



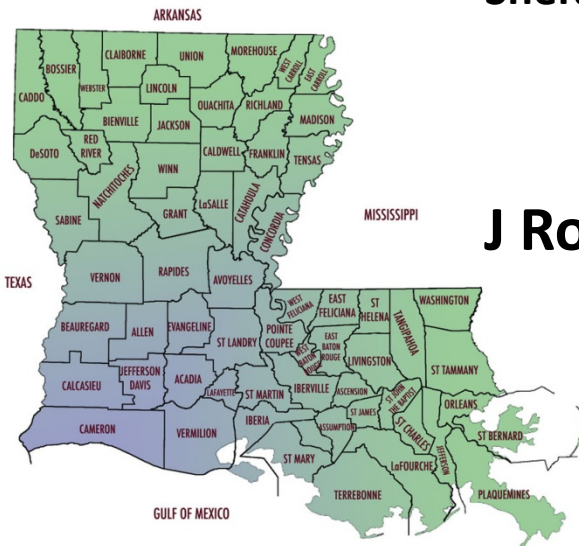
South Louisiana EOR / Sequestration R&D Project FE0006823

Carbon Storage R&D Program Project Review Meeting

Sheraton Station Square Hotel, Pittsburgh, PA

August 21-23, 2012

J Roger Hite, Principal Investigator
Blackhorse Energy, LLC





Presentation Outline

- ✓ **Benefit to the Carbon Storage Program**
- ✓ **Project Objectives**
- ✓ **Project / Technical Status**
- ✓ **Accomplishments to Date / Summary**



Benefit to Carbon Storage Program

✓ Program Goals:

- Conduct field test to support development of Best Practices Manuals

✓ Benefits:

- Acquire field data on CO₂ sequestration in beach barrier bar, in the State of Louisiana, as part of EOR project
- Evaluate technologies
 - 3D seismic
 - Horizontal injector
 - Advanced logging tools
 - Fiber optic cables
 - CO₂ foam



Project Objectives

✓ **The primary objective**

- Understand CO₂ behavior and migration in a beach/barrier near shore bar depositional environment.

✓ **Secondary objectives:**

- Demonstrate that successful sequestration projects can be performed safely in Louisiana;
- Demonstrate that Louisiana is a major sequestration target; and
- Enhance the future prospects for commercialization of sequestration.



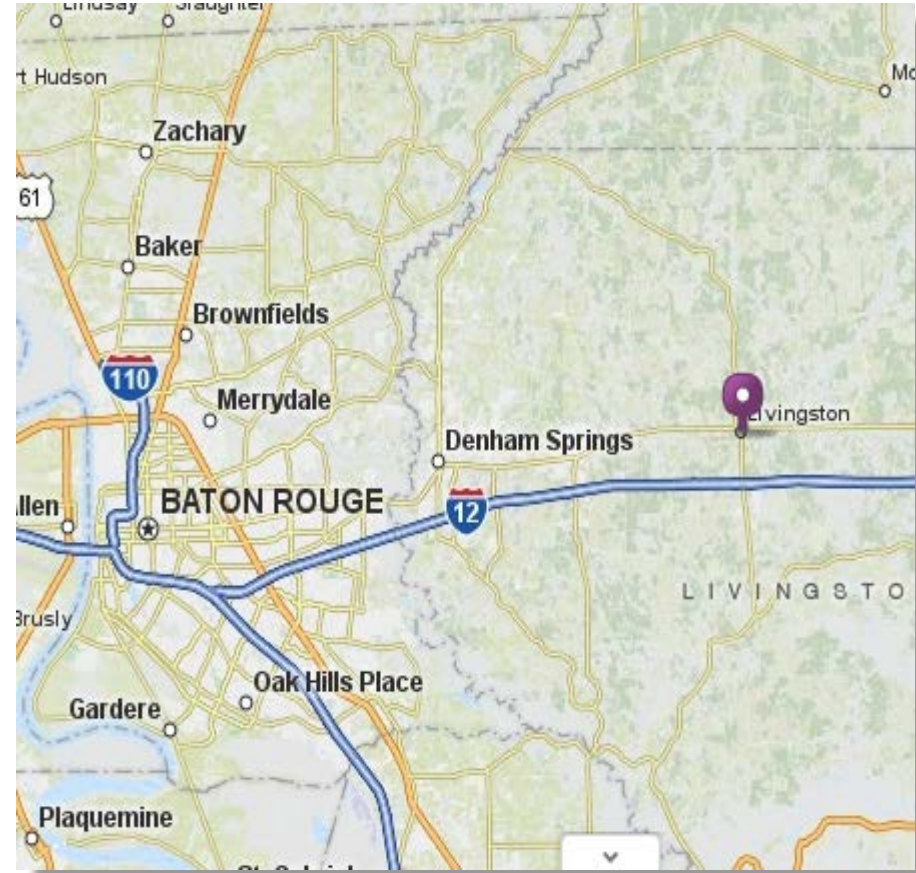
Project / Technical Status

- ✓ **Reservoir Characterization**
 - Completed a careful review of facies continuity and of rock properties
- ✓ **Simulation**
 - Improved physics
 - Included shale above pay zone
- ✓ **Production Facilities**
 - Staged development



Livingston Reservoir

- ✓ Productive Formation: Wilcox
 - 10,000 ft deep
 - 2,200 acres
 - Structural trap against fault
- ✓ OOIP 28 MM Bbls of 39° API oil

