

# Aquifer Storage and Recovery and Aquifer Recharge Program at the TWDB

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Texas Water Development Board*

*Presented for the Texas Groundwater Protection Council  
January 11, 2023*

# Introduction

- Texas has historically used surface water reservoirs; however, availability of surface storage has not kept up with growing demand
- In 2015, the Texas Legislature appropriated funds and directed the TWDB to provide grant support for demonstration projects and/or feasibility studies to increase water availability through innovative storage approaches
- This grant funding supported three aquifer storage and recovery (ASR) demonstration projects in Corpus Christi, New Braunfels, and Victoria

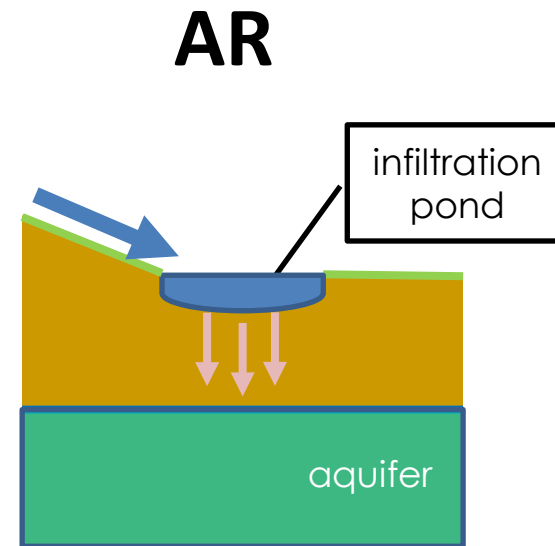
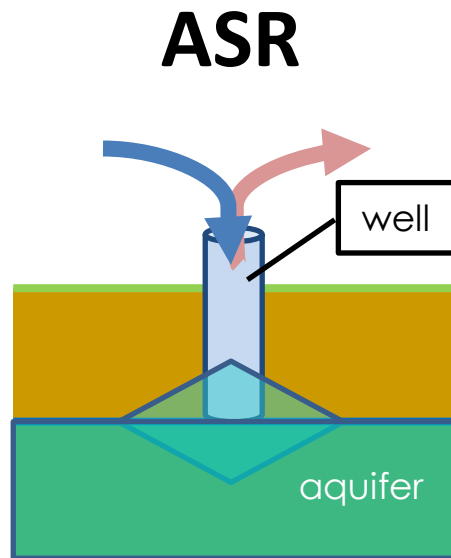
# Introduction – House Bill 721

- In 2019 Texas House Bill 721 (Texas Water Code § 11.155) tasked the TWDB with studying ASR and AR (aquifer recharge) in Texas
  - Statewide survey of aquifer suitability for ASR and AR projects in Texas
  - Conduct ASR and AR studies identified in the State Water Plan or by interested persons
  - Report results of these studies



# What is ASR and AR?

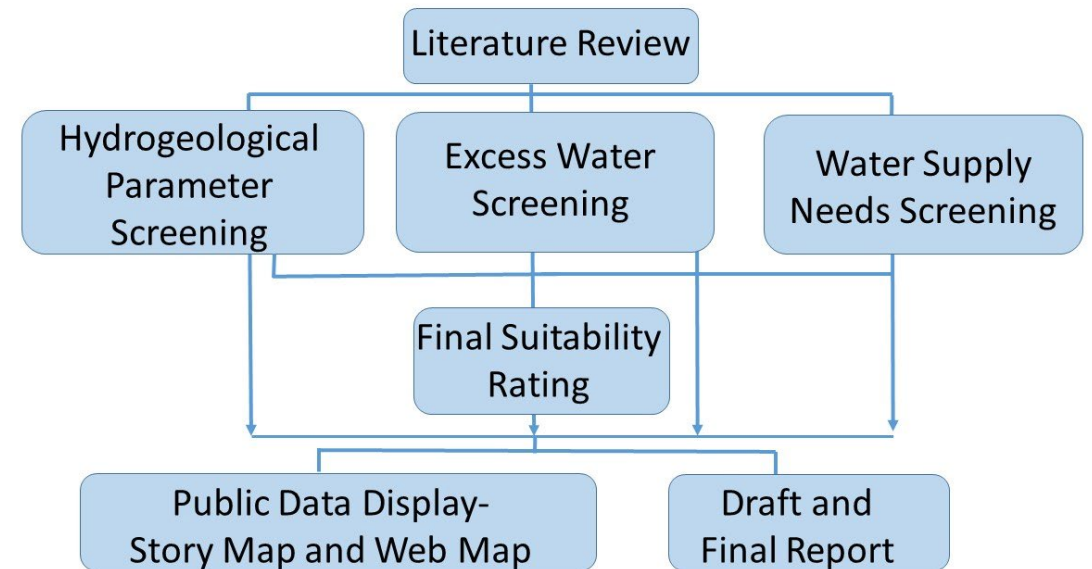
- **Aquifer storage & recovery (ASR)** is using a well to inject water into an aquifer for the purpose of subsequent recovery and beneficial use
- **Aquifer Recharge**, (AR, or sometimes MAR) is the controlled recharge of an aquifer at the surface through various methods such as infiltration basins.





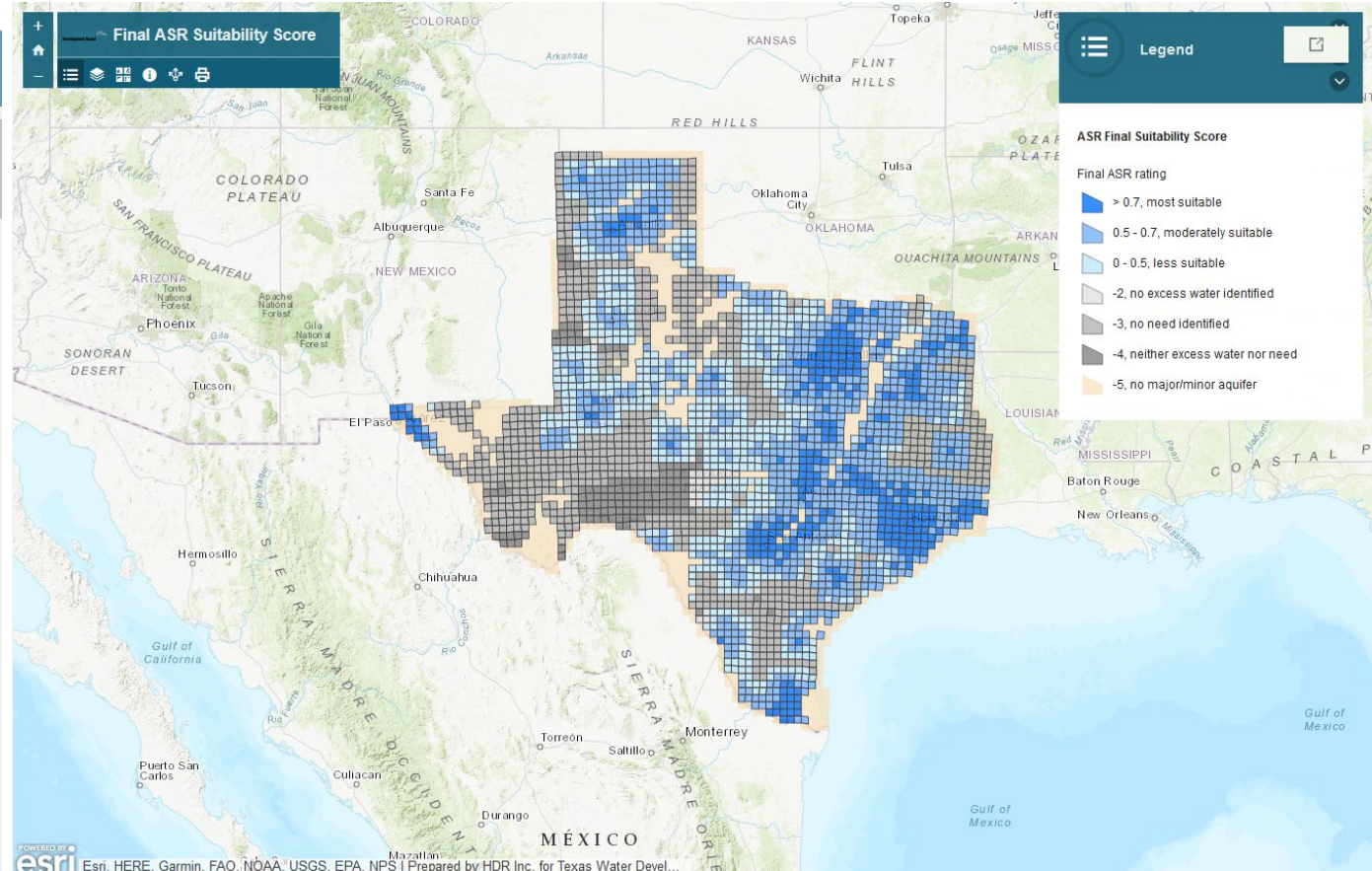
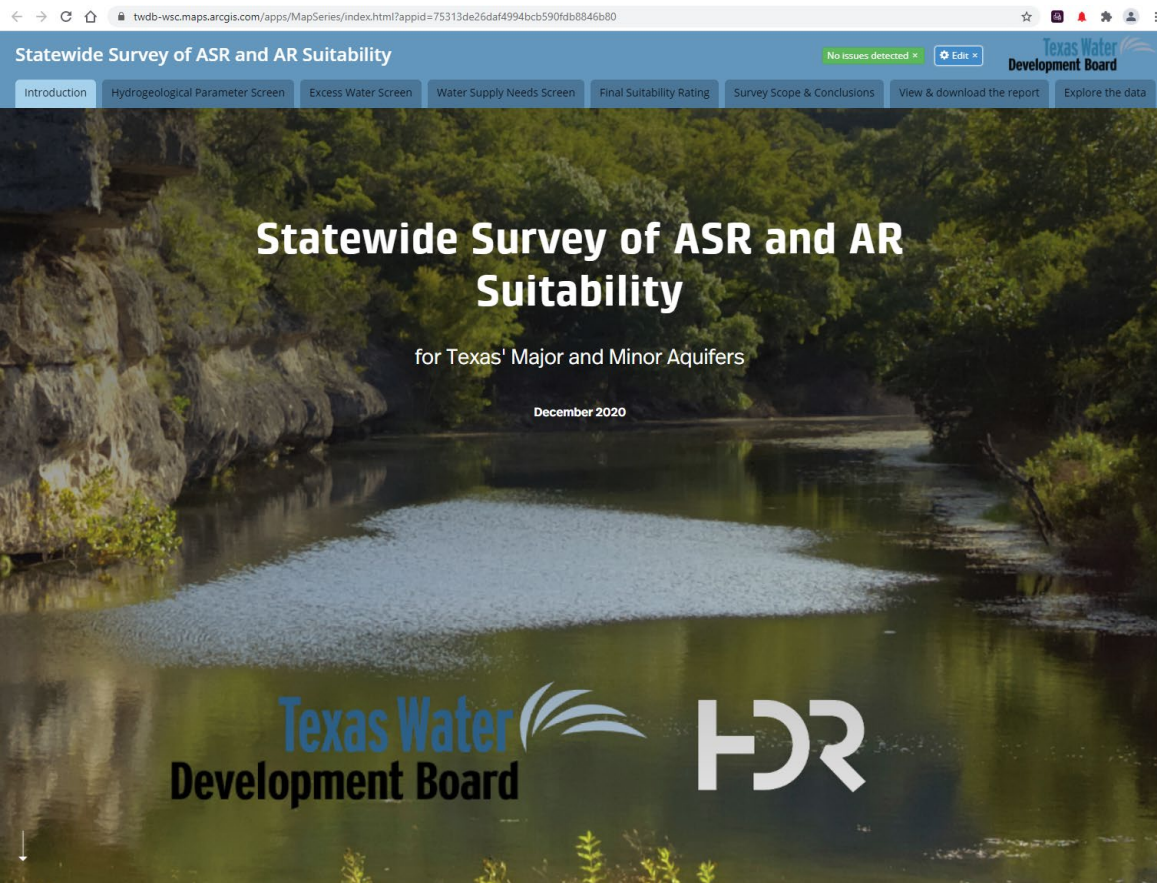
# Statewide Suitability Survey for ASR and AR

