6-5-2014

SLIDES: Industry Growth and Change

Stuart Ellsworth

Industry Growth and Change

2014 Martz Summer Conference

University of Colorado Law School
Getches-Wilkinson Center for Natural Resources, Energy, and the Environment

June 5, 2014

COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

Stuart Ellsworth, P.E.
Engineering Manager

Industry Growth and Change

- What is different today?
- What are some issues related to onshore development?
- Why should we care?

What is Different Today?

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What is Different Today?

Reservoirs

Development Plans (Drilling and Production)

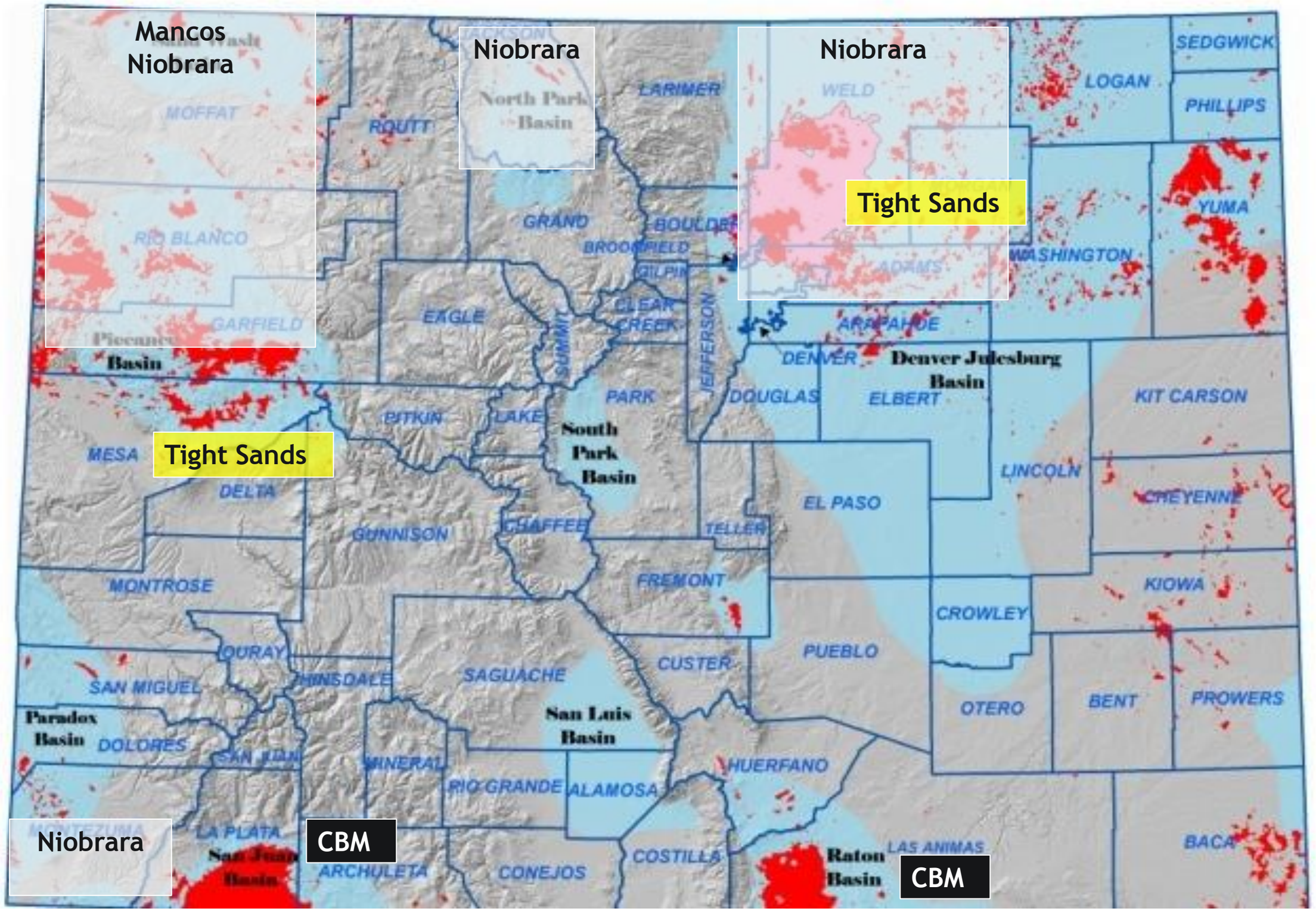
Economics

Conventional vs. Unconventional Resources

Conventional oil and natural gas reservoirs are within geologic formations capable of flow and the internal fluid force allows for flow without other influences.

Unconventional oil and natural gas reservoirs are the exact opposite, meaning they cannot flow without other influences.

Oil and Gas Fields in Colorado



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Conventional vs. Unconventional Resources

"Tight" Sands (Piceance Basin, Wattenberg Field)

Coal Bed Methane (CBM: San Juan and Raton Basins)

"Shale" plays (Niobrara and Mancos Formations)

