



BAKKEN BASICS

AADE Annual Technical Symposium

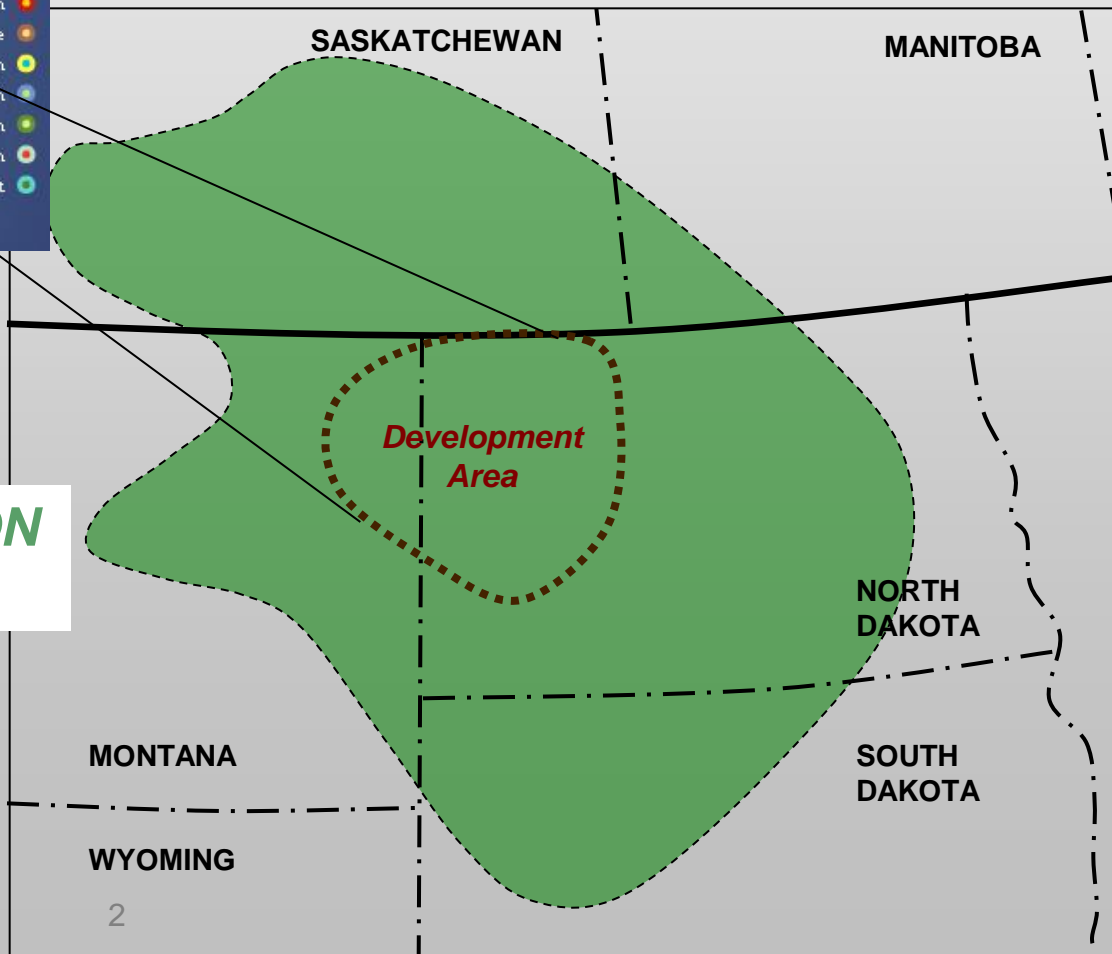
January 19, 2011

Ross Lubbers and Cole Walton

Locator Map



**WILLISTON
BASIN**



Bakken 2010 Program

450,000 net acres

Primary Reservoir Objectives

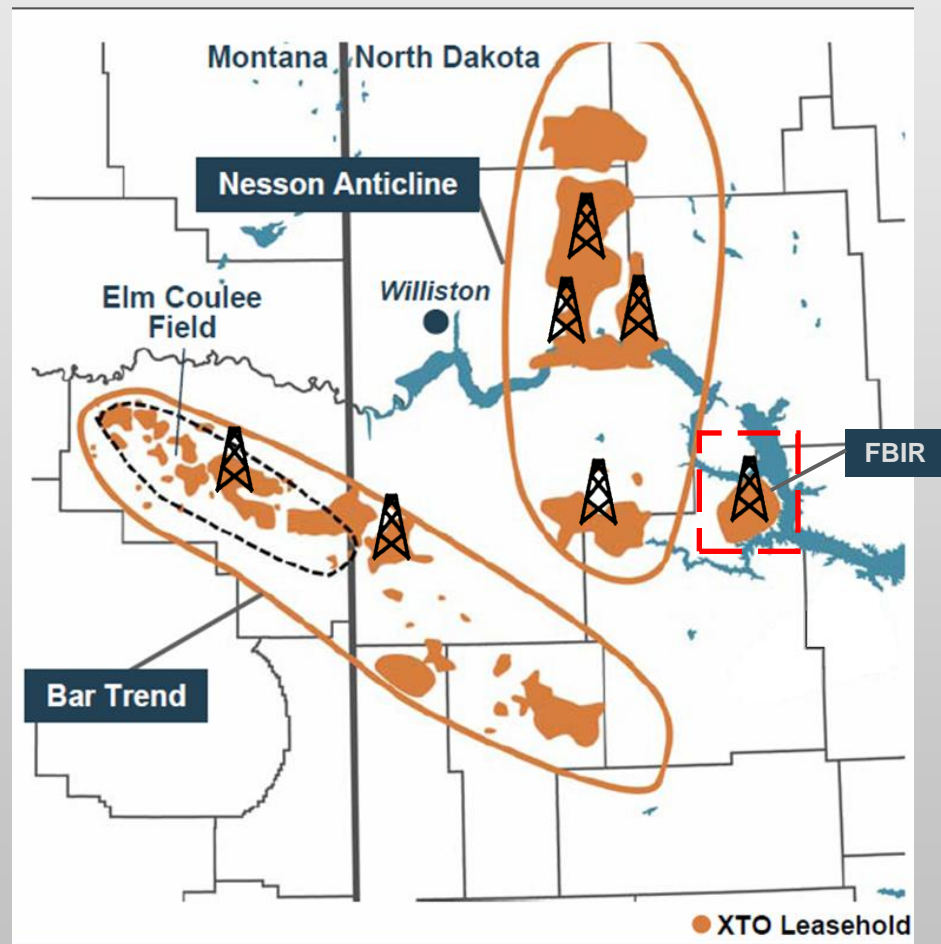
Middle Bakken & Three Forks

5 – 6 operated rigs

55 horizontal wells

\$4.3 – \$7.2MM/well (gross)

400 – 600 MBOE/well

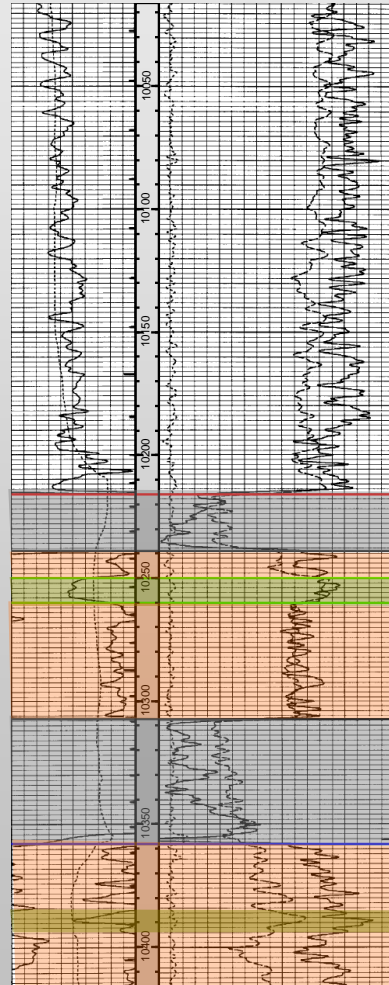


Pay !

