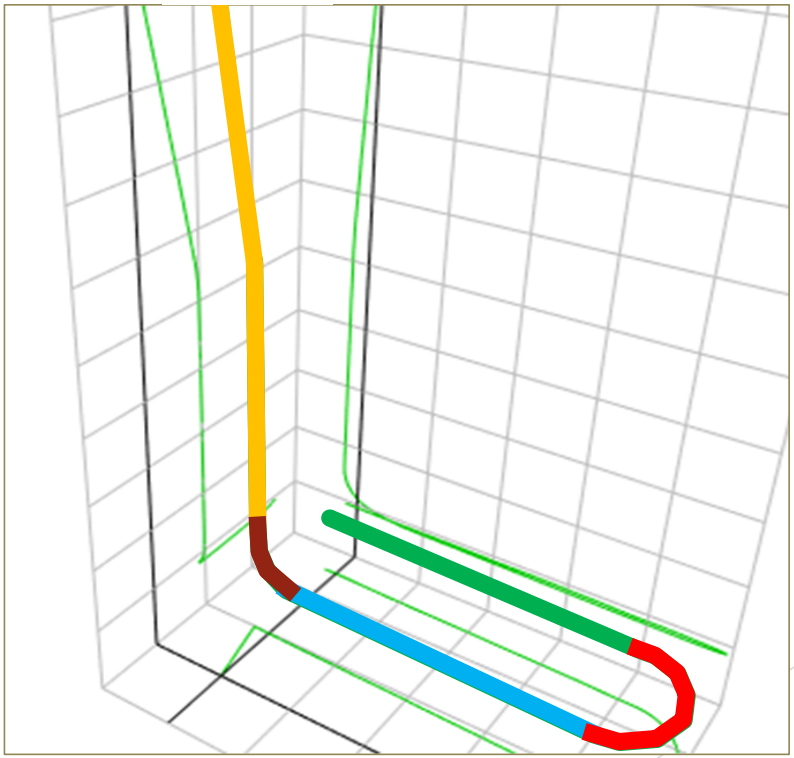
Lessons From U Laterals

John Huycke

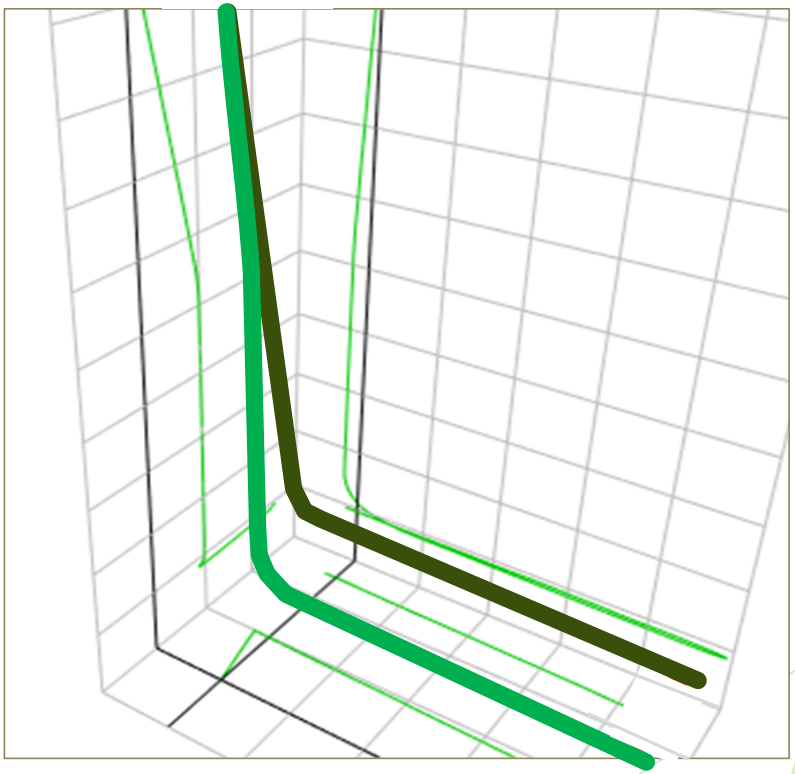
U Lateral Terminology

- **"Vertical Hole"** — the near-vertical hole
- **Curve** – transition from vertical to horizontal
- **Outgoing Leg** – lateral drilled away from surface location
- **Turn** – reverse lateral azimuth
- **Return Leg** – lateral drilled toward surface location



Stranded Sections

- One-mile laterals are marginally economic or uneconomic
- Two-mile laterals are not possible in a stranded section
- How to drill a two-mile lateral in a stranded section?



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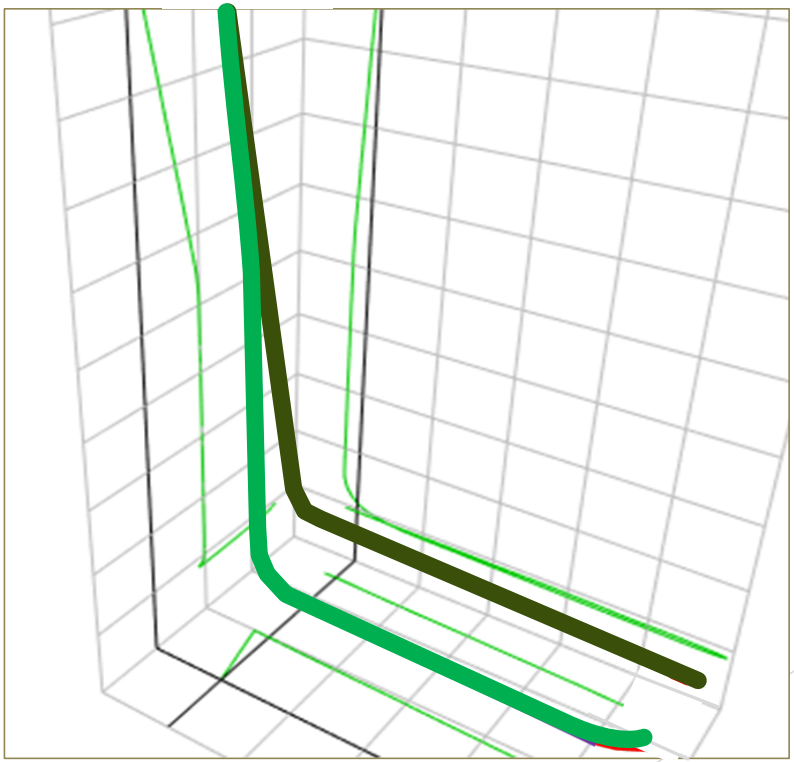

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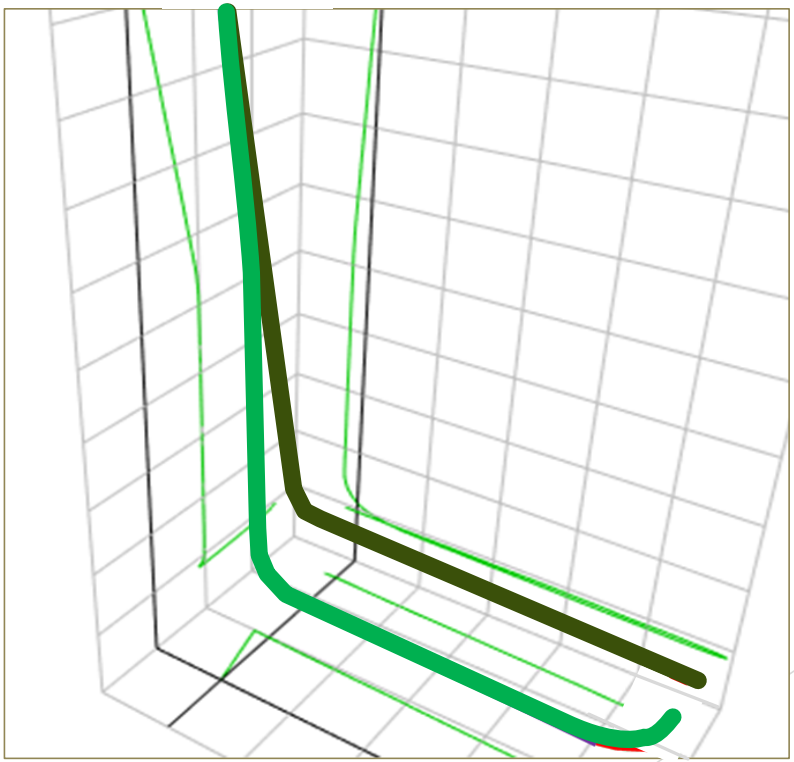

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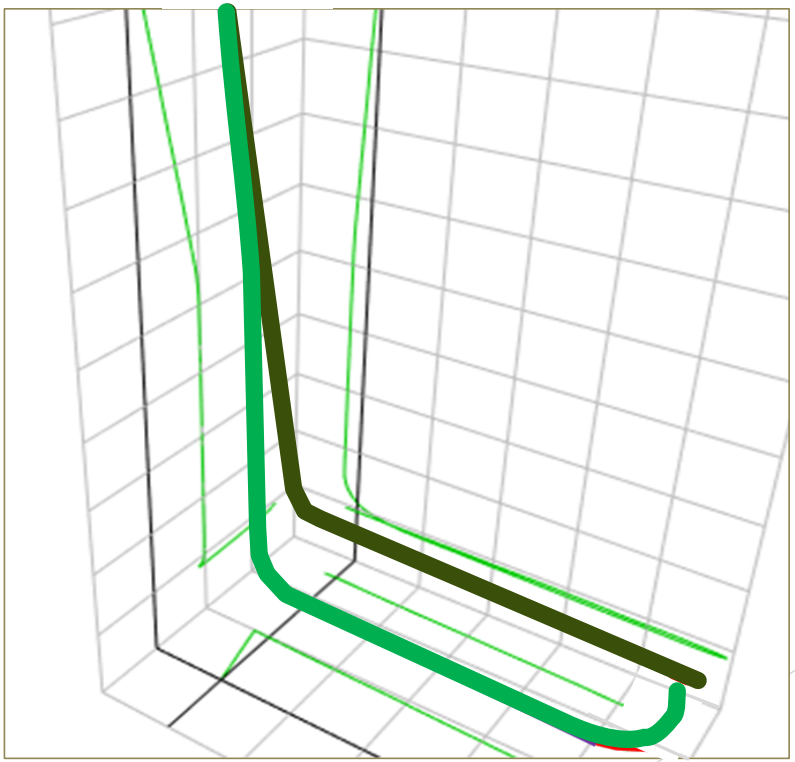