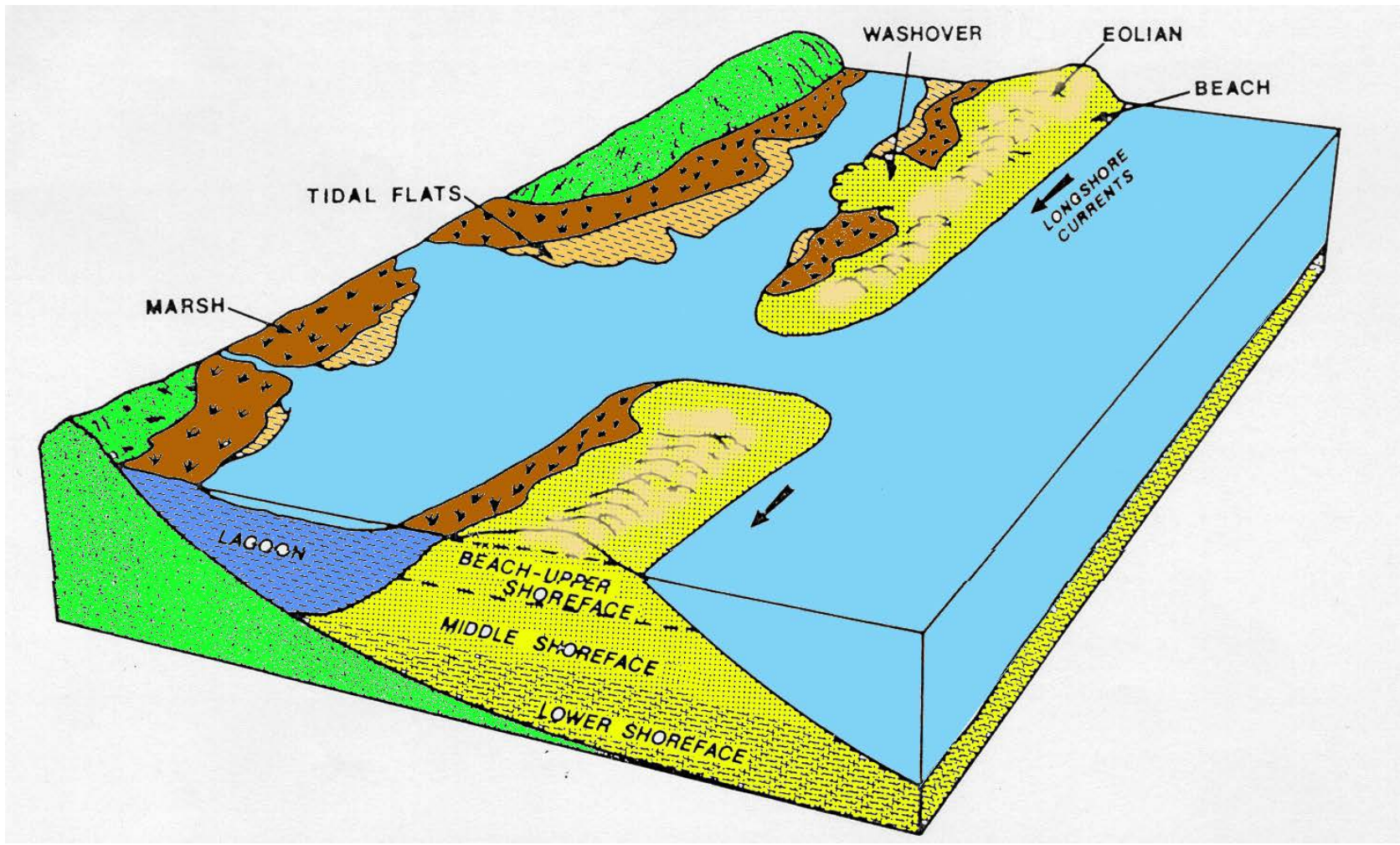


Production History

- ✓ Discovered in 1983
- ✓ Waterflooding began in 1987 by Amoco
- ✓ Primary and waterflood recovery 8.2 MM Bbls (29% OOIP)

