Niobrara Resource Play

Niobrara, Colorado/Wyoming

January 18th, 2012

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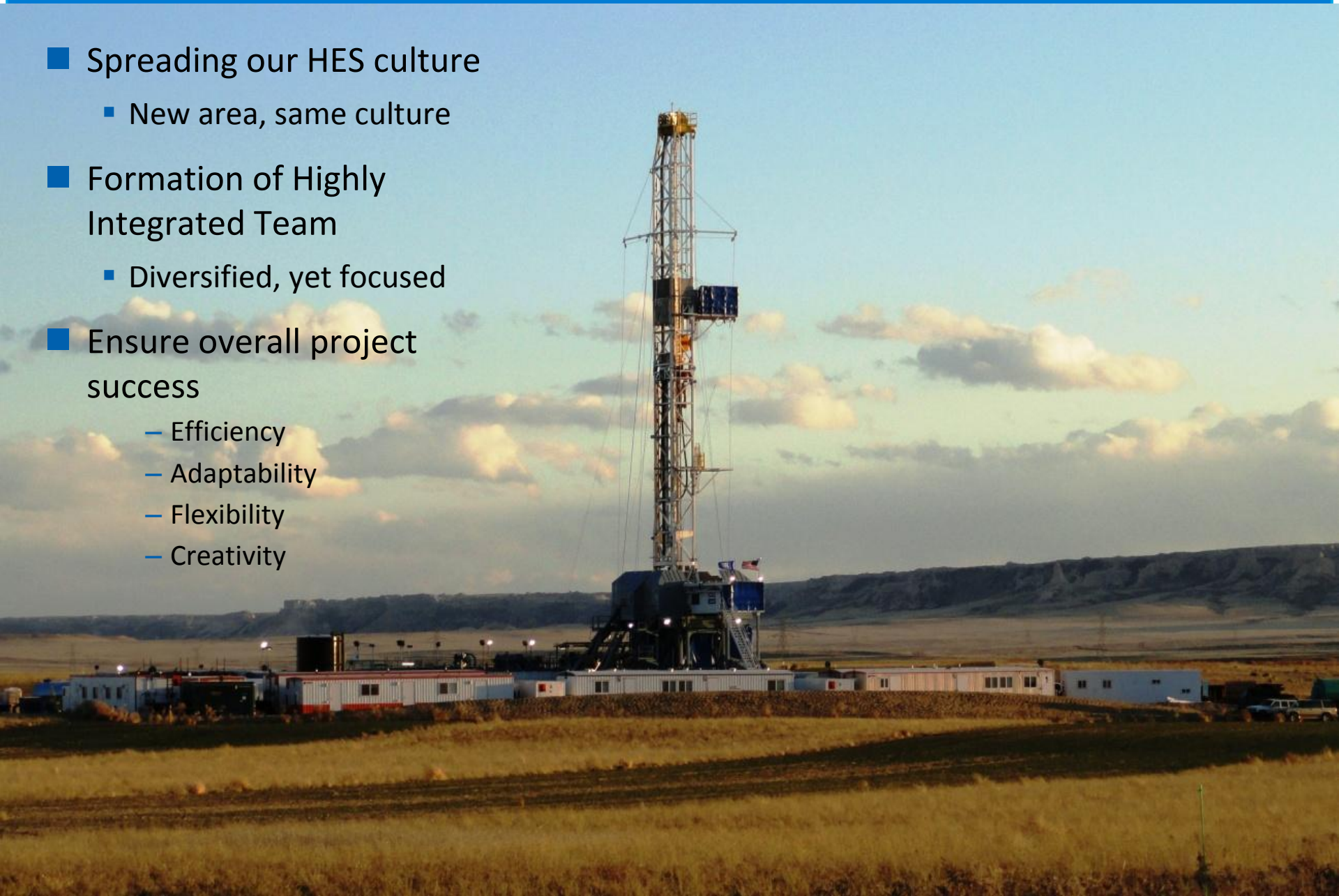
General Outline

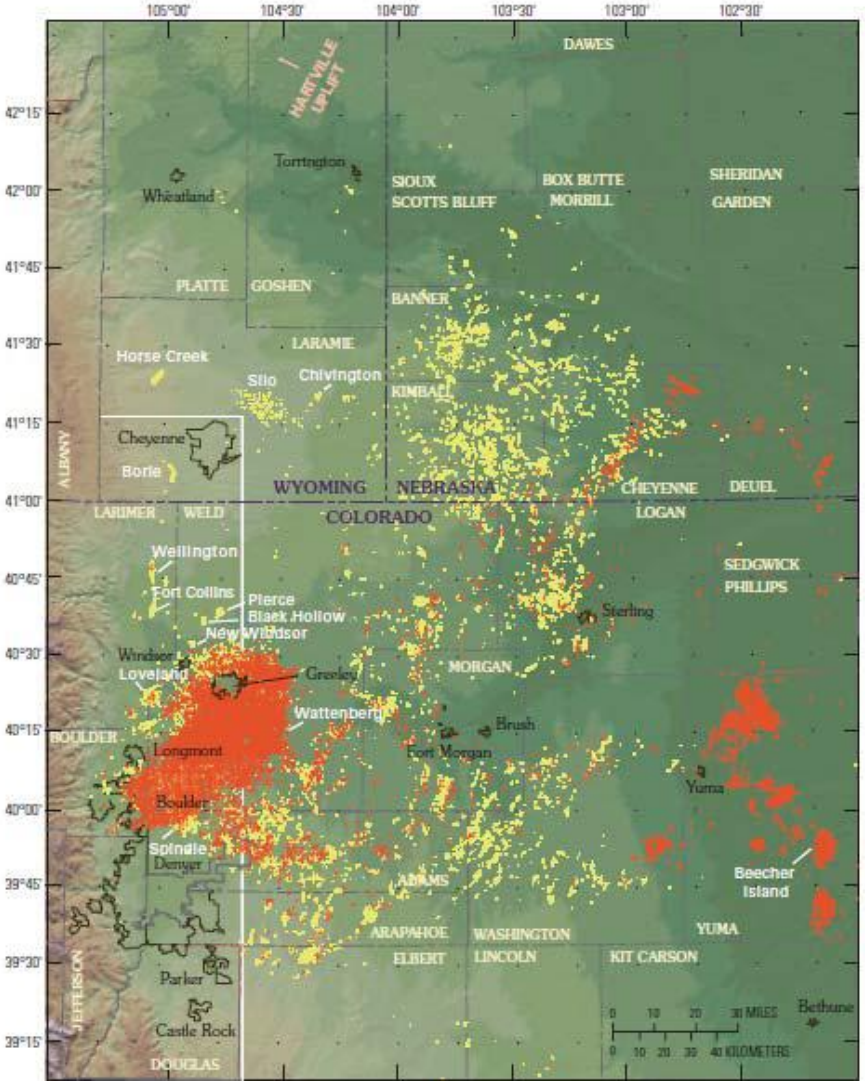
- Introduction
- Beginning the Project
  - Formation of the team
  - Monitor wells and data acquisition
  - Early well design
  - First horizontal
- Lessons Learned
  - Wellbore stability issues
  - Well construction and design
- Current Drilling Techniques
  - BHA design
  - Directional planning/considerations
  - Geosteering
- Future Plans
  - Drilling/Completion optimization