- TWDB contracted with HDR
- The study included:
  - hydrogeological characteristics
  - availability of excess water sources
  - current and future water supply needs
- Resulted in final suitability ratings
- Published December 2020

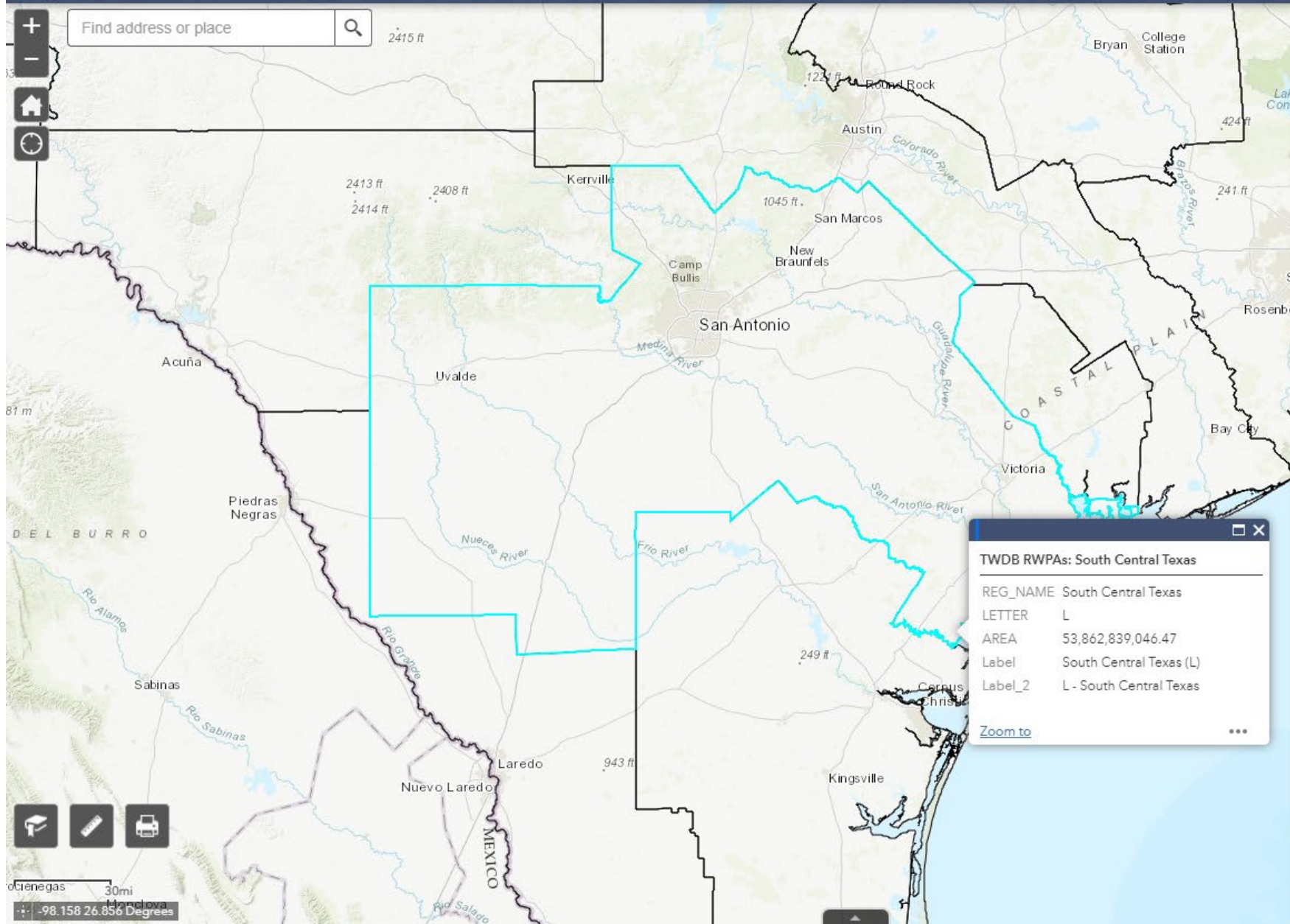


# Public Data Display

- TWDB recognized the spatial nature and produced an interactive public data display
- Tabs with more information on each screening, conclusions, links, and an interactive web map







### Layer List

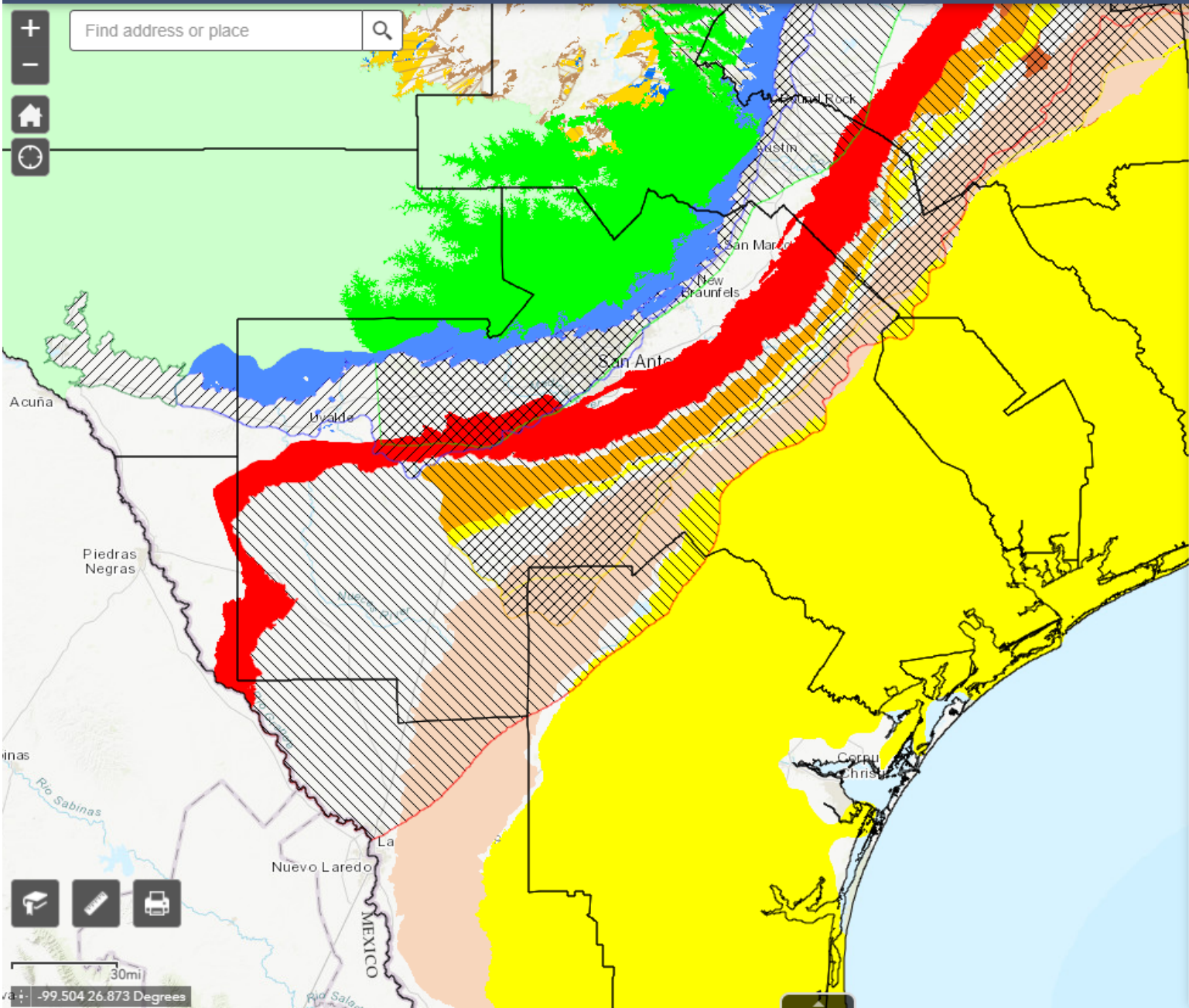
- Statewide Grid
- Regional Water Planning Areas
- Groundwater Conservation Districts
- Texas County Boundaries
- Priority Groundwater Management Areas
- Major River Basins
- Texas State Senate Districts
- Texas State House Districts
- Final ASR Suitability Rating (simple)
- Final ASR Suitability Rating (full data)
- Final AR Suitability Rating (simple)
- Final AR Suitability Rating (full data)
- Major Aquifers
- Minor Aquifers
- Need scores used for ASR final suitability rating
- Need scores used for AR final suitability rating
- Need Score Sum Normalized
- Manufacturing Needs GRID

