

Future of ASR in Texas: TWDB Supporting Projects Across the State

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Innovative Water Technologies
Texas Water Development Board

Texas American Water Works Association

Capital Area Chapter

February 9, 2024 – Austin



Outline

- Introduction
 - Texas Water Development Board (TWDB)
 - Aquifer Storage and Recover (ASR)
- Texas Water Code § 11.155
 - 1st Mandate: Statewide Suitability Survey
 - 2nd Mandate: ASR studies
 - Study Selection
 - Completed Studies
 - Current Studies

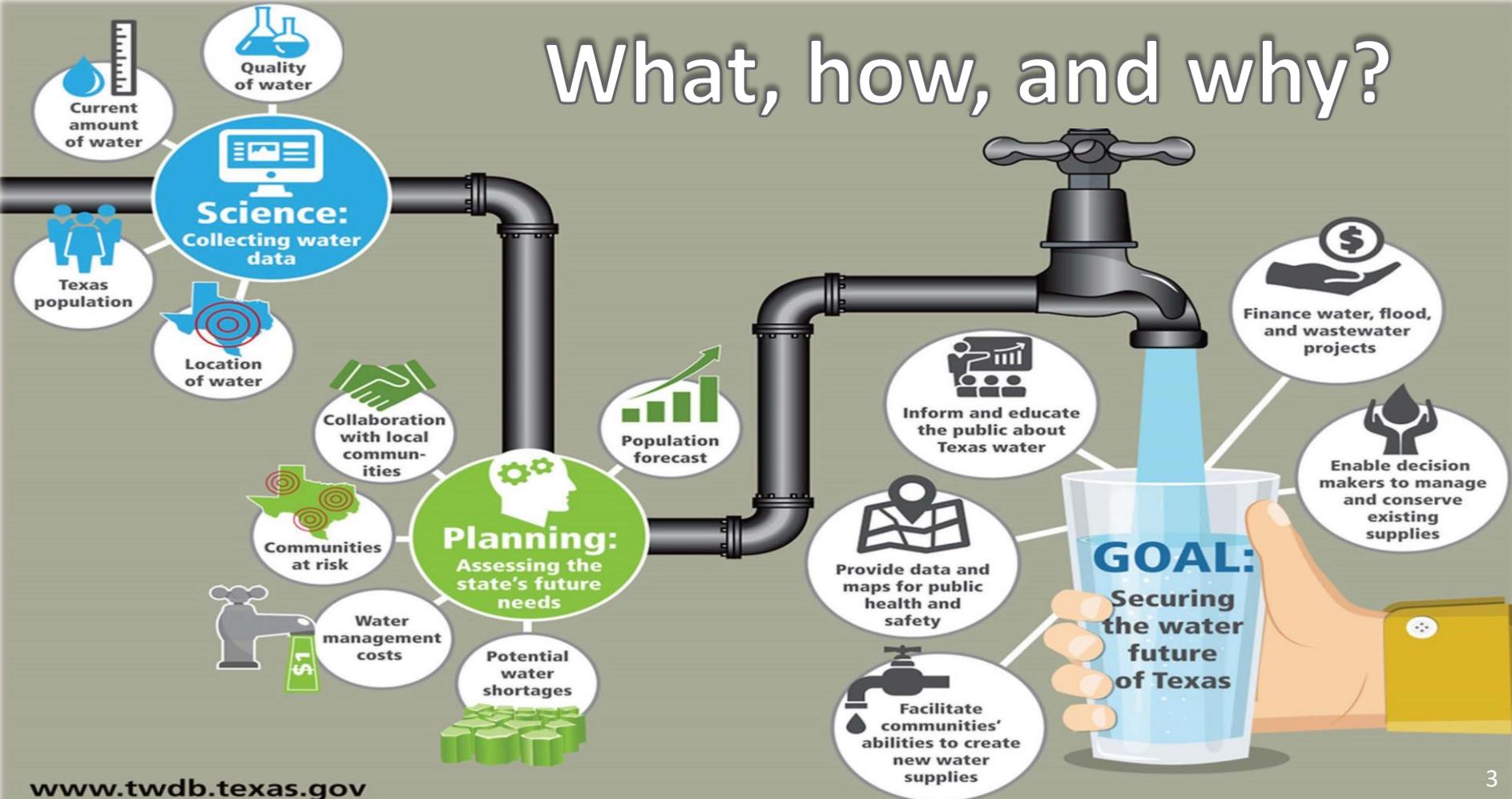
Texas Water Development Board

Introduction

TWC § 11.155
1st Mandate

TWC § 11.155
2nd Mandate

What, how, and why?



Texas Water Development Board

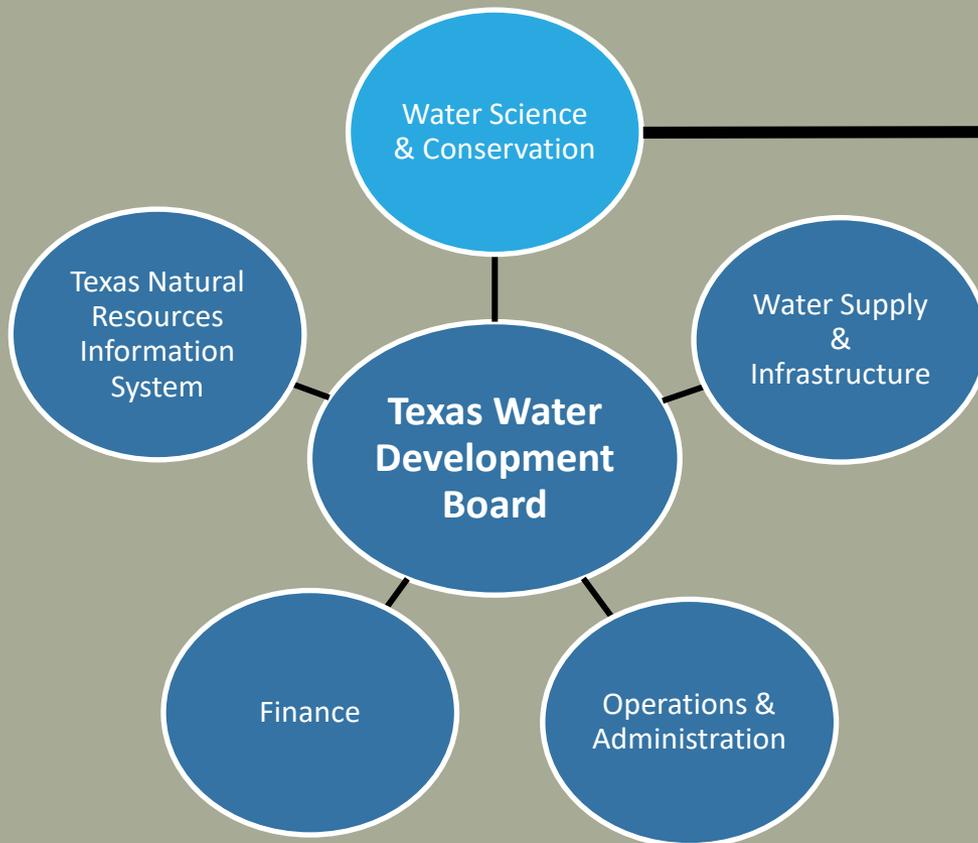
Introduction



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2nd Mandate



Innovative Water Technologies (IWT)

- Aquifer storage and recovery (ASR) + aquifer recharge (AR)
 - Desalination
 - Reuse



IWT goal:

“To research, develop, and disseminate information to advance and promote the development and use of alternative water supplies in Texas.”

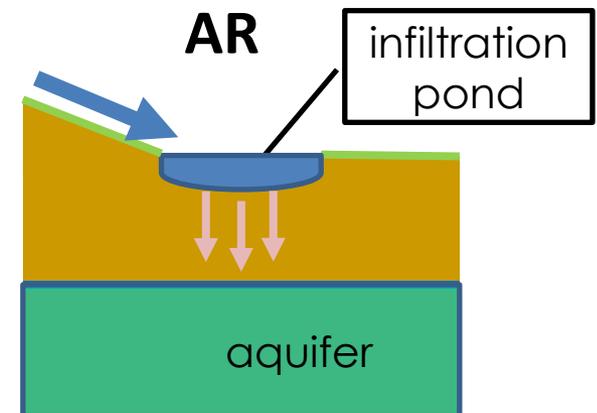
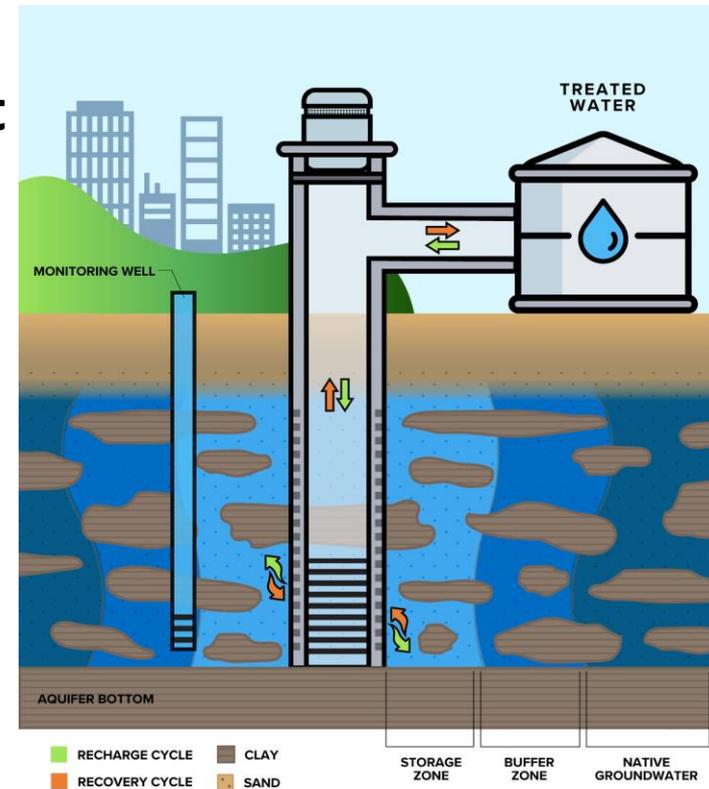
What is ASR?

Water savings account

- Texas Water Code § 27.151

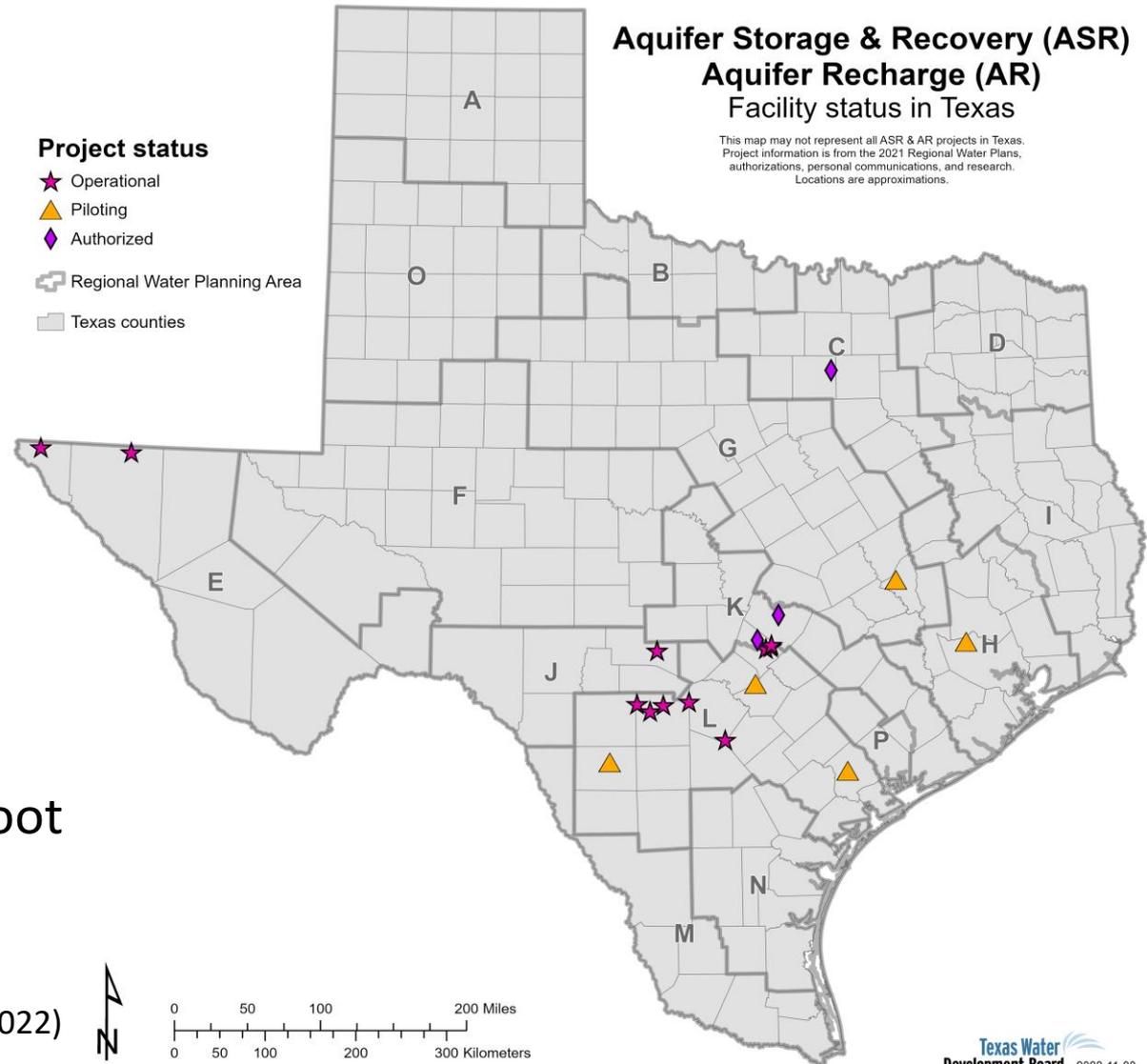
“...a project involving the injection of water into a geologic formation for the purpose of subsequent recovery and beneficial use by the project operator.”

