FOURPOINT ENERGY

ERD DEVELOPMENT IN THE SHELF PLAY WESTERN ANADARKO BASIN

How to maintain drilling efficiency, while increasing well design complexity

Ben Sellers

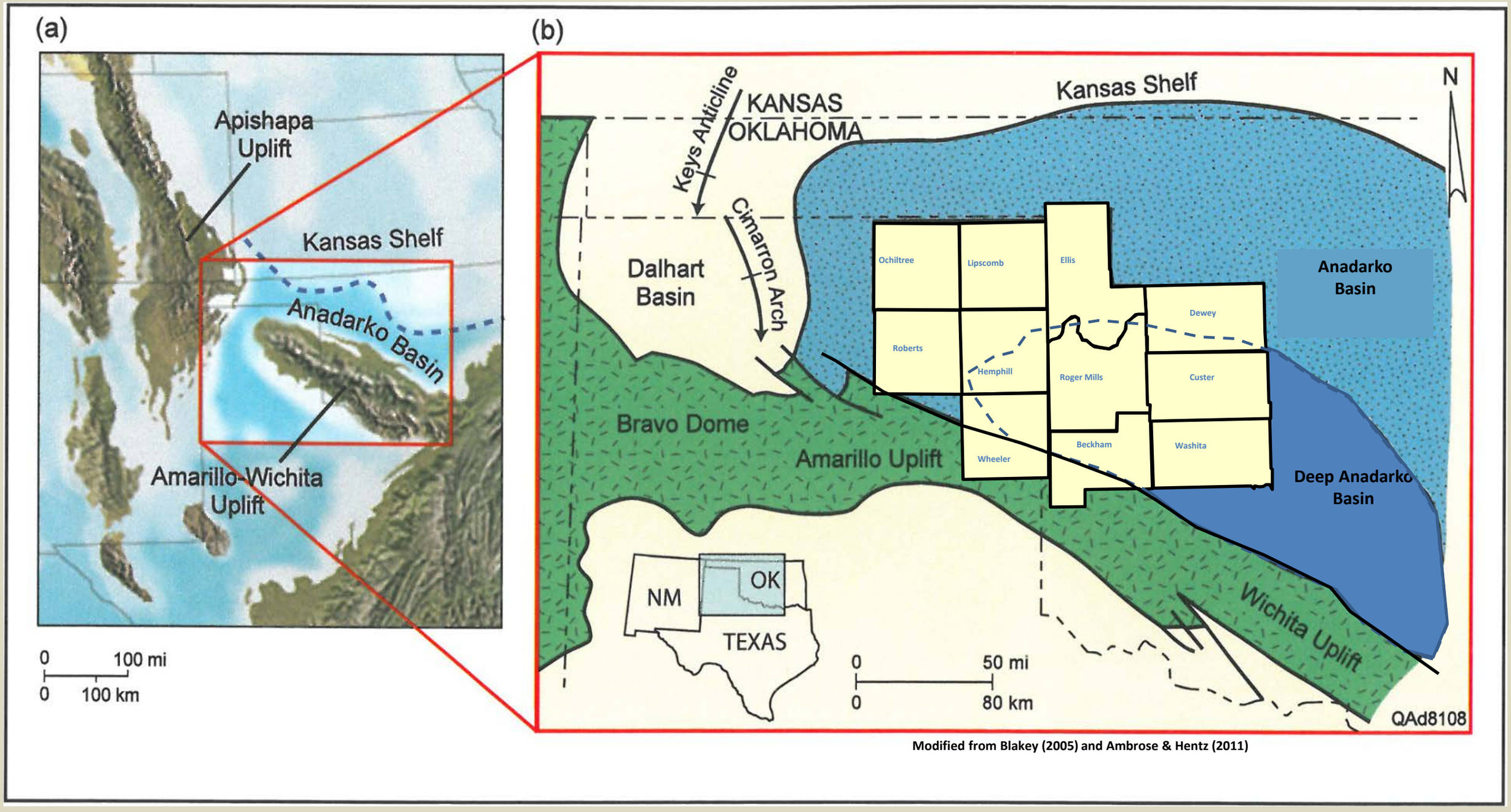
02-13-2019

OUTLINE

- **Background Information**
  - **Western Anadarko Basin (WAB) Geology**
  - **FourPoint Energy's (FPE) Shelf Timeline Overview**
- **Well Plan Design Progression (2016 – Present)**
  - **Well Plan Design Changes (5k -10k Laterals)**
  - **Execution (DvD and Operational and BHA Design Changes)**
  - **Performance Highlight**
- **Present and Future Considerations**

Anadarko Basin

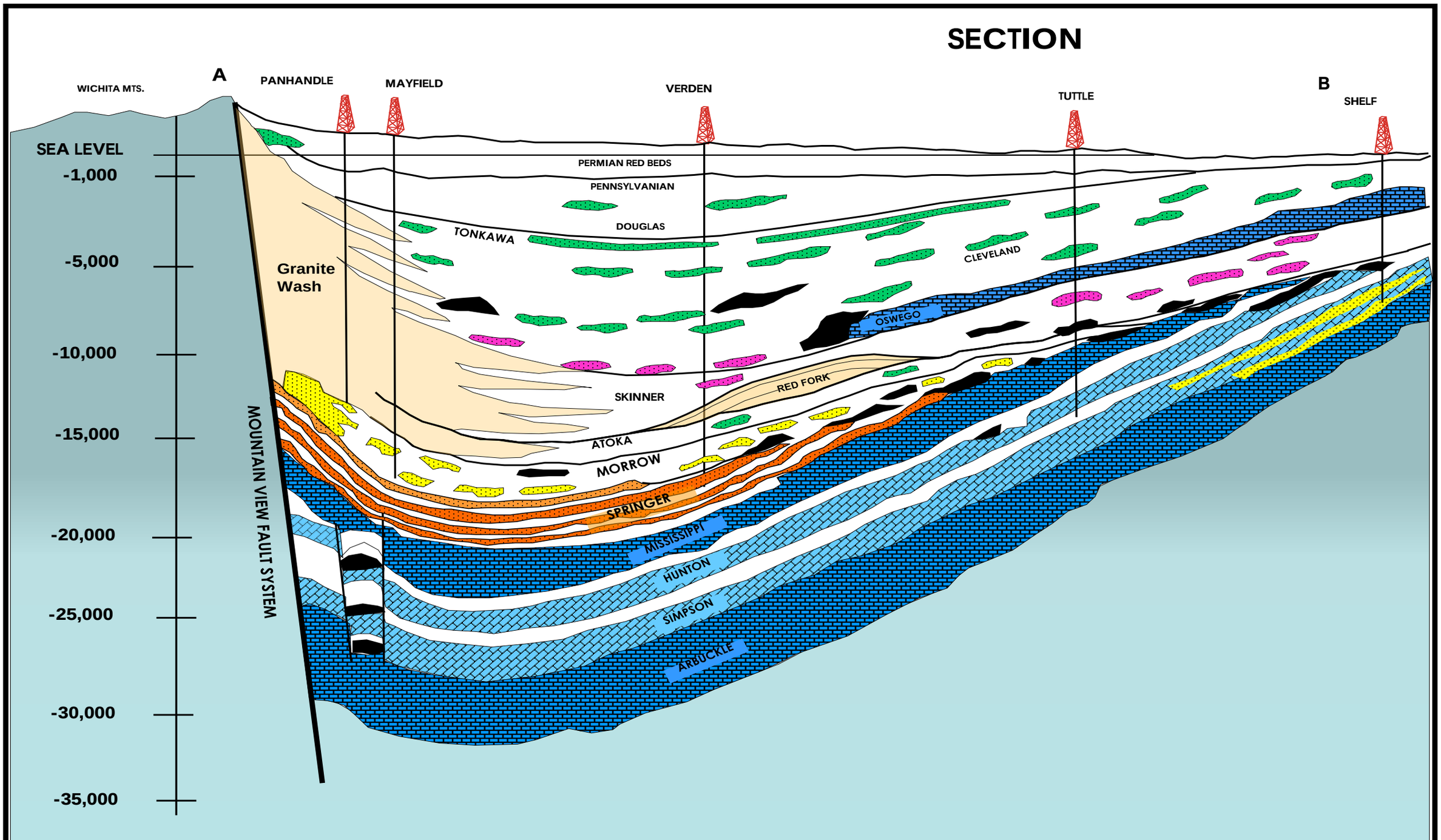
Paleo-Geography and Tectonic Setting



Modified from Blakey (2005) and Ambrose & Hentz (2011)

Anadarko Basin

Generalized Section



Play Activity

Granite Wash and Shelf Sandstones

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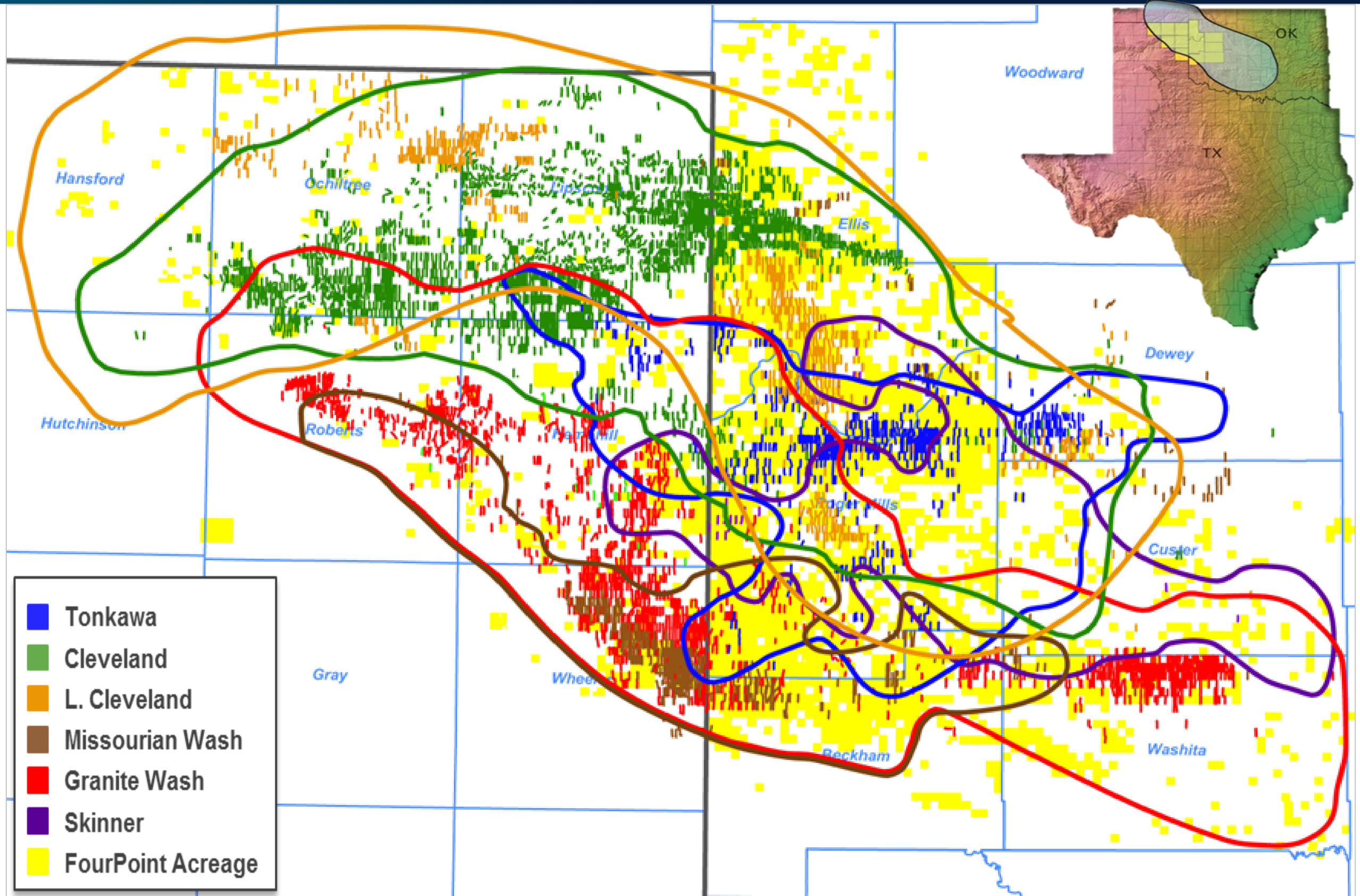
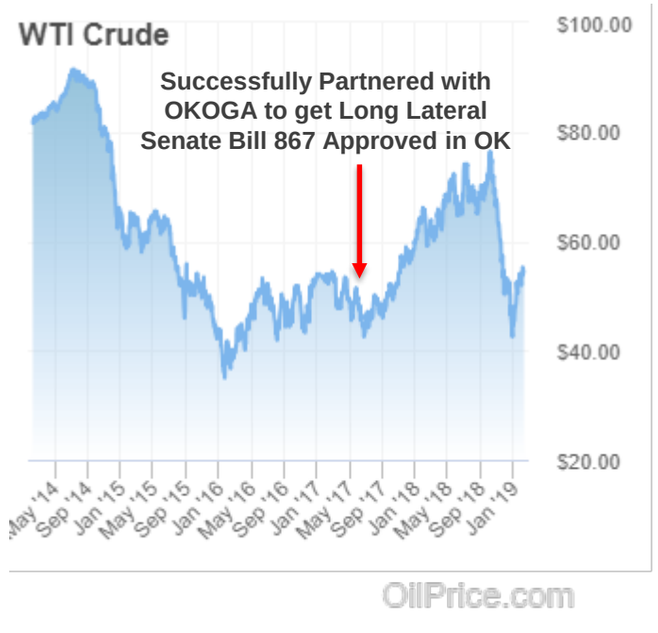
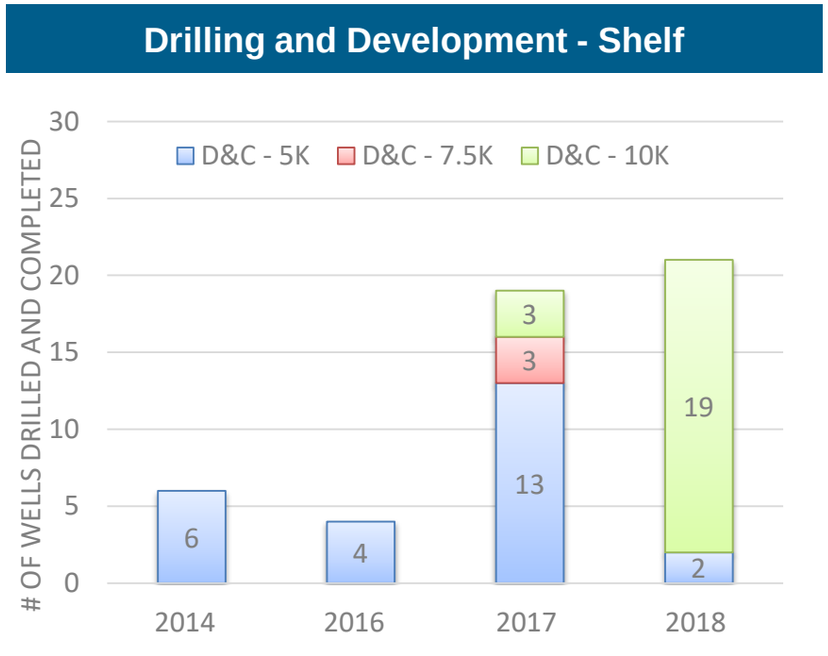


