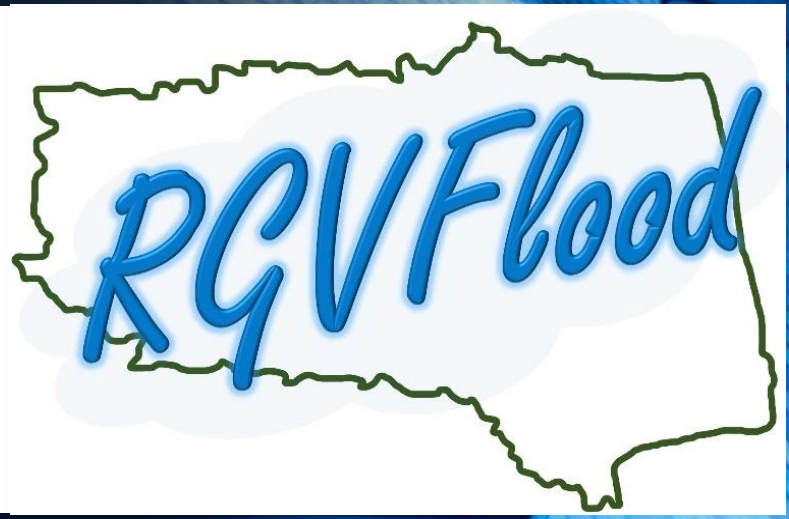


Regional Flood Management

2022 STORMWATER CONFERENCE

ANDREW N.S. ERNEST, PH.D., P.E., BCEE, D.WRE
PRESIDENT & CEO

JAVIER GUERRERO, M.S., PH.D. CANDIDATE, EIT
CHIEF PROJECT & COMMUNITY DEVELOPMENT OFFICER

CHRISTOPHER FULLER, PH.D.
CHIEF OPERATIONS OFFICER

WILLIAM KIRKEY, PH.D.
CHIEF RESEARCH OFFICER

Lower Laguna Madre Watershed-Based Planning

Rio Grande Valley Stormwater Management

Basis: 20+years of Regional Water Quality Efforts

Saltillo Flats

Port Mansfield

Raymondville Drain

Willacy Main

Hidalgo Main

North Floodway

McAllen

Arroyo Colorado

CC Ditch 2

CC Ditch 1

Rio Grande

Ship Channel

Watershed Coordinator

- Watershed Characterization
- Watershed Protection Plan
- Rio Grande Watershed Initiative

- Raymondville Drain Steering Committee
  - Technical Subommittee
  - Subcommittee
  - Subcommittee
  - Subcommittee
- Hidalgo Main Steering Committee
  - Technical Subommittee
  - Subcommittee
  - Subcommittee
  - Subcommittee
- IBWC Floodway Steering Committee
  - Technical Subommittee
  - Subcommittee
  - Subcommittee
  - Subcommittee
- Arroyo Colorado Steering Committee
  - Technical Subommittee
  - Subcommittee
  - Subcommittee
  - Subcommittee
- LLM BSC Steering Committee
  - Technical Subommittee
  - Subcommittee
  - Subcommittee
  - Subcommittee

LRGVDC (Willacy, Hidalgo, Cameron)

604(b)

Regional Water Resources Advisory Committee

Regional Water Resource Advisory Committee

Formalization & Commissioning of Regional FIF

- Established January 30, 2019
- Under LRGVDC Authority
- 15 Members
  - 3 Counties, Large & Small Cities, Special Purpose Districts, Stormwater Taskforce, UTRGV, IBWC, Region M
- Purpose
  - educate, promote, foster, and coordinate community and regional planning efforts on the environmental, economic, and other social impacts of existing, new or proposed regulations, policies, and control regarding water resources management

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

Vision

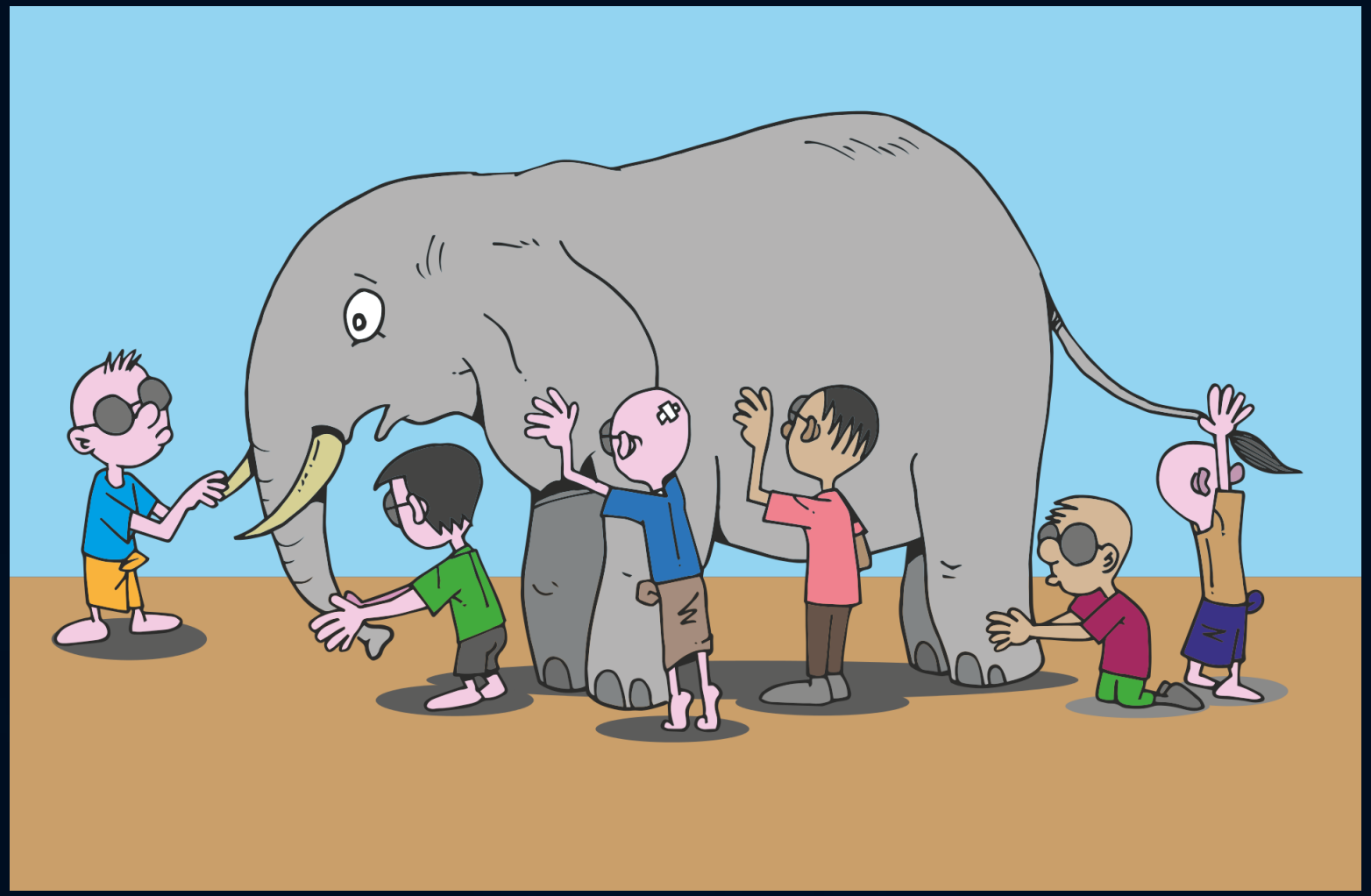
Unbiased Capacity Development

Democratizing Water Intelligence for Knowledge-Enabled Policy & Decision Making

- Mission: "***Make knowledge-based policy and decision making possible with regards to water resource management.***"
  - **Data**: address monitoring needs of under-served areas to ensure technology and monitoring solutions are available to all
  - **Information**: Translate water & environmental data into actionable intelligence
  - **Knowledge**: Educate decision makers and elected officials to promote knowledge-based decision making
  - **Wisdom**: Support implementation through facilitation of collaborative efforts between stakeholders such as municipalities, academic institutions, not-for-profits, conservancy & environmental groups as well as state and federal regulatory agencies

The Fable of the Six Blind Men and the Elephant

Foundation for Regional Decision Making

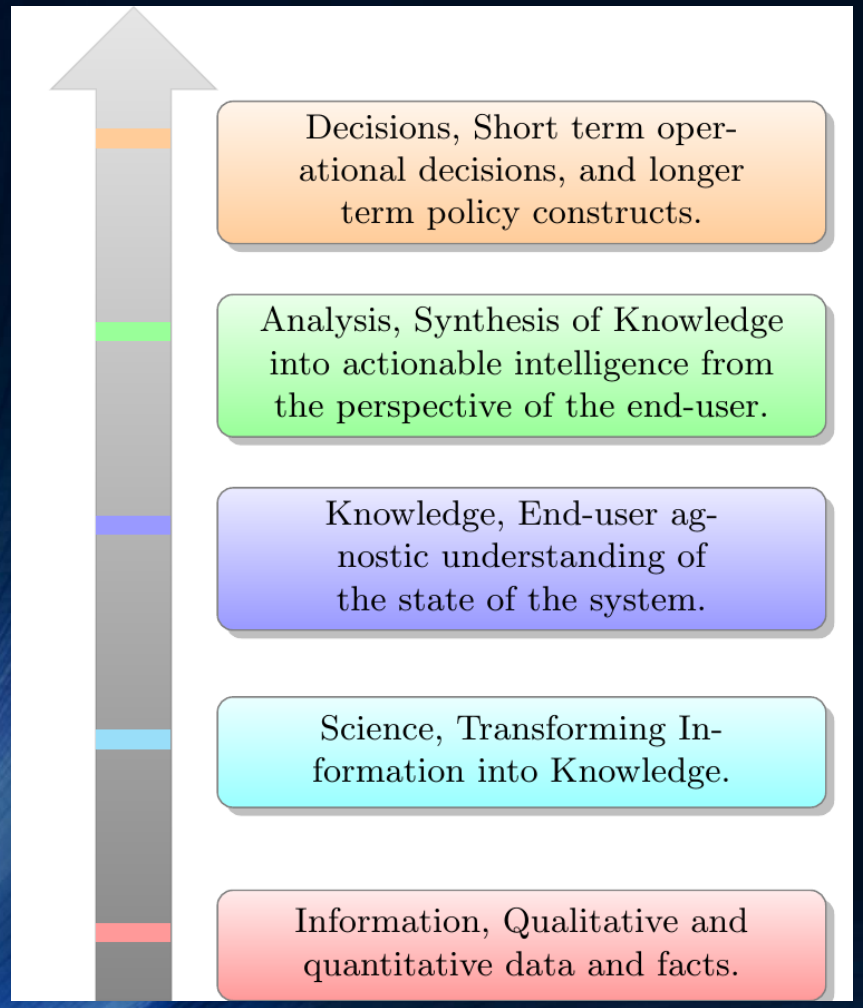


RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

The Case for a Common Operating Picture

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

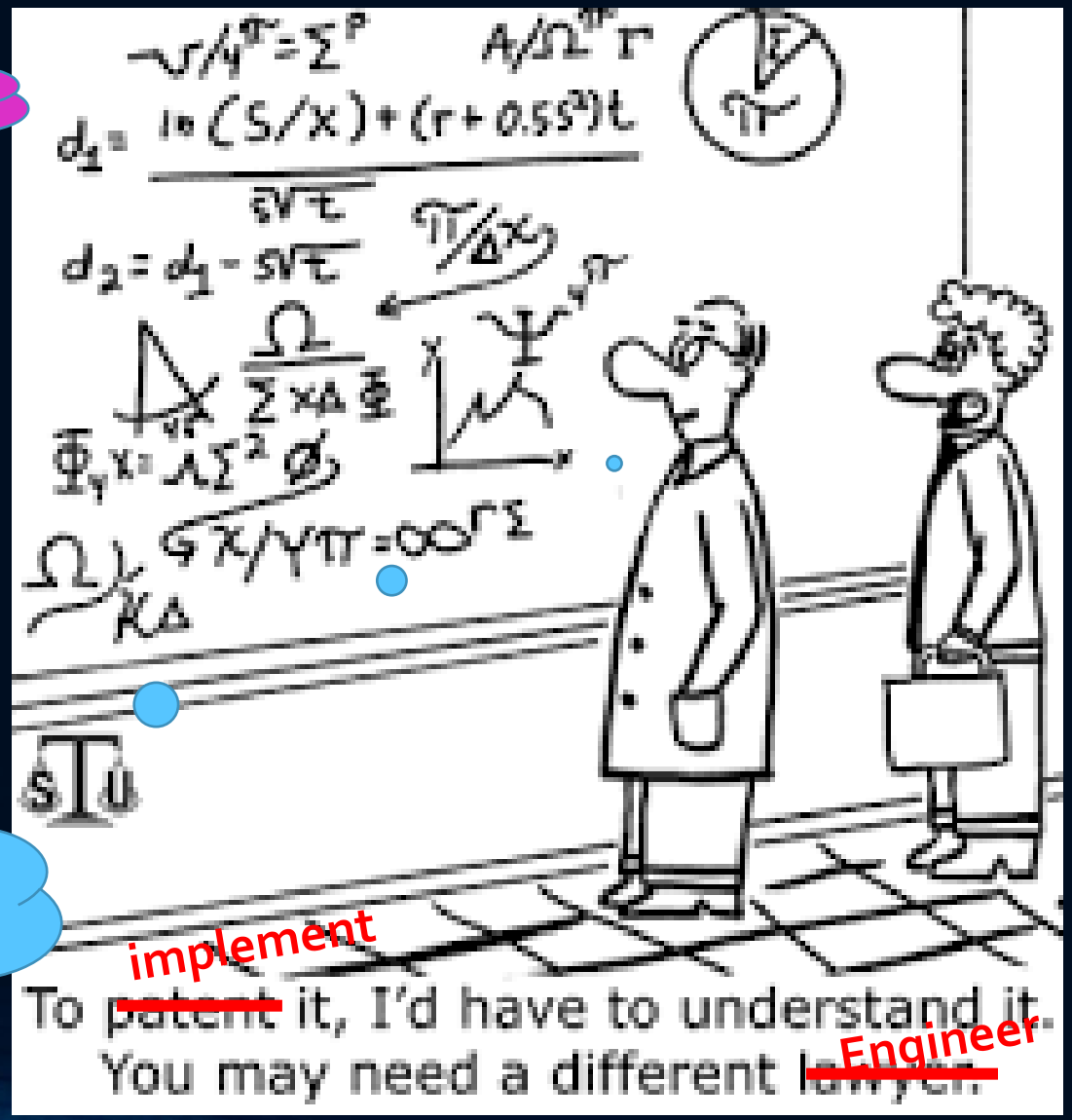
What's DIKW Got to Do with It?



