January 2018, SPEE / SPE Presentation

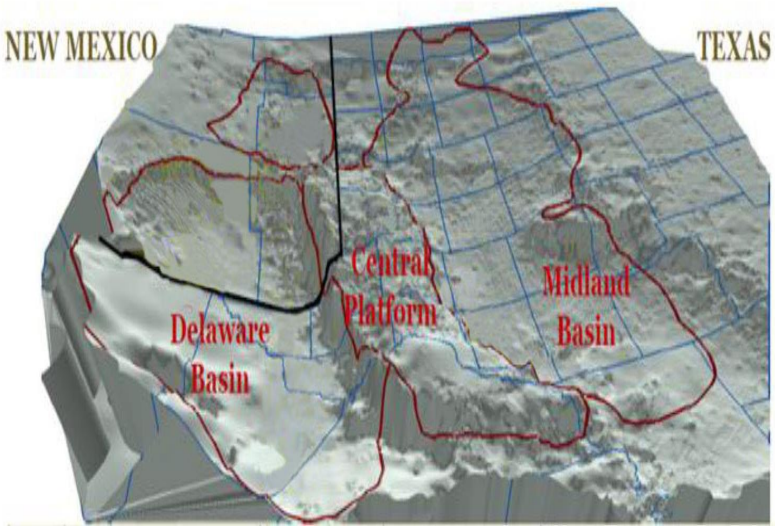
What Makes the Delaware Tick?

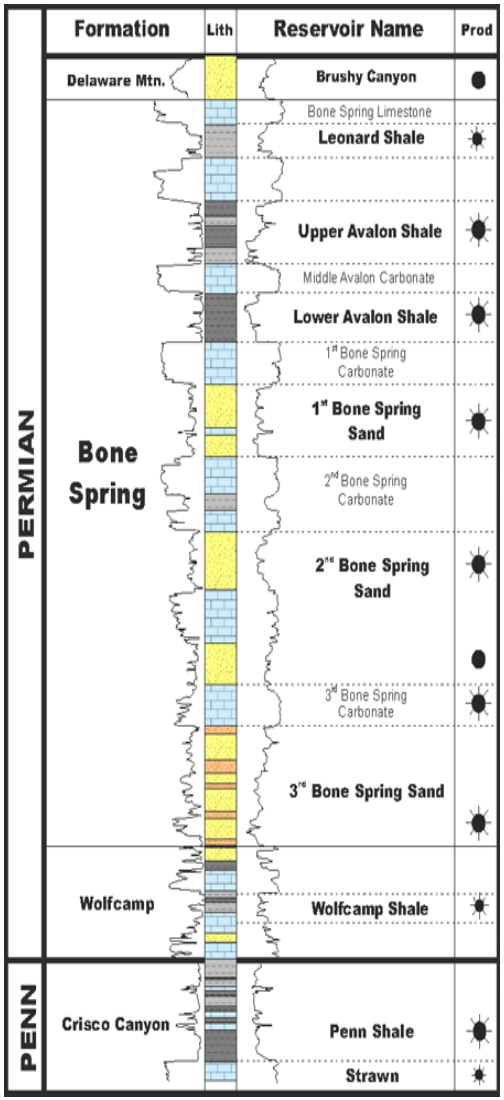
Jeff Sieler, Managing Director Citigroup

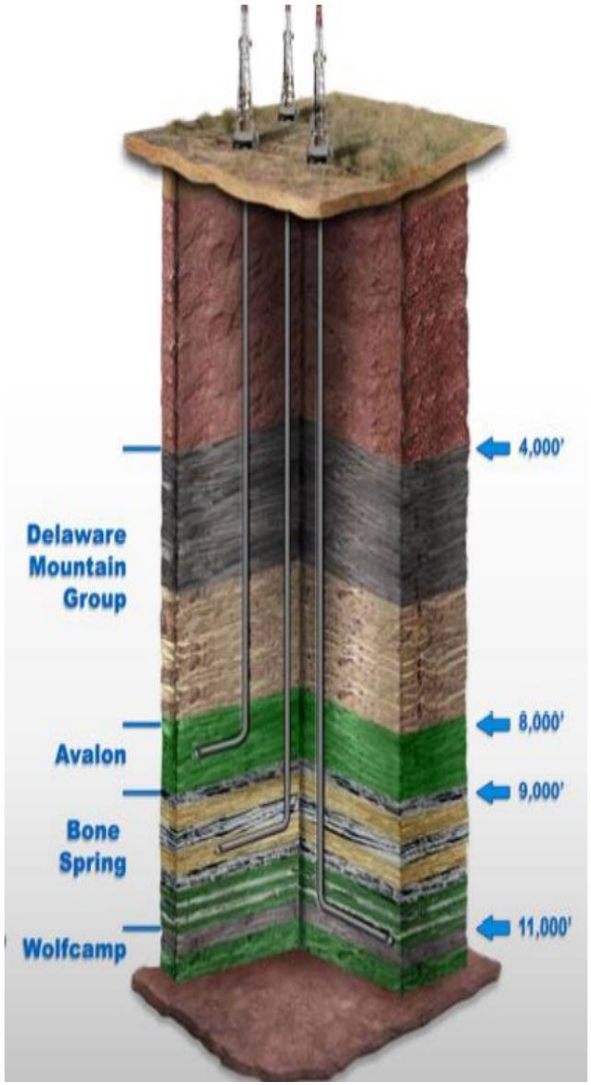
Delaware Basin Renaissance

Prolific hydrocarbon producing province with ~6.3 billion barrels of oil and 57 Tcf of gas produced since 1935.

- Structural low for most of Permian time: inlet for marine water
- This led to the deposition of deep water deposits as well as carbonate buildups and other shallow/deep marine deposits
- **This cyclicity of source rock and carbonate/deep water deposition resulted in the stacking of several hydrocarbon 'plays'**
  - **Up to 9 separate targets in the Permian section**
- Permian age unconventional targets are the Delaware Mountain Group, Avalon, Bonesprings, and Wolfcamp Formations





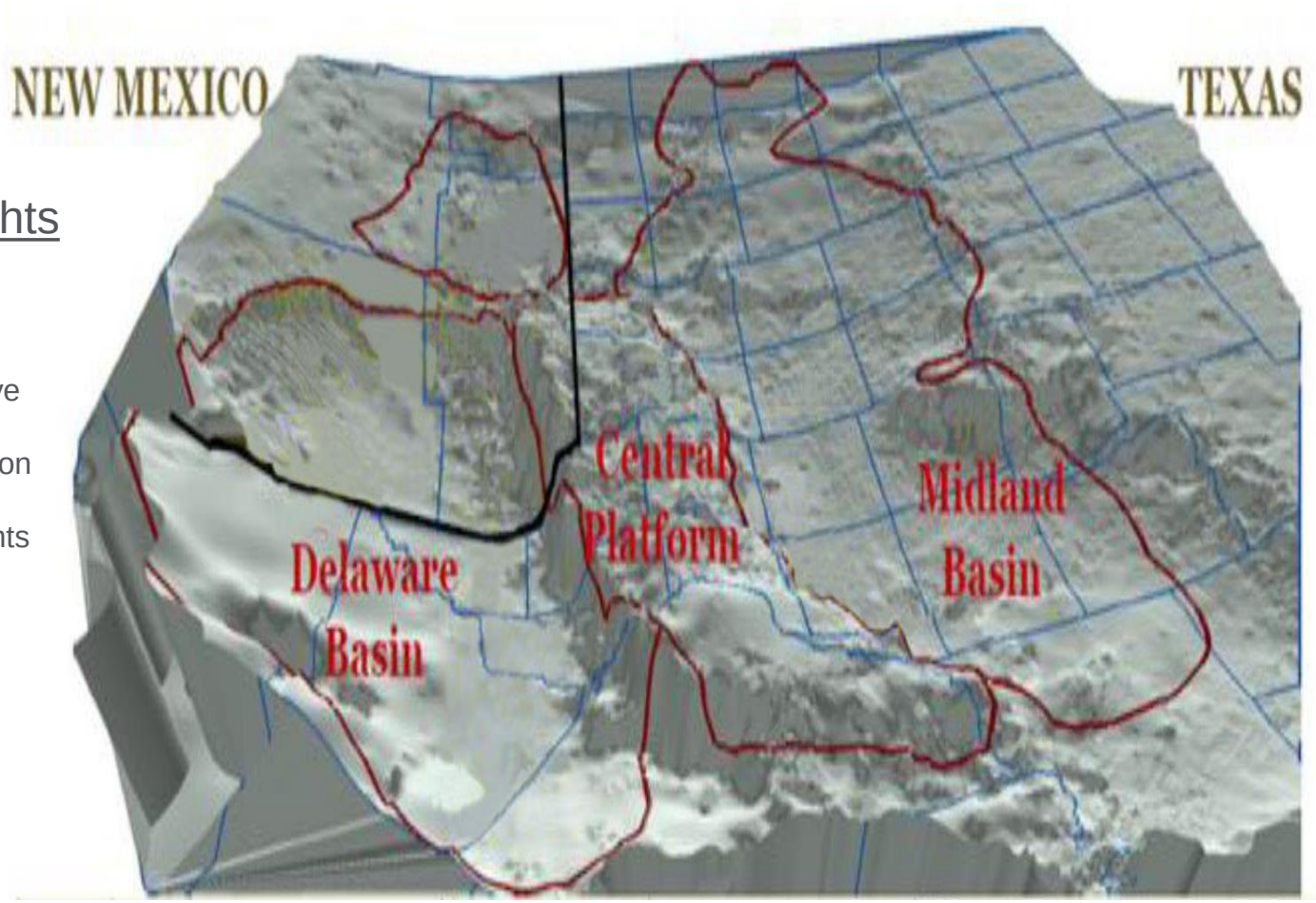


Source: Drillinginfo, Concho Investor Presentation

Understanding the Structural Setting is Essential

Depositional Highlights

- Ocean Deep Water
- Transgressive / Regressive
- Carbonate Shelf Generation
- Multiple Clastic Entry Points
- Frackable Lithology

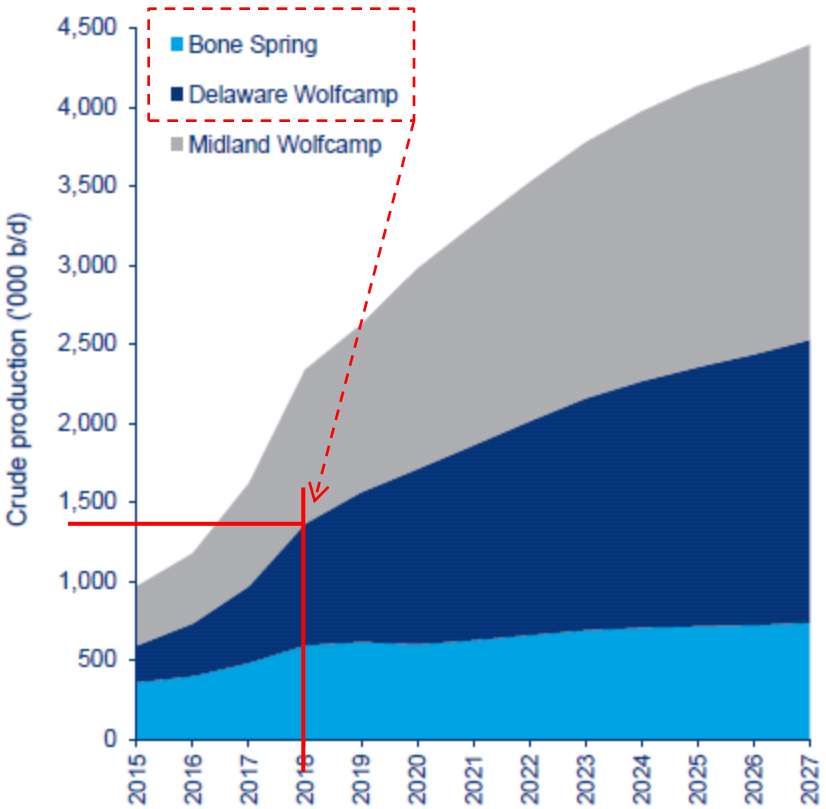


Source: Drillinginfo, Concho Investor Presentation

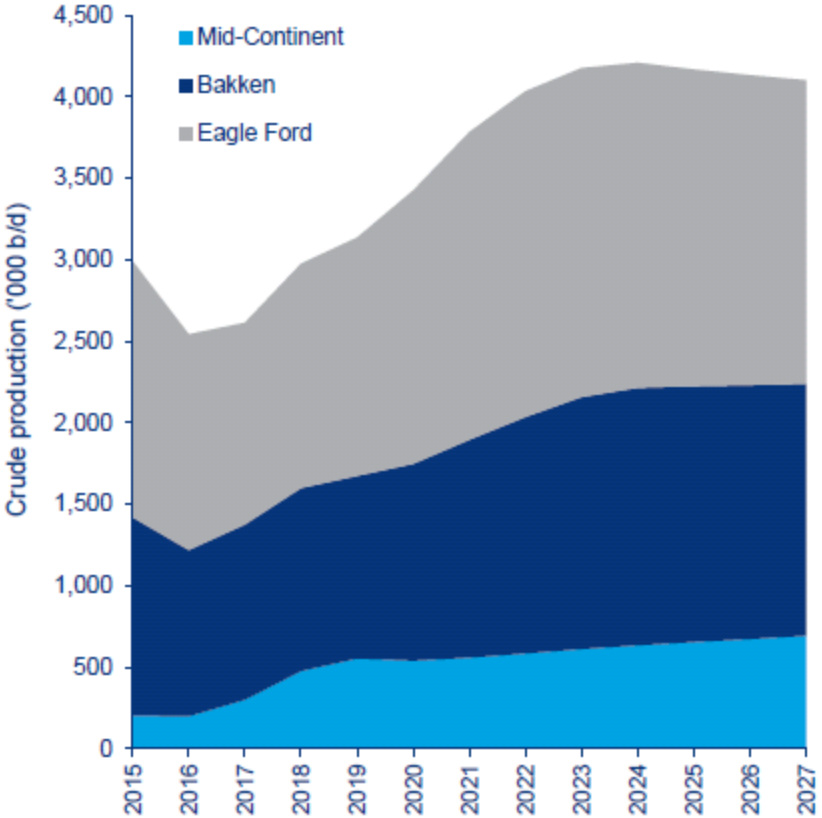
The Headline Formations Are on a Steep Production Incline

Permian vs. non-Permian tight oil

Permian tight oil to account for 50% of all US tight oil production by the mid-2020s



Source: Wood Mackenzie



Source: Wood Mackenzie

Significant Crude Oil Takeaway Capacity to Be Added

Despite recent expansion of many crude oil pipelines, strong production growth is quickly exceeding current infrastructure, creating the need for additional pipeline projects.

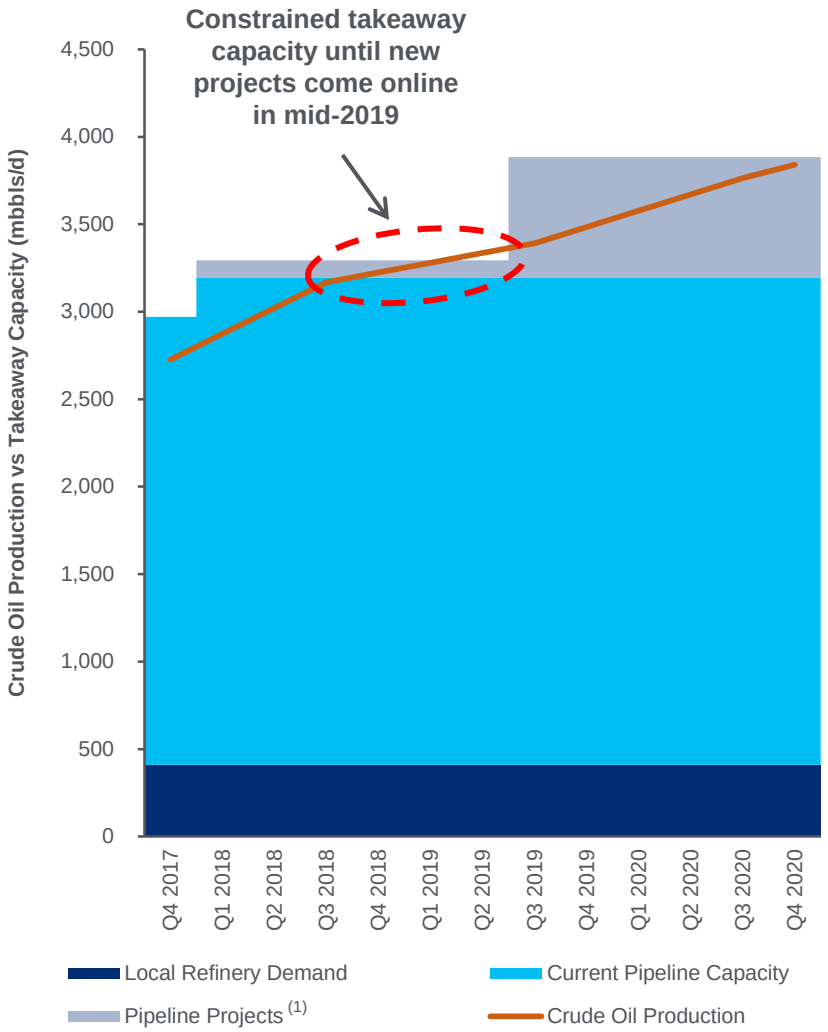
- While current pipeline capacity is meeting production demands, constraints likely to occur in late 2018, only alleviated as significant expansion projects in 2019
  - Existing takeaway capacity of 2.8mmbbs/d with
  - Limited in-basin refining demand
- Over 3.4mmbbls/d of announced crude oil takeaway projects
  - 5 open seasons totaling close to 2mmbbls/d launched since 11/30/17
- Delaware could remain more constrained than Midland basin as most existing pipelines originate at Midland

Near-Term Crude Oil Takeaway Projects

Pipeline	Destination	Anticipated In-Service	Capacity (mbbls/d)
Permian Express III	Nederland	Q4 2017	100
BridgeTex Expansion	Houston	Early 2019	40
Sunrise Expansion	Cushing	Early to Mid-2019	120
EPIC Crude Pipeline	Corpus Christi	2019	590
South Texas Gateway	Corpus Christi & Houston	2019	600
Cactus II	Corpus Christi	Q3 2019	575
Grey Oak Pipeline	Corpus Christi & Houston	2H 2019	385
Magellan - Permian / Eagle Ford to Houston	Houston	By Year End 2019	350
Enterprise NGL Conversion	Houston	1H 2020	650
Total Potential Additional Capacity			**3,410**

Permian Production vs Takeaway Capacity

(mbbl/d)



Source: Company filings, Wall Street Research, Wood Mackenzie.
(1) Only includes projects that have announced successful open seasons.

