

“Haynesville Play Next Steps- One Operator’s Perspective”

Richard Newhart | Team Lead

Shales Moving Forward..... Conference

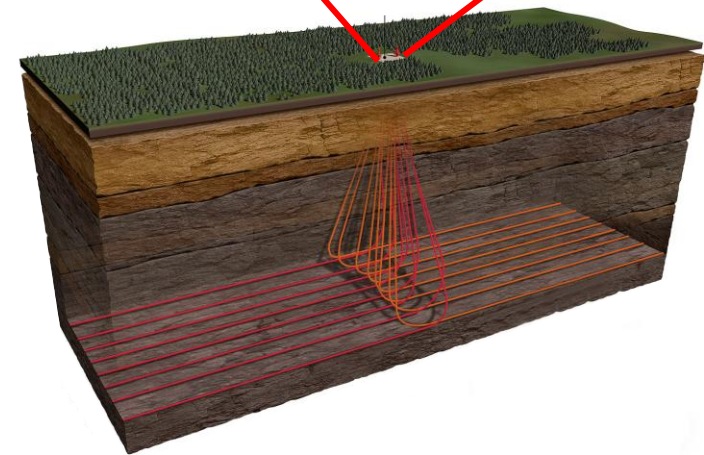
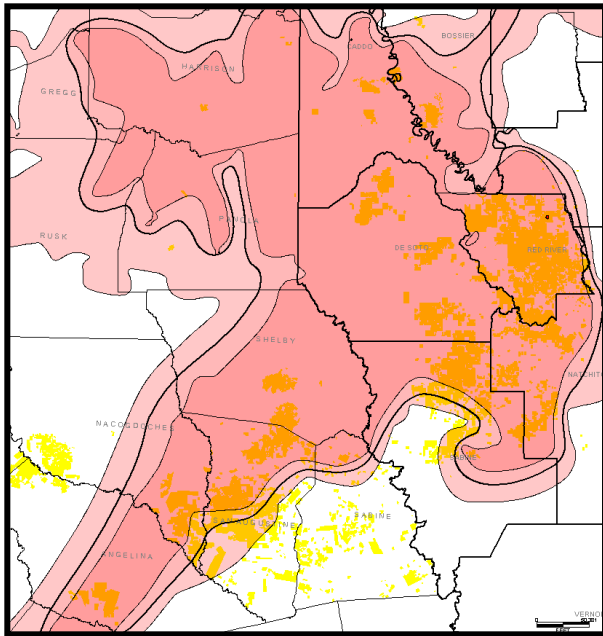
Norman, Oklahoma | July 21 | 2011

Remember the days when a TCF was a lot of Gas?

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So we found a few TCF of gas.

Now what do we do?

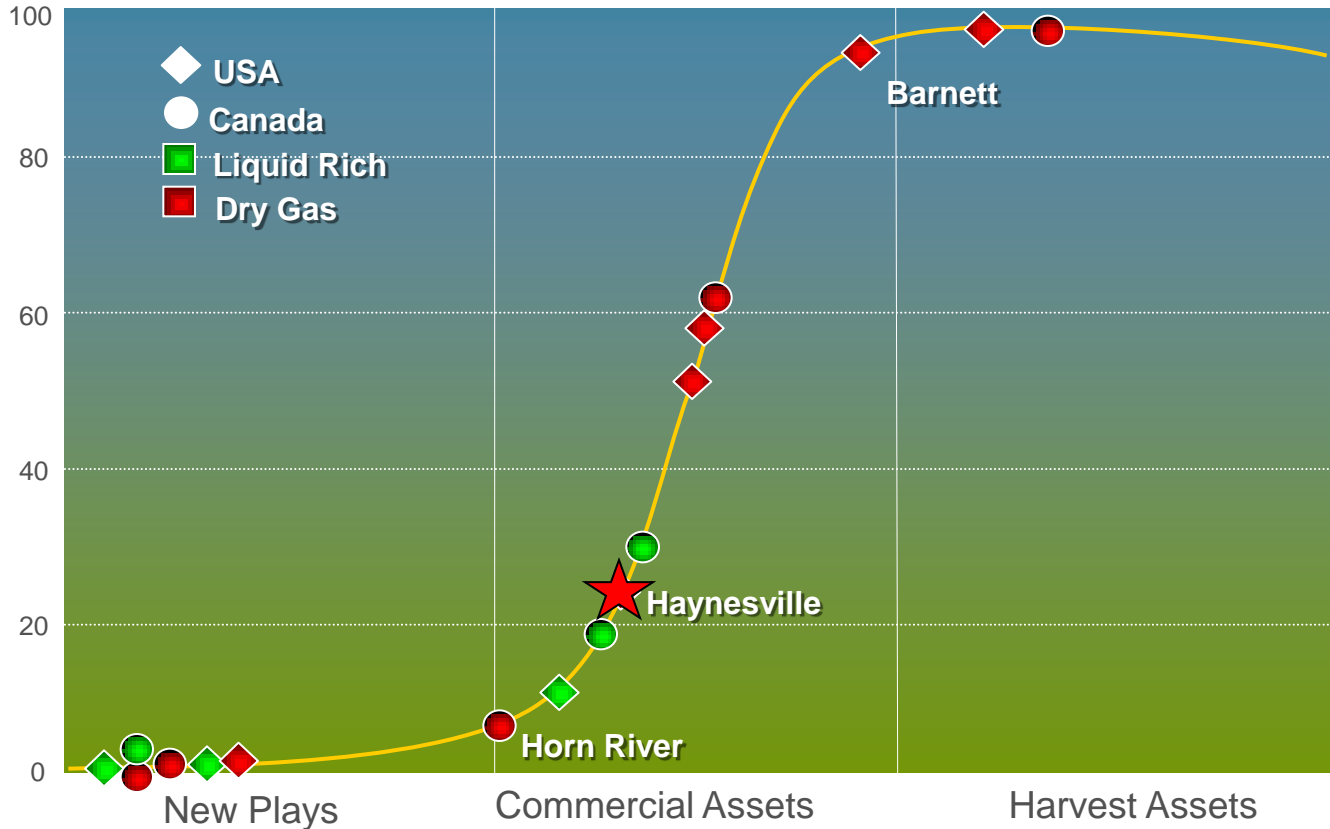


- 21 Rigs Drilling
- 3 Completion Crews
- Transition to Resource Play Hub (RPH) Development

What Inning are we in?