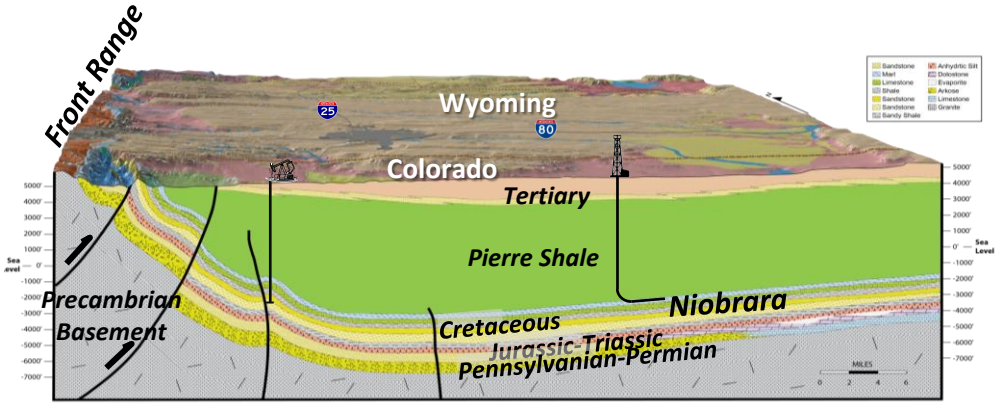
Beginning the Project

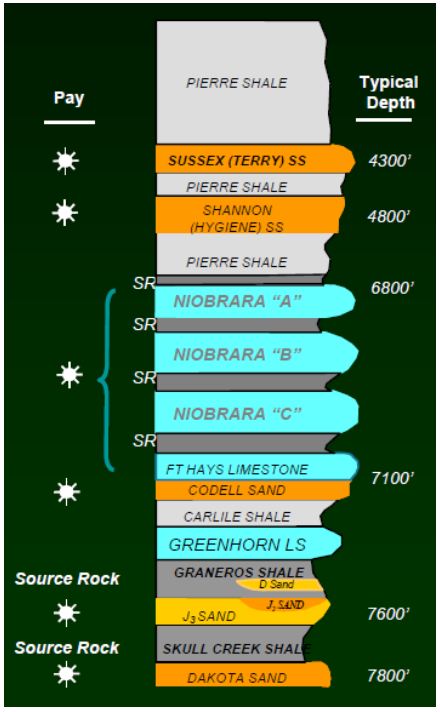
- Spreading our HES culture
  - New area, same culture
- Formation of Highly Integrated Team
  - Diversified, yet focused
- Ensure overall project success
  - Efficiency
  - Adaptability
  - Flexibility
  - Creativity



General DJ Basin Information







- Ranges from 275 to 400 feet thick in the DJ Basin
- Thickness increases to the west
- Interbedded brittle chalk and ductile shale
- Three main carbonate-rich benches 10 to 25 feet per bench, total thickness up to 70 feet thick
- 5 to 12% porosity
- Small faults are common in Niobrara
- Oil is self-sourced from interbedded organic-rich shales

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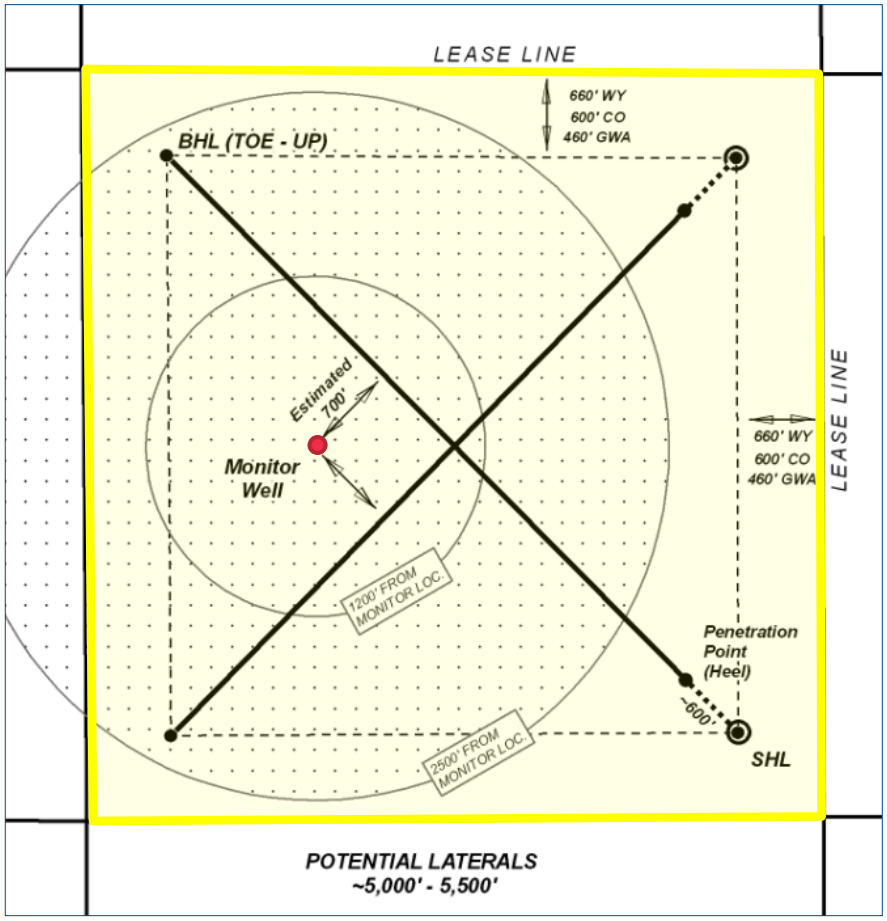
Evaluating the Niobrara

- Monitor/Test Wells
- Data Acquisition
  - Drilling data
  - Geological samples
  - Extensive wireline logging
  - Reservoir data
  - Frac Monitoring/Evaluation
  - Vertical Seismic Profiles
- Permit two possible horizontals, choose one.
- Establish development areas/techniques



