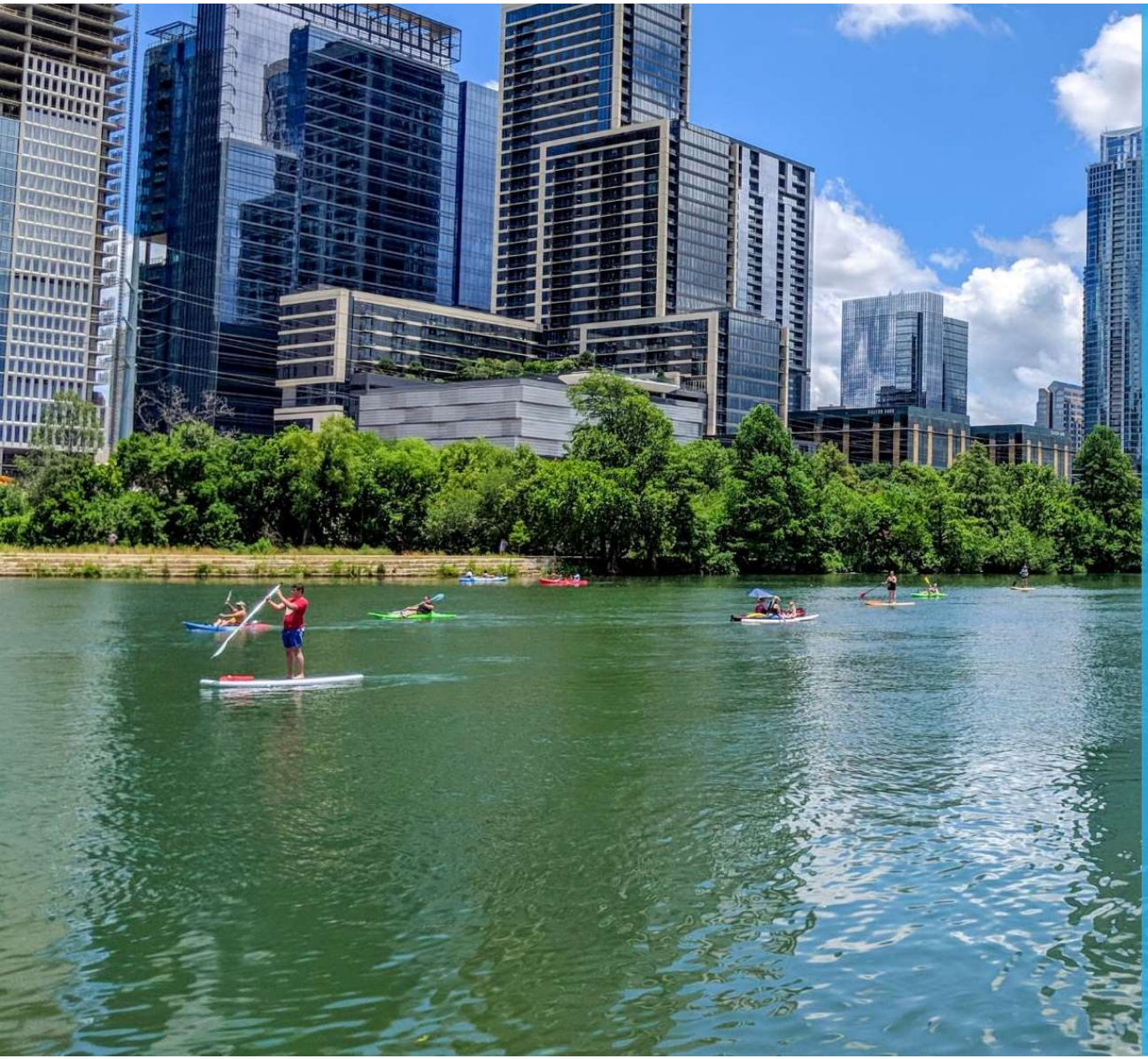


ASR Pilot and Program Management Project

Phase 1a Update

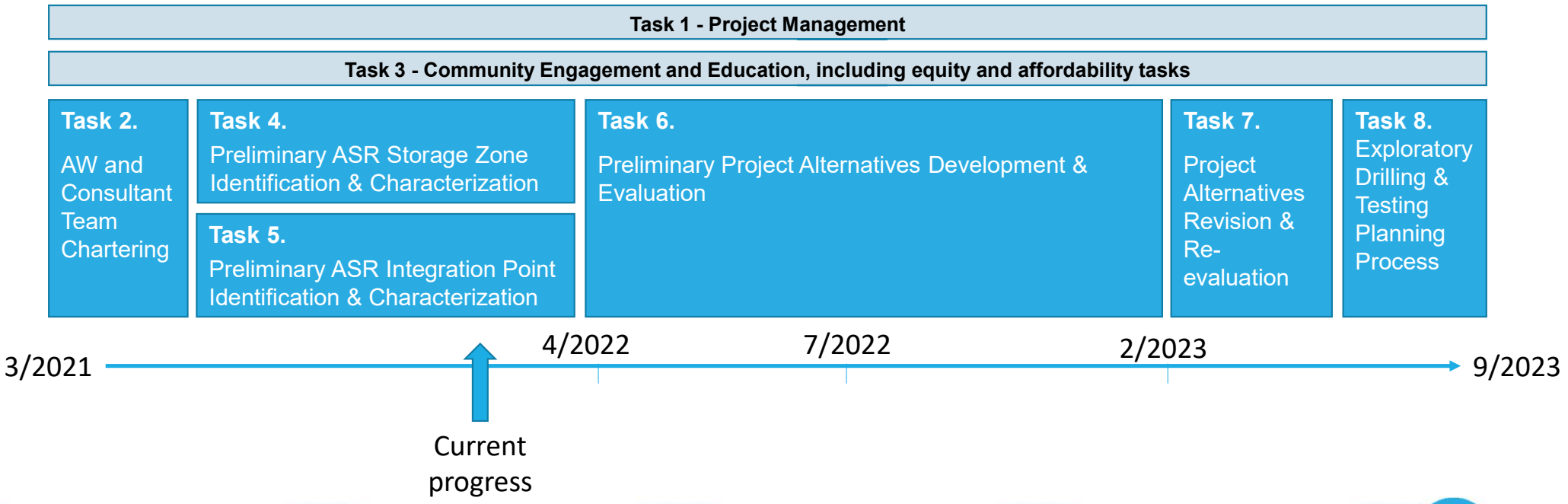
Water Forward Task Force Meeting

Austin WATER

January 11, 2011

Overview of Phase 1a Project Approach

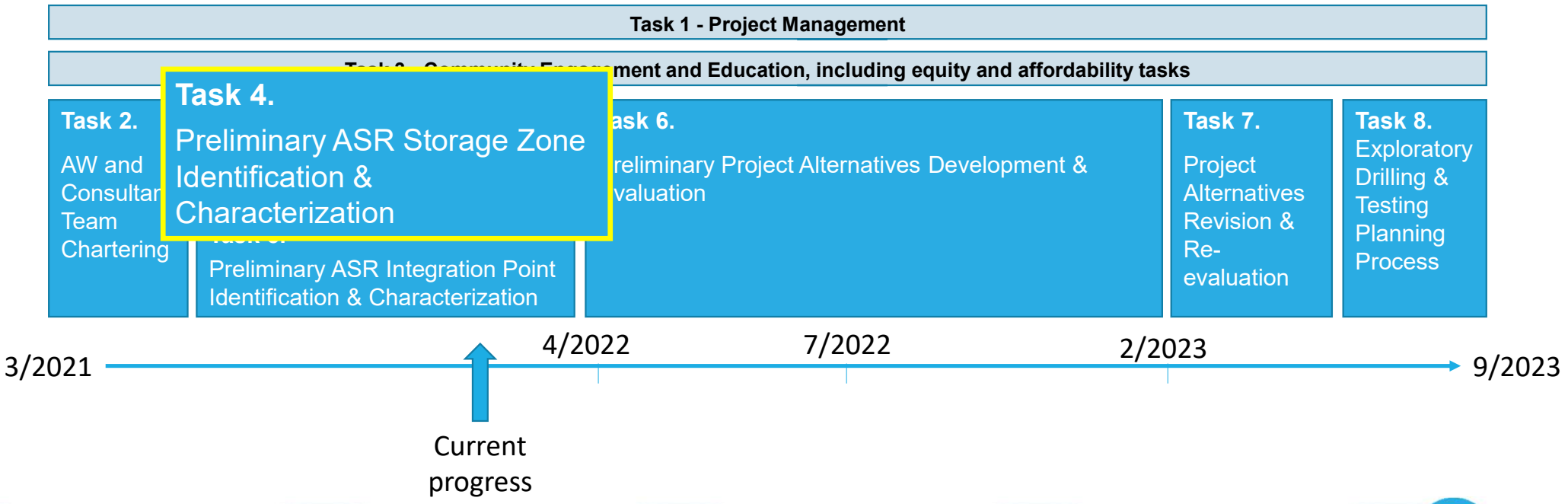
Approximate dates; not to scale; subject to change



Aquifer Storage and Recovery video

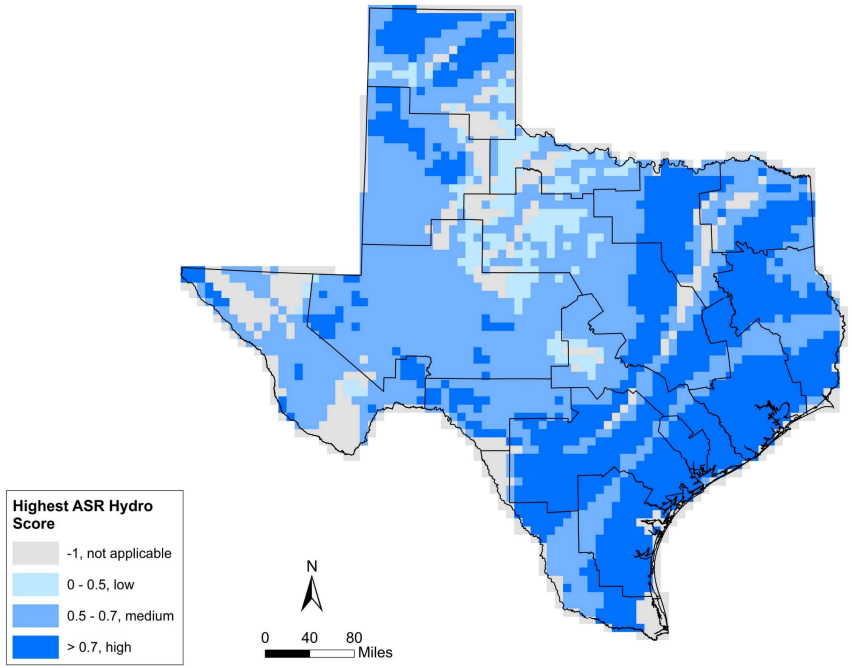
Overview of Phase 1a Project Approach

Approximate dates; not to scale; subject to change