- ASR uses the same well to inject and retrieve
- Other forms of managed aquifer recharge (AR) might use infiltration basins
- AR maybe implemented for multiple uses such as subsidence mitigation, improving groundwater levels, or improving water quality



ASR & AR in Texas

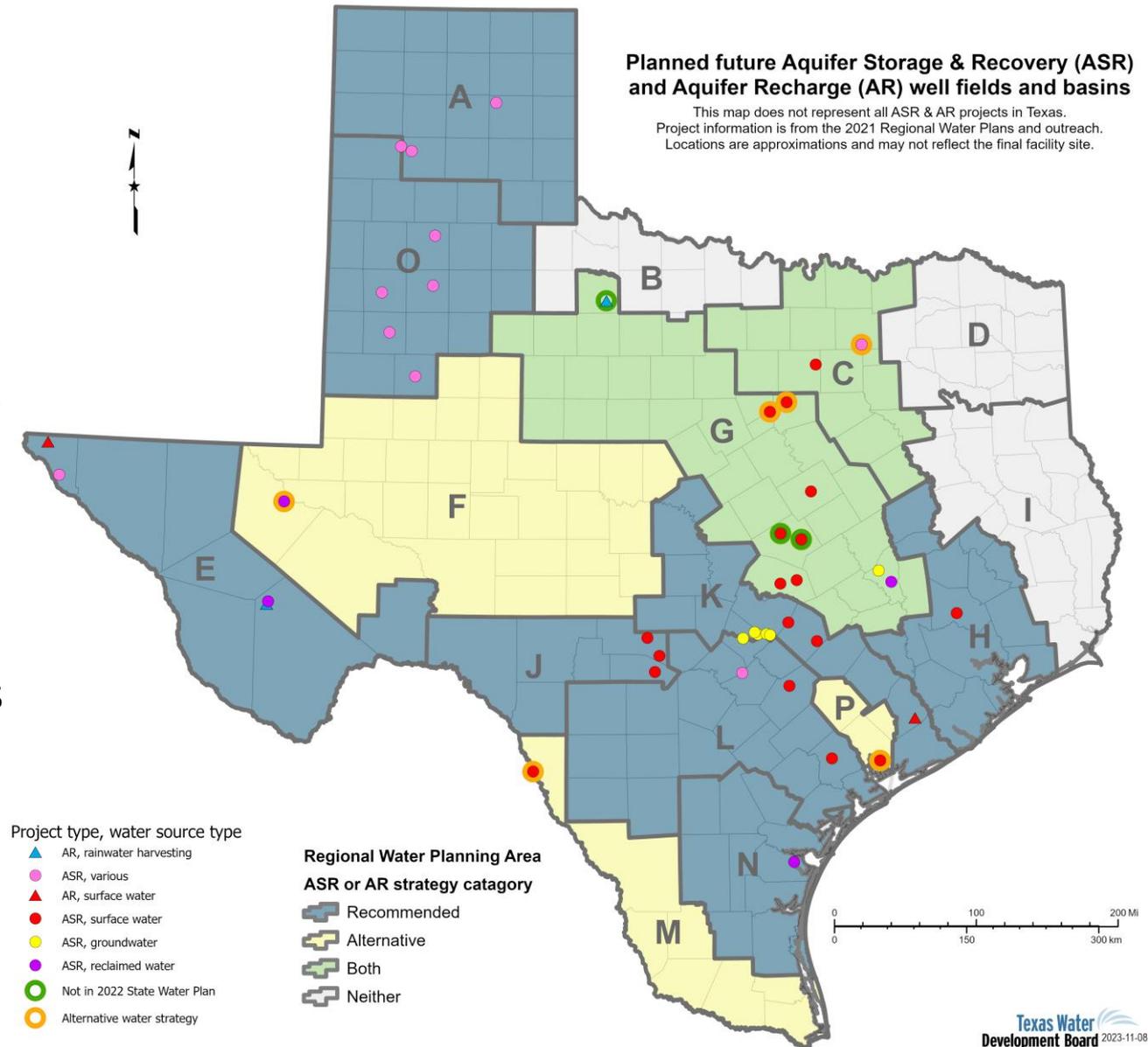
- 8 operational
 - 4 ASR
 - 4 AR
- 5 in testing (piloting)
- 4 authorized
- Scales vary greatly
 - Kerrville ~ 3,000 Acre-foot stored (March 2022)
 - San Antonio ~ 186,000 Acre-foot stored (October 2022)





ASR & AR in Texas

- 13 of 16 regional water planning groups are planning on ASR
- 37 ASR well fields, 4 AR surface infiltration facilities
- 193,000 AFY in 2070, 3% of new supply



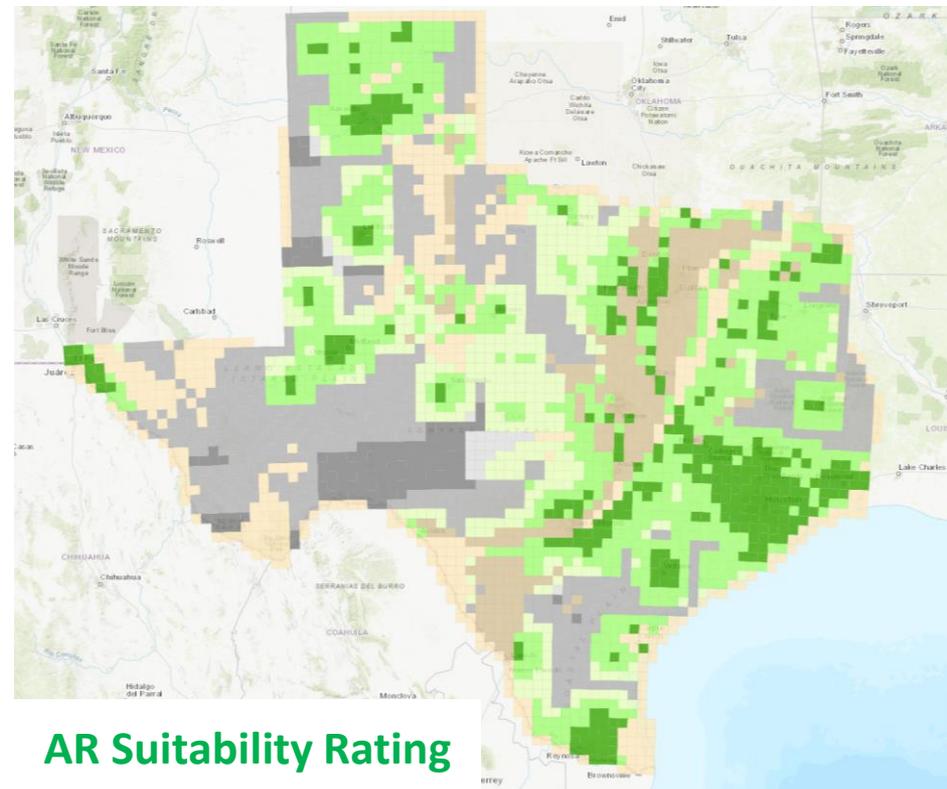
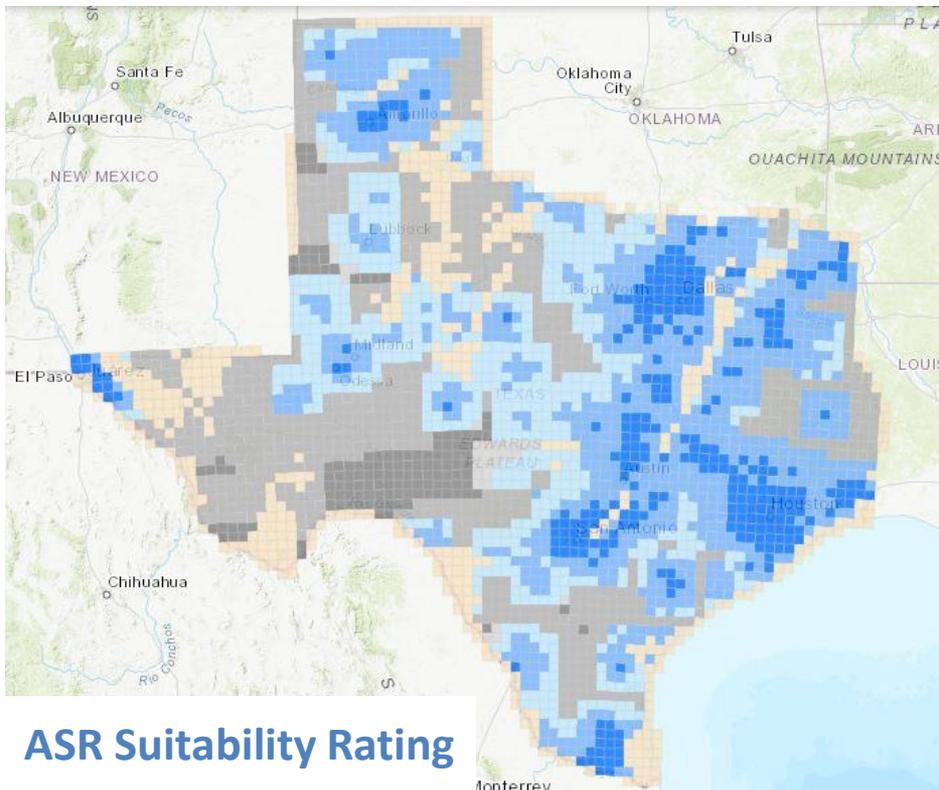
ASR legislative 1st mandate

TWC § 11.155
1st Mandate

TWC § 11.155
2nd Mandate

Texas Water Code § 11.155 ASR mandate:

Statewide survey of aquifer suitability for ASR or AR projects in Texas

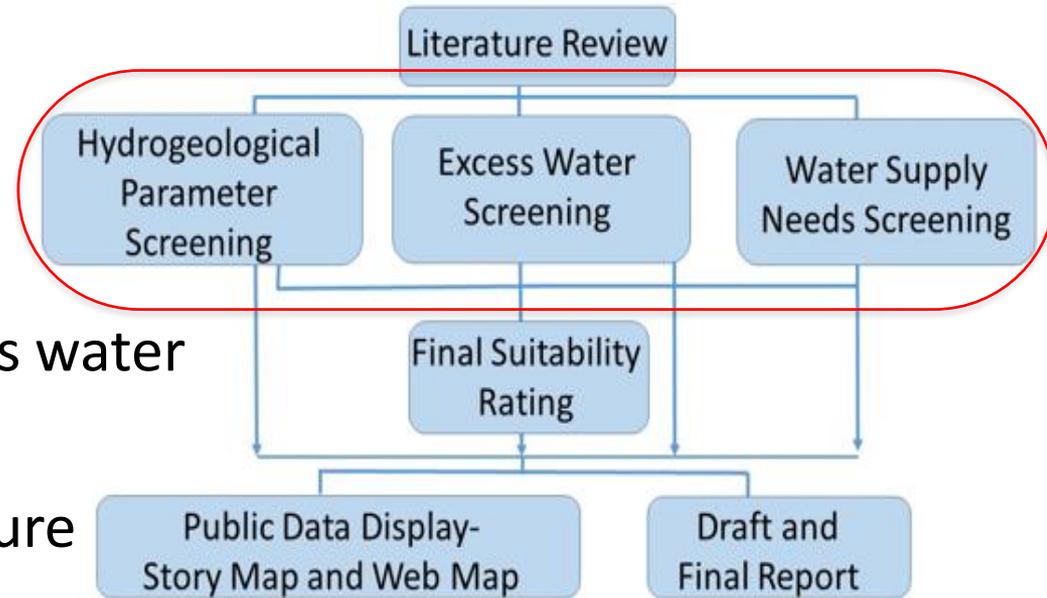


Intro to the survey

- TWDB contracted with HDR

- Must include:

- hydrogeological characteristics,
- availability of excess water sources, and
- the current and future water supply needs



- Resulted in final suitability ratings
- Completed and published December 2020

Survey Benefits and Uses

- Free and public
- Data accessibility
- Data versatility
- Dovetails with the water planning process
- Start conversations
- Explore the data
- Identify areas that could warrant a feasibility analysis
- Arrive at your own conclusions

Access data:

Project web page:



Story map:





ASR legislative 2nd mandate

Texas Water Code § 11.155 ASR mandate:

Conduct studies - work with appropriate interested persons to conduct studies of ASR and AR projects and report the results to the regional water planning groups and interested persons





ASR studies: prioritization criteria and info

(Based on most current available information)

Criteria

- 1) Sponsor interest and activity
- 2) Project planning status
- 3) Data availability and quality
- 4) Staff skillset
- 5) Online decade

Supporting information

- Statewide Suitability Survey final rating for both ASR & AR
- Source water type
- Strategy goal
- Proposed study type



Completed and current studies

Texas Water Development Board ASR and AR Projects

ASR = aquifer storage and recovery
AR = aquifer recharge
See Texas Water Code § 11.155

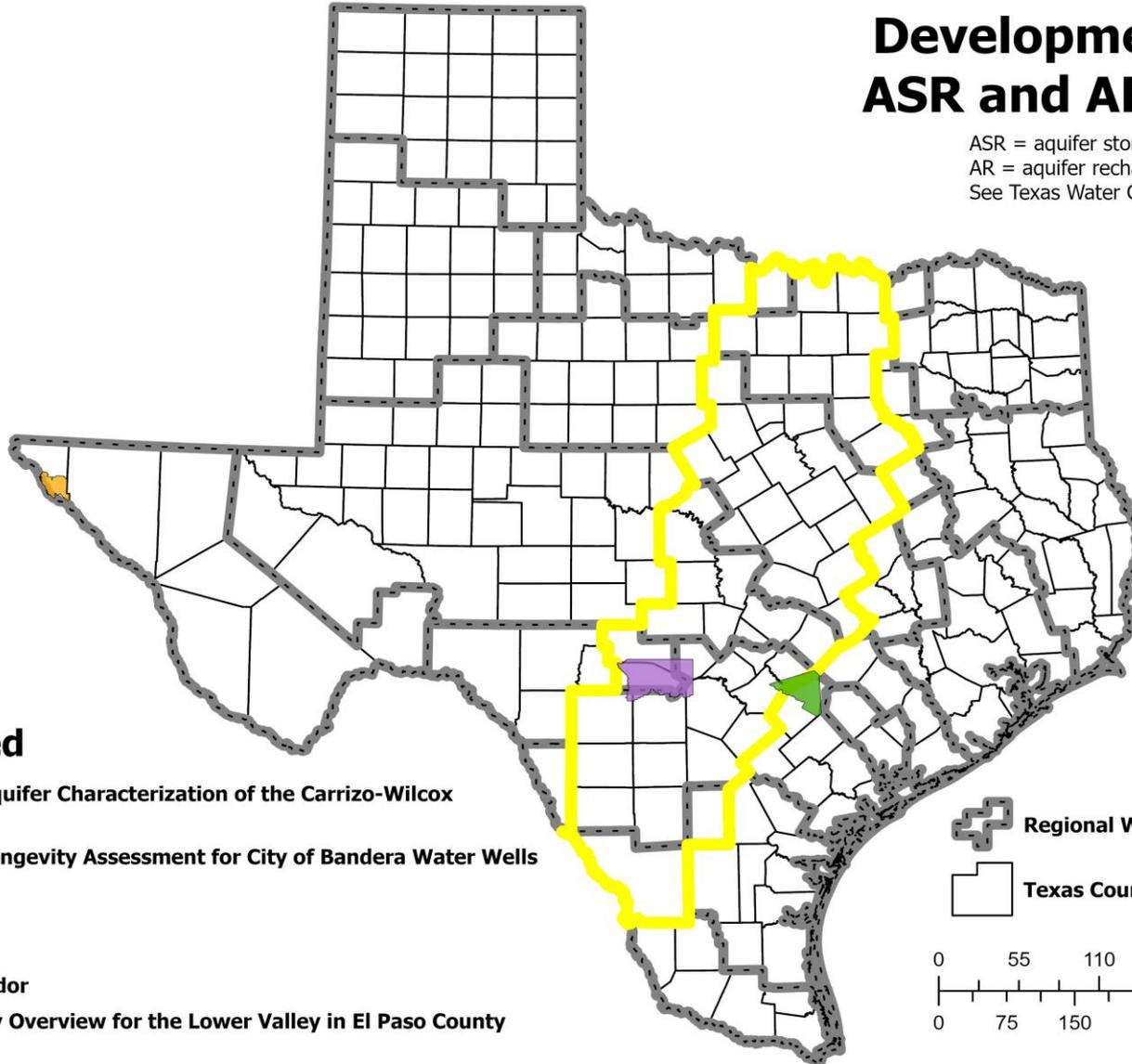
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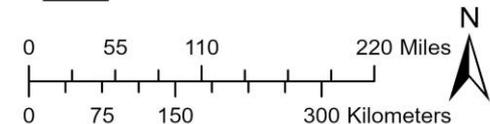
Completed

-  R387 - Aquifer Characterization of the Carrizo-Wilcox
-  R389 - Longevity Assessment for City of Bandera Water Wells

Current

-  I35 Corridor
-  Suitability Overview for the Lower Valley in El Paso County

-  Regional Water Planing Areas
-  Texas Counties



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

Completed Studies



Guadalupe-Blanco River Authority (GBRA)

Mid-basin Water Supply Project

Plans to inject treated surface water from the Guadalupe River into the Carrizo-Wilcox Aquifer when availability from the river exceeds customer demand and there is available capacity at the new water treatment facility.

