center for ENERGY STUDIES
Rice University's Baker Institute

RICE

Economic Valuation of Water in the Permian Basin

Gabriel Collins, J.D.
Baker Botts Fellow for Energy & Environmental Regulatory Affairs
Baker Institute for Public Policy, Rice University
gabe.collins@rice.edu

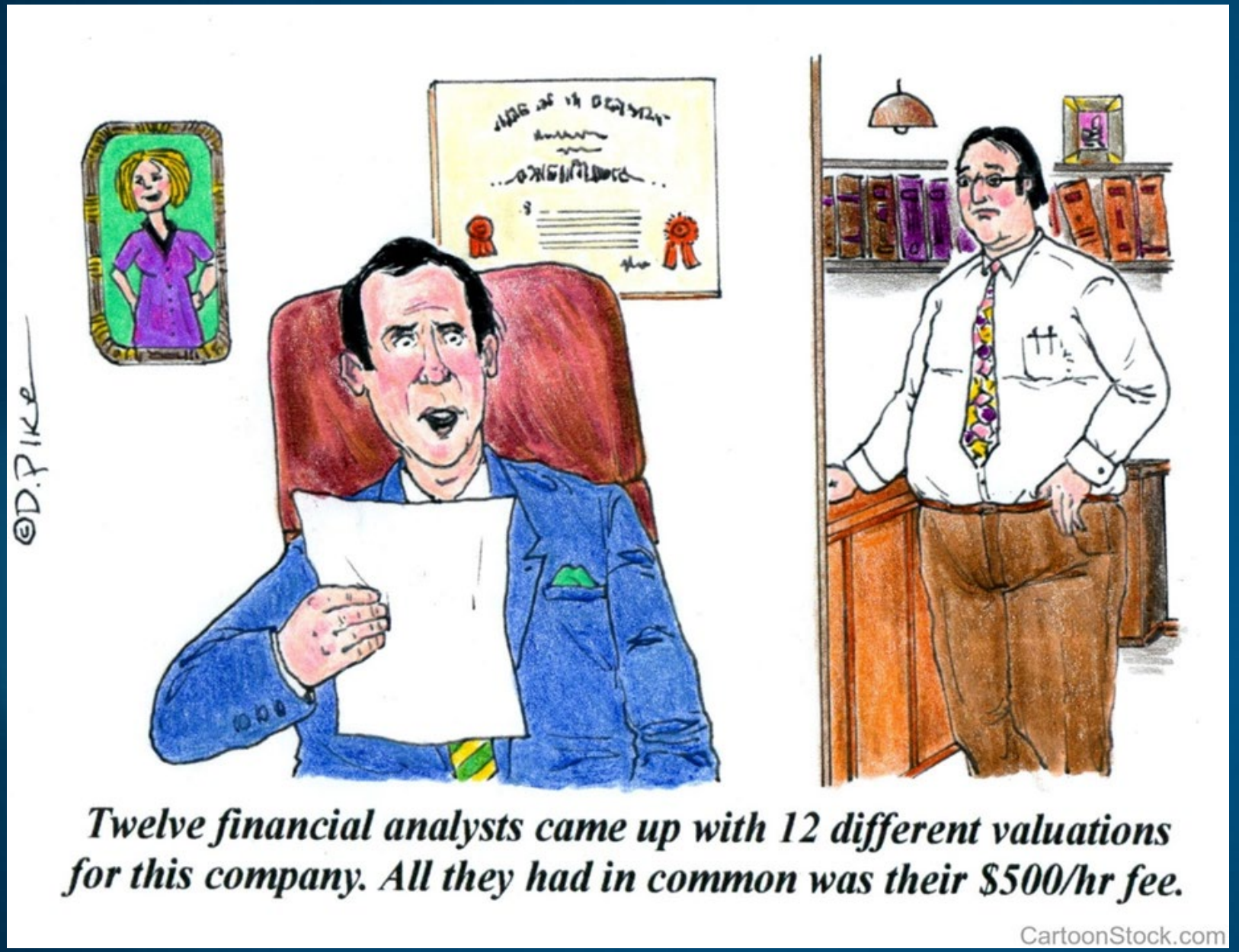
Please cite as:

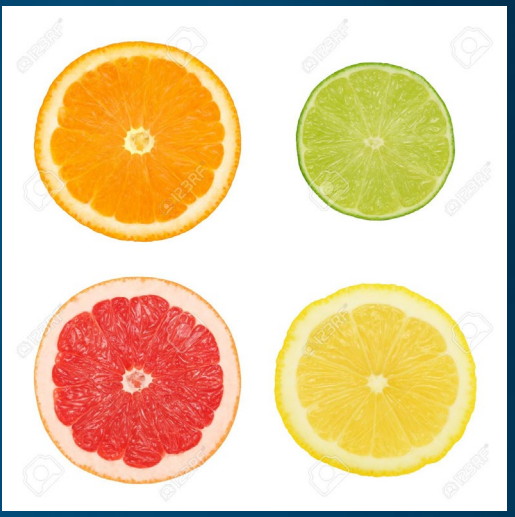
Gabriel Collins, "Economic Valuation of Water in the Permian Basin," Presentation to American Society of Appraisers' Energy Valuation Conference, 2 May 2019, Houston, TX.

Disclaimer

This analysis reflects my personal opinions and assessments only. It is designed solely to be illustrative and stimulate broader thought, with the objective of elevating the conversation in the energy and water space. It IS NOT an investment analysis or investment advice. It is also NOT offering any legal opinions or advice and does not create an attorney-client relationship with any reader or consumer of the information presented herein. Readers rely on the information in this analysis at their own risk. Neither the author nor the Baker Institute for Public Policy are liable for any loss or damage caused by a reader's reliance on information contained in any of the charts, data series, opinions, or other information presented herein. I am not a hydrologist, geologist, or engineer and am not offering advice on technical aspects of any assets which may be discussed in this analysis, including, but not limited to geological factors and engineering challenges that may arise in an oilfield water development project. The information and opinions contained in, and expressed by this analysis, are based on sources deemed reliable. However, there is no warranty, assurance, or guarantee, express or implied, about the completeness, reliability, or accuracy of this content. The views expressed herein are my interpretations as of the date the report is published and are subject to change without notice.

Groundwater Valuation: What's the Goal?





Source: CartoonStock, Doug Pike, HEB, Michigan Apple Committee, 123rf, Wikipedia

What Are You Buying?

Paper

Groundwater Rights Sales Contract

This Contract ("**Contract**") to buy and sell groundwater rights is between Sellers, Winkler Services and Buyer, all as identified below. Buyer must deliver the Earnest Money to Escrow Agent and obtain a signature acknowledging receipt of the Earnest Money before the Earnest Money Deadline provided in paragraph A.1. for this Contract to be effective. For and in consideration of the mutual covenants set forth herein, and other good and valuable consideration, the receipt and sufficiency of which is herein acknowledged, Sellers, Winkler Services and Buyer hereby agree as follows:

Sellers: **Roark Resources, Inc., Murray B. Roark, the Estate of Bill B. Roark, James C. Roark, George H. Roark, and Robert B. Roark (collectively, the "Roark Parties") and Winkler Land, LLC ("Winkler Land", and collectively with the Roark Parties, the "Sellers")**

Roark Parties: **(listed above)**

Address:

Phone:

Fax:

E-mail:

Roark Parties' Attorney:

Address:

Phone:

Fax:

E-mail:

Winkler Land:

Address:

Phone:

521643 000004 11924833.1

Pipe

Water

Source: DBS&A, Garney Construction, Midland County Fresh Water Supply District No.1

How To Value It?

Use value

Comparable sales

Avoided cost

Residual value

Income capitalization

Market surveys

Cash flow

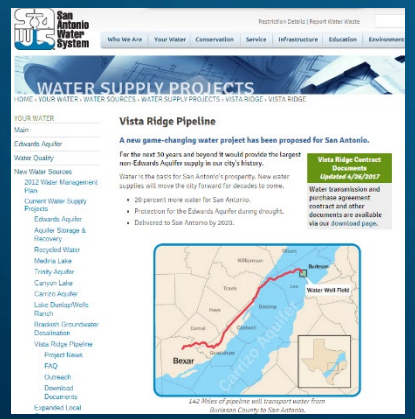
Land Value Method

Willingness/Capacity to Pay

Existence value

Conservation

Water as the final good.

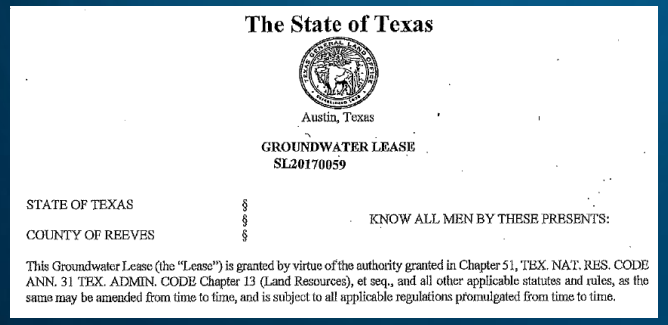


Water as an intermediate input.

Core Concept: Fair Market Value

1. Level 1: “Quoted prices in active markets for identical assets or liabilities.”
2. Level 2: “Inputs other than Level 1 that are observable, either directly or indirectly, such as **quoted prices for similar assets or liabilities**; quoted prices in markets that are not active; or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities,” and
3. Level 3: “Unobservable inputs that are supported by little or no market activity and **that are significant to the fair value of the assets or liabilities**.”

Forestar Group, Form 10-K, 2016. Pg. 70. Available from http://investor.forestargroup.com/phoenix.zhtml?c=216546&p=irol-sec&control_symbol=&control_symbol=
Ibid.
Ibid.



The State of Texas

Austin, Texas

GROUNDWATER LEASE
SL20170059

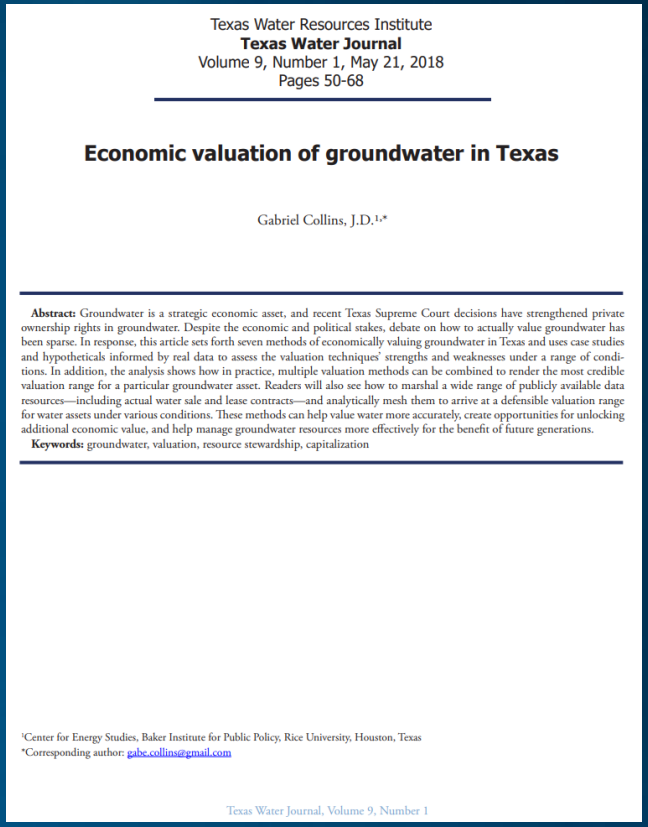
STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF REEVES §

This Groundwater Lease (the "Lease") is granted by virtue of the authority granted in Chapter 51, TEX. NAT. RES. CODE ANN. 31 TEX. ADMIN. CODE Chapter 13 (Land Resources), et seq., and all other applicable statutes and rules, as the same may be amended from time to time, and is subject to all applicable regulations promulgated from time to time.

6.04. Fair Market Value Alternative. If Lessee (i) purchases the groundwater or (ii) enters into a contract for the disposition of groundwater from the Premises with an Affiliate or which is otherwise not negotiated on an arms-length basis, Lessor shall be entitled, at Lessor's election, to receive the fair market value of Lessor's Royalty Share of groundwater produced and saved from the Premises as reasonably established by Lessor. For purposes of the foregoing, it shall be presumed that Lessor has reasonably established the fair market value of the groundwater if Lessor identifies three or more contracts for the disposition of groundwater from properties having reasonably similar characteristics as the Premises and then averages the price paid under the identified group of contracts.

Groundwater Valuation: Some Key Variables

- Water location, the existence of production and delivery infrastructure, and the cost of such infrastructure and cost of producing the water
- Market competition: For Water Sales *and* Water Purchases
- Protection from drainage by neighboring pumpers
- Political, legal, and regulatory barriers that could impede development of the resource.
- The potential buyer's capacity to pay (economic and political dimensions, in the case of cities)
- Time sensitivity (a/k/a consumer urgency) of the water use
- Drought resistance of the resource



Texas Water Resources Institute
Texas Water Journal
Volume 9, Number 1, May 21, 2018
Pages 50-68

Economic valuation of groundwater in Texas

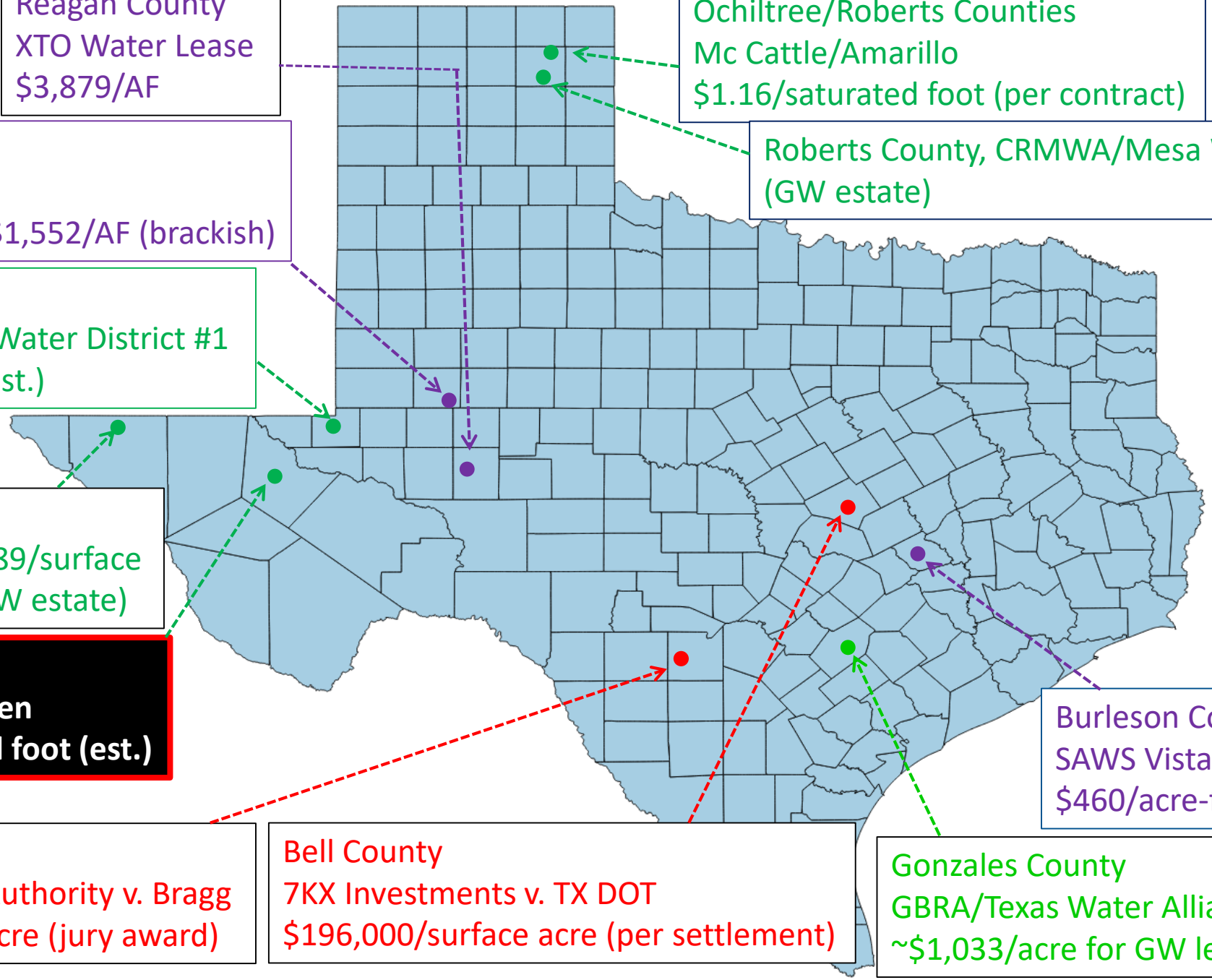
Gabriel Collins, J.D.[1,*]

