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# Halftime in the Permian

An IHS Energy discussion

JUNE 2017

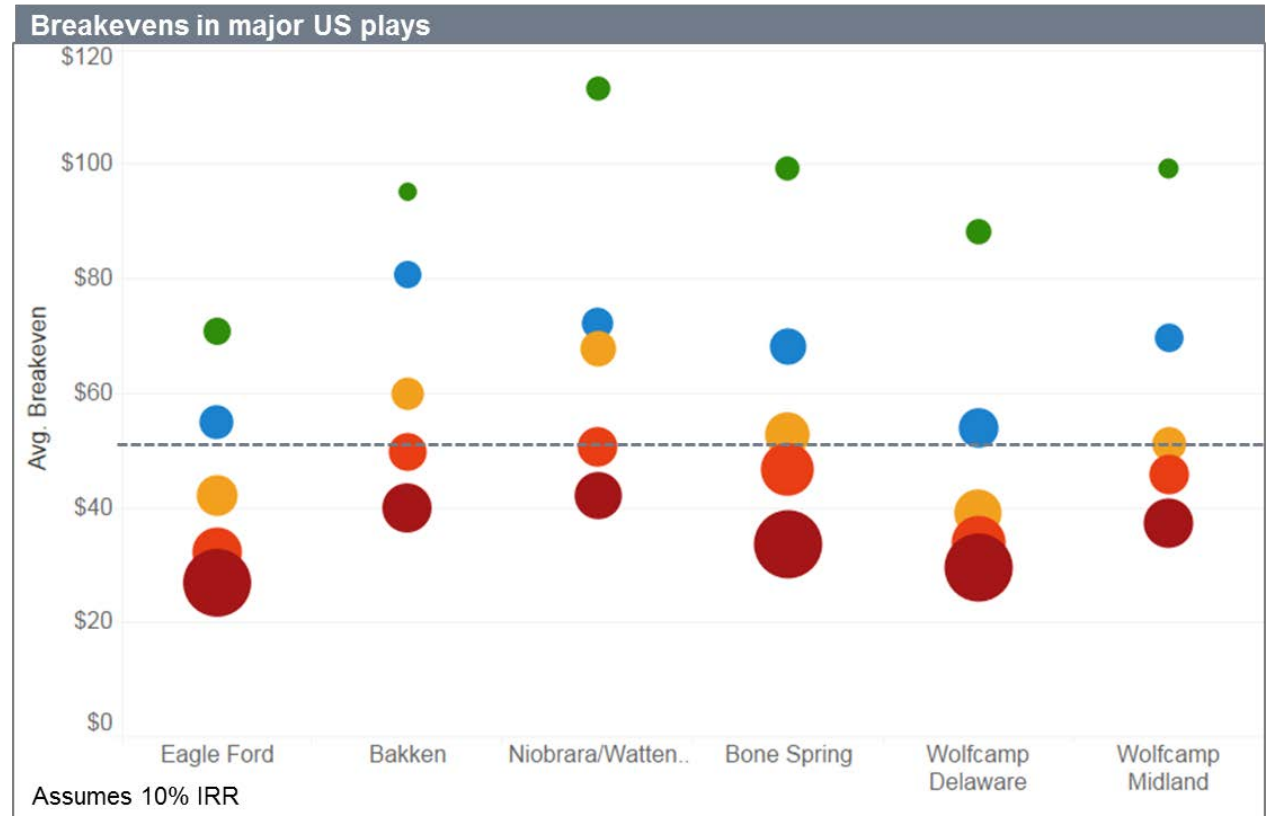
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# Permian break-evens support continued investment

Best wells in major plays are economic even at current prices, but majority of “best” wells are located in the Permian Basin.