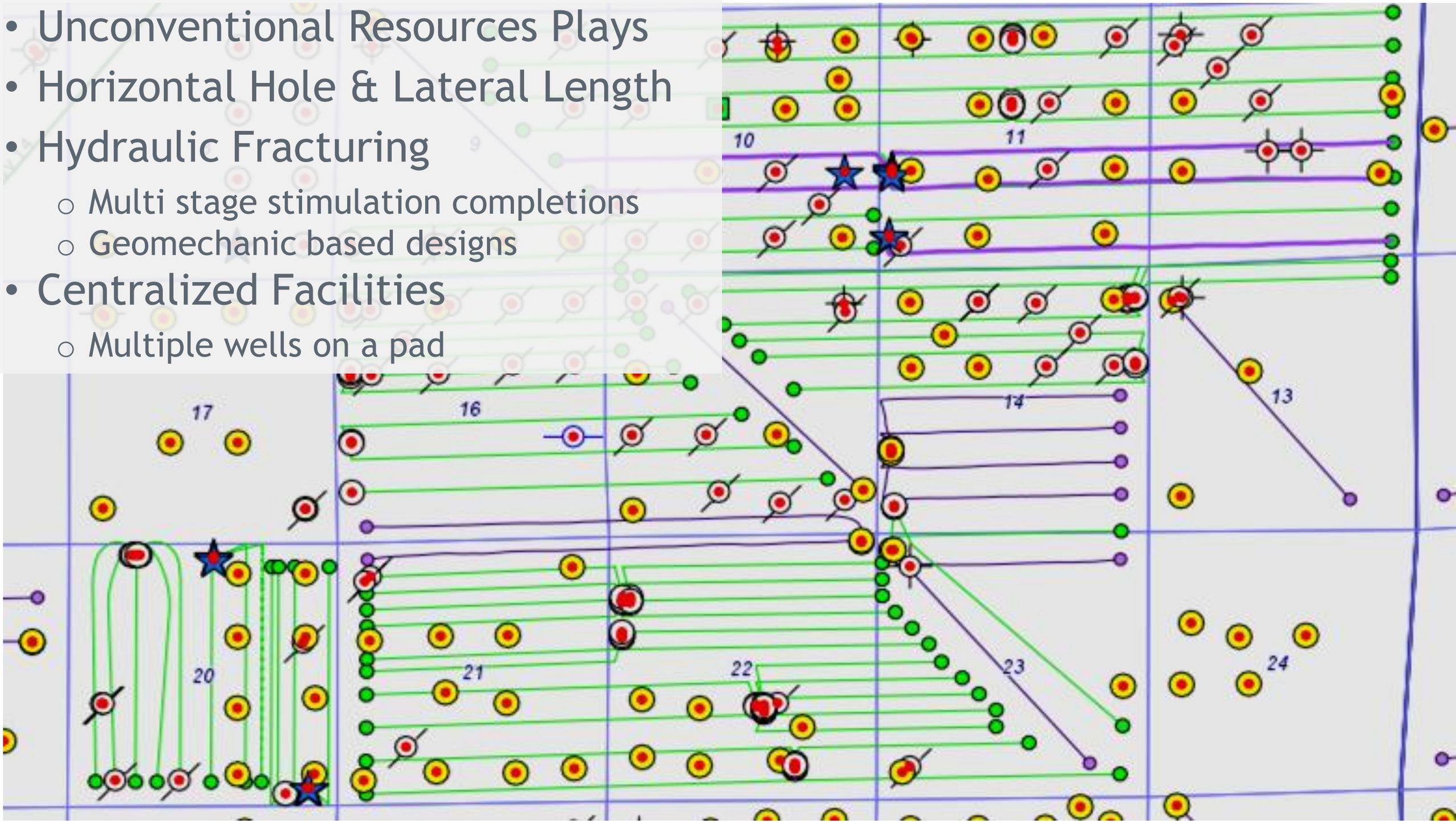
These are self-sourced reservoirs

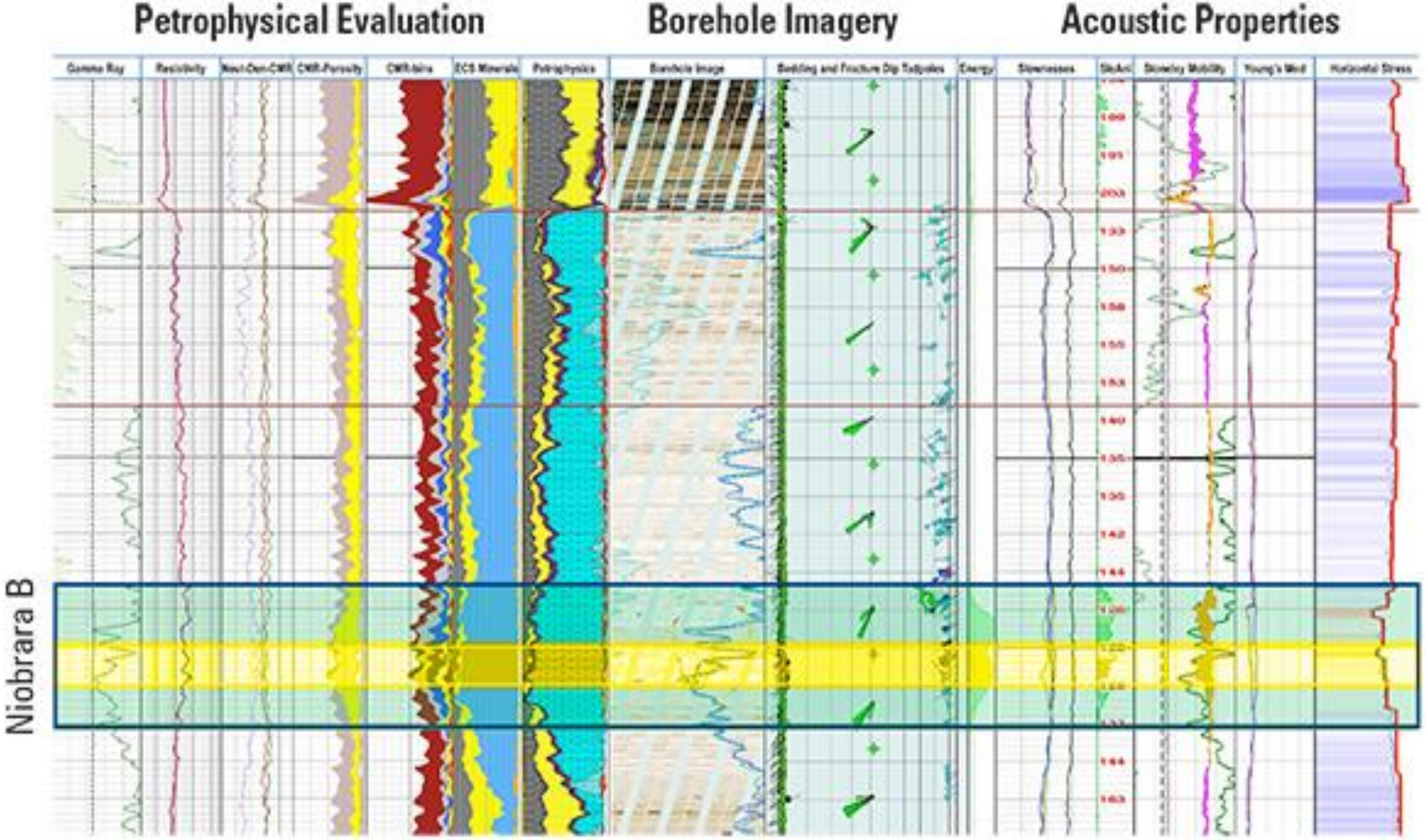
Drainage: Well spacing and pooling

Development Plans

Development Plans

- Unconventional Resources Plays
- Horizontal Hole & Lateral Length
- Hydraulic Fracturing
  - Multi stage stimulation completions
  - Geomechanic based designs
- Centralized Facilities
  - Multiple wells on a pad



