

ASR Pilot and Program Management Project

Phase 1a Update

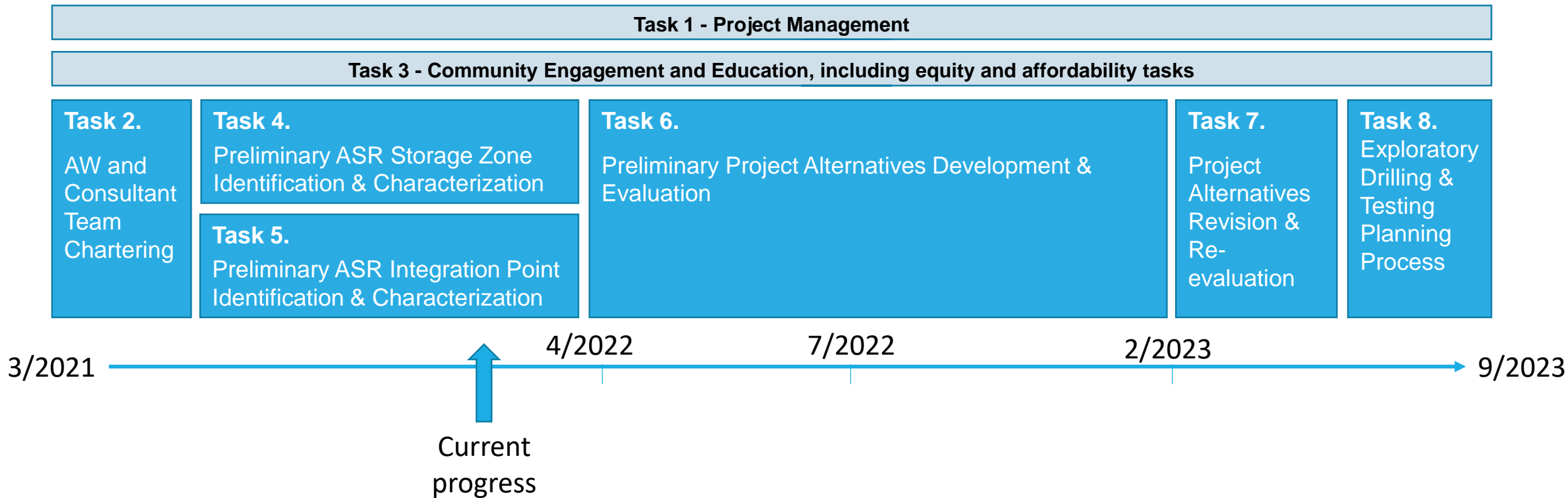
Water Forward Task Force Meeting



January 11, 2011

Overview of Phase 1a Project Approach

Approximate dates; not to scale; subject to change

