ASR Panel Discussion:
Aquifer Storage & Recovery *"The New Reservoir"*

Neil Deeds
Principle Water Resources PE PG.
INTERA, Inc.

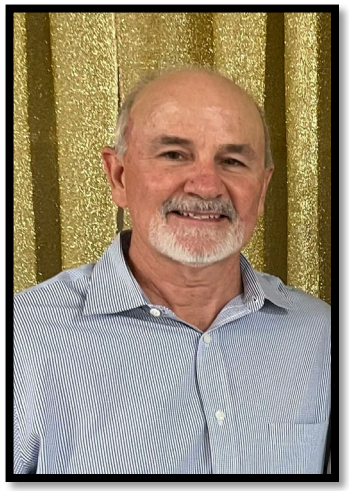
Andrea Croskrey, PG
Innovative Water Technologies Group
TWD Board

David Smith
Environmental Scientist
ASR Discipline Lead
CDM Smith

Clearwater
Underground Water Conservation District
Every drop counts!

ASR Panel Discussion:
Aquifer Storage & Recovery "*The New Reservoir*"

Brian Dosa, PE
Director of Public Works
Ft. Cavazos



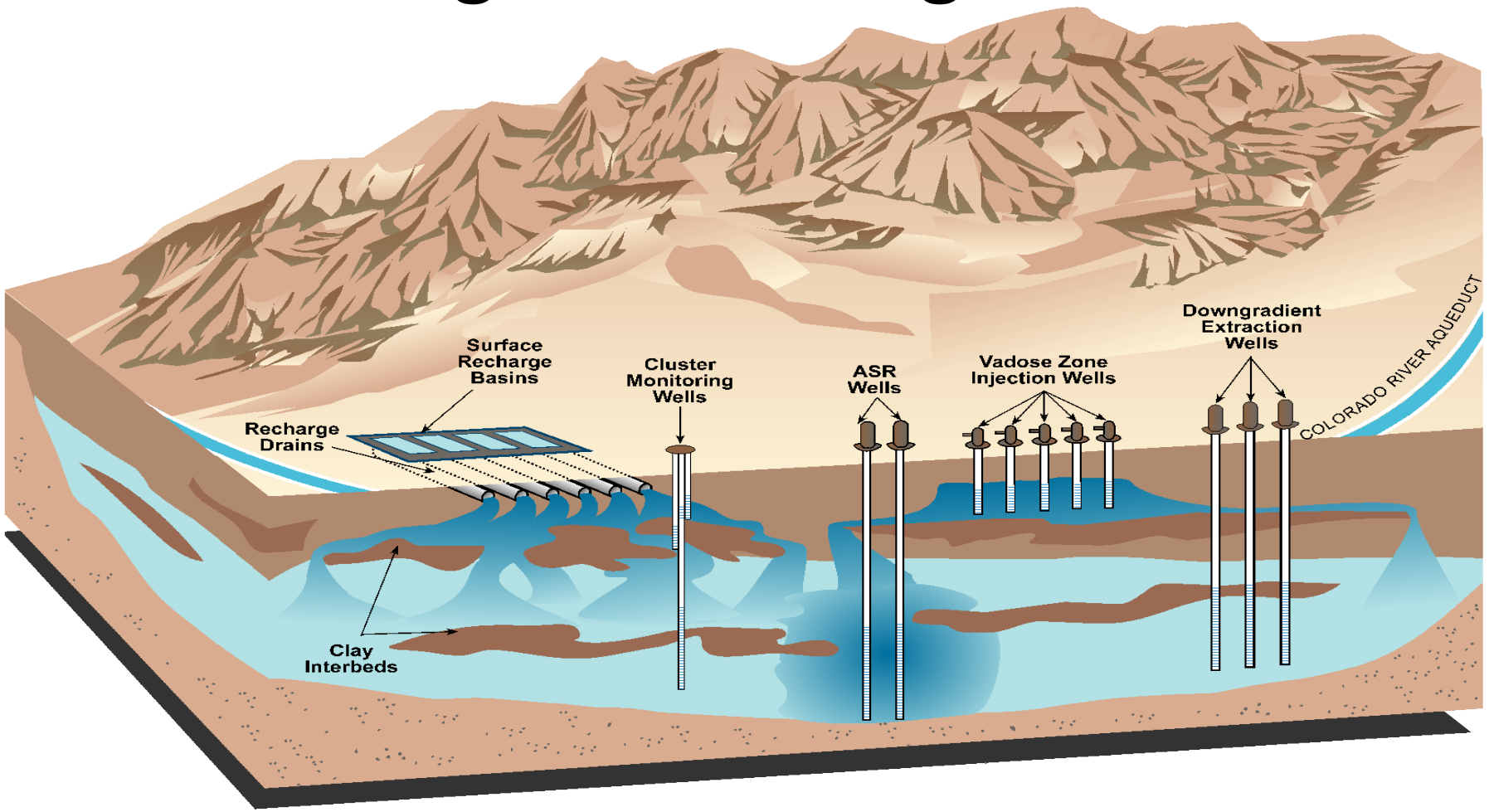
Ricky Garrett,
General Manager
Bell Co. WCID #1

Rick Kasberg, PE
President
KPA Engineers

David Olson
Assistant City Manager
City of Temple

Clearwater
Underground Water Conservation District
Every drop counts!