Abstract: Groundwater is a strategic economic asset, and recent Texas Supreme Court decisions have strengthened private ownership rights in groundwater. Despite the economic and political stakes, debate on how to actually value groundwater has been sparse. In response, this article sets forth seven methods of economically valuing groundwater in Texas and uses case studies and hypotheticals informed by real data to assess the valuation techniques' strengths and weaknesses under a range of conditions. In addition, the analysis shows how in practice, multiple valuation methods can be combined to render the most credible valuation range for a particular groundwater asset. Readers will also see how to marshal a wide range of publicly available data resources—including actual water sale and lease contracts—and analytically mesh them to arrive at a defensible valuation range for water assets under various conditions. These methods can help value water more accurately, create opportunities for unlocking additional economic value, and help manage groundwater resources more effectively for the benefit of future generations.

Keywords: groundwater, valuation, resource stewardship, capitalization

[1]Center for Energy Studies, Baker Institute for Public Policy, Rice University, Houston, Texas
*Corresponding author: gabe.collins@gmail.com

Gabriel Collins, "Economic Valuation of Groundwater in Texas," Texas Water Journal, Vol. 9, No.1, 2018 (50-68), https://twj.media/economic-valuation-of-groundwater/, (peer reviewed)



Reagan County
XTO Water Lease
$3,879/AF

Ochiltree/Roberts Counties
Mc Cattle/Amarillo
$1.16/saturated foot (per contract)

Roberts County, CRMWA/Mesa Water, $488/acre (GW estate)

Martin County
PXD Water Lease
$2,482/AF (potable)/ $1,552/AF (brackish)

Winkler County
Midland County Fresh Water District #1
$0.83/saturated foot (est.)

Hudspeth County
CL Ranch/El Paso, $1,889/surface acre (~$689/acre for GW estate)

Reeves County
Layne Christensen
$1.09/saturated foot (est.)

Burleson County
SAWS Vista Ridge
$460/acre-foot (per contract)

Medina County
Edwards Aquifer Authority v. Bragg
$25,000/surface acre (jury award)

Bell County
7KX Investments v. TX DOT
$196,000/surface acre (per settlement)

Gonzales County
GBRA/Texas Water Alliance
~$1,033/acre for GW leases

RICE UNIVERSITY'S
BAKER INSTITUTE
FOR PUBLIC POLICY

ISSUE BRIEF 12.07.17

Valuation of Groundwater In Place at a Texas Frac Water Supplier

Gabriel Collins, J.D., Baker Botts Fellow in Energy & Environmental Regulatory Affairs, Center for Energy Studies

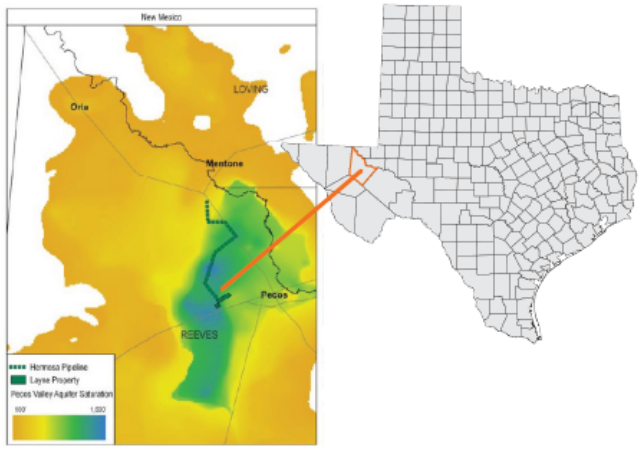
Texas law recognizes the existence of a distinct groundwater estate where water is owned as real private property while still in the ground. Groundwater's unique private property status in Texas creates incentives for business transactions, but it also potentially gives rise to damage claims by water owners who believe another party's actions have impaired their ability to access and/or use their groundwater. To either close deals or resolve disputes, parties and courts must be able to attach a credible economic value to water. In many cases, the water at issue may still be underground in the aquifer. Accordingly, the techniques in this issue brief demonstrate how input and investment costs can be combined with hydrological data to estimate the residual value paid for water—one potential way to value groundwater in place.

This brief analyzes a major Permian Basin oilfield water supply asset that recently came online. It leverages primary research and multiple publicly available data sets to establish what the groundwater estate purchased was likely worth *in place*. Layne Christensen Company, a major global water drilling services provider, disclosed in June 2017 that it had invested $18 million to create a set of infrastructure capable of delivering more than 100,000 barrels per day of frac water to customers in the Delaware Basin.[1] Layne's stated capital expenditure (CAPEX) included land acquisition costs.[2] The project is located on a former cotton farm approximately 1,000 acres in size just west of Pecos, Texas (Figure 1).

BREAKING DOWN THE TRANSACTION

Surface land in Texas includes the groundwater estate unless the groundwater has been sold separately, reserved by the seller, or otherwise split from the surface. This makes acquiring the surface tract, in effect, a purchase of both the "dirt" and the water beneath it. "Unbundling" the value of the surface alone can thus shed light on the likely value of the groundwater beneath.

FIGURE 1 — APPROXIMATE LOCATION OF LAYNE'S FRAC WATER SUPPLY ASSET



SOURCE Layne Water Midstream Presentation, Texas Department of Transportation

TABLE 1 — ESTIMATING THE LIKELY VALUE FOR THE GROUNDWATER ESTATE AT LAYNE'S HERMOSA OILFIELD WATER SUPPLY ASSET

Item	Units	Number	Unit Cost	Total
Wells (new drill)	—	2	$127,250	$254,500
Wells (refurbish)	—	4	$65,000	$260,000
Storage pond (built and lined) capacity	barrels	750,000	$1.25	$937,500
Pumps (200 HP)	—	4	$25,000	$100,000
Booster pumps on pipeline	—	3	$10,000	$30,000
22-inch high-density polyethylene pipeline	feet	107,000	$90.20	$9,651,400
Pipe fusion	joint welds	2,112	$150.00	$316,800
Trencher operation (Vermeer T1155)	feet	107,000	$7.50	$802,500
Right-of-way	miles	20	$71,680	$1,433,600
Riser stations for water offtake	—	13	$15,000	$195,000
Labor	days	90	$8,400	$756,000
Branch lines linking wells to central pits	feet	21,000	$12	$252,000
Electronics on wells	—	6	$10,000	$60,000
Electrification	—	1	$50,000	$50,000
Concrete	tonnes	500	$167	$83,250
Rebar	tonnes	16	$600	$9,494
Roads	miles	1.50	$50,000	$75,000
Total (excluding land)				**$15,267,044**

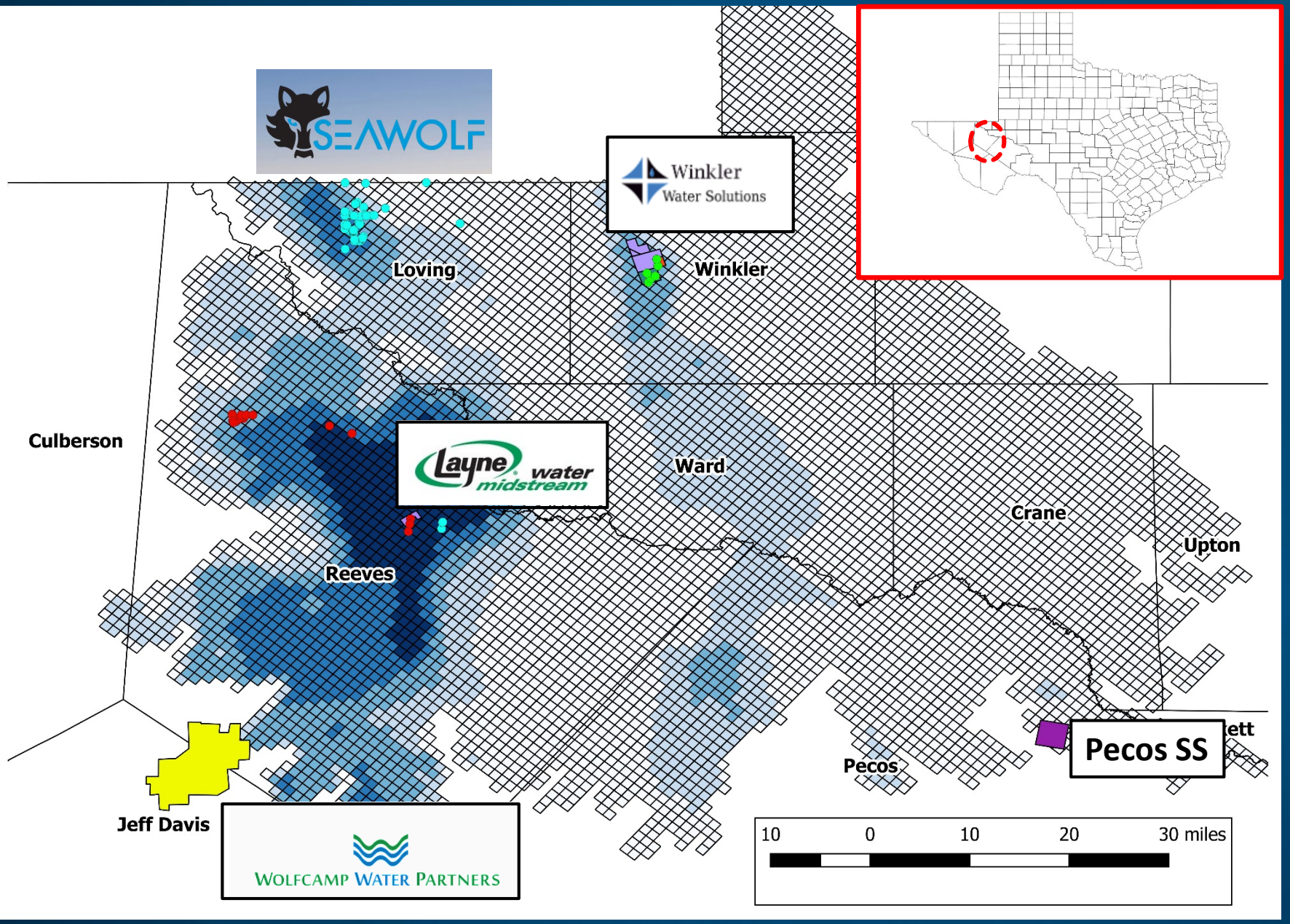
Total estimated CAPEX	**$18,000,000**
Total (excluding land)	– $15,267,044
Implied land cost (1,000 acre tract)	**$2,732,956**
Implied land value per acre	$2,733
Est. value of "farming only" farmland in Trans-Pecos region ($/acre)	– $750
Implied value premium for water ($/acre)	$1,983
Average saturated thickness under tract (feet)	[1,825]
Implied price paid for groundwater estate ($/available saturated foot per acre)	**$1.09**

SOURCES Company reports, author's interviews of relevant providers of goods and services

Groundwater Valuation: Some Key Variables

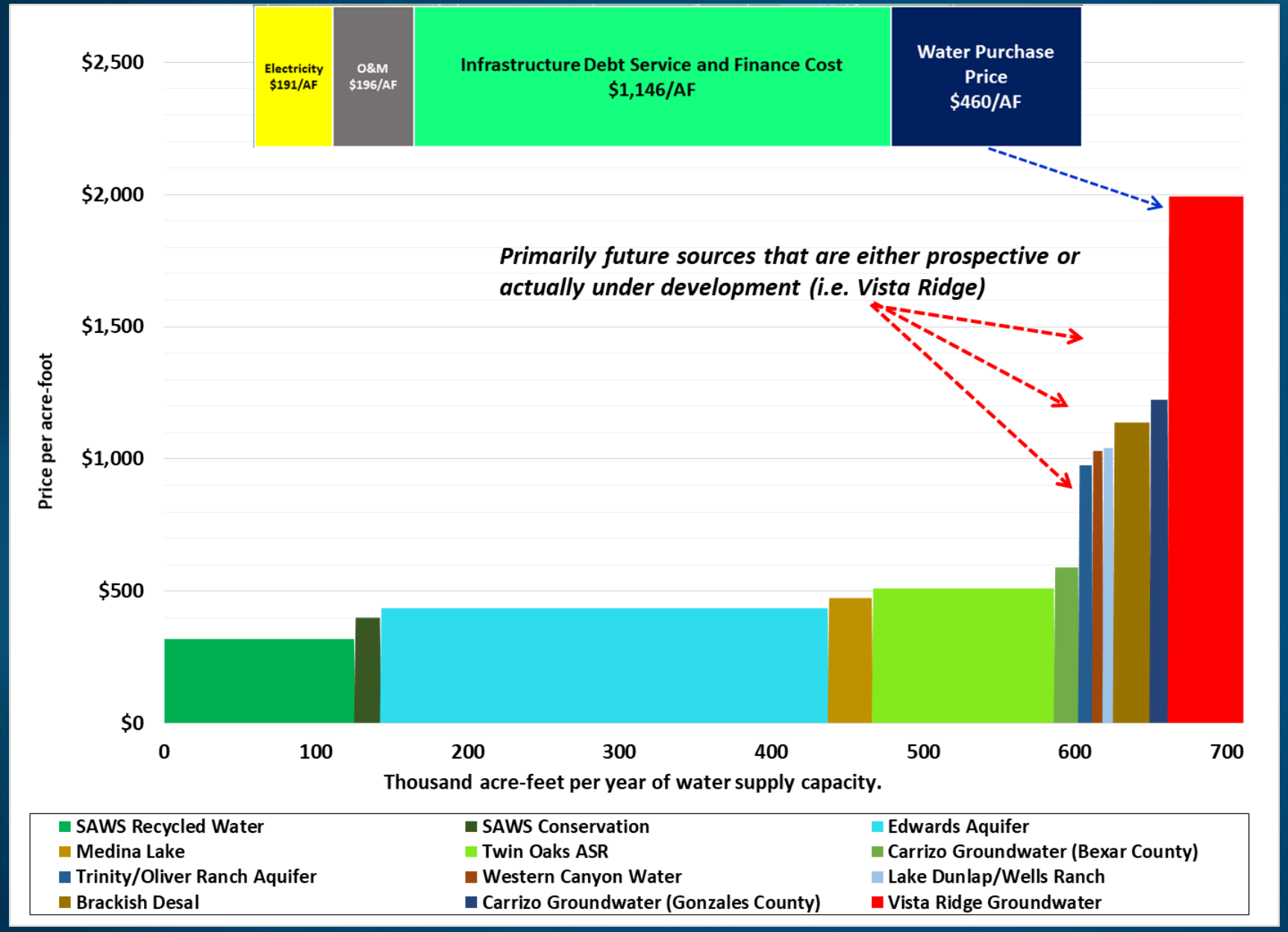
- Water location, the existence of production and delivery infrastructure, and the cost of such infrastructure and cost of producing the water
- Market competition: For Water Sales *and* Water Purchases
- Protection from drainage by neighboring pumpers
- Political, legal, and regulatory barriers that could impede development of the resource.
- The potential buyer's capacity to pay (economic and political dimensions, in the case of cities)
- Time sensitivity (a/k/a consumer urgency) of the water use
- Drought resistance of the resource

