

Apache

IMPROVEMENTS IN THE TONKAWA

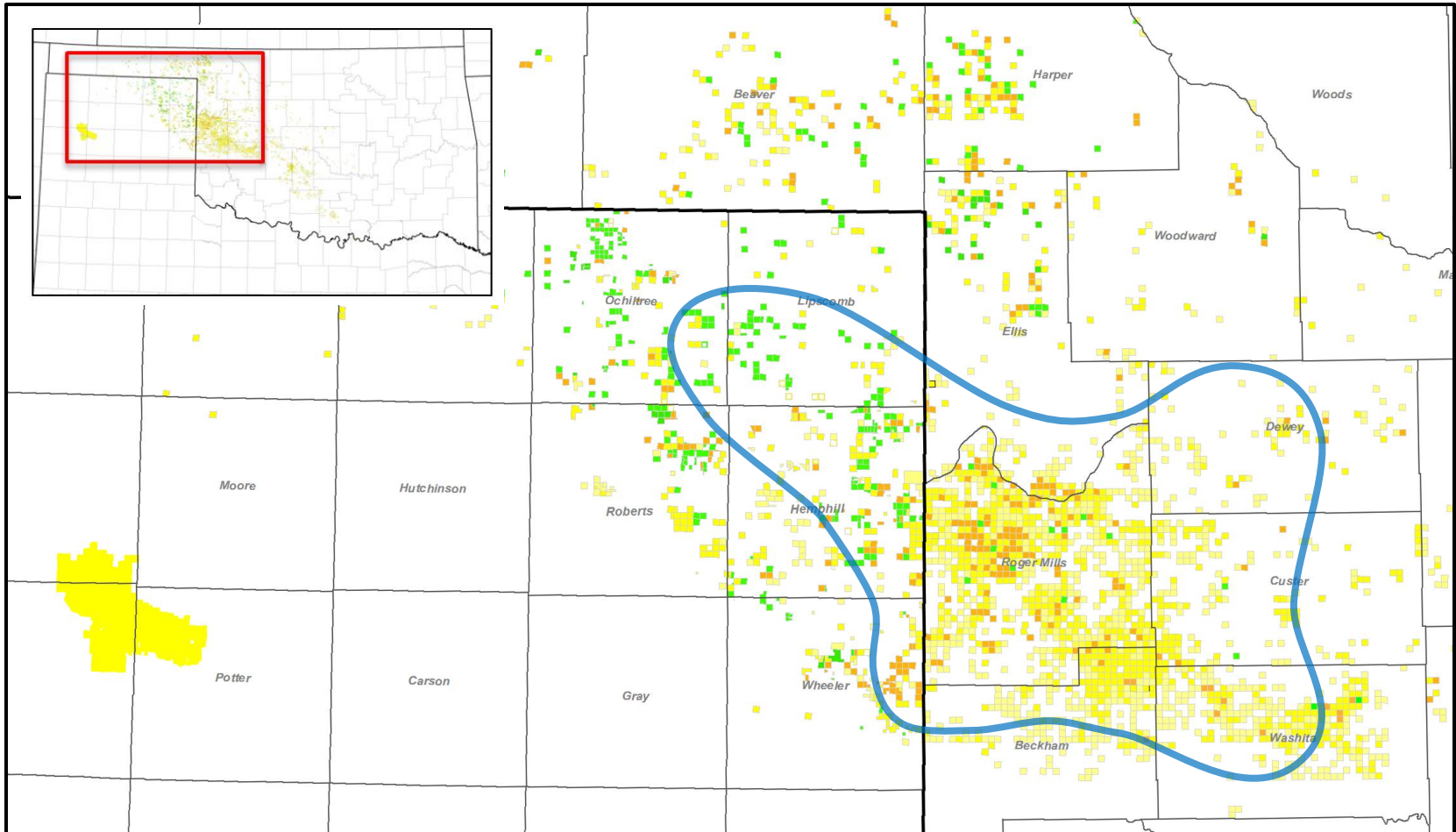
2.19.2014

CODY

MARTIN



TONKAWA OVERVIEW



Shallow prolific oil play

TONKAWA OVERVIEW

- ▶ *First Apache Tonkawa Drilled in March 2012*
- ▶ *Cordillera acquisition expanded position*
- ▶ *Learn and modify in 2012*
- ▶ *Operate and excel in 2013, drill 70 Tonkawa locations*
- ▶ *2014*