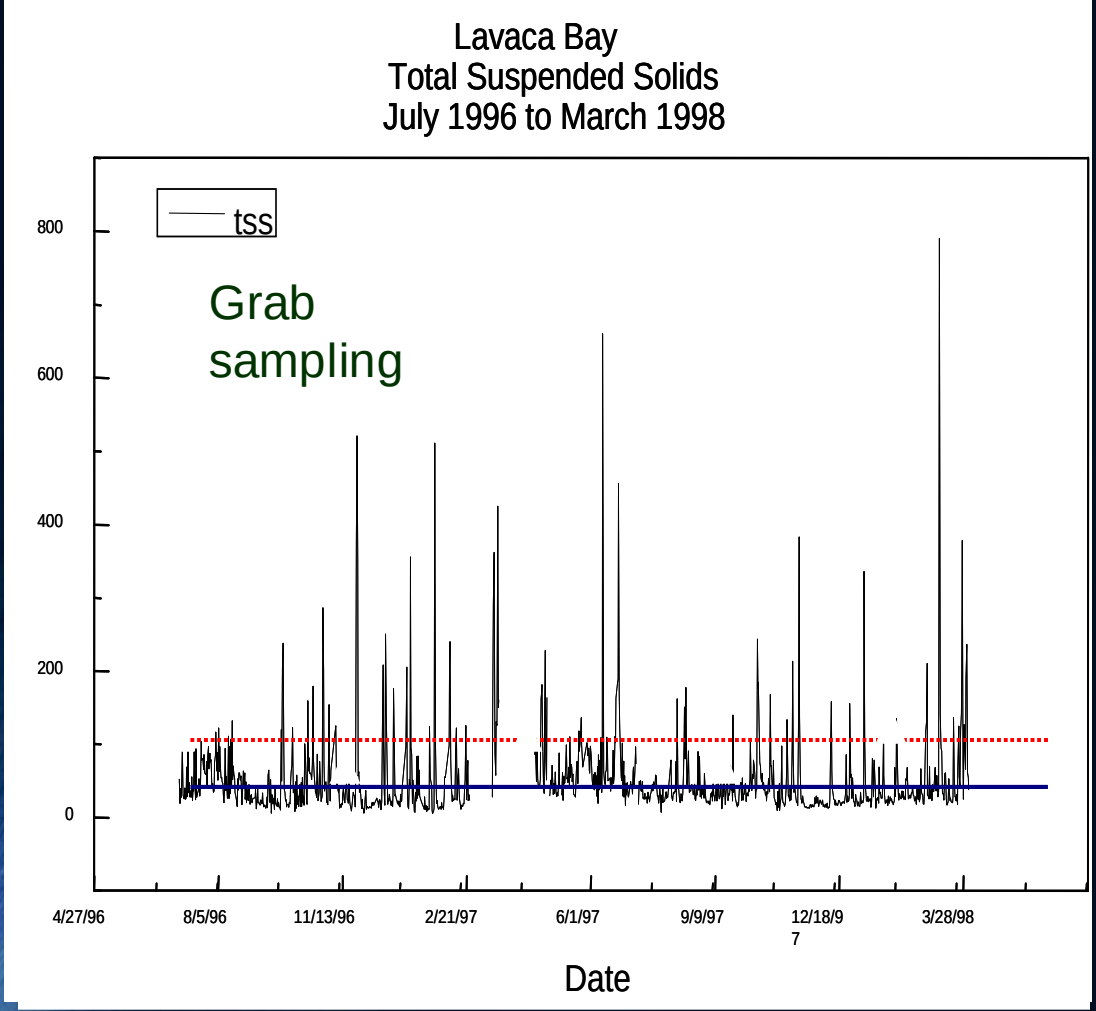
How we Build Capacity

Bridging Data to Decisions

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE



Paradigm shift in Monitoring



Blue line represents the mean. Red line represents 1 standard deviation

"99% of environmental change occurs on the order of 1% of the time"

-- James S. Bonner, Ph.D.
Founder, RATES

in essence, If you didn't see it, it didn't happen

Design and Respond to the Event, not to the Average

The Need for Community Sensor Networks

- Management Needs Data Outside Jurisdictional Boundaries
- COTS Sensor Costs are Exorbitant
- Sensor Placement Should Meet both LOCAL and REGIONAL Management Needs
- LOCAL Control Promotes Effective Local Decision Making
- Multi-Jurisdictional Sharing Promotes Regional Coordination

Bring the Data to the Local Decision Makers

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

Use Cases

- Flood Early Warning/Forecasting
- Flood Planning/Mitigation
- Stormwater Management (Compliance, IDDE, Performance Assessment)
- Water & Wastewater Treatment (Low-Cost SCADA, Industrial Dischargers)
- BMP Placement, Sizing, Performance Monitoring
  - Retention/Detention Ponds (Local)
  - Regional Detention Facilities (Multi-Jurisdictional)
  - Low Impact Development/Green Infrastructure

Stage Height/Water Temp

- Low Power
- Easily deployed and maintained
- Small size makes them easily adaptable
- Durable
- Low Cost (~$200.00)
- Real-Time
- Large Range/High Accuracy

Make it Affordable…

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

Water Quality Sonde

- Measured parameters
  - pH
  - Dissolved Oxygen
  - Conductivity/Salinity
  - Chlorophyll
  - Turbidity
- Low cost
- Good Field performance, comparable to YSI Multi-Parameter sonde
- Ambient light reduction
- Tested to 100 psi submersible depth

And Apply it to Other Needs…

Precipitation Gauge

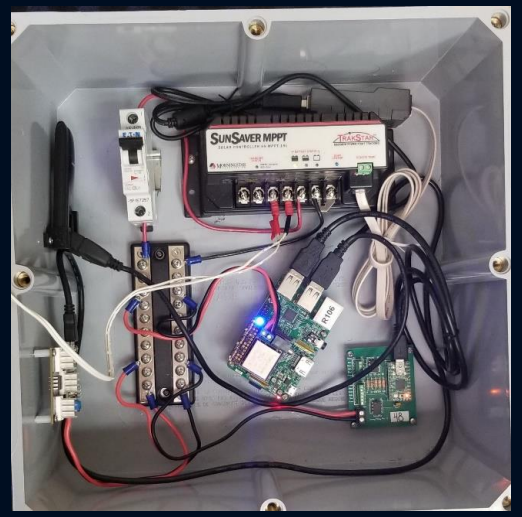
- Low power
- Extended duty life
- All season performance
- Results comparable to NOAA observations

Adapt the Technology to the Application….
Soil Moisture….Solar Irradiance…

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

Real-Time Hydrologic System

- COTS Meteorological Pole
  - Wind Speed/Direction
  - Relative Humidity
  - Air Temperature
  - Barometric Pressure
- Can be solar powered or grid tied
- Master control box
  - Raspberry Pi Microcomputer
  - Sensor Circuit Boards
  - Solar Controller
  - Cell Stick



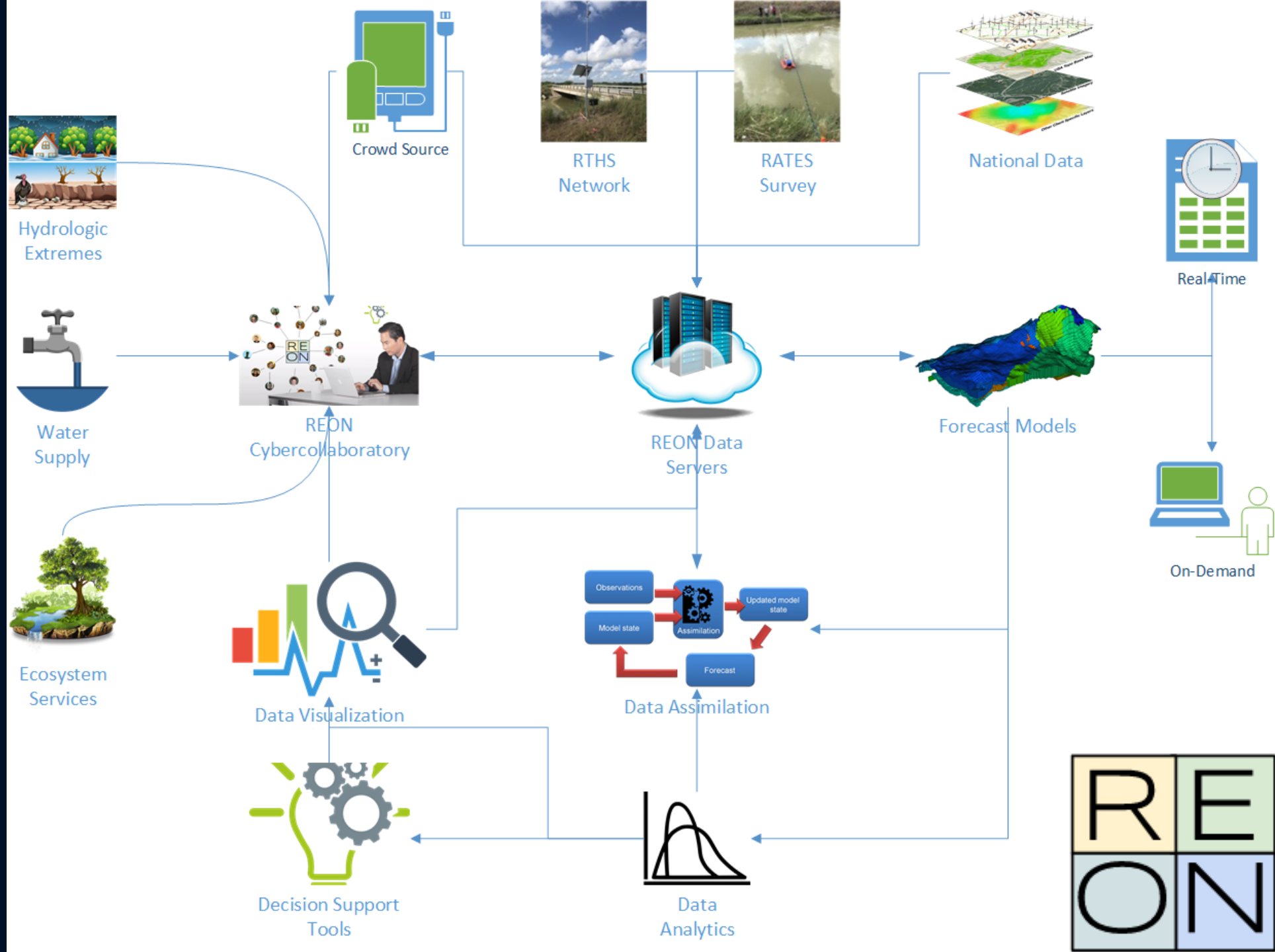
RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