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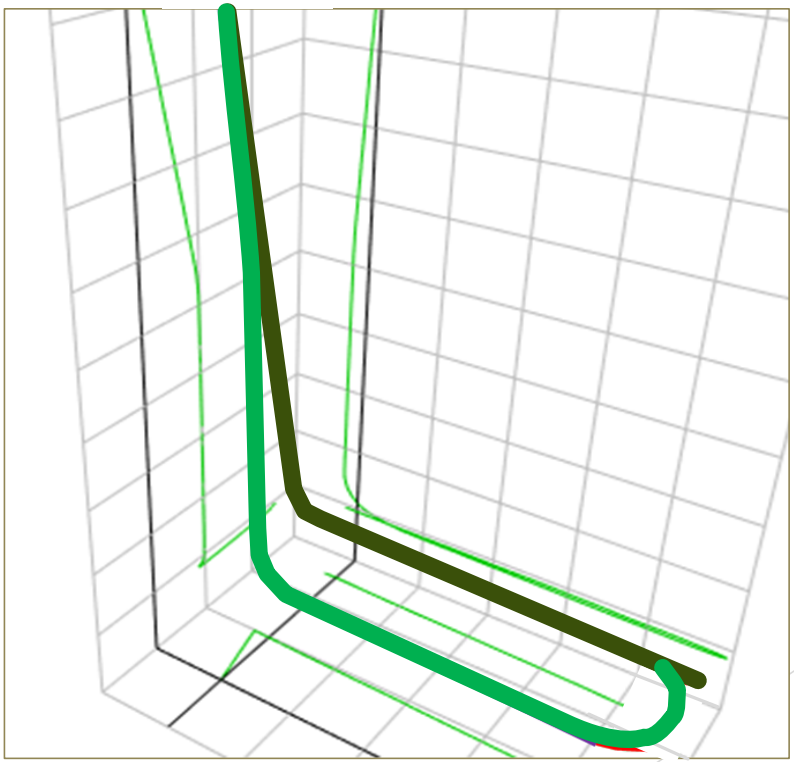

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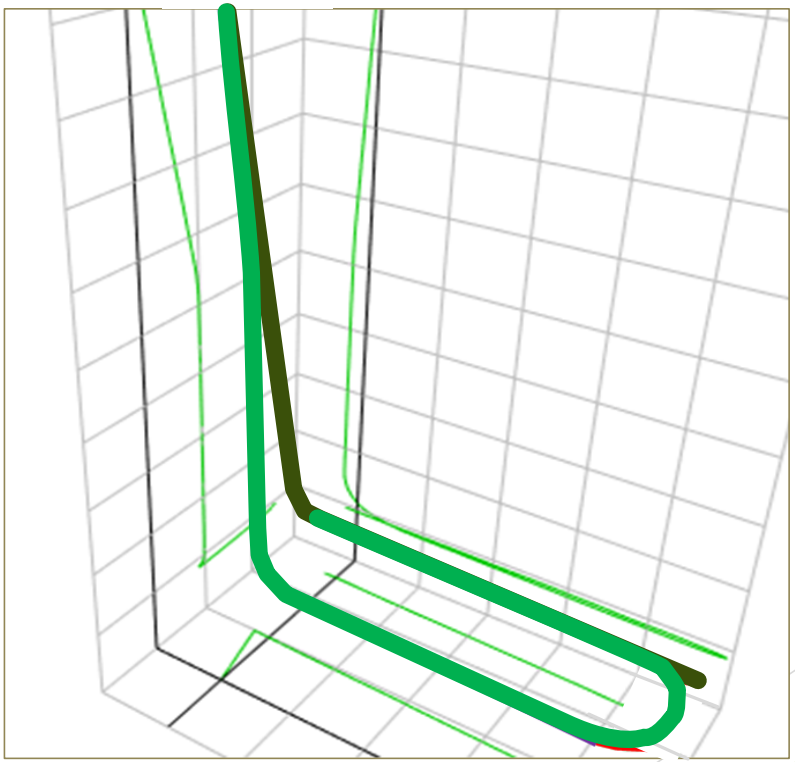

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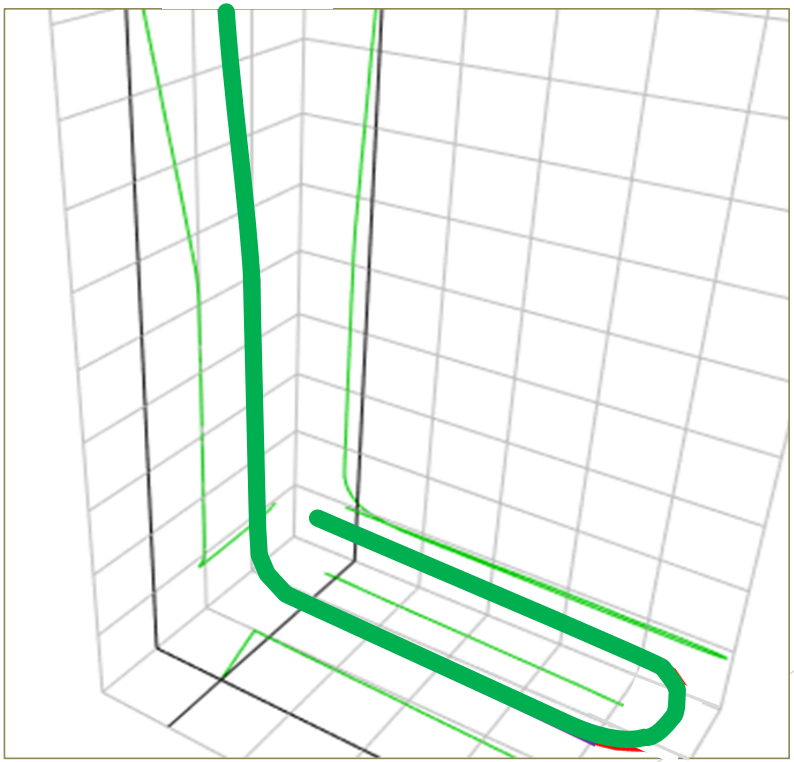
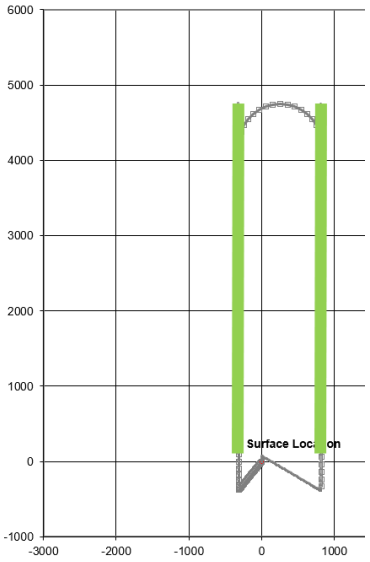


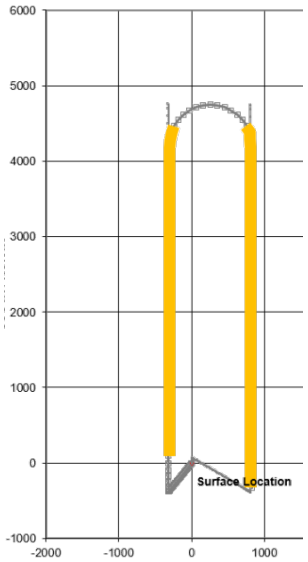
U Lateral Economics

Footage Comparison

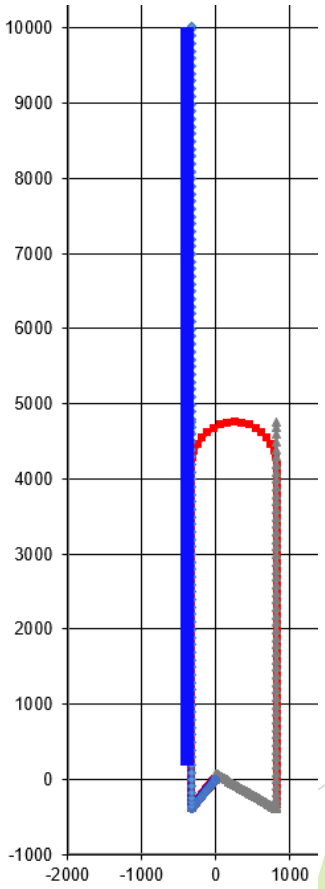
2 one-mile laterals:
9410’



U lateral:
9213’

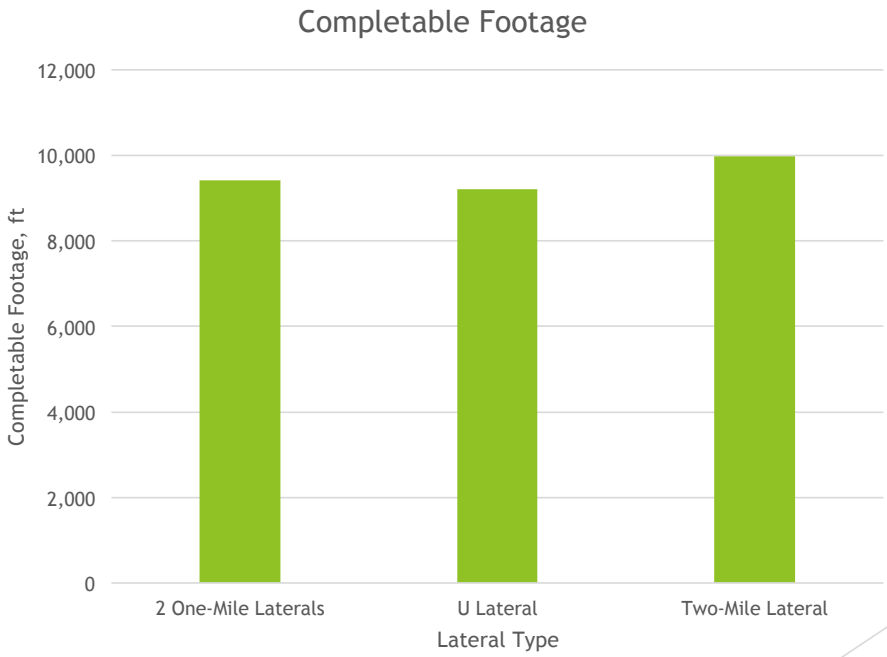


Two-mile lateral:
9985’