Proximity to Markets Influences Water's In-Situ Value and Cash Flow Generation Potential



- Seawolf Resources
  - Est. productive capacity = 300-350 kbd from ~70 wells
- Winkler Water Solutions
  - Productive capacity = 250 kbd from 6 wells, soon to be 325 kbd from 8 wells
- Layne Water Midstream
  - Productive capacity = 175 kbd
- ***Wolfcamp Water Partners***
  - Potential productive capacity = 200-400 kbd
- Pecos SS
  - Productive capacity = 357 kbd from 6 wells

Proximity to Market, Depth, and Quality Influence Water's Economic Value



- What does this mean for entities looking to acquire water and landowners who might be considering selling it?
- Capital requirements
- Risk/Reward
  - Price
  - Contract structures

Source: SAWS, Author's Analysis

Groundwater Valuation: Some Key Variables

- Water location, the existence of production and delivery infrastructure, and the cost of such infrastructure and cost of producing the water
- Market competition: For Water Sales *and* Water Purchases
- Protection from drainage by neighboring pumpers
- Political, legal, and regulatory barriers that could impede development of the resource.
- The potential buyer's capacity to pay (economic and political dimensions, in the case of cities)
- Time sensitivity (a/k/a consumer urgency) of the water use
- Drought resistance of the resource

“Above Ground” Risks Are The Most Significant Valuation Wild Card

From Forestar Group 2016 Form 10-K

Risks Related to our Other Operations

Our water interests may require **governmental permits**, the **consent of third parties** and/or **completion of significant transportation infrastructure prior to commercialization**, all of which are **dependent on the actions of others**. Many jurisdictions require governmental permits to withdraw and transport water for commercial uses, the granting of which may be subject to discretionary determinations by such jurisdictions regarding necessity. In addition, we do not own the executory rights related to our non-participating royalty interest, and as a result, third-party consent from the executor rights owner(s) would be required prior to production. The process to obtain permits can be lengthy, and governmental jurisdictions or third parties from whom we seek permits or consent may not provide the approvals we seek. We may be unable to secure buyers at commercially economic prices for water that we have a right to extract and transport, and transportation infrastructure across property not owned or controlled by us is required for transport of water prior to commercial use. Such infrastructure can require significant capital and may also require the consent of third parties. We may not have cost effective means to transport water from property we own, lease or manage to buyers. As a result, we may lose some or all of our investment in water assets, or our returns may be diminished.

“Above Ground” Risks Are The Most Significant Valuation Wild Card

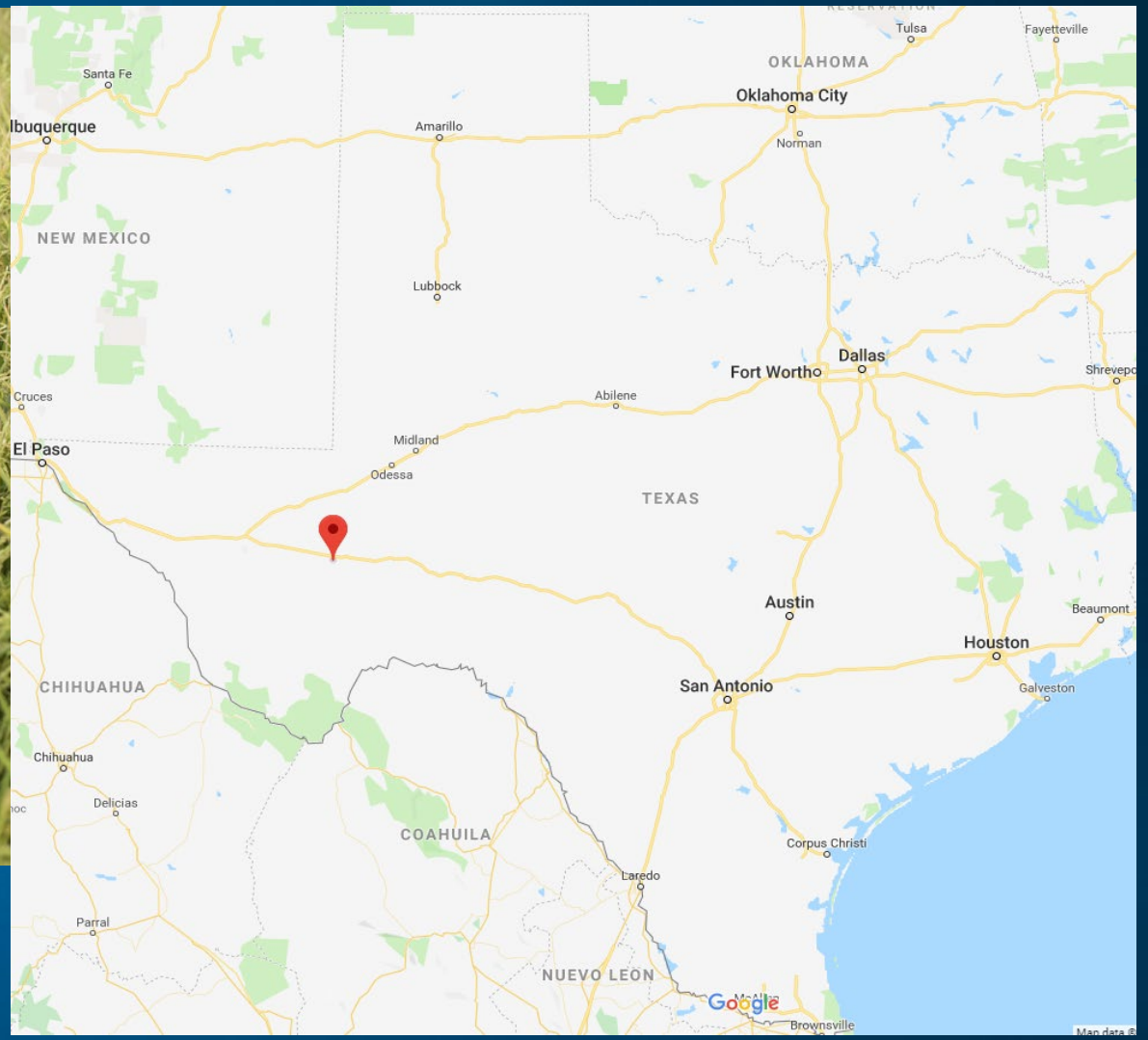
CliffNotes Version:

We can overcome Mother Nature much more easily than human nature!

Restrictions on Water Trade & Transport in Texas

Regulatory Restrictions

Photo Source: Our Desired Future



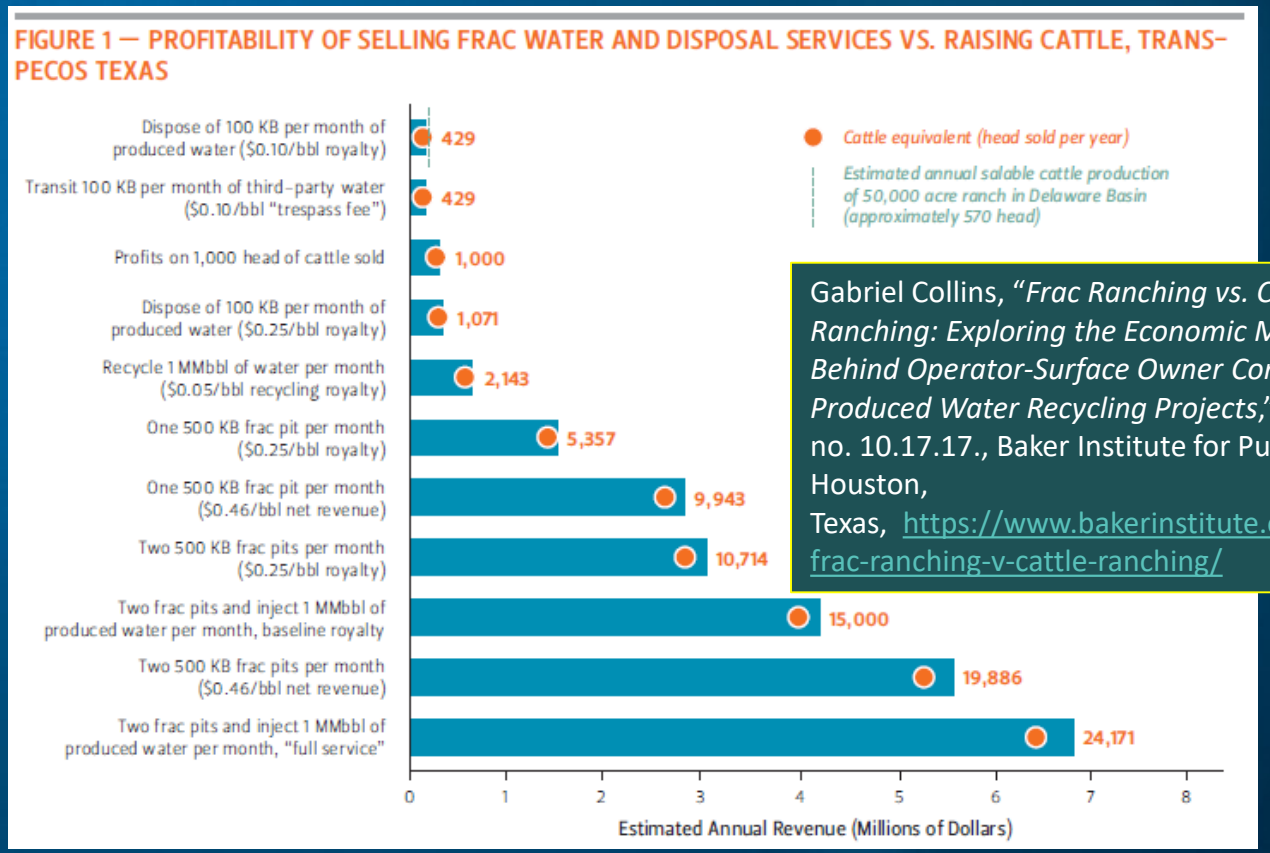
- "I thought it would be interesting to show I could grow rice in the Chihuahuan Desert, but I can't sell water to people who really need it."—Jeff Williams, Williams Farms & Ranches

Restrictions on Water Trade & Transport in Texas

Surface Owner Challenges

Some examples of barriers to trade:

- Crossing or "trespass" fees
- Surface use agreements that require E&Ps to use the surface owners' water for all on-tract activities.
- No forced pooling of water rights



Gabriel Collins, "*Frac Ranching vs. Cattle Ranching: Exploring the Economic Motivations Behind Operator-Surface Owner Conflicts Over Produced Water Recycling Projects*," Issue brief no. 10.17.17., Baker Institute for Public Policy, Houston, Texas, https://www.bakerinstitute.org/research/frac-ranching-v-cattle-ranching/

Source: Texas Pacific Land Trust

Being in the Right Place Makes Surface Incredibly Valuable: TX Example

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 8-K

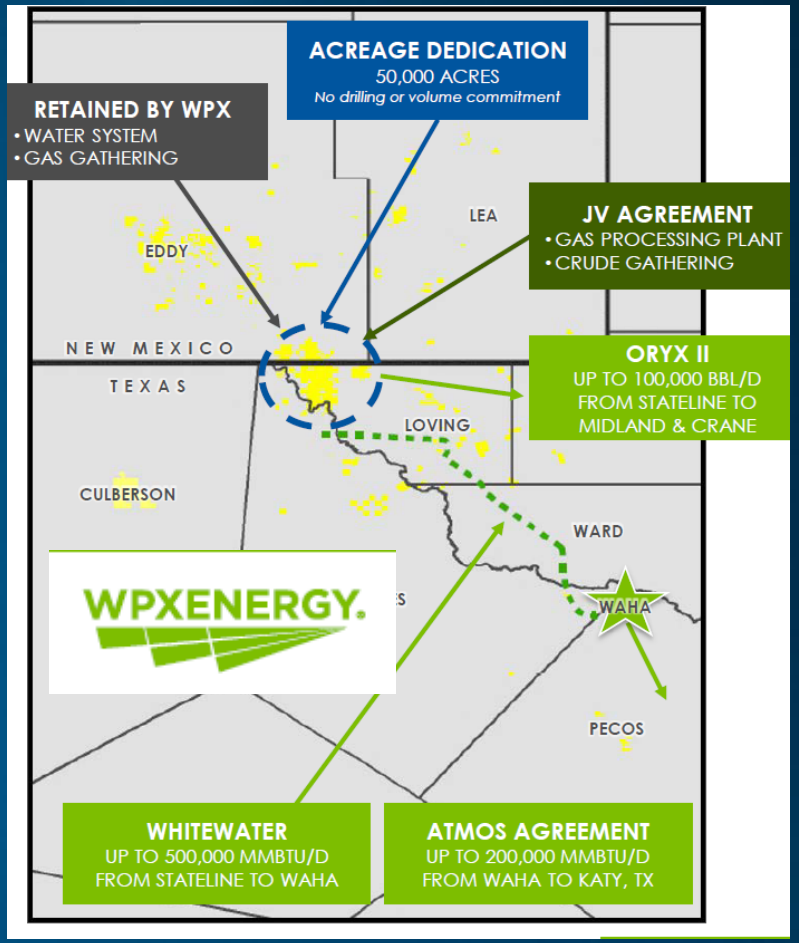
CURRENT REPORT
Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934
Date of report (Date of earliest event reported): **January 7, 2019**

TEXAS PACIFIC LAND TRUST
(Exact Name of Registrant as Specified in its Charter)

Item 2.01. Completion of Acquisition or Disposition of Assets.

On January 7, 2019, Texas Pacific Land Trust (the "Trust") consummated the previously announced sale of approximately 14,000 surface acres of land in Loving and Reeves Counties, Texas to WPX Energy Permian, LLC for an aggregate price of $100,000,000 (the "Sale"). The Sale excludes any mineral or royalty interest in the lands to be conveyed and the Trust reserved certain usage, disposal and water rights in approximately 1,280 acres of the lands conveyed.

