Understanding Well Spacing Strategies in the Midland Basin

February 2020

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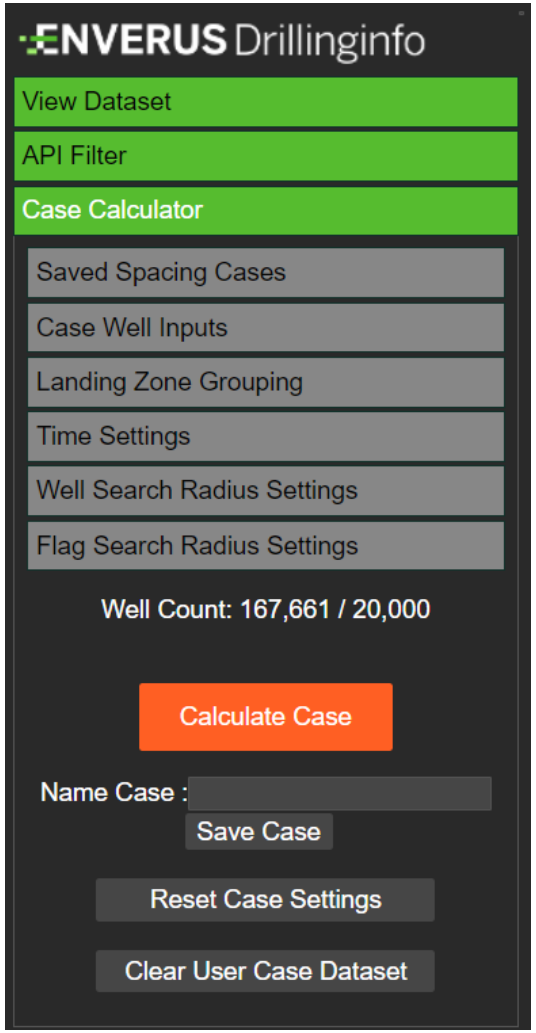
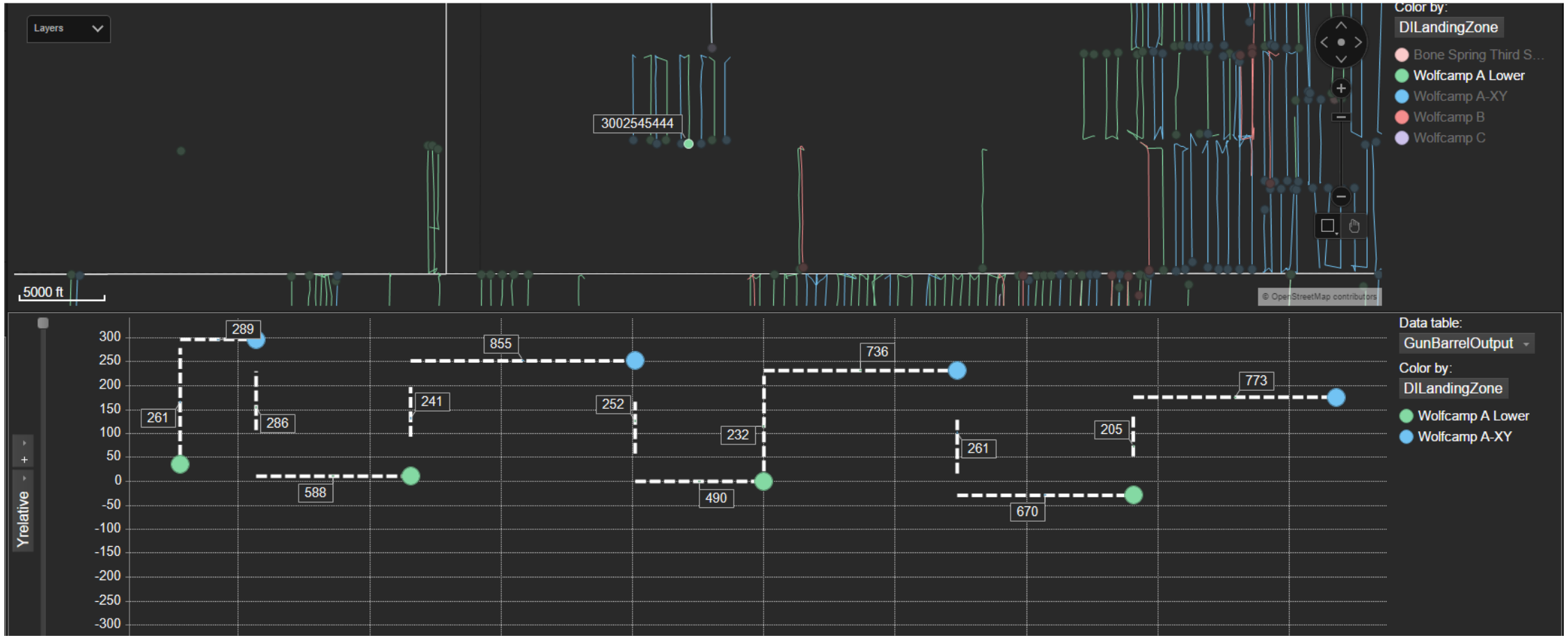
Well Spacing Dynamic Calculator



The Enverus Well Spacing Premier solution now incorporates a Dynamic Calculator, that allows you to **create a custom well spacing dataset** based on your desired assumptions. This platform arms you with a comprehensive dataset needed to understand the interactions between geology, well spacing, engineering variables, and parent/child well relationships.

Gun Barrel View



The GBV helps understand vertical and horizontal well spacing distances of offset wells within 2640 ft horizontally on either side of a subject well. Every subject well has a unique GBV depending on how its offset wells land when looking from the subject well's toe towards its heel.

Outline

- Methodology Overview

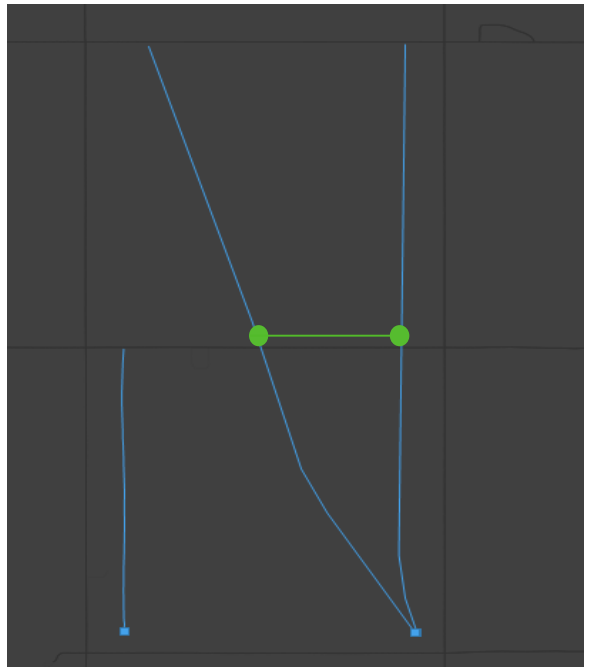
- Midland Basin Spacing Trends
  - Has Productivity Peaked?

- Case Study on Improvements in 2019
  - Gun-Barrel Views and Wellbore Orientation
  - Comparing Developments and Economics

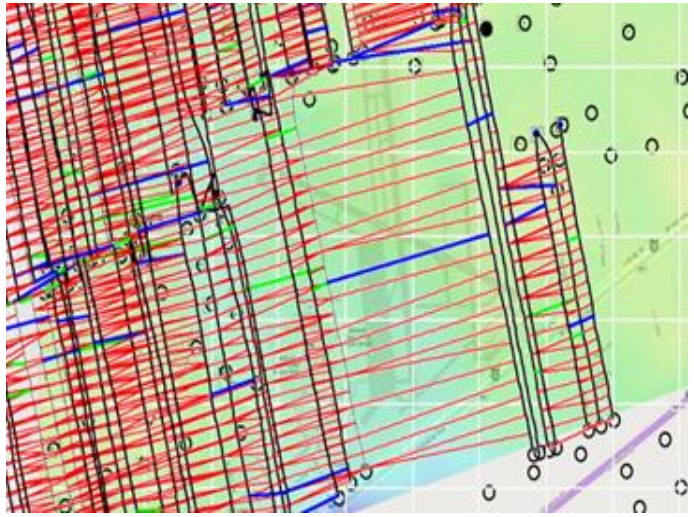
- Conclusions and Q&A

Well Spacing Methodology

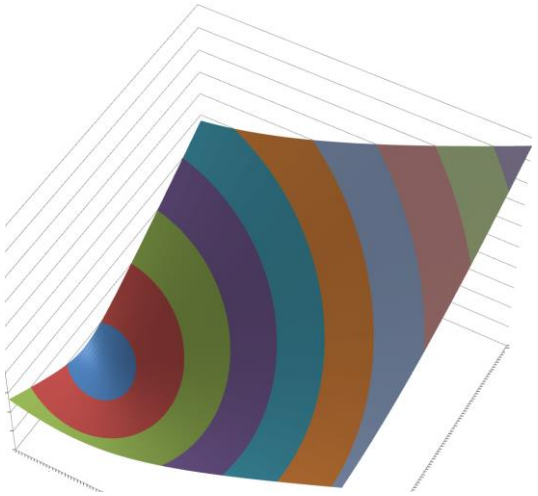
Changing the paradigm of well spacing calculations



Mid-point distances



Sampling



Segment-wise analytical distances

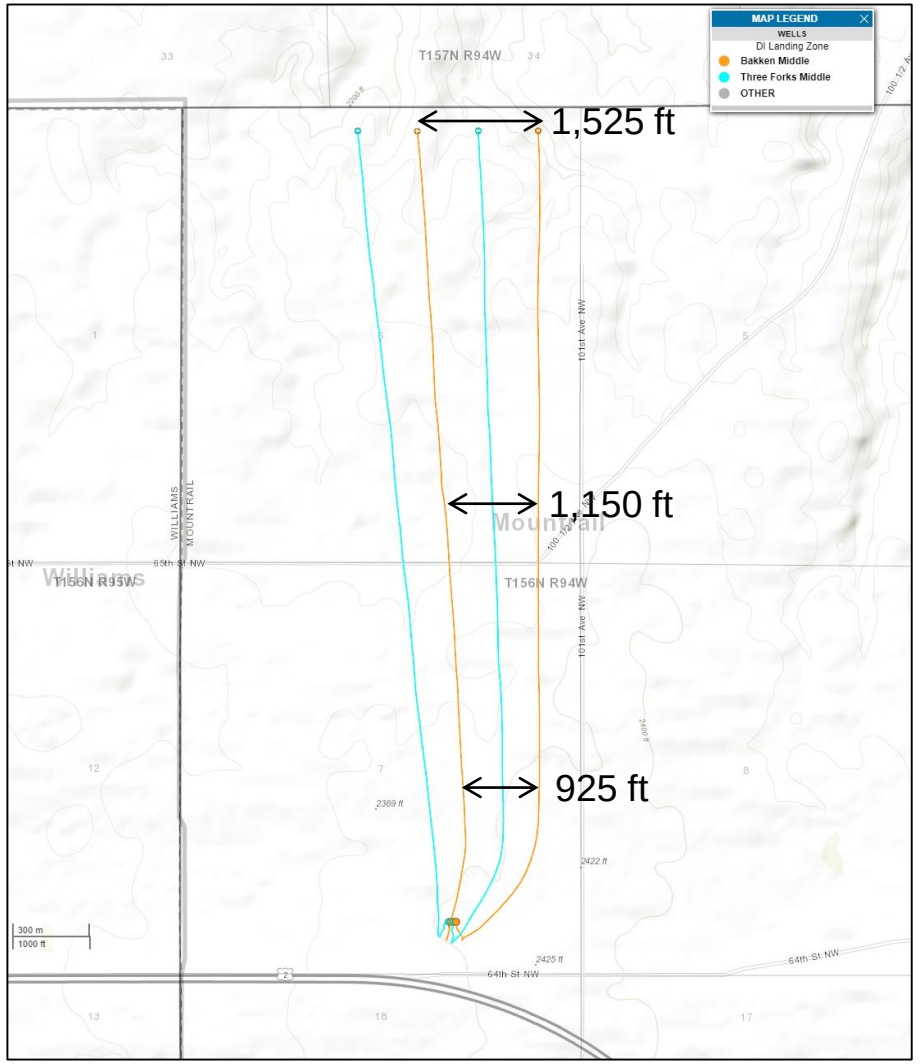
Midpoint vs. Segment-wise

- In the graphic on the right are four wells in the Williston Basin:

- Across the whole Williston Basin, a midpoint approach would underestimate Middle Bakken formation spacing **by 10%.**

Basin	Formation	Midpoint (ft)	DI (ft)	Difference
Williston	Middle Bakken	866	954	10%

