

Unconventional Oil and Gas

C. H. Scott Rees, III

Disclaimer

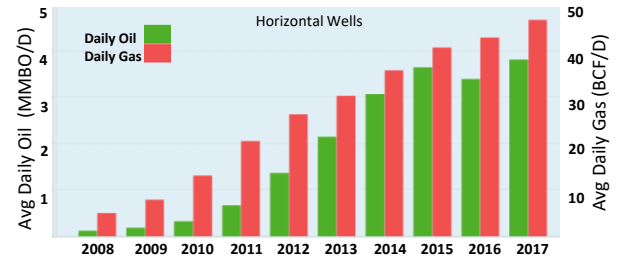
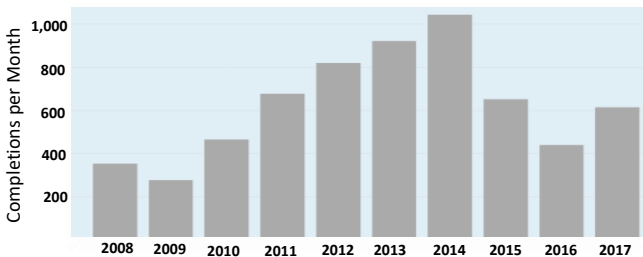
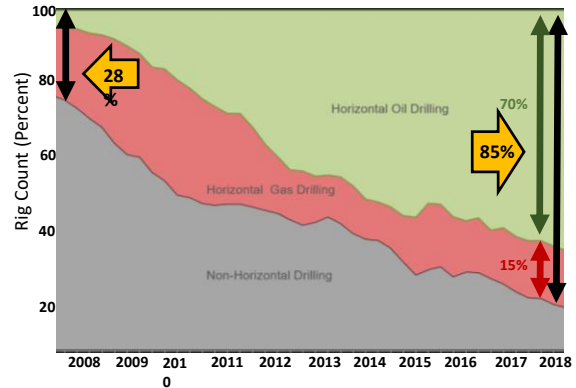
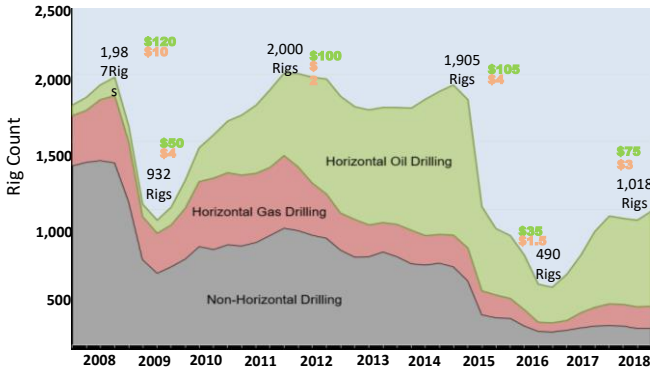
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Presentation Outline

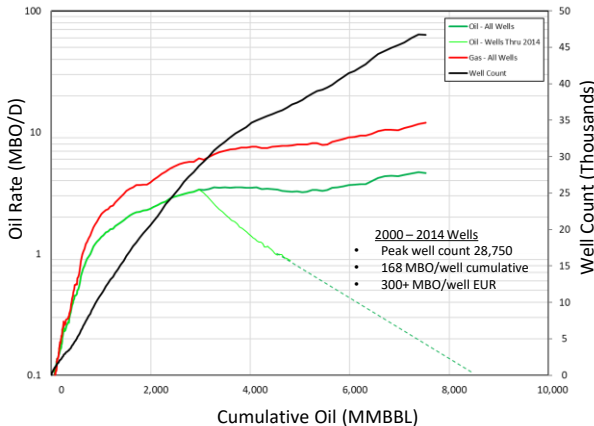
- Unconventional oil and gas development activity in the US
- Trends and observations
- Potential and issues of major basins

