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PRRC Carbon Storage Research Program

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NMT Research Symposium
March 1, 2024

DOE Funded Projects- PRRC REACT Research Group

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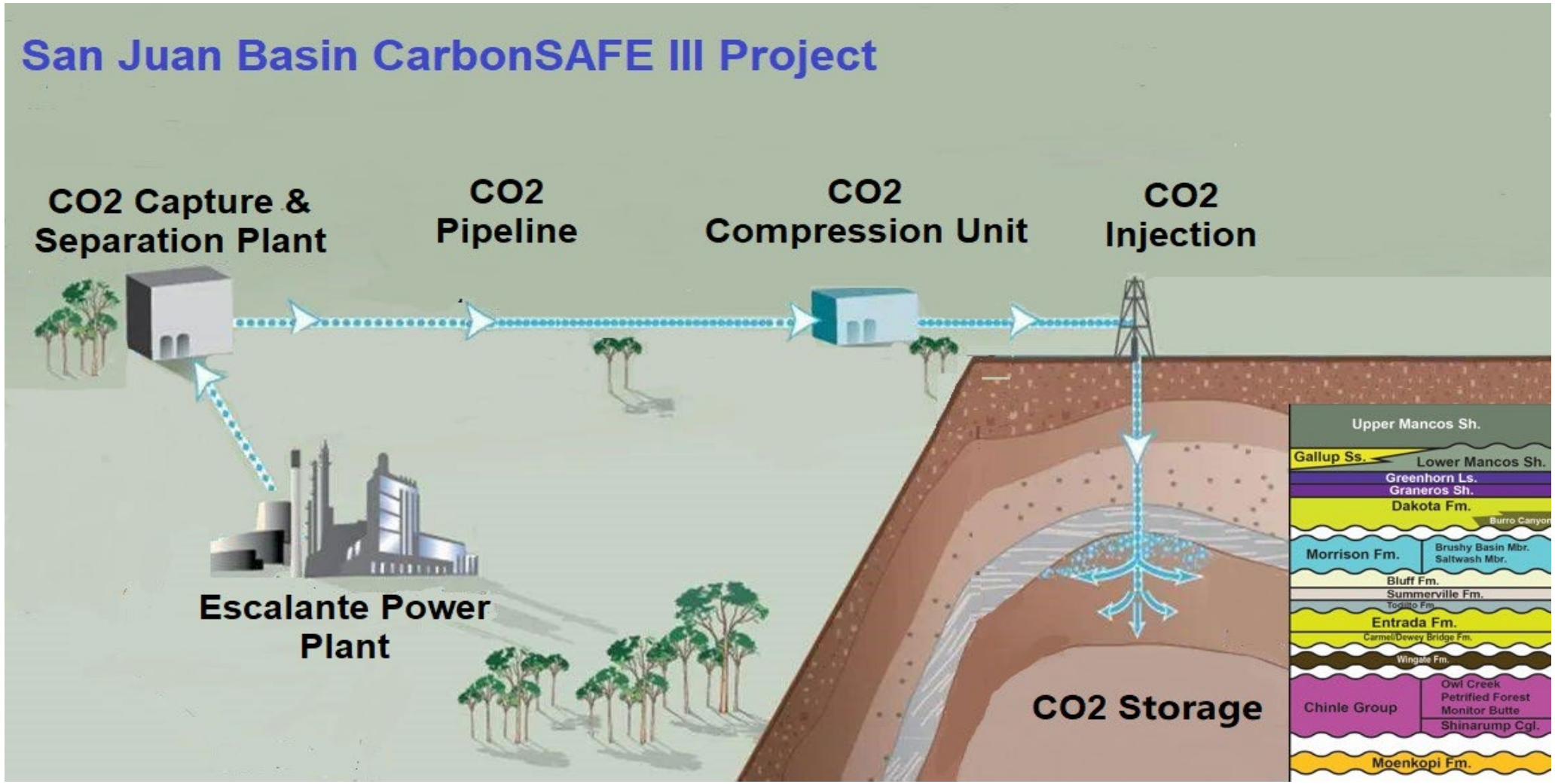
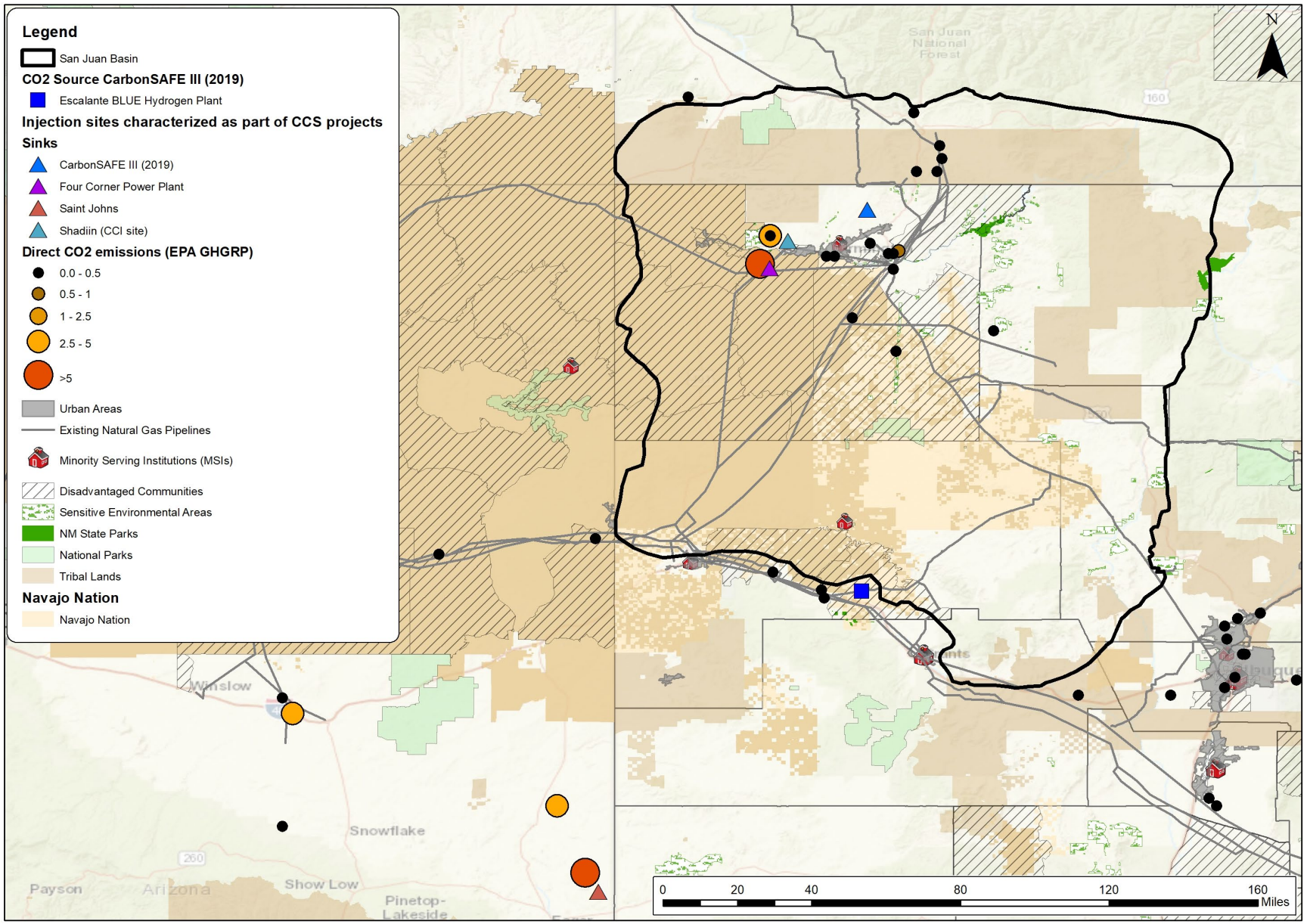
- San Juan CarbonSAFE Phase III Project – [$28 Million]
- San Juan Basin Fault Characterization Project – [$ 1.5 Million]
- Subsurface Stress Characterization Project – [$ 2 Million]
- Basalt CO_2 Storage in NM – [$1.2 Million]
- Southwest Regional Partnership for CO_2 Sequestration [SWP] – [$106 Million]
- Carbon Utilization Storage Projects [CUSP-Western US] – [>$17 Million]
- Utah CarbonSAFE Phase II - [$320,000]
- Four Corners Regional Initiative Project – [$3.1 Million] ~ Starts in Spring 2024
- Four Corners Carbon Storage Hub – [$52 Million] ~ Starts in Spring 2024
- Permian Carbon Storage Hub – [$5 Million] ~ Starts in Spring 2024
- Four Corners Integrated Storage Project – [$1.3 Million] ~ Starts in Spring 2024
- Southwest Regional Direct Air Capture Hub– [$2.5 Million] ~ Starts in Spring 2024
- Hydrogen Subsurface Engineering Solutions – [1.2 Million] ~ Starts in Summer 2024

