

# CarbonSAFE Rocky Mountains Phase I: Ensuring Safe Subsurface Storage of CO<sub>2</sub> in the Intermountain West

DE-FE-0029280



Brian McPherson

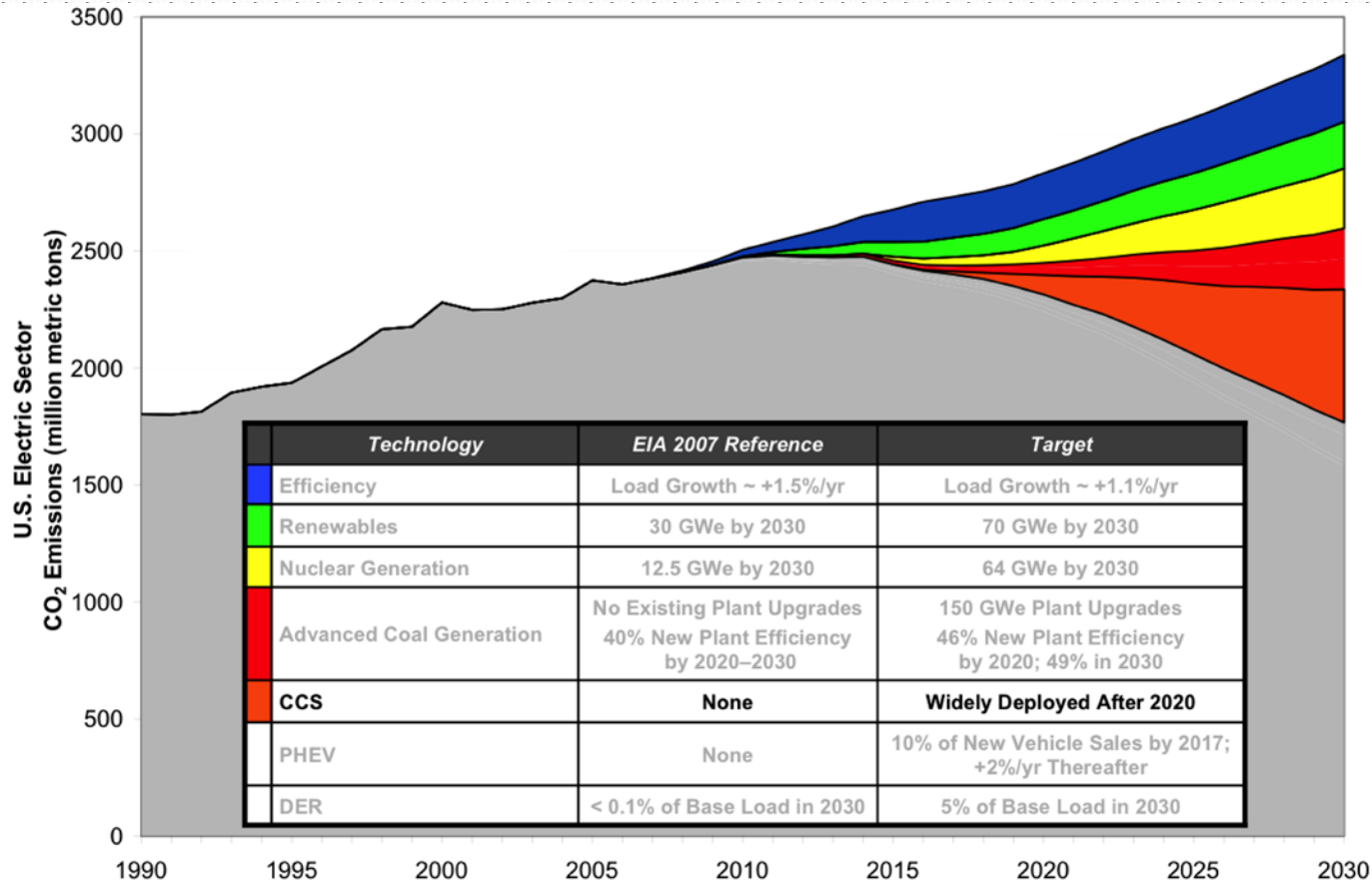
University of Utah

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Mastering the Subsurface through Technology Innovation & Collaboration:  
Carbon Storage & Oil and Natural Gas Technologies Review Meeting