Natural Gas Takeaway Considerations

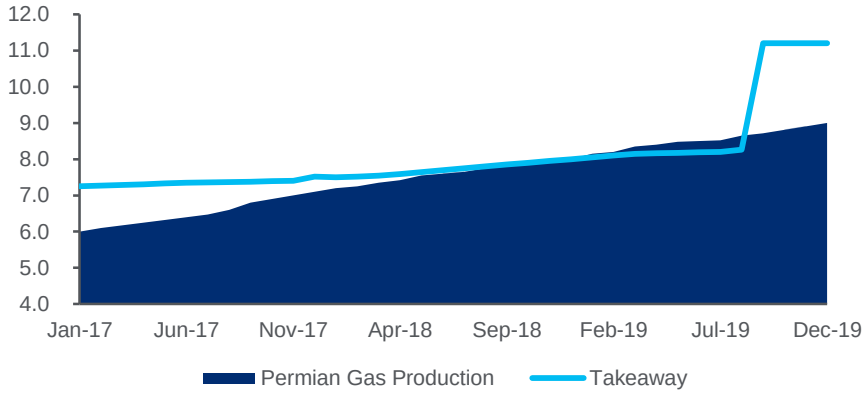
As crude production grows in Permian basin, associated gas production expected to also grow, creating a need for additional residue gas takeaway.

Overview

- **Natural Gas production in the Permian Basin has increased from 3.5 Bcf/d in 2012 to more than 6.5 Bcf/d today with an 800 MMcf/d production increase in the last year**
- Estimates of continued Permian gas production growth could lead to constrained natural gas pipeline capacity as early as late 2018
  - Takeaway constraints expected to be lifted through completion of pipeline projects to Agua Dulce
  - Proximity to Waha and multiple takeaway options increasingly important to producers searching for highest price markets
- Additional capacity originating at Waha market likely to support demand at already favorable pricing point relative to El Paso

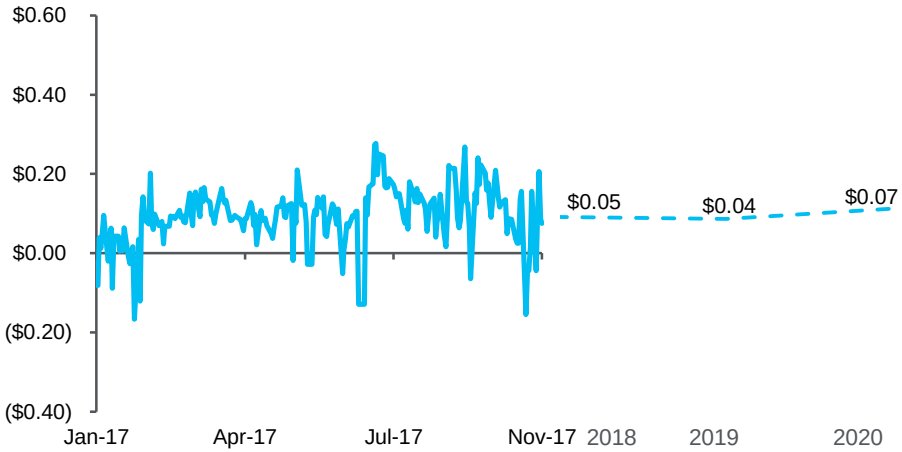
Permian Gas Takeaway Capacity

(Bcf/d)



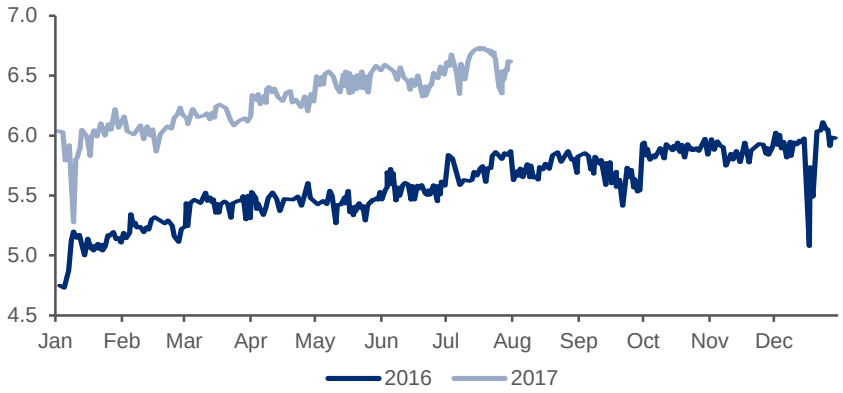
Waha – El Paso Permian Spread

(Bcf/d)



Y-o-Y Permian Dry Gas Production

(Bcf/d)



Source: RBN Energy, WoodMackenzie, Baker Hughes.

Delaware & Midland Basin Valuations are Converging

Valuations in core areas of both the Midland and Delaware Basins have remained robust despite volatility in commodity prices.

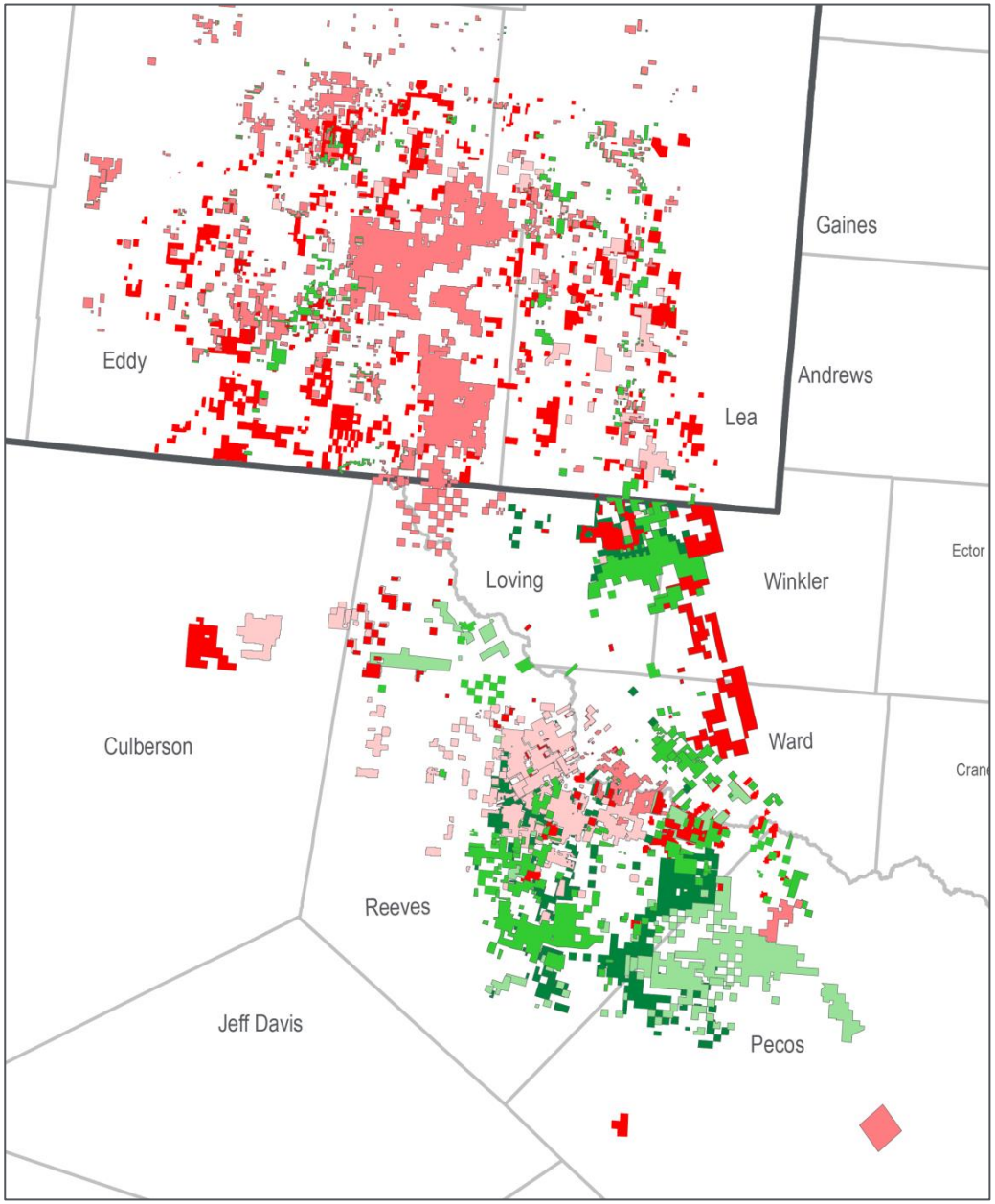
Source: Factset Commodities, Bloomberg, market data as of 12/8/2017.
Note: Data does not include transactions with undisclosed deal metrics.
Approach Resources November 2017 acquisition of Amistad Energy Partners acreage in Midland Basin includes PDP value in acreage value multiple; acreage is in Crockett County, south of all primary activity.

Multiples Reflect Quality, Oil Price, Supply, Life Cycle Economics

	Delaware Basin $/Acre Transaction Bands	
	Lower Band	Upper Band
	$40,000	>$40,000
	$30,000	$40,000
	$24,000	$30,000
	$20,000	$24,000
	$15,000	$20,000
	<$15,000	$15,000

Oasis Acquire Forge Acreage

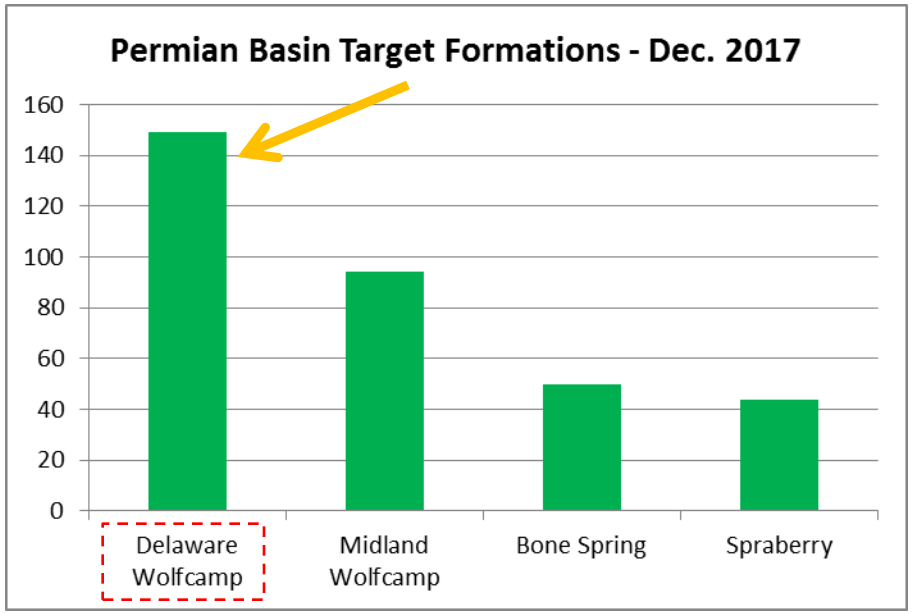
- 20,300 net acres
- $946 MM, $46,600 / acre
- PDP $170 MM, $33,300/acre
- 507 net locations, $1.5 MM
- Loving, Ward, Winkler, and Reeves Counties
- “deepest and highest pressured” – Oasis CEO



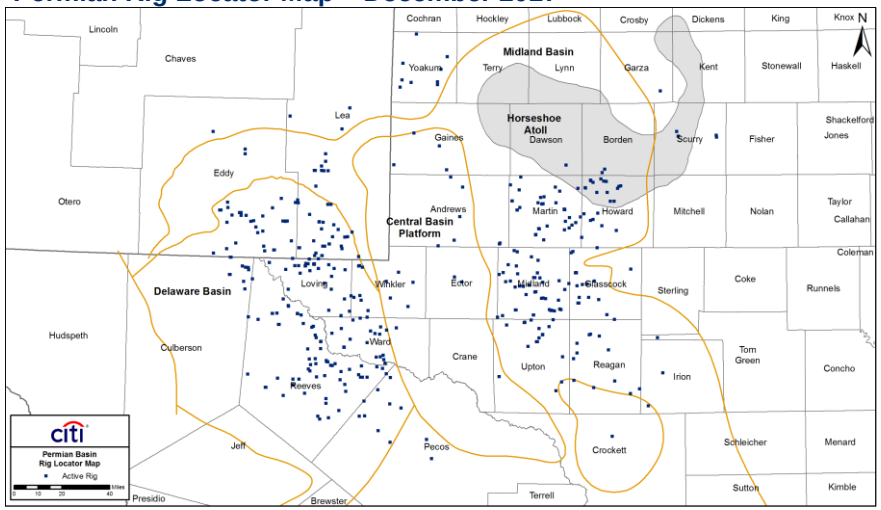
The Permian Has the Most Drilling Activity of the Top 5 Basins

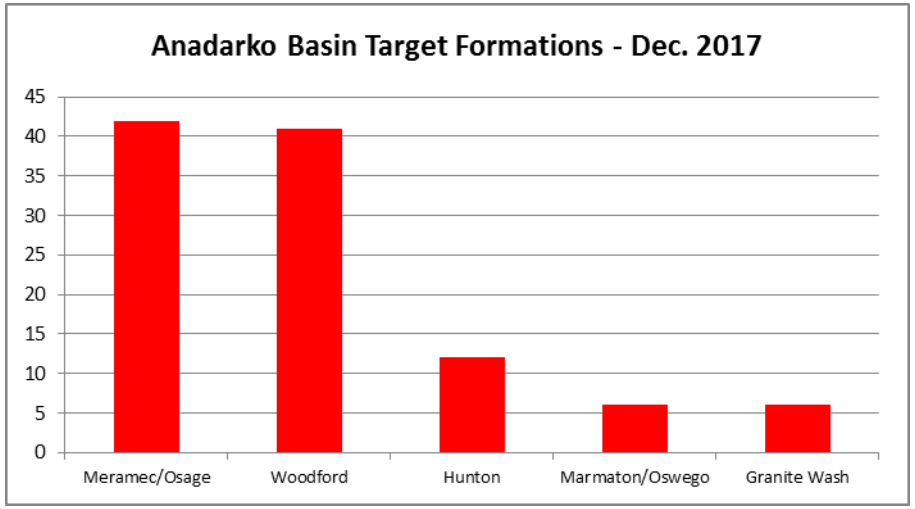
The Wolfcamp is the most drilled formation in the Lower 48, the Meramac is the most drilled formation in the Anadarko basin.

Basin	Top Operators (Number of Active Rigs)
Permian	Pioneer (22), Concho (20), Apache (17), Parsley (16), EOG (16), XTO (14), Chevron (13), Diamondback (11)
Anadarko	Continental (13), Devon (12), Newfield (7), Marathon (6), OK Energy (6), 4P Energy (4) Cimarex (4), Citizen (4). Comanche (4)
South Texas	EOG (8), Anadarko (7), Sanchez (6), Wildhorse (6), CHK (5), Marathon (5), Hilcorp (4), BHP (3), Enervest (3), EP Energy (3), Penn Virginia (3)
Appalachian	EQT (7), Ascent (6), Antero (5), Rice (5), Range (4), Gulfport (3), SWN (3), Cabot (2), Chief (2), CNX (2), Eclipse (2), Tug Hill (2)
Williston	Continental (5), HESS (5), Oasis (5), Anadarko (4), Whiting (4), Marathon (3), XTO (3), Enerplus (2), Kraken (2), Slawson (2), Statoil (2), WPX (2)



Permian Rig Locator Map – December 2017





Source: Drillinginfo.com data pull on 1-03-18.

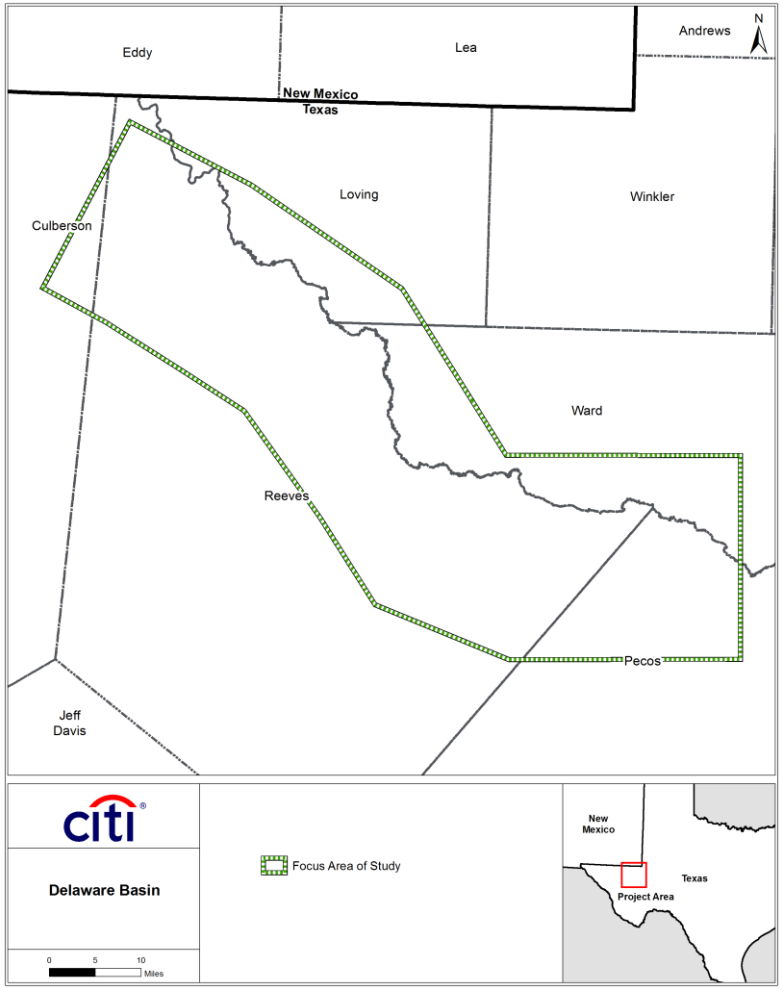
Central Delaware Area of Study

This acreage is significantly de-risked via both vertical well control and horizontal well performance.