CENTRAL REGION

TONKAWA TEAM

► Drilling

▲ Sharaf Eid

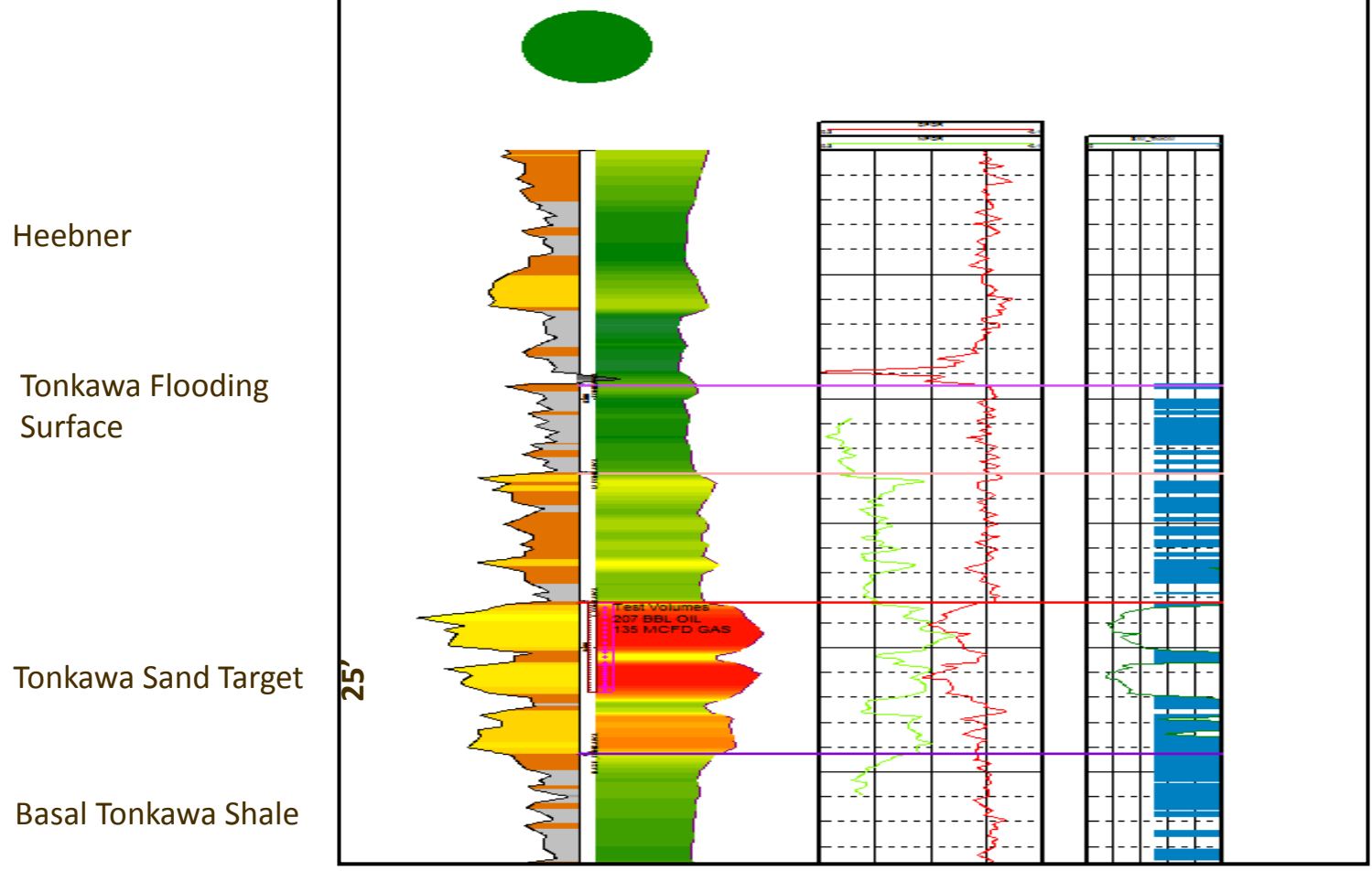
▲ Cody Martin

▲ Charles Patrick

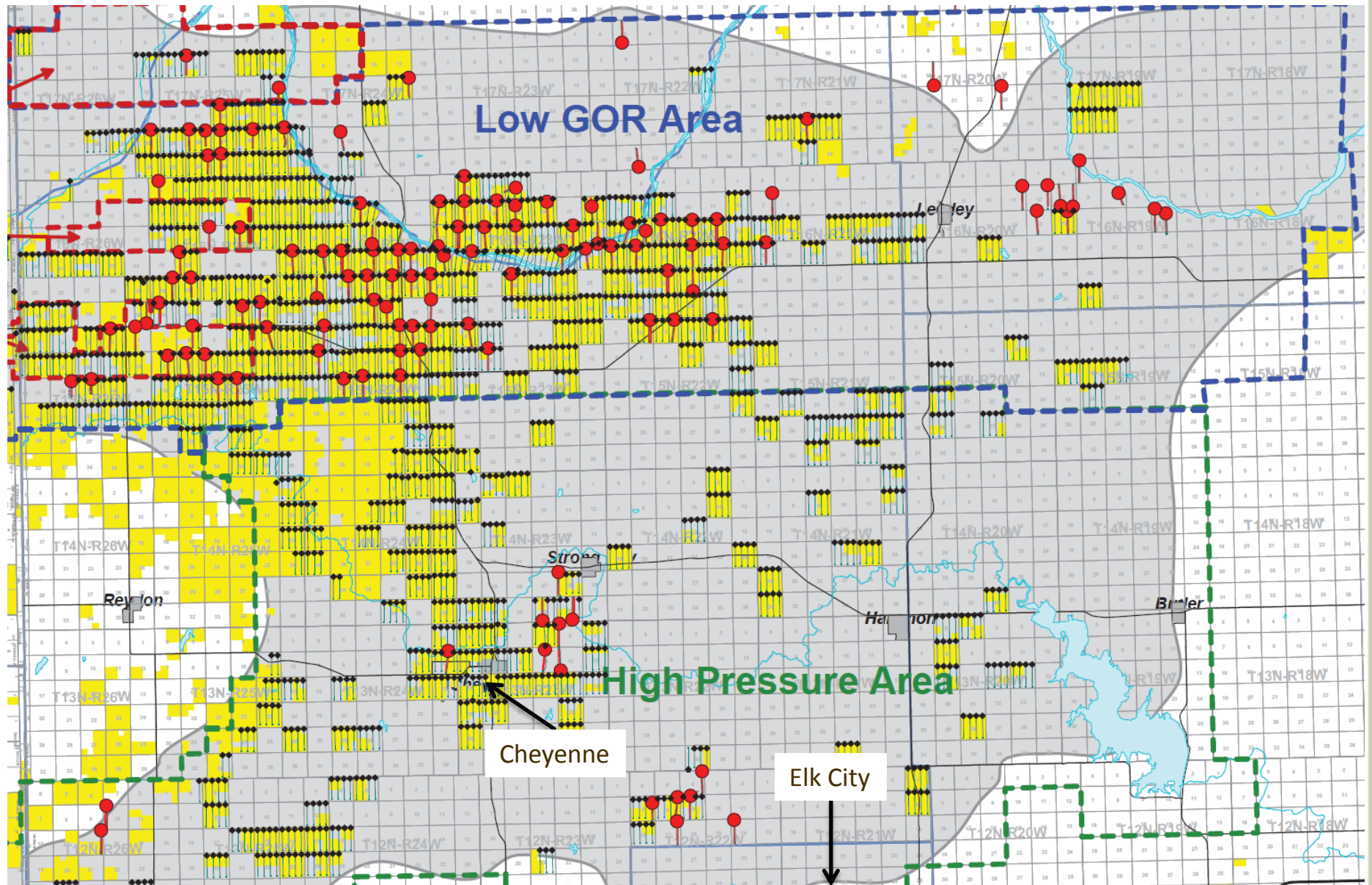
▲ Cliff Frates

▲ Eric Perner

Tonkawa Type Log