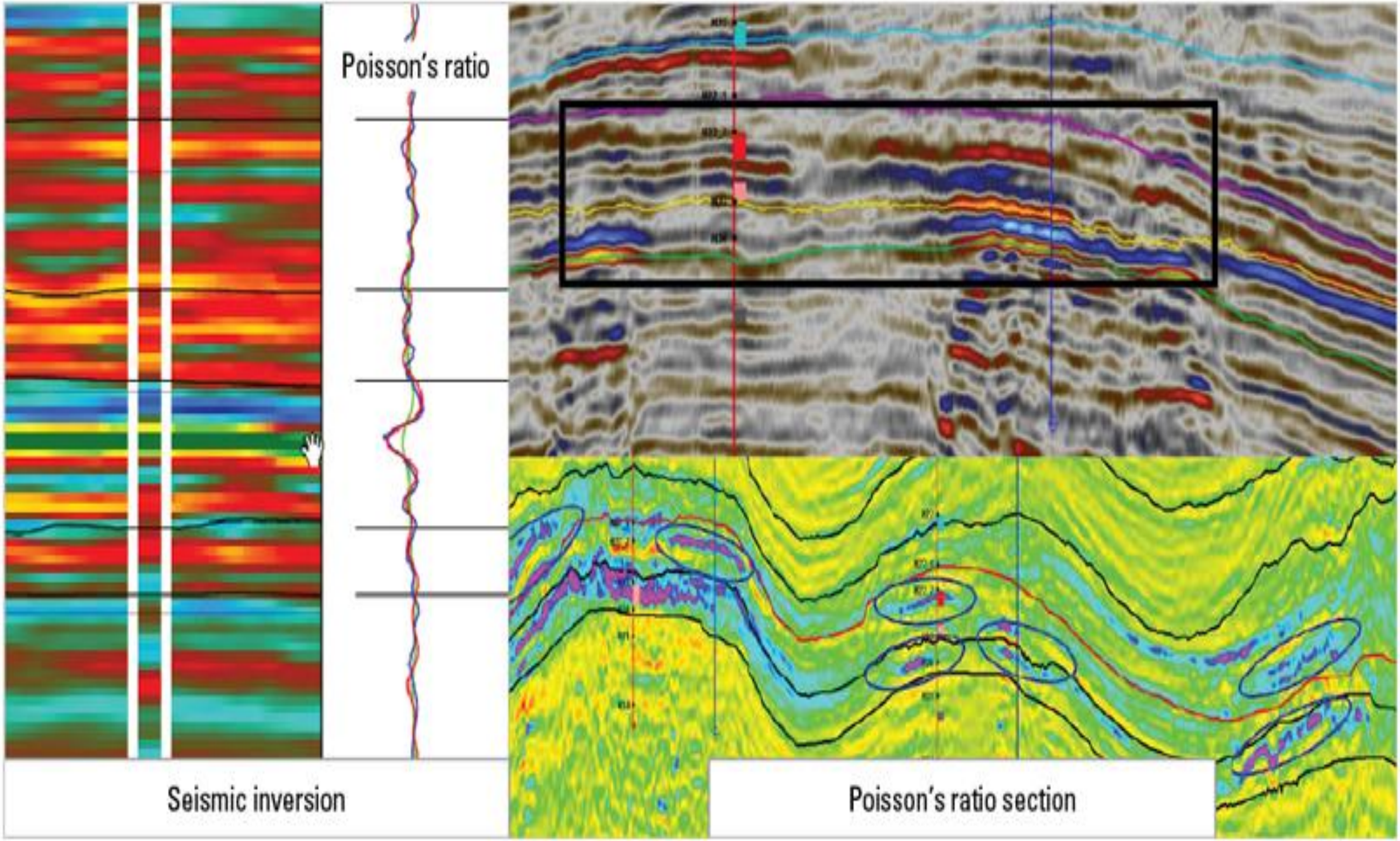


Expert analysis of high-tier log measurements determined that a 10-ft interval, shown in yellow, in the Niobrara B, displayed in green, was the zone of greatest potential production.

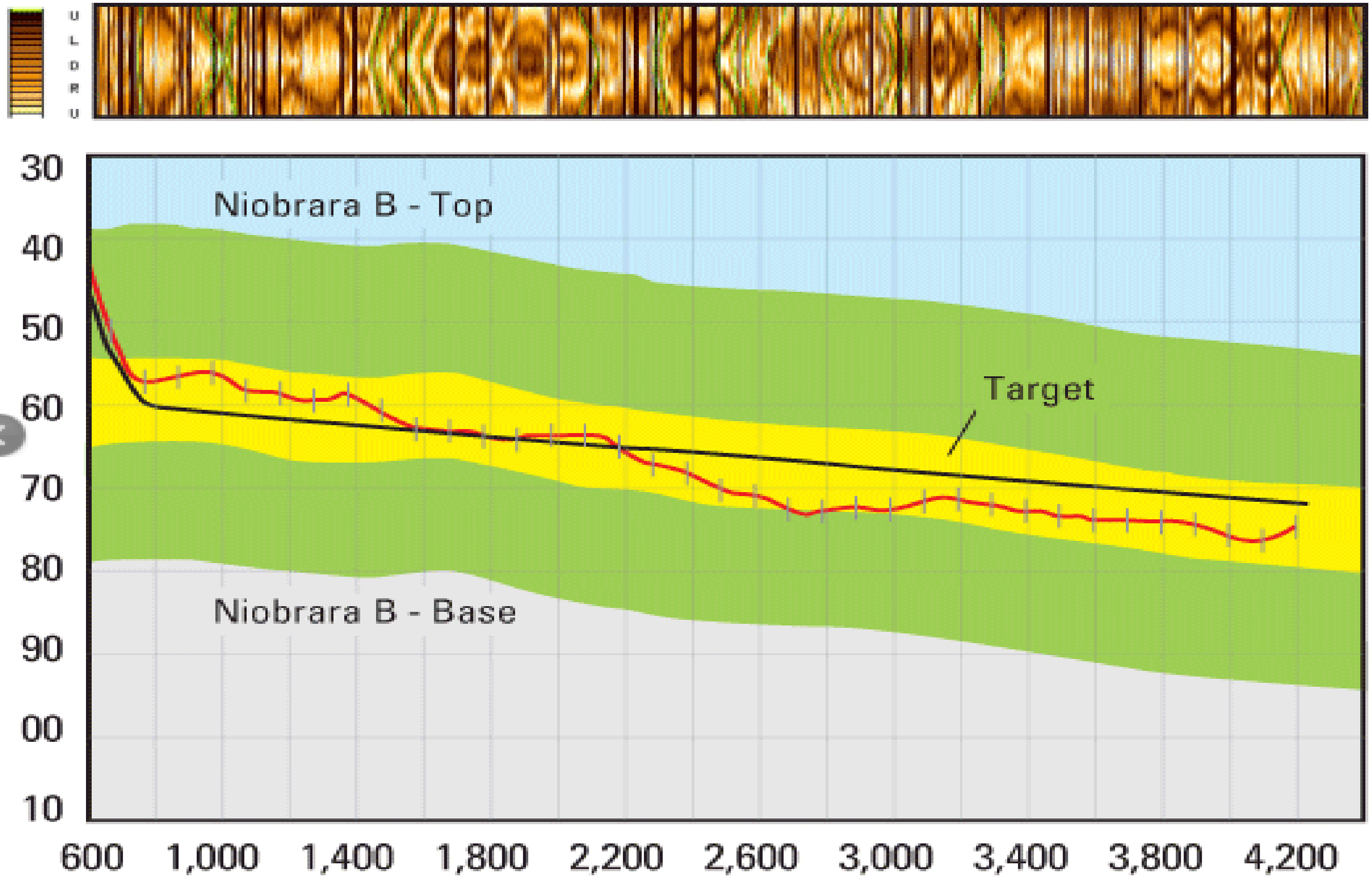
GOHFER's
Complete Stress Equation

$$P_c = \frac{\nu}{(1-\nu)}\left[P_{ob} - \alpha_v P_p\right] + \alpha_h P_p + \varepsilon_x E + \sigma_t$$

- P_c = closure pressure, psi
- ν = Poisson's Ratio
- P_{ob} = Overburden Pressure
- α_v = vertical Biot's poroelastic constant
- α_h = horizontal Biot's poroelastic constant
- P_p = Pore Pressure
- ε_x = regional horizontal strain, microstrains
- E = Young's Modulus, million psi
- σ_t = regional horizontal tectonic stress



Poisson's ratio, derived from simultaneous seismic inversion, was used in geological modeling to predict gas saturation and to map zones of higher reservoir quality.



Real-time interpretation of high-resolution resistivity images successfully maintained the wellbore within the 10-ft target zone for more than 3,000 ft.