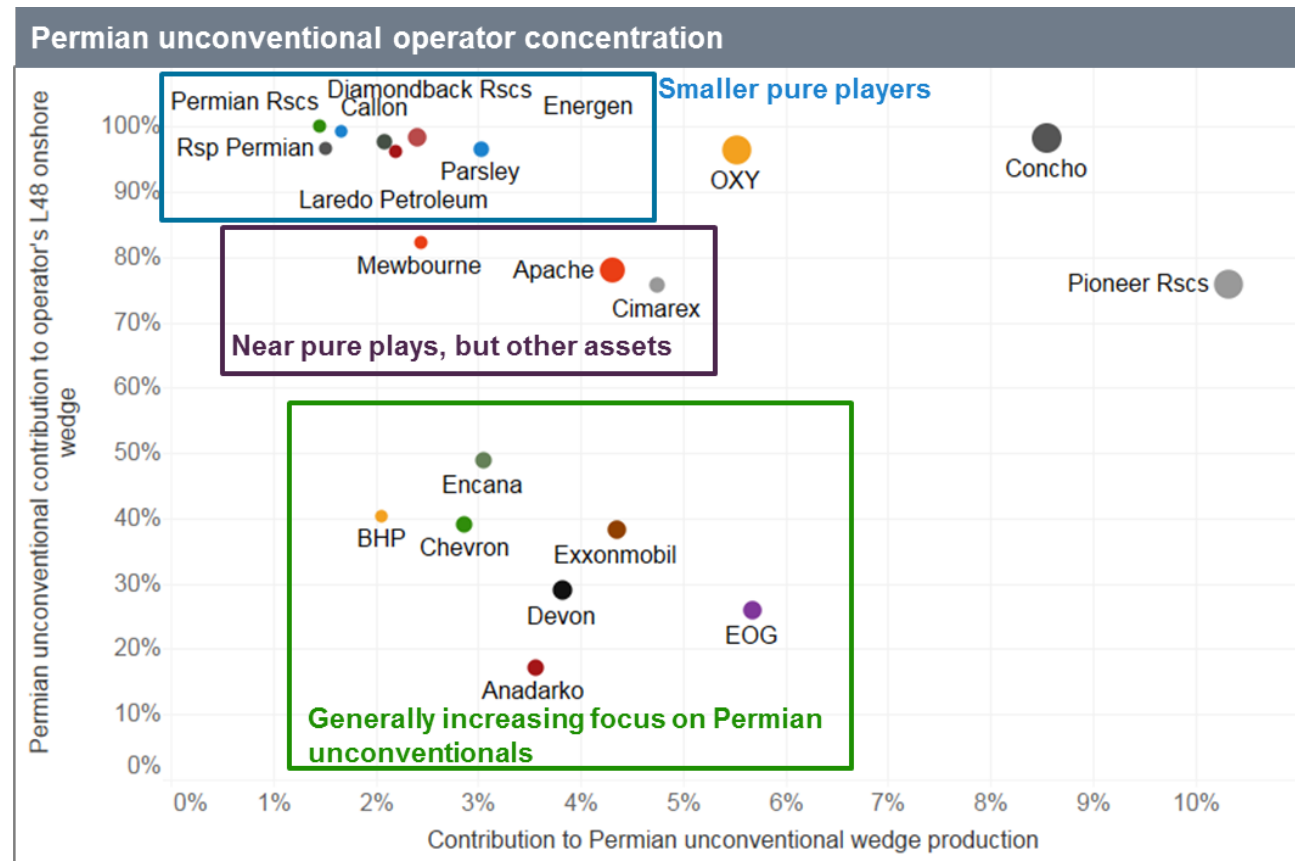
In more mature plays, the issue remains of inventory and improvement; the Permian continues to improve in productivity while more mature plays have reached a plateau, with economics primarily altered by costs.



