Pecos Slope Field Geology

Location: Chavez Co. New Mexico

Pecos Slope Field Classification and Field Notes

From Pecos Slope Field-U.S.A. Permian Basin, New Mexico by Leslie Bentz

Location: Chavez and Debaca Counties, New Mexico

Basin: NW shelf of the Delaware Basin (NW corner of the larger Permian Basin)

Basin Type: Foredeep (Def) an elongate sediment-filled sea-floor depression bordering an island arc or other orogenic belt.

Reservoir Rock Type: Sandstone

Depositional Environment: Fluvial

Trap Description: Lateral wedge-out of fluvial clastic facies coupled with tectonically induced fracture systems; updip seal unknown but probably coincides with change from meandering channel to braided channel facies (L. Bentz)

(See Slide No 4 For Braided Stream Description)

Reservoir Age: Permian

Petroleum Type: Gas

Trap Type: Regional Depositional Facies Change

Structure: Average dip rate from the west side of the field (Pecos Slope W.) is 66 ft per mile or ¾ deg and the dip direction is E20 deg S. (110 deg)

Reservoir Characteristics

Gross Thickness of Abo Pay Zone: 400’ (West side) to 650’ (East side)

Porosity: 12-14%: can exceed 20% in some areas

Natural Permeability: 0.03 – 0.05 md

Reservoir Characteristics The gross thickness of the Abo Formation in the producing area varies from over 650 ft (198 m) in thickness in the Pecos Slope field to less than 400 ft (122 m) thick in the West Pecos Slope field (Figure 11). Production is limited to the upper two-thirds of the formation, with pay thicknesses averaging 30 ft (9 m). However, pay thickness can exceed 80 ft (24 m) with a minimum figure being 10 to 12 ft (3-4 m). Producing sandstones are described as red, finegrained to silt, with the major constituents being quartz and plagioclase feldspar. Mica and heavy minerals can be found in trace amounts. Clays (illite and chlorite), calcite, dolomite, and anhydrite are the cementing agents (Figure 15). The natural permeability of the sandstones is very low, 0.03 to 0.05 md (Figure 14). The average porosity is 12-14%, but porosities can exceed 20%.

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Comparison of Geophysical Log and Core Data

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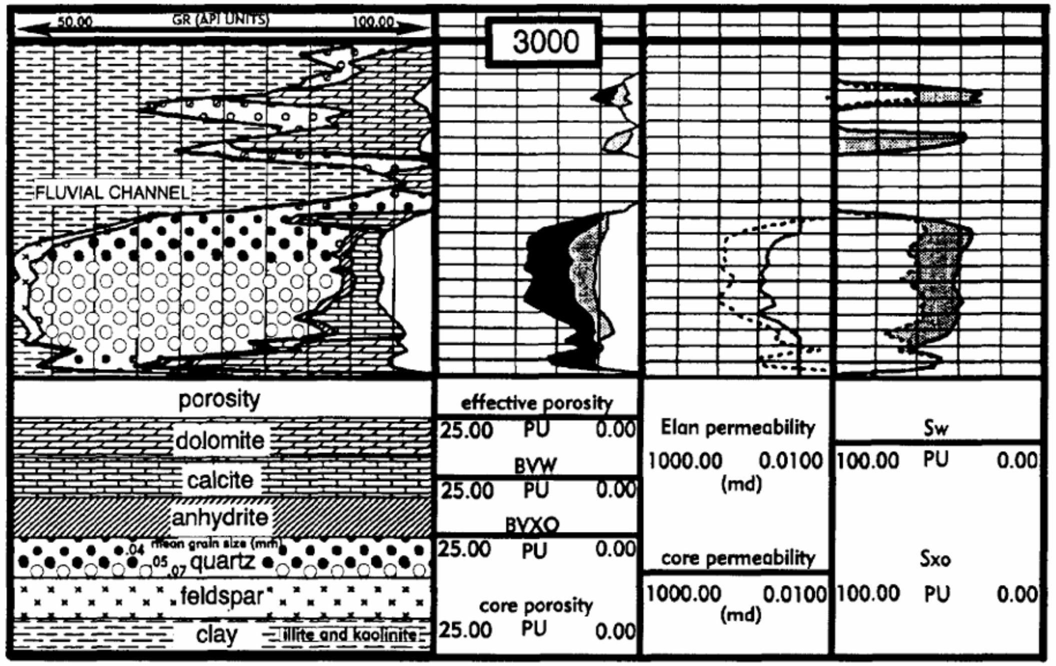

Figure 14. Comparison of geophysical log and core data in the Mitchell and Halbouty Energy No. 3 M & M Federal, SW/4 NW/4 NW/4 Sec. 31, T5S, R23E, Chaves County, New Mexico. The gamma ray curve (left) illustrates the correlation between gamma ray response and mean grain size. The upward fining sequence from 0.07 mm to 0.04 mm indicates the fluvial channel nature of the sandstone. Quartz is the dominant mineral, with other constituents being dolomite, calcite, anhydrite, feldspar, and clays. The clays are illite and kaolinite. This plot graphically defines the mineralogy in their relative percentages. Geophysical log and core porosity are described in porosity units (PU). The solid line indicates effective log porosity whereas core porosity is described by the dashed line. Porosity determined from both means correlated favorably although core porosity peaks higher at certain points. Bulk volume water (BVW) is shown in white, residual hydrocarbon saturation in gray, and movable hydrocarbons (BVXO) (gas) in black. Permeability is described by both methods in a logarithmic plot in md. Elan (log derived) permeabilities are consistently higher than core-derived permeabilities. The final plot illustrates core derived water saturations (SW or S_w) (solid line) versus hydrocarbon saturation (SXO or S_{xo}) (dashed line). Geophysical log plots were provided courtesy of Schlumberger and core data were provided courtesy of Mitchell Energy.

