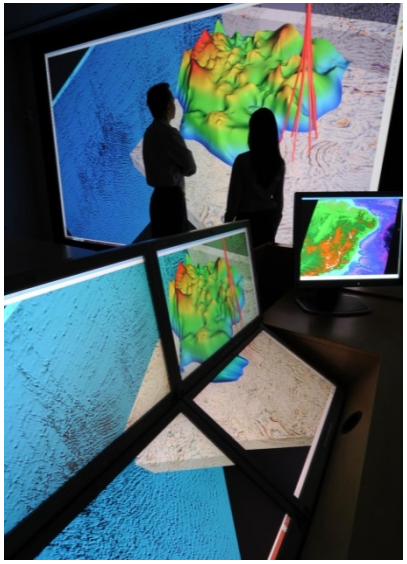
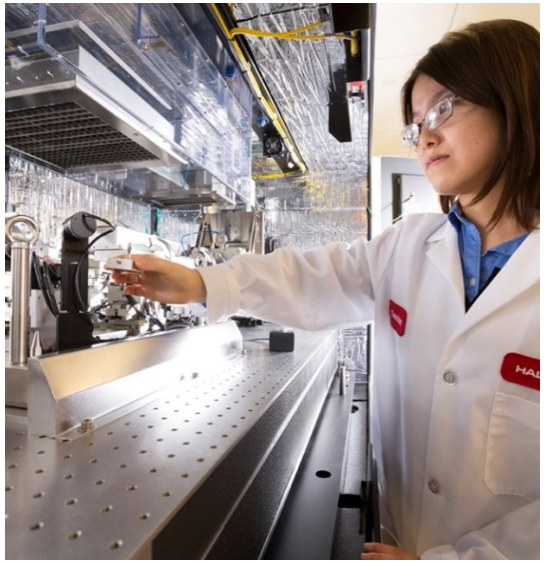
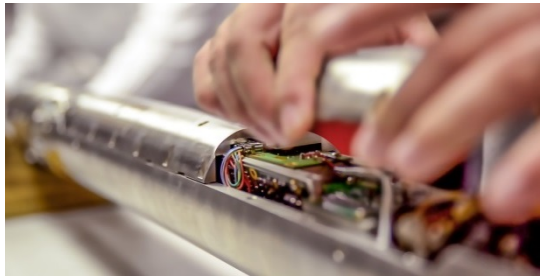






Halliburton Testing and Subsea Flowback Case Study

Darryl Tompkins
Technical Advisor
Reservoir Evaluations

HALLIBURTON

Flowback Case Study

Challenge

- Flowback comparison between two adjacent wells with the same completion strategy
- Improve well performance through managed pressure flowback
- Well A is highest performer, Well B is expected to be marginal

Solution

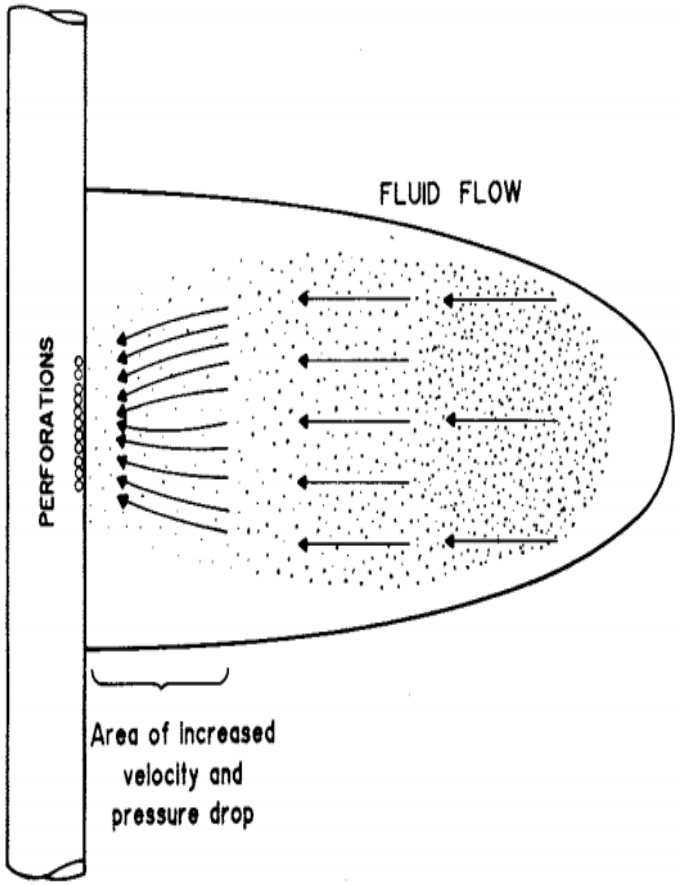
- Flowback analysis employed for flowback design and choke management
- Collaboration between Reservoir Engineering Team and flowback crew to manage flowback

