



Northern and Central Watersheds Characterization Phase II

2024 Regional Small Cities Coalition Annual Conference

Research Applied Technology Education and Services, Inc

Funding Source

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.



Background

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.

Lower Laguna Madre Importance

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



Dissolved Oxygen

Previous Efforts



South Padre Island Birding And Nature Center

- Watershed Characterization Phase I (2019-2021) UTRGV: Thesis and Research Publication.
- Lower Laguna Madre Fresh Water Flows (2021-2023) RATES
- Phase II: Water Quality Data Collection (2022-Present) RATES

Scope of Work

Characterize water quality and flow at three of the primary watersheds that discharge into the Lower Laguna Madre.

Waterways Analyzed:

- Raymondville Drain
- Hidalgo Willacy Main Drain
- IBWC North Floodway
- Project Duration: 24-36 months.



North and Central Watersheds

Objectives

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.

Modeling Component:

- QAPP Draft
- Water Quality Analysis: Summarize all data collected.
- Load Duration Curves: Characterized watersheds by load reductions.
- Load Characterization: GIS Spatial Analysis Tool: Spatially Explicit Load Enrichment Calculation Tool (SELECT).



Lower Laguna Madre

Monitoring Sites

Esri, CGIAR, USGS | Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmi...

10 km ______ Powered by Esri

Raymondville Drain (RVD)

Cities discharging into it:

- Edinburg
- Raymondville
- San Perlita



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

۵.	Maria Del			Mayo Rd
rcia	Mayo Rd			Mayo Ku
Rd		70		
		odr		M
		igue		209
	Phodos Pd	iz R		z
		4		
Esri, NASA, NGA, USGS, FEMA Tex	as Parks & Wildlife, CONAN	NP, Esri, To	1,000 m 📖	Powered by Esri

Raymondville Drain Monitoring Station



Rodriguez Road



Hidalgo Willacy Main Drain (HWMD)

Cities discharging into it:

- 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



US-International Boundary Water Commission North Floodway (US-IBWC NF)

Cities discharging into it:

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



Intersection of US-IBWC and FM 1420



US-IBWC North Floodway Monitoring Station



Project Value

- **Leveraging Data:** LRGVDC Flood Infrastructure Fund Project: Flow measurements taken at the N&C sites can be used.
- Continuous water quality and stream stage heights.
 - Address measurement bias.
 - Can be combined with derived flows to quantify **nutrients loads.**
 - Ability to characterize episodic events (e.g. spills, extreme weather)

- Watershed Protection Plan:
 - Best Management Practices
 - Nutrient Management
 - Irrigation Management



Water Quality Characterization

Types of Data

- **Continuous:** Real-time water quality data taken over the total length of the project (18 months).
- Instantaneous: Six quarterly sampling campaigns over the length of the project.





Nitrogen as Nitrate (NO3) in Surface Water at Station 13036



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.



QAQC Activities.

Instantaneous Data

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

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

Frequency: Quarterly based, two out of six completed.

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

Bacteria Concentration over the years

TCEQ's maximum allowable bacteria concentration value for recreational waterways is **126 cfu/mL**. From the **58** observations made across the three waterways, **42 exceedances** were detected.



Water Quality measurements at Station 22404.

Historical E. Coli Concentration

Modeling Component



1) Water Quality Analysis, 2) Load Duration Curve (LDC), and 3) SELECT Modeling.

Project Timeline

9/2022	Contract Executed
5/2022	1st Stakeholder Meeting- Weslaco, TX
3/2023	Monitoring QAPP Draft
5/2023	Conference
0/ 2020	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

March 12, 2024

1st Sampling Campaign



2nd Monthly Service Visit



3rd Monthly Service Visit

4th Monthly Service Visit and 2nd Sampling Campaign.



5th Monthly Service Visit

April 17, 2024

May 14, 2024

July 18, 2024

Future: August 14, 2024

6th Monthly Service Visit and 3rd Sampling Campaign



Partial Watershed Protection Plan Development: Northern and Central Lower Rio Grande Valley (LRGV) Watershed

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).



Award Acceptance Letter

November 2023

Work Plan Submission

December 2023

Project Start

TBD (Late 2024)

Project Completion

TBD (Late 2028)

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.or	
	g	
Project Manager	Linda Navarro, MS, EIT	
	Inavarro@office.ratesresearch.	
	org	
Data Manager	Ivan Santos, MS	
	isantos@office.ratesresearch.or	
	g	
Quality Assurance Officer	William Kirkey, PhD	