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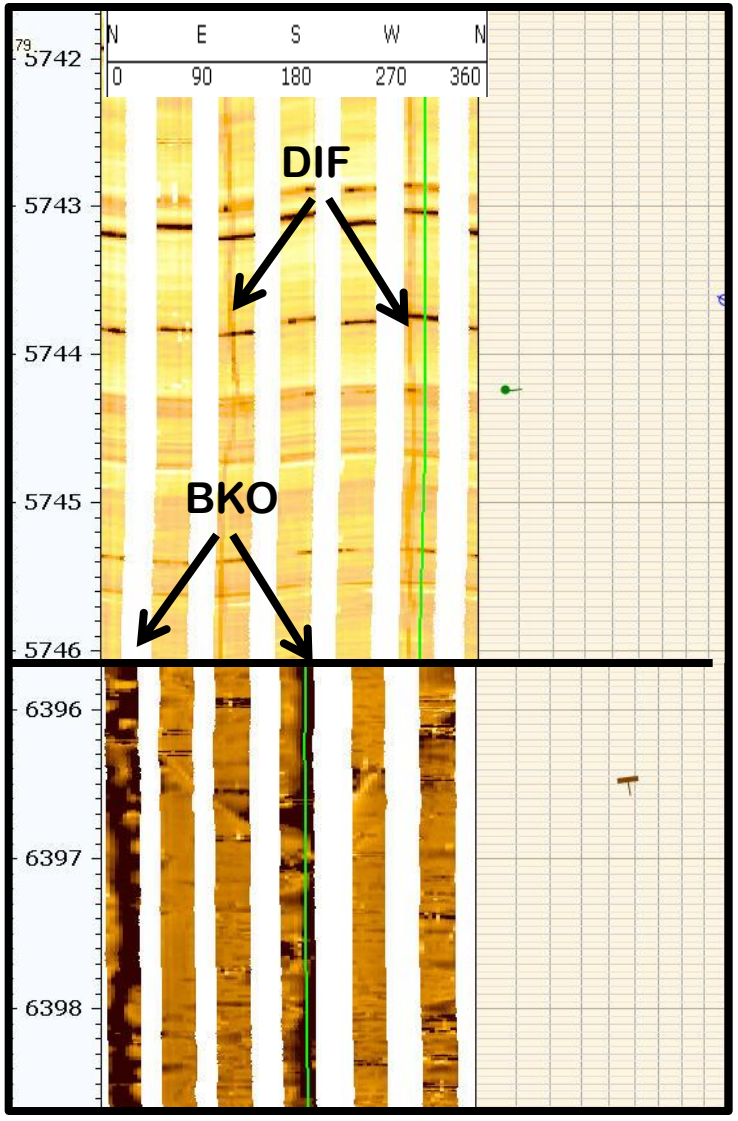
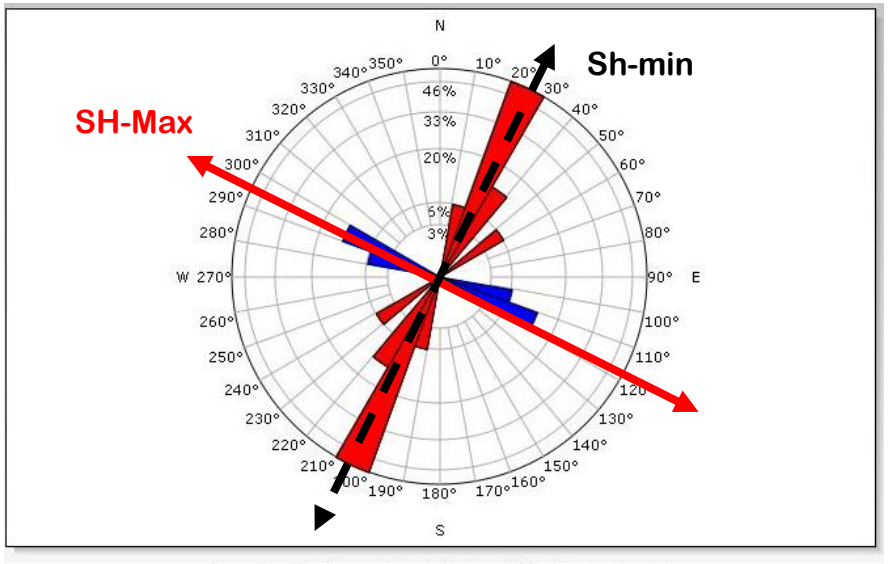
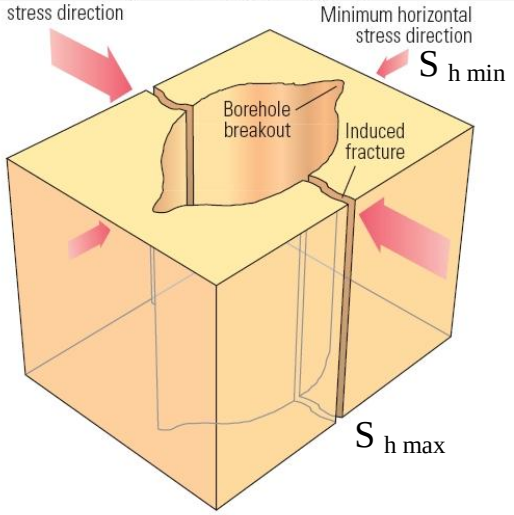
Sh-max/Sh-min orientation and lateral placement

Drill the lateral as perpendicular to SHmax as possible (parallel with Sh-min) in order to maximize the hydraulic fracture stimulation.







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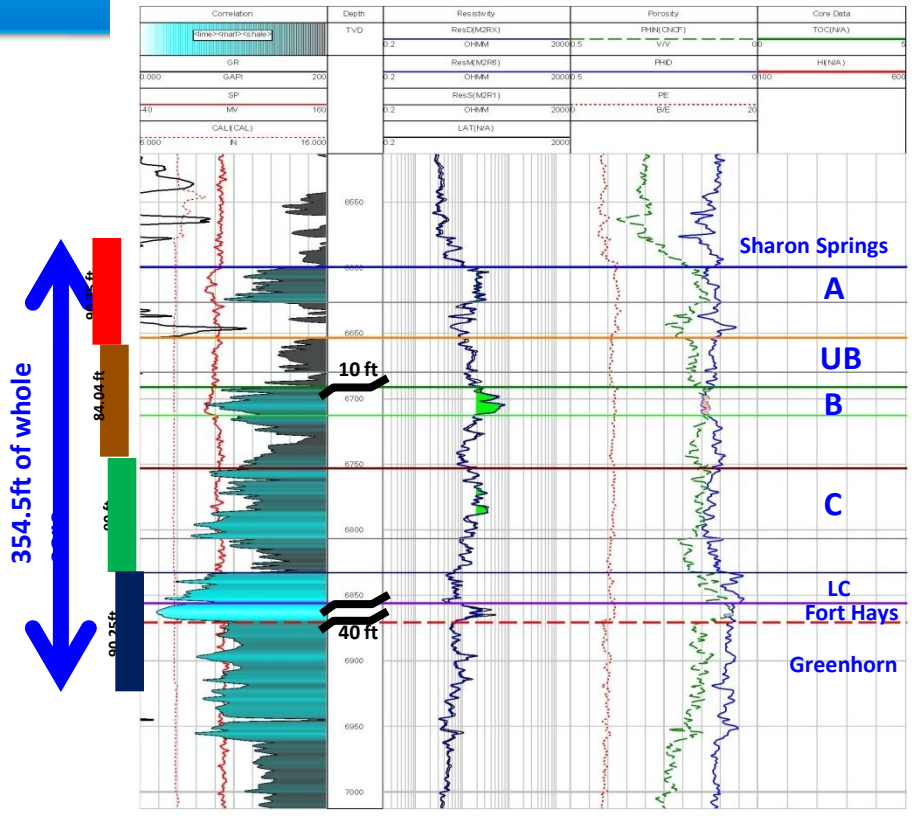
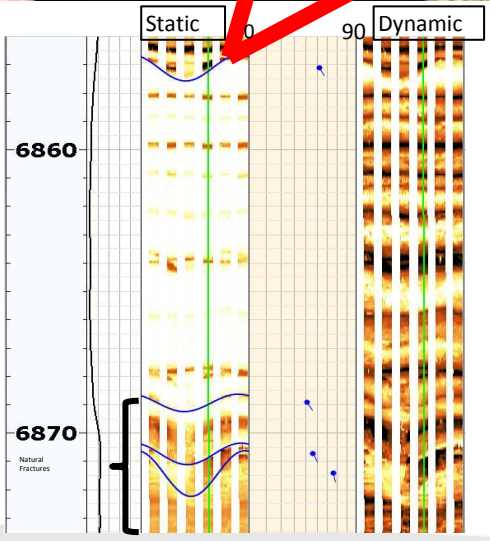
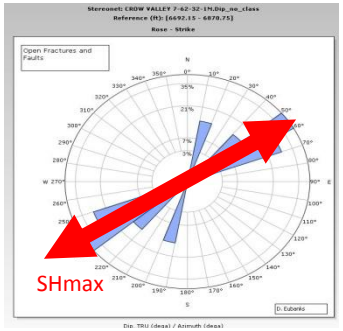
Coring Operations