August 2-4, 2017

# Carbon Management Wedges from 2007

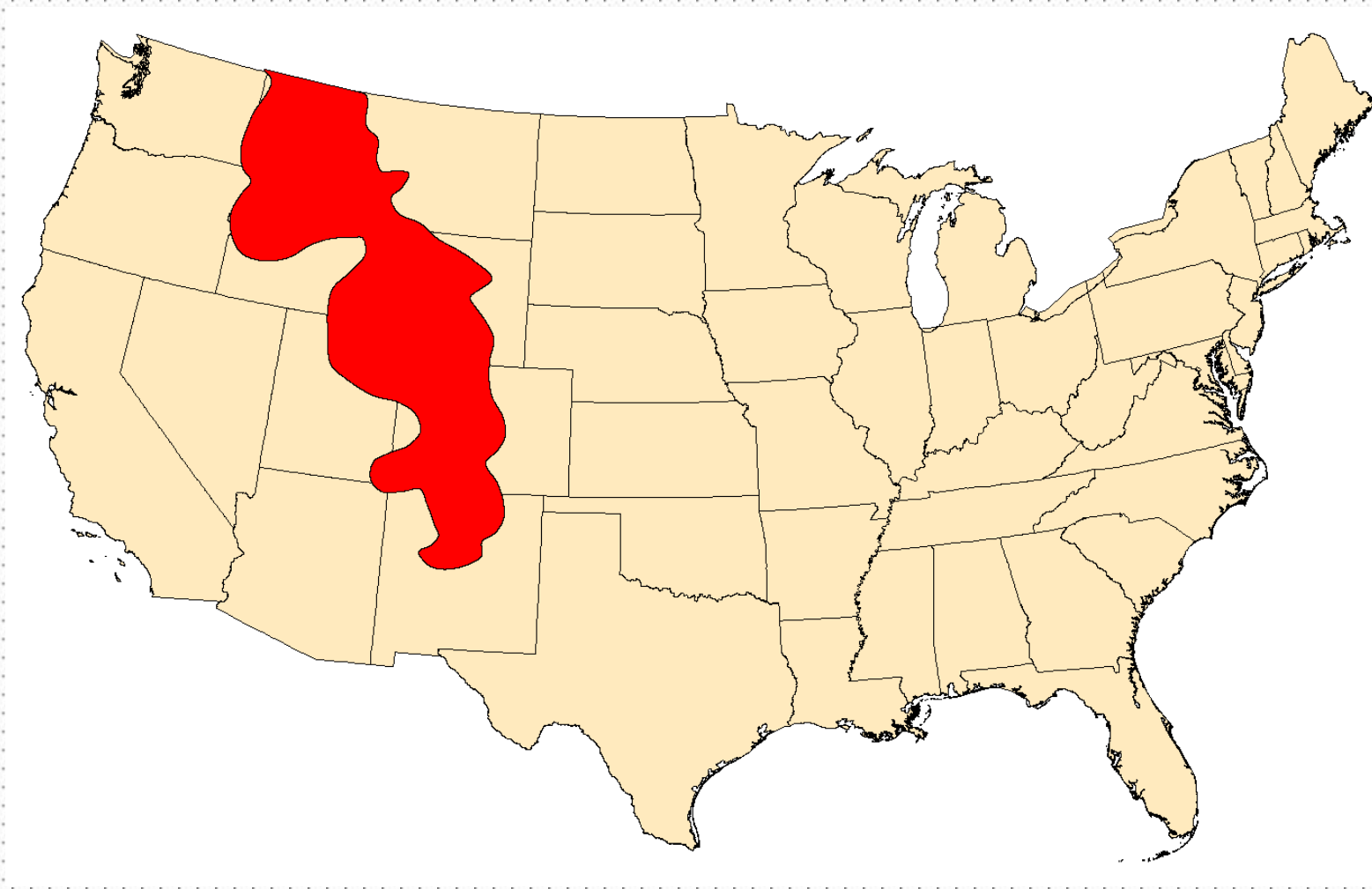


Opinion:

CCS is a great path forward, but perhaps only in the short term.

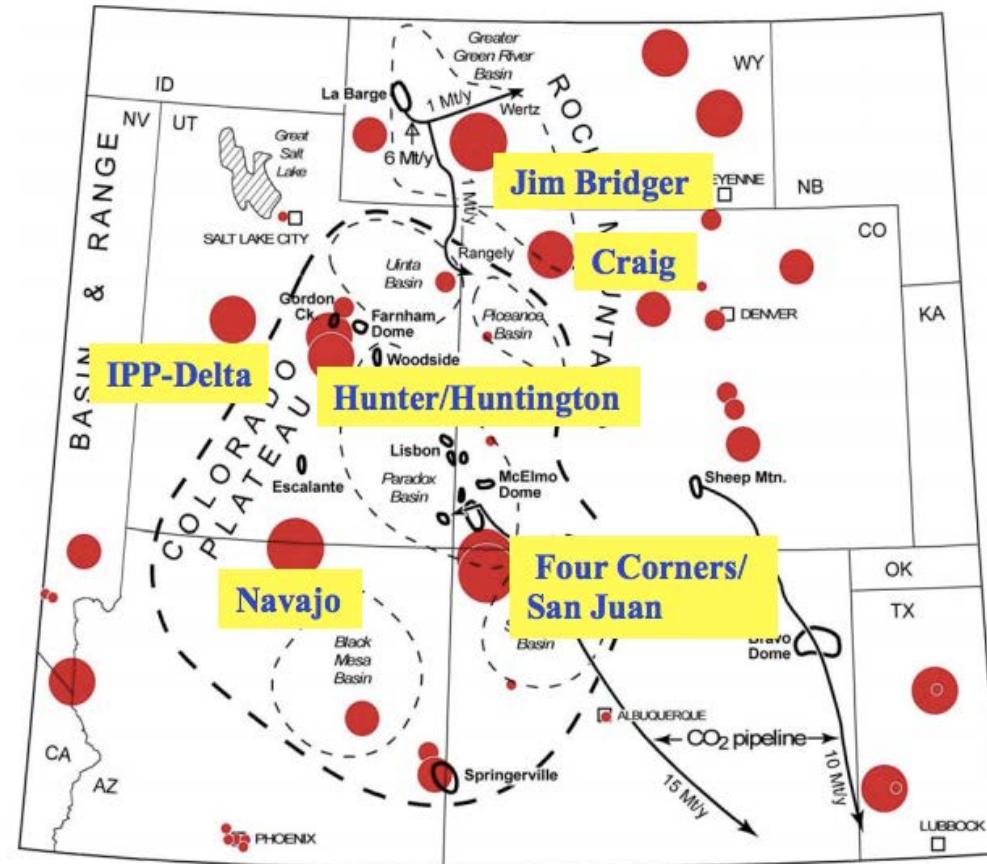
The ultimate goal is to reduce emissions with “clean” energy.