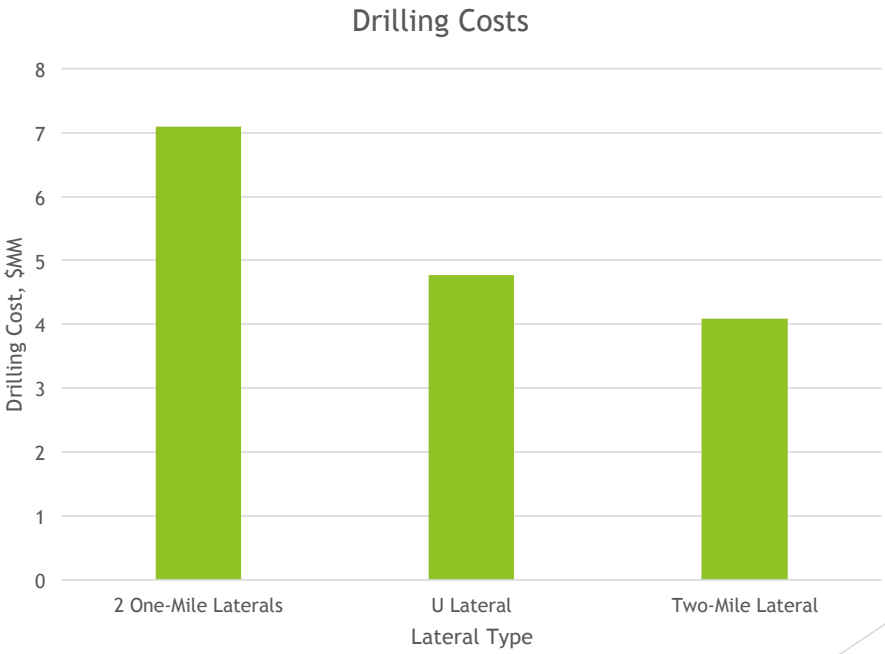
Completable Footage

- Two-mile lateral gives best formation exposure—that's where we'd like to be if the acreage position is right
- Two one-mile lateral is 600' behind
- U lateral is about 200' behind the 2 one-mile option



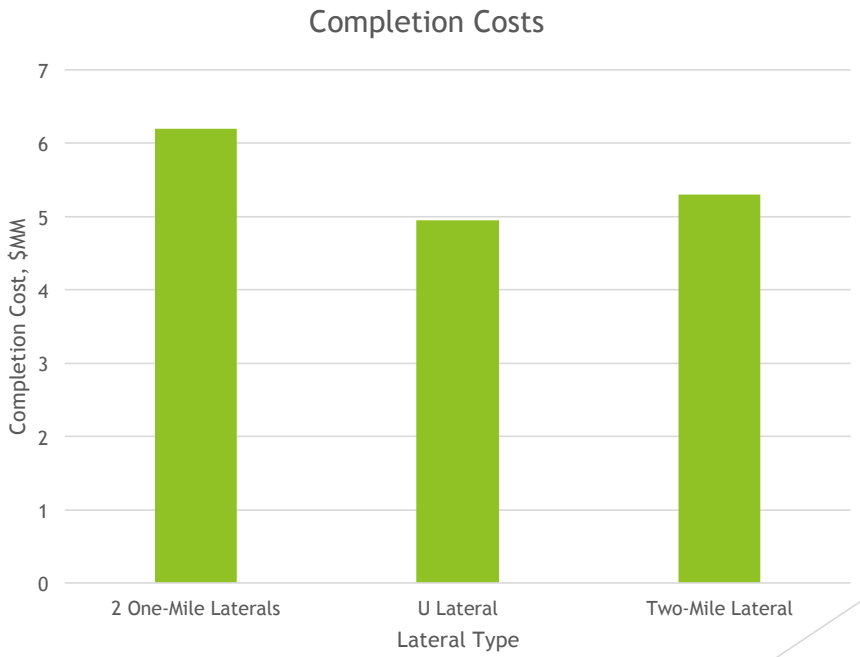
Drilling Cost

- Substantial savings with U and 2-mile laterals
- 2-mile laterals not an option in stranded sections
- Savings from eliminating intermediate through landing



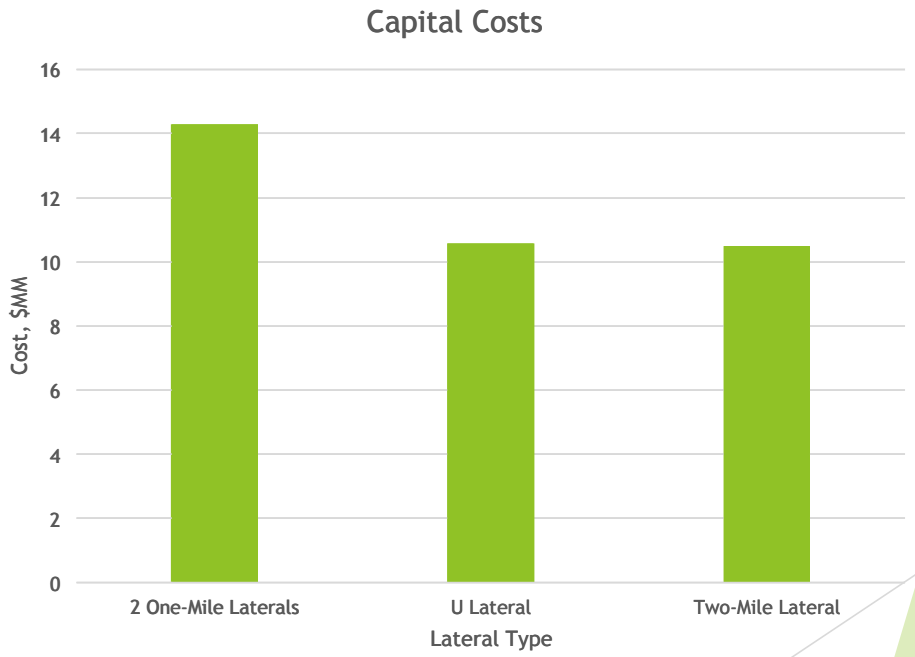
Completions Costs

- Substantial savings with U and 2-mile laterals
- 2-mile laterals not an option in stranded sections
- Savings from eliminating a tubing string, additional trips and rental duplications



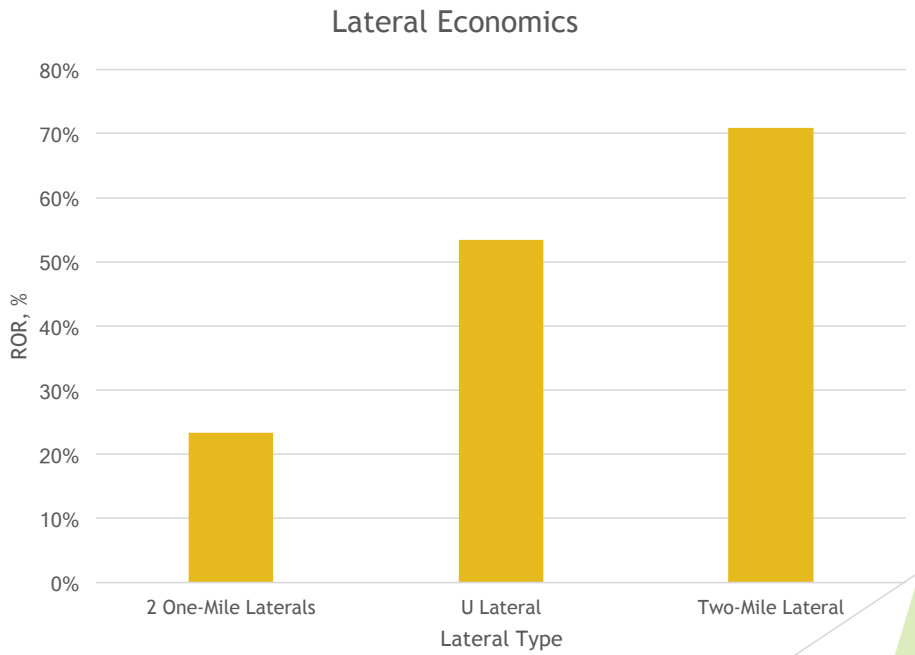
Total Cost Well Cost

- One-mile program is expensive
- The U lateral well is about the same cost as a two-mile lateral, but delivers 800’ fewer completable feet



Rate of Return

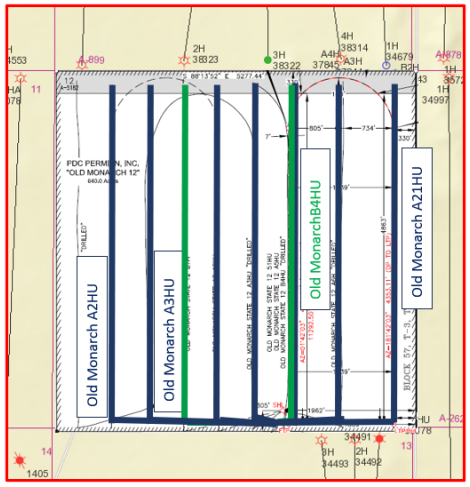
- In stranded sections, U laterals boost the ROR
- (Two-mile lateral shown for comparison but not an option in stranded sections)