Historical Rig Activity in the United States



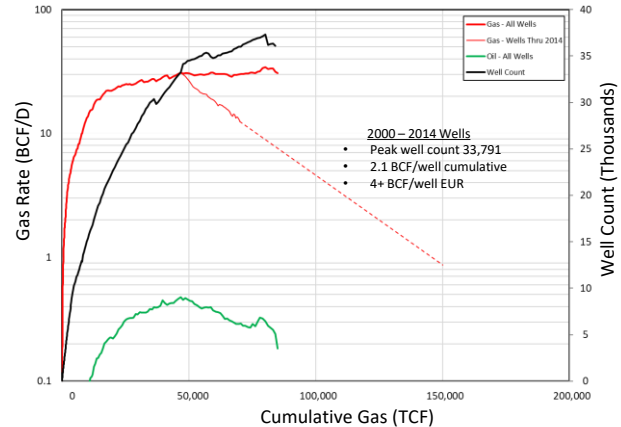
Impact of Horizontal Drilling – Wells Drilled from 2000 to 2014

Bakken, Eagle Ford, and Permian HZ Oil Wells



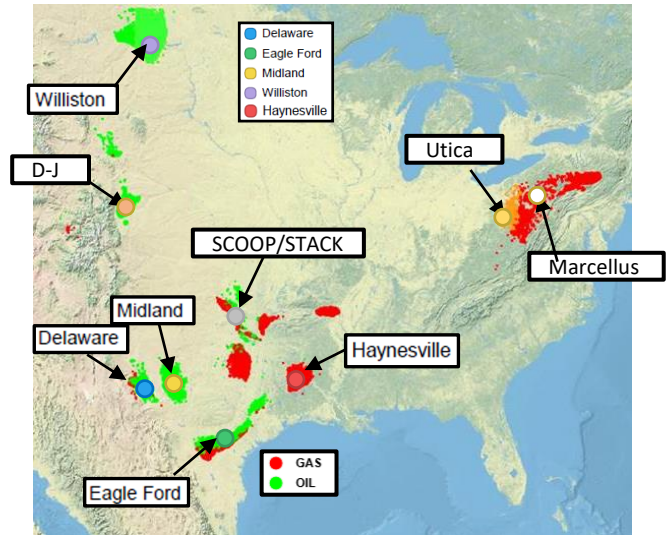
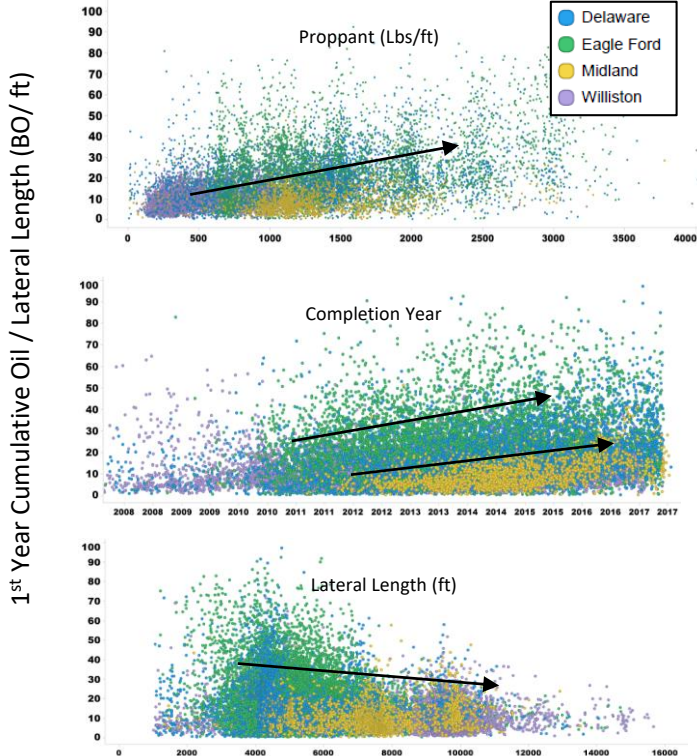
- Cumulative production for Pre-2015 oil wells: 4.8 billion barrels of oil (BBO), 9.0 trillion cubic feet (TCF) of gas
- Estimated ultimate recovery (EUR): ~9 BBO, ~15 TCF

Marcellus, Haynesville, Utica, Eagle Ford, Barnett, Woodford, and Fayetteville HZ Gas Wells

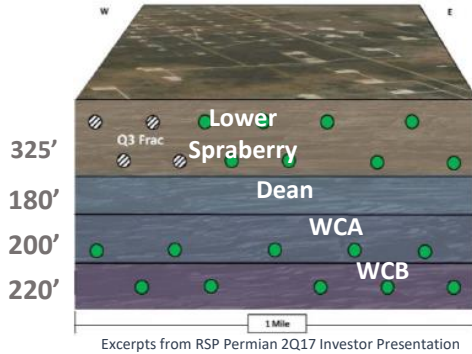


- Cumulative production for these gas wells: 70 TCF, 0.7 BBO
- Estimated ultimate recovery: ~150 TCF, ~1.4 BBO