Type Log Basin Center

**Target TVD:
9,200 – 10,600'**

**Pore Pressures
9.5 - 14.5 ppg**



LOGDGEPOLE

U. BAKKEN SHALE

Target: 4 – 10 ft (typical)

MIDDLE BAKKEN

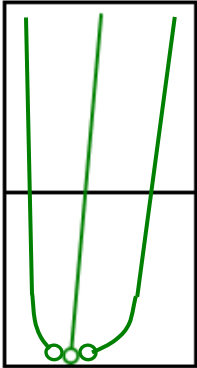
L. BAKKEN SHALE

THREE FORKS

Target: 3 – 8 ft (typical)

Pay porosities average <8% and permeabilities from .05 to .001 millidarcies

Current Config - Long Single Lateral



1280 Acre
Spacing Unit

Plan View
Configuration

- **Initial well in center of unit**
- **Fulfill lease obligations**
- **Prove up acreage**
- **Infill at later date**

Goals:
Drill Fast and Safe
(Minimize NPT)
Provide Reliable Wellbore
for the Long Hall

How do we get there?

Surface Hole

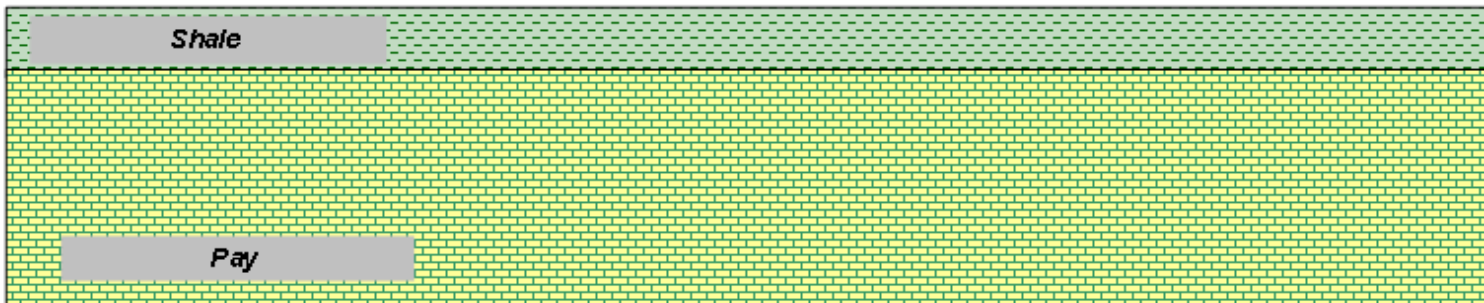
13-1/2" tri-cone
FW w/ sweeps
Set 9-5/8" @ 1,200 – 2,100'

Issues

Hole Cleaning
Lost Circulation
During Cementing

Responses

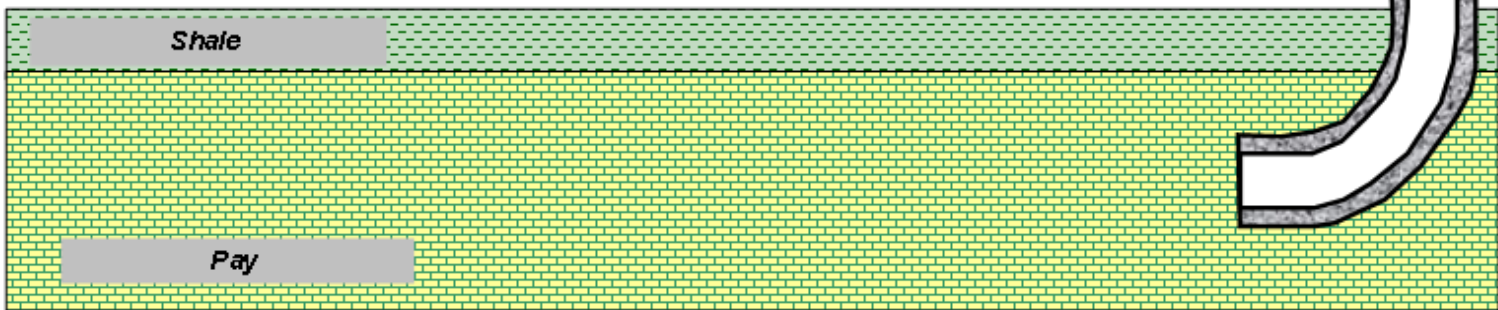
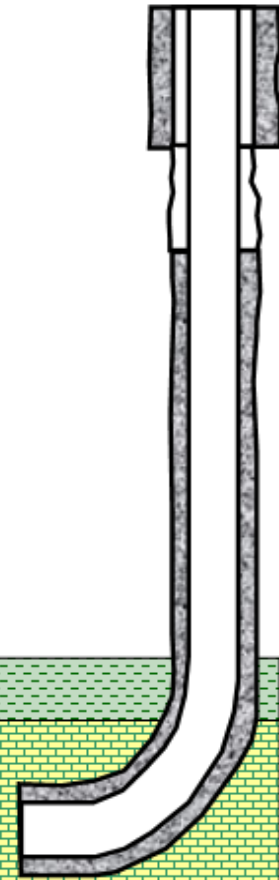
Pump Rate
Top Job
Cement Squeeze



Intermediate Hole

8-3/4" PDC
OBM
 KOP 600-700' above pay
 12 - 14 deg/100 build rate
 7" Set in Producing Horizon
 9,500 – 11,000' MD
 (9,200 – 10,600' TVD)