Field Characteristics:

Average elevation	4075 ft
Initial pressure	1125psi
Present pressure	? psi
Pressure gradient	0.267 psi/ft
Temperature	102°F
Geothermal gradient	0.024°F/ft
Drive	Gas expansion
Gas column thickness	Indefinite (about 2900 ft)
Gas-water contact	Indefinite
Connate water	38.5%
Water salinity, TDS	104,000 ppm
Resistivity of water	0.07 at 72°F
Bulk volume water	(%) 0.045%
Field size:	Proved acres 138,240 ac
Well spacing	160 ac
Ultimate recoverable	750 bcf
Cumulative production	577 bcf (IHS)
Annual production	2022 – 4.4 bcf
Present decline rate	76% est.
Initial decline rate	35%
Overall decline rate	19% est
In place, total reserves	1000 bcf
In place, per acre foot	560 mcf/ac-ft
Primary recovery	750 bcf

Braided River Systems

Braided rivers are a type of river that form a network of many branches within a channel. They often form when the bedload sediment is high compared to the suspended load, which then helps the development of bars, creating the braided character. Fast flow and steep gradients characterize braided rivers.

How is a braided river formed?

In big floods the rocks and sediments are carried out across the plains toward the coastline. Braided rivers form when these rocks and sediment build up on the riverbed. In time the build-up becomes so high that the water, seeking the lowest path, begins to flow down a new channel.
What characterizes braided river systems?

A braided river is a wide, shallow river composed of ever-changing alluvial islands (bars) and several channels that branch and rejoin. Characteristically, these rivers form from steep source waters with high water flows that carry large sediment loads of sand and gravel along the river's bed.

Braided River Systems

Simply, braided River channels are formed where you have steep slopes, shallow wide channels, high water velocity which in turn allow large sediment loads that when deposited form islands or bars within the river bed. This in turn cause the flow to be diverted forming additional channels which when duplicated over time, form a braided sequence of depositional fluvial channels. Most modern braided channel river systems are located in Alaska, Canada, the Himalaya's and New Zealand.

New Zealand

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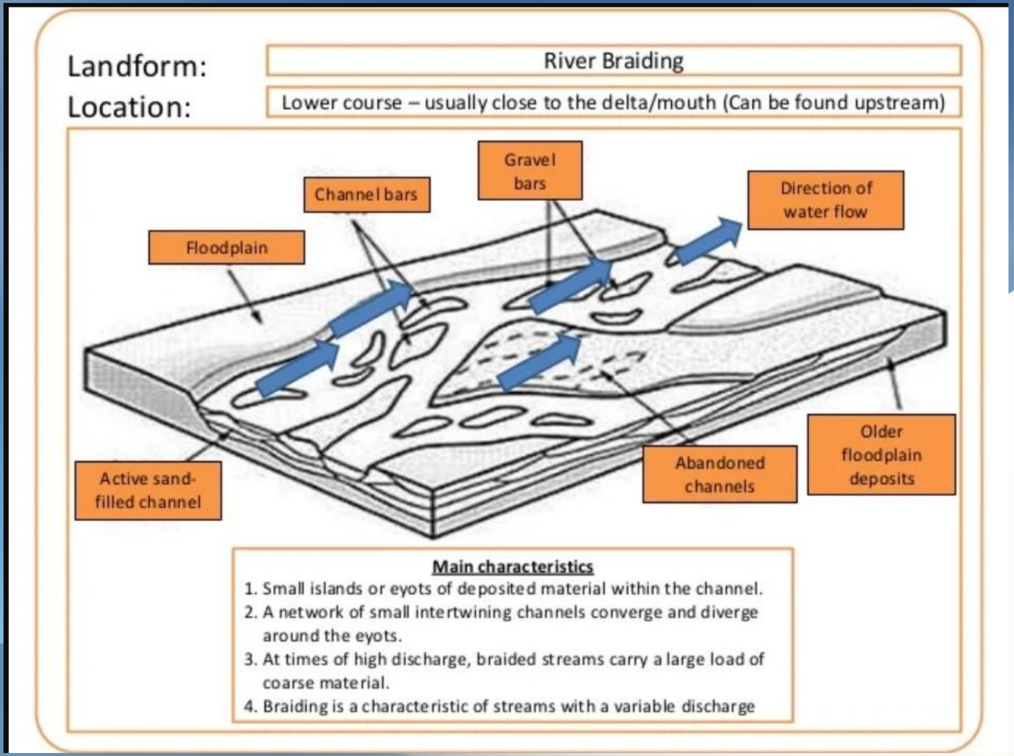
Physically similar extensive braided rivers are rare world-wide and occur only in Alaska, Canada and the Himalayas. Canterbury contains 60% of the braided- river habitat in New Zealand, and the Mackenzie Basin contains some of the most pristine of these rivers.



What characterizes a braided river?

Braided rivers are bedload-dominated systems characterized by a network of unstable channels, ephemeral bars, and limited riparian vegetation (Ashmore, 2013). They possess a relatively high slope for the available discharge and a large proportion of bedload concerning the total load.