Motivation to Pivot Drilling Ops. to the Shelf

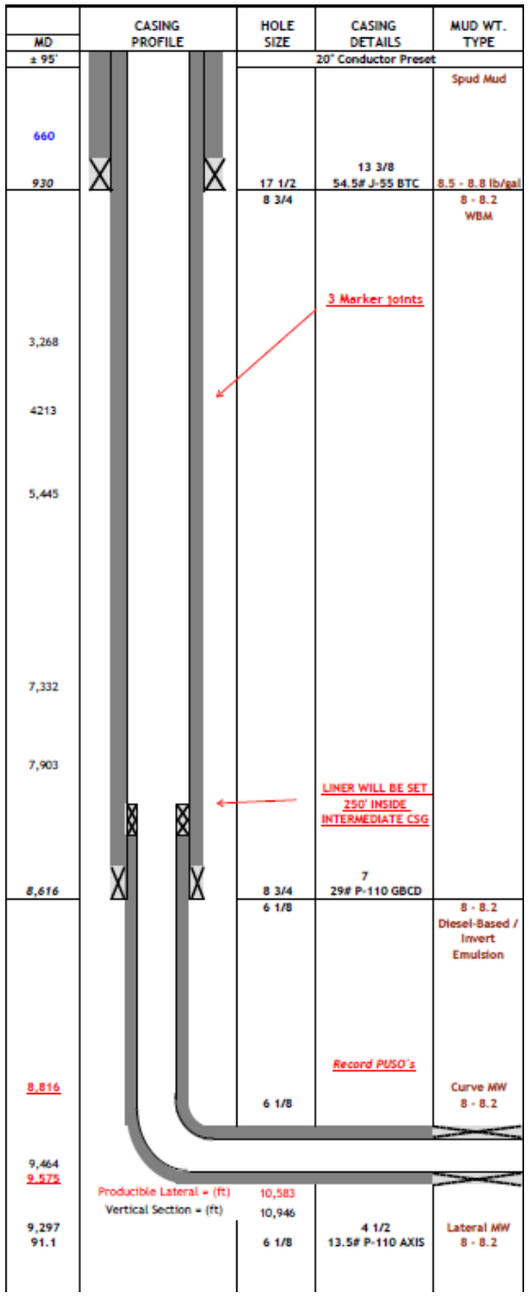
- **Adapting to Market Conditions**
  - Went from a 6 Rig Program (4 Wash, 2 Shelf) to ultimately a 4 Rig Program (1 Wash, 3 Shelf).
- **Two main drivers:**
  - Commodity Prices (Oil vs. Gas)
  - Senate Bill 867
    - Signed in under “Oklahoma Energy Jobs Act of 2017”
    - Passed 05-31-2017
    - Major significance to FPE came in the approval to drill two section laterals in non-shale (conventional) sources



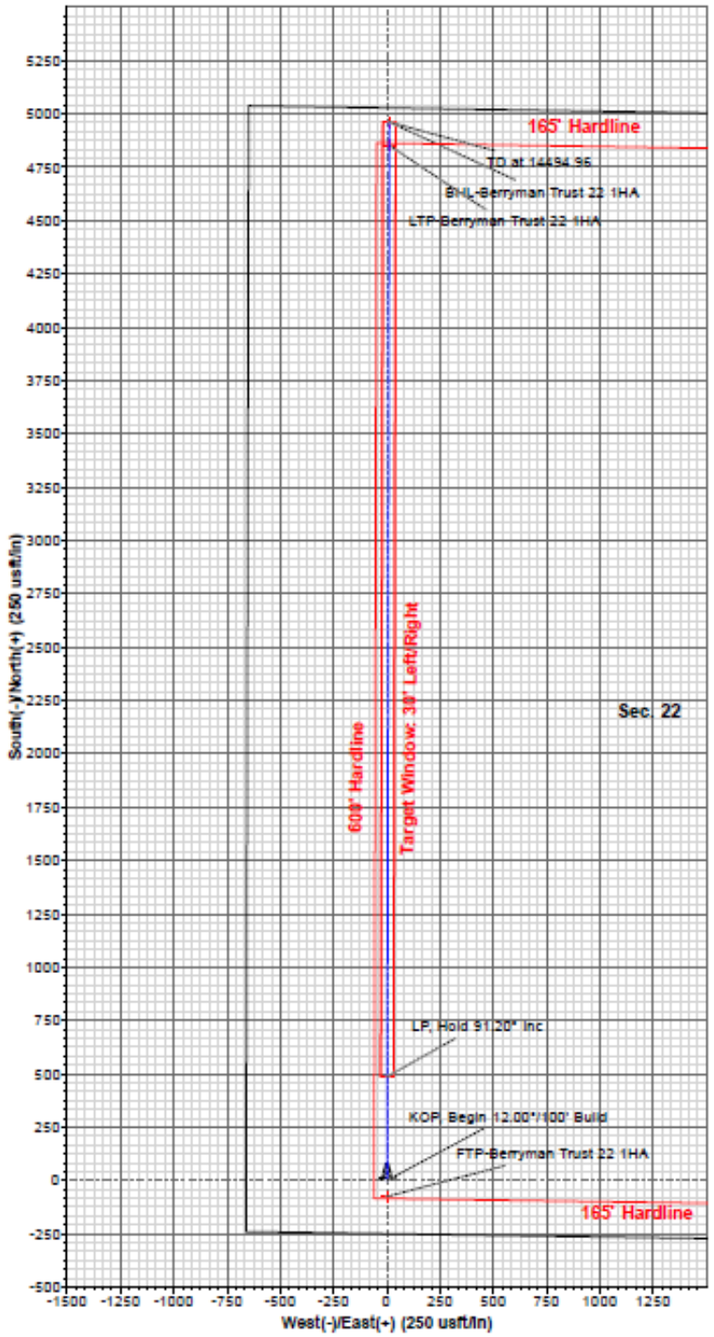


In the Beginning… (Initial Well Design)

Standard Shelf Wellbore Diagram (WBD)

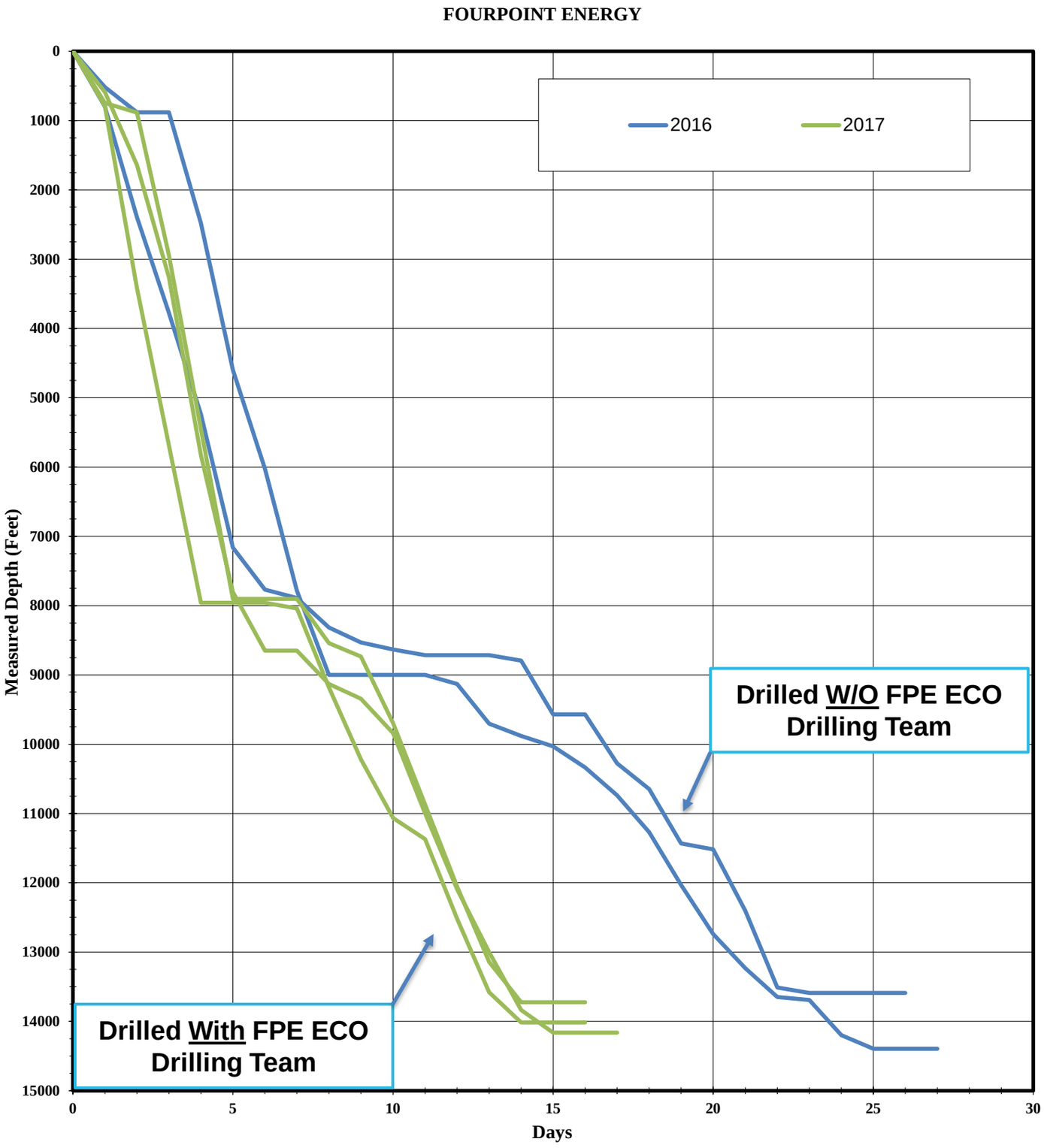


03-04-17: Single Section Lateral, Drill Vertical, 2-D Curve/Lat.



- **Initial CLVD Well Design:**
  - Drill Vertical to KOP
  - Medium Radius Curves
  - Single Section Laterals
  - Drilling wells for lease retention and/or delineation
- **Simple Well Design Allowed:**
  - Refinement of Fluids Program
  - BHA Selection
    - Bits
    - Motors
    - Stabilization
  - Single Run PDC Curves
  - Gain <u>Consistency</u> in Drilling DvD

Initial Well Design: DvD Refinement & Consistency 2016 - 2017



Vertical (Intermediate)

- **8 ¾” Bit Selection**
  - Bit designed competent enough for a single run, however aggressive enough to maximize ROP through varying lithology
  - Managed Parameters
  - Shaped Cutters (i.e. Axe Blade)
  - 6 to 5 Blade PDCs
- **Mud Motor Selection**
  - Started at 0.242 RPG
  - Experimented w/higher RPG (7 ¼” MM)
  - Went back to a 0.242 RPG after DBRing bits

Curve (Production)

- **6 1/8” Bit Selection**
  - Initial PDC runs yielded variable DLS
  - Kymera Trials to key in on single run
  - Went back to PDC when motor config. was figured out
- **Mud Motor Selection**
  - Key Finding was going from a Regular BTB to a Short BTB with Superhawk bearing assembly ~39 inches (Next Slide)