Key Observations

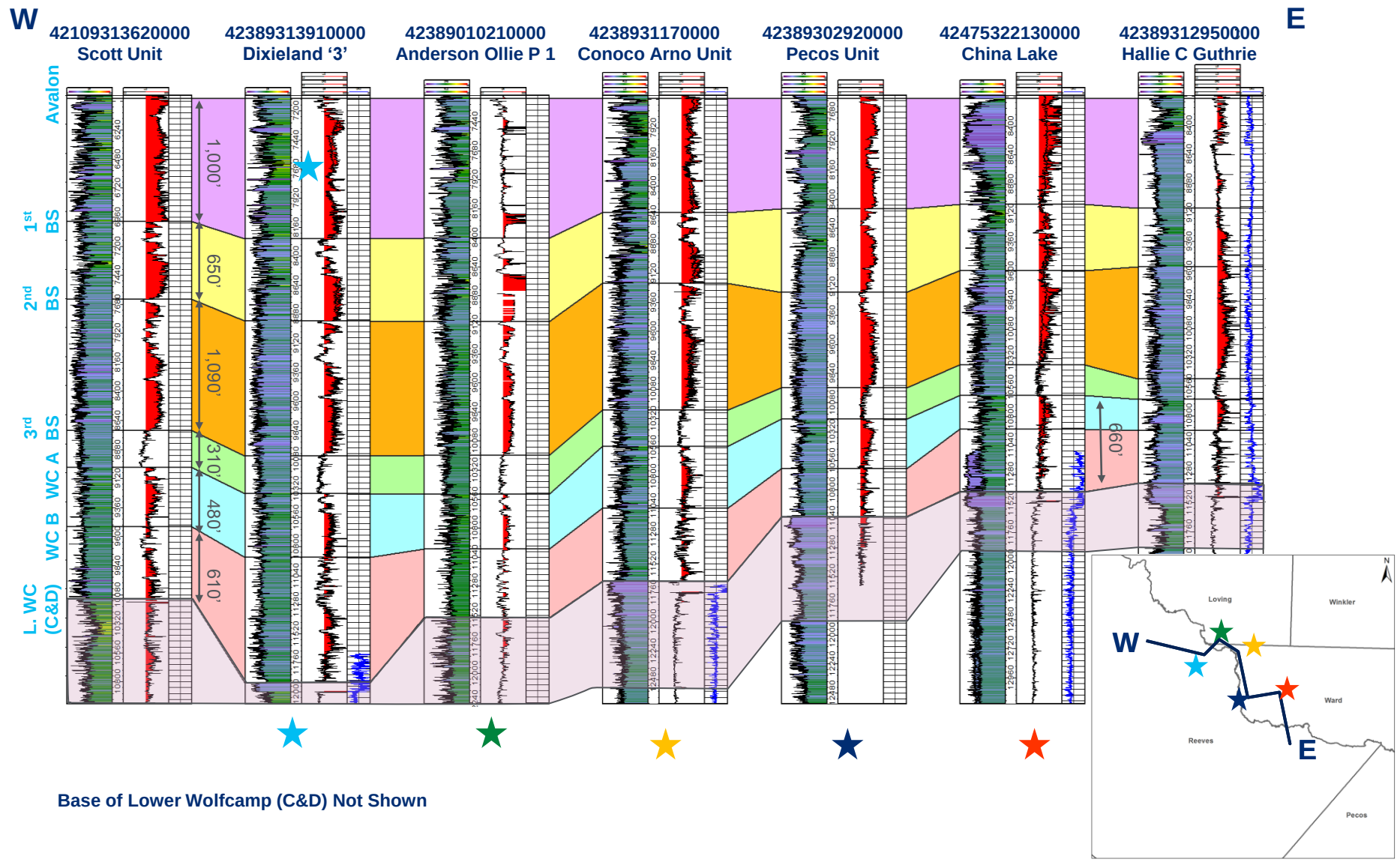
- Currently, operators are shifting toward highly efficient pad drilling
- Wolfcamp A and B, as well as all three benches of the Bone Spring are under active development
- The entire Wolfcamp across the study area ranges from 1,100' to 2,100' thick with porosities and TOCs of up to ~7.5% and ~6% respectively
- Wolfcamp horizontals are testing at 320 boepd/1,000' with significant improvement via proppant loading still to be recognized
- The Bone Spring is between 2,000' and 3,000' in thickness with an average porosity of ~10%
- Bone Spring wells are being routinely reported as having IP30s above 1,000 boepd with some as high as 1,700 boepd
- 7,500' to 10,000' laterals with 2,000 lbs/ft proppant loading are generating ever improving economics and increased unit recovery without any sign of diminishing effect
- Operators have reported drilling days reduced from 43 to as low as 13 for a 4,500' lateral Wolfcamp well

Central Delaware Area of Study Map



Multi-Stack Bone Spring and Wolfcamp Horizons across the Area

The Wolfcamp A and B intervals exist at thicknesses of about 500' and 600', respectively, across this area Each formation of the Wolfcamp has multiple landing zones and is an ideal unconventional target. Additionally, the Bone Spring and Avalon have proven to be prolific multi-landing zone formations.



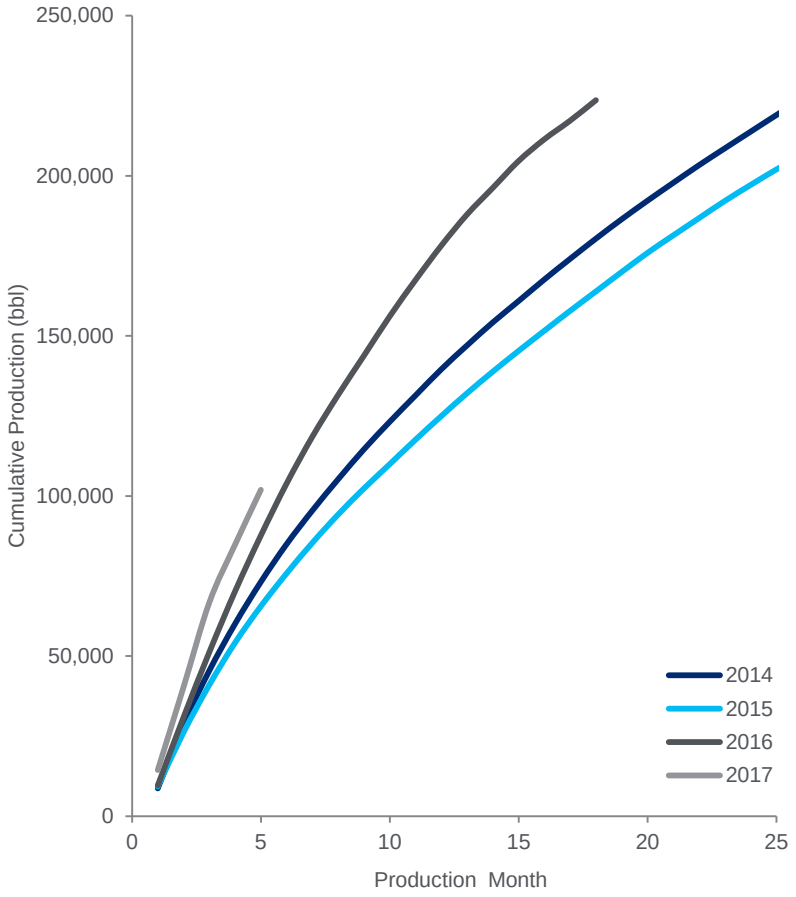
Base of Lower Wolfcamp (C&D) Not Shown

 Source: Citi, IHS log data.

Improving Well Results and Activity Drive Well Performance Higher

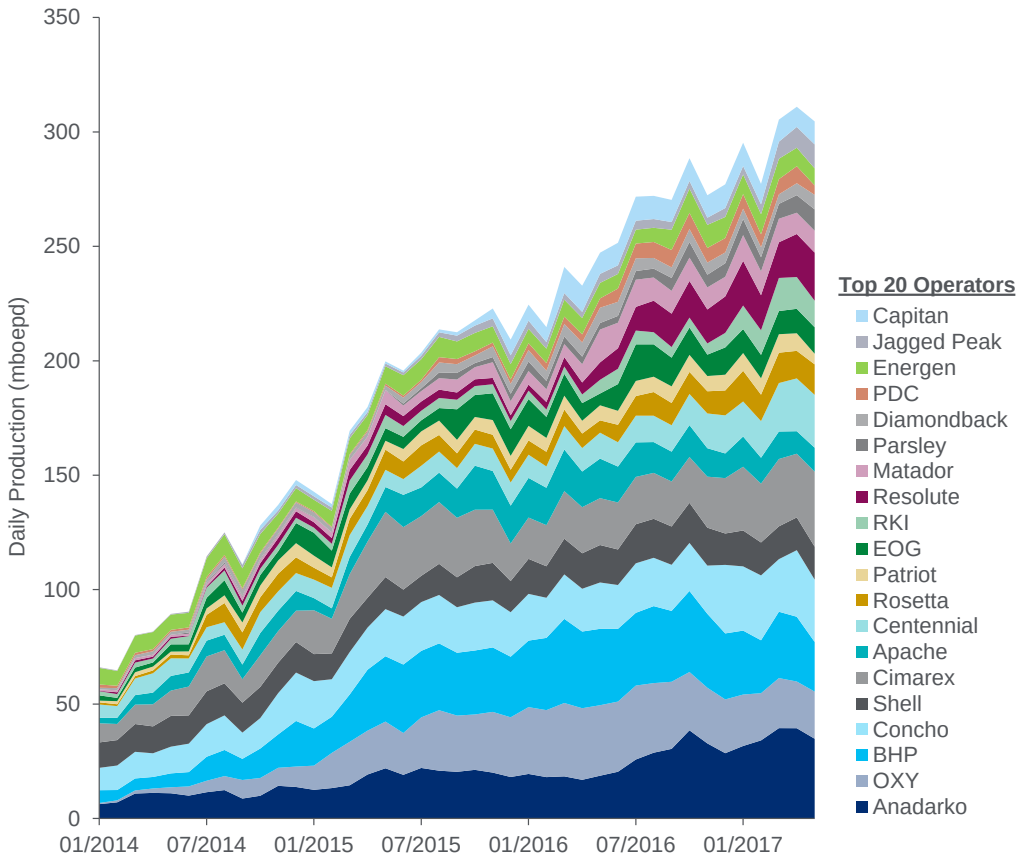
As the Delaware Basin well results continue to improve, breakeven well economics remain well below 2017 commodity prices.

Performance Evolution by Production Year



Productivity has increased year over year due to enhanced landing zone understanding and increasing completion intensity.

Annual Growth For Top 20 Operators in the Core of the Area



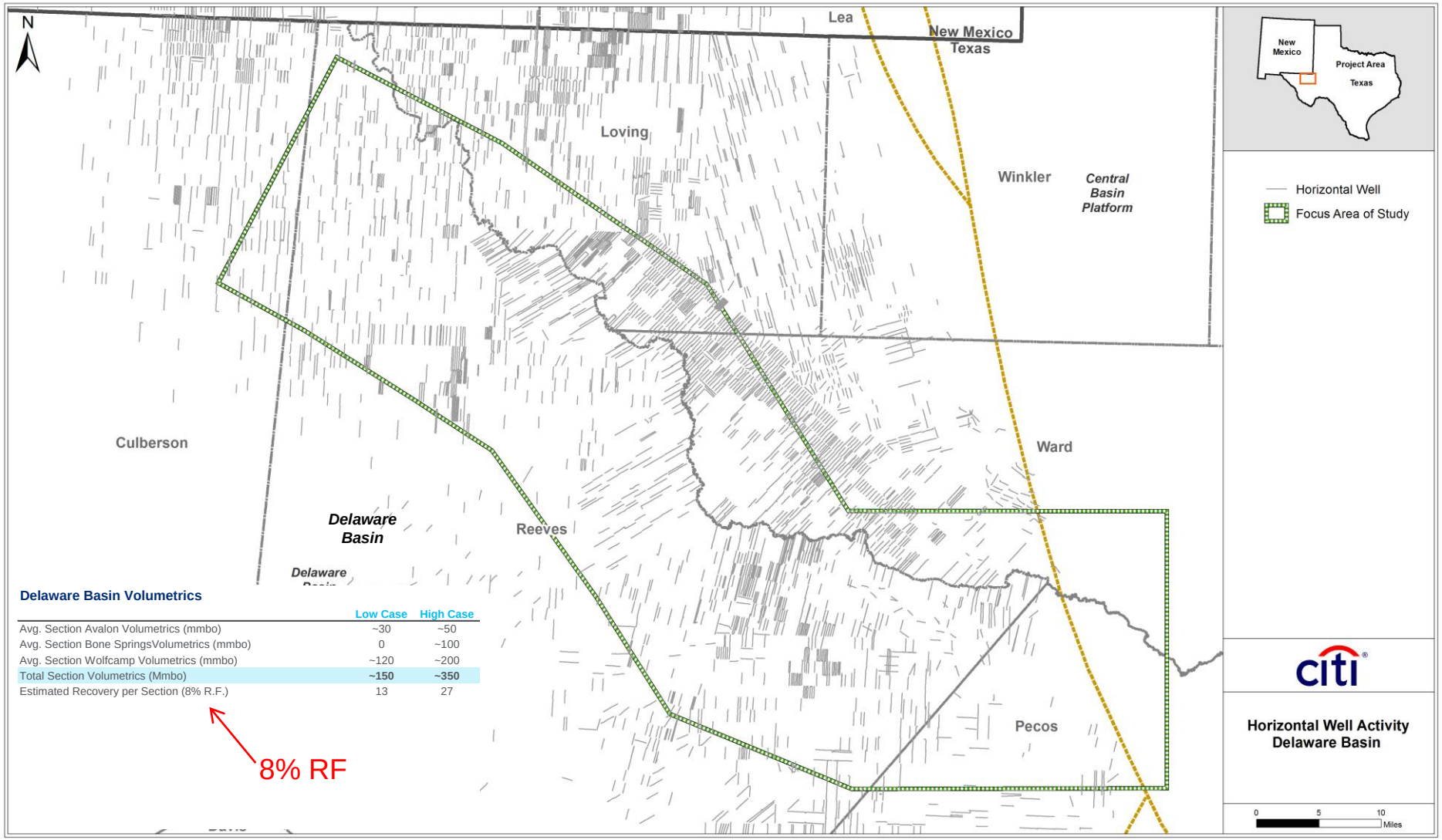
Many different operators drive the increasing production volumes within the core of the area.

Source: Citi A&D, IHS Markit Enerdeq, company presentations.
(1) All wells have >25% IRR for gas breakeven price of $0.25/mmbtu.

Up to 45 Bbo Can Be Produced From This Area

Assuming constant properties, section OOIPs range from ~150 to ~350 mmbo. Combined, the WC and BS contain ~45 bbo of technically recoverable resources across the area of study. Assuming current Delaware Basin oil production, there is over 150 years of potential hydrocarbon possible.

Delaware Area of Study



Delaware Basin Volumetrics

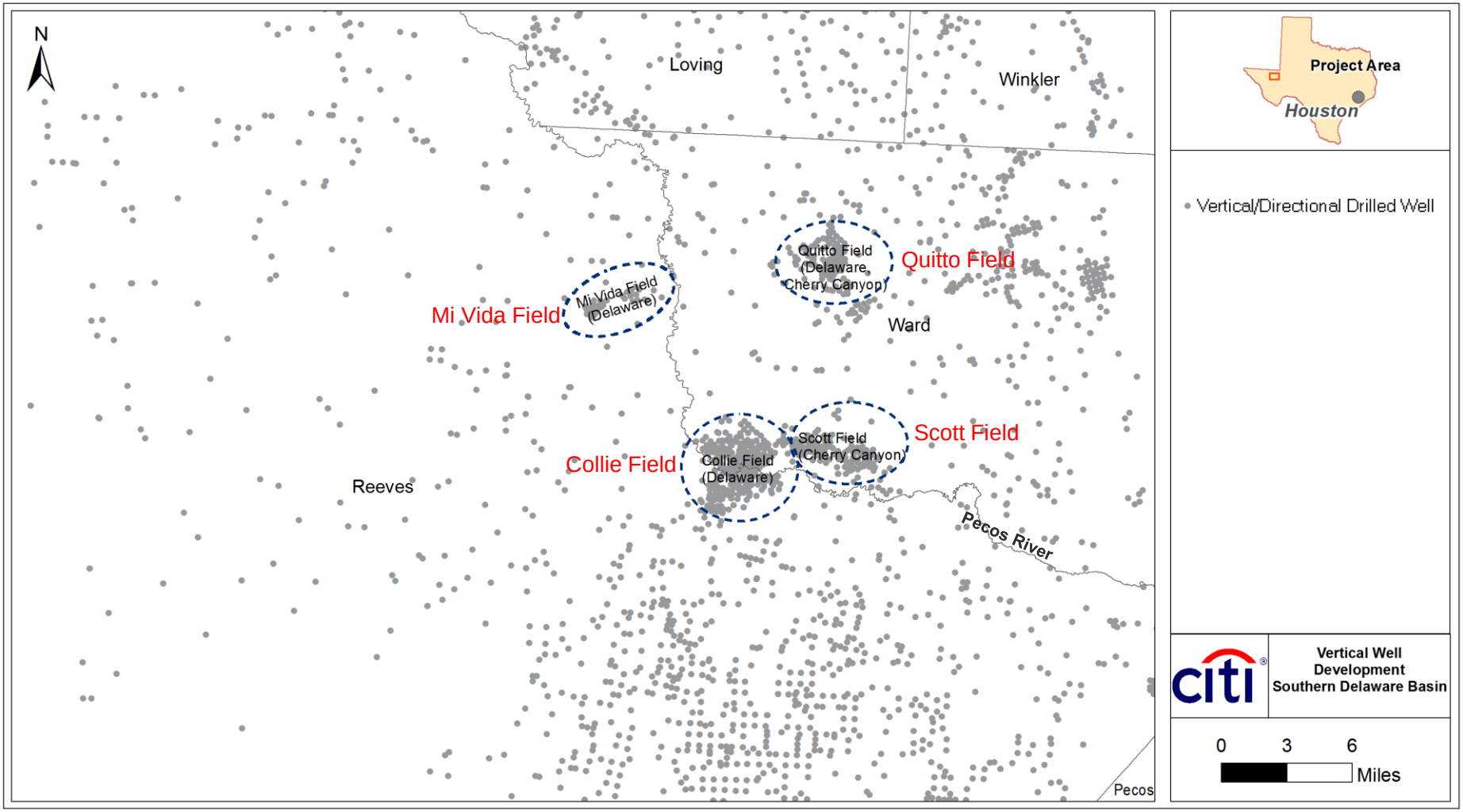
	Low Case	High Case
Avg. Section Avalon Volumetrics (mmbo)	~30	~50
Avg. Section Bone SpringsVolumetrics (mmbo)	0	~100
Avg. Section Wolfcamp Volumetrics (mmbo)	~120	~200
Total Section Volumetrics (Mmbo)	**~150**	**~350**
Estimated Recovery per Section (8% R.F.)	13	27

8% RF

Source: Citi A&D, IHS Markit Enerdeq.
Note: Includes all horizontal wells from 2014 to present.

Vertical Well Control Has Greatly De-risked Certain Areas

The Delaware Basin is a legacy producing region with thousands of vertical penetrations that provides significant understanding of the subsurface characteristics of the primary producing horizons.