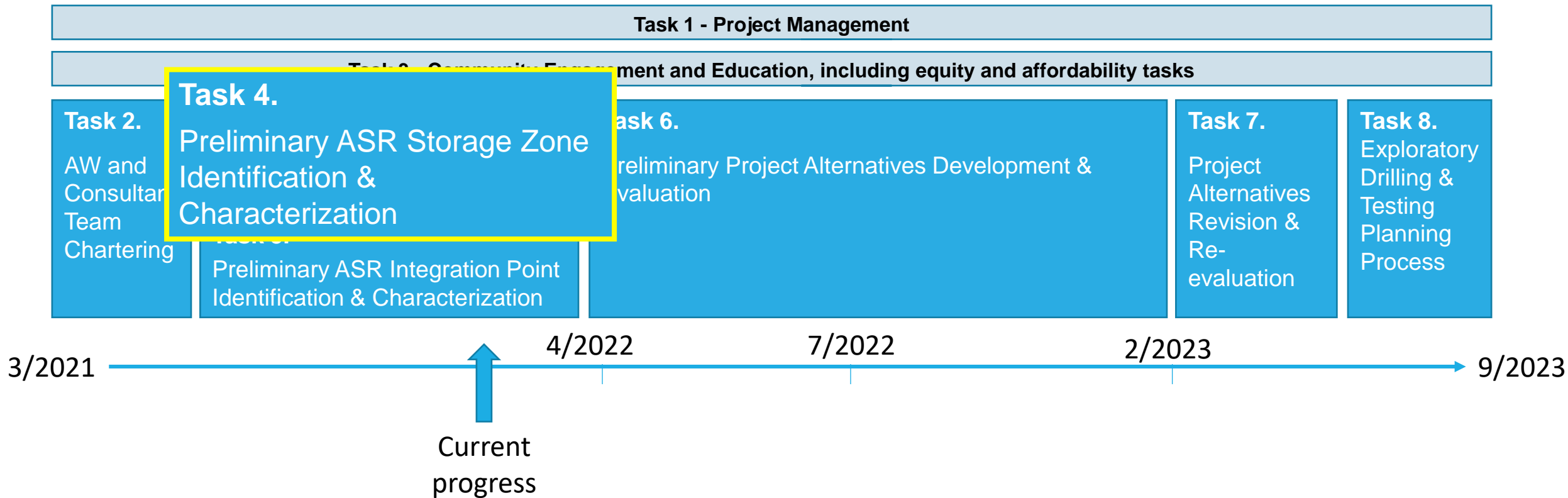


Aquifer Storage and Recovery video



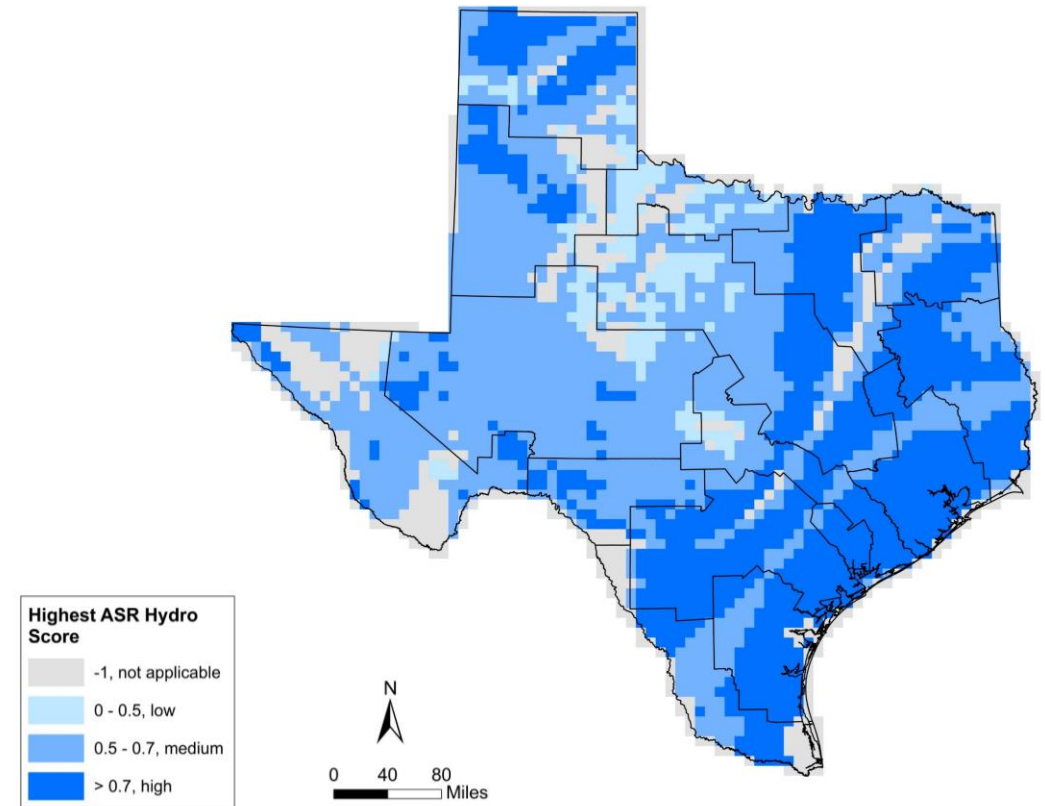
Overview of Phase 1a Project Approach

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

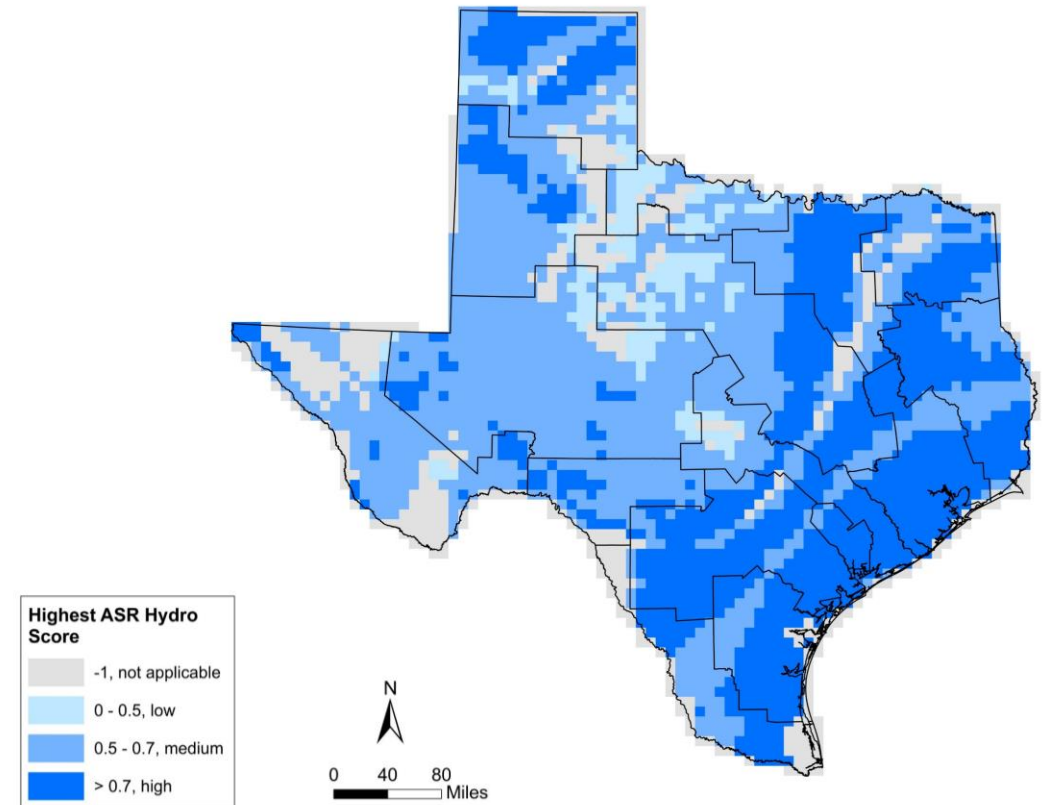