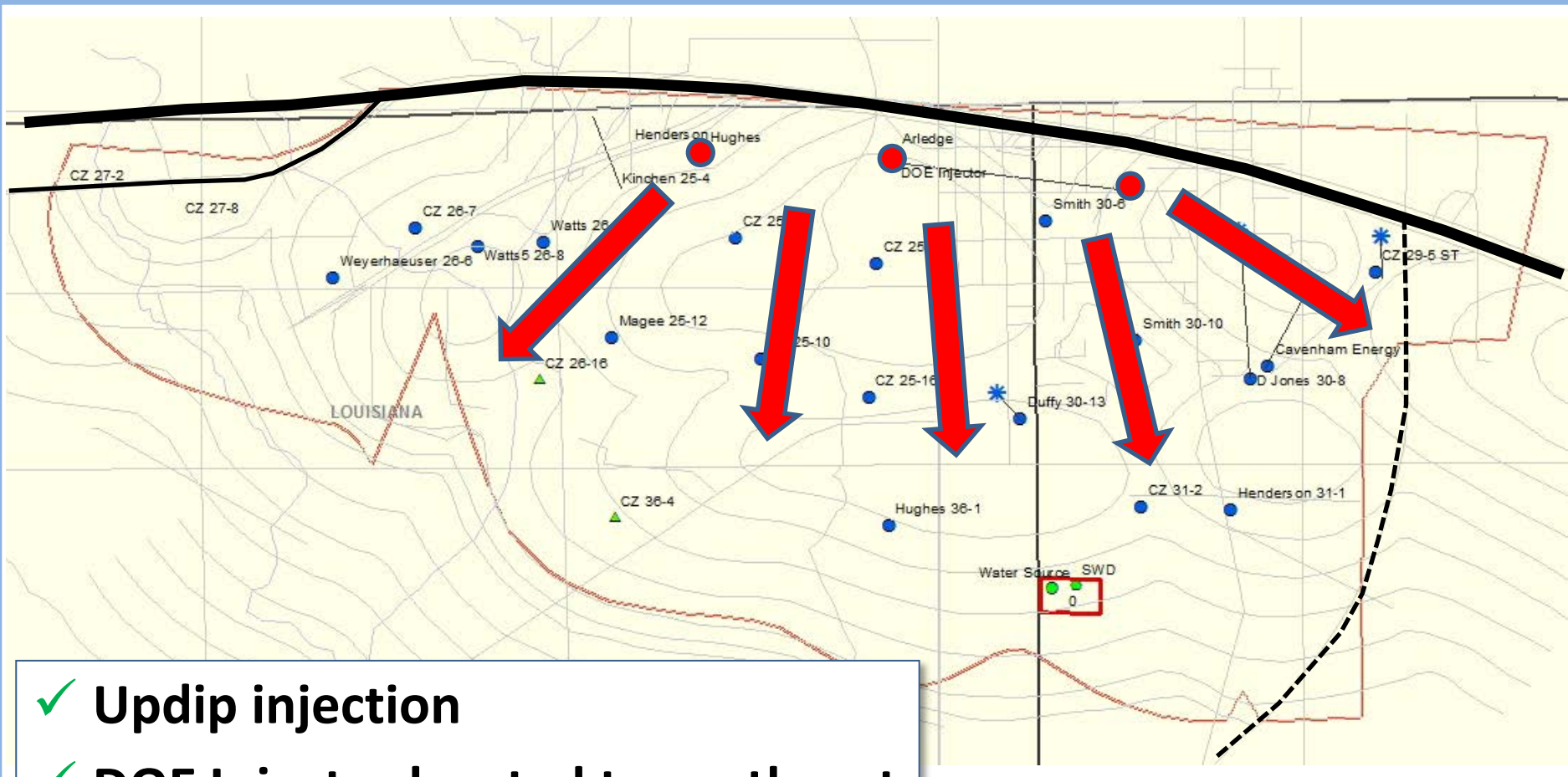


Depositional Environment



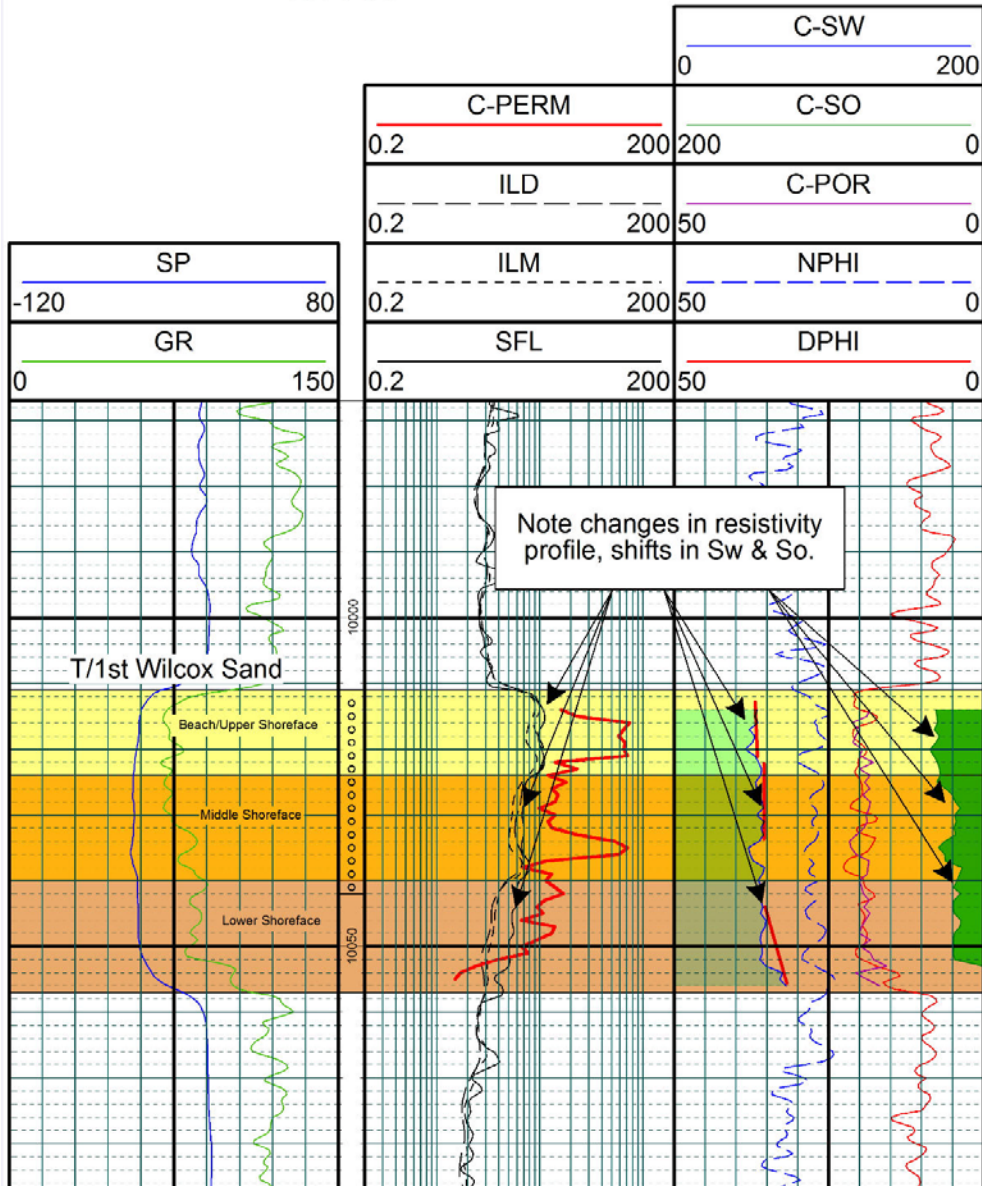


Well Map



- ✓ Updip injection
- ✓ DOE Injector located to northeast
- ✓ CO2 front moves downdip to south and west