Colorado Oil and Gas Conservation Commission

Horizontal Well Activity

January 7, 2014

County	Prior Years			2009		2010		2011		2012		2013		2014			Completion			
	Drilled	DA	PA	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Spud	AC	PR	DA	PA
ADAMS				6	5	2	3	1		17	2	26	2		1	13	5	4		
ARAPAHOE	2							10	1	22	4	12	3			10	2	1		
ARCHULETA	17			7	6	15	7	10	8	5	9	2				47		40		
BENT												1	1			1				
BOULDER								4								0				
CHEYENNE	5		4									7	3		1	9		1		4
DELTA										6	2	1				2		1		
DOLORES	9			18	2	6				9	1	5				12		6		1
EL PASO										10						0				1
MONTEZUMA	6		1	23	6	11	2	8	3	18	2	3				19		29		1
MORGAN								6	2	2	1	13	1			4		2		
PARK						1	1	1								1				
RIO BLANCO	7	2				1	1	11	2	15	2	4	5			17	1	7	3	
ROUTT	10	6	1							1		1				10		3	6	1
SAN MIGUEL	1			1												1				
WASHINGTON	1		1													1				1
WELD	11	3		12	5	208	95	763	235	964	598	2115	1045	18	33	2022		867	8	16
YUMA	1		1	6												1				1
TOTAL Horizontal	**156**	**25**	**14**	**147**	**32**	**333**	**132**	**901**	**288**	**1203**	**641**	**2262**	**1089**	**18**	**35**	**2373**	**9**	**1117**	**30**	**39**
Percent of Total HZ		**16%**	**9%**														**0%**	**47%**	**1%**	**2%**
Total All Permits				**5159**		**5996**		**4659**		**3773**		**3661**		**3661**						
Percent of Total				**2.8%**		**5.6%**		**19.3%**		**31.9%**		**61.8%**		**0.5%**						

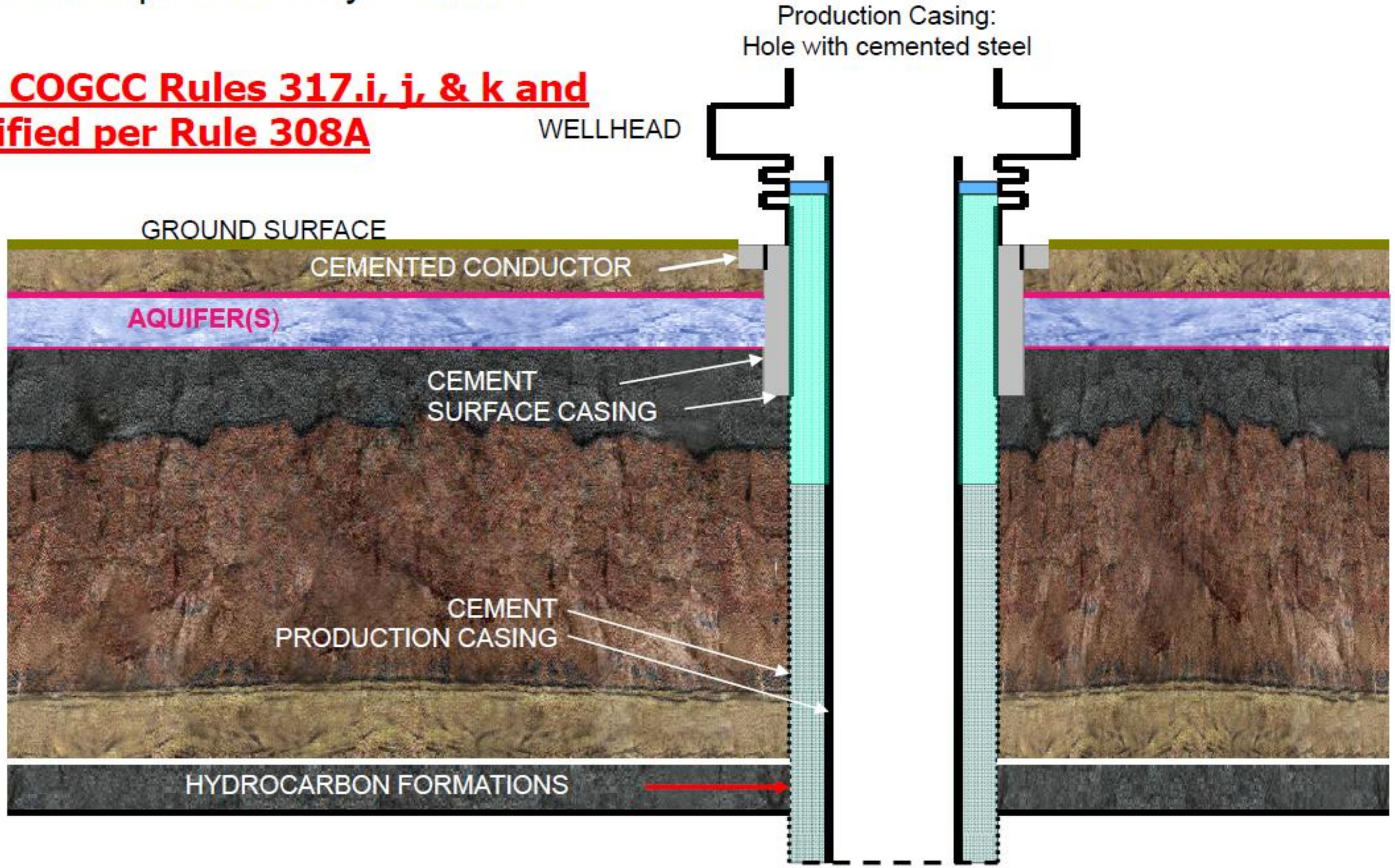
County	2013 Permit	2013 Spud	2014 Permit	2014 Spud	Spud	Completion AC	PR	DA	PA
WELD	2115	1045	18	33	2022		867	8	16
YUMA					1				1
TOTAL Horizontal	**2262**	**1089**	**18**	**35**	**2373**	**9**	**1117**	**30**	**39**
Percent of Total HZ						**0%**	**47%**	**1%**	**2%**
Total All Permits	**3661**		**3661**						
Percent of Total	**61.8%**		**0.5%**						

WELL BORE DIAGRAM

PLACE & CEMENT PRODUCTION CASING

Fluid inflow prevented by cement

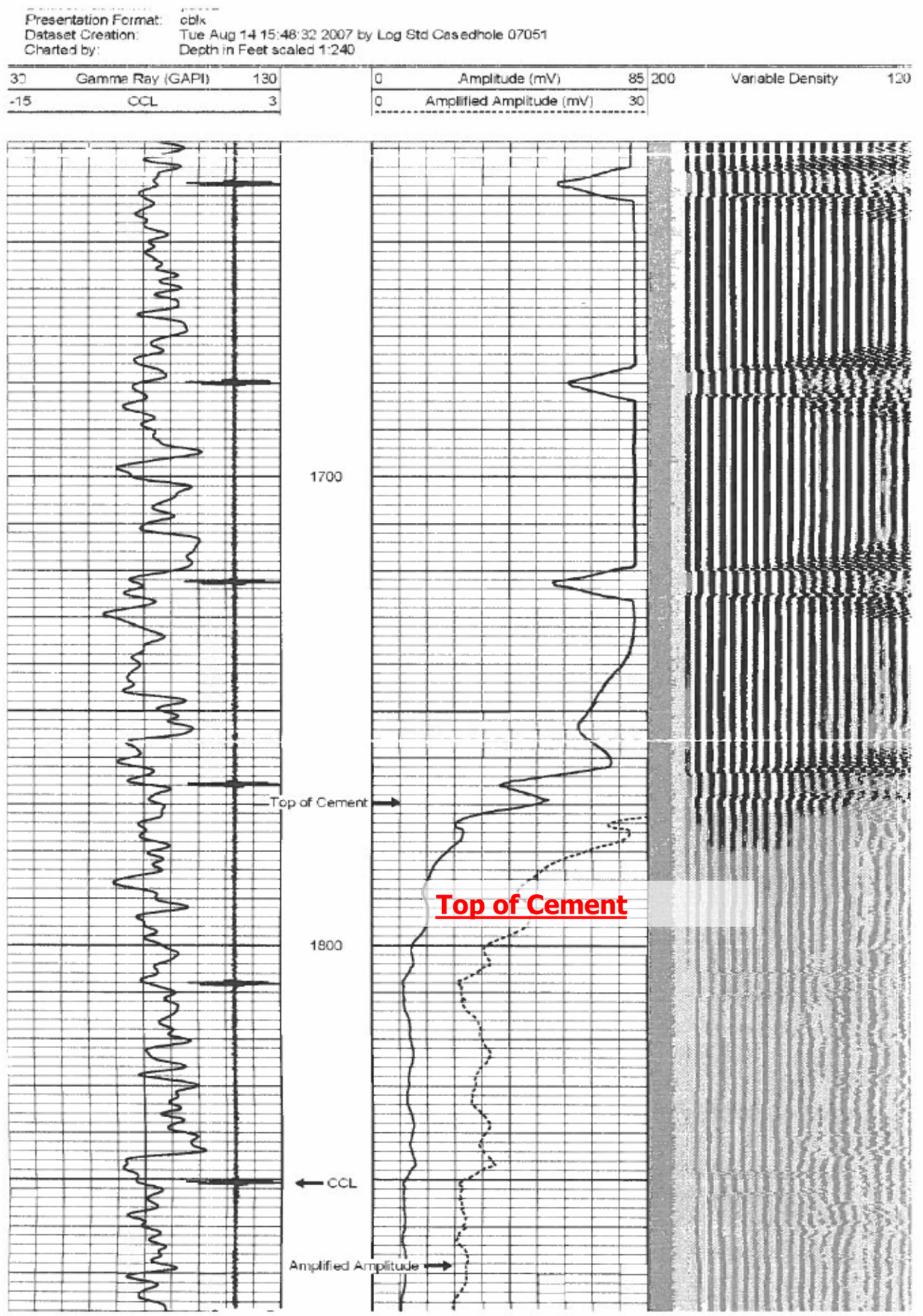
Per COGCC Rules 317.i, j, & k and verified per Rule 308A