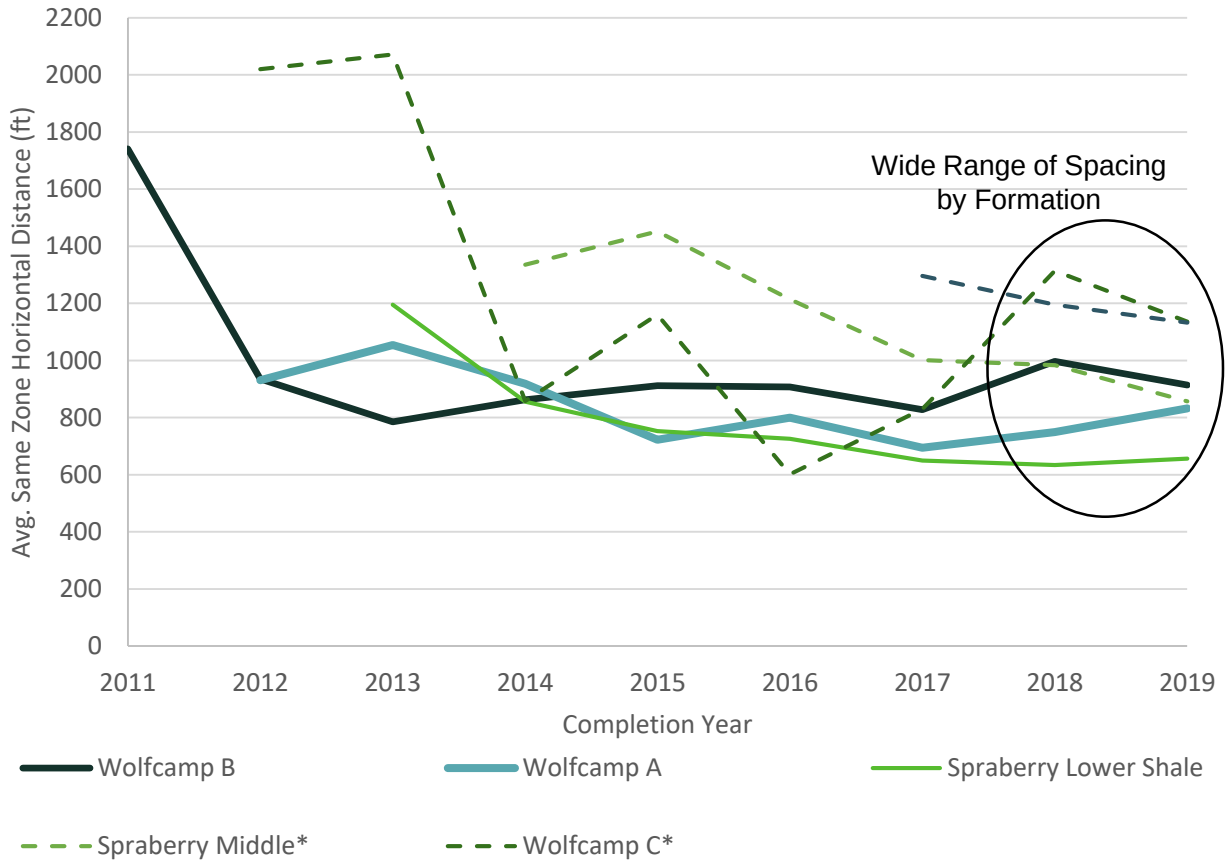
Williston Well Spacing Example



Source: Drillinginfo, DI Spacing

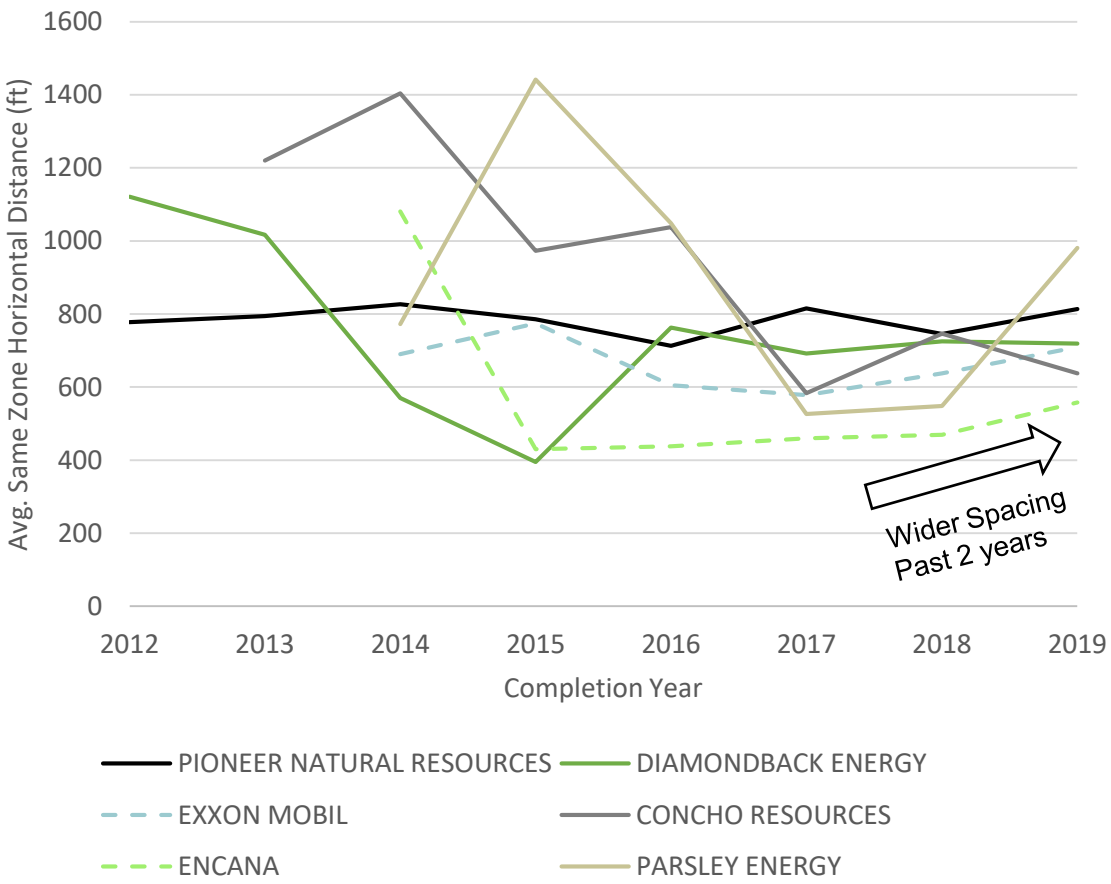
Midland Basin Spacing Trends

Avg. Same Zone Horizontal Distance vs. Year

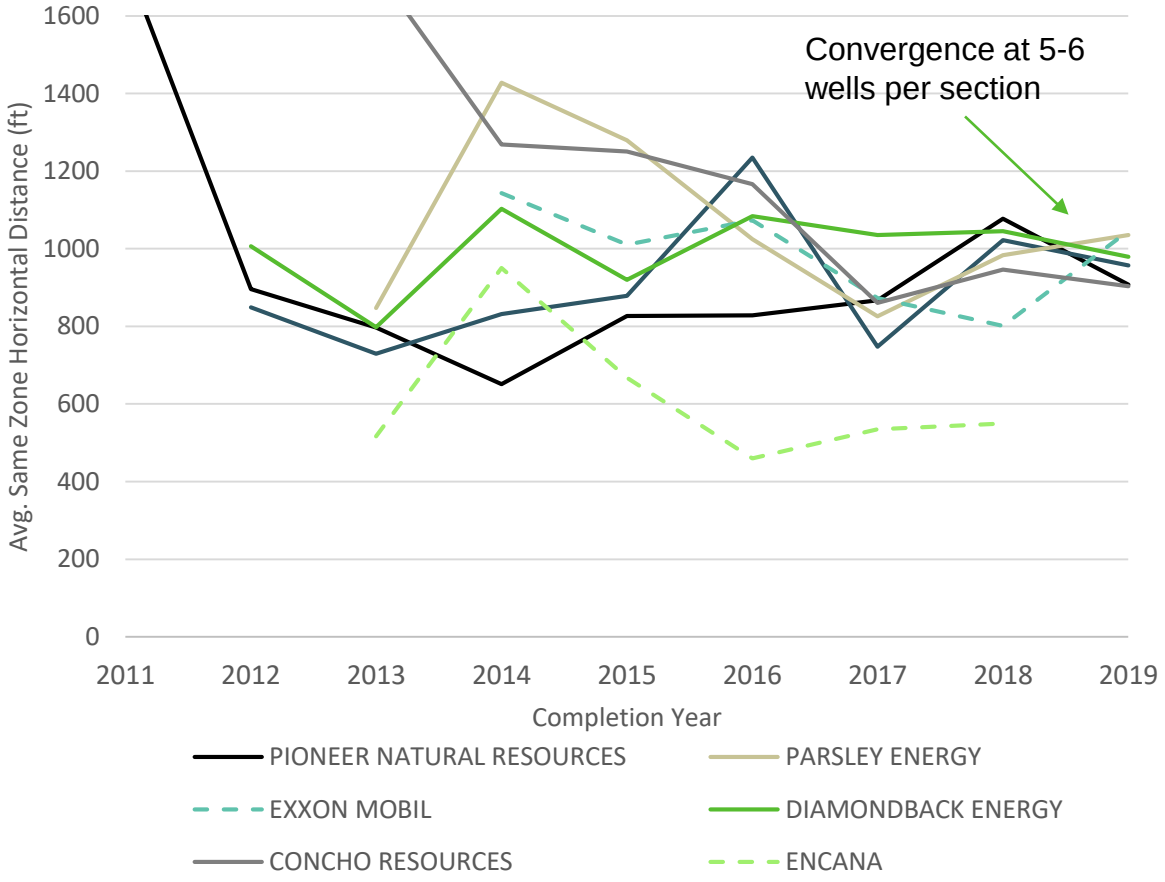


Operator Variance

Wolfcamp A

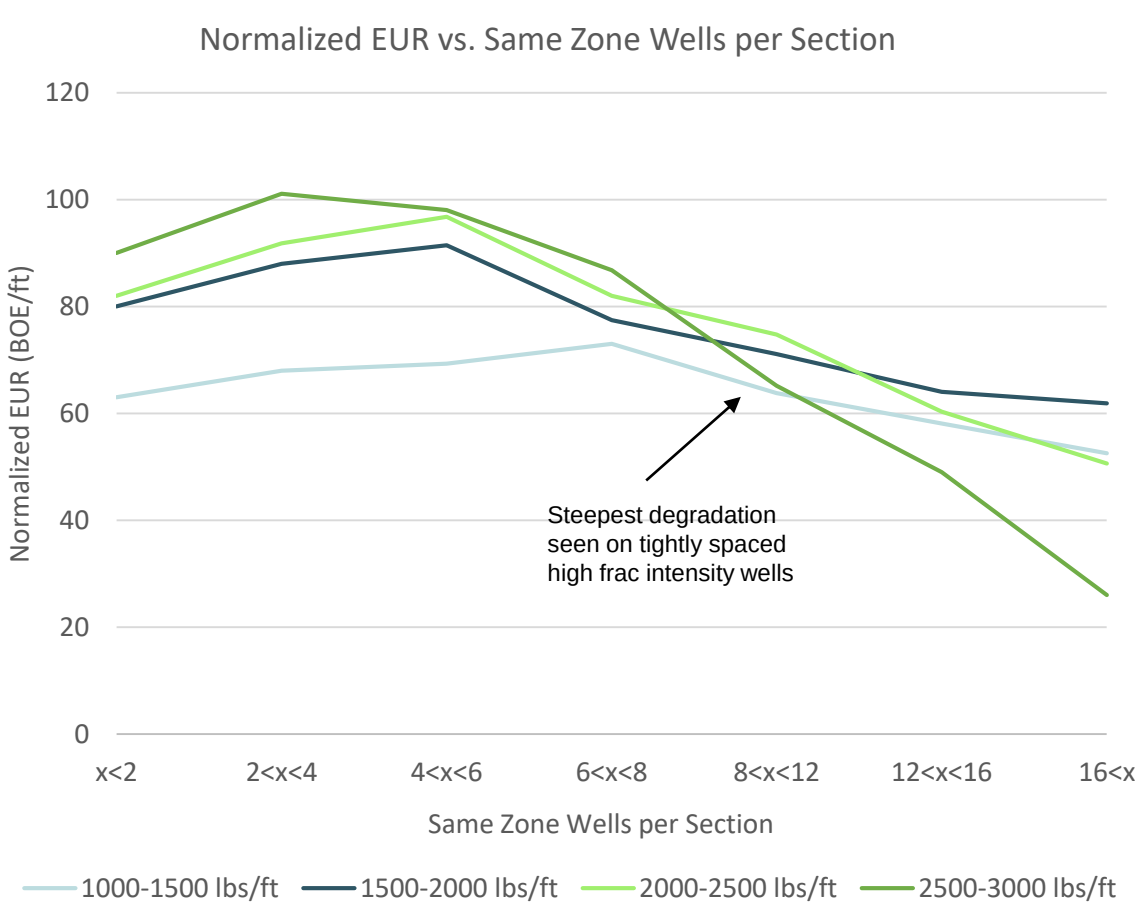