# CarbonSAFE: CCS in the Rocky Mountain Regiona



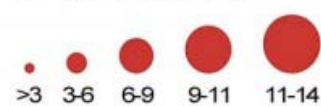
Primary Goal: Develop a "Blueprint" for CCS in the Rocky Mountain West

# Power Plants in the Region



(image: UGS)

Annual mass of CO<sub>2</sub> emissions from power plants (Mt/y)



Natural CO<sub>2</sub> reservoir

Sedimentary basin

CO<sub>2</sub> pipeline (flow in megatonnes/year)

↑ 6 Mt/y vented CO<sub>2</sub> production



# CarbonSAFE Rocky Mountains - Objectives

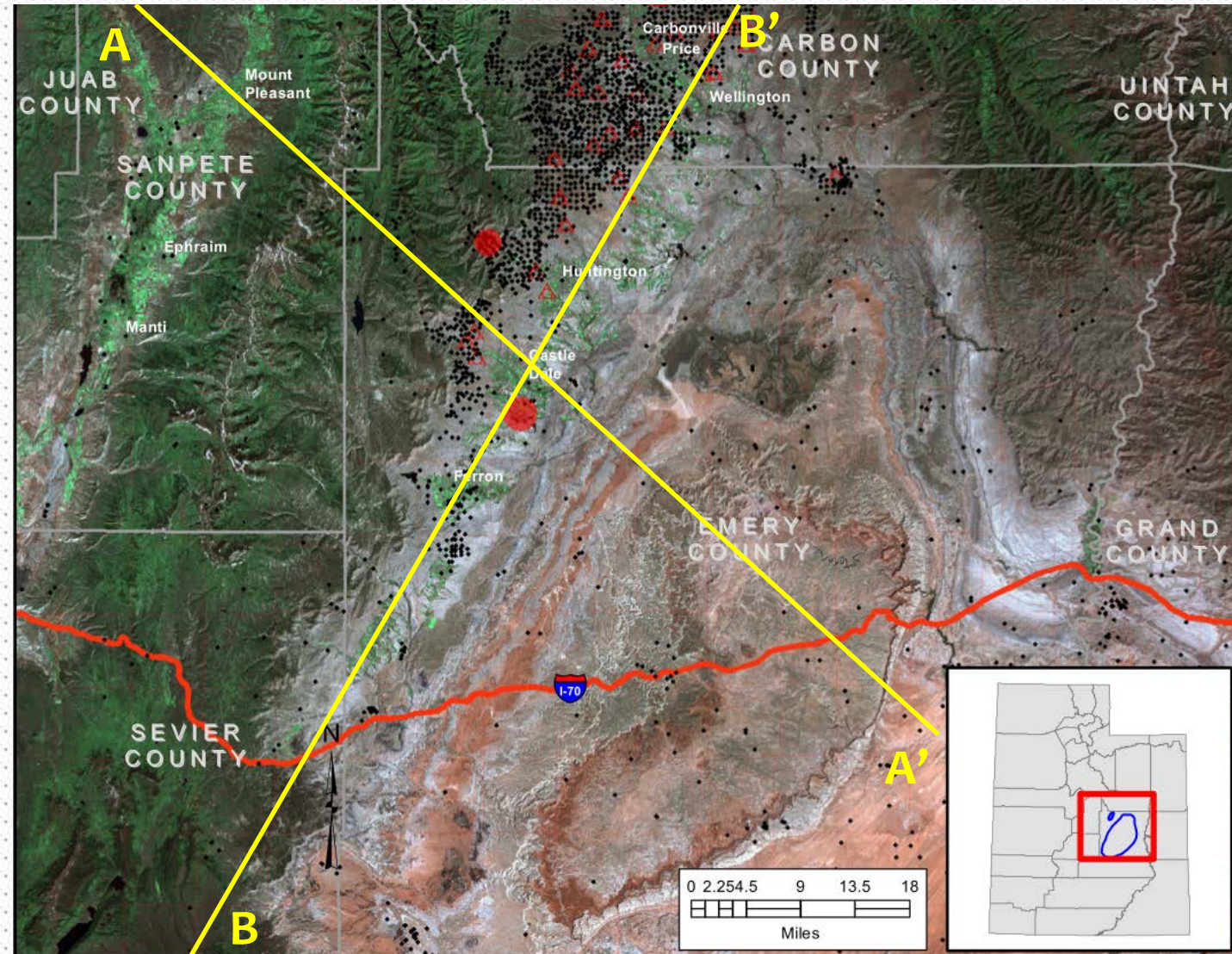
- Compare and contrast the range of possible injection sites and storage reservoirs
- Identify minimum risk, maximum storage efficiency, and minimum cost
- CarbonSAFE Rocky Mountains Phase I CCS coordination team will conduct a high-level evaluation of potential storage sites near the Hunter plant
- multiple practical storage (injection) sites will be identified and compared using a state-of-the-art systems analysis of competing costs as well as regulatory and technical requirements
- All facets considered, from permitting, capture, compression, transport, injection to monitoring.

# CarbonSAFE Rocky Mountains - Project Team

Partner	Role
PacifiCorp	Plant Operator and Power Sector Requirements
Utah Geological Survey	Geologic Characterization
New Mexico Tech	Seismic and Geologic Characterization
Los Alamos National Lab	Systems Analysis (Economic-Technical)
Sandia National Lab	Caprock Characterization
Schlumberger Carbon Services	Model Development, Injection/Monitoring Well Design and Risk Assessment
University of Utah	Project Management, Simulation and Risk Assessment
University of Utah Law School	Legislative and Other Policy Requirements
Utah Department of Env. Quality	UIC and Other Permitting Requirements
Stakeholder Advisory Board	Advice on Non-Technical CCS Requirements and Public Relations