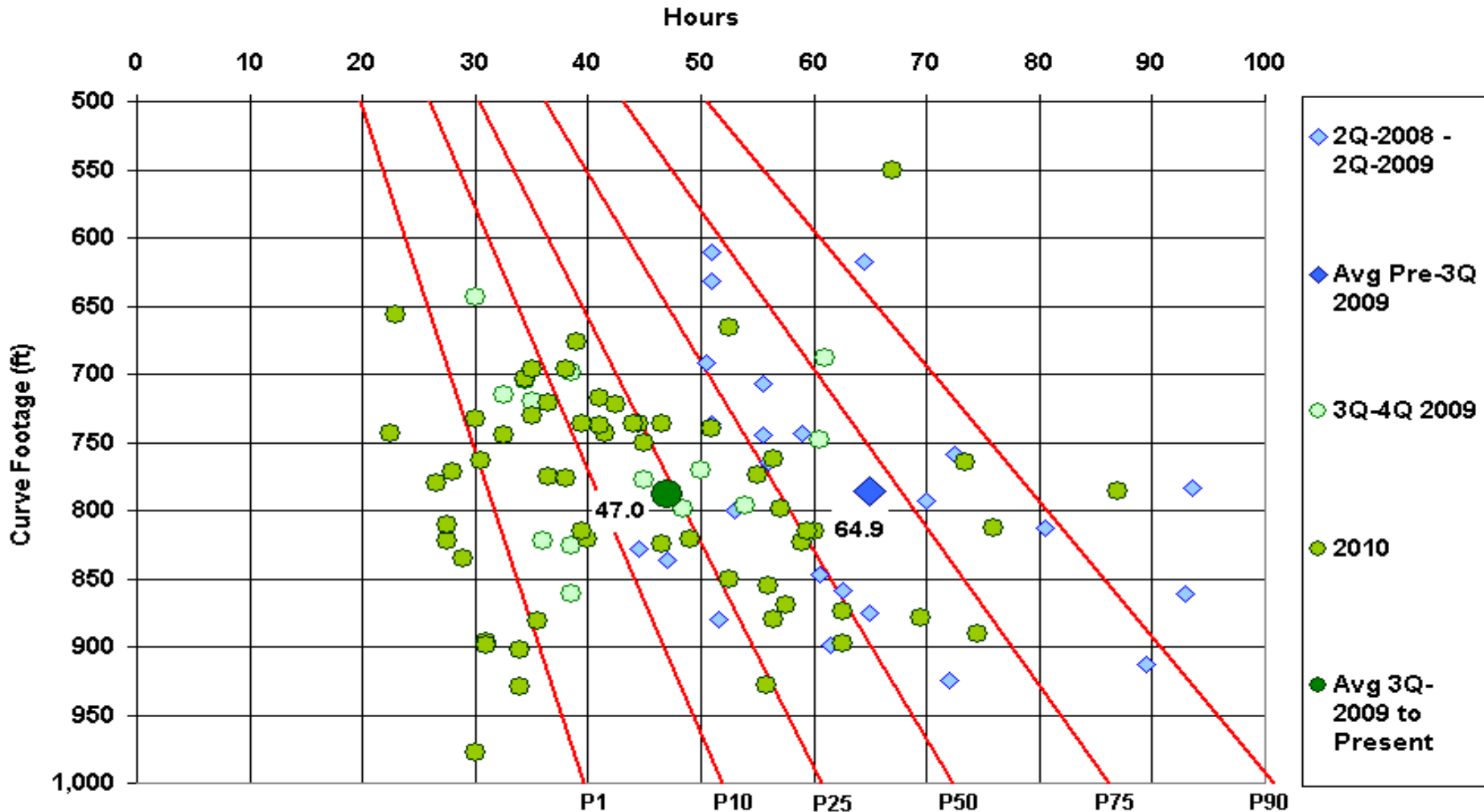
Issues	Responses
Hole Cleaning	Pump Rate
Shallow Deviation	Dir Drill Vertical
N2 Kicks	MW > 9.5 ppg
Reactive Shales	OBM
PDC Bit Damage	Slower RPM's at Bit Driller Experience
Salt Zones	Wiper Trips / FW Sweeps 7" 32# HC L-80 or P-110 Gauge Hole & Good Cement Job
Lost Circulation	Max MW 11.5 ppg Avoid Swab / Surge / Excessive ECD



Curve Performance



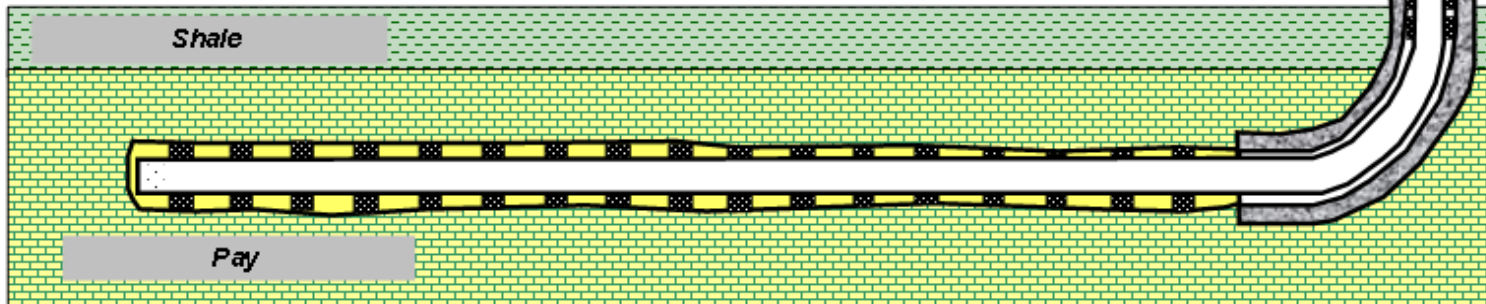
ND Bakken Total Curve Build Time



Production Hole

6" PDC
Brine Water (9.5 – 10.5 ppg)
TD 19,500 – 23,800' (MD)
(9,500 – 10,400 lateral)
4-1/2" Liner (KOP to TD)
with 18 – 24 Swell Packers,
Liner Hanger Packer, &
Pre-perf'd Toe Section

Issues	Responses
Hole Cleaning	Pump Rate
Staying in Zone	Geo-Steer Using MWD - GR & Mudlogger Experience
High Pressure with Perm	OBM (> 12 ppg)
MWD & Motor Life	Slower RPM Motor Real Time Vibration Monitoring
Torque & Drag (last 1/3 of hole)	Lubricants