The Trust intends to use the proceeds from the Sale to acquire like kind properties.



Avg. price of $7,143/surface acre or nearly 10X the 2018 median price for rangeland in Trans-Pecos Texas

Cross-Border Water Arbitrage between TX and NM

Where politicians see theft…

"Texas is stealing New Mexico's water…If you put a whole bunch of straws in Texas and you don't have any straws in New Mexico, you're sucking all the water from under New Mexico out in Texas and then selling it back to New Mexico." --Aubrey Dunn, New Mexico State Land Commissioner (June 2018)

Source: Texas Tribune

Businesspeople see opportunity…

Solaris Water Midstream Acquires New Mexico Water Supply Business from Vision Resources, Inc. and Launches Major Expansion in the Delaware Basin

Jun 5, 2018, 9:30am EDT

• • •

Major Expansion to Pecos Star System

Solaris Water also announced that it has started construction of a new 11-mile water supply line that will connect into its Pecos Star System. The high-capacity pipeline will add crucial, permanent water supply infrastructure to one of the most prolific areas in the Permian Basin and will be capable of transporting approximately 150,000 barrels of water per day from Loving County, Texas, to Eddy County, New Mexico. Construction of this strategic pipeline is underway. The line is expected to come into service in July 2018.

Source: Dallas Business Journal

In New Mexico, Oilfield Water Issues Make Border Ranches a Generational Asset Class

NGL Energy Partners LP

Delaware SWD Overview

- Buying these ranches gives NGL 122,000 acres and 32 thousand bpd of freshwater rights, plus at least 20 SWD locations.
- NGL paid $93 million for these ranches in 3Q2018.
- Meanwhile, Intrepid Potash paid $65 million for the nearby Dinwiddie Ranch in 1Q2019.

INTREPID
Essential Minerals for Success

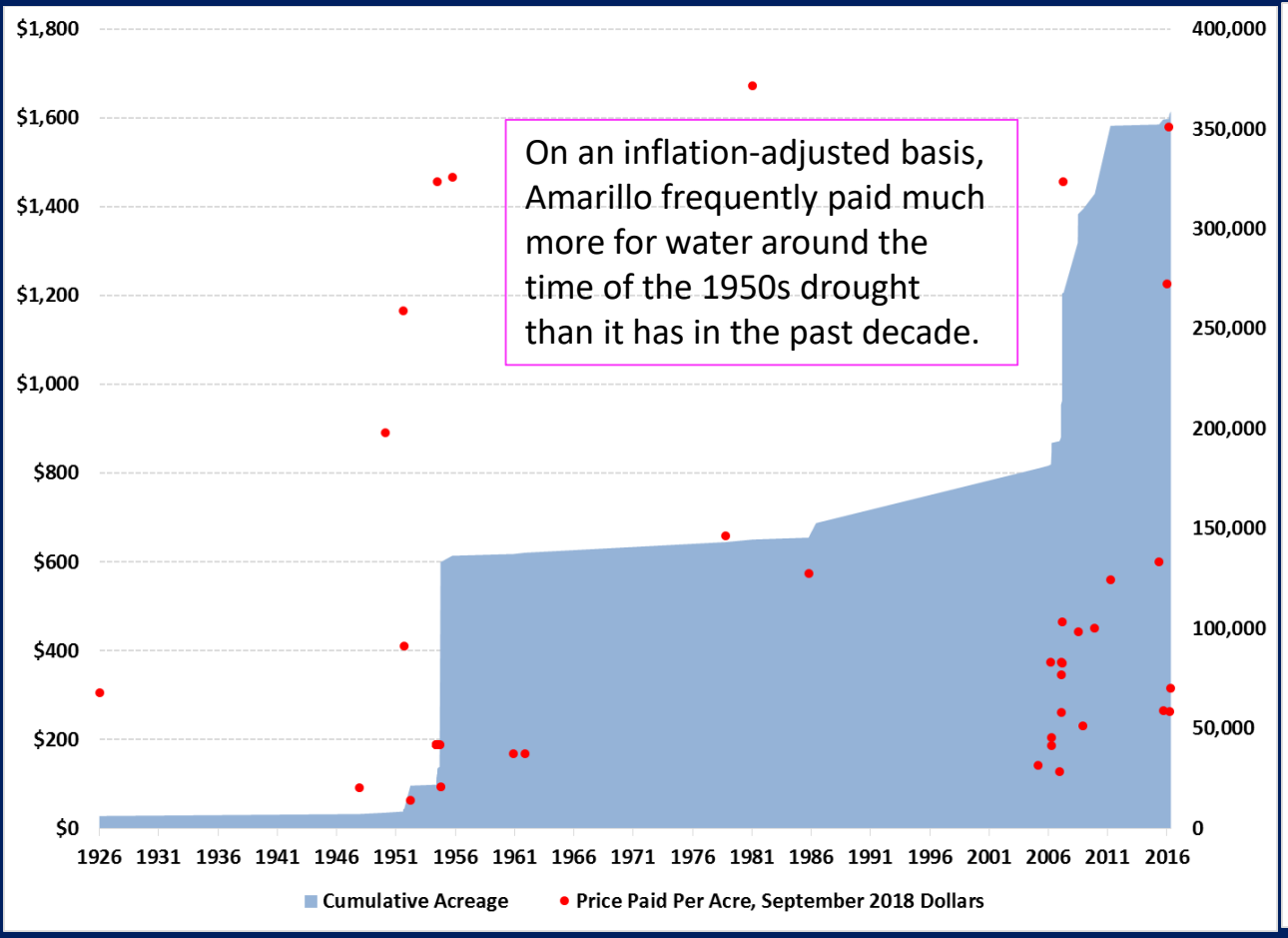
Source: NGLP March 2019 Investor Presentation, Company Disclosures

X-Factor: Drought & Climate

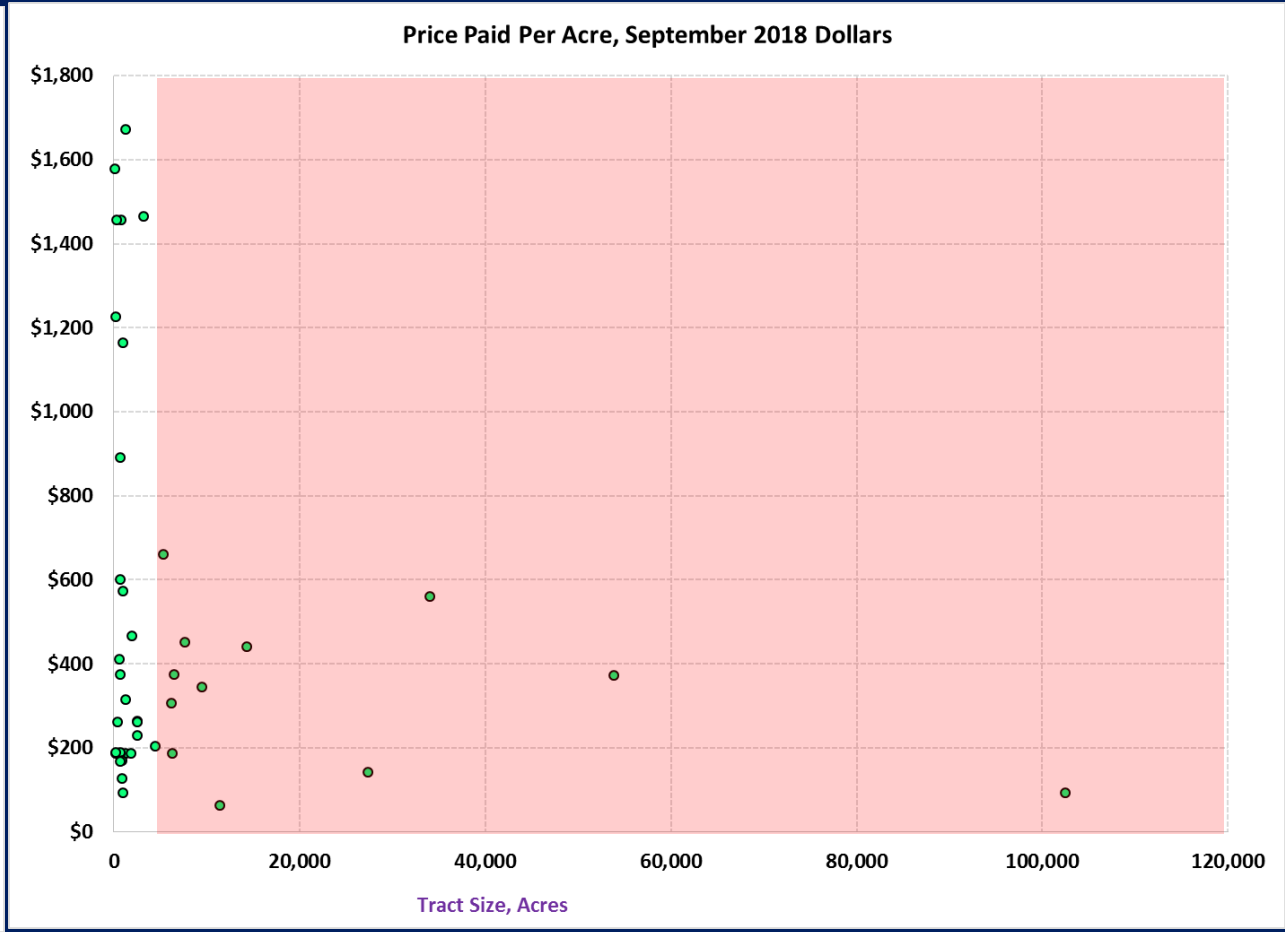
Fear, Need, and Perhaps a Little Greed

Human emotions react far faster than the water levels in an aquifer.

City of Amarillo Cumulative Groundwater Rights Purchases



City of Amarillo, Groundwater Rights Price Paid vs. Tract Size



Source: City of Amarillo (October 2018), FRED St. Louis (CPI data)

Oilfield Water In The Permian Basin: Valuing a Flow of Water Over Time

Per Well

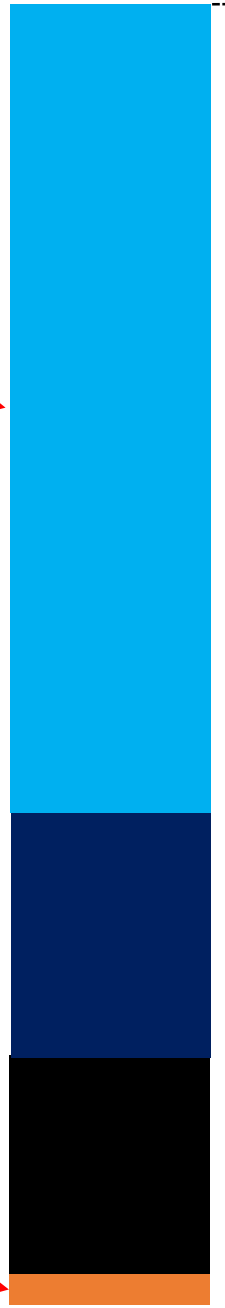
Long-Lateral Permian Oil Well Inputs and Outputs Weigh ~405,000 metric tons

Produced water:
Over 250,000 metric tons

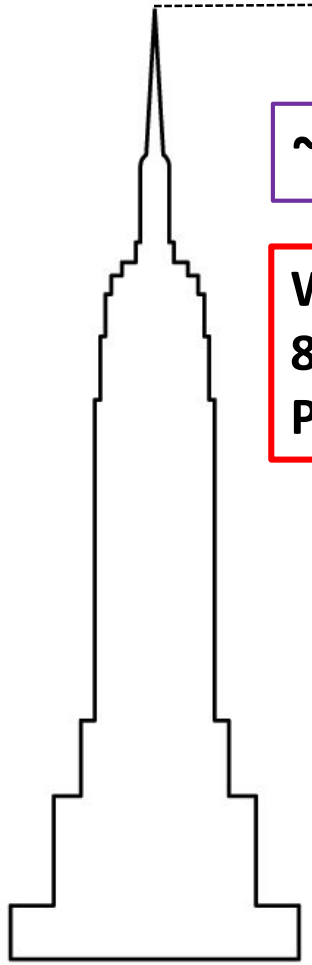
Frac source water:
76,000 metric tons

Crude oil and liquids:
68,000 metric tons

Pipe, sand, misc. consumables:
Approx. 10,000 metric tons



Empire State Building Weighs ~340,000 metric tons



~400-450 wells completed/month

Water will likely account for approximately 80% of lifetime "mass moved" for many Permian Basin wells.

Source: CME Group, Empire State Realty Trust, FracFocus, TexasBrine.com

This analysis assumes 500,000 barrels of oil produced, with a water-to-oil ratio of 3:1. In many cases, wells will ultimately produce more oil and at a higher water cut.

Valuing Produced Water Assets: Developers' Seeking Liquidity Events

Announced Date	Basin	Acquirer	Asset	Seller	Price (Million USD)	EV/EBITDA Multiple	Contract Length
September 2015	Appalachia	Antero Midstream Partners, L.P.	integrated water services system, dropdown	Antero Resources	$1,050	8.5-9.0X	20 yrs + MVC+ ROFR on future drilling areas
June 2017	DJ, Permian	NBLX/affiliated DevCos	multiple asset dropdown	NBL	$270	8.2-9.2X	15-yr fee-based
July 2017	Multiple	Select Energy	Rockwater	SCF Partners	$516	7.2X	-
February 2018	Permian	TETRA Technologies	SwiftWater Energy Services	SwiftWater	**$85** (including $15 million in potential earnout payments)	**4.3-5.3X** (based on NTM expected EBITDA)	-
October 2018	Permian	Waterbridge	Halcón Delaware water infrastructure	Halcón	**$200 million** (not counting potential $125 million of incentive payments)	~9X	-
March 2019	Bakken/Eagle Ford/Permian	TPG Capital	Majority stake	Goodnight Midstream	$930 million	Unknown	Unknown

Gabriel Collins, "*What Does it Take to Create a Billion Dollar Oilfield Water Midstream Company?*," PWS Permian Basin 2018 Symposium, 9 August 2018, Midland County Horseshoe Arena & Pavilion, https://www.bakerinstitute.org/media/files/files/6268339d/collins-oilfieldwatercompany.pdf

Simple rule of thumb:

- at $0.75/bbl of revenue, 475 kbd of produced water flows could potentially justify a billion dollar valuation. ***(@ 7.0X EBITDA)***
- For premium price sales into NM, 425 kbd sold at $1.25/bbl could justify a billion-dollar valuation **(@5.5X EBITDA)**

Oilfield Water Valuation Adjustment Factors

1. Strength of contracts
2. Diversity of customer base
3. Drilling plans in area
4. Watercut trends in market area
5. Potential for tie-ins with other pipeline operators' systems
6. Surface damage schedules—are they perpetual or 10-year renewable?
   A. $200/rod for a 20-mile pipeline renewed every 10 years is equivalent to $130k/yr in cost.
7. Infrastructure integrity
   a. In particular, what are the SWDs' downhole conditions like?
   b. Potential buyers of water midstream firms would be wise to conduct full downhole and engineering diligence to make sure they aren't buying a set of components intended for 5 years of use that are now in their 4th year of operation.