### TWDB RWPAs: South Central Texas

REG_NAME	South Central Texas
LETTER	L
AREA	53,862,839,046.47
Label	South Central Texas (L)
Label_2	L - South Central Texas

[Zoom to](#)

Find address or place



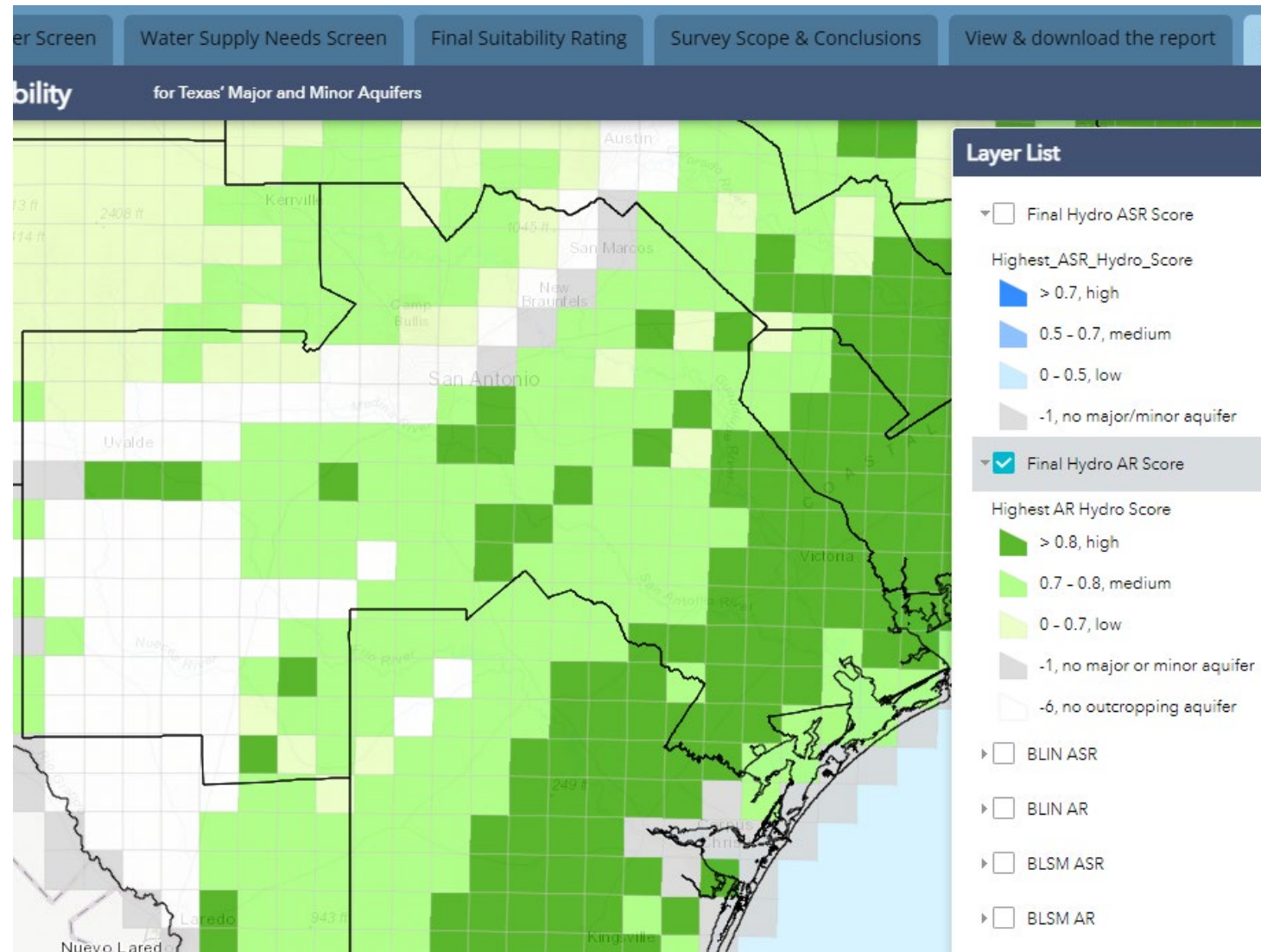
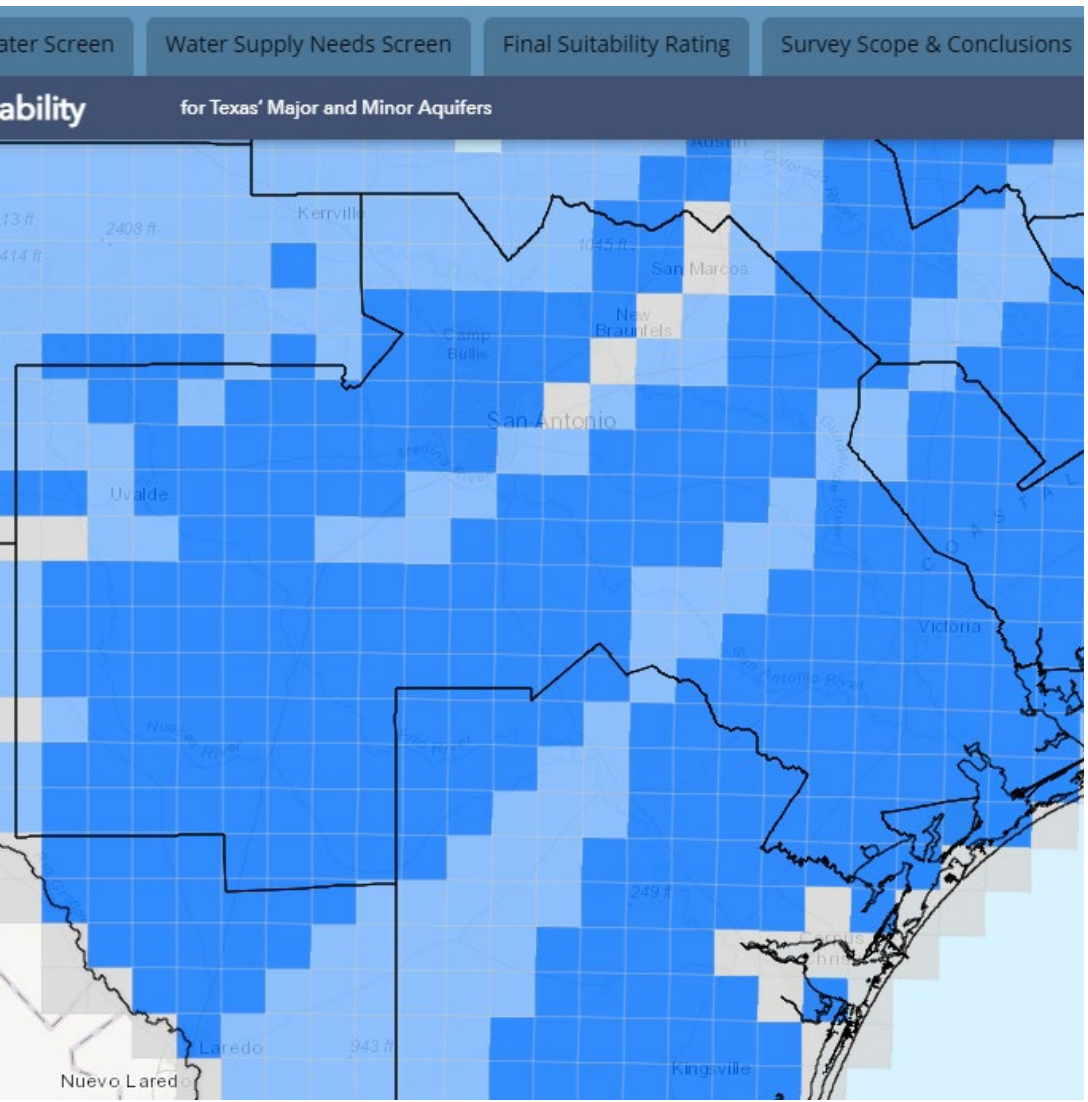
### Layer List