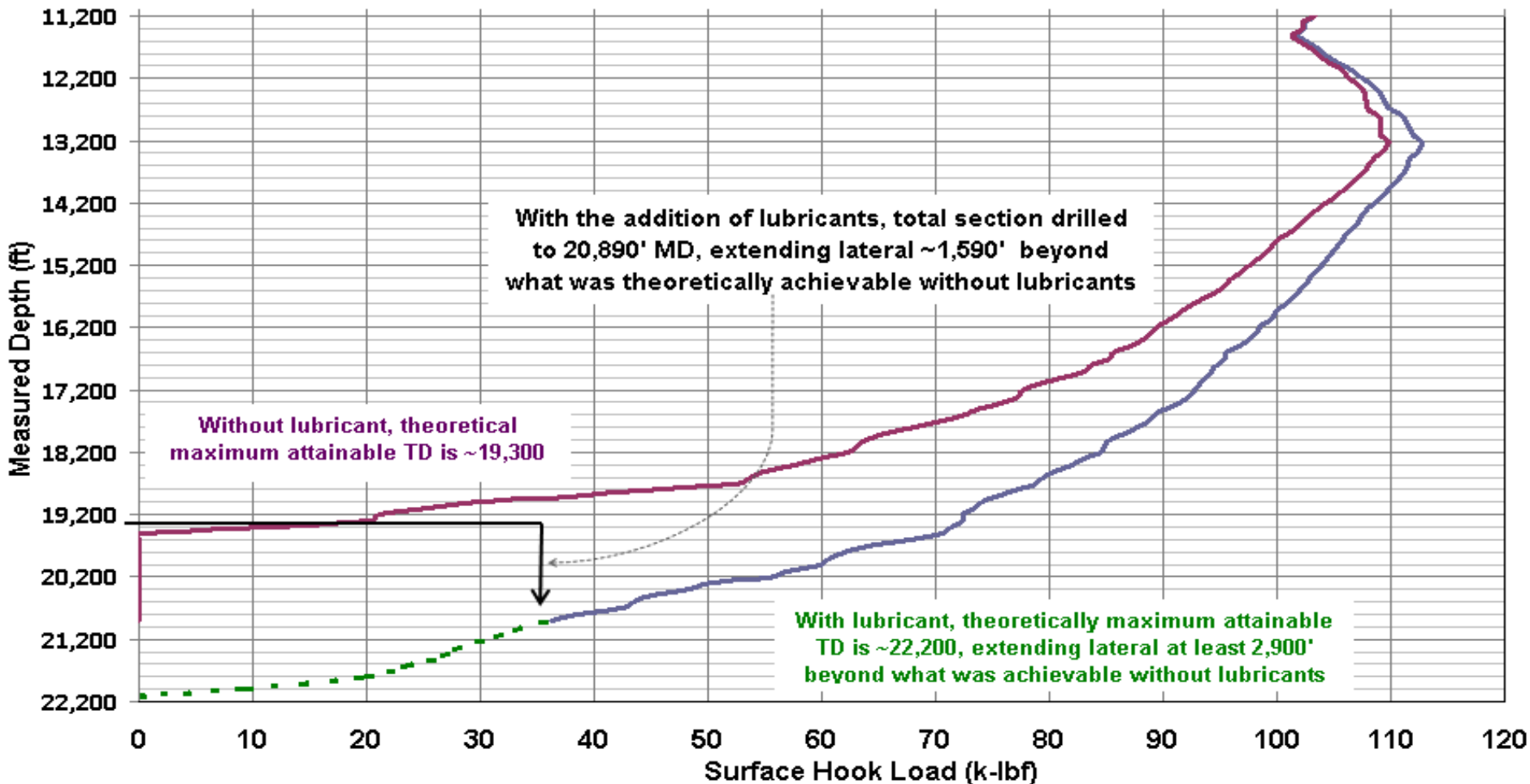
Brine Emulsion



Torque and Drag Issues

Dakota Fed 6" Hole Lateral - Modeled Hookload at Depth as Indicated at Surface - Steering w/ Bent Motor

- 30K WOB - No Rotary RPM - With Lubricant
- 30K WOB - No Rotary RPM - No Lubricant
- - - With Lubricant - Extended to Zero Hookload

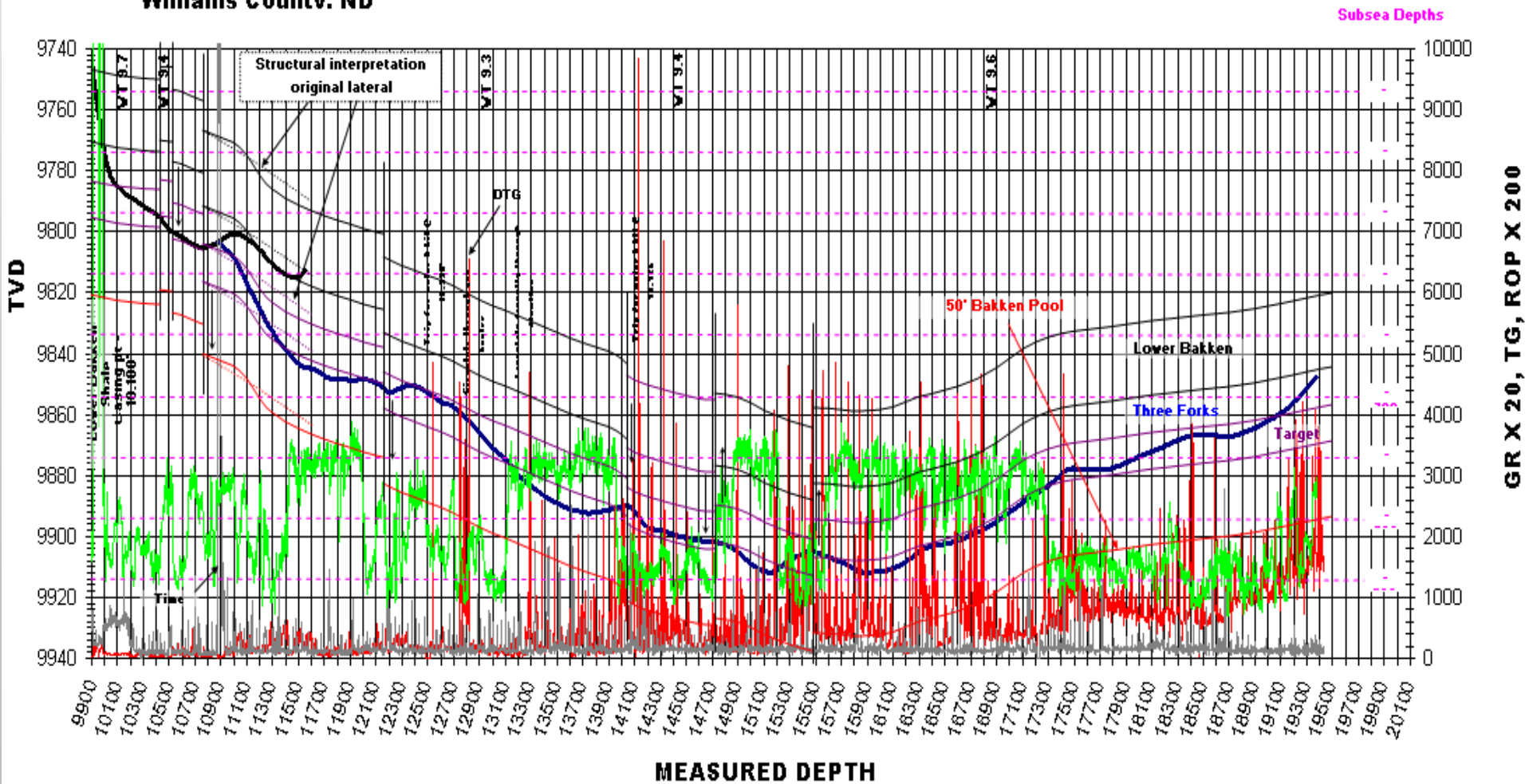
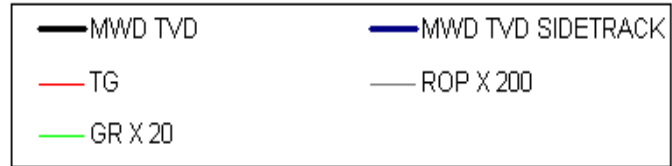