ASR Hydrogeological Parameter Scores, TWDB Statewide ASR/AR Assessment



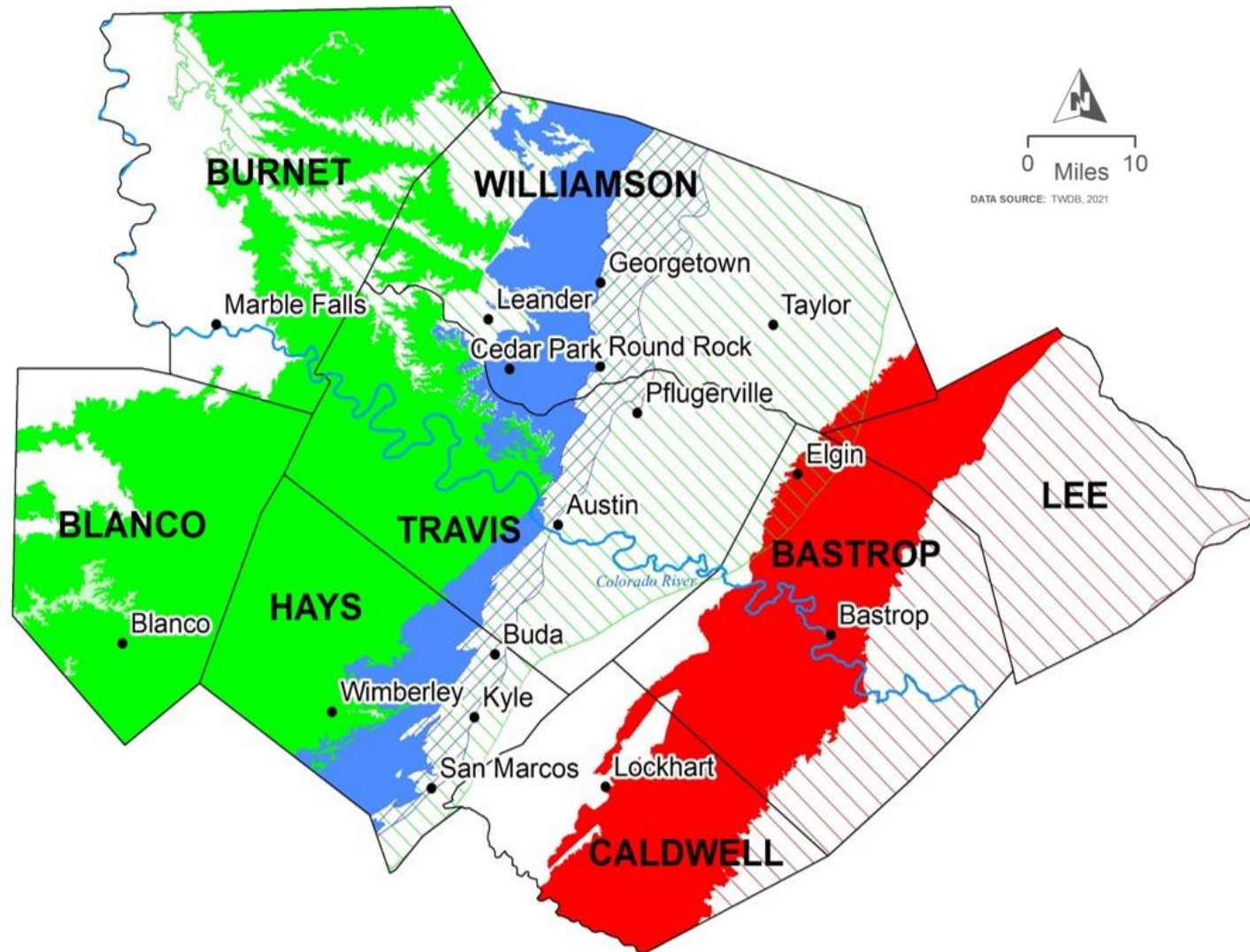
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ASR Hydrogeological Parameter Scores, TWDB Statewide ASR/AR Assessment