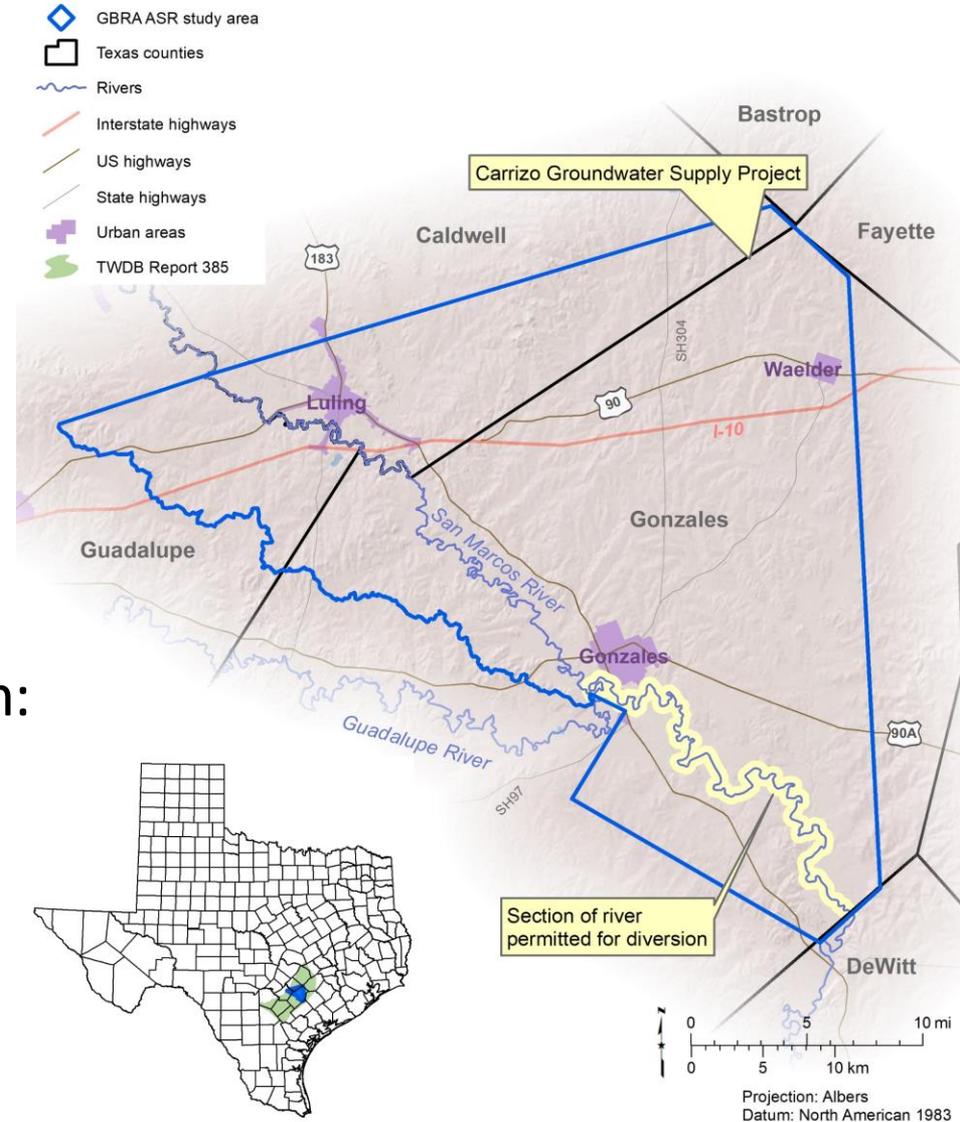
ASR study: aquifer characterization

The GBRA needed to better understand the storage parameters and options of the aquifers in the vicinity of its Mid-Basin Water Supply Project

IWT studied the hydrogeological characteristics of the aquifer system:

- Stratigraphy
- Lithology
- Groundwater salinity

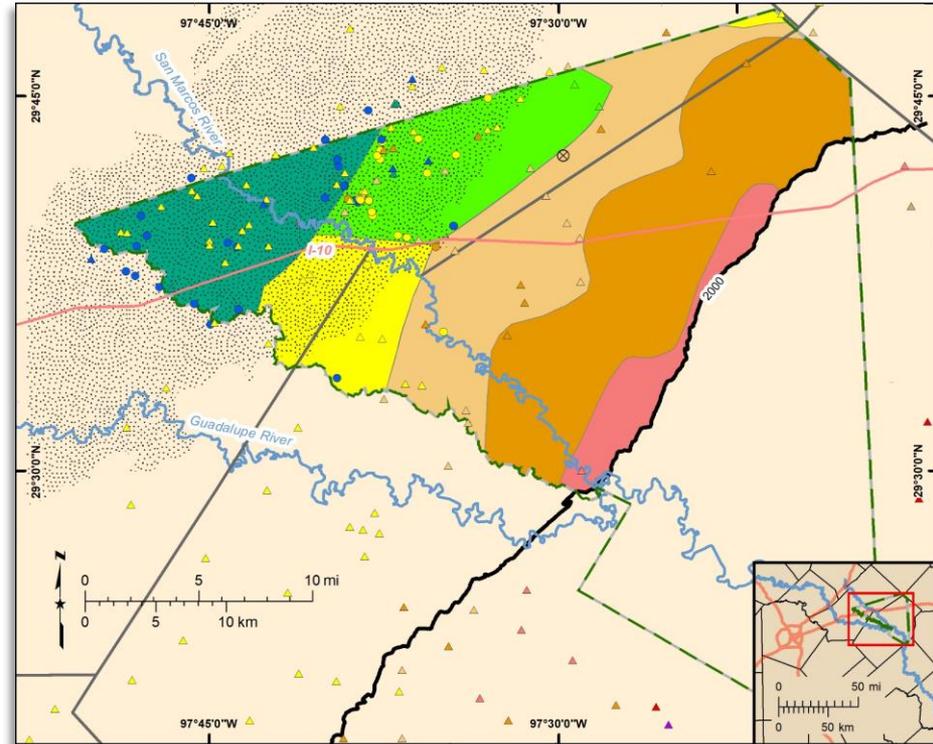
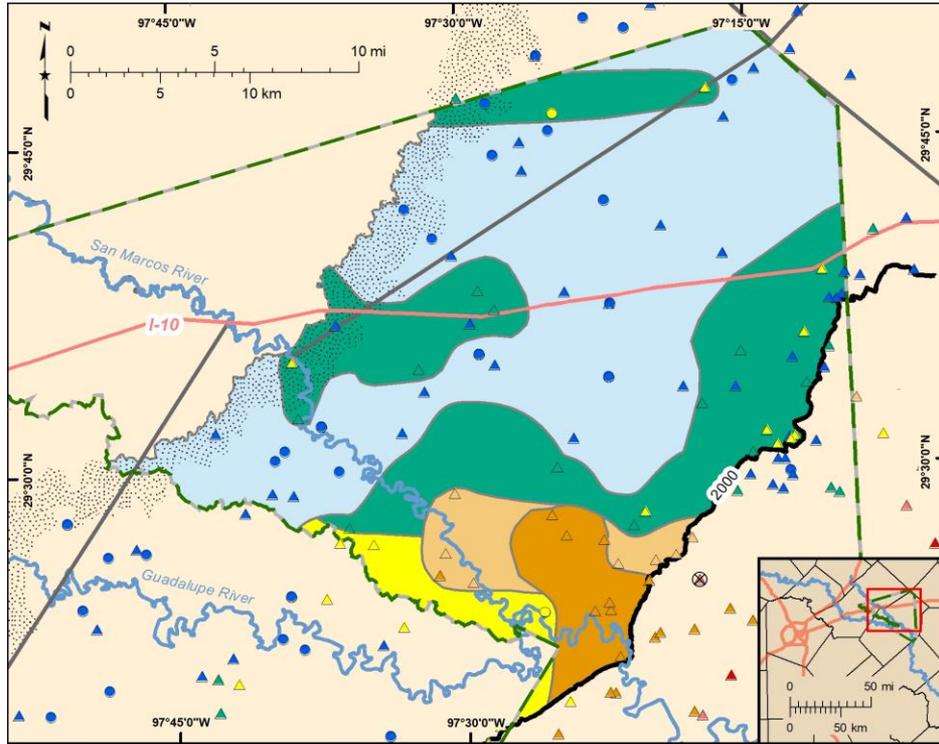
Published



Results: groundwater salinity

Carrizo Sand

Wilcox Group



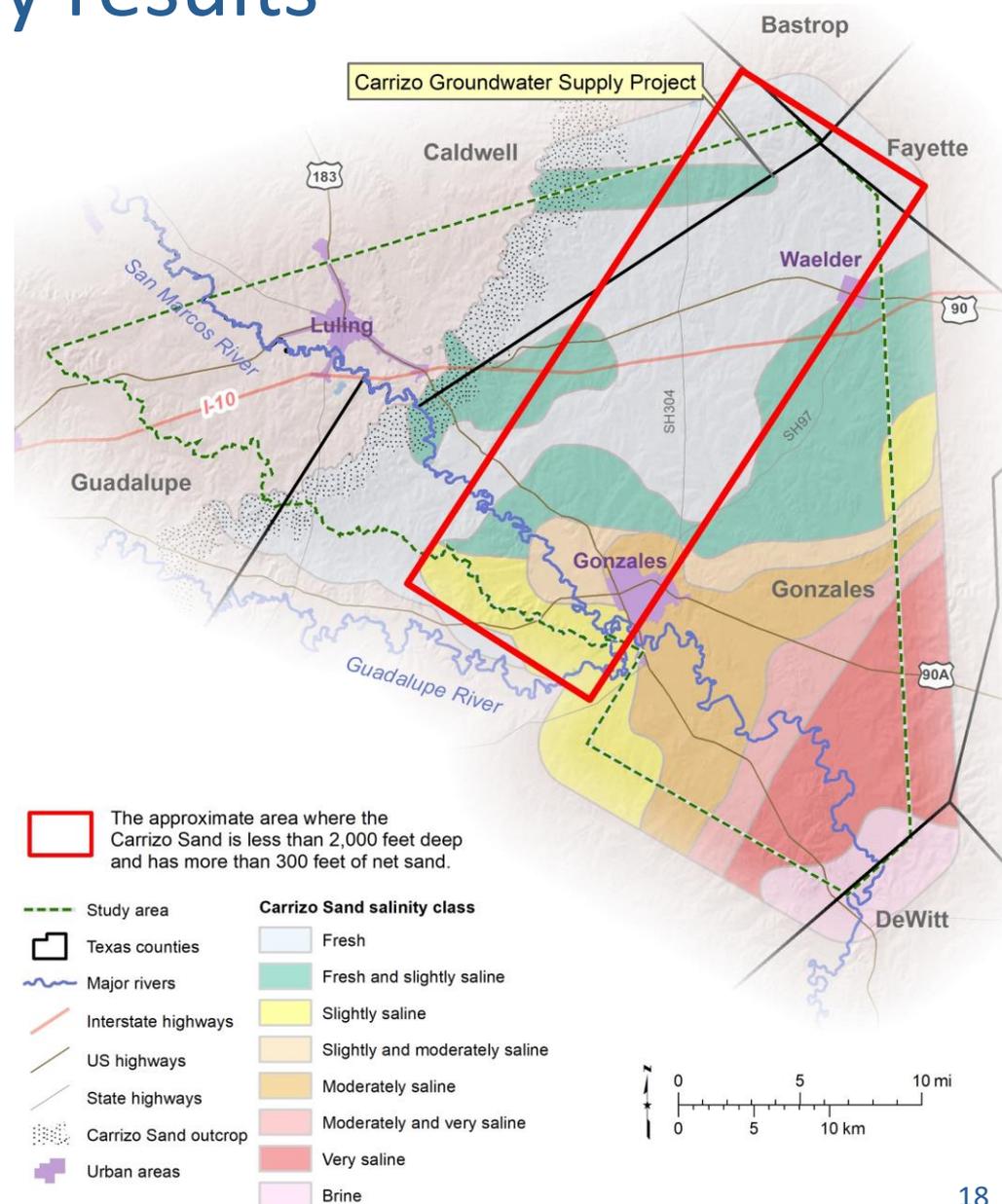
Reklaw	Clay, youngest
Carrizo	Aquifer
Wilcox	Aquifer
Midway	Clay, oldest

Salinity class	Calculated TDS	Measured TDS
Fresh	Fresh	Fresh
Fresh and slightly saline	Fresh and slightly saline	Slightly saline
Slightly saline	Slightly saline	Moderately saline
Slightly and moderately saline	Slightly and moderately saline	Very saline
Moderately saline	Moderately saline	Brine
Moderately and very saline	Moderately and very saline	Study area
Very saline	Very saline	Wilcox Group outcrop
Rivers	Ignored	2000-ft depth contour
Interstate highways		
Texas counties		

Reklaw	Clay, youngest
Carrizo	Aquifer
Wilcox	Aquifer
Midway	Clay, oldest

Study results

- The aquifer characterization identified:
 - most suitable unit and zone in the study area for an ASR project
 - potential water quality implications on well design
- The GBRA hired a contractor for final site selection, well construction and design



Introduction



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2nd Mandate

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

Report 387
Published in March 2022



Aquifer Storage and Recovery Report:
Carrizo-Wilcox Aquifer Characterization
for Eastern Gonzales and Parts of
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Andrea Croskrey, P.G., James Golab, Ph.D., P.G., Daniel Collazo

Report 387
March 2022

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www.twdb.texas.gov





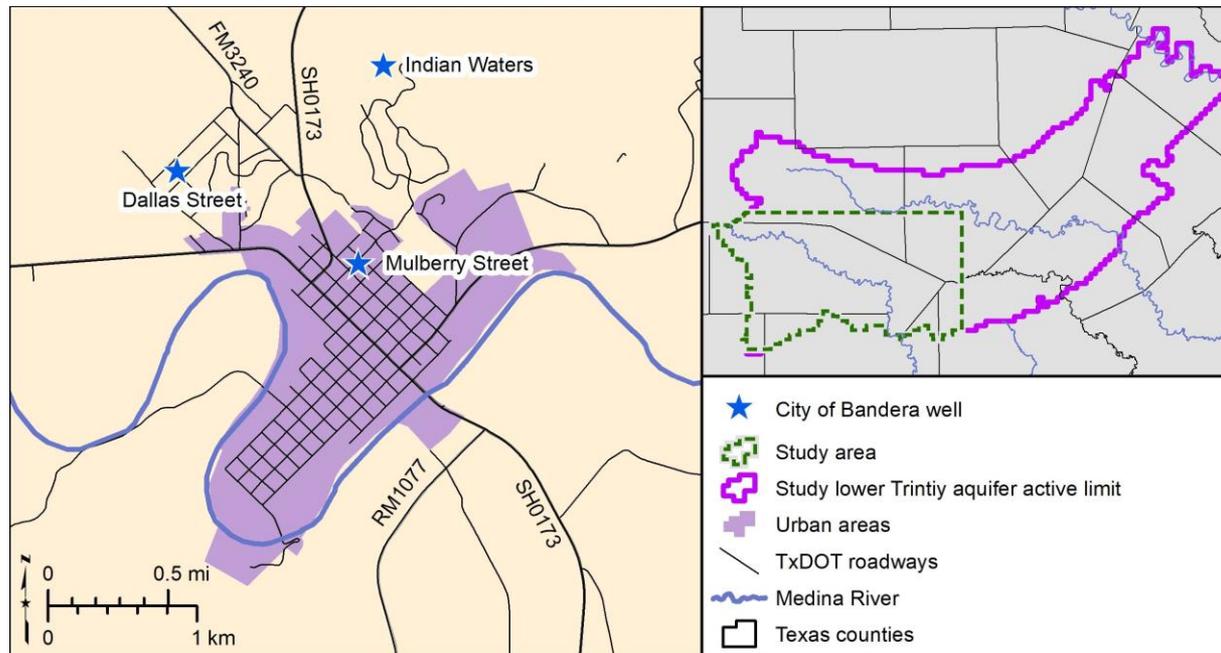
City of Bandera Surface Water Acquisition Treatment and ASR

Plans to inject treated surface water from the Medina River into the lower Trinity aquifer to be recovered when water supply demand is high using existing water supply wells



ASR Report: Longevity Assessment for the City of Bandera Water Wells

- The City of Bandera wanted to understand the longevity of their existing wells:
 - Trinity Aquifer is the main supply source
 - Wells already reaching max drawdown
 - Little redundancy in case of failure



- IWT created a model to assess the longevity of the City of Bandera's lower Trinity aquifer wells.