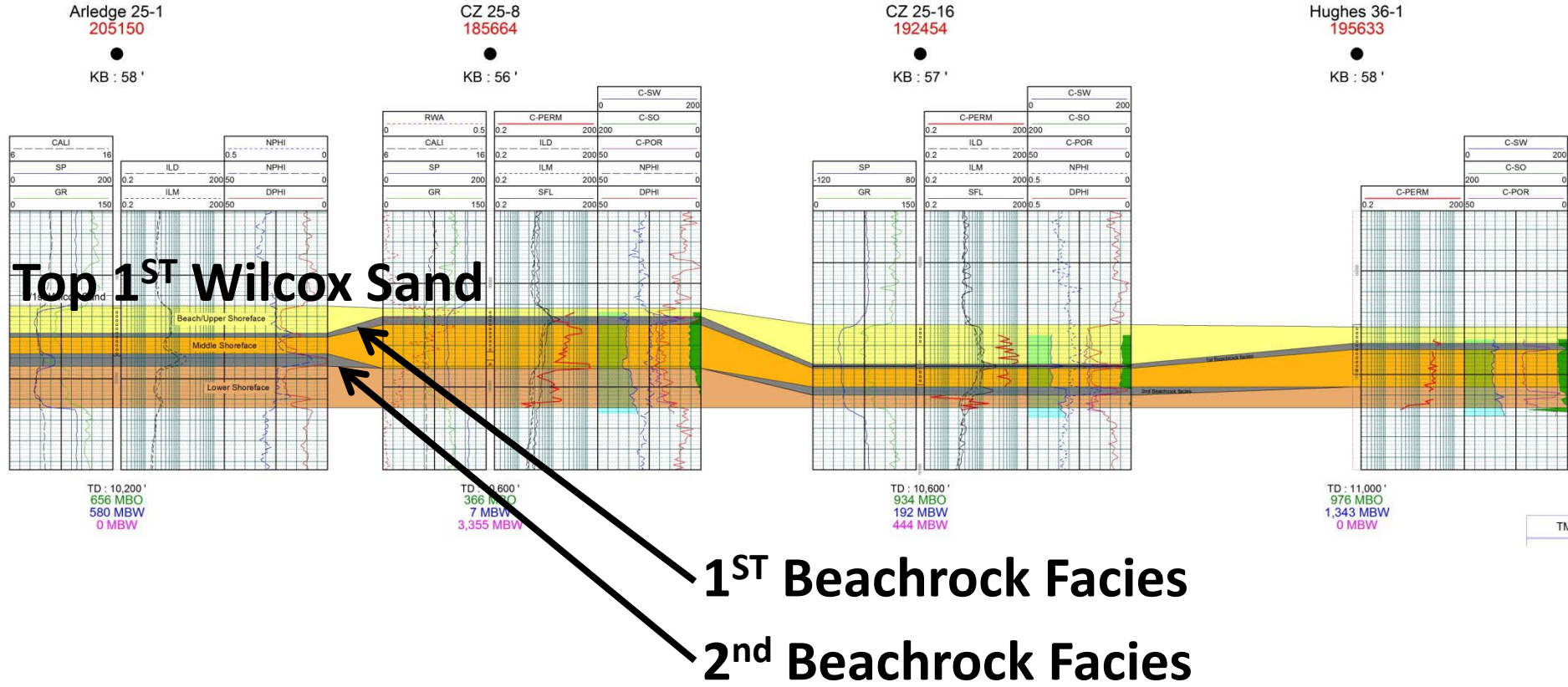
Type Log



Depositional Faces

- Beach / Upper Shoreface
- Middle Shoreface
- Lower Shoreface

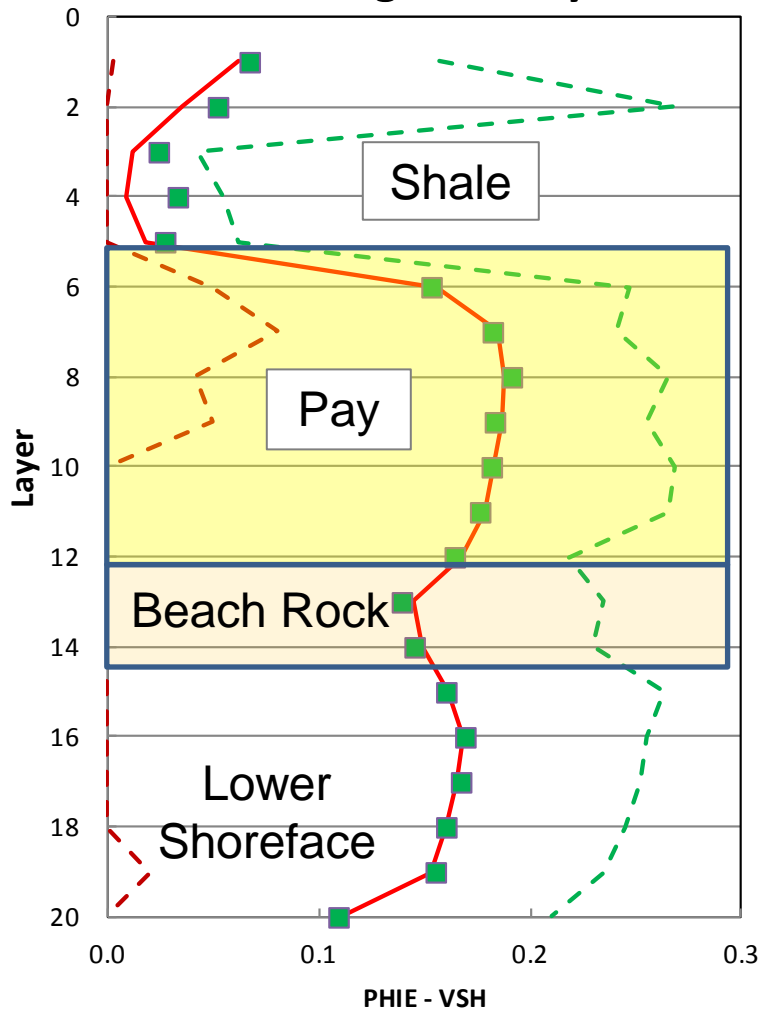
Reservoir Characterization



TM

Reservoir Characterization

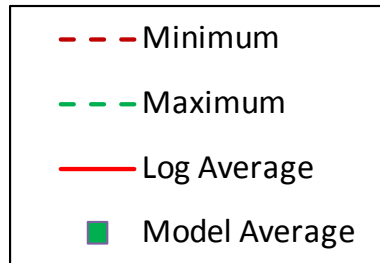
Log Porosity vs Model Porosity



Model was built from 33 PHIE logs in Builder using Gaussian Simulation

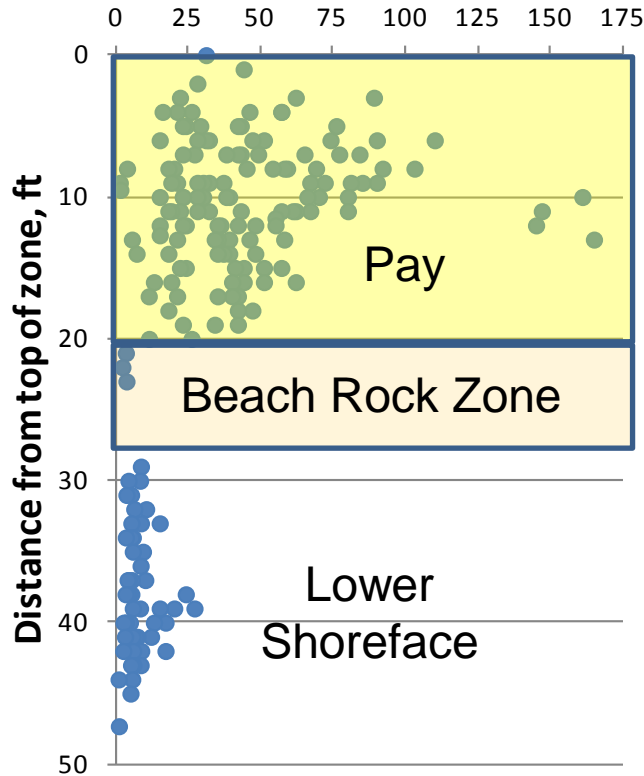
Maximum and minimum porosities were honored for each layer