Geosteering



XTO Energy, Inc.
Smouse 31X-28
NE NW 28-T155N-R96W
Williams Countv. ND

Lateral Section Sidetrack #1



Topography / Regulatory / Land Owner



Off-Unit Surface Locations

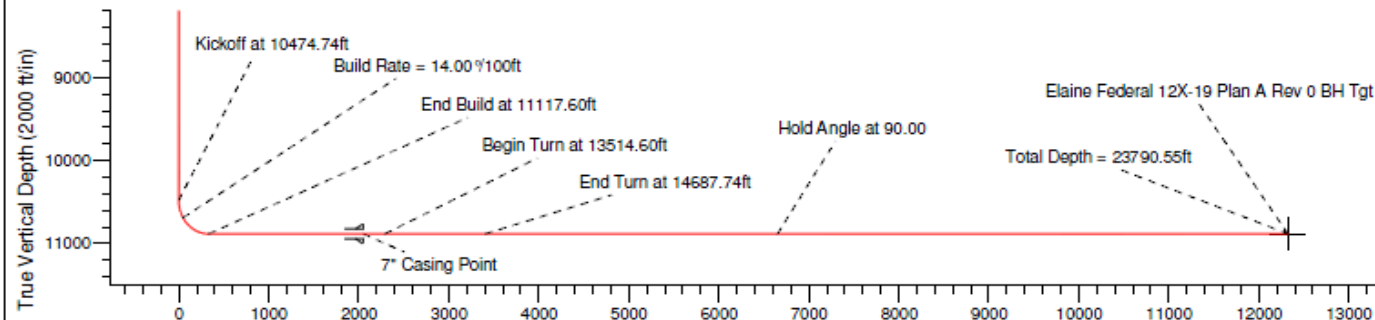
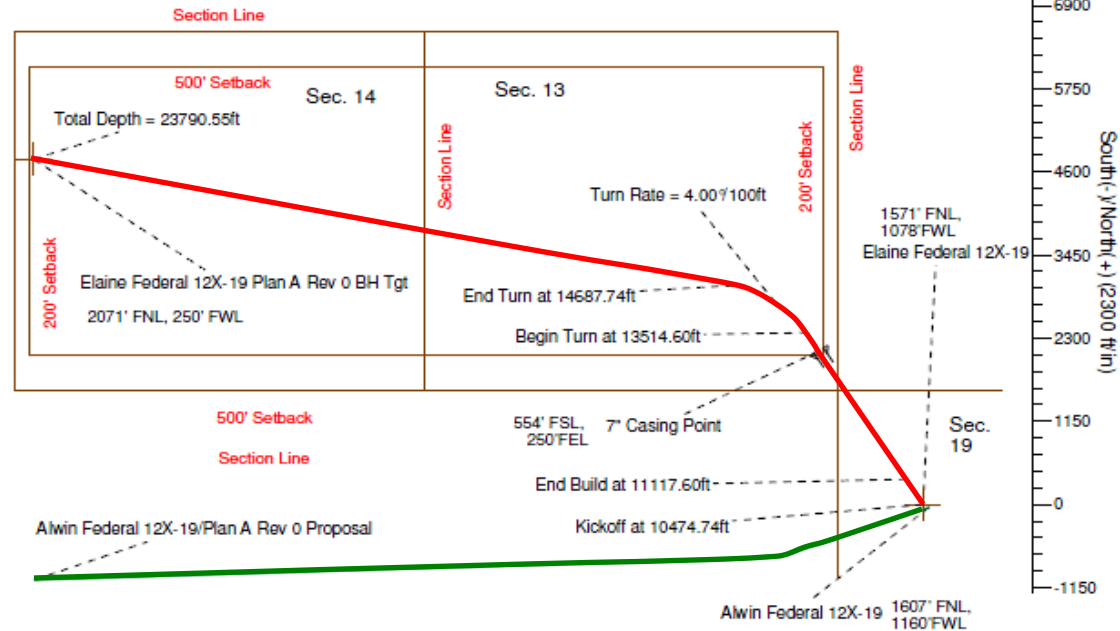
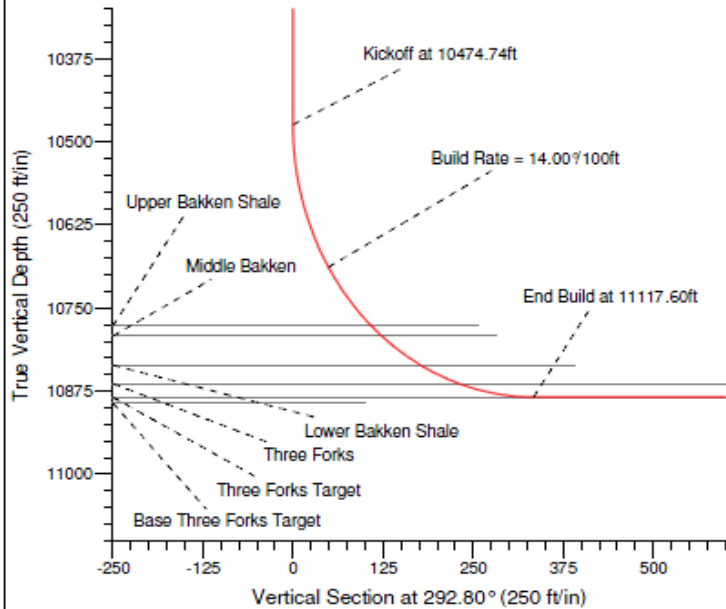


SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N-S	+E-W	DLeg	TFace	VSec	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	10474.74	0.00	0.00	10474.74	0.00	0.00	0.00	0.00	0.00	
3	11117.60	90.00	328.00	10884.00	347.07	-216.87	14.00	328.00	334.42	
4	13514.60	90.00	328.00	10884.00	2379.84	-1487.09	0.00	0.00	2293.08	
5	14687.74	90.00	281.07	10884.00	3026.51	-2426.69	4.00	-90.00	3409.86	
6	23790.55	90.00	281.07	10884.00	4775.00	-11360.00	0.00	0.00	12322.75	Elaine Federal 12X-19 Plan A Rev 0 BH Tgt

West(-)/East(+) (2300 ft/in)

-6900	-5750	-4600	-3450	-2300	-1150	0	1150
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WELL DETAILS: Elaine Federal 12X-19			
Ground Level:	2071.00		
Northing	Easting	Latitude	Longitude
724744.41	1360157.26	47° 37' 39.600 N	102° 58' 2.460 W

Plan: Plan A Rev 0 Proposal (Elaine Federal 12X-19/Plan A Rev 0)

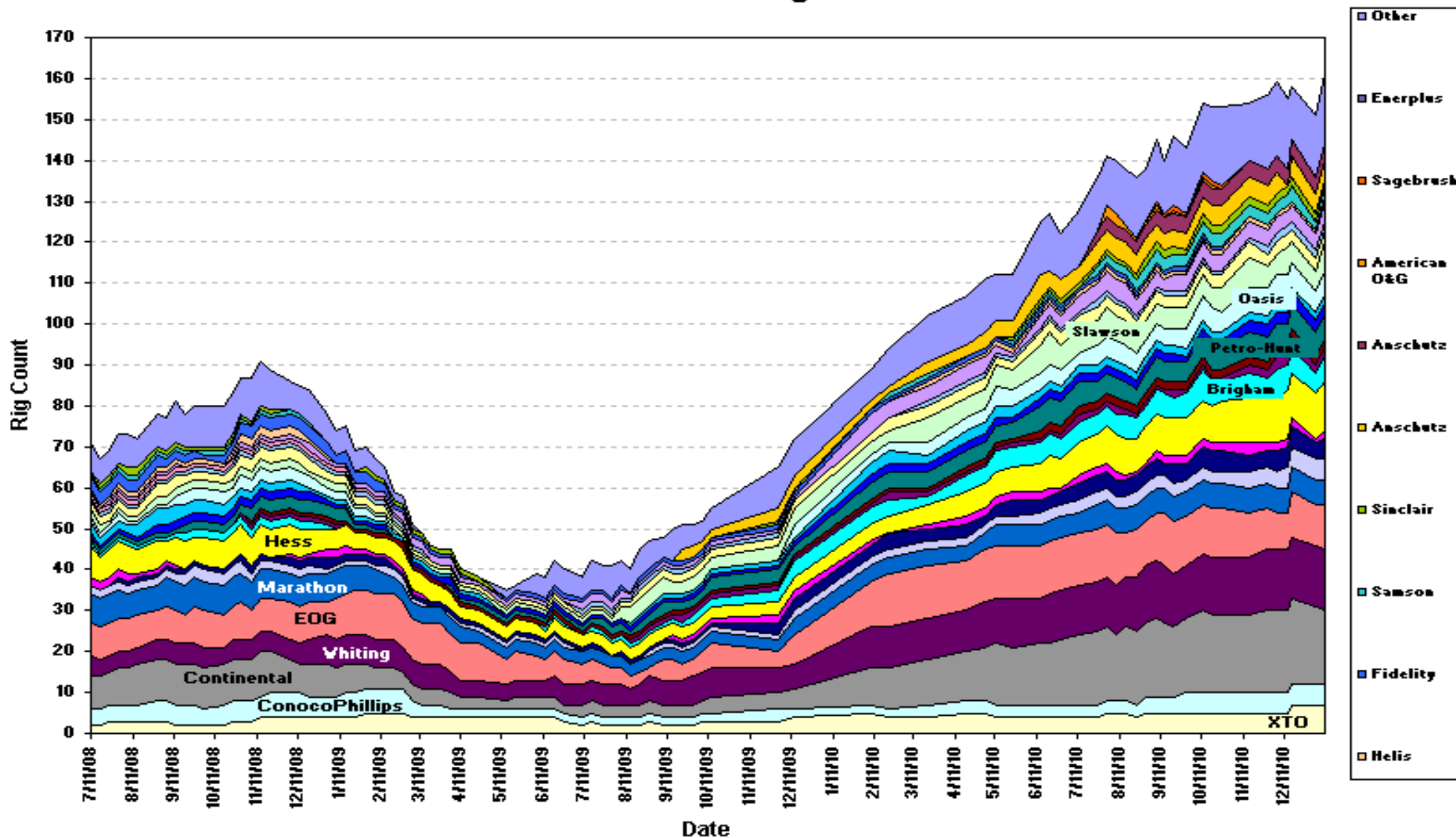
Created By: Isaiah Rodolph	Date: 10/11/2010
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Reviewed: _____	Date: _____