TONKAWA AREA



LP VS HP TONKAWA

► Low Pressure

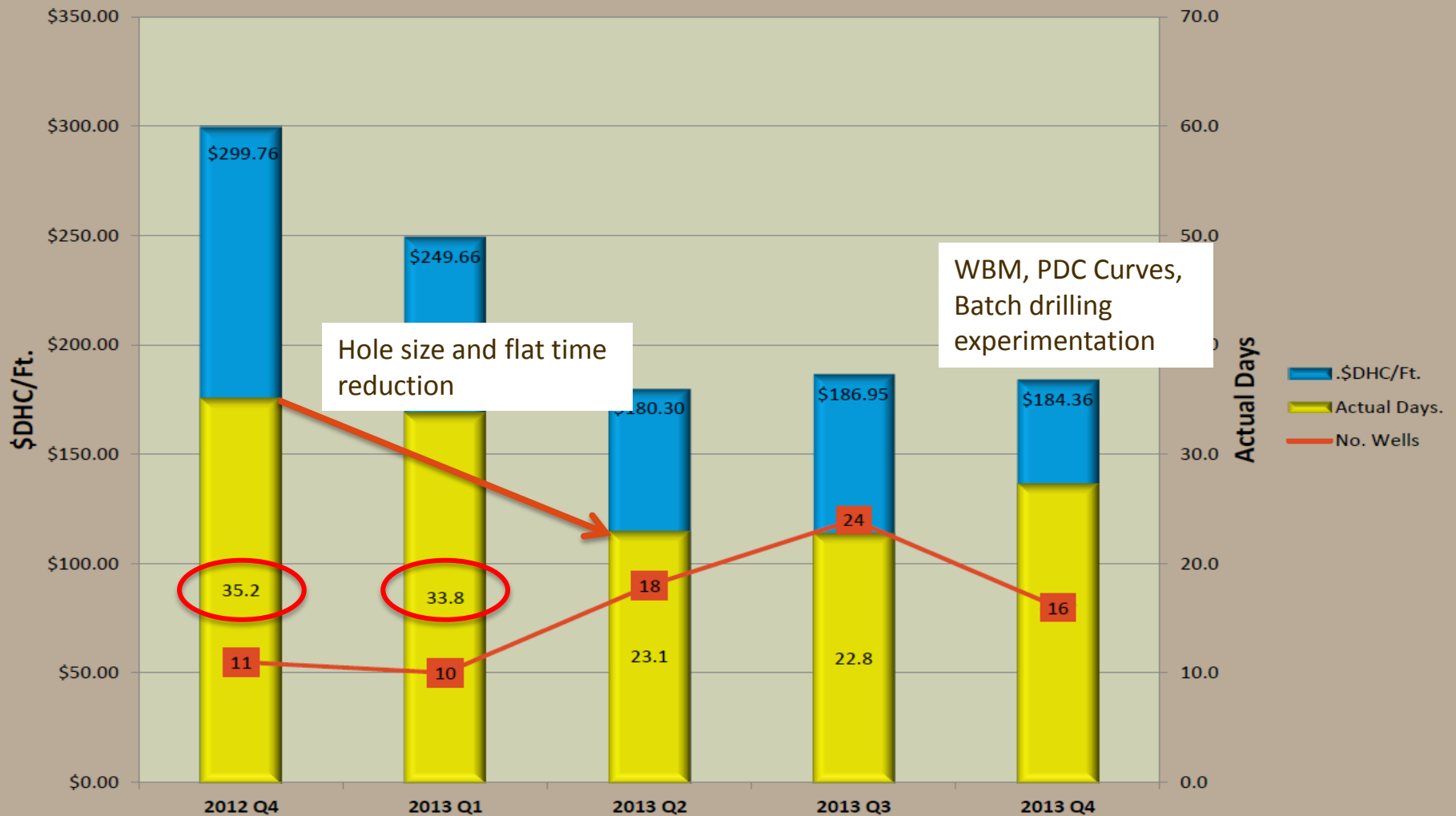
- ▲ Top set intermediate casing, displace to OBM on drillout
- ▲ < 8.2# OBM preferred in most cases
- ▲ Drill curves on 10°

