Tulare County Carbon Storage Project DE-FE0032264

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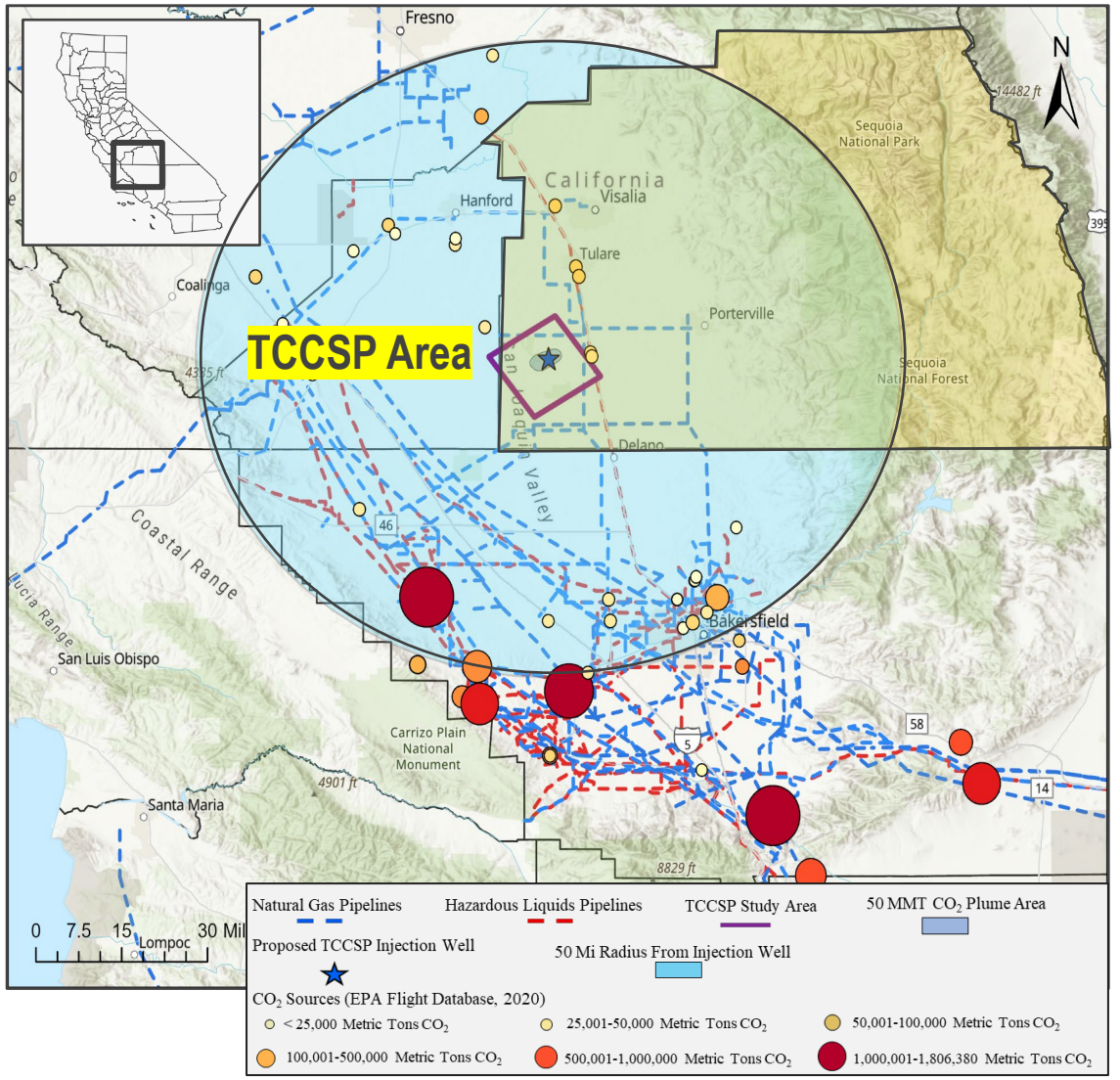
Presentation Outline

- Project Overview
- Project Background
- Technical Approach and Scope
- Summary of Community Benefits / Societal Considerations and Impacts
- Current Status of Project



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Project Overview

Key Phase II Project Participants

Sponsors

U.S. Department of Energy

NETL

Tulare County Carbon Storage Project

CALGREN Renewable Fuels

Advanced Resources International, Inc.