Cement Bond Logs

to verify placement of cement

Per COGCC Rule 317.o requires cement bond logs for all wells.



Drilling and Production

Drilling and Completion times

Number of Active Rigs

Number of Drilling Permits

Number of New Drills

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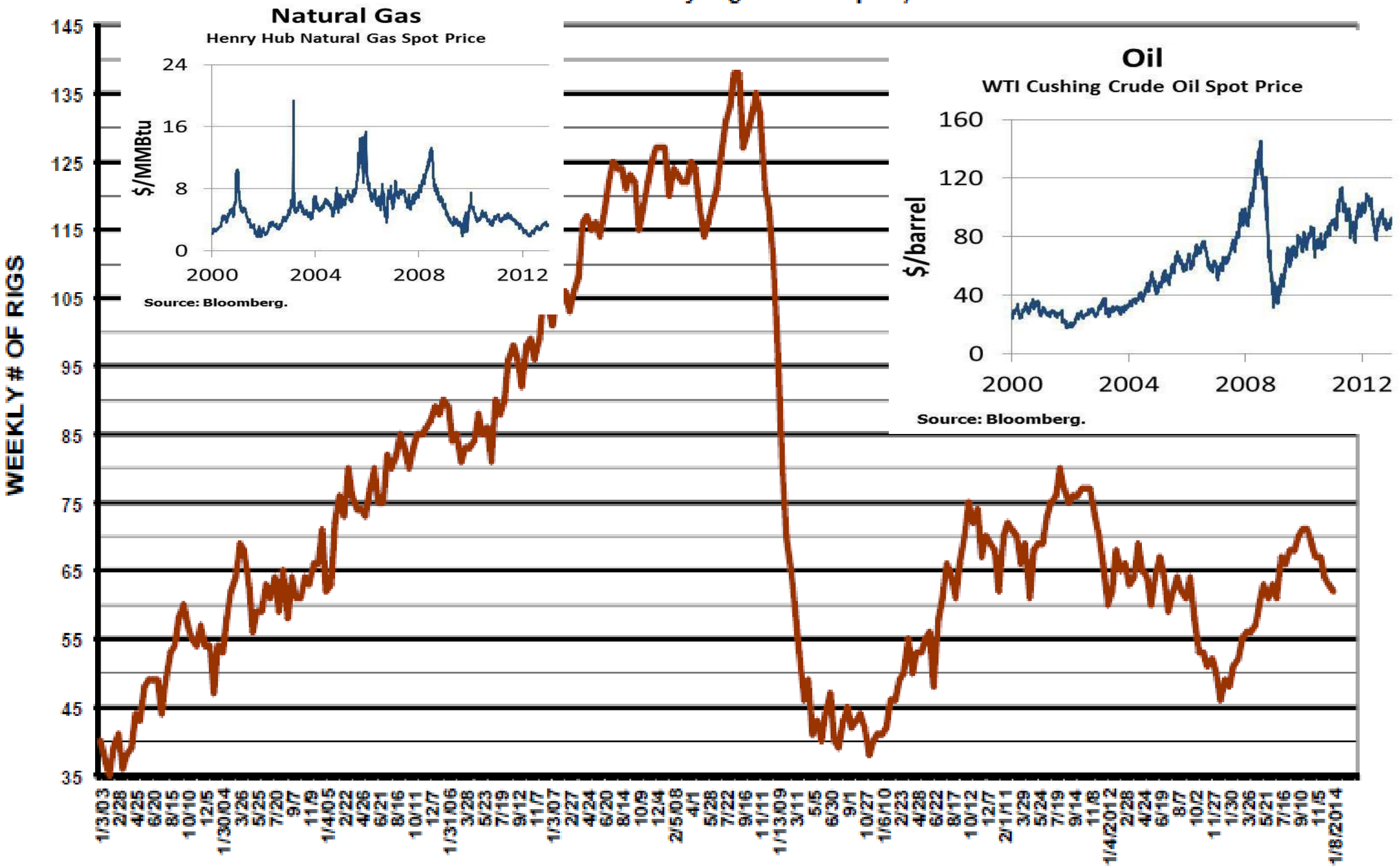
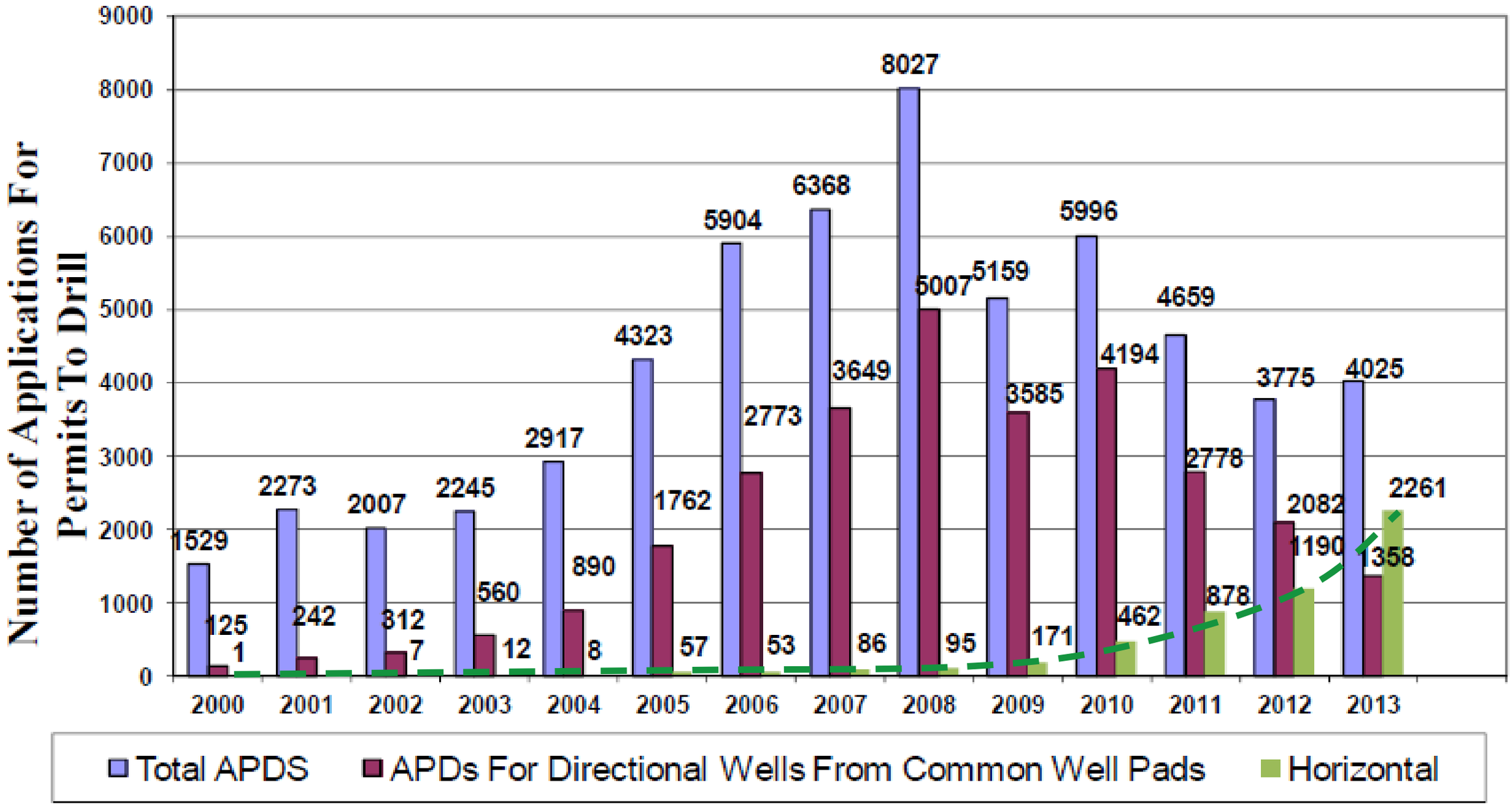
TOTAL DRILLING RIGS RUNNING IN COLORADO EVERY OTHER WEEK IN 2003-2014