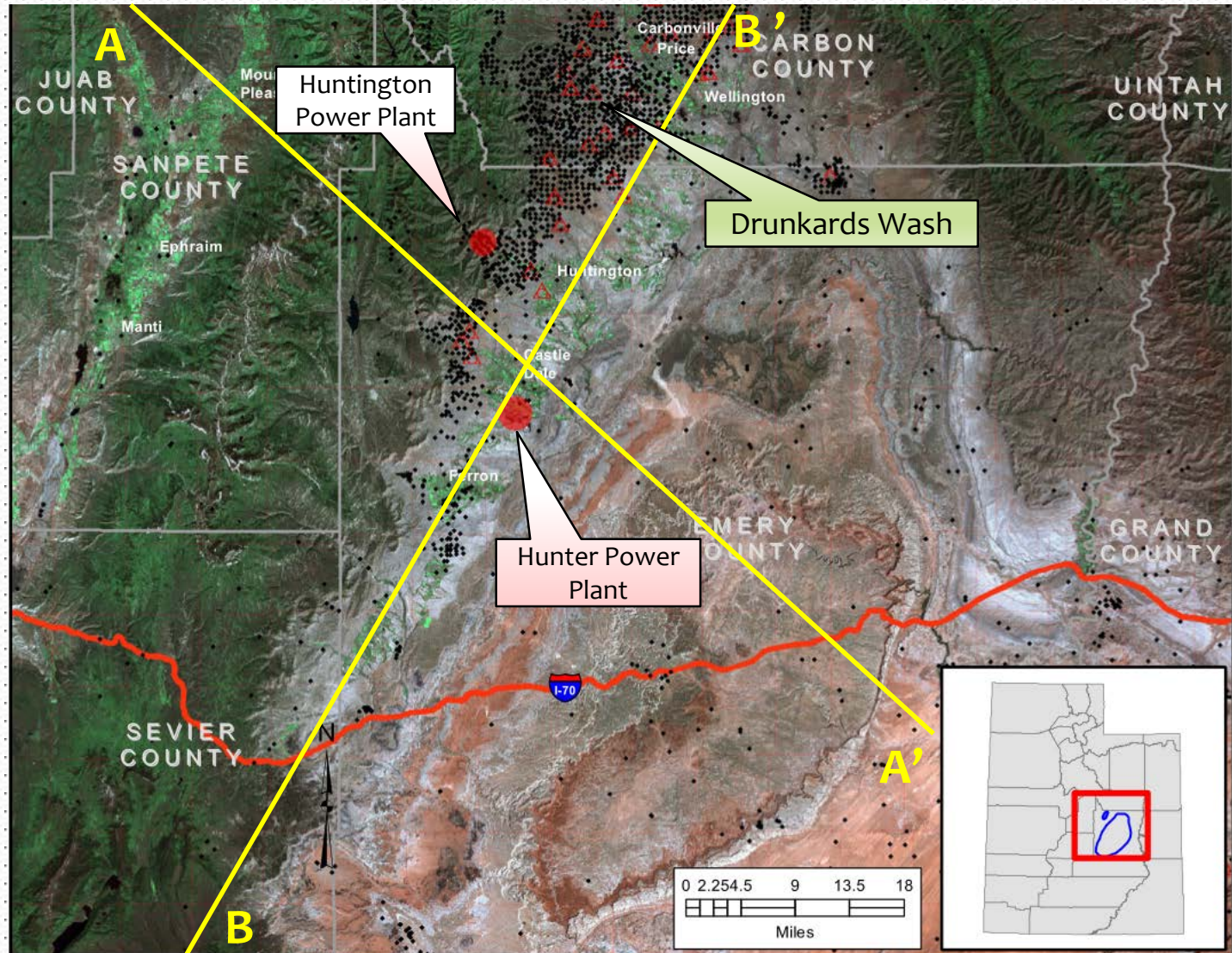
# Storage Complex – Site Characterization

- Geologic structural anticline (San Rafael Swell)
- Hydrostratigraphic trap with multiple sealing layers above injection horizon(s)
- Primary Reservoir (White Rim SS)
  - Porosity: 4~5%
  - Permeability: 0.1~0.2 mD
- Secondary reservoir (Navajo SS)
  - Sufficiently deep: >5000 ft
  - Thick: ~420 ft
  - Thick overlying seal units
  - High porosity: >10%
  - High permeability: >100 mD
  - >50 million metric tons CO<sub>2</sub> storage capacity