Task 4: Preliminary ASR Storage Zone ID and Characterization

- Initial high-level screening of aquifers in surrounding areas
- Detailed spatial analysis on screened aquifers to identify most favorable potential ASR wellfield areas



ASR Hydrogeological Parameter Scores, TWDB Statewide ASR/AR Assessment

Task 4: Preliminary ASR Storage Zone ID and Characterization

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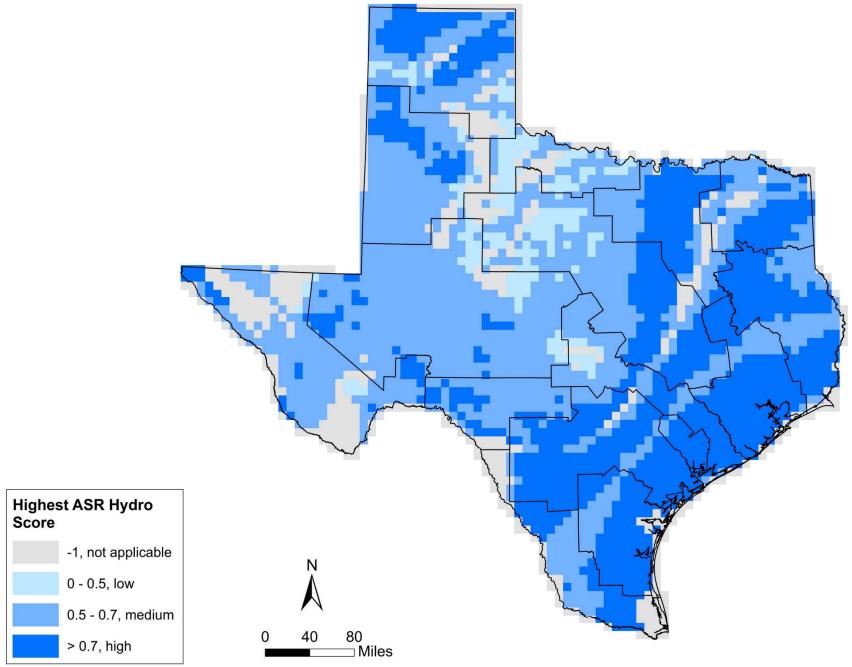