2016 – 2017 Performance Highlight

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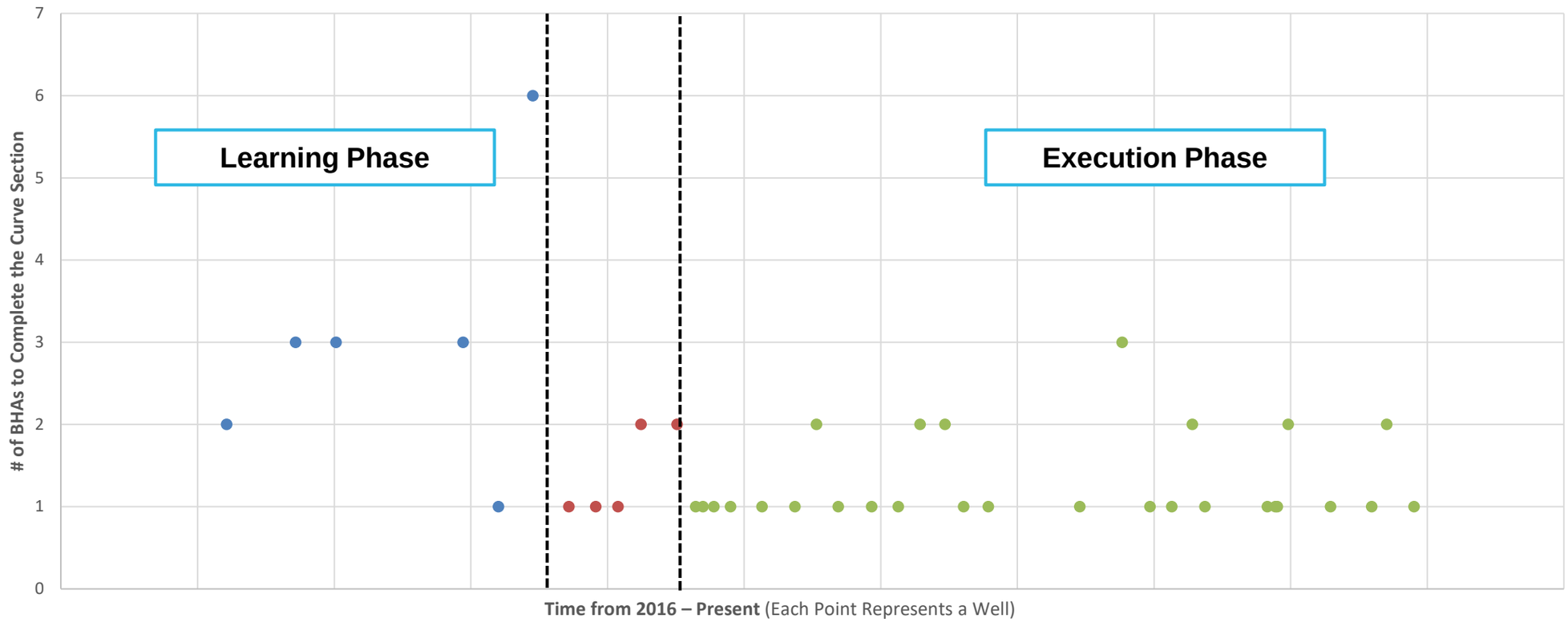
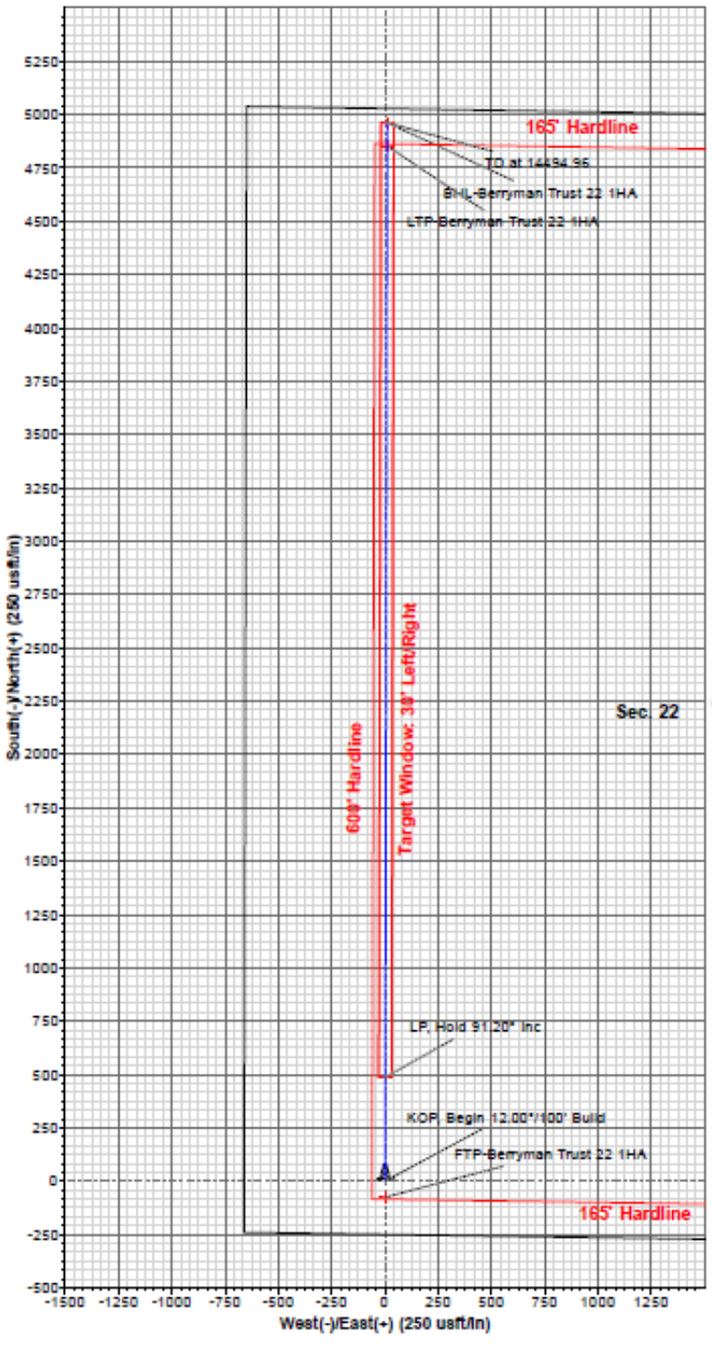
- **Gaining Consistency in the Curve Section**
  - Goal: Execute Curve Section of the Well Plan with a Single BHA
  - Experimentation Phase:
    - Well Plans built curves on 10 – 16º/100 ft. (12 & 14's Standard; Increased BUR for decrease in Curve MD)
    - Initial BHA Design utilized RBTB 4 ¾ - 5" MM (ABH & FBH f/2 – 3º with & without NBS)
    - Observed a significant variance in motor build rate potential throughout the curve and from well to well (geographical loc.)
  - Lessons Learned:

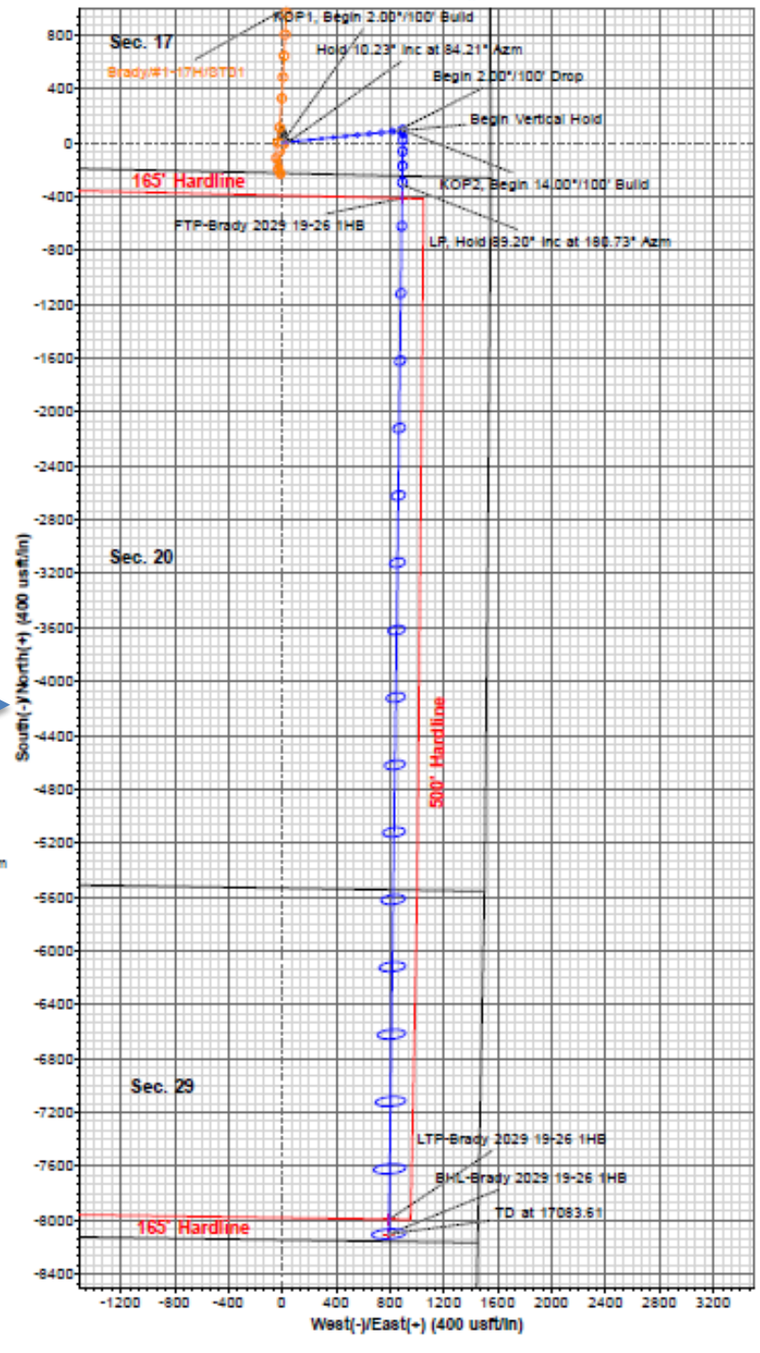


2017 Well Design Progression

03-04-17: Single Section Lateral, Drill Vertical, 2-D Curve/Lat.



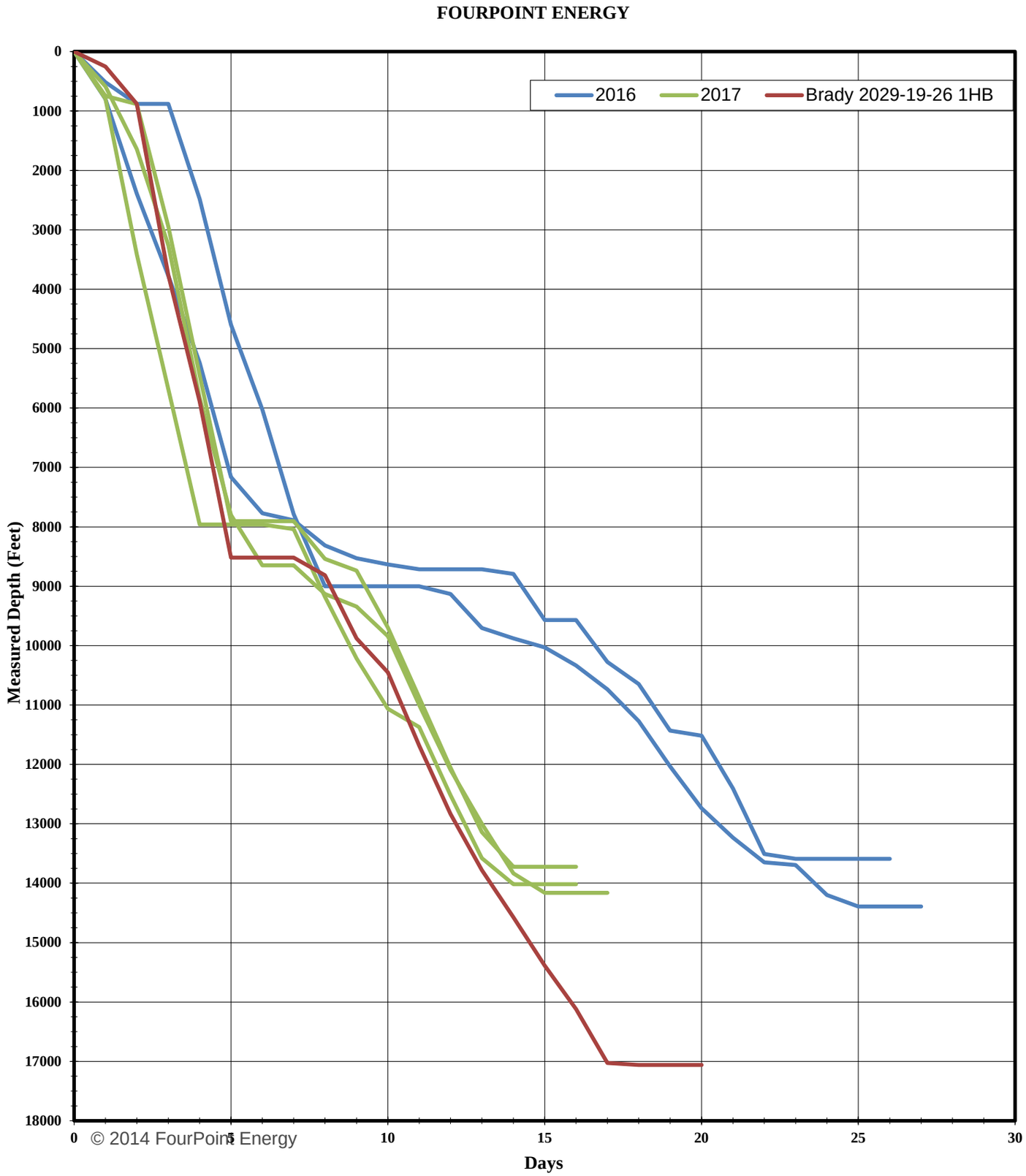
08-24-17: 7.5 K Lateral, Re-Occupy Pad = Up-Hole Tangent



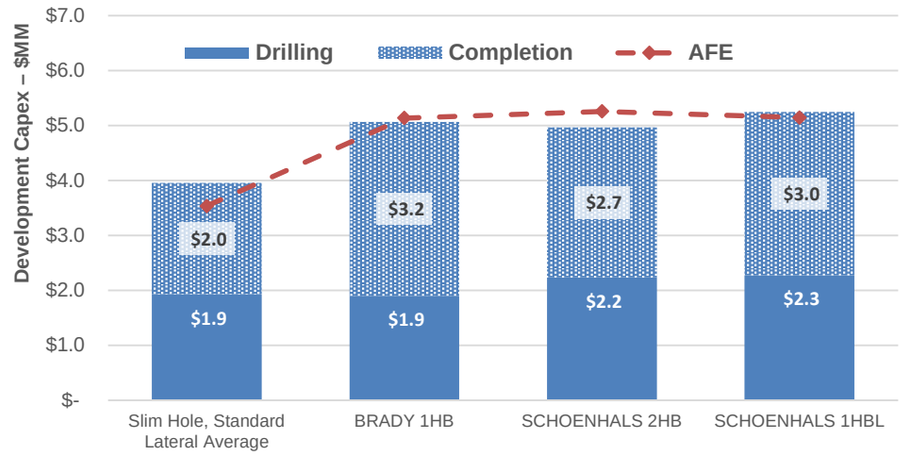
What challenges were introduced from the design changes over 2017?