Drilling Challenges

- **High Pressure with Conductivity**
 - Drilling Brine Contamination
 - OBM – Loss of Penetration Rate
- **Geosteering In Zone**
- **Downhole Tool Reliability**
- **Topography / Regulatory Agencies / Land Owners**
 - Longer Laterals
 - Pad Drilling
- **Skilled People & Costs!**

Williston Basin Activity Level

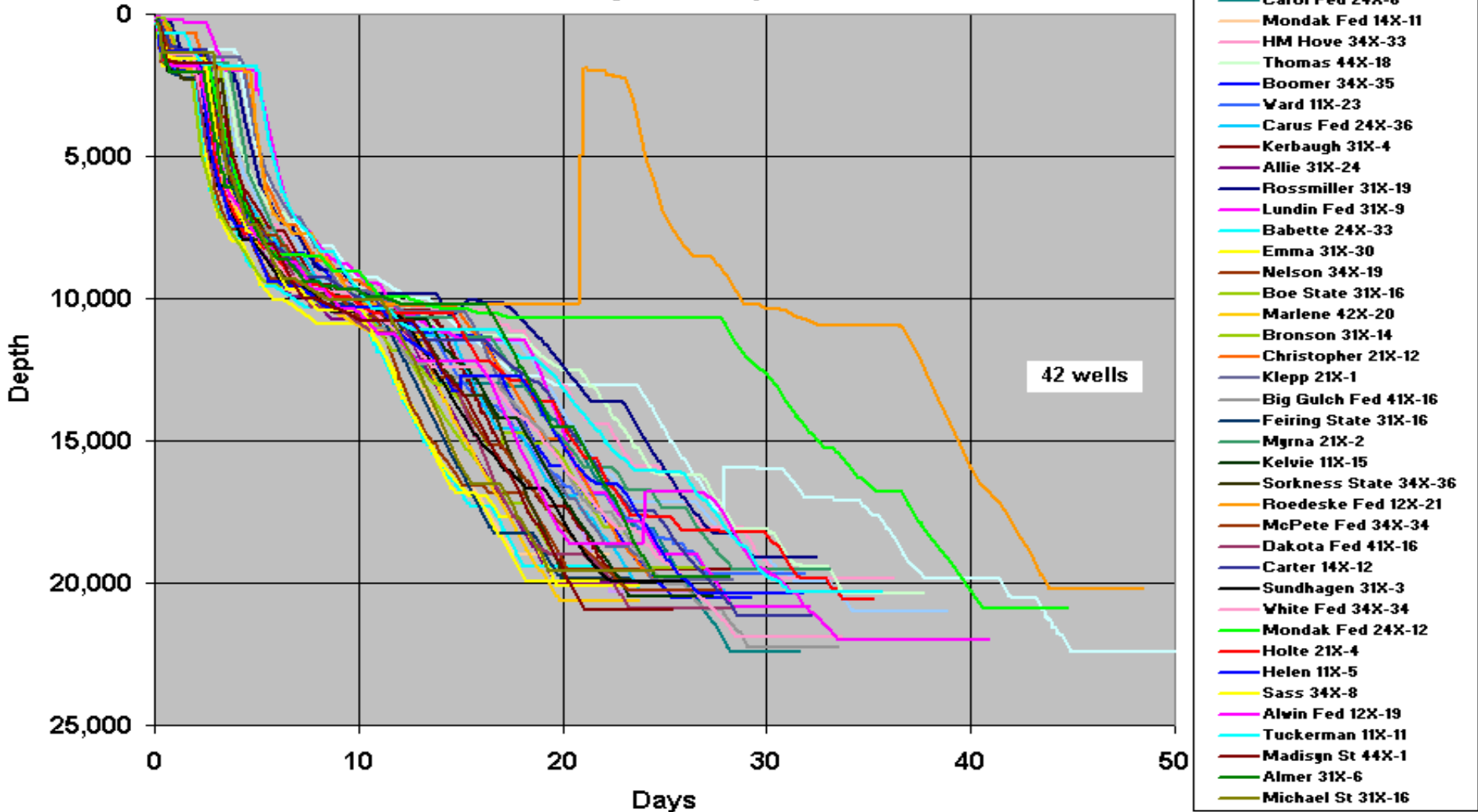