Wolfcamp B

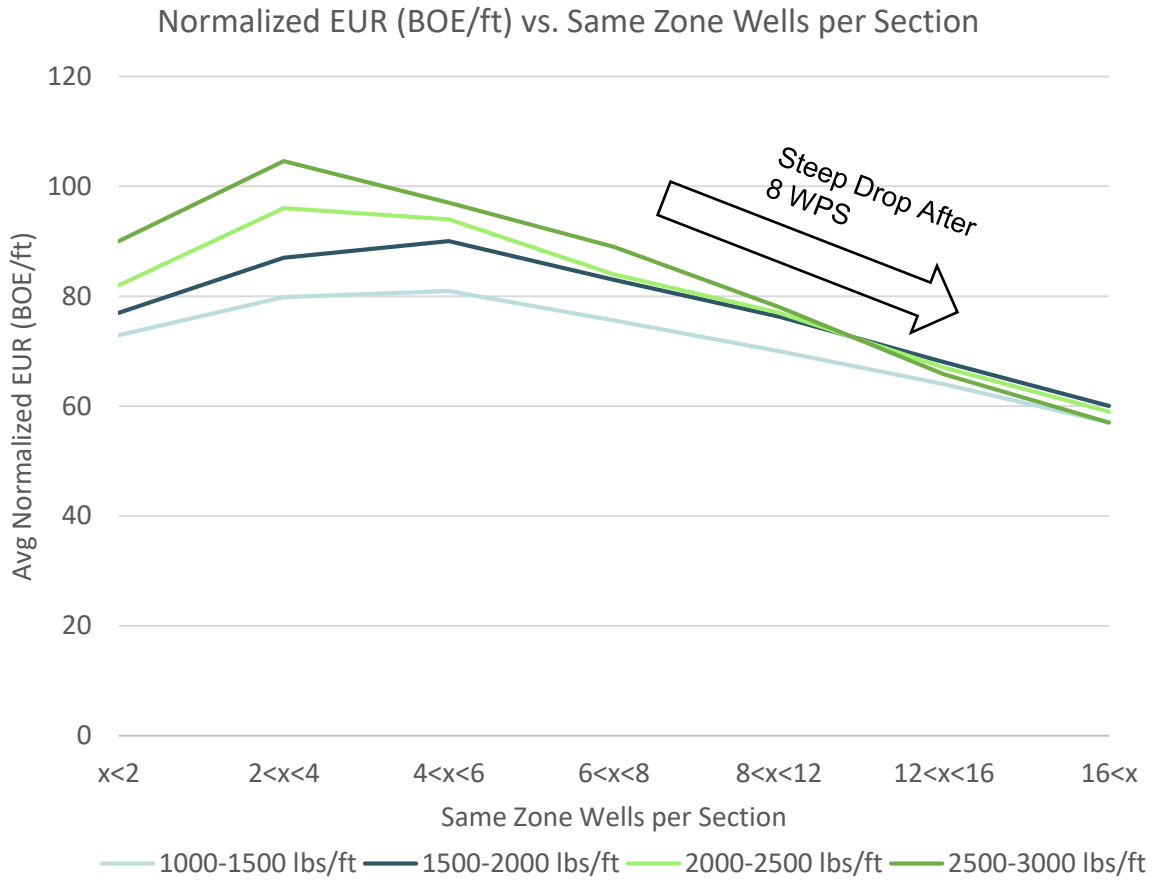


Spacing vs Frac Size vs Productivity

Wolfcamp A



Wolfcamp B



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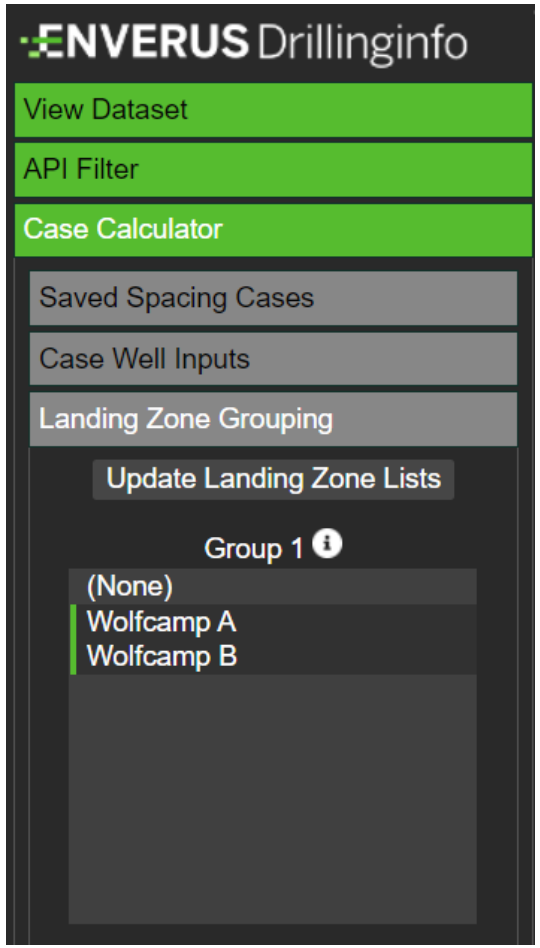
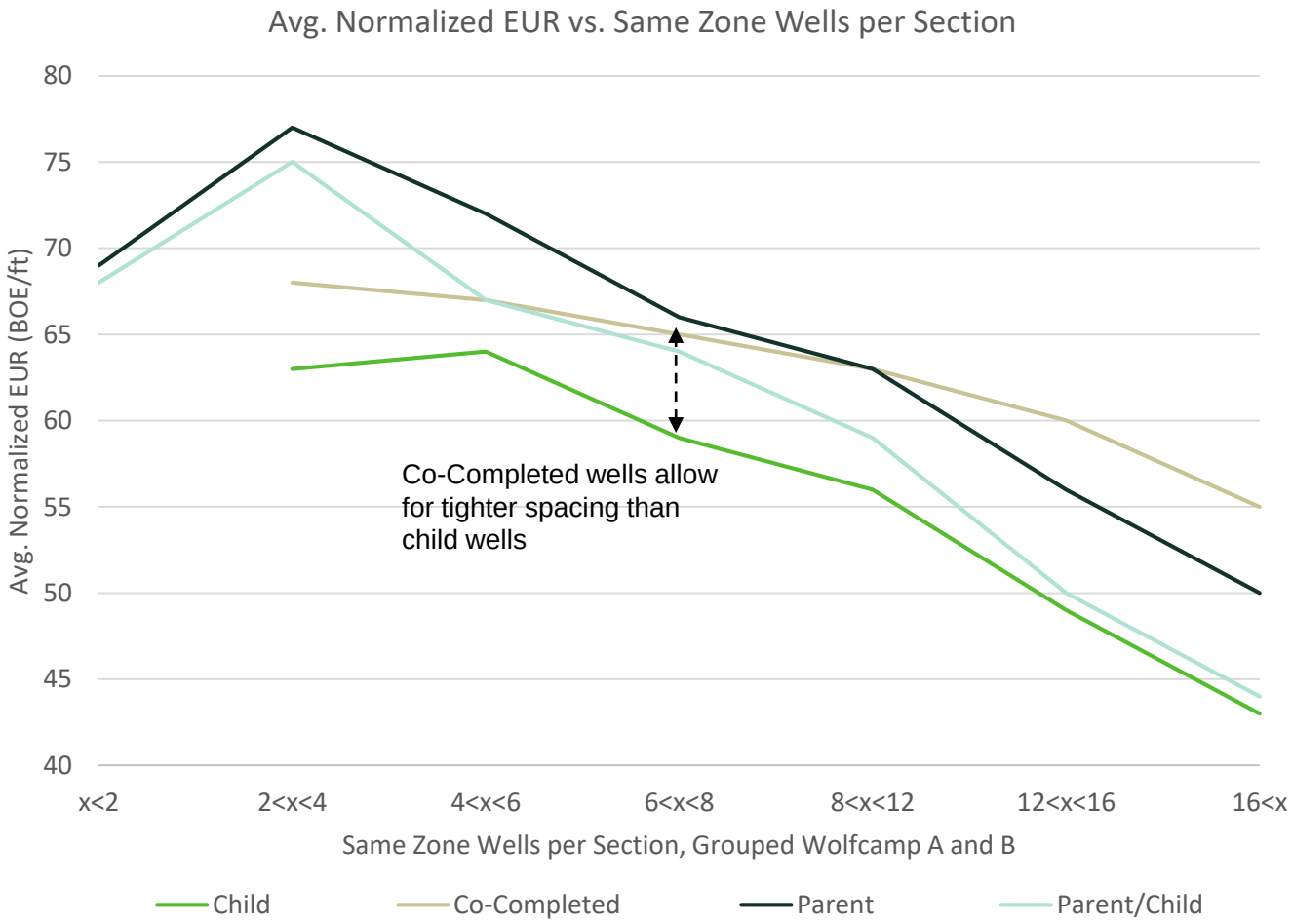
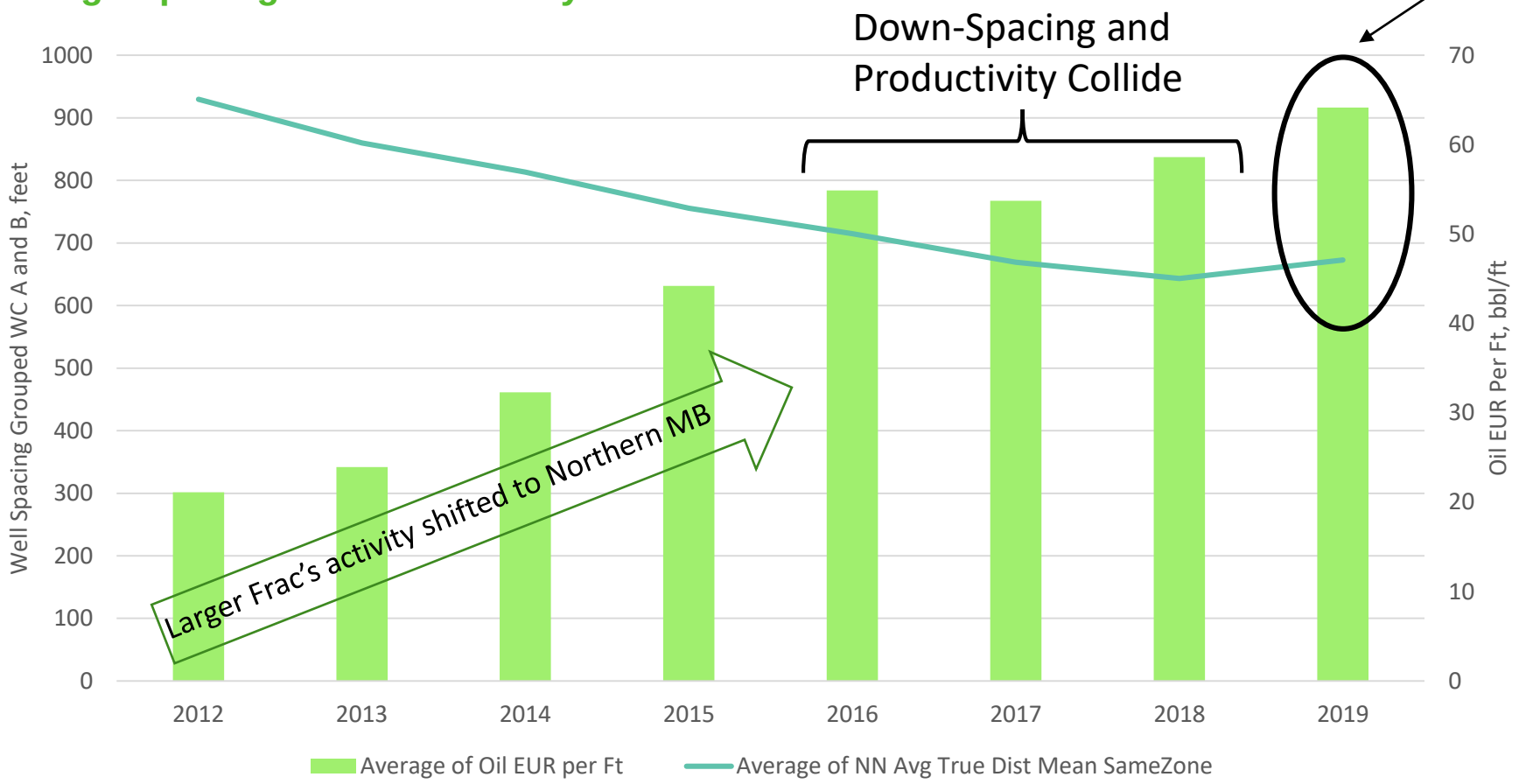
Parent and Child Productivity