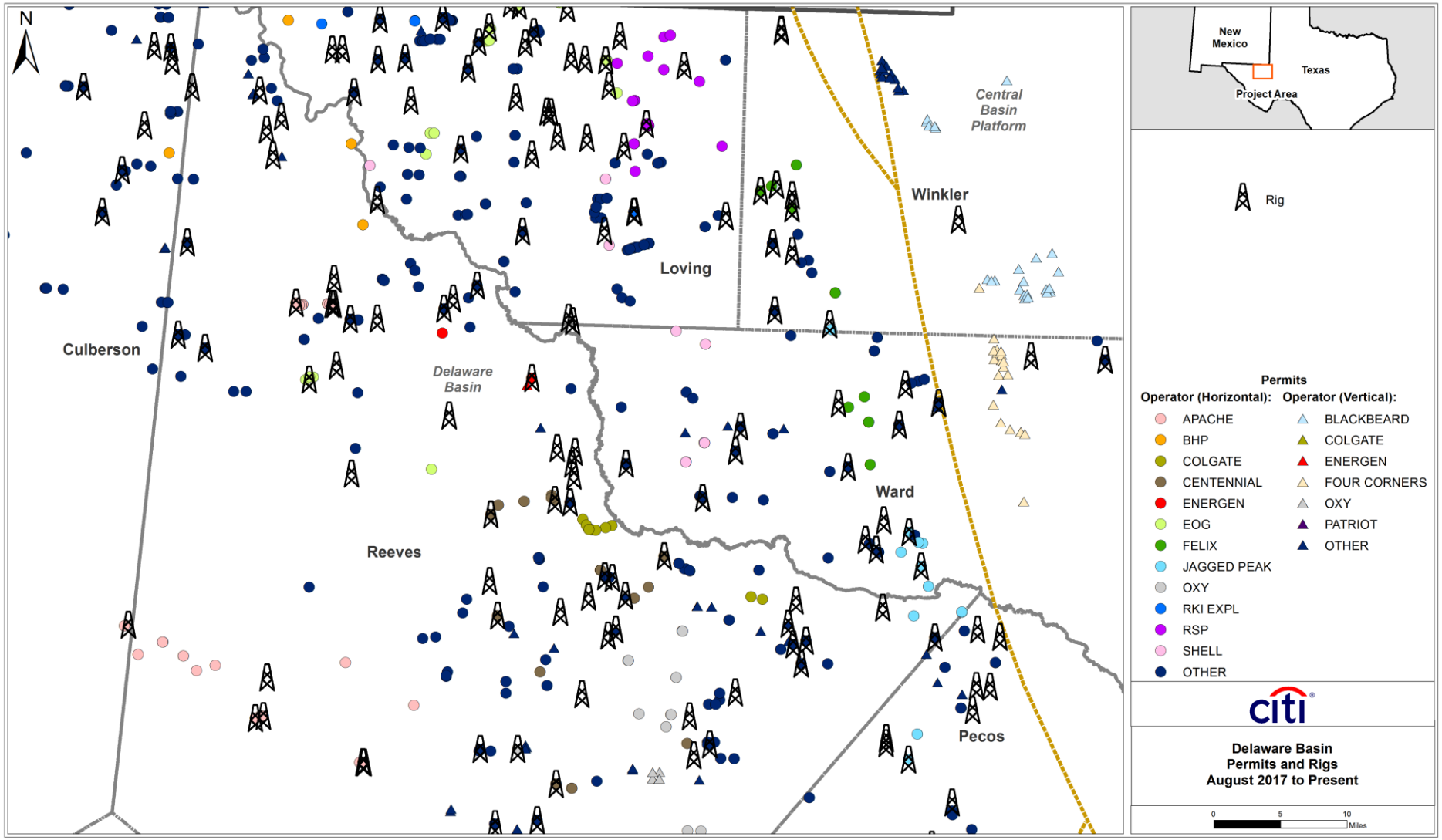


Source: Citi A&D.

Active Drilling Operations Reflect the Industries Interest

Operators have continued to lease extensively and are expected to expand activity and increase production. There are over 70 rigs and 250 permits in the core of the area in the last 90 days.

Active Permits and Rigs (July 2017 to Present)

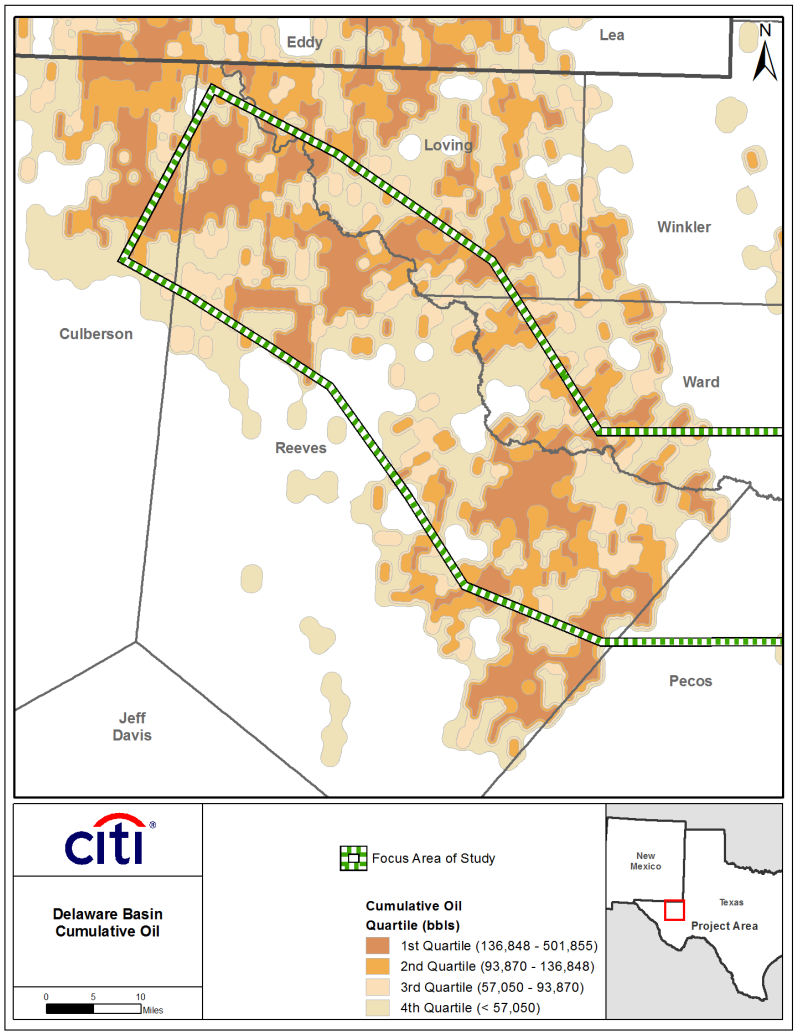


Source: Citi A&D, IHS Markit Enerdeq, DrillingInfo.
Note: Active rigs as of last 90 days from July 2017.

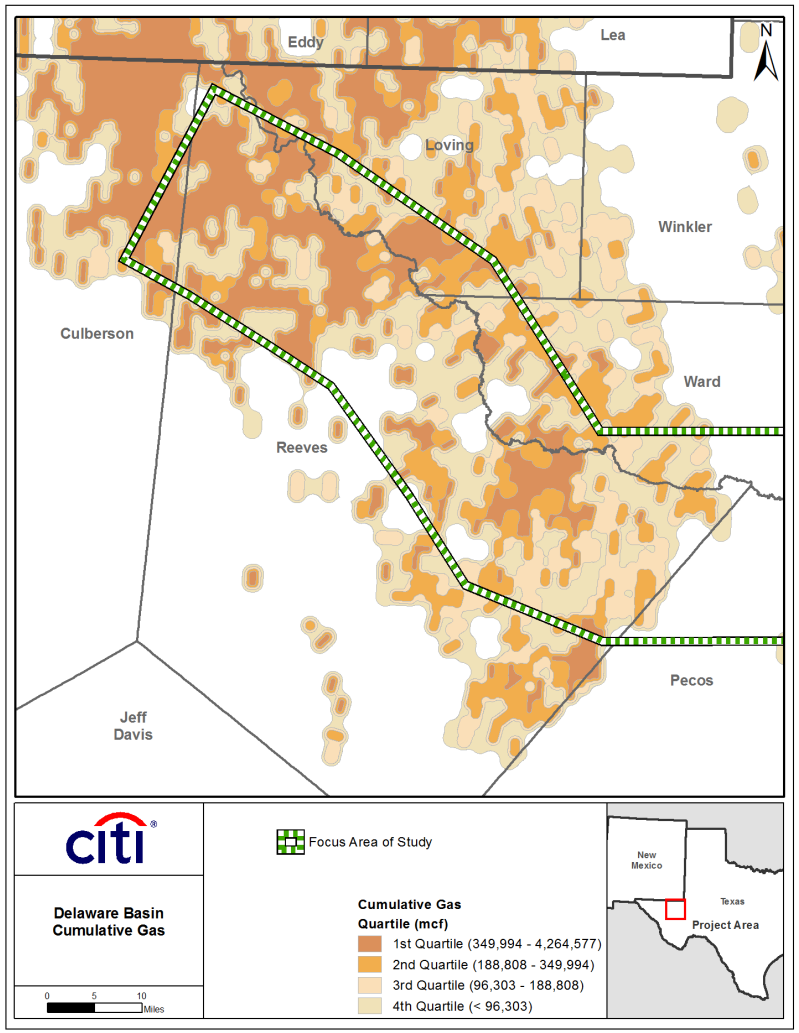
Development is Demonstrating Top Quartile Performance

The Wolfcamp and Bone Spring are prolific oil and gas producing formations that are driving the horizontal development in the Delaware

Cumulative Oil (bbl), By Quartile – HZ Wells Only



Cumulative Gas (mcf), By Quartile – HZ Wells Only



Source: Citi A&D, IHS Markit Enerdeq.
Note: Includes active Wolfcamp and Bone Spring horizontal wells from 2014 to present.

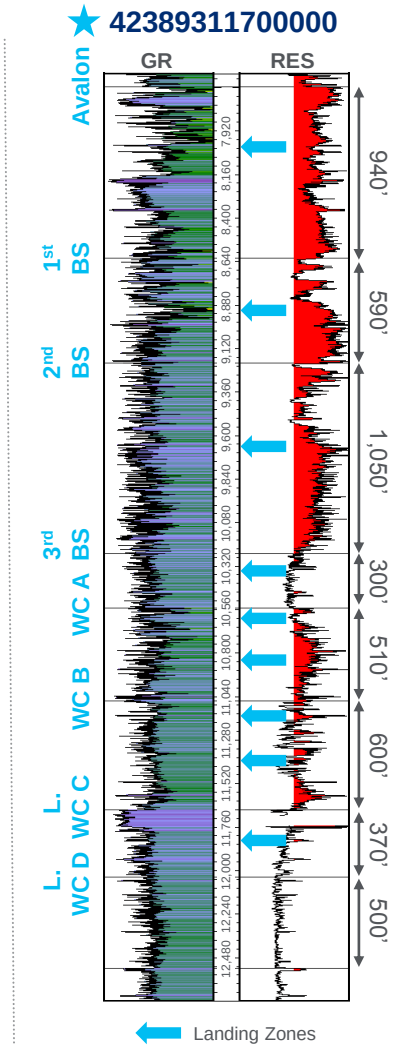
Delaware Basin Overview

The Delaware Basin consists of multi-zone potential with quality rock and fluid properties.

- Combination of depth, pressure, rock quality, thickness/number of targets and hydrocarbon mix makes this one of the highest performing basins for resource plays
- Permian age unconventional targets are the Avalon, Bone Spring, and Wolfcamp Formations
- Recently, highly-propped slick water/thin fluid fracs have dramatically improved well results

Key Formation Properties

Formation Property	Avalon	1st Bone Spring	2nd Bone Spring	3rd Bone Spring	Wolfcamp A	Wolfcamp B	Lower Wolfcamp (C&D)
Gross Thickness (ft.)	800-1,400	~700	~1,000	~200	~350–550	~900–1,400	~400-1000
Average Porosity (%)	~7	~12	~10	~12	~7.5	~7.0	~5-8
Average Sw (%)	~40	~50	~55	~50	~40	~55	~45-55
Clay Content (%)	10-30	~10	~10	~5	~25	10-30	~15-25
Quartz Content (%)	20-50	~50	~60	~70	~50	~60	~40-55
Pressure (psi/ft.)	Normal to Over-pressured	Normal to Over-pressured	Normal to Over-pressured	Normal to Over-pressured	Normal to Over-pressured	Normal to Over-pressured	Normal to Over-pressured
Fluid Type	Oil and associated Wet Gas	Oil and associated Wet Gas	Oil and associated Wet Gas	Oil and associated Wet Gas	Oil and associated Wet Gas	Oil and associated Wet Gas	Condensate and associated Wet Gas



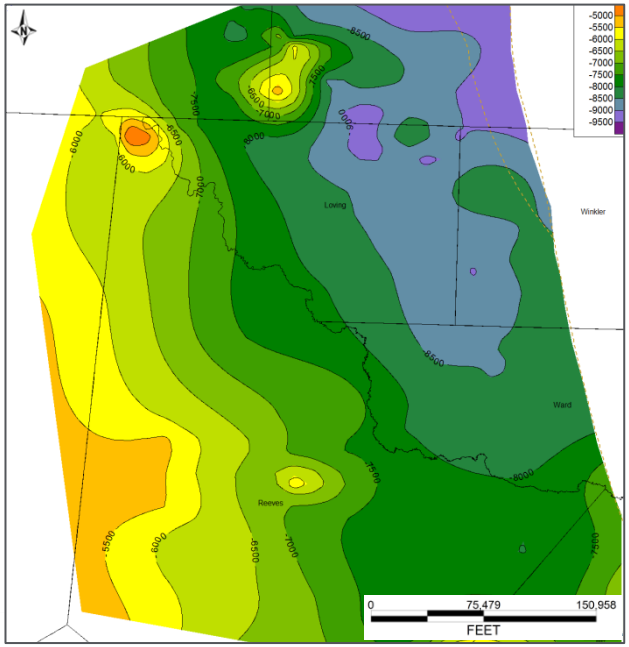
Source: Citi A&D, company presentations, DrillingInfo.
(1) Baker Hughes.

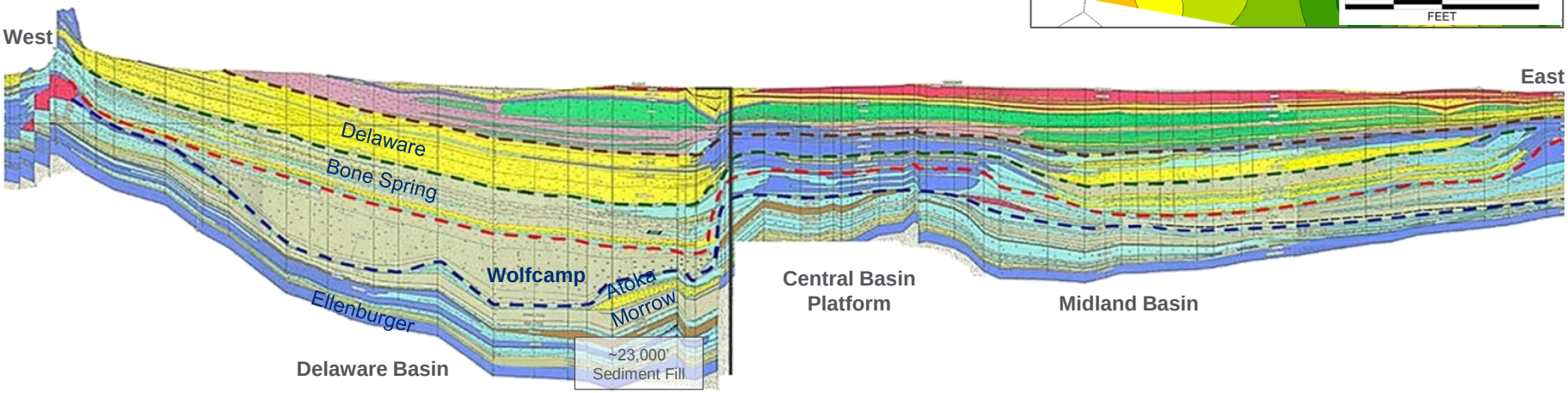
Delaware Wolfcamp Geology

The area of study overlies the thickest, deepest, over pressured, liquids rich part of the Wolfcamp formation.

- Wolfcampian deposition was controlled by tectonics and sea level fluctuations
- Structural low for most of Permian time: inlet for marine water
- This led to the deposition of deep water deposits as well as carbonate buildups and other shallow/deep marine deposits
- This cyclicity of source rock and carbonate/deep water deposition resulted in the stacking of several hydrocarbon plays
- Composed of shales, siltstones, and significant packages of high porosity sands
- Traps are stratigraphic, with reservoirs enclosed in organic rich basinal shales which act as both seal and source rock

Wolfcamp Structure in the Delaware Basin



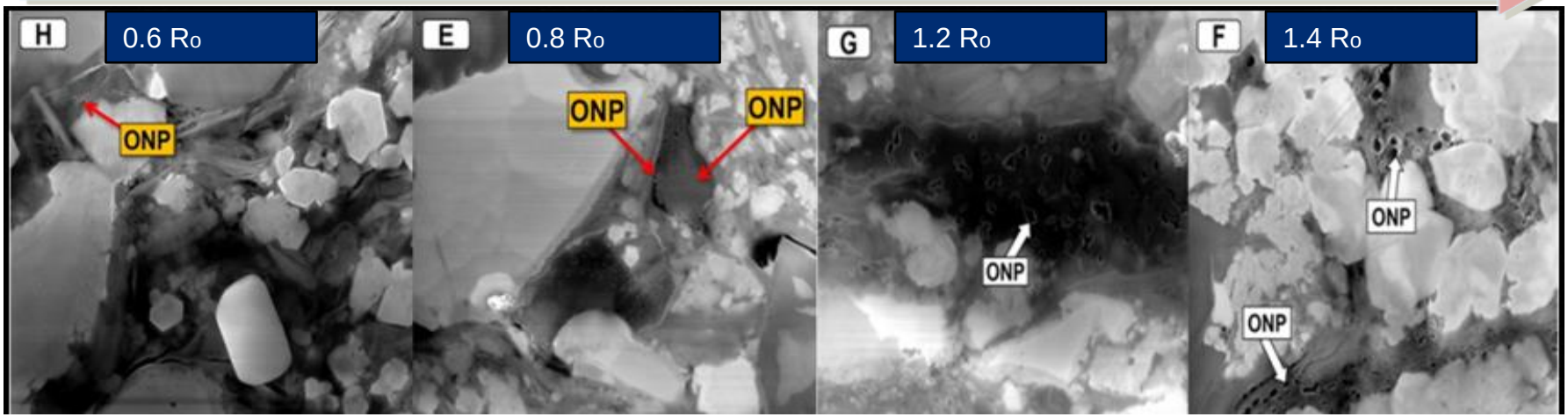


Source: Citi A&D, Matador Investor Presentation, AAPG.

Wolfcamp Rock Quality

Delaware basin Wolfcamp shale has more kerogen porosity, higher reservoir pressures and more organic matter than Midland basin Wolfcamp shale.