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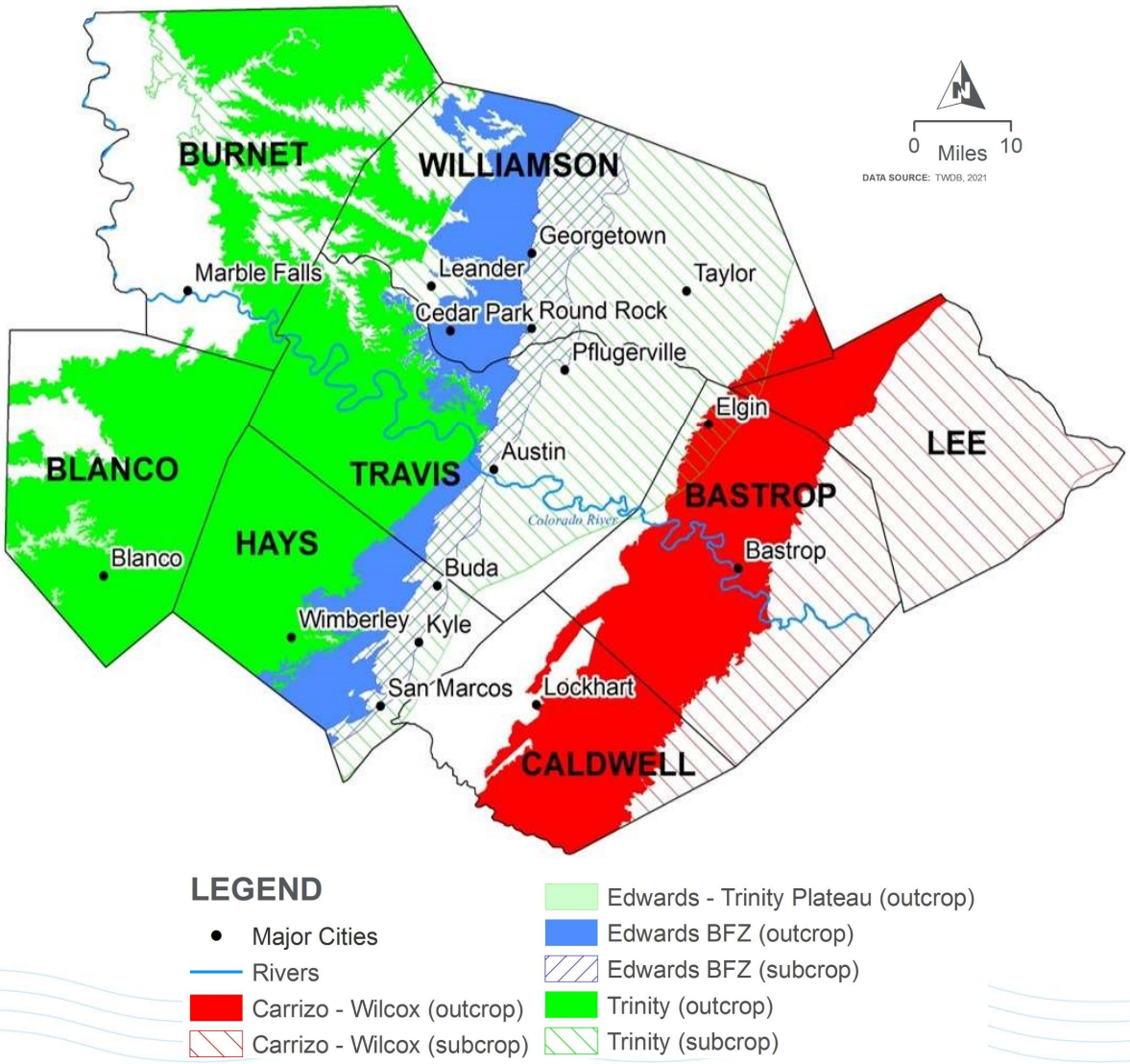
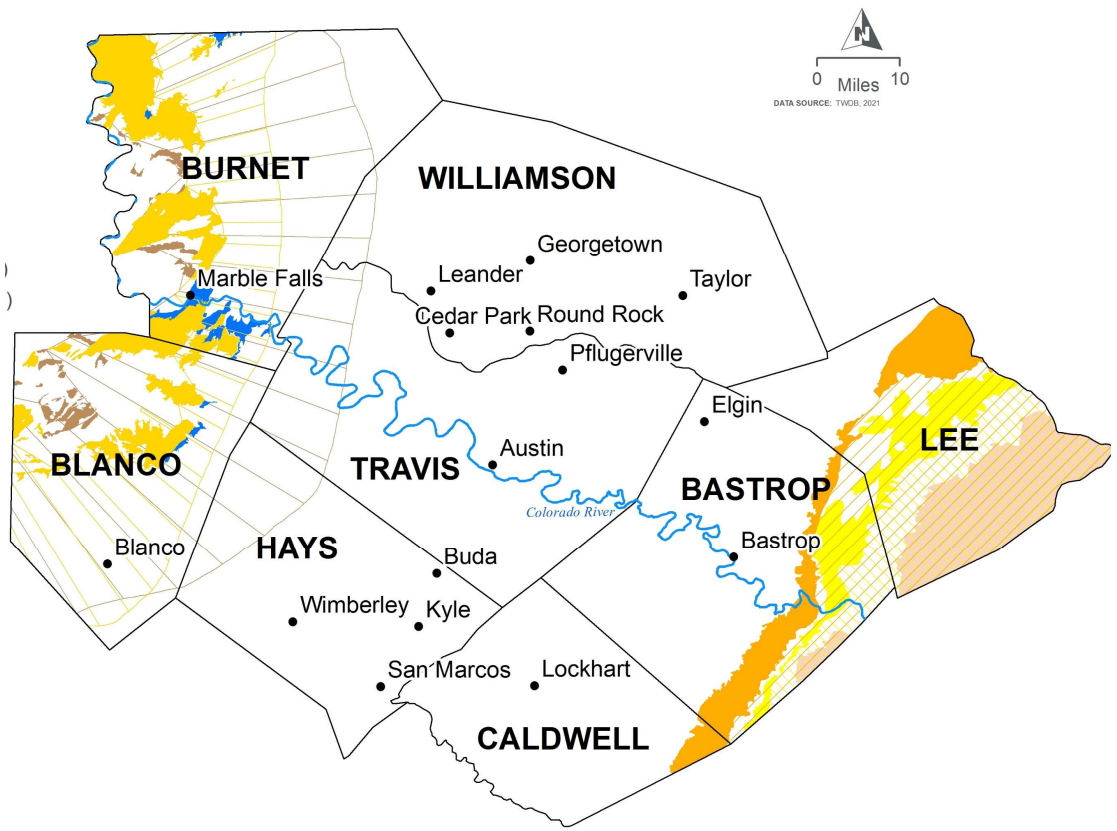