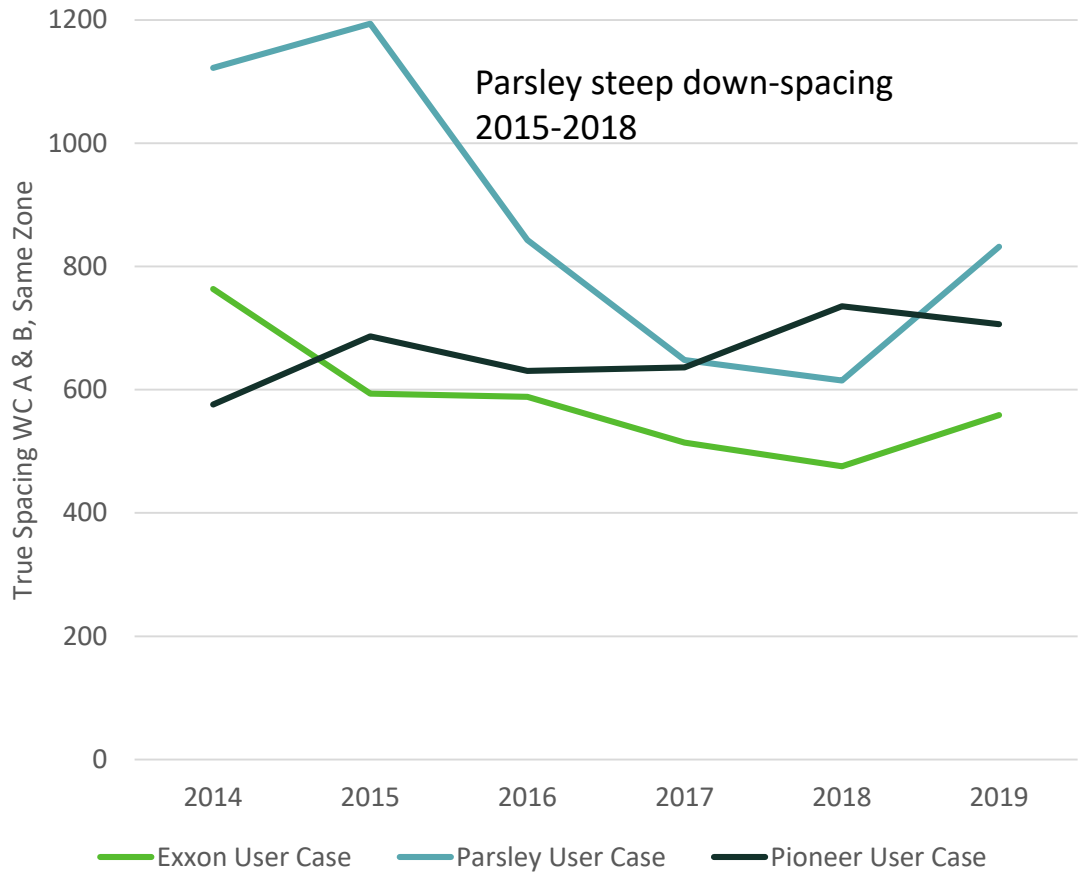
Has Productivity Peaked?

Vintage Spacing and Productivity

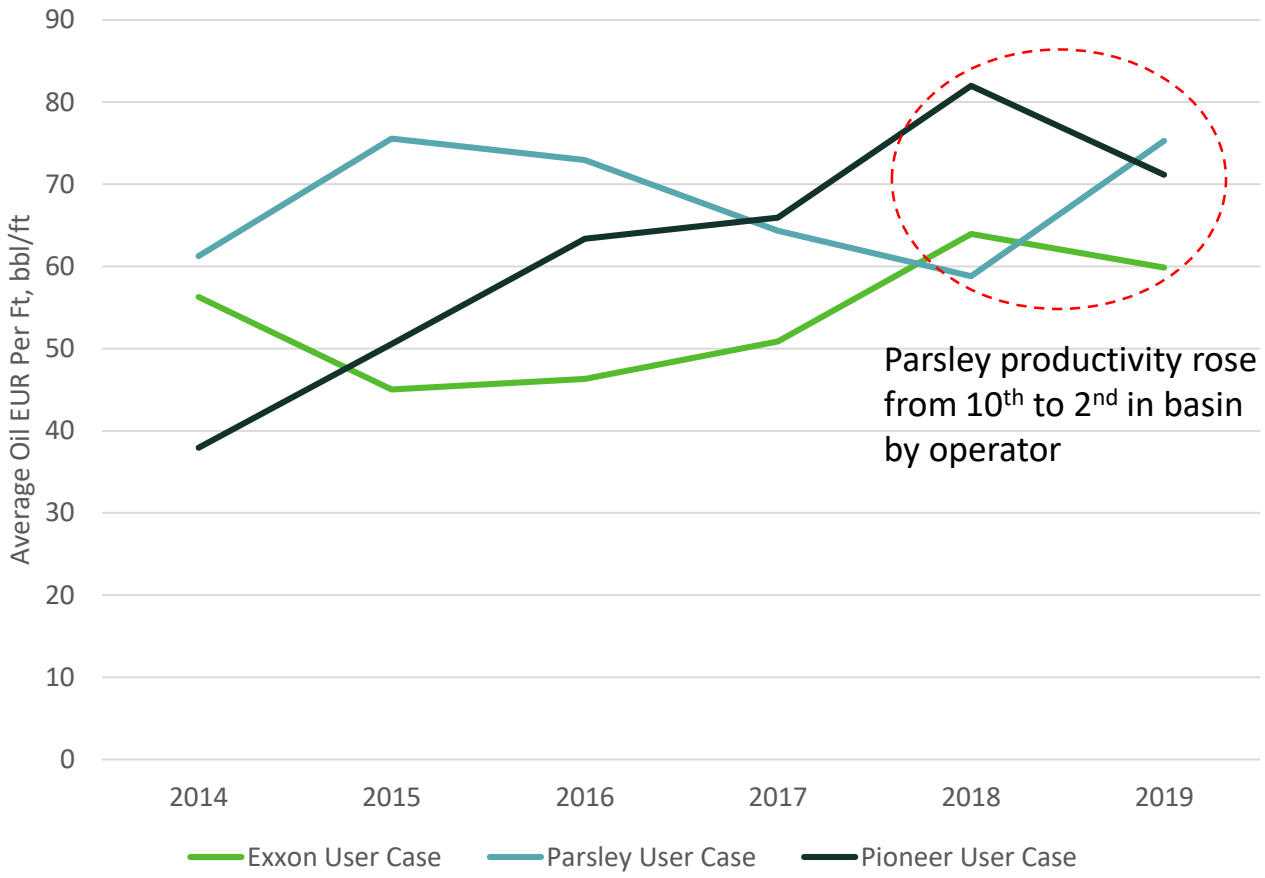


Dueling Development Models Case Study Introduction

Grouped Zone Spacing Vintage Comparison



Normalized EUR Vintage Comparison



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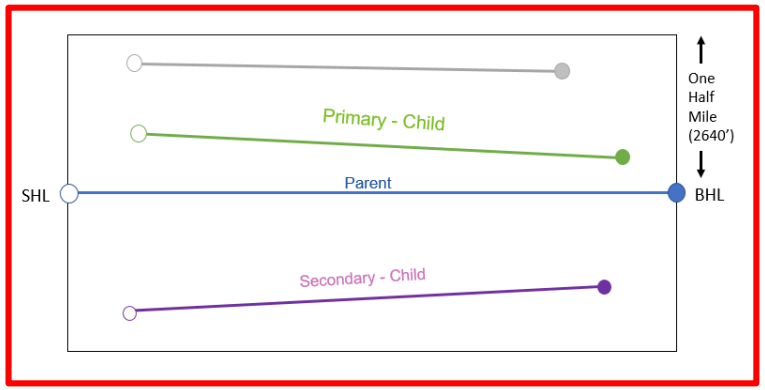
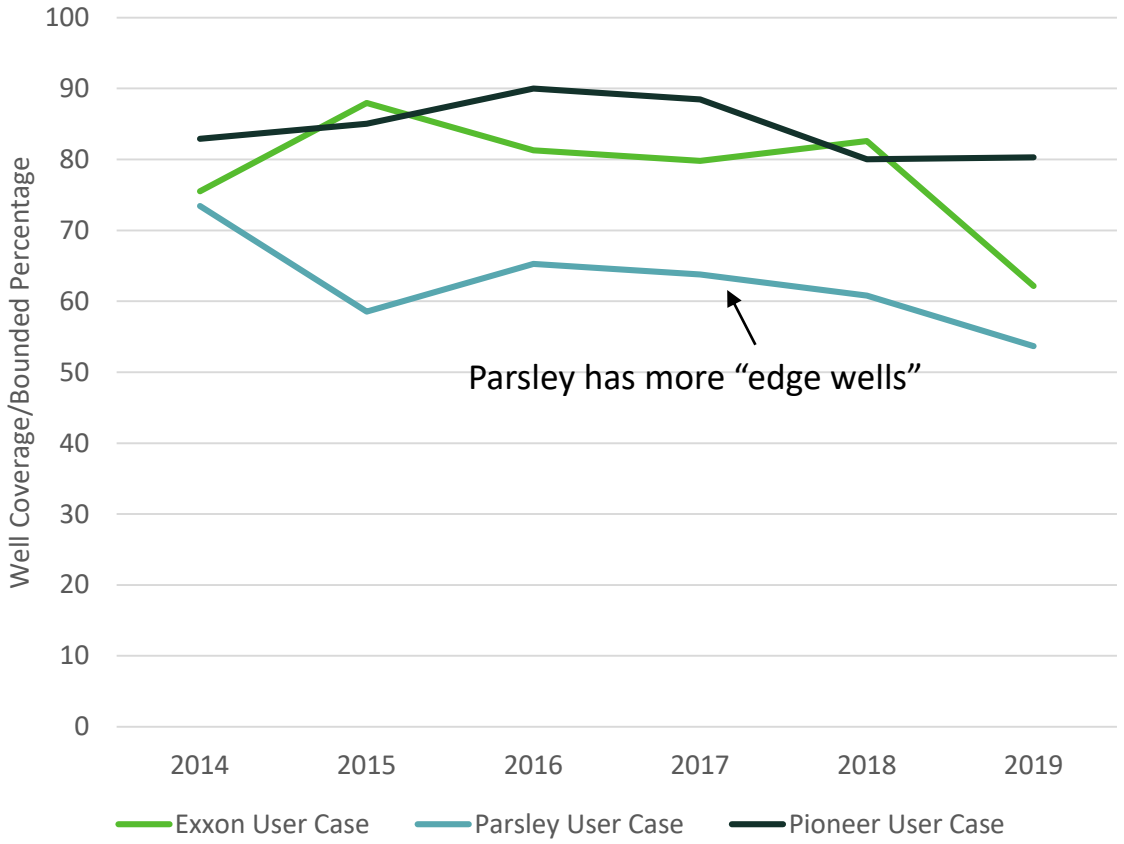
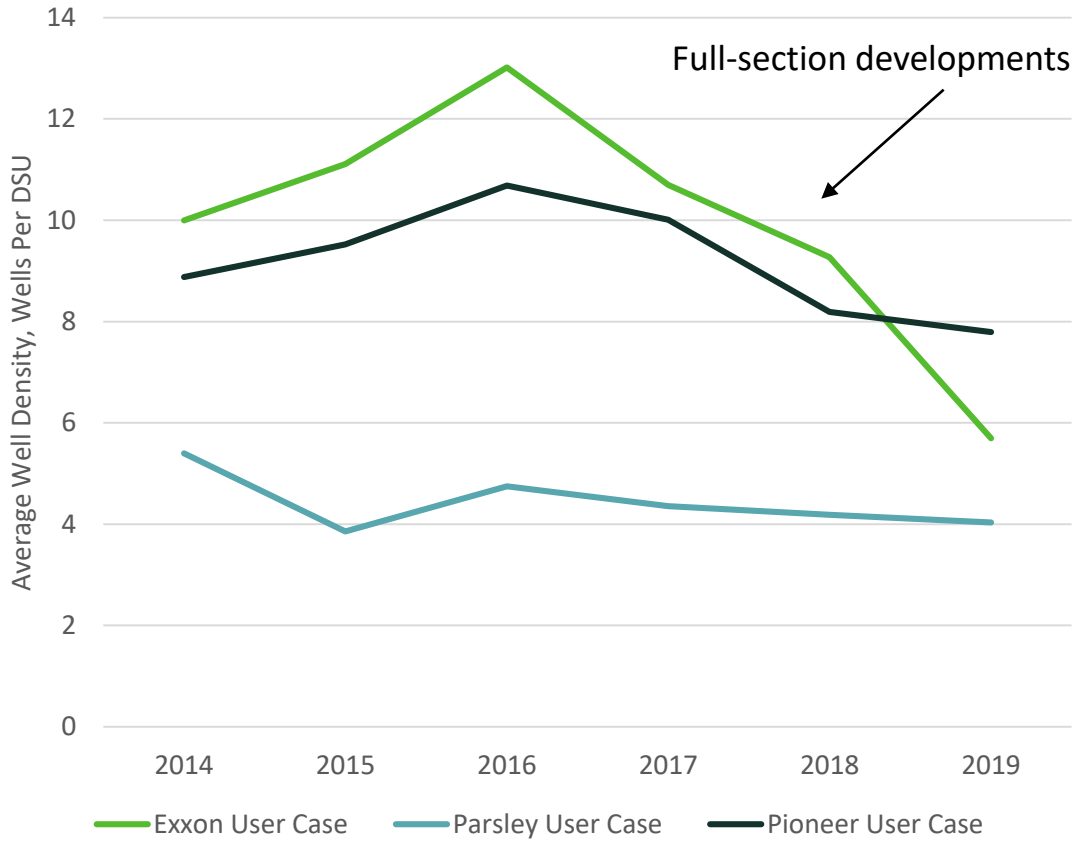
Development Complexity