Nella Invest

Stanford University

SEEN SocioEnvironmental and Education Network

Dansk Investment Group, Inc.

Los Alamos National Laboratory

Visage Clean Energy Consulting

Project Advisors

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Dr. A. Duguid (ARI)
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Dr. S. Saltzer (Stanford)
Dr. A. Kovscek (Stanford)
Will Johnson (Visage)

Task 1: Project Management and Planning
Principal Investigator: Manoj Valluri (ARI)
Project Manger: Shawna Cyphers (ARI)

Task 2: Societal Considerations and Impacts Planning
Leader: Denise Hills (ARI)

Task 3: Stratigraphic Well Permitting
Leader: Manoj Valluri (ARI)

Task 4: Well Drilling and Data Acquisition
Leader: Andrew Duguid (ARI)

Task 5: Data Synthesis and Modeling
Leader: Zachary Cotter (ARI)

Task 6: Risk Assessment and Mitigation Planning
Leader: Andrew Duguid (ARI)

Task 7: Data Gathering and Permitting Plan
Leader: Manoj Valluri (ARI)

Task 8: Techno-Economic Assessment
Leader: Chuck Miller (Dansk)

Task 9: Environmental Justice
Leader: Tim Morillo (Calgren)

Task 10: Community and Stakeholder Engagement
Leader: Travis Lane (Calgren)

Project Overview

Project Objective

- Establish the technical, community, and economic foundation for a commercial-scale regional geologic storage complex for CO_2 captured from a diverse array of industrial facilities in the Central Valley of California.

CarbonSAFE Phase II Objectives

- Acquire site-specific characterization data to validate CO_2 storage capacity of reservoir units and the competency of confining layers in the region in order to develop a commercial-scale CO_2 storage hub.

- Assess technical, economic, and stakeholder considerations to accelerate commercial development while reducing future investment risk and supporting business decisions.

Project Overview

Period of Performance

- As proposed, period of performance is 24 months covered by a single budget period.
  - Total of nine tasks spread across two years
  - Estimated start: September 2023
  - Estimated end: September 2025