- **Intermediate Tangent Work**
  - Slot Placement
  - SSE or Pad Off-Section
  - Re-occupy Pad
- **Anti-Collision Concerns**
- **Trials Begin to Extend Lateral Length F/5k – 7.5k**

How FPE Initially Met Complexity w/Efficiency



Operational Performance



8 ¾" Tangent Work

- **Significant Step-Outs (1–2k ft.)**
  - Before executing model tangent placement in ERA
    - ERA results indicated to keep DLS low in build/drop =<2º/100 ft. (hold angle was not a key component)
    - The KOP1 point should be as low in the 8 ¾" section as possible (Due to increased T&D impact from high DLS uphole)
  - Couple ERA Model results with real-world drilling tendencies to develop final solution

6 1/8" Lateral (Production) – Dealing with an Extra 2.5k FT.

- **T&D Impact**
  - Again Model the Extra 2.5k ft. of lateral in ERA
  - Increase PUSO collection frequency on the first few 7.5k ft. wells to have a higher density dataset
- **Surface & Downhole Tool Utilization**
  - ERA currently doesn't model the effects of vibratory/oscillator tools, therefore FPE trialed many different types and configurations of downhole vibratory tools and ensured each shelf rig had an top drive oscillator system

2017 - 2018 Performance Highlight

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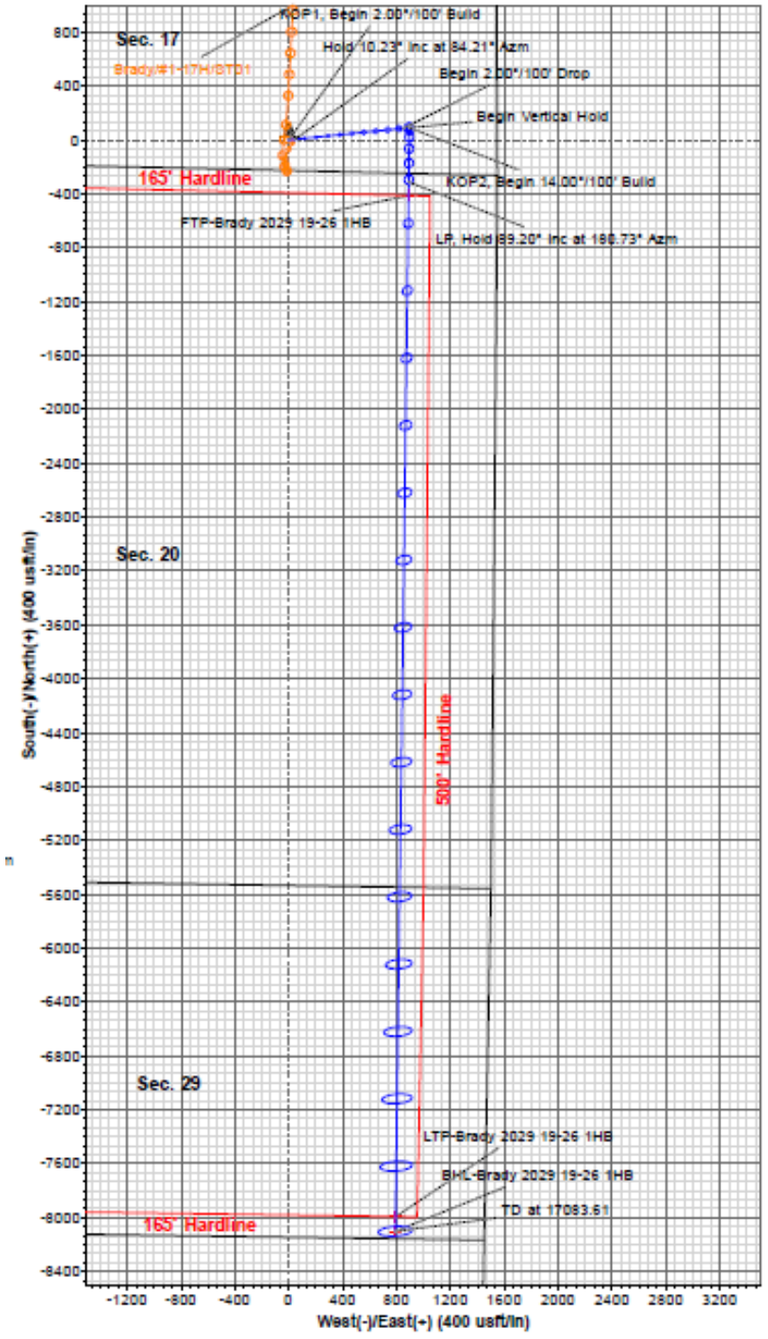
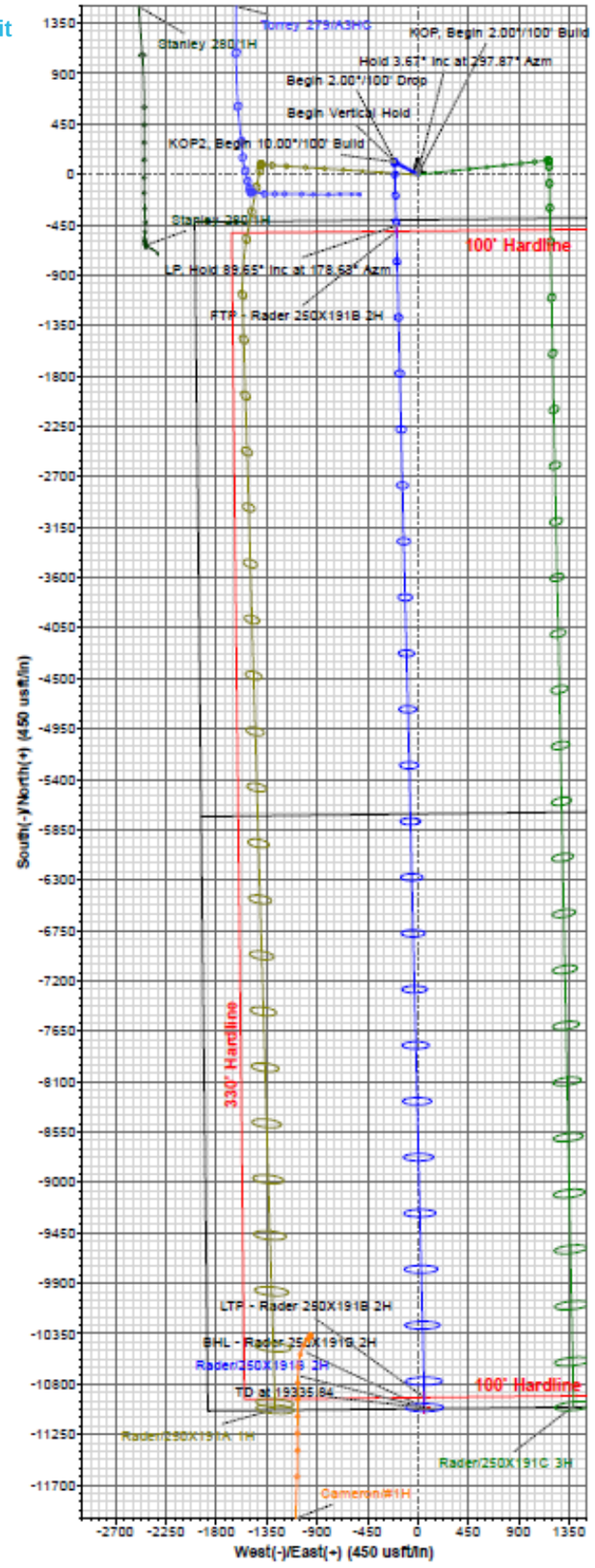
- **Making the Tangent Execution Seamless, let the Rock work for you.**
  - Goal: Almost every well from here on out will have a significant step-out (=>1,000 ft. displacement). Find the most efficient route to that displacement.
  - Experimentation Phase:
    - Initial BHA Design utilized 6 ¾" MM (FBH f/1.25 – 1.83º w/SS)
    - Tried all sorts and sizes of stabilized assemblies (Nortrak, RR, NBS, RBS)
    - Brought learnings from the Granite Wash intermediates and they applied nicely to the shelf. (Even with the two differing in hole sizes)
  - Lessons Learned:
    - Formation Trends Uphole:
      - Primary Control: Geology/Formations
      - Secondary Control: Drillstring/BHA Design
      - Minor Control: Mechanical Drilling Parameters (i.e. RPM, GPM, WOB)
    - Continue to refine: As more data is collected well to well by our FPE DDs, a more robust dataset aids in setting up predictive well planning for the tangent section.
    - Take Home Message: Understand real world execution is different than the simplicity of a well plan.
      - Plan DLS limits lower than the actual model limit
      - Plan sliding for build/hold/drop sections in sections with high ROP or easy steering. Very intuitive, but how often do we see this executed?

2018 Well Design Progression

(Left Plot) 08-24-17: 7.5 K Lateral, Re-Occupy Pad = Up-Hole Tangent

(Right Plot) 08-28-18: Double Section Lateral, Large Tangent to Hit Slot Positions, Change lateral slot position after first section

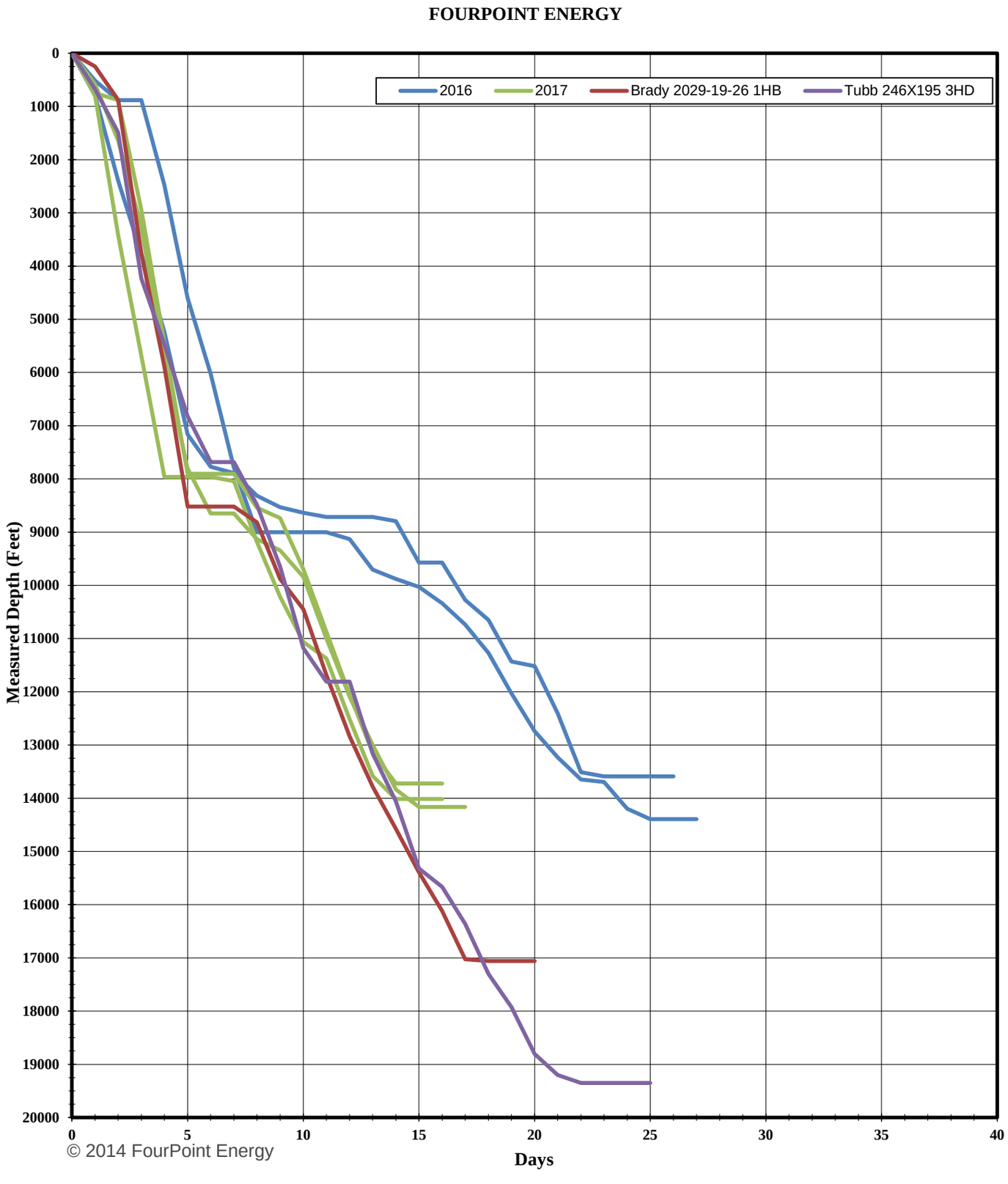




Design Changes F/2017 - 2018

- **Change from lease retention to development mode drilling**
- **Multi-Well Pads**
  - Slot Density/Placement
  - SSE/Reoccupy
- **10K Laterals**
  - Up-dip
  - Down-Dip
- **Allows for batch drilling**
  - Surface – KOP (Wells A – C)
  - KOP – TD (Wells C – A)