Well Coverage



Well Density



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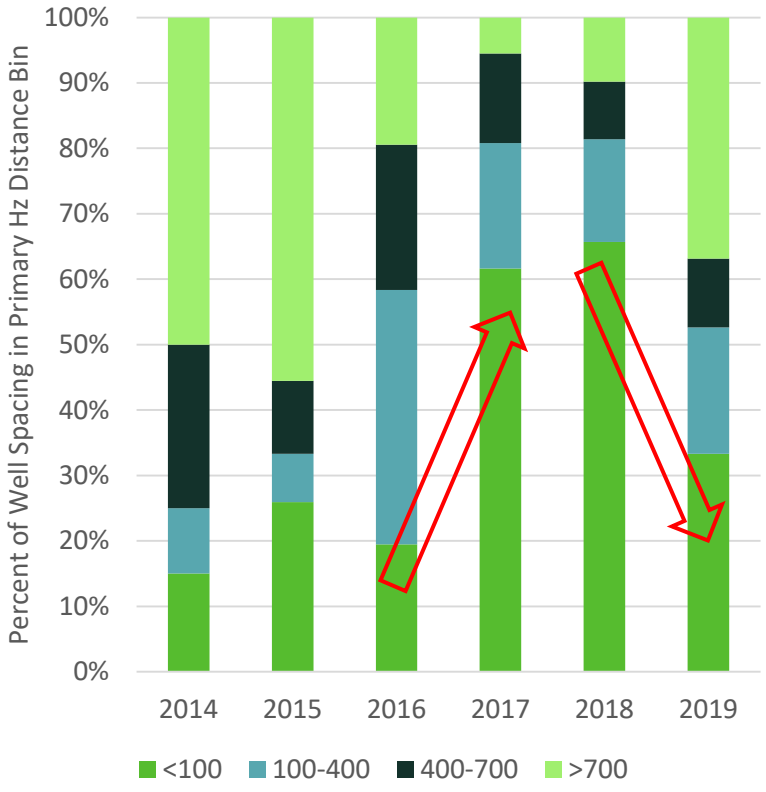
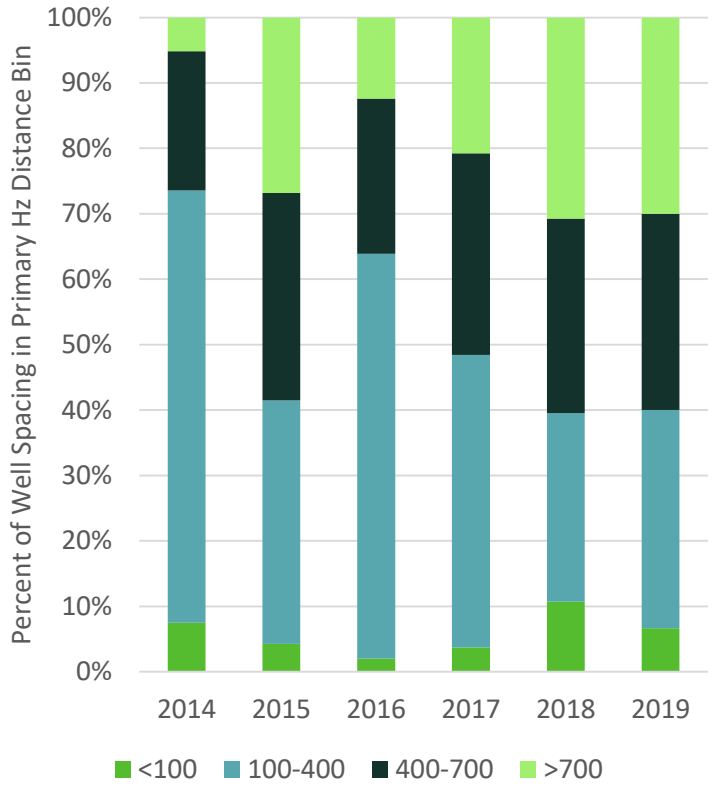
“Stacked Lateral” Comparison

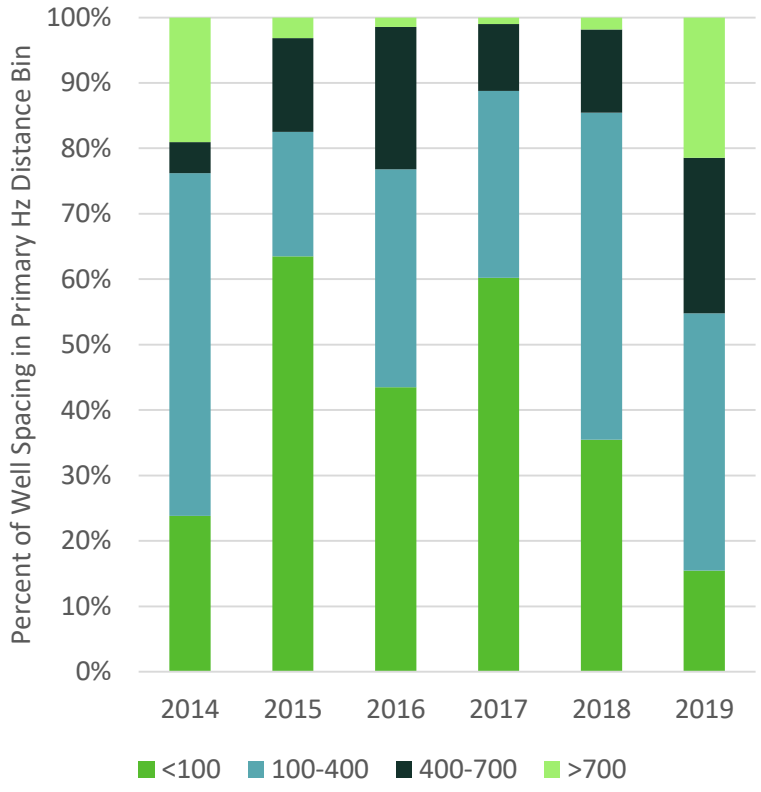
Parsley



Pioneer



Exxon



< 100’ Primary Hz Distance = “Stacked Lateral”

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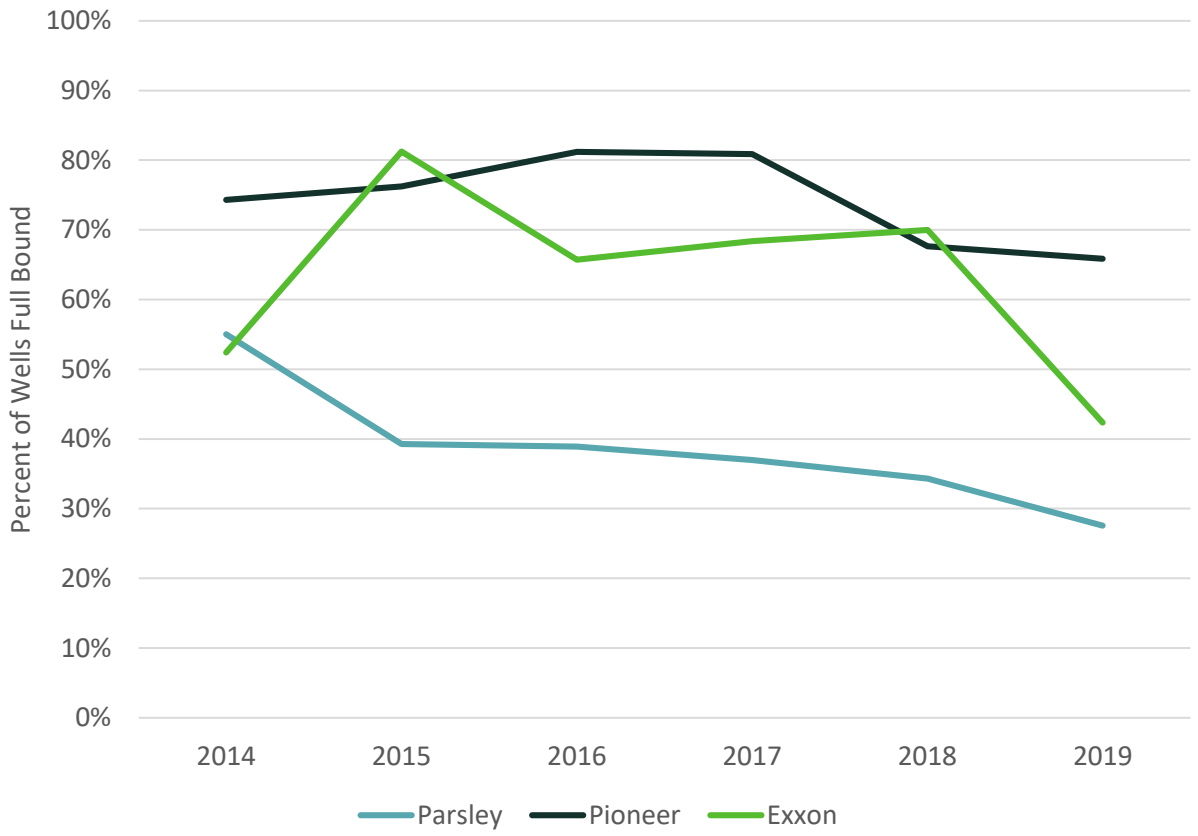
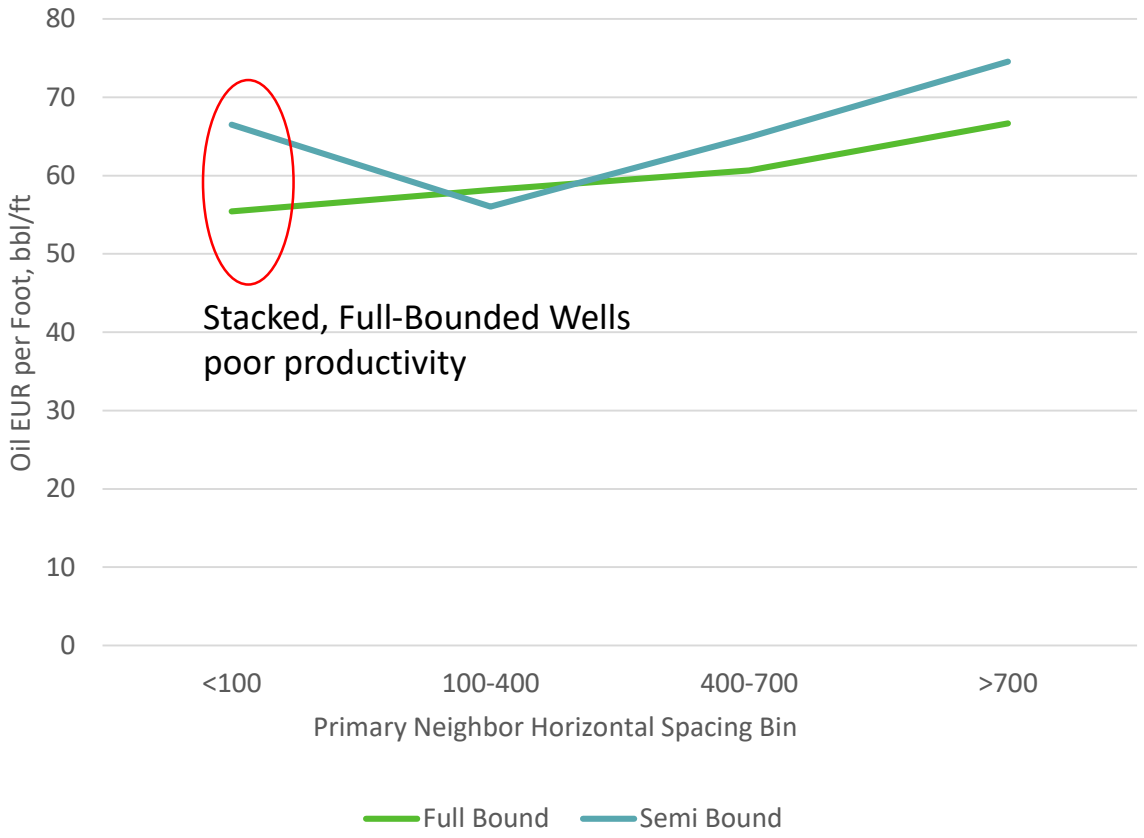
Full vs Semi Bound