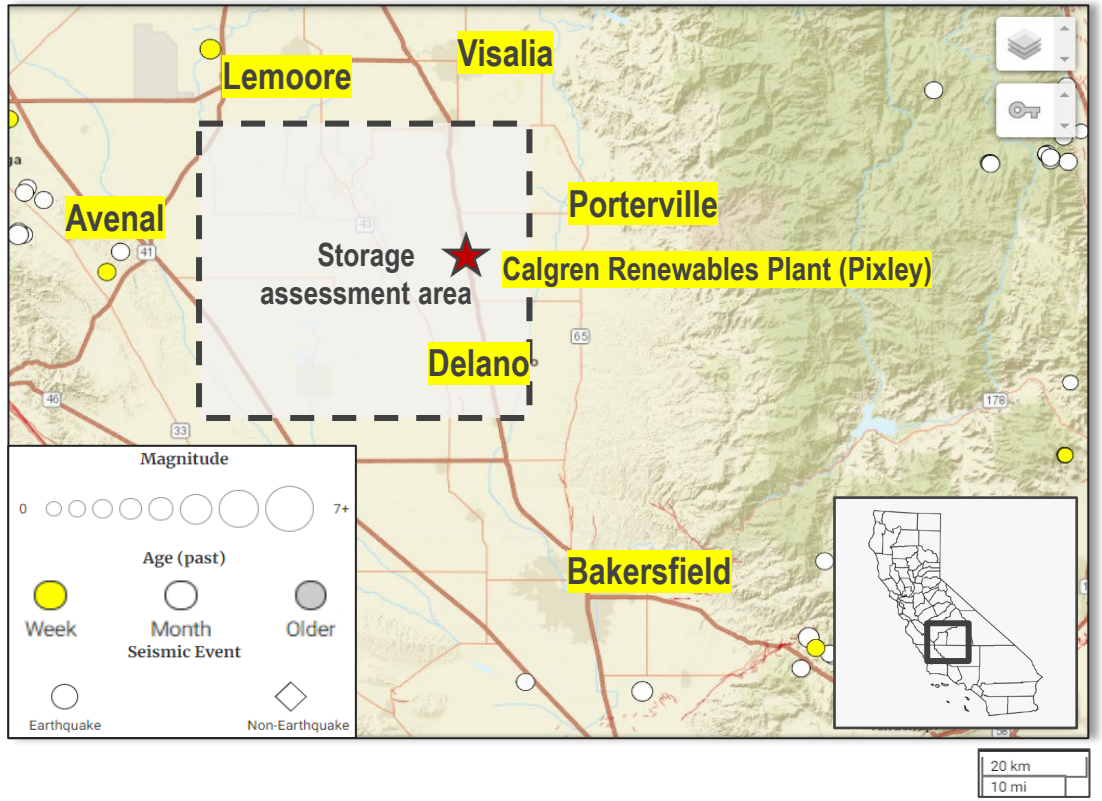
Funding Summary

- Total project value is $12,088,520.
  - DOE share is $9,312,293 (77% of total project value).
  - Cost share is $2,776,228 (23% of total project value).
  - Cost share is provided by Calgren Renewables through their partners Dansk Investment Group , Inc. and Nell Holdings, LLC.

Project Background

Project Potential and Readiness

- **Initial study estimates over 500 MMT of CO_2 storage in the project area.**
  - DOE/NETL's CO_2 SCREEN and reservoir simulations were conducted to evaluate prospective storage estimates and validate dynamic storage capacity/CO_2 injectivity.
- **Project location is ideal for developing CO_2 storage.**
  - Rural area covered with grasslands and dairy farms (NLCD)
  - Little to no risk of earthquakes, landslides, floods or liquefaction (per U.S. FEMA flood map)
  - Positive relationships with local landowners and agencies through previous infrastructure projects
  - Experience developing RNG infrastructure
- **There are abundant and diverse CO_2 sources within a 50-mile radius.**
  - Over 6MMTPA of CO_2 emissions from utilities, cement, dairy and food processing facilities
  - Over 500,000 TPA of CO_2 from local dairies and food processing facilities that are interested in reducing their GHG footprint



Seismic events map indicating few seismic events in and near the project storage area (USGS, 2022)

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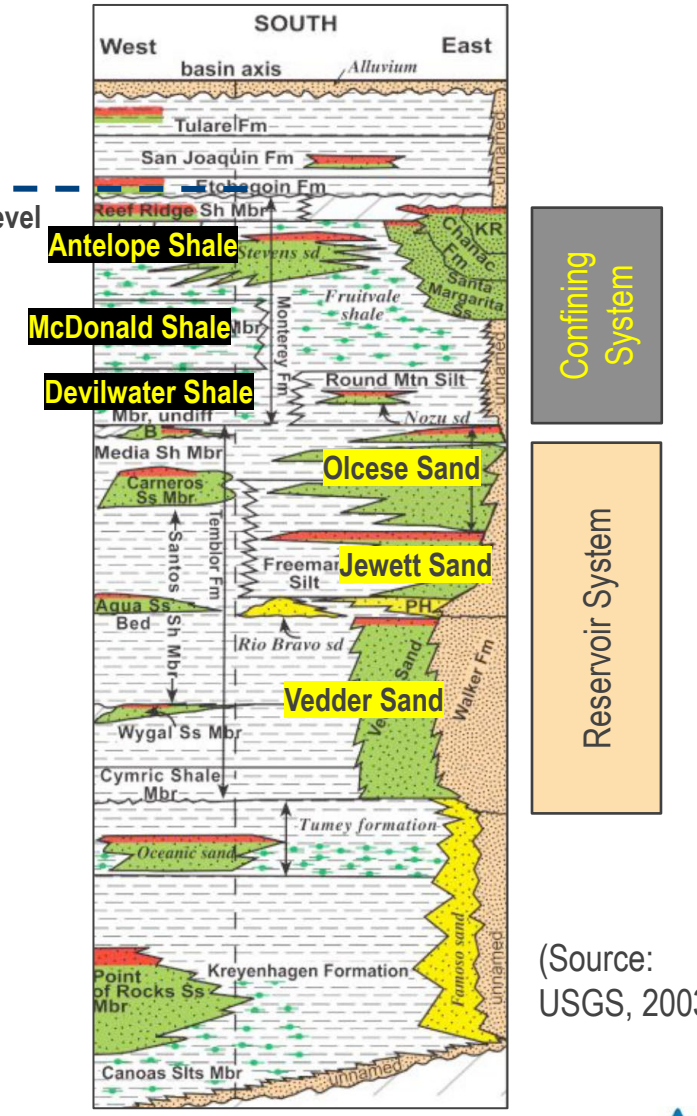
Project Background