Averages in model agree well with averages from logs

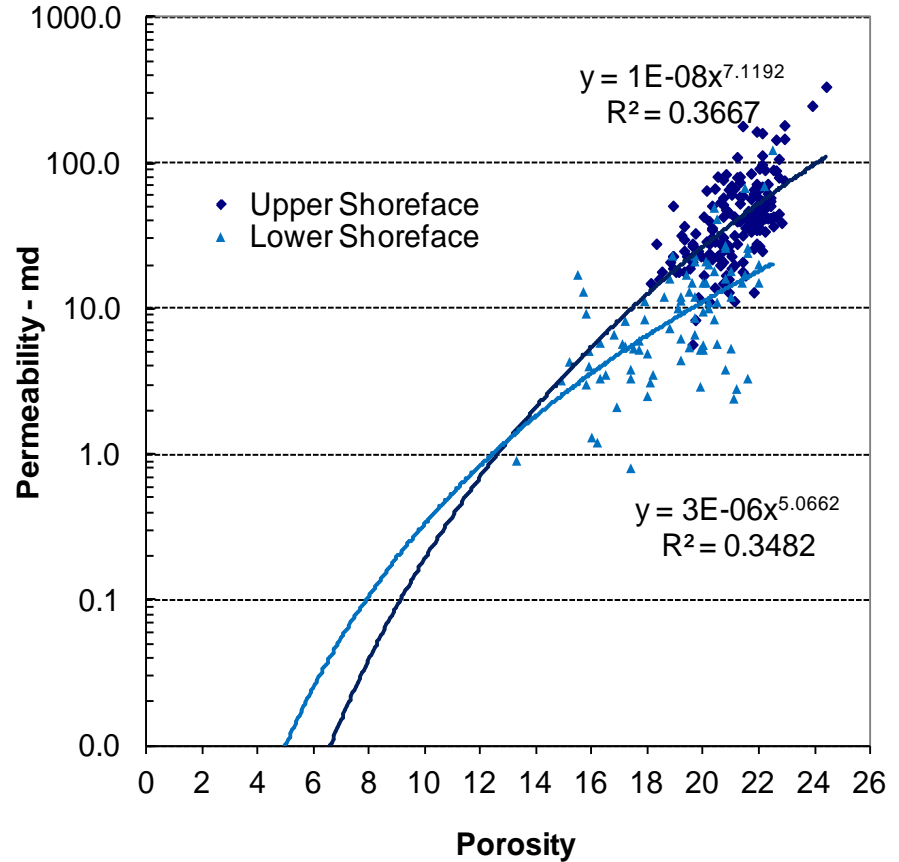


Reservoir Characterization

Core Permeabilities

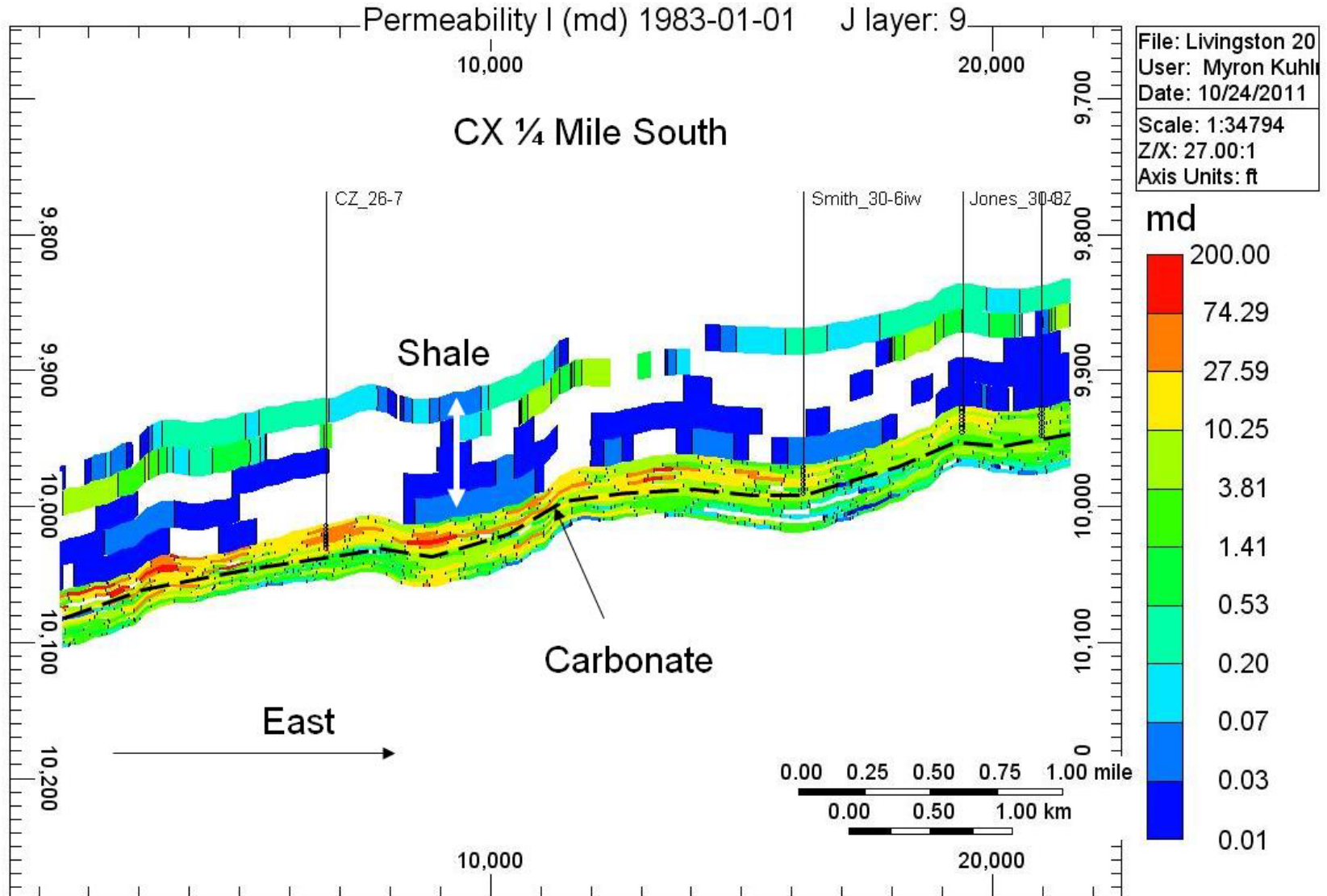


Permeability versus Porosity



Separate Correlations for Perm versus Porosity were used for Pay Sand and lower shoreface sand.