Oil seeping out from Niobrara chalks and marls

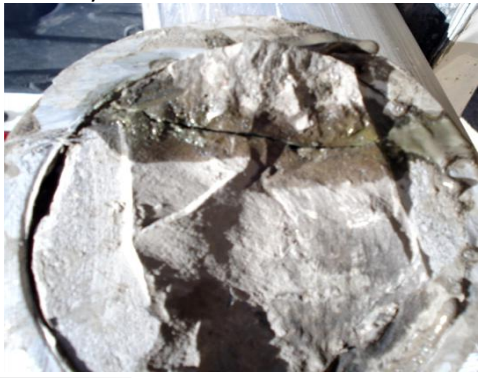
Fault





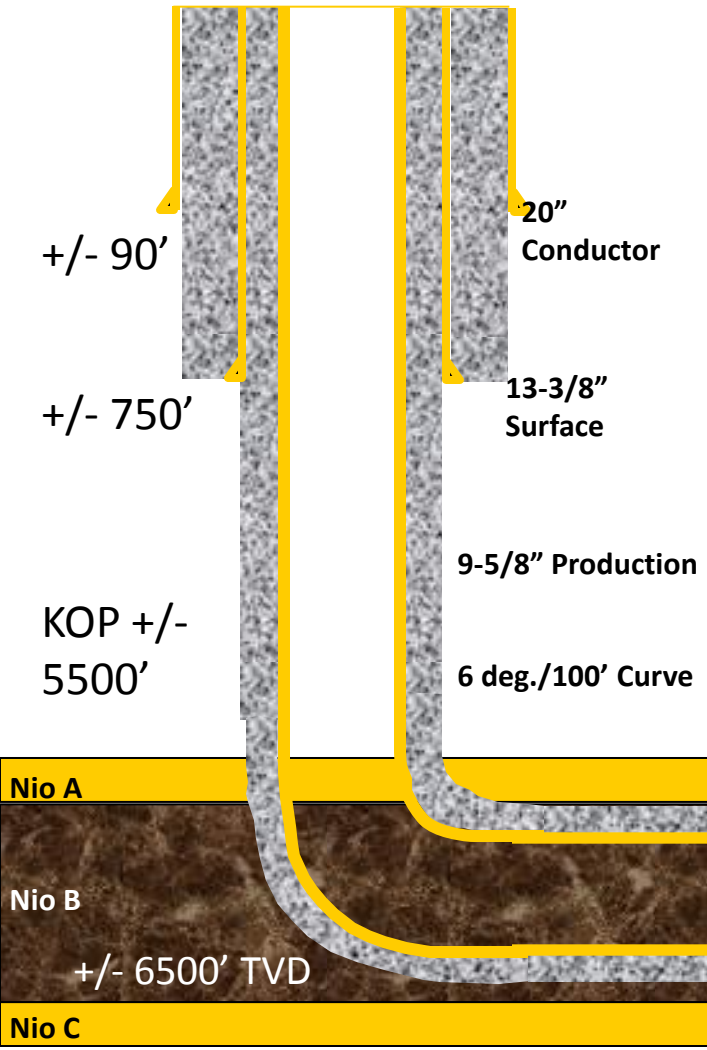
Fault and N. Fractures showing N 58 E strike directions in line with the present day stress Field.

Natural fracture stained with oil (core depth at 6873 ft)



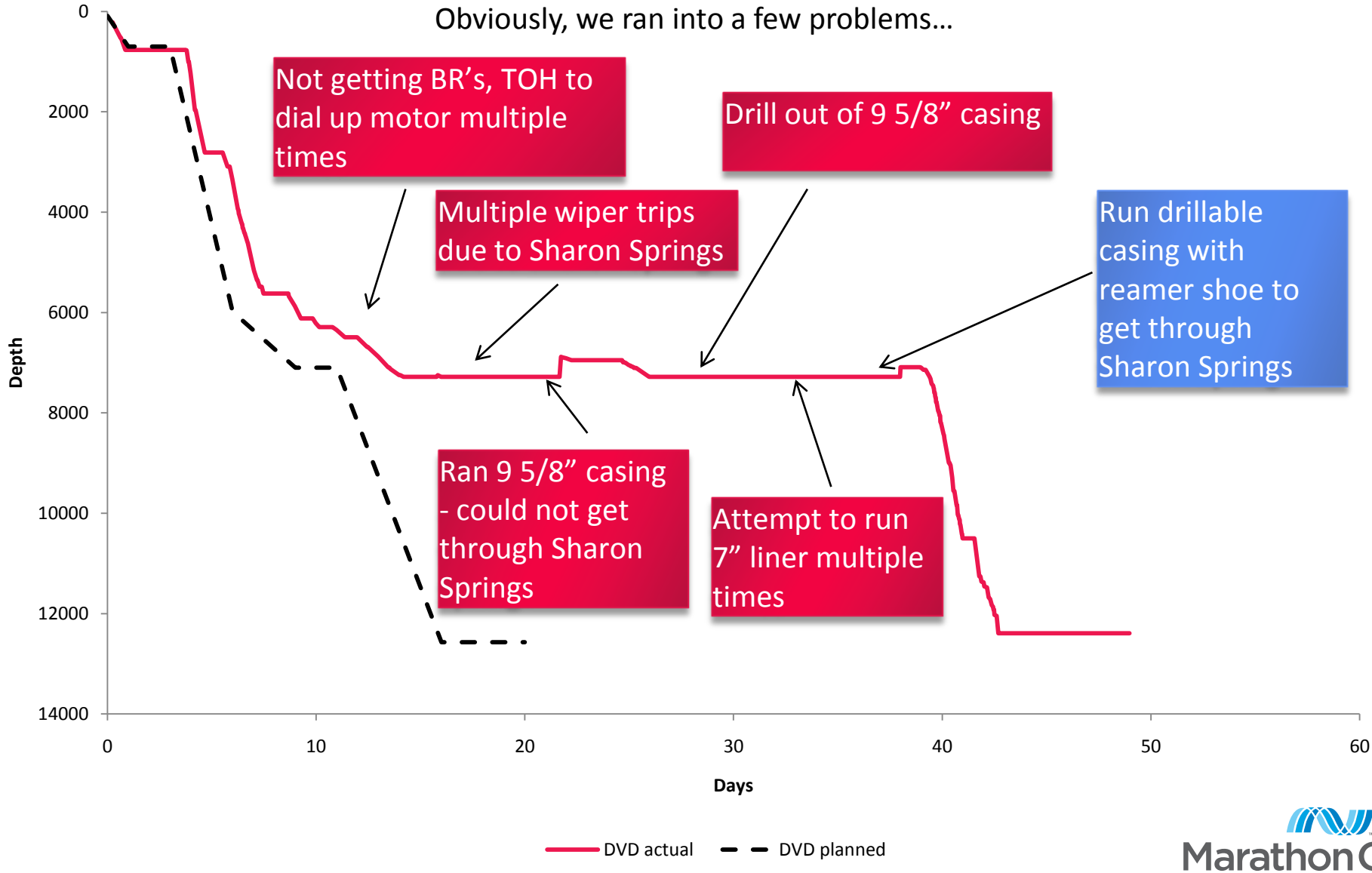
Greenhorn (calcite –rich siltstone showing *Inoceramus* traces)