(Based on Data in: through 4/30/03, PI/Dwights Drilling Wire -- after 4/30/03, Anderson Reports Weekly Rig Status Report)



Number of Oil and Gas Well Permits For Wells Drilled Directionally & Horizontally From Common Well Pads in Colorado 01-07-14



What are some issues related to onshore development?

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What are some issues related to onshore development?

- Increased Regulations
- Public Concerns
- Renewed domestic drilling and production
- Multiple well pads and Centralized facilities

Regulatory Changes

Rule 318A GWA (1998)

Ignacio Blanco Field Orders 112-156, 112-157, 112-180, and 112-181 (2004)

Rule Making (2008)

Fracture Treatment Disclosure (2011)

Rule 318A Amendment (2011)

Groundwater Rule Making (2012)

Setback Rule Making (2012)

Spill Reporting Rule Making (2013)

Public Concerns

- Opportunities for mitigation
  - Noise
  - Air emissions
  - Spill containment
  - Traffic
  - Construction Activity
  - Disturbed Areas

Multi-Well Pads

Develop by Vertical or Horizontal Wells? 4 sq. mile area (2560 acres)

Vertical wells - 64 vertical wells on 2 acre pads uses 128 acres of land, about 26 miles of roads, 26 miles of pipelines, plus 4 to 8 facility pads to effectively capture the gas reserves.

Horizontal wells – 16 horiz. wells from 1 pad of 6 acres, with 2 miles of roads, 2 miles of pipeline and one facility on the same pad as the wells.

Horizontal well advantages:

- Less land used & placement choices,
- Fewer roads and pipelines,
- Less traffic,
- Less dust,
- Less urban & wildlife disturbance,
- Less air pollution.
- All wells penetrate the ground in the same area – can be easily monitored

Vertical vs. Horizontal Drilling

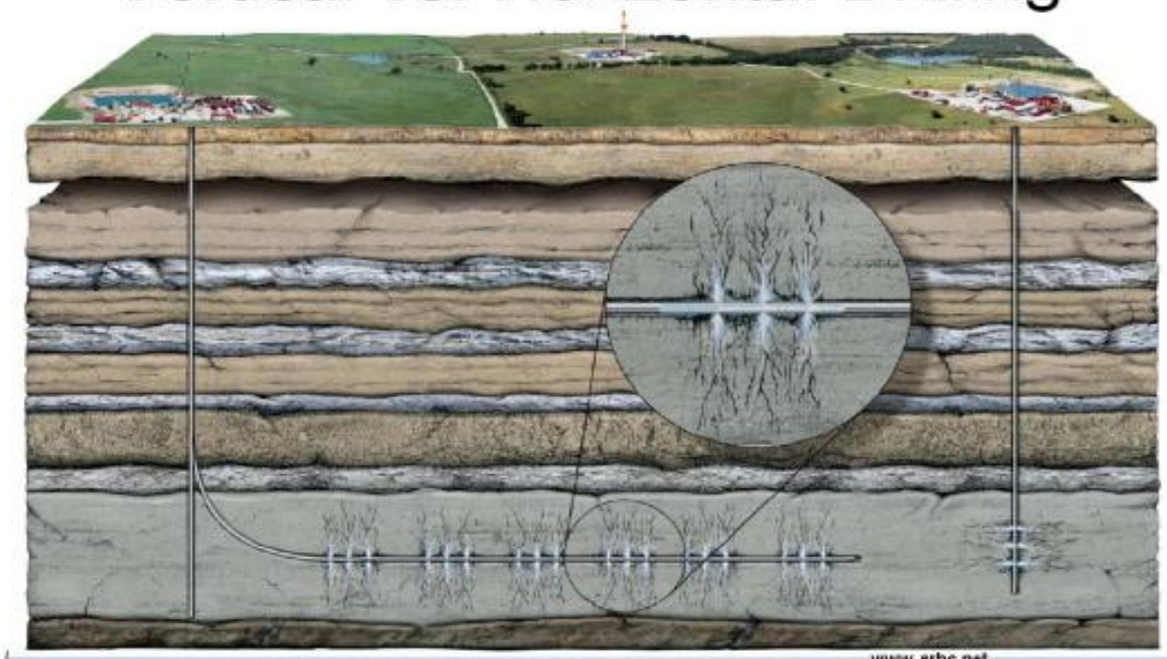
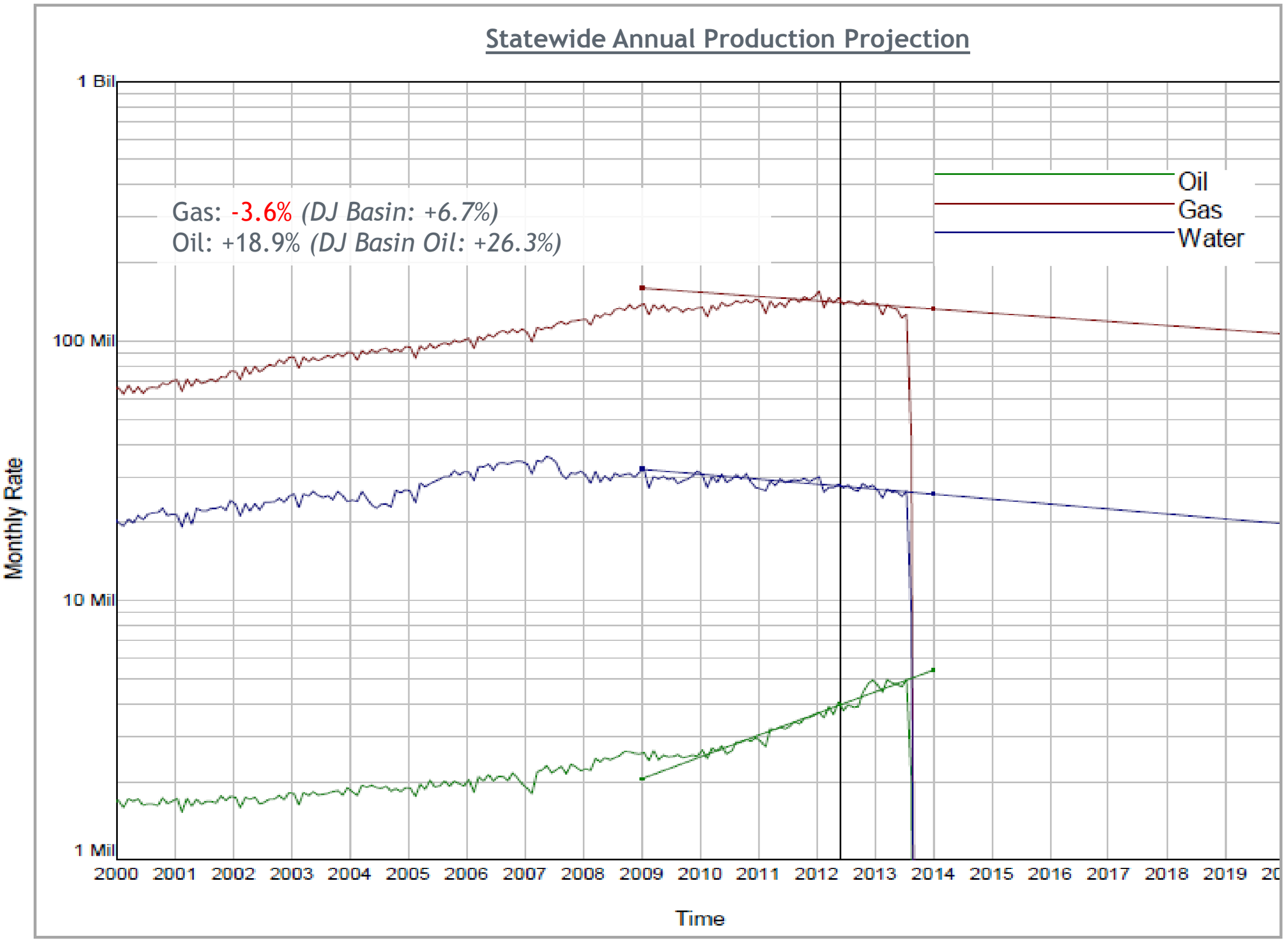