County/Aquifer Combinations for Initial Screening:

Major Aquifers



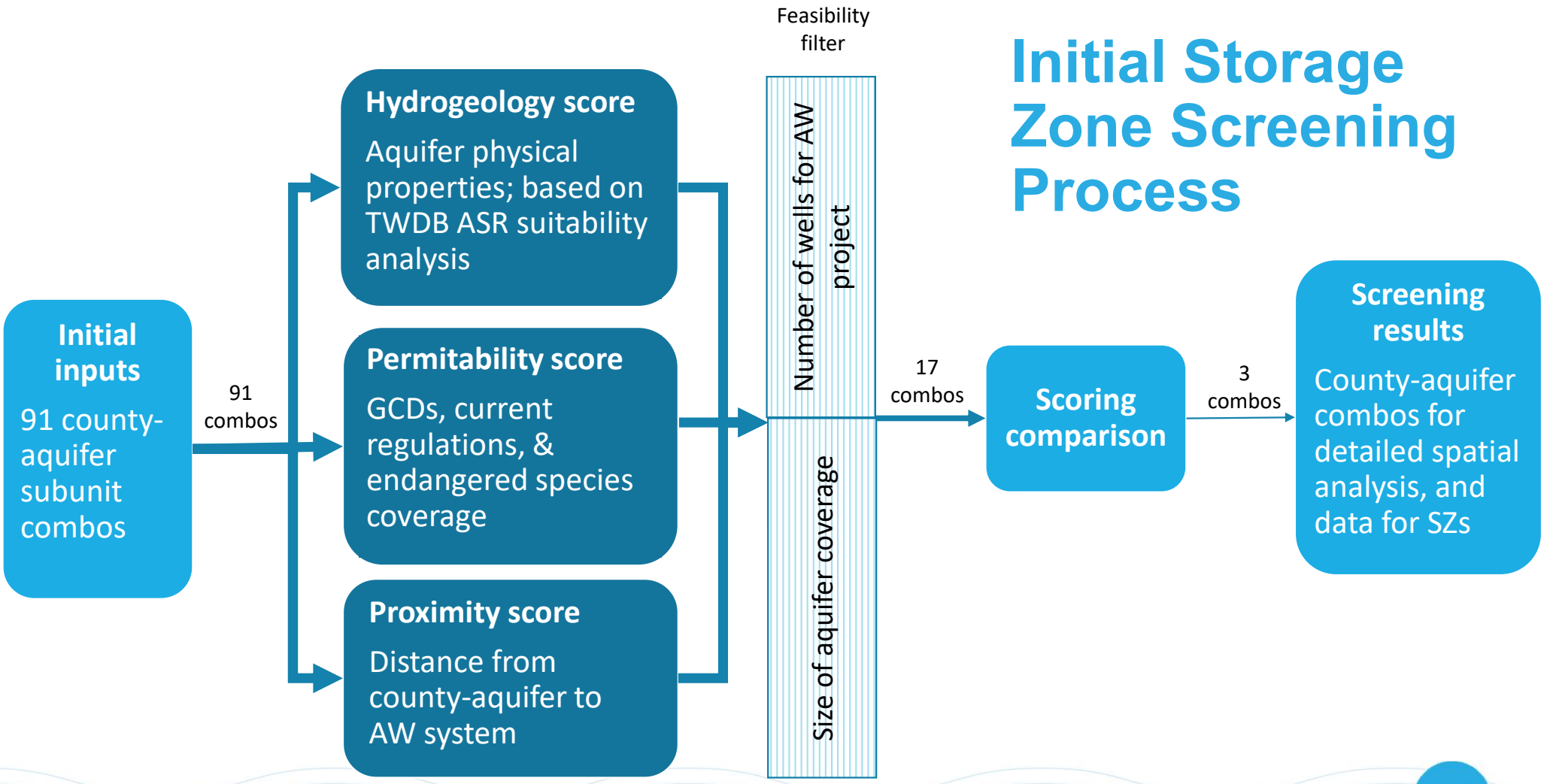
LEGEND

- Major Cities
- Rivers
- Yegua Jackson
- Sparta (outcrop)
- Sparta (subcrop)
- Queen City (outcrop)
- Queen City (subcrop)
- Marble Falls
- Ellenburger - San Saba (outcrop)
- Ellenburger - San Saba (subcrop)
- Hickory (outcrop)
- Hickory (subcrop)

County/ Aquifer Combinations for Initial Screening:

Minor Aquifers

Initial Storage Zone Screening Process



Hydrogeology Score

- Based on analysis in TWDB statewide ASR suitability survey
- Analyzes suitability of aquifer unit for ASR projects of all sizes and costs

Table 2. Hydrogeological parameter screening for ASR

Parameter name	Category	Notes
Storage zone depth	Recharge	Depth to top of aquifer in a confined system. In an unconfined system, storage zone depth is estimated to be 100 feet below the top of the saturated zone
Horizontal hydraulic conductivity	**Recharge**, Recoverability	Primary factor for rate of recharge or production
Drawup available	Recharge	Distance between hydraulic head and ground surface
Dominant lithology	**Recharge**, Recoverability	Aquifer texture/porosity. Parameter scoring also includes secondary porosity features associated with fractured rock and limestone or karst formations.
Aquifer thickness	**Storage**, Recharge	For unconfined aquifers, this is based on saturated thickness
Aquifer storativity	Storage	Relevant in confined aquifers
Specific yield	Storage	Relevant in unconfined aquifers
Sediment age	Storage	A qualitative indication of aquifer induration.
Confinement	Recoverability	Important for control of recharge water
Groundwater quality	Recoverability	Total dissolved solids (TDS)
Drift velocity	Recoverability	Natural drift of recharged water
Drawdown available	Recoverability	Amount of head available above the top of aquifer

Note: Where multiple categories exist, the category for which the parameter contributes to scoring is bolded.