From 5k to 7.5k to 10k Seamlessly



Curve (Production)

- **Push Curve Assembly into the Lateral**
  - Setup the curve assembly where it can be taken out into the lateral without elevated risk
  - More on this subject on the following slide

Lateral (Production)

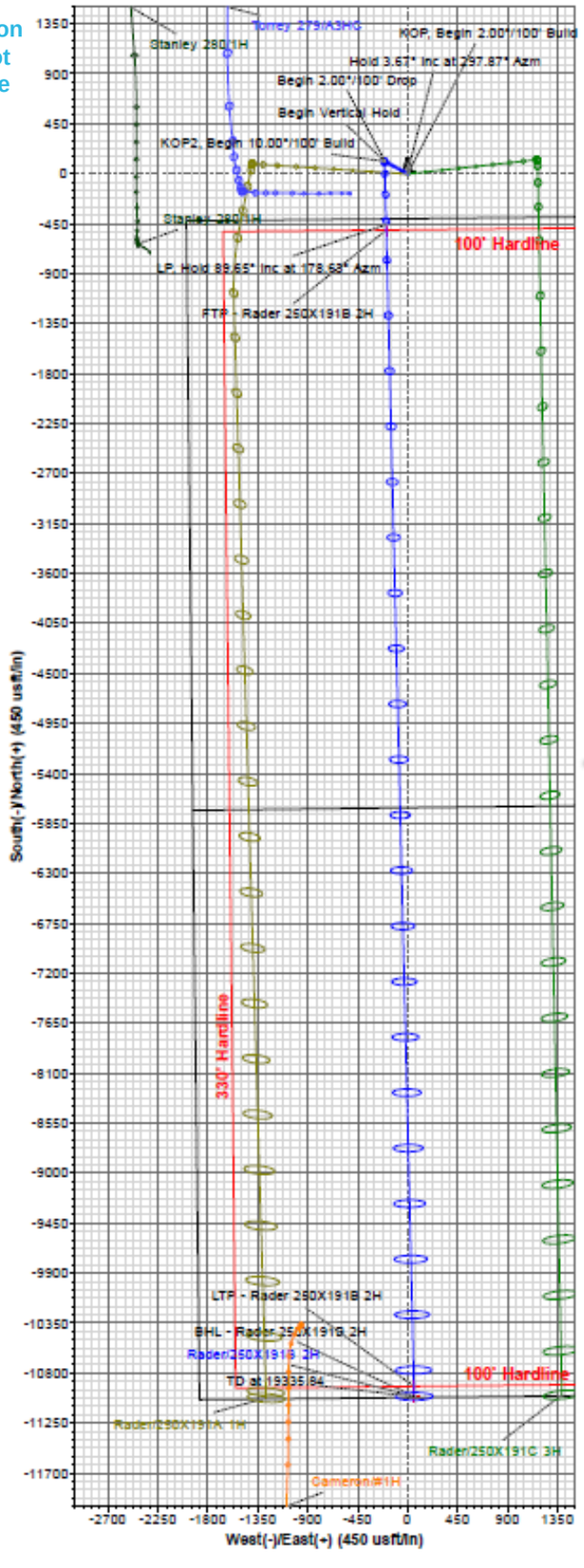
- **T&D of the last 2.5k on a 10k lateral**
  - Modeled SO values always fail within the last 2.5k of the lateral. Where within that 2.5k depends on tangent, up/down-dip lateral and real world execution.
- **Stabilization**
  - The current dataset indicates that a strong overall building trend is expressed in the lateral (very few exceptions that have been attributed to geological control – i.e. hard streaks). Design lateral BHAs to neutralize the building trend.
- **Drilling Windows**
  - FPE Geo's initially were very strict on the +/- 3 ft. above/below Geo. CL windows. As production result came in on wells with a higher % steered out of the drilling window, it was shown that economics could not justify the tight drilling windows. So we currently steer off of +/- 5 ft. and sometimes open those up towards TD. Heavily utilize continuous INC and sometimes BINC.

2018 Performance Highlight

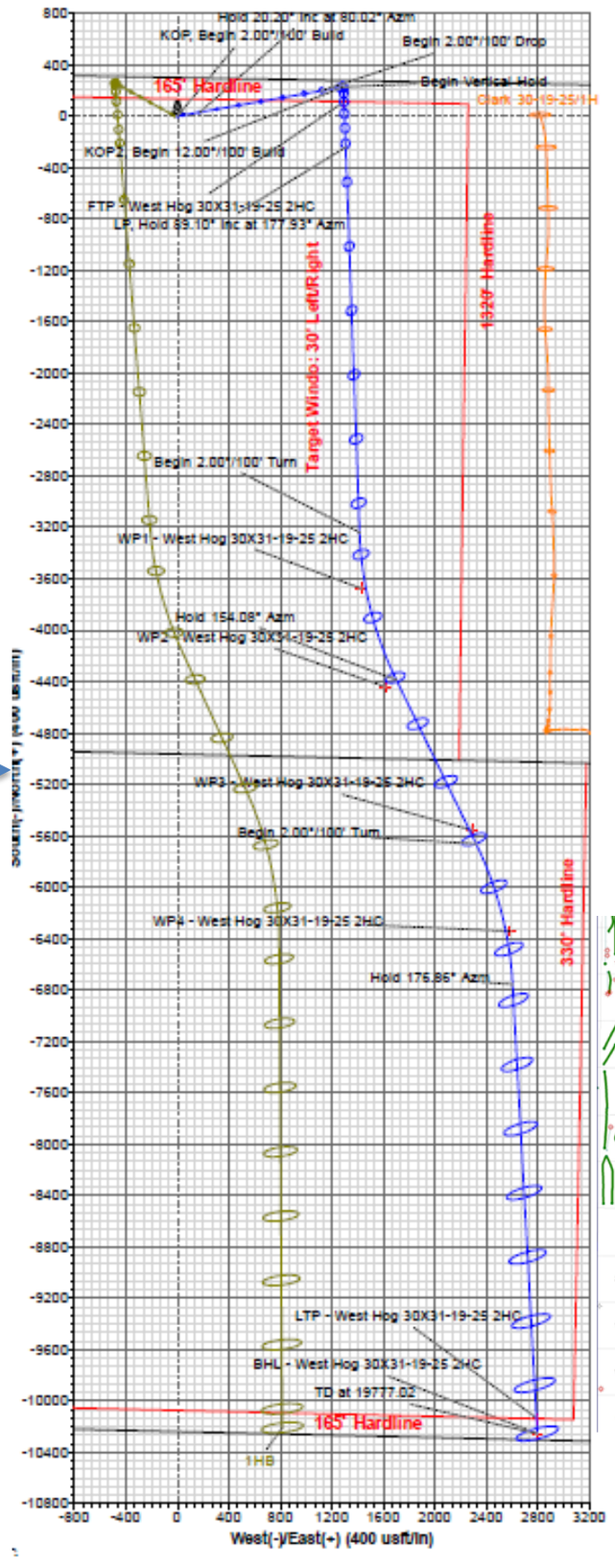
- **Transitioning from a dedicated curve assembly to pushing out in the lateral further with our curve assembly.**
  - **Goal:** After landing the curve drill as far as possible, while maintaining >800 ft./day.
  - **Experimentation Phase:**
    - Initial BHA Design utilized SBTB 4 ¾” MM (FBH f/1.5 – 2.12º w/SS)
    - Tried both slick and lateral stabilized assemblies
    - Fixed the bit type to a 6 1/8” 6-Blade PDC (Similar bit as we predominantly run in the lateral)
  - **Lessons Learned:**
    - Initial success: First attempt drilled the curve and ~2k ft. of the lateral (On 7.5k Lateral).
    - Continue to refine: Decrease FBH angle to 1.83 deg. for the ability to increase RPMs for hole cleaning and longevity of motor components.
    - Most recent data point: Curve and ~6.5k of the lateral @ >1k/day.

Current Well Design Progression

(Left Plot) 07-17-18: Double Section Lateral, Large Tangent to Hit Slot Positions, Some minor 3-D at the base of the curve

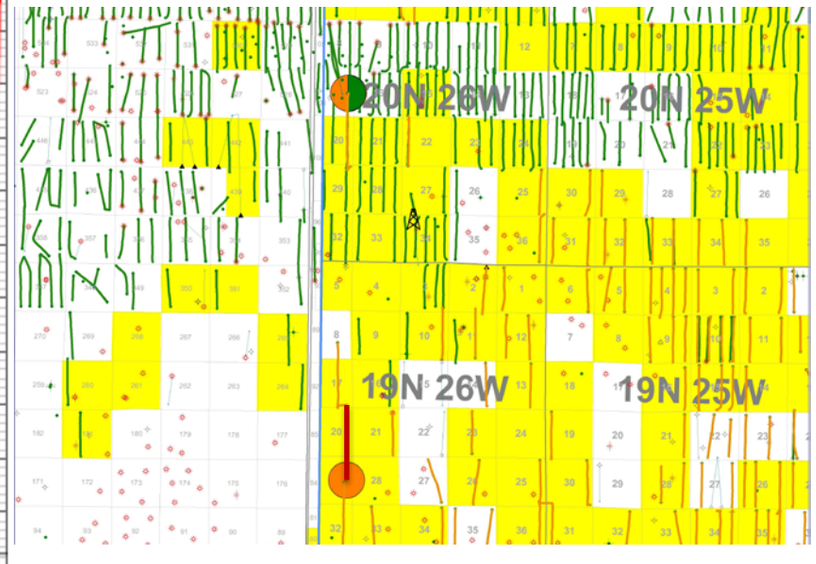


(Right Plot) 10-28-18: Double Section Lateral, Large Tangent to Hit Slot Positions, Change lateral slot position after first section

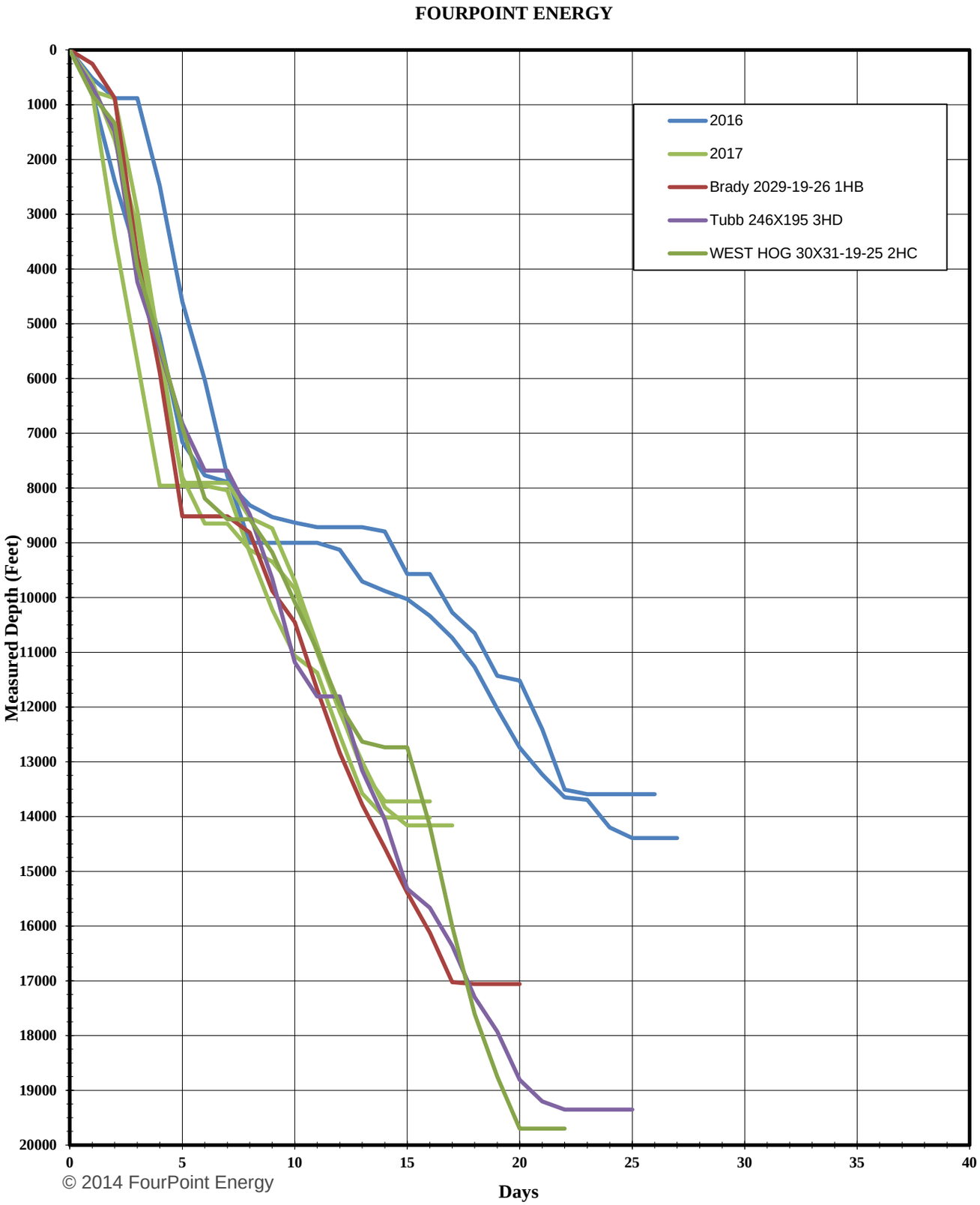


Current Design Adjustments

- A summation of all the previous years adjustments. Back to gaining consistency.
  - Multi-Well Pad
  - Uphole Tangent
  - 10k Lateral
  - Updip Lateral
  - “S-Turn” in the lateral