Prediction scenarios

The model was used to forecast future conditions based on three scenarios:

Introduction



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No change
scenario



No increase in
pumping

Projected use
scenario



Pumping will
increase to
match the
projected
demands in the
2022 State Water
Plan

Max supply use
scenario

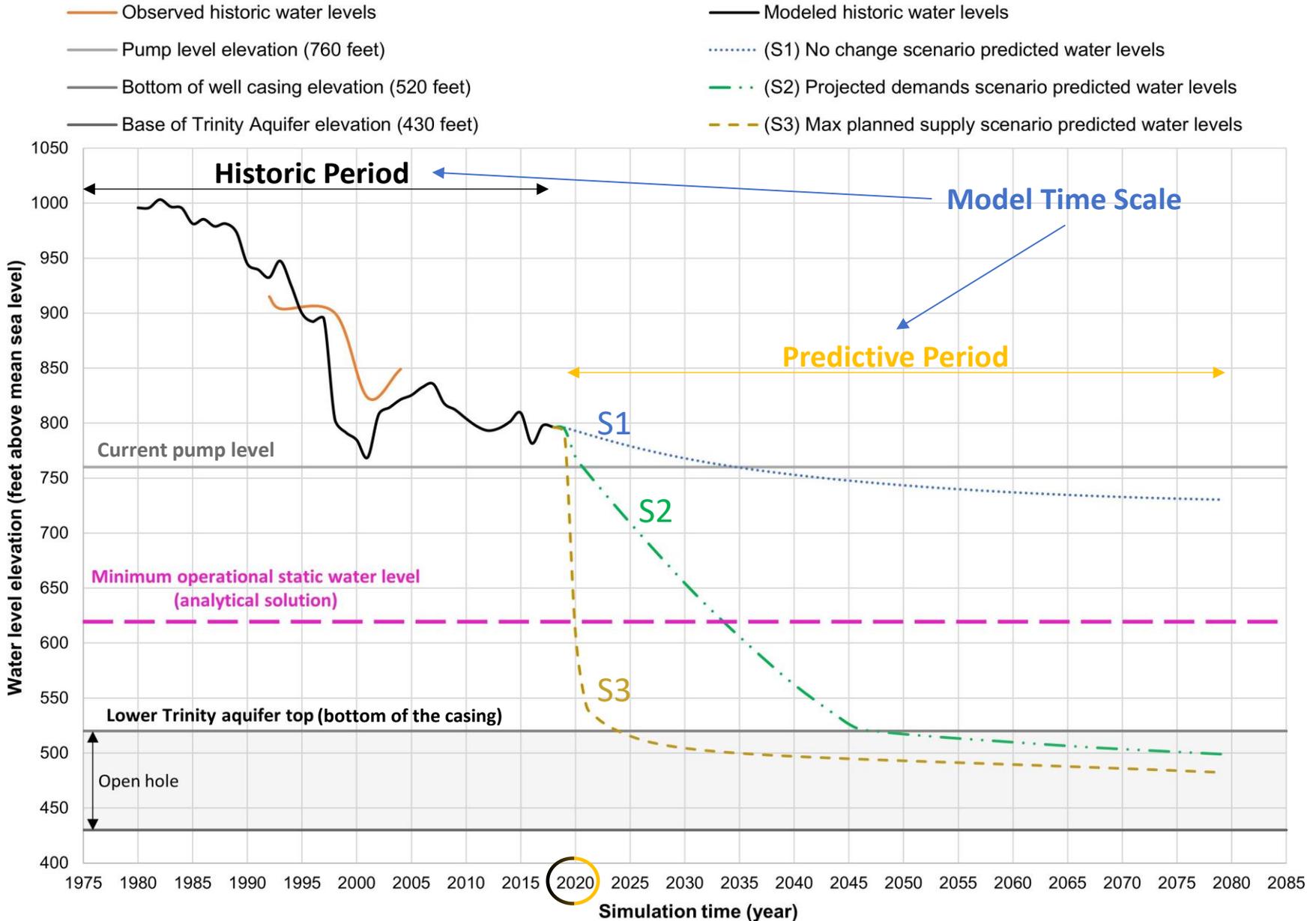


Pumping will
increase to
produce all
groundwater
listed as available
to the City of
Bandera in the
2022 State Water
Plan



Predictive model results

Mulberry Street Well Predictive Results



Introduction



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Aquifer Storage and Recovery Report: Longevity Assessment for the City of Bandera Water Wells

Report 389

Published in February 2023



Aquifer Storage and Recovery Report:
Longevity Assessment for the
City of Bandera Water Wells

Azzah AlKurdi, Shirley C. Wade, Ph.D., P.G., James Golab, Ph.D., P.G., Andrea Croskrey, P.G.

Report 389
February 2023

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Current Studies



ASR study: high-level suitability analysis

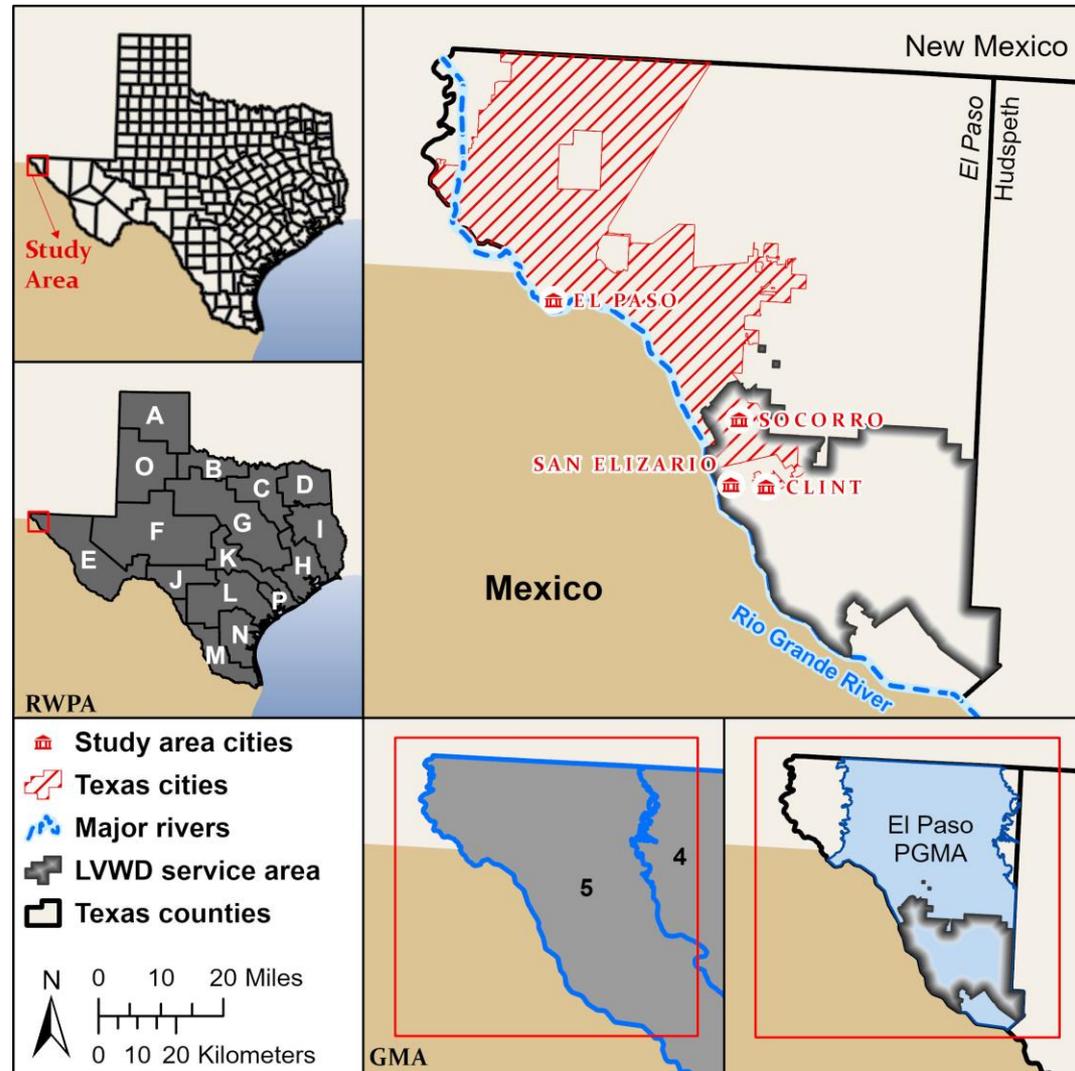
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Lower Valley Water District ASR project:

Plans to inject reclaimed water
into the Hueco-Bolson aquifer

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



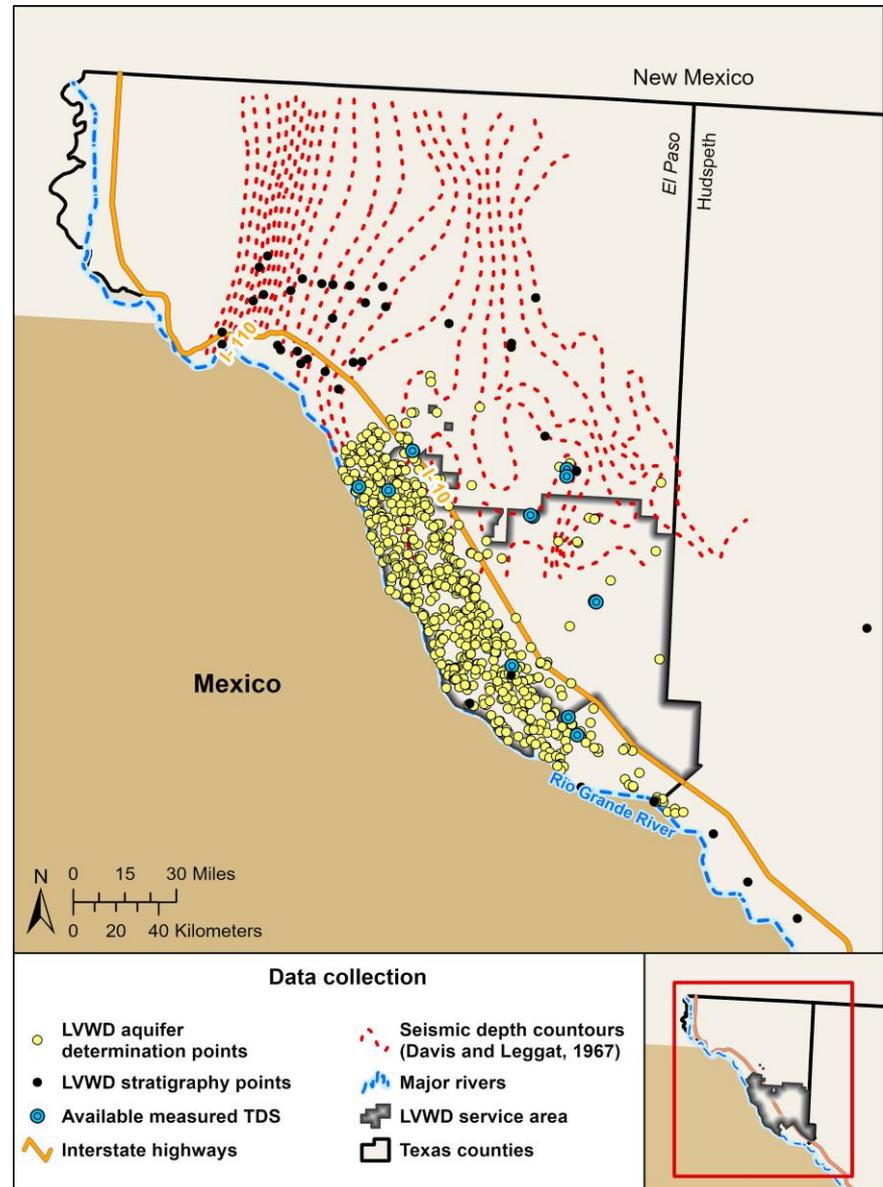
ASR study: high-level suitability analysis

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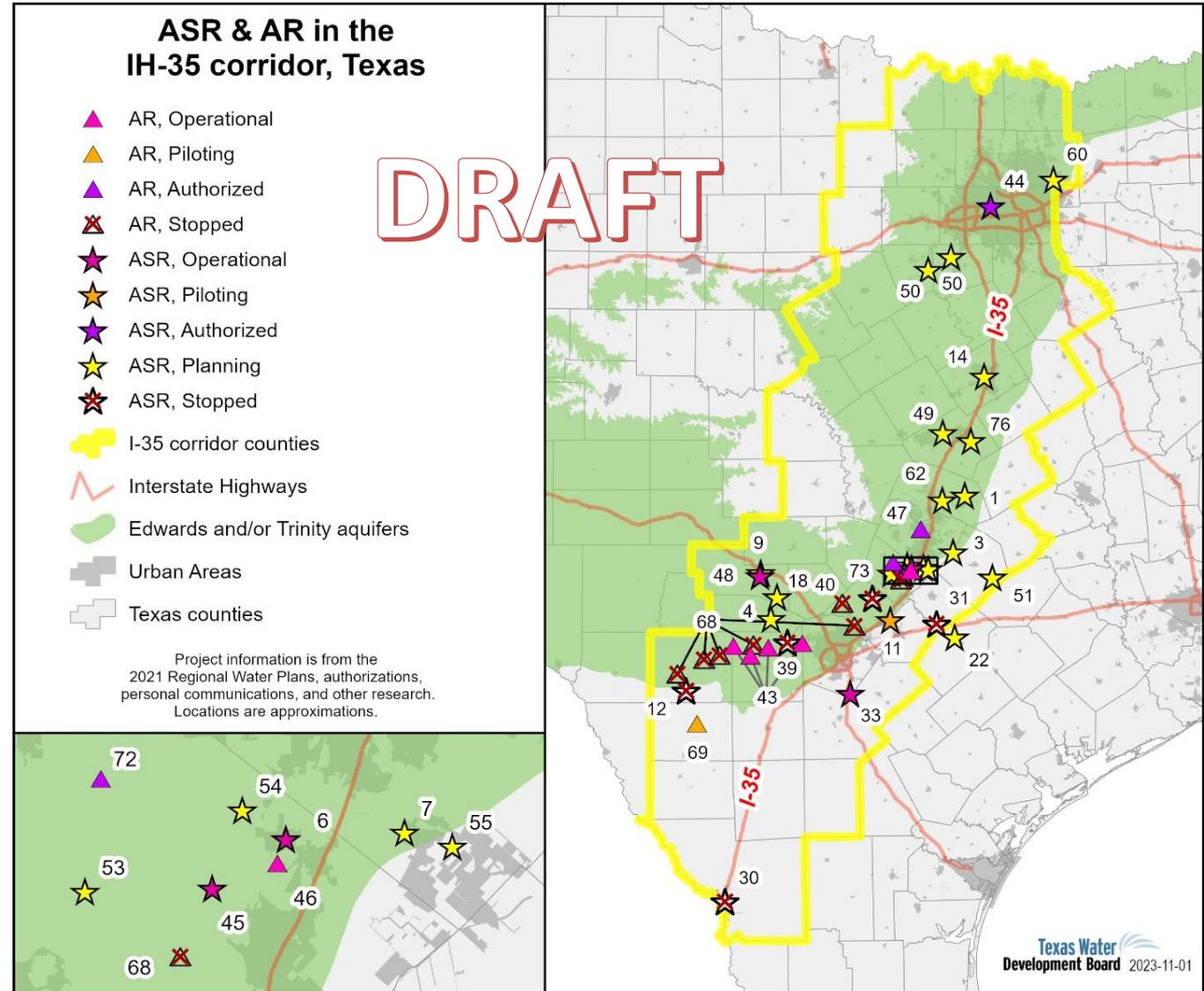
Description: Report will include an analysis of the hydrogeological characteristics of the Hueco Formation and excess water and supply needs analysis from the statewide survey and data from the LVWD.