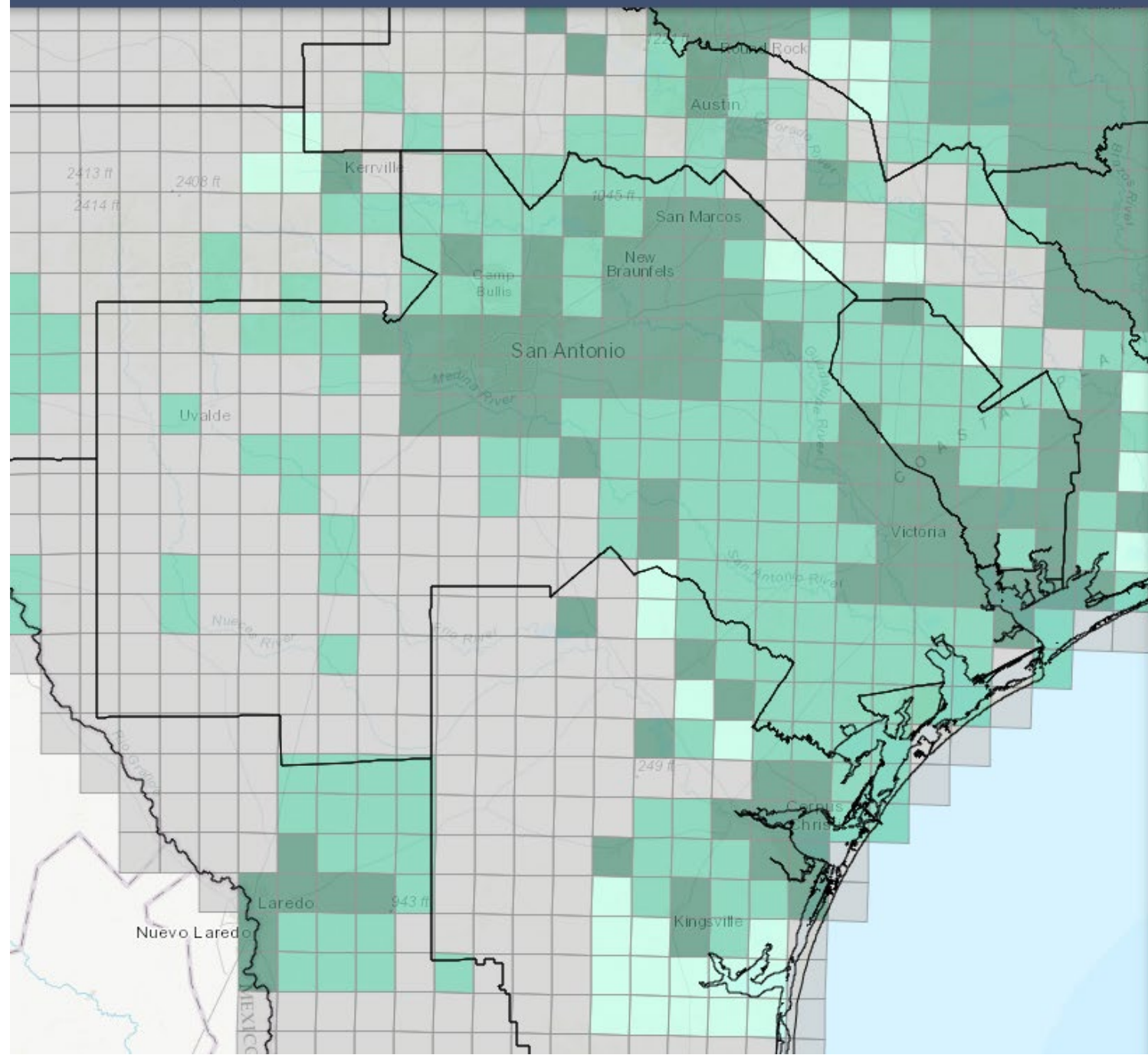
- Major Aquifers
  - Pecos Valley
  - Seymour
  - Gulf Coast
  - Carrizo - Wilcox (outcrop)
  - Carrizo - Wilcox (subcrop)
  - Hueco - Mesilla Bolson
  - Ogallala
  - Edwards - Trinity Plateau (outcrop)
  - Edwards - Trinity Plateau (subcrop)
  - Edwards BFZ (outcrop)
  - Edwards BFZ (subcrop)
  - Trinity (outcrop)
  - Trinity (subcrop)
- Minor Aquifers
  - Brazos River Alluvium
  - West Texas Bolsons
  - Lipan (outcrop)
  - Lipan (subcrop)
  - Yegua Jackson
  - Igneous
  - Sparta (outcrop)
  - Sparta (subcrop)
  - Queen City (outcrop)
  - Queen City (subcrop)
  - Nacatoch (outcrop)



30mi  
-99.504 26.873 Degrees



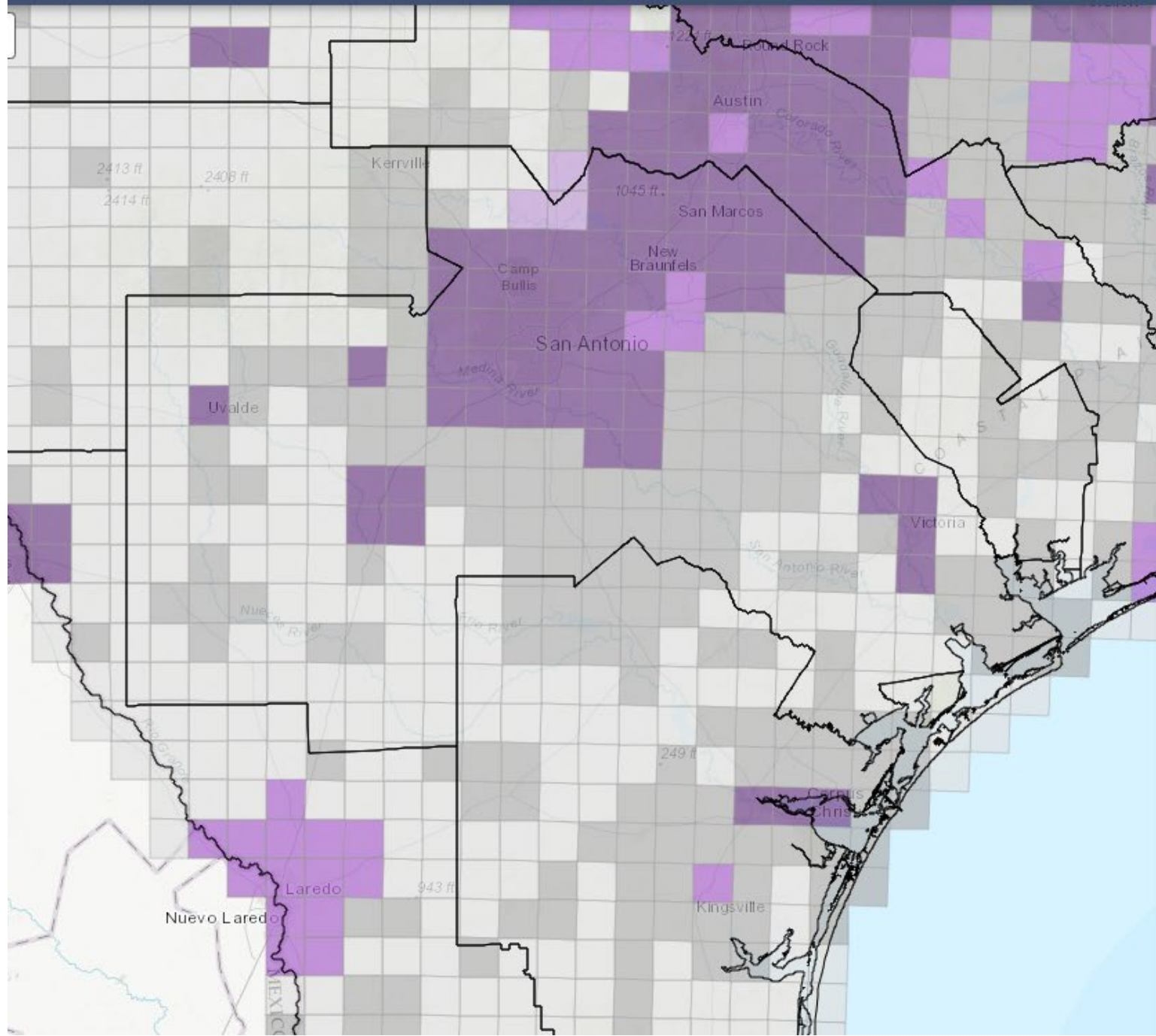




### Layer List

- Excess Score Sum Normalized ...
  - N/A, no excess water identified
  - Low, <0.34
  - Medium, 0.34 - 0.67
  - High, >0.67
- Excess Surface Water GRID ...
- Excess Reclaimed Water GRID ...
- Excess Groundwater GRID ...
- Surplus Appropriated Surface Water GRID ...
- Surplus Appropriated Surface Water (Run of River) GRID ...
- Surplus Appropriated Surface Water (Reservoirs) GRID ...
- Unappropriated Flow WAM Points GRID ...
- Reservoir Storage GRID ...
- Excess Groundwater (Major) GRID ...
- Excess Groundwater (Minor) GRID ...
- Surplus Appropriated Surface Water (Run of River) ...
- Surplus Appropriated Surface Water Reservoirs ...
- Unappropriated Flow WAM Points ...