Results

- Improved surface operations
- Identification of lost performance
- Increased cumulative BOE

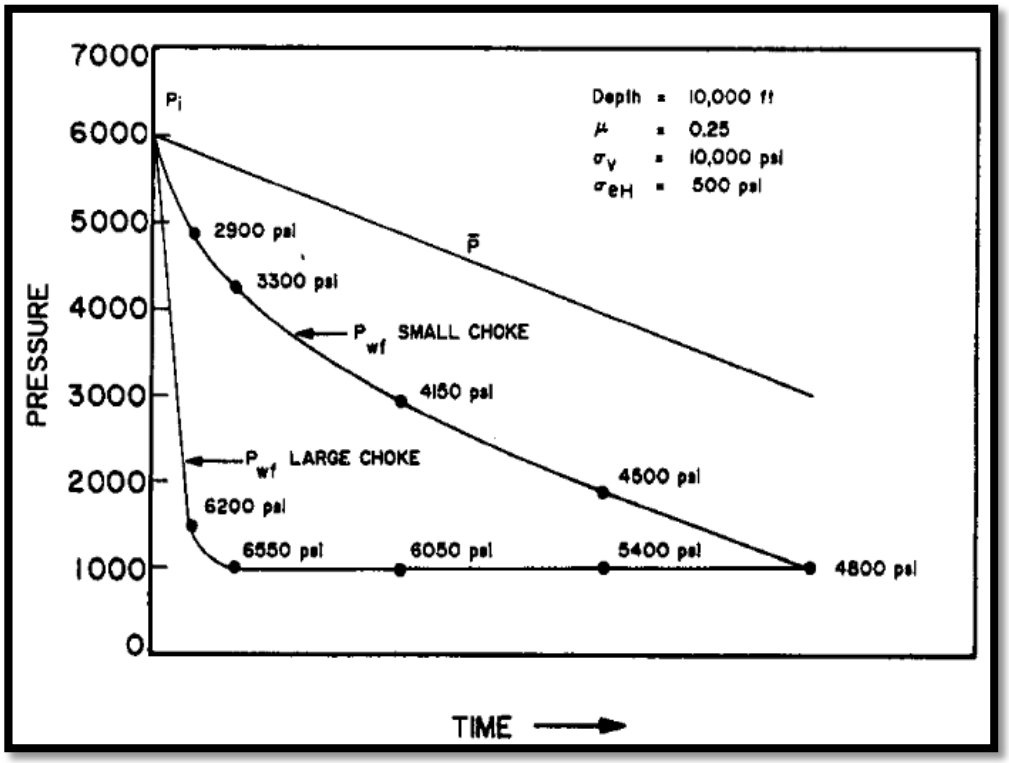
Flow Back Goals and Strategies

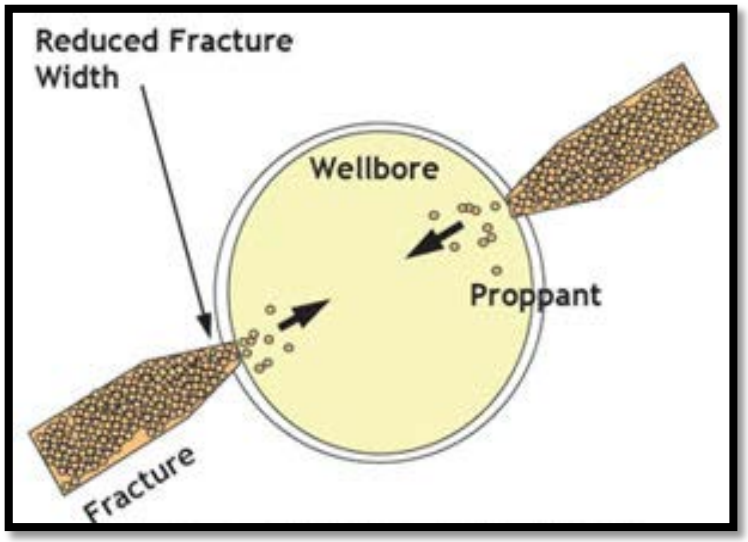
- Goals:
  - Maximize hydrocarbon recovery
  - Maximize load fluid recovery
  - Reduce damage to fractures (washout, crushing, embedment, fines migration, spalling)
- Strategies:
  - Diagnostic Flowback Analysis
  - Stimulation design