North Dakota Rig Count



Days vs. Depth

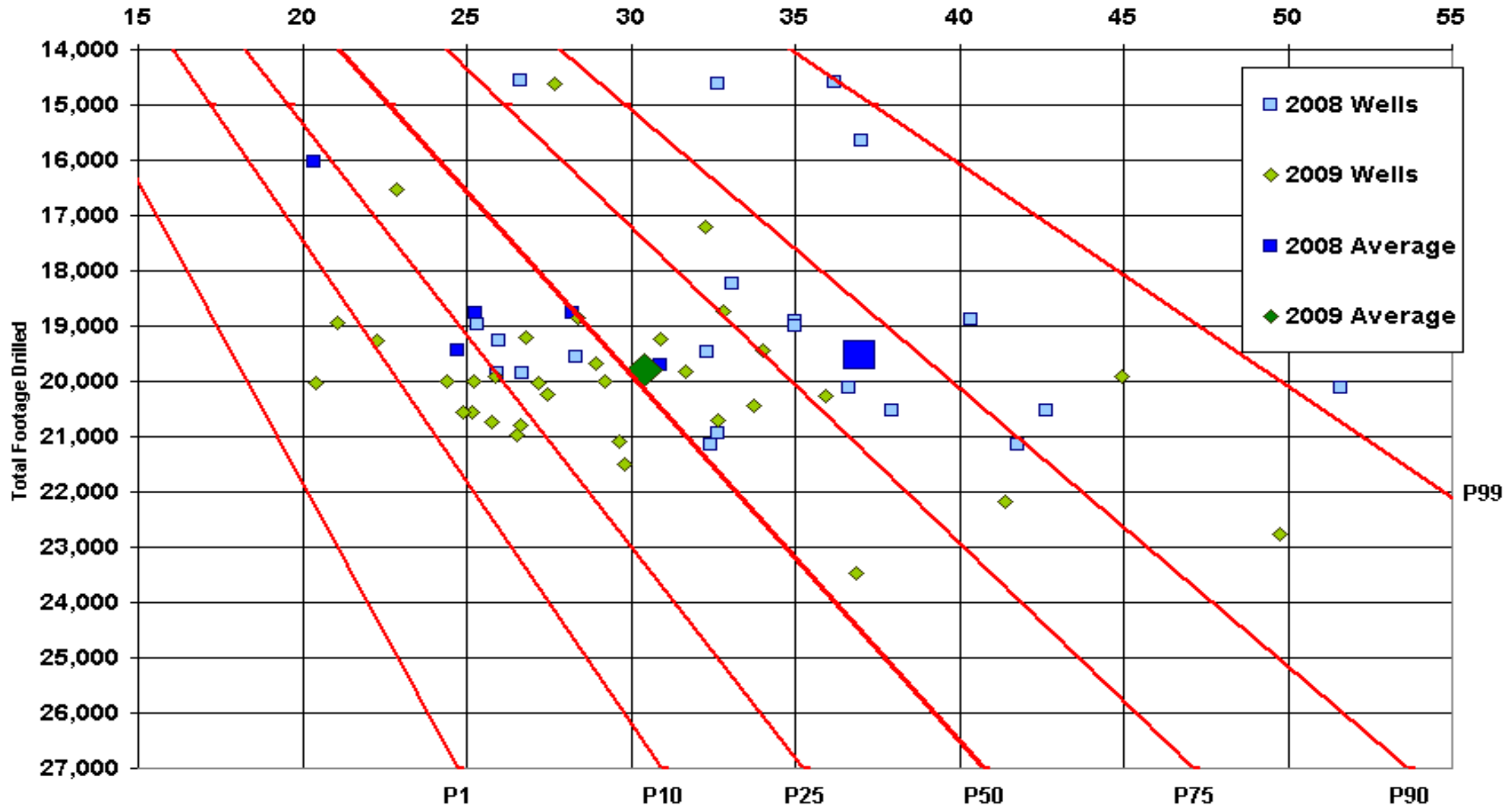


**North Dakota Bakken and Three Forks
2010 Days vs. Depth**



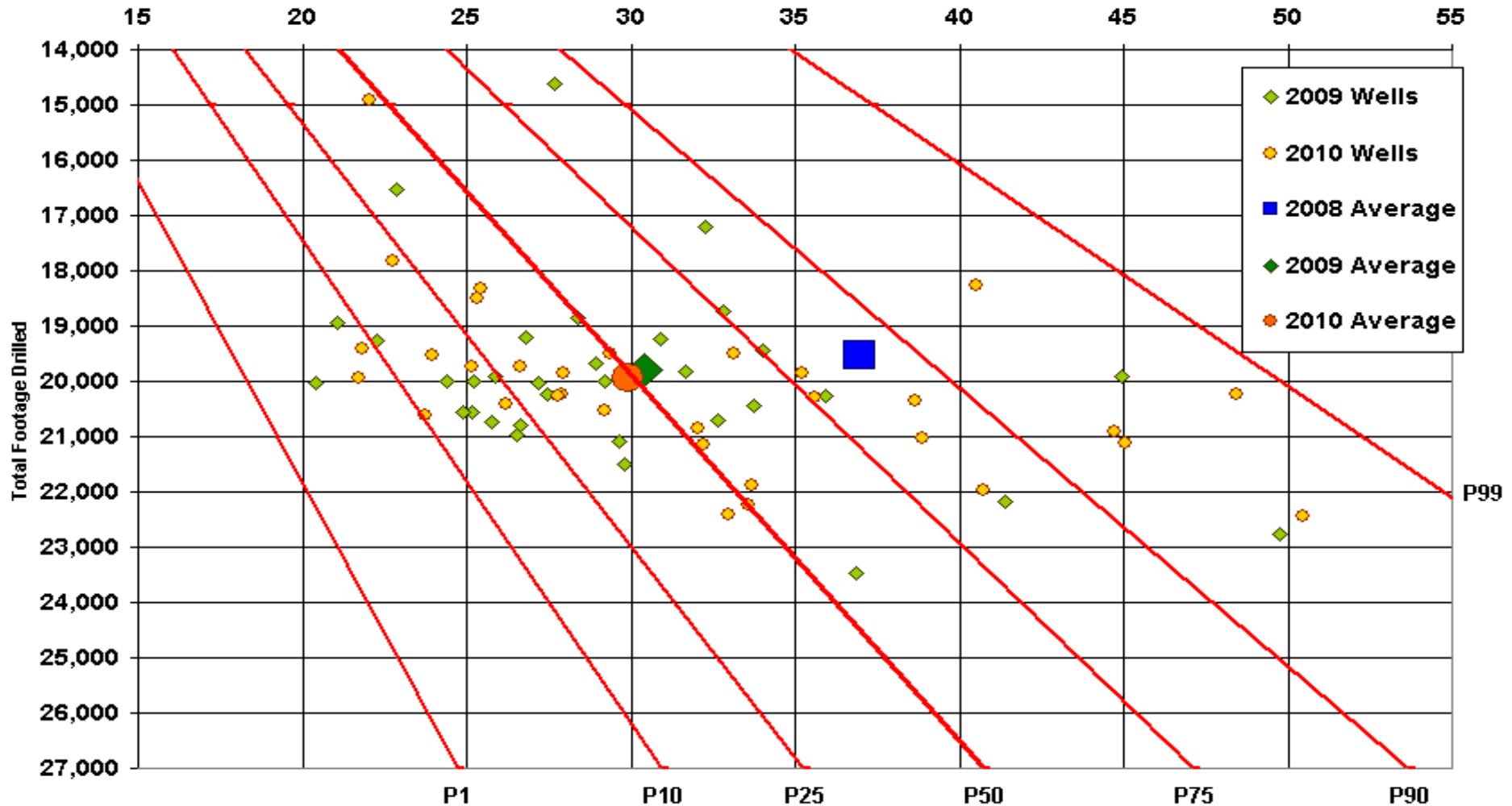
2008 – 2009 Days vs. Depth

Bakken 2008 - 2009
 Probability Based on 2009 Data
 Spud-Release



2009 – 2010 Days vs. Depth

Bakken 2009 - 2010
 Probability Based on 2009 Data