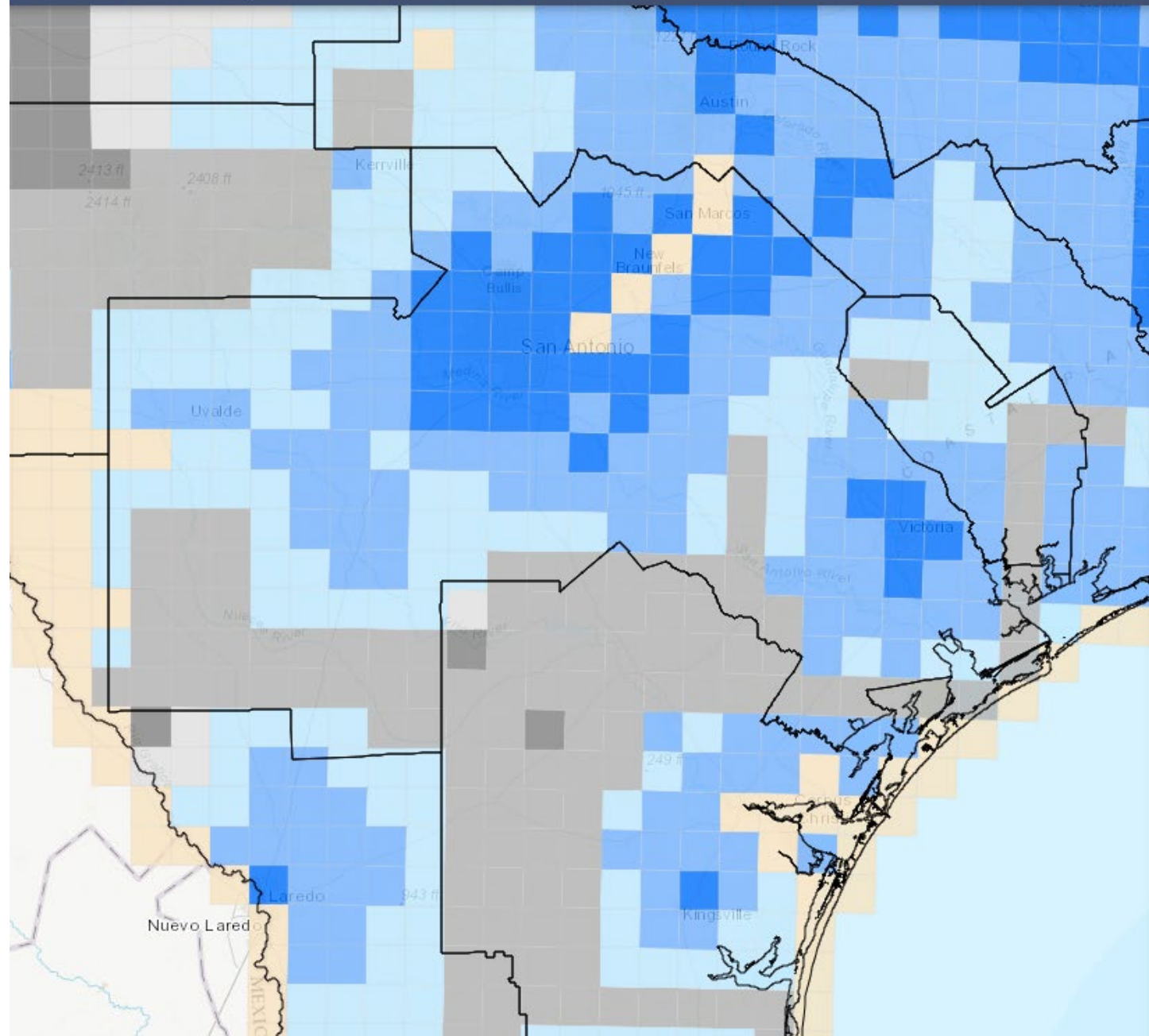
### Layer List

- Need Score Sum Normalized ...
- no WUG identified, -1
- WUG, but no need identified, 0
- Low, <0.34
- Medium, 0.34 - 0.67
- High, >0.67
- Manufacturing Needs GRID ...
- Municipal Needs GRID ...
- Steam Electric Needs GRID ...
- Manufacturing WUG ...
- Municipal WUG ...
- Steam Electric WUG ...
- ASR Project Points ...
- Excess water scores used for ASR final suitability rating ...
- Excess water scores used for AR final suitability rating ...
- Excess Score Sum Normalized ...
- Excess Surface Water GRID ...
- Excess Reclaimed Water GRID ...
- Excess Groundwater GRID ...



# ASR and AR Suitability

for Texas' Major and Minor Aquifers



## Layer List

Final ASR Suitability Rating (full data) ...

Final\_ASR\_rating

- > 0.7, most suitable
- 0.5 - 0.7, moderately suitable
- 0 - 0.5, less suitable
- 2, no excess water identified
- 3, no need identified
- 4, neither excess water nor need
- 5, no major/minor aquifer

Final AR Suitability Rating (simple) ...

Final AR Suitability Rating (full data) ...

Major Aquifers ...

Minor Aquifers ...

Need scores used for ASR final suitability rating ...

Need scores used for AR final suitability rating ...

Need Score Sum Normalized ...

Manufacturing Needs GRID ...

Municipal Needs GRID ...

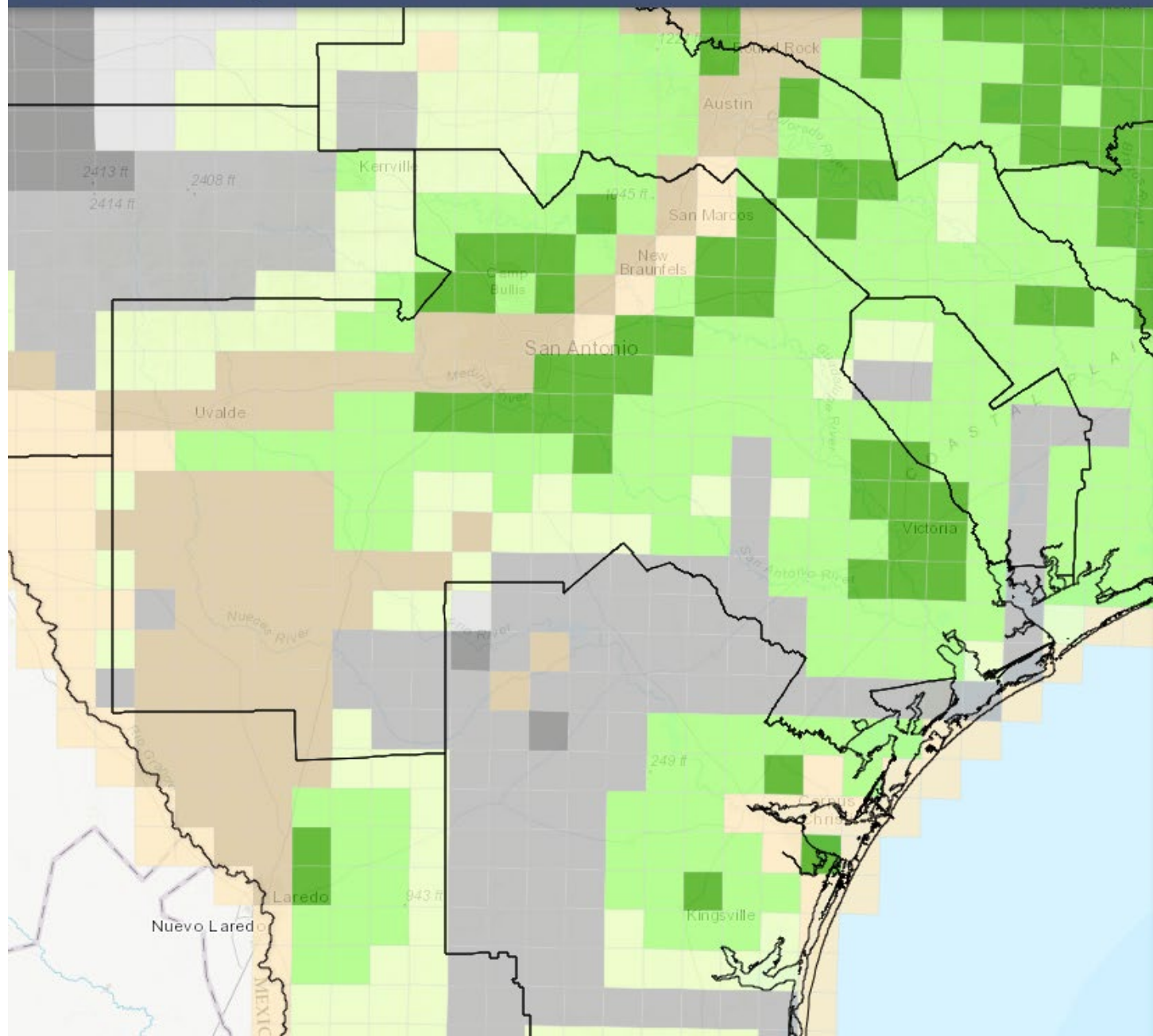
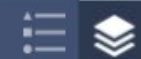
Steam Electric Needs GRID ...

Manufacturing WIUG ...



# SR and AR Suitability

for Texas' Major and Minor Aquifers



## Layer List

Final AR Suitability Rating (full data) ...

- Final\_AR\_rating
- > 0.7 - 1, most suitable
  - > 0.5 - 0.7, moderately suitable
  - 0 - 0.5, less suitable
  - 2, no excess water identified
  - 3, no need identified
  - 4, neither excess water or need identified
  - 5, no major or minor aquifer
  - 6, no outcropping aquifer

Major Aquifers ...

Minor Aquifers ...

Need scores used for ASR final suitability rating ...

Need scores used for AR final suitability rating ...

Need Score Sum Normalized ...

Manufacturing Needs GRID ...

Municipal Needs GRID ...

Steam Electric Needs GRID ...

Manufacturing WUG ...

Municipal WUG ...

# Benefits and Uses

## • Benefits

- Free and public
- Data accessibility
- Data versatility
- Dovetails with the water planning process

## • Uses

- Start conversations
- Explore the data
- Identify areas that could warrant a feasibility analysis
- Arrive at your own conclusions

## Access the Data:

[www.twdb.texas.gov/innovativewater/asr/projects/Statewide/index.asp](http://www.twdb.texas.gov/innovativewater/asr/projects/Statewide/index.asp)

# ASR and AR studies

- Conduct ASR and AR studies identified in the State Water Plan or by interested persons
- First completed study is *“Aquifer Storage and Recovery Report: Carrizo-Wilcox Aquifer Characterization for Eastern Gonzales and Parts of Caldwell and Guadalupe Counties, Texas”*
- Second study (under review) is *“Aquifer Storage and Recovery Report: Longevity Assessment for the City of Bandera Water Wells”*

Aquifer Storage and Recovery Report:  
Carrizo-Wilcox Aquifer Characterization  
for Eastern Gonzales and Parts of  
Caldwell and Guadalupe Counties, Texas

