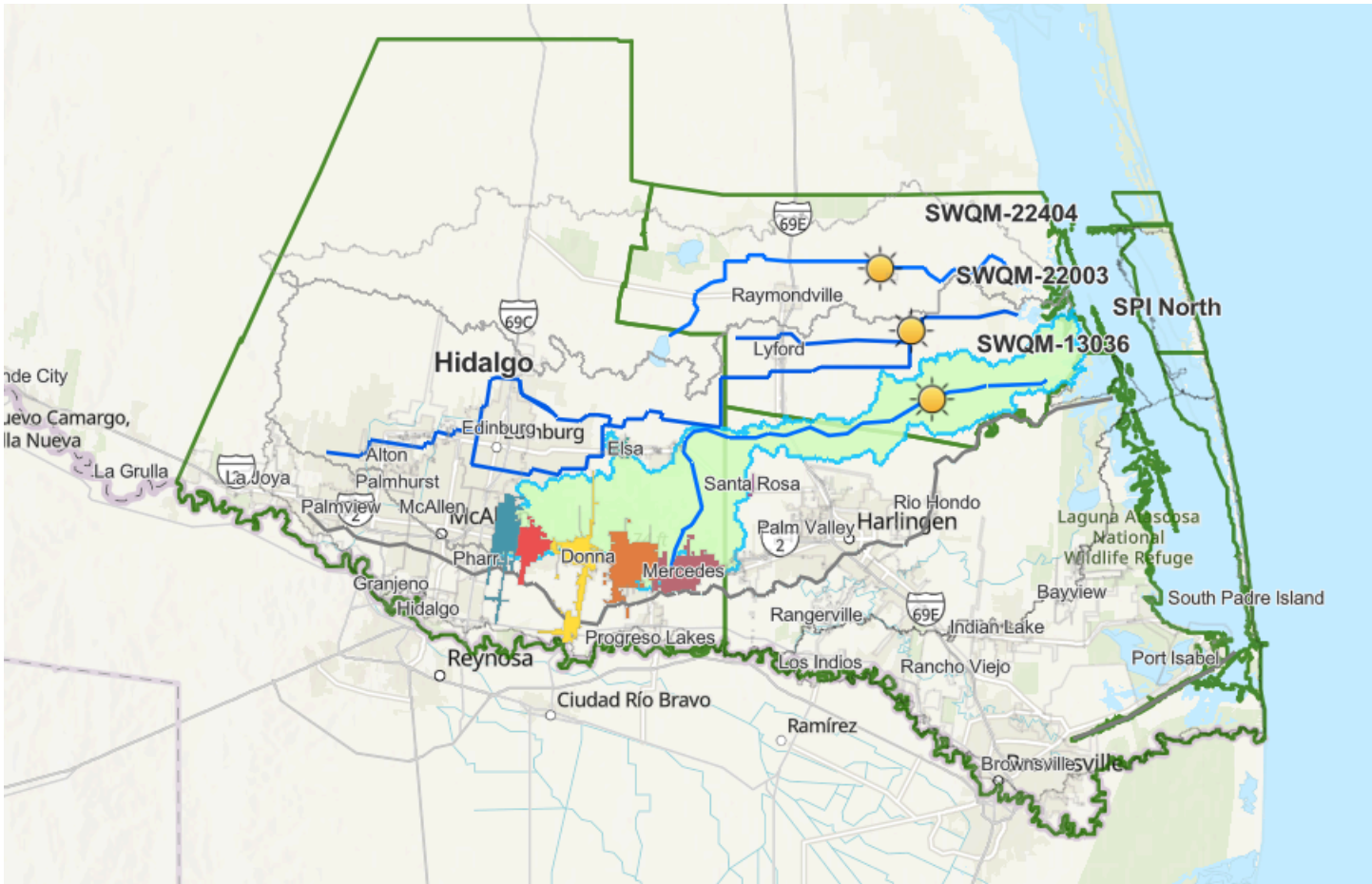Intersection of HWMD and FM 1420 (Willacy County, TX).

HWMD Monitoring Station

South of Willamar, FM 1420

:

Esri, CGIAR, USGS | Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmi…   20 km └──────┘ Powered by Esri
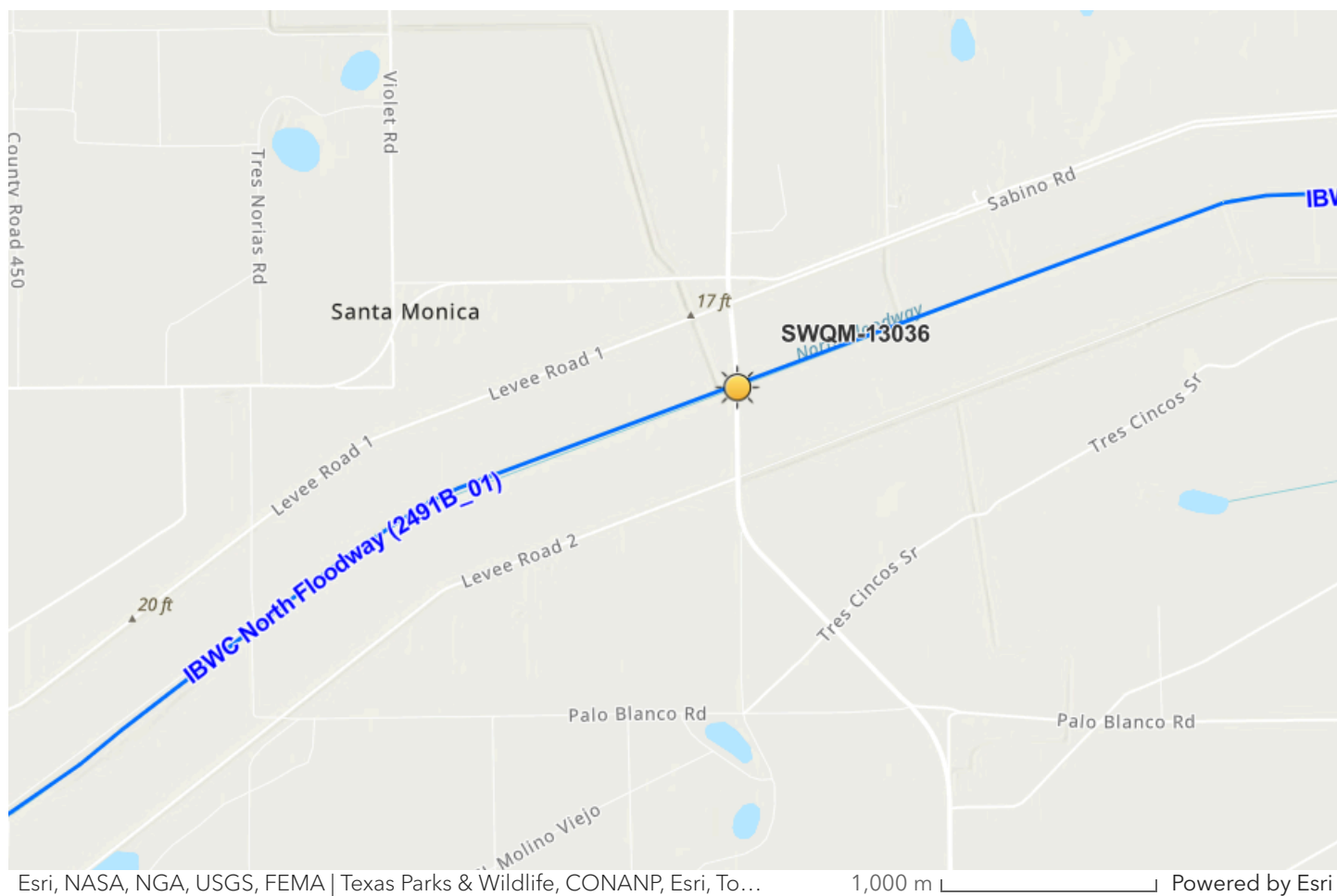
US-International Boundary Water Commission North Floodway (US-IBWC NF)

- San Juan
- Alamo
- Donna
- Weslaco
- Mercedes
- La Feria

Intersection of US-IBWC and FM 1420

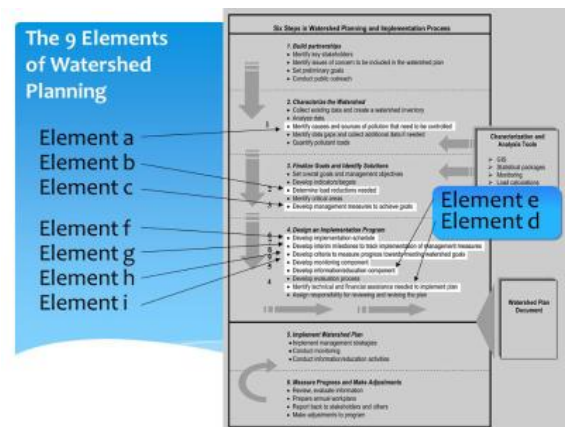US-IBWC North Floodway Monitoring Station

EPA 9 Elements Watershed Protection Plan (WPP)

Step 1

a. Build Partnerships

EPA 9 Elements of Watershed Planning

- Working at watershed level requires cooperative efforts among local stakeholders and other partners.

- Partner participation ensures commitments to solutions and makes resources and skill sets available.

b. Stakeholder Identification

- Those responsible for implementing watershed plan.

- Those affected by implementation measures.

- Those who can provide information on issues and concerns in watershed.

- Those with knowledge of existing programs or plans that may be applicable (e.g. soil and water conservation districts, irrigation districts, other).

- Those who can provide technical and financial assistance in developing and implementing plan.

c. Meeting Objective

- Identify stakeholder groups for each of the 3 sub-watersheds within the LRGV N&C Watersheds:
  - Raymondville Drain
  - Hidalgo-Willacy Main Drain
  - US-IBWC North and Central Watershed
- Secondary objective to identify and/or nominate a chairperson for each watershed group.
  - The rational being is that individual water sheds present unique challenges and concerns that must be addressed in WPP development.

Step 2 - Watershed Characterization

- **Current project (Phase II Characterization).**

Step 3 - WPP Development

- WPP Development (Phase I Partial WPP)
  - Expanding data collection to characterize causes and sources of NPS contamination.
  - Data will be applied to Quantify Pollutant Loads and Sources.
  - Applicable to BMPs development.