Overview of Carbon Storage



Overview: PRRC-NMT Carbon Storage Program



- SJB CarbonSAFE Phase III project
- Four Corners Carbon Storage Hub
- Four Corners Power Plant Integrated CCS Project
- Southwest DAC Hub
- Four Corners Regional Initiative

SJB CarbonSAFE Project

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Key Project Facts

- Funding: $28 Million Project
- Perform Site Characterization of storage complex within San Juan Basin
- Source CO2 from Escalante H2 plant, located in Prewitt, NM, USA.
- Initial UIC Class VI permit submitted in 2023
- Community and stakeholder outreach on CCS technology and its benefits

Characterization Plan

- Drilled characterization well, perform injectivity tests
- Recovered ~ 450 ft of Core, sampled drilling cuttings, advanced log suites measurements
- Perform suites of laboratory experiments and numerical models
- Purchased 100 sq.miles 3D seismic, acquire 3D VSP,
- Installed DAS/DTS/DSS Optical fiber behind casing

Fault Characterization Project

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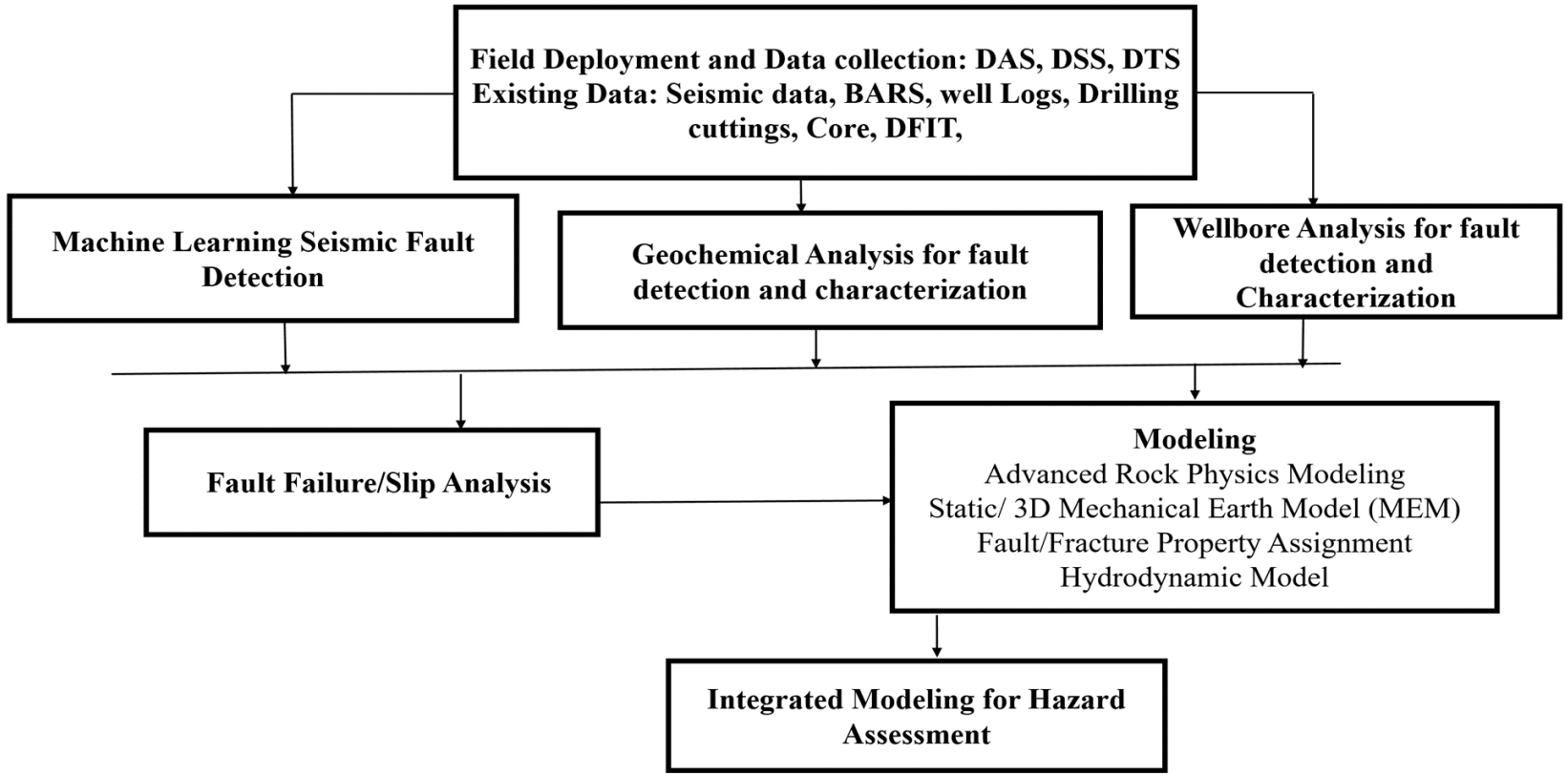
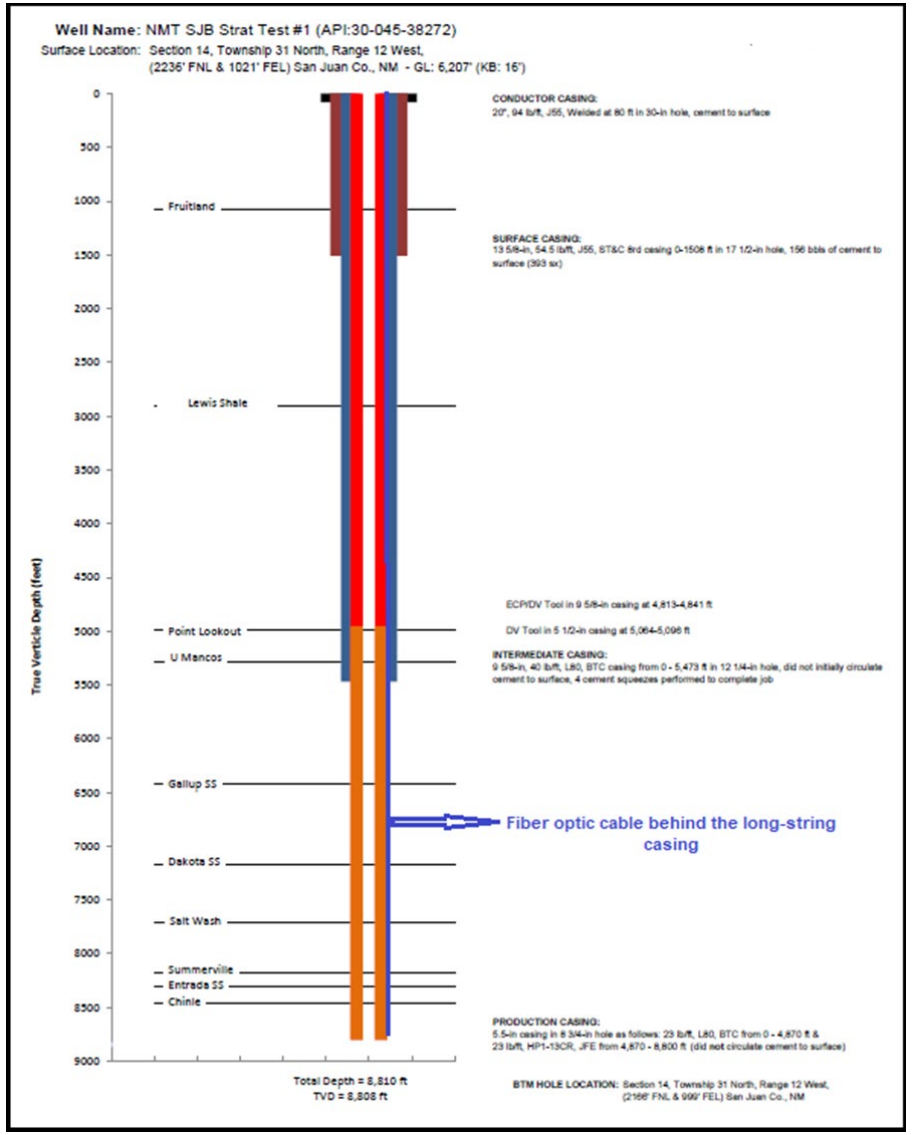
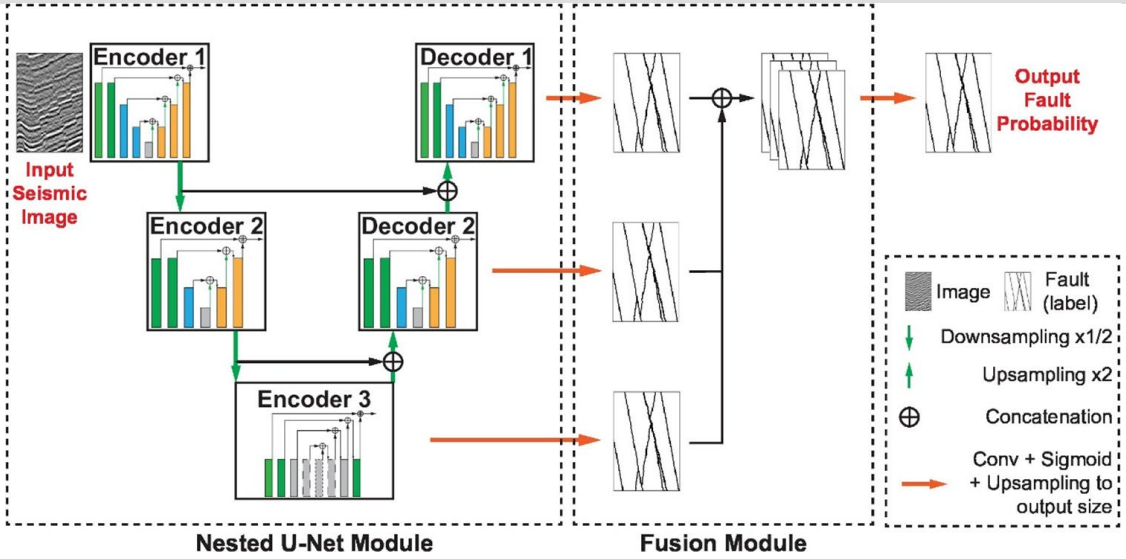
Project workflow