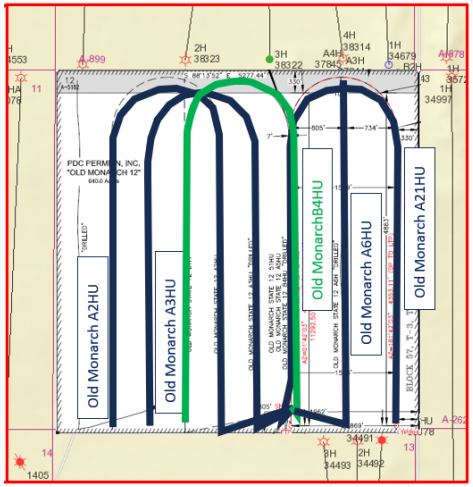
Old Monarch Current Economics (today's cost structure)

Development Plan	Wellbores		Capital $MM	ROR %
	One-Mile	U Lateral		
Conventional	9	0	64	23
U Lateral	1	4	49	47
Actual	3	3	53	38

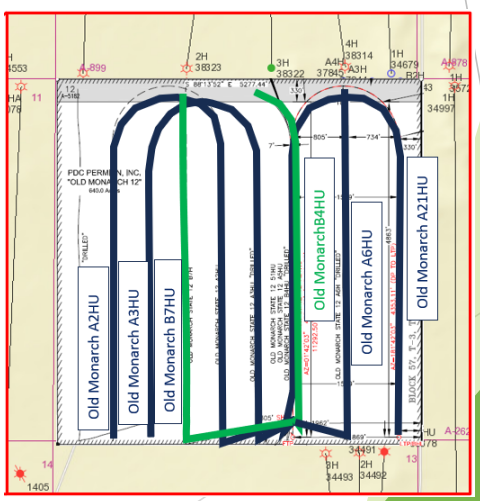
Conventional



U Plan



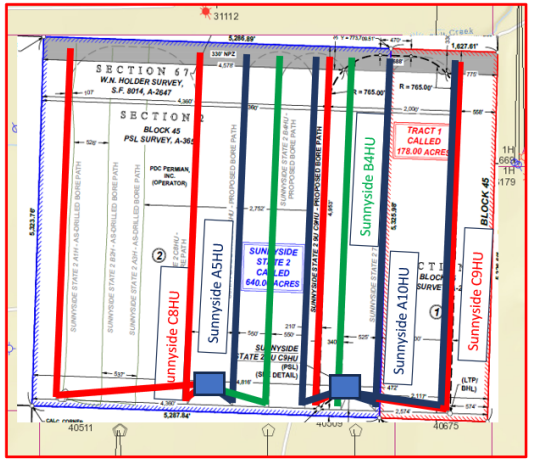
Actual



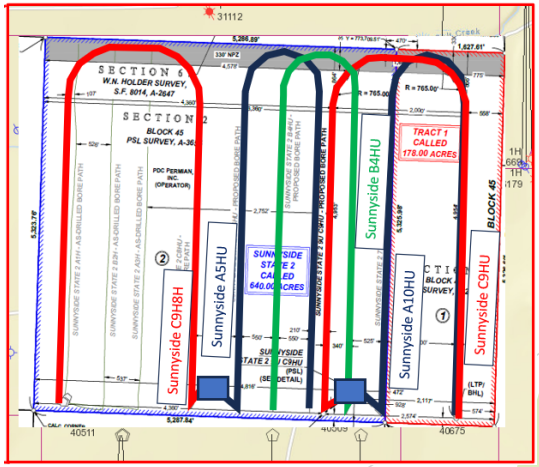
Sunnyside Current Ecomonics (today's cost structure)

Development Plan	Wellbores		Capital $MM	ROR %
	One-Mile	U Lateral		
Conventional	10	0	71	23
U Lateral	0	5	53	53

Conventional



U Lateral



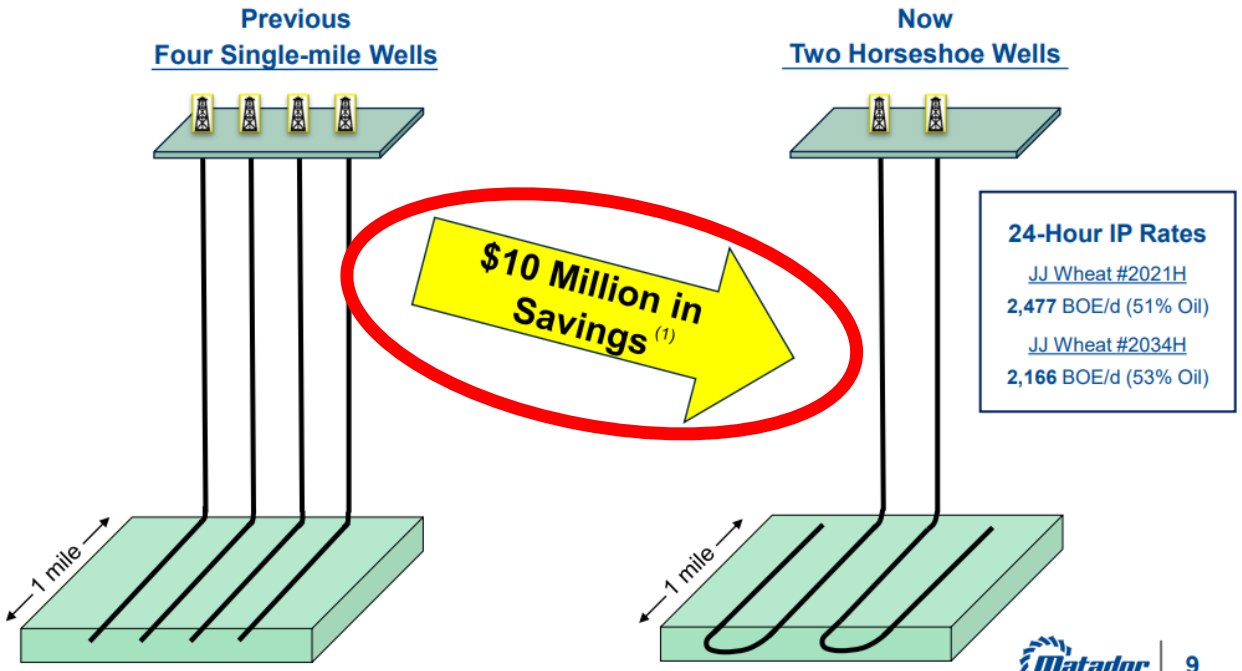
Economics Using U Laterals

- ROR Increase: 25 - 40%
- Cost Reduction: $3.5MM - $4.0MM
- Matador Cost Reduction: Bigger Savings

SLIDE F

"Horseshoe" Wells – Savings Achieved Through Successful Operational Execution

- **Q4 2023**: Two Horseshoe wells turned in line
  - ***Increases value and potential*** of acreage portfolio
  - ***Drilled wells in record time***



24-Hour IP Rates

JJ Wheat #2021H
2,477 BOE/d (51% Oil)

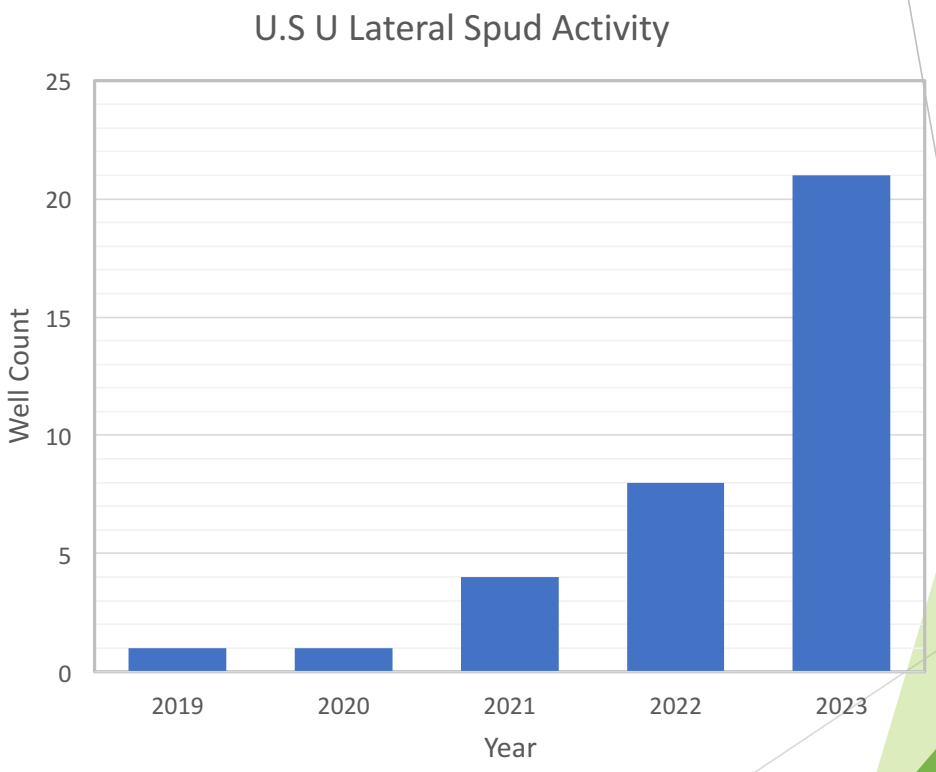
JJ Wheat #2034H
2,166 BOE/d (53% Oil)

(1) Savings based on cost estimates for drilling four single-mile laterals versus two horizontal horseshoe well designs.