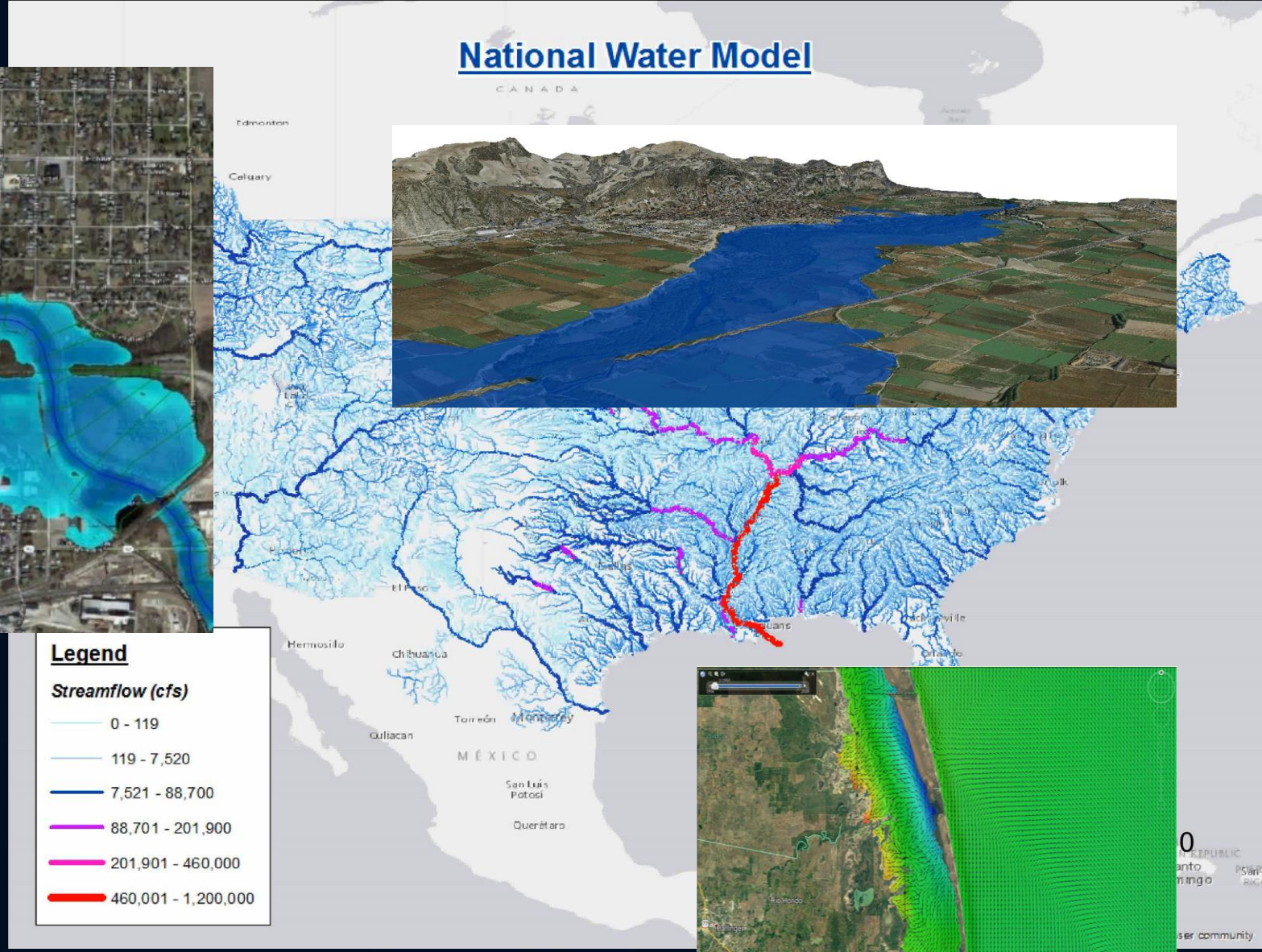
RTHS Sensor Deployment

- Customizable sensor mounts all for installation in many different environments or conditions

River & Estuary Observation Network

Operational Components



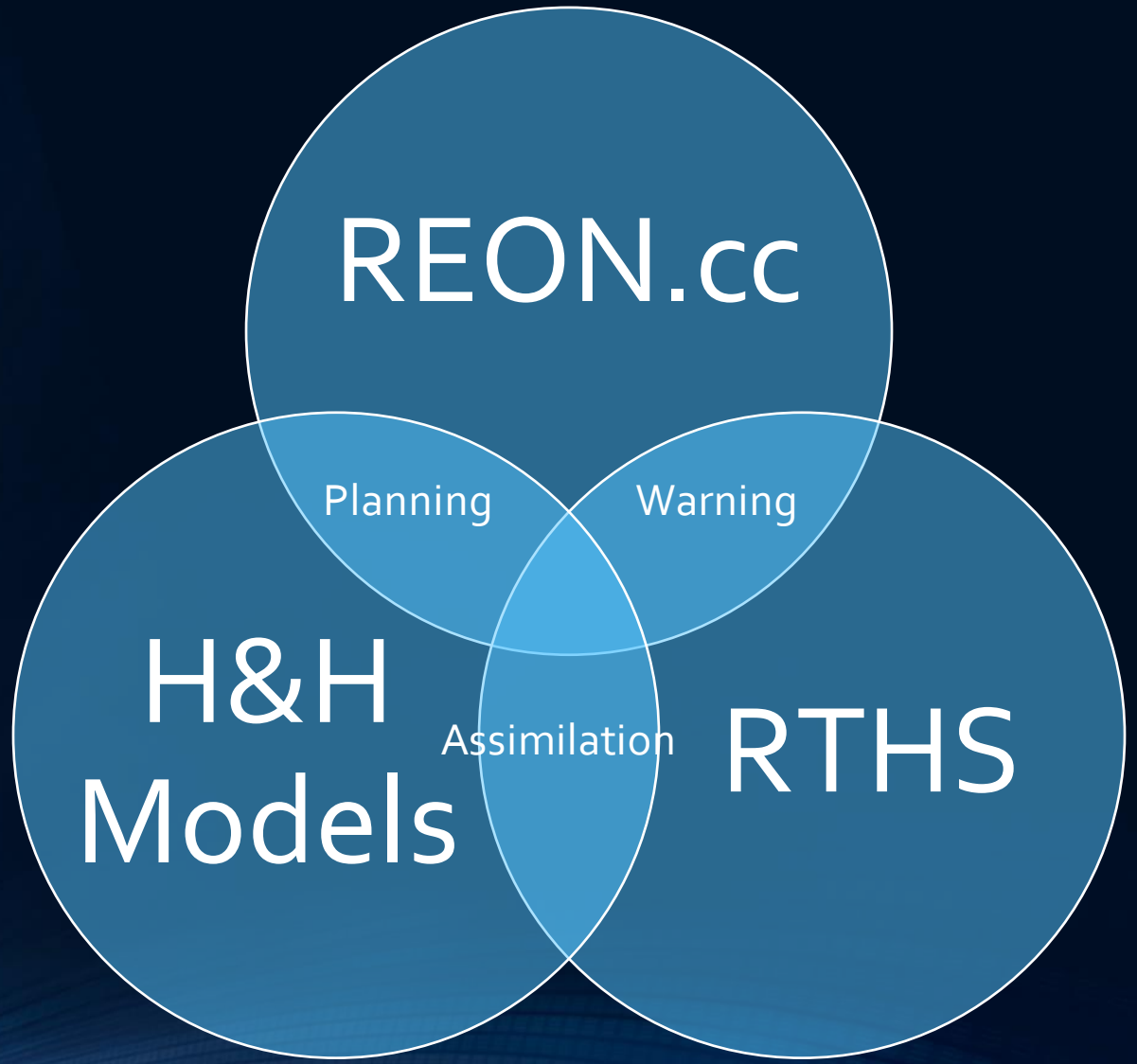


Real Time Forecasting

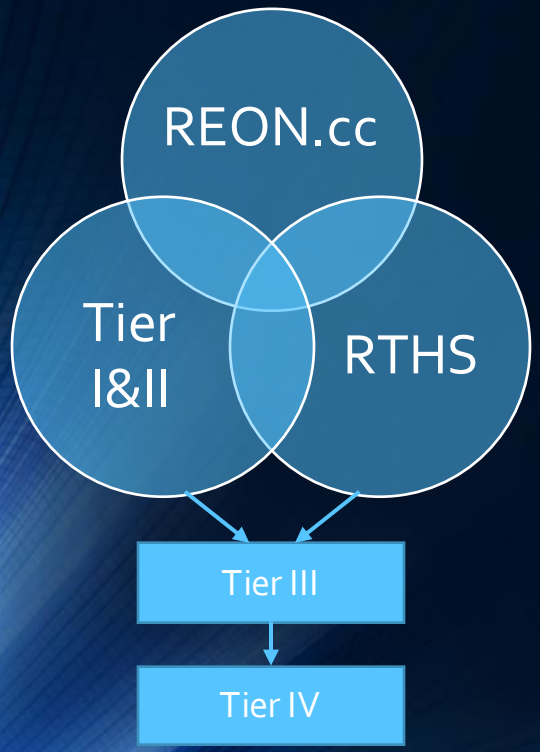
- Flood Warning
- Flood Planning
- Disaster Declaration
- Water Supply
- Ecosystem Services

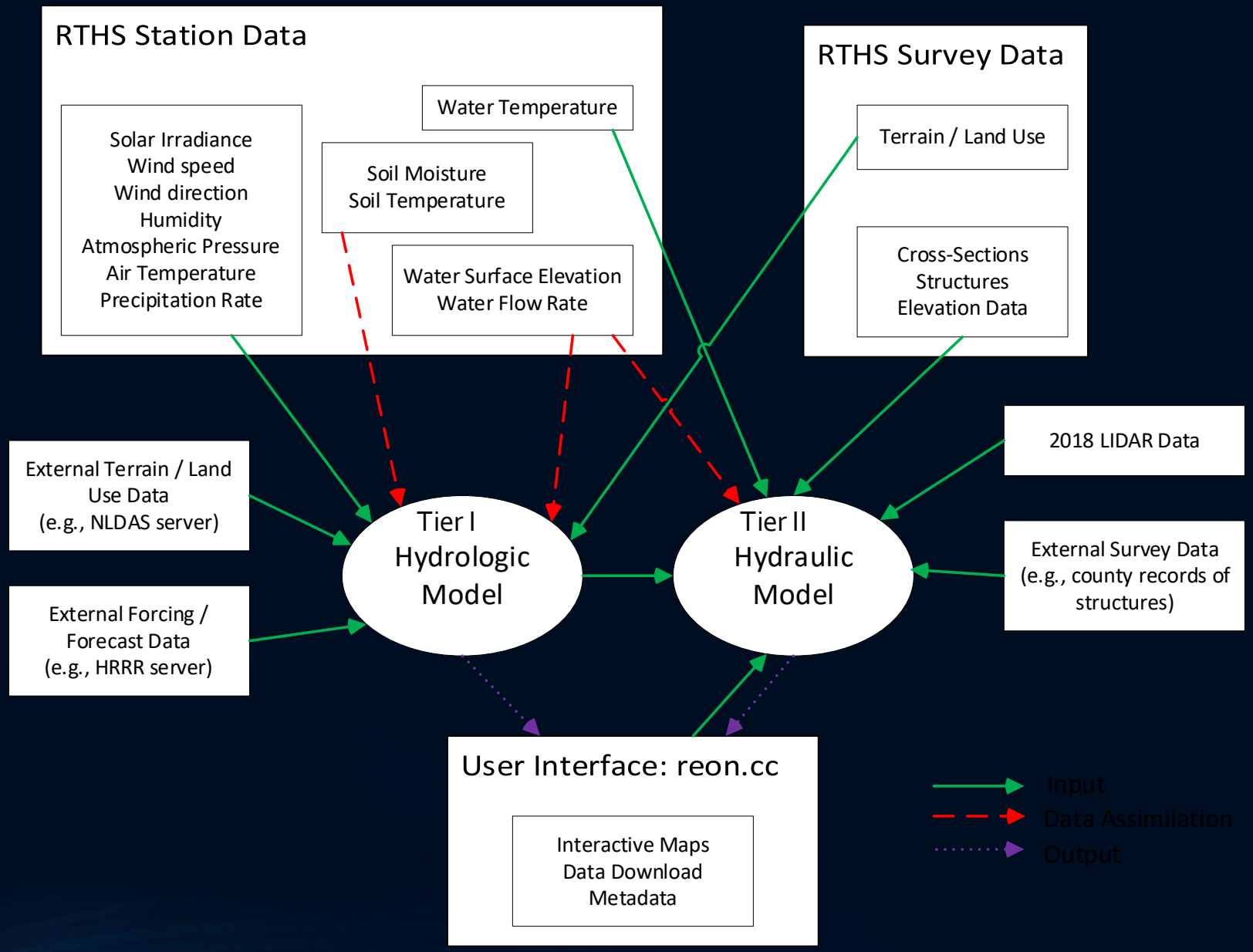
RE
ON

Hydrologic & Hydraulic Assessment



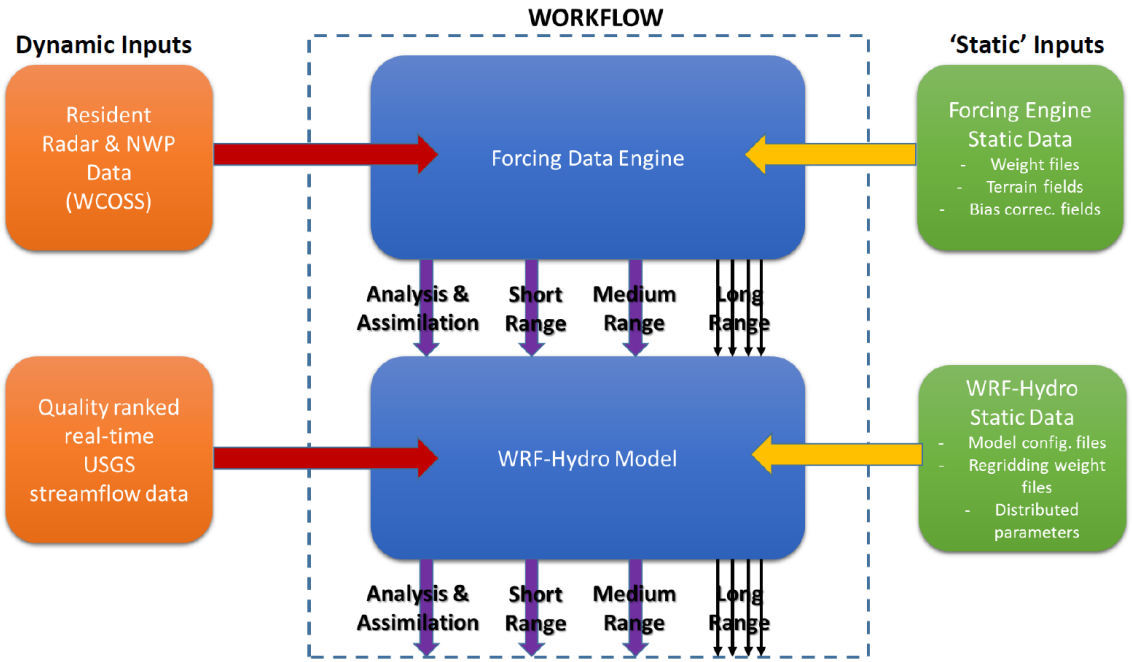
Tier I & II Integration





RTHS: Hydrologic Data Assimilation

Operational Cycling of the National Water Model



Hydrologic Data Assimilation (RTHS) is Necessary to Overcome Gaps in Hydrography & Forcing

