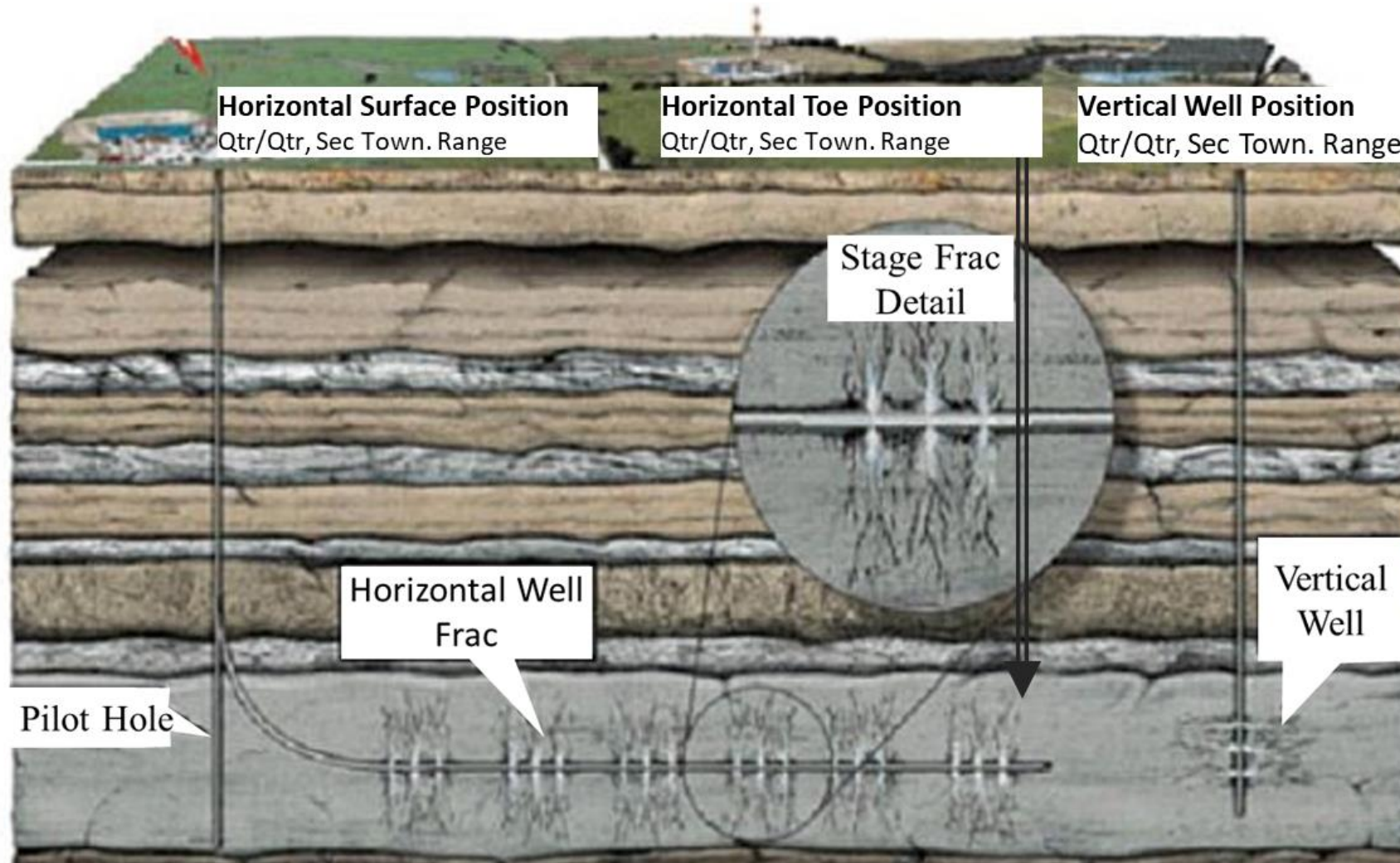


Are Vertical Wells Impacted by Horizontal Drilling?