Geologic Setting

- TCCSP is located on the eastern edge of margin of the San Joaquin Basin.

- Storage **reservoir system** is deeper than 4,000 feet in the project area.
  - ❑ Deep enough to maintain injected CO_2 in a supercritical phase.
  - ❑ Olcese, Jewett and Vedder sands form the reservoir system.
  - ❑ Characterized to exhibit moderate to high porosity (> 25%) and permeability (> 100mD).

- The proposed **confining system** is the Miocene-aged, lower-to-Middle members of the Monterey Formation
  - ❑ Key members include Devilwater-Gould, McDonald Shale, and Antelope Shale.
  - ❑ Caprock unit is laterally extensive across the study area, where it thickens to the west and south and thins eastward.
  - ❑ Shale members were found to exhibit extremely low porosity (<1%) and permeability (< 1mD).



(Source: USGS, 2003)

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Project Background

Calgren Renewables Plant, Pixley, CA [55MGPY]

- Deep focus on utilizing sustainable energy practices to lower carbon intensity (CI)
  - ❑ Plant is powered by an ultra low NOx co-gen gas turbine producing 5,800kW of electricity
  - ❑ Turbine exhaust is used to generate process steam
  - ❑ Dairy digester collects local dairy waste and converts it into methane for use in the co-gen turbine
  - ❑ Installed a first of its kind electric thermal energy storage (ETES) system on site to reduce fuel combustion needs

- Calgren is continually exploring ways to minimize carbon footprint and utility consumption
  - ❑ Plans for expanding CO_2 capture on site
  - ❑ Exploring partnership with other alternative energy sources such as H_2

(Source: Top – Calgren.com; Bottom – Rondo.com)

Project Background

Brief Project History

Q4 2021	Calgren/ARI started evaluating the feasibility of a CCS project near Calgren's Pixley plant.
Q1 2022	Geology near Pixley was found to be supportive of a commercial scale CO_2 storage project.
Q2 2022	Calgren/ARI started outreach with local leaders and key stakeholders; geologic modeling studies confirmed local CO_2 storage capacity.
Q3 2022	Calgren/ARI assembled the TCCSP project team and responded to DE-FOA-0002610 (AOI 1).
Q4 2022	Calgren/ARI continued refining geologic models and engaging local stakeholders.
Q1 2023	DOE/NETL notified ARI of selection for award for CarbonSAFE Phase II project; contract negotiations started.

Project Background

Project's Importance Towards Advancing DOE's Program Goals

- **Reduce project risks and costs for future projects**
  - Technical risks: Pair current site knowledge with advanced data and modeling to evaluate overall project risks
  - Logistical risks: Engage key stakeholders early in the process to gather feedback and secure their acceptance.
  - Financial risks: Secure investor support through technical data and logistical support generated during the project.