NCAR UCAR | RAL Research Applications Laboratory *science • serving • society*

Hydrologic Data Assimilation: The New Frontier of Hydrologic Prediction

'Hydrologic Data Assimilation' is the science of numerically optimizing the process through which hydrologic observations are integrated into simulation and prediction models. When done effectively, hydrologic data assimilation can add critical value to hydrologic predictions by increasing analysis and forecast accuracy and increasing skillful forecast lead times. NCAR/RAL is actively engaged in developing a host of new hydrologic data assimilation methods.

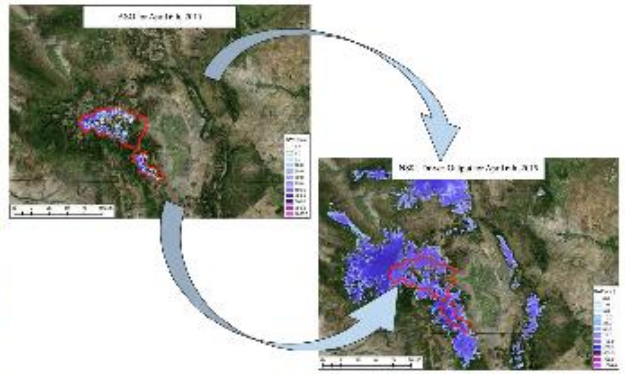
Problem Statement:

Hydrologic models suffer from numerous sources of error such as, errors in meteorological forcing, hydrologic process representation uncertainty, model parameter uncertainty and errors in the characterization of initial hydrologic conditions at the start of a simulation or forecast. As new measurement methods emerge and new sensor networks are deployed there exist new opportunities to fuse these observations into numerical models using data assimilation. However, hydrologic data assimilation is still in its infancy and there are many challenges to making the most use of newly available, real-time observations.

Research Questions:

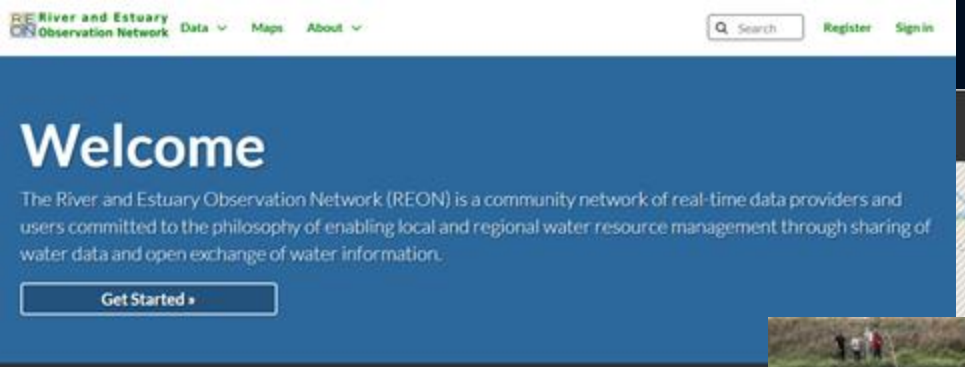
Key research questions in hydrologic data assimilation include:

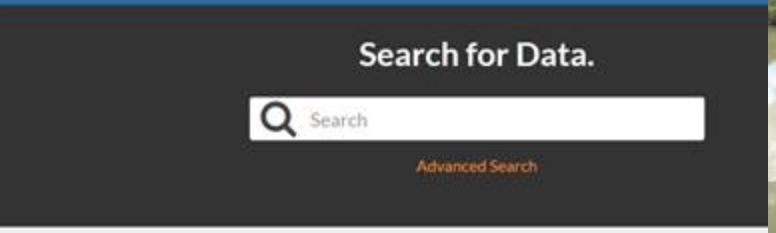
1. *How representative is a given measurement with respect to a simulated model state or flux?*
2. *What level observation quality is necessary to make effective use of a given observation?*
3. *Are there optimal ways to assimilate point and/or gridded observations that preserve mass balances within models?*
4. *How do we minimize the computational demand added by performing data assimilation into global and continental domain, high-resolution hydrologic models?*

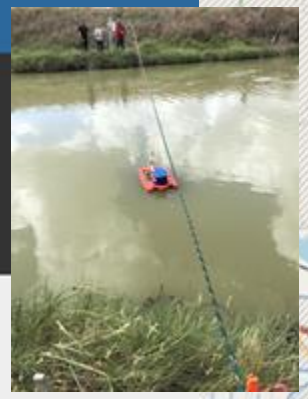


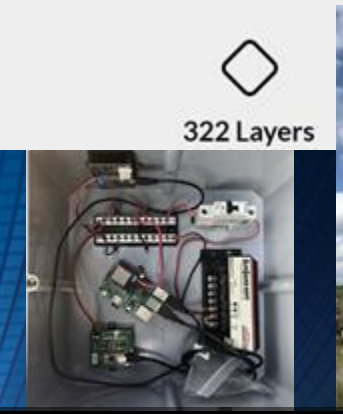
Assimilation of NASA airborne lidar snowpack estimates into a radar-driven, WRF-Hydro simulation of snowpack in the Upper Rio Grande river basin.

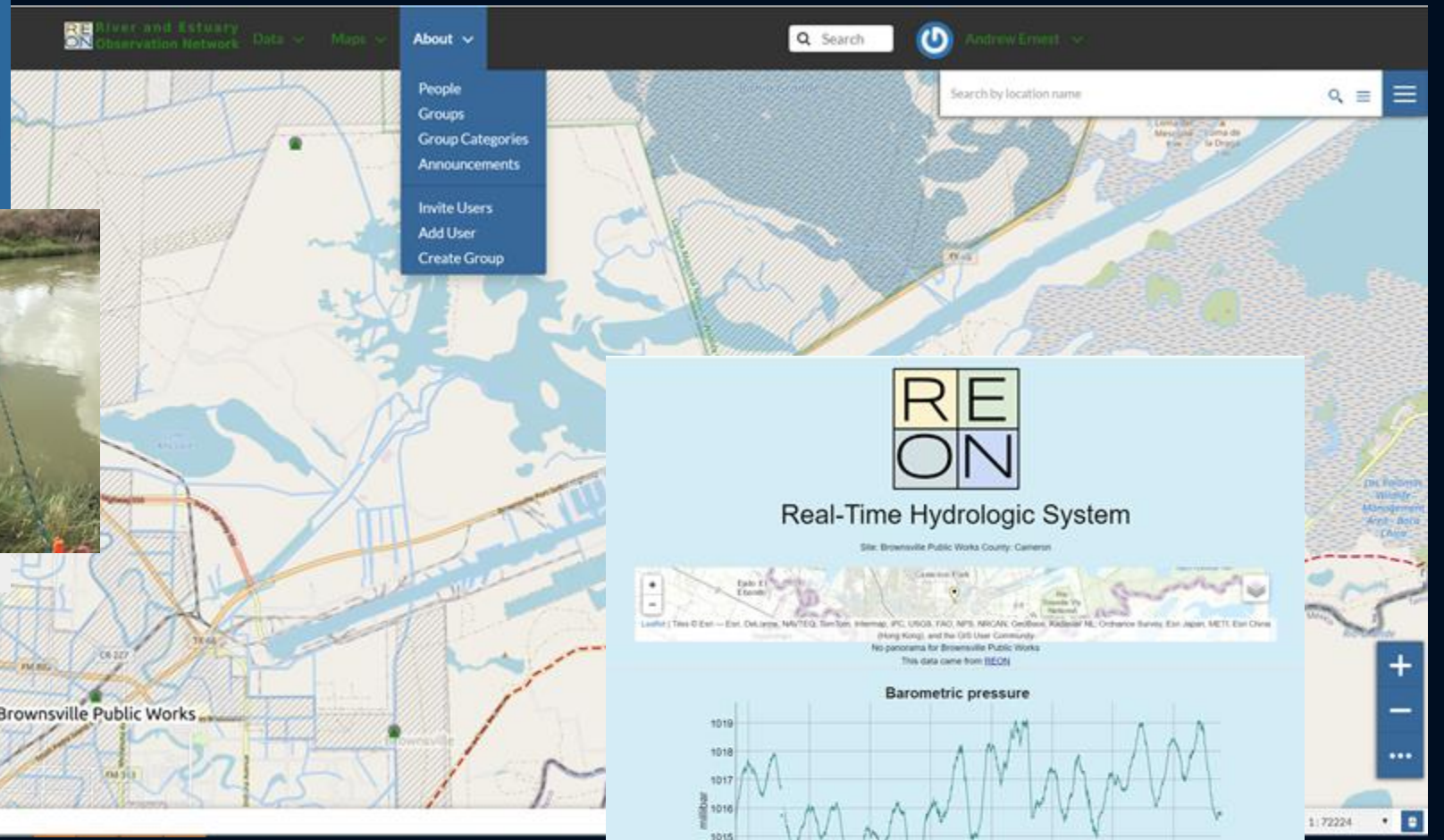
Contact Information: WRF-Hydro Website: https://www.ral.ucar.edu/projects/wrf_hydro
James McCreight (jamesmcc@ucar.edu), David Gochis (gochis@ucar.edu)









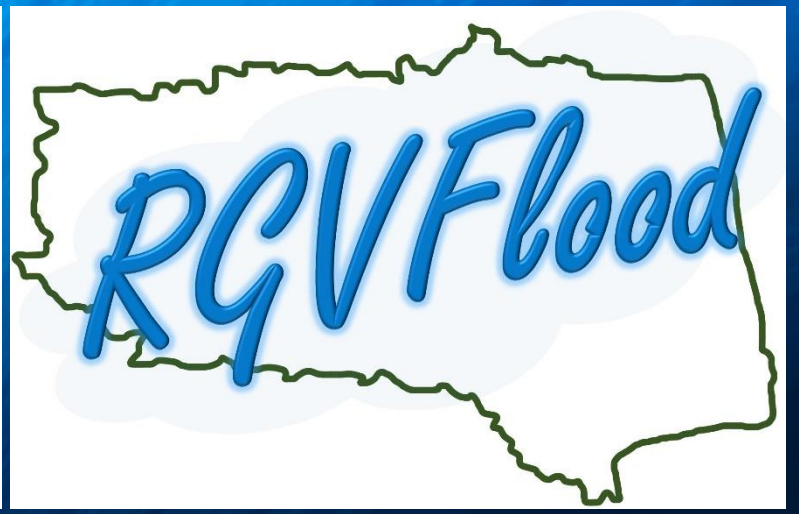


REON.cc is Designed for:

- Regional Decision Making
- Preventing Duplication

RE
ON

River & Estuary Observation Network Cybercollaboratory

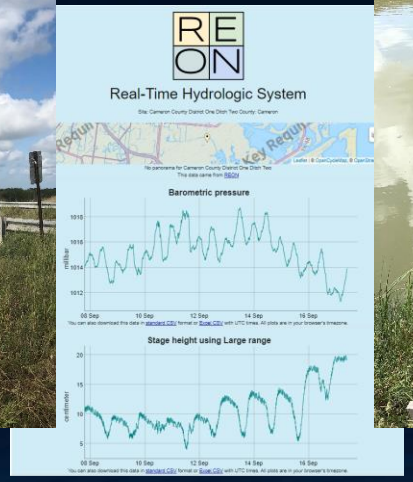


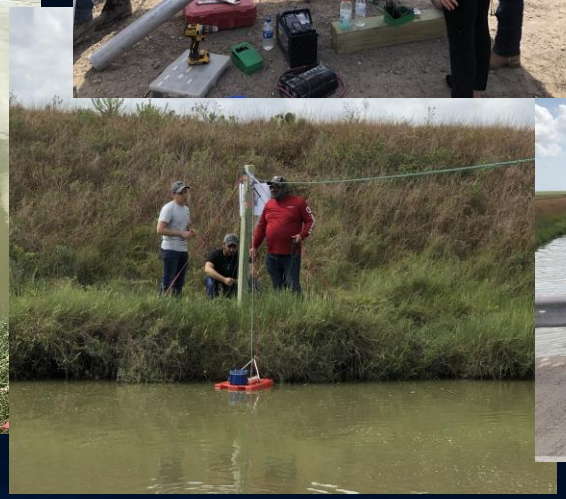
RGVFlood

REON RIO GRANDE VALLEY

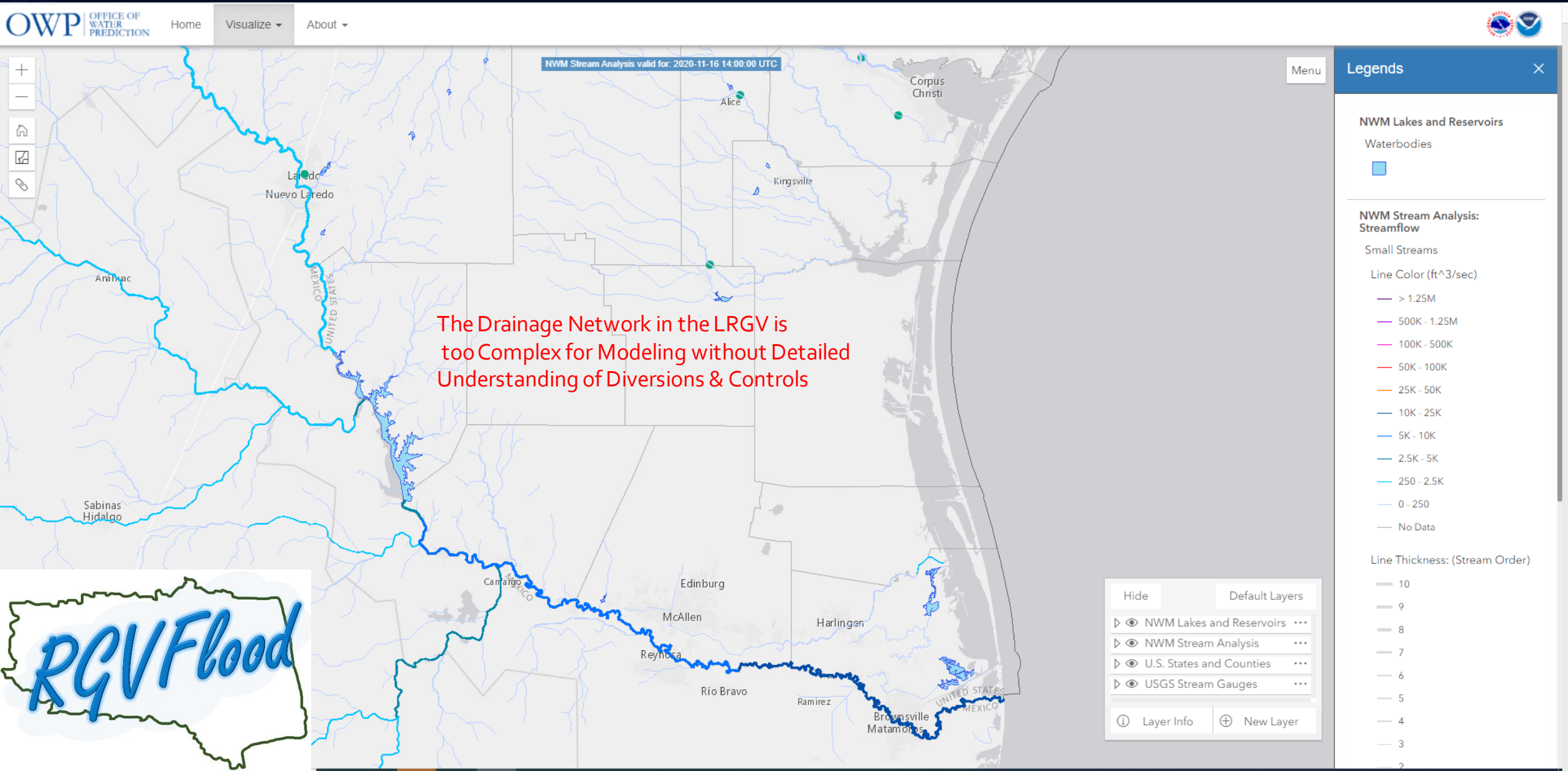
RGVFlood: An Affordable Real-Time Sensor Network for Regional Water Resource Management

- Proposed commissioning of ~70-RTHS at strategic locations
  - Promote inter-jurisdictional engagement and collaborative decision making
  - Stream gauging for discharge rating curves



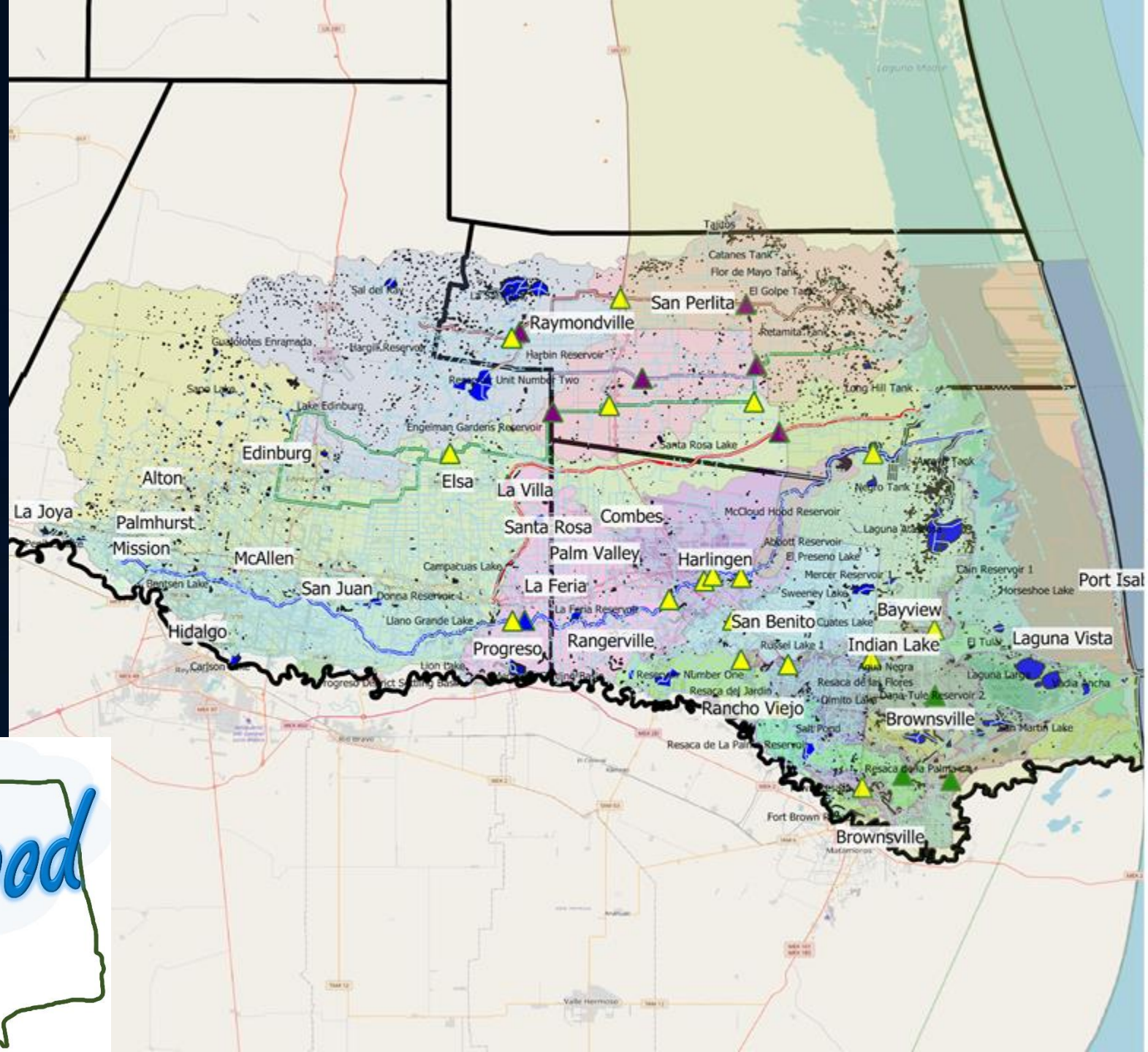


National Water Model: LRGV Gaps



Real Time Hydrologic System Network

- Data Democratization
  - Local Ownership
  - Regional Integration
- Regional
  - Basin Management
  - Flood Planning
- Local
  - Flood Warning
  - Design Development



RGVFlood

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

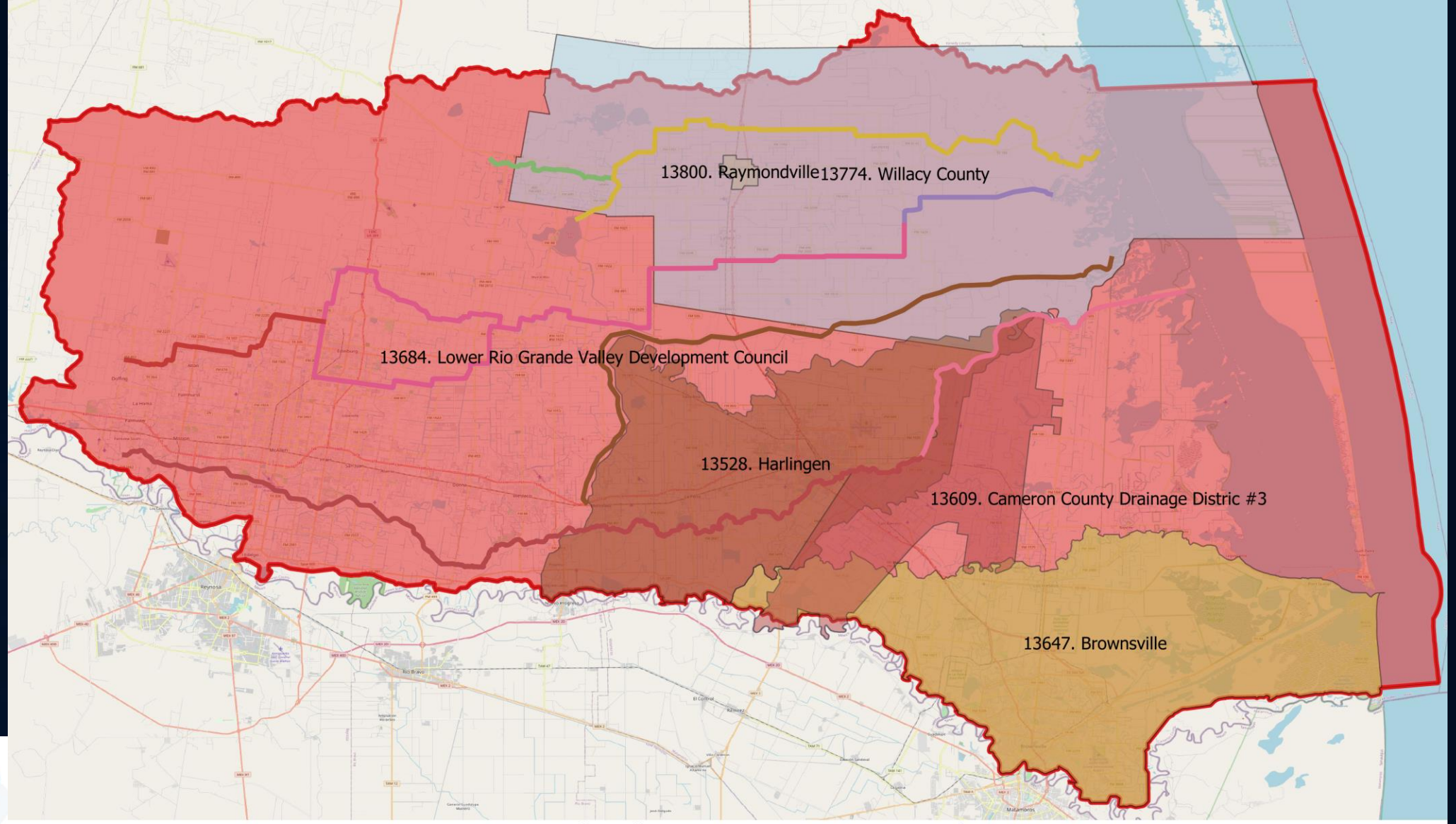
LRGVDC Flood Study

- 44 Real Time Hydrologic Stations
- LRGV Regional Real Time Hydrologic Model
- On-Demand Sub-Regional Hydraulic Models
- Selected Urban Stormwater Models
- River & Estuary Observation Network Cyber infrastructure
- Coordination of Regional Projects
- Selected Feasibility Assessments

Total	$8.9M
Grant	$7.9M
Cost-Share (Counties)	$1.0M
LRGVDC	$0.4M
RATES	$5.5M
Cameron County	$1.0M
Hidalgo County	$1.0M

TWDB FIF Cat 1 Projects

Brownsville	$1.2M
CCDD#3	$1.5M
Harlingen	$5.6M
LRGVDC	$7.9M
Raymondville	$400K
Willacy County	$1.6M