Percentage of Full Bound Wells

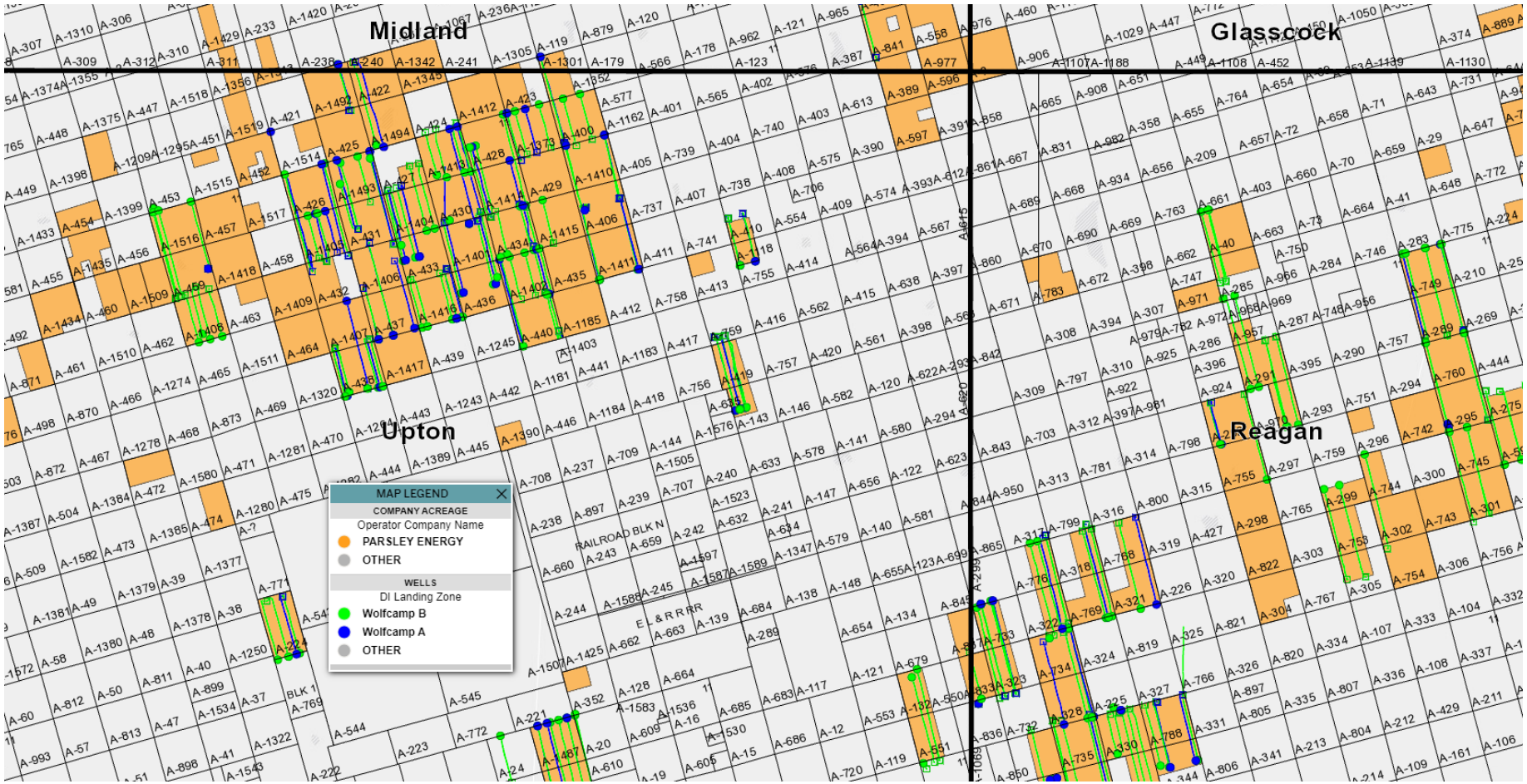


Stacked Productivity Comparison



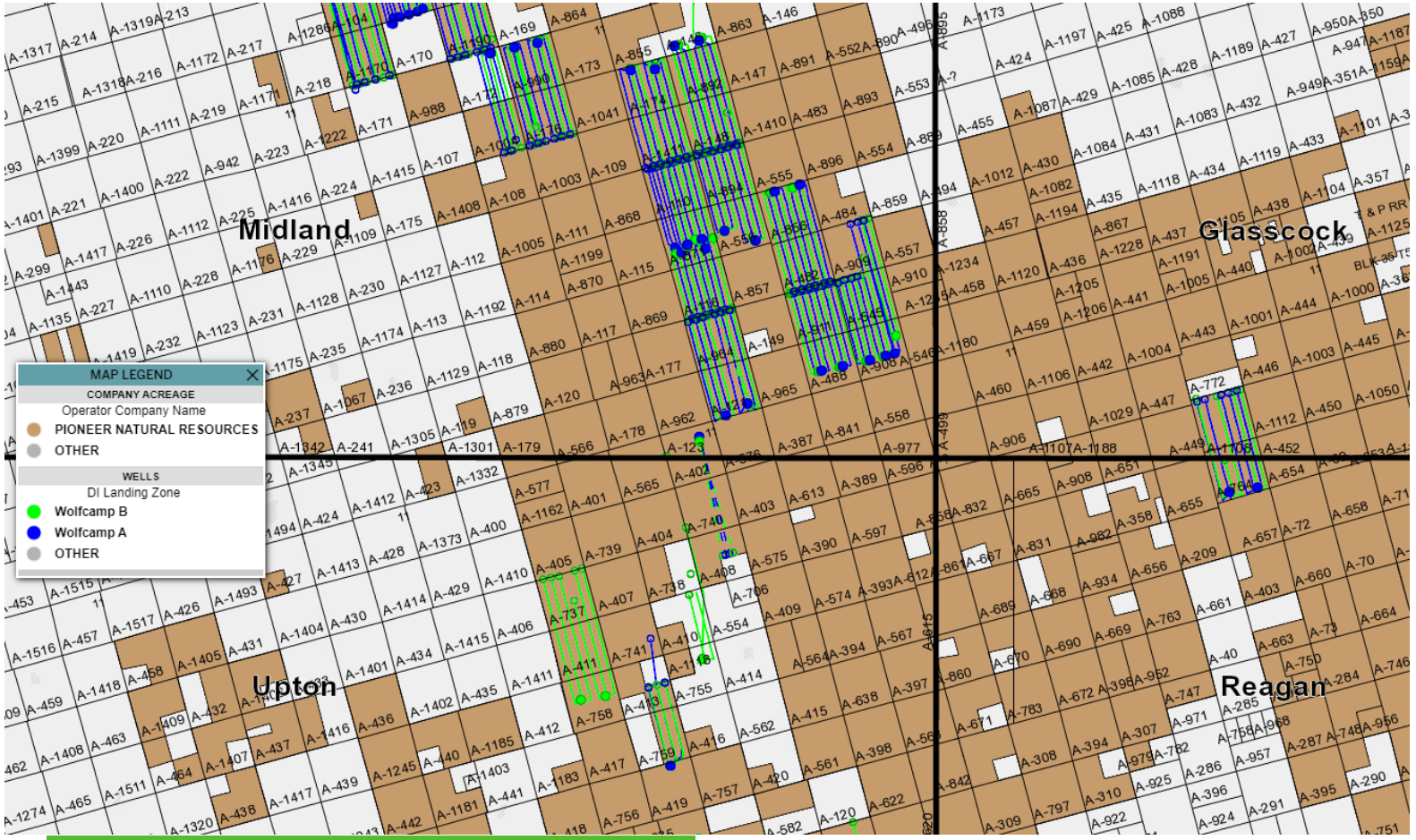
Parsley Acreage and Delineation

Parsley Central Midland Basin Acreage Position with Completed WC A and B



Pioneer Acreage and Delineation

Pioneer Central Midland Basin Acreage Position with Completed WC A and B



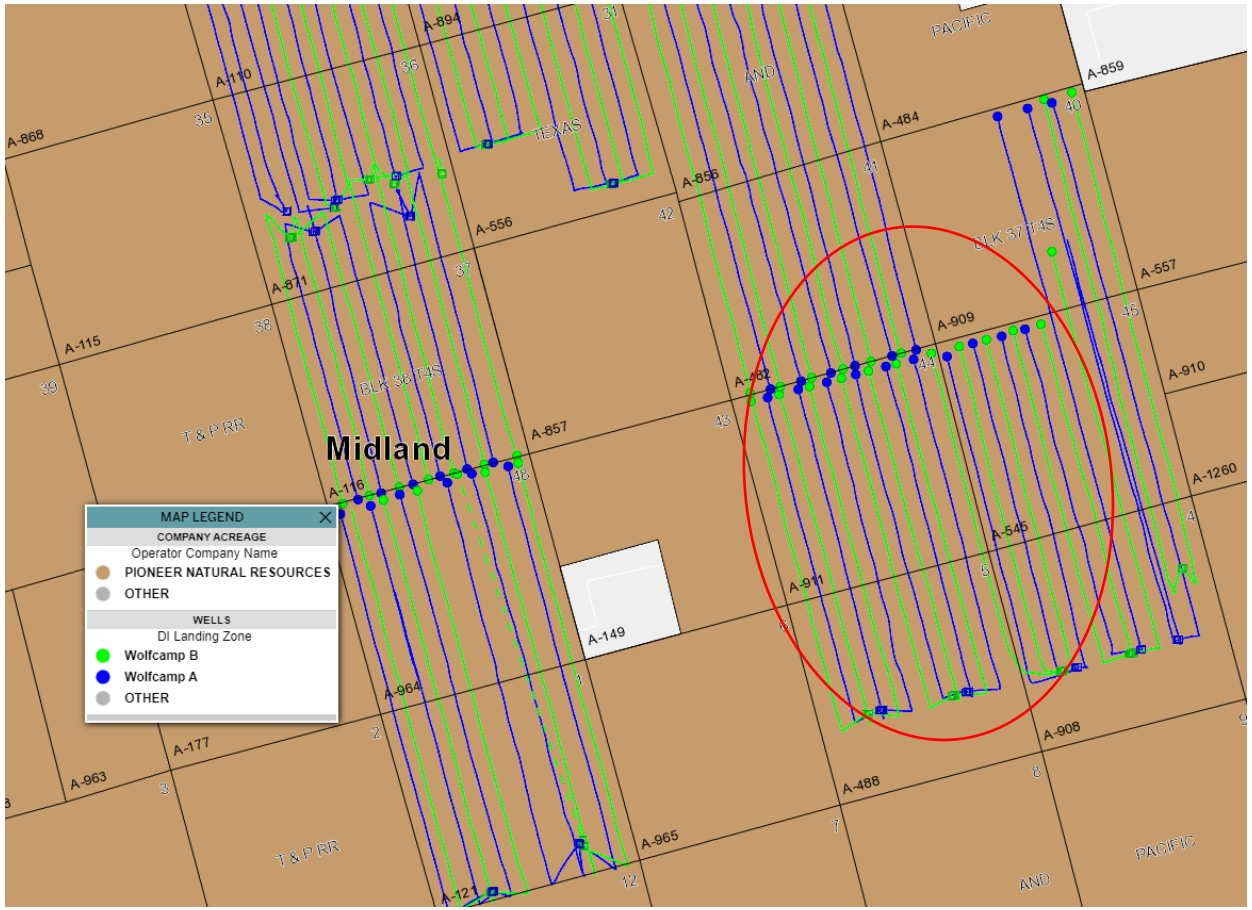
Exxon Acreage and Delineation

Exxon Central Midland Basin Acreage Position with Completed WC A and B

Map View Comparison

Parsley

Pioneer



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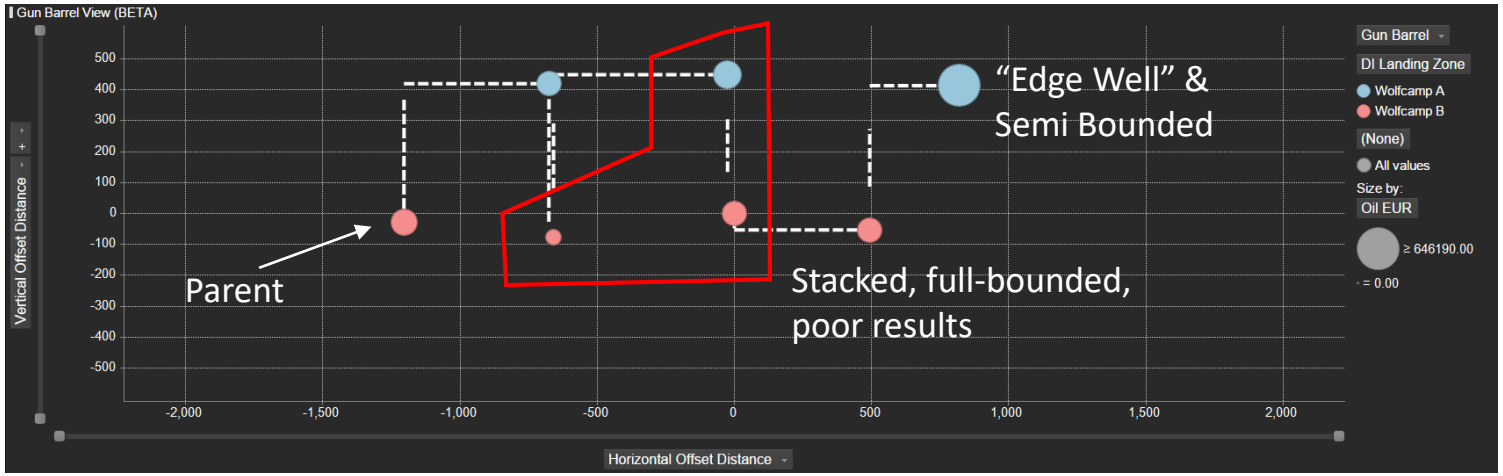
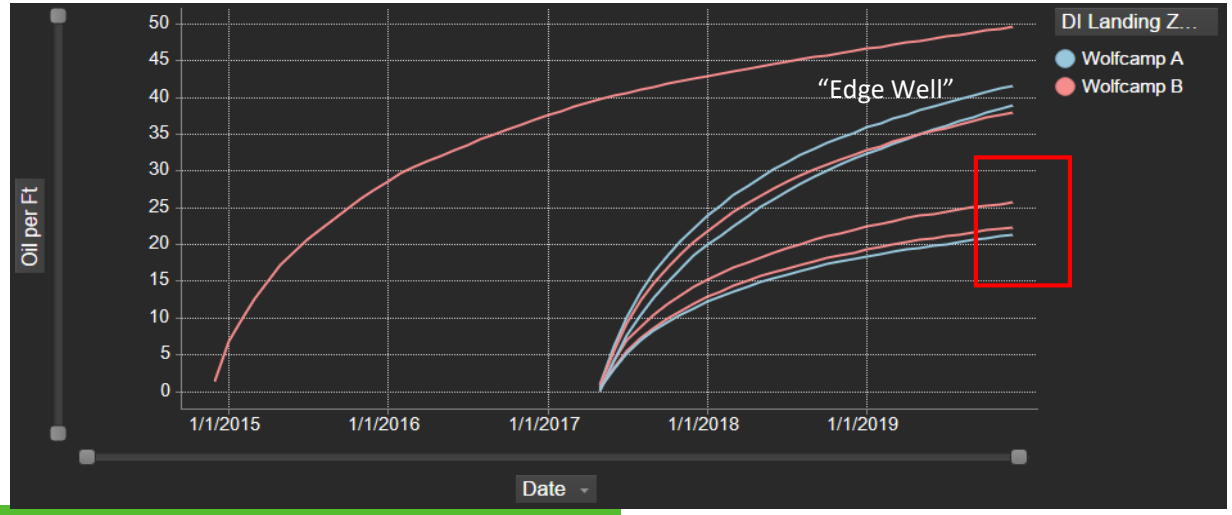