If SWD components in a well using 5.5 inch tubing with packer set at 15,000 ft must be replaced…

- $650k for tubing
- $150k for CR alloy packer
- $500k for drilling rig
- $300k in additional miscellaneous costs
- 10-14 days offline X 15k bbl/day X ($0.50 foregone injection fee/bbl + $2.50/bbl in trucking cost and injection charge at backup disposal) means as much as $630k in lost revenue + incurred costs

Total tab per well could exceed $2.2 million

UNIVERSITY LANDS
RATE AND DAMAGE SCHEDULE

VI. PIPELINE EASEMENT – UNIVERSITY LANDS MINERAL LESSEE

- Any line which exclusively serves the University Lands' oil and gas lease on which it is located does not require a separate easement. All other lines require easements.
- Pipelines must be removed at expiration of easement or lease.
- ADVANCE NOTIFICATION to the University Lands Designated Field Representative is REQUIRED BEFORE ANY WORK IS INITIATED. Failure to properly notify University representative may subject operator to a penalty of a minimum of $3,000 per occurrence.
- If cross country pipeline construction and/or maintenance activity occurs during big game hunting season and/or during lambing/kidding season (potentially year-round), loss reimbursement per affected acre is payable to the University Lands Grazing Lessee. All such payments will be determined and monitored by University Lands.

A. New Pipeline Easement (Maximum 10-year term)
- All Pipe Sizes are Nominal
- Ordinary Construction Damages Included

	Consideration
1. Less than 6 inches	NEGOTIABLE Min. $28.00/rod
2. 6 inches to Less than 12 inches	NEGOTIABLE Min. $48.00/rod
3. 12 inches to Less than 24 inches	NEGOTIABLE Min. $72.00/rod
4. 24 inches or Greater	NEGOTIABLE Min. $120.00/rod
5. Hunting and Lambing/Kidding loss reimbursement payable to University Lands Grazing Lessee may apply.	NEGOTIABLE Hunting – Maximum $4.00/acre* Lambing/Kidding – Maximum $6.00/acre*

*Separate payment required, delivered to University Lands office, payable to grazing lessee.

B. Renewal of Pipeline Easement (Maximum 10-year term)
- All Pipe Sizes are Nominal

	Consideration
1. Less than 6 inches	NEGOTIABLE Min. $20.00/rod
2. 6 inches to Less than 12 inches	NEGOTIABLE Min. $40.00/rod
3. 12 inches to Less than 24 inches	NEGOTIABLE Min. $60.00/rod
4. 24 inches or Greater	NEGOTIABLE Min. $80.00/rod

Pricing Produced Water Disposal Contracts: How to Rank

Current Prevalence

Exclusive acreage dedication

Spot water taker:
via truck, pipe, or some combination of the two

Firm Service:
Guaranteed capacity,
minimum volume commitment

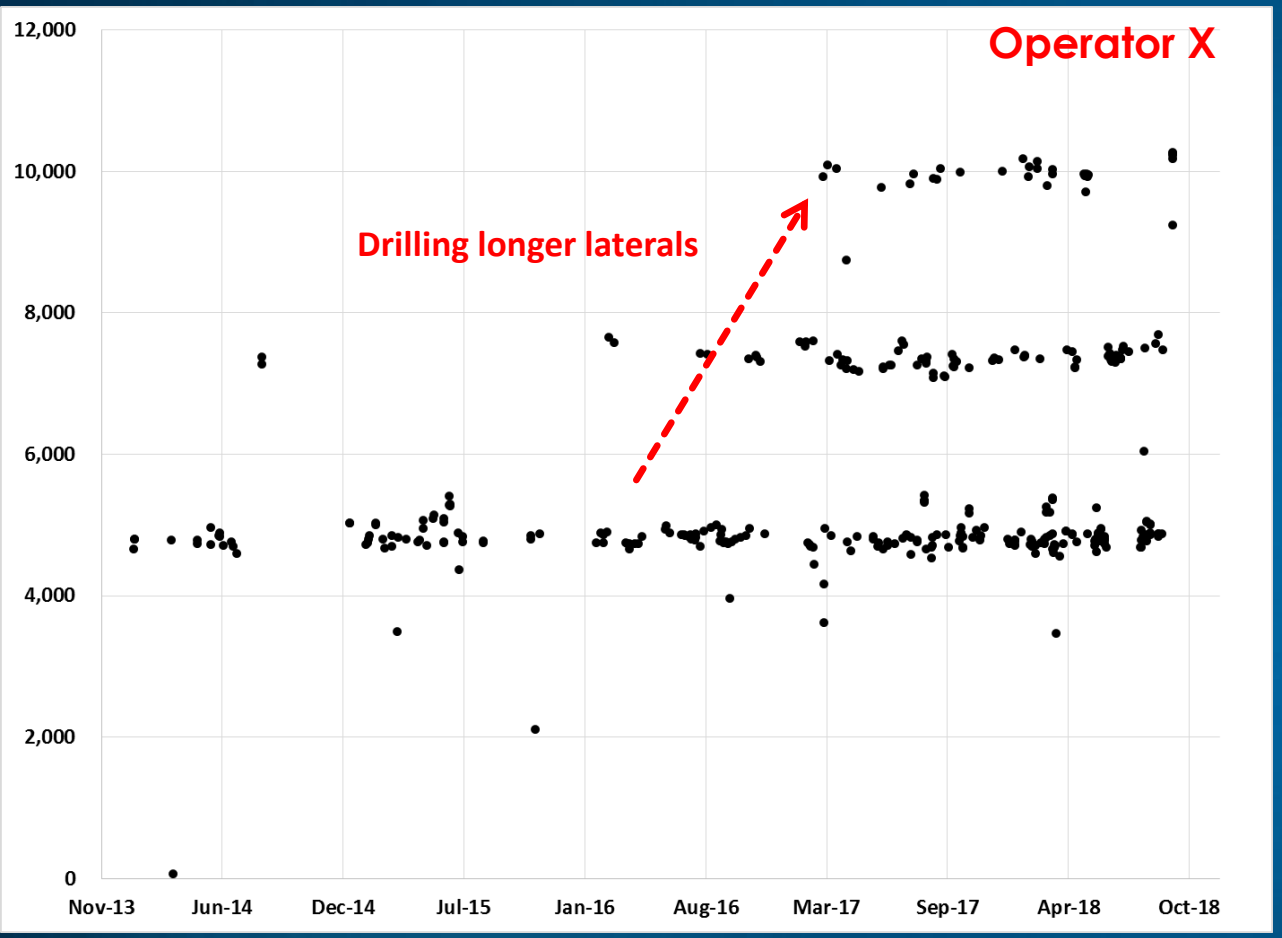
True “take-or-pay” agreement

Cash Flow Stability and Revenue Predictability

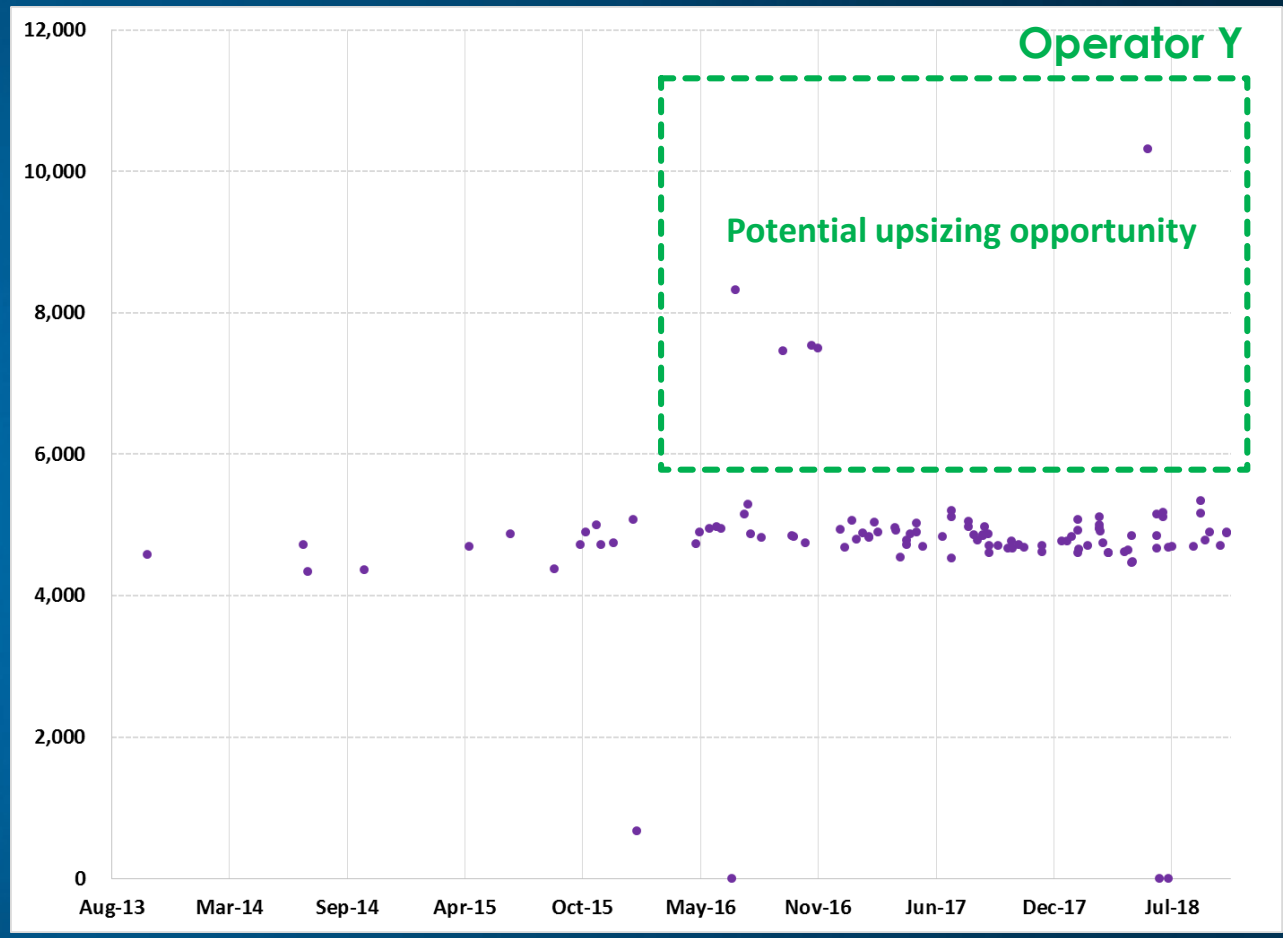
Source: https://digital.lib.uh.edu/collection/p15195coll18/item/33

Takeover Logic Hypothetical Example: Why Drilling Plans and Geographic Position Matter

1. Potential Acquirer is Scaling Up



2. Potential Acquiree (Ideally Adjacent) Has Proven Acreage But Not Yet Scaled Up



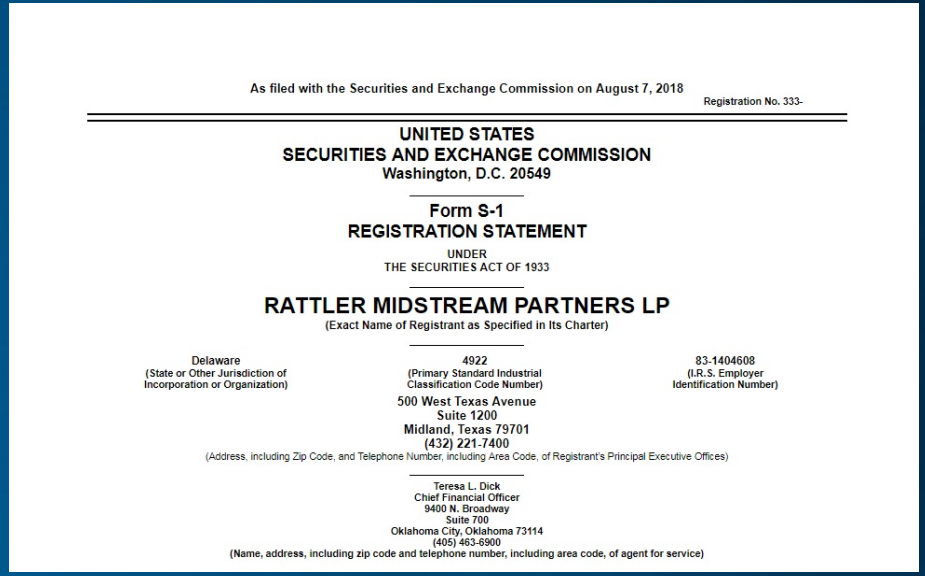
Source: NM OCD, Author's Analysis (*Research assistance provided by Nosa James)*

Valuing Produced Water Assets From An E&P Perspective

Key Issues to Consider:

- Third-Party CAPEX + Return+ OPEX vs. CAPEX + OPEX
- In a “live within cashflow” world, E&Ps may have to think of water system investments at least partially in terms of “wells that could have been.” That calculation is rife with uncertainty, as it requires estimates of forward commodity prices, but it is real.
- Even if internal teams within an E&P don’t see the full cycle cost of water, that full cycle cost is real and will ultimately affect the bottom line in potentially material ways.
- There is not an easy answer to this fundamental question—it will be company and asset specific.

For Big, Blocky Acreage Firms, In-House Water Systems May Offer Market Optionality



As filed with the Securities and Exchange Commission on August 7, 2018
Registration No. 333-

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Form S-1
REGISTRATION STATEMENT
UNDER
THE SECURITIES ACT OF 1933

RATTLER MIDSTREAM PARTNERS LP
(Exact Name of Registrant as Specified in Its Charter)

Delaware	4922	83-1404608
(State or Other Jurisdiction of Incorporation or Organization)	(Primary Standard Industrial Classification Code Number)	(I.R.S. Employer Identification Number)

500 West Texas Avenue
Suite 1200
Midland, Texas 79701
(432) 221-7400
(Address, including Zip Code, and Telephone Number, including Area Code, of Registrant's Principal Executive Offices)

Teresa L. Dick
Chief Financial Officer
9400 N. Broadway
Suite 700
Oklahoma City, Oklahoma 73114
(405) 463-6900
(Name, address, including zip code and telephone number, including area code, of agent for service)

DIAMONDBACK Energy

Transformational Combination with Energen

August 14, 2018

Sourcing→ Transfer→ Storage→ Flowback→ Disposal/Treatment

Even in a pipeline-centric world, this full cycle cost can exceed $2.00/bbl

Oilfield Water Wear & Tear: Effects of OPEX and Depreciation

Source: Reuters (February 2019)

	Original CAPEX	Depreciation Period, Yrs.	Annual Depreciation Cost
Hard Pipe	$103.0	25	$4.12
SWDs	$79.5	7	$11.36
Miscellaneous	$18.5	7	$2.64
Pits	$2.3	10	$0.23
Layflat	$1.1	7	$0.16
Total	$204.3		$18.5

Consider contrast with municipal systems. City of Midland, TX reported owning about $484 million worth of water and sewer infrastructure in 2017. Depreciation for that fiscal year was just under $14 million.

Key Points

- Even if an oilfield water company bills itself as a "utility" asset, depreciation timetables suggest significant distinctions that valuation professionals and investors should be aware of.
- Foremost among these is the reality that saltwater disposal wells make up a big portion of total system cost and will likely need to be replaced/worked over much more often than the pipes and pumps in a "traditional" water utility model.