► High Pressure

- ▲ Top set casing
- ▲ Drill curves on 12° (set as much casing as possible, cover losses)
- ▲ 10#-10.5# MW expected
- ▲ High connection gas
- ▲ High trip gas

THE PROBLEM, Q4 2012/Q1 2013

Tonkawa
\$DHC/Ft. & Actual Days



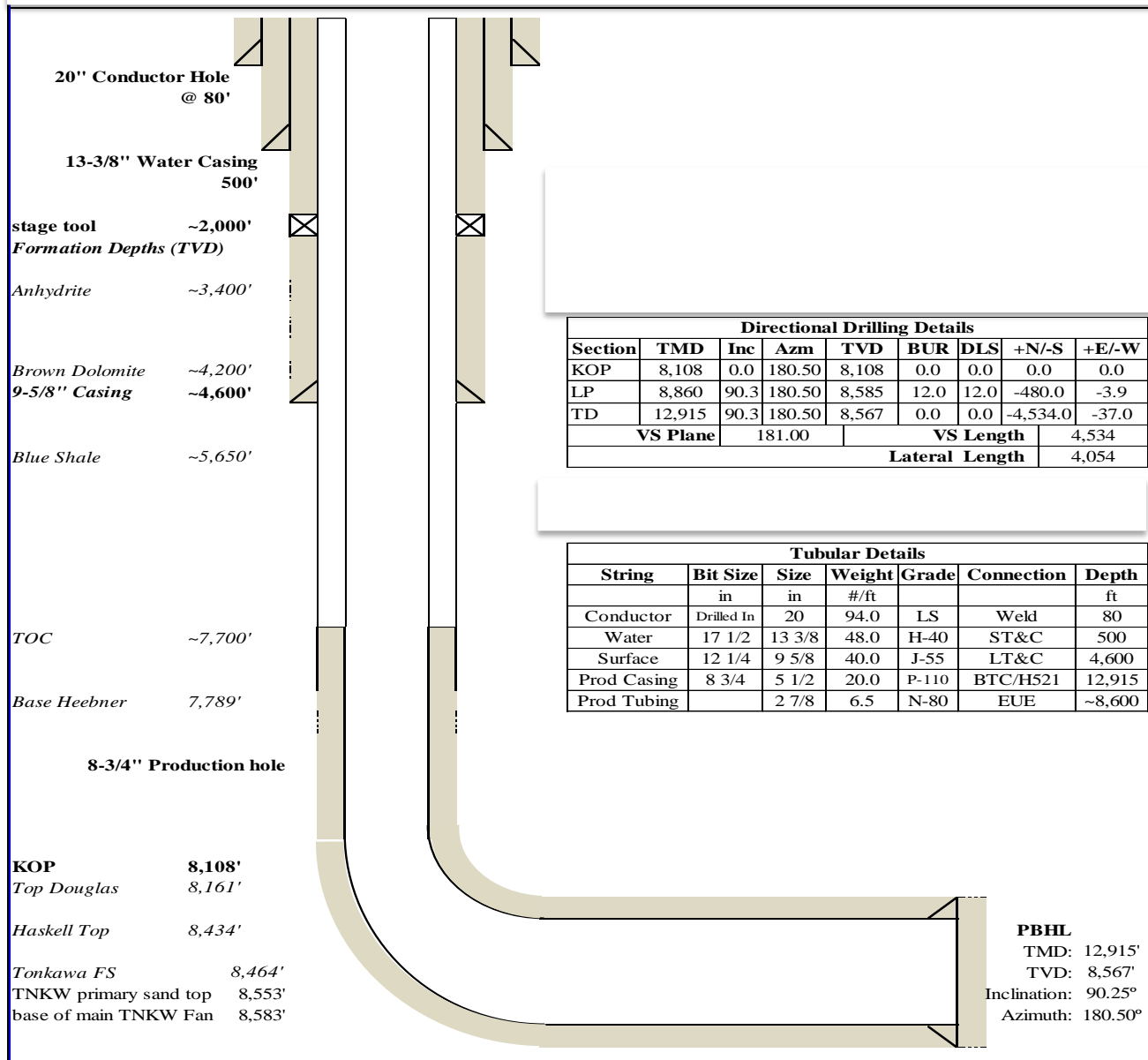
COST REDUCTION PLAN OF ATTACK

► Primary

- ▲ Hole size reduction
- ▲ Mud program optimization
- ▲ Flat time reduction
- ▲ ROP increase

► Secondary

- ▲ Water based mud in lateral
- ▲ PDC curve assembly
- ▲ Multi-bowl wellhead systems



20" Conductor Hole @ 80'

13-3/8" Water Casing 500'

stage tool ~2,000'
Formation Depths (TVD)

Anhydrite ~3,400'