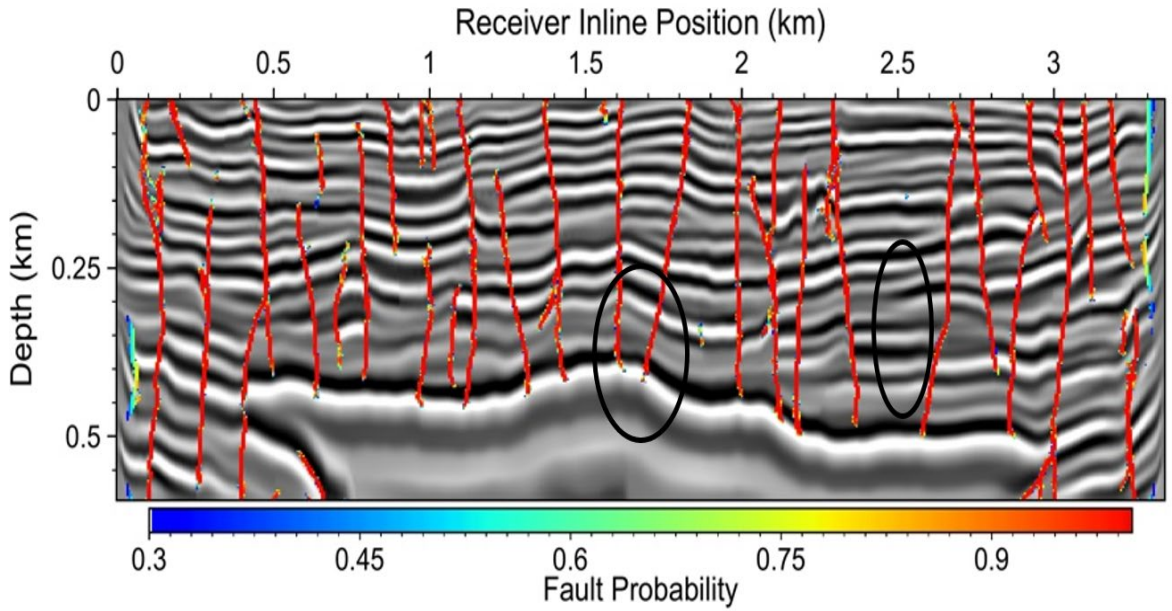




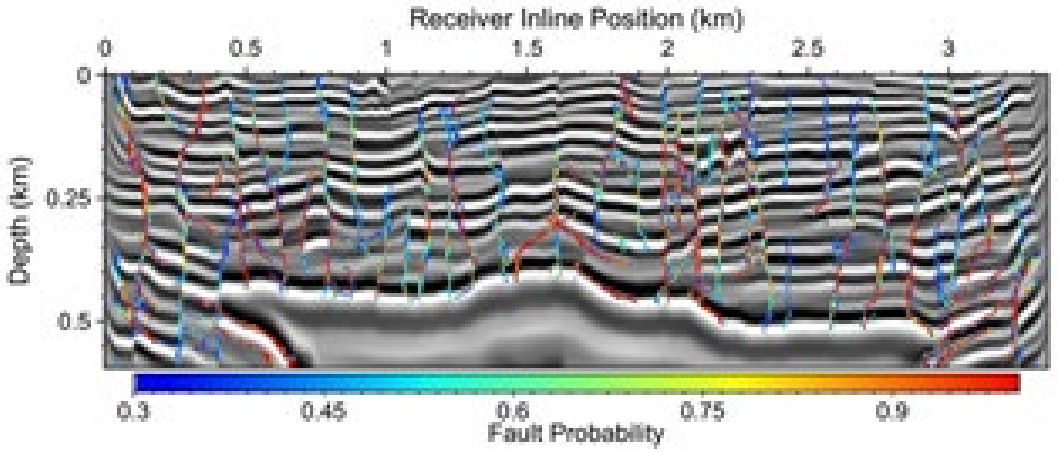
Fault Characterization Project- Machine Learning



Architecture of multiscale connection-fusion convolutional neural network method (MCFU).- Gao, Huang, Zheng, 2022



Fault Segmentation from Seismic Image via MCFU



Ant tracking

Technology Advantages

- Improved in Faults Detection
- Reliable Large-scale Fault Mapping
- Enhanced cost efficiency

Fault Characterization Project- Fiber Optic Technology

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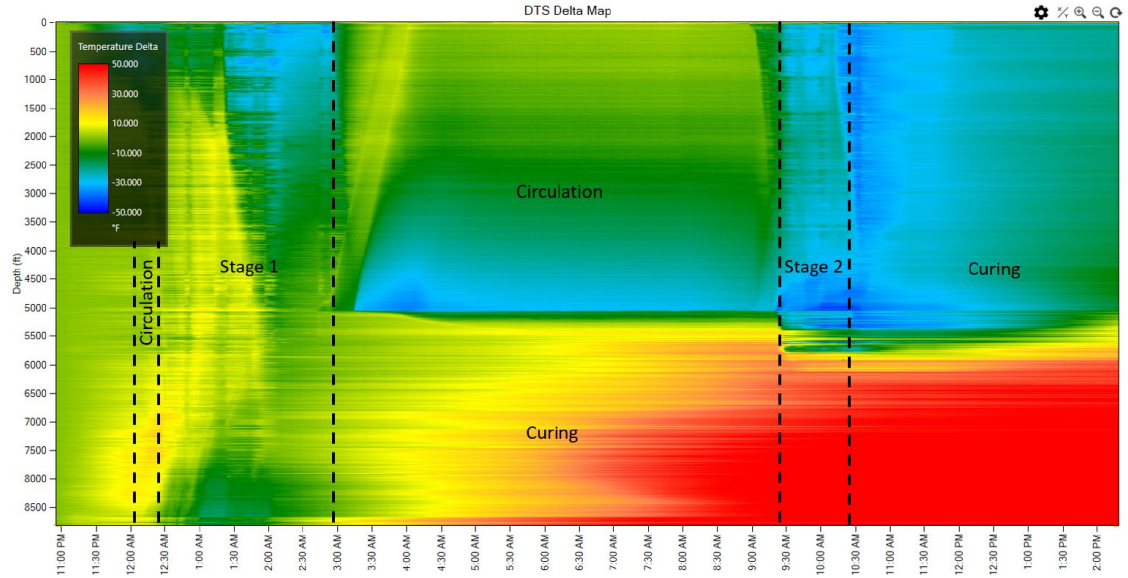
Monitoring Solutions

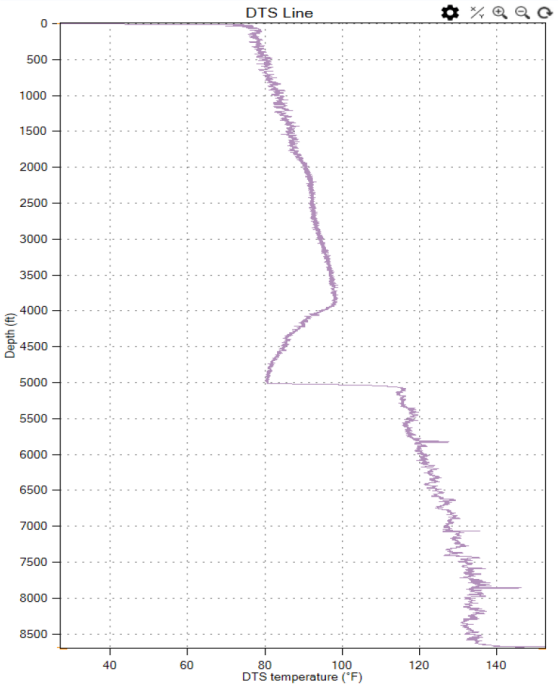
DTS (temperature)