Increasing Thermal Maturity



Midland Basin	Midland Basin	Delaware Basin	Delaware Basin
• Only captured occurrence of organic porosity • Small nanopore • 6,994.50' • 18% Oil saturation, 37% Gas saturation (GRI) • 1.7% TOC, 0.19 PI, 89 TI mg/g C, 372 HI mg/g/C • Kerogen (vol%) 3.8	• Bigger nanopores • 10,402' • 1.69% Oil saturation, 40.89% Gas Saturation (GRI) • 2.16% TOC, 0.427 PI, 71 TI mg/g C, 95 HI mg/g/C • Kerogen (vol%) 4.9	• Numerous larger nanopores • 9,298' • 5.9% Oil saturation, 56% Gas Saturation (GRI) • 4.72% TOC, 0.69 PI, 89 TI mg/g C, 40 HI mg/g/C • Kerogen (vol%) 10.4	• Numerous larger nanopores • 8,640.5' • 8.61% Oil saturation, 70.39% Gas Saturation (GRI) • 4.65% TOC, 0.454 PI, 67 TI mg/g C, 81 HI mg/g/C • Kerogen (vol%) 10.2

- SEM Photos of the Wolfcamp shale showing images across thermal regimes in the Midland and Delaware basins
  - Delaware basin Wolfcamp more thermally mature (deeper)
- As a result of being more thermally mature, the Delaware basin Wolfcamp has more organic nanoporosity (intra-kerogen storage) and higher reservoir pressures due to fluid expansion (oil to gas cracking)
- Delaware basin Wolfcamp also has higher TOC values
  - More organic due to less clastic 'dilution' of organic material

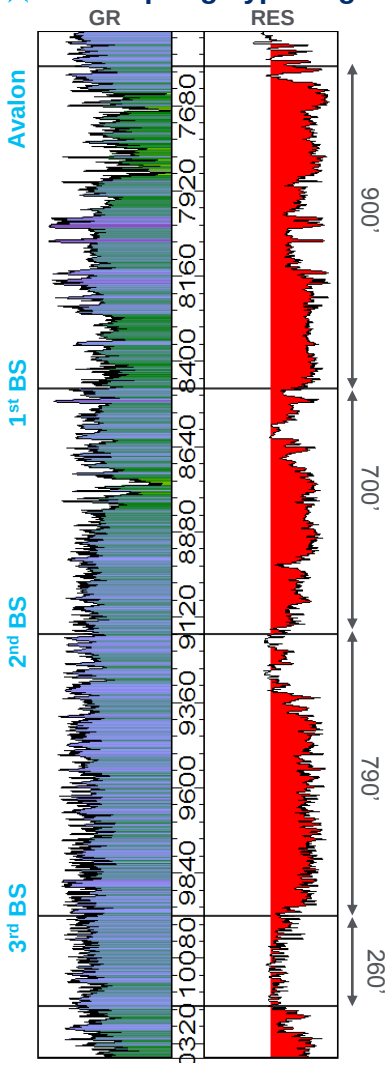
ONP = Organic nanoporosity
PI = Production Index
HI = Hydrogen Index
TI = Transformation Index

Source: Corelab, AAPG

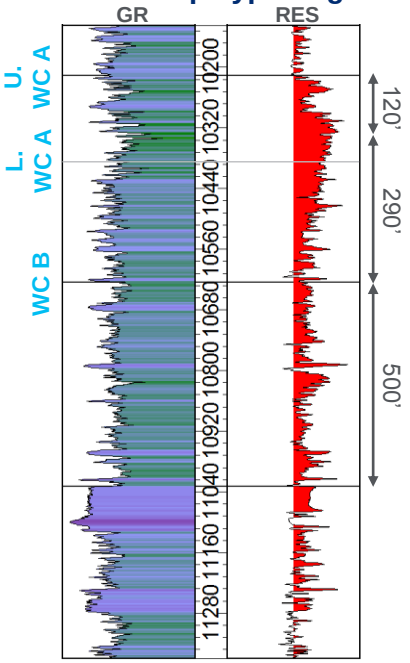
Wolfcamp and 3rd Bone Spring Have OOIPs That Support Dense Well Spacing

Across the vast majority of the study area, the Wolfcamp A, Wolfcamp B, and Bone Spring formations are present with thickness and volumetrics described below.

★ **Bone Spring Type Log**



★ **Wolfcamp Type Log**



Locator Map

Citi Development Plan

	Wolfcamp A	Wolfcamp B	3rd Bone Spring
Average OOIP (mmbo/section)	73	82	51
Assumed Oil Recovery Factor	8%	8%	9%
Recoverable OOIP (mmbo/section)	5.8	6.6	4.6
Type Curve EUR (5,000' lateral) (mbo)	610	620	707
Maximum Possible Development Plan (wells/section)(1)	**12**	**12**	**10**
Citi Development Plan (wells/section)	**8**	**8**	**6**

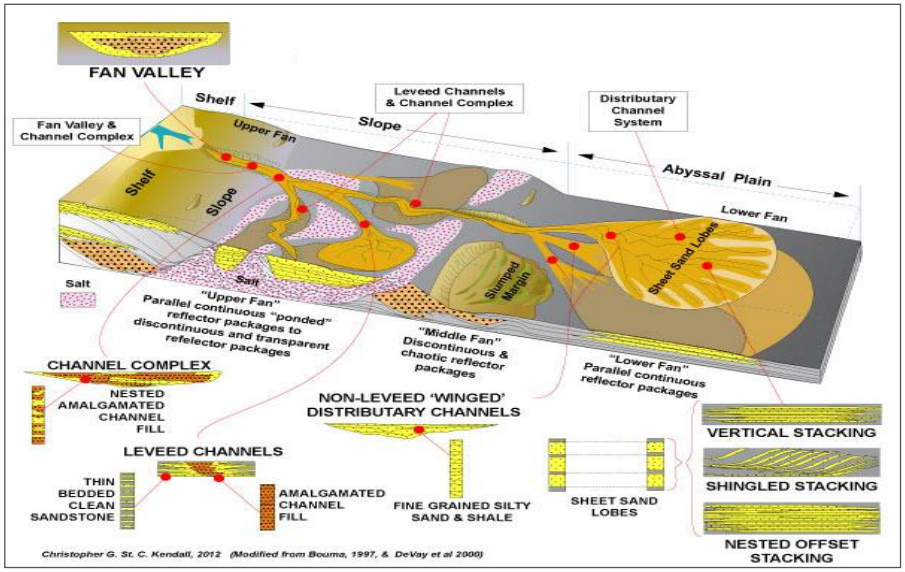
Source: Citi A&D, company presentations, IHS.
(1) Assumes up to maximum 14% recovery factor.

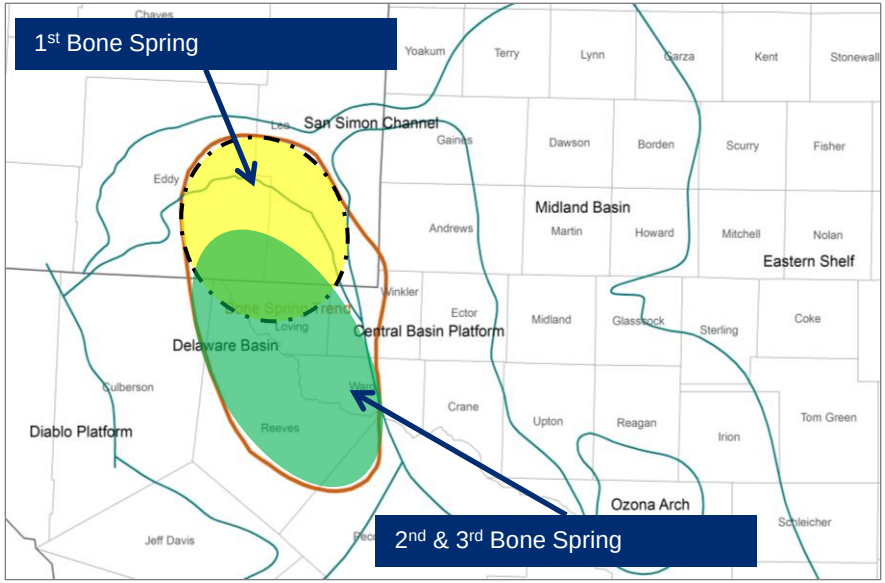
Bone Spring Play Geology

The Bone Spring consists of multiple productive benches in the Delaware Basin. Production is from submarine fans interbedded with carbonate debris flows, mudstone and organic shale.

- Bone Spring is a well understood deep marine turbidite formation
- Production comes from carbonate debris flows and sandstone members
- The debris flows consist of dolomitized breccia and packstones with secondary porosity
- The submarine upper fan was deposited in a channel and fan system at the base of the depositional slope with a lower fan system being deposited in the abyssal plain

Bone Spring Depositional Model





Source: Citi A&D, DrillingInfo, AAPG.

Lateral Length Impact on Well Performance

Recent well results and operator presentations from the basin support drilling longer laterals with improved well performance.

Completion Enhancements Drive Continued Well Improvements

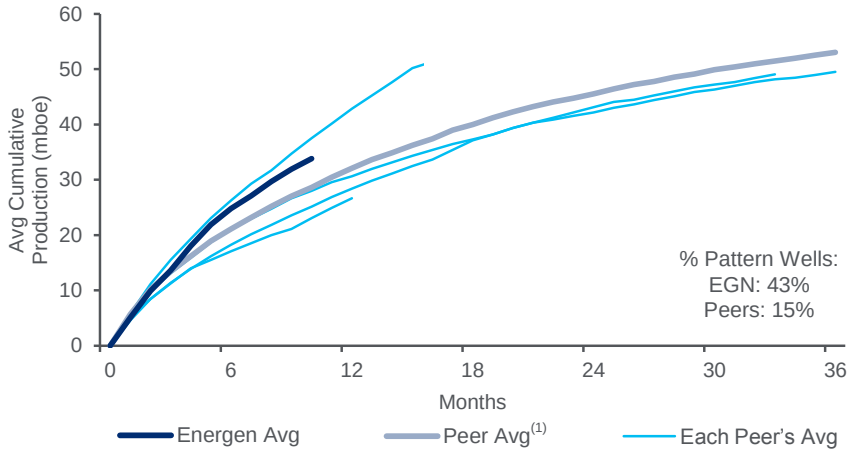
ENERGEN

Reeves/Culberson County Well Performance by Lateral Length (bbl)

Delaware Basin

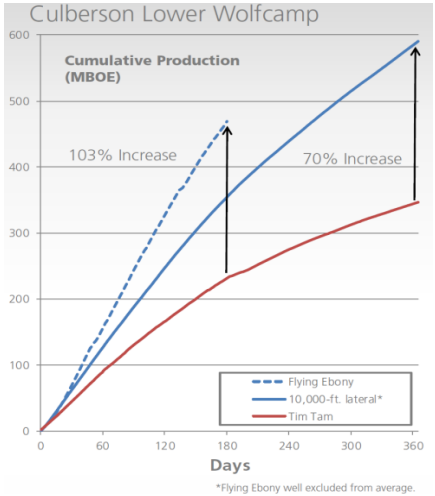
Generation 1 (2012 – 2014)	Generation 2 (2015)	Generation 3 (2016 – 2017)
• 1,000 lbs/ft proppant	• 1,330 lbs/ft proppant	• 1,800 to 2,400 lbs/ft proppant
• 240’ stage spacing	• 260’ stage spacing	• 200’ stage spacing
• 39 bbls/ft fluid	• 39 bbls/ft fluid	• 40 bbls/ft fluid
• 50’ cluster spacing	• 65’ cluster spacing	• 33’ cluster spacing

Gen 3 Wells vs. Peer Wells (w/ Similar Proppant Loads)



Companies See Linear Lateral Length Enhancements

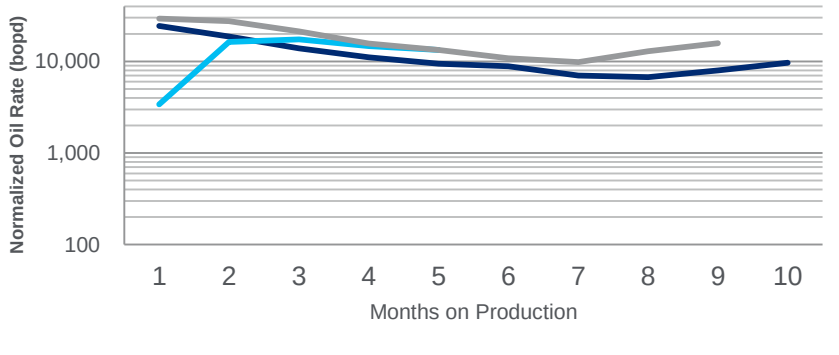
CIMAREX



- 15 10,000’ laterals with average 30-day peak IP of 2,361 boepd (25% oil, 46% gas, 29% NGL)
- Flying Ebony well was completed with 2,400 lb/ft and 48 stages, with an average 30-day peak IP of 3,217 boepd (23%oil, 47% gas, and 30% NGL)

Source: Cimarex January 2017 Investor Presentation.

CENTENNIAL
RESOURCE DEVELOPMENT, INC



Source: Centennial, IHS Enerdeq.

Source: Energen.
(1) Peers include: CPE, CXO, FANG, LPI, PE, PXD and RSPP.

Delaware Completion Evolution

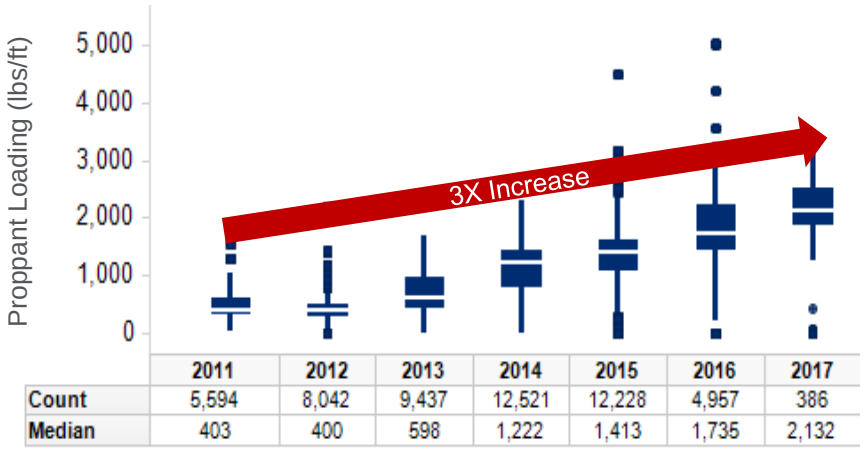
Operators have increased the amount of proppant and fluid volumes being pumped in the Wolfcamp resulting in a marked increase in well performance.

	2013 – 2014 Completion Design	2015 – 2017 Advanced Completion Design
Frac Fluid	Crosslinked (~70%)	Linear Fluid (~70%)
Water	Fresh	Fresh / Produced
Surfactants	Generic	Generic / Nano-surf
Pump Rate	60 bpm	85 bpm
Cluster Spacing	80’	25’
Sand Loading	1,000 – 1,500 lb/ft	2,500+ lb/ft

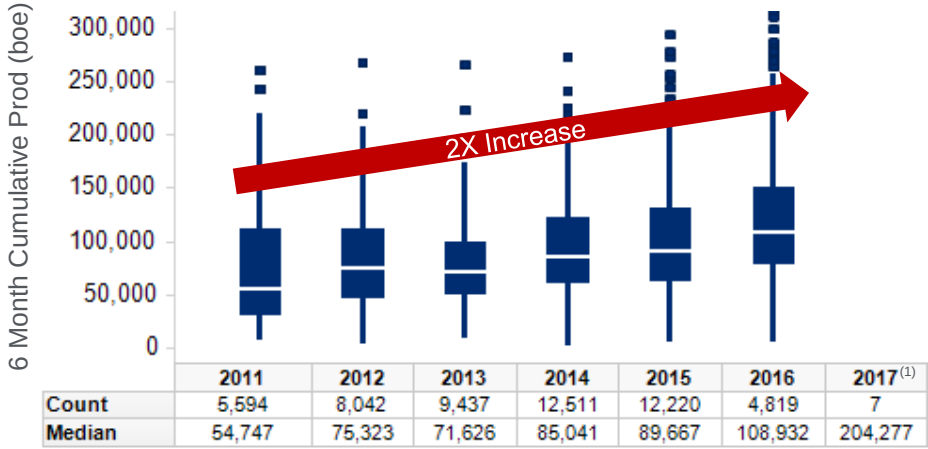
Advanced Completion Concepts

- Maximizing stimulated rock volume (“SRV”) with large volumes of slickwater and low-quality proppant
- Eliminating gelled fluid due to skin damage and planar fracture geometry
- Maximizing proppant loading (2,500+ lb/ft); poor reservoir matrix permeability prohibits drainage not far beyond fracture network created by stimulation; proppant volume more critical than conductivity
- Pumping large volumes of 100 mesh proppant to increase fracture complexity

Wolfcamp A Year-by-Year Improvement in Well Performance



	2011	2012	2013	2014	2015	2016	2017
Count	5,594	8,042	9,437	12,521	12,228	4,957	386
Median	403	400	598	1,222	1,413	1,735	2,132



	2011	2012	2013	2014	2015	2016	2017[1]
Count	5,594	8,042	9,437	12,511	12,220	4,819	7
Median	54,747	75,323	71,626	85,041	89,667	108,932	204,277

Source: IHS, 568 Wolfcamp wells in Culberson County.
(1) Insufficient data to populate 2017 6 Month Cumulative Production chart.

West Type Curve Area Overview

The West type curve area is a fully delineated Wolfcamp region with the closest proximity to the shallower delineated Bone Spring reservoirs.

Key Commentary

Core delineated landing zones easily justify over 28 wells per section with potential to almost double the wells per section as new benches are drilled

The West area is considered an oily portion of the Delaware with a large volume of associated gas that will continue to be a hot spot for rig activity.