Brown Dolomite ~4,200'

9-5/8" Casing ~4,600'

Blue Shale ~5,650'

TOC ~7,700'

Base Heebner 7,789'

8-3/4" Production hole

KOP 8,108'

Top Douglas 8,161'

Haskell Top 8,434'

Tonkawa FS 8,464'

TNKW primary sand top 8,553'

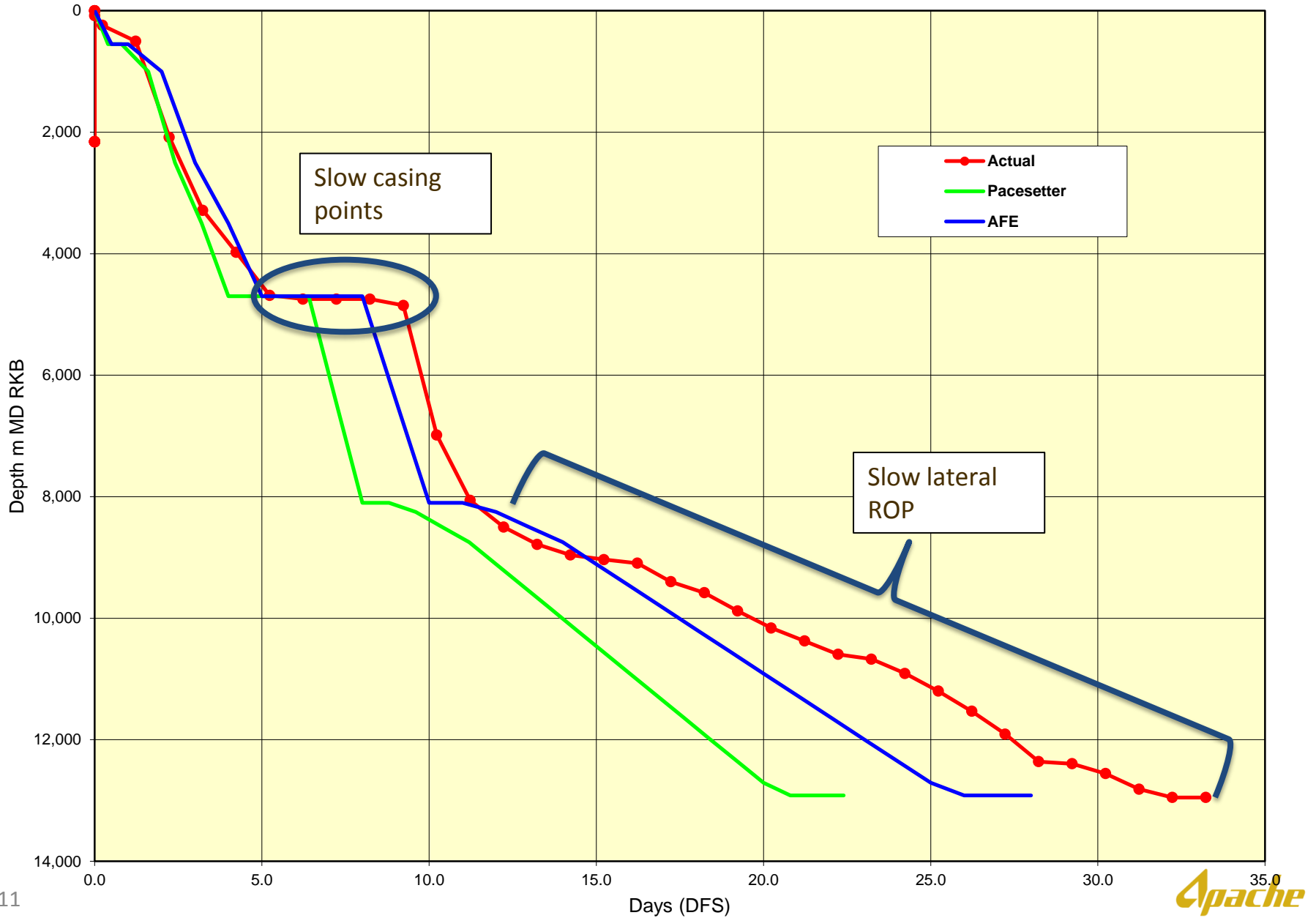
base of main TNKW Fan 8,583'

Directional Drilling Details									
Section	TMD	Inc	Azm	TVD	BUR	DLS	+N/-S	+E/-W	
KOP	8,108	0.0	180.50	8,108	0.0	0.0	0.0	0.0	
LP	8,860	90.3	180.50	8,585	12.0	12.0	-480.0	-3.9	
TD	12,915	90.3	180.50	8,567	0.0	0.0	-4,534.0	-37.0	
VS Plane			181.00	VS Length			4,534		
							Lateral Length		4,054

Tubular Details						
String	Bit Size	Size	Weight	Grade	Connection	Depth
	in	in	#/ft			ft
Conductor	Drilled In	20	94.0	LS	Weld	80
Water	17 1/2	13 3/8	48.0	H-40	ST&C	500
Surface	12 1/4	9 5/8	40.0	J-55	LT&C	4,600
Prod Casing	8 3/4	5 1/2	20.0	P-110	BTC/H521	12,915
Prod Tubing		2 7/8	6.5	N-80	EUE	~8,600