U Lateral History

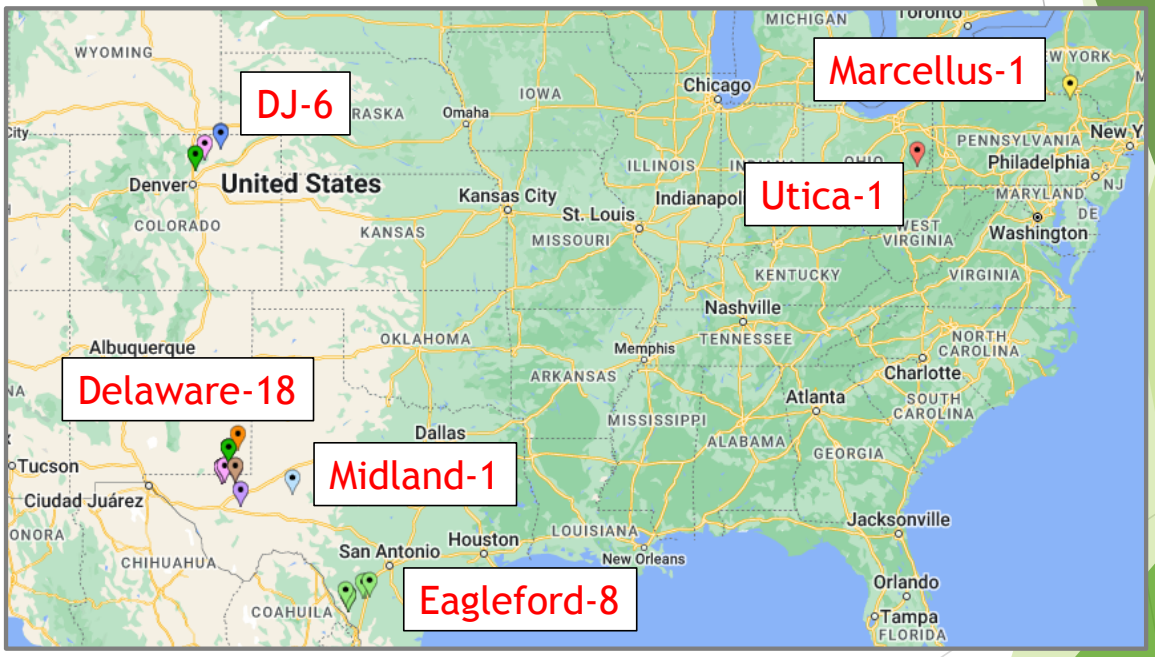
U Lateral History

- 2019:
  - Shell in Delaware Basin
- 2020:
  - Chesapeake in Eagleford
- 2021:
  - Chesapeake in Eagleford
  - 3 wells by PDC in Delaware
- 2022:
  - 8 wells by Chesapeake, Ascent, Bison and Oxy
- 2023:
  - 21 wells by Chesapeake, Coterra, Forge Energy, Hibernia, Matador, Oxy, PDC & Marathon

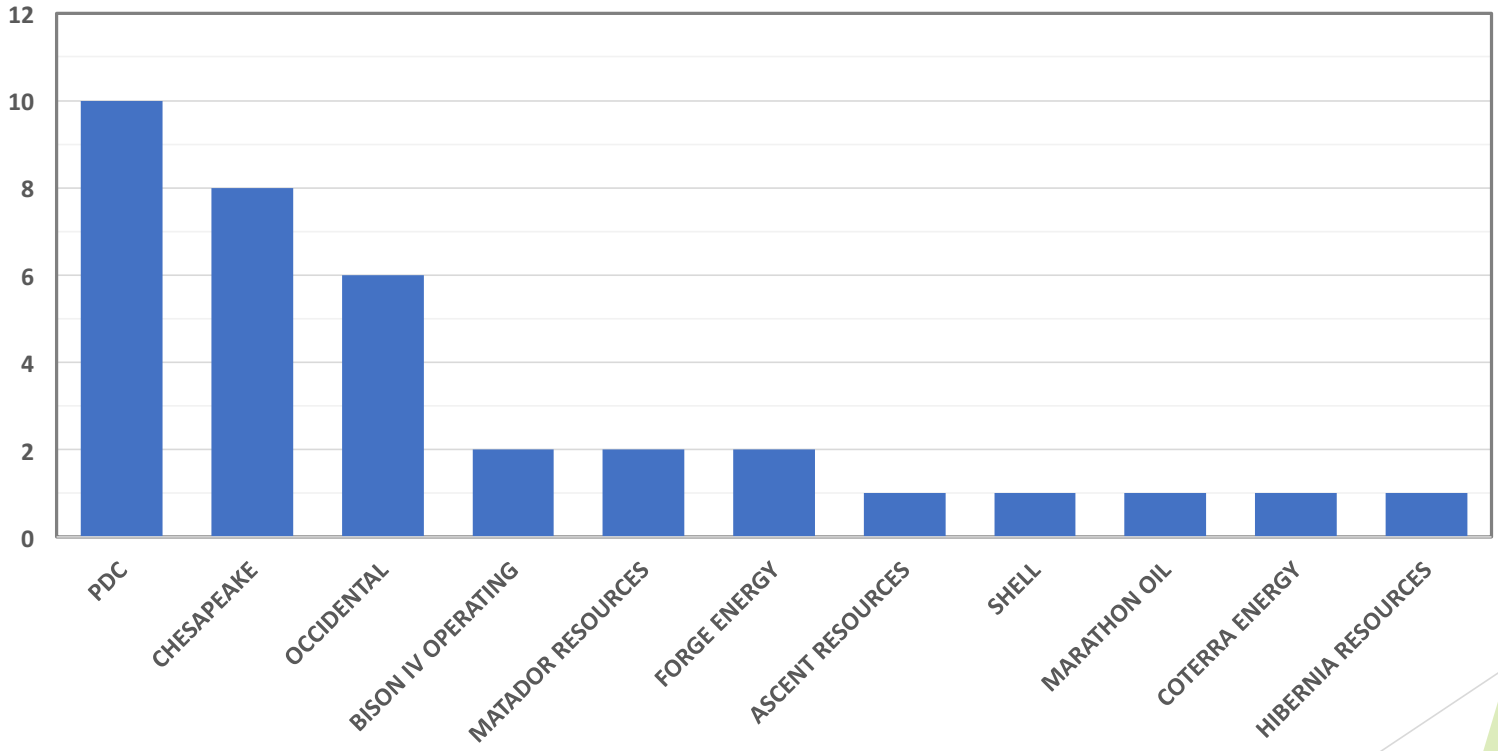


Well Locations

- Basins:
  - Delaware
  - Eagleford
  - DJ
  - Midland
  - Marcellus
  - Utica
- Total is 35 wells