Present Benchmark

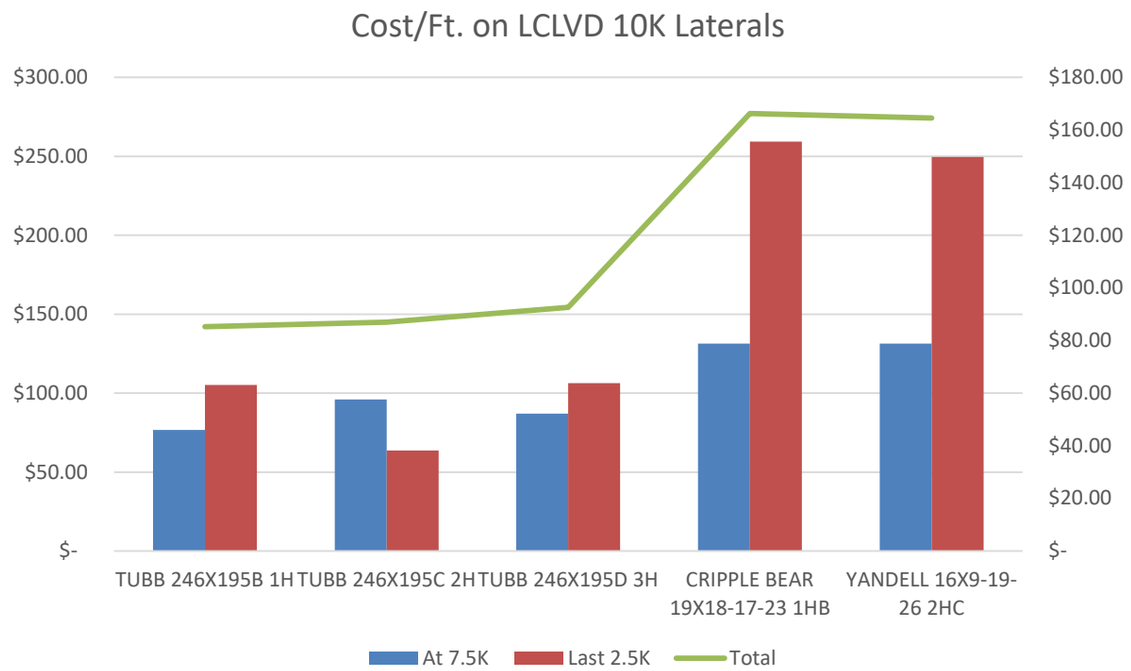


Applying and Successfully Executing all Discussed Techniques

- Continue to gather data and refine processes

Lateral (Production)

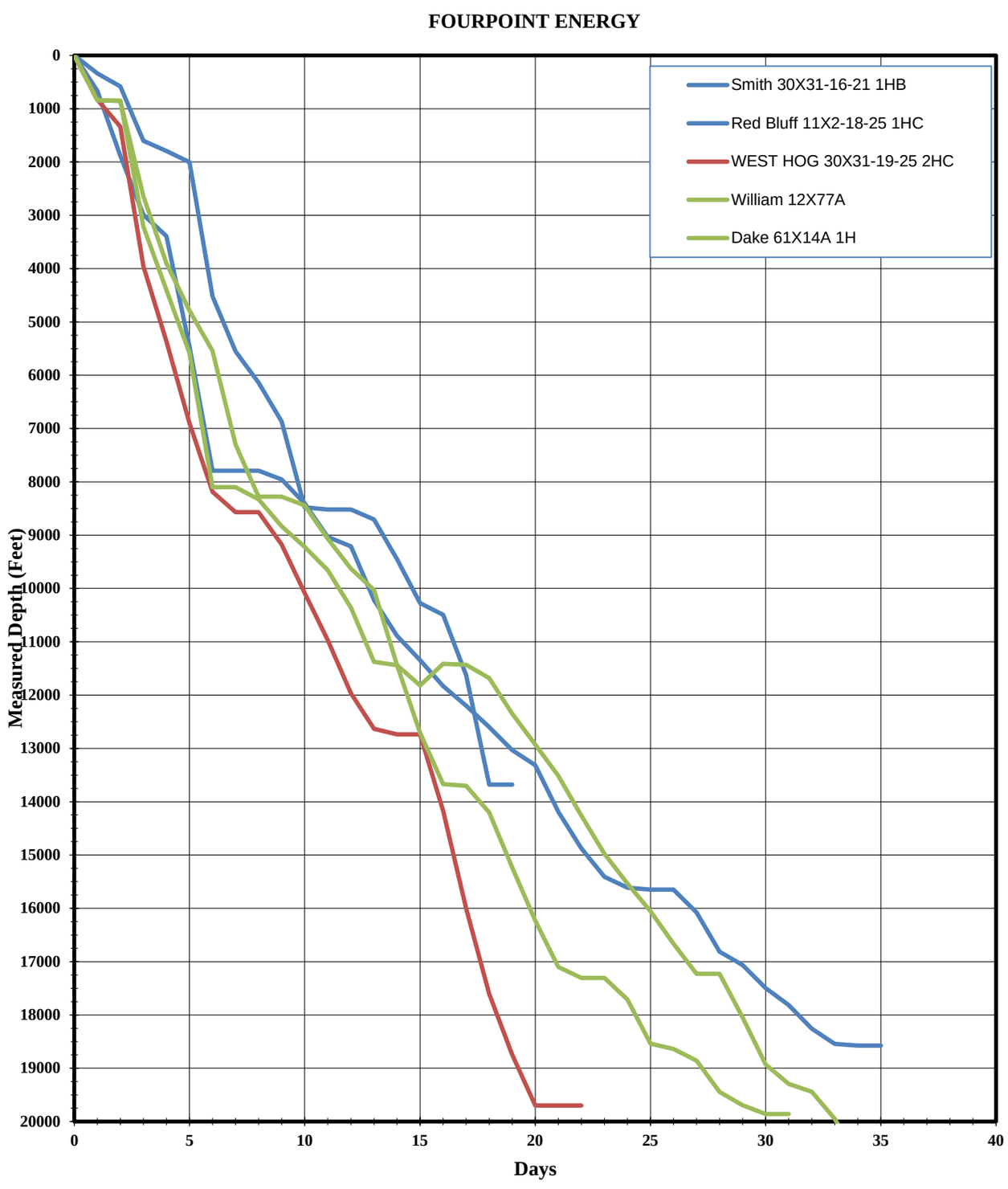
- How to Efficiently Drill that Last 2.5k is the current challenge.



PRESENT AND FUTURE DIRECTIONS

RSS Trials – Push/Point the Bit = Mixed Results

- **Current Path Forward**
  - Push the Bit:
    - Advantages
      - Actual results have been the better of the RSS Systems
    - Disadvantages
      - Results have tended to be area specific (Pad Wear, Wash, LCM tolerances)
      - Requires specific execution of certain hole sections (Primarily the curve section)
  - Point the Bit:
    - Advantages
      - In theory the mechanical means of displacement is better suited for isolated areas of the Cleveland Play
    - Disadvantages
      - If ran non-motor assist (i.e. Well Guide), pipe wear becomes a concern due to excessive surface RPMs
      - Requires specific execution of certain hole sections (Primarily the curve section)



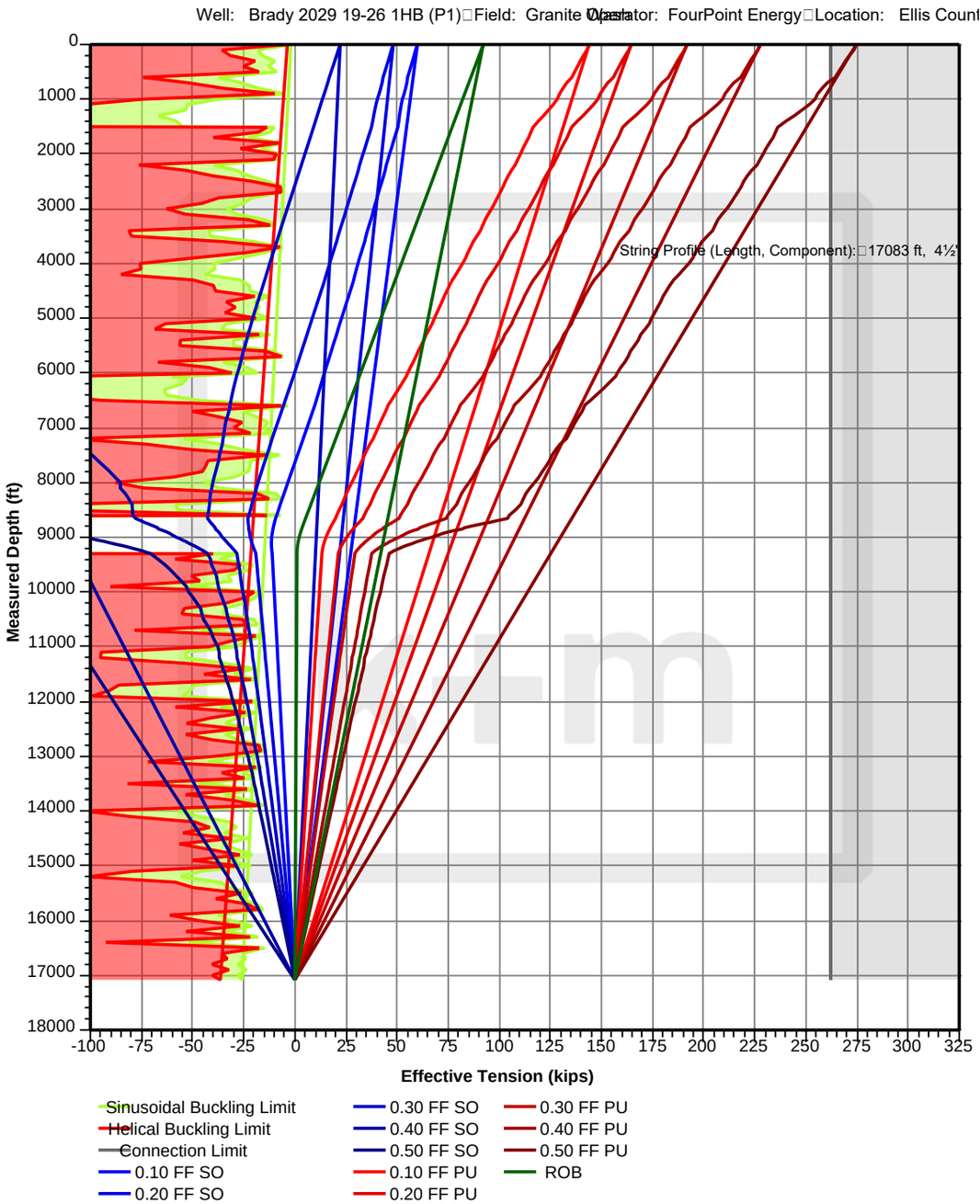
Future Considerations

- **Some Other Future Considerations**
  - MWD Advancements (Mud Pulse to EM Telemetry)
    - Reduce Mud Costs from Forgoing MP Telemetry (Fluids Program is no longer limited by MWD constraints)
    - Limit Unnecessary Trips due to Pack-Off Events
  - Longer Curve/Lateral Runs (Roller Cutter Tech)
    - Curve/Lat. Runs are Tripped for PR Primarily
      - Solution: Eliminate the Shoulder Wear on the Cutters Causing the ROP Decline

Questions?