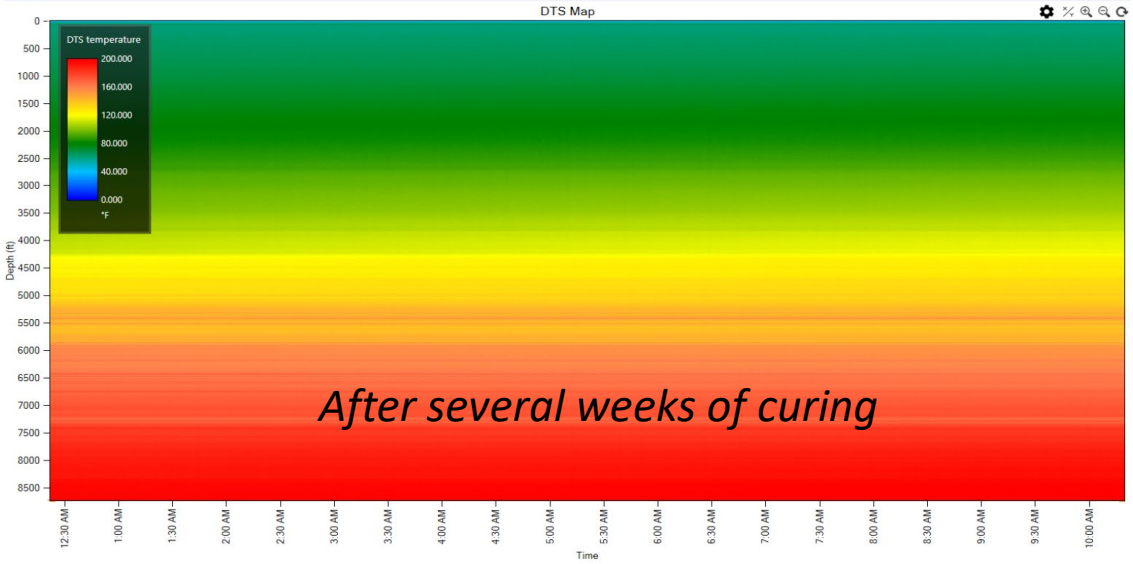
DAS (acoustic)

DSS (strain)

Data Interpretation

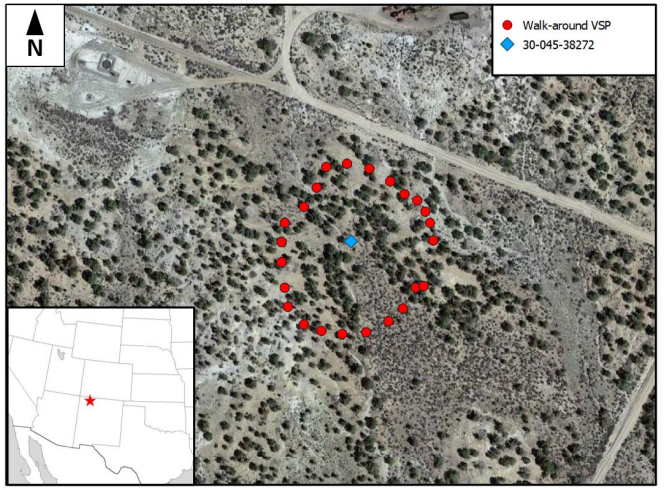






Assess Risks

- Faults/Fractures Detection and Characterization
- Matrix/Fractures/ Faults Geomechanical Properties Evaluation
- Micro-seismicity Monitoring



Fault Characterization Project- Geochemistry

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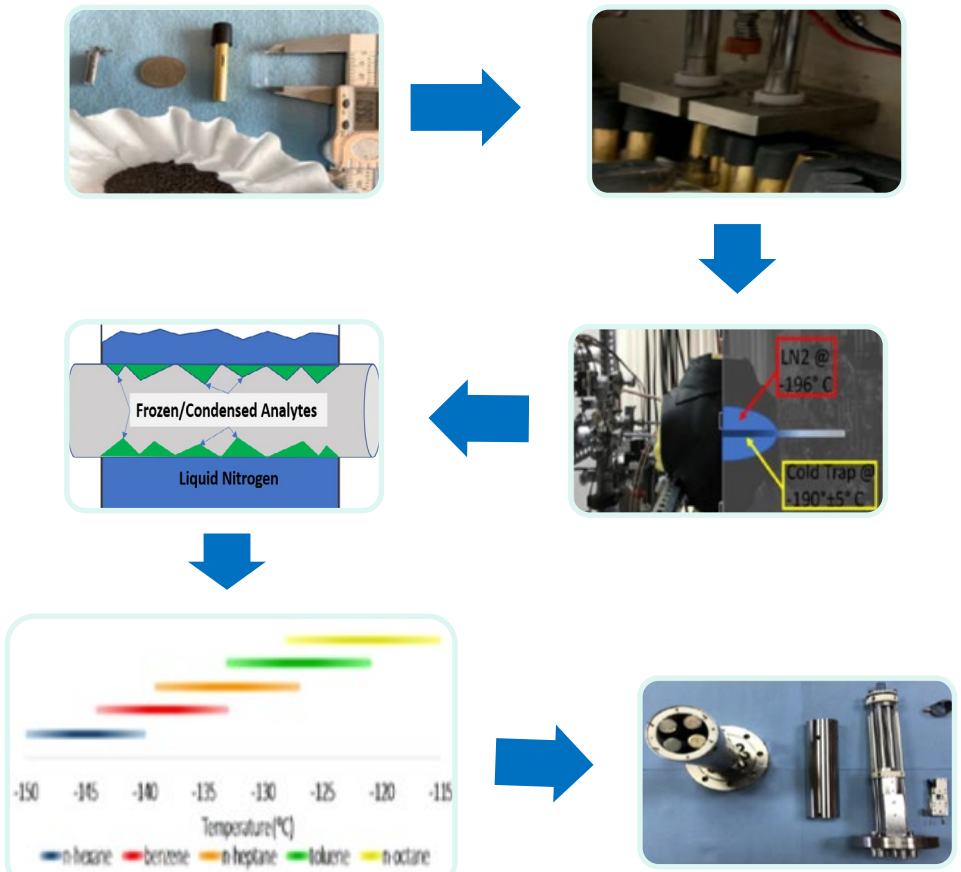
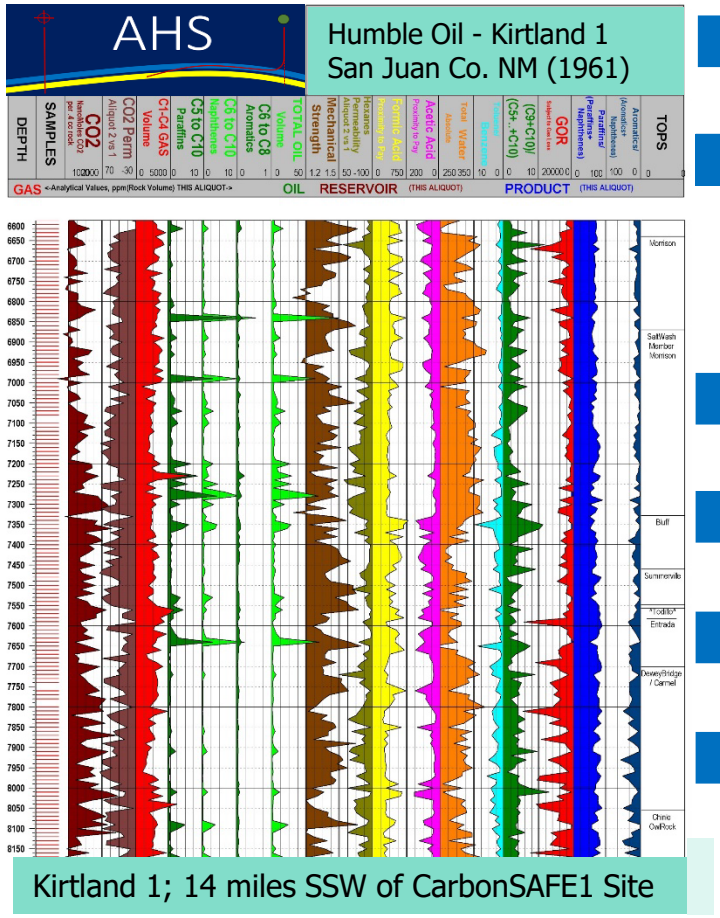
Analyze Rock Volatiles