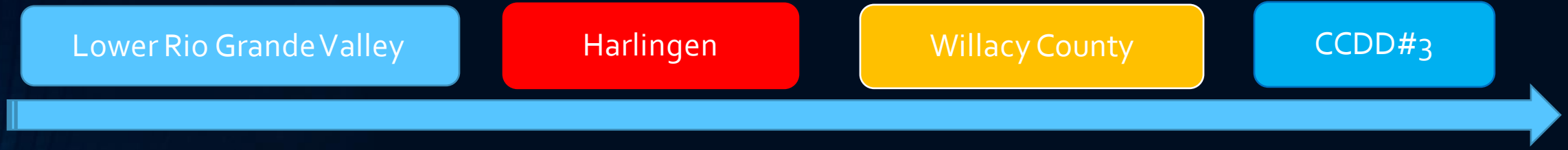
Lower Rio Grande Valley TWDB-FIF Category 1 Applications

Main Drains
- Raymondville Drain
- Raymondville Drain II
- IBWC Floodway
- HidalgoWillacy W Spur
- Hidalgo-Willacy
- HCDD1 NMD
- Arroyo Colorado West-Central
- Arroyo Colorado East (Tidal)

Category 1 Applications
- CCDD3
- Brownsville
- Raymondville
- Harlingen
- Willacy
- LRGVDC

Regional Water Resource Advisory Committee

Coherent Project Goals



Objective 1

REON/RGV

*the establishment of a **regional coordination and decision making** network, along with the assimilation of hydrologic and hydraulic knowledge to support science-driven policy and decision making*

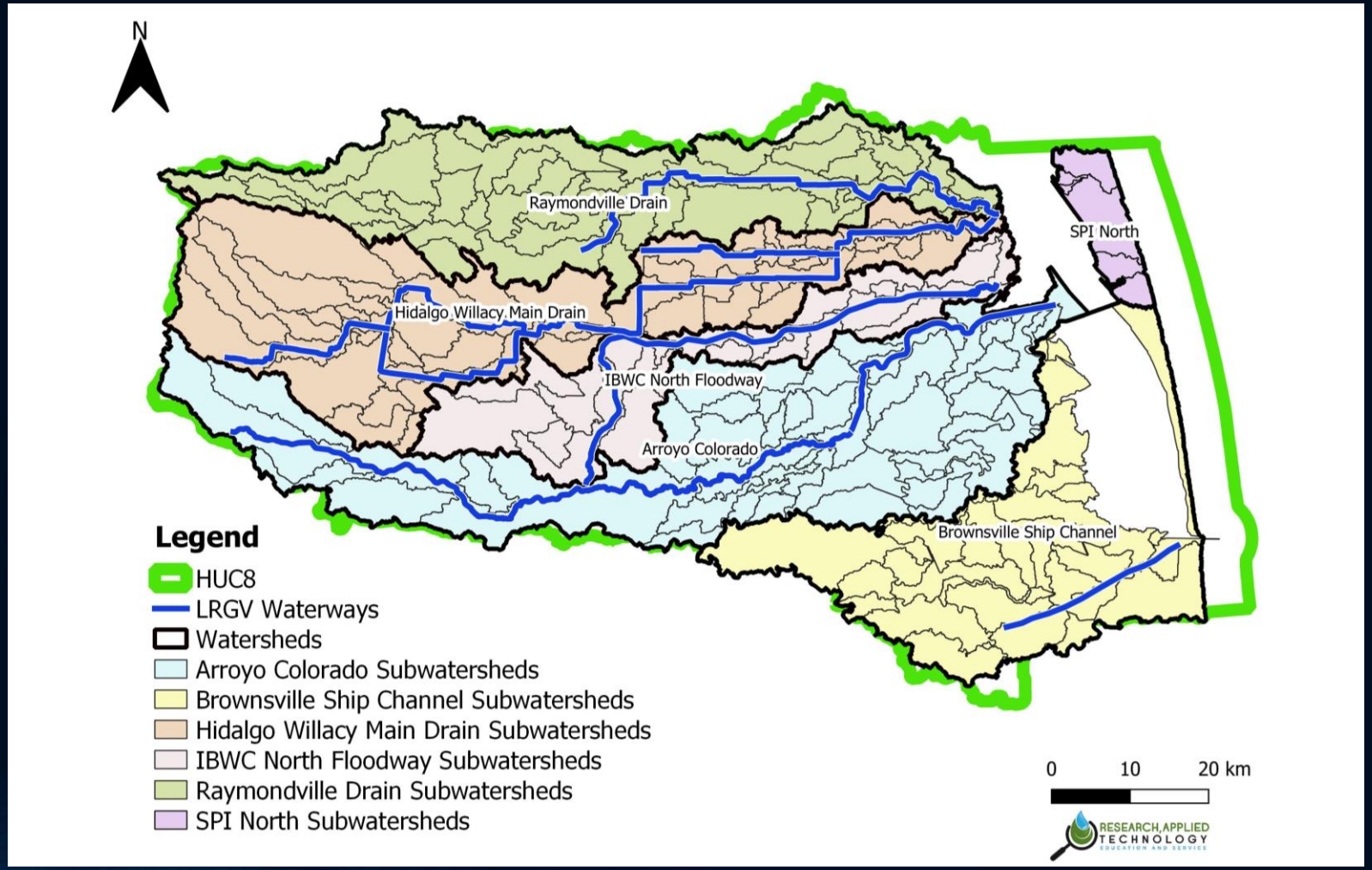
Objective 2

CIP Identification

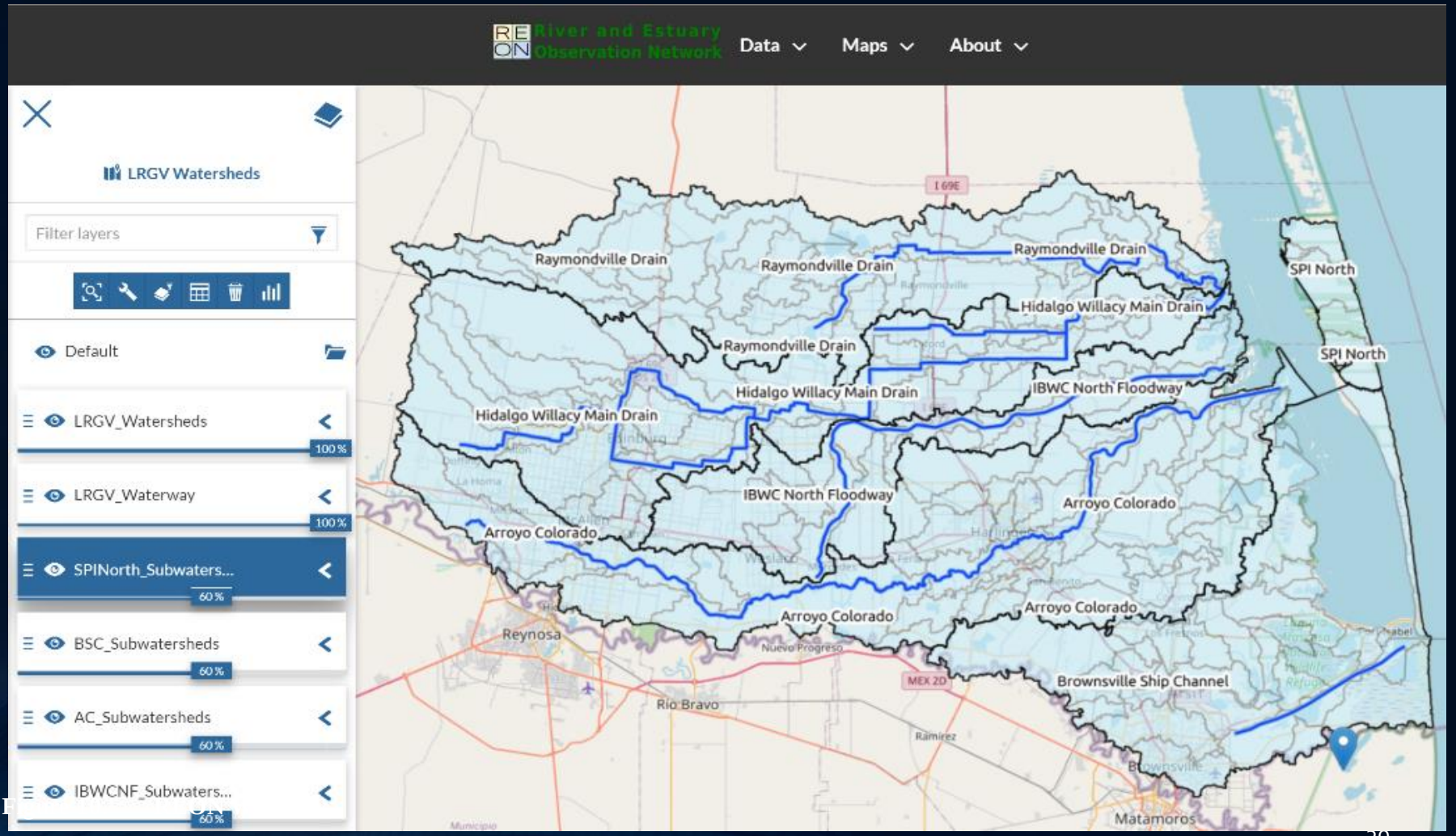
*the identification of local and regional **capital improvement projects** that support **regional flood management***

Watersheds and Subwatersheds

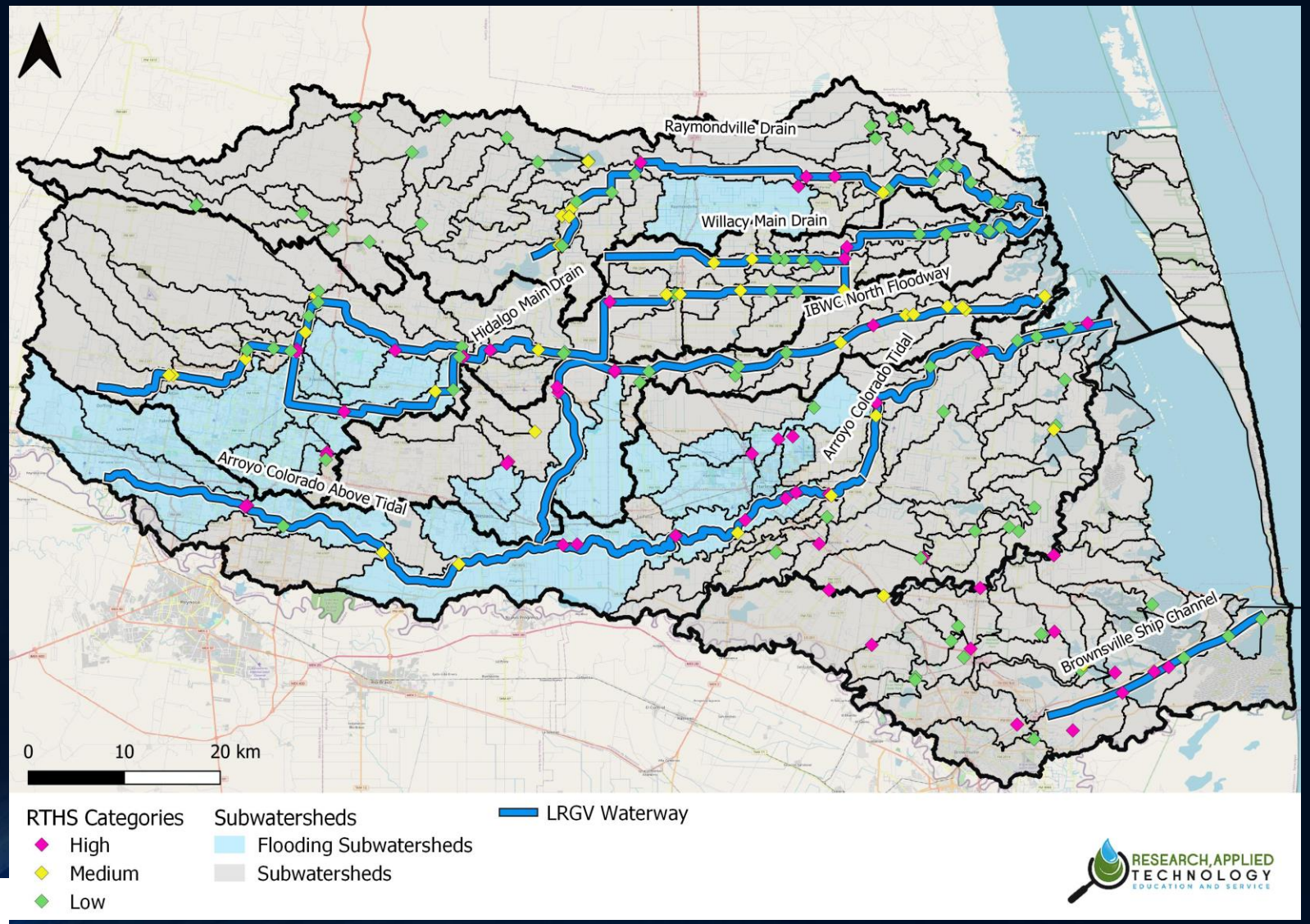
Watershed Name	Watershed Area (km^2)	Number of Subwatersheds
AC	1876.3	43
BSC	1481.2	29
HWMD	1602.4	48
IBWCNF	730.9	21
RVD	1333.9	43
SPI North	136.3	7
Total:	7161.1	191