4½" Casing: Tension Snapshot at 17,083 ft

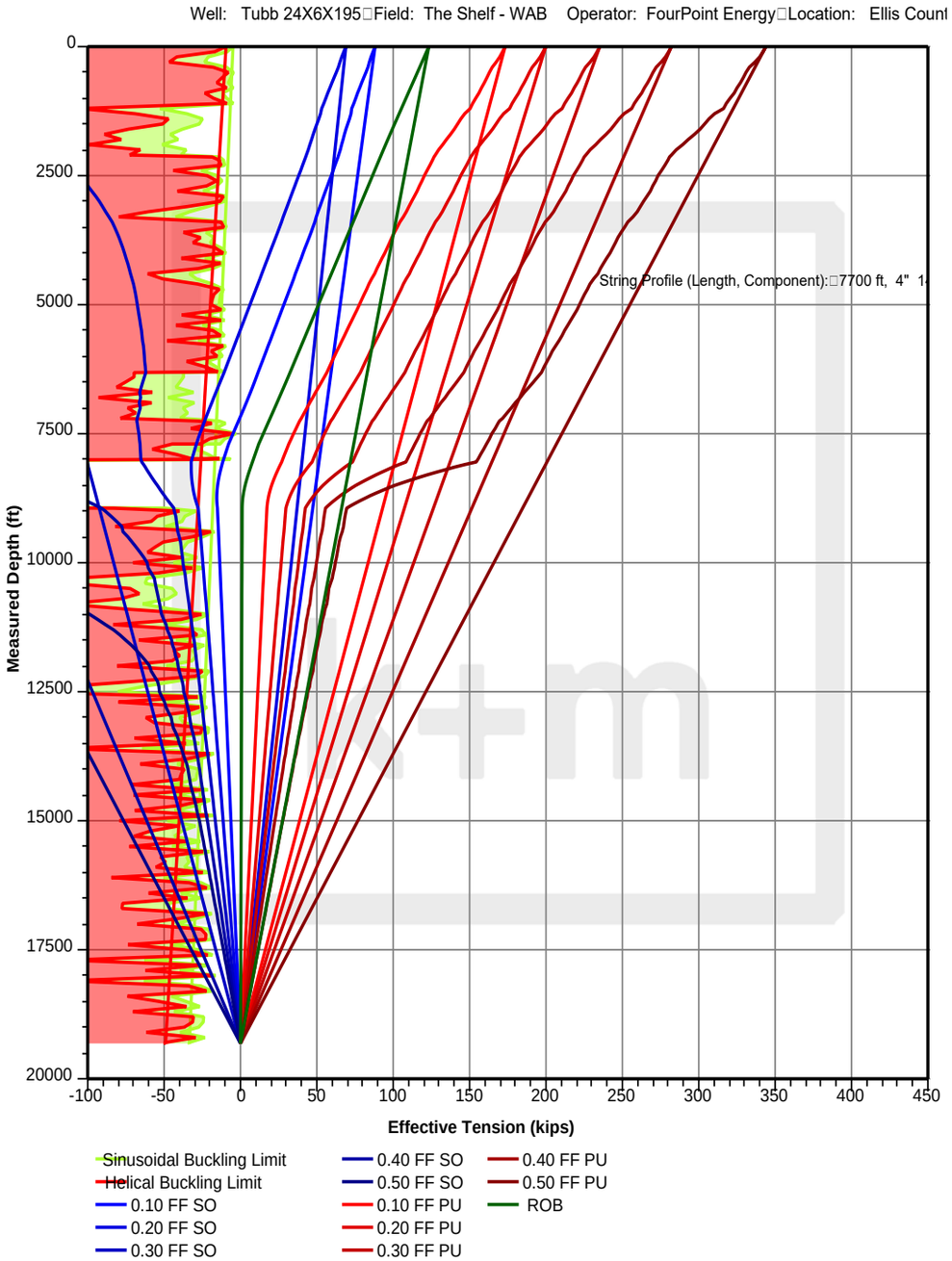
Sensitivity to Friction Factor



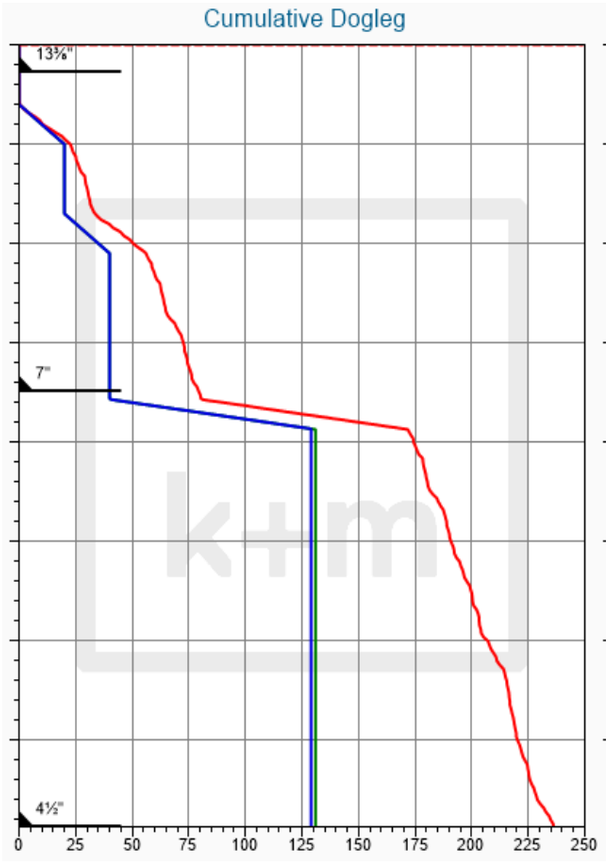
ERA - 4.27.0 FourPoint Energy - Brady 2029 19-26 1HB (P1) - 4½" Casing BS - 2/4/2019

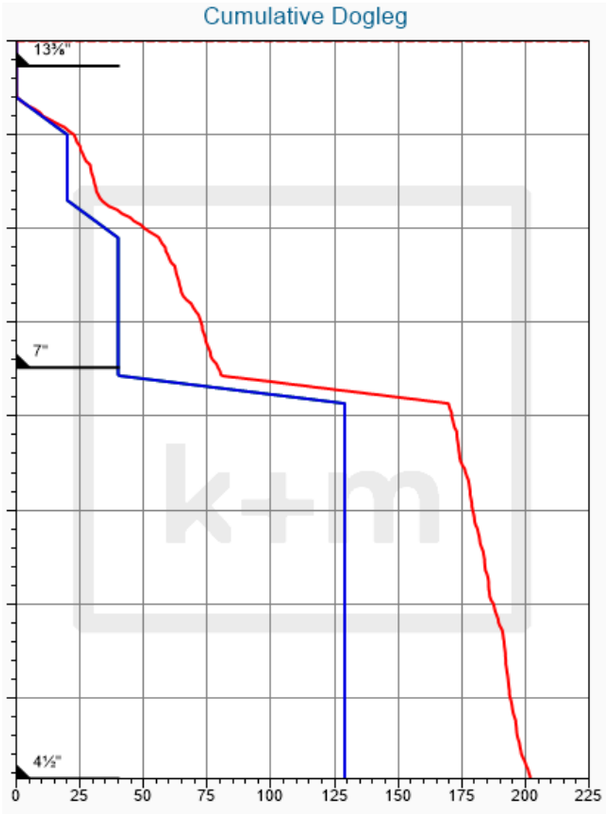
4½" Liner: Tension Snapshot at 19,315 ft

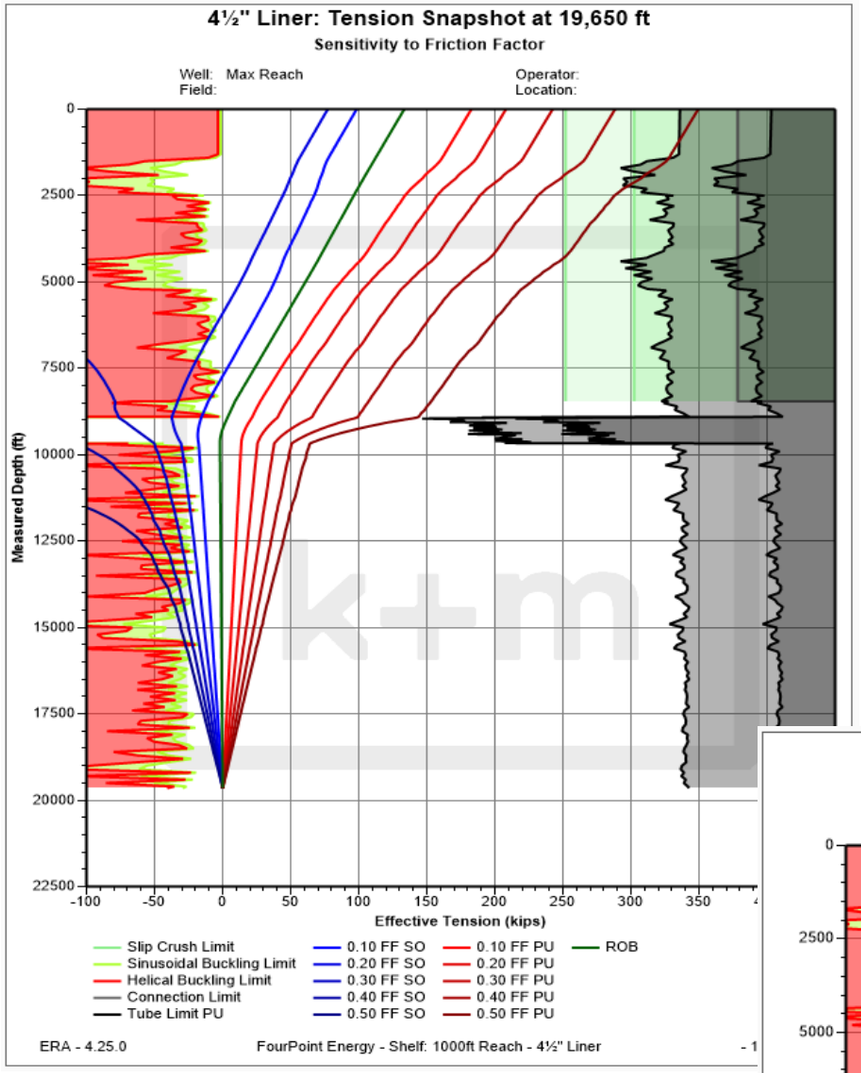
Sensitivity to Friction Factor

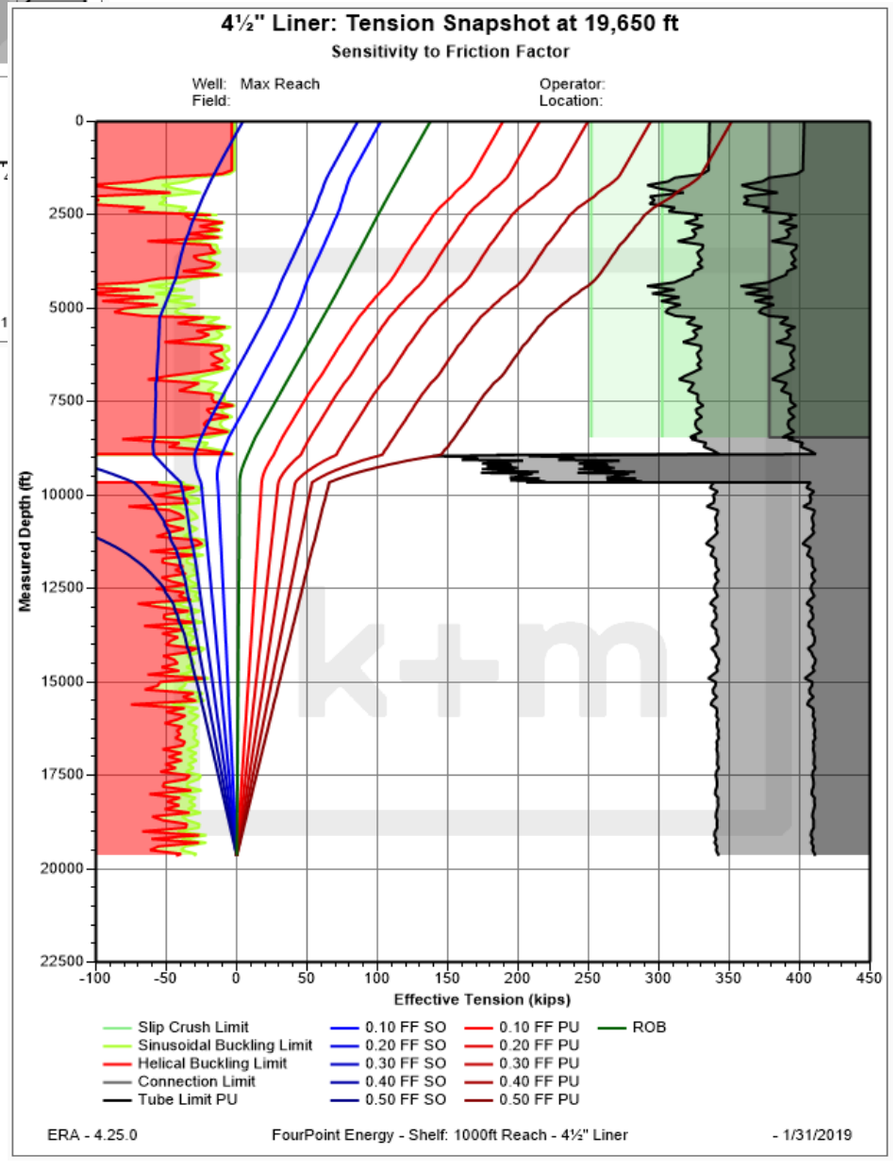


ERA - 4.27.0 FourPoint Energy Copy 1 Copy 1 - Xtreme 21 - Tubb - 4½" Liner BRS - 2/4/2019









WAB Stratigraphic Targets

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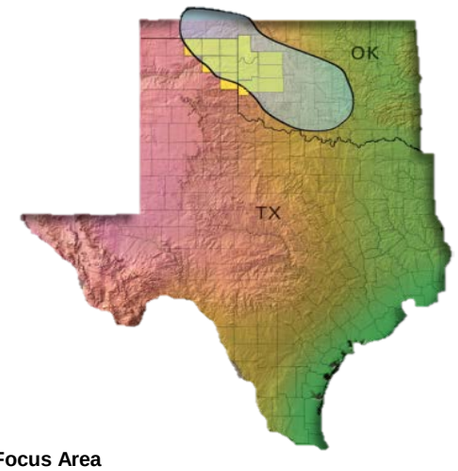
Western Anadarko Granite Wash and Shelf Sandstone plays

- Targeted plays cover 4.5 MM acres with active horizontal targets from 7,500’ – 15,500’
- Over 5,000 Hz wells drilled to date
- Thousands of potential drilling locations on FourPoint’s land position.
- Oily shelf Ss plays and liquids-rich upper GW drilling activity increasing over the past 6 months
- Exposure to significant natural gas resource in lower Granite Wash