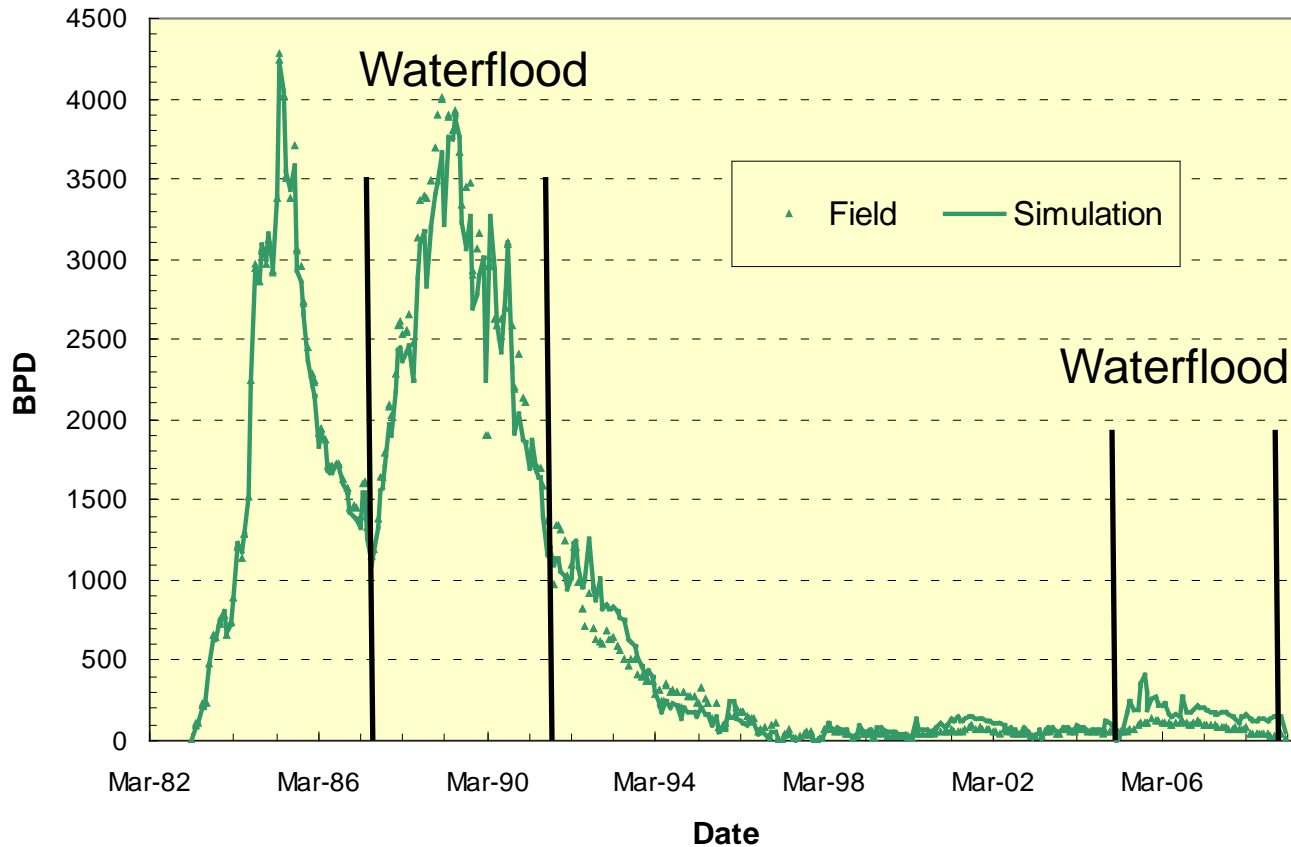
Reservoir Modeling





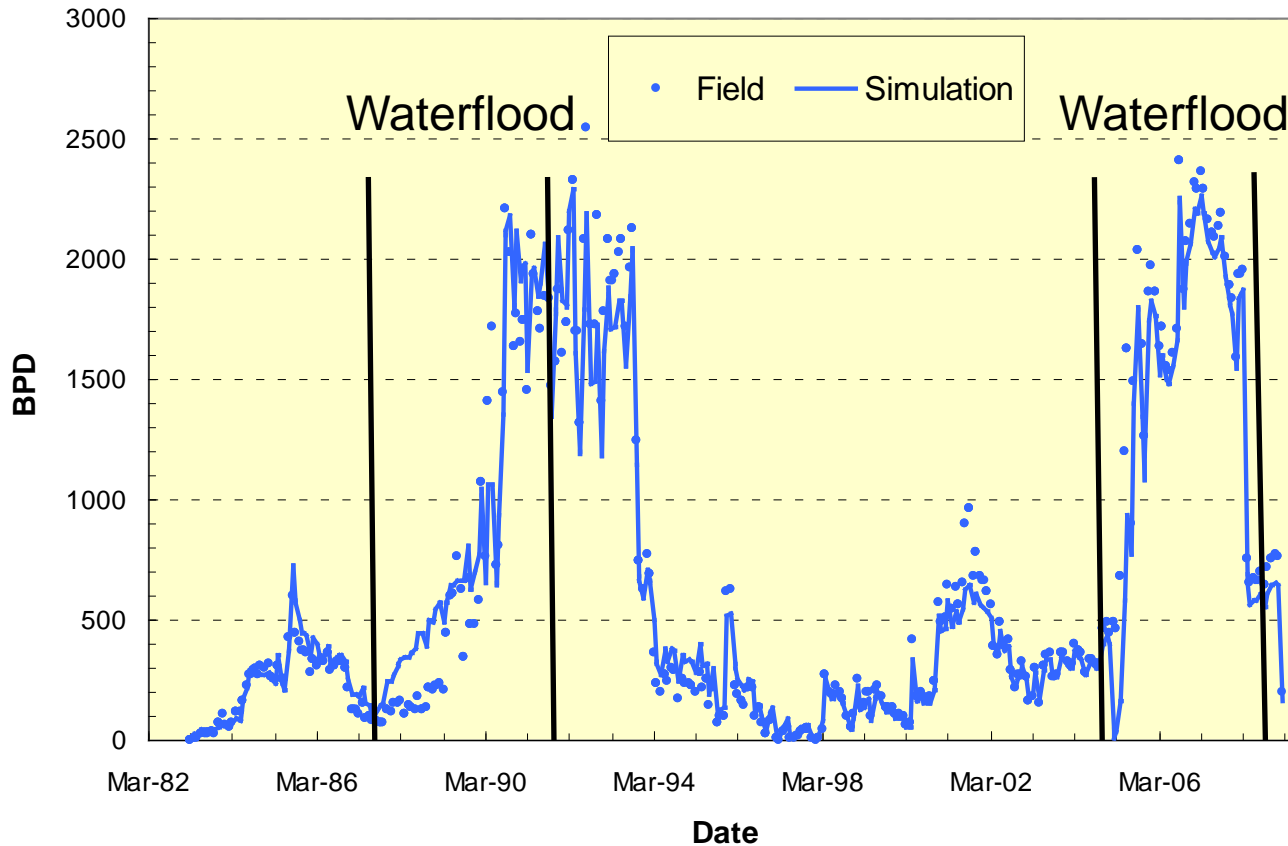
History Match – Oil Production

Livingston Model Oil Production



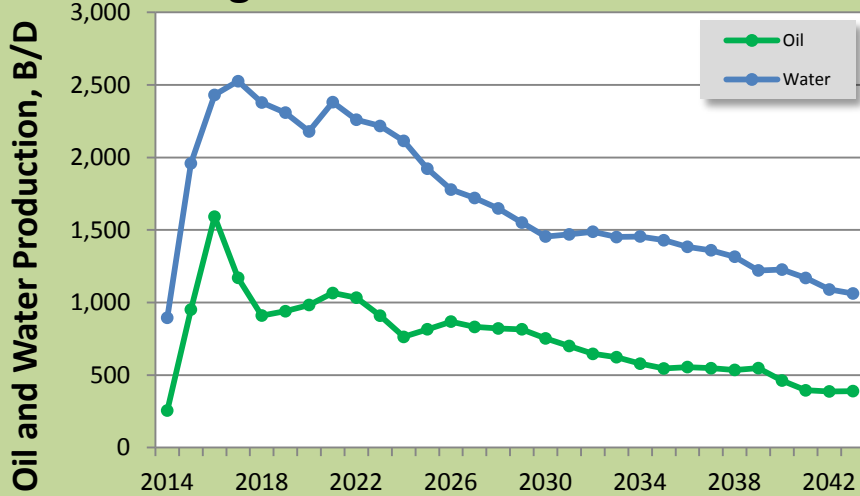
History Match – Water Production

Livingston Model Water Production

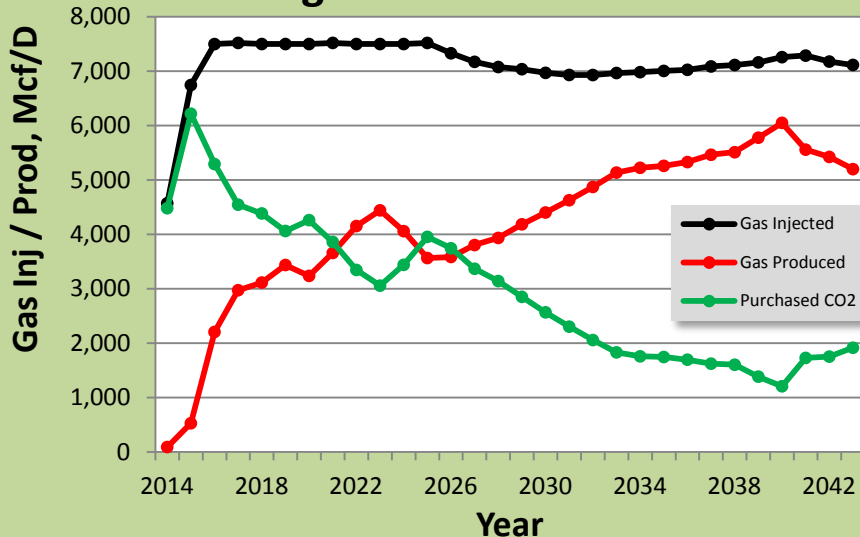


CO₂ Flood Forecast

Livingston EOR Production Rates

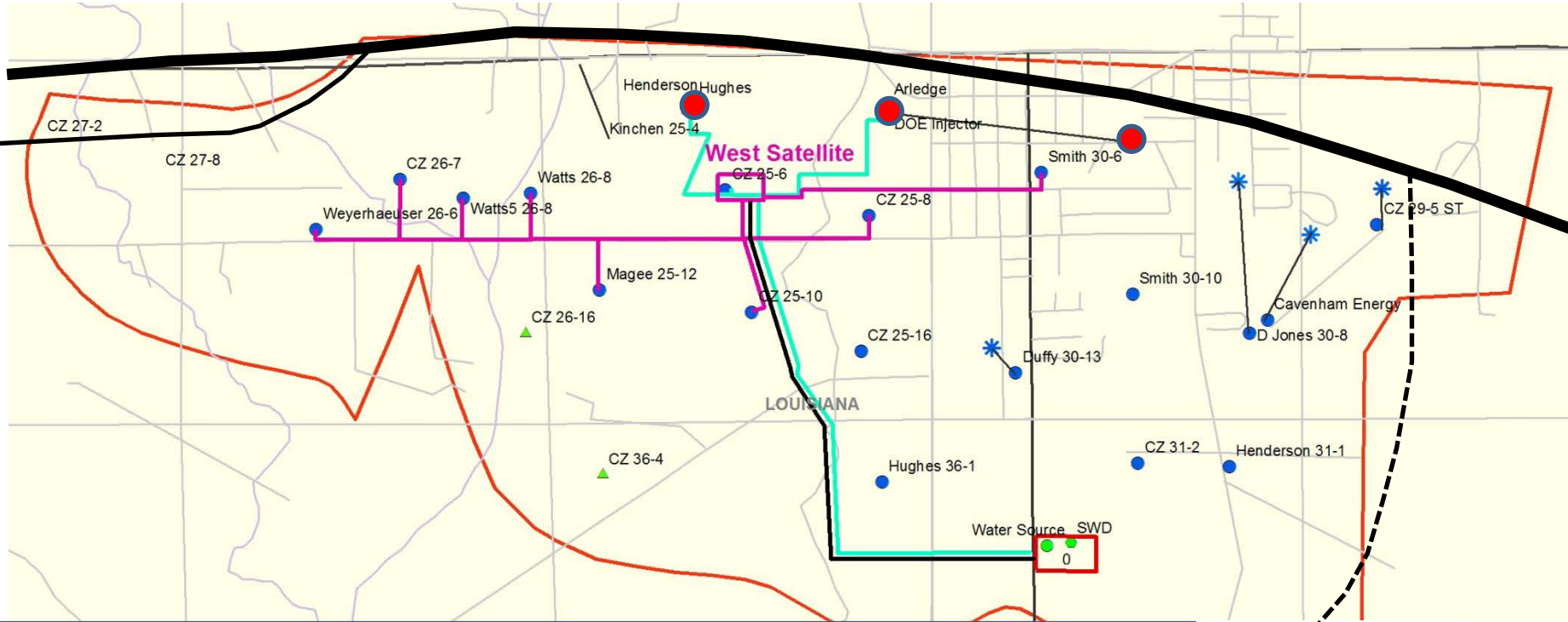


Livingston EOR Gas Rates



- ✓ **30 Year Production Life**
- ✓ **Oil Production**
 - 8.17 MM Bbls (29% OOIP)
- ✓ **Water Production**
 - 18.6 MM Bbls
- ✓ **Gas Production / Injection**
 - 78.1 Bcf Injection
 - 32.6 Bcf Purchased
 - All produced gas recycled