Steering Committee Members Nominations

1. **Stakeholder Roles**

   a. Chair

   b. Members

2. **Stakeholders Engagement Goals**

   a. Identification of Sources of pollution

3. **Stakeholder Nominations**

   a. Existing Appointments
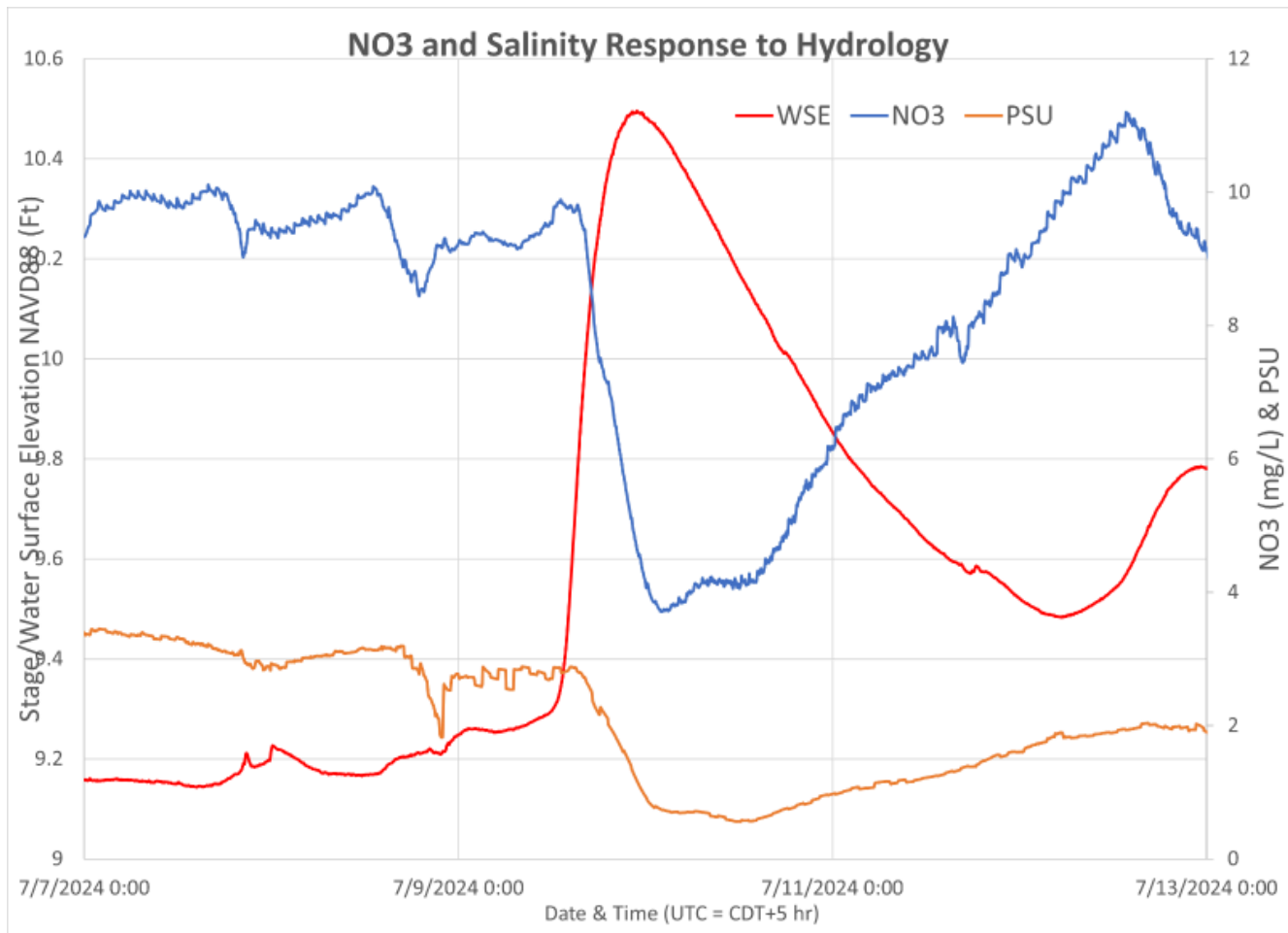
   b. Open Seats

   c. Request for Nominations

Steering Committees Groups

Phase II: Characterization Update

Types of Data

- **Continuous:** Real-time water quality data taken over the total length of the project (18 months). 18 out of 18 had been completed.

- **Instantaneous:** Six out of six quarterly sampling campaigns had been completed.

NO3 and Salinity Response to Hydrology

Continuous Data

- Real-Time water surface elevations **(WSE)** and **stage height** measurements.

- **Water quality measurements using Aqua Troll 500:** real-time temperature, salinity, DO, specific conductivity (SpC), and nitrate.

- **Monthly field service visits:** QAQC sondes, stations monthly, and calibration checks. Four of eighteen conducted.