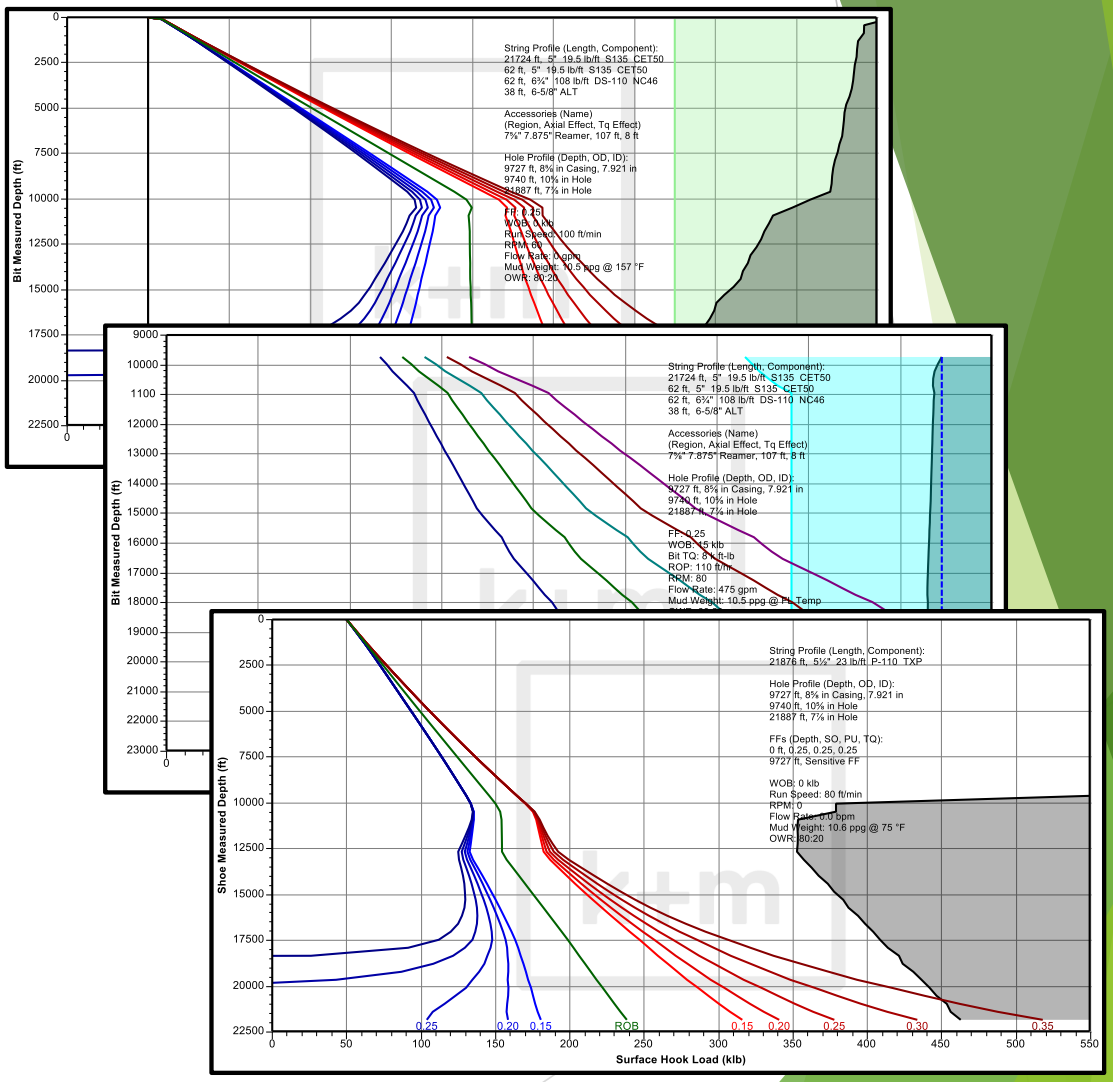
Operator Well Count



Planning and Execution

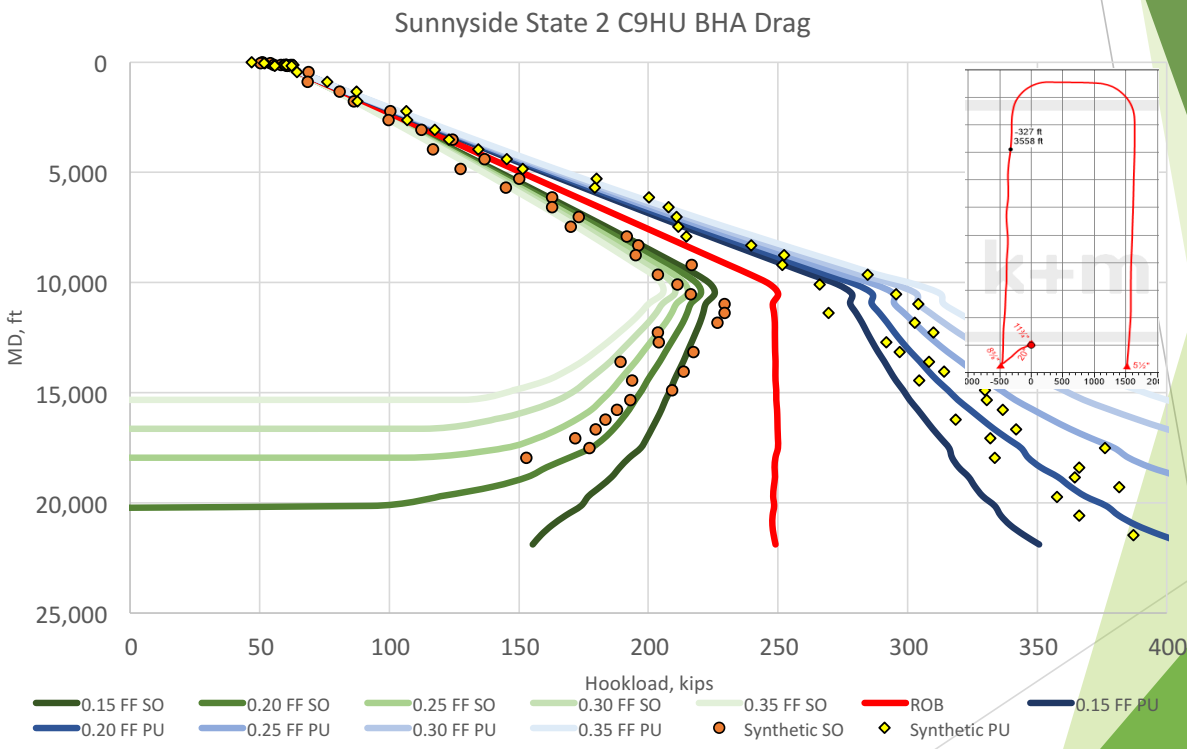
Drilling Success

- Tripping BHA's in and out of the hole
- Capability to drill
  - Drill pipe torque capacity
  - Rig TDS torque capacity
- Tripping casing to bottom around the U
  - Connection strength in rotation
- Cementing—no change from 2-mile laterals