Analyze Nearby Well



Kirtland 1; 14 miles SSW of CarbonSAFE1 Site

Assess Risks

- Faults/Fractures
- Fault Activating
- Fluid Conduits
- CO_2 Seals
- CO_2 Permeability
- Past CO_2 Loss
- Future CO_2 Loss

Application of Machine Learning in Simulation Modeling

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ML models utilizes the following categories of data in our project

Reservoir Characteristic Data
(Class ***A*** data)

Characterization
- Seismic data
- VSP data
- Well logs
- Core data
- Mechanical data
- Microseismic
- etc.

Fluid properties
- PVT data
- Fluid composition
- etc.

Rock/fluid interaction
- Relative permeability
- Capillary pressure
- etc.

Engineering Design Parameters
(Class ***B*** data)

- Injection/production well specification
- Pattern design
- Well spacing
- Injection timeline
- Injection fluid
- Other project-specific design parameters
- etc.

Project Response Data
(Class ***C*** data)

- Oil production data
- Gas production data
- Water production data
- Pressure data
- Stress from VSP
- Moment Magnitude
- etc

In this project we will train two different version of proxies to assist the history matching:

1. Forward-looking *Proxy*: $A \times B \rightarrow C$

2. Inverse History matching *Proxy*: $C / B \rightarrow A$

Application of Machine Learning in Simulation Modeling

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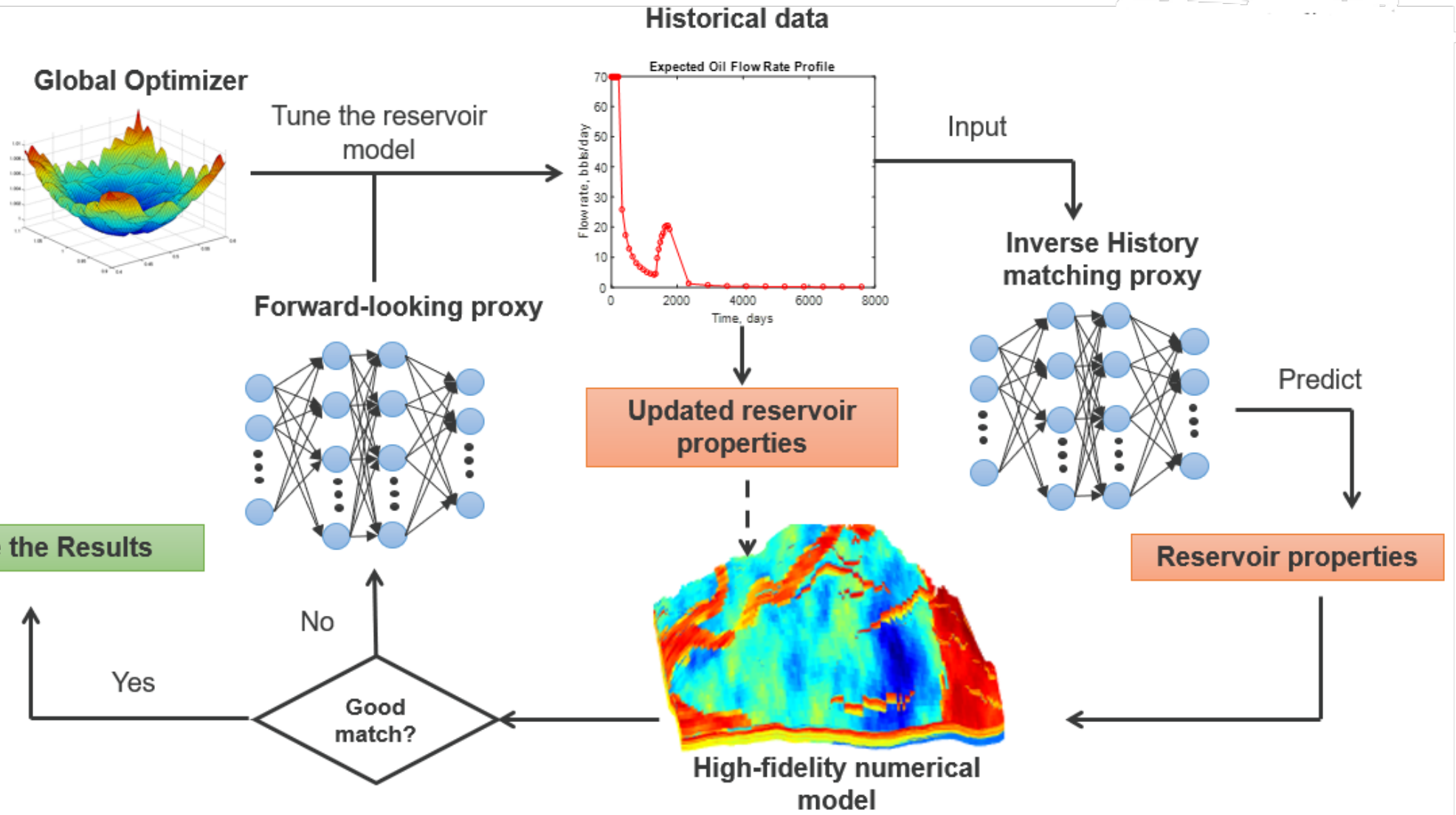
The workflow displayed comprehensively employed:

- Forward-looking proxies
- Inverse proxies
- Global optimizer
- High-fidelity numerical model