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Peak Rate (%)



2nd

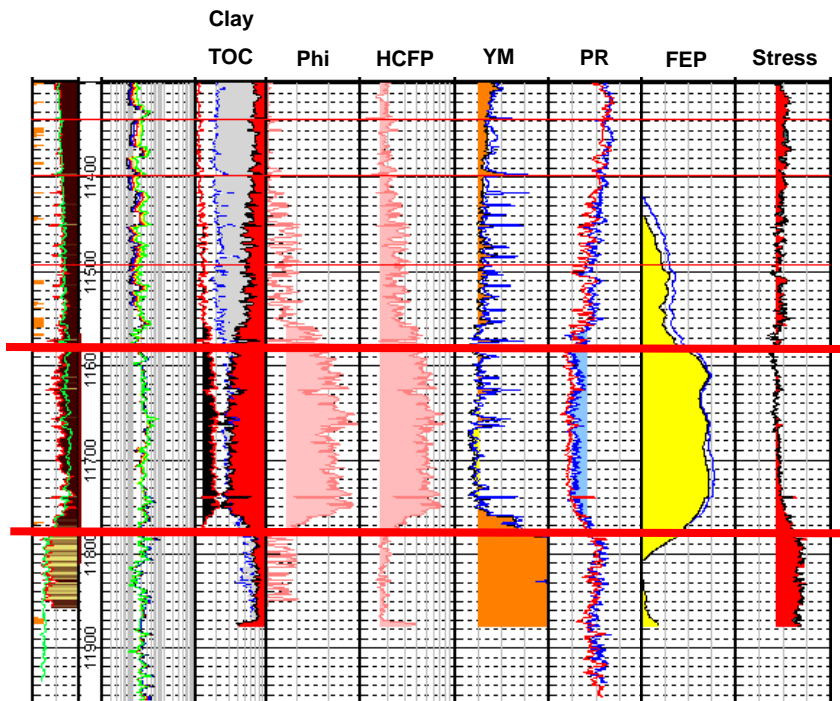
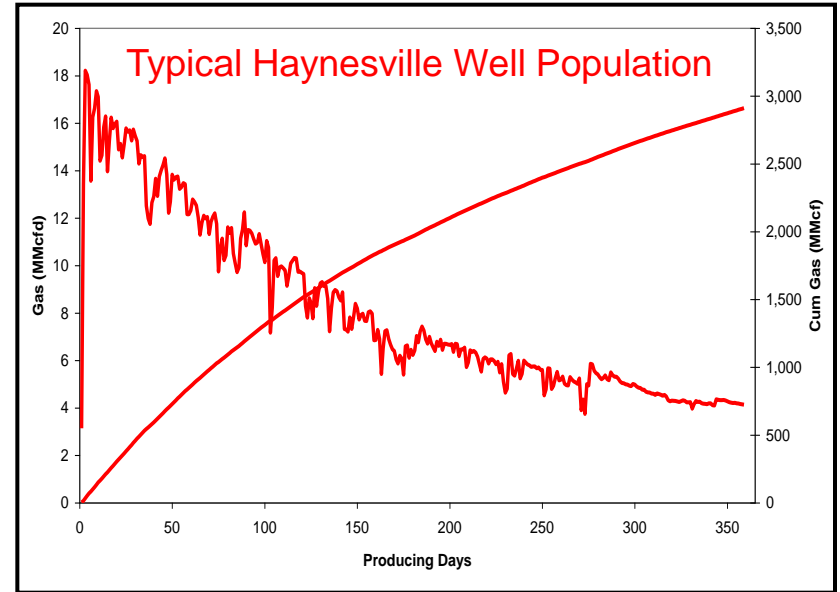
- Haynesville has grown at an alarming rate in the last 3 years
- Play has evolved quickly and progressively as new techniques and new areas of commercial development have been identified
- We are data rich!.....But, many challenges and learnings lie ahead

What We Know.....

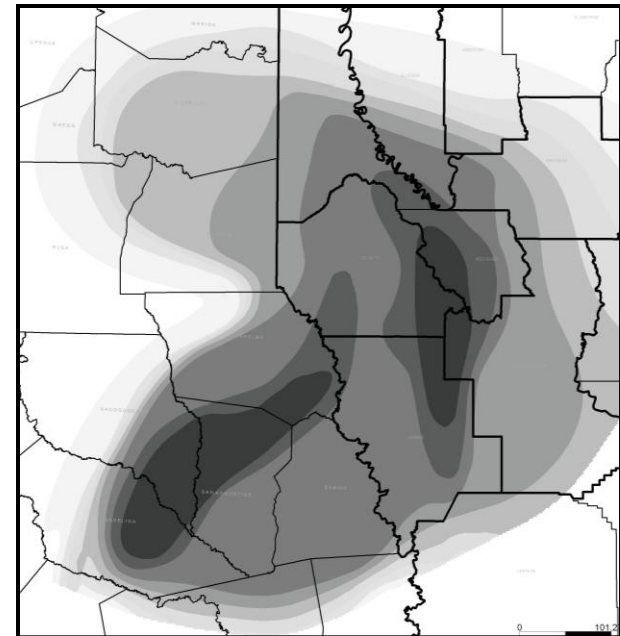
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- Pay Identification → OGIP
- TOC Distribution → Porosity
- Fracability/Containment
- Flow Potential