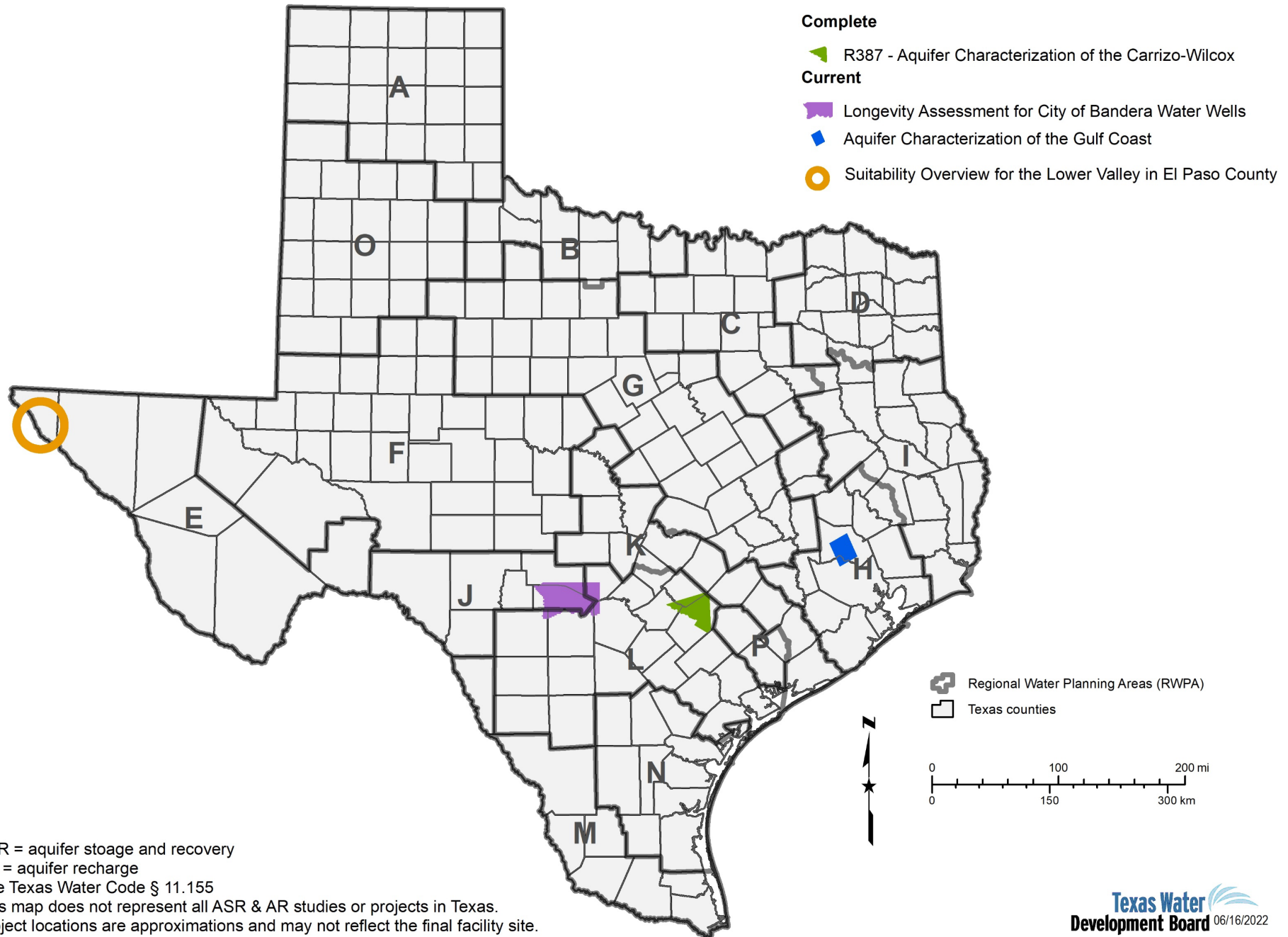
Andrea Croskrey, P.G., James Golab, Ph.D., P.G., Daniel Collazo

Report 387  
March 2022

Texas Water Development Board  
[www.twdb.texas.gov](http://www.twdb.texas.gov)



# TWDB ASR or AR study status



ASR = aquifer storage and recovery  
 AR = aquifer recharge  
 See Texas Water Code § 11.155  
 This map does not represent all ASR & AR studies or projects in Texas.  
 Project locations are approximations and may not reflect the final facility site.

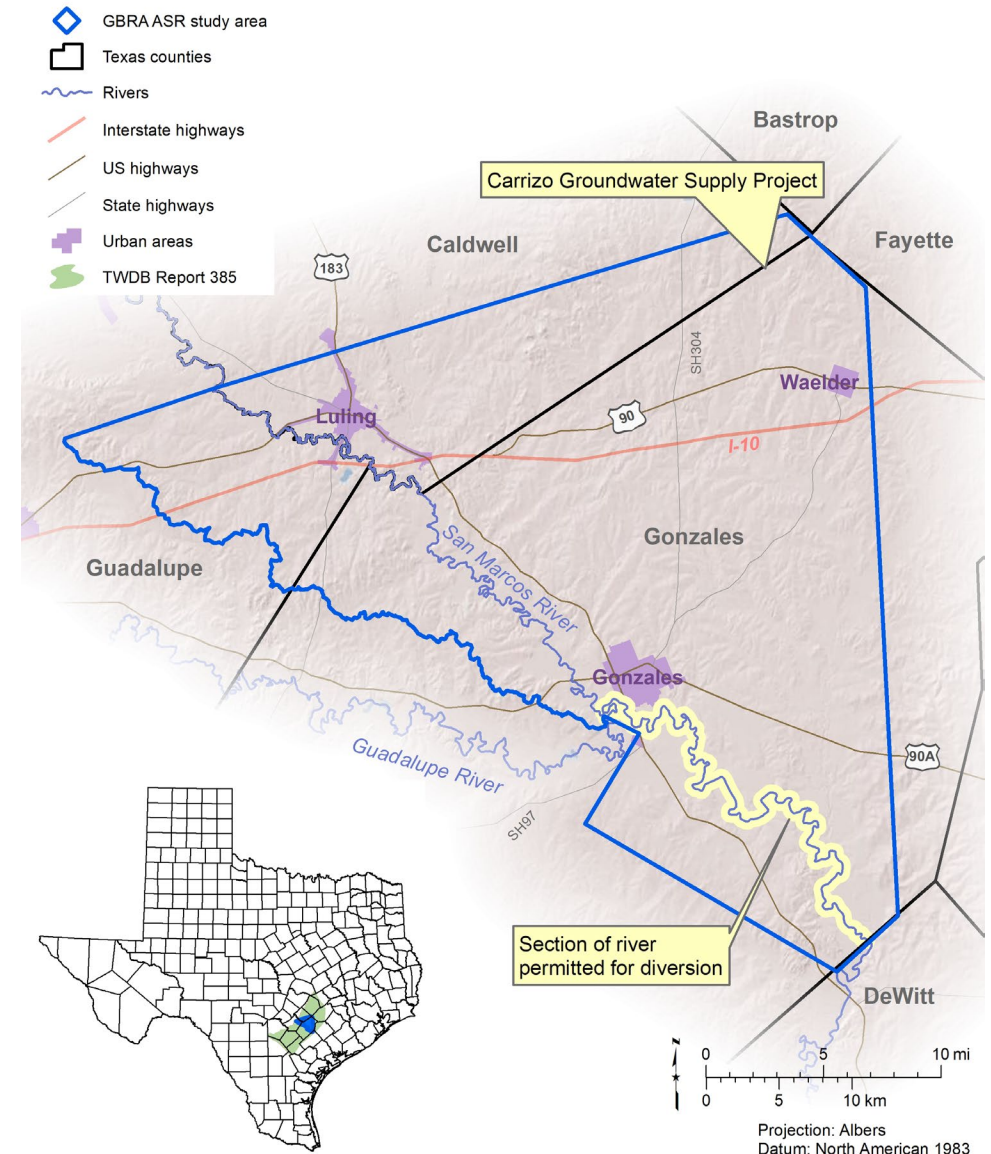


# Study selection process

- Researched ASR and AR strategies across TX
- Contacted project sponsors
- Prioritized areas with
  - Strategies in the state water plan
  - Data
  - Staff skills and abilities
  - Sponsor interest
  - Project status, timeline

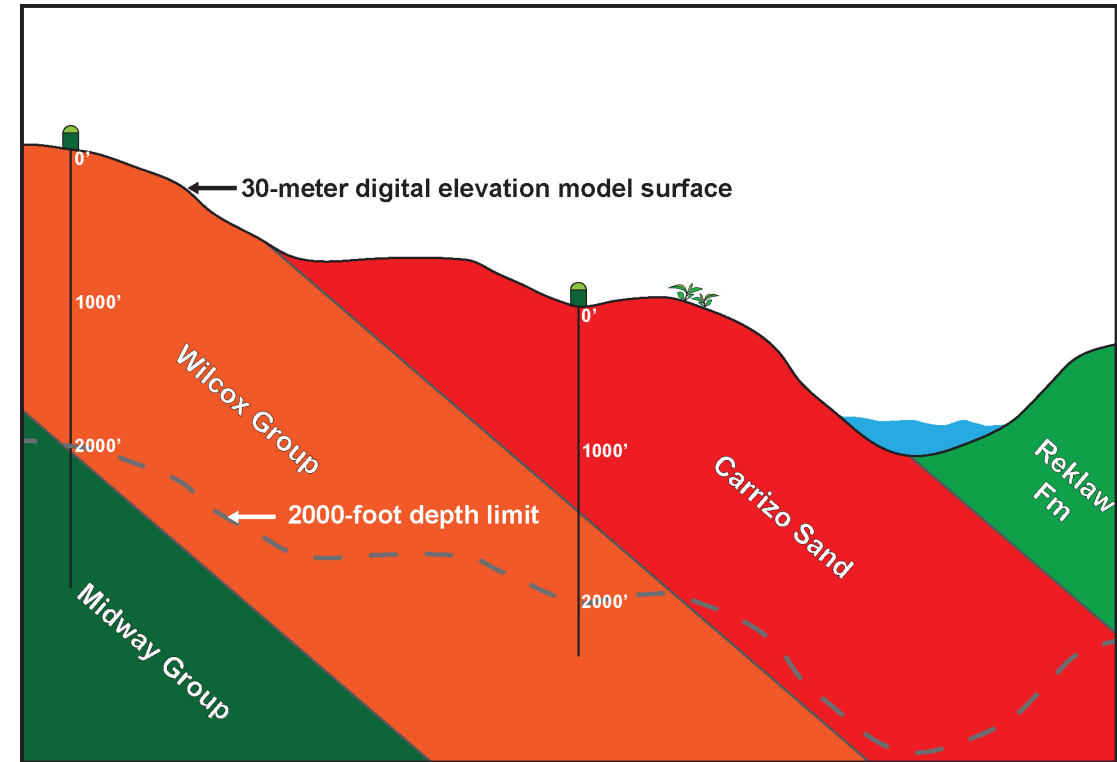
# Completed studies – Guadalupe-Blanco River Authority ASR

- GBRA Mid-Basin Water Supply Project
  - Surface water from Guadalupe River and groundwater from Carrizo Aquifer
  - Conjunctive use project involving groundwater production and ASR
  - Stored water and groundwater will be used to meet demand when surface water does not.