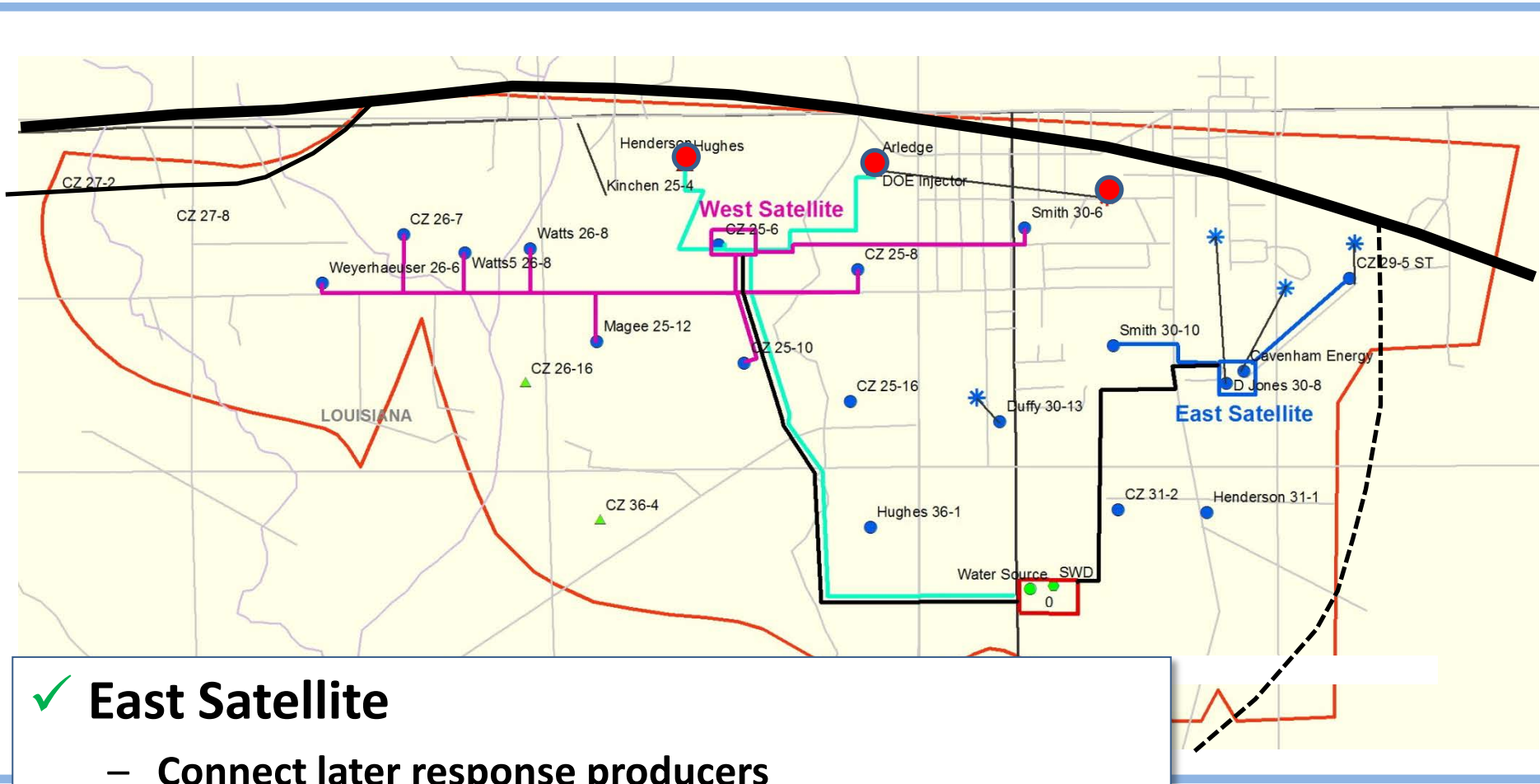
Staged Facilities Plan – Stage I



✓ West Satellite

- Connect early response producers
- Construct CO2 source facilities and distribution line
- Well test, G/L separation, recycle compression

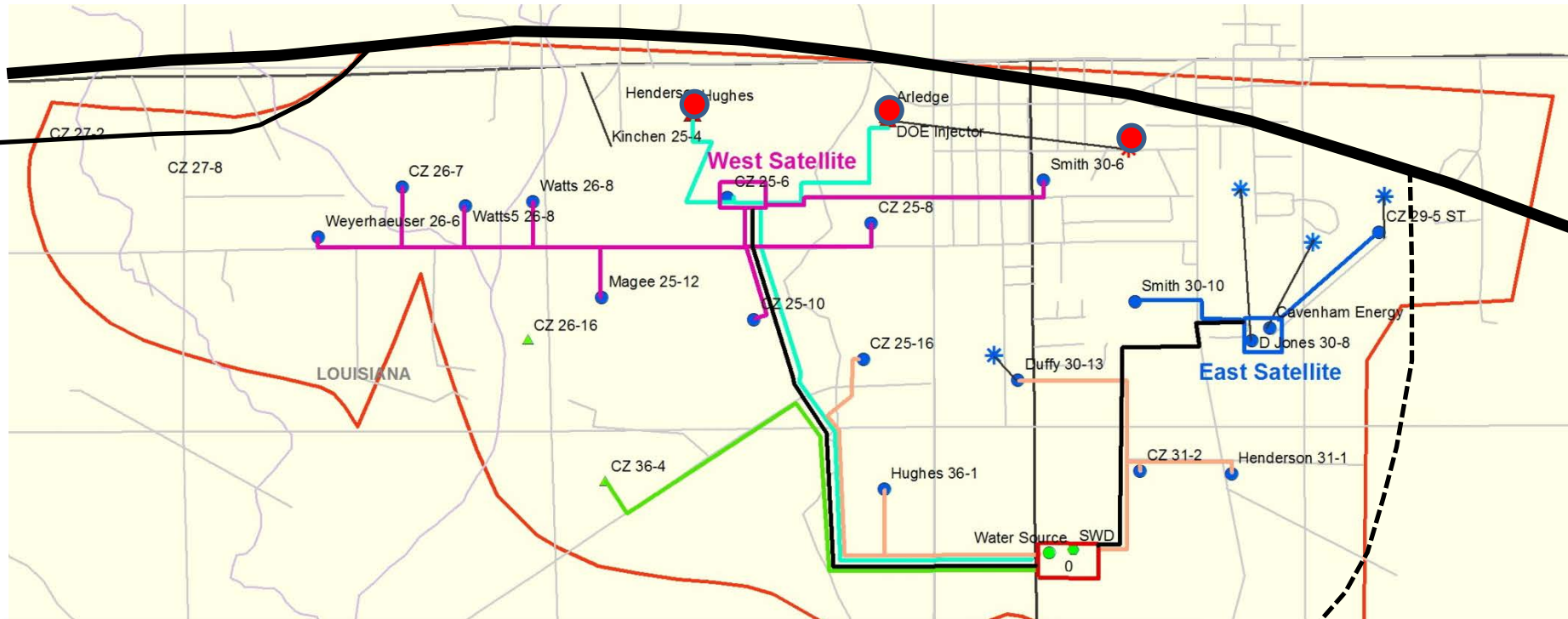
Staged Facilities Plan – Stage II



✓ East Satellite

- Connect later response producers
- Well test
- G/L separation, recycle compression at Central Facility

Staged Facilities Plan – Stage III



✓ Central Facilities Site

- Additional well test, G/L separation, recycle compression, oil storage
- Connect late response producers