Basalt Storage Project

PI: Dr. Sai Wang, PRRC
Funding: 1.2 Million

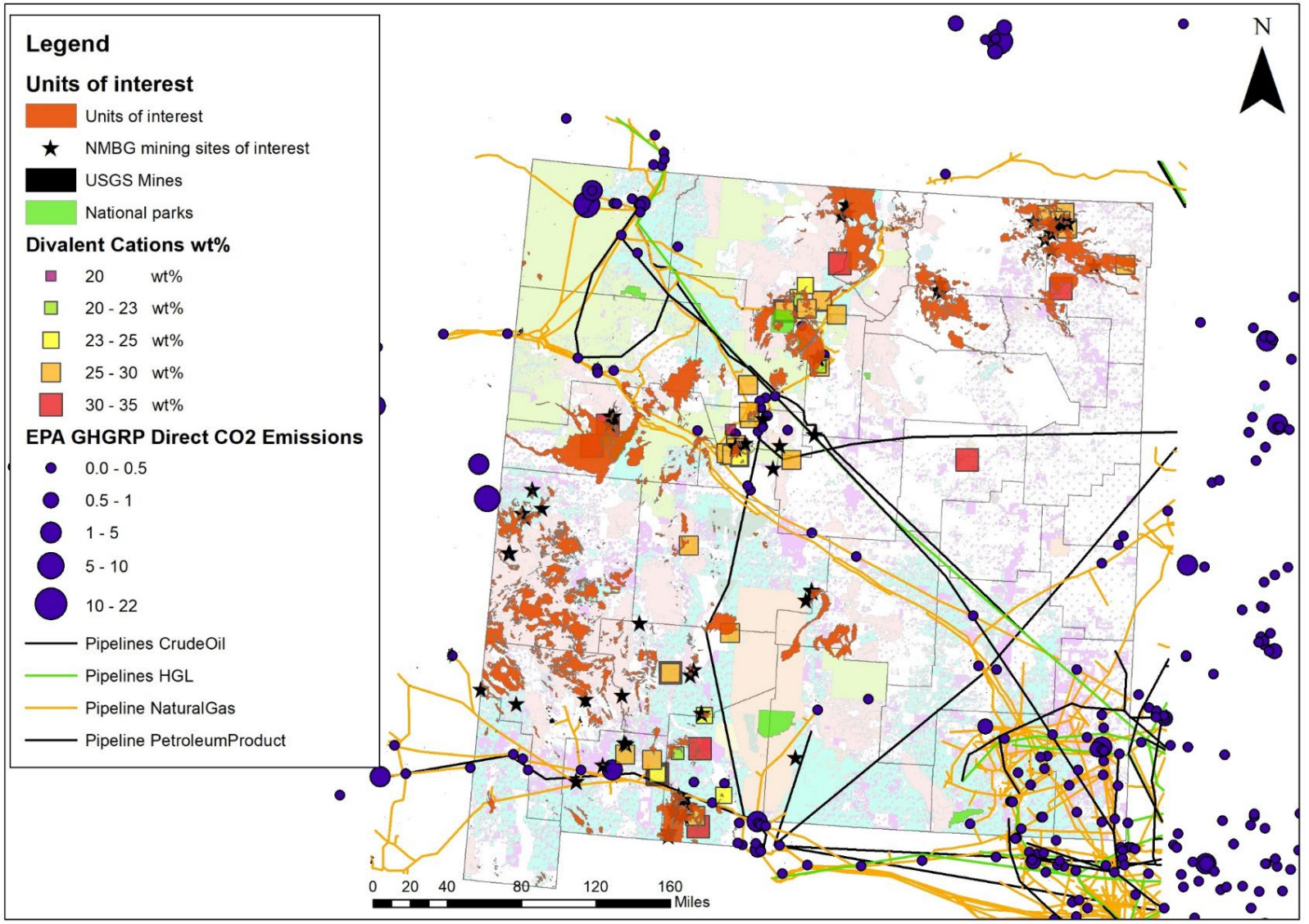
Project Overview

Overall Objective:

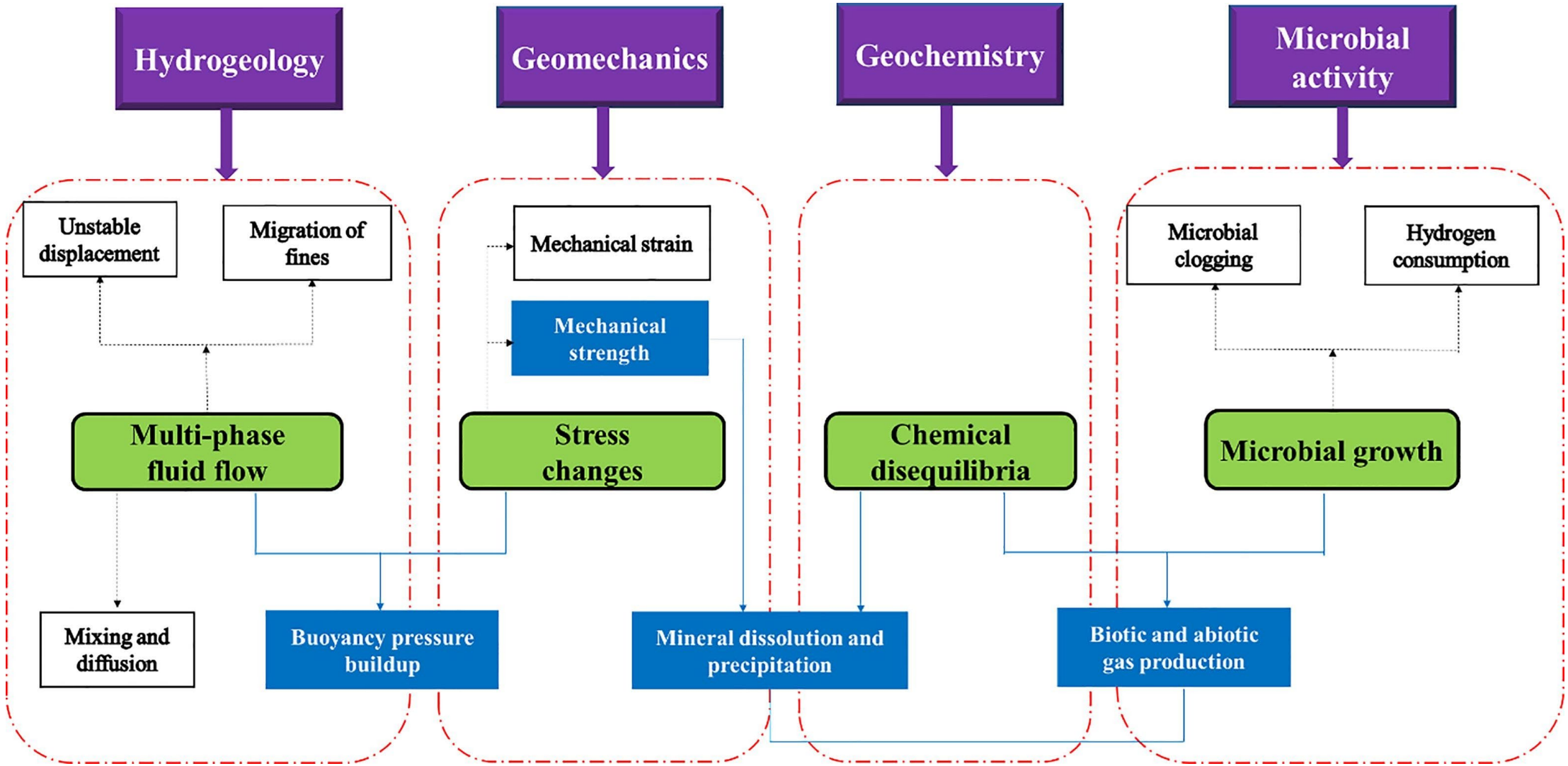
Identify and access statewide resources for potential CO_2 storage via mineralization processes, including mafic/ultramafic formations (basalts), stratigraphic units, and mining wastes in New Mexico.