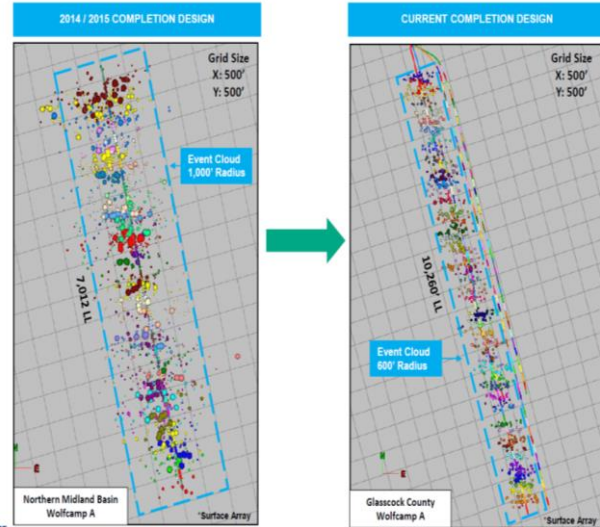
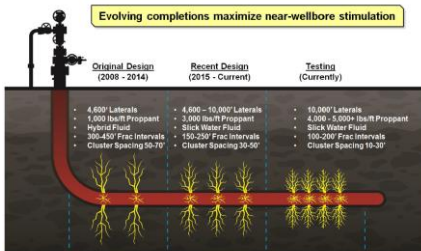
Well Performance Trends Normalized by Lateral Length