Early Horizontal Well Design



- Set 20" conductor at +/- 90'
- Drill 17-1/2" hole to +/- 750'
- Set 13-3/8" surface casing
- Drill 12-1/4" intermediate hole
  - Vertical to KOP @ +/- 5500'
  - Drill curve w/ 6 deg./100' BR – land @ ~90 deg.
  - Drill +/- 5000' lateral to +/-11000' TMD
- Set 9-5/8" intermediate casing
- Drill 8-3/4" production hole
- Set 5-1/2" production casing

First Horizontal



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First Horizontal

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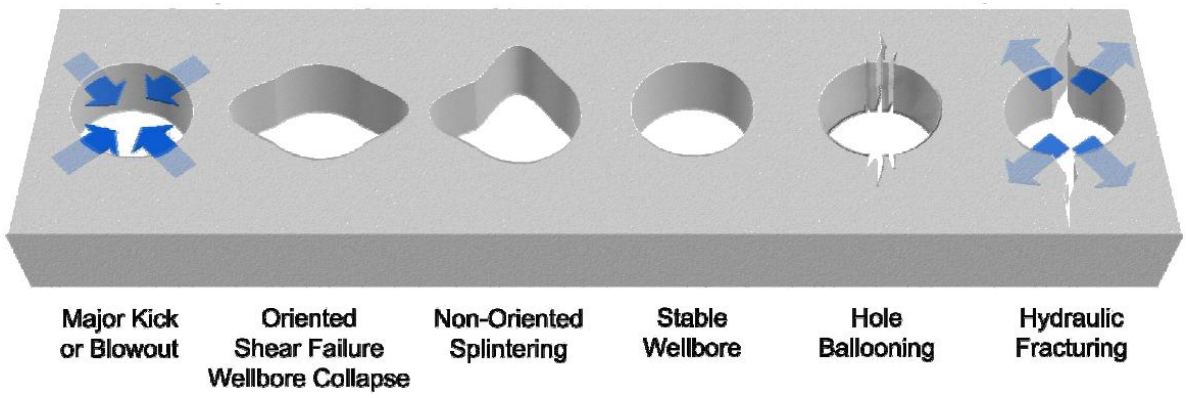
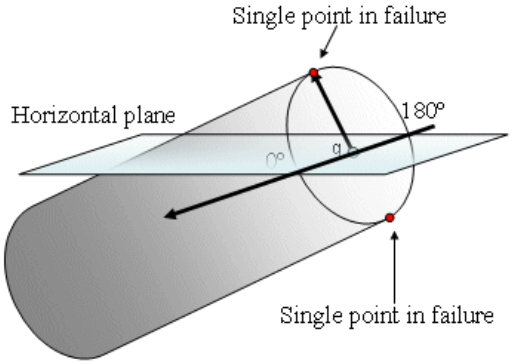
Lessons Learned

- In-house drilling specialists conducted wellbore stability research from horizontal well data, monitor well logs, & directional plan
  - Discovered root cause – mechanical instability, not chemical
  - Back to the drawing board
  - Tailored directional plan to incorporate findings
- Well Construction:
  - Smaller hole sizes, smaller directional tools, higher build rates, less shale exposure
- Discussed with company men the importance of monitoring hole conditions through curve





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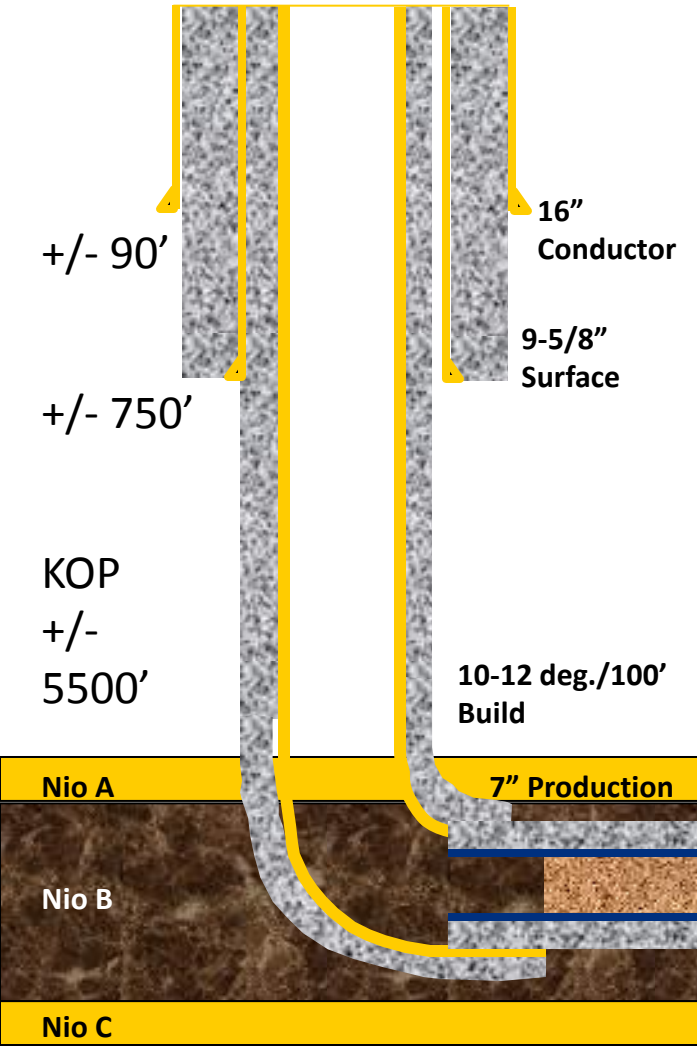
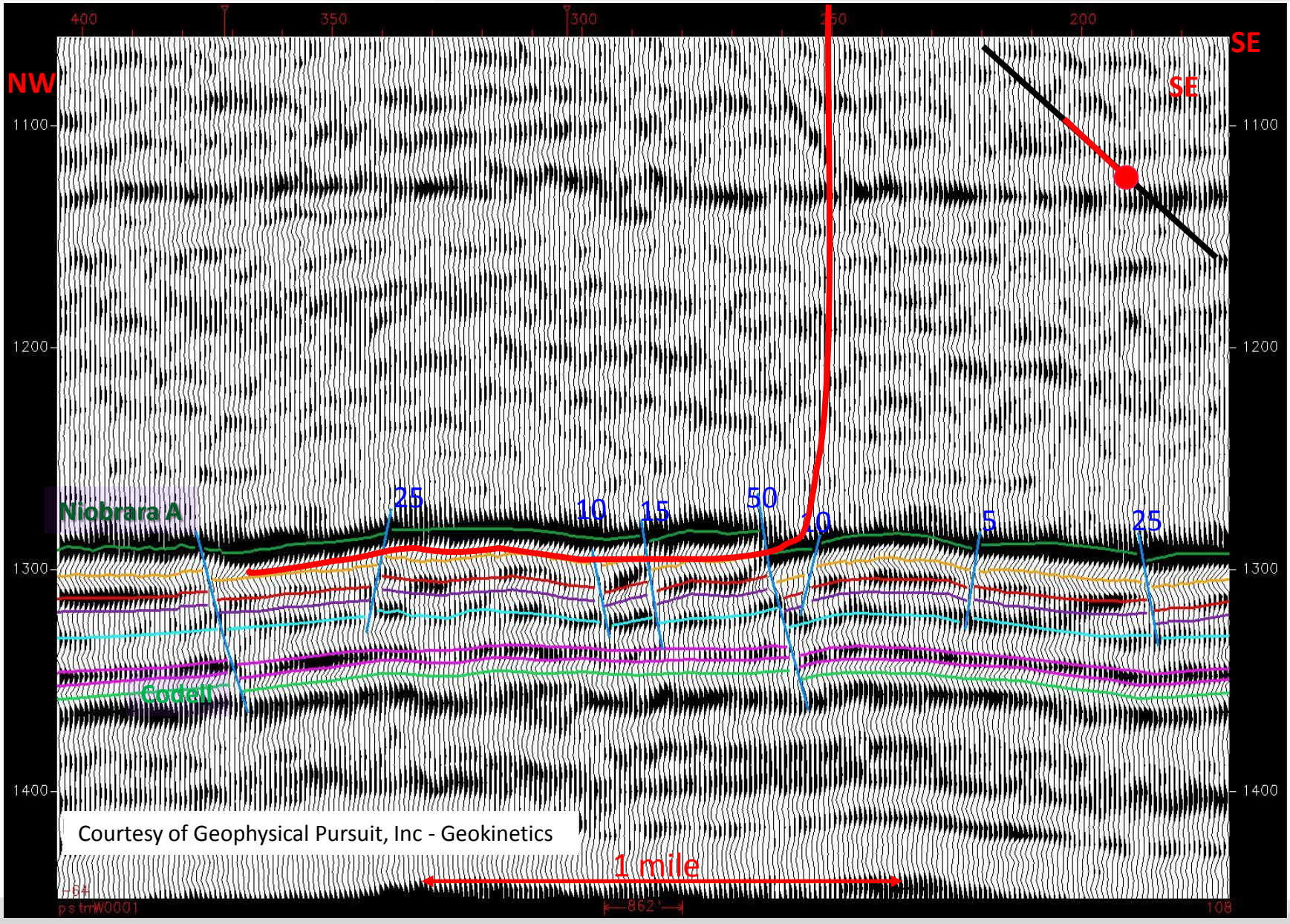
Current Niobrara Well Design