# Completed studies – Guadalupe-Blanco River Authority ASR

- Aquifer Characterization Study
  - Hydrogeological characteristics of the Carrizo-Wilcox Aquifer (stratigraphy, lithology, and salinity)
  - Site selection considerations
  - Well constructions considerations
  - Comparison with the existing San Antonio Water System ASR project
- Next Steps
  - GBRA will be hiring an engineering consultant for wellfield and system design



# Completed studies - City of Bandera

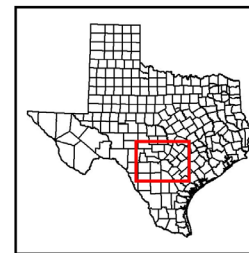
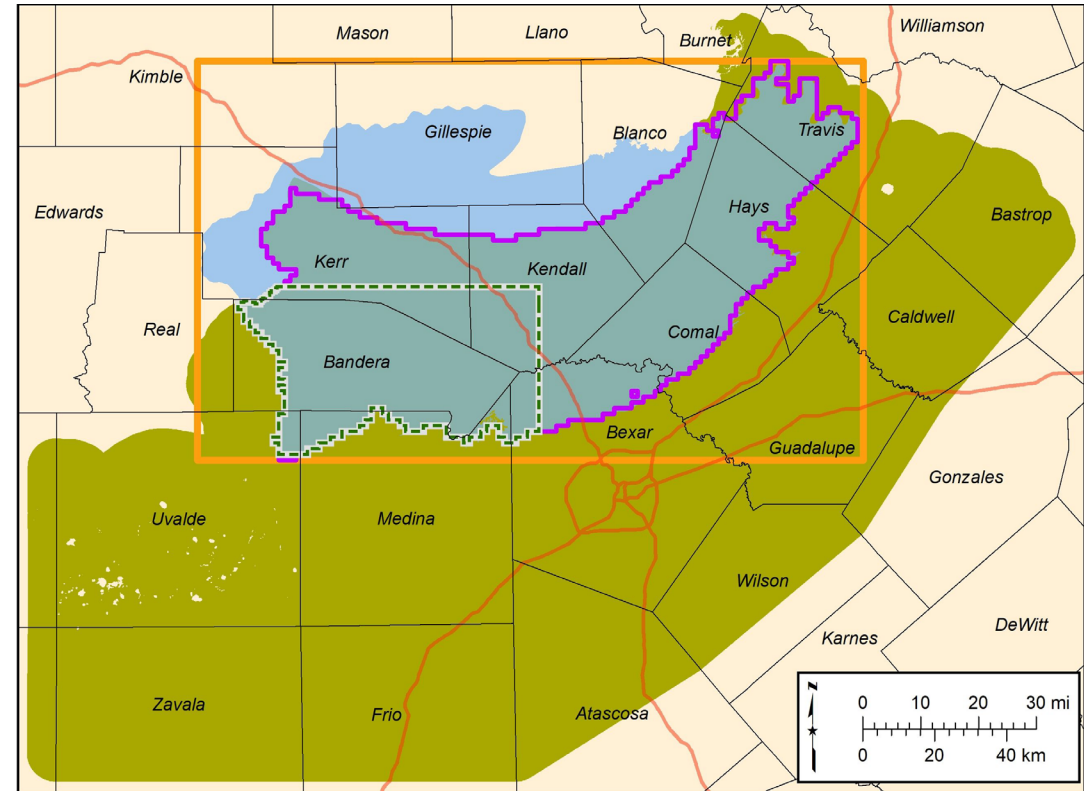
## Currently in Review

**Description:** The City of Bandera plans to inject treated surface water from the Medina River into the lower Trinity aquifer to be recovered when water supply demand is high.

IWT created a numerical model to assess the longevity of the City of Bandera's lower Trinity aquifer wells. The model is based on the Hill Country Groundwater Availability model

The model was used to forecast three future scenarios:

1. pumping will remain static
2. pumping will increase to match the projected demands in the 2022 State Water Plan
3. pumping will increase to produce all the groundwater listed as available to the City of Bandera in the 2022 State Water Plan.



- Study area
- Study lower Trinity aquifer active limit
- Study model extent
- Groundwater availability model lower Trinity aquifer extent (Jones and others, 2011)
- Brackish groundwater map lower Trinity aquifer extent (Robinson and others, 2022)
- Interstate highways
- Texas counties



# Current Projects – SJRA ASR

- **Goal:** Fill some data gaps identified in SJRA’s Raw Water Supply Master Plan including local aquifer characteristics and aquifer storage potential
- **Description:** Aquifer characterization of the Gulf Coast Aquifer with a focus on the Evangeline and upper Jasper formations
- **Additional note:** In addition to supply resiliency, SJRA also identified ASR as a strategy that could contribute to their groundwater use reduction plan

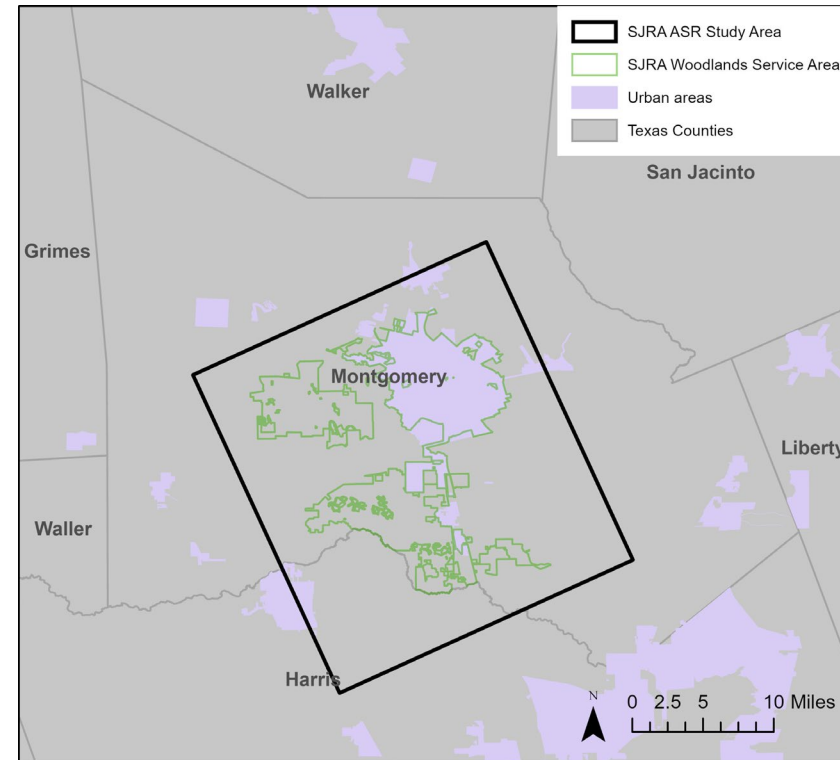


Table 5. Summary of Data Gaps Identified in the Strategy Evaluation for the Raw Water Supply Masterplan

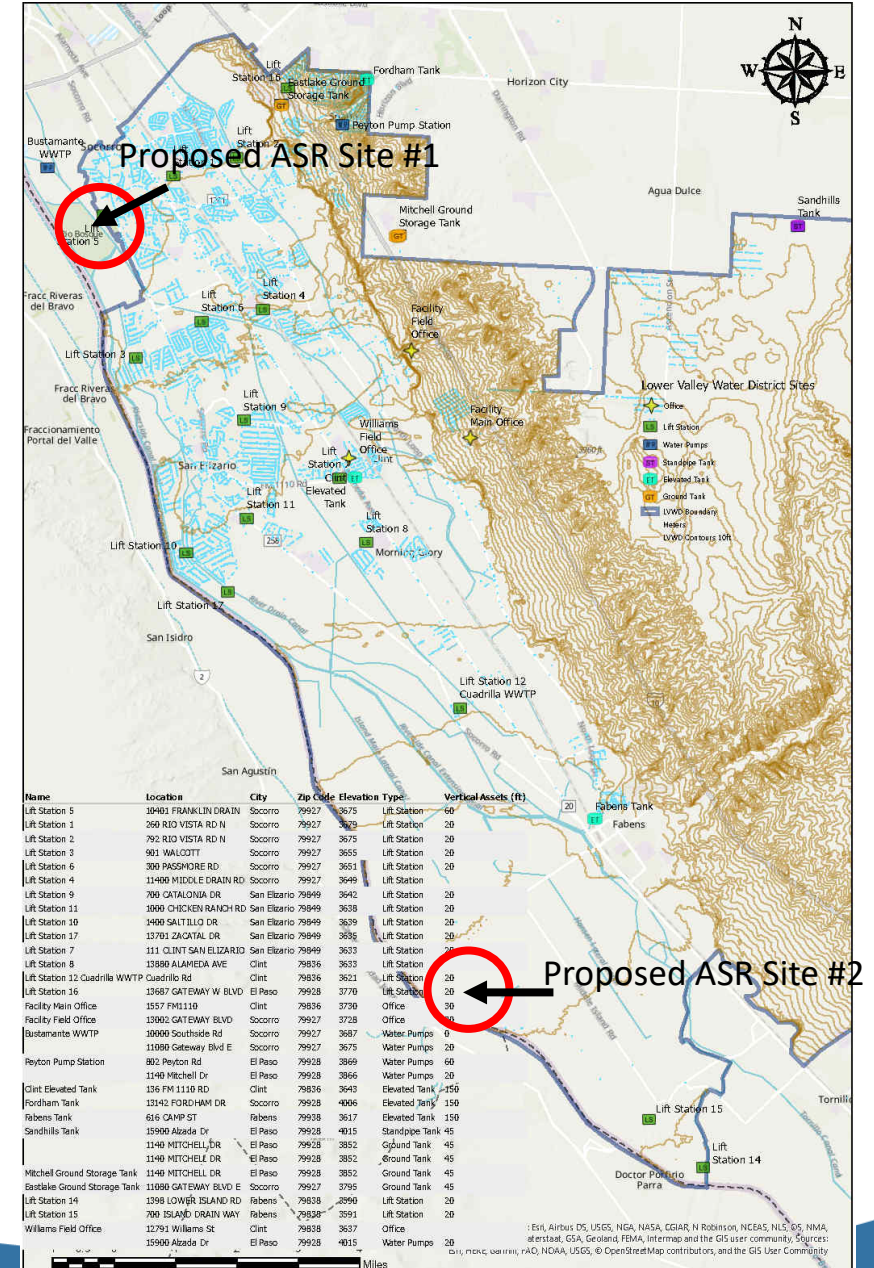
Project			
Number	Strategy Name	Sub-Type	Data Gaps
1	Aquifer Storage and Recovery	Developed by SJRA GRP Participants	Local Aquifer Characteristics, Aquifer Storage Potential, Source of Supply, Treatment Costs, Potential Participants Interested
2	Aquifer Storage and Recovery	Developed by SJRA (GRP Treated)	Local Aquifer Characteristics, Aquifer Storage Potential, Source of Supply, Treatment Costs
3	Aquifer Storage and Recovery	Developed by SJRA (Mildly Treated)	Local Aquifer Characteristics, Aquifer Storage Potential, Source of Supply, Treatment Costs

# Current Projects – LVWD ASR

**Goal:** Provide a refined suitability analysis for ASR and determine what additional data needs to be collected

**Description:** Report will include an analysis of the hydrogeological characteristics of the Hueco Formation and an excess water and needs analysis from the statewide survey and data from the LVWD.