Well Spacing and Improving Completions



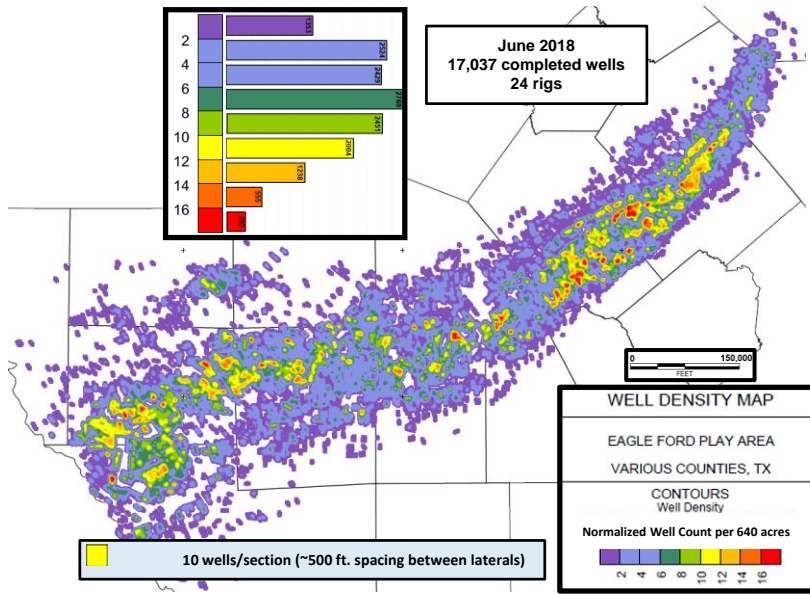
Haynesville Completion Evolution



Microseismic Case Study: Confirming Near-Wellbore Stimulation

Excerpts from RSP Permian 2Q17 Investor Presentation

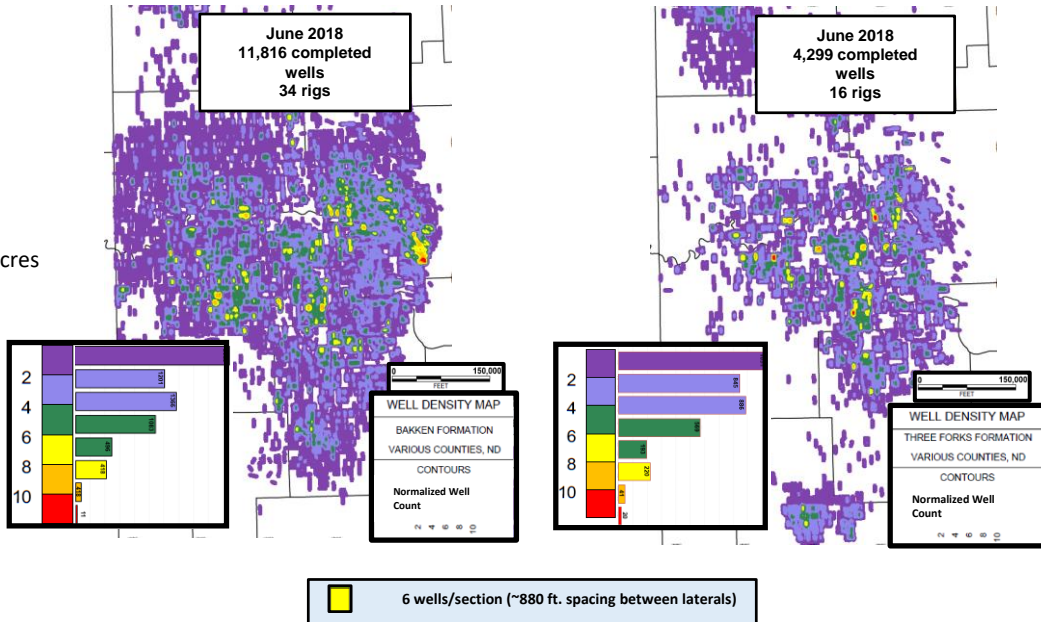
Well Spacing - Eagle Ford Well Density Map



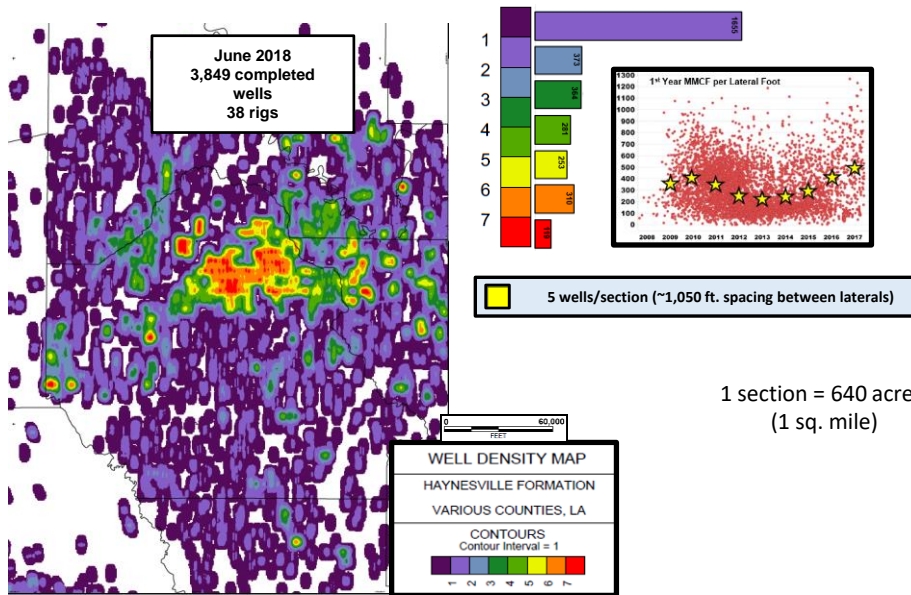
1 section = 640 acres
(1 sq. mile)