Surface Equipment

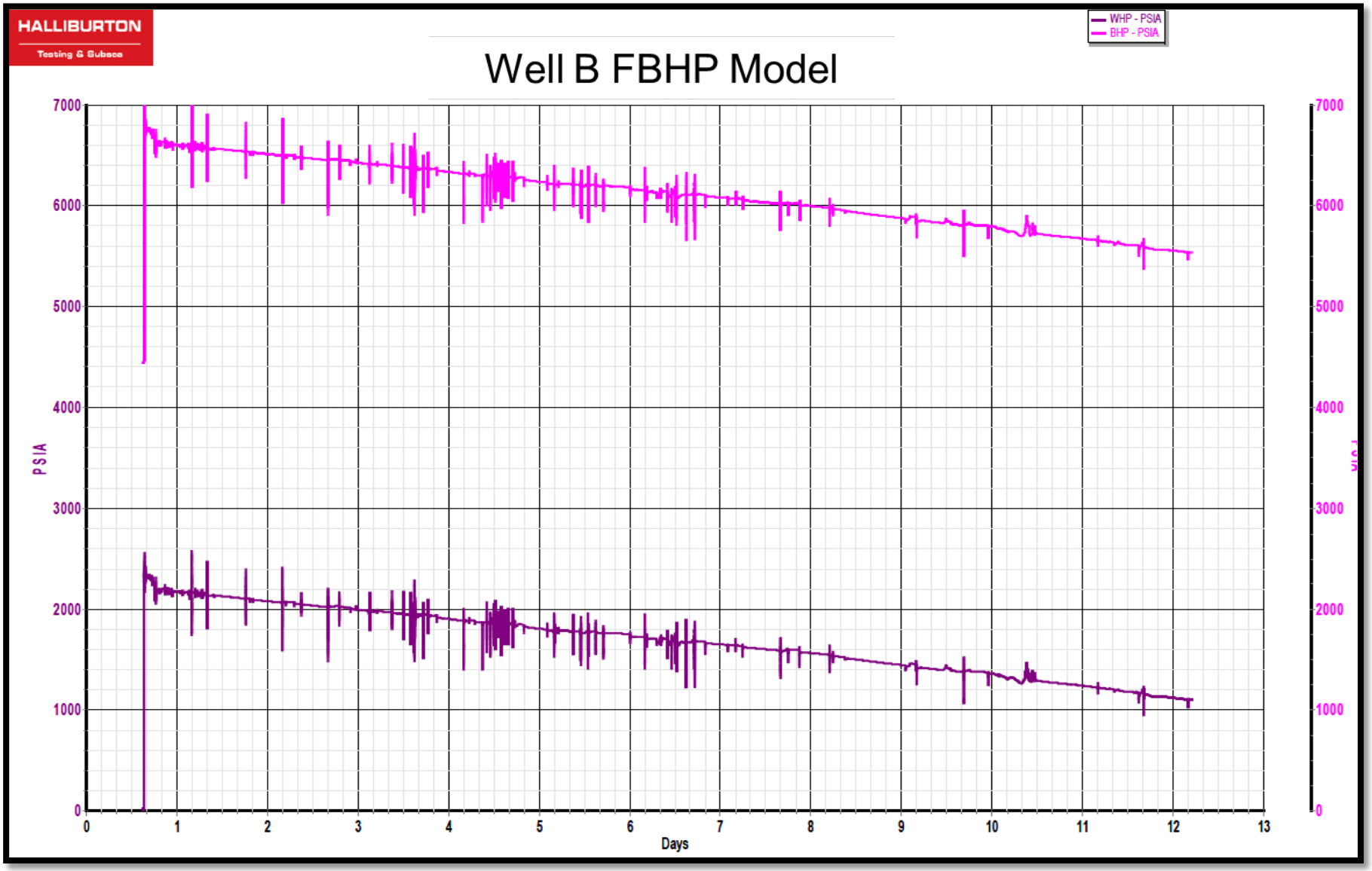
Reducing Fracture Damage





- Keeping BHFP high will reduce stress on proppant (crushing/embedment)
- Control BH fluid velocity to reduce proppant flowback, fines migration, and spalling
- Maintain stable BHP and reduce cyclic loading on proppant pack