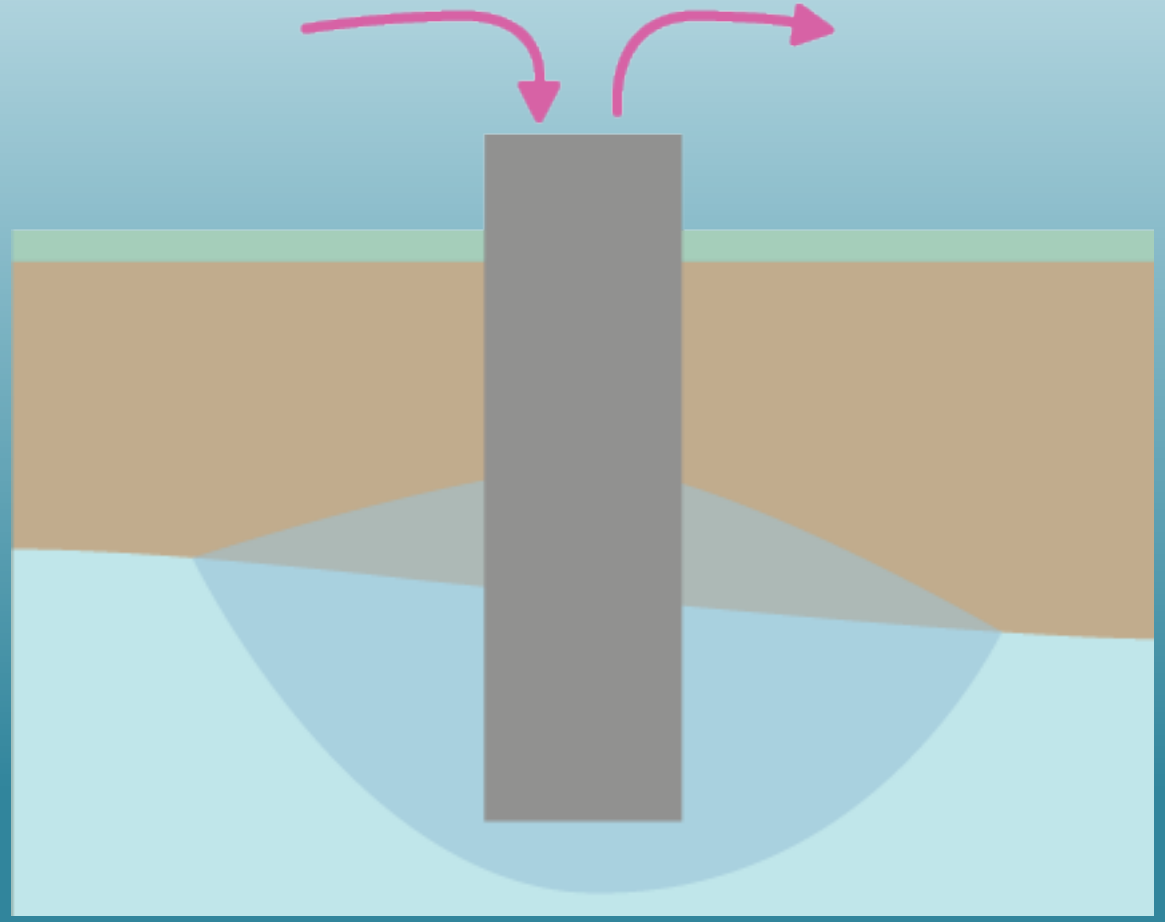
Aquifer Recharge Technologies



Aquifer Storage & Recovery (ASR)

Moderator:
Judge David Blackburn

Panelists:
Dr. Steve Young, INTERA
Dr. Neil Deeds, INTERA
Mr. Ricky Garrett, WCID No. 1
Mr. Rick Kasberg, KPA Engineers
Mr. David Olson, City of Temple
Mr. Brian Dosa, DPW Ft. Cavazos
Andrea Croskrey, Texas Water Development Board
Mr. David Smith, CDM Smith



November 14, 2023
22nd Annual Bell County Water Symposium
Belton, Texas

What is ASR?

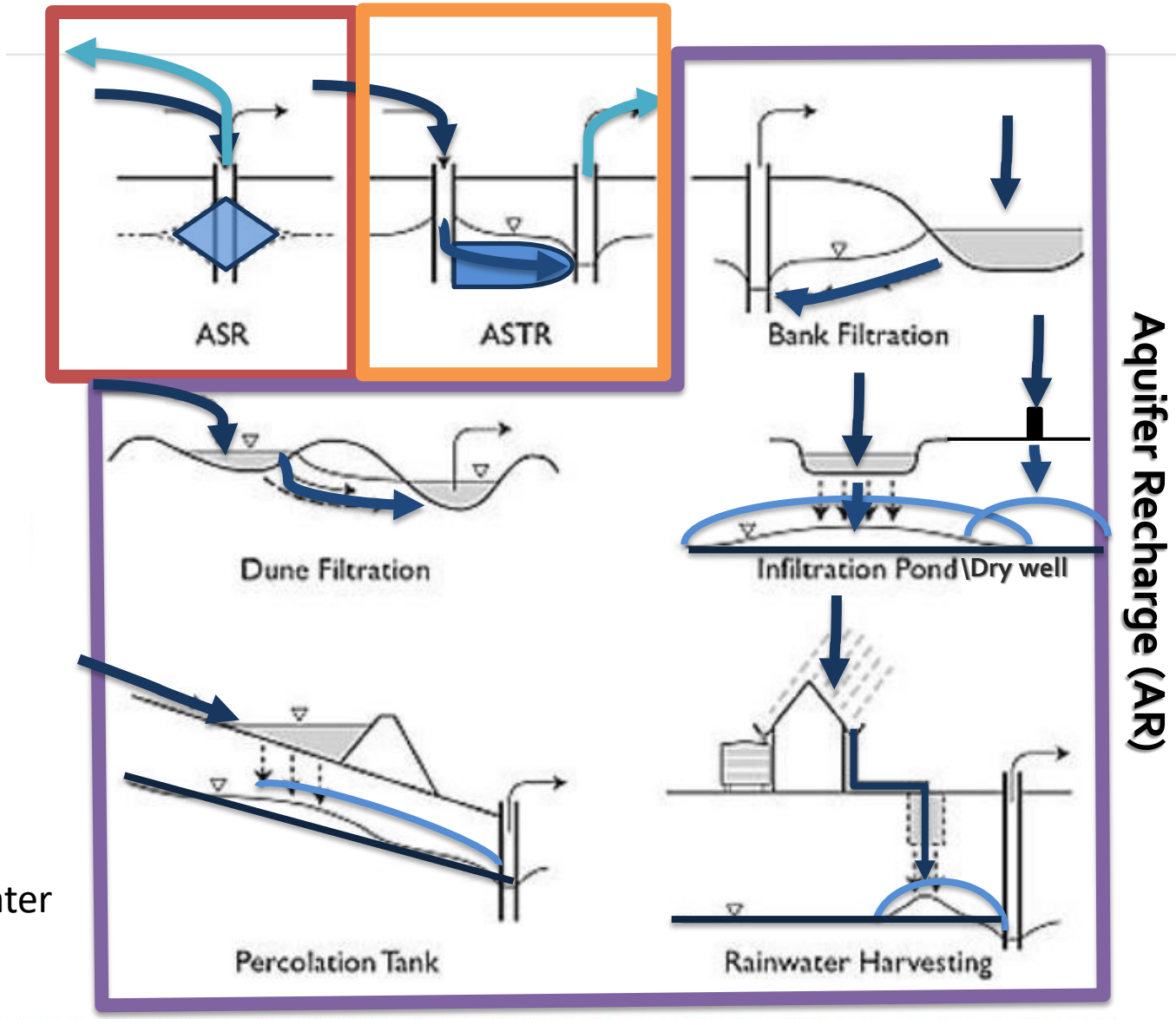
Texas Water Code:

Aquifer storage and recovery (ASR), a project involving the injection of water into a geologic formation for the purpose of subsequent recovery and beneficial use by the project operator (TWC §27.151)

Aquifer recharge (AR), a project involving the intentional recharge of an aquifer by means of an injection well authorized under this chapter or other means of infiltration (TWC §27.201)

Informally:

- ASR, a water saving account
- Aquifer Storage, Transfer & Recovery (ASTR), a water savings account but you transfer your deposit
- AR, a water investment



Most common MAR techniques (Gale and Dillon 2005) ASR: Aquifer Storage and Recovery; ASTR: Aquifer Storage Transfer and Recovery

ASR: a brief TX legislative history

- 1993, SB 1477: Edwards Aquifer Act, EAA may increase/enhance recharge of the aquifer
- 1995, HB 1989: statutes for ASR, $500K for pilot projects, reports to 75th & 76th Legislature
- 2001, SB 2: no injection wells through the Edwards Aquifer in Kinney, Uvalde, Medina, Bexar, Kendall, Comal, Hays, Travis, and Williamson counties [30 TAC 331.19(b)]
- 2015, HB 655: amended TWC for ASR projects; TCEQ can authorize by permit or rule, public notice required, injected water must meet Federal Safe Drinking Water Act standards, role of TCEQ & GCDs defined, recovery determination required; new rules effective May 19, 2016
- 2015, HB 1 Rider 25: $1M for alternative water supply demonstration projects
- 2019, SB 483: allows injection through the Edwards Aquifer for ASR in BSEACD
- 2019, SB 520: allows NBU to have an ASR injection well in Edwards Aquifer >5k mg/L TDS
- 2019, HB 720: adds statutes for AR; surface water, including stormwater and floodwater, may be appropriated for ASR & AR; may apply to amend surface reservoir water right to ASR with evaporation or sedimentation losses credit
- 2019, HB 721: TWDB mandate for ASR studies

What is TWDB's role in ASR?

- **Science**
  - Reports, contracts, and in-kind services
  - https://www.twdb.texas.gov/innovativewater/asr/docs.asp
- **Planning**
  - Regional and statewide
  - https://www.twdb.texas.gov/waterplanning/index.asp
- **Funding**
  - Grants and loans for feasibility studies, design, construction
  - https://www.twdb.texas.gov/financial/index.asp

TWDB Innovative Water Technologies

Mandate

- Texas Water Code §11.155
- Conduct ASR or AR studies
- Work with and report the results to water planners, engineers, government officials, and other appropriate interested persons that may be investigating the development of ASR and AR projects within Texas.

Goals

- Inform through public education
- Provide all available study materials & data
- Facilitate the application of best practices among entities

Who regulates ASR?

ASR or AR well

- TCEQ: Underground Injection Control Class V injection well authorization
- TCEQ: public water supply permit if for drinking water

ASTR or AR infiltration basin

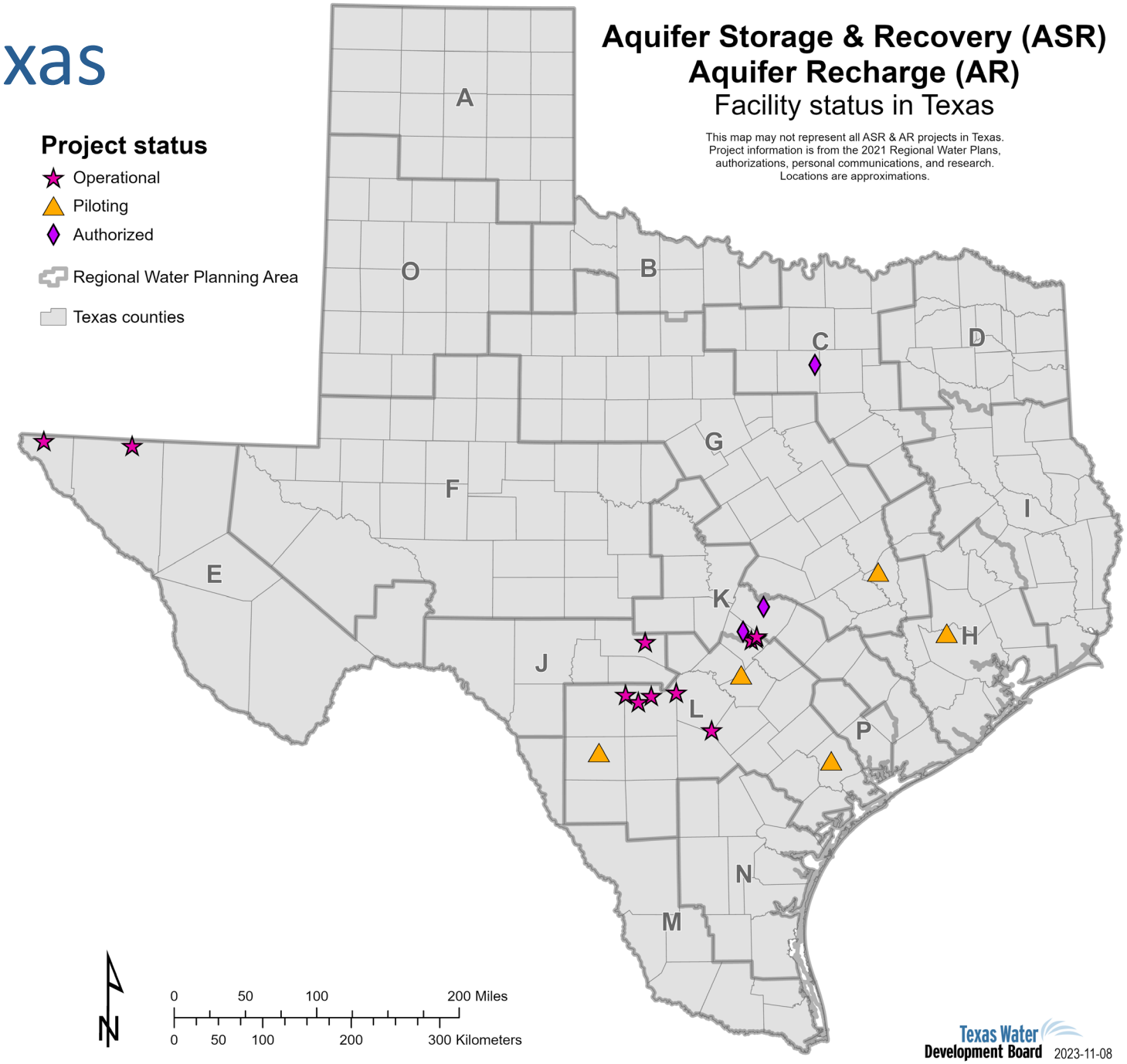
- Regulation on the source water supply

Source water supply for injection or infiltration

- Surface water: TCEQ, surface water rights determination or amendment
- Groundwater permit: possibly a GCD permit
- Reclaimed water: some regulatory ambiguity

Existing ASR and AR in Texas

- 11 operational (4 ASR, 7 AR)
- 5 are pilot testing, 3 have authorizations
- Scales vary greatly
  - Kerrville, ~3,000 acre-feet stored (March 2022)
  - San Antonio, ~186,000 acre-feet stored (October 2022)



Future ASR and AR in Texas

88th Texas Legislature (2023)

- SB 28 - New water supply for Texas fund

  [Proposition 6 PASSED!!!]