Well Spacing - Bakken and Three Forks Well Density Maps

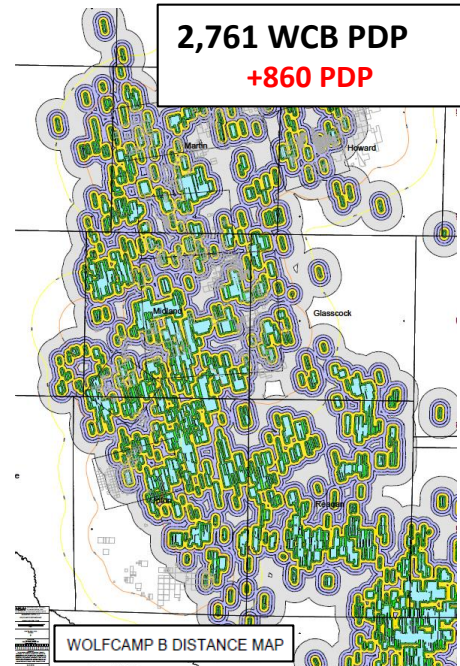
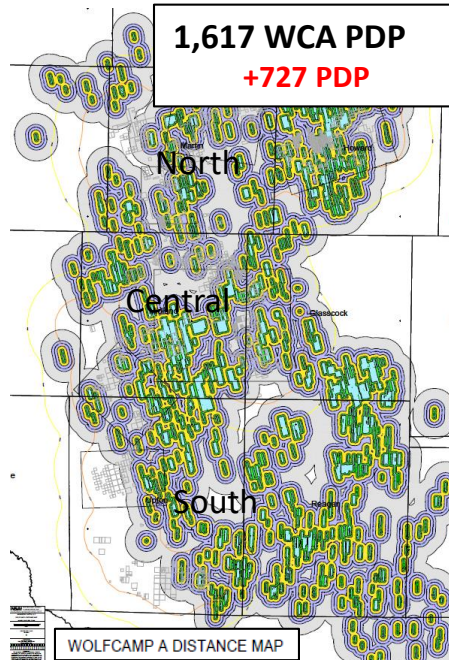
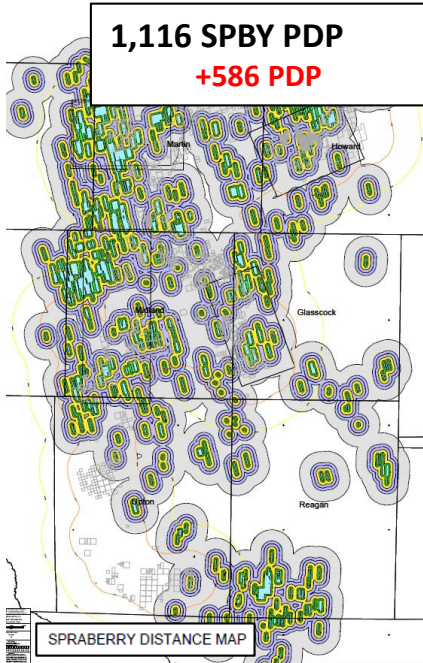
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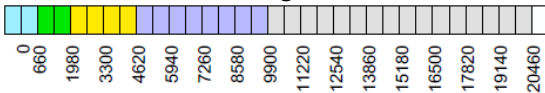
Well Spacing - Haynesville Well Density Map