Well B Pre Hydrocarbon Breakthrough BHP Model

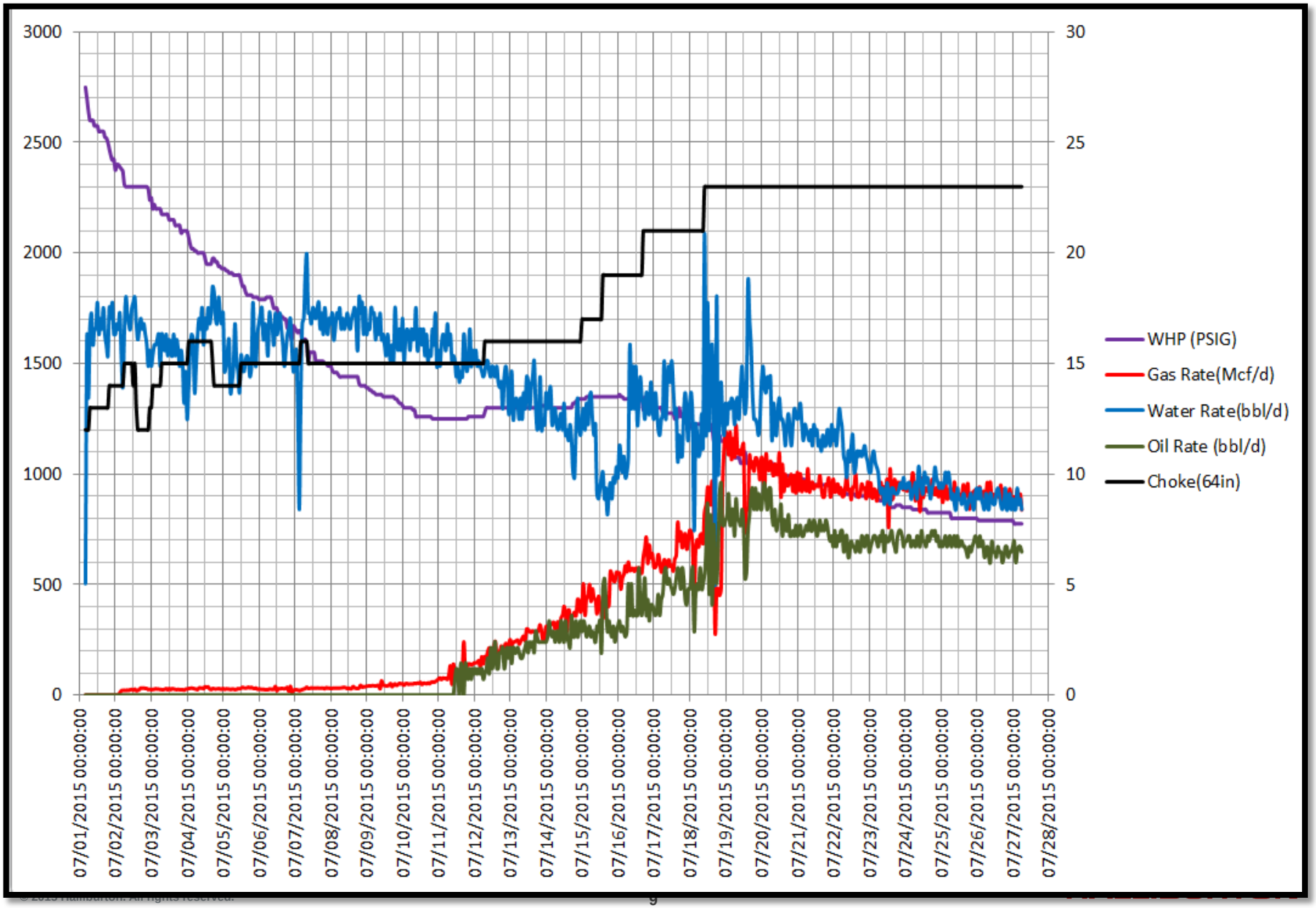