A study of Kingfisher County

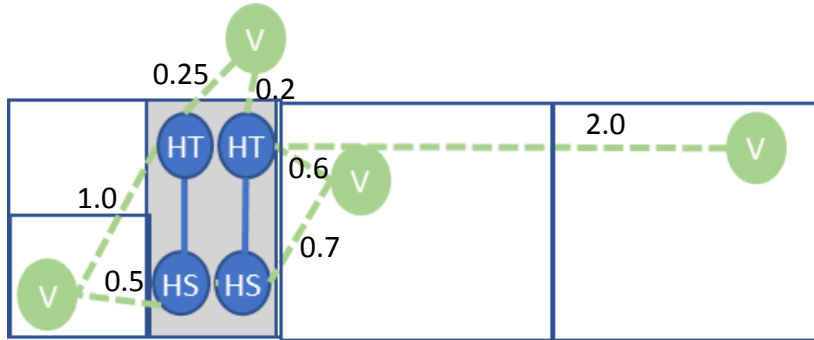
September 14, 2017

Illustration of Vertical and Horizontal Well

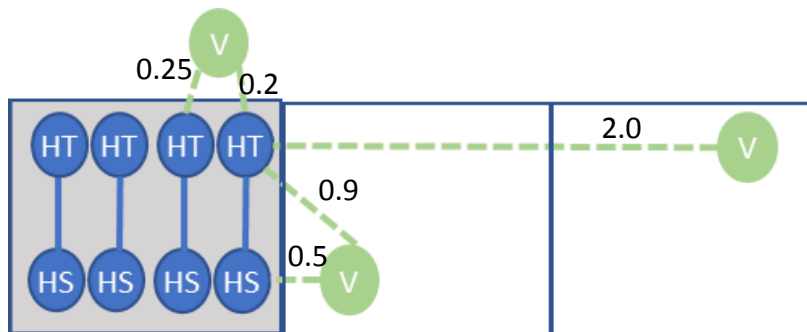


Vertical Well to Horizontal Well

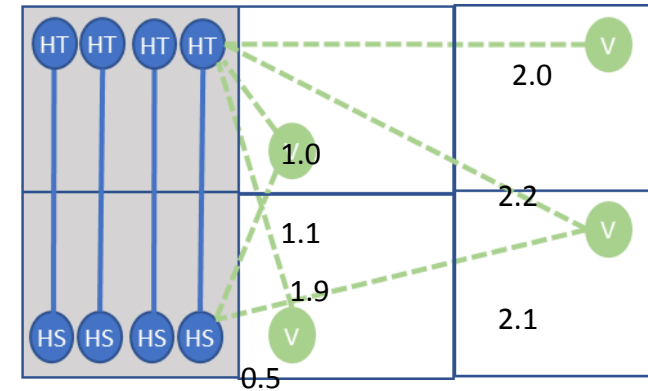
Example: 5000 foot horizontals on 320 acre



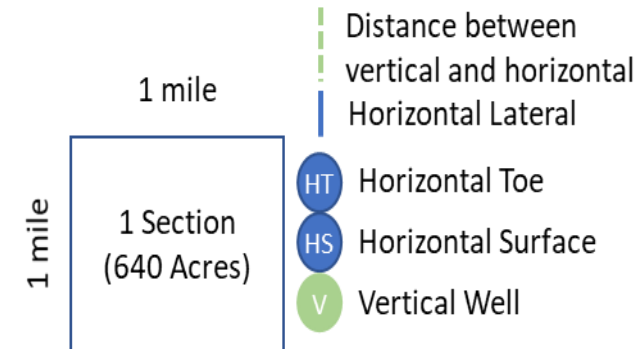
Example: 5000 foot horizontals on 640 acre



Example 10,000 foot horizontals on 1280 acre



Legend:

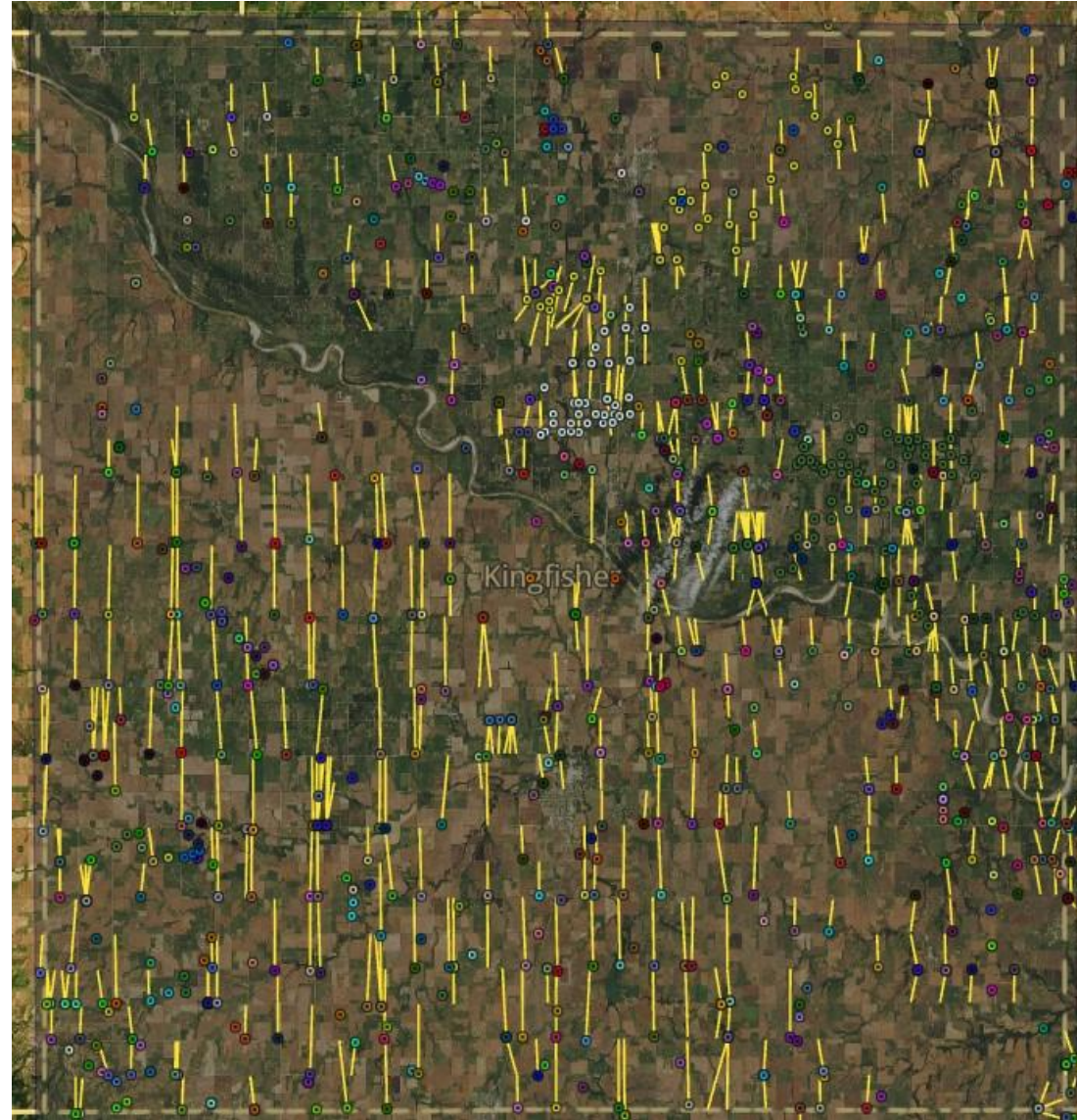


Need for Independent Report

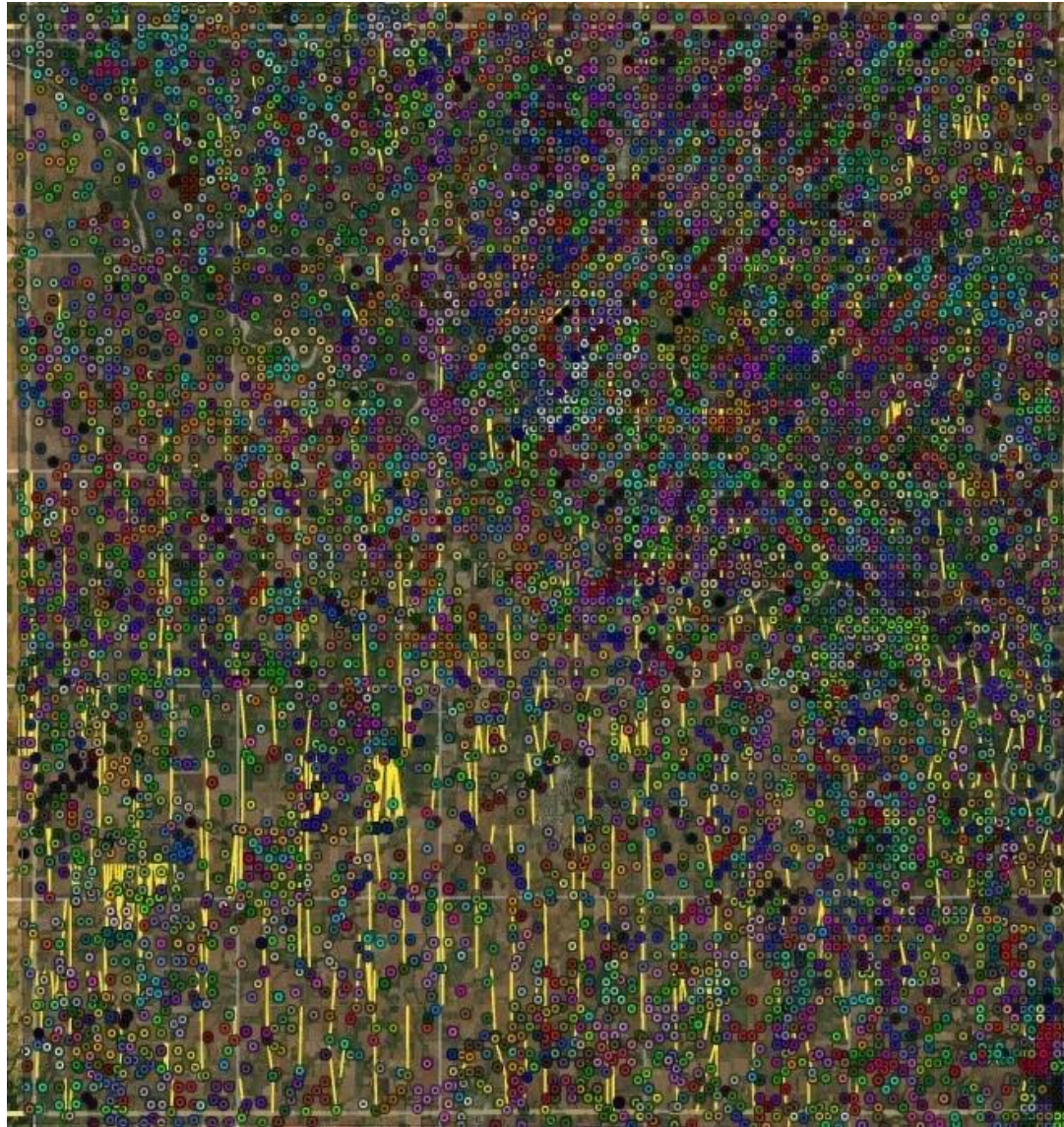
Industry Challenges

- Known damage to OEPA member wells
- Increasing number of horizontal wells create more opportunity to impact more vertical wells
- Increasingly bigger fracks create greater opportunity to damage more vertical wells
- Significant Anecdotal Evidence – Reports of Vertical Wells Damaged
 - Changed operational conditions
 - Circulating wells to remove sand influx
 - Swabbing wells to remove sudden fluid increase
 - Shutting in wells in attempt to minimize impact
- Denials of damage by major horizontal drillers

Horizontal Wells Kingfisher County



Overlaid by Vertical Wells



OEPA Selected Derek Reid/PeakWin For Independent Study

OEPA Criteria for Independence	
Independence from OEPA	<ul style="list-style-type: none">• No prior knowledge of OEPA• No prior relationships with founding members
Degreed Petroleum Engineer	<ul style="list-style-type: none">• BSPE University of Tulsa
Operational Experience	<ul style="list-style-type: none">• Managed operations for many wells• Different production lift methods and reservoir drive mechanisms
Ability to develop solution	<ul style="list-style-type: none">• Brought potential solution method
Experienced in art of the possible	<ul style="list-style-type: none">• MBA with extensive problem solving experience• Energy regulatory background, assisting with assessment to support successful regulatory change• Past management consultant

Objective: Identify Vertical Wells Impacted by Horizontal Drilling in Kingfisher County

Identify number of vertical wells:

- Within 2 miles of a horizontal well
- With average long term production changes of +/- 25% after horizontal well fracked
- With month-to-month short term production changes +/-50% after horizontal well fracked
- Investigation period March 2014 to January 2017

Sources of Information

- Oklahoma Tax Commission production records
- Oklahoma Corporation Commission well records