Targeted Storage Sites:

Identify and characterize potential storage sites/complexes to determine storage capacity.



PRRC Hydrogen Subsurface Research



ARPA-E – DOE sponsored project

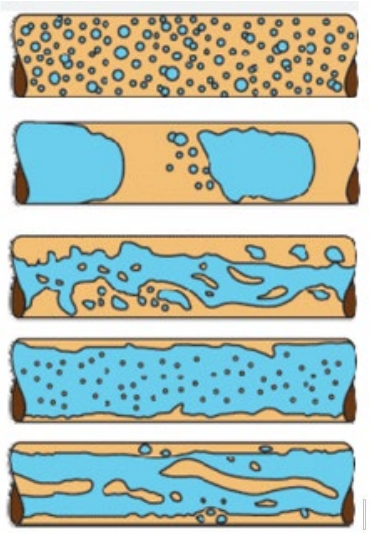
Recipient: New Mexico Tech (PI: Robert Czarnota)

Sub-recipient: Sandia National Laboratories

Award: $1,200,000

Timeline: 2 years (kick-off in May 2024)

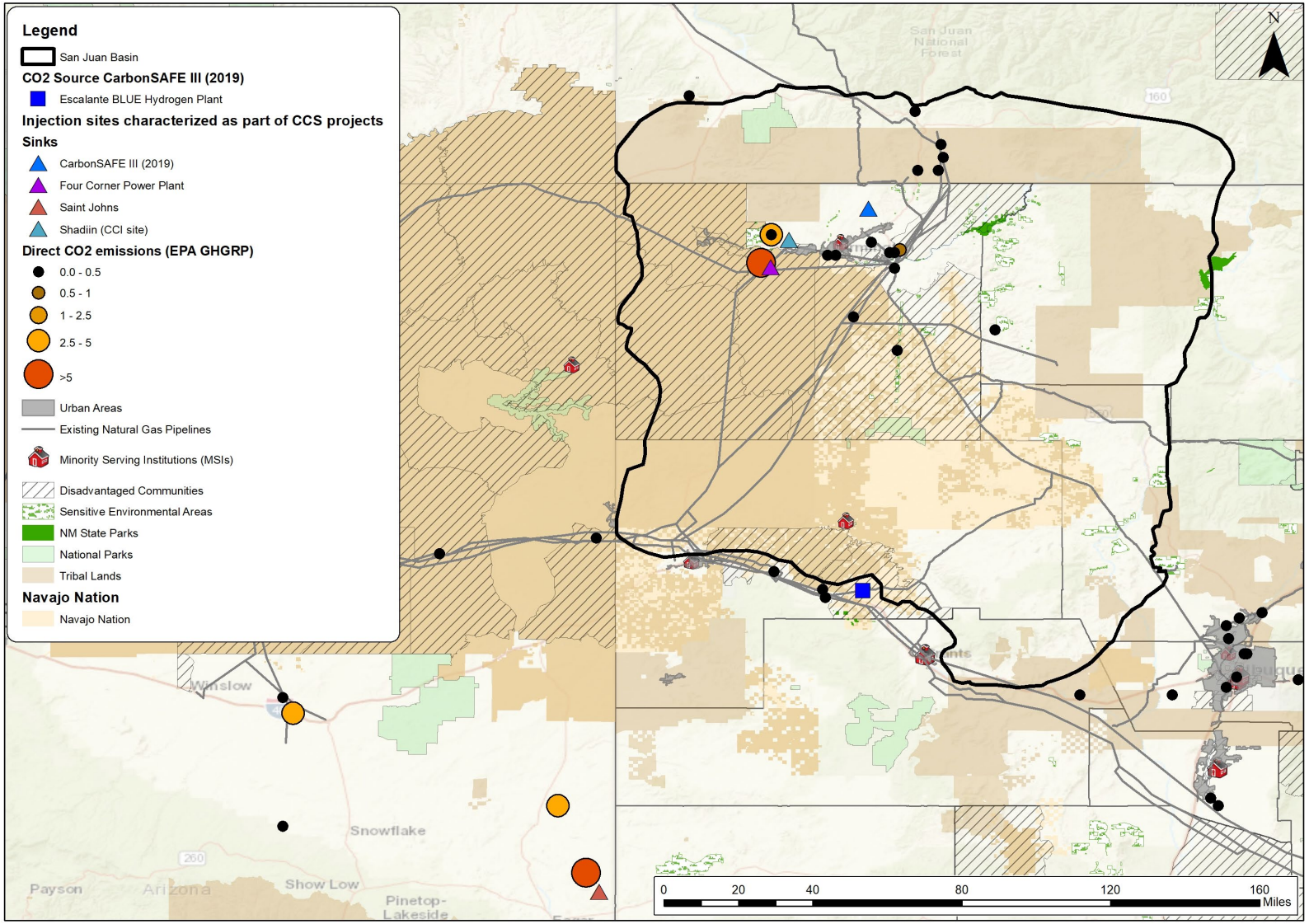
Project Title: Subsurface Engineering Solutions and Management for Sustainable In-Situ Hydrogen Production and Economic Extraction



Complex flow of H2/steam in tight channels of porous media

Summary: New Mexico Institute of Mining and Technology is developing subsurface engineering approaches for geologic hydrogen reservoir management, including ways to mitigate the risk of induced seismicity and hydrogen leakage. In addition to conducting laboratory experiments to explore hydrogen generation rates from ultramafic rocks and transport using steam (multiphase flow), the team will test methods to estimate rock volume expansion and identify ecological indicators of hydrogen leakage.

Four Corners Carbon Storage Hub



- $52 Million Project
- Develop 3 storage sites in the San Juan Basin to store at least 50 million tons of CO2
- Drill two stratigraphic wells to collect subsurface data
- Acquire about 1000 ft of Core for analysis
- Perform detailed experimental and numerical analysis on acquired data
- Prepare and submit UIC Class VI applications for 3 sites