Choke Rocking

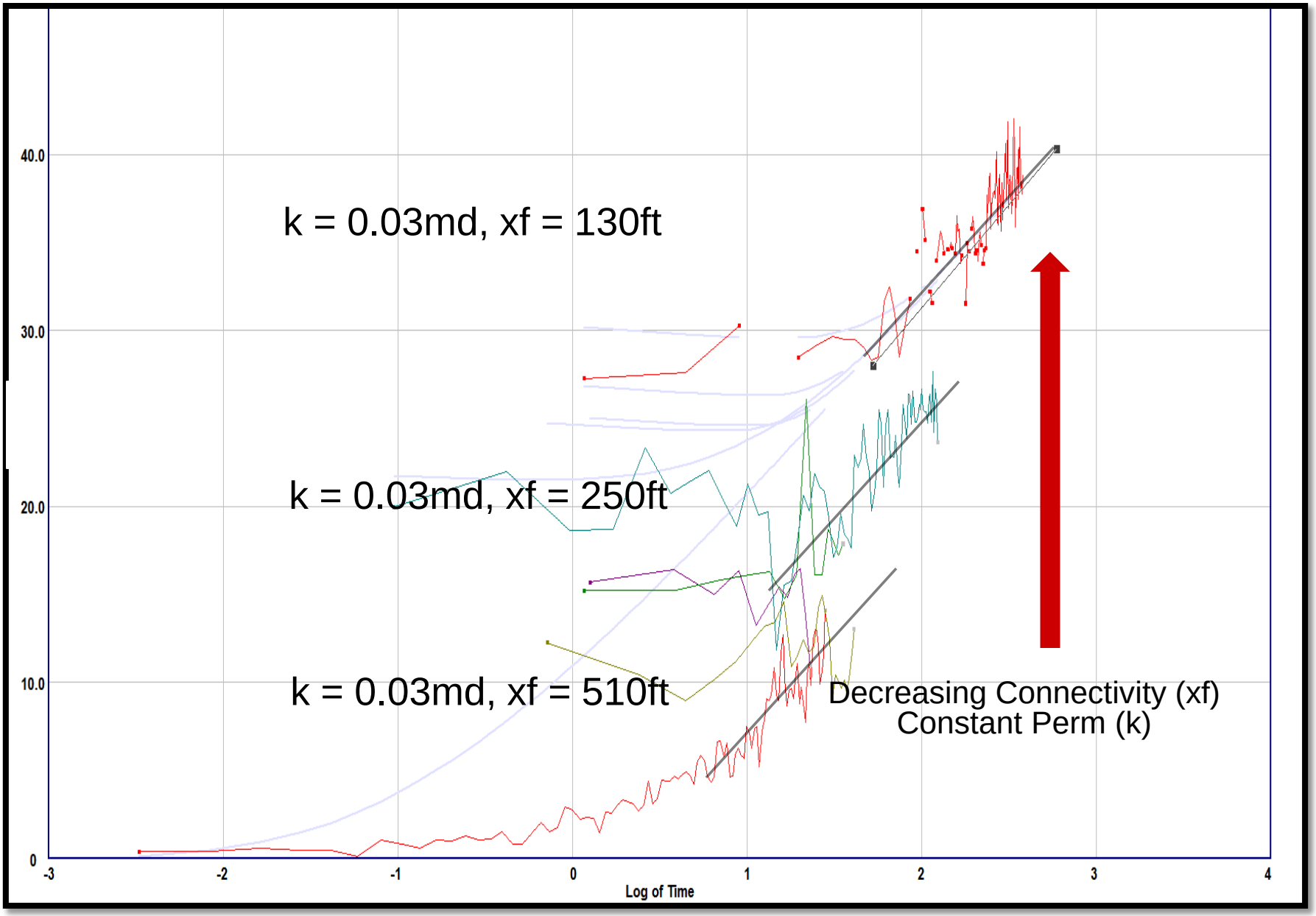
Well A and B Completion / Reservoir Parameters