In Short, Basic Drivers to Well Performance



Petrophysical Workflow



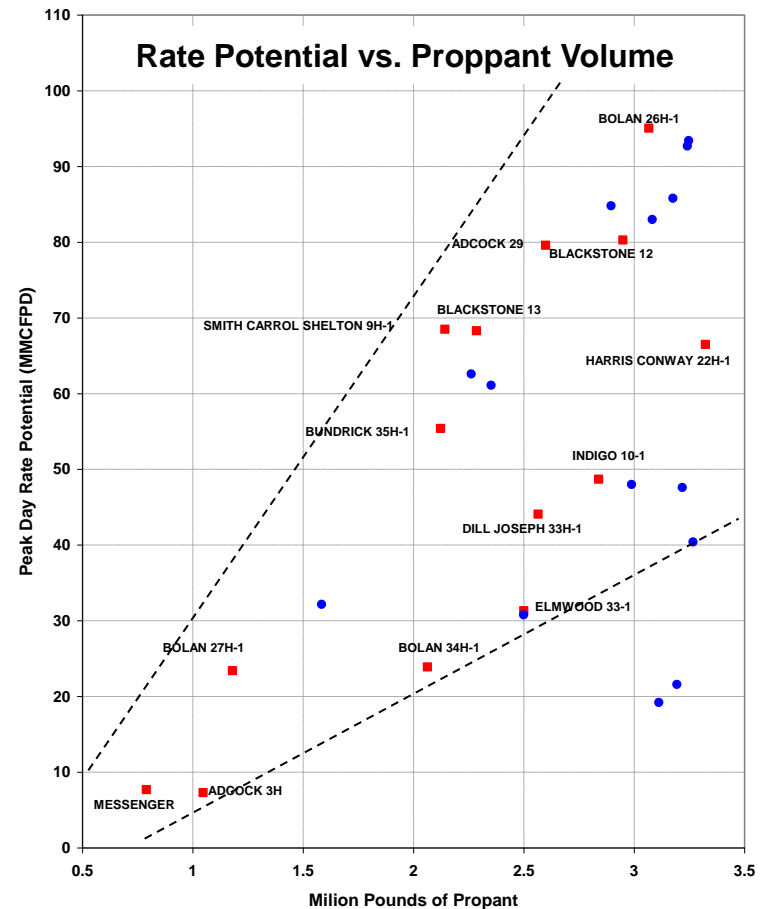
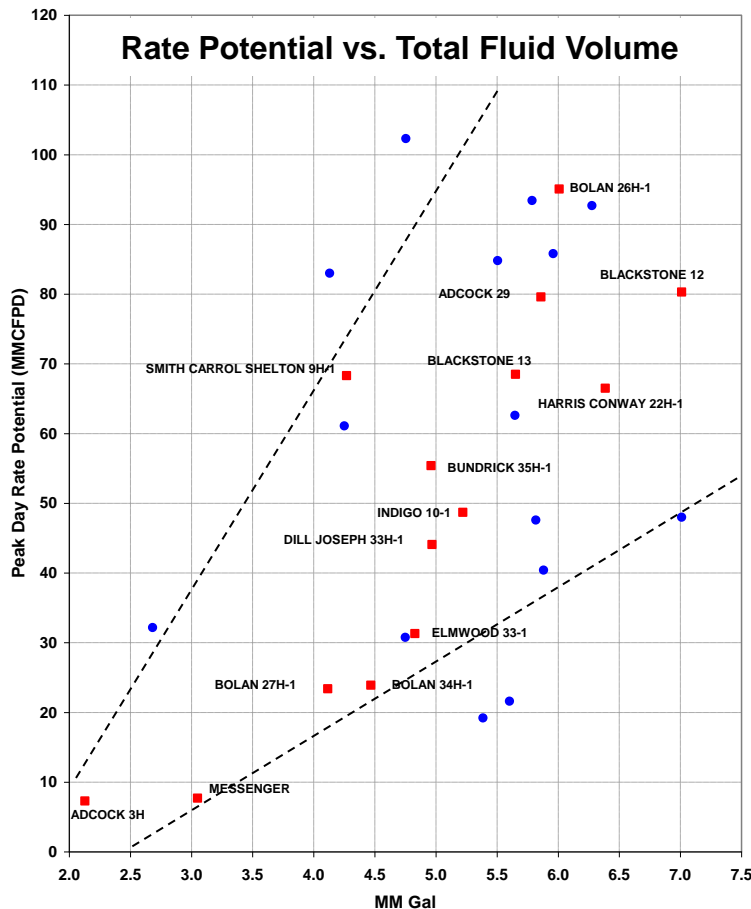
Log Derived Proxy for TOC

What Drives Haynesville Well Performance Early Knowledge

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Well Performance is driven by connecting reservoir quality rocks to fracture surface area from the stimulation.

You Get what You Frac...



What we are working on.....

BUT IS IT REALLY THAT EASY?

- How does the rock fail and what are actual fracture network geometries being created by the stimulation?
- How is the proppant transport determined and mapped?
- How is fracture conductivity distributed around the well bore and does it change with production drawdown?
- What drives fracture conductivity change? Stress...fines or both?
- What is effect of zonal targeting to well performance?
- Is well performance scalable to frac job size and lateral length?
- Does the introduced frac fluid interact with the rock matrix?
- How does the rock matrix behave with production drawdown?