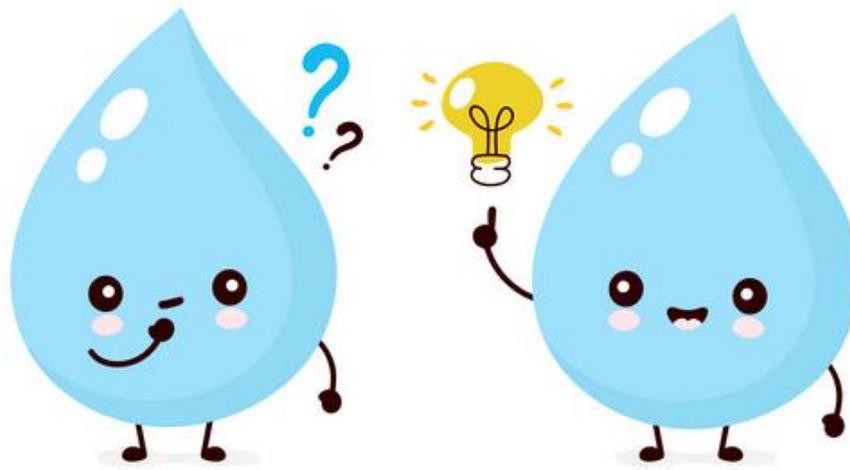
Report expected: Summer 2024



Edwards and Trinity ASR and AR in the I-35 Corridor

- Draft in progress
- Highlights ASR and AR projects along the IH-35 corridor
- Discusses the driving factors, challenges, and opportunities





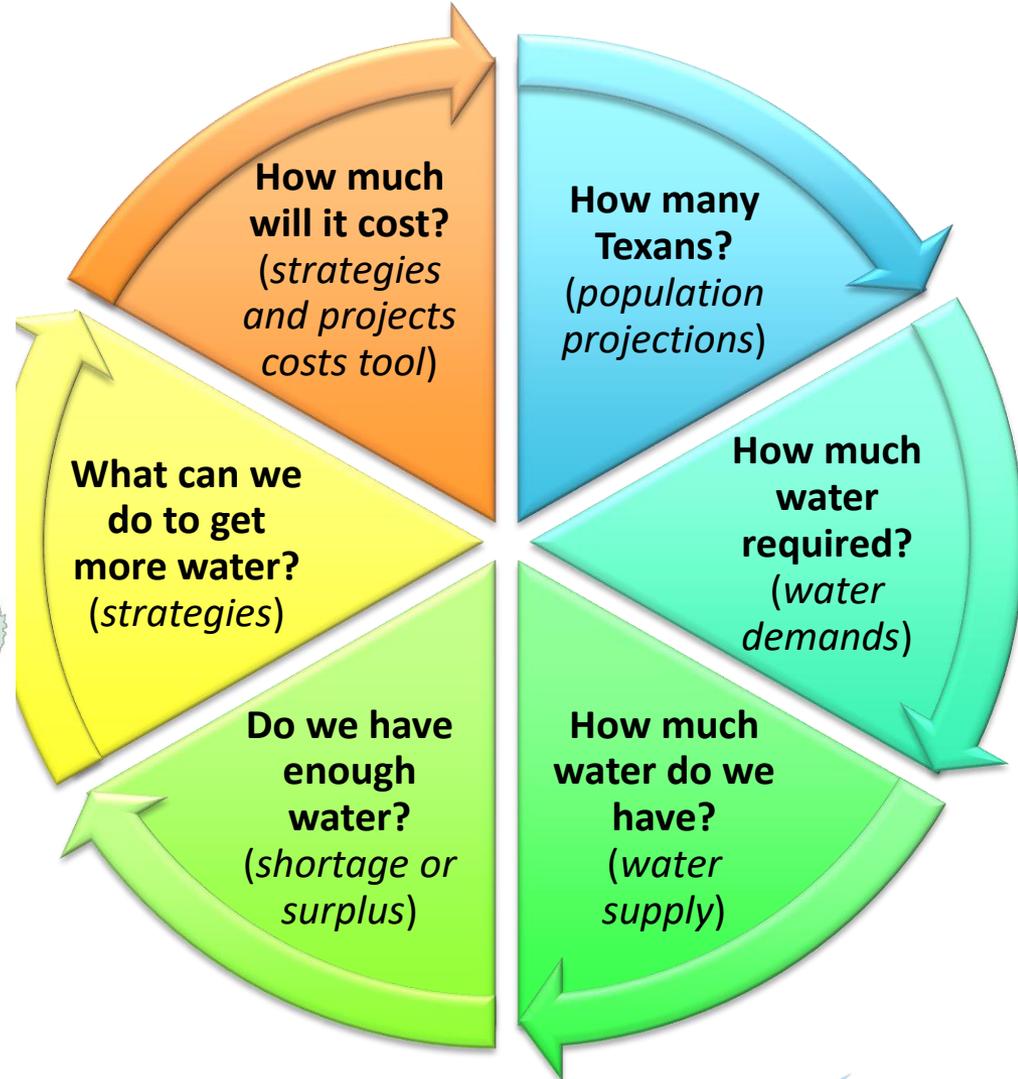
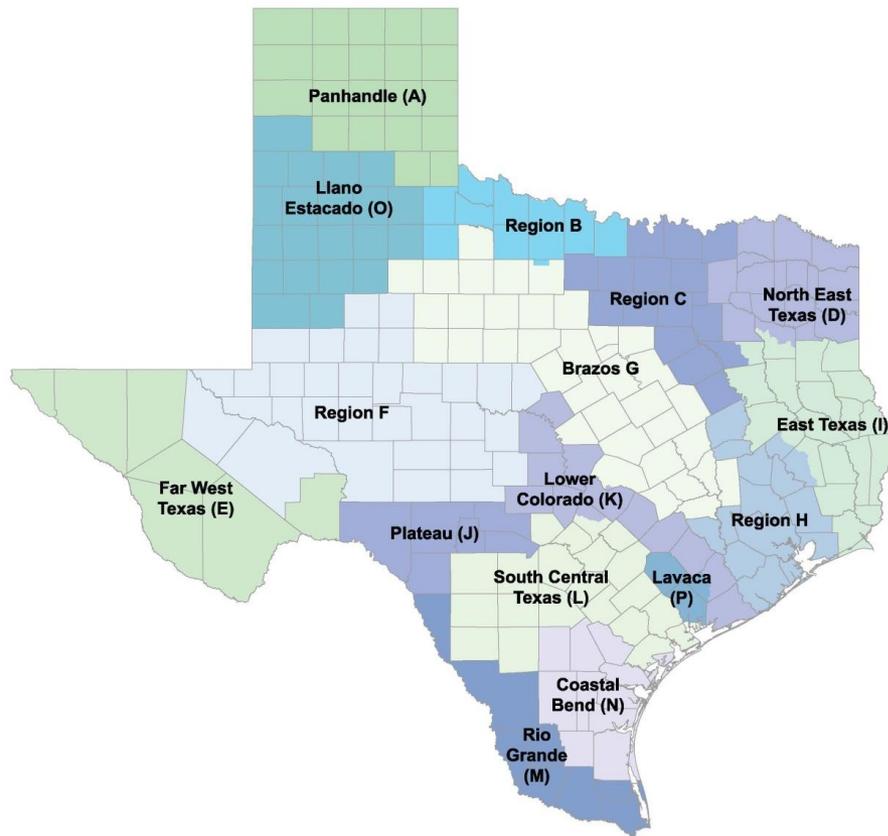
Let us know if you would like to know more!

Texas Water Development Board

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Water Planning



Public Data Display

Tabs with more information on each screening, conclusions, and links

Statewide Survey of ASR and AR Suitability

Introduction Hydrogeological Parameter Screen Excess Water Screen Water Supply Needs Screen Final Suitability Rating Survey Scope & Conclusions View & download the report Explore the data

Explore the data

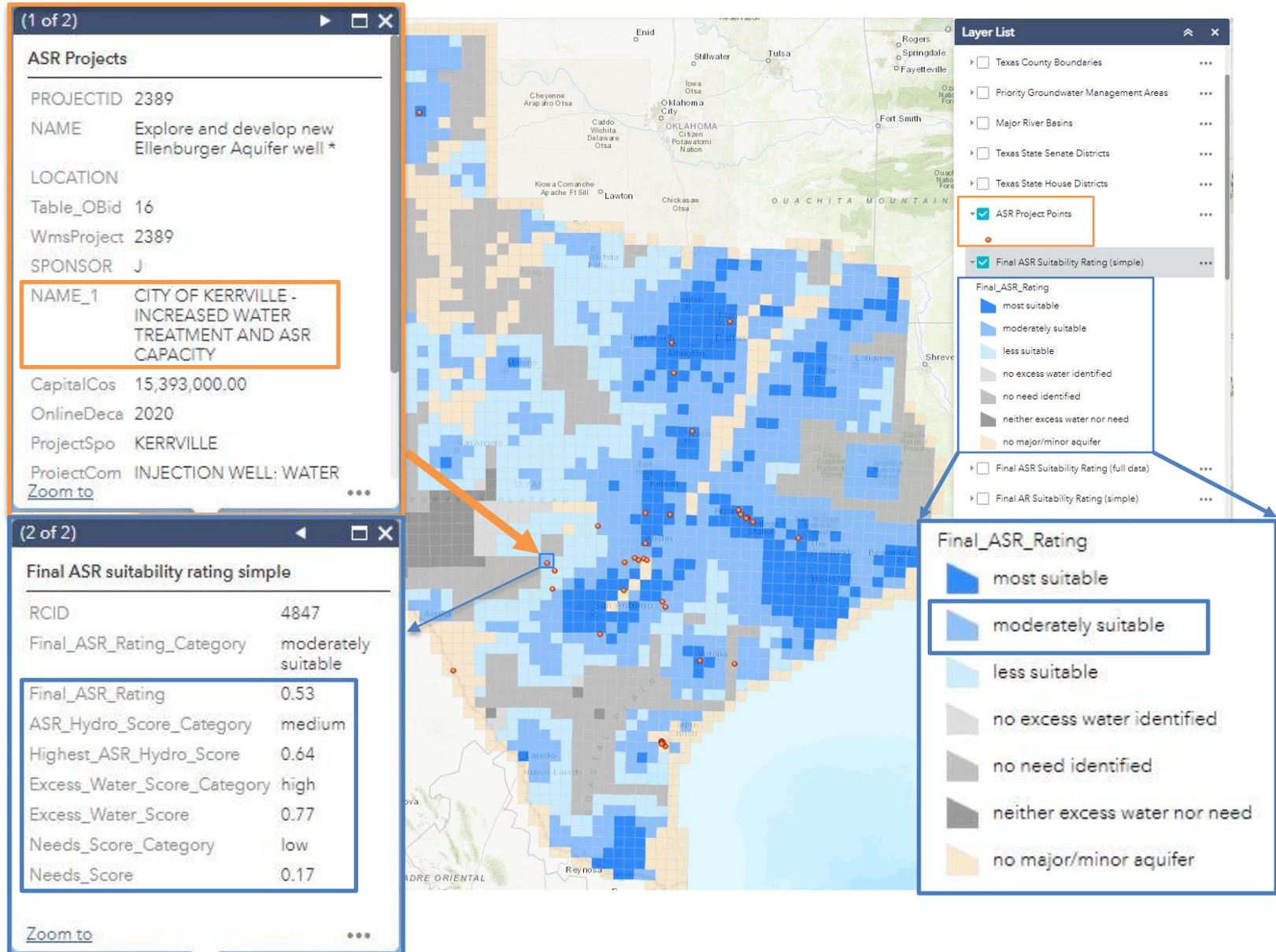
Statewide Survey of ASR and AR Suitability