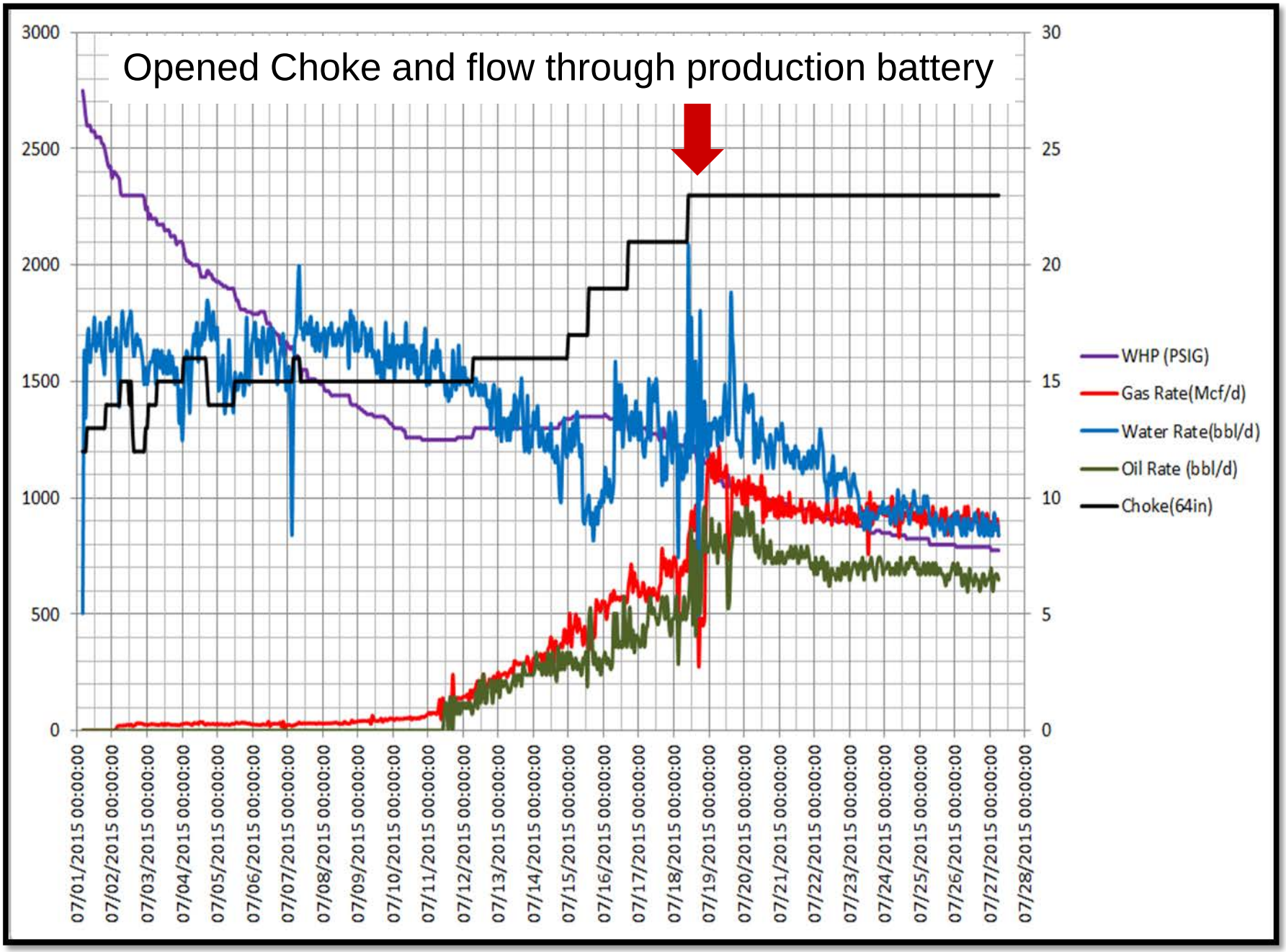
	Well A	**Well B**
Total Vertical Depth (ft)	10513	10145
Lateral Length (ft)	3919	3823
Tubing String	2 7/8 to 9571 ft.	2 7/8 to 9500 ft.
Production Casing	5.5” 20lb/ft	5.5” 20lb/ft
# of Stages	20	20
Proppant lbs/ft	1542	1572
Total Load Fluid (bbl)	99680	106235
Est. Pore Pressure (psia)	6000	6000
API Gravity	41.6	40.6
Water Saturation (%)	60	45