Top operators in the Delaware Basin are active with 22 rigs in this area in the last 90 days

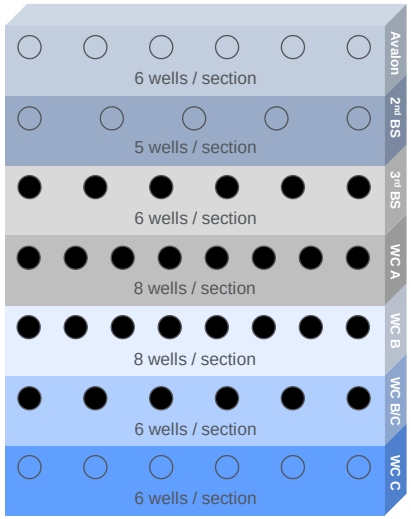
Currently 400 horizontal wells are producing in this West type curve area

The West area is shallower than the Central and East areas with the source rocks being less mature and more oil prone

The West area has a relatively high gross thickness with all four Wolfcamp intervals present, however, the Wolfcamp C and D are beginning to thin towards the western margin of the basin

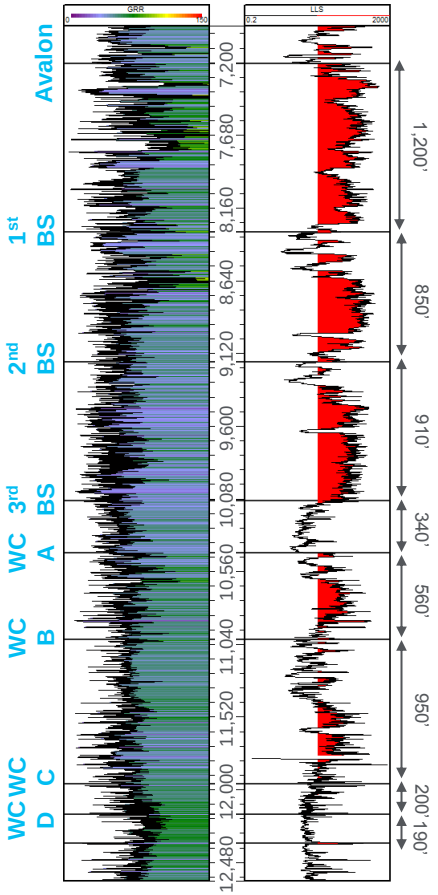
Locator Map

Illustrative Well Spacing



28 delineated wells per section
45 total wells per section

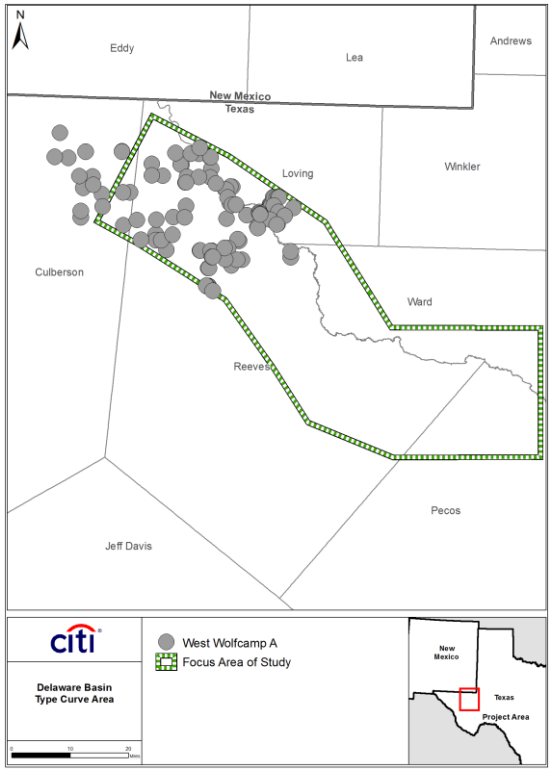
42389315010000 Dixieland 6

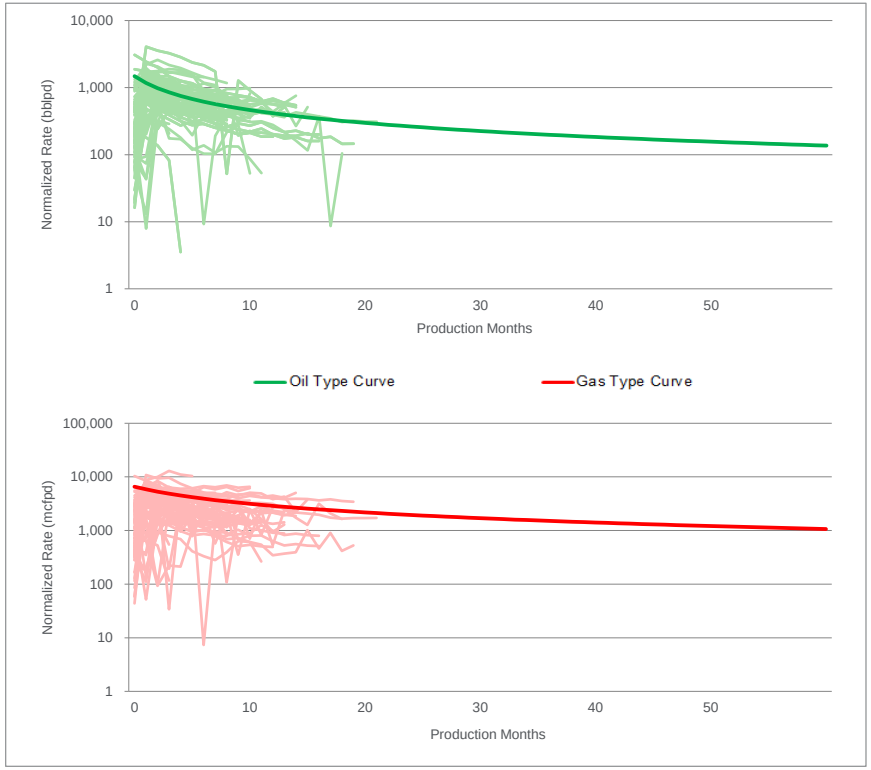


Source: Citi A&D.

Wolfcamp A West Type Curve

The West Wolfcamp A type curve has an EUR of ~2,700 mboe and a IRR of 97%. The type curves were constructed using 120 wells with as much as 30 months of production history.





Economic Assumptions

Gross Capex per Well / 10,000' LL ($mm)	$8,921
Fixed Opex / Well / Month ($m)	$9,000
Oil Variable Opex ($/bbl)	$1.11
Gas Variable Opex ($/mcf)	$0.76
Water Variable Opex ($/bbl)	$0.84
Ad Valorem Tax (%)	2.40%
Severance Tax (Oil / Gas / NGL) (%)	4.6% / 7.5% / 7.5%
Oil Differential to WTI ($/bbl)	($3.20)
Gas Differential to HH ($/mcf)	($1.85)
NGL Differential to WTI (%)	32%
Total Shrink (%)	32%
NGL Yield (bbl/mmcf)	119
Residue Btu	1,280
WI / NRI (%)	100% / 75%

- Key operators are Energen, BHP, Anadarko, Apache, Cimarex, EOG, Resolute and Shell
- The average lateral length of wells drilled in 2016 is ~6,600' but has increased to 8,000' of the 86 wells drilled in 2017.
- The average completion for 2017 as 2,000 lbs/ft and 2,100 gal/ft

Type Curve Parameters	IP24 (bopd / mcfpd)	Initial Decline (%)	b-factor	Terminal Decline (%)	WOR	Initial GOR (scf/bbl)	EUR (mbo / mmcf)
Oil	1,700	75	1.3	6	6	4,118	1,217
Gas	7,000	58	1.3	6			8,931

Results[1]

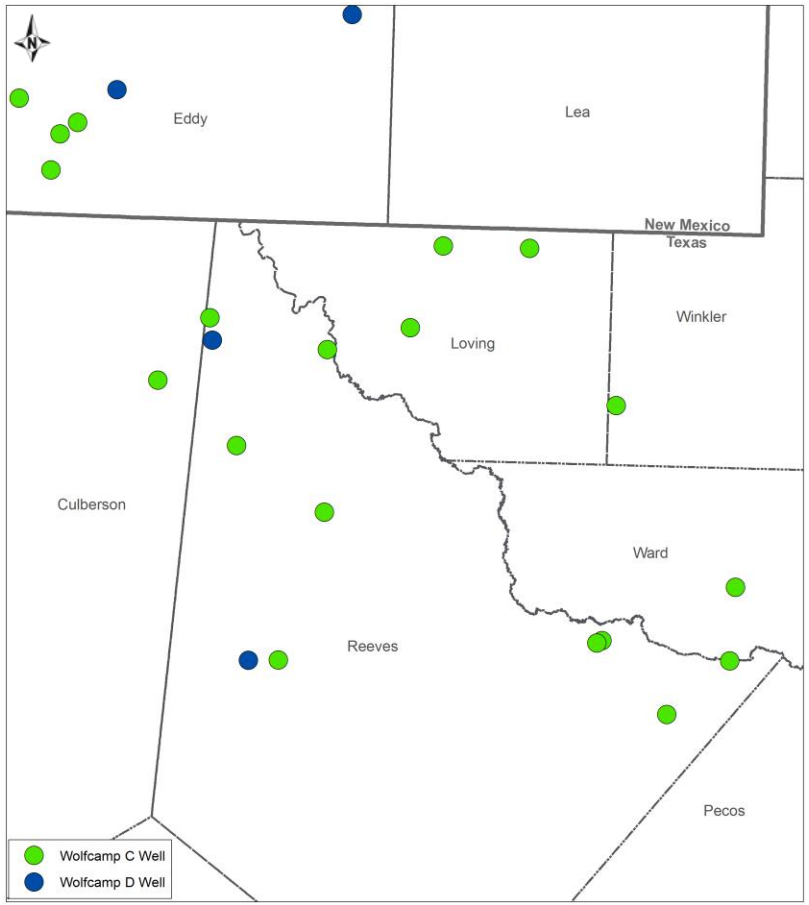
EUR (mboe)	2,706
IRR (%)	97%
PV_0 ($mm)	$30,095
PV_{10} ($mm)	$14,271

Source: Citi A&D. Economics assume NYMEX strip pricing as of October 12, 2017 through 2022, held flat thereafter.
1) Normalized to 10,000' lateral.

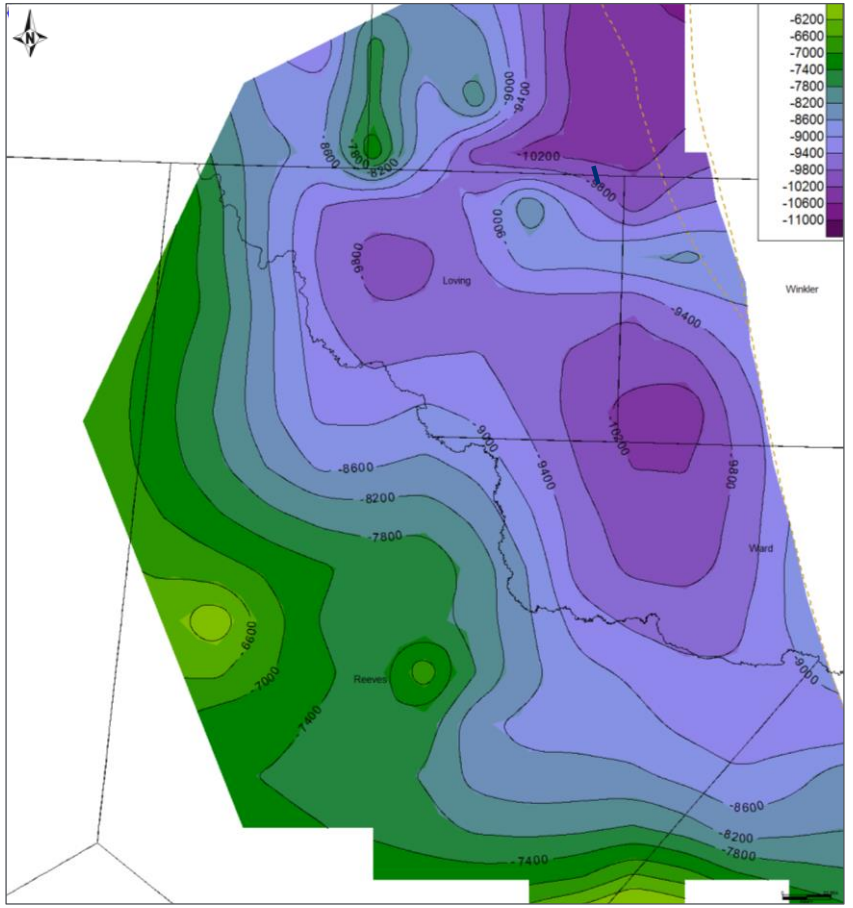
Lower Wolfcamp Locator Map and Wolfcamp C Structure Map

Several Wolfcamp C and D (Lower Wolfcamp) wells have been completed in the general area providing yet another possible drilling target in Delaware Basin.

Lower Wolfcamp Locator Map



Wolfcamp C Structure (400' Contour Intervals – SSTVD)

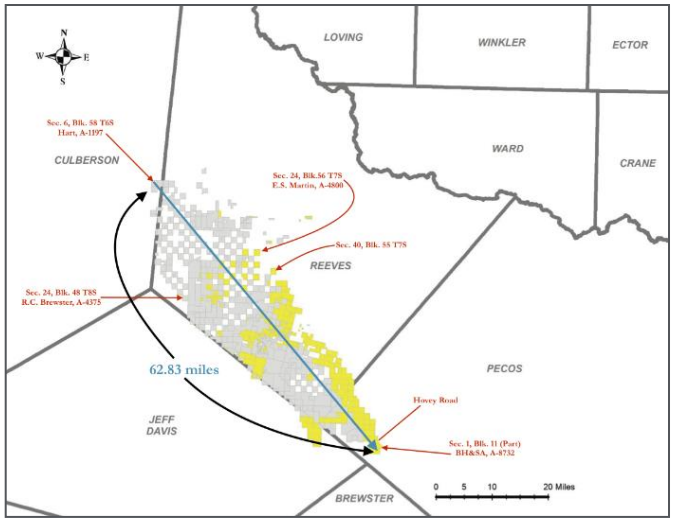


Source: Citi A&D, Wood Mackenzie.

Alpine High Update as of October 2017

Key Highlights

- Current net acreage of approximately 336,000
- Significant oil associated with the wet gas play
  - **Attractive economics**
  - **Location count continues to increase**
- Driven by low cost and high volumes of oil and NGL
- Longer laterals will provide additional upside
- There is an emerging oil play identical to the headline formations currently under development in the Delaware



Summary Economics

	Wet Gas	Dry Gas	Oil[1]
Location Count	3,500+	1,000+	500+
EUR *(Bcfe)*	9–21	17–23	600 *(Mboe)*
NPV-10 *($ in Millions)*	$5–19	$3–7	$3.0
BTAX IRR	44–345%	31–59%	>100%
Well Cost *($ in Millions)*	$4–6	$5–6	$4.5

Operational Activity

- More than 70 wells drilled by Apache on the Alpine High
- Extensive geographic and stratigraphic delineation of the fairway
- High-graded acreage position
- Commenced and progressed extensive infrastructure buildout

Source: Apache Investor Presentation.
(1) Economics based on two most recent oil tests.

Essential Subsurface Elements Required to Understand the Play

Structural History

Thermal Maturity

Reservoir Quality

- The play is a paleo high unlike much of the surrounding western Delaware basin.
- Both the deeper source rock and shallower Permian section are viable petroleum systems
- The underlying source rock generated depth dependent rich wet gas and dry gas
- Multiple producing wells and penetration coverage creates a high probability of continuous high quality reservoir

Impact of Deep Seated Faults

Seal Integrity of Source Rock

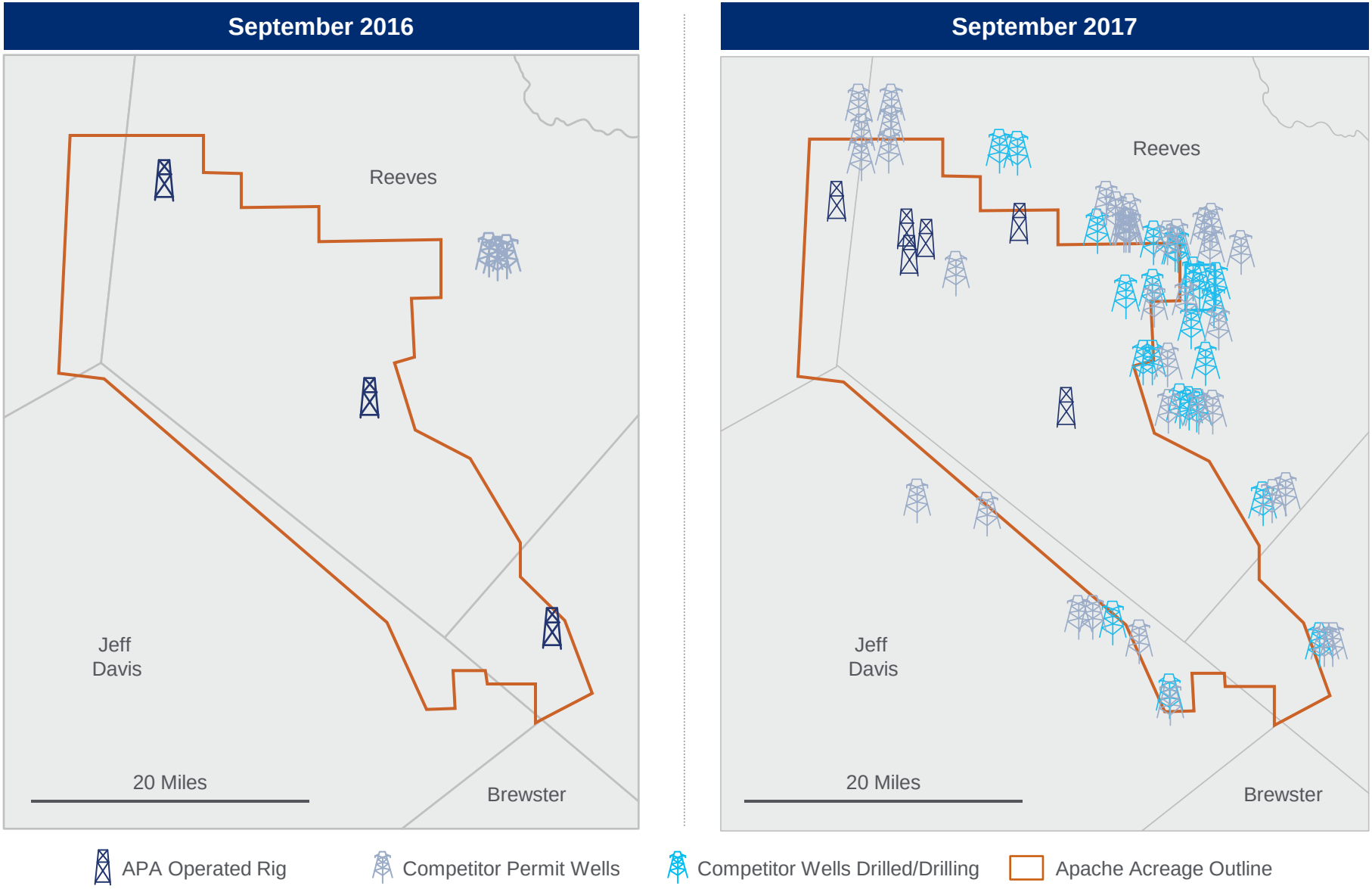
- 3D seismic and initial concept tests identified deep faults and seal integrity as defining parameters
- Delineation drilling required to determine impact on well performance and location count
- Acreage position and location count has been risked accordingly

Shallow Geologic Complexities

- Shallow complexities are modeled / understood through the availability of over 70 penetrations

Source: Apache Investor Presentation.

Industry Activity has Increased Significantly since Announcement



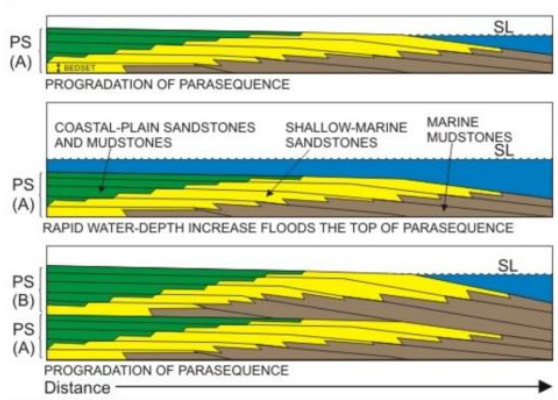
Source: Apache Investor Presentation, Drilling Info.