Source: http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/2000012405.pdf?d=12515.800000011921

Permitting Score

Larger permitting score indicates an option is more favorable for permitting and ease of project siting to avoid protected species habitat or conserved lands

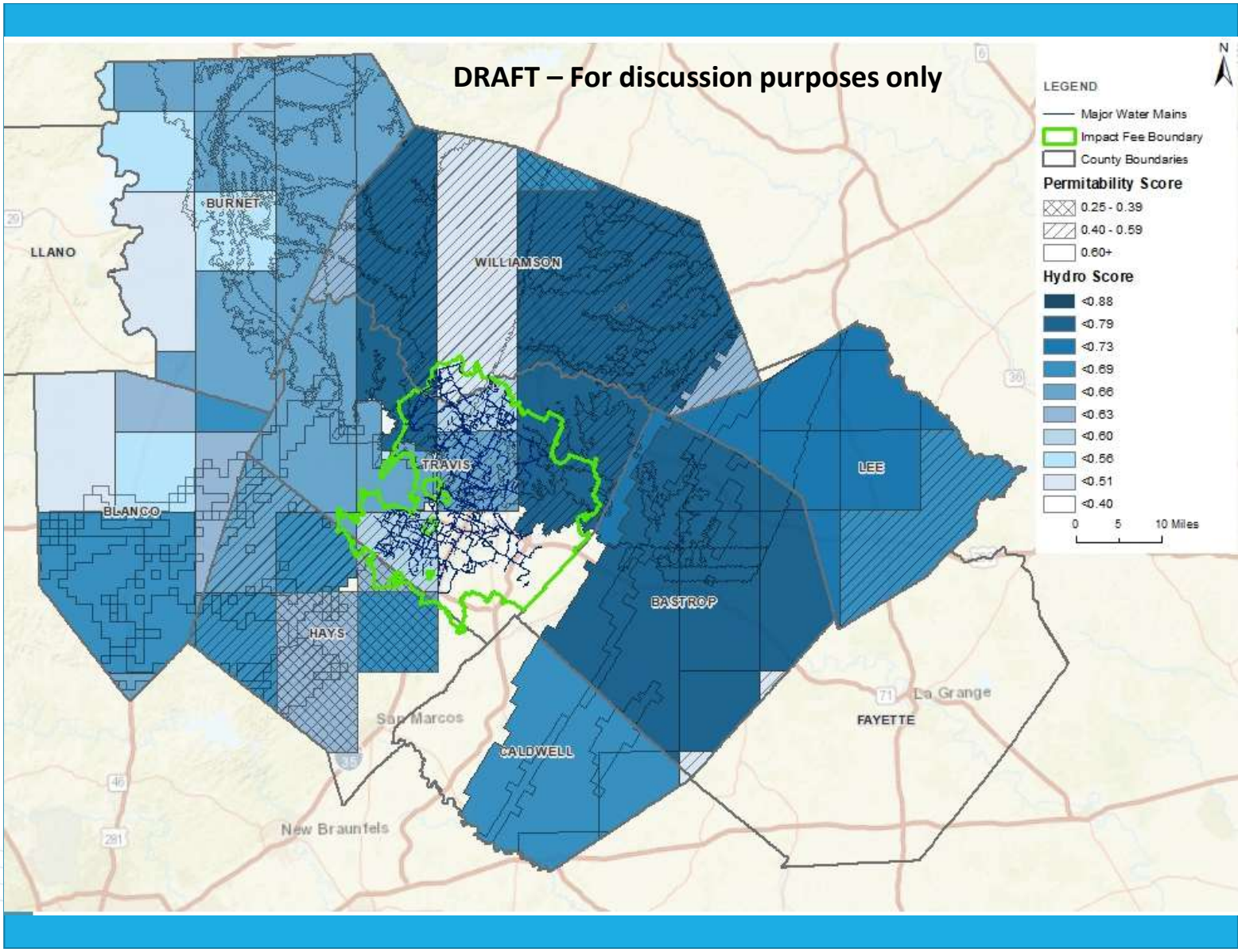
- Based on three criteria:
  - Ease of receiving TCEQ storage authorization with current rules (45%)
  - Presence and extent of groundwater conservation district with permitting authority over ASR projects (30%)
  - Potential for threatened/endangered species habitat and conserved or protected land affecting project siting (25%)

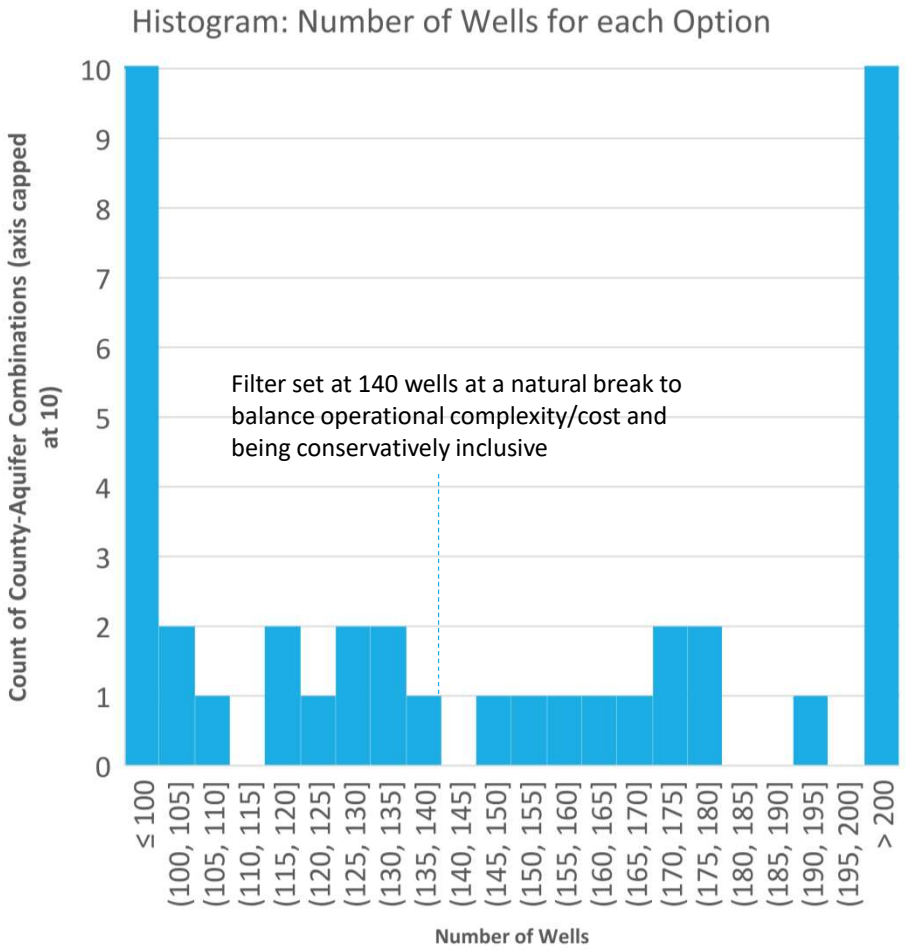
Proximity Indicator

- Based on distance from county-aquifer centroid to the nearest major Austin Water pump station
- Larger indicator value shows an option is closer to AW pump station
- Distance of storage zone from AW service area has direct impact on capital and operating cost