Data Accessibility

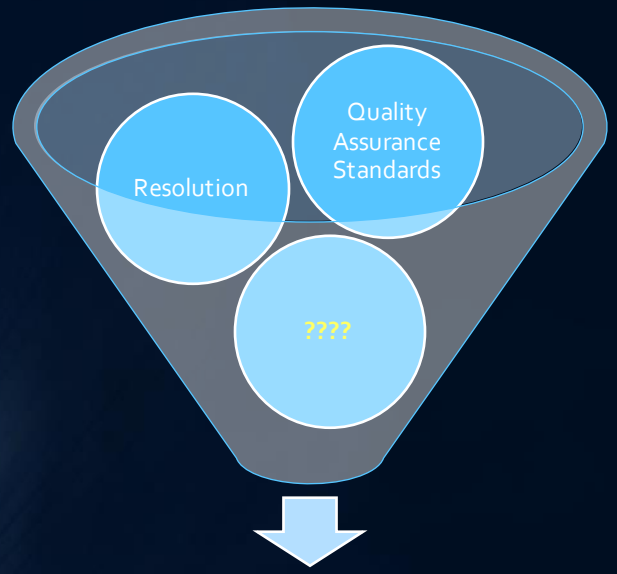


Initial RTHS Locations

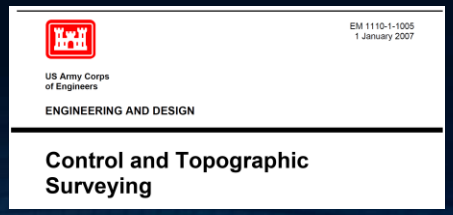


End-User Data Dictionary: Brainstorming Outcomes

ELEMENTS & ISSUES



LRGV Water Resources Field Survey Manual


EM 1110-1-1005
1 January 2007

US Army Corps of Engineers

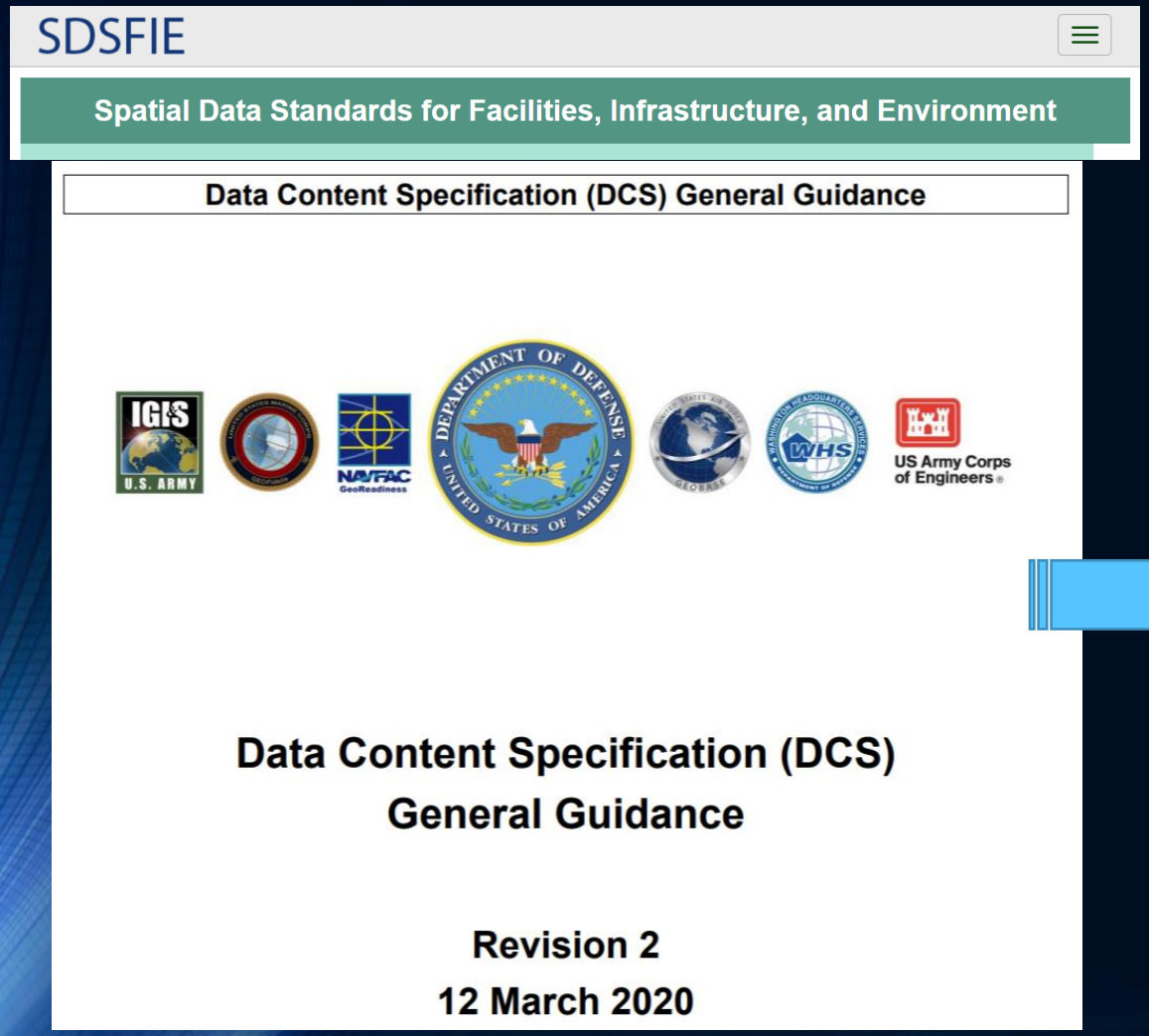
ENGINEERING AND DESIGN

Control and Topographic Surveying

COLLABORATORS & END USERS

- Guzman & Munoz Engineers & Surveyors
- South Texas Infrastructure Group/ROW Surveying

End-User Data Dictionary: Process



End-Users

REON.cc

LRGV Water Resources Field Survey Manual

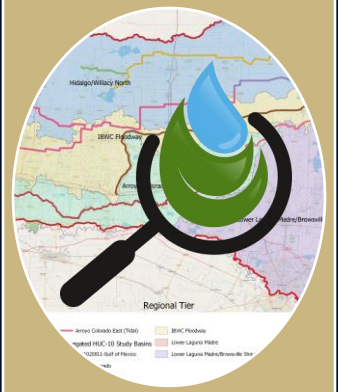
Field Survey Data Model

Hydraulic Asset Inventory Data Model

Regional Coordination

&

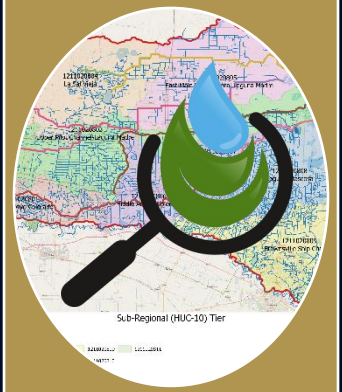
Technical Infrastructure



Tier 1
Real-Time

Regional Hydrology

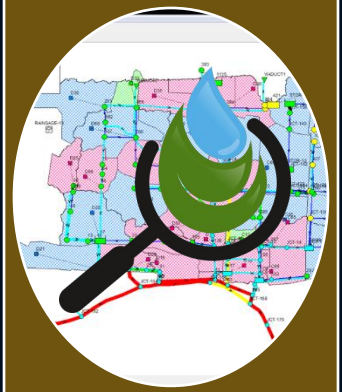
RATES



Tier 2
On-Demand

Sub-Regional Hydraulics

RATES



Tier 3
Needs-Based

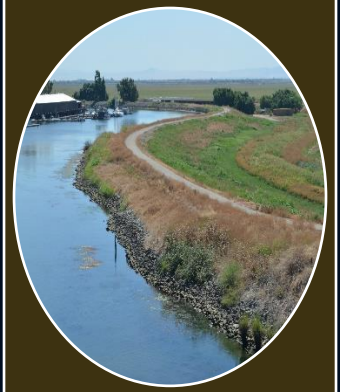
Urban Stormwater

RATES

Harlingen

Willacy County

CCDD#3



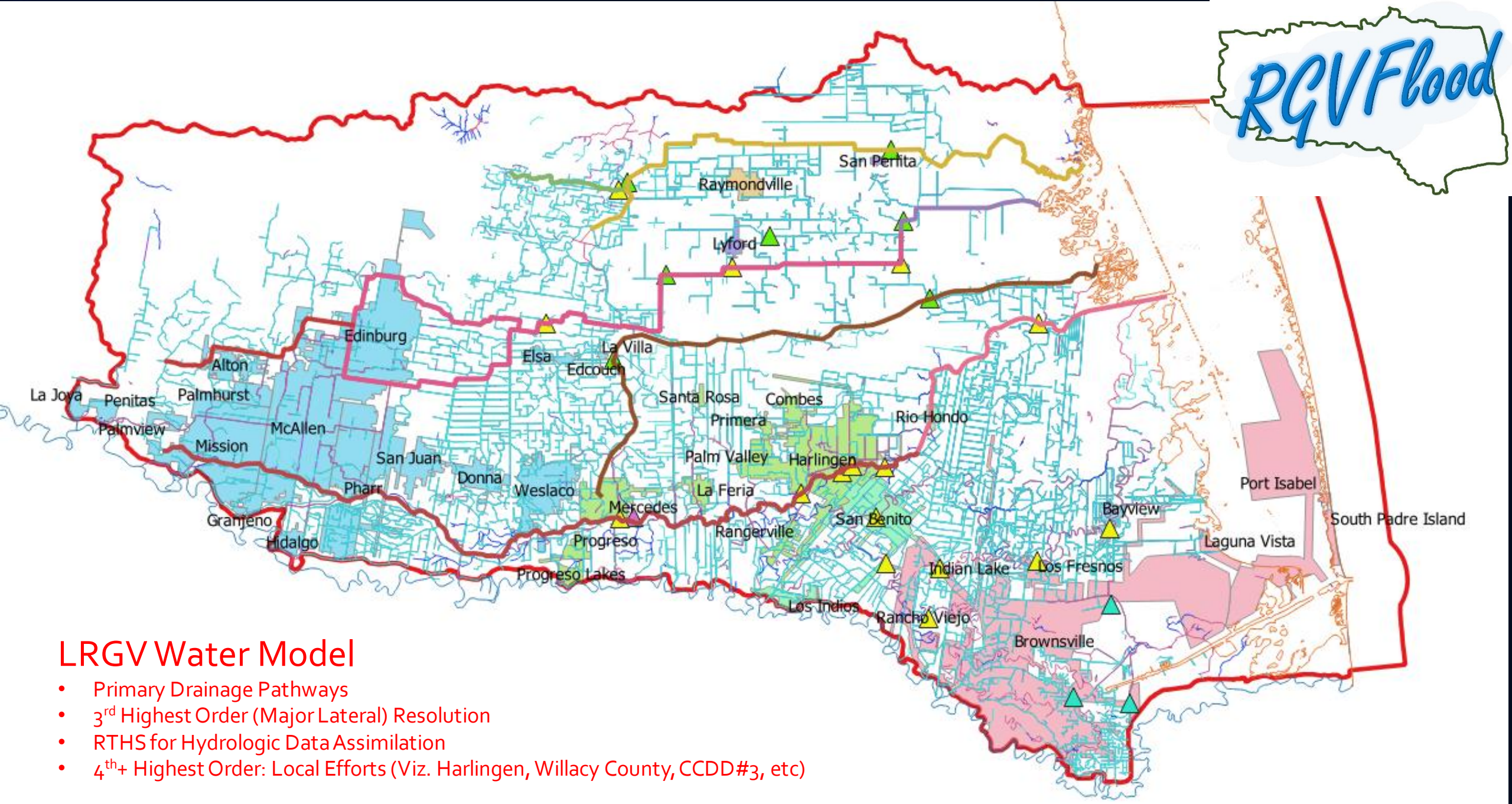
Tier 4
Capital Improvement

Project Specific

Contractors

RGVFlood

LRGV Hydrologic & Hydraulic Modeling: Adaptive Resolution

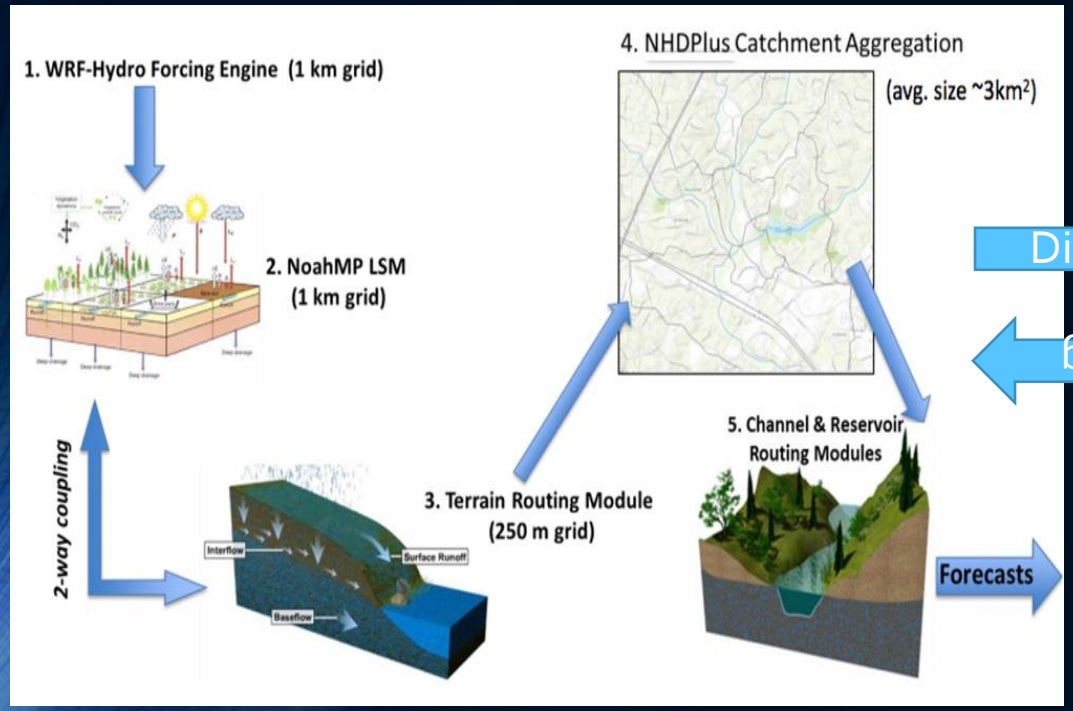


LRGV Water Model

- Primary Drainage Pathways
- 3rd Highest Order (Major Lateral) Resolution
- RTHS for Hydrologic Data Assimilation
- 4th+ Highest Order: Local Efforts (Viz. Harlingen, Willacy County, CCDD#3, etc)