Accomplishments to Date / Summary

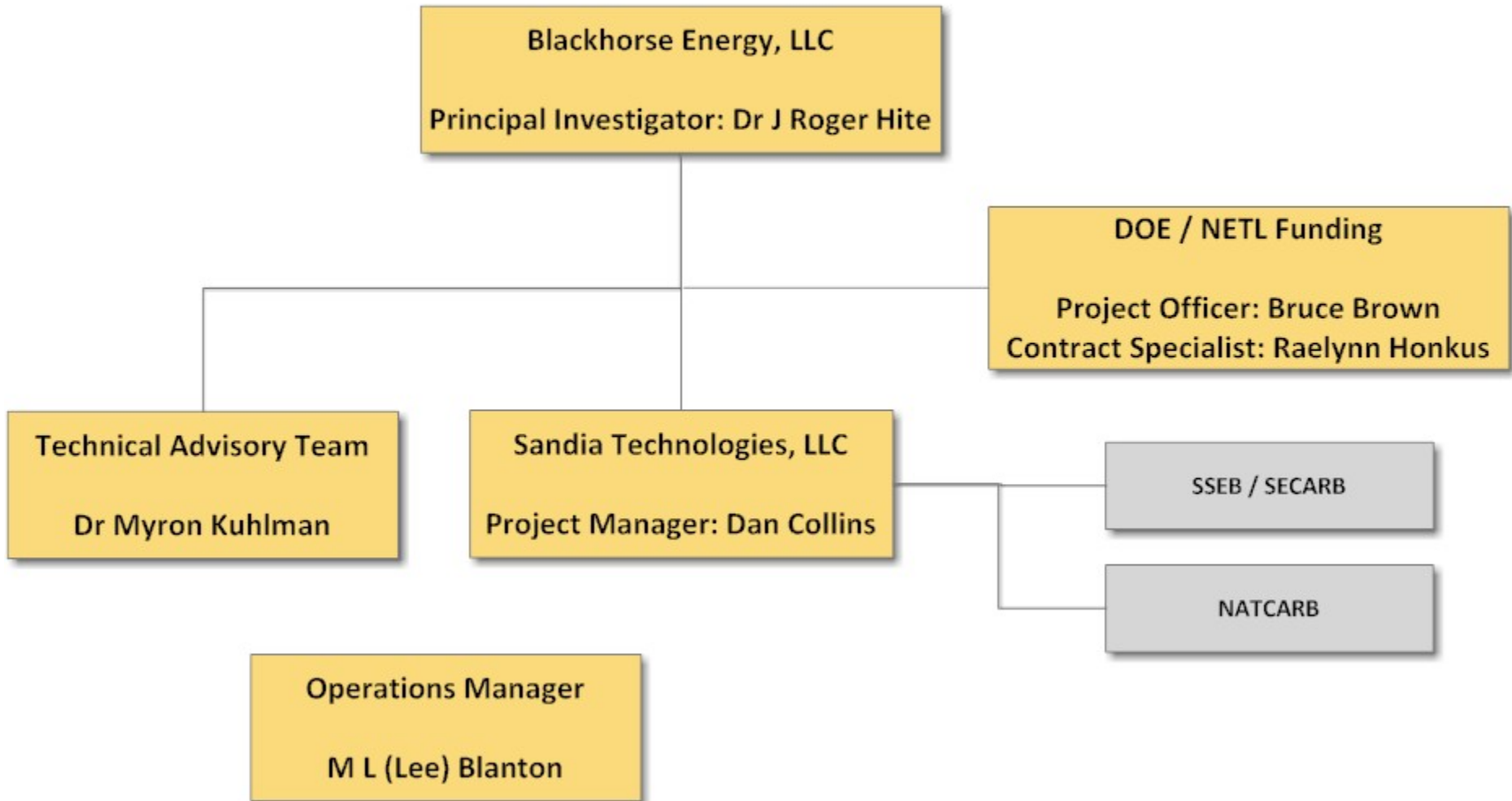
- ✓ **Improved reservoir modeling**
 - Reservoir characterization
 - Expanded / improved simulation model
- ✓ **Staged production facilities plan**
- ✓ **DoE Contract**
 - Agreed on cost share
 - SOPO complete
 - PMP in progress
 - Project management team in place



Discussion

Project Organization

Steering Team





Project Organization

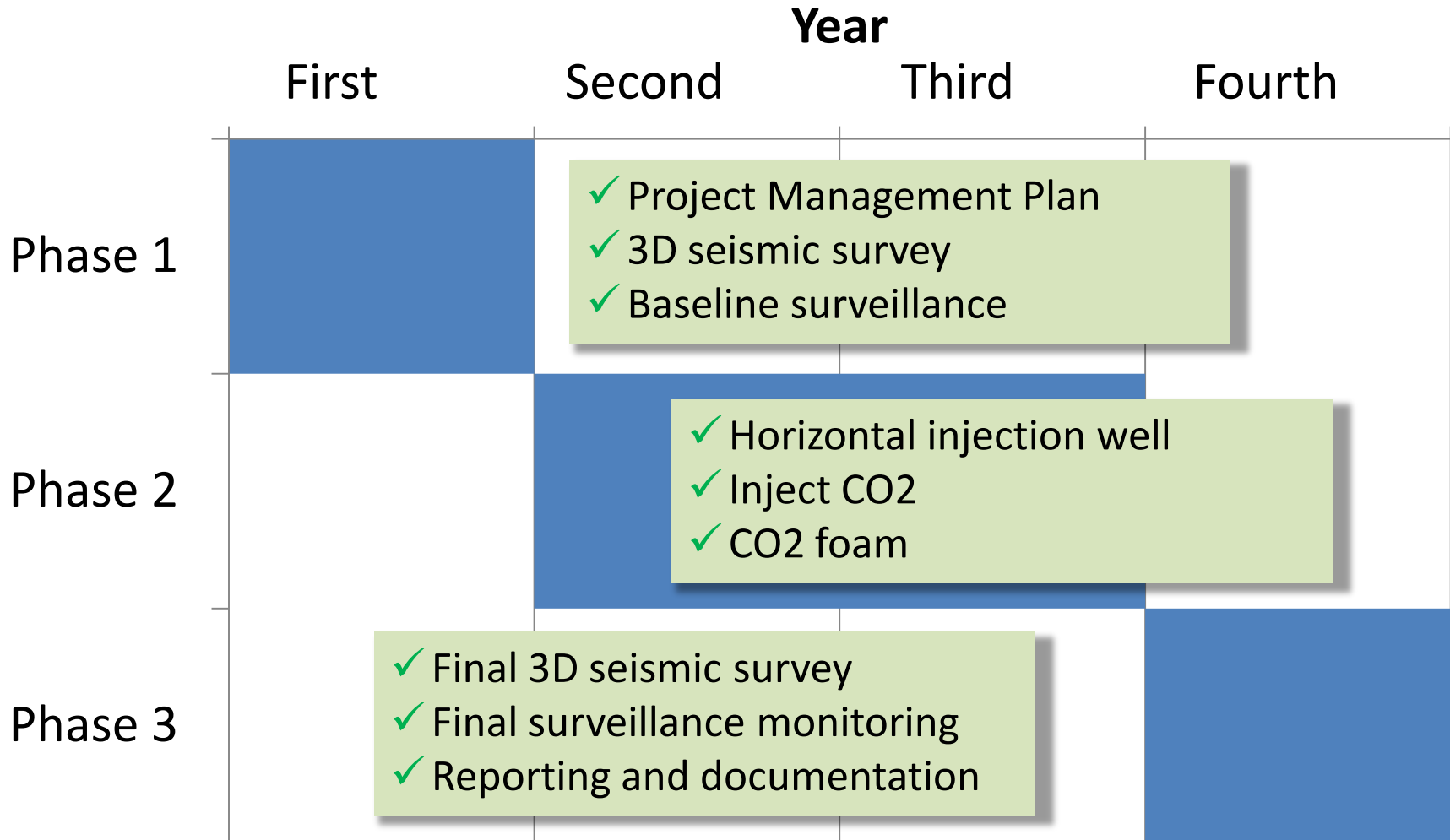
✓ Other Participants

- Universities
 - Rice University
 - Louisiana State University
 - University of Texas - Austin
- Schlumberger Carbon Management Services
- Computer Modeling Group

✓ Endorsements

- Scott Angelle, Secretary, Louisiana Department of Natural Resources
- Ken Nemeth, Executive Director, Southern States Energy Board

Project Timeline





Publications

✓ None to date