- SB 2379 - ASR in eastern Williamson County

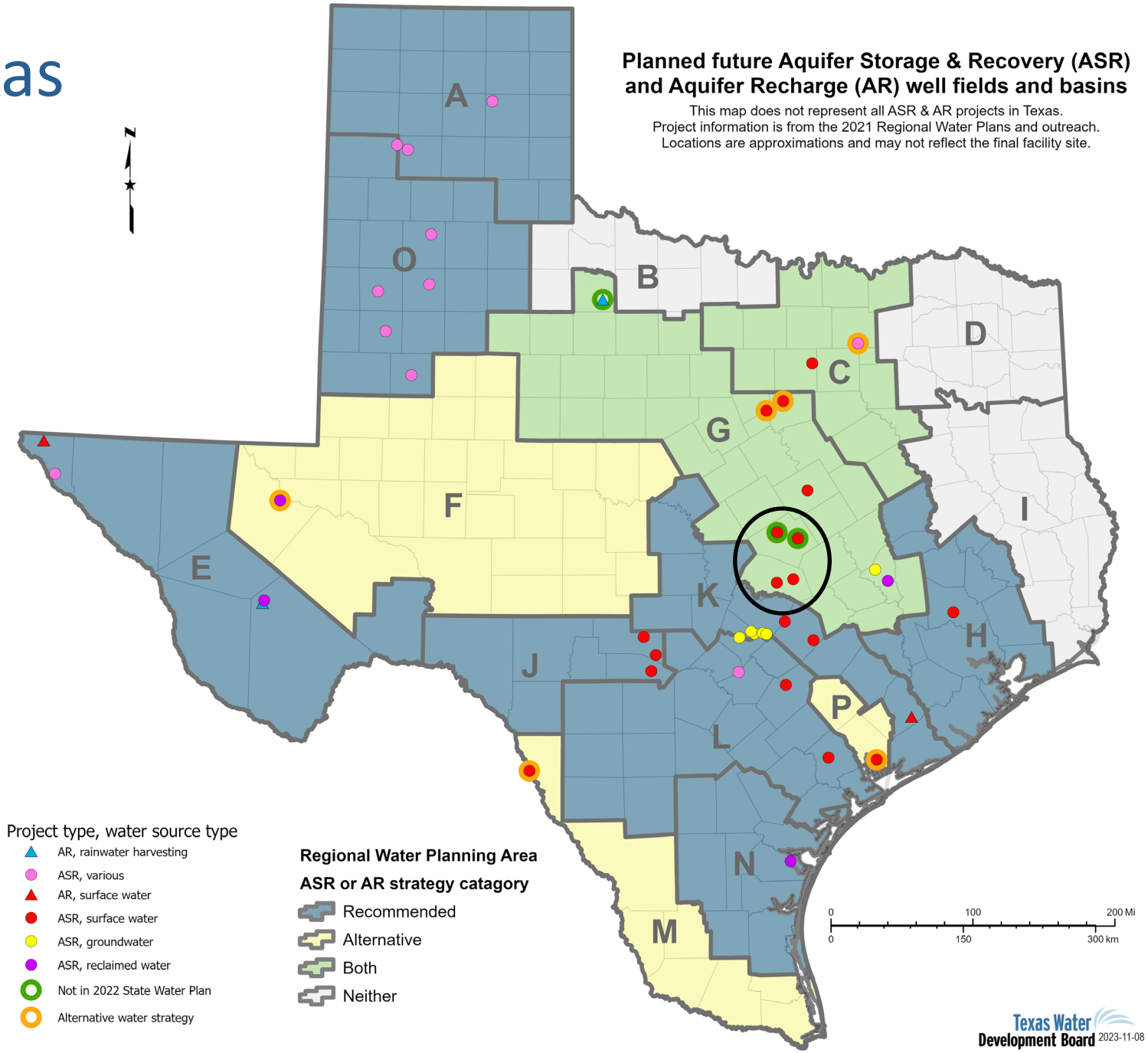
  [vetoed]

State Water Plan (2022) strategies

- 10 of 16 regional water planning groups
- 37 ASR well fields, 3 AR surface infiltration
- 193,000 acre-feet per year in 2070, 3% of the total
- $2.7B total capital costs, $18.5M median capital cost per project, $39-$1,330/acre-foot

Additional planned projects

- 2 ASR well field, 1 AR surface infiltration



TWDB ASR & AR Program

Andrea Croskrey, P.G.

Geoscientist, ASR discipline lead

Innovative Water Technologies Department

andrea.croskrey@twdb.texas.gov

512-463-2865

http://www.twdb.texas.gov/innovativewater/index.asp

Stay connected:

Aquifer Storage and Recovery Coalition

- CUWCD and INTERA Proposal to County Judge David Blackburn
  - Educate the water supply community about the benefits associated with ASR
  - Identify and assess ASR projects that have a strong potential to help Bell County meet its future water needs
  - Model the recharge and migration of water associated with potential ASR operations using groundwater models to estimate recoverability
  - Identify considerations for GCD monitoring and regulation of ASR projects

- Judge David Blackburn's Creation of ASR Coalition
  - Meeting with Water Suppliers and Water Distributors
  - Optional visit to the San Antonio Water Systems (SAWS) H2Oaks ASR Facility
  - Benefits of pooling private and public resources
  - Discuss CUWCD/INTERA Proposal
  - Sign Interlocal Teaming Agreement

ASR Eight Coalition Members

- Brazos River Authority
  - Nearly all surface water rights in the two lakes
  - Partner with customers to extend supplies
- Fort Cavazos
  - Hold water rights in excess of present/future use
  - Emergency supply is prime application, desire control of ASR facility
- Bell County Water Control Improvement District #1
  - Two water treatment plants with about 77 MGD
  - No immediate ASR needs, storage for summer peaking would be done in partnership with a customer