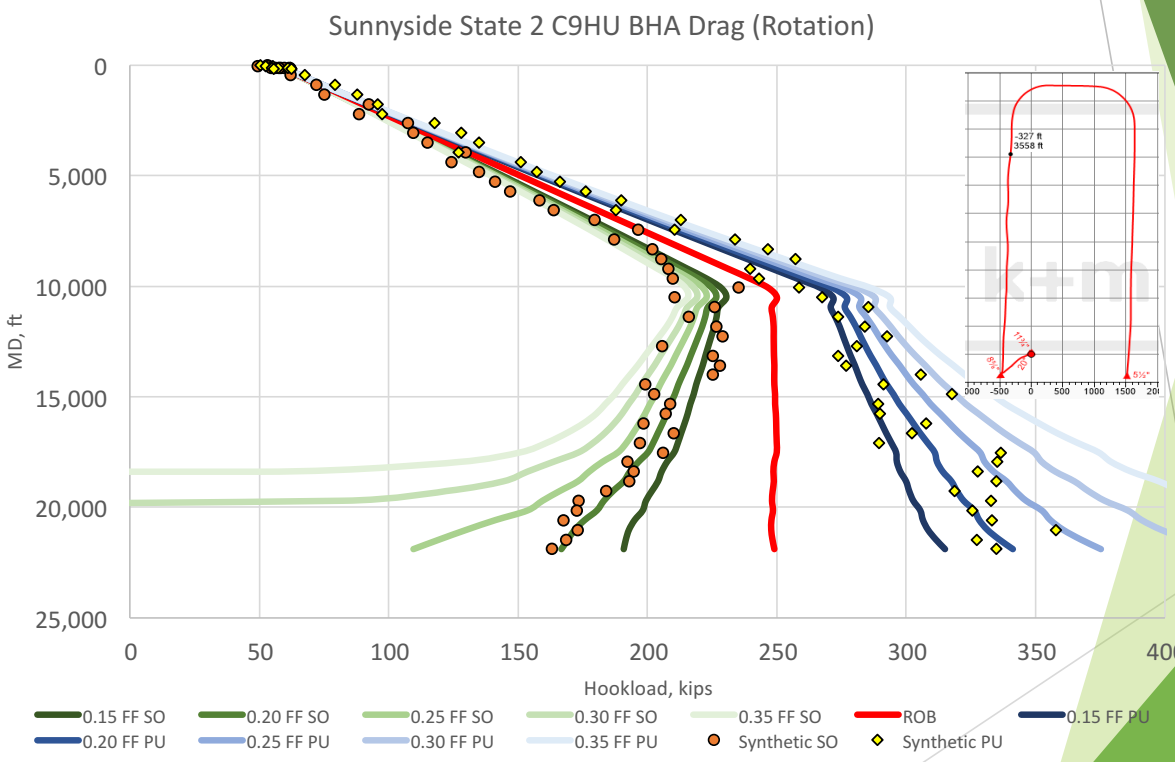
Tripping BHA

- Texas RRC Surveys
- Synthetic drag points
- TIH without rotation



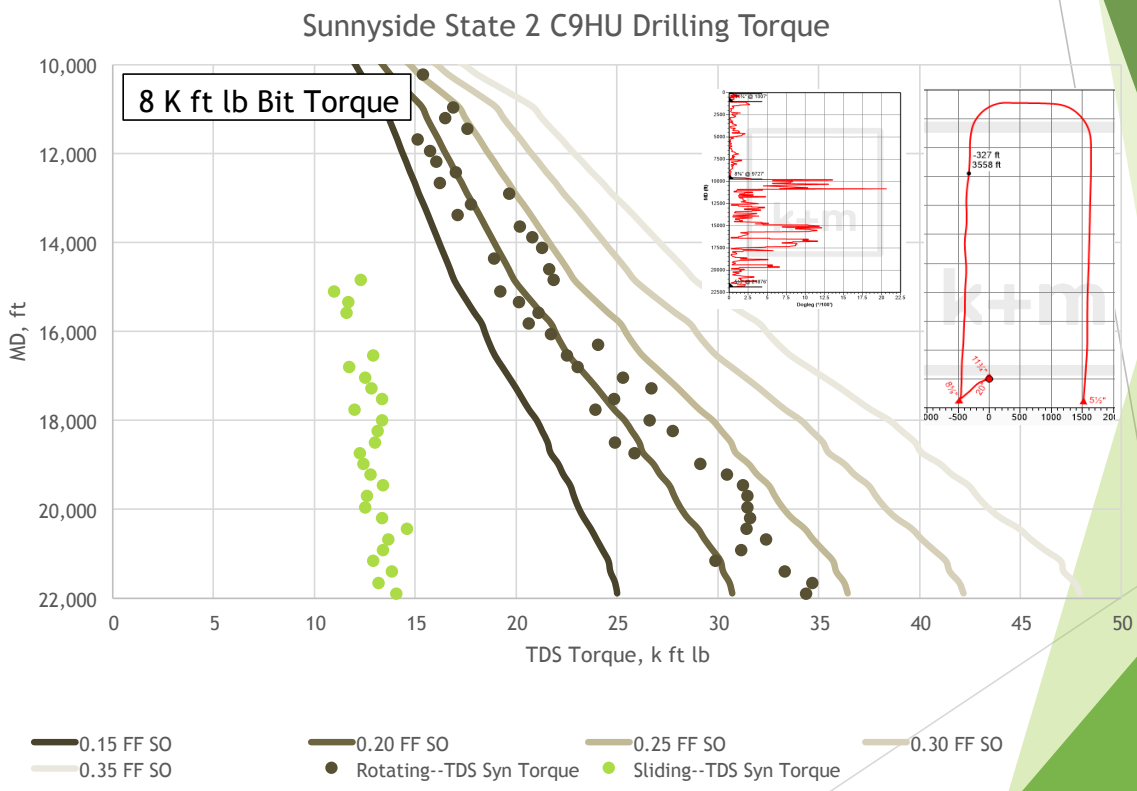
Tripping BHA—Rotation

- Texas RRC Surveys
- Synthetic drag points
- Rotation



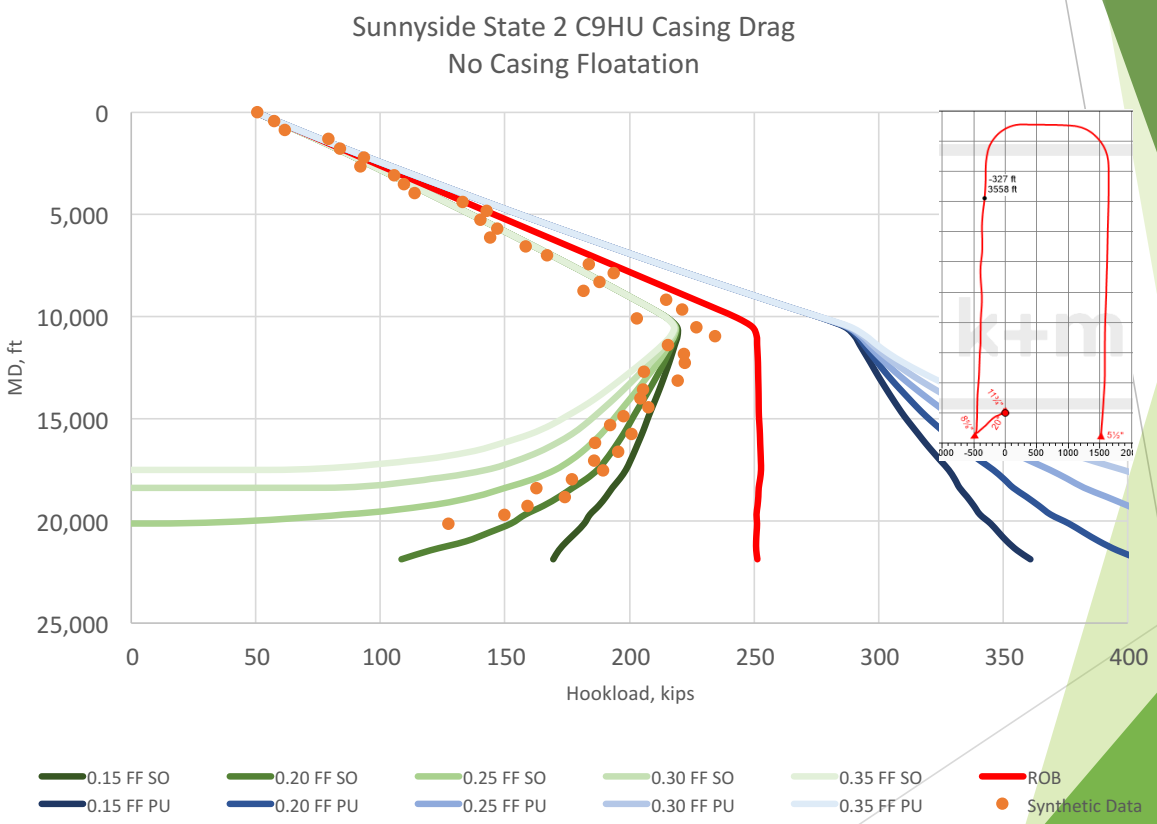
Drilling Torque

- Texas RRC Surveys for Sunnyside C9HU
- Synthetic torque points
- Turn with BH mud motor
- Return with BH mud motor (based on DLS)