Well A Flowback



Transient Analysis




Opened Choke and flow through production battery
3000
2500
2000
1500
1000
500
0
30
25
20
15
10
5
0
07/01/2015 00:00:00
07/02/2015 00:00:00
07/03/2015 00:00:00
07/04/2015 00:00:00
07/05/2015 00:00:00
07/06/2015 00:00:00
07/07/2015 00:00:00
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07/25/2015 00:00:00
07/26/2015 00:00:00
07/27/2015 00:00:00
07/28/2015 00:00:00
WHP (PSIG)
Gas Rate(Mcf/d)
Water Rate(bbl/d)
Oil Rate (bbl/d)
Choke(64in)

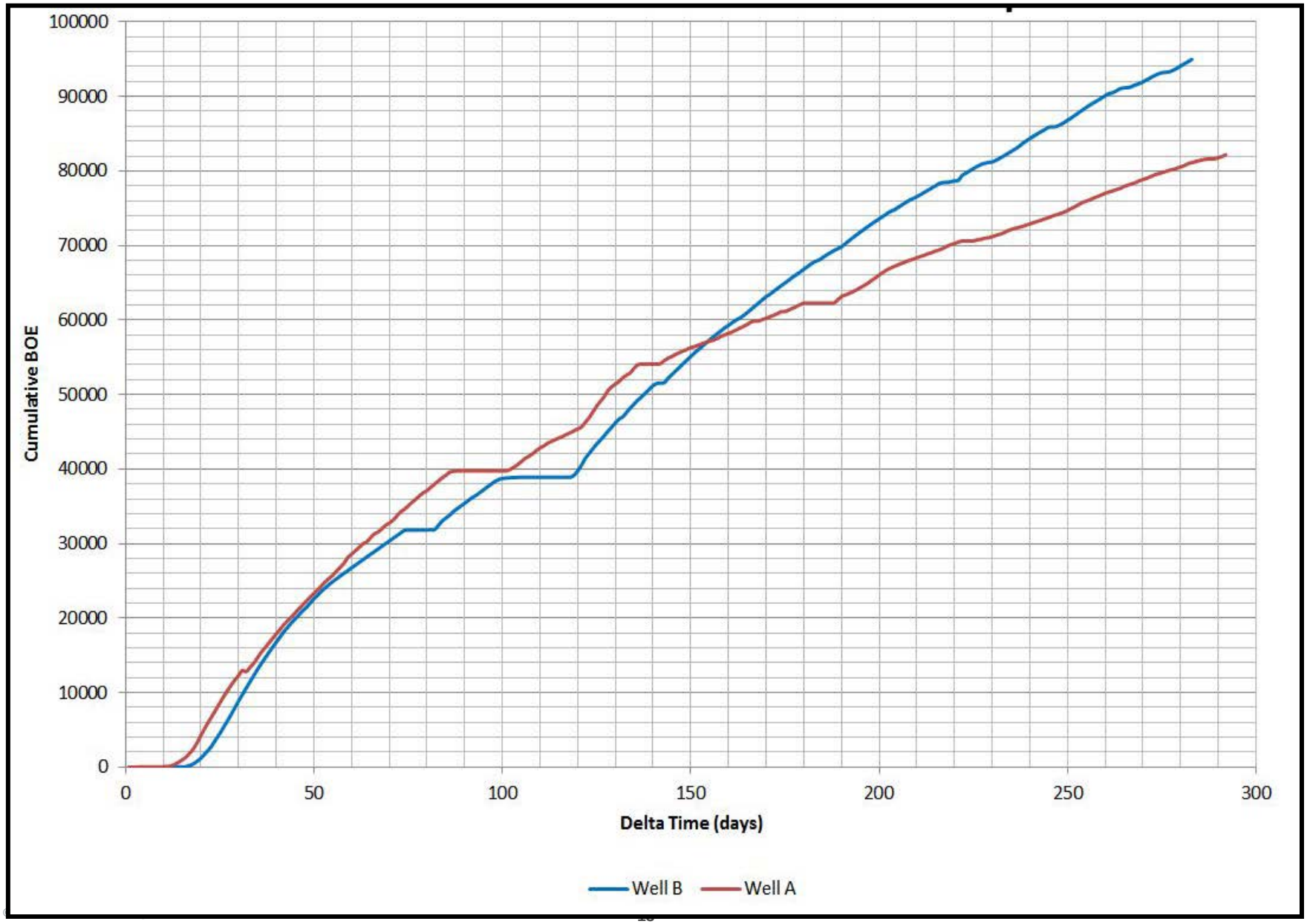
Well A and B End of Flowback Comparison

Well Name	Choke 64th in.	WHP psi	Water Rate bbl/d	Oil Rate bbl/d	Gas Rate Mcf/d
Well A	23	775	840	648	838
Well B	34	325	552	696	792

Well Name	Load Fluid Recovered	Est. Pore Grad. (psi/ft.)	GOR Mcf/bbl	GWR Mcf/bbl	OWR bbl/bbl
Well A	35264 (35%)	0.57	1.3	1.0	0.7
Well B	34474 (32%)	0.52	1.1	1.4	1.3

Well Name	PI BOPD/psi
Well A	1.4
Well B	2.5

Well A and Well B Cumulative BOE Comparison



Results:

- The potential for damage on Well B was reduced
- Initial production was much higher than anticipated
- SPIDR® gauges provide high resolution surface data integral to BHP conversion and diagnostic analysis
  - Identify and mitigate damage mechanisms from surface operating practices
- Real time collaboration between Halliburton Reservoir Engineering team and well test personnel improved well performance through optimized flowback operations

CALIBR^{SM} Engineered Flowback Service helped turn marginal acreage into the customer's biggest success story!

THANK YOU