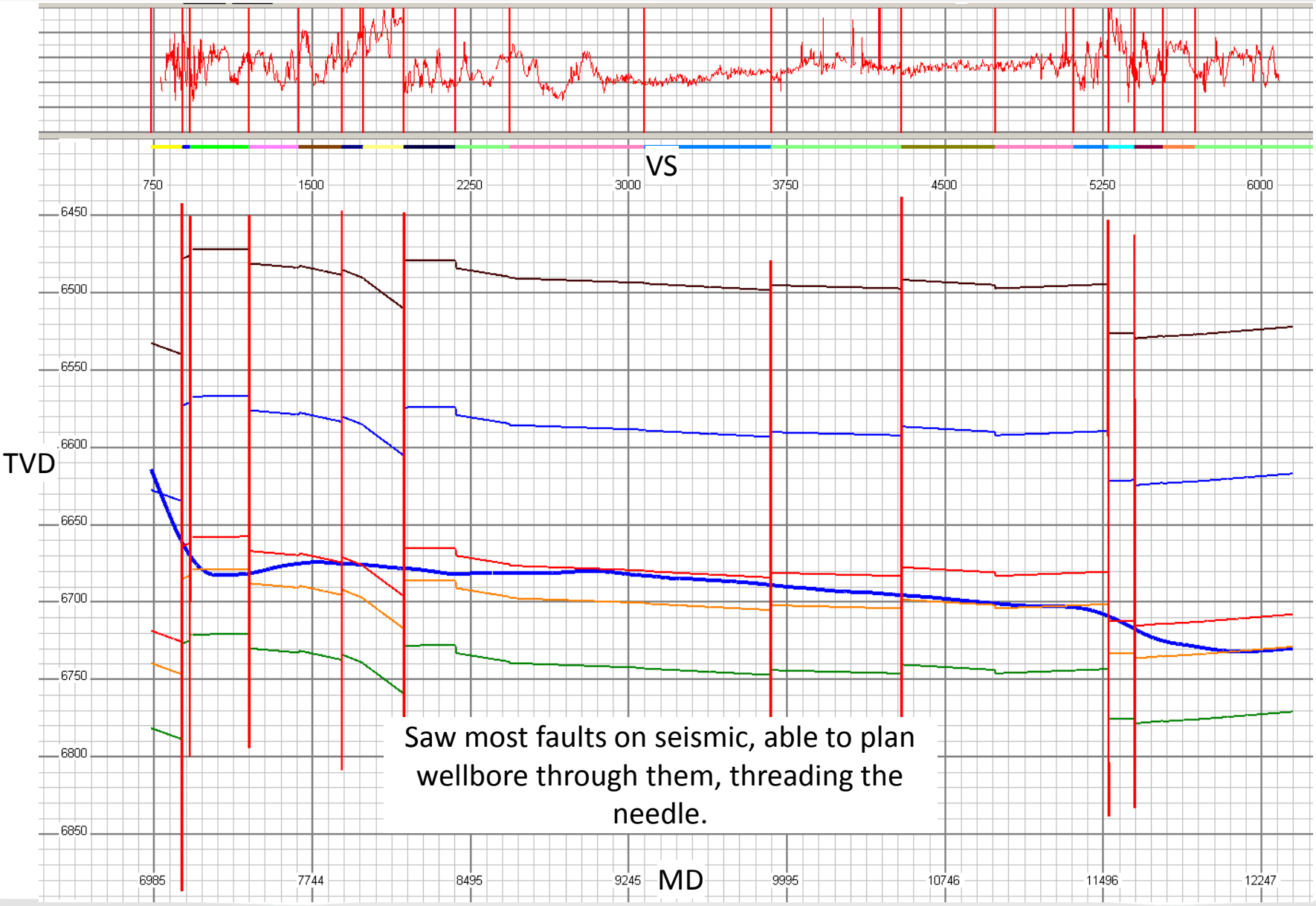


- Set 16" conductor at +/- 90'
- Drill 12-1/4" hole to +/- 750'
- Set 9-5/8" surface casing
- Drill 8-3/4" intermediate hole
  - Vertical to KOP @ +/- 5500'
  - Drill curve w/ 10-12 deg./100' BR
  - Land curve in Nio B interval at +/-90 deg. inc.
- Set 7" intermediate casing
- Drill +/- 5000' of 6" lateral to +/- 11,000' TD
- Run 4-1/2" cemented liner