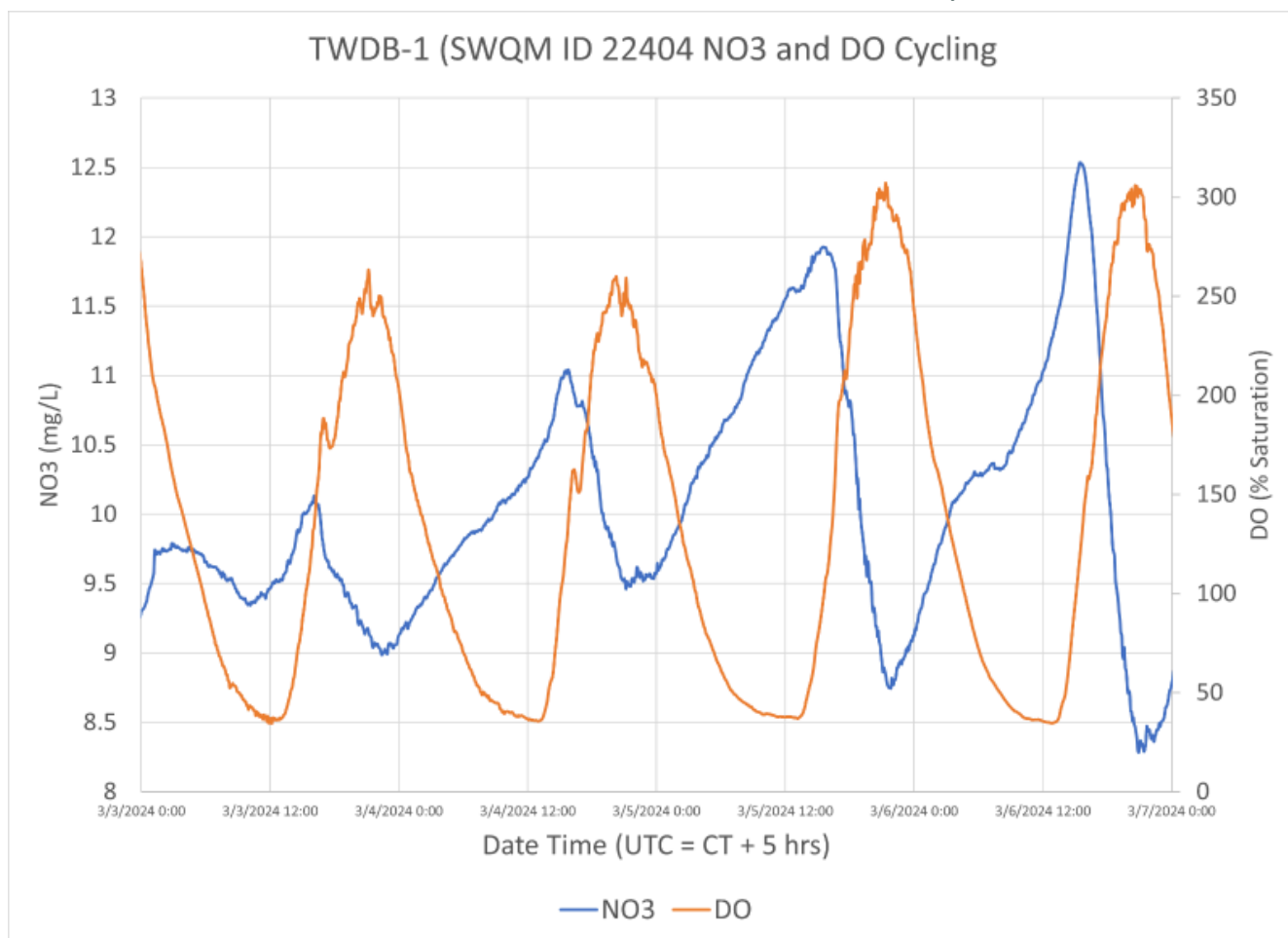- **Remote weekly checks:** review data availability and quality.

RTHS Stations enable continuous monitoring.

In-Situ Sonde place at each station.

Sonde installed at each of the three monitored waterways.

NO$_3$ and DO Cycling at TWDB-1

Instantaneous Data

Instantaneous data (from sampling campaigns) is being uploaded to TCEQ via the Surface Water Quality Monitoring Information System (SWQMIS) following their criteria and methodologies.

Equipment: YSI EXO-2, Acoustic Doppler Current Profiler (ADCP), Sampling Pole.

Frequency: Quarterly based, six out of six completed.

Results: Uploaded to TCEQ through SWQMIS. Data is publicly available through TCEQ's website.

Data Collection: flow, water quality parameters, bacteria and nutrients concentration.

Field Work and QAQC Activities.

Pathogenic Bacteria Characterization

TCEQ's **maximum allowable bacteria concentration** value for Primary Contact Recreation (PCR) 1 waterways is **126 coliforms/100mL**. From the **58 observations** made across the three waterways, the PCR 1 criteria has been **exceeded 42** times.

- **Primary Contact Recreation (PCR) 1:** Water recreation activities, such as wading by children, swimming, water skiing, diving, tubing, surfing, and whitewater kayaking, canoeing, and rafting, involving a significant risk of ingestion of water.

- **Primary Contact Recreation (PCR) 2:** Water recreation activities that involve a significant risk of ingestion of water occur, but less frequently than for PCR 1. Will be designated where recreation occurs less frequently due to physical characteristics of the water body or limited public access.

Bacteria (E. Coli) limits based on water uses. Source: 2022 Guidance for Assessing and Reporting Surface Water Quality in Texas TCEQ

- **Secondary contact recreation (SCR) 1:** Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion and that commonly occur.

- **Secondary contact recreation (SCR) 2:** Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion but that occur less frequently than for SCR 1 due to (1) physical characteristics of the water body and/or (2) limited public access.

- **Noncontact Recreation (NCR):** Activities, such as ship and barge traffic, birding, and using hike and bike trails near a water body, not involving a significant risk of water ingestion, and where primary and secondary contact recreation should not occur because of unsafe conditions. The recreation use for these water bodies is protected by the same criteria and

indicators assigned to contact recreation waters— E. coli, and enterococci.

Bacteria and Concentration Observations

The following charts display the bacteria (E. Coli) and nutrients (TP, NO3-NO2, TKN) concentration observed at each of the three waterways. The observations come from three different projects: CRP (2013-2019), TWDB-FWF (2021-2022), N&C Phase 2 (2024-2025).