# Permian unconventional operators fall in distinct categories

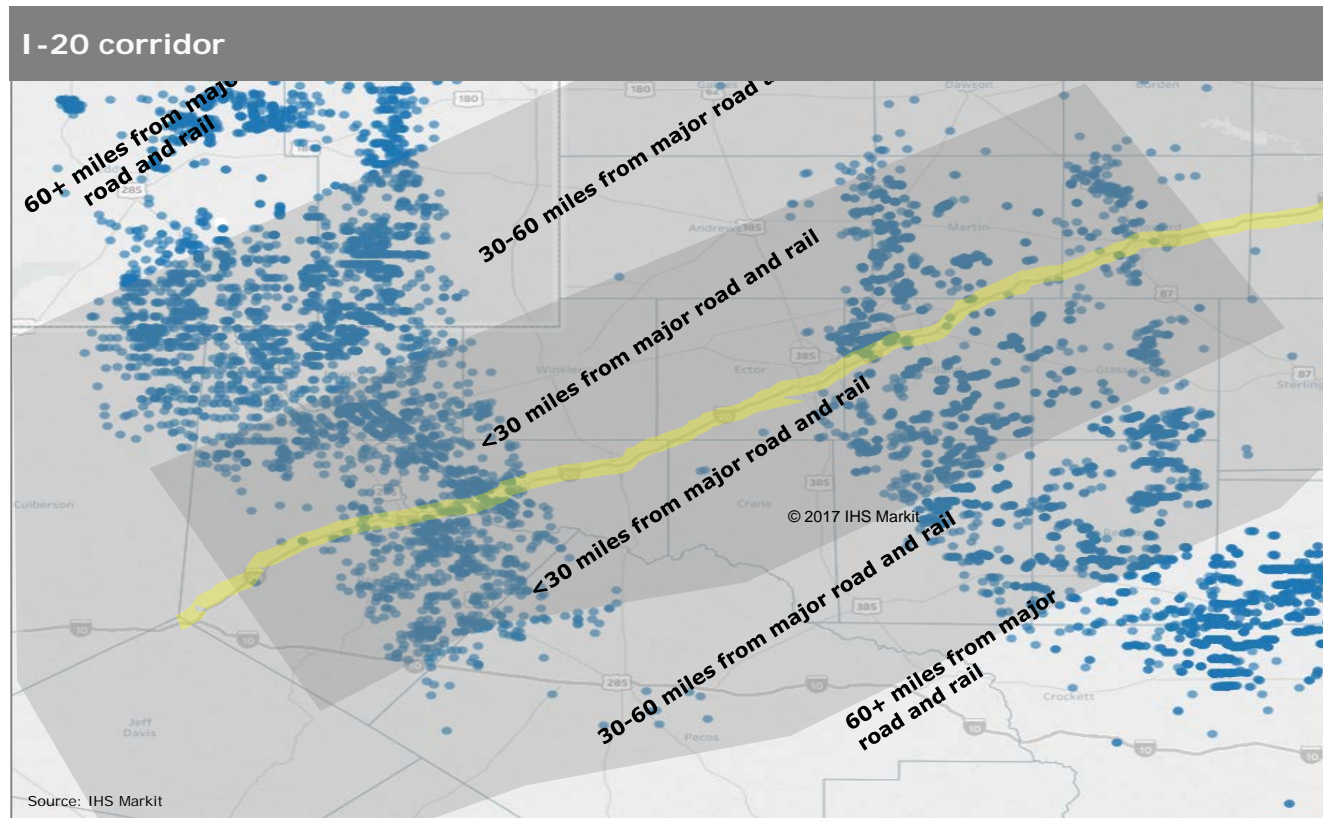
Permian wedge production volumes are less concentrated than in mature plays, though Pioneer and Concho are clearly more material and committed to the basin than most other operators.

10 operators contributed 50% of the wedge, with over 100 total unconventional operators in the play.



# No one lives there: Remoteness will force trade-off between cost and execution

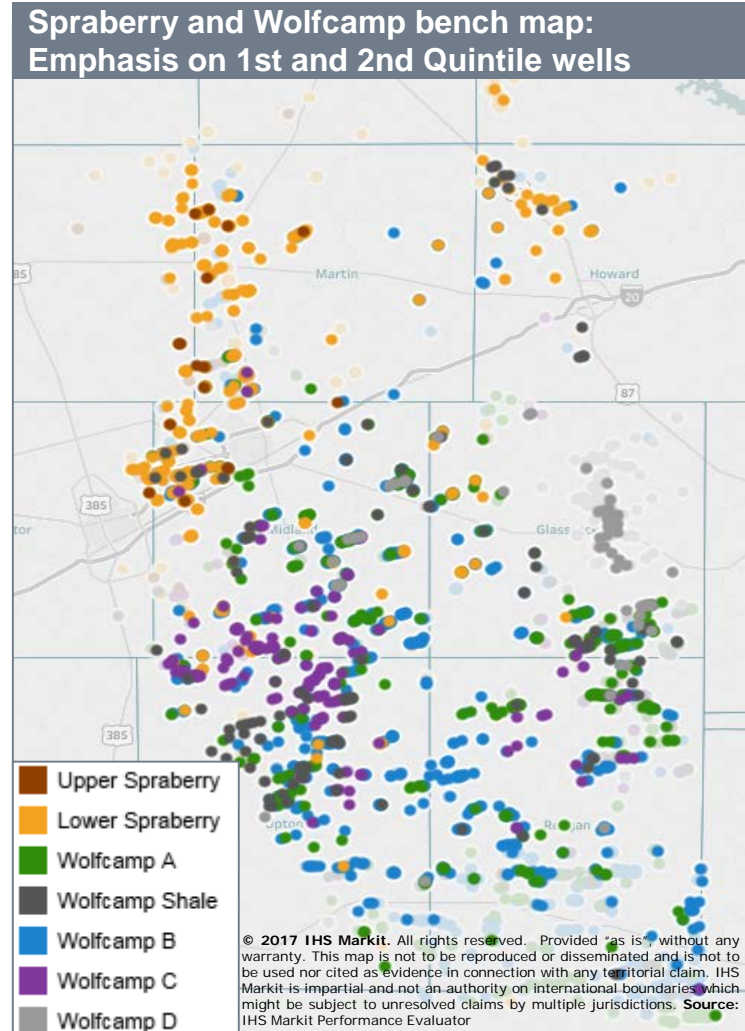
- Interstate-20 – and the parallel rail lines – form the only corridor with good access to the various Permian subplays. Last mile costs / challenges increase materially as distance to supply artery rises.
- Operations farther from this northwest-to-southeast axis should have higher costs and lower access to services, especially in near and medium term, when infrastructure is tight.
- On the manpower front, population sparsity is a more important driver of labor inflation than wages, as virtually all employees will commute to the Permian:



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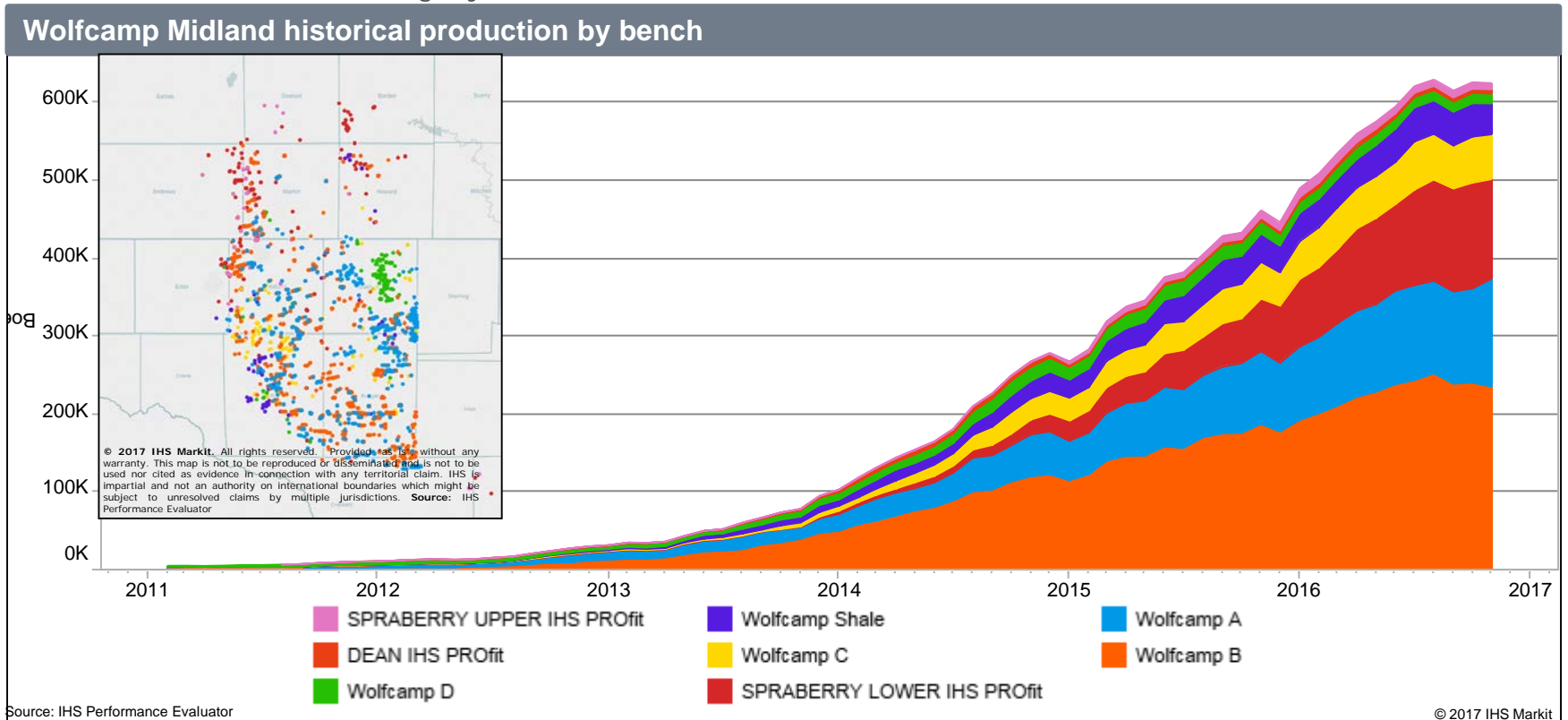
# Wolfcamp benches are widespread throughout the play, while Spraberry is limited to northern area