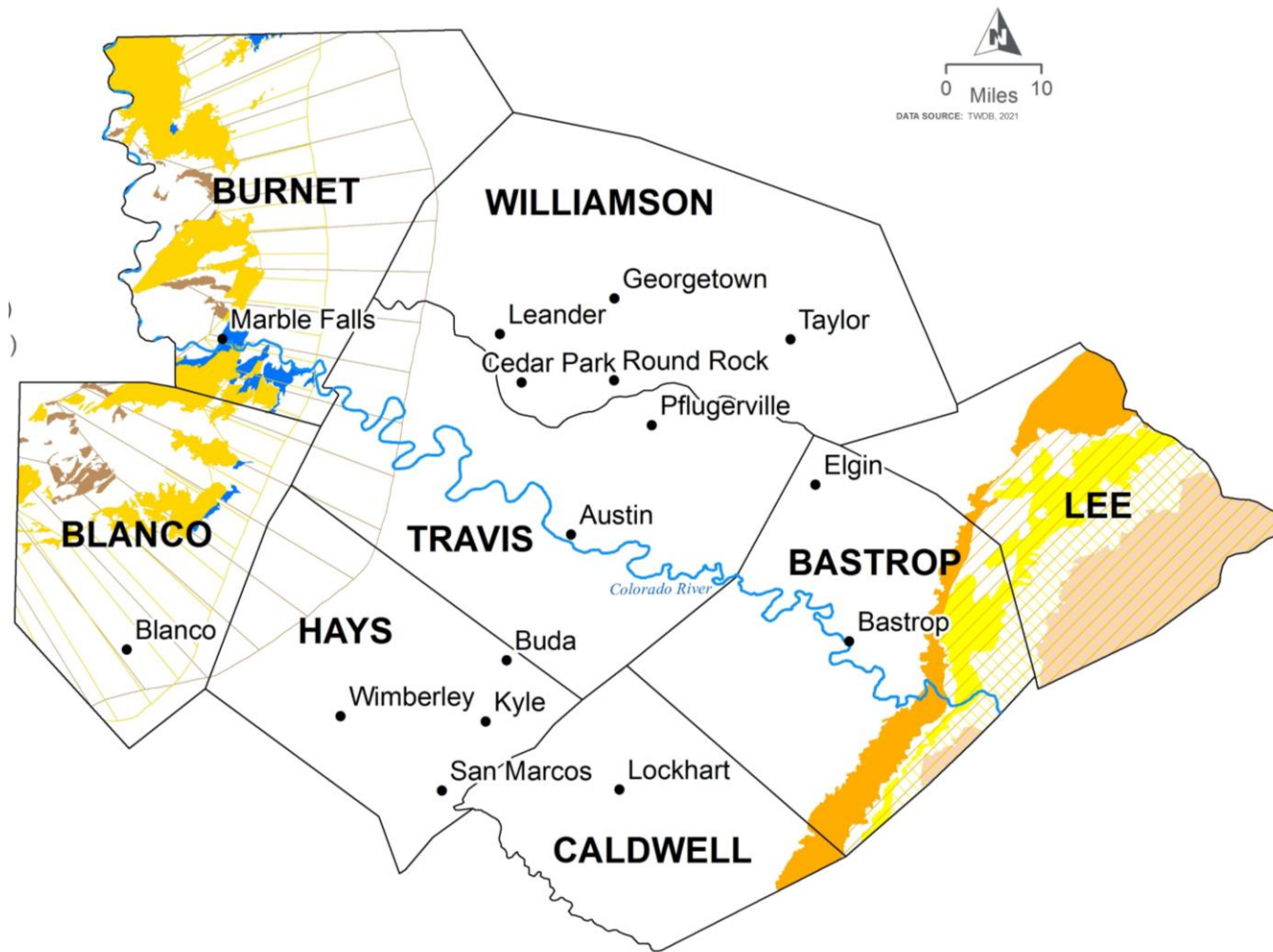


LEGEND

- Major Cities
- Rivers
- Carrizo - Wilcox (outcrop)
- ▨ Carrizo - Wilcox (subcrop)
- Edwards - Trinity Plateau (outcrop)
- ▨ Edwards BFZ (outcrop)
- ▨ Edwards BFZ (subcrop)
- Trinity (outcrop)
- ▨ Trinity (subcrop)

County/Aquifer Combinations for Initial Screening: Major Aquifers





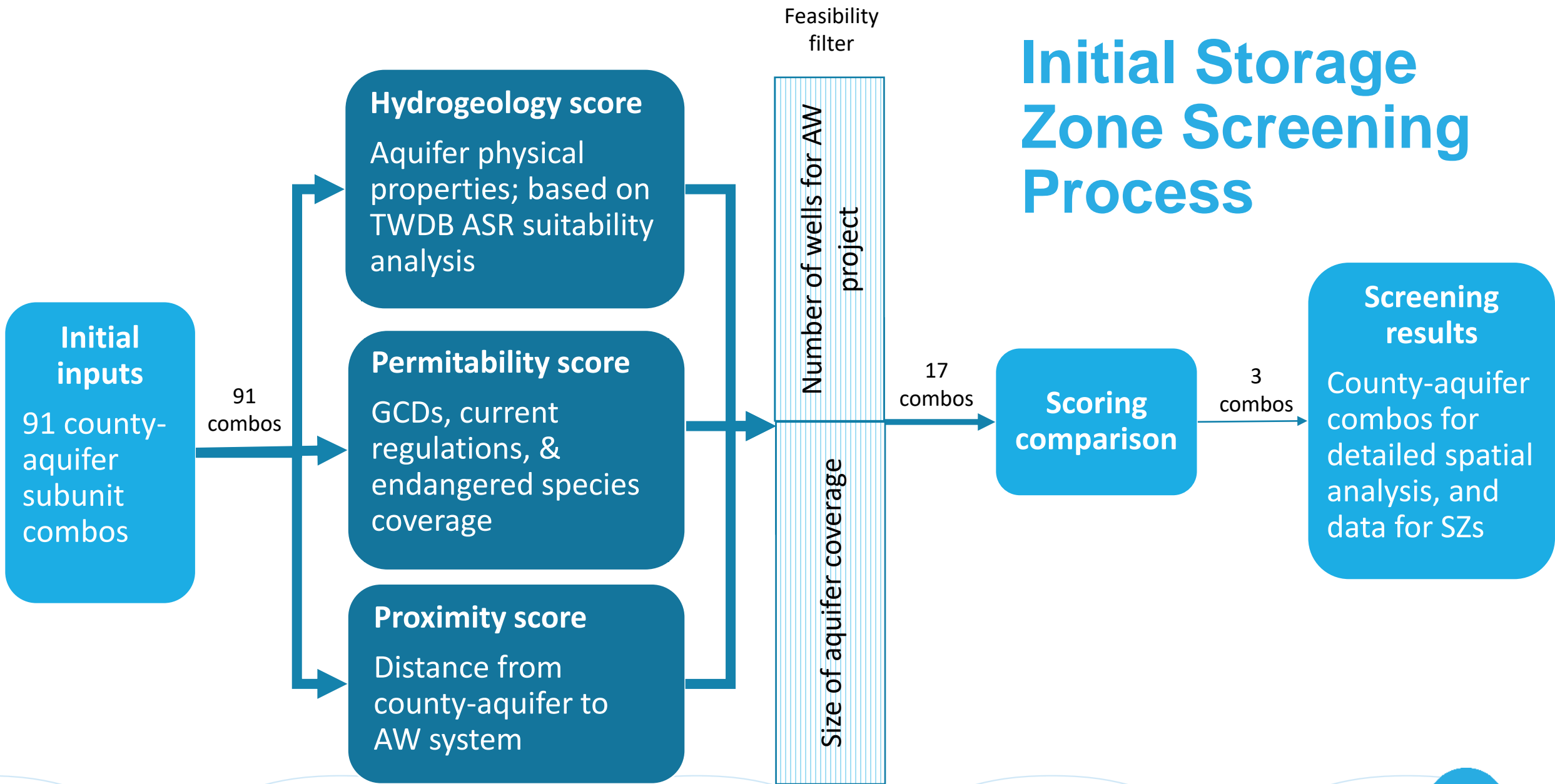
LEGEND

- 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%)