Bacteria (E. Coli) Concentrations
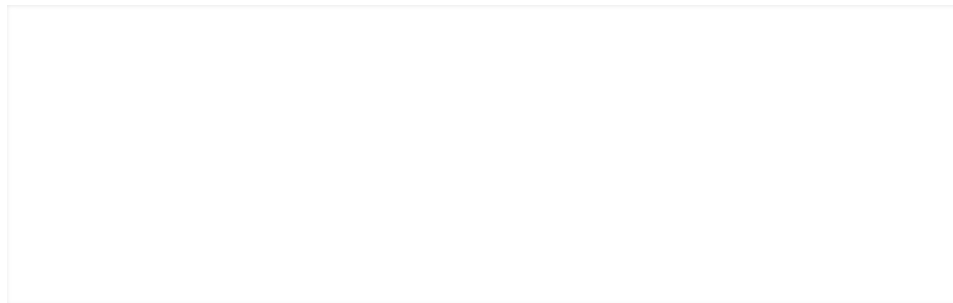
Historical E. Coli Concentration

Total Kjeldahl Nitrogen (TKN) Concentrations

Waterways   USIBWC N. Floodway   Raymondville Drain
   Hidalgo Willacy Main Drain

Total Kjeldahl Nitrogen (TKN) concentrations from 2021 until
March 2025 collected by RATES. The "+" symbol is for data
collected under the N&C Characterization Phase II, while
circles are for data retrieved during the TWDB FWF Project.

Total Phosphorous (TP) Concentrations
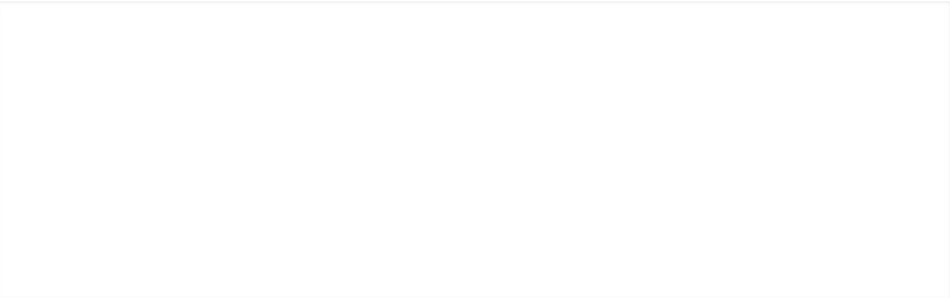
Total Phosphorous (TP) concentrations since 2021 until March 2025 collected
by RATES. The "+" symbol is for data collected under the N&C Characterization
Phase II, while circles are for data retrieved during the TWDB FWF Project.
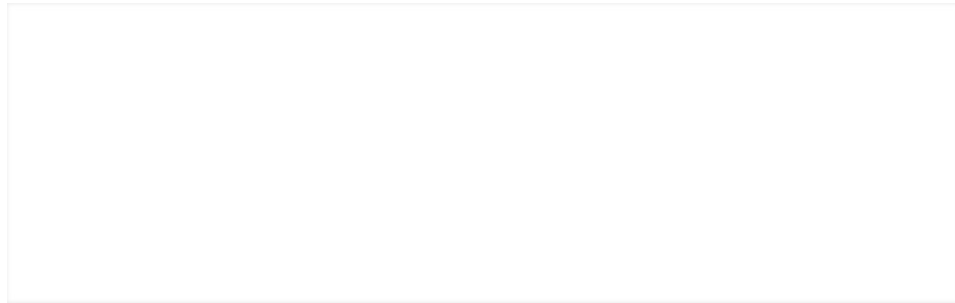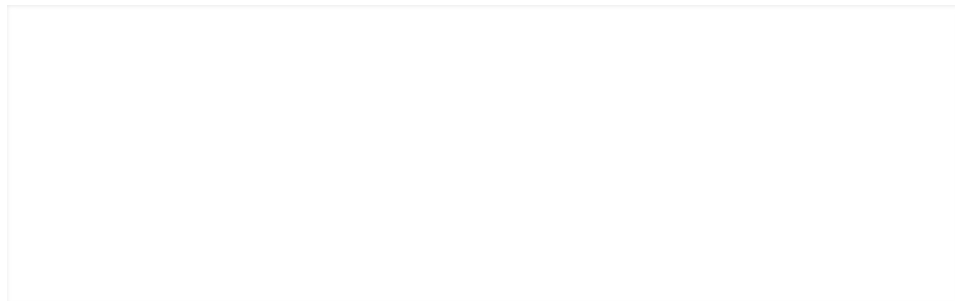
Nitrite-Nitrate (NO$_2$-NO$_3$) Concentrations

Nitrite-Nitrate (NO_2-NO_3) concentrations since 2021 until March 2025 collected by RATES. The "+" symbol is for data collected under the N&C Characterization Phase II, while circles are for data retrieved during the TWDB FWF Project.

Dissolved Oxygen (DO)

Dissolved Oxygen (DO) concentrations since 2021 until March 2025 collected by RATES. The "+" symbol is for data collected under the TWDB FWF Project. Circles are for data retrieved during the N&C Characterization Phase II.

Specific Conductance (SpC)
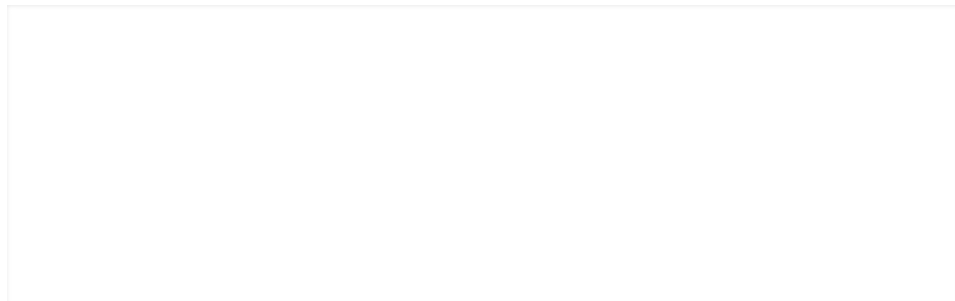
Specific Conductance since 2021 until March 2025 collected by RATES. The "+" symbol is for data collected under the N&C Characterization Phase II, while circles are for data retrieved during the TWDB FWF Project.