Drilling Issues - Faulting

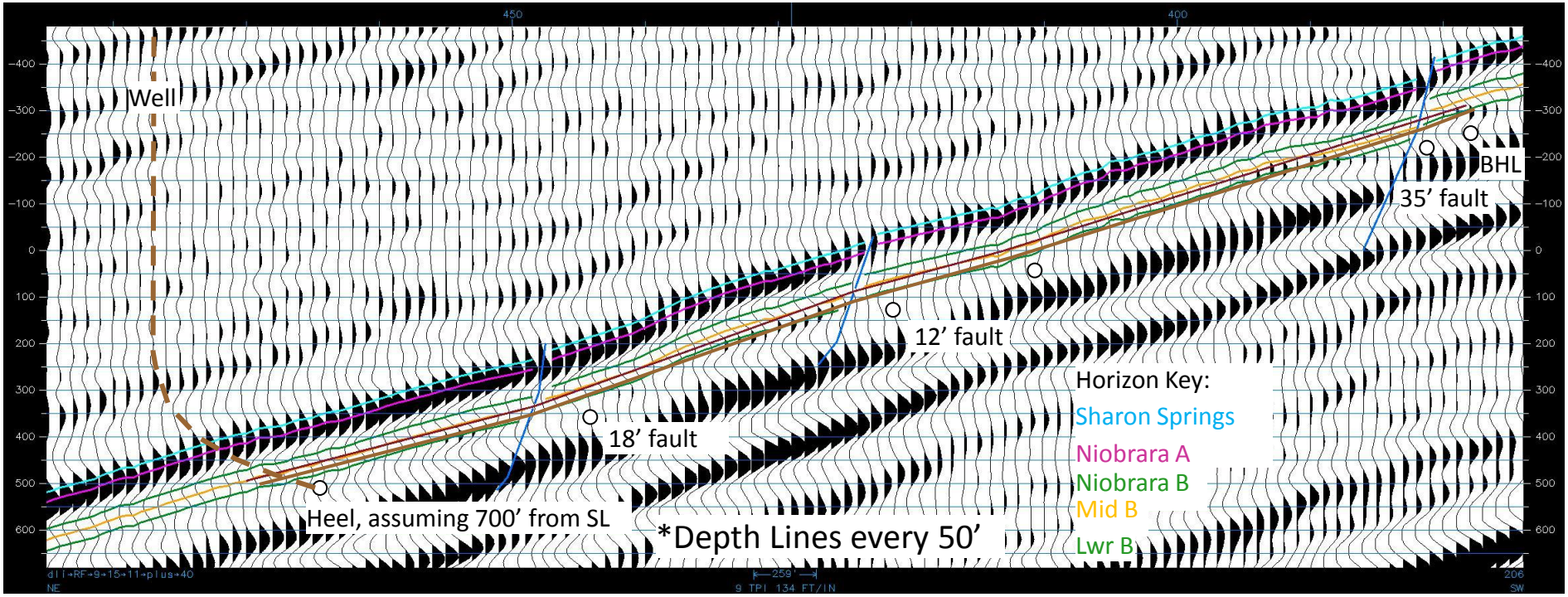


Geosteering - Faulting



Saw most faults on seismic, able to plan wellbore through them, threading the needle.

Geosteering - Faulting



Courtesy of Geophysical Pursuit, Inc - Geokinetics

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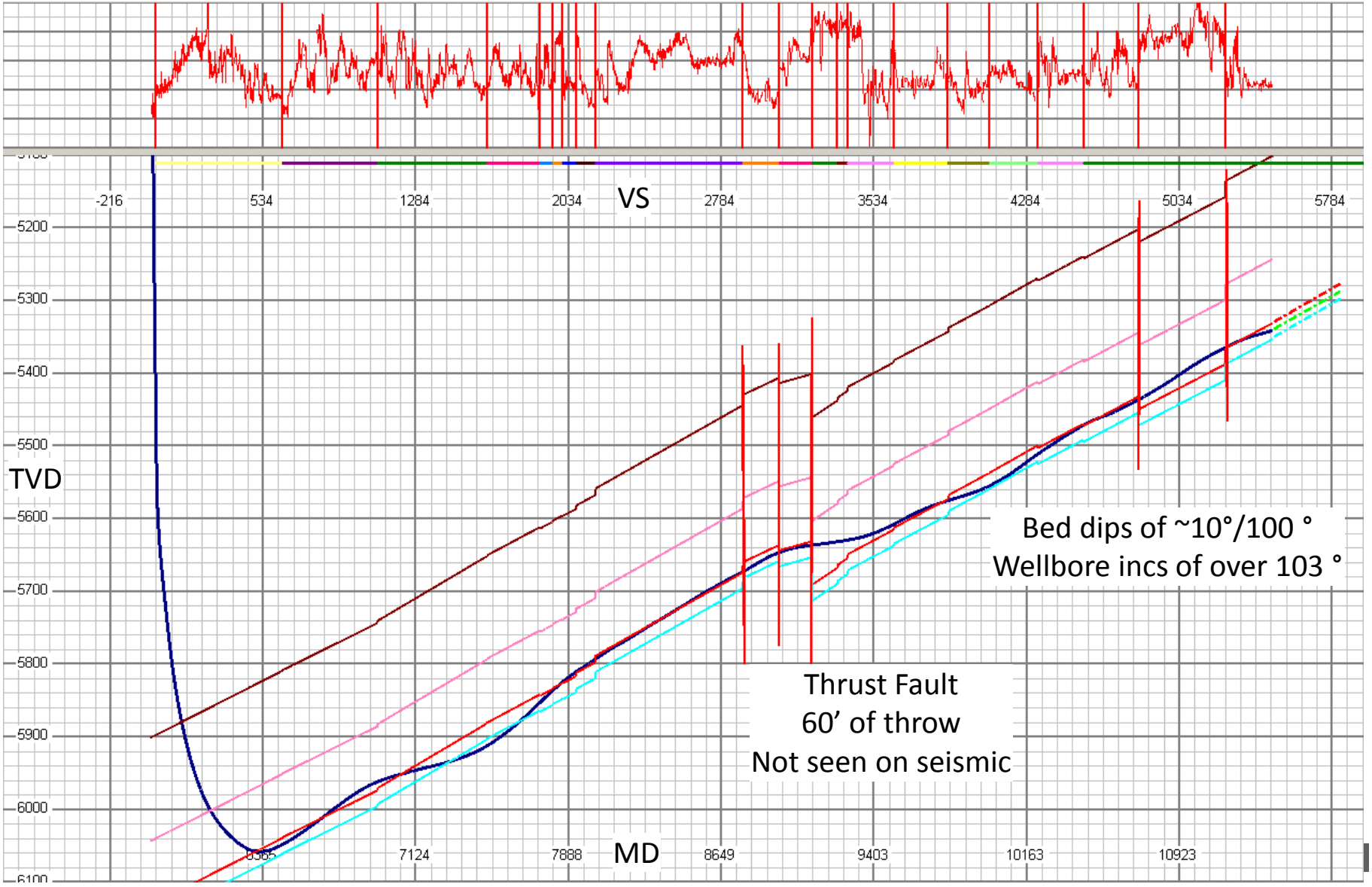
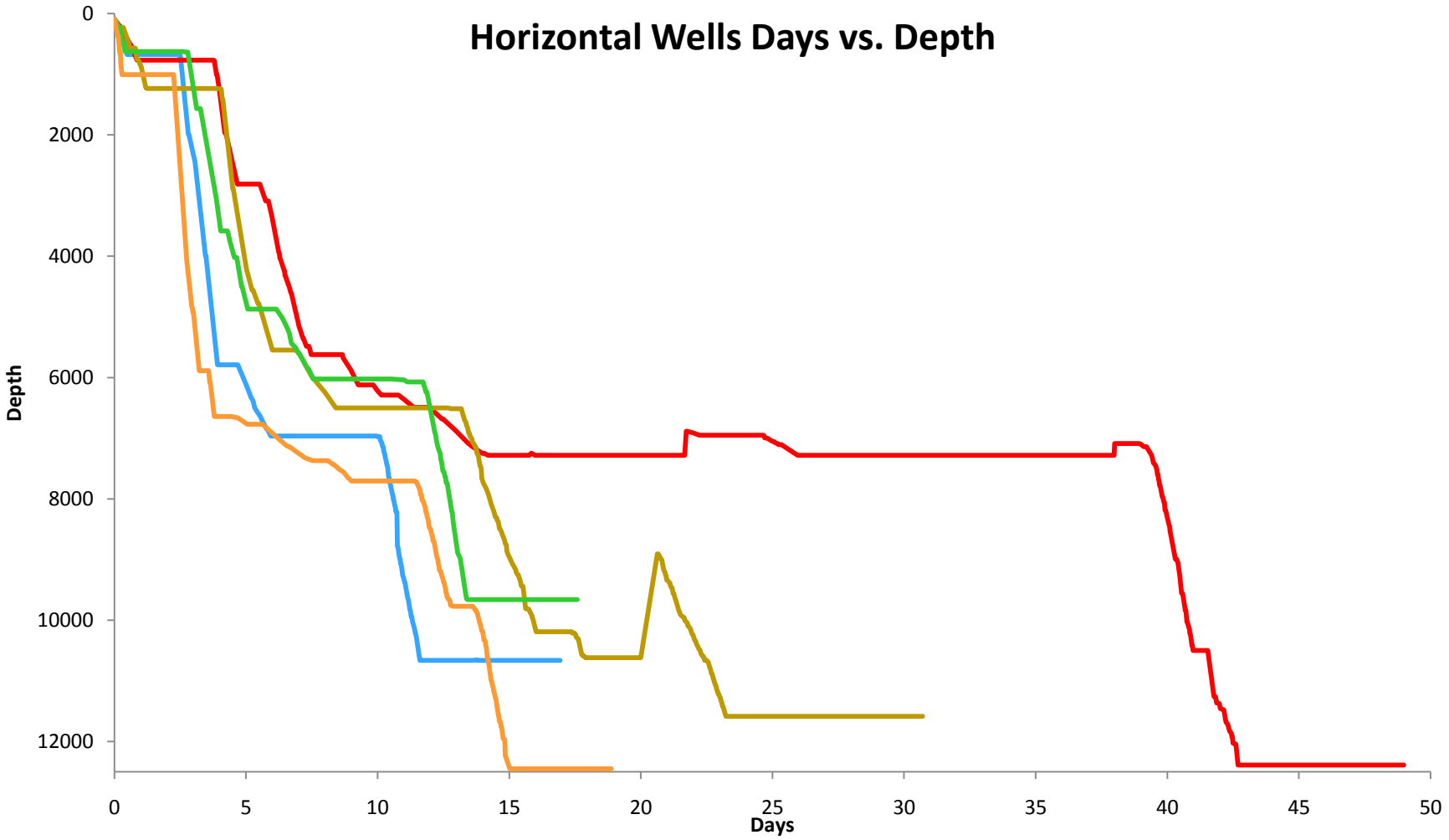
Geosteering - Faulting