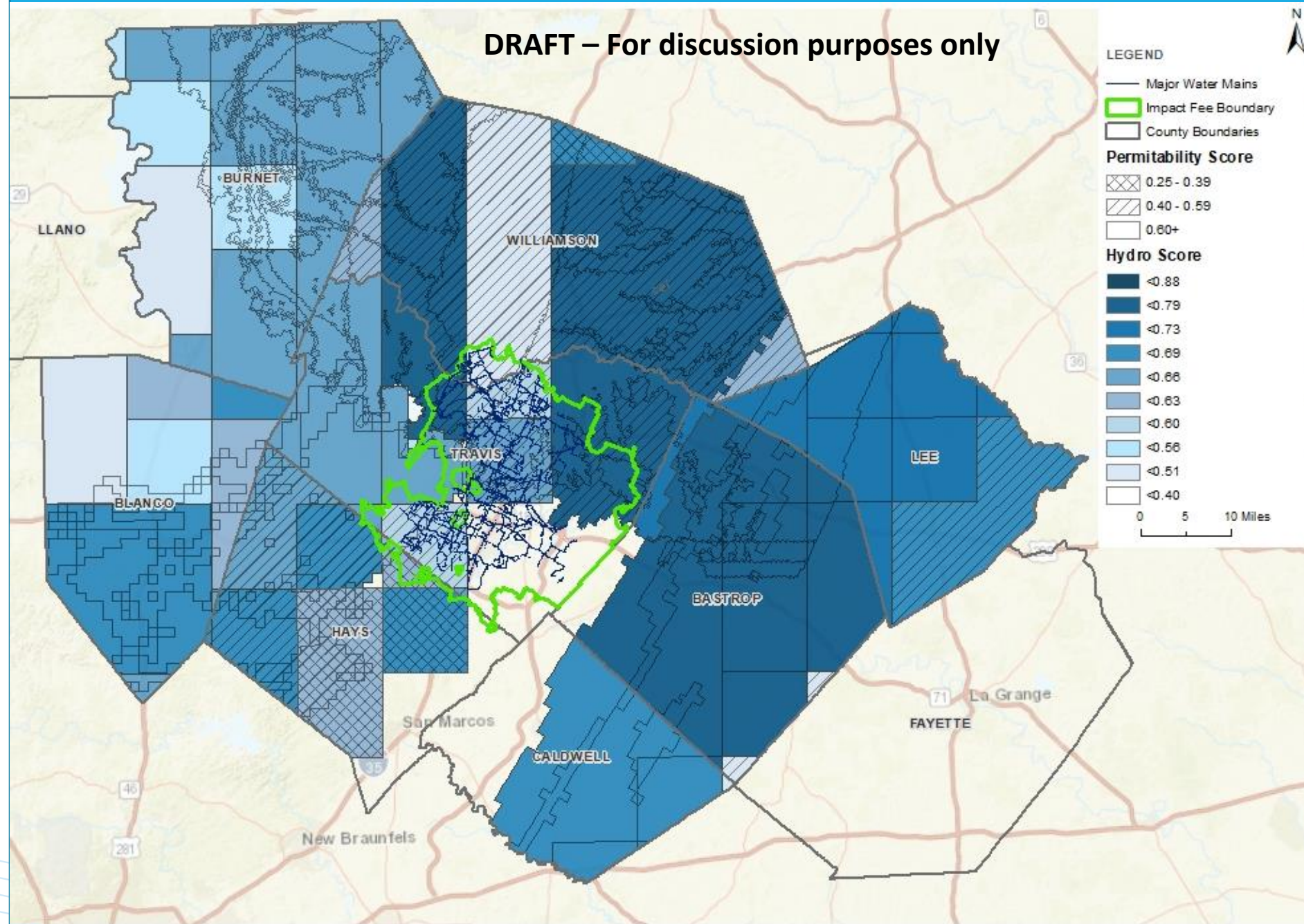
Proximity Indicator

- 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

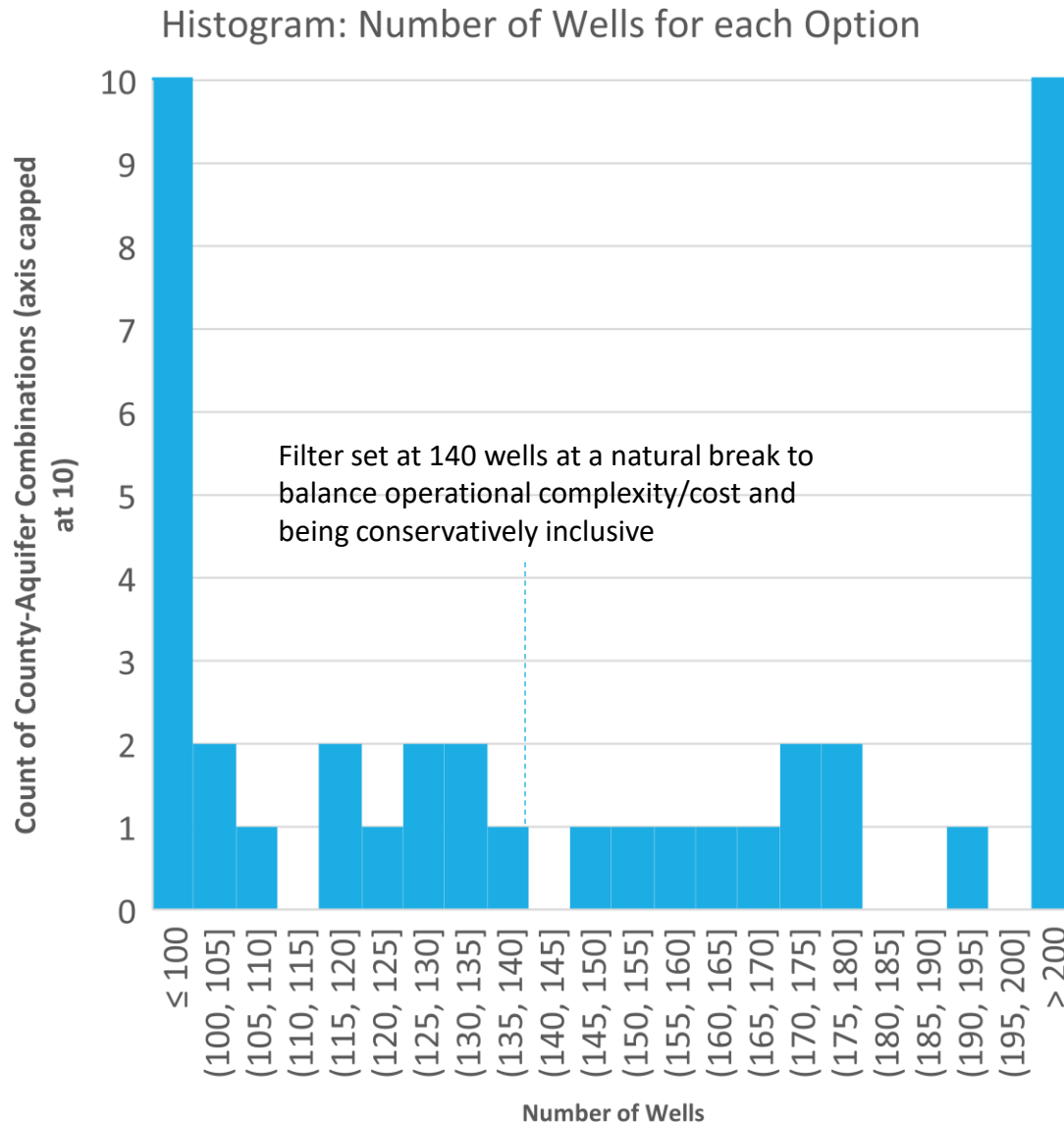