Thank You!

gabe.collins@rice.edu

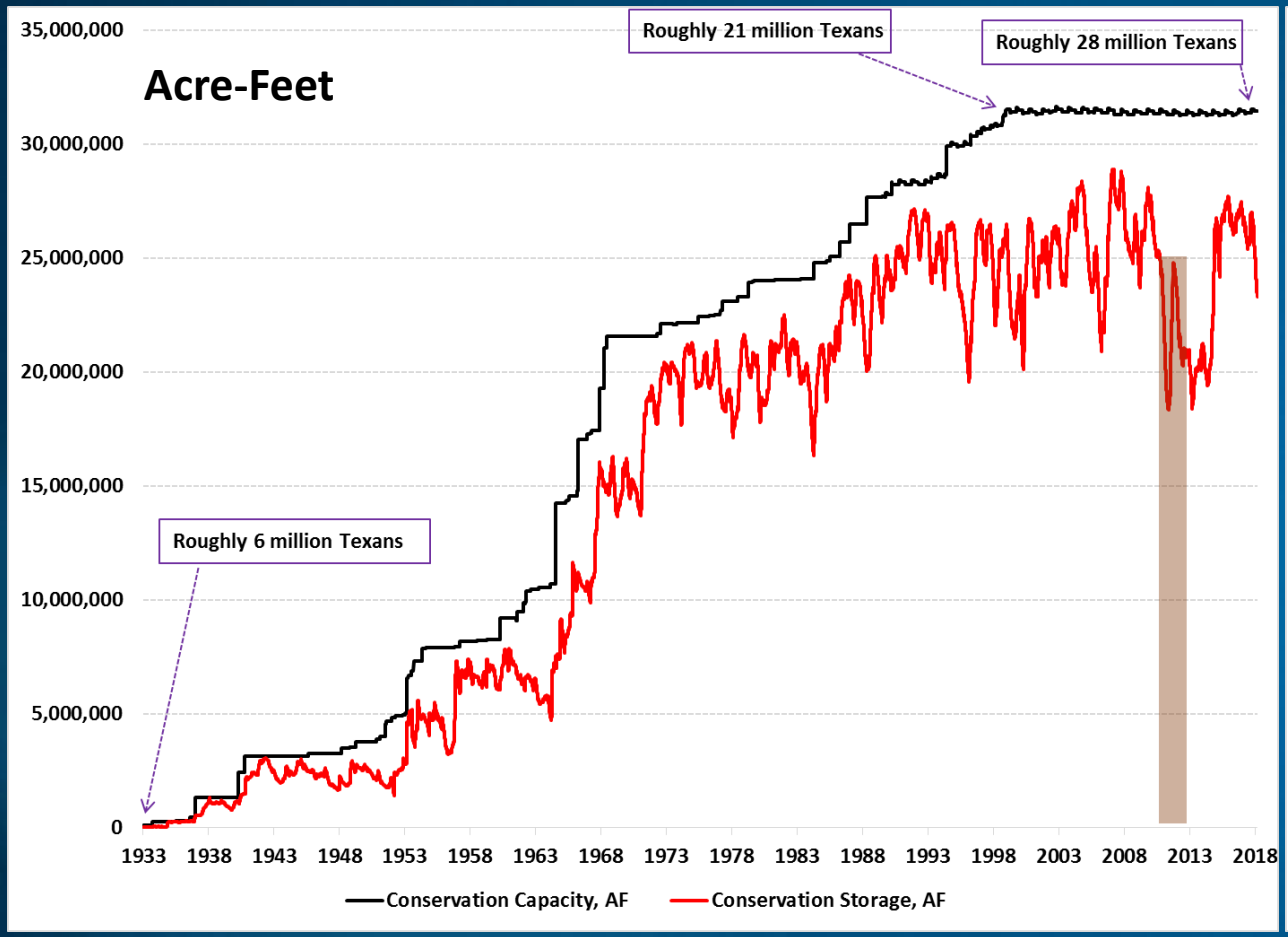
Cutting-Edge Texas Groundwater and Oilfield Water Research

- Gabriel Collins, "*What Does it Take to Create a Billion Dollar Oilfield Water Midstream Company?*," PWS Permian Basin 2018 Symposium, 9 August 2018, Midland County Horseshoe Arena & Pavilion, https://texaswaterintelligence.files.wordpress.com/2018/08/collins_billion-dollar-oilfield-water-company_14-august-20181.pdf
- Gabriel Collins, *"Economic Valuation of Groundwater in Texas,"* Texas Water Journal, Vol. 9, No.1, 2018 (50-68), https://twj.media/economic-valuation-of-groundwater/, (peer reviewed)
- Gabriel Collins, "*Groundwater Valuation in Texas: The Comparable Transactions Method*," Baker Institute Report no. 03.20.18, Baker Institute for Public Policy, Houston, Texas, https://www.bakerinstitute.org/research/groundwater-valuations-texas/
- Gabriel Collins, "*Valuation of Groundwater In Place at a Texas Frac Water Supplier*," Issue brief no. 12.07.17. Baker Institute for Public Policy, Houston, Texas, https://www.bakerinstitute.org/research/valuation-groundwater-place-texas-frac-water-supplier/
- Gabriel Collins, ""*Oilfield Produced Water Ownership in Texas: Balancing Surface Owners' Rights and Mineral Owners' Commercial Objectives*," February 2017, Baker Institute for Public Policy, Houston, Texas, https://www.bakerinstitute.org/media/files/files/23bd889f/CES-pub-ProdWaterTX-020817.pdf
- Gabriel Collins and Hilmar Blumberg, *"Implementing three-dimensional groundwater management in a Texas groundwater conservation district,"* Texas Water Journal, Vol. 7, No.1, 2016 (69-81), https://journals.tdl.org/twj/index.php/twj/article/view/7037/pdf_17 (peer reviewed)
- Gabriel Collins, "*Blue Gold: Commoditize Groundwater and Use Correlative Management to Balance City, Farm, and Frac Water Use in Texas*," 55 Nat. Resources J. 441 (2015). (peer reviewed)

Reference Slides

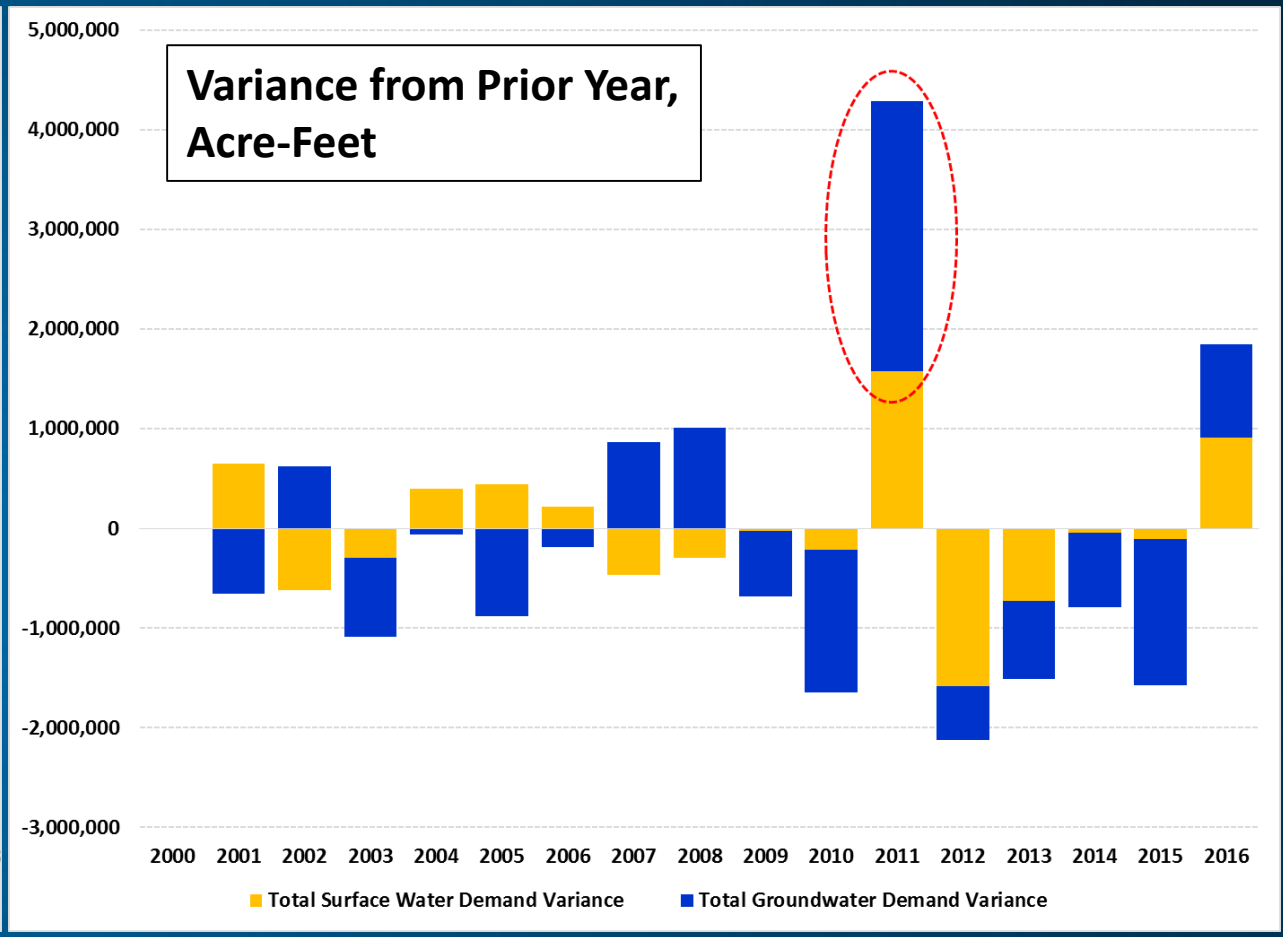
Groundwater is Texas's Primary Supply-Side Drought Hedge

Texas Reservoirs: Capacity vs. Actual Storage



Source: US Census Bureau, TWDB

Groundwater Balances the System During Droughts

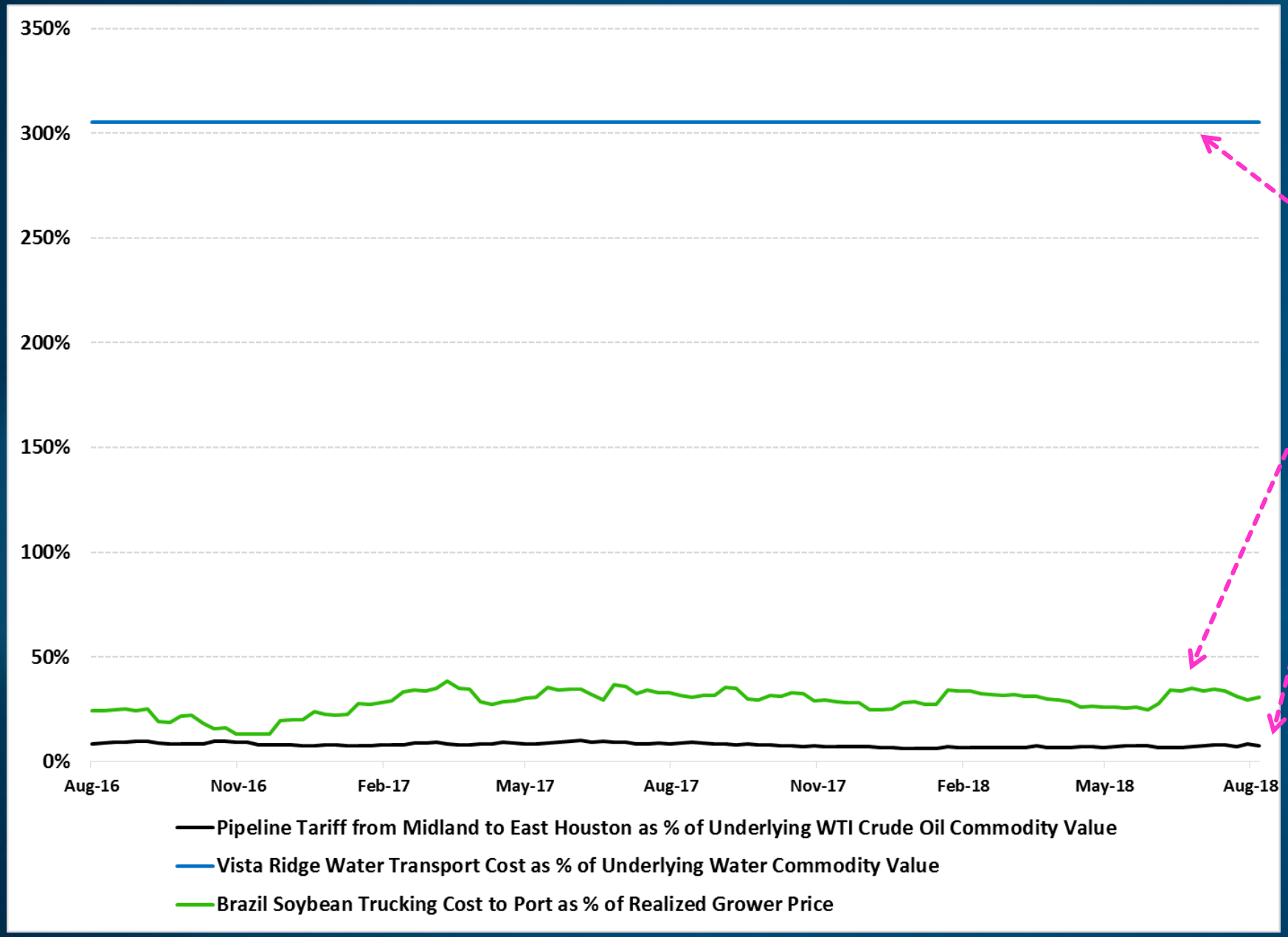


Source: TWDB, Author's Analysis

Valuing Water: Unique Aspects

- No substitutes in certain applications.
- Must be removed for production process to continue in other instances.
- It is immutable and can potentially be indefinitely recycled
- Cost-effectiveness looms in virtually all of these situations.
- Distinct “flow” vs. “stock” aspects since surface and many groundwater sources are fundamentally rechargeable.
- Water is sometime valued as an intrinsic natural capital asset, and other times is being evaluated much more on its capacity to generate cash flow in a given application (for instance, utilities or oilfield water disposal operations.