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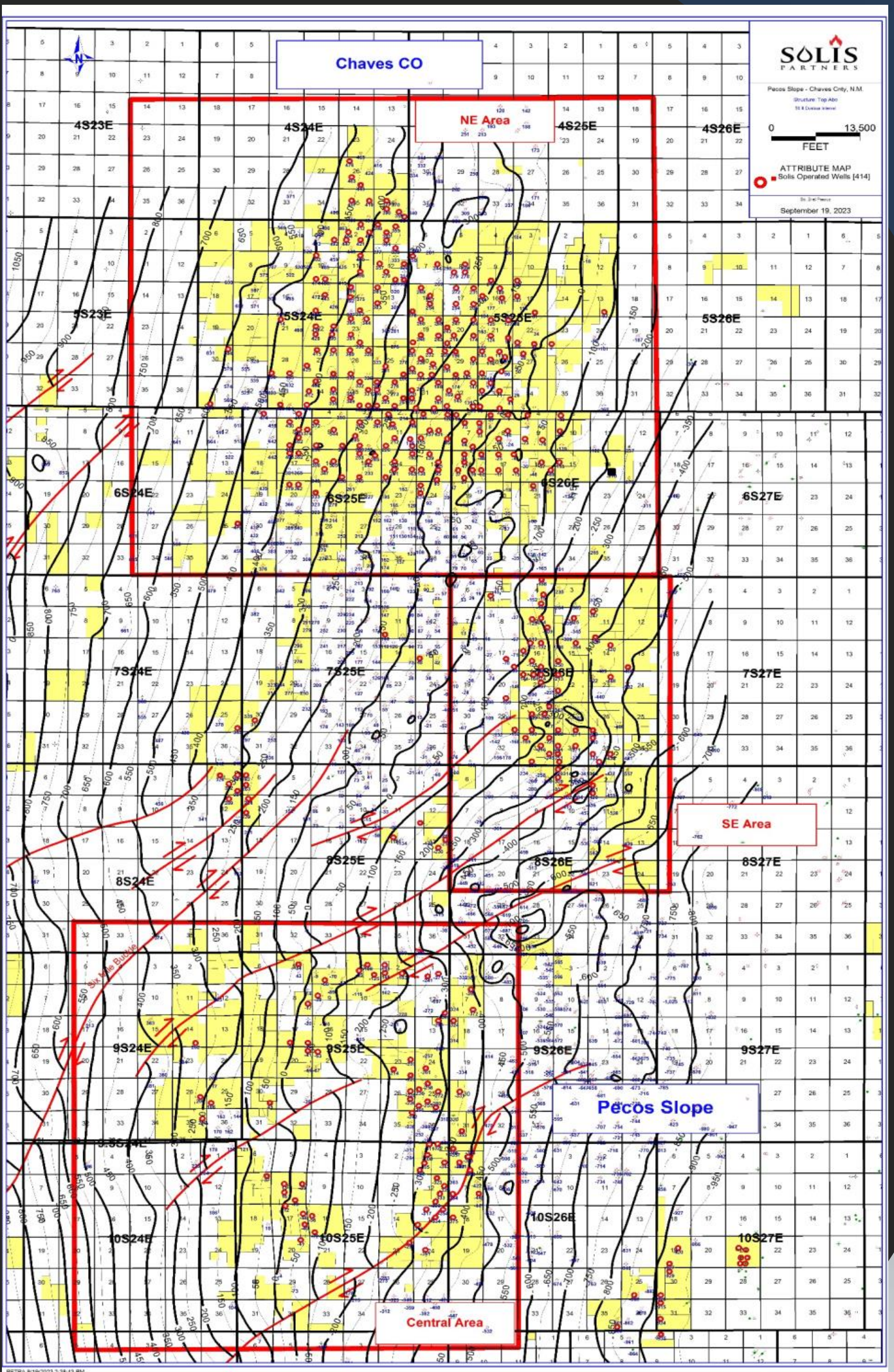

Abo Structure Map

CI: 50'

Structure: **Average dip rate from the west side of the field (Pecos Slope W.) is 66 ft per mile or ¾ deg and the dip direction is E20 deg S. (110 deg)**

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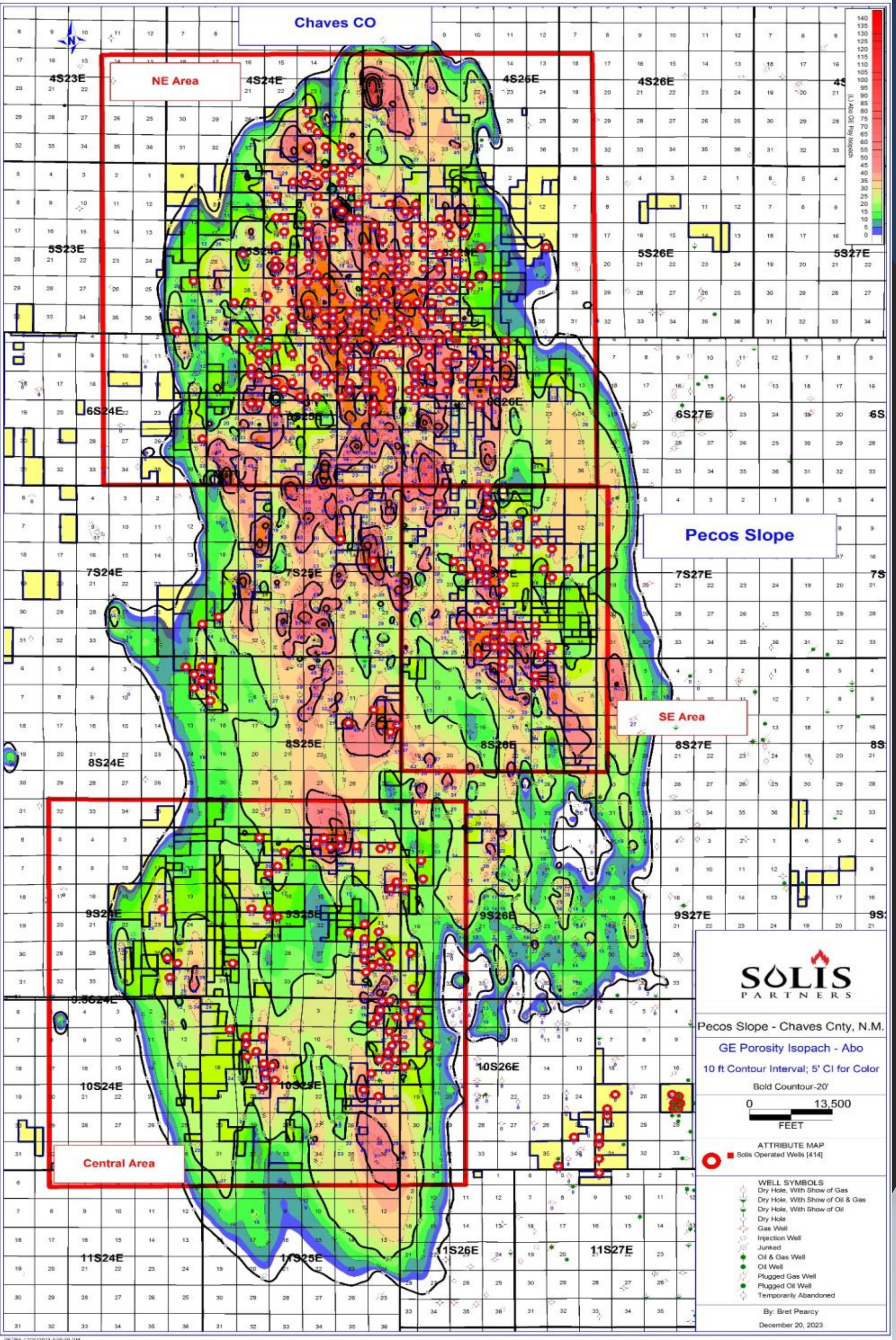
Abo Gas Effect Porosity Map *(No Cut Off's)*