Illustration retrieved from: Independent Oil and Gas Association of Pennsylvania's *Drilling & Developing the Marcellus Shale*

Economics

- Budgets
    - DJ Basin Niobrara 2013 - $4 billion
- Production
    - Rose to a 50 year high for oil production

Statewide Annual Production Projection



Why Should We Care?

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Why Should We Care?

- Natural gas has reduced emissions

  EPA Quad-O and CDPHE regulation of fugitive emission.

  Power plants and vehicle conversions to NG/CNG/LNG

- Manufacturing use of natural gas

  US Steel is converting steel plants to natural gas.

  Long term contracts for natural gas.

- Taxes

  Severance Tax –

  Ad Valorem Tax – County tax on production

  Weld County (8%) -

  Garfield County (7%) -

Exxon Bets Big on Gas With Deal For XTO

By RUSSELL GOLD

Updated Dec. 15, 2009 12:32 p.m. ET

Exxon Mobil Corp. placed a $31 billion bet that natural gas will play a critical role in the world's future energy needs, saying it would purchase XTO Energy Inc. in an all-stock

Mar 2, 2012, 12:22pm MST | **UPDATED:** Mar 2, 2012, 3:21pm MST

Colorado land board OKs ConocoPhillips deal on Lowry Range

Xcel lays out natural-gas conversion plan for metro area

By Drew FitzGerald The Denver Post The Denver Post
Posted:

DenverPost.com

Xcel Energy plans to spend $1.3 billion over 12 years to convert Denver-area power plants from coal to natural gas to meet a state mandate to reduce pollution around the Front Range.

Shale-Gas Revolution Spurs Wave of New U.S. Steel Plants: Energy

By Sonja Elmquist - Dec 31, 2012

The U.S. shale-gas revolution, which has revitalized chemicals companies and prompted talk of domestic energy self-sufficiency, is attracting a wave of investment that may revive profits in the steel industry.

Austrian steelmaker Voestalpine AG (VOE) said Dec. 19 it may const
cheap gas. Nucor Corp. (NUE), the most valuable U.S. steelmaker, p
among at least five U.S. plants under consideration or being built tha
steel.

Dec 19, 2013, 5:24pm MST | **UPDATED:** Dec 20, 2013, 4:02am MST

Colorado gets $30M for more natural gas vehicles, fueling stations

Jan 28, 2014, 4:01am MST | **UPDATED:** Jan 28, 2014, 7:00pm MST

Colorado's oil and gas boom could spill into construction sector

2012 Industry Economic and Fiscal Contributions in Colorado

From University of Colorado Boulder Leeds School of Business

Direct and Related Value from oil and gas activities: $13.7 Billion

Production Value $9.3 Billion on 29,300 direct jobs: (average salary: $101,000)

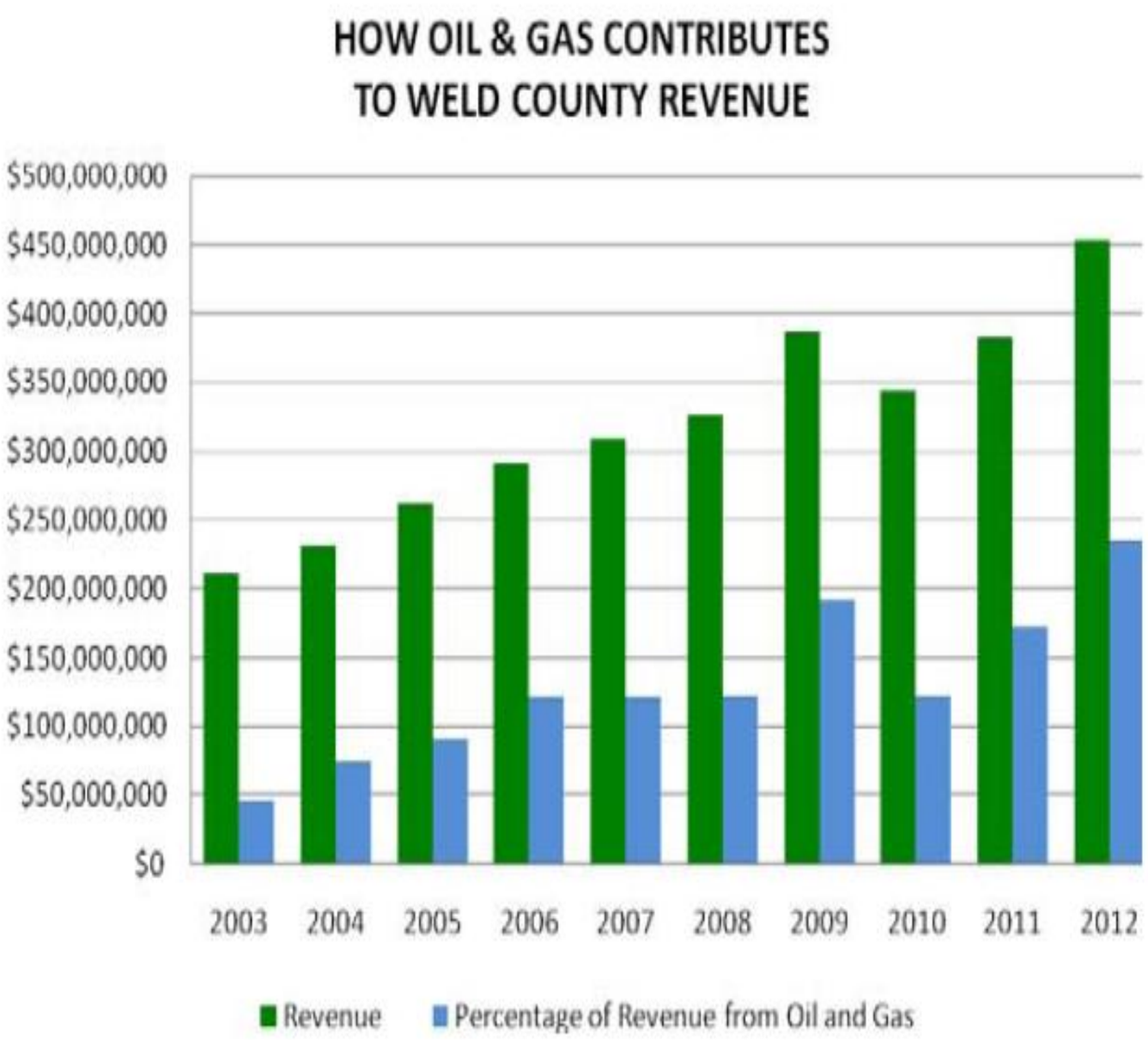
Additional related jobs: $3.8 Billion on 51,200 (average salary: $74,800)