- Spraberry
  - > Majority of production occurs in western Martin and Midland counties.
  - > The Lower Spraberry member is the main target, with over 470 wells. Only ~60 wells are currently producing from the upper member, therefore it is not considered a “major bench” in the Wolfcamp Midland play.
- Wolfcamp
  - > Wolfcamp A and B benches produce from the greatest geographic extents, with the highest concentrations of 1st and 2nd Quintile wells in Upton, southern Glasscock, and Reagan counties. Nearly 2,000 wells target the Wolfcamp A and B, making these the two most targeted benches in the play.
  - > Wolfcamp Shale interval is most productive in Upton and southern Glasscock counties.
  - > Wolfcamp C bench is spatially confined mostly to the western side of the play, while D (Cline Shale) production is centered in Glasscock County.

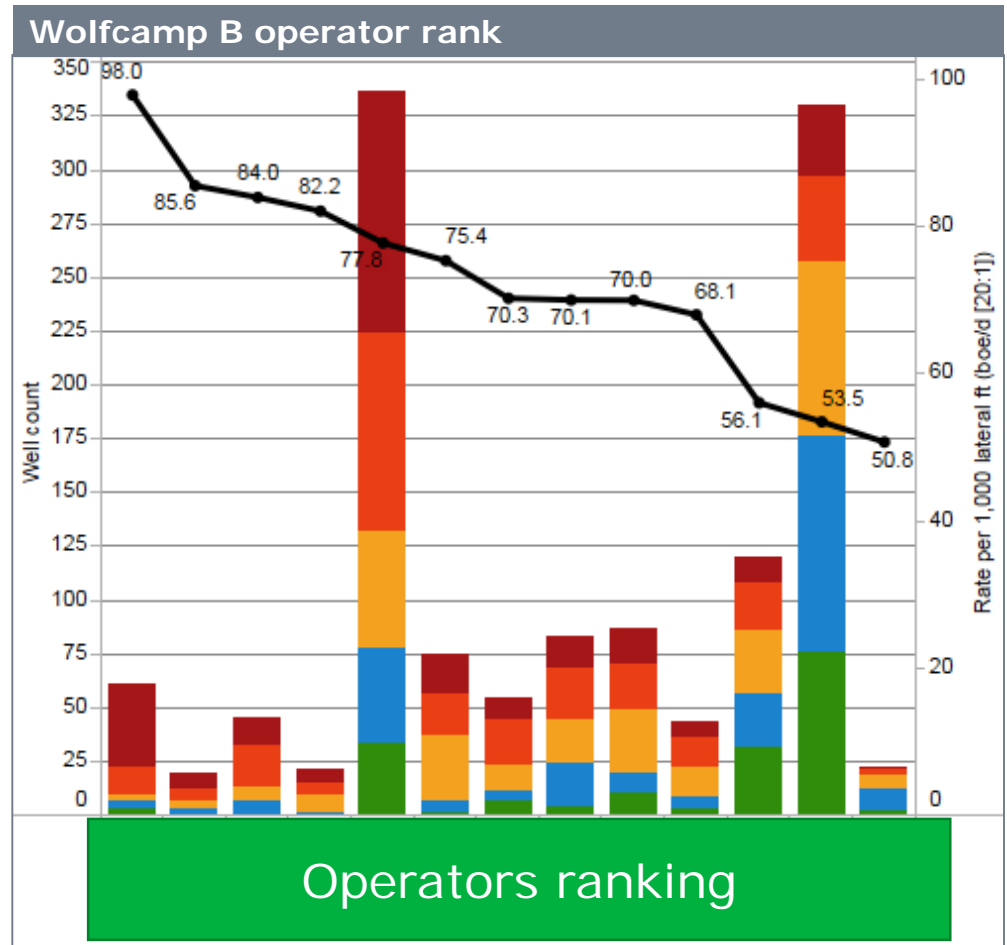
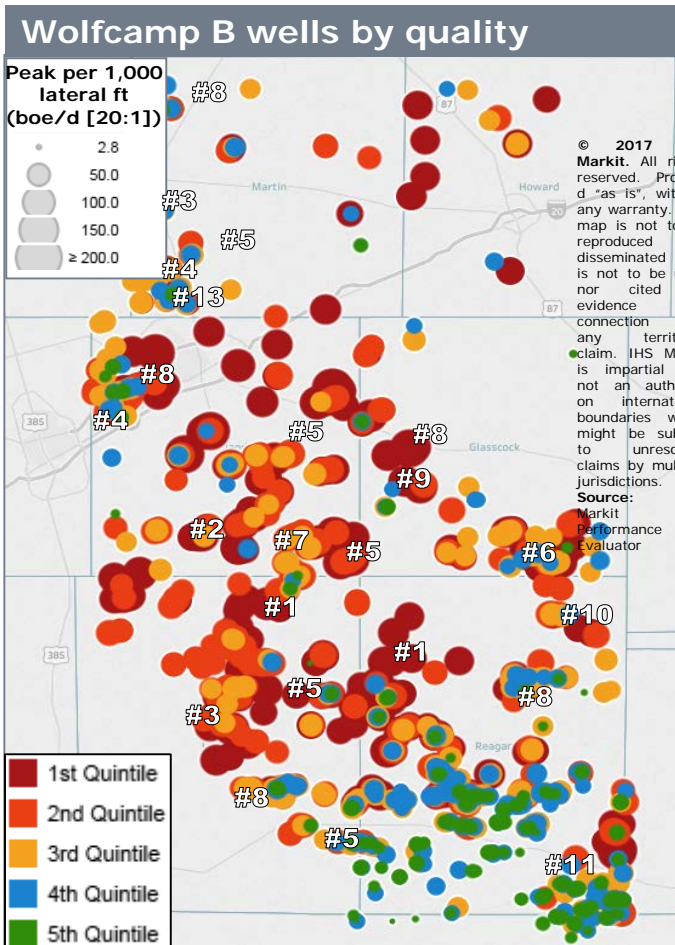