CI: 10'



Gross Thickness of Abo Pay Zone: **400' (West side) to 650' (East side)**

Porosity: **12-14%: can exceed 20% in some areas**

Natural Permeability: **0.03 – 0.05 md**

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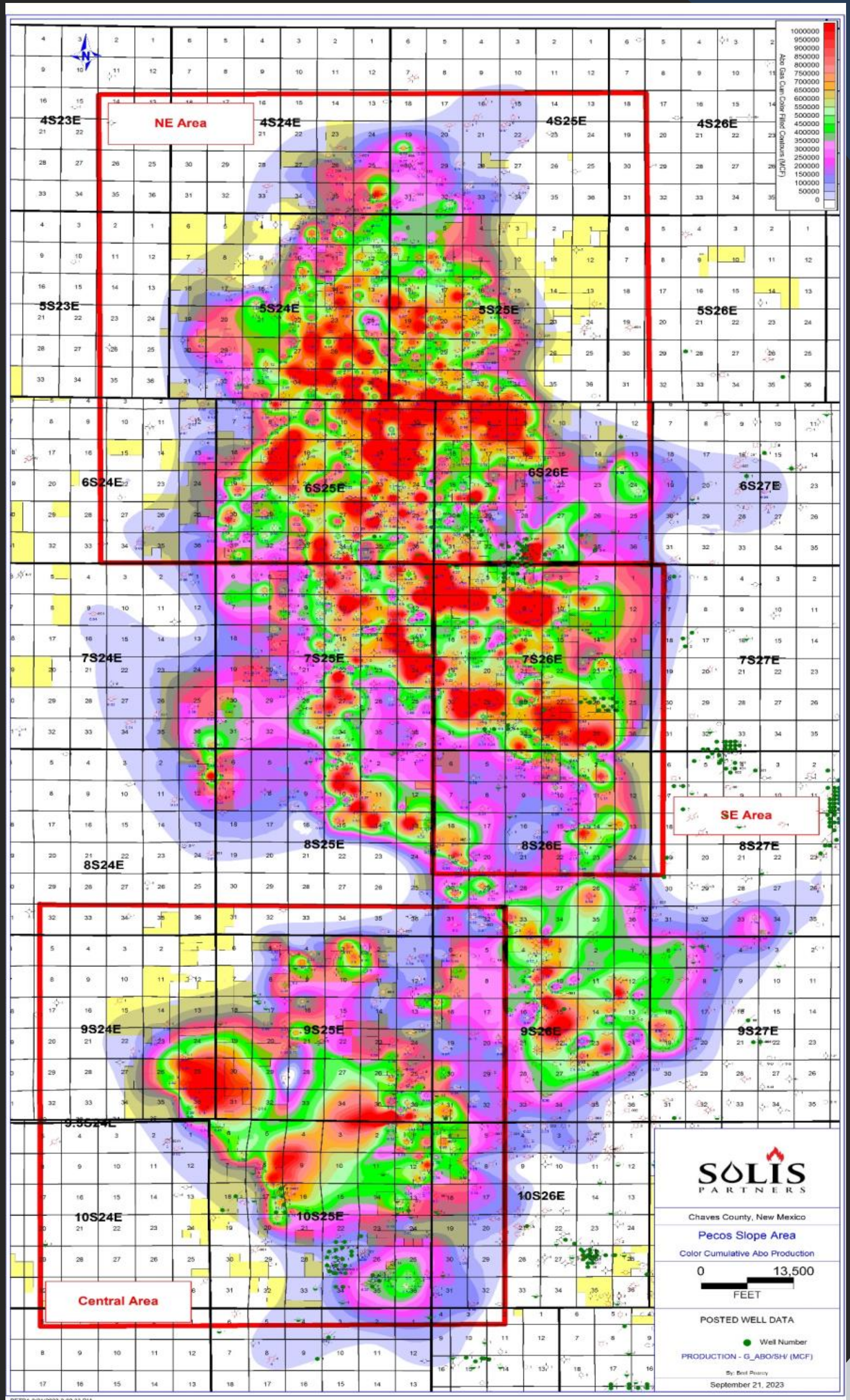