Parsley GBV - 2017 Pad

Gun-Barrel View, Sized by Oil EUR

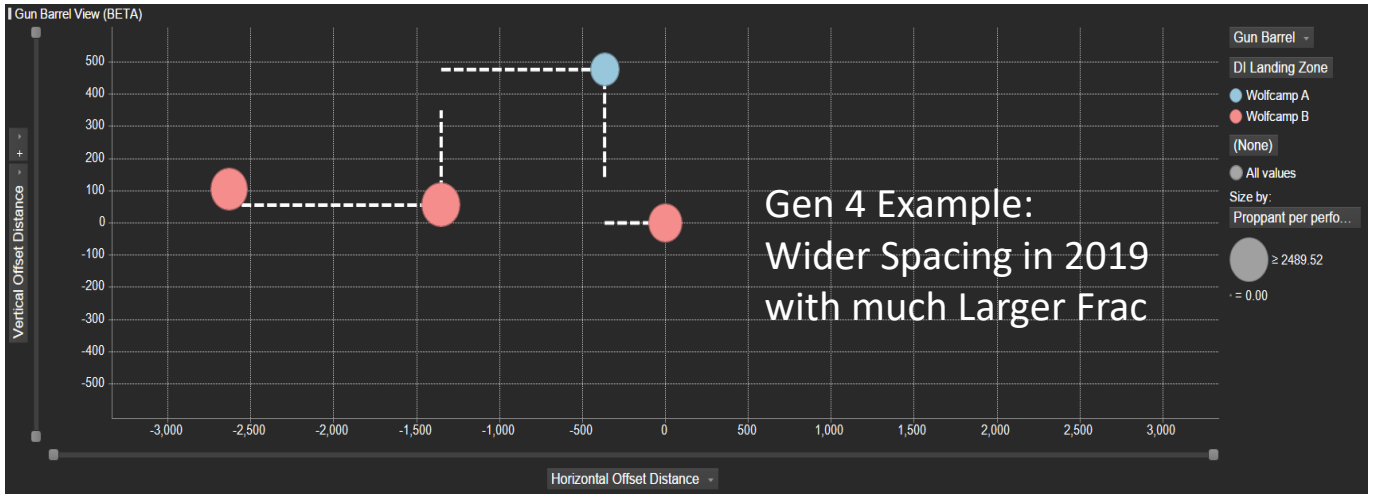


Normalized Cum Oil over Time



Parsley GBV - 2019 Pad

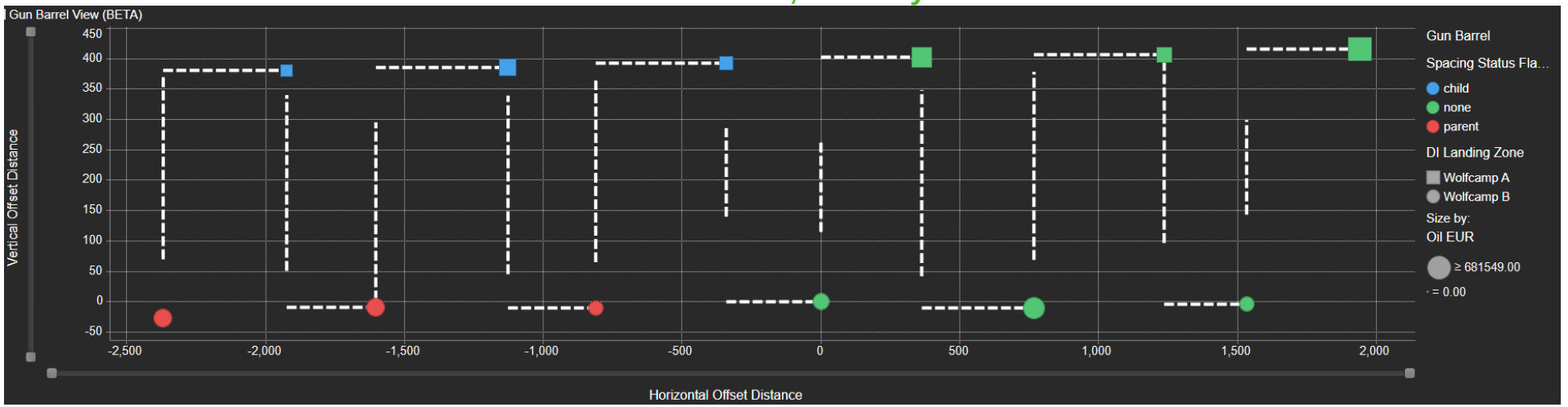
Gun-Barrel View



Proppant Intensity vs Time, Sized by Spacing

Pioneer GBV – 2016 Pad

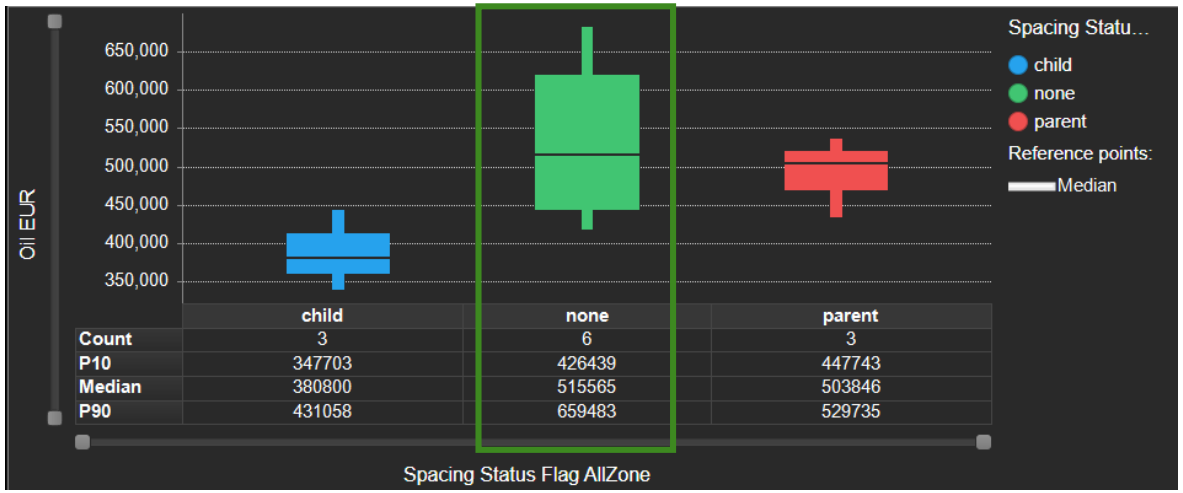
Gun-Barrel View, Sized by Oil EUR



Staggered, Full Bound Laterals indicate limited interference

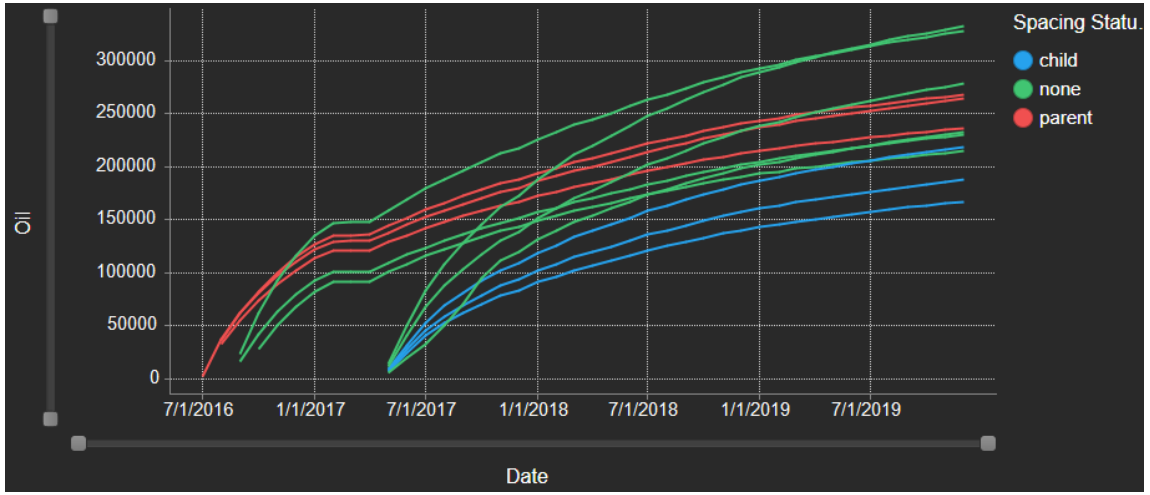
880’ Per Bench
440’ Staggered between A and B

EUR by Spacing Status



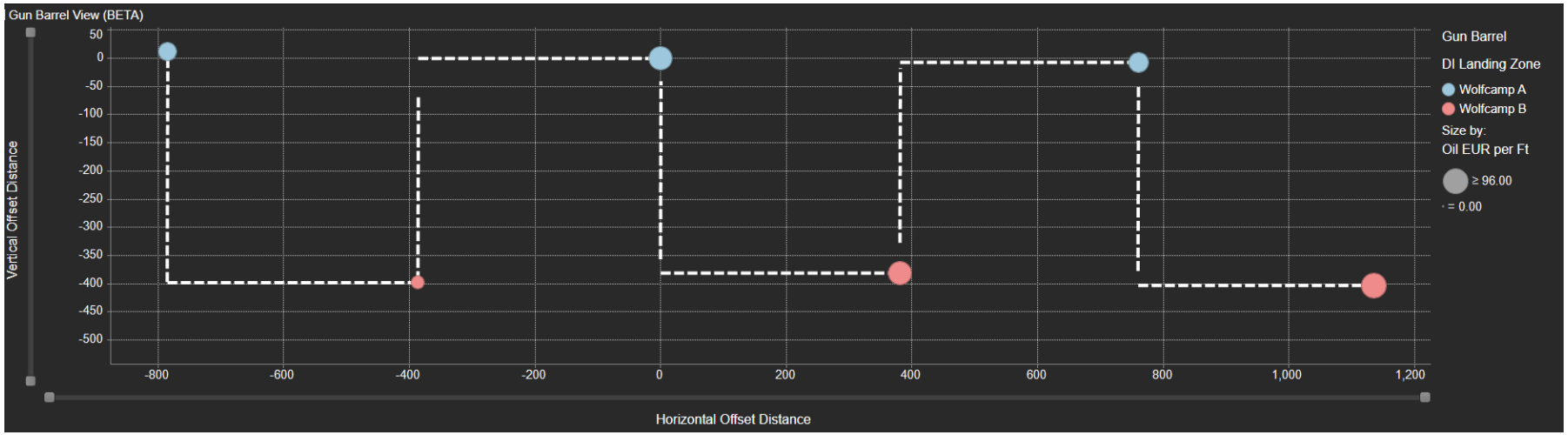
	child	none	parent
Count	3	6	3
P10	347703	426439	447743
Median	380800	515565	503846
P90	431058	659483	529735