- **Storage Resources into Commercial Classifications that Support Business and Financial Decisions**
  - Discovery status: Confirm pore space is accessible and injectable through testing and characterization.
  - Commerciality: Accelerate path to commercialization through implementation planning (timeline, budgets, regulatory)
  - Project maturity: Advance project for future phases by addressing technical risks while gaining stakeholder acceptance

- **Encourage Rapid Growth of a Vibrant, Geographically Widespread Industry for CCS**
  - Promote CCS and the opportunity it presents to low-income communities in the Central Valley of CA
  - Explore untapped CO_2 capture potential in the dairy and food processing industry
  - Accelerating post-combustion capture at power plants and process industries

Technical Approach & Scope

High-Level Execution Plan

Task	Lead	Objective
1. Project Management	ARI	Overall project and data management, reporting, tech transfer
2. Community Benefits Plan	ARI	Track, document and report project efforts on DEIA, CSE, quality jobs, and EJ
3. National Environmental Protection Act	ARI	Support DOE/NETL in NEPA assessments
4. Well Drilling and Data Acquisition	ARI	• Permit and drill stratigraphic test well • Acquire and analyze seismic, log, core, and well test data • Develop models to assess geomechanical risks of CO_2 injection on site (Stanford)
5. Data Synthesis and Modeling	ARI	Develop computational models for area of review determination
6. Risk Assessment and Mitigation Planning	ARI	• Define, rate, and plan to mitigate key subsurface risks (Stanford, LANL) • Develop a preliminary CO_2 Management Plan
7. Data Gathering and Permitting Plan	ARI	• Define data gaps and path to obtaining a UIC Class VI Permit to Construct • Develop a preliminary Project Implementation Plan
8. Techno-Economic Assessment	Dansk	• Assess CO_2 supply and transport for most likely project/hub scenario • Pipeline pre-FEED based on most likely project development scenario
9. Environmental Justice Planning	Calgren	Define a framework to integrate J40 principles into Project Implementation Plan
10. Community and Stakeholder Engagement	Calgren	Periodically engage project stakeholders to gather feedback on project findings