Initial screening inputs

- 91 county-aquifer combinations
- Hydrogeology and permitting score shown



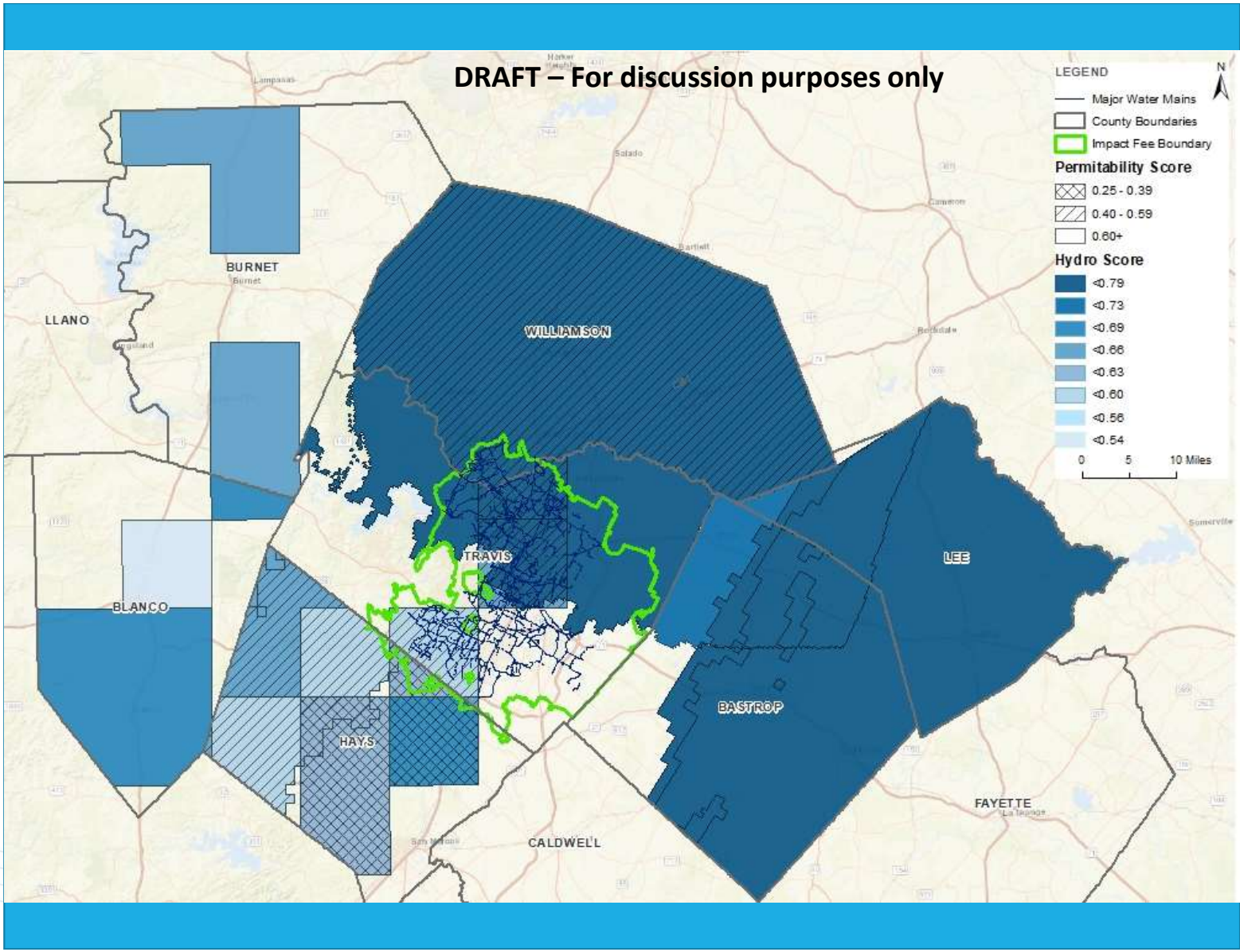


Feasibility filter: number of wells and space available

- AW project goal is 60,000 AFY of ASR supply by 2040
  - Estimated well yield was determined for each option
  - Number of wells = desired supply ÷ well yield
  - Operational complexity (based on # of wells needed) determined one feasibility filter
- County/aquifer combos less than 75 square miles were considered less feasible options and were filtered out

Feasibility filtering results

- 17 more feasible county-aquifer combinations



Aquifer/Aquifer System	County	Approximate Well Yield (MGD)	# of wells to achieve 2040 yield (60k AFY)	Proximity Indicator (to AW system)	Permitting Score	Hydro Score
CW-Simsboro	Lee	1.08	50	0.13	76%	79%
CW-Carrizo	Bastrop	0.54	100	0.48	84%	77%
CW-Carrizo	Lee	0.58	93	0.07	76%	77%
CW-Simsboro	Bastrop	0.51	105	0.43	82%	76%
NT-Hosston	Williamson	0.41	130	0.62	50%	74%
NT-Hosston	Travis	0.46	116	0.72	60%	74%
NT-Hosston	Bastrop	0.88	61	0.58	78%	71%
NT-Hosston	Lee	0.97	55	0.40	77%	71%
Edwards BFZ	Hays	31.4	2	0.66	25%	68%
Ellenburger - San Saba	Blanco	0.72	75	0.39	79%	67%
Edwards BFZ	Travis	4.92	11	1.00	51%	65%
Hickory	Hays	0.40	134	0.66	84%	65%
Ellenburger - San Saba	Burnet	0.45	119	0.23	82%	64%
Edwards BFZ	Hays	125.1	0	0.79	31%	61%
Edwards BFZ	Travis	39.4	1	0.99	52%	59%
TrinHC - Middle Trinity	Hays	0.43	123	0.72	58%	58%
Ellenburger - San Saba	Blanco	0.39	138	0.35	77%	54%

Feasibility filtering results

- 17 combinations considered more feasible based on filter
- Shown here sorted by hydro score

Screening Results

- Counties moving forward to detailed spatial analysis:
  - Bastrop
  - Lee County
  - Travis County
- Data for all screened combinations will be used in conjunction with future analysis