Initial screening inputs

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



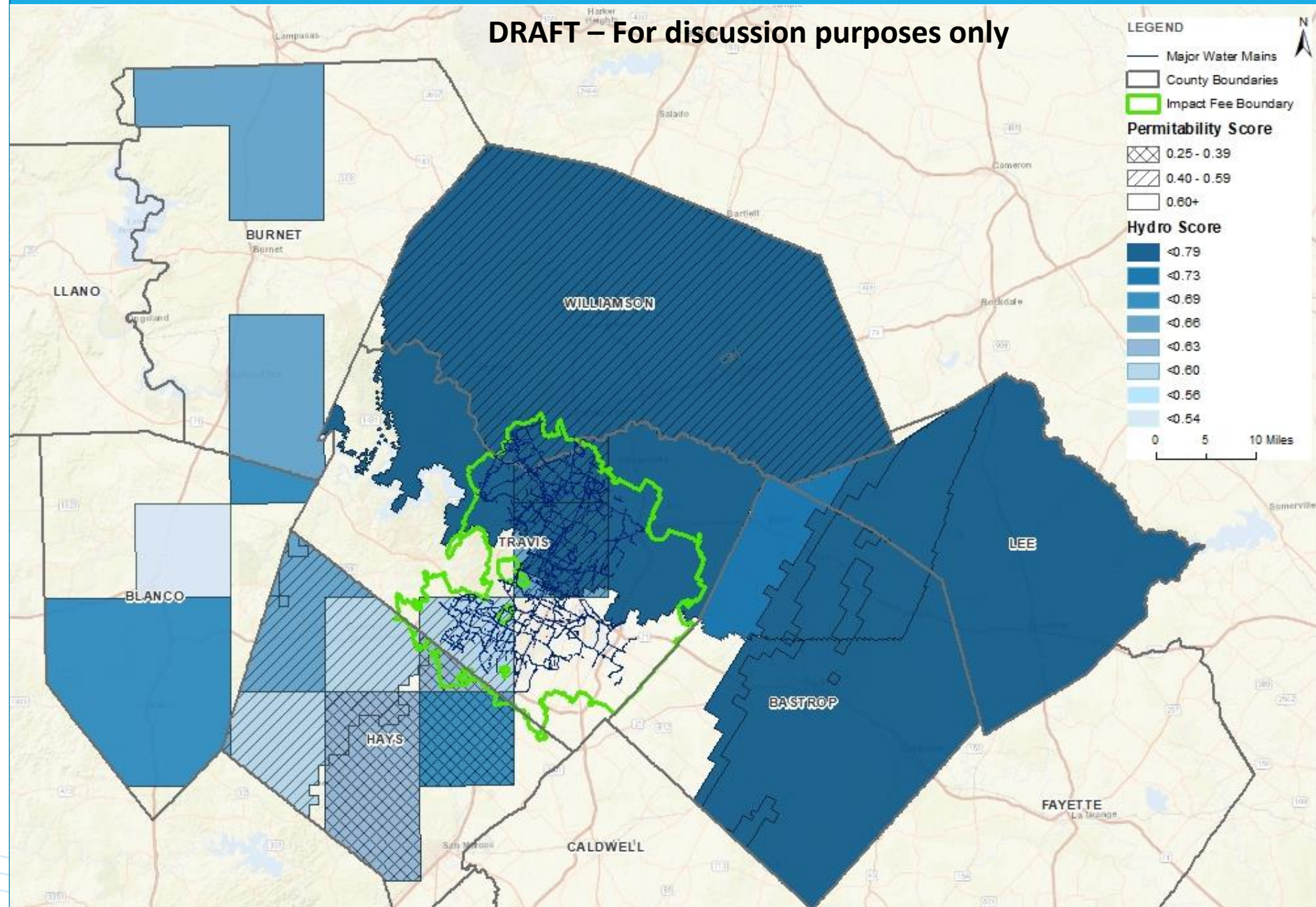
Feasibility filter: number of wells and space available