TCEQ was an important non-member partner in the process, participating in workshops and providing guidance

ASR Eight Coalition Members (con't)

- City of Temple
  - Temple water treatment plant
  - Summer peaking is most likely application, emergency supply is of interest
- Central Texas Water Supply Corporation
  - ~14 MGD WTP near Stillhouse Lake and ~7 MGD membrane Plant
  - Possible ASR application is to improve water quality from groundwater augmentation or improve system performance near Oenaville
- City of Rogers
  - Originally had excess permits from Central Texas WSC (renegotiated during project)
  - Envisioned multi-entity ASR application
- Clearwater UWCD
  - Exploring feasibility of ASR in underserved areas to reduce pressure on groundwater supplies
  - ASR application for load leveling or drought resiliency

Project Overview: Workshops

- **Phase 1**
  - Identify ten sites candidate locations for ASR
  - Develop evaluation criteria
  - Initial screening of ASR locations

  Workshop #1
- **Phase 2**
  - Identify specific ASR projects
  - Perform scoping analysis of economics and recoverability
  - Select priority ASR sites/projects
  - Review District ASR Policies and Monitoring

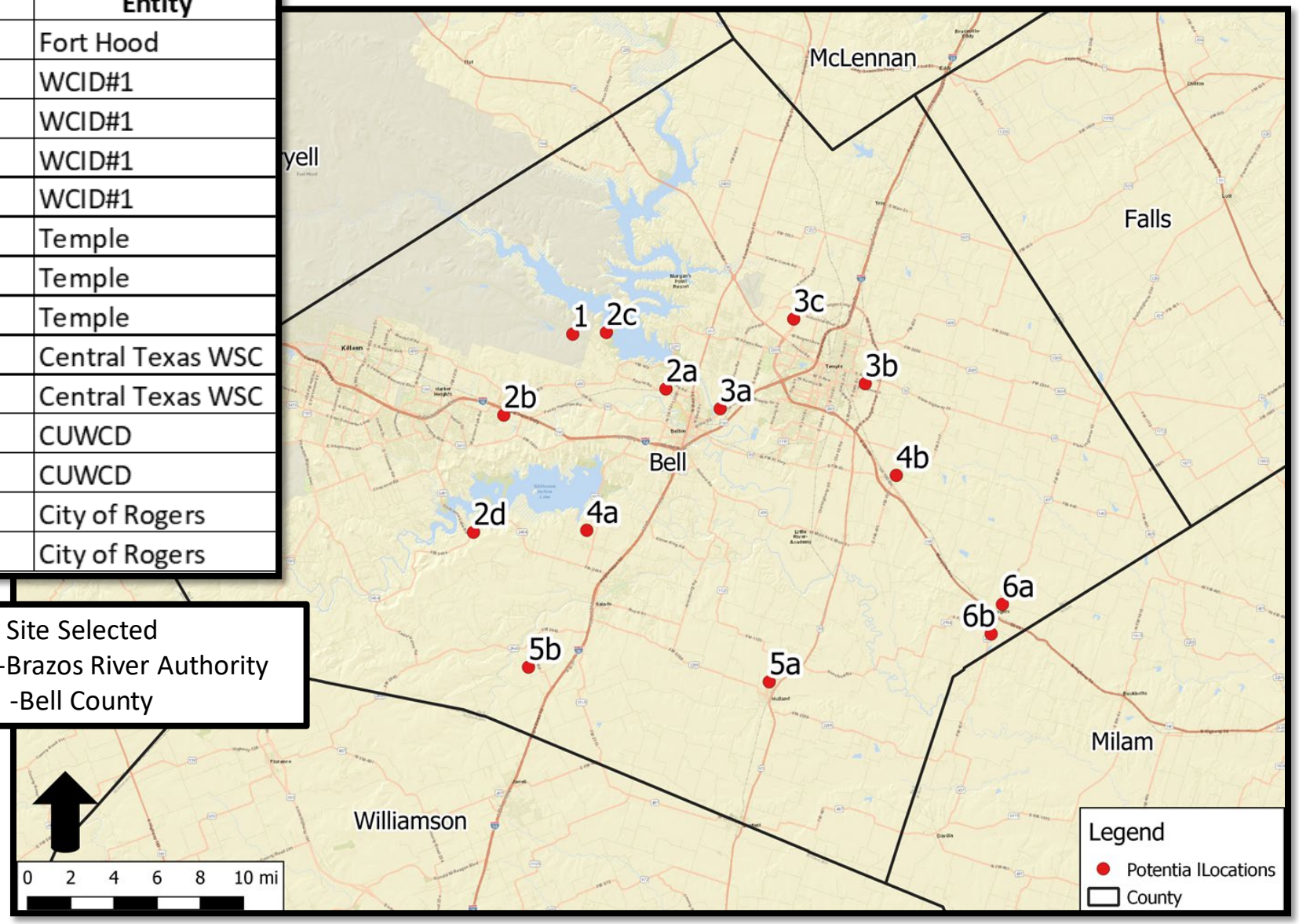
  Workshop #2 & 3
- **Phase 3**
  - Detailed modeling of ASR operations for recoverability and potential drawdown impacts
  - Implementation and costing of ASR Facilities
  - Permitting Process with Texas Commission on Environmental Quality
  - Approaches for including ASR into Regional Water Plan
  - Funding strategies
  - Provide recommendation regarding District policies, data collection & groundwater model development

  Workshop #4 & 5

Phase 1: Fourteen Candidate ASR Sites Identified

ID	Entity
1	Fort Hood
2a	WCID#1
2b	WCID#1
2c	WCID#1
2d	WCID#1
3a	Temple
3b	Temple
3c	Temple
4a	Central Texas WSC
4b	Central Texas WSC
5a	CUWCD
5b	CUWCD
6a	City of Rogers
6b	City of Rogers