County	Aquifer-Aquifer Subunit	# of wells for 2040 yield	Permitting Score	Hydro Score	Screening Result
Bastrop	CW-Carrizo	100	84%	77%	Moving forward to Task 4.5 for further analysis. Specific subunits for Task 4.5 include the Carrizo-Wilcox Carrizo, CW-Simsboro, and NT-Hosston units in Bastrop County.
	CW-Simsboro	105	82%	76%	
	NT-Hosston	61	78%	71%	
Lee	NT-Hosston	55	77%	71%	Moving forward to Task 4.5 for further analysis. Subunits for Task 4.5 include the Northern Trinity Hosston unit, CW-Simsboro, and CW-Carrizo units in Lee County.
	CW-Carrizo	93	76%	77%	
	CW-Simsboro	50	76%	79%	
Travis	**NT-Hosston**	116	60%	74%	Moving forward to Task 4.5 for further analysis. Subunits for Task 4.5 include the Northern Trinity Hosston unit in Travis County.
Williamson	NT-Hosston	130	50%	74%	Lower permitting score and higher number of wells needed.
Hays	Edwards BFZ	2	25%	68%	Lower hydro/permitting score than other options.
Blanco	Ellenburger - San Saba	75	79%	67%	Lower hydro score than other options.
Travis	Edwards BFZ	11	51%	65%	Lower hydro/permitting score than other options.
Hays	Hickory	134	84%	65%	Lower hydro score and higher number of wells needed.
Burnet	Ellenburger - San Saba	119	82%	64%	Lower hydro score and higher number of wells needed.
Hays	Edwards BFZ	0	31%	61%	Lower hydro/permitting score than other options.
Travis	Edwards BFZ	1	52%	59%	Lower hydro/permitting score than other options.
Hays	TrinHC - Middle Trinity	123	58%	58%	Lower hydro/permitting score than other options.
Blanco	Ellenburger - San Saba	138	77%	54%	Lower hydro score and higher number of wells needed.

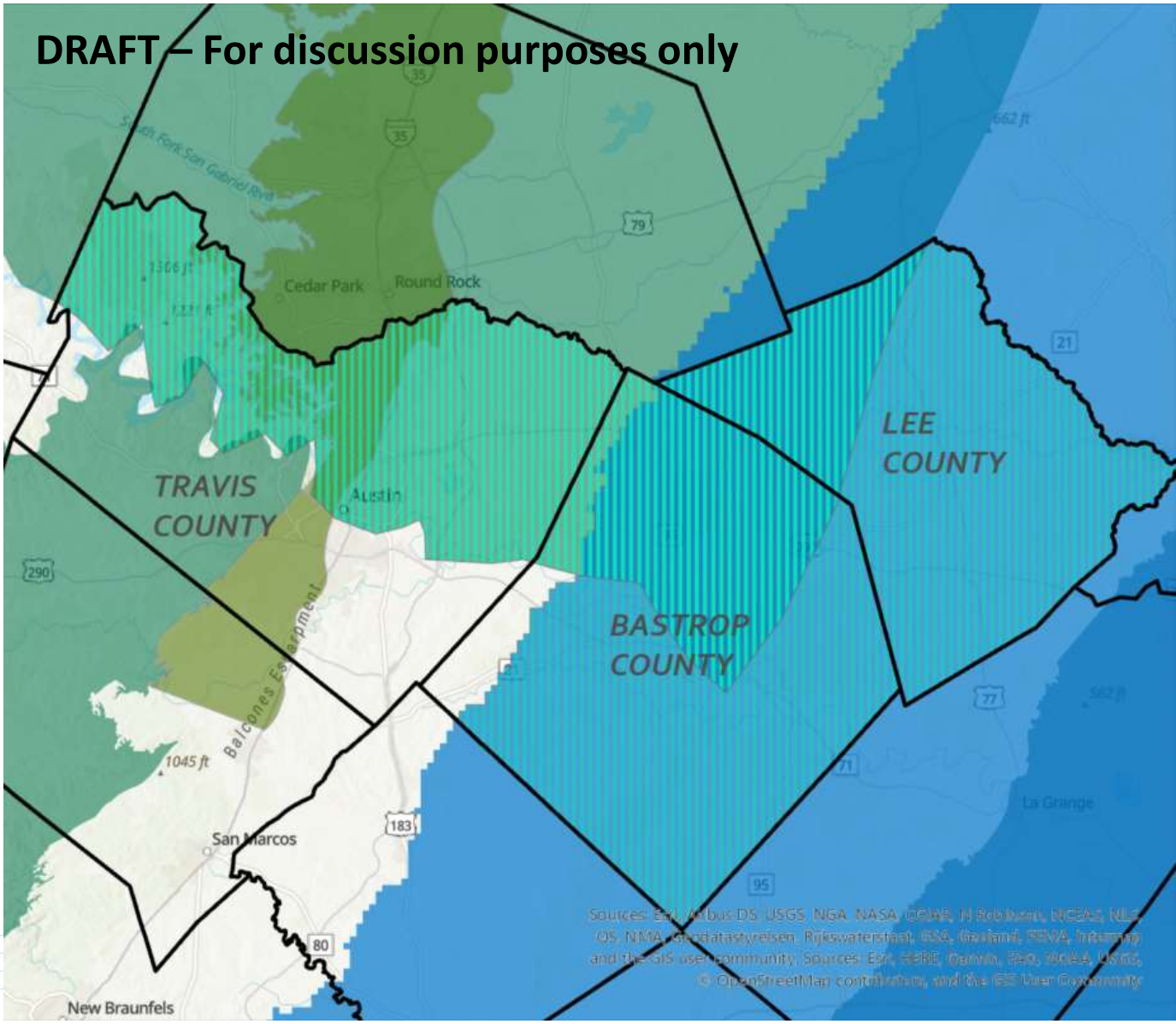
Initial storage zone screening results

Legend:

- County_boundaries
- ScreeningResults

Major Aquifers:

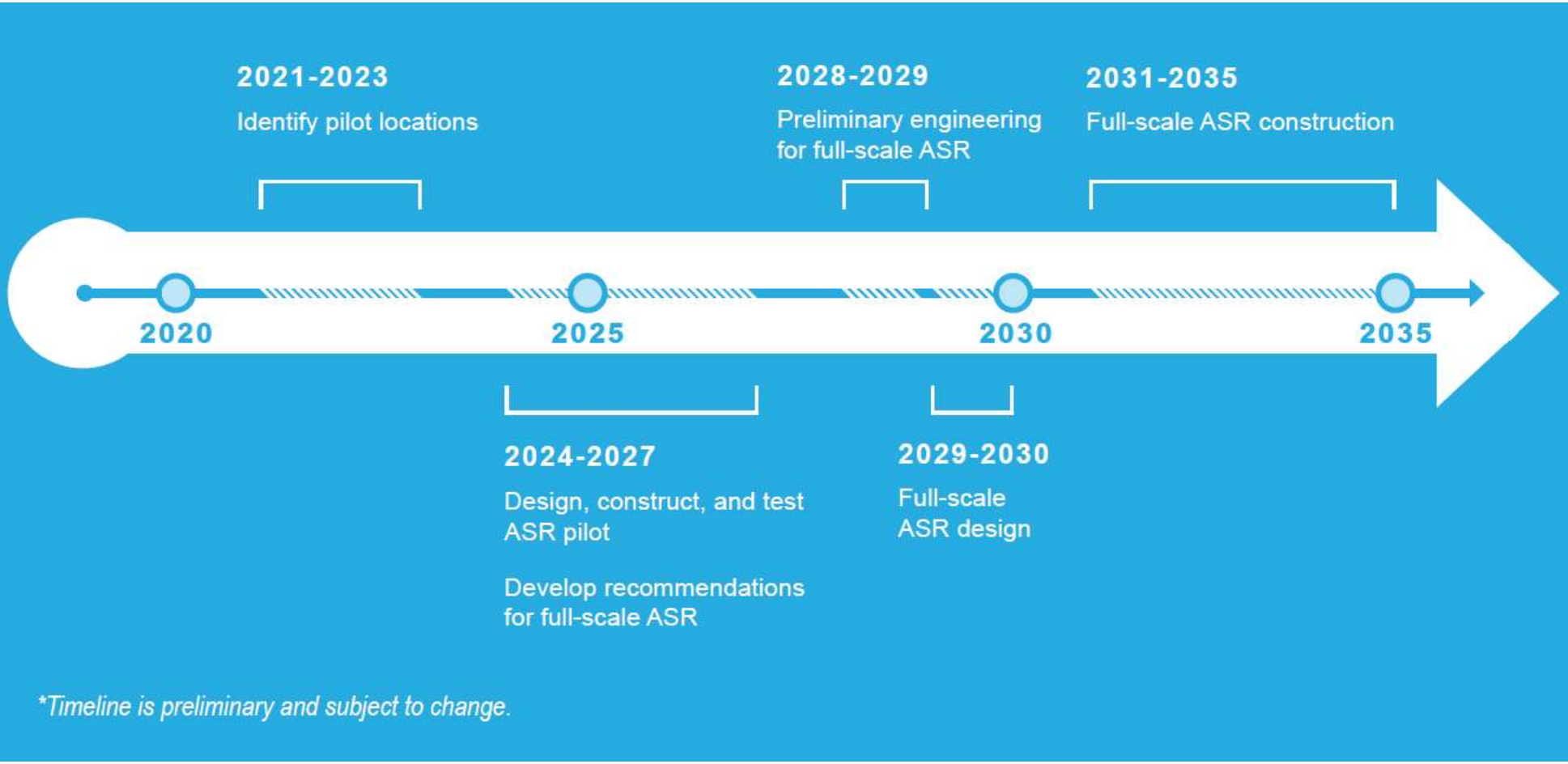
- BSEdwards
- Edwards
- Carrizo
- TrinityHC
- Trinity
- NGulfCoast



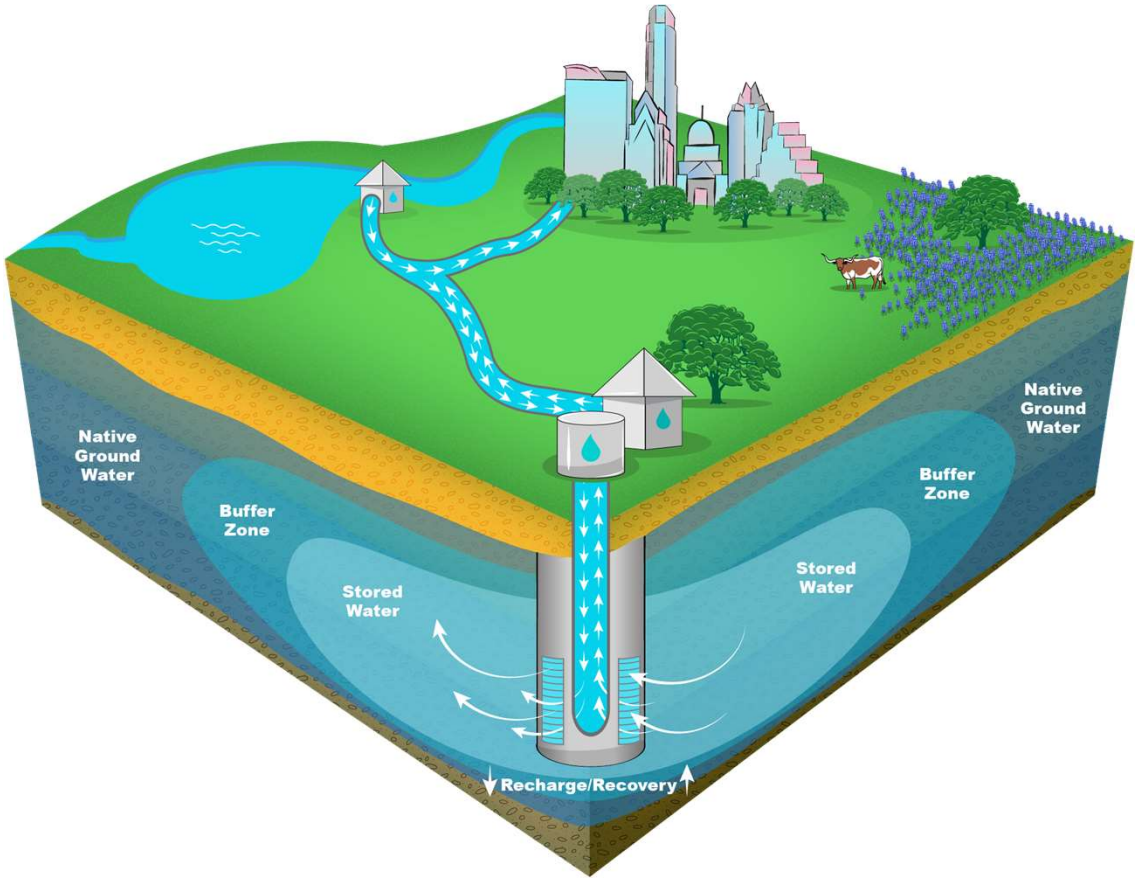
ASR phase 1a next steps

- Detailed spatial mapping of areas identified through screening to identify most favorable ASR wellfield areas
- Combine with results of integration point analysis to develop full project alternatives
- Trade-off analysis of project alternatives based on community input (begin spring 2022)

ASR project timeline



*Timeline is preliminary and subject to change.



Questions?

ASR resources:

https://www.speakupaustin.org/asr

https://www.austintexas.gov/ASR