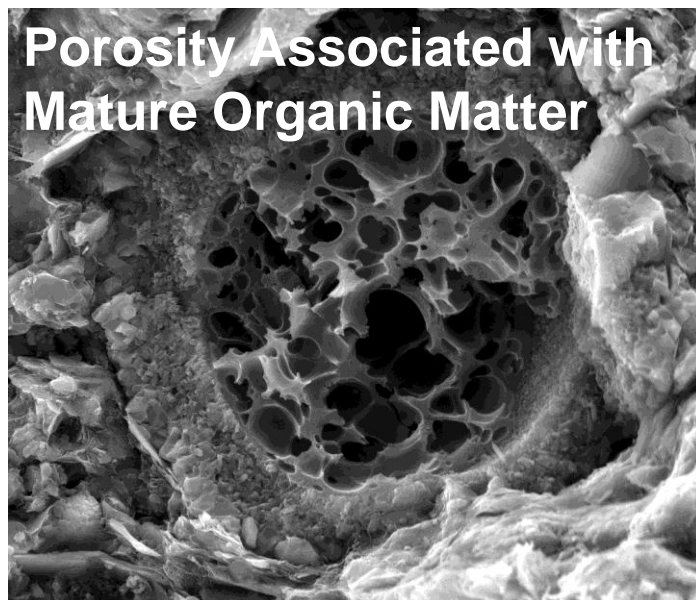
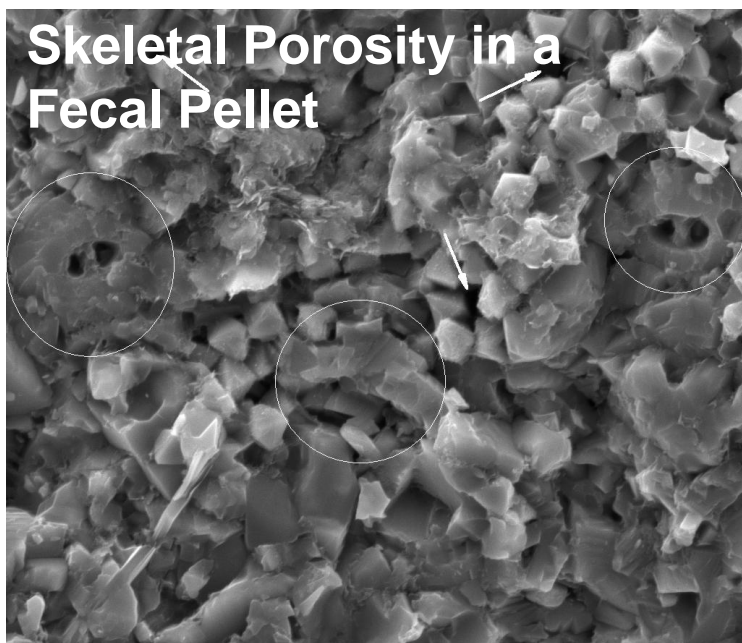
Reservoir Properties-Continue Matrix Investigations

Stress Sensitivity of Permeability Systems

Water Imbibition Propensity and its Effects

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- Multiple Porosity Systems
- Skeletal, Intergranular & TOC
- Wettability and Stress Sensitivity the same for both?
- Degree of Connection the same for both?

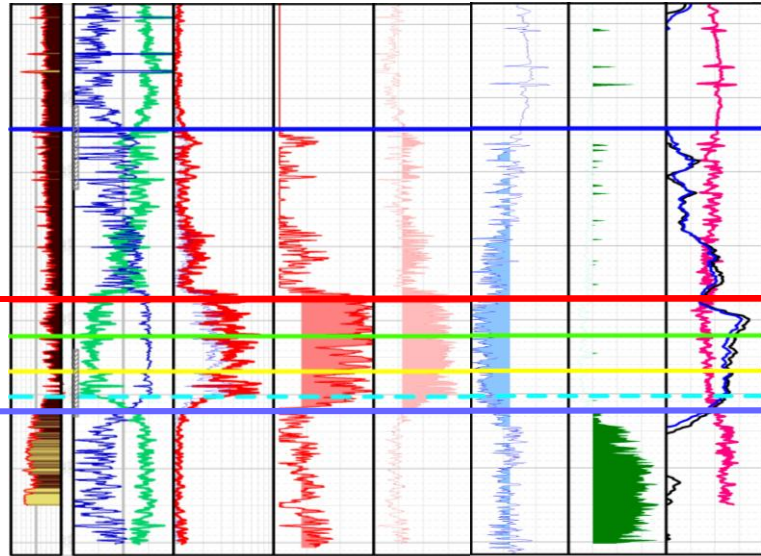


- Where does our frac water go?
- Running plug analysis to determine propensity of water to imbibe into matrix.
- Evaluating whether reservoir parameters are altered from frac fluid imbibition
- What do production trends tells us?
- Are permeability systems sensitive to pressure depletion of reservoir pressure