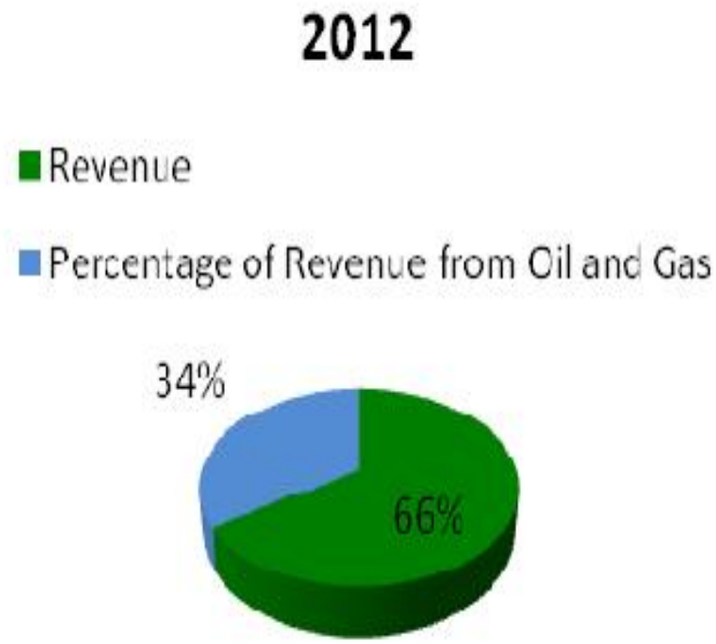
Private land owner (royalty and lease terms): $614 million

Public Revenues from oil and gas activities: $1.6 Billion

Severance Taxes, public leases/royalty: $1.0 Billion

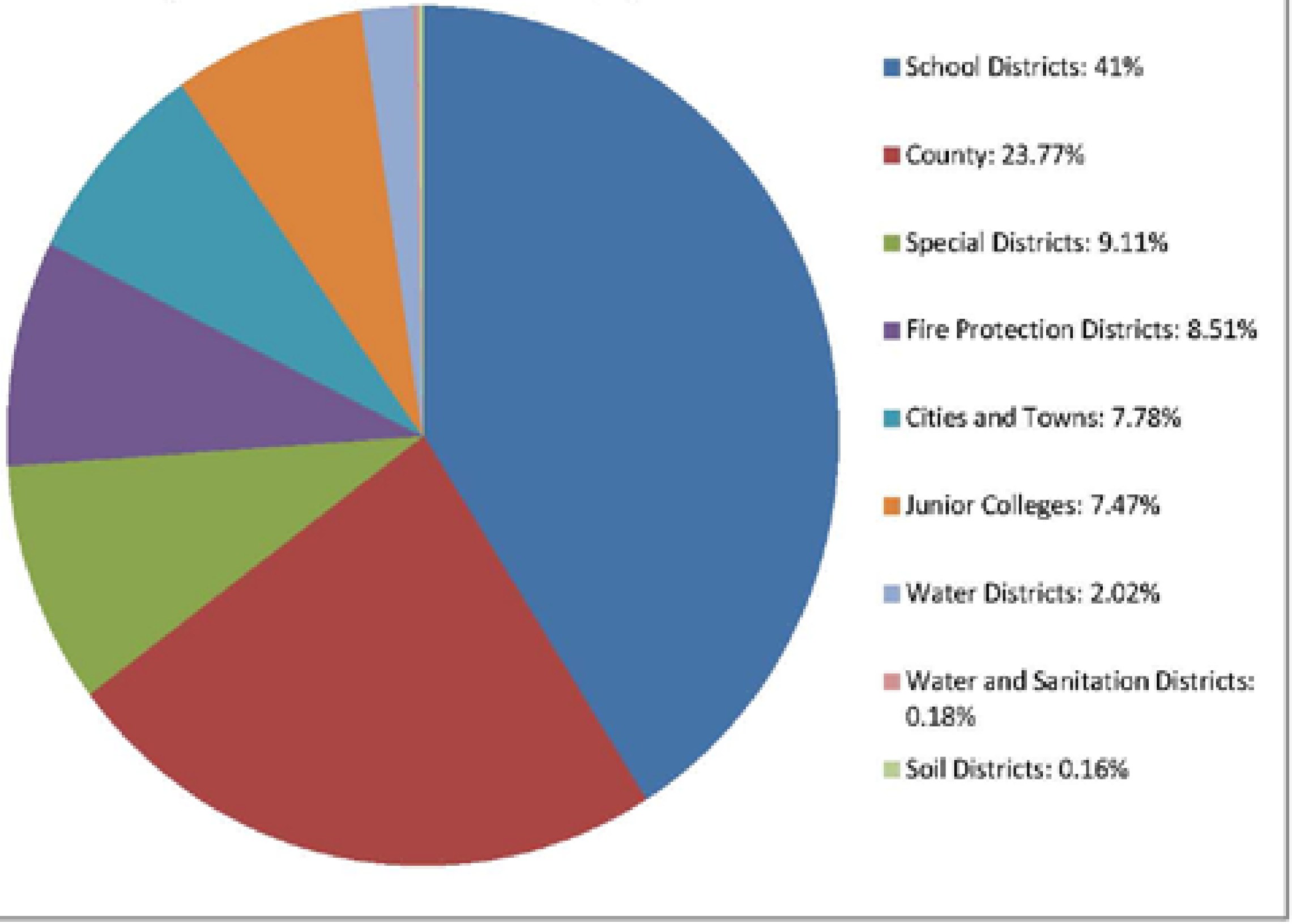
Weld County Revenue





4/30/13 Weld County Press Release

Breakdown of distribution from Anadarko tax payment:



Industry Growth and Change

- What is different today?

  Unconventional Resources Plays

- What are some issues related to onshore development?

  Reducing and managing the impacts

- Why should we care?

  We can all benefit

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