Cumulative Oil over Time

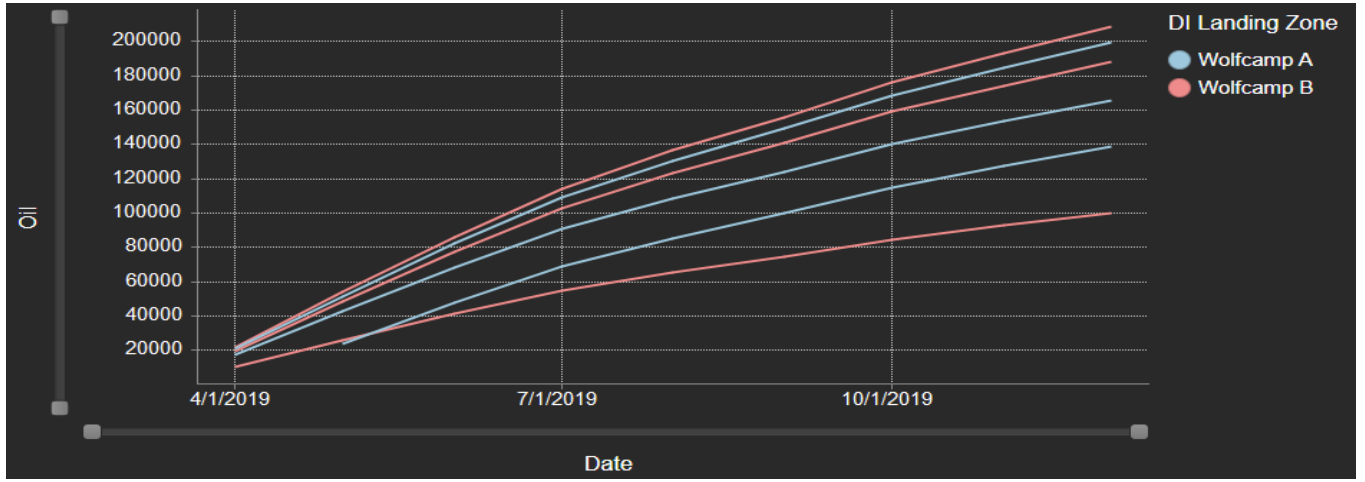


Pioneer GBV – 2019 Pad

Gun-Barrel View, Sized by Oil EUR/ft



Cum Oil over Time



Another PXD staggered full-bound example 6 wells on half section

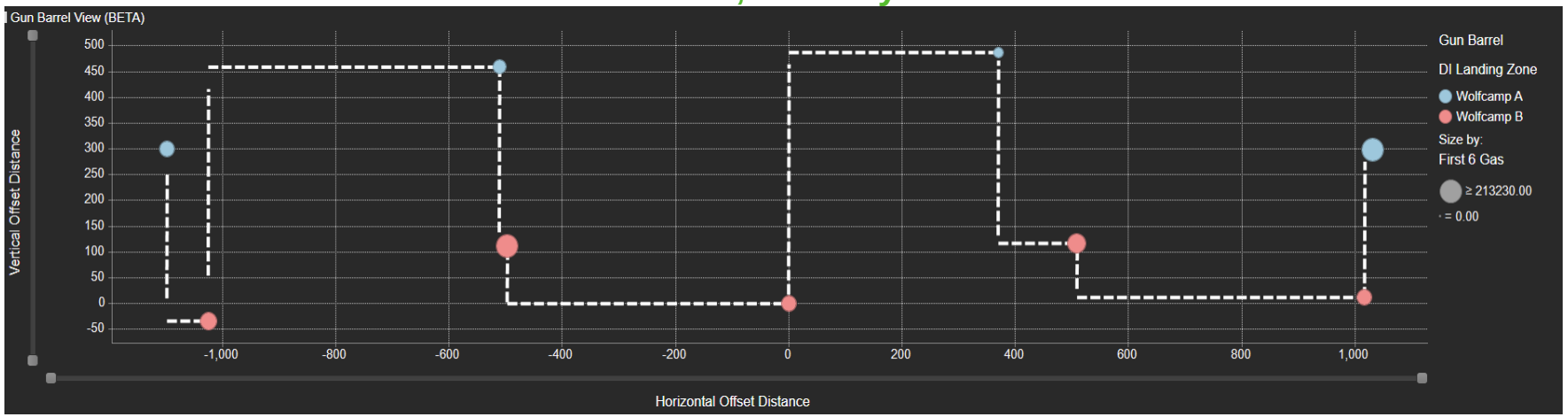
All co-completed in 2019

+700 lb/ft frac &
+25% First 6 Month Oil vs 2016

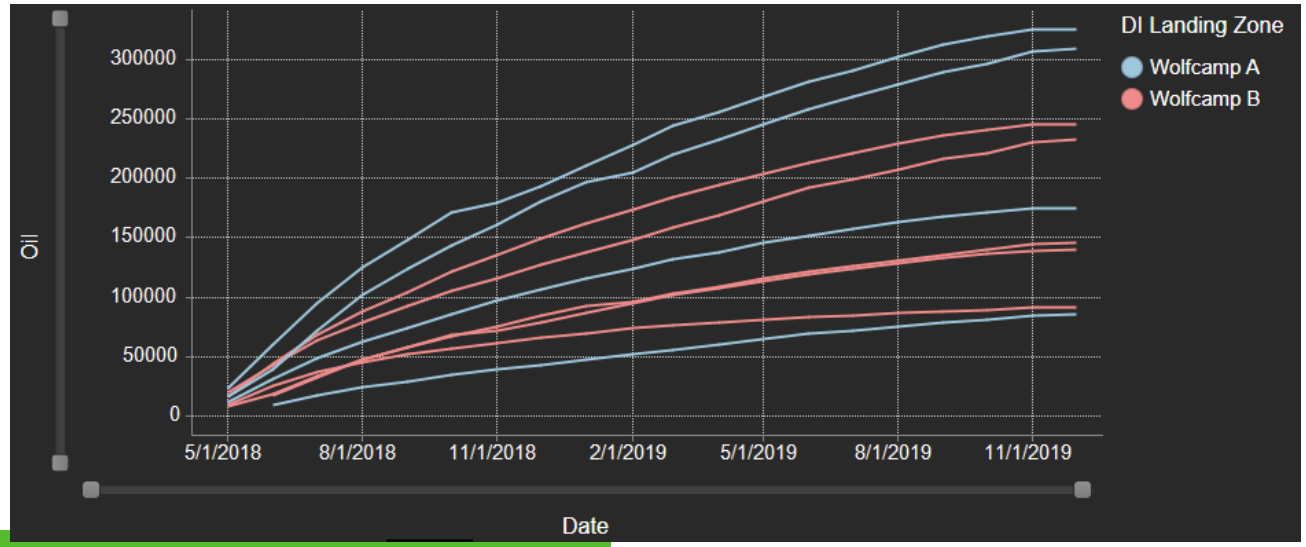
Limited interference when co-completed

Exxon GBV – 2017 Pad

Gun-Barrel View, Sized by First 6 Oil/ft



Cum Oil by Un-normalized Time



9 Wells on Half a Section

Mixed results on inference

4 “sub-bench” development helped mitigate risk

Relative small frac jobs at 1250-1500 lb/ft

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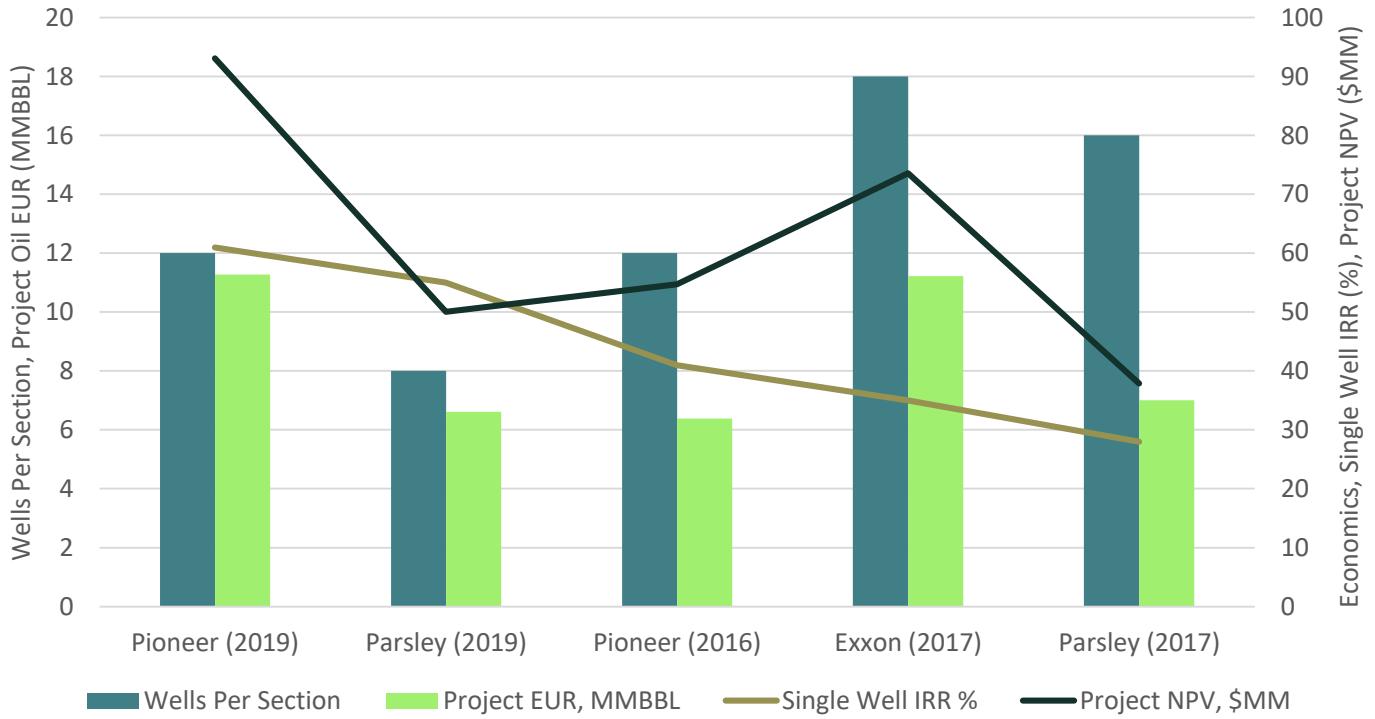
Project Economics Results

Development	Wells Per Section	Avg Proppant Lb/ft	Single Well IRR	Single Well Oil Breakeven $/bbl	Project NPV $MM	Project EUR MMBBL Oil
Pioneer (2019)	12	2200	61%	$24	$93.09	11.28
Parsley (2019)	8	2250	55%	$27	$50.03	6.61
Pioneer (2016)	12	1500	41%	$27	$54.74	6.38
Exxon (2017)	18	1400	35%	$31	$73.58	11.22
Parsley (2017)	16	1700	28%	$34	$37.89	7.01



Price Assumptions:

$45/bbl & $2/mcf net back. $7 LOE/boe,

Type Curve Normalized to 10,000 LL,

D&C varied on proppant intensity

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Conclusions

Gun-Barrel Views and Dynamic Spacing Calculations Assist in Rigorous Benchmarking for Custom Analysis

- Development orientations are an important engineering consideration
  - “Stacked laterals” show potential for degradation
- Parsley’s transition from stacked lateral development to one with wide spacing and large fracs doubled IRR’s
- Pioneer has been extremely consistent with staggered development and steadily increased EUR/section and single well IRR
  - Co-Completions allowed for increasing frac size, mitigating child well risk
- Exxon has some of the most complex developments
  - Targeting multiple sub-benches within the WC A and B can mitigate risk

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Contact us

If you’re interested in a custom well spacing demo to understand various well spacing strategies and it’s impact on productivity:

businessdevelopment@enverus.com
(512) 519-3711

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