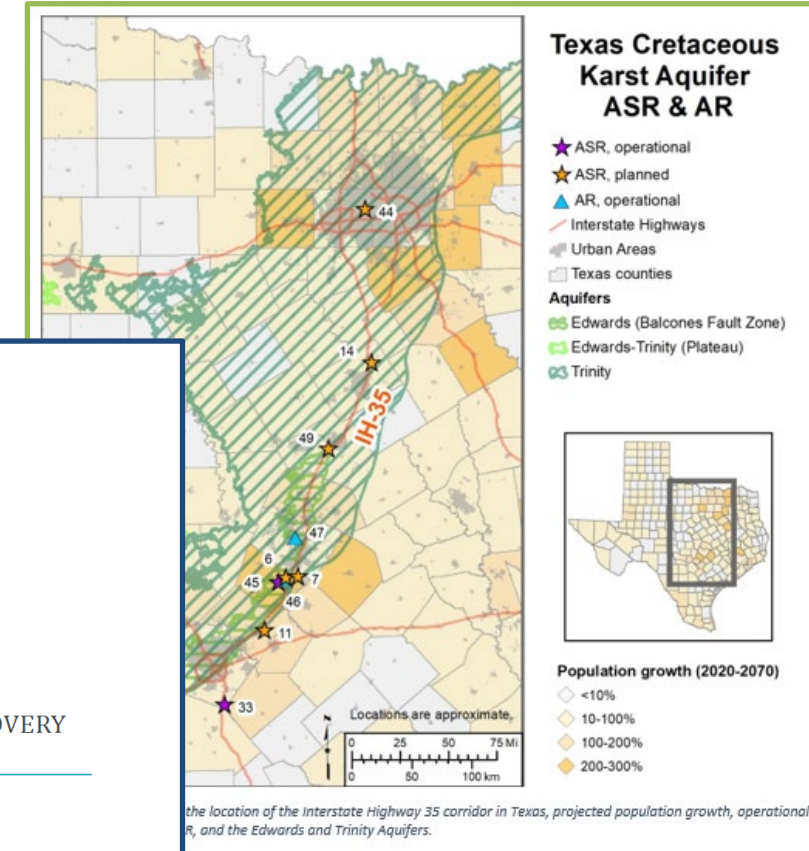
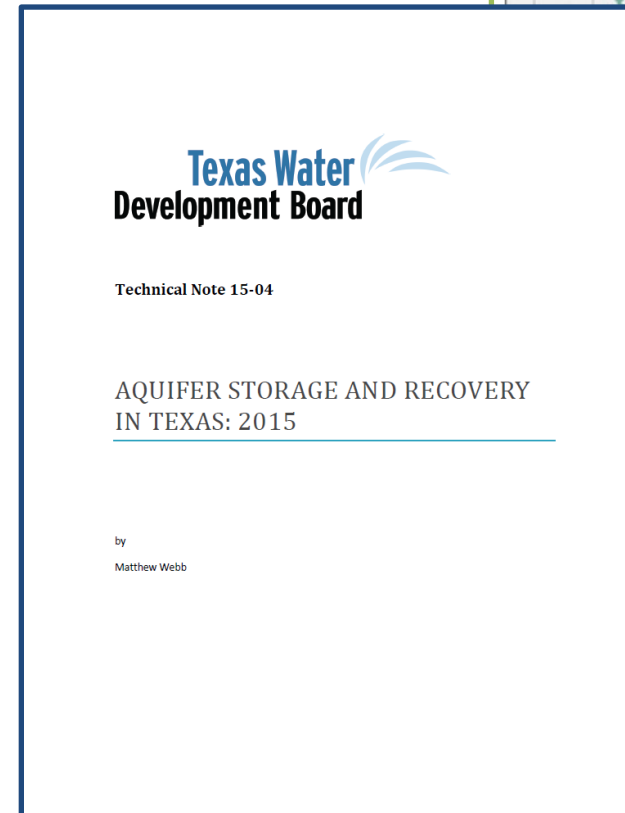
**Additional notes:** LVWD recently received an ~\$23 million loan for wastewater infrastructure from the North American Development Bank and the project will consider treated wastewater injection



# Current Projects – ASR/AR White Papers

- **Topics:**

1. ASR and MAR in Texas Cretaceous Aquifers
2. Update ASR in Texas Tech Note (2015)
3. Hot spots: Analysis of the highest scoring areas from the Statewide Suitability Survey

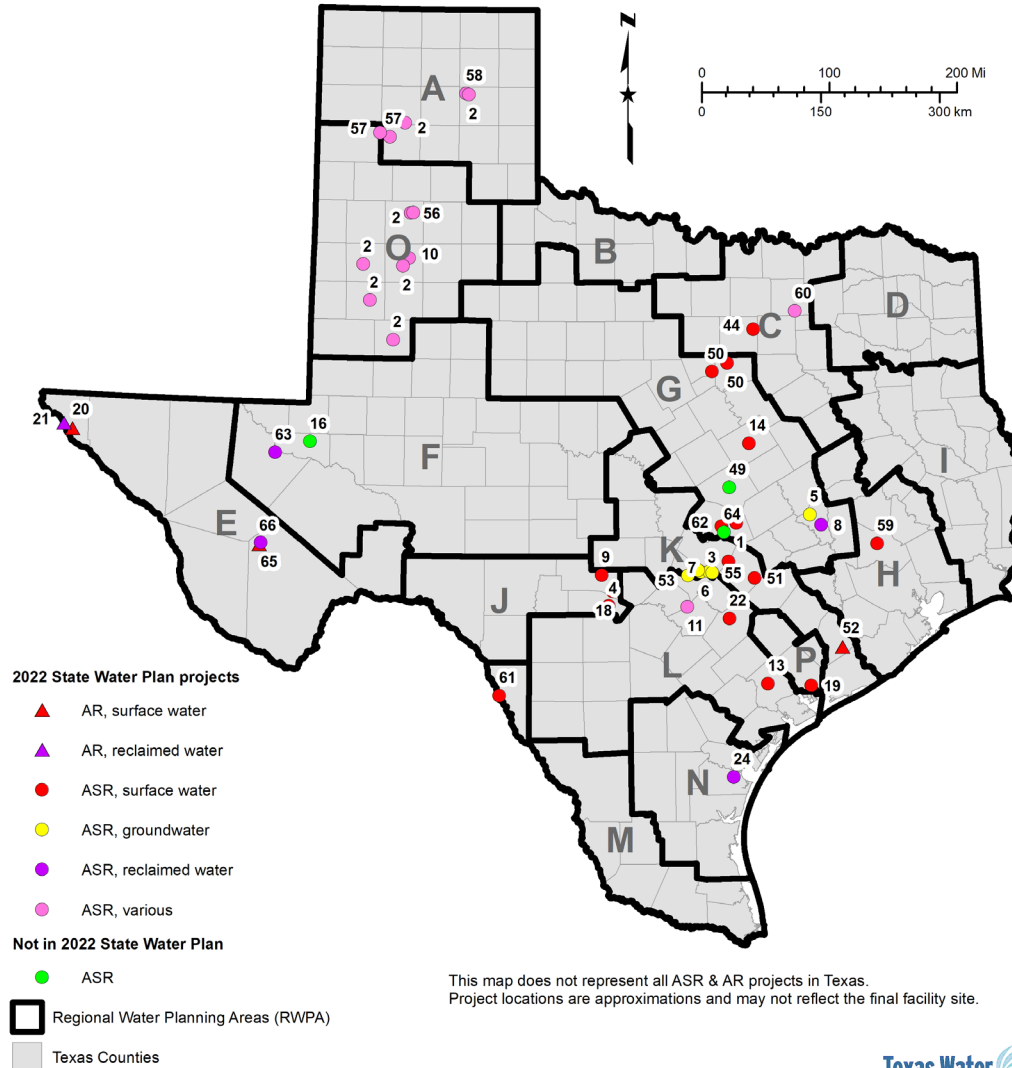




# Potential Future ASR/AR Projects

Projects considered for TWDB ASR or AR study

ID	Project name
1	Brazos River Authority - Lake Granger
2	Canadian River MWA
3	City of Austin
4	City of Bandera
5	City of Bryan
6	Buda Middle Trinity-Buda
7	Buda Saline Edwards
8	City of College Station
9	City of Kerrville
10	City of Lubbock
11	City of New Braunfels
13	City of Victoria
14	McLennan County (City of Waco)
16	Colorado River Municipal Water District
18	Eastern Kerr County Regional Water Supply Project
19	Lavaca Navidad River Authority (alternative)
20	Lower Valley Water District
21	El Paso Water Utilities, expansion
22	GBRA Mid Basin Phase II
24	Corpus Christi ASR
44	Tarrant Regional WD ASR Pilot
49	Brazos River Authority - Bell County
50	Johnson County SUD and Acton MUD (Alternative)
51	LCRA ASR Carrizo-Wilcox
52	LCRA Enhanced Recharge
53	Buda Middle Trinity-Hays County-Other
54	Buda Middle Trinity-Hays
55	Buda Middle Trinity-Creedmoor-Maha WSC
56	City of Plainview
57	City of Amarillo
58	City of Pampa
59	San Jacinto River Authority
60	North Texas MWD ASR (alternative)
61	Eagle Pass (alternative)
62	Brazos River Authority - Lake Georgetown
63	City of Pecos (alternative)
64	City of Hutto ASR
65	City of Alpine, wastewater treatment facility
66	City of Alpine, rainwater harvesting



This map does not represent all ASR & AR projects in Texas. Project locations are approximations and may not reflect the final facility site.

# Questions?

## Contact info:

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512-475-1541