Abo Cumulative Gas

CI: 50 MMCF

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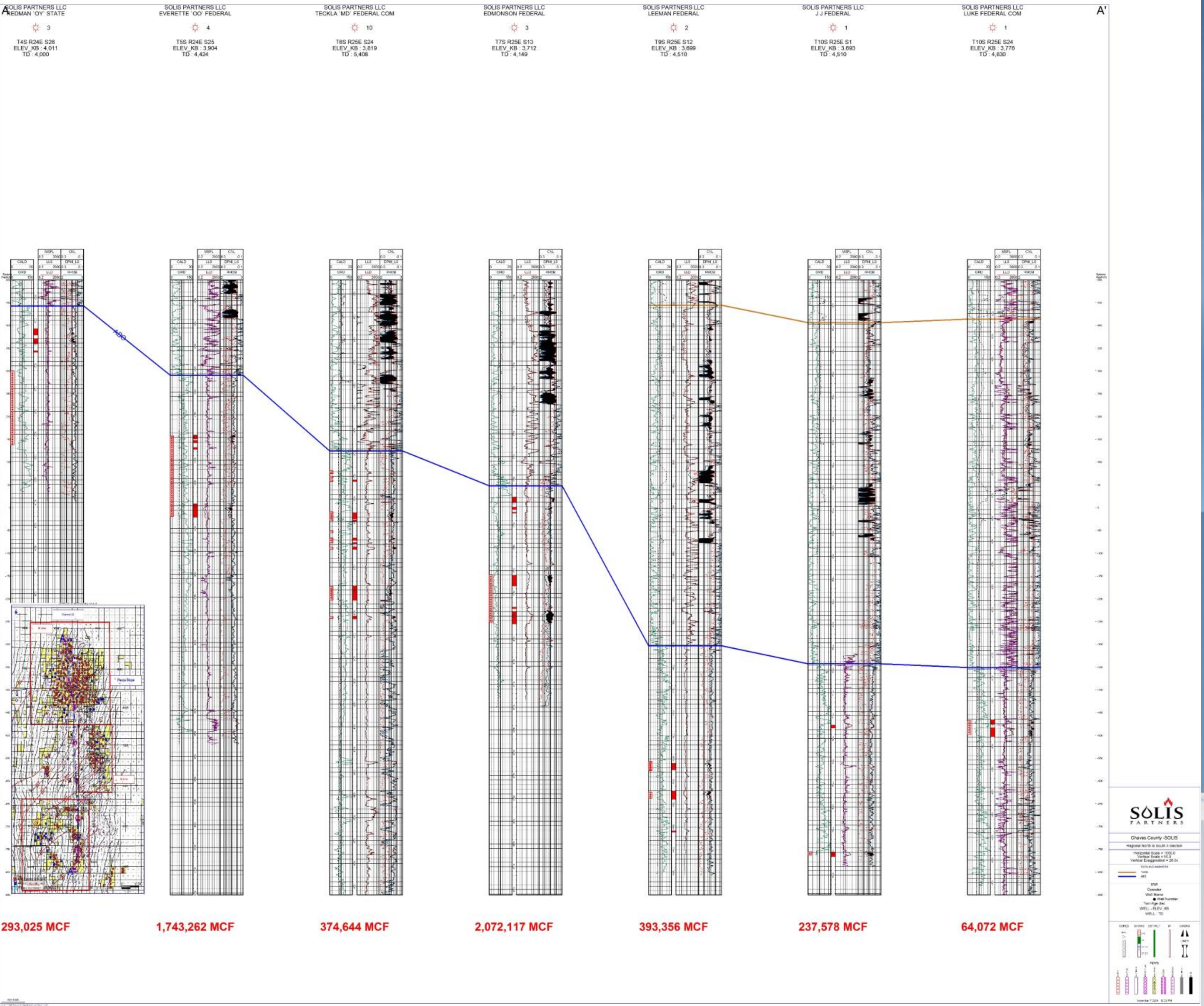
North to South Structural X-Section



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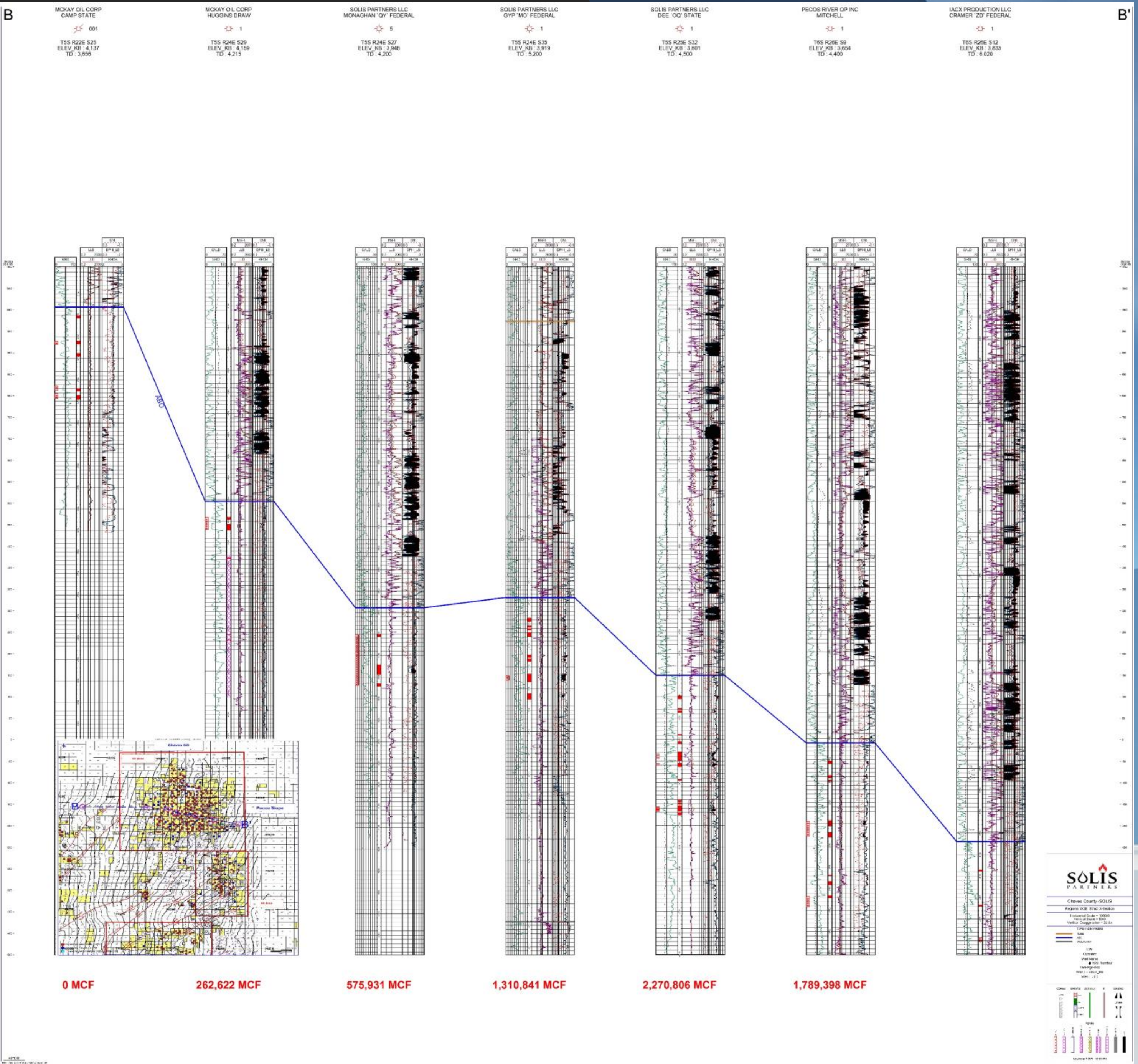
West to East Structural X-Section