Where we are now



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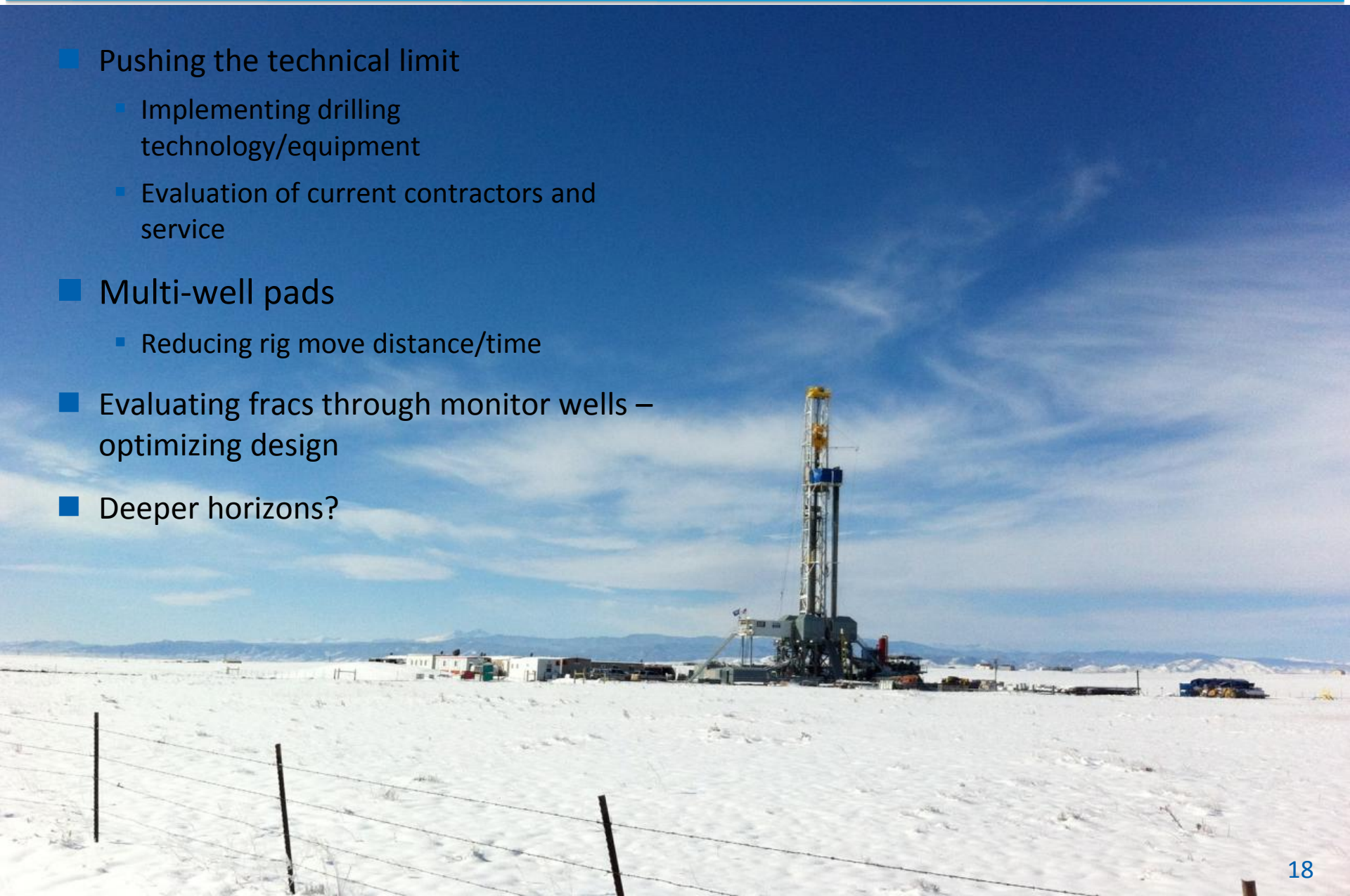
Moving Forward



- Pushing the technical limit
  - Implementing drilling technology/equipment
  - Evaluation of current contractors and service
- Multi-well pads
  - Reducing rig move distance/time
- Evaluating fracs through monitor wells – optimizing design
- Deeper horizons?

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