# Storage Complex– Site Characterization

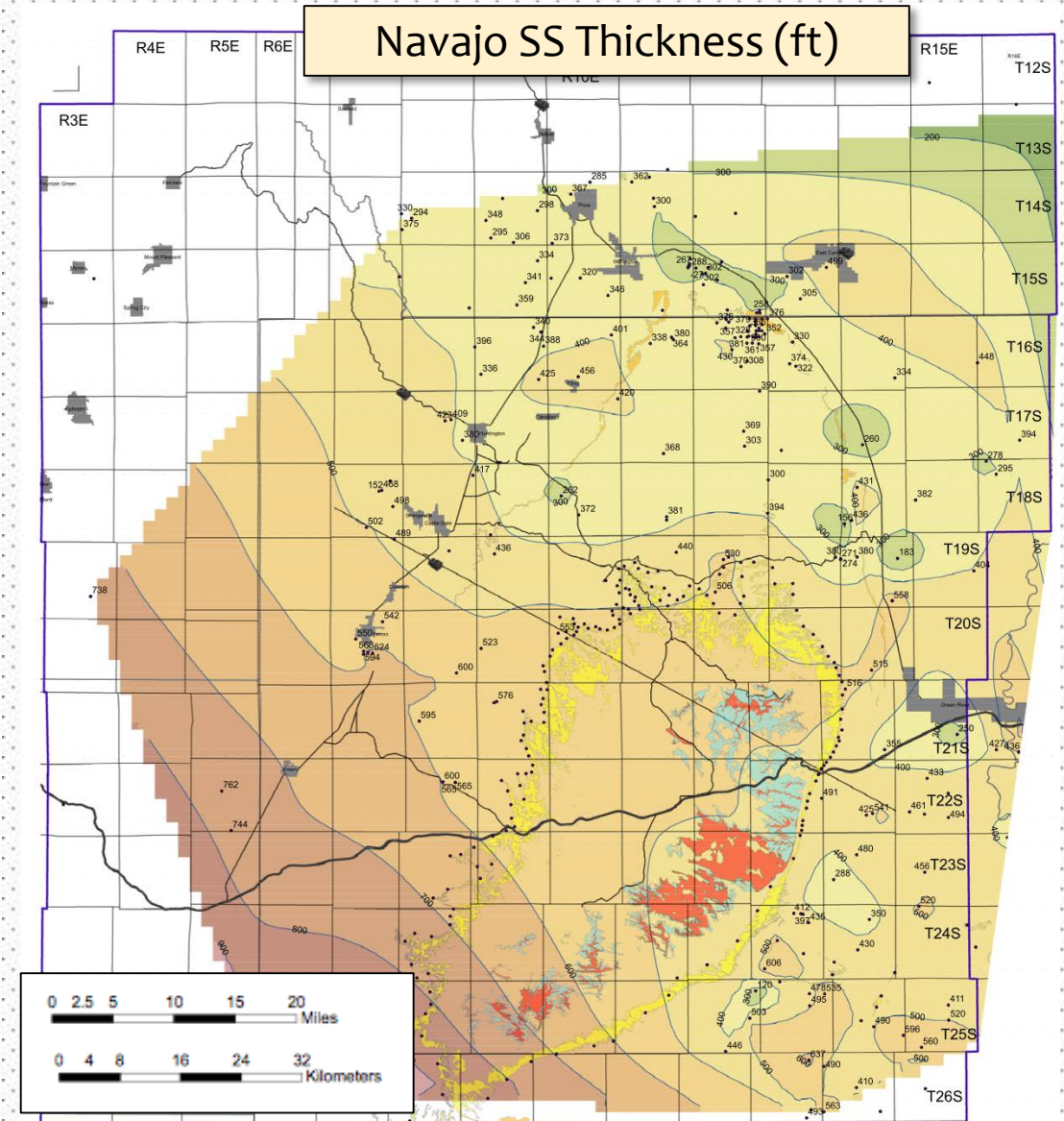
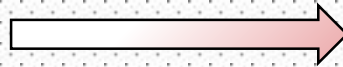
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# Storage Complex– Site Characterization

- CarbonSAFE Rocky Mountains Team Site Characterization
  - Investigating existing wells, logs and core
  - Field trips to assess surface exposures of reservoir and seal units to correlate to subsurface
  - Constructing isopach and structure maps of site
  - Constructing 3D geocellular model of site
  - Acquiring legacy 2D seismic lines to augment well data
  - Performing CO<sub>2</sub> storage and flow simulations



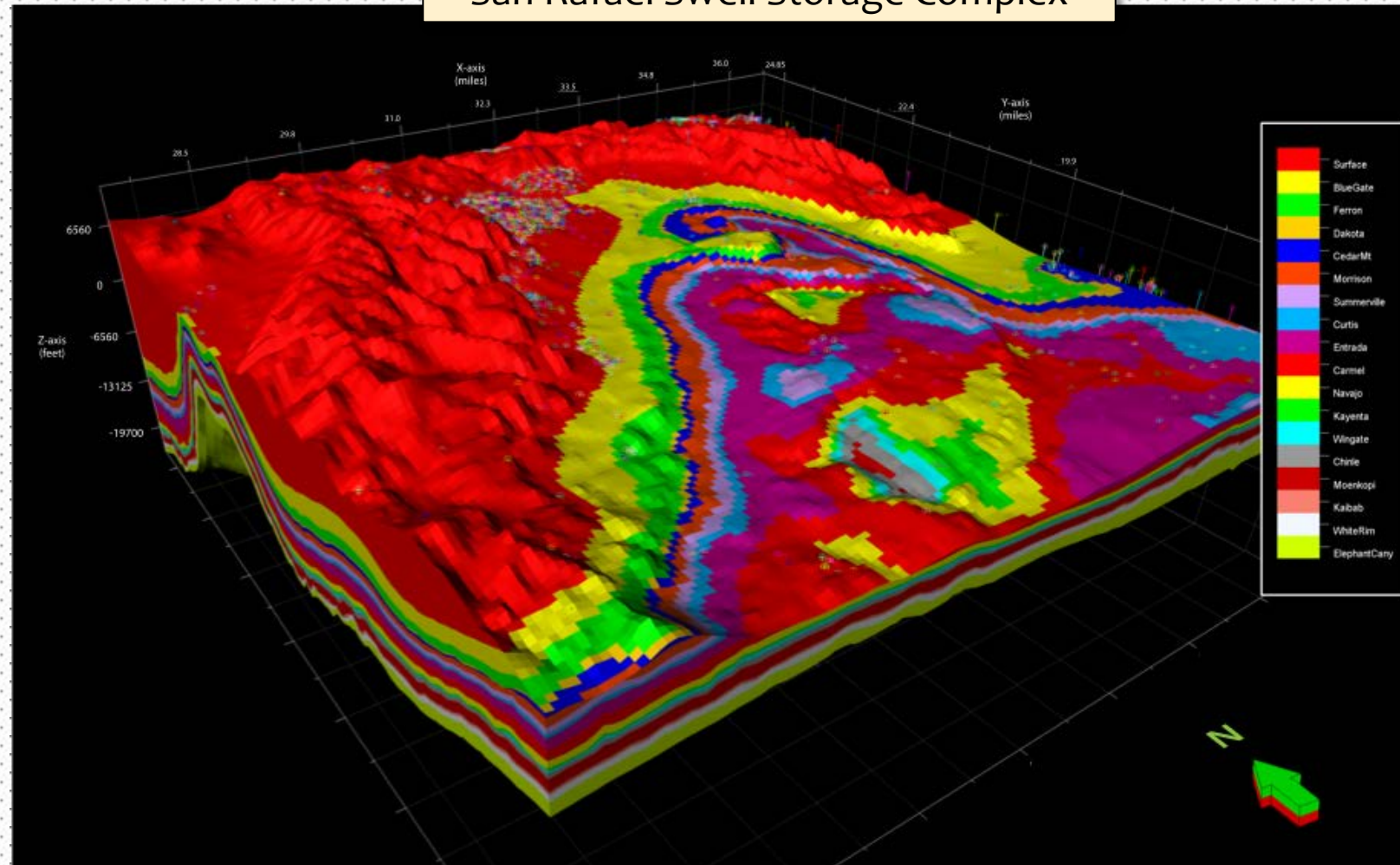
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### San Rafael Swell Storage Complex