Linked/Coupled Hydrology & Hydraulics

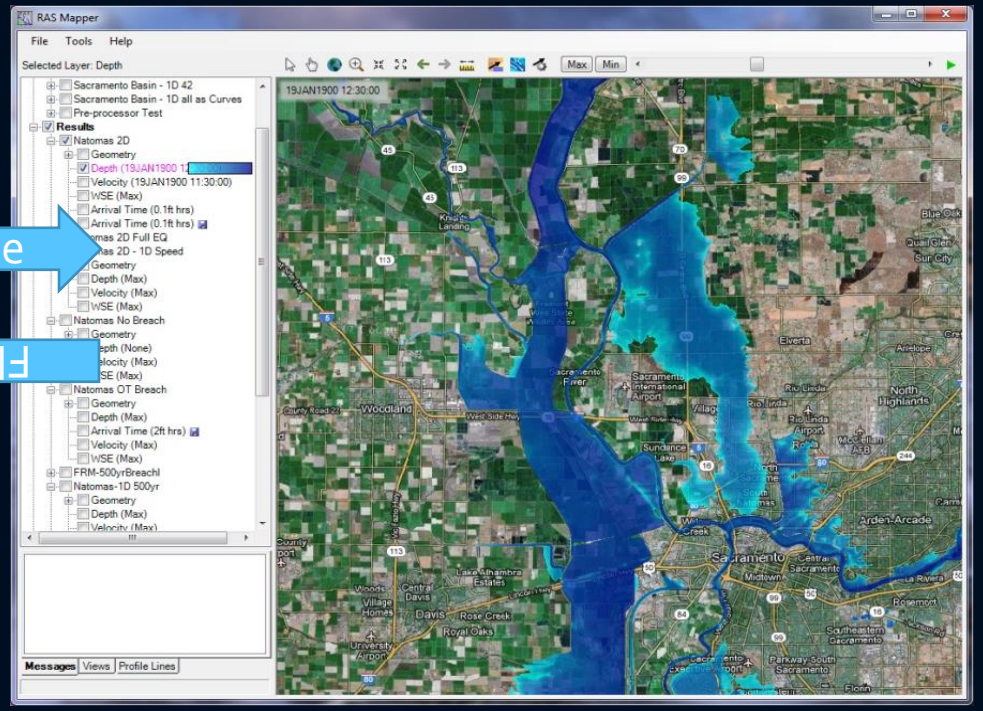
WRF-HYDRO (REAL-TIME)



Discharge

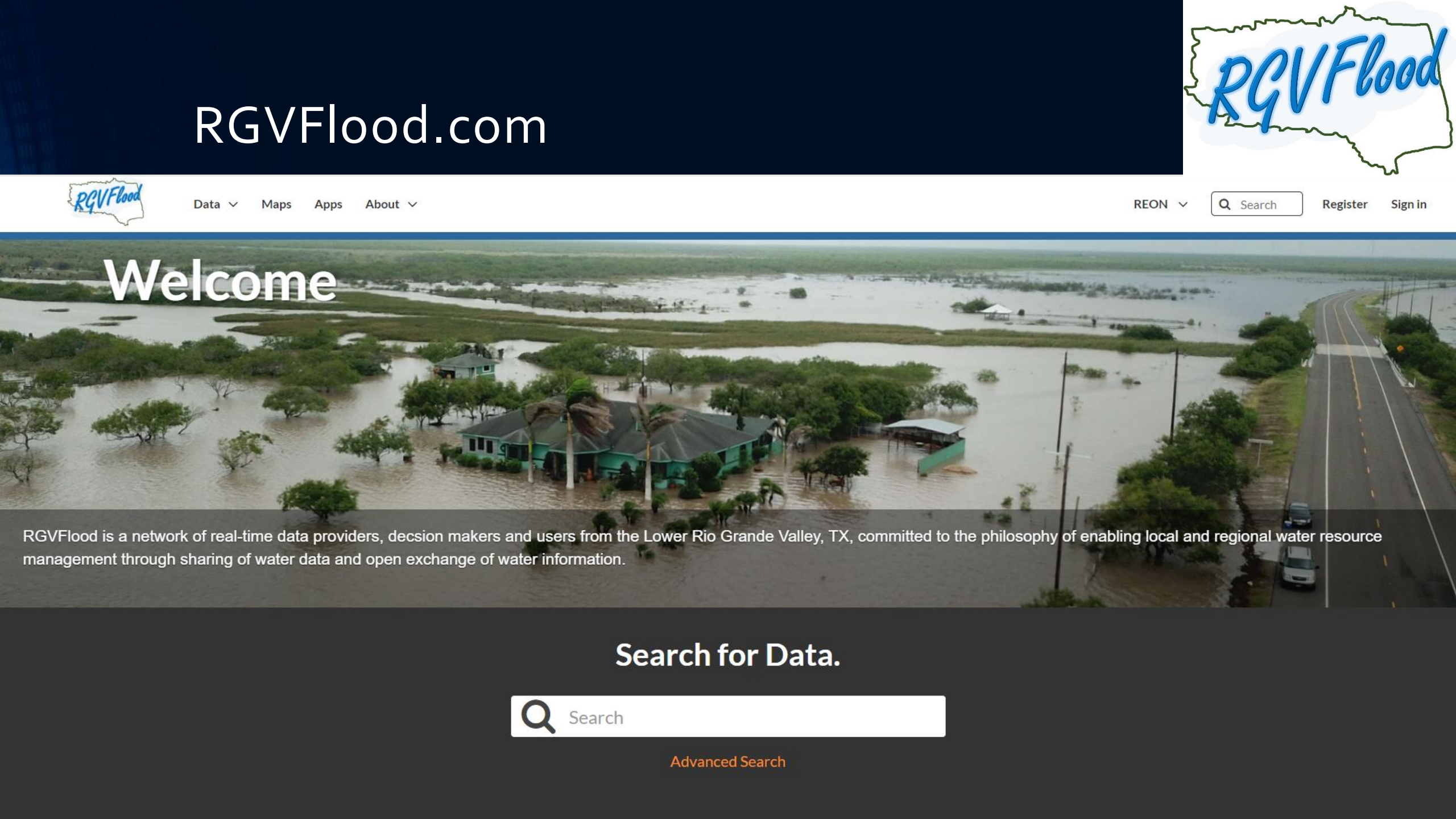
Flooding

HEC-RAS (STEADY/UNSTEADY)

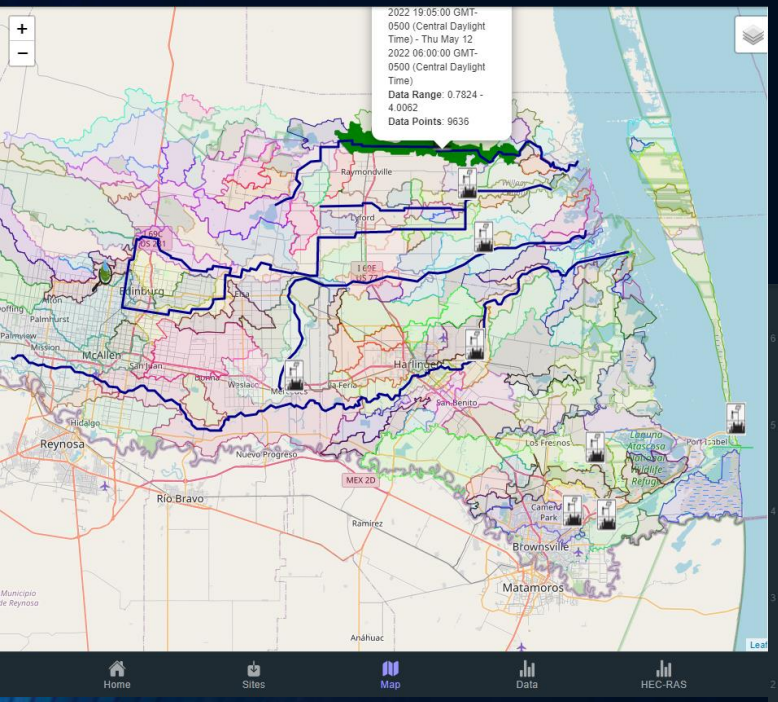


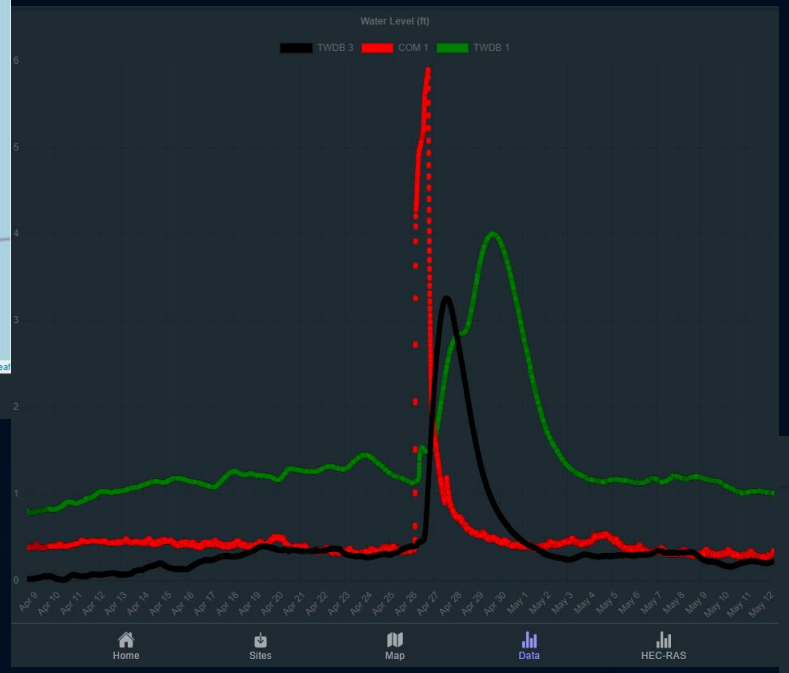
REON/RGV Implementation Component Interactions

RGVFlood.com



RGVFlood Wizard:
Regional Flood Management DSS





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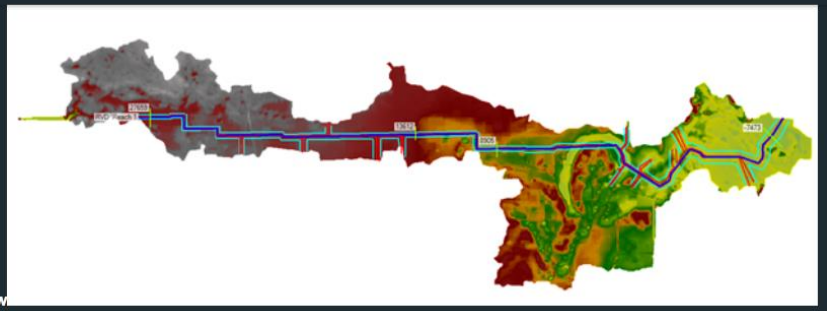
Tier II Model



Bay View

- Project file. Contains current plan files, units and project description.
- Geometry file. Cross-sectional data, hydraulic structures and modeling approach data are stored here.
- Steady Flow file. Profile information, flow data and boundary conditions written in this file.
- Plan file. Contains a list of the associated input files, and all simulation options.

RESEARCH, APPLIED TECHNOLOGY
EDUCATION AND SERVICE

RGVFlood
Serving The Lower Rio Grande Valley

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