# Operators favor Wolfcamp B despite lowest productivity

- Of all the Wolfcamp Midland benches, the WFMP B is the most targeted, with nearly 950 horizontal wells. It is the most widespread producing bench, generating economic volumes throughout the core of the Wolfcamp Midland play. Operators targeting the WFMP B also tend to drill the WFMP A, and as a result, well counts targeting these two benches are about the same, while productivity from the WFMP A is overall slightly better.
- The WFMP D, or Cline Shale, is productive predominantly along the eastern portion of the play; therefore, operators holding acreage in this area, are better able to exploit it.



# Wolfcamp B: the bench that keeps on giving



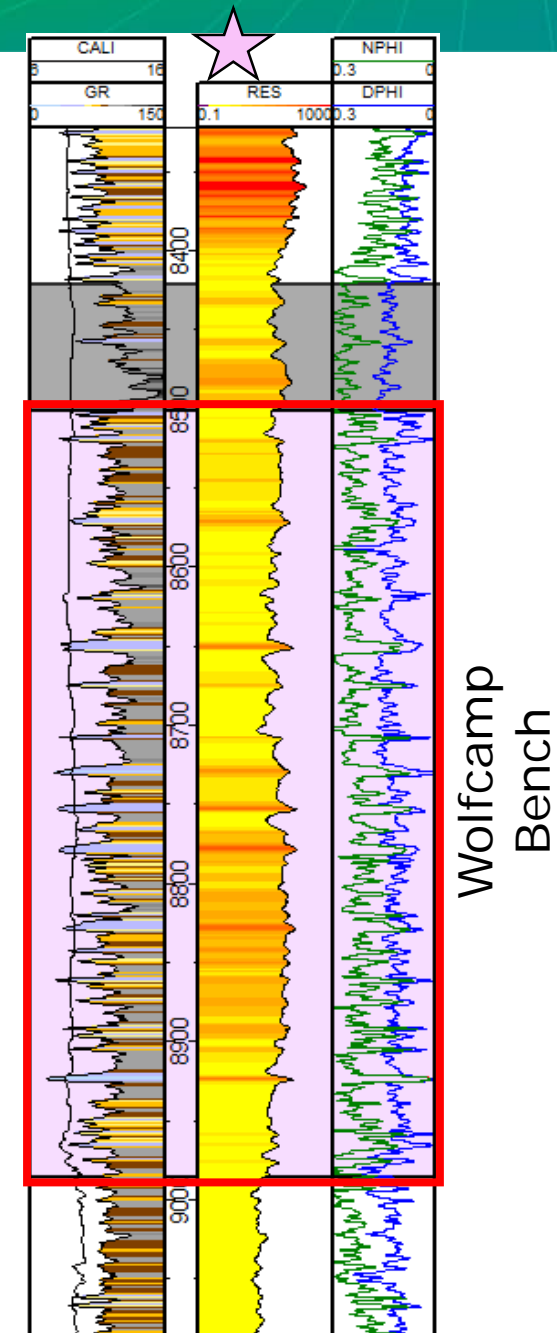
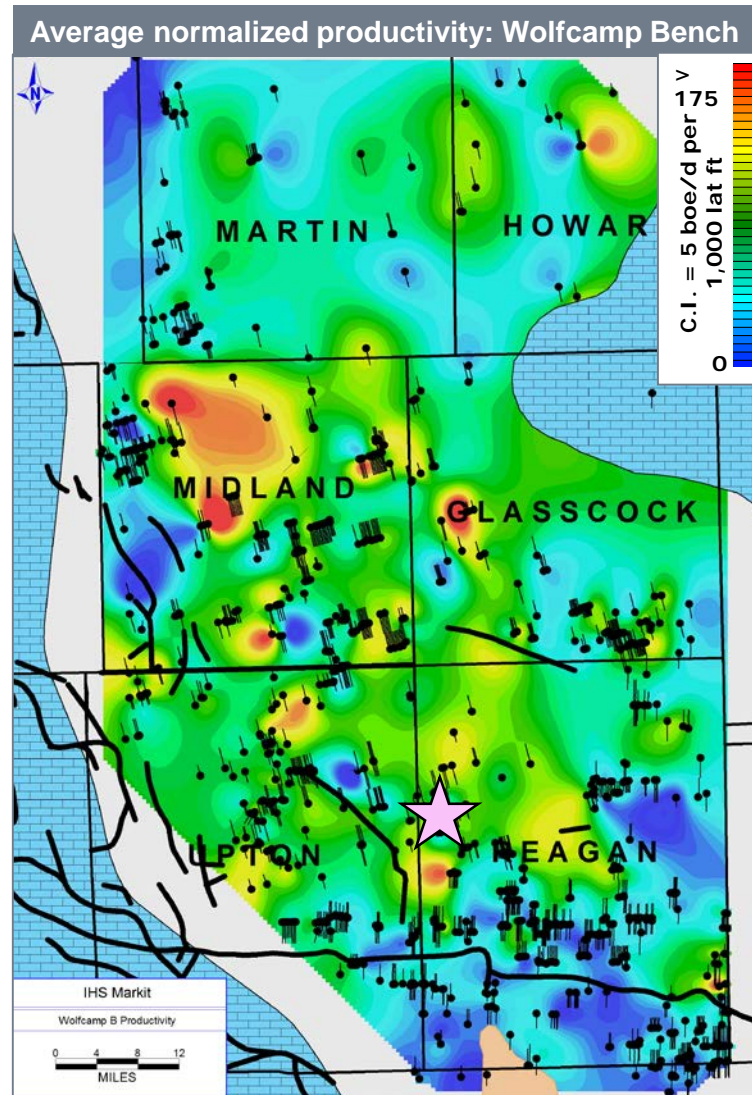
Source: IHS Markit Performance Evaluator

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- Despite having slightly more favorable results in the Wolfcamp A, the top operator has favored drilling in the Wolfcamp B, with over 60 wells targeting the bench. Despite having overall lower productivity than the Wolfcamp A, it is worth noting that few Wolfcamp B wells produce under 70 boe'd per 1,000 lateral feet (20:1).
- The leading operator in terms of quantity of Wolfcamp B wells (~170) has significantly improved its well performance, increasing productivity from an average of 64 boe/d per 1,000 lateral feet in 2014 to 105 in 2016.