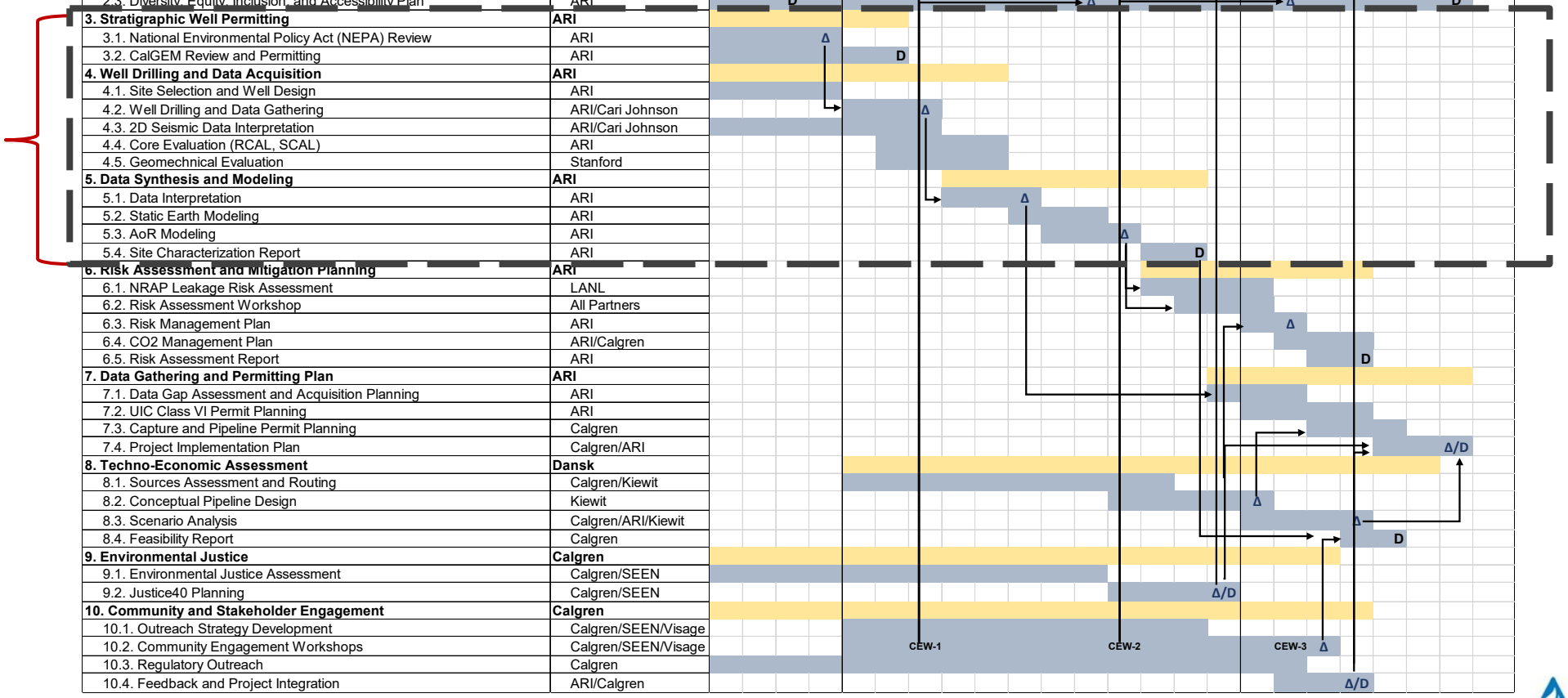
Technical Approach & Scope

Project Schedule

Critical path items

- ❑ Well Permitting
- ❑ Data Acquisition and Processing
- ❑ AoR Modeling

Budget Period	Task/Subtask Lead	BP1																							
Task	Team Member	2023				2024												2025							
		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Project Management	**ARI**																								
1.1. Project Management Plan	ARI	D																							
1.2. Data Management Plan	ARI																								
1.3. Reporting and Tech Transfer	ARI																								
2. Community Benefits Plan	**ARI**																								
2.1. Justice40 Plan	ARI			D								Δ												D	
2.2. Community and Stakeholder Engagement Plan	ARI			D								Δ												D	
2.3. Diversity, Equity, Inclusion, and Accessibility Plan	ARI			D								Δ												D	
3. Stratigraphic Well Permitting	**ARI**																								
3.1. National Environmental Policy Act (NEPA) Review	ARI				Δ																				
3.2. CalGEM Review and Permitting	ARI					D																			
4. Well Drilling and Data Acquisition	**ARI**																								
4.1. Site Selection and Well Design	ARI																								
4.2. Well Drilling and Data Gathering	ARI/Cari Johnson						Δ																		
4.3. 2D Seismic Data Interpretation	ARI/Cari Johnson										Δ														
4.4. Core Evaluation (RCAL, SCAL)	ARI												Δ												
4.5. Geomechnical Evaluation	Stanford													Δ											
5. Data Synthesis and Modeling	**ARI**																D								
5.1. Data Interpretation	ARI																								
5.2. Static Earth Modeling	ARI																								
5.3. AoR Modeling	ARI																								
5.4. Site Characterization Report	ARI																								
6. Risk Assessment and Mitigation Planning	**ARI**																								
6.1. NRAP Leakage Risk Assessment	LANL																								
6.2. Risk Assessment Workshop	All Partners																								
6.3. Risk Management Plan	ARI																								
6.4. CO2 Management Plan	ARI/Calgren																								
6.5. Risk Assessment Report	ARI																								
7. Data Gathering and Permitting Plan	**ARI**																								
7.1. Data Gap Assessment and Acquisition Planning	ARI																								
7.2. UIC Class VI Permit Planning	ARI																								
7.3. Capture and Pipeline Permit Planning	Calgren																								
7.4. Project Implementation Plan	Calgren/ARI																								
8. Techno-Economic Assessment	**Dansk**																								
8.1. Sources Assessment and Routing	Calgren/Kiewit																								
8.2. Conceptual Pipeline Design	Kiewit																								
8.3. Scenario Analysis	Calgren/ARI/Kiewit																								
8.4. Feasibility Report	Calgren																								
9. Environmental Justice	**Calgren**																								
9.1. Environmental Justice Assessment	Calgren/SEEN																								
9.2. Justice40 Planning	Calgren/SEEN																								
10. Community and Stakeholder Engagement	**Calgren**																								
10.1. Outreach Strategy Development	Calgren/SEEN/Visage																								
10.2. Community Engagement Workshops	Calgren/SEEN/Visage																								
10.3. Regulatory Outreach	Calgren																								
10.4. Feedback and Project Integration	ARI/Calgren																								