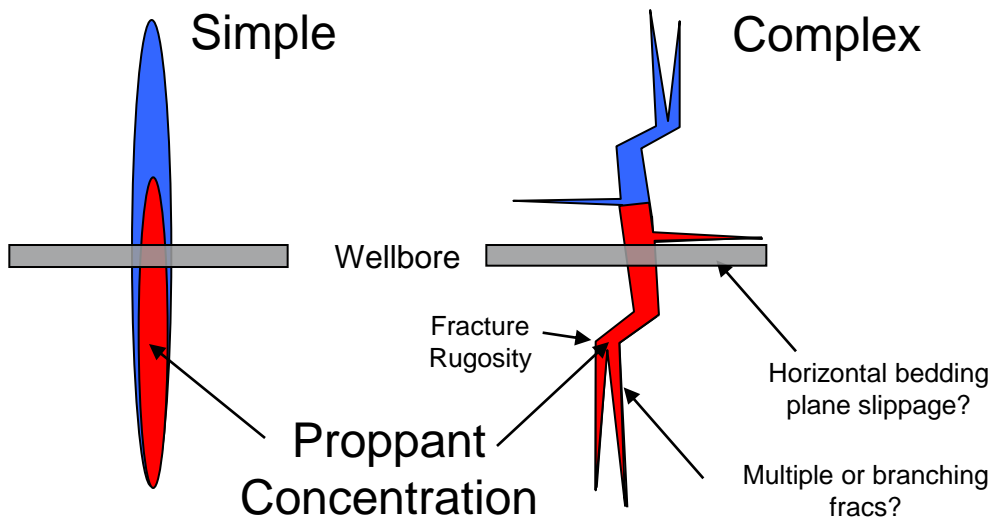
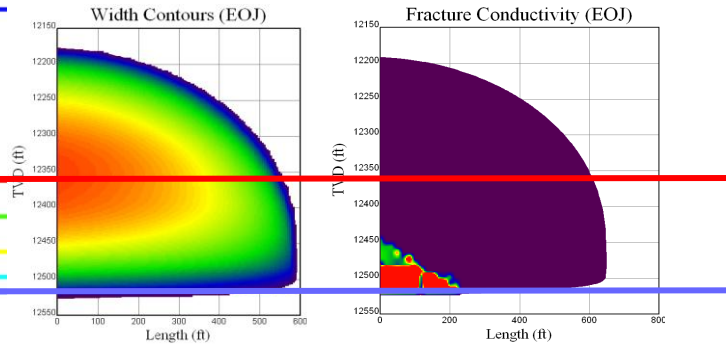
Fracture Propagation Geometry

Understanding Actual Geometry is Difficult

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Frac Height contained by Lower