Water Temperature

Waterway   USIBWC N. Floodway   Raymondville Drain
Hidalgo Willacy Main Drain

Water Temperature since 2021 until March 2025 collected by RATES. The
"+" symbol is for data collected under the N&C Characterization Phase
II, while circles are for data retrieved during the TWDB FWF Project.

Flow

Waterway: USIBWC N. Floodway   Raymondville Drain
     Hidalgo Willacy Main Drain

Flow Measurements collected by RATES from November 2021 until March 2025. The "+" symbol is for data collected under the N&C Characterization Phase II, while circles are for data retrieved during the TWDB FWF Project.

Modeling Component

- **Modeling QAPP approved in Fall 2024.**

- **Modeling efforts in progress.**

- **Water Quality Analysis:** Bacteria and nutrients concentration along with flow data will be utilized to gather actual discharge loads, the total mass of a nutrient (i.e, TP, TKN, NO_2-NO_3) being transported in the water over a given period.

- **Load Duration Curves:** tool driven by discharge loads and (i.e., high, medium, low) that allows to identify potential sources of pollution, address Total Maximum Daily Loads (TMDLs), and support the development of appropriate Base Management Practices (BMPs).

- **Bacteria Load Characterization:** Implementation of a Spatial Analysis Tool called Spatially Explicit Load Enrichment

Calculation Tool (SELECT), that predicts potential E. Coli discharge loads coming from multiple sources (i.e., Wastewater Treatment Facilities, On-Site Sewage Facilities, Pets, Wildlife and Stock) per sub-watershed. The results will be reviewed with the stakeholders to support the development of BMPs.
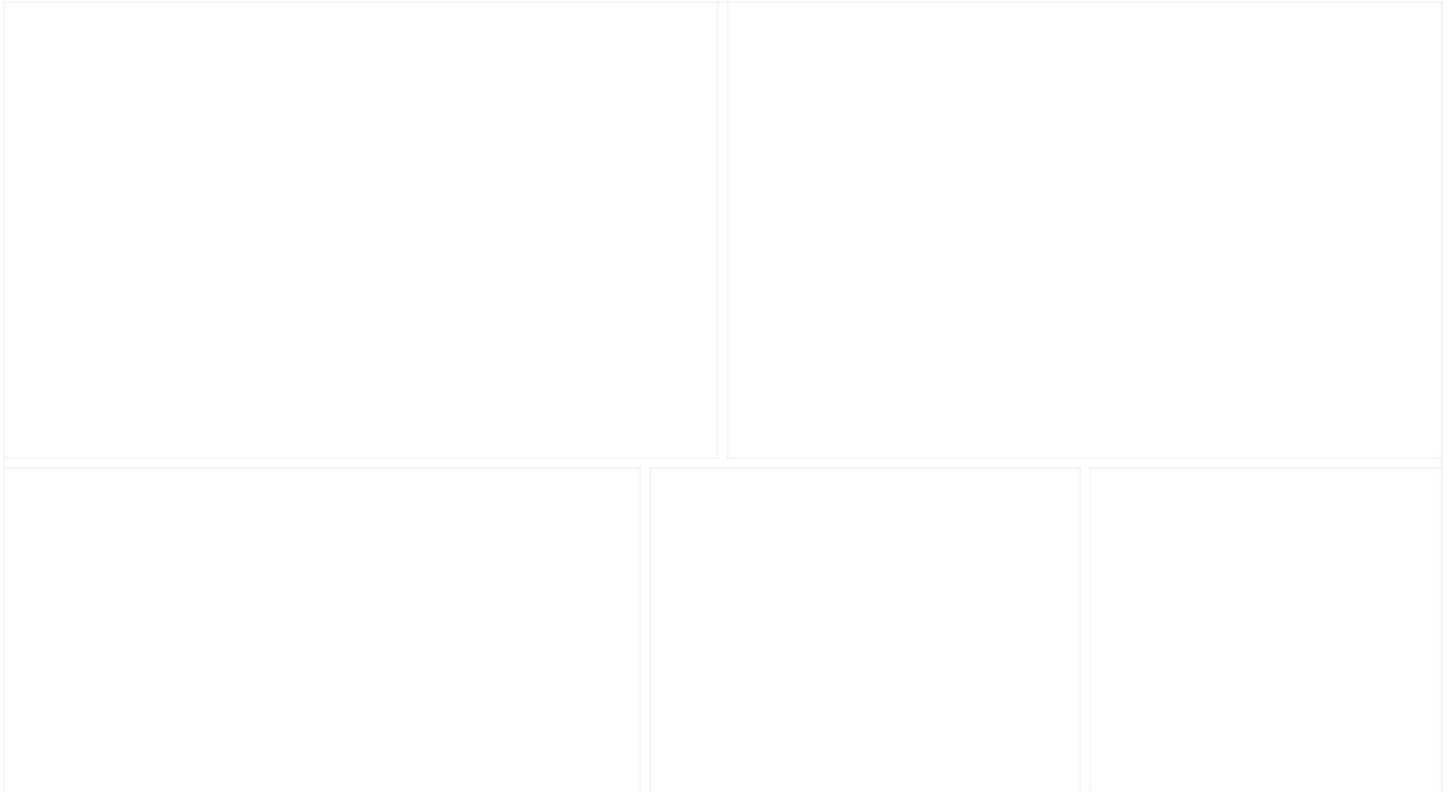
1) N&C watersheds, 2) Land Cover Analysis for N&C Watersheds, 3) Load Duration Curve (LDC), and 4) SELECT Modeling in BSC/LLM.