for Texas' Major and Minor Aquifers

December 2020

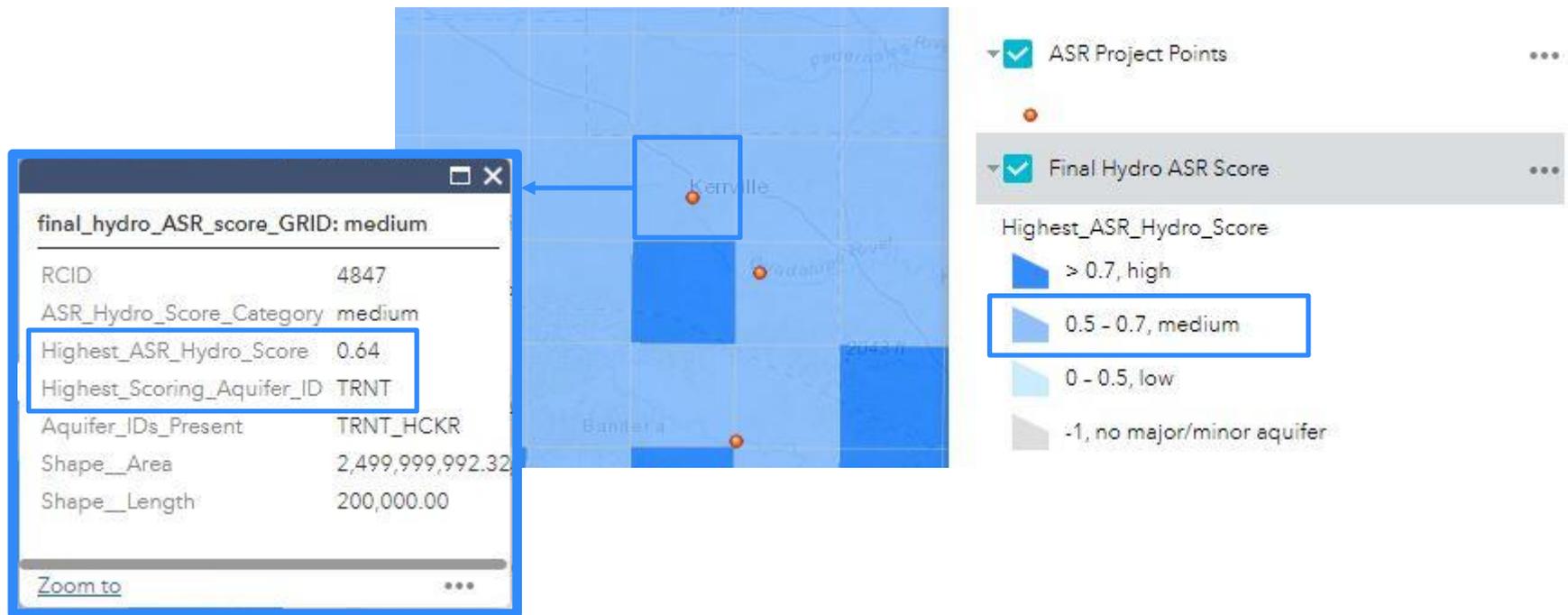
Texas Water Development Board HDR

Survey Results



City of Kerrville Increased Water Treatment and ASR Capacity

Hydrogeological Score



City of Kerrville Increased Water Treatment and ASR Capacity

Excess Water Score



City of Kerrville Increased Water Treatment and ASR Capacity

Water Needs Score

Needs Grid - Normalized Needs Score Sum:
No

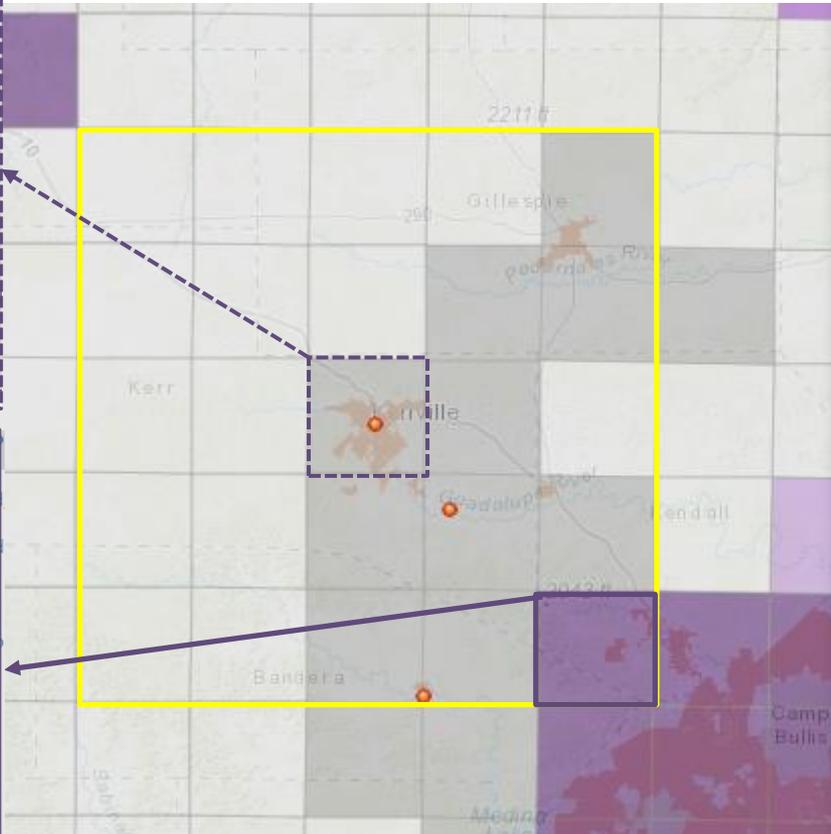
RCID	4,847
Manu_Score	
Max_Muni_Score	0.00
SE_score	
Need_sum	0.00
Need_Sum_Normalized	0.00
used_for_AR_rating	No
used_for_ASR_rating	No
Need_Score_Category	WUG, no need

Zoom to

Needs Grid - Normalized Needs Score Sum:
Yes

RCID	5,049
Manu_Score	
Max_Muni_Score	0.75
SE_score	
Need_sum	0.75
Need_Sum_Normalized	0.68
used_for_AR_rating	Yes
used_for_ASR_rating	Yes
Need_Score_Category	High

Zoom to

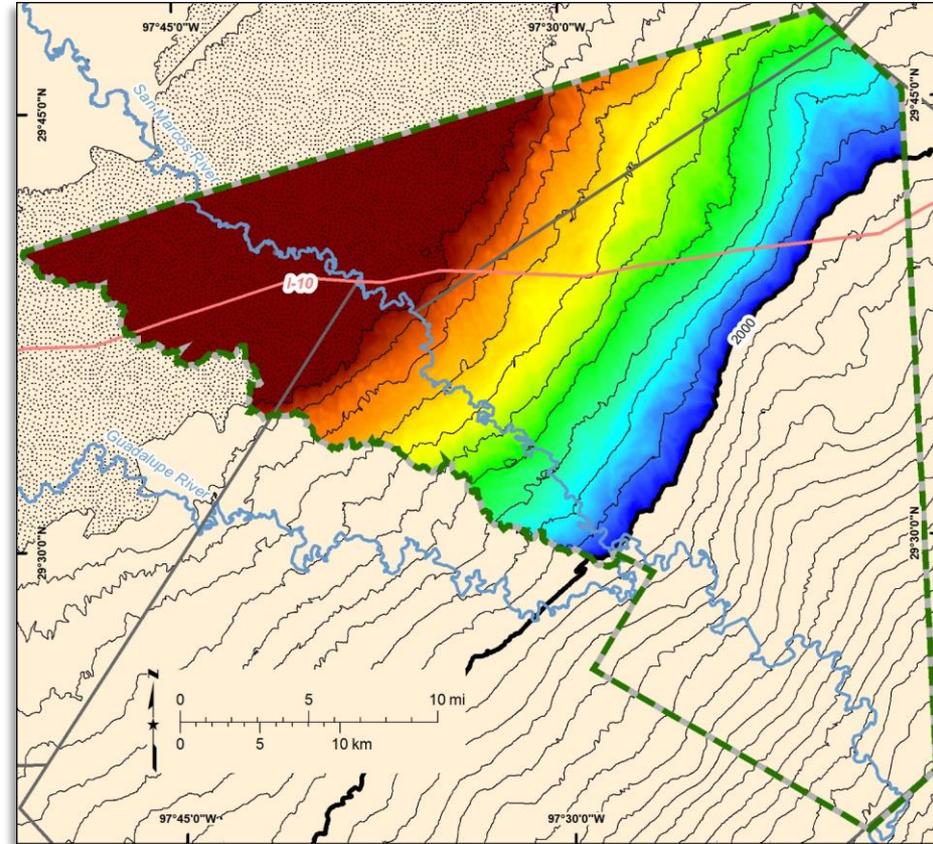
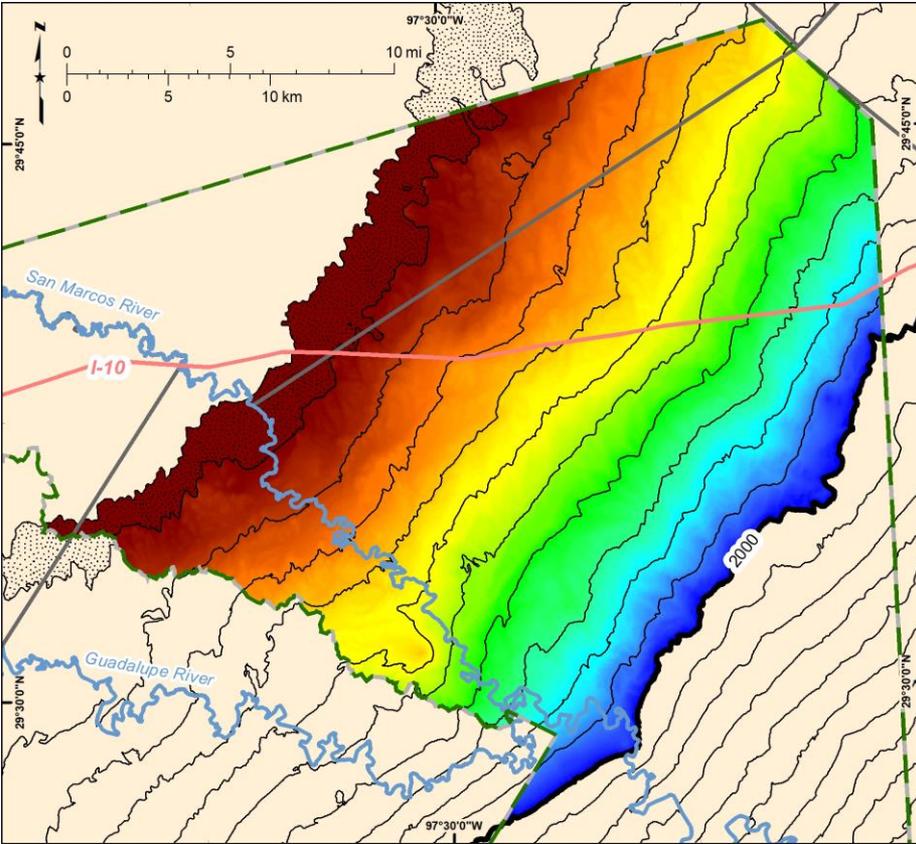


- Need scores used for ASR final suitability rating
- Need scores used for AR final suitability rating
- ASR Project Points
- Need Score Sum Normalized
- no WUG identified, -1
- WUG, but no need identified, 0
- Low, <0.34
- Medium, 0.34 - 0.67
- High, >0.67
- Municipal WUG

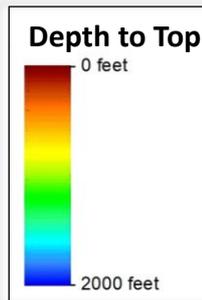
Results: stratigraphy

Carrizo Sand

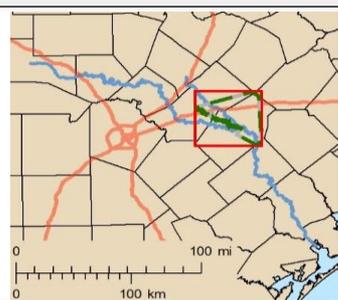
Wilcox Group



Reklaw	Clay, youngest
Carrizo	Aquifer
Wilcox	Aquifer
Midway	Clay, oldest



- Study area
- Carrizo Sand outcrop
- Interstate highways
- ~ Rivers
- 2000-foot depth contour
- 200-foot depth contours
- Texas counties

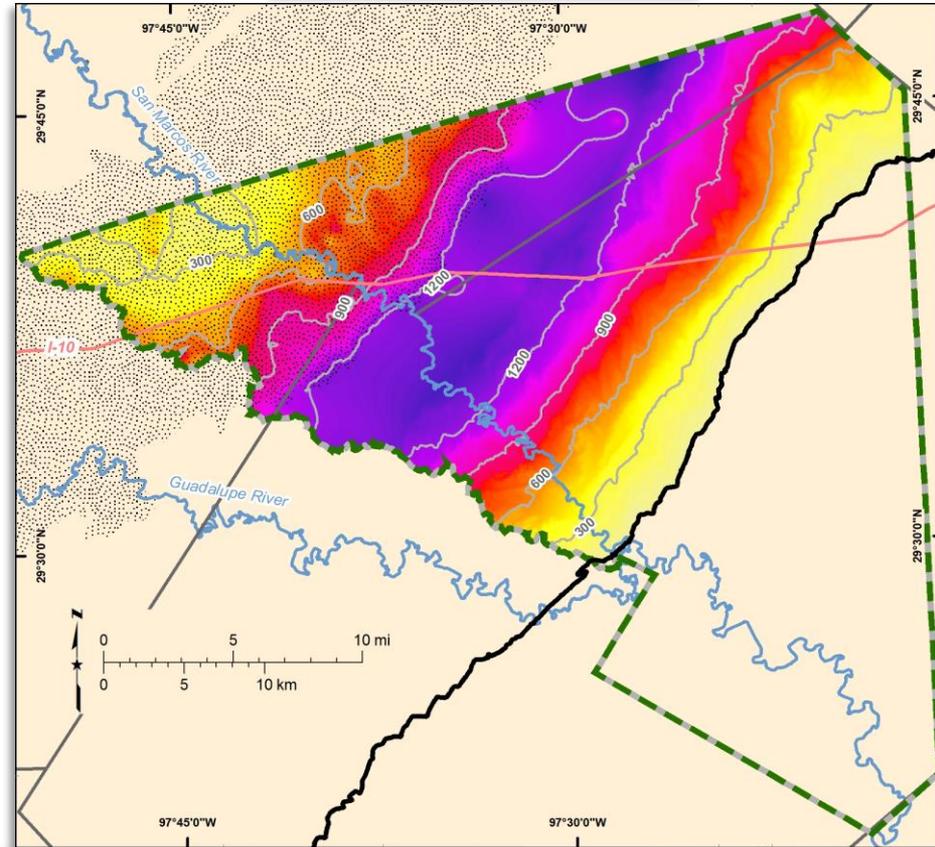
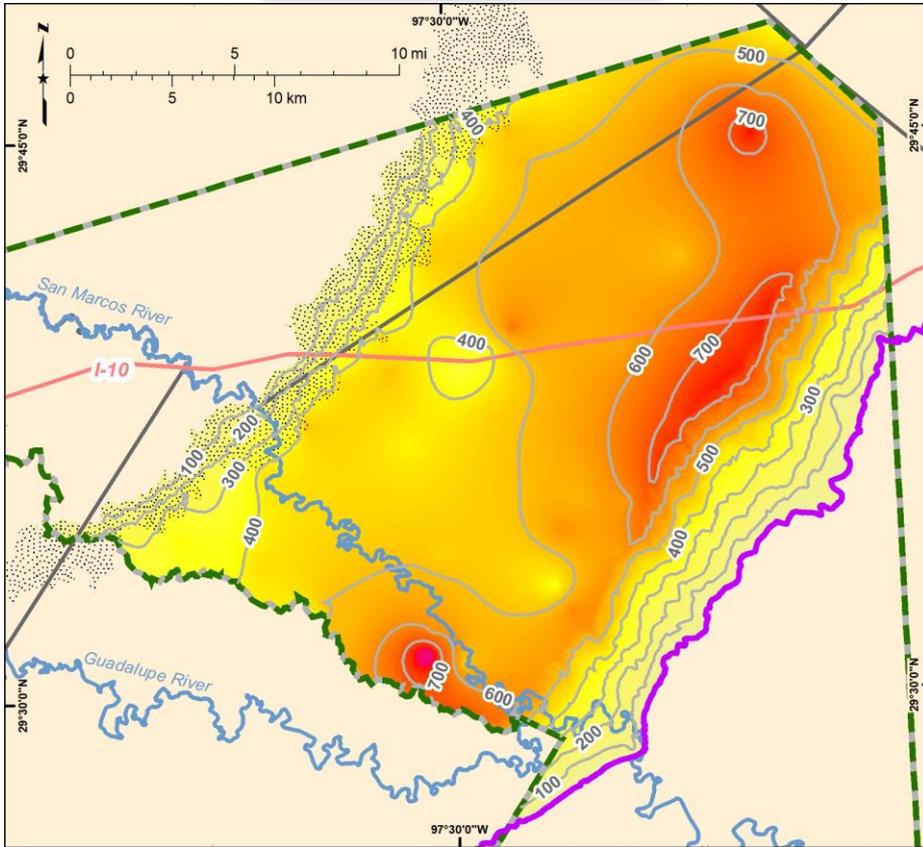


Reklaw	Clay, youngest
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Wilcox	Aquifer
Midway	Clay, oldest

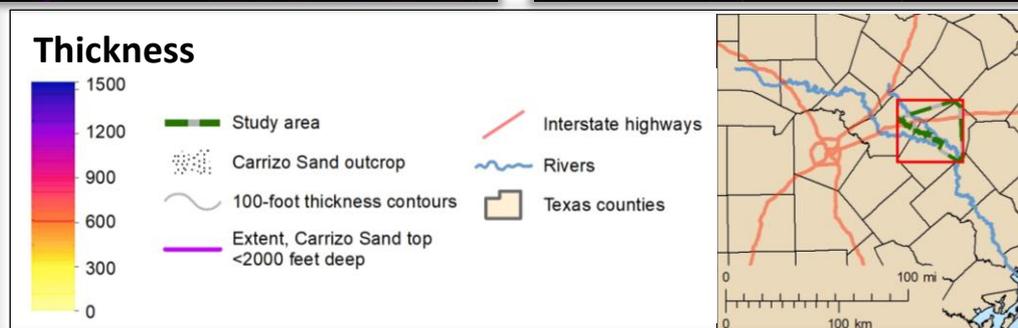
Results: thickness

Carrizo Sand

Wilcox Group



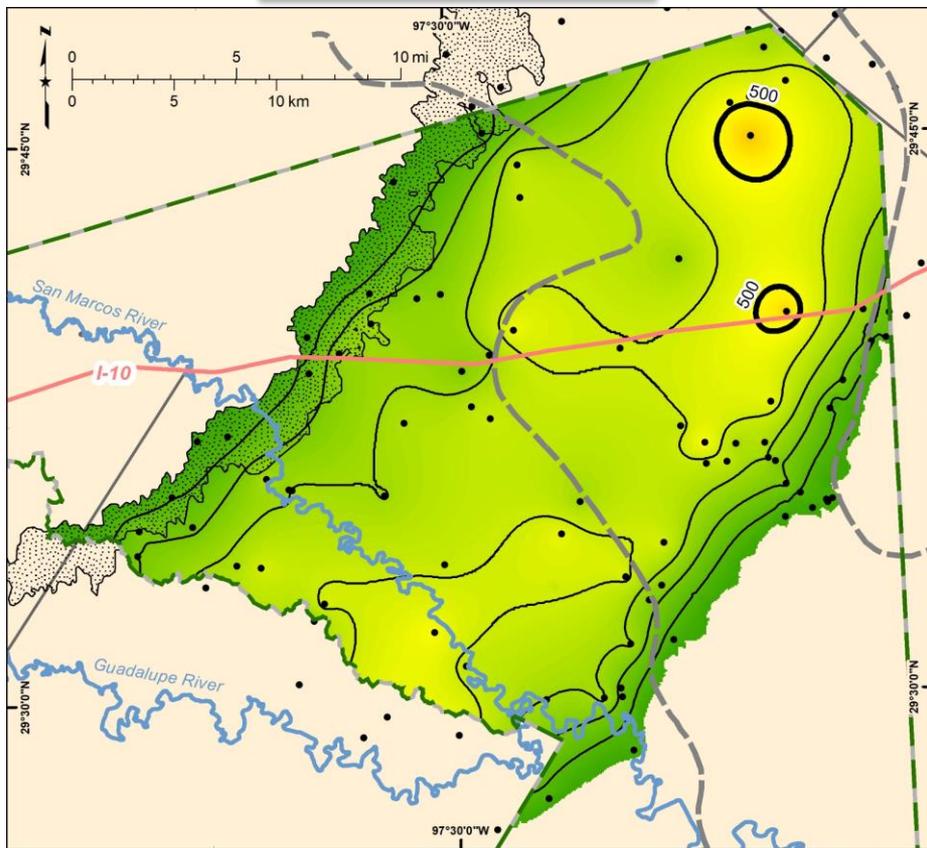
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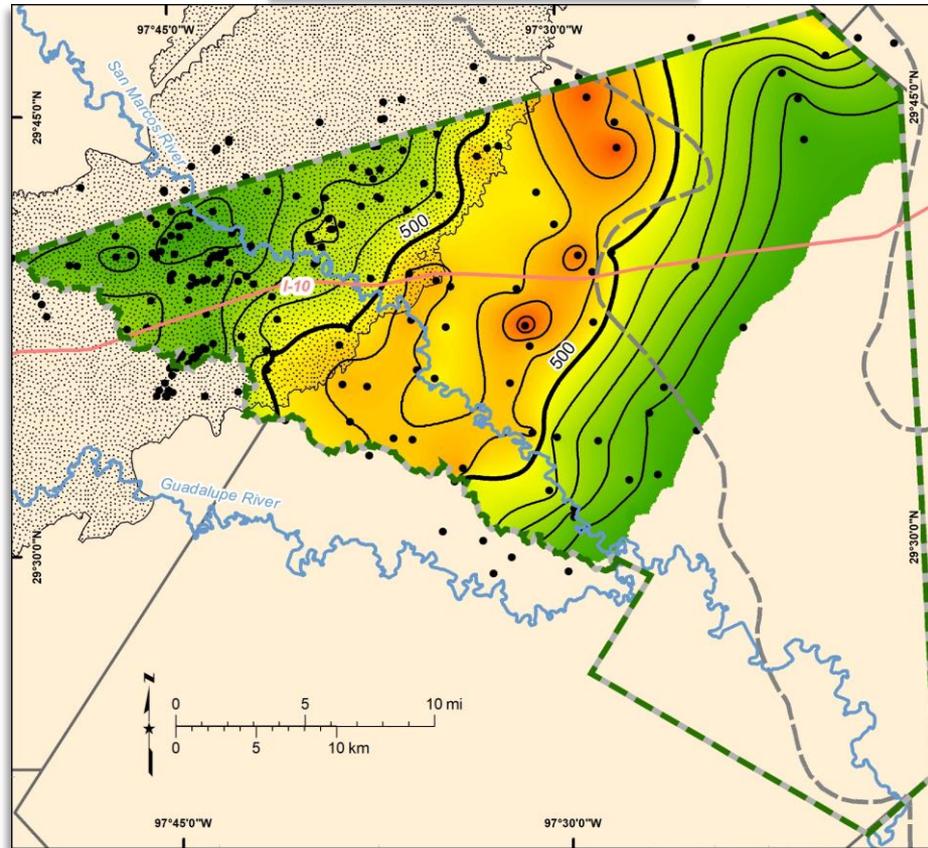
Reklaw	Clay, youngest
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Wilcox	Aquifer
Midway	Clay, oldest

Results: lithology

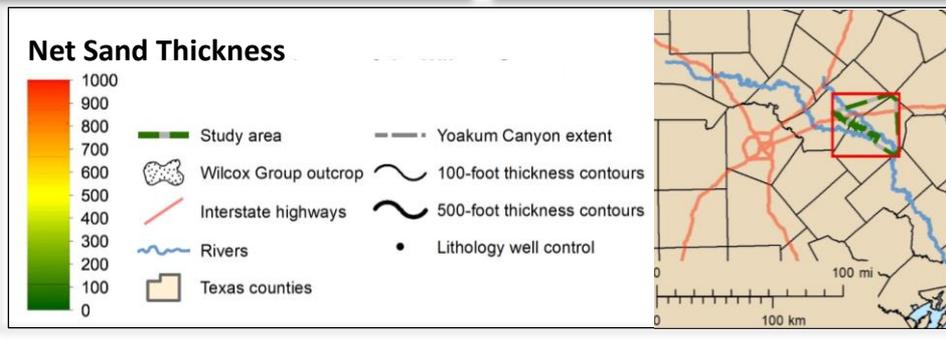
Carrizo Sand



Wilcox Group



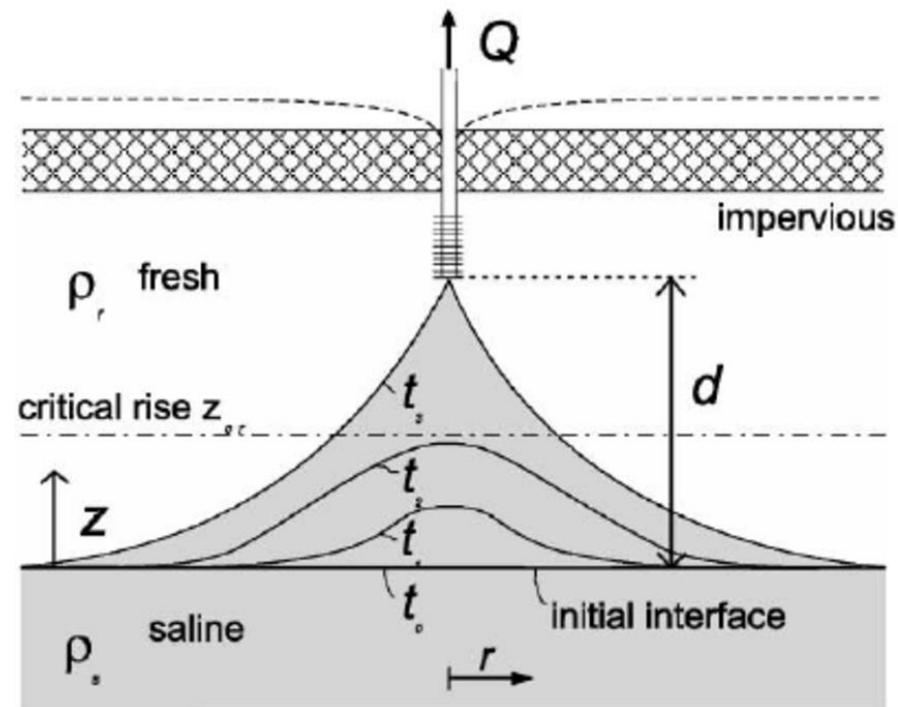
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Reklaw	Clay, youngest
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Midway	Clay, oldest

Well construction

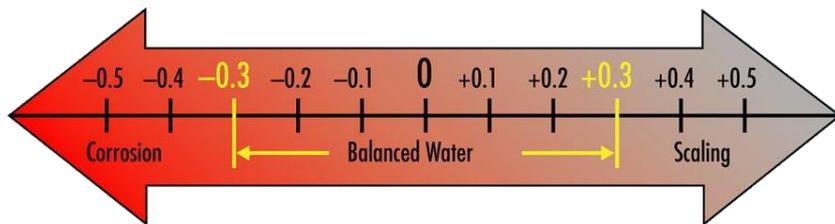
- Water quality (injected and native) has implications on well design, construction, and operations
 - Interbedded clays may lead to lower water quality
 - More saline environments will require more water loss to establish a buffer
 - The units contain many stacked salinity zones so potential drawup of more saline water may be a concern



From Essink (2001)

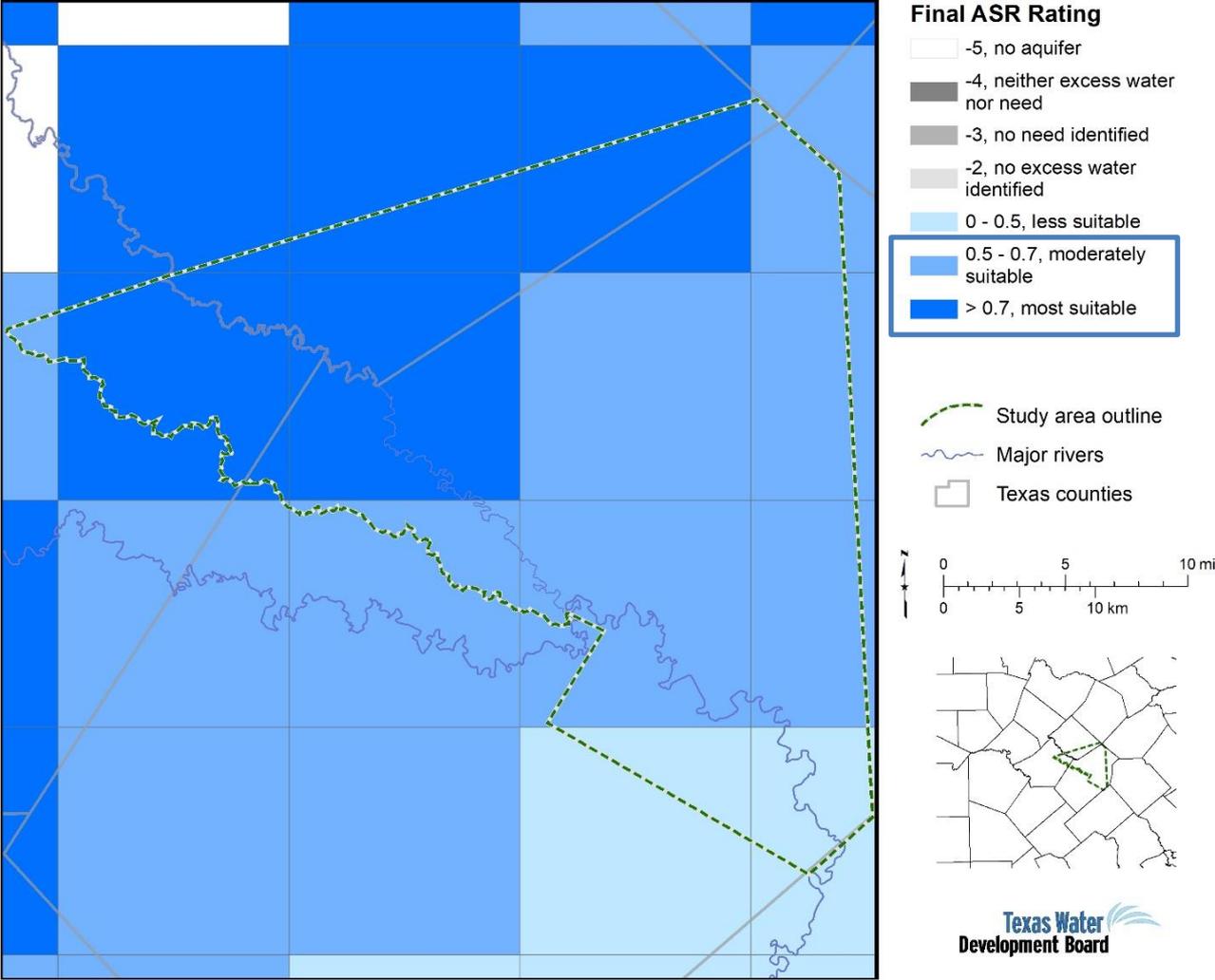
Well construction

- Chemical compatibility
 - Corrosive or encrusting groundwater conditions
 - Langelier Saturation Index (LSI) – shows whether water will be encrusting (positive) or corrosive (negative)
- Carrizo Groundwater Supply Project (Phase I) wells 1-3 have an LSI from -2.30 to -2.55 (corrosive) so plan casing material accordingly



$$LSI = pH + \log \left(\frac{K_a \cdot \gamma_{Ca^{2+}} \cdot [Ca^{2+}] \cdot \gamma_{HCO_3^-} \cdot [HCO_3^-]}{\gamma_{H^+} \cdot K_{sp}} \right)$$

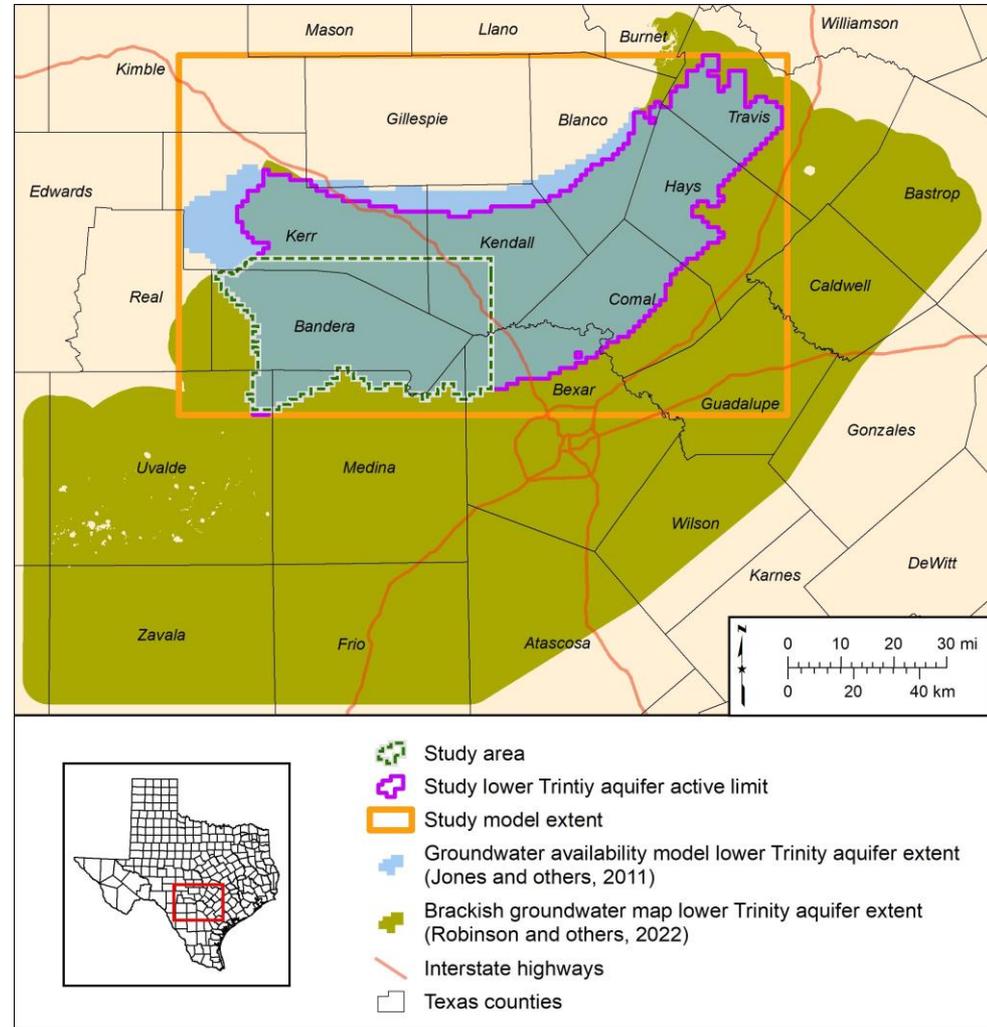
Statewide Suitability Survey final rating for ASR



Bandera Well Longevity Model

The model is based on:

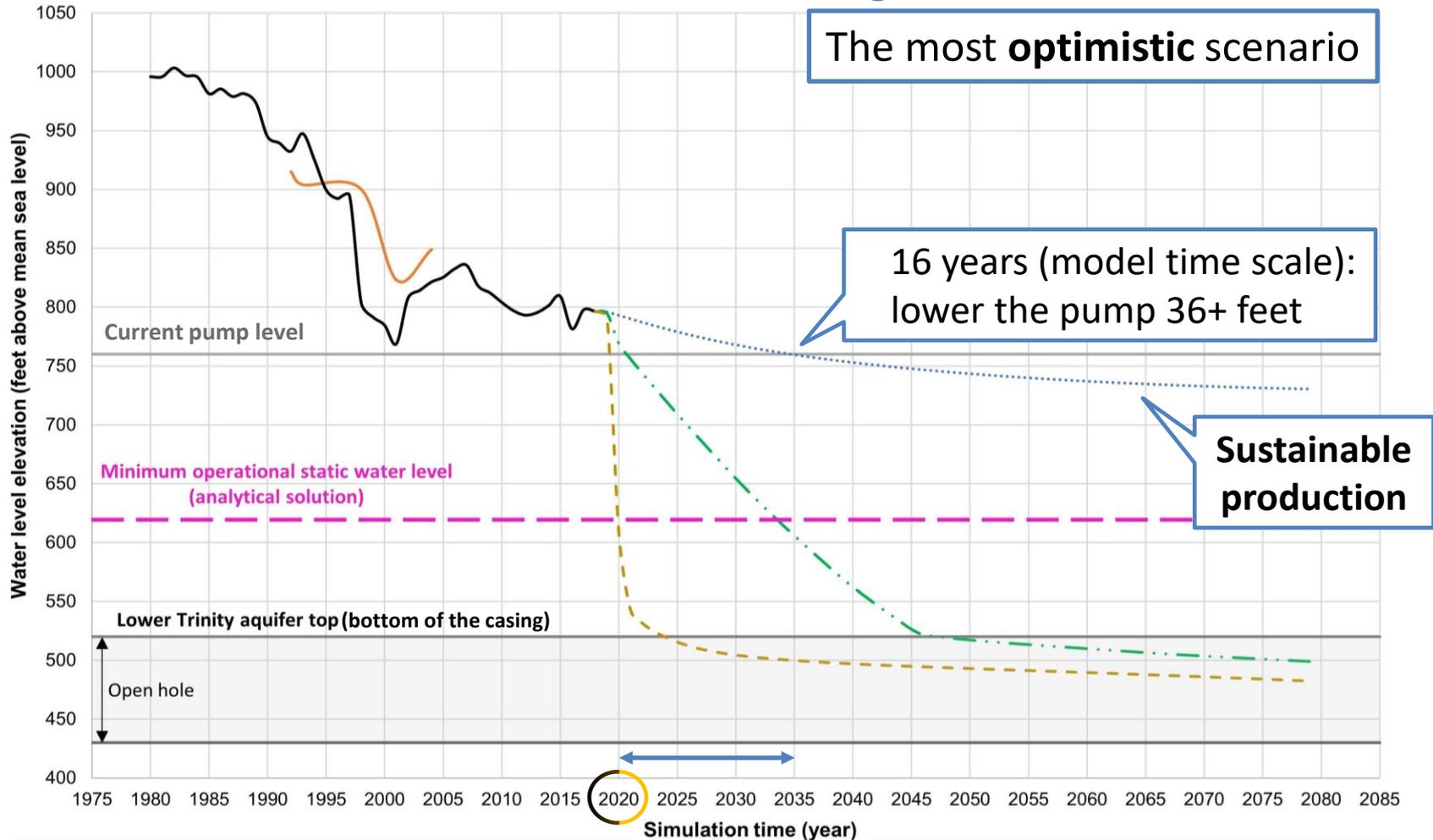
- the Hill County Groundwater Availability Model (GAM), and
- the surfaces generated by the Hill Country Trinity Brackish Resources Aquifer Characterization System (BRACS) study



Predictive Model Results

The Mulberry Street Well

Scenario 1: No change

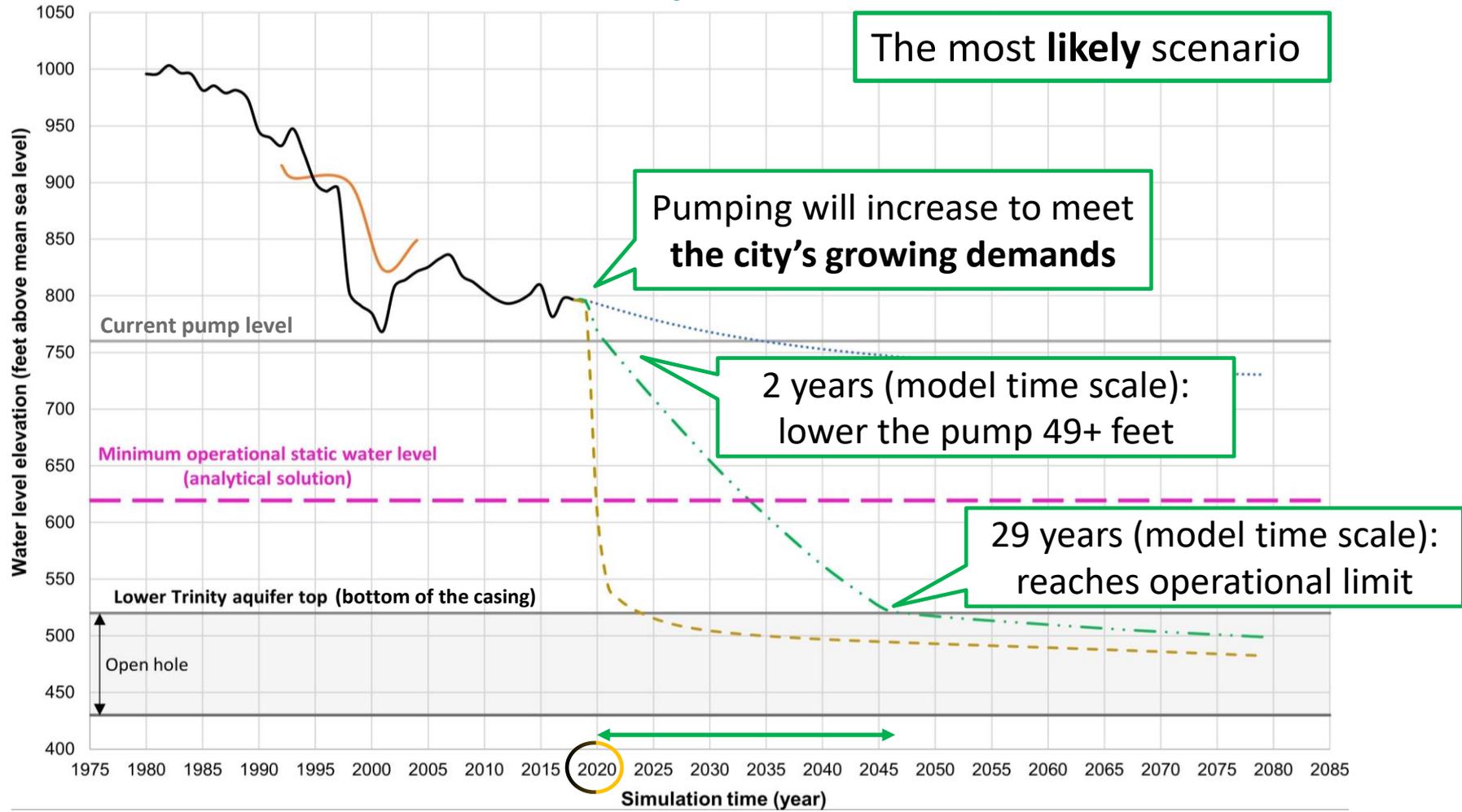


The City of Bandera will need to modify their existing wells and may not need to implement new water supply strategies

Predictive Model Results

The Mulberry Street Well

Scenario 2: **Projected demands**

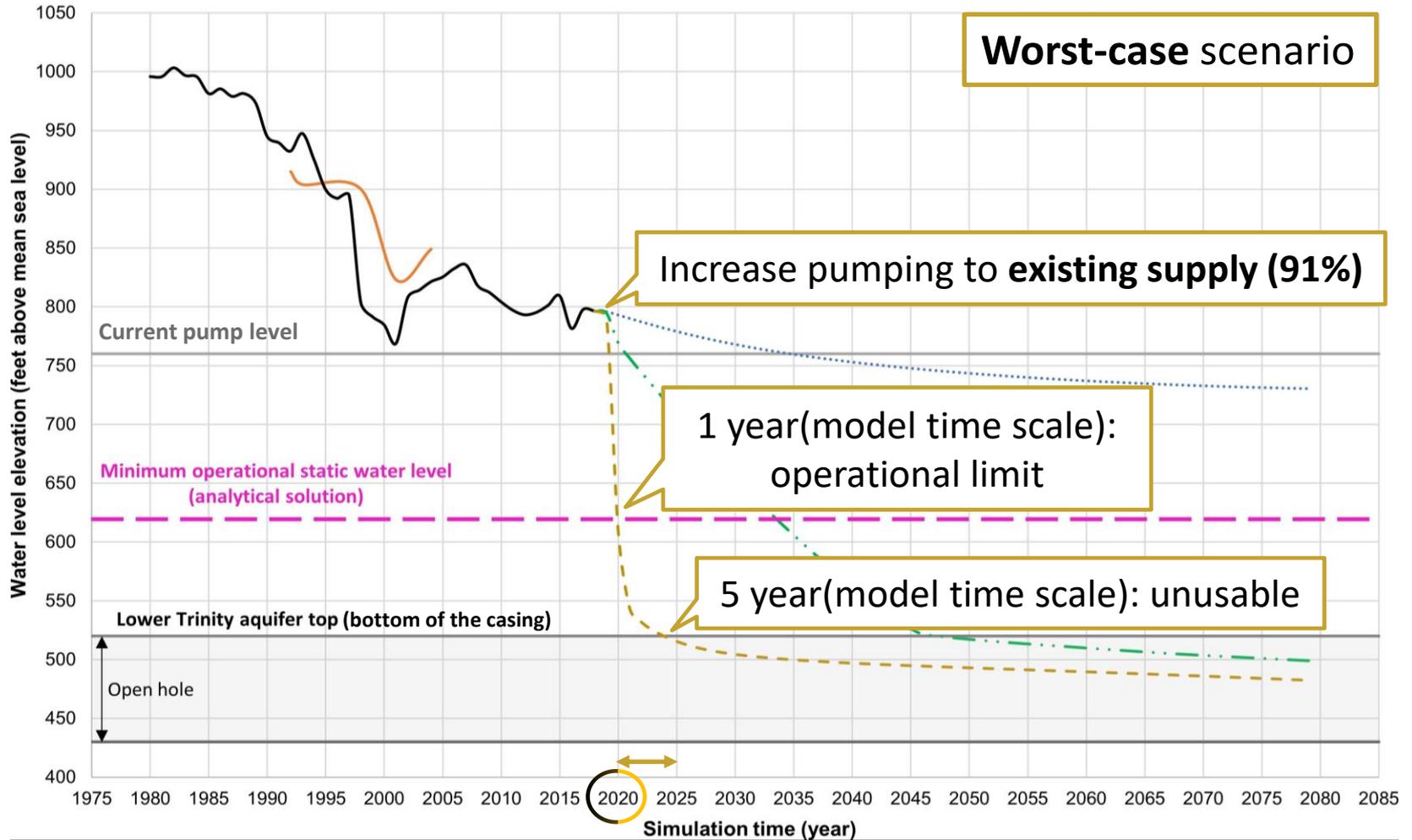


The City of Bandera has less than 29 years left on the existing wells and will need to implement new water supply strategies

Predictive Model Results

The Mulberry Street Well

Scenario 3: **Maximum planned supply**



The City of Bandera does not have the existing supply accounted for in the 2022 State Water Plan

Statewide Suitability Survey final rating for ASR