Bossier Shale Above and Smackover Below

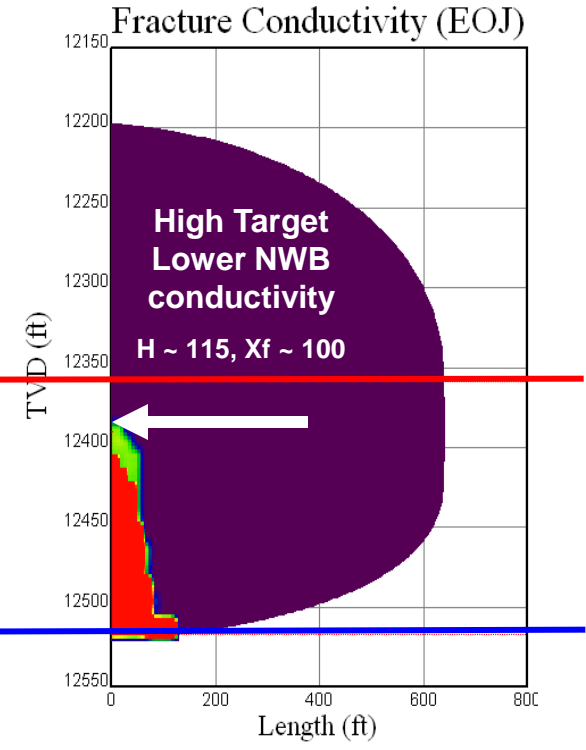
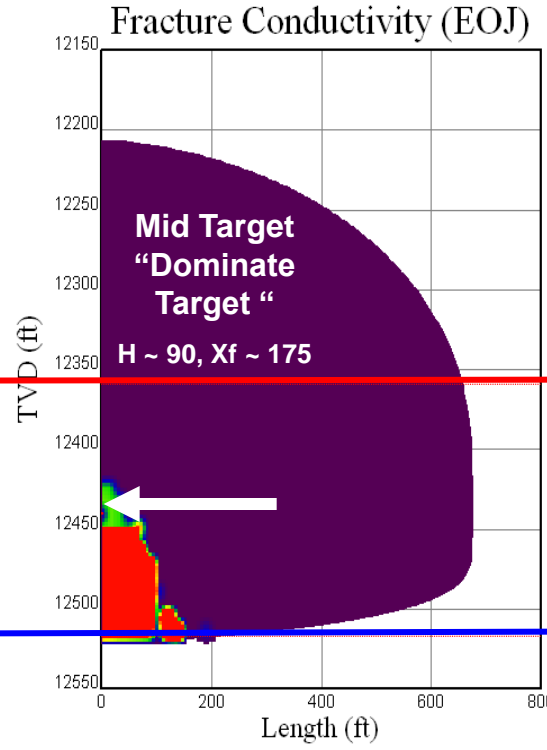
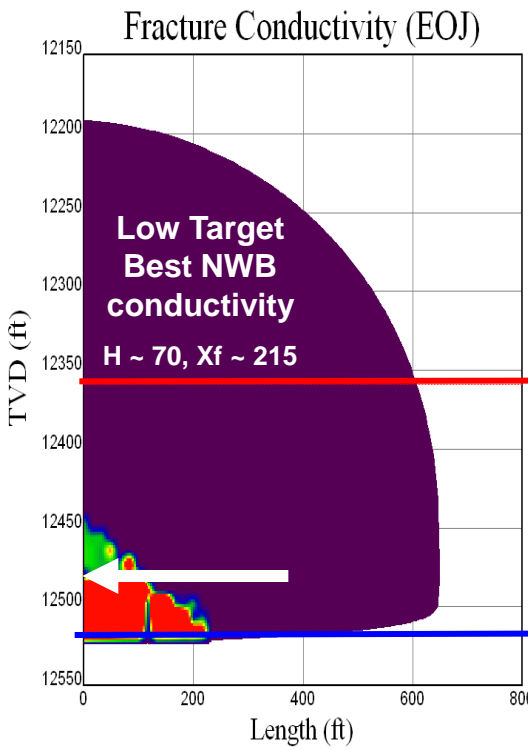
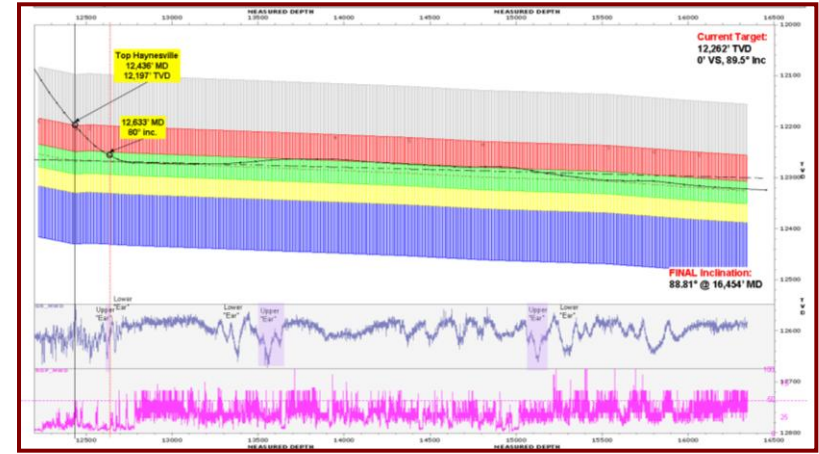
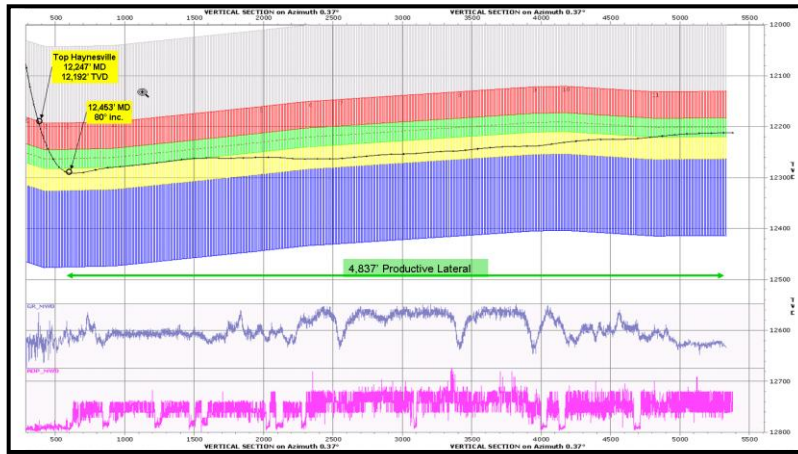