- 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

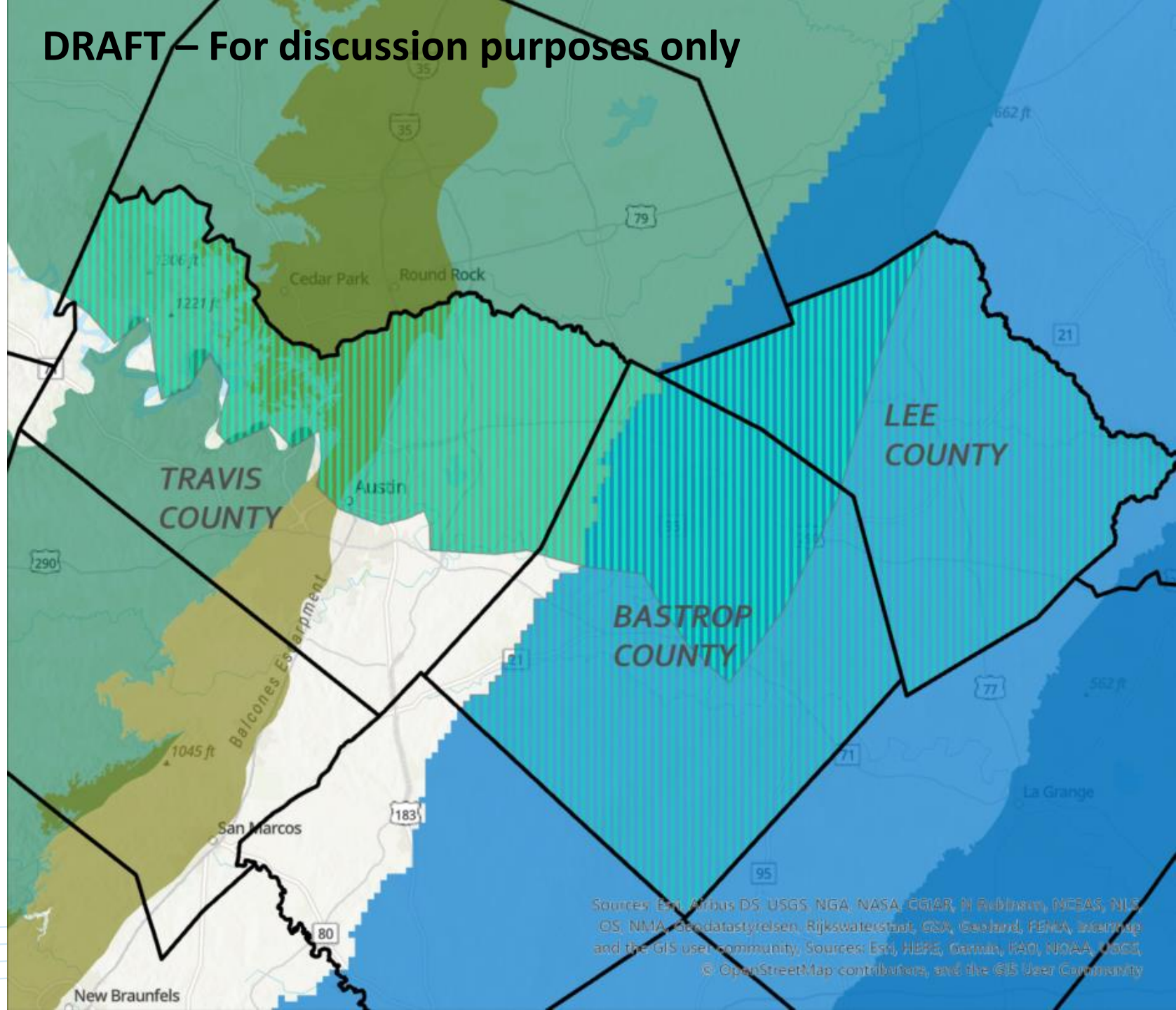
Legend:

- County_boundaries
- ScreeningResults

Major Aquifers:

- Carrizo
- TrinityHC
- Trinity
- GulfCoast
- Edwards

DRAFT – For discussion purposes only



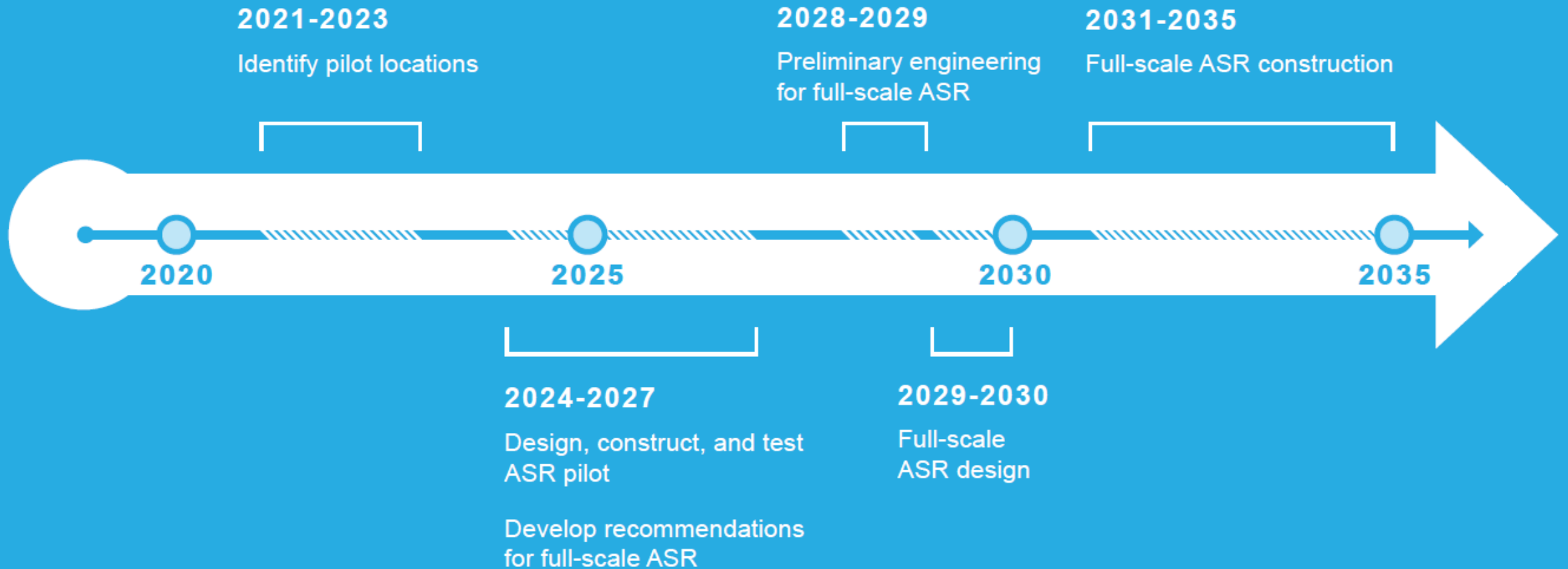
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N. Rubenstein, MESA, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community. Sources: Esri, HERE, Garmin, IAOI, NOAA, DeLorme, © OpenStreetMap contributors, and the GIS User Community