In addressing water quality concerns, relying solely on modeling output from LDCs or SELECT may provide limited insights, as they primarily focus on estimating pollutant loads and identifying critical loading periods or areas. While these methods are useful for certain types of assessments, they lack the comprehensive predictive capabilities necessary for long-term water resource management and planning.

Limitations of LDCs and SELECT

- **LDCs:** LDCs are static and retrospective, providing information on historical pollutant loads but not offering predictions or

detailed spatial insights on how changes in land use or management practices will impact future water quality.

- **SELECT:** The SELECT tool does not account for the dynamic nature of watershed hydrology and lacks the capability to simulate the temporal effects of changes in land use or climate on water quality.

- Integrating other water quality models, such as the **Soil and Water Assessment Tool (SWAT)**, alongside LDCs or SELECT, would offer a far more detailed and predictive approach to managing water quality. SWAT, for instance, simulates the complex interactions between hydrology, land use, and nutrient cycling. Additionally, it can simulate the movement of nutrients and sediments across the landscape, test BMP effectiveness, and incorporate climate projections to model future water quality.

Stakeholder's Feedback

Scan the QR code or use the link below to access this survey:

https://arcg.is/15LKu42

E-Newsletter

E-Newsletter

Phase II Characterization Timeline

9/2022	Contract Executed
5/2022	1st Stakeholder Meeting- Weslaco, TX
3/2023	Monitoring QAPP Draft
5/2023	Conference Presentation
8/2023	Executed Monitoring QAPP
9/2023	Setting up Monitoring Equipment
02/2024	**Begin Field Observations**
05/2024	QAPP Annual Review
5/2025	**End Field Observations**
8/2025	**Final Report**

Site Visits Timeline

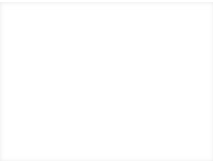February 20, 2024   1st Monthly Service
                           Visit

February 21, 2024   1st Sampling
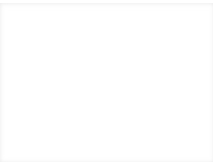   Campaign

March 12, 2024

                           2nd Monthly Service
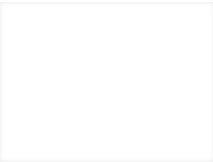   Visit

April 17, 2024

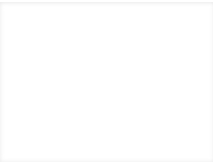   3rd Monthly Service
                           Visit

May 14, 2024

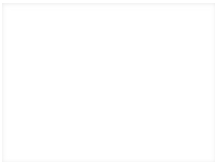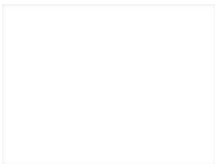   4th Monthly Service
                           Visit and 2nd Sampling
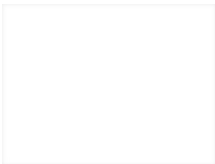   Campaign.

June 13, 2024

                           5th Monthly Service
                           Visit

July 18, 2024

6th Monthly Service Visit
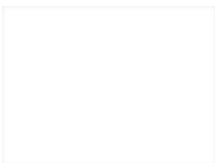
August 14, 2024

7th Monthly Service Visit and 3rd Sampling Campaign

September 17, 2024

8th Monthly Service Visit

October 18, 2024

9th Monthly Service Visit

November 2024

10th Monthly Service Visit and Fourth Sampling Campaign

December 2024

11th Monthly Service Visit

January 2025	12th Monthly Service Visit
February 2025	13th Monthly Service Visit
March 2025	Fifth Sampling Campaign and 14th Monthly Service Visit
April 2025	15th Monthly Service Visit
May 2025	Sixth Sampling Campaign and 16th Monthly Service Visit
June 2025	17th Monthly Service Visit
July 2025	18th Monthly Service Visit

Esri, CGIAR, USGS | Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmi…   20 km   Powered by Esri
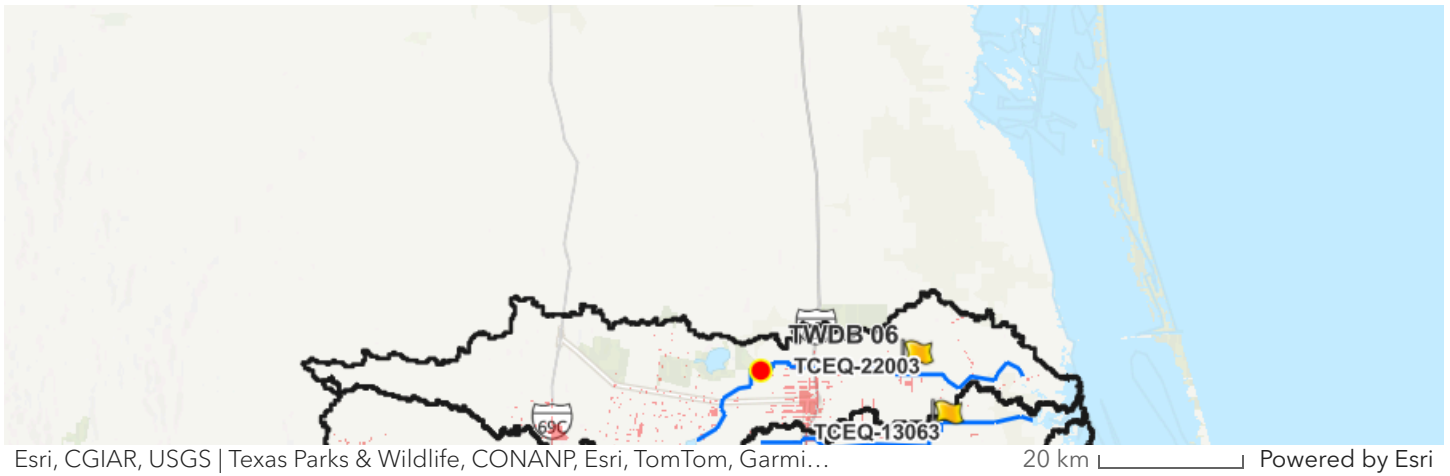
Watershed Protection Plan Development
Phase I: Northern and Central Lower Rio Grande Valley (LRGV) Watershed Development

Recently awarded by TCEQ.