PBHL
 TMD: 12,915'
 TVD: 8,567'
 Inclination: 90.25°
 Azimuth: 180.50°

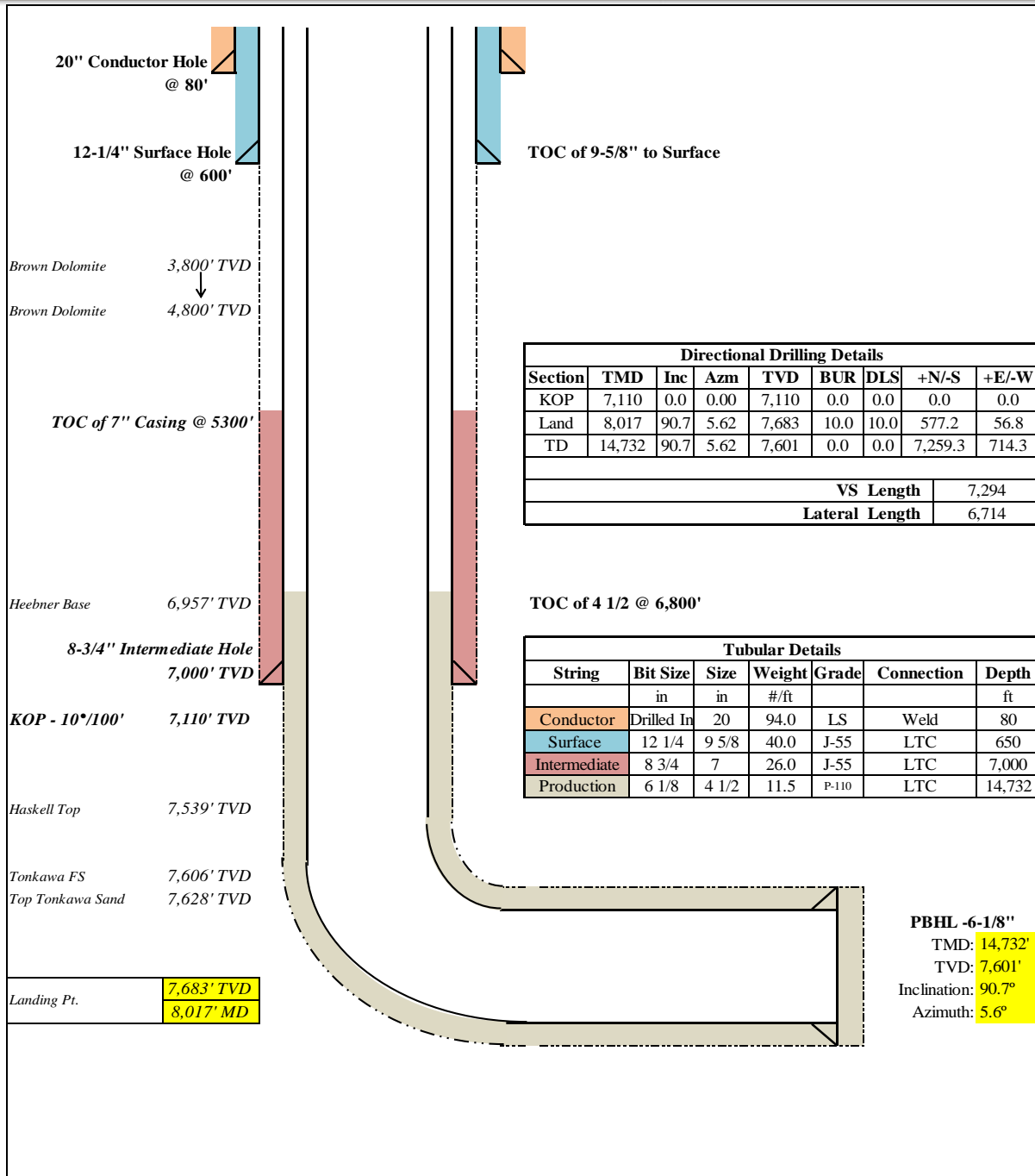
Larger lateral DvD Curve



LEARNINGS OF LARGER HOLE SIZE

- Desired production longstring, drilled 8 ¾" Lateral
 - ▲ Slower ROP in Lateral
 - ▲ More expensive casing
 - ▲ Well IP's did not demand 5 ½" production casing

- Result
 - ▲ Drill 6 1/8" Lateral
 - ▲ Top set 7" casing above KOP, remove jewelery
 - ▲ Keep OBM, but relax properties



Directional Drilling Details								
Section	TMD	Inc	Azm	TVD	BUR	DLS	+N/-S	+E/-W
KOP	7,110	0.0	0.00	7,110	0.0	0.0	0.0	0.0
Land	8,017	90.7	5.62	7,683	10.0	10.0	577.2	56.8
TD	14,732	90.7	5.62	7,601	0.0	0.0	7,259.3	714.3
VS Length							7,294	
Lateral Length							6,714	

TOC of 4 1/2 @ 6,800'

Tubular Details						
String	Bit Size	Size	Weight	Grade	Connection	Depth
	in	in	#/ft			ft
Conductor	Drilled In	20	94.0	LS	Weld	80
Surface	12 1/4	9 5/8	40.0	J-55	LTC	650
Intermediate	8 3/4	7	26.0	J-55	LTC	7,000
Production	6 1/8	4 1/2	11.5	P-110	LTC	14,732