ASR phase 1a next steps

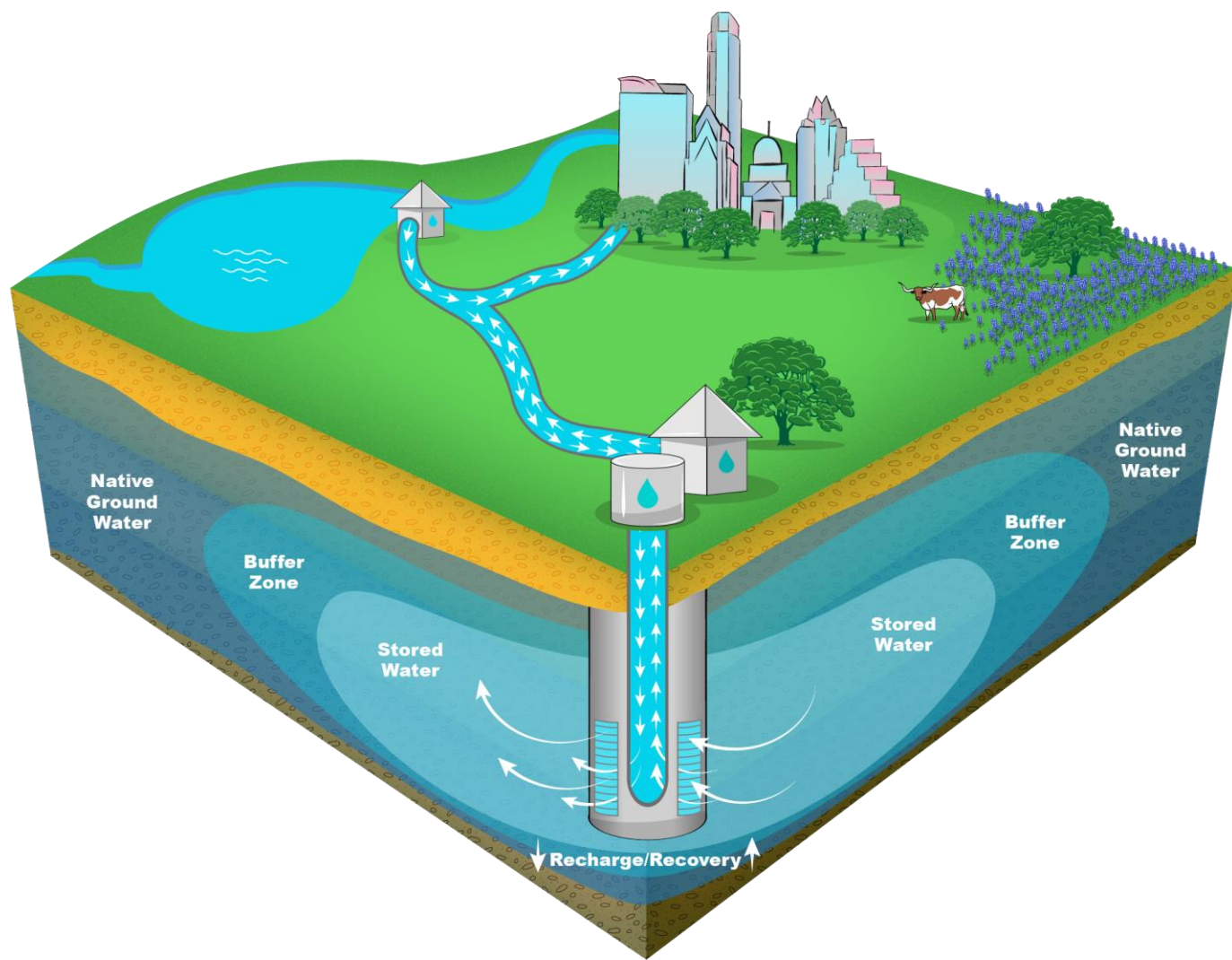
- Detailed spatial mapping of areas identified through screening to identify most favorable ASR wellfield areas
- Combine with results of integration point analysis to develop full project alternatives
- Trade-off analysis of project alternatives based on community input (begin spring 2022)



ASR project timeline



**Timeline is preliminary and subject to change.*



Questions?

ASR resources:

<https://www.speakupaustin.org/asr>

<https://www.austintexas.gov/ASR>