Geology of the Southern Delaware Basin

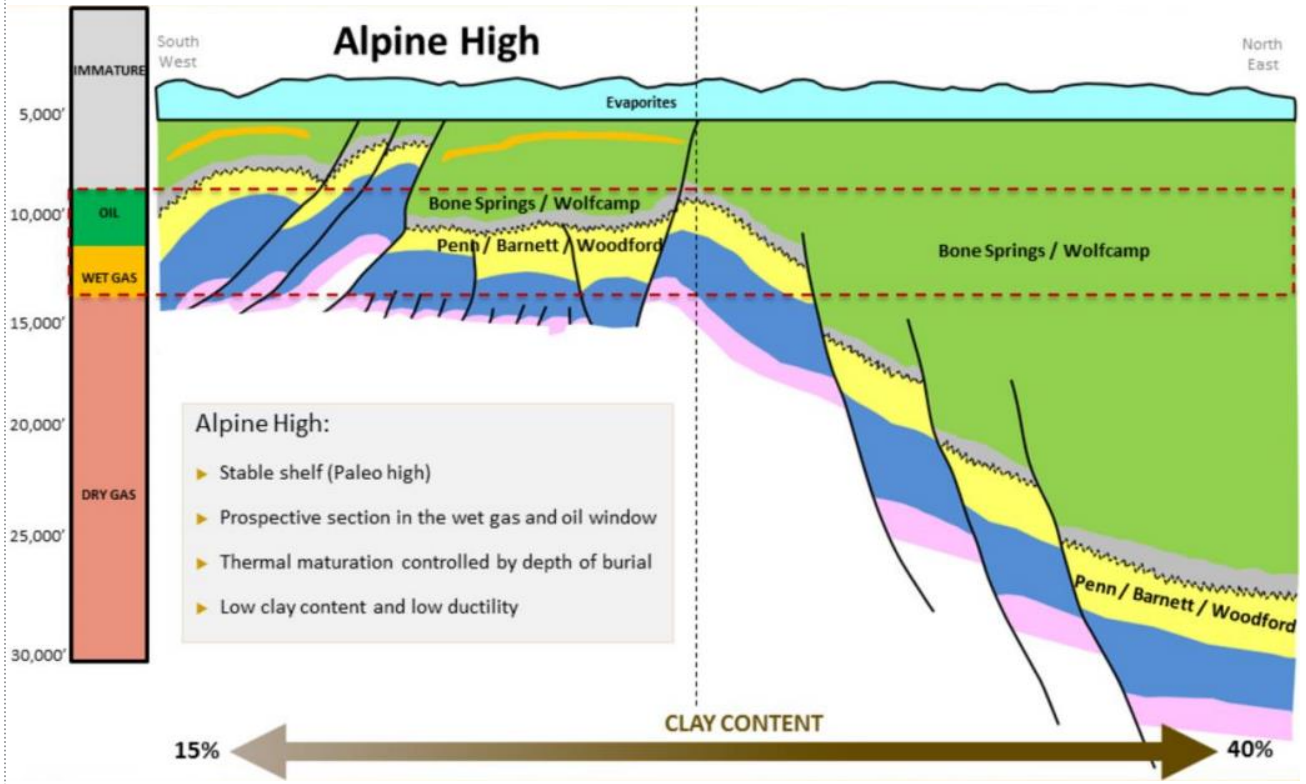
Key Attributes

- Woodford to Penn
- Deep water source rock
- Thick and continuous
- High organic content
- Overlying parasequence
  - Wolfcamp
  - Bone Springs

Parasequence Illustration



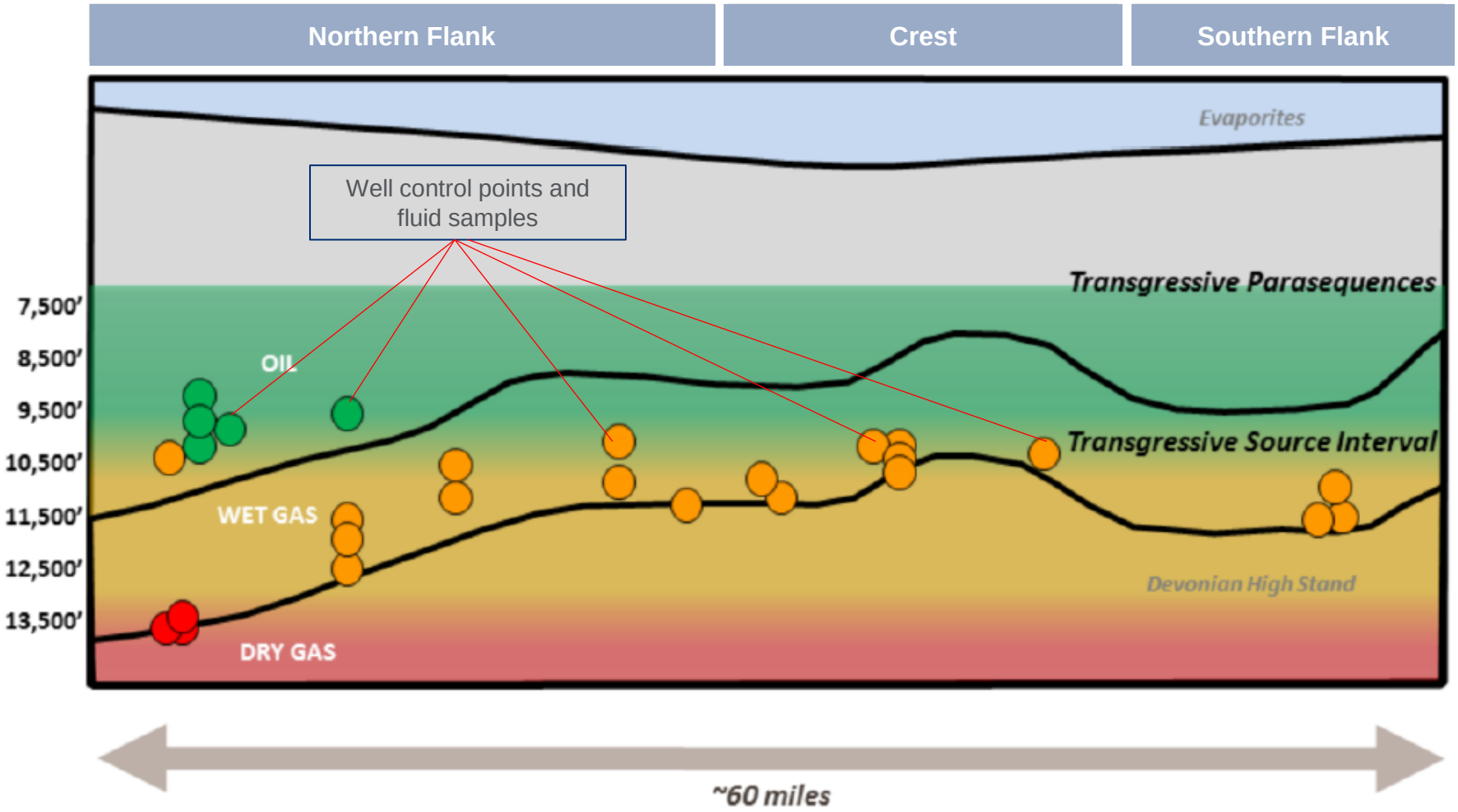
Geographic Overview



Source: Apache Investor Presentation.

Structural Cross Section of Alpine High

This is a true unconventional play as can be observed by the fact that the hydrocarbons have not migrated and that gas is below oil in a vertically contiguous hydrocarbon system.



Source: Apache Investor Presentation.
Note: Vertical and horizontal scales are not equivalent.

Distinct Source Rock and Parasequences Intervals

The source rock, which comprises the Woodford, the Barnett and the Pennsylvanian, is very consistent, predictable and contiguous deposition, like that seen in most other true resource plays.

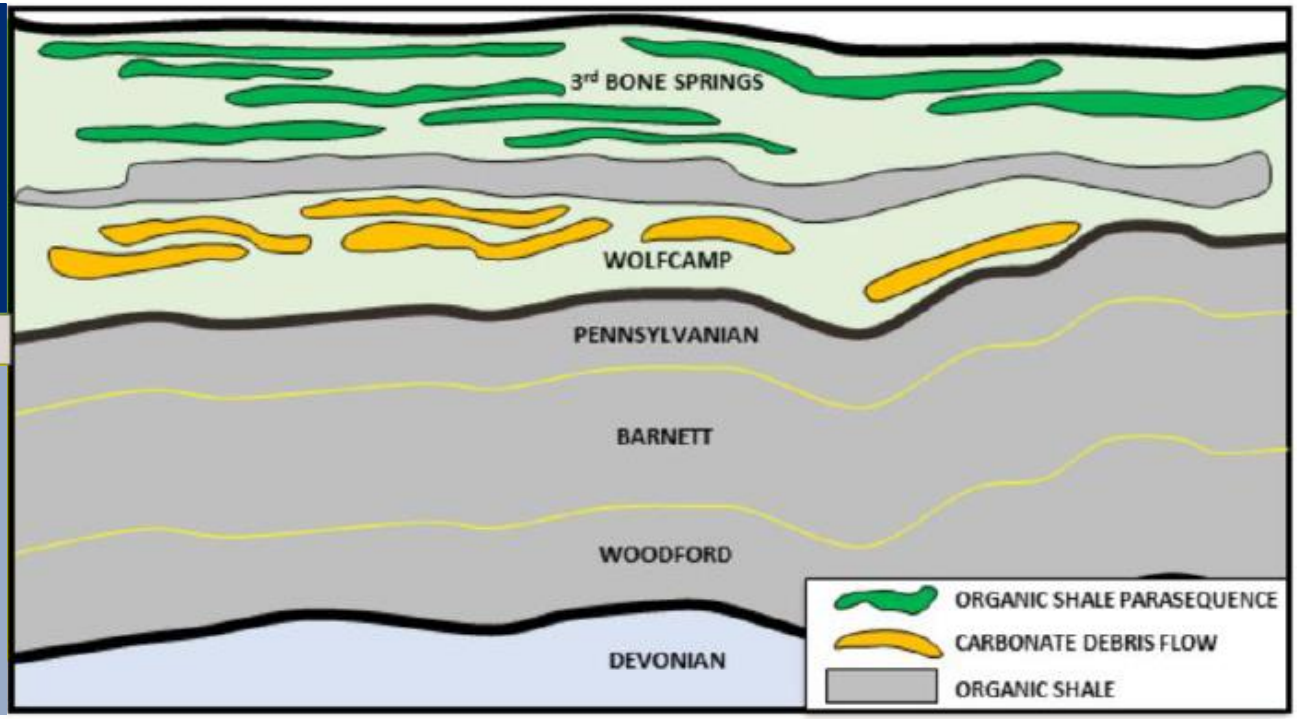
High Frequency, Rapidly Rising and Falling Sea Level Environment

Parasequences

UNCONFORMITY

Tranquil Marine Environment, Gradually Rising Worldwide Sea Level Conditions

Source Rock

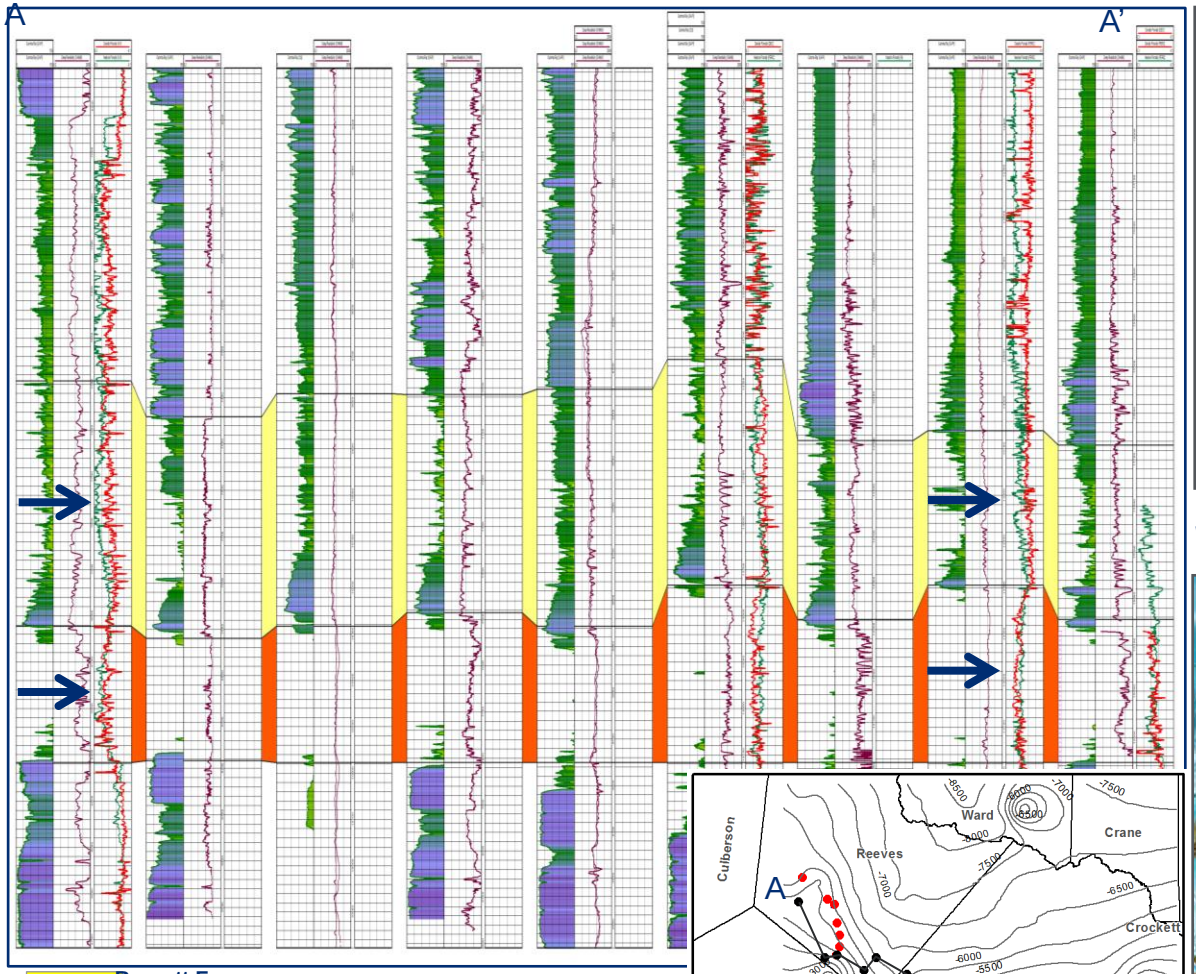


Woodford + Barnett + Penn	3rd Bone Springs + Wolfcamp
• Thick, consistent and contiguous deposition	• Higher variability with sweet spots
• Oil, wet gas and dry gas windows	• Oil and wet gas windows
• Minimal in-situ water	• Water wet rock
• Indigenous, organic shale	• Indigenous shale and migrated hydrocarbons

Source: Apache Investor Presentation.

Alpine High –Woodford, Barnett and Bone Spring Potential

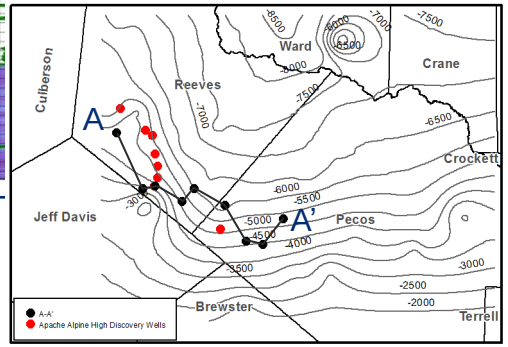
Significant upside potential exists in the Woodford, Barnett and Bone Spring formations on Whitehorse South Delaware position. The Woodford and Barnett are the headline formations of the Alpine High discovery.



Barnett Fm.
350 -500 ft

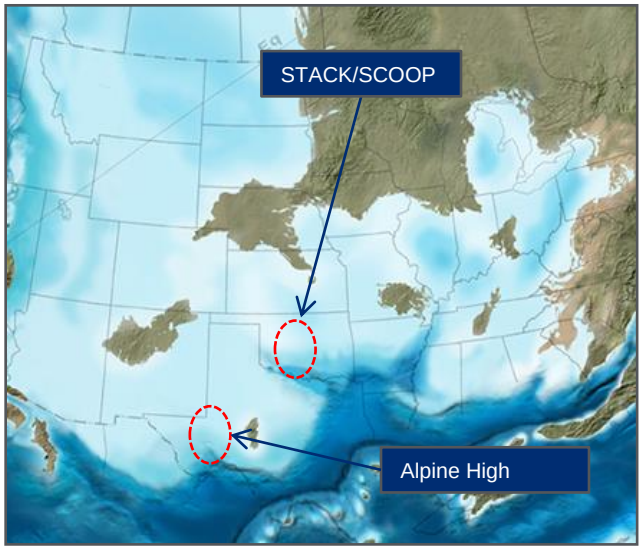
Woodford Shale
300 -350 ft

Target Zone



Shale Play Comparison	TX Alpine High Area/Woodford	OK SCOOP/Woodford
Lithology	Siliceous Mudstone	Siliceous Mudstone
Lithology Descriptor	Organic Shale with Interbedded Siltstone	Organic Shale with Interbedded Siltstone
Storage Capacity		
Formation Thickness	300-500'	150-300'
Porosity	8-12%	4-10%
Water Saturation (Sw)	15-25%	10-25%
Silica Content	40-65	30-50
Depth	10,000-13,000	11,000-15,000
Productive Capacity		
Clay Content	10-20%	20-35%
Total Organic Content (TOC)	4-10%	4-10%
Permeability	<0.1 mD	<0.1 mD
Reservoir Pressure (psi/ft)	0.5-0.65	0.5-0.7

Late Devonian – Early Mississippian Paleo-Geographic Map
Woodford/Barnett Deposition

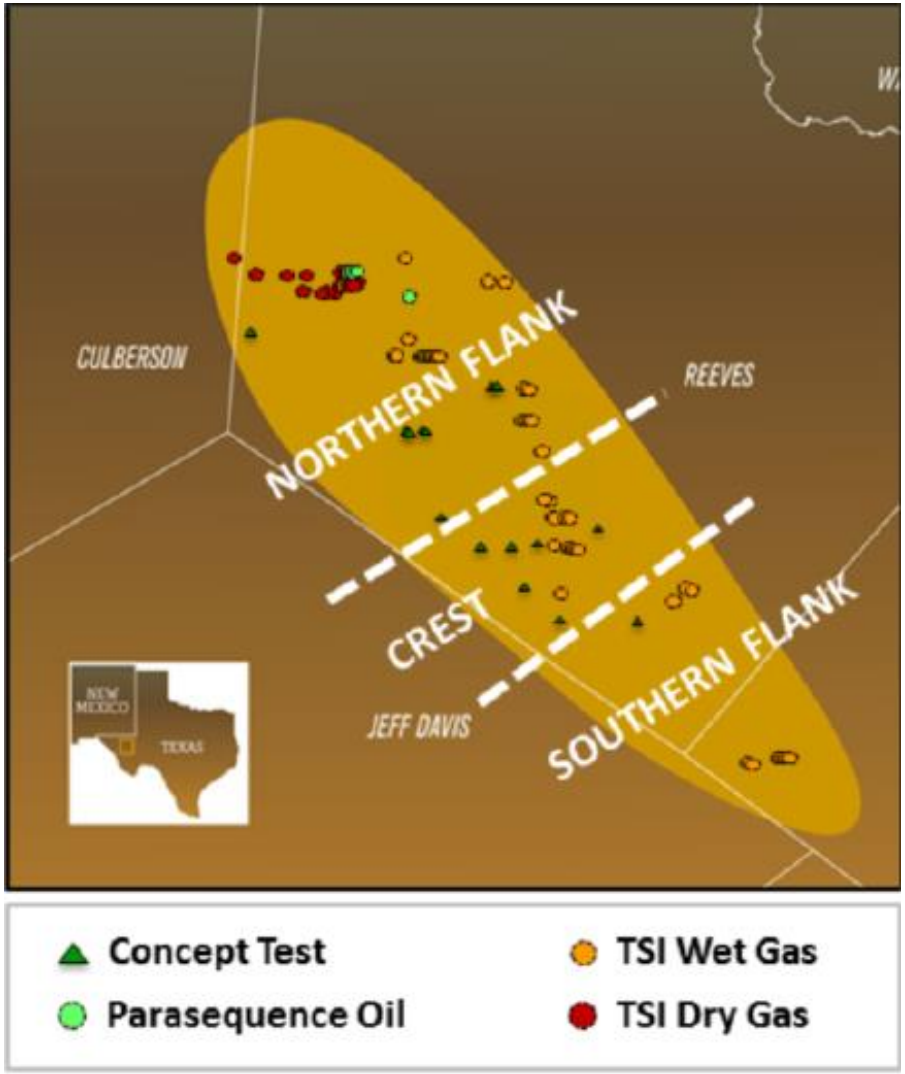


Dividing Alpine High into Three Settings

Alpine High Phase Windows

Northern Flank	• ~56% of Alpine High acreage • 54% of Alpine High wells drilled to date • Activity driven primarily by lease expiration • Over-pressured • Initiated parasequence testing
Crest	• ~16% of Alpine High acreage • 32% of Alpine High wells drilled to date • Moderately over-pressured • Currently mapping parasequences
Southern Flank	• ~28% of Alpine High acreage • 14% of Alpine High wells drilled to date • Over-pressured • Cooler temperature regime • Currently mapping parasequences