- No Site Selected
  - -Brazos River Authority
  - -Bell County



Phase 2: Specific Projects at Qualified Sites

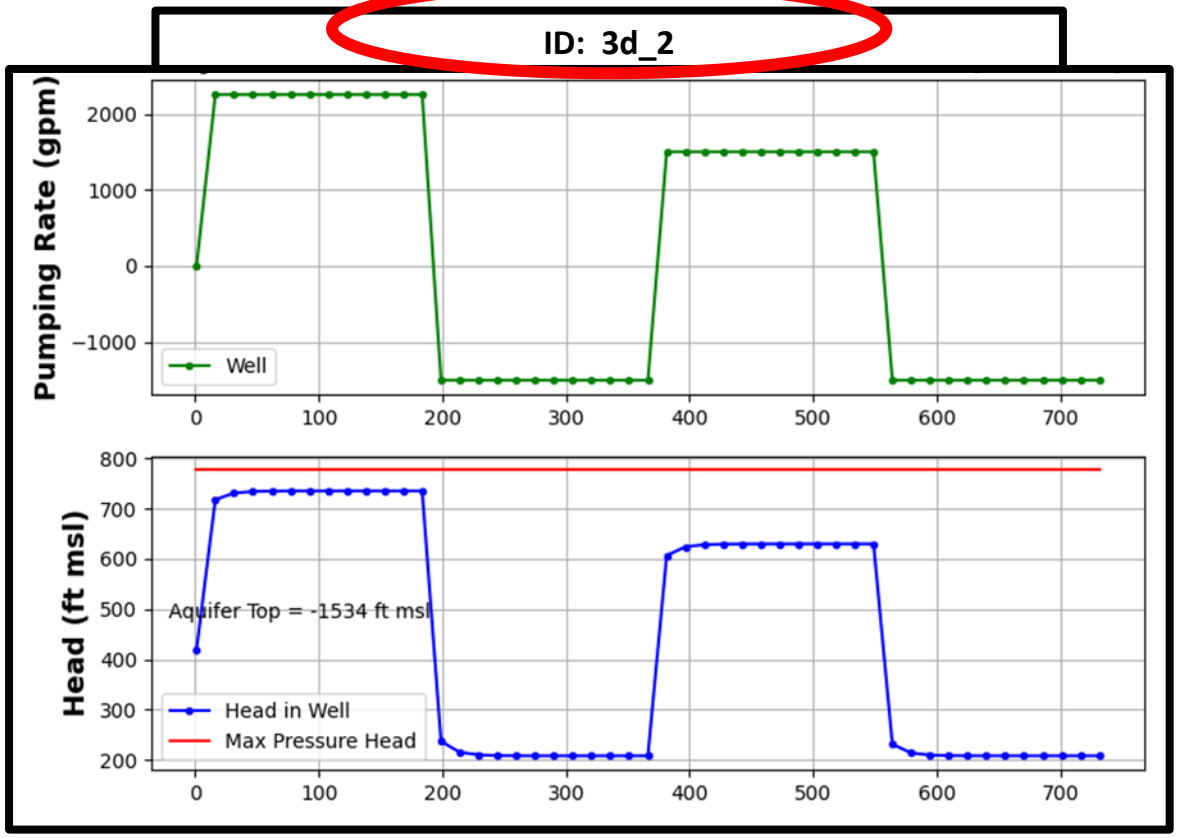
- Evaluation
  - Only Hosston Sites Survived Hydrogeology Criteria
  - Scoping Opportunity for Excess Water
  - Options for Transmission

NTGAM Layer	Average of Exceedance of Hydraulic Head Critieria (ft)	
	Injection Stage	Pumping Stage
Woodbine	>1,000	>1,000
Washita/ Edwards	602	1,732
Paluxy	>1,000	>1,000
Glen Rose	220	359
Hensell	3,774	8,898
Persall	1,402	3,057
Hosston	-241	-1156

ID	Entity and Site	Excess Water		Transmission		Hydrogeology	
		Annual	Seasonal	Capacity	Note	Productivity	Recoverability
1	Fort Hood: Inside Eastern Boundary	high	high	high	48"	moderate	high
2a	WCID#1: Belton Chisolm Trail Park	high	high	high	21"	moderate	high
2b	WCID#1: Nolanville	high	high	high	18",24",36"	moderate	high
2c	WCID#1: On or near Belton WTP	high	high	high	24",36"	moderate	high
3a	Temple: At or near WTP[1]	medium	high	high	30"	moderate	high
3b	Temple: James B. Wilson Park	medium	high	medium	12"	high	moderate
3c	Temple: Monitor Well Site	medium	high	low	6"	moderate	high
4a	Central Texas WSC: Retrofit well at MTP	medium	high	high	assumed	moderate	high
4b	Central Texas WSC: Near Oscar	medium	high	medium	10"	high	high
5a	CUWCD: Near Holland	n/a	n/a	medium	10"	high	high
5b	CUWCD: South of Patterson's Crossing	n/a	n/a	low	no pipes?	high	high
6a	City of Rogers: North of Town[2]	high	high	medium	12"	high	high
6b	City of Rogers: South of Town	high	high	medium	10"	high	high
1 - WTP Expansion							
2 - Excess rights, GW							

Phase 2: Simple "Box" Numerical Model

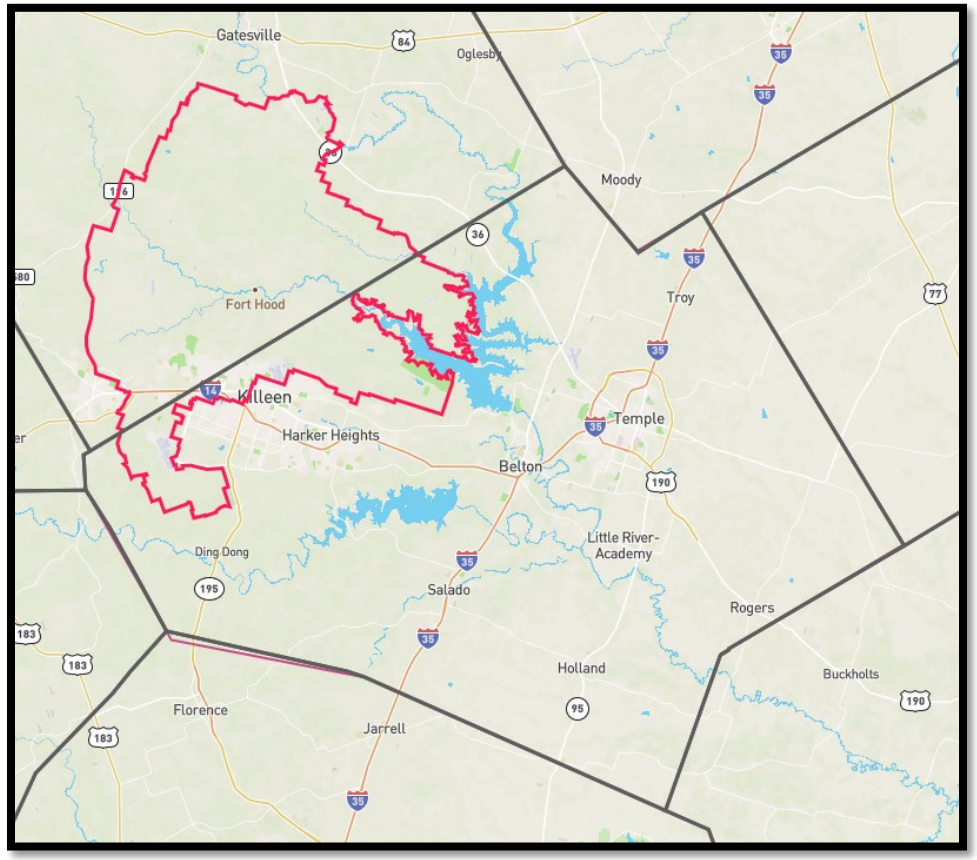
- Specific Application
  - Specific Loading, Drought, Emergency Application
  - Numerical model with particle tracking