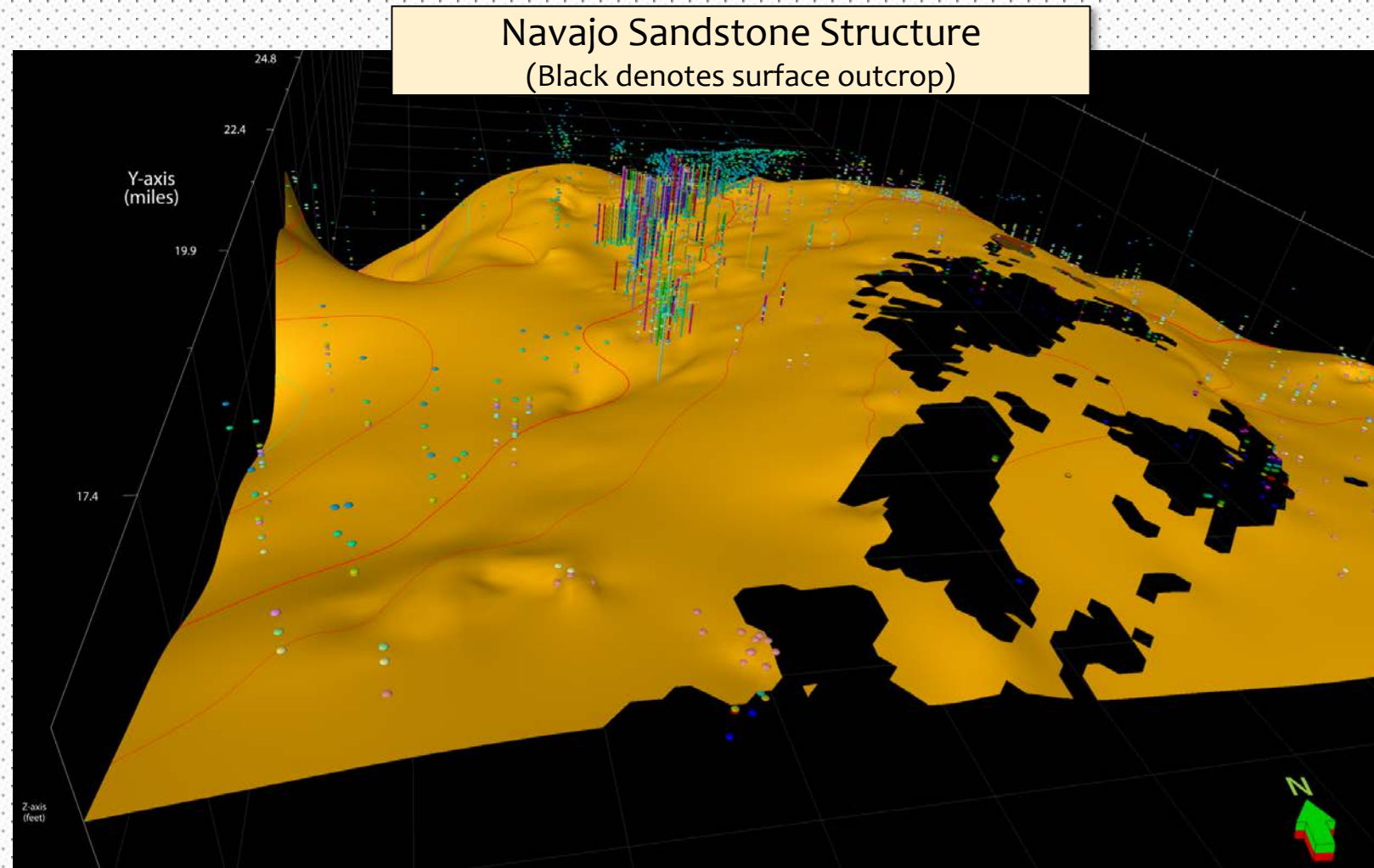
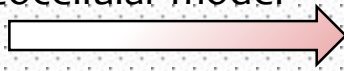


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- CarbonSAFE Rocky Mountains Team