 Spud-Release



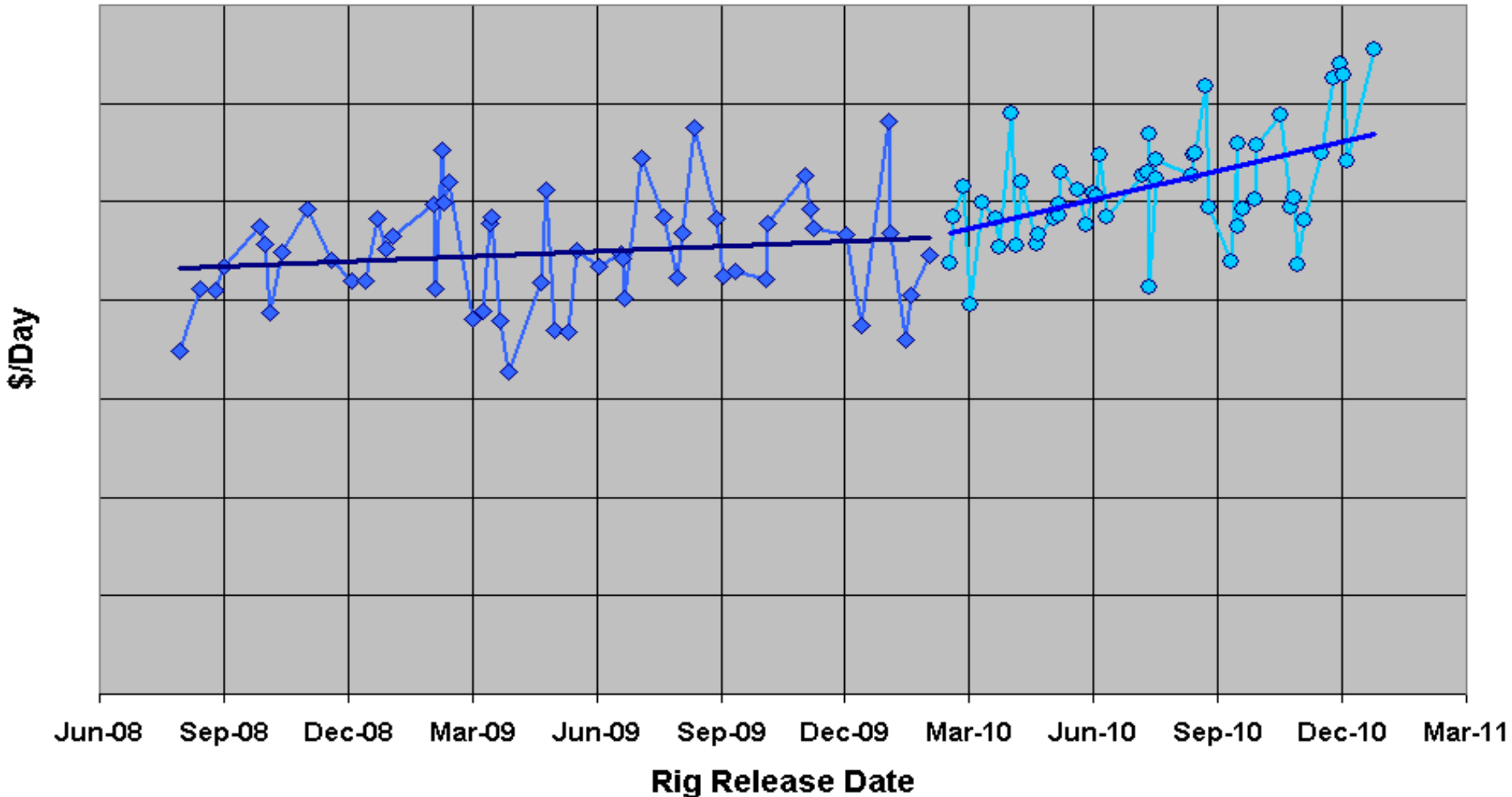
Cost Pressures



Drilling \$/Day to Rig Release

◆ Majority of Well Costs Incurred Before 2010

● Majority of Costs Incurred in 2010



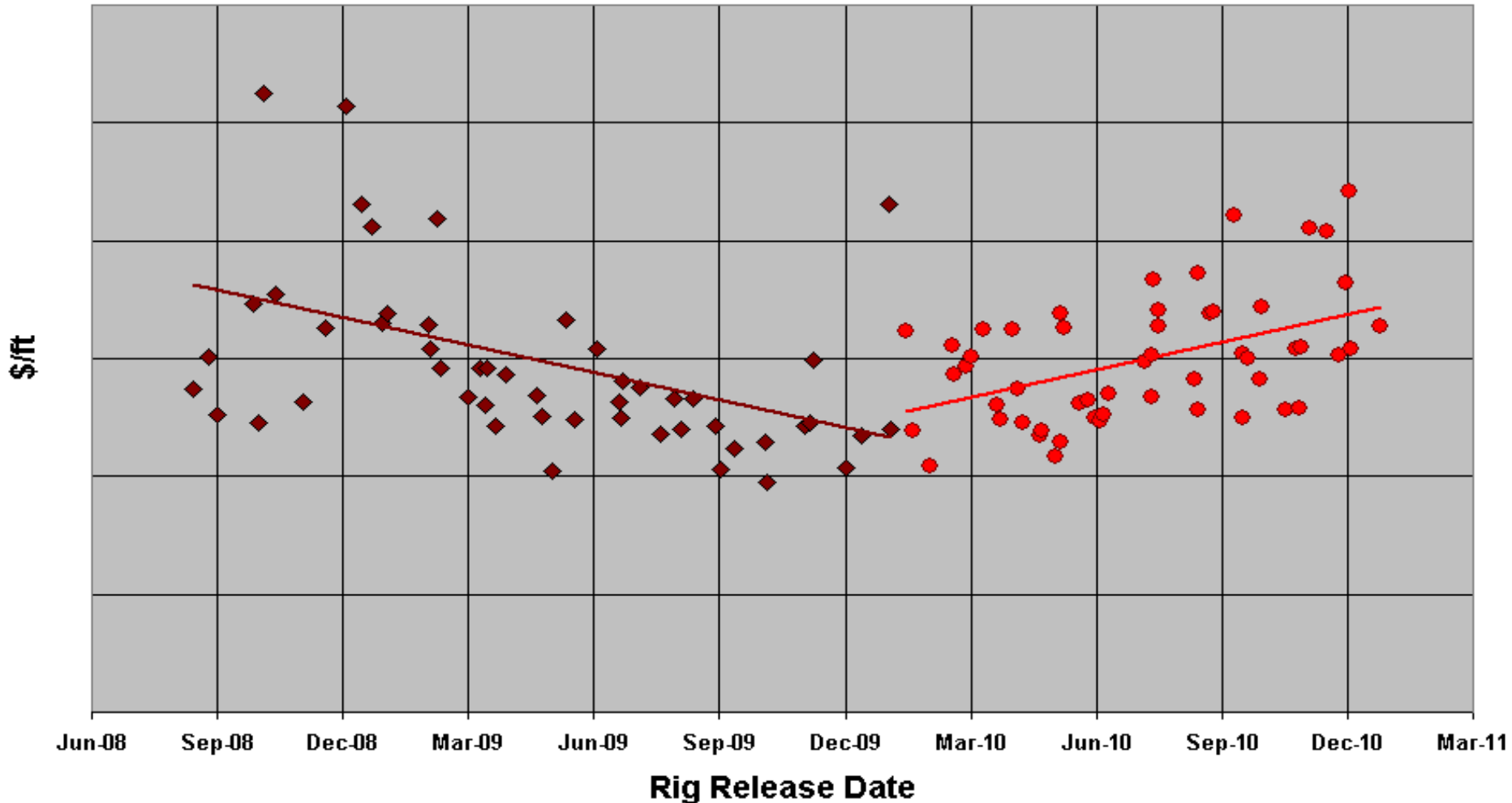
Cost Pressures



Drilling \$/ft to Rig Release

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Questions?