Water's Logistics Cost/Underlying Value Ratio Poses Economic Challenges

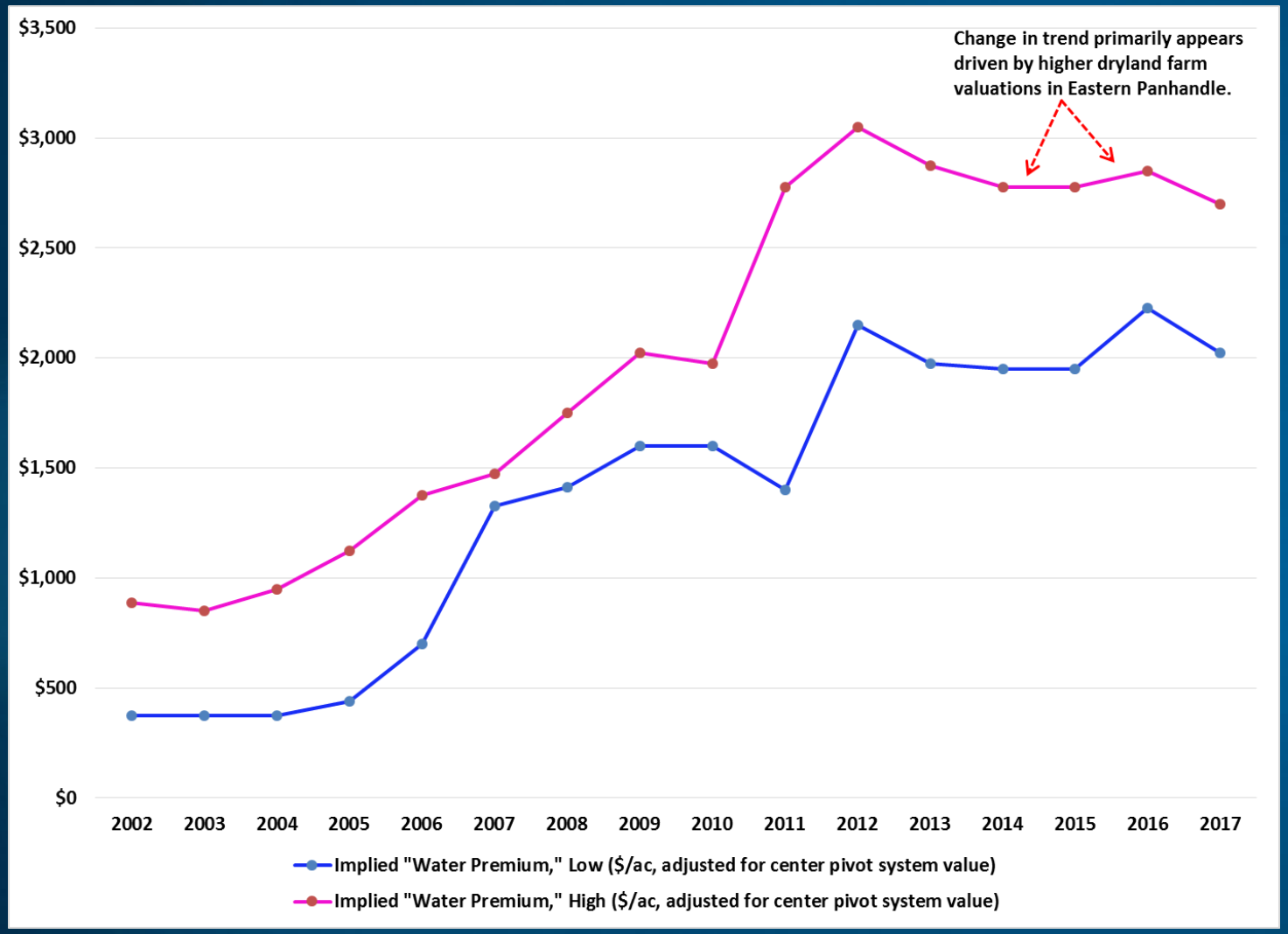


- Water moving 142 miles
- Soybeans moving nearly 1,400 miles
- Crude oil moving about 500 miles

Source: Bloomberg, SAWS, Texas RRC

Economic Value of Groundwater in Place: Is There a "Distance Discount?"

Implied water value in North Texas Panhandle based on land value method



Source: ASFMRA, Author's Analysis

1/6/2015

CONTRACT OF SALE
Groundwater Rights
(Mc Cattle Company and M&D McLain Family, LP)

THIS CONTRACT OF SALE ("Contract") is made and entered into by and between **Mc Cattle Company**, a Texas general partnership, and **M&D McLain Family, LP**, a Texas limited partnership, (hereinafter referred to as "Seller" whether one or more), and **City of Amarillo** ("Purchaser").

1/6/2015

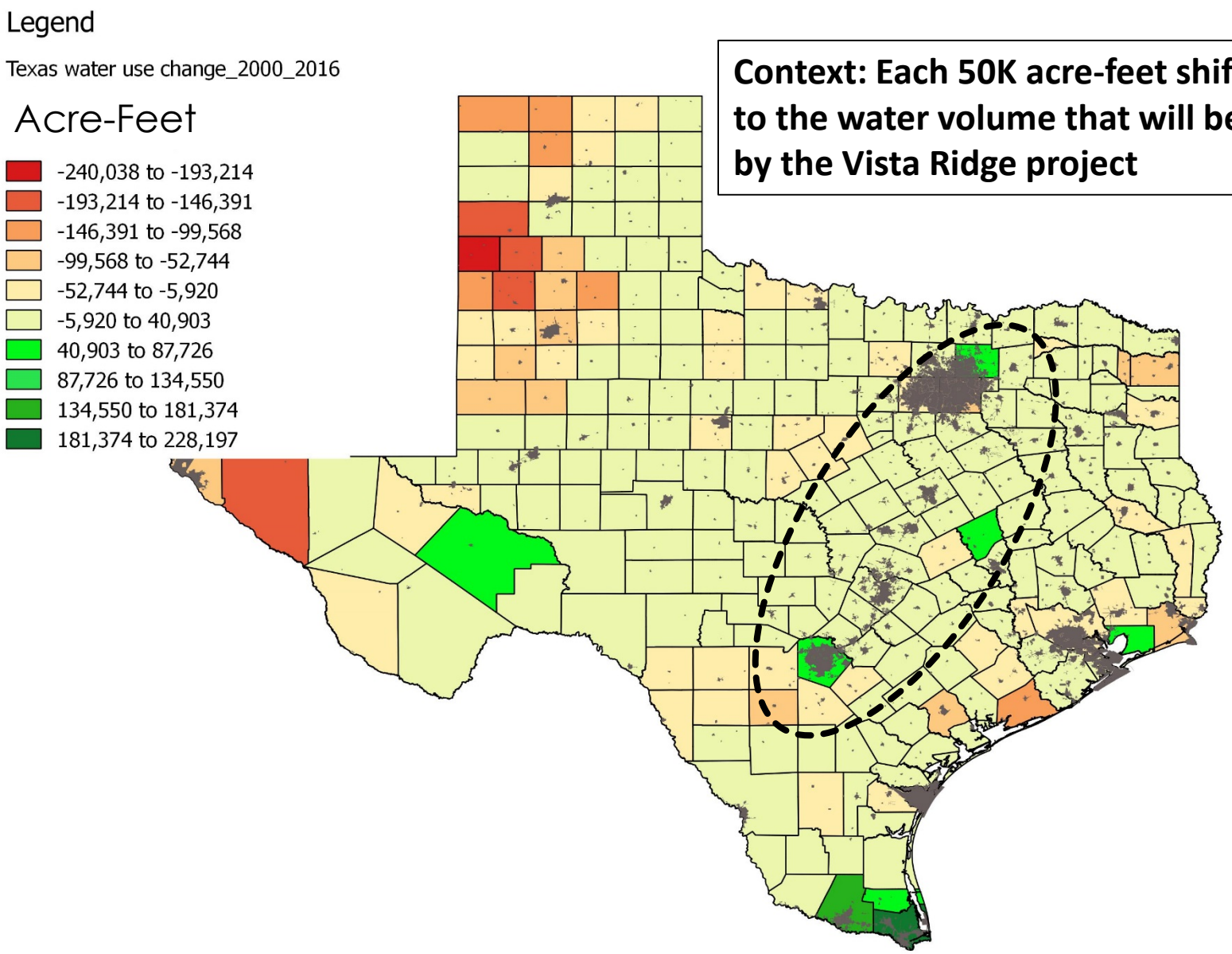
II.
Consideration

2.01 Purchase Price. The purchase price ("Purchase Price") to be paid by Purchaser to Seller for the sale and conveyance of the Groundwater Estate shall be as follows:

- $1.16 per average saturated foot of Groundwater per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness of 258 feet or greater;
- $300.00 per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness between 200 and 257 feet; and
- $250.00 per acre of Groundwater Rights being purchased out of the Real Property for acreage determined to have an average saturated thickness of less than 200 feet. (Pursuant to Section 5.04 a. below, Purchaser has the option to reject any acreage determined to have an average saturated thickness of less than 200 feet.)

The Purchase Price shall be payable to Seller in cash (in United States Dollars) at closing of the transaction contemplated hereby ("Closing") by cashier's check or wire transfer.

How Will Demand Shifts Potentially Affect Water Valuations?



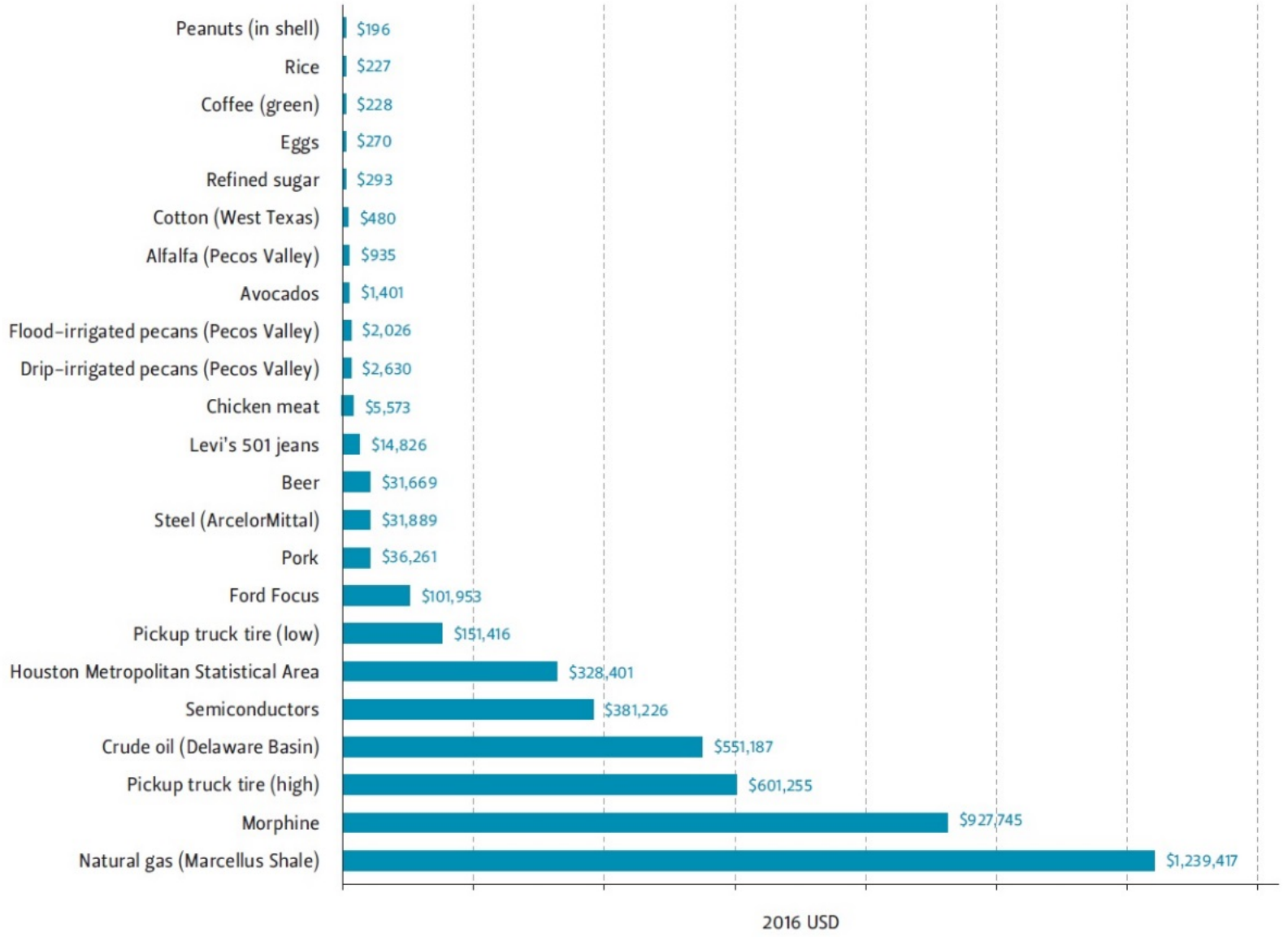
Context: Each 50K acre-feet shift is equal to the water volume that will be delivered by the Vista Ridge project

Key themes moving forward:

1. Changing composition of demand
2. Pressure comes from demand side, short-term shocks more from the supply side

Value Generated is a Proxy for Capacity to Pay

FIGURE 2 — ECONOMIC VALUE GENERATED PER ACRE-FOOT OF WATER USED



SOURCES Agricultural Extension data, company reports, FracFocus, Mekonnen and Hoekstra, U.S. Census Bureau, U.S. Department of Agriculture, and author's estimates

Can Water Get to Market? If Not, Valuation Suffers

Case 17-45166-mxm11 Doc 1 Filed 12/28/17 Entered 12/28/17 14:29:10 Page 1 of 8

Fill in this information to identify the case:

United States Bankruptcy Court for the:

Northern District of Texas (State)

Case number (If known): _____ Chapter 11

☐ Check if this is an amended filing

Official Form 201

Voluntary Petition for Non-Individuals Filing for Bankruptcy 04/16

If more space is needed, attach a separate sheet to this form. On the top of any additional pages, write the debtor's name and the case number (if known). For more information, a separate document, *Instructions for Bankruptcy Forms for Non-Individuals*, is available.

1. **Debtor's name** KC7 Ranch, Ltd.