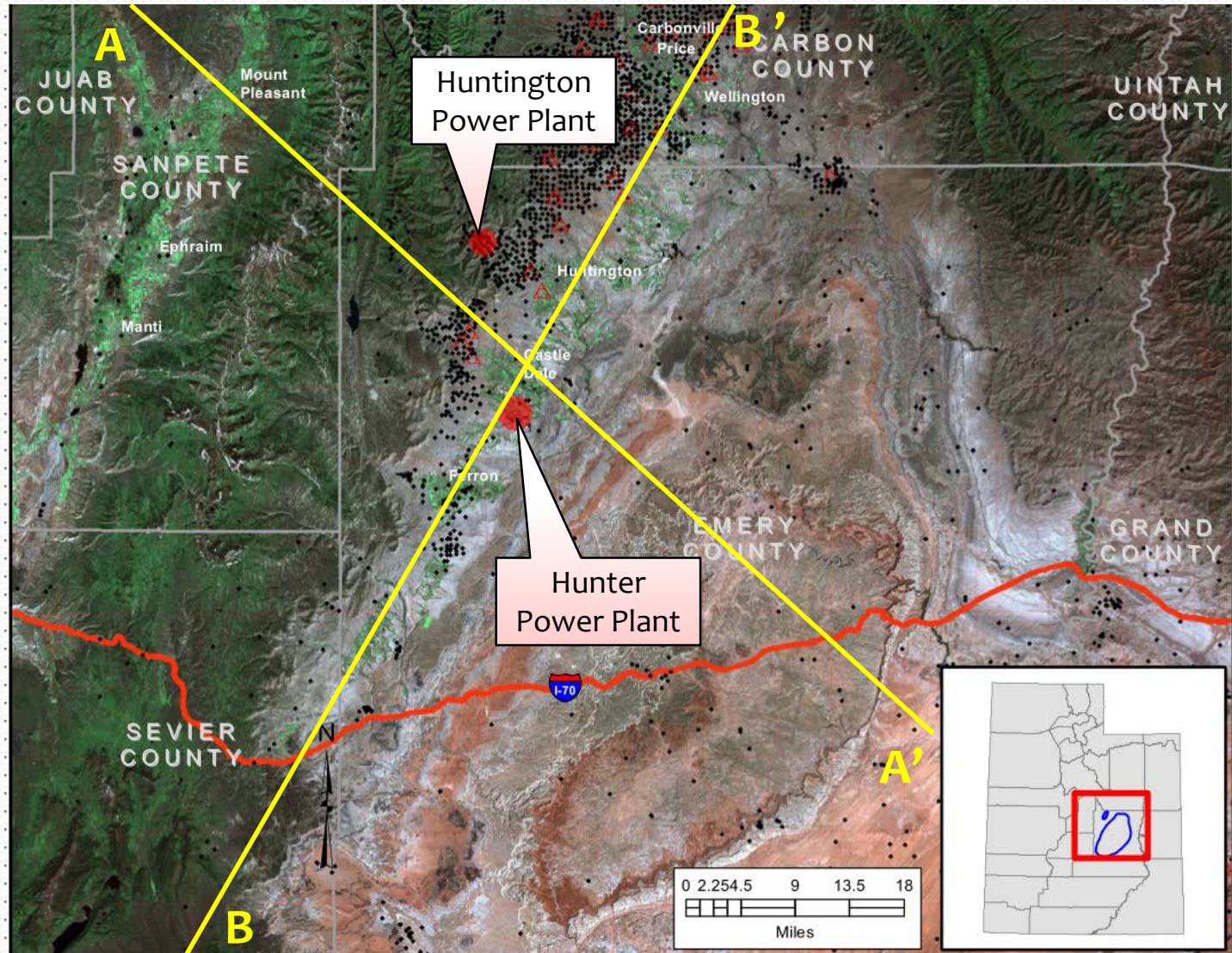
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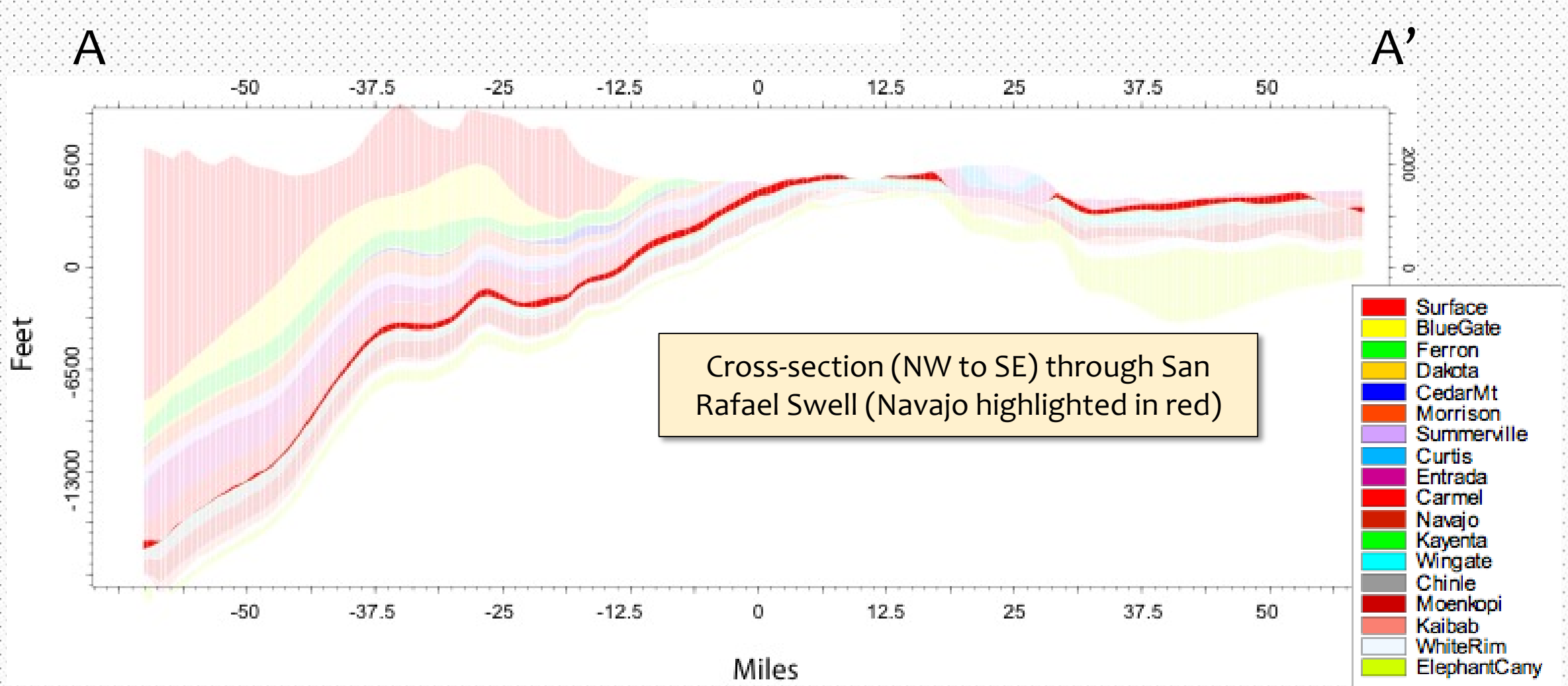