Well Spacing – Midland Basin Well Density Maps

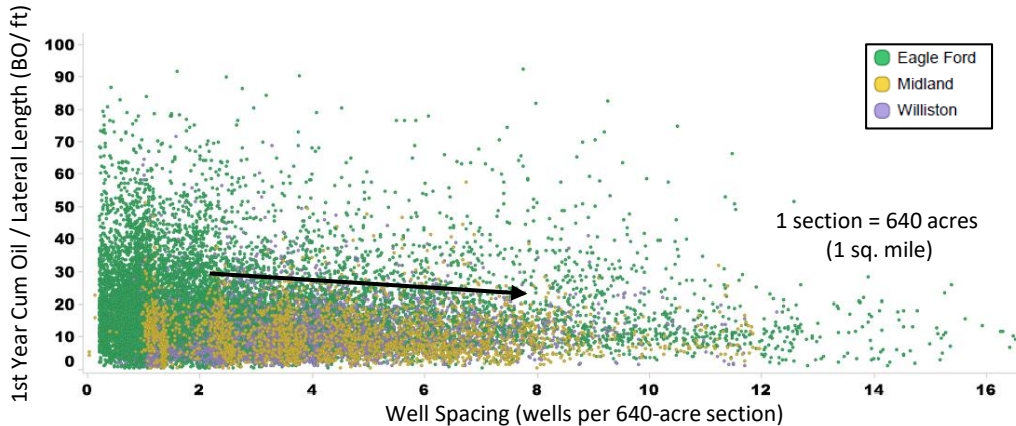


Distance from Producing well



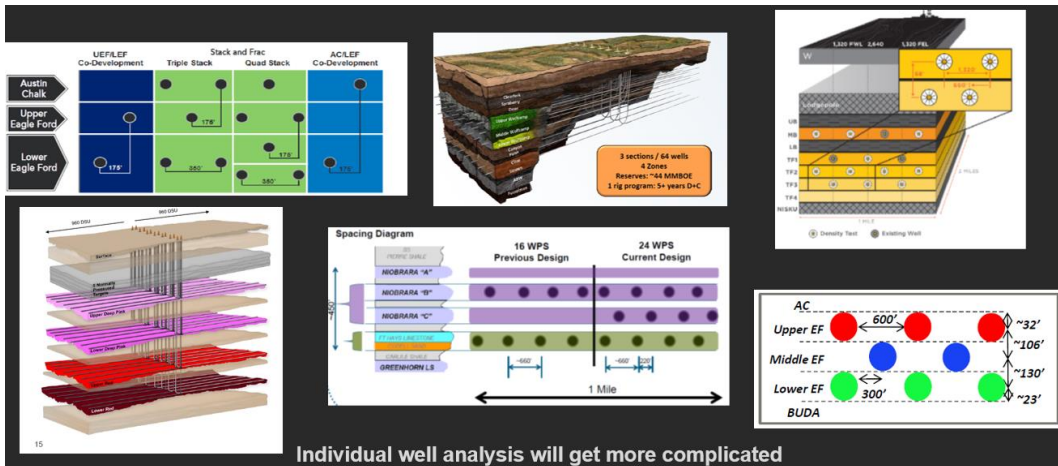
Blue areas are developed at 4 or greater wells per section in landing zone mapped

Impact of Well Density on Performance



- Increased well density eventually results in interference and decreased well performance for subsequent wells
- Performance for widely spaced initial wells may not be representative of future full-development performance

Unconventional Well Development Patterns



- Well spacing in map view is not the only spacing issue to consider
- Plays in US have multiple productive intervals and consideration should be given to the 3D aspects of the development patterns

Optimizing Well Spacing

Maximizing NPV of the Field vs. Single Well Economics¹

	5,280'	660'	440'
Well Spacing	5,280'	660'	440'
Est. Reserves per Section ²	1,250 MBOE	7,850 MBOE	9,900 MBOE
Completed Well Cost ³	\$5.9 MM	\$5.9 MM	\$5.9 MM
NPV per Section ⁴	\$5.7 MM	\$28.5 MM	\$31.0 MM
Direct ATROR ⁵	72%	50%	40%
IP30, Boed	2,500	2,300	2,000

(1) Analysis based on Delaware Basin wells.
(2) Section = 640 acres, 1 square mile.
(3) Includes drilling, completion, well-site facilities and flowback. This analysis does not consider potential cost savings from larger scale development.
(4) NPV calculated using \$40 WTI and \$2.50 NYMEX fixed for life of wells.
(5) Direct ATROR calculated using \$40 WTI and \$2.50 NYMEX fixed for life of well. See reconciliation schedules.

STACK Meramec Maximizing Value Through Unit Development

SCOOP Springer Maximizing Value Through Unit Development

SCOOP Springer Unit Economic Model

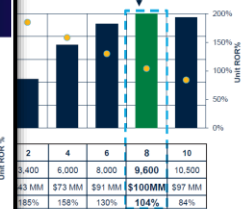
- Max. PV-10¹⁰ achieved with 4 wells
- 183% ROR¹¹
- 11 months payout¹¹
- \$3.7 million incremental first year gross cash generated per well
- 1,200 MBoe (~75% oil)
- 7500' lateral
- \$9.5 million CWC

Maximum PV-10¹⁰ Achieved With 4 Wells



1. All references to ROR, PV-10, and payout are based on \$61 WTI and \$3.00 gas, see ROR tables on slide 20. Referring to increase in Oklahoma gross production.
2. Unit EUR.

Maximum PV-10¹⁰ Achieved With 8 Wells



Referring to increase in Oklahoma gross production.

- Operators plan to optimize development economics
- Economics dependent on price outlook, well spacing, interference and potential of loss opportunity is not downspaced early

Summary

- Each play and horizon within each play has its own unique characteristics.
- Still improving completion techniques and drilling longer laterals, but...
- Still in early to mid- stages of development in most active basins.
- Many operators seeing necessity of changing completion designs to match with well spacing plans
- Development potential dependent on many variables, including:
 - Ultimate well spacing
 - Price Outlook
 - Economics

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