Landing Pt.	7,683' TVD
	8,017' MD

PBHL -6-1/8"
 TMD: 14,732'
 TVD: 7,601'
 Inclination: 90.7°
 Azimuth: 5.6°

LEARNINGS OF SMALLER HOLE SIZE

- Embrace Horizontal Hole Cleaning Practices
- Consistency with TCI curves (few exceptions), but slow
- Faster PDC curves, but need a fine tuned assembly. Trial and error must be acceptable, and pull for a TCI assembly when it's still safe
- Low pressure reservoir, keep MW \leq 8# if needed
- Engineer out all speed bumps possible

DURABILITY AND SPEED

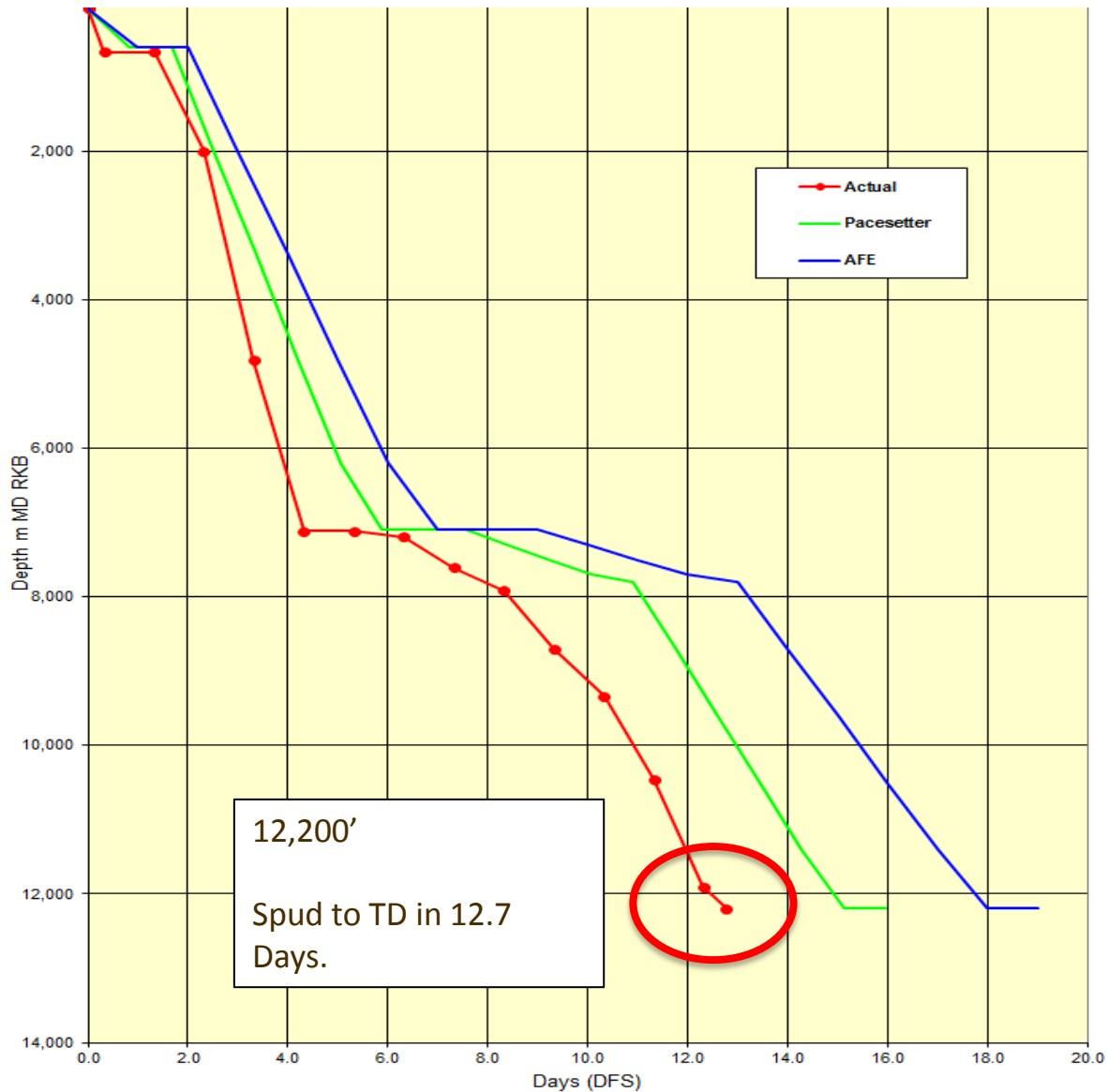
► Motor selection

- ▲ Most common lateral power sections in Apache
 - ▲ 7:8 4.5 (+/-0.46rpg)
 - ▲ 7:8 2.6 (+/- 0.26rpg)
- ▲ Higher speed motors have resulted in DBR events

► Bit selection

- ▲ 6 blade 13mm cutter designs provide great ROP vs Durability across the board

CULMINATION OF EFFORTS



TONKAWA DRILLING – Q2 2013

□ Q2 Action List:

- Using 4" drill pipe in drilling 8-3/4" hole ✓
- Not using a DV tool or float collar in the 7" casing ✓
- Single stage cement job for the 7" casing ✓
- Displace to OBM, drill float equipment and FIT through directional tools ✓
- Will be looking to turnkey directional drilling contract ✓