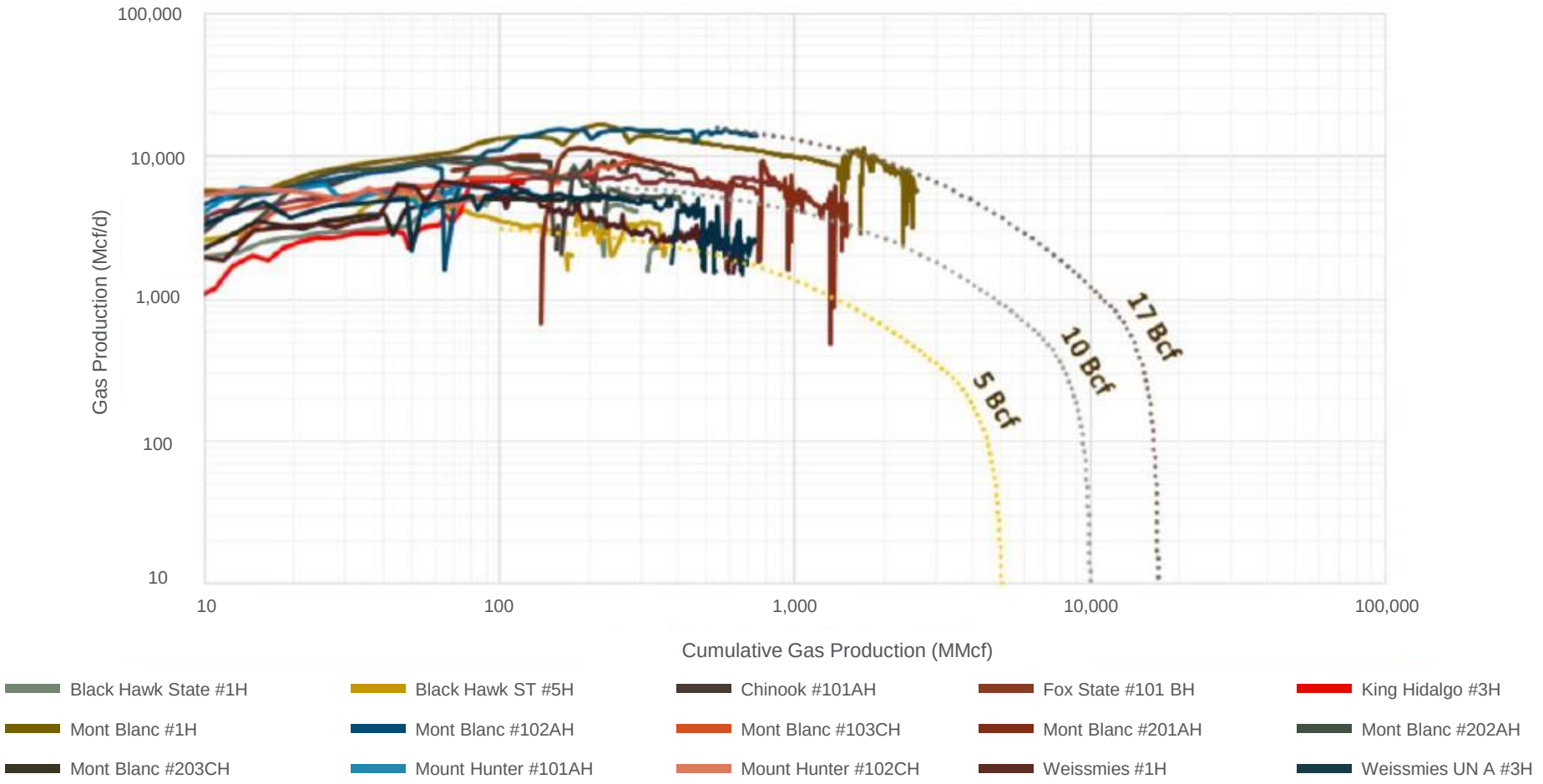
Alpine High Fairway



Source: Apache Investor Presentation.

Wet Gas Well Performance

When accounting for all the liquids, the ultimate recovery in gas equivalents for these wells can range from 1.2 to 1.8 times the wet gas EUR.



Source: Apache Investor Presentation.
Note: Gross Wellhead Production.

Wet Gas Play Typical Single Well IRR of 44 to 79%

Upper range wells have single well IRRs exceeding 100% and in some cases exceeding 300%.

Typical Well			
EUR/Well (Bcfe)	9	–	15
Fully Burdened Economics @ $50 WTI/$3.00 HHub			
NPV-10 ($ in Millions)	$5	–	$8
BTAX IRR	44%	–	79%
Product Mix			
% Oil (Mbbls)	3%	–	15%
% NGL (Mbbls)	51%	–	56%
Well Cost ($ in Millions)	$4.0	–	$6.0

Upper Range Well			
EUR/Well (Bcfe)	16	–	21
Fully Burdened Economics @ $50 WTI/$3.00 HHub			
NPV-10 ($ in Millions)	$8	–	$19
BTAX IRR	133%	–	345%
Product Mix			
% Oil (Mbbls)	0%	–	9%
% NGL (Mbbls)	41%	–	55%
Well Cost ($ in Millions)	$4.0	–	$6.0

Single Well Economic Assumptions

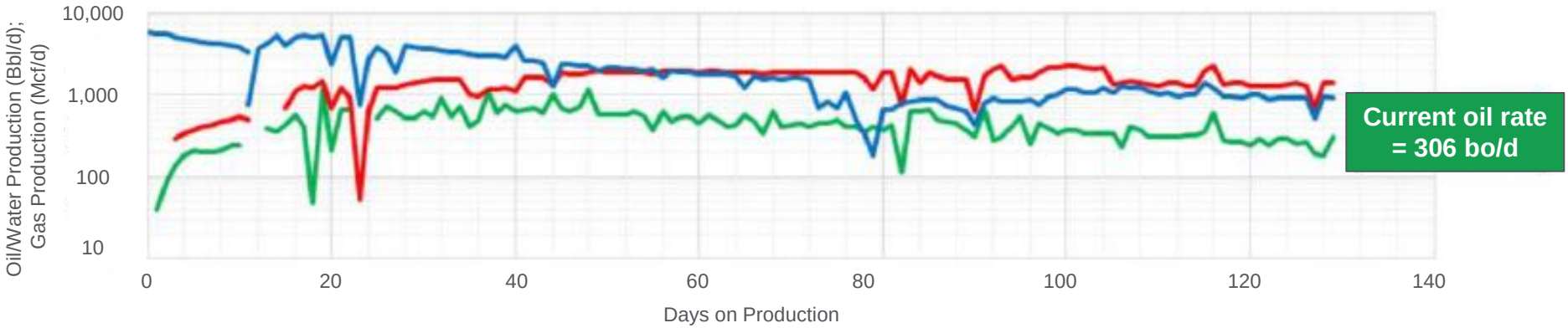
- Prices: $50 WTI / $3.00 HH / NGL = 60% WTI
- Waha basis = $0.35/MMbtu; midstream fee = $0.93/Mcf
- NGL yields and midstream fees assume cryogenic processing
- Economics include overhead, workover, abandonment and E&P facility burdens

Source: Apache Investor Presentation.
Note: End the points shown for EUR, NPV, products mix and well costs are ranges and may not correlate directly when read in a column.

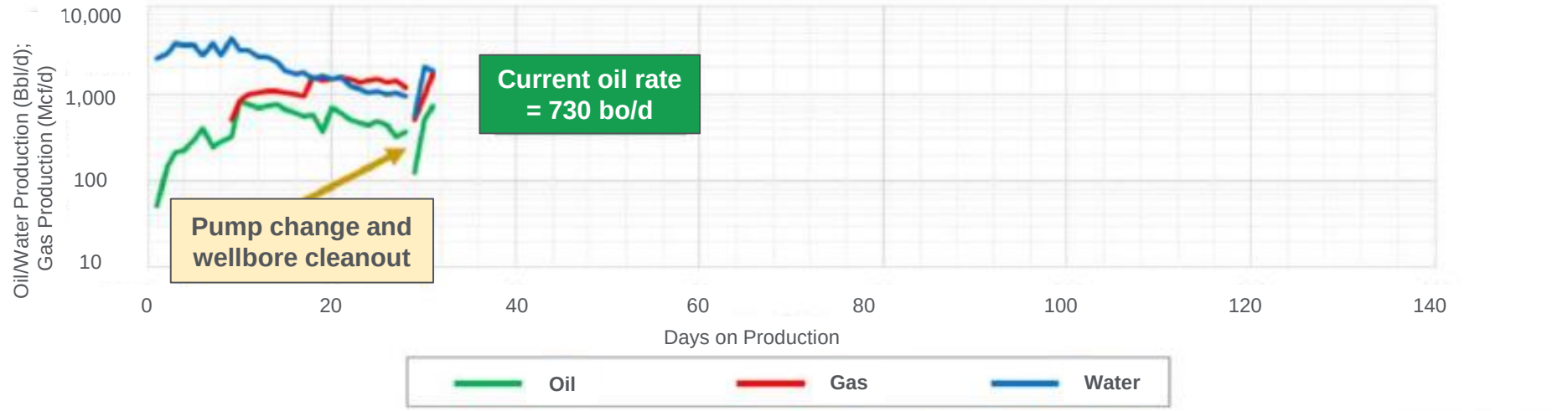
Wolfcamp Formation Tests Demonstrate Economic Viability

Well 401H completed in the Upper Wolfcamp with a 4,590' lateral produces 44°API crude. Well 402H completed in the Upper Wolfcamp with a 4,500' lateral produces 45°API crude. Both wells have high quality production.

Cypress State 402H



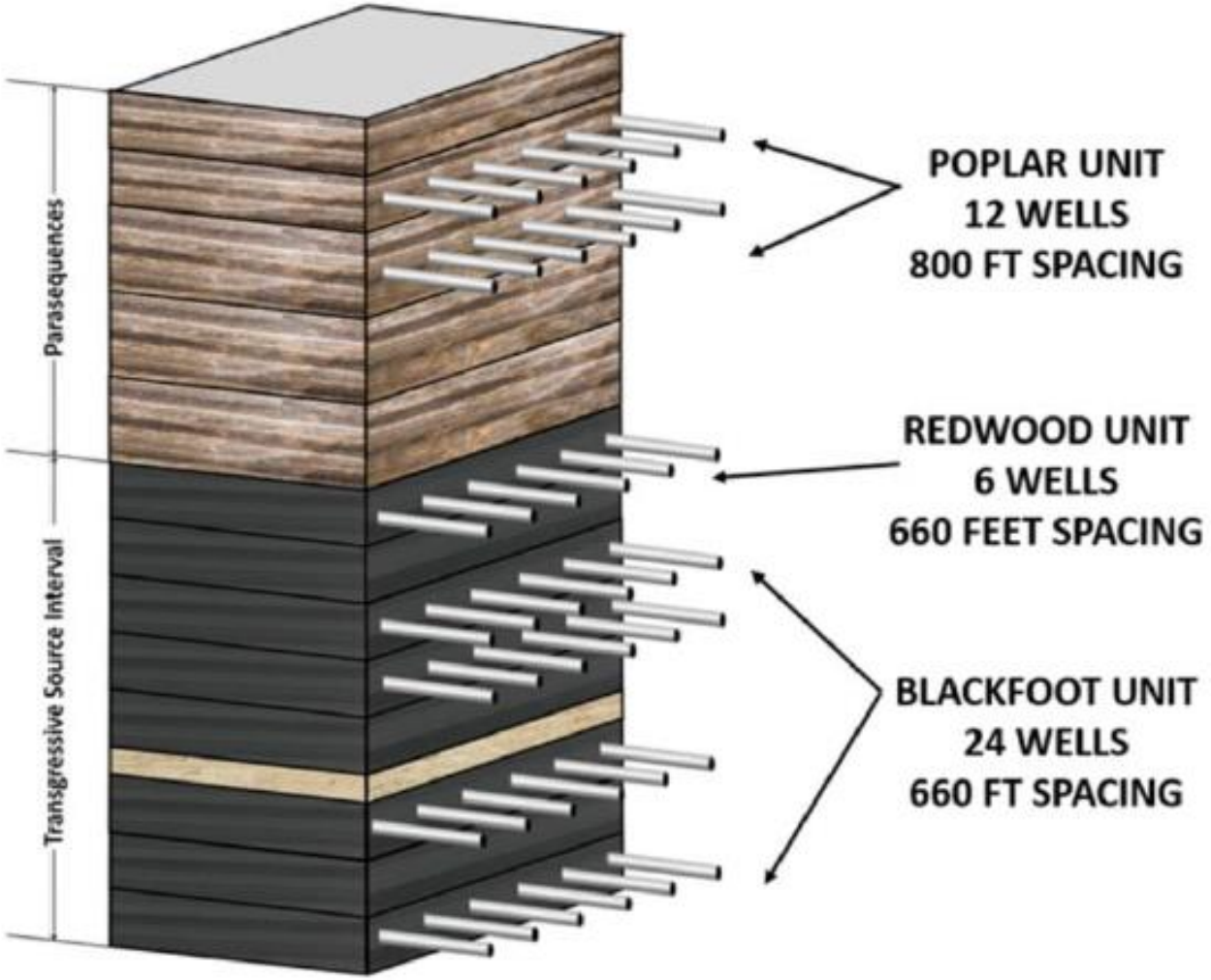
Cypress State 401H



Source: Apache Investor Presentation.

Most Likely Development Scenario in the North Flank

Apache has directed most of its delineation and testing activities in the Northern Flank and therefore have a better understanding of how area would likely look under development.



Source: Apache Investor Presentation.

That’s Not All!

- Delaware Mountain Group
- Northern Delaware: Eddy & Lea Counties
  - Abo and Yeso
- Penn to the Ellenberger in the central Delaware
- Wolfcamp C & D
- Other?

IRS Circular 230 Disclosure: Citigroup Inc. and its affiliates do not provide tax or legal advice. Any discussion of tax matters in these materials (i) is not intended or written to be used, and cannot be used or relied upon, by you for the purpose of avoiding any tax penalties and (ii) may have been written in connection with the "promotion or marketing" of any transaction contemplated hereby ("Transaction"). Accordingly, you should seek advice based on your particular circumstances from an independent tax advisor.

In any instance where distribution of this communication is subject to the rules of the US Commodity Futures Trading Commission ("CFTC"), this communication constitutes an invitation to consider entering into a derivatives transaction under U.S. CFTC Regulations §§ 1.71 and 23.605, where applicable, but is not a binding offer to buy/sell any financial instrument.

Any terms set forth herein are intended for discussion purposes only and are subject to the final terms as set forth in separate definitive written agreements. This presentation is not a commitment to lend, syndicate a financing, underwrite or purchase securities, or commit capital nor does it obligate us to enter into such a commitment, nor are we acting as a fiduciary to you. By accepting this presentation, subject to applicable law or regulation, you agree to keep confidential the information contained herein and the existence of and proposed terms for any Transaction.

Prior to entering into any Transaction, you should determine, without reliance upon us or our affiliates, the economic risks and merits (and independently determine that you are able to assume these risks) as well as the legal, tax and accounting characterizations and consequences of any such Transaction. In this regard, by accepting this presentation, you acknowledge that (a) we are not in the business of providing (and you are not relying on us for) legal, tax or accounting advice, (b) there may be legal, tax or accounting risks associated with any Transaction, (c) you should receive (and rely on) separate and qualified legal, tax and accounting advice and (d) you should apprise senior management in your organization as to such legal, tax and accounting advice (and any risks associated with any Transaction) and our disclaimer as to these matters. By acceptance of these materials, you and we hereby agree that from the commencement of discussions with respect to any Transaction, and notwithstanding any other provision in this presentation, we hereby confirm that no participant in any Transaction shall be limited from disclosing the U.S. tax treatment or U.S. tax structure of such Transaction.

We are required to obtain, verify and record certain information that identifies each entity that enters into a formal business relationship with us. We will ask for your complete name, street address, and taxpayer ID number. We may also request corporate formation documents, or other forms of identification, to verify information provided.

Any prices or levels contained herein are preliminary and indicative only and do not represent bids or offers. These indications are provided solely for your information and consideration, are subject to change at any time without notice and are not intended as a solicitation with respect to the purchase or sale of any instrument. The information contained in this presentation may include results of analyses from a quantitative model which represent potential future events that may or may not be realized, and is not a complete analysis of every material fact representing any product. Any estimates included herein constitute our judgment as of the date hereof and are subject to change without any notice. We and/or our affiliates may make a market in these instruments for our customers and for our own account. Accordingly, we may have a position in any such instrument at any time.

Although this material may contain publicly available information about Citi corporate bond research, fixed income strategy or economic and market analysis, Citi policy (i) prohibits employees from offering, directly or indirectly, a favorable or negative research opinion or offering to change an opinion as consideration or inducement for the receipt of business or for compensation; and (ii) prohibits analysts from being compensated for specific recommendations or views contained in research reports. So as to reduce the potential for conflicts of interest, as well as to reduce any appearance of conflicts of interest, Citi has enacted policies and procedures designed to limit communications between its investment banking and research personnel to specifically prescribed circumstances.

Citi believes that sustainability is good business practice. We work closely with our clients, peer financial institutions, NGOs and other partners to finance solutions to climate change, develop industry standards, reduce our own environmental footprint, and engage with stakeholders to advance shared learning and solutions. Highlights of Citi's unique role in promoting sustainability include: (a) releasing in 2007 a Climate Change Position Statement, the first US financial institution to do so; (b) targeting $50 billion over 10 years to address global climate change: includes significant increases in investment and financing of renewable energy, clean technology, and other carbon-emission reduction activities; (c) committing to an absolute reduction in GHG emissions of all Citi owned and leased properties around the world by 10% by 2011; (d) purchasing more than 234,000 MWh of carbon neutral power for our operations over the last three years; (e) establishing in 2008 the Carbon Principles; a framework for banks and their U.S. power clients to evaluate and address carbon risks in the financing of electric power projects; (f) producing equity research related to climate issues that helps to inform investors on risks and opportunities associated with the issue; and (g) engaging with a broad range of stakeholders on the issue of climate change to help advance understanding and solutions.

Citi works with its clients in greenhouse gas intensive industries to evaluate emerging risks from climate change and, where appropriate, to mitigate those risks.

efficiency, renewable energy and mitigation