Map of Anadarko Basin



Stacked Pay Zones

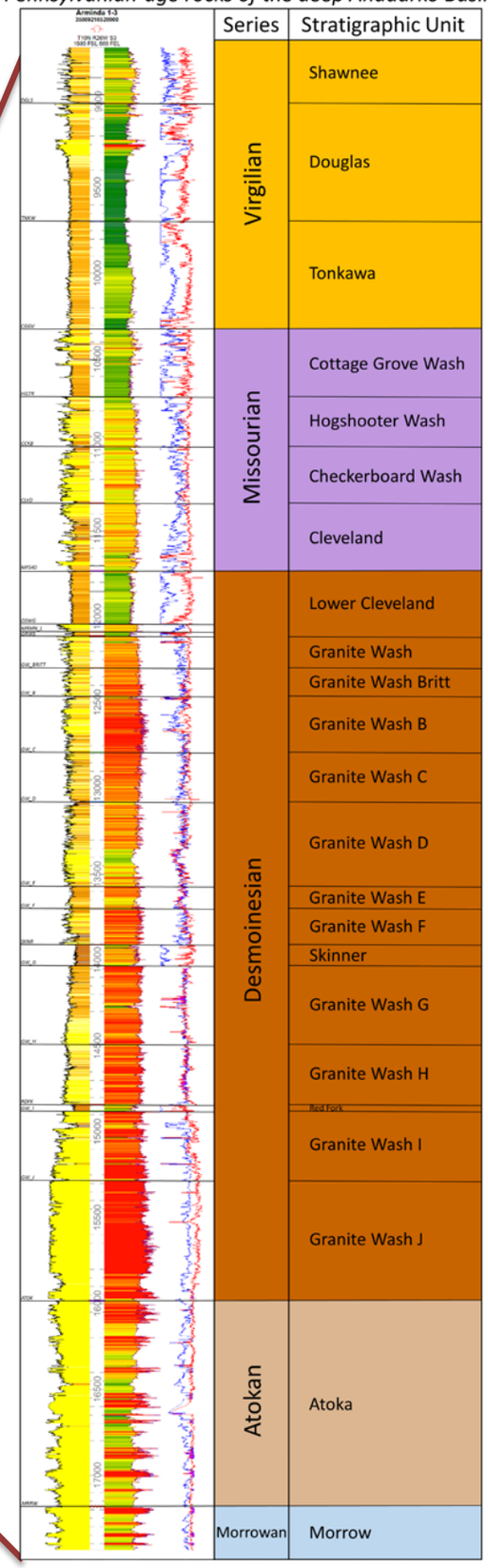
Anadarko Basin		
System	**Series / Epoch**	**Generalized Stratigraphic Column**
Lower Permian	**Wolfcampian**	Hugoton / Pontotoc (Brown Dolomite)
		Chase / Council Grove
		Admire
Pennsylvanian	**Virgilian**	Wabaunsee
		Shawnee
		Douglas Tonkawa
	Missourian	Cottage Grove
		Hoxbar / Hogshooter
		Checkerboard
		Cleveland
	Desmoinesian	Marmaton Group (Glover / Big Lime / Oswego)
		Cherokee (Skinner / Pink Lime / Red Fork)
	Atokan	Atoka Lime
		13 Finger Lime
	Morrowan	Morrow Shale / Dornick Hills Shale
Mississippian	**Chesterian - Meramecian - Osagean - Kinderhookian**	Springer
		Meramec Lime / St. Louis
		Osage Lime / Osage Chert
		Kinderhook / Sycamore Lime
Devonian	**Upper Devonian**	Woodford
		Hunton

Granite Wash

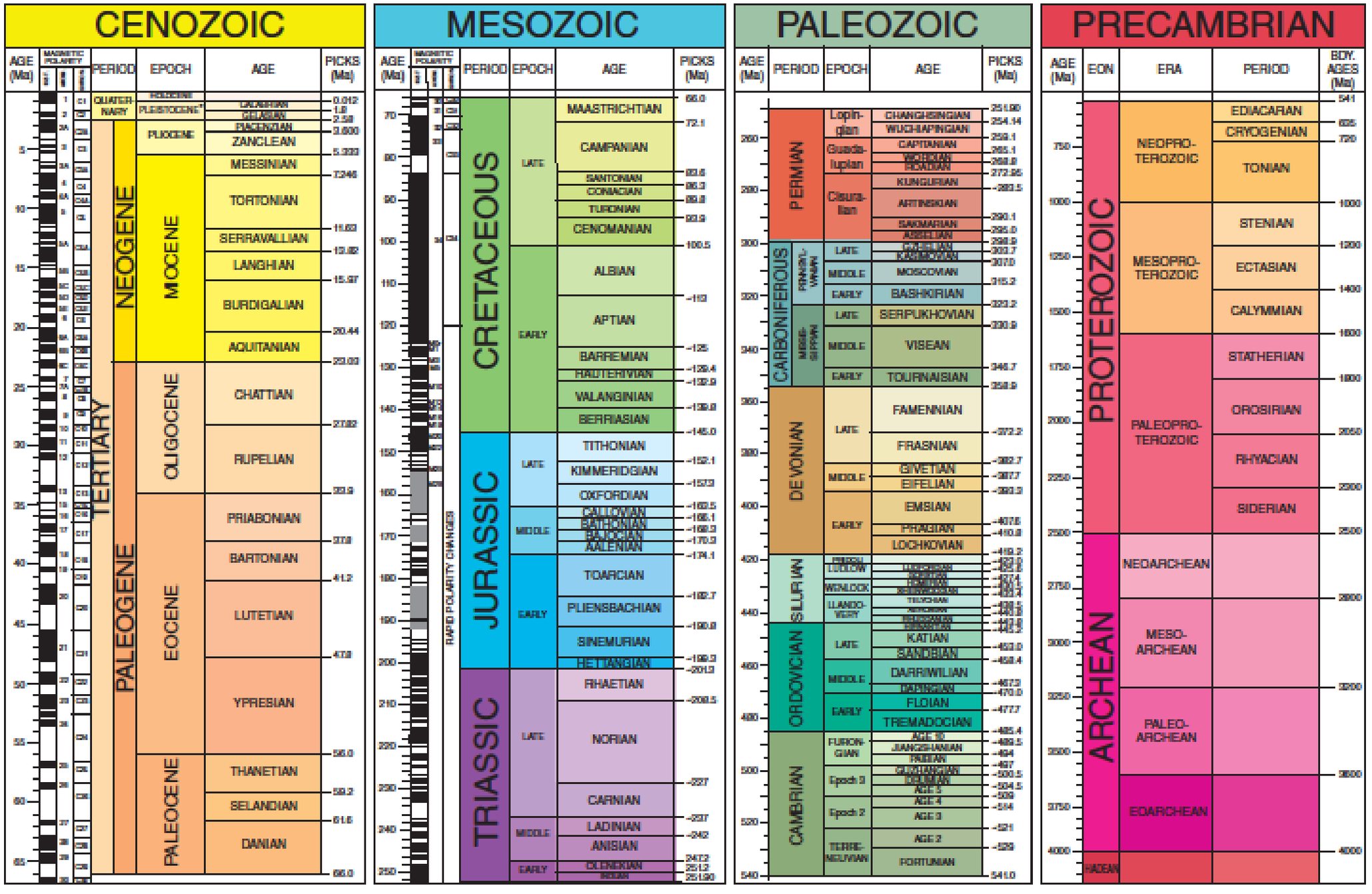
Oil
Gas
Liquids

Note: Granite Wash spans from the Lower Permian to the Pennsylvanian in age. Areas marked with an oil, gas or liquids symbol represent zones present in the Western Anadarko Basin.

Pennsylvanian-age rocks of the deep Anadarko Basin



GSA GEOLOGIC TIME SCALE v. 5.0



Walker, J.D., Geissman, J.W., Bowring, S.A., and Babcock, L.E., compilers, 2018, Geologic Time Scale v. 5.0: Geological Society of America, https://doi.org/10.1130/2018.CTS005R3C. ©2018 The Geological Society of America

*The Pleistocene is divided into four ages, but only two are shown here. What is shown as Calabrian is actually three ages—Calabrian from 1.80 to 0.781 Ma, Middle from 0.781 to 0.126 Ma, and Late from 0.126 to 0.0117 Ma.

The Cenozoic, Mesozoic, and Paleozoic are the Eras of the Phanerozoic Eon. Names of units and age boundaries usually follow the Gradstein et al. (2012), Cohen et al. (2012), and Cohen et al. (2013, updated) compilations. Numerical age estimates and picks of boundaries usually follow the Cohen et al. (2013, updated) compilation. The numbered epochs and ages of the Cambrian are provisional. A "~" before a numerical age estimate typically indicates an associated error of ±0.4 to over 1.0 Ma.

REFERENCES CITED

Cohen, K.M., Finney, S., and Gibbard, P.L., 2012, International Chronostratigraphic Chart: International Commission on Stratigraphy, www.stratigraphy.org (accessed May 2012). (Chart reproduced for the 34th International Geological Congress, Brisbane, Australia, 5–10 August 2012.)

Cohen, K.M., Finney, S.C., Gibbard, P.L., and Fan, J.-X., 2013, The ICS International Chronostratigraphic Chart: Episodes v. 36, no. 3, p. 199–204 (updated 2017, v. 2, http://www.stratigraphy.org/index.php/ics-chart-timescale; accessed May 2018).

Gradstein, F.M., Ogg, J.G., Schmitz, M.D., et al., 2012, The Geologic Time Scale 2012: Boston, USA, Elsevier, https://doi.org/10.1016/B978-0-444-59425-9.00004-4.

Previous versions of the time scale and previously published papers about the time scale and its evolution are posted to http://www.geosociety.org/timescale.

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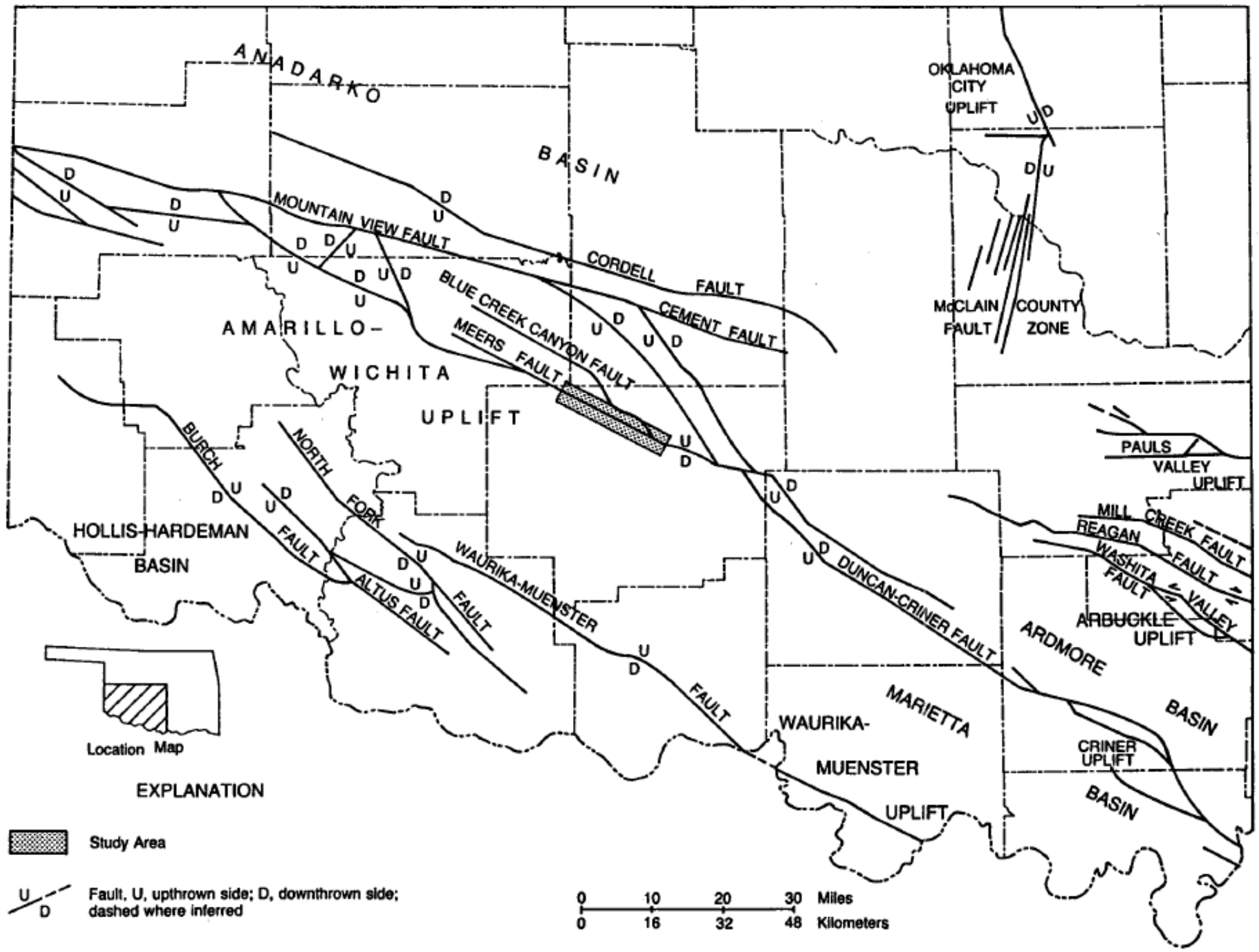

Figure 3. Major structural features in southwestern Oklahoma. Compiled from Ham and others (1964) and Harlton (1951, 1963, and 1972).

SYS.	SUB SYS.	SERIES	GROUP	UNIT
CARBONIFEROUS	PENNSYLVANIAN	VIRGILIAN	Shawnee/Cisco	Topeka Ls Pawhuska Ls Hoover Ss Elgin Ss Oread Ls Heebner Sh Endicott Ss
			Douglas/Cisco	Lovell Ls Haskell Ls **Tonkawa Ss**
		MISSOURIAN	Lansing/Hoxbar	Avant Ls Cottage Grove Ss
			Kansas City/Hoxbar	Dewey Ls Hogshooter Ls Layton Ss Checkerboard Ls **Cleveland Ss**
		DESMOINESIAN	Marmaton	Big Lime Oswego
			Cherokee	Cherokee Marker Prue Ss Verdigris Ls Skinner Ss Pink Ls **Red Fork Ss** Inola Ls Mona
		ATOKAN	Atoka	**Atoka** 13 Finger Ls
		MORROWAN	Morrow	**Morrow** Primrose