- Complexity of fracture network is difficult to predict
- Degree of complexity will have some effect on proppant settling
- Transport models suggest proppant bottom-loading in Slickwater fluids
- Fracture Conductivity is directly linked proppant loading
- Un-propped fractures likely close and maintain little conductivity

Zonal Targeting Yields Differing Proppant Distribution

Lower Target provides better contact to proppant pack
Higher targeting covers more vertical pay

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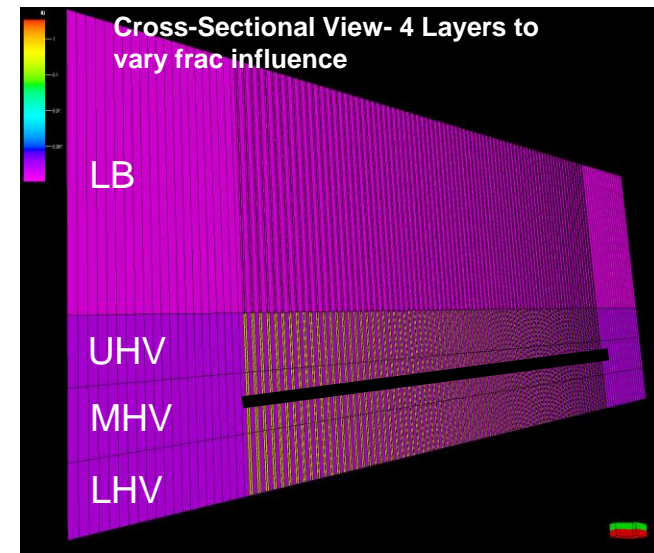
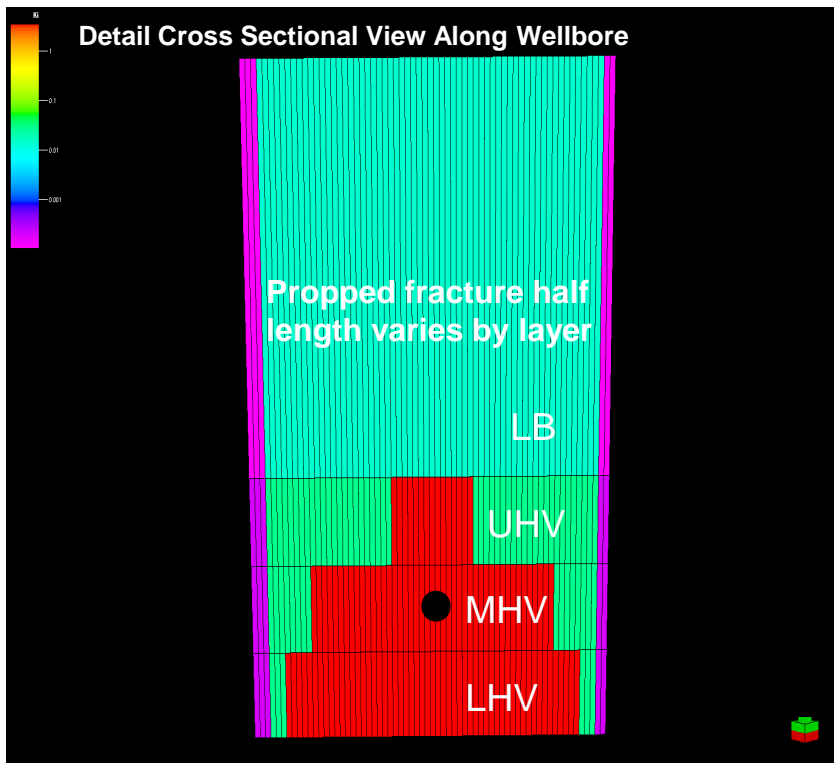
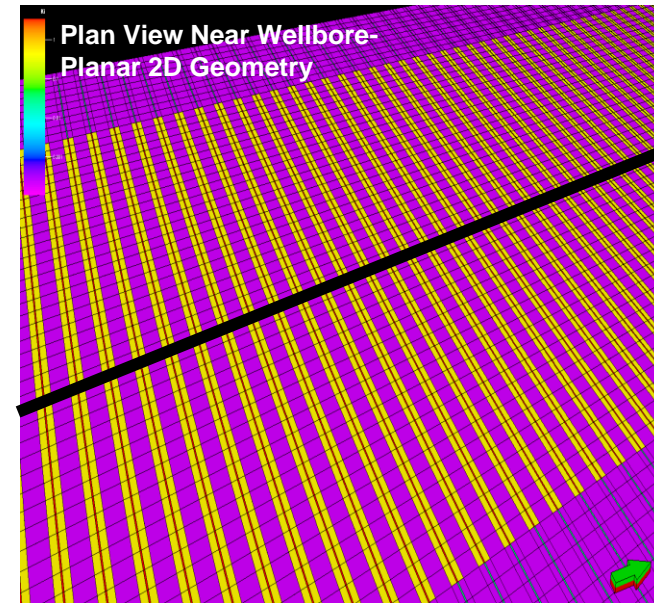
Reservoir Simulation Modeling

Matching Outcomes to Reservoir Physics - Set Up

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Initial Permeability/Conductivity

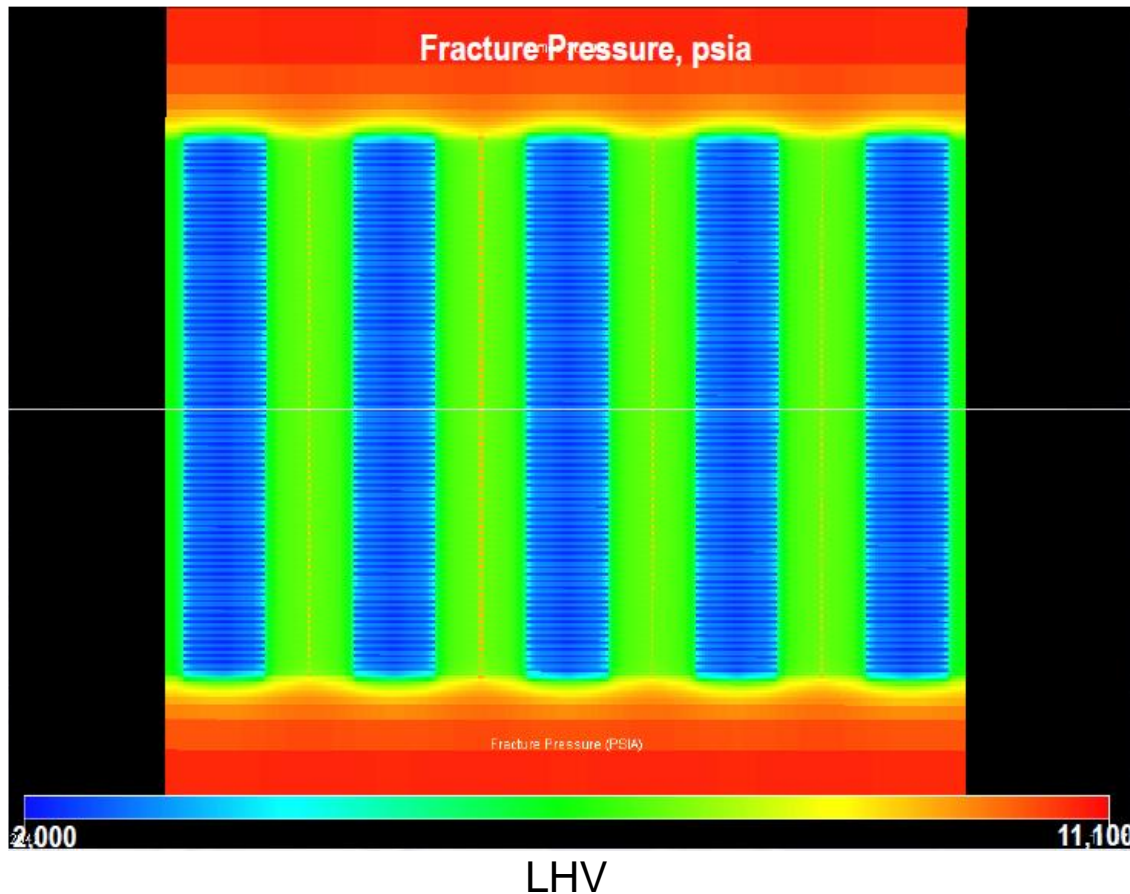
- Magenta=Matrix
 - Yellow=SRV
 - Red=Propped Fracture
 - Green/Blues=Un-propped Fracture
- Apply Pressure dependent conductivity and permeability factors over model life