## Wolfcamp Bench *example* productivity and type log

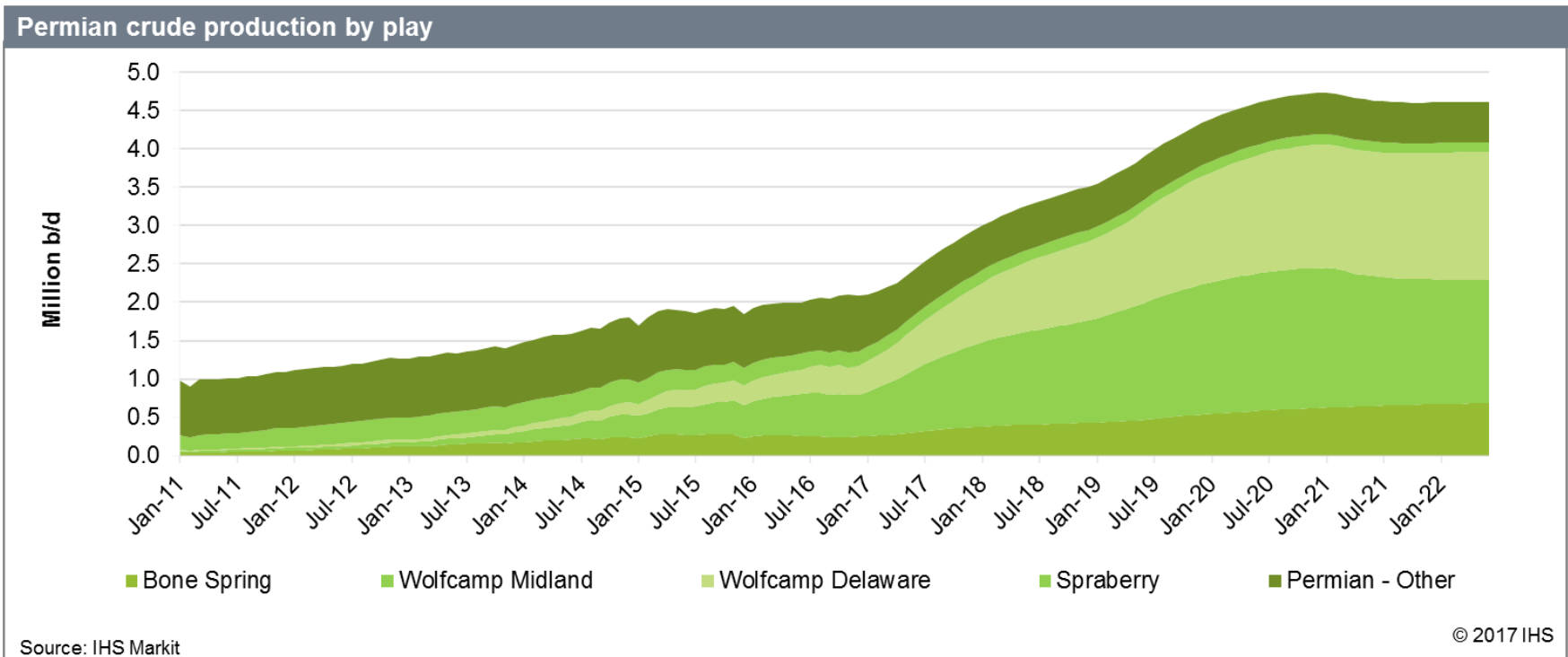
- Currently there are nearly 1,300 wells producing from the Wolfcamp Bench in the Wolfcamp Midland core area.
- While the Bench is productive throughout the Wolfcamp Midland core, the highest concentration of wells occurs in southern Reagan County.
- The Wolfcamp Bench significantly thickens in Reagan County, with increasing carbonate debrite and turbidite intervals shed from the Ozona arch to the south and eastern shelf to the east, sandwiched between organic-rich shales, providing thin reservoir, or storage, intervals.
- Shales throughout the Wolfcamp Bench appear to be brittle based on caliper logs; therefore, they may produce from more interconnected fractures during well completion.





# Permian to grow to 4 MMbbl/d by 2019

- Permian spending is set to increase from \$8bn in 2016 to over \$40bn in 2021, a 35% CAGR; the total L48 onshore will grow at a 27% CAGR. Total Permian capex will represent nearly one-third of all L48 onshore spending through 2021.
- Growth combined with positive cash flow results in rapid production growth in the Permian.
- Wolfcamp plays will increase ~1mmbbl/d each, with the remaining volumes coming from the significantly smaller Bone Spring.



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