Objectives:

- Expand instantaneous monitoring at upstream stations.

- Identify source of nonpoint source contaminants (Geospatial Analysis).

- Quantify nonpoint sources loads (Pollutant Load Calculations).

- Involve stakeholders in the WPP planning process. (Educational/Technical Workshops).

- Increase Public Awareness (Outreach Activities).

Esri, CGIAR, USGS | Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmi… 10 km Powered by Esri
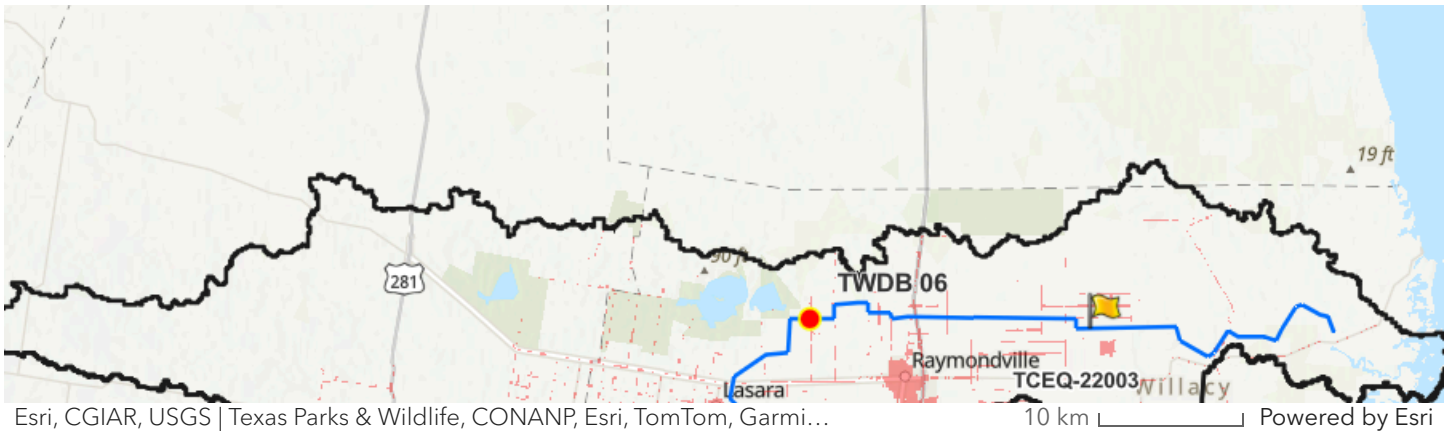
Award Acceptance Letter

November 2023

Work Plan Submission

December 2023

Project Start

September 1, 2024

Start of Monitoring

Fall 2025

Project Completion

August 31, 2027

Overall Comments and Questions

Water quality is everyone's responsibility. By engaging the community in open dialogue, we not only raise awareness but empower citizens to be active stewards of their environment. Every comment and question brings us closer to solutions that benefit all.

RATES Staff

Next Stakeholder Meeting Date Selection

RATES staff preparing for water quality characterization. August 2024 at US-IBWC Station 13036.
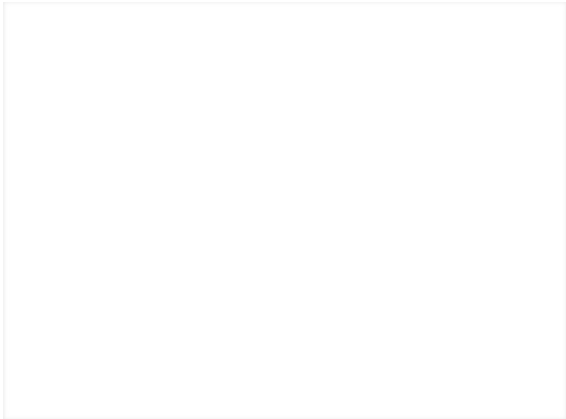
Other related projects:

RTHS Datahub

EPA-NAD Bank

TWDB Fresh Water Flows

RTHS Platform to view data results

About RATES

RATES, Research, Applied Technology, Education, and Service is a 501(c)3 Not for Profit Corporation formed to promote and coordinate the collaborative and cooperative use of technology by and among colleges, high schools, public schools, community school districts, public and school libraries, health care facilities, government offices, businesses, health and educational professionals, other educational and community service organizations and community residents for the benefit of the collaborating organizations, their clients, and community residents.

Principal Investigator	Christopher Fuller, PhD cfuller@office.ratesresearch.org
Project Manager	Linda Navarro, MS, EIT lnavarro@office.ratesresearch.org
Data Manager	Ivan Santos, MS isantos@office.ratesresearch.org
Quality Assurance Officer	William Kirkey, PhD
Stormwater Task Force Executive Director	Javier Guerrero, MS, EIT jguerrero@office.ratesresearch.org