Symmetry Element Modeling Pressure at 30 Years

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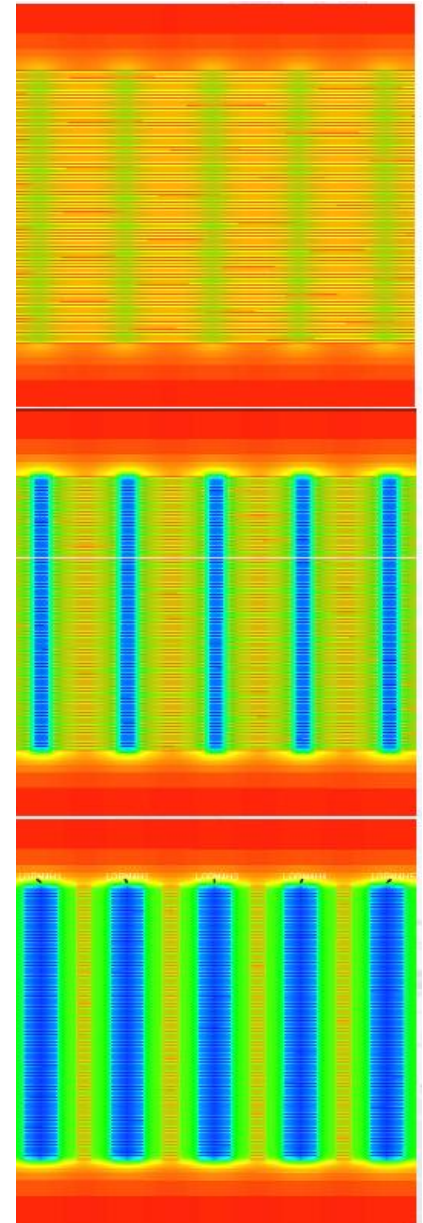
- Propped Fracture Areas achieve greatest drawdown but all intervals contribute



LB

UHV

MHV



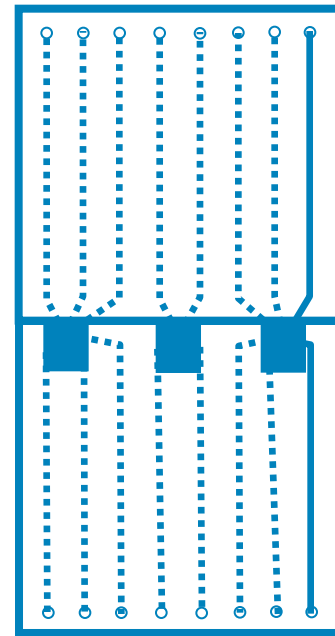
Development Evolution

Long Laterals-Maximizing Parent Wellbores to Fullest Extent

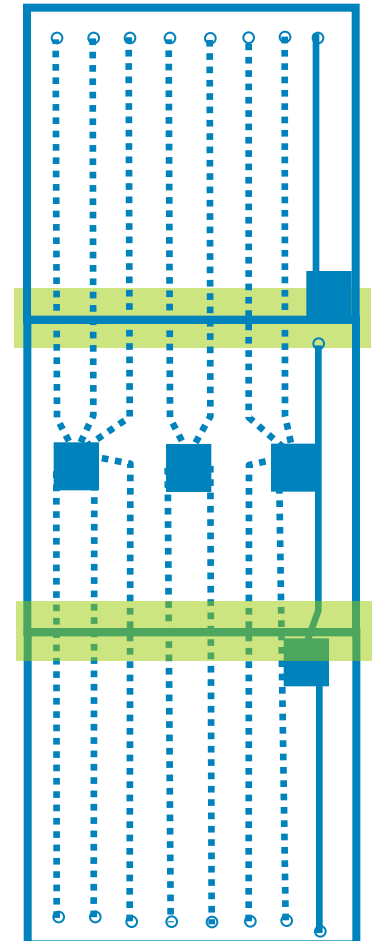
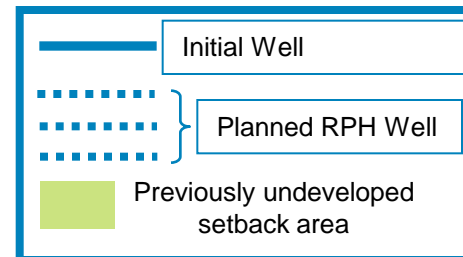
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Scaling Well Performance to Lateral Length and Completion Stage Count

- Cross Unit Permits Granted in LA
 - 7500' laterals planned
 - 1st wells spud this year
 - 13% additional recovery from undeveloped setback area
 - Positive Surface Use Impact
 - Examine and model physical and reservoir constraints



Current Pattern
640 ac, 4600' lateral



New Planned Pattern
1920 ac, 7500' lateral

Conclusions

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We have come a long way but.....We have a lot to learn.

- Continued Completion Trials
- Well Density Pilots Around the Play by All Operators
- Additional Knowledge Around Matrix Behavior
- Frac Understanding....Frac Understanding....and More Frac Understanding



Acknowledgments

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Entire Encana Haynesville Asset Team

This represents the work of hundreds of staff and consultants

- Images from Consulting Company Studies
 - Schlumberger DCS
 - Schlumberger TerraTek

- Offset Operators
 - Data sharing and trades have made rapid learning possible for all involved in the Haynesville Play