Ultimate Goal: "48/7" Casing point
Will save Apache 3 Days & around \$150,000 ✓

TONKAWA DRILLING – Q3/4 2013 ACTIONS

□ Q3/4 Action List:

- Reduce the cost of the soil farming ✓
- Reduce the cost of building locations (Rocking, cement pits,..) ✓
- Ask the contractor to provide 4” drill pipe and handling tools ✓
- Use speed head instead of the conventional wellheads Building Inventory
- Use economic 7” casing that meets the design criteria Building Inventory

\$200,000 expected reduction

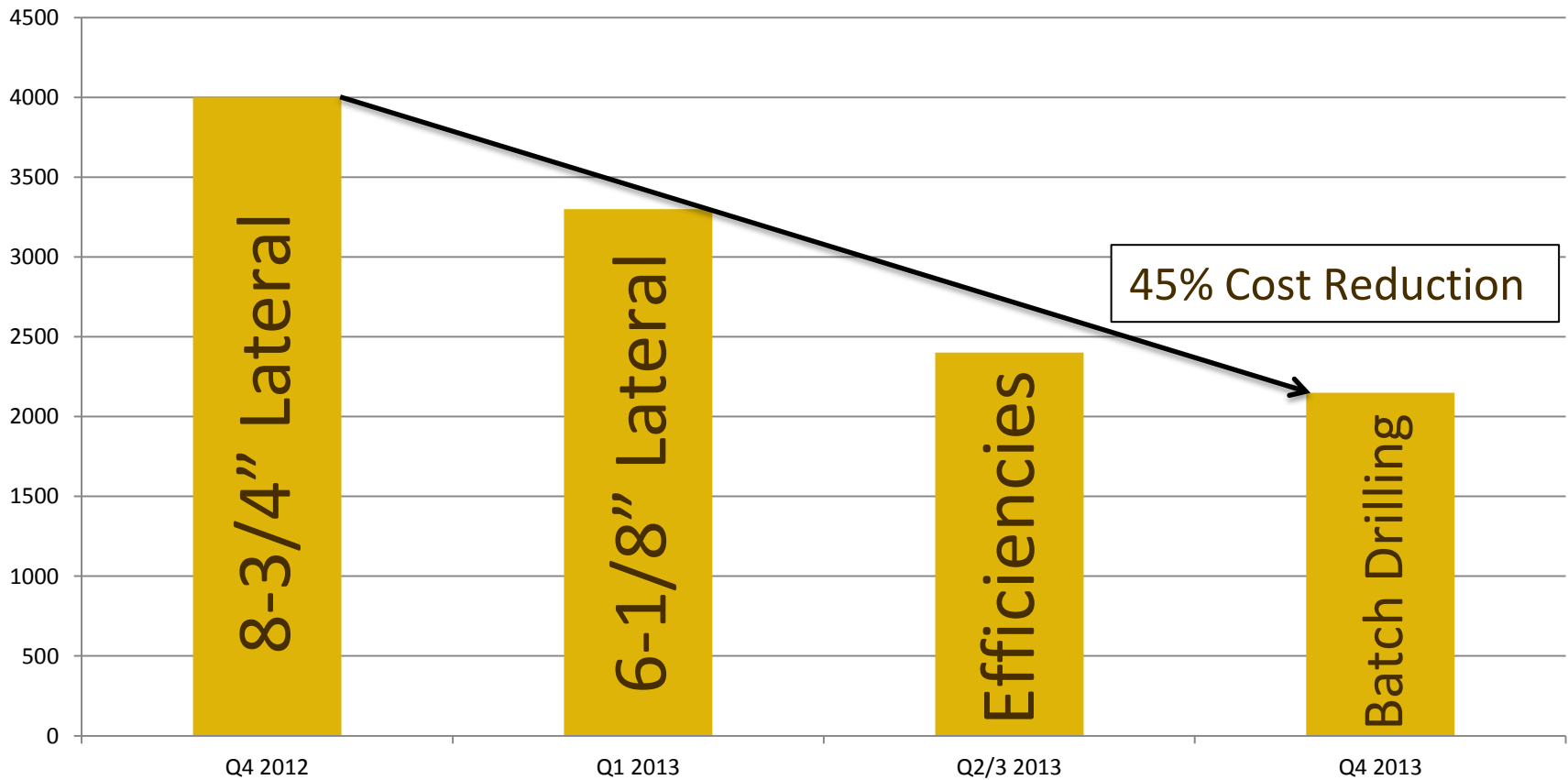
BATCH DRILLING AND SIMOPS

- Reduce environmental impact and economic burden per well
- Challenging topography in Roger Mills warrants Multi-well pads (or using existing pads) wherever possible
- Prolific BLM and ODWC locations exist, lowest footprint is best

- Significant savings with skid rigs and batch drill capability

EFFICIENCY + BATCH DRILLING

Approximate Actual cost, M\$



2014+

- ▶ Aggressive casing designs
 - ▲ Less 7" casing , where does it balance?
- ▶ WBM vs OBM
 - ▲ Potential savings greater than the induced risk?
- ▶ PDC vs TCI curves
 - ▲ Solid build rates vs PDC Speed and no KRev limitation
 - ▲ Important for 3D or extended curves for pad work
- ▶ Drilling shaly/silty streaks
 - ▲ Can completions perform an effective frac?

QUESTIONS

- Thank you for listening.