# Storage Complex– Site Characterization

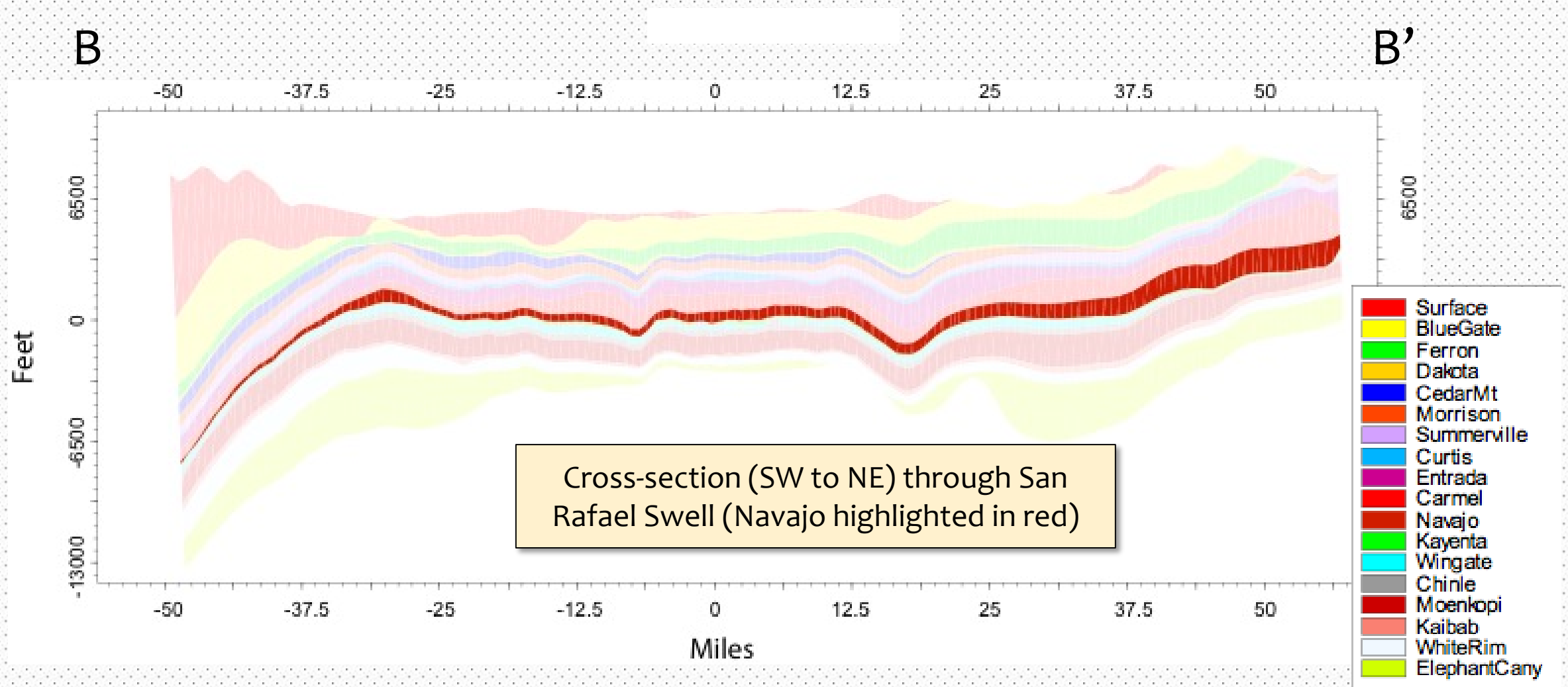
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# Storage Complex– Site Characterization



# Storage Complex– Site Characterization



# Ongoing and Imminent Tasks

- Site Characterization
- Geocellular Model Development (initial model complete)
- 3-D Fully Coupled THCM Simulation Model from Geocellular Model (initial model complete)
- Forecast Storage Capacity
- Forecast PDFs and CDFs for Projected Top Risk FEPs
- Identify and Vet All Commercial Permutations – Capture, Injection, Storage
  - Hunter / Huntington Power Plants Primary Sources
  - Drunkard's Wash (Gas Field) and San Rafael Swell Primary Storage Complex
  - Local (inter-county), State and Federal Regulations
  - UIC Permit Application Preparation



# Rocky Mountain CarbonSAFE

<http://CarbonSAFE.rocks>