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Technical Approach & Scope

Project Milestones

Task	Milestone	Completion	Verification Method
2	Incorporation of project data and preliminary stakeholder feedback into CBP complete	August 2024	Mid-Project CBP Update
2	CBP summary action items complete	February 2025	End of Project CBP Update
3	Required approvals for well drilling obtained	December 2023	Submittal of Well Drilling Permits
4	Characterization well data collection complete	June 2024	Submittal of Well Drilling Report
5	Project area of review modeling complete	September 2024	Submittal of Site Characterization Report
6	Assessment and mitigation of project risks complete	February 2025	Submittal of Risk Assessment Report
7	Project resources, permitting, and schedule planning complete	July 2025	Submittal of Project Implementation Plan
8	Assessment of project implementation options complete	April 2025	Submittal of Project Feasibility Report
9	Environmental justice assessment update complete	December 2024	Submittal of Updated CBP/J40 Plan
10	Implementation of community and stakeholder outreach complete	April 2025	Submittal of CEW summaries and Updated CBP Plan

Technical Approach & Scope

Project Success Criteria

- TCCSP success criteria were identified to outline specific metrics to advance the project from a Phase II to a Phase III CarbonSAFE initiative.

- The Phase II project would be deemed a success if:
  - Relevant site characterization data is gathered and supports a commercial-scale CO_2 storage feasibility and risk assessment.
  - A most likely scenario for connecting the capture and storage locations is developed.
  - There is ample participation and actionable feedback from local landowners, community leaders, and disadvantaged communities

Technical Approach & Scope

Key Project Risks/Mitigation Steps

- Well permitting can take much longer than anticipated; impacts overall project implementation timeline
  - ❑ Engage local and state regulators (EPA, CalGEM) early in the process and even before the award if necessary to inform of project plans.
  - ❑ Submit comprehensive permit applications to minimize data requests.

- Well drilling EPC issues can drag project timeline
  - ❑ Develop a detailed drilling prognosis prior to permitting
  - ❑ Engage vendors early in the drilling design process
  - ❑ Drill well on paper to mitigate local drilling hazards as best as possible