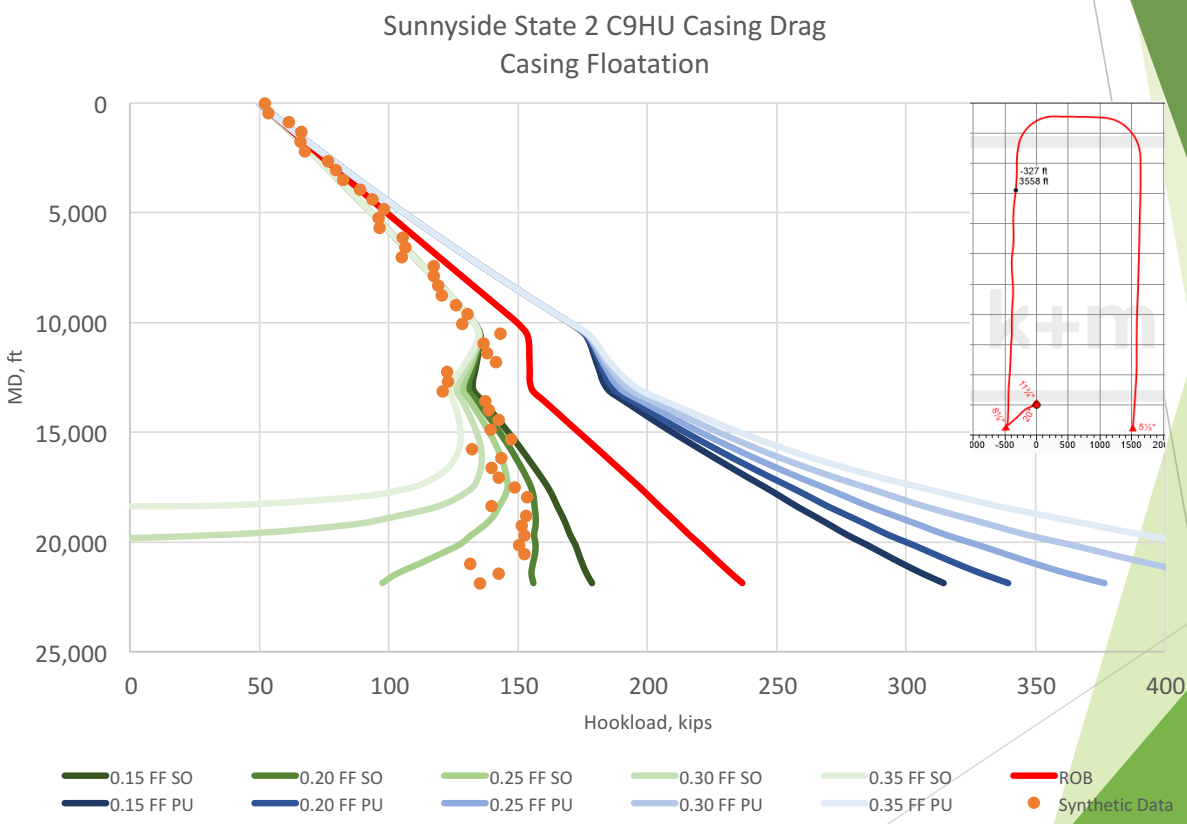
Running Casing

- Texas RRC Surveys
- Synthetic drag points
- No Floatation



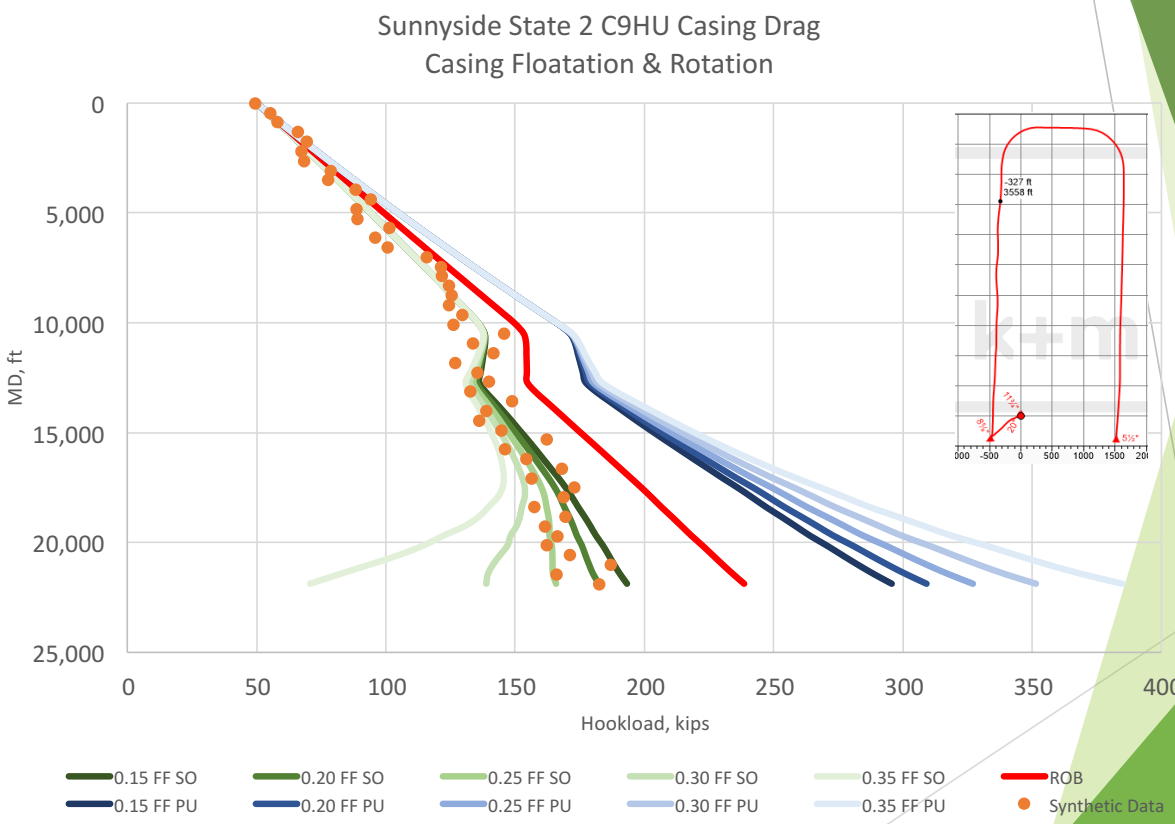
Running Casing—Floatation

- Texas RRC Surveys
- Synthetic drag points
- Floatation



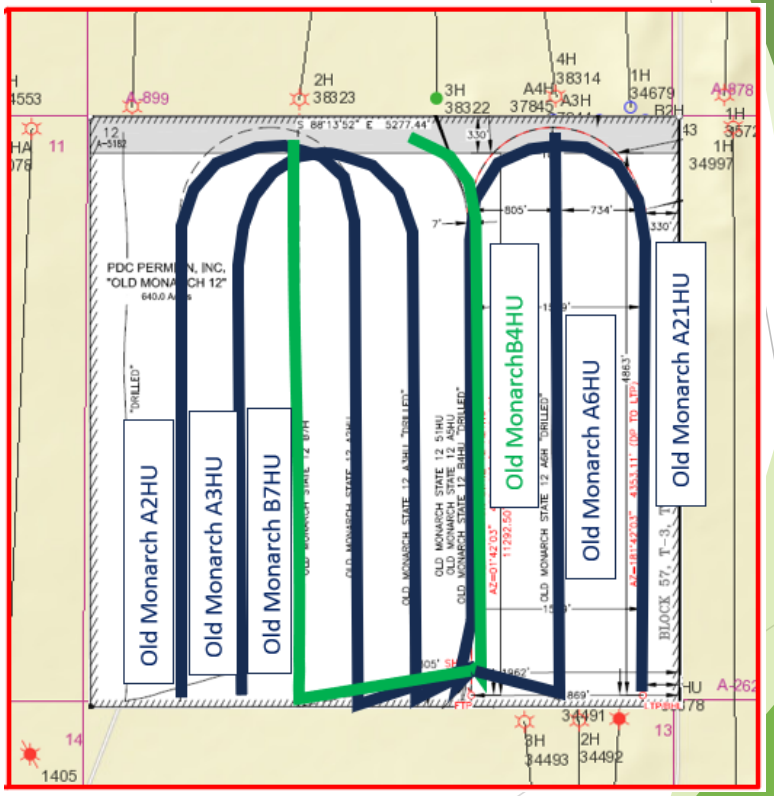
Running Casing—Floatation & Rotation

- Texas RRC Surveys
- Synthetic drag points
- Floatation & Rotation



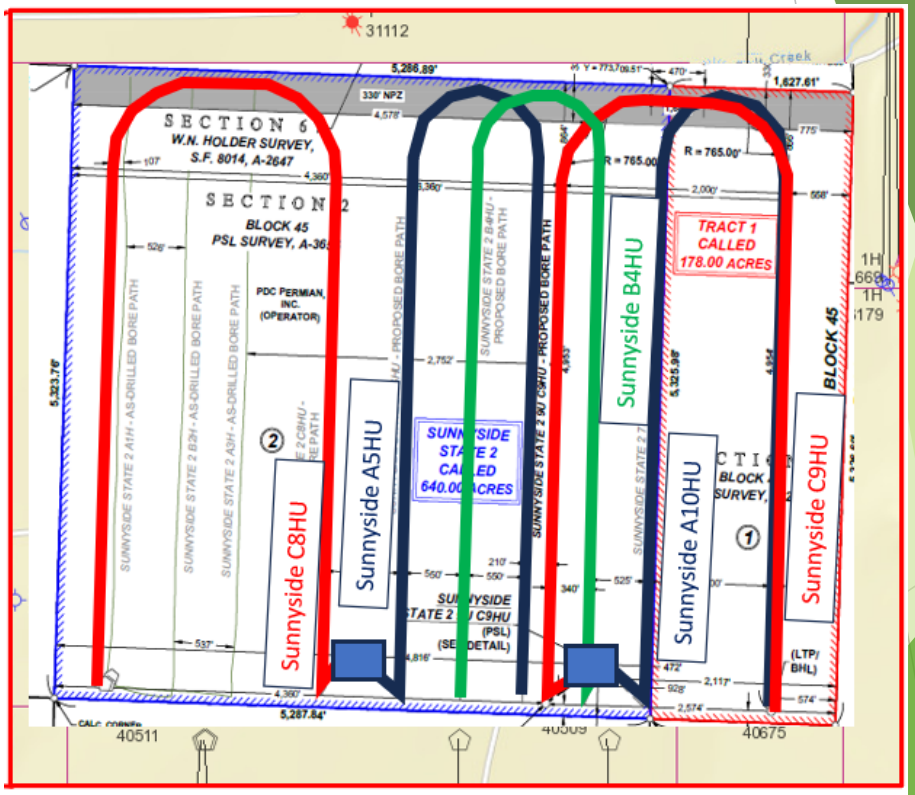
Old Monarch Location

- Old Monarch A3HU, A2HU and A21HU were successful in the Wolfcamp A
- Old Monarch B4HU drilled through 70 degrees in turn and the well was terminated and completed in the Wolfcamp B as a one mile lateral
- Another one-mile lateral was drilled to replace the return leg
- Severe depletion in the intermediate hole from producing wells to the south
- Severe depletion in the Wolfcamp A turn section—lost circulation



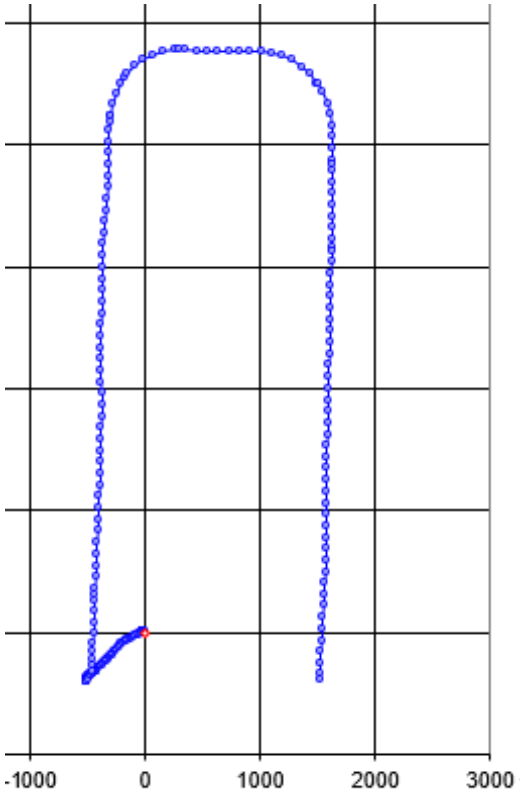
Sunnyside Location

- All five wells were successfully drilled and cased
- The B4HU intermediate casing was stuck high. The lateral had an inadvertent sidetrack in the U
- Operation issues in the intermediate hole:
  - The A10HU had an extra expandable string of casing (4 strings) for intermediate hole trouble
  - The C8HU and A5HU wells set surface casing deeper to prevent trouble and used a 3-string design



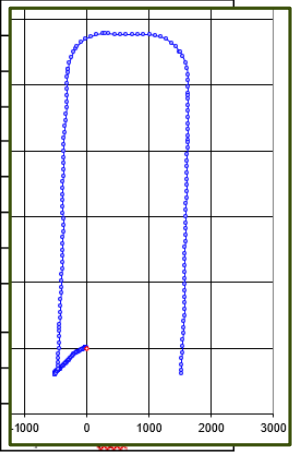
Drilling the Turn

- The turn is the same as drilling two curves but laid out 1 mile horizontally—need good DD's
- Turn BHA
  - 2.0 deg **slick** bent housing motor with high rpm's
  - Reamer a stand behind the BHA
  - Two agitators 2000' and 4000' behind the BHA
- Turn mechanics
  - Hole cleaning
  - Wellbore rugosity
  - BH motors versus RSS



Example Turn BHA

7-7/8" Hole – Turn BHA									
Description	Dimensions (±)				Cum Length (ft)	Connection		Comments	
	O. D. (in)	I. D. (in)	Gauge (in)	Length (ft)		Top	Bottom		
7-7/8" Drill Bit	7.875		7.875	1	1	4-½" Reg-P			
6-5/8" Drill Mtr, 5/6 Lobe, 8.2 stage, 2.0° Slick BH (BFF)	6.625			30	31	NC50-B	NC50-P	DIR	0.420 rpg 300 – 600 gpm Op Diff 1930 psi Max torq 11760 ft lb
6-1/2" UBHO	6.625	3.250		3	34	NC50-B	NC50-P	DIR	
NMDC	6.625	3.250		38	72	NC50-B	NC50-P	DIR	
NMDC	6.625	3.250		31	103	NC50-B	NC50-P	DIR	
Float Sub	6.500	2.750		4	107	NC50-B	NC50-P	DIR	
Cross Over	6.625	3.000		5	112	HT-B	NC50-P	DIR	
1 stds 5" DP	5.000	4.276		93	205	HT-B	HT-P	RTL	
Reamer	6.750	3.250		9	214	HT-B	HT-P	RMR	
20 stds 5" DP	5.000	4.276		1880	2074	HT-B	HT-P	RTL	
6-1/2" Agitator w/ Safety Sub	6.500			14	2093	HT-B	HT-P	AGI	
20 stds 5" DP	5.000	4.276		1880	3307	HT-B	HT-P	RTL	
6-1/2" Agitator	6.500			14	3326	HT-B	HT-P	AGI	
5", 19.5 ppf, S-135 DP	5.000	4.276				HT-B	HT-P	RTL	



Example Return BHA

7-7/8" HOLE – RETURN BHA									
DESCRIPTION	DIMENSIONS (±)				CUM LENGTH (FT)	CONNECTION		COMMENTS	
	O. D. (IN)	I. D. (IN)	GAUGE (IN)	LENGTH (FT)		TOP	BOTTOM		
7-7/8" Drill Bit	7.875		7.875	1	1	4-½" Reg-P			
6-5/8" Drill Mtr, 7/8 Lobe, 6.9 stage, 1.83° Slick BH (BFF)	6.625			30	31	NC50-B	NC50-P	DIR	0.230 rpg 300 – 700 gpm Op Diff 1960 psi Max torq 19010 ft lb
6-1/2" UBHO	6.625	3.250		3	34	NC50-B	NC50-P	DIR	
NMDC	6.625	3.250		38	72	NC50-B	NC50-P	DIR	
NMDC	6.625	3.250		31	103	NC50-B	NC50-P	DIR	
Float Sub	6.500	2.750		4	107	NC50-B	NC50-P	DIR	
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6-1/2" Agitator w/ Safety Sub	6.500			14	2093	HT-B	HT-P	AGI	
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6-1/2" Agitator	6.500			14	3326	HT-B	HT-P	AGI	
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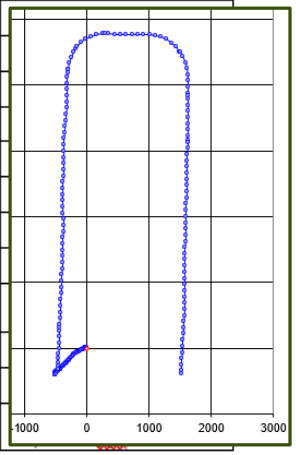

Stranded Sections

- If you have stranded sections, executing on U laterals--drilling and completions--needs to be a **core** competency

- Don’t burn investors’ capital!

- More U lateral information at udriller.com