Site Info
Run ID: 3d_2
Entity: City of Temple
Location: SE Industrial Park
ASR Operation
Purpose: Emergency Supply
Recovery Rate (MGD): 6.5
Recovery Duration(months): 6
Hosston Info
Total Thickness (ft): 333
Transmissivity(ft2/day): 5,545
Depth (ft): 2,013
Water Level Info
Static Level (ft, msl): 419
Hydraulic Gradient(ft/ft): 0.0003
Max Drawup(ft): 436
Max Drawdown(ft): 419
Well Info
Number: 2
Spacing(ft): 1000
Screened Interval (ft): 200
Max Injection(gpm): 3,385
Max Pumping (gpm): 2,257

Phase 2: Project Costs & CUWCD Role

- Project Costs
  - Example Planning Level Costs
  - Standardized TX costing tools
  - Example ASR project costs
  - Well Drilling

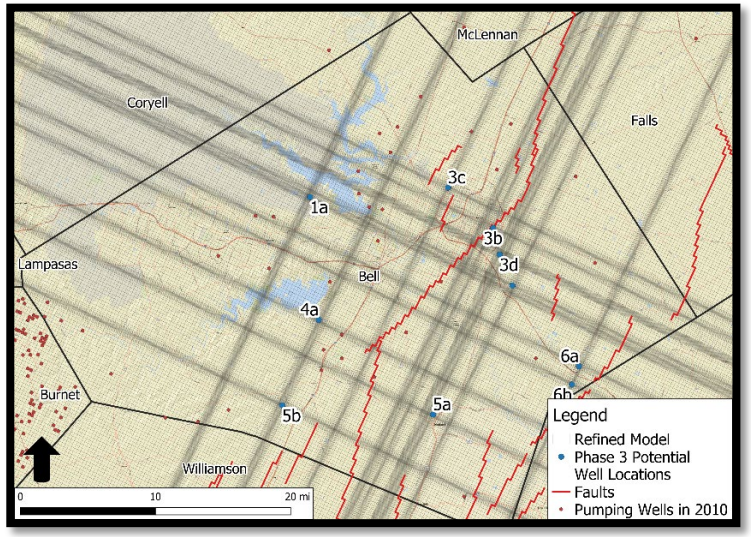


- UWCD Role
  - Mandated by TX Statutory & Regulatory Law
    (TCEQ Staff available)
  - Possibility for Special Permits
  - Recharge Credits
  - Modified Well Spacing Regulations

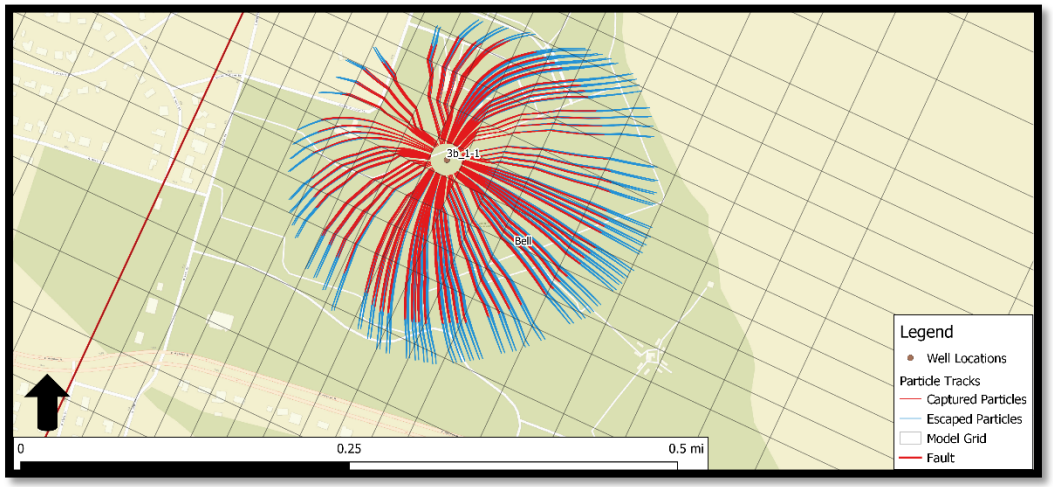
Phase 3 – Refined Modeling/Implementation Guidance + Next Steps

- Recovered Water Quality and Recovery Efficiency
  - Mixing with native groundwater
  - Geochemistry
  - Microbiology
- Well Design
  - Optimized for injection control, minimize well plugging and allow redevelopment
- Wellfield Design and Operation
  - Performance of every well will not be identical so optimization and control required
- Cycle Testing
  - Target Storage Volume