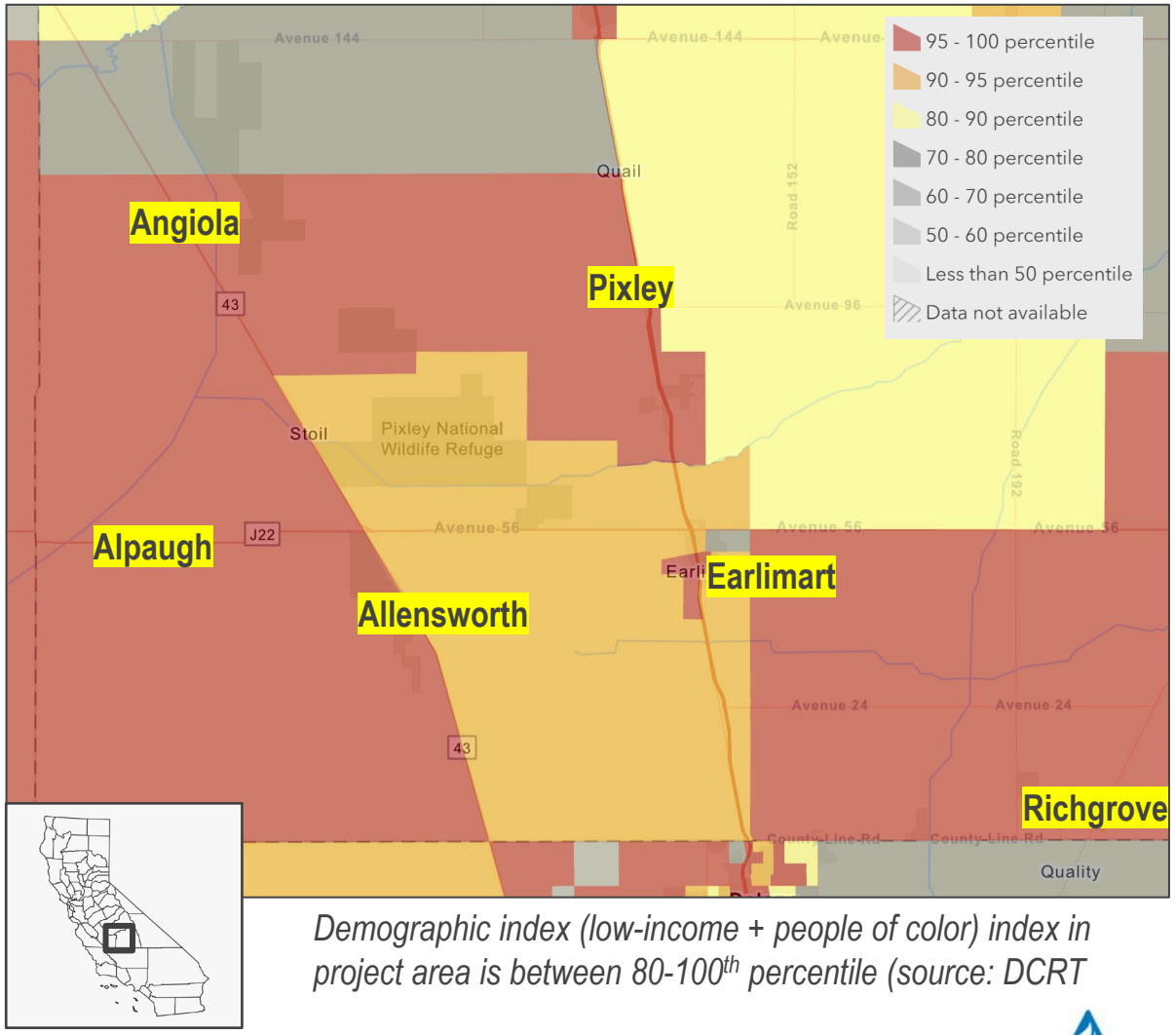
- Stakeholder outreach may be tougher than anticipated
  - ❑ Begin outreach early in the project with a local CBP partner
  - ❑ Engage local leaders and stakeholders to develop a tailored outreach program
  - ❑ Understand **what the communities need** versus **what the project can offer**

Community Benefits Planning

Tulare County's Socio-Economic and Environmental Assessment

- In Tulare County, 22% of the population live below poverty line
  - ❑ Nearly 27% around Pixley

- Per OEID's Disadvantaged Communities Reported Tool (DCRT), Tulare County ranks:
  - ❑ 90th percentile for most mobile homes
  - ❑ 94th percentile for most low-income population
  - ❑ 95th percentile for high transportation costs
  - ❑ 96th percentile for high unemployment rates
  - ❑ 98th percentile for little to no job access
  - ❑ 100th percentile for population with no high school education



Demographic index (low-income + people of color) index in project area is between 80-100th percentile (source: DCRT

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Community Benefits Planning

Highlights of Phase II Strategy

- Community and Labor Engagement
  - ❑ Implement focused Community Engagement Workshops (CEWs) periodically during the project that share project information and shape/evolve the project's CBP strategy
- Investing in Quality Jobs and Skilled Workforce
  - ❑ Integrate workers into project design the HSE process
  - ❑ Collectively explore owner/worker agreements that serve mutual interests of workers and project developers
- Diversity, Equity, Inclusion, and Accessibility
  - ❑ Explore partnerships with local Minority Business Enterprises (MBEs), woman owned business and veteran owned businesses
  - ❑ Develop apprenticeship programs for students from local Minority Serving Institutions to learn from experienced staff
- Environmental Justice
  - ❑ Develop a framework to quantify benefits and disbenefits
  - ❑ Engage local DACs in Richgrove, Porterville and Tule River Tribe

SEEN

UCMERCED

COUNTY OF TULARE CALIFORNIA

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Current Status

- Currently involved in finalizing award details with DOE
- Engaging local regulators and stakeholders for well permitting
- Calgren hosted ARI, SEEN, and UC Merced for a tour of their Pixley biofuel facility
  - Project team started designing an outreach strategy for the Phase II project

Acknowledgements

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