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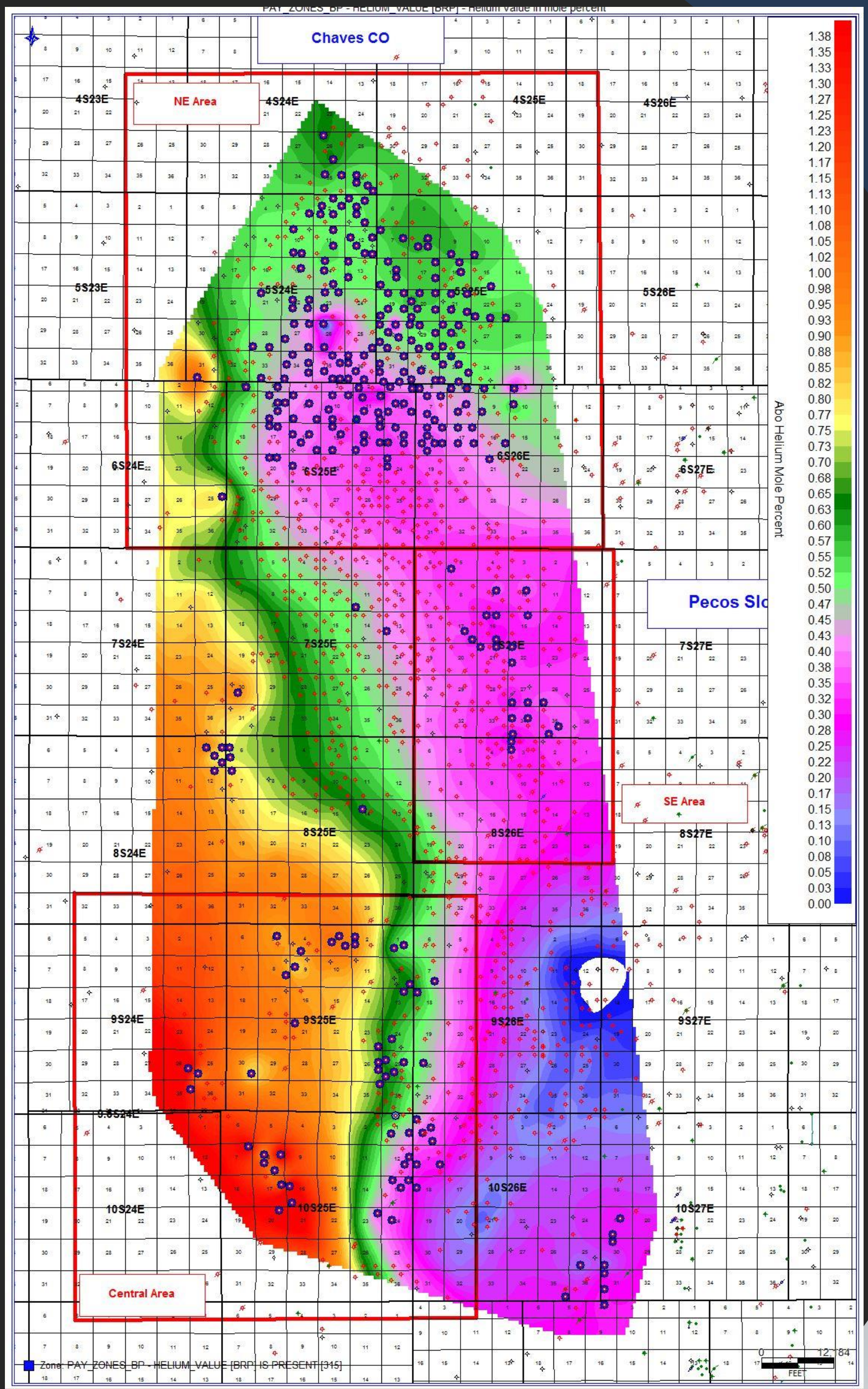
Helium Color Map



