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Managing Oilfield Water Use: Perspectives from a Large Permian Basin Mineral Owner

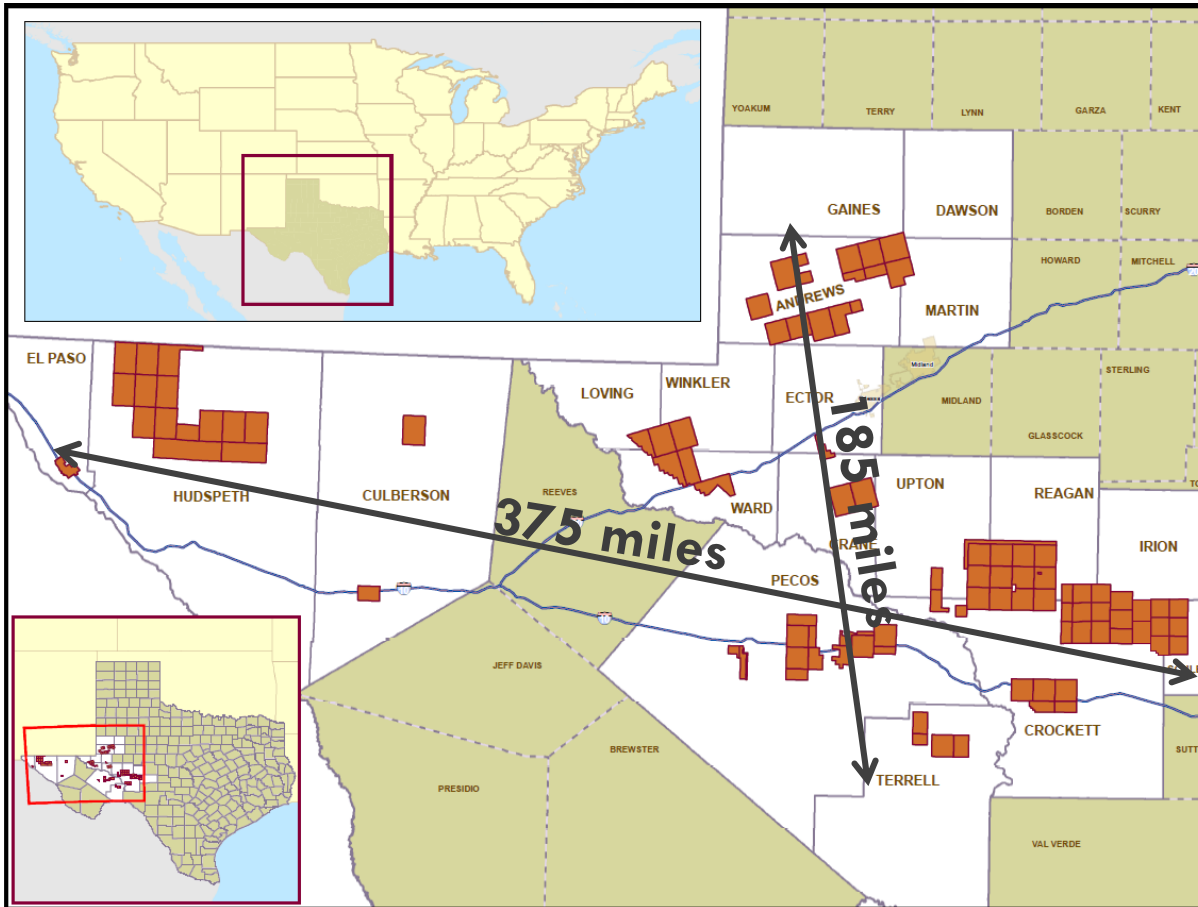
Mark Houser
Chief Executive Officer
University Lands



UNIVERSITY LANDS

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The PUF Lands & University Lands Organization