2. **All other names debtor used in the last 8 years**
Include any assumed names, trade names, and *doing business as* names

3. **Debtor's federal Employer Identification Number (EIN)** 2 0 - 2 9 9 0 3 0 4

Mailing address, if different from principal place of business

Number Street

P.O. Box

City State ZIP Code

Location of principal assets, if different from principal place of business

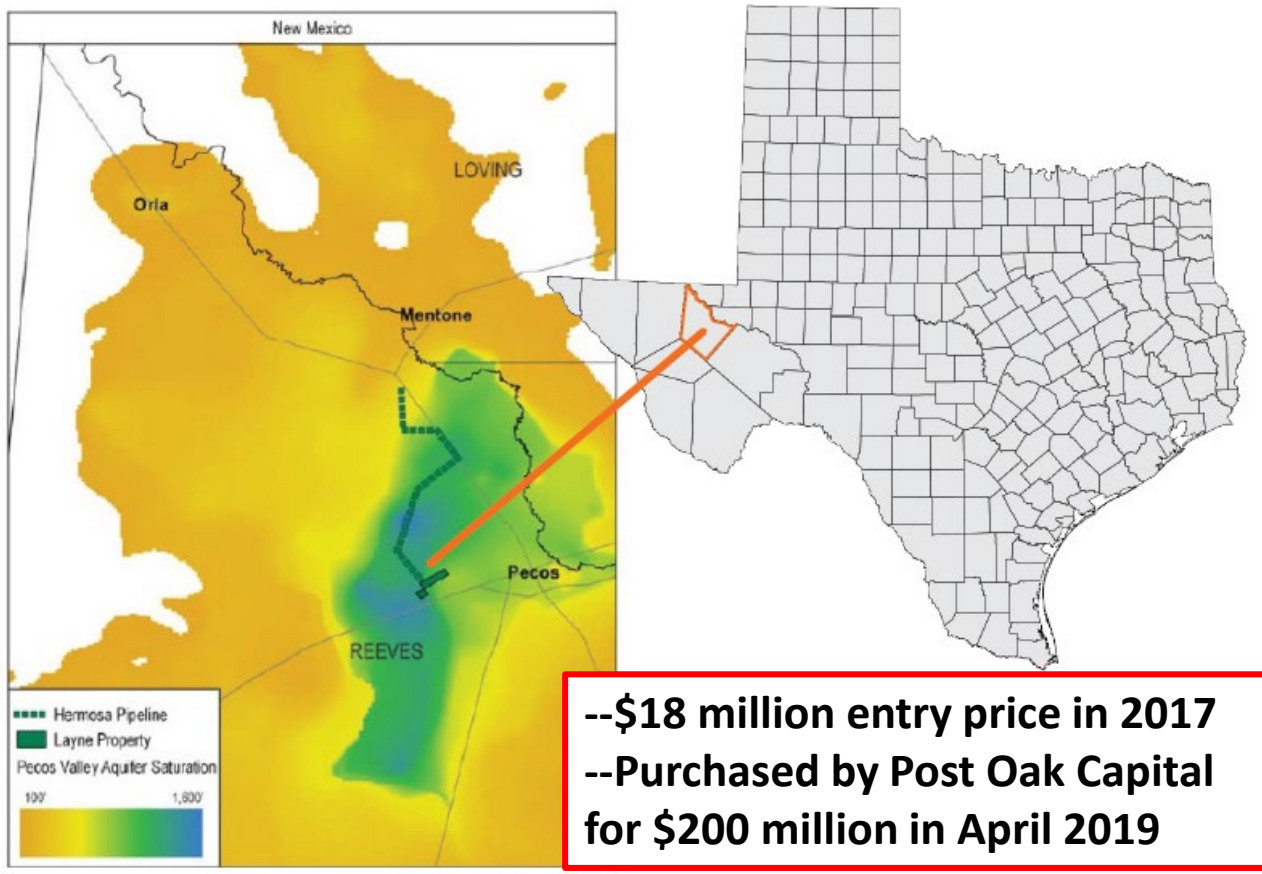
Number Street

WOLFCAMP WATER PARTNERS

Contact Information:

Wolfcamp Water Partners
4800 Bryant Irvin Court
Fort Worth, Texas 76107
O: 682.990.9141
F: 817.870.1950
info@wolfcampwaterpartners.com

FIGURE 1 — APPROXIMATE LOCATION OF LAYNE'S FRAC WATER SUPPLY ASSET

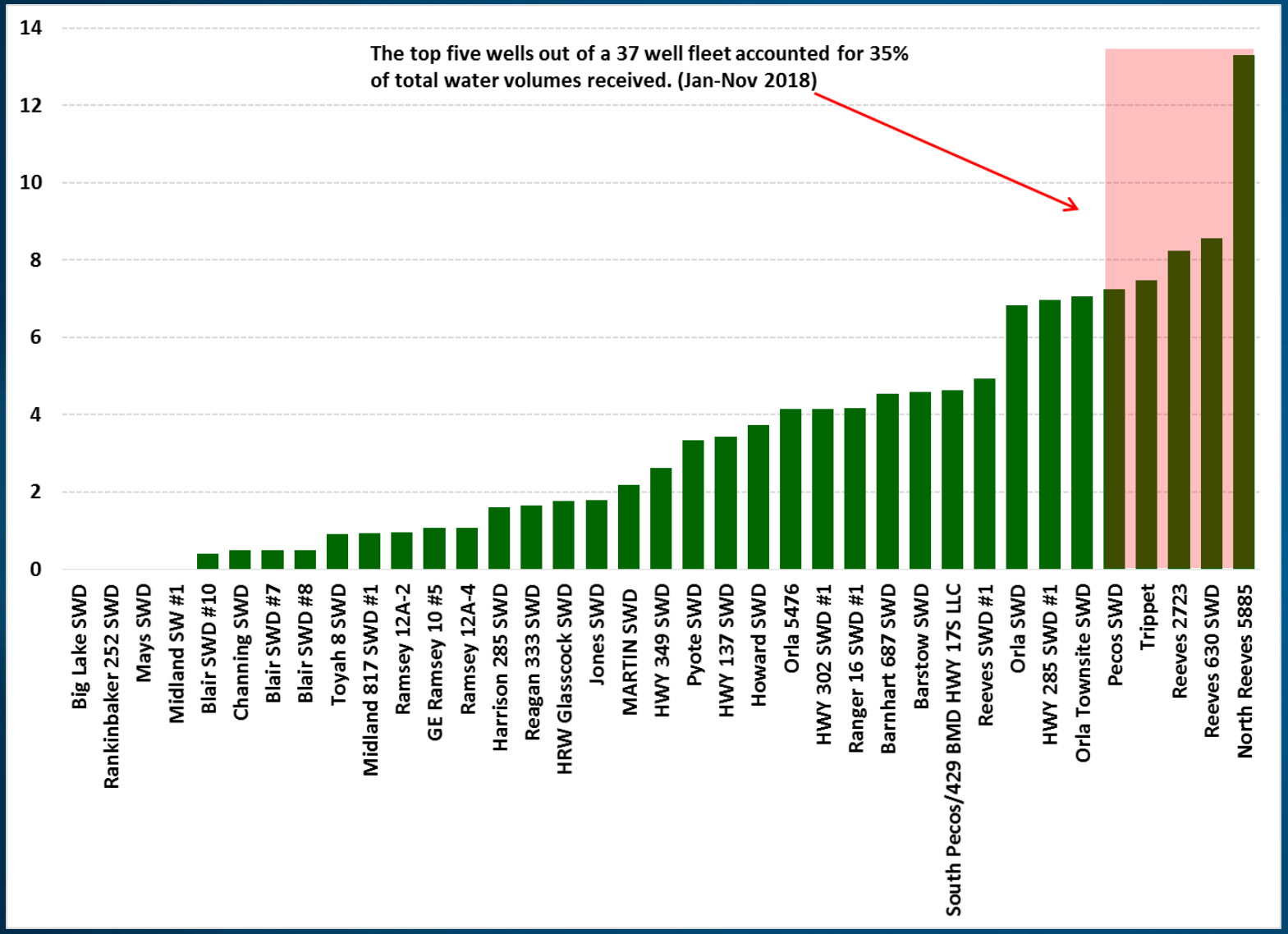


--$18 million entry price in 2017
--Purchased by Post Oak Capital for $200 million in April 2019

SOURCE Layne Water Midstream Presentation, Texas Department of Transportation

Volume Diversity Reduces Water Midstreams' Cashflow Risk

NGL Permian Water Solutions 2018 YTD Volumes Received , By Well (Mmbbl)

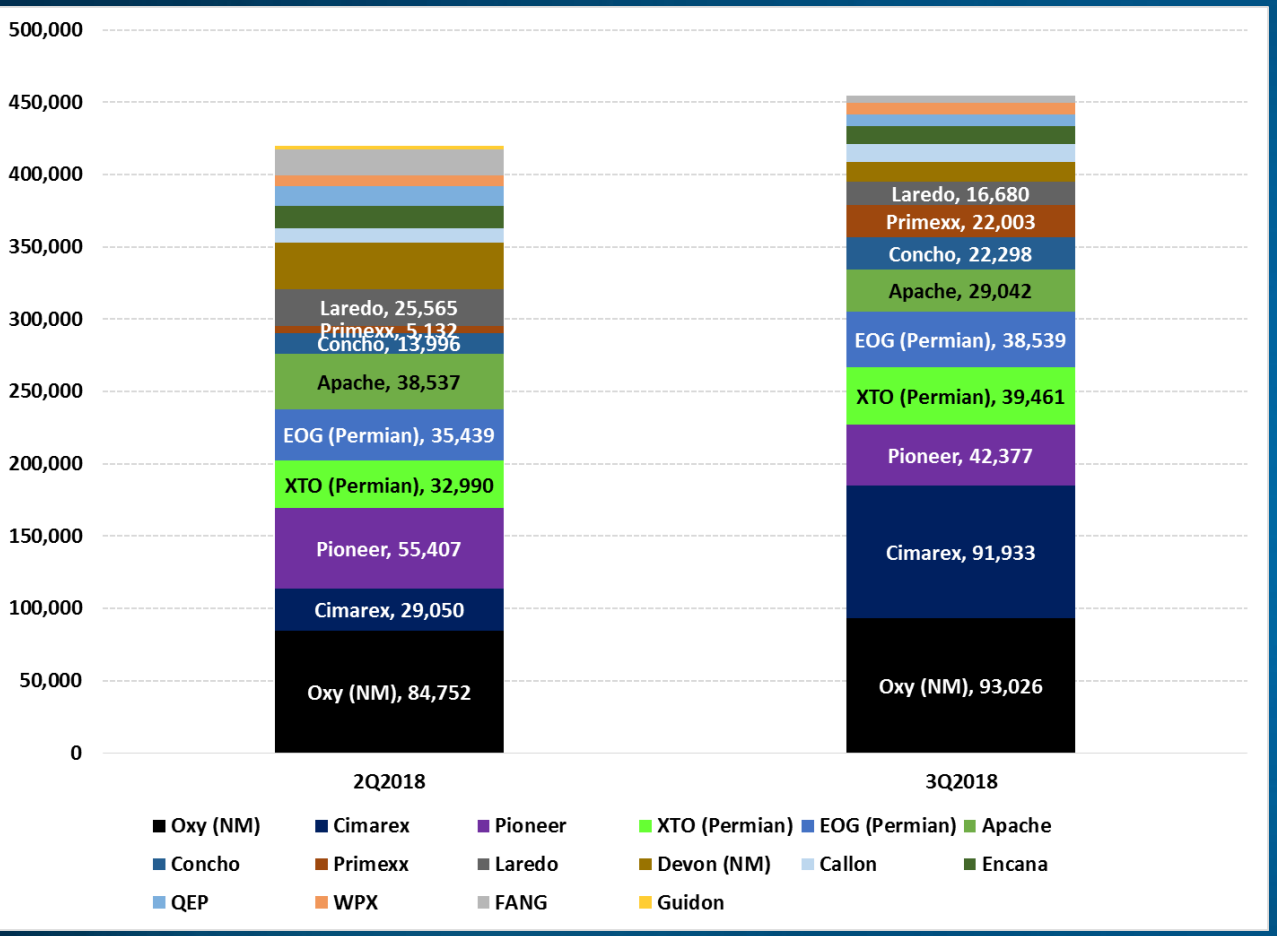


- Greater volume stability is a key value driver
- A smaller midstream whose portfolio consists of a relatively few wells that are high-quality and attract large volumes is likely worth more as part of a bigger midstream firm. There is potential for a natural value uplift.
- In other words, the post-M&A whole can be worth more than the sum of the individual parts.

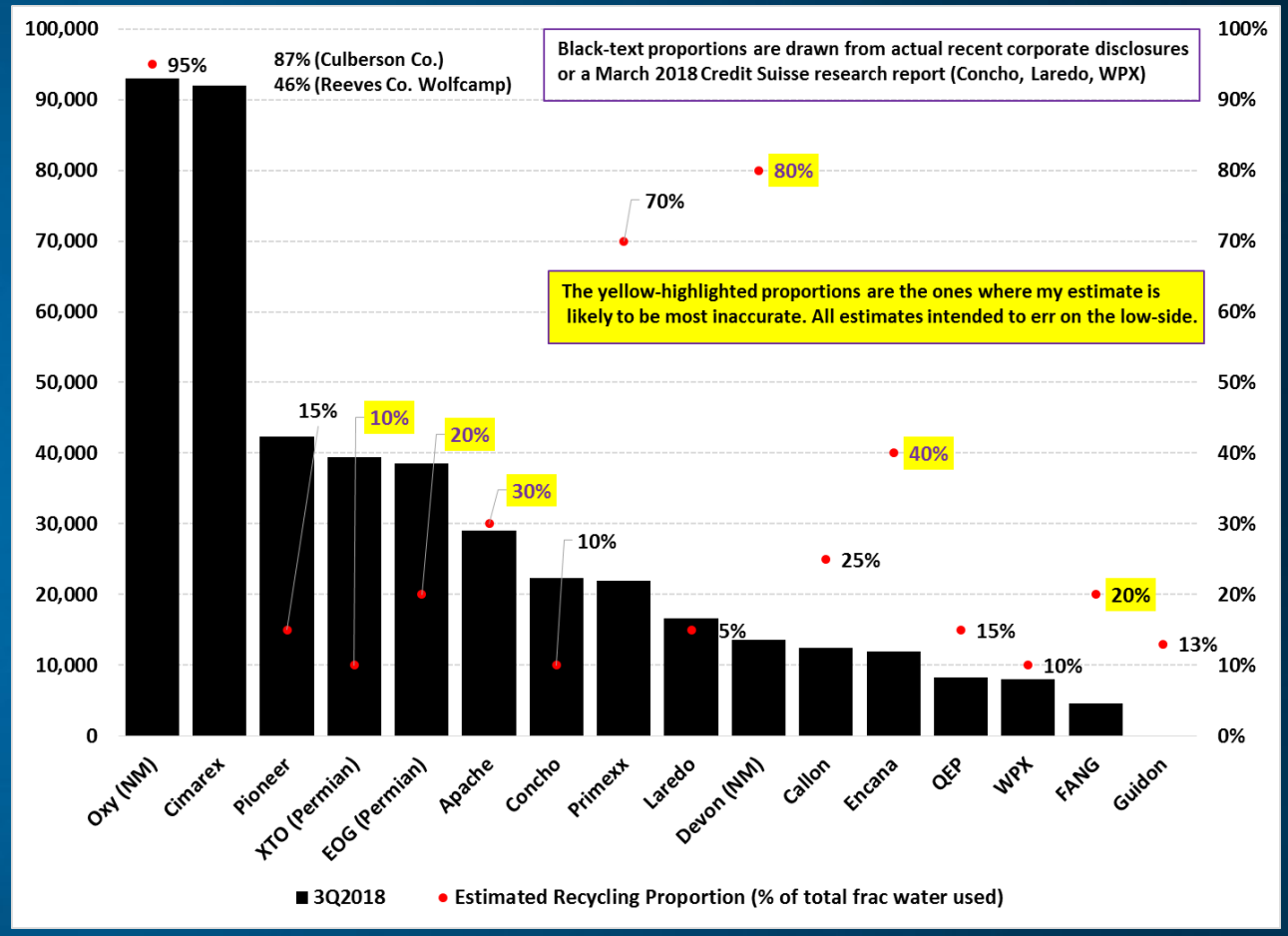
Source: Texas RRC

Recycled Water Could Now Account for Close to 10% of Permian Frac Sourcewater Supplies

Estimated Daily Average Recycled Water Volumes by Selected Permian Operators, Bpd



Estimated Proportion of Recycled Water as % of Total Frac Fluid Stream, 3Q2018



Source: Company Reports, Credit Suisse, Author's Estimates

- Methodology: Take management statements to investors, any other corporate communications I could locate detailing produced water re-use intentions or actual volumes/proportions, and a Credit Suisse research report on the same topic, apply these numbers to frac water usage data each operator reported to FracFocus and estimate recycling volumes for 2Q2018 and 3Q2018.