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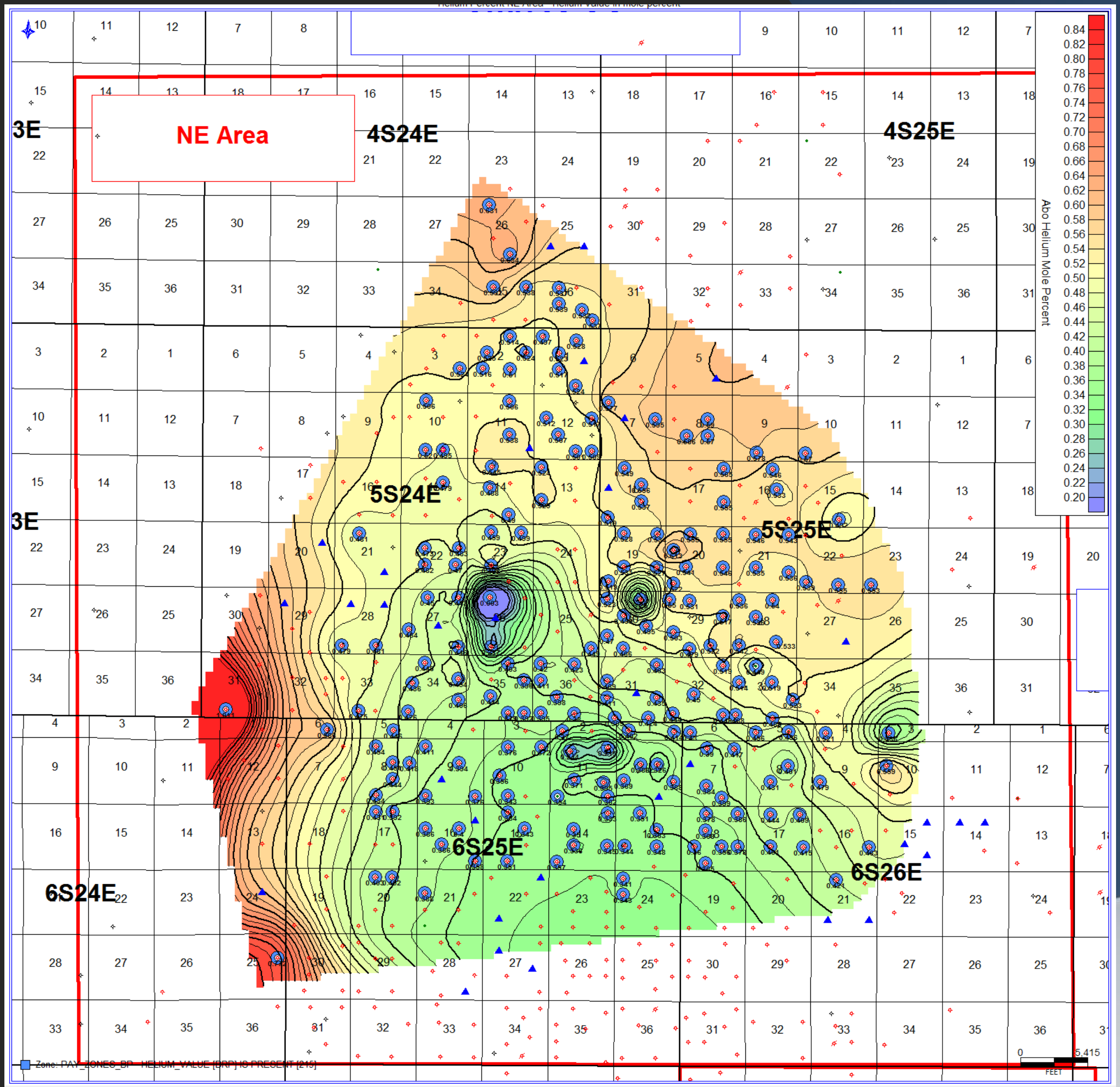
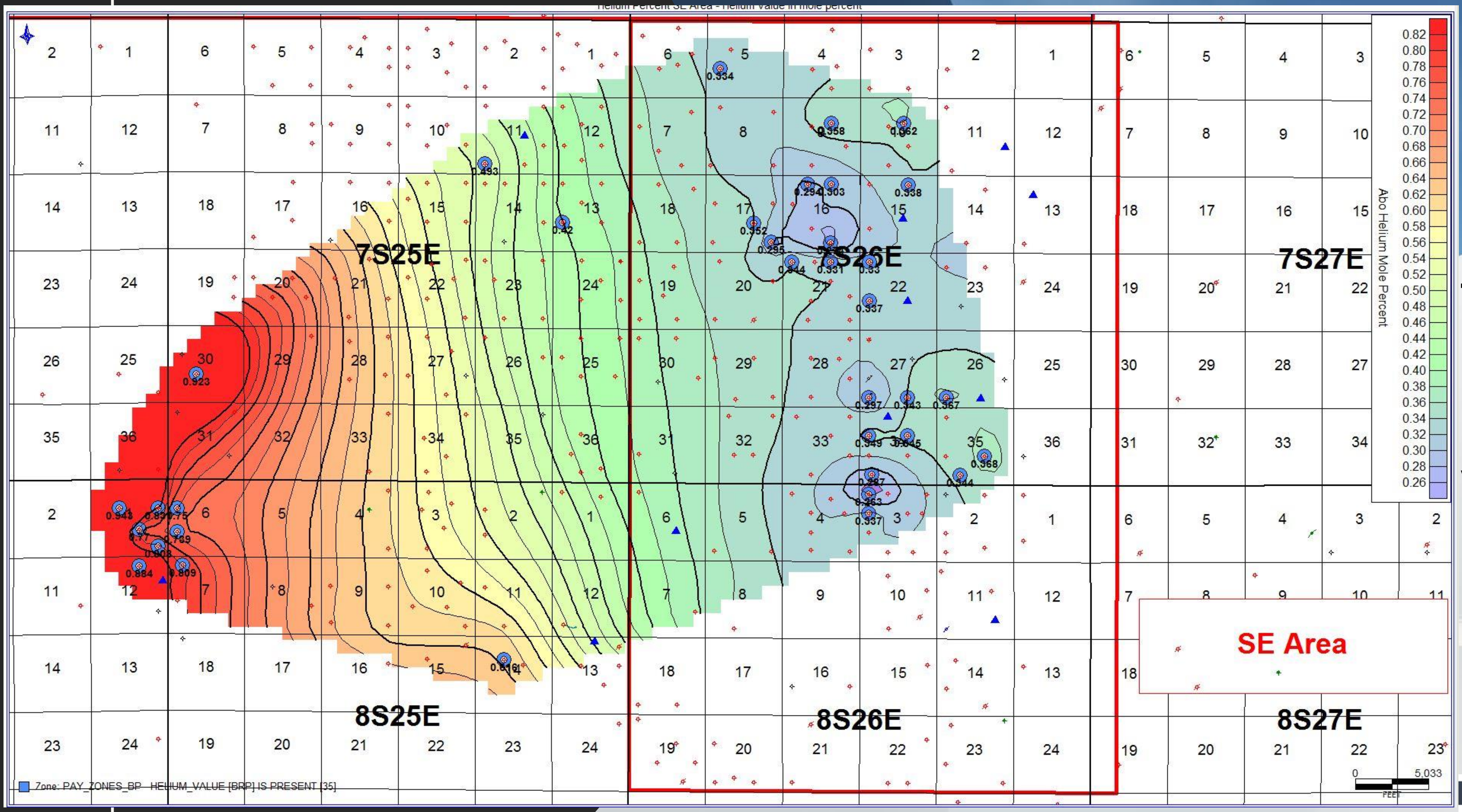
NE Area Helium Color Map