Findings: 451 Potentially Impacted Vertical Wells

- 360 (80%) impacted vertical wells outside horizontal well unit boundaries
- 91 (20%) impacted vertical wells within horizontal well unit boundaries
- 371 (82%) impacted vertical wells operated by vertical well only operators
- 80 (18%) impacted vertical wells operated by horizontal well operators

IMPACTED WELL ADDITIONAL OPERATIONAL COSTS

- COST TO CLEAN OUT SAND AND WATER FROM WELLBORE
- COST TO REPLACE DAMAGED EQUIPMENT, SURFACE AND SUBSURFACE
- COST TO CONTINUALLY REBALANCE PRODUCTION SYSTEM AND VESSELS
- COST TO DISPOSE OF IMPACTION WATER AND SAND
- COST TO ADDRESS ENVIRONMENTAL DAMAGE
- COST OF INCREASED GENERAL ONGOING OPERATIONAL EXPENSES
- THE ULTIMATE DISASTER: COLLAPSED CASING FROM FRAC PRESSURES

Environmental Damage



Horizontal Well Operators in Kingfisher County

	Horizontals Wells Drilled March 2014 to June 2017	% of Total
Newfield Exploration	117	28%
Oklahoma Energy Acquisitions	81	19%
Chaparral Energy	41	10%
Devon Energy	36	9%
Gastar Exploration	36	9%
Chesapeake	33	8%
Marathon Oil	24	6%
Hinkle Oil & Gas	11	3%
Chisholm Oil & Gas Operating	10	2%
Longfellow Energy	8	2%
Blake Production Company	6	1%
Cimarex Energy	5	1%
Payne Exploration	3	1%
Husky Ventures	3	1%
Sandridge	1	0%
Gulf Exploration	1	0%
Total	416	100%

Total Horizontal Well Count in Kingfisher County: 633

New OCC Form: Aid in Formal Identification of Impacted Wells

WELL IMPACT REPORT					
Date: _____					
Operator: _____		Oper. # _____			
Well Name: _____		Well # _____			
API Number: _____		SHL: SEC _____ TWP _____ RGE _____		(10-DIGIT API# - FOR EXAMPLE, 3500321606)	
County: _____		Datum used: _____			
SHL: _____		Latitude: _____		Longitude: _____	
		(decimal degrees)		(decimal degrees)	
BHL: _____		Latitude: _____		Longitude: _____	
		(decimal degrees)		(decimal degrees)	
		TD (MD) _____		TD (TVD) _____	
Date of impact or when impact consequence was observed: _____					
Producing formation1: _____		Perforated Interval: _____			
Producing formation2: _____		Perforated Interval: _____			
(if applicable)					
Producing formation3: _____		Perforated Interval: _____			
(if applicable)					
Was frac notice received? _____ (Y/N) ➔		If "yes", date received: _____			
Was well flowing or on artificial lift prior to impact? _____		(Gas lift, Plunger Lift, Rod pump, Flowing)			
Distance to well being hydraulically fractured: _____		(ft)			
Offset well being hydraulically fractured:					
Well Name: _____		Well # _____			
Operator: _____		Oper. # _____			
API Number: _____		SHL: SEC _____ TWP _____ RGE _____		(10-DIGIT API# - FOR EXAMPLE, 3500321606)	
County: _____		Datum used: _____			
SHL: _____		Latitude _____		Longitude _____	
		(decimal degrees)		(decimal degrees)	
BHL: _____		Latitude _____		Longitude _____	
		(decimal degrees)		(decimal degrees)	
Formation being hydraulically fractured: _____					
Perforated Interval: _____		TD (MD) _____		TD (TVD) _____	
Was incident reported to District office? _____ (Y/N) ➔		if "yes", date: _____			
Was a 1085 filed by the District? _____ (Y/N)					
Report filed by: _____		Title _____			
Phone _____		Email _____			
RULE: 165-10-3-10(b)(4) effective date 9/11/17					
(4) If an operator believes there is evidence that hydraulic fracturing operations have impacted its well(s), the operator may report the occurrence either by facsimile or electronic mail to the appropriate Conservation District Office with 24 hours of discovery.					
PRODUCTION INFORMATION					
Report 12 months production prior to impact and all production after impact to current date.					
DATE (MM/yyyy)	OIL (bbls)	GAS (mcf)	WATER (bbls)	CASING (psi)	TUBING (psi)

QUESTIONS?

THANK YOU