Refine Grid in Bell County



Perform Particle Tracking

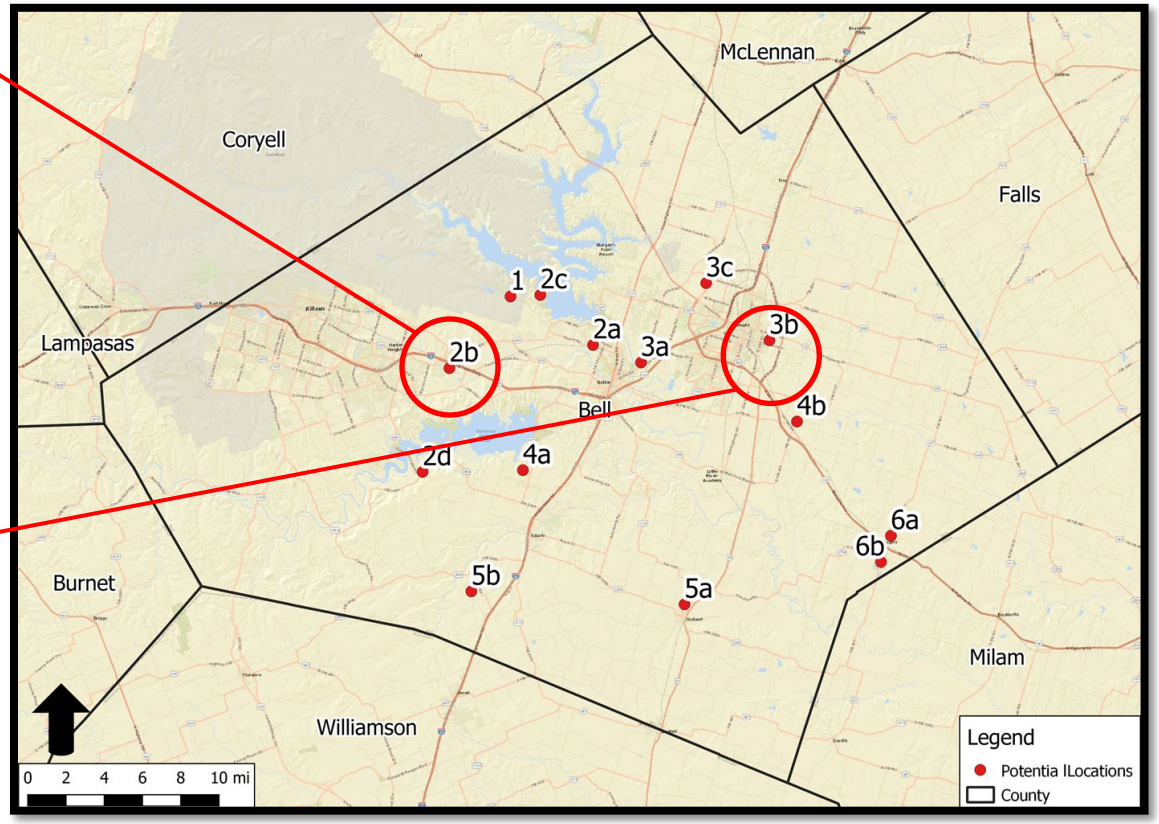


Initial Outcomes

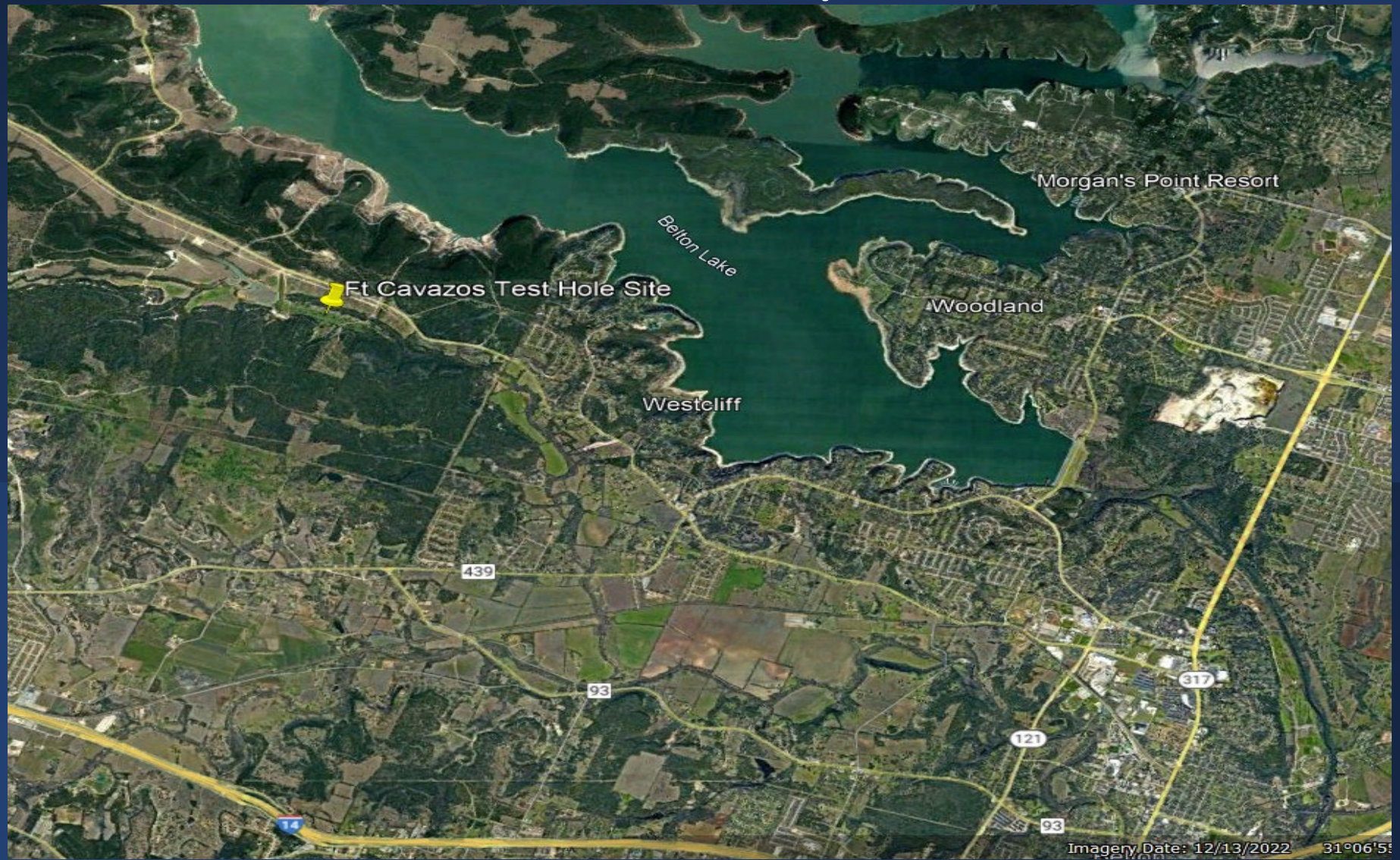
Two projects involving three coalition members are moving forward into next stages

Fort Cavazos/WCID #1
Test Well Program

City of Temple
Stage 2 Feasibility
(with production well)



Aquifer Storage & Recovery



A Fort Cavazos Resiliency Project

Background

- Bell County entered into a county-wide ASR feasibility project in 2019 to explore possibilities in Bell County as a water management strategy. Several entities participated including Bell County WCID 1, Fort Cavazos, the City of Temple and others. Each entity expressed a water availability goal.

Background continued

- The Bell County Study utilized data from available well information and published reports. From the desktop findings Fort Cavazos appears to have a suitable project for Aquifer Storage and Recovery to meet their resiliency goals. The next step toward the project is to conduct sufficient aquifer testing to confirm the desktop results.