The NE Area has Helium concentrations from 0.2 mole % to a little over 1.0 mole % per well.

***Notice that the much lighter Helium migrates updip to the west.**

SE Area Helium Color Map



The SE Area has Helium concentrations from 0.3 mole % to a little over 0.9 mole % per well.

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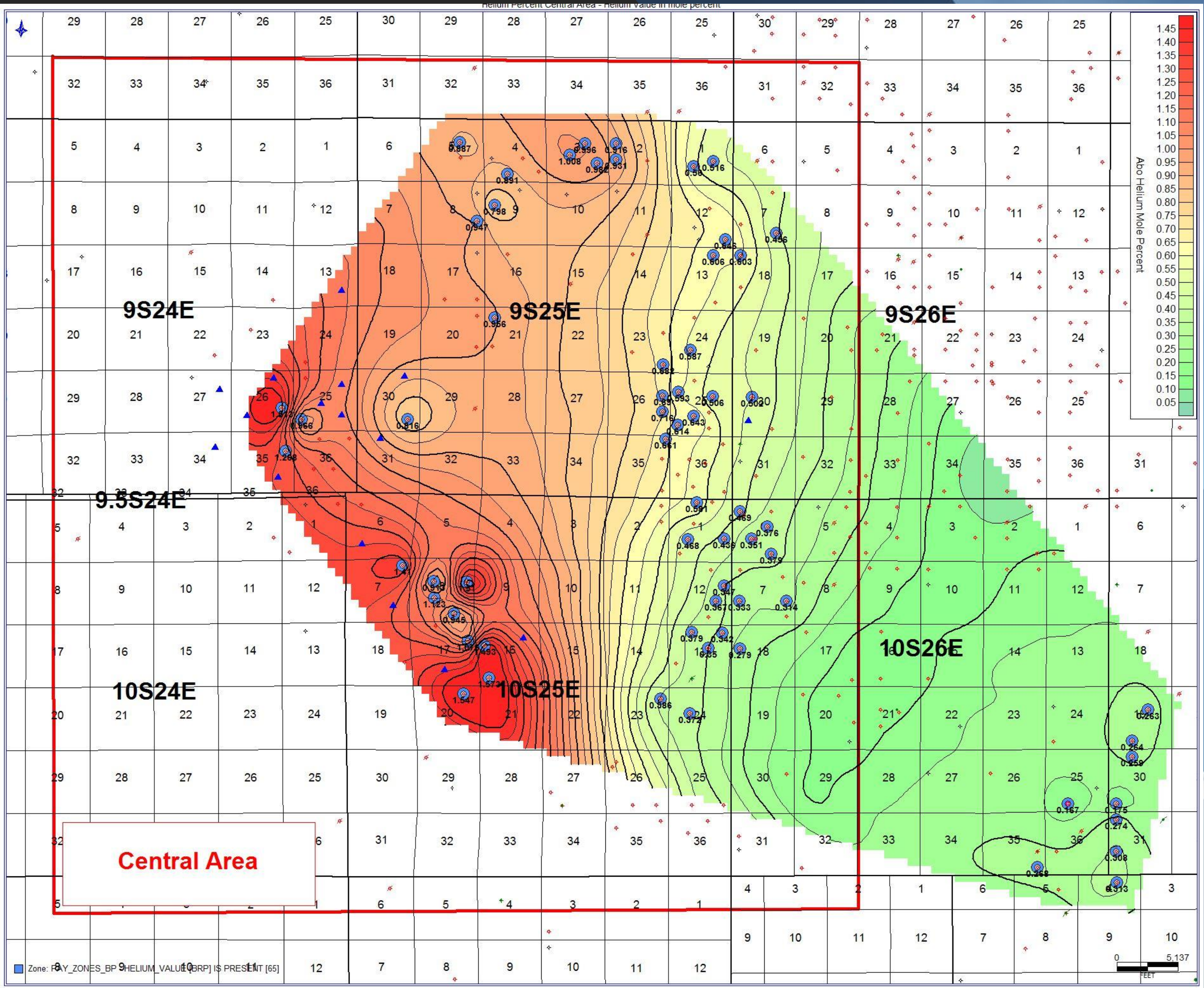
Central Area Helium Color Map



The Central Area has some of highest Helium concentrations per well within Pecos Slope Field.

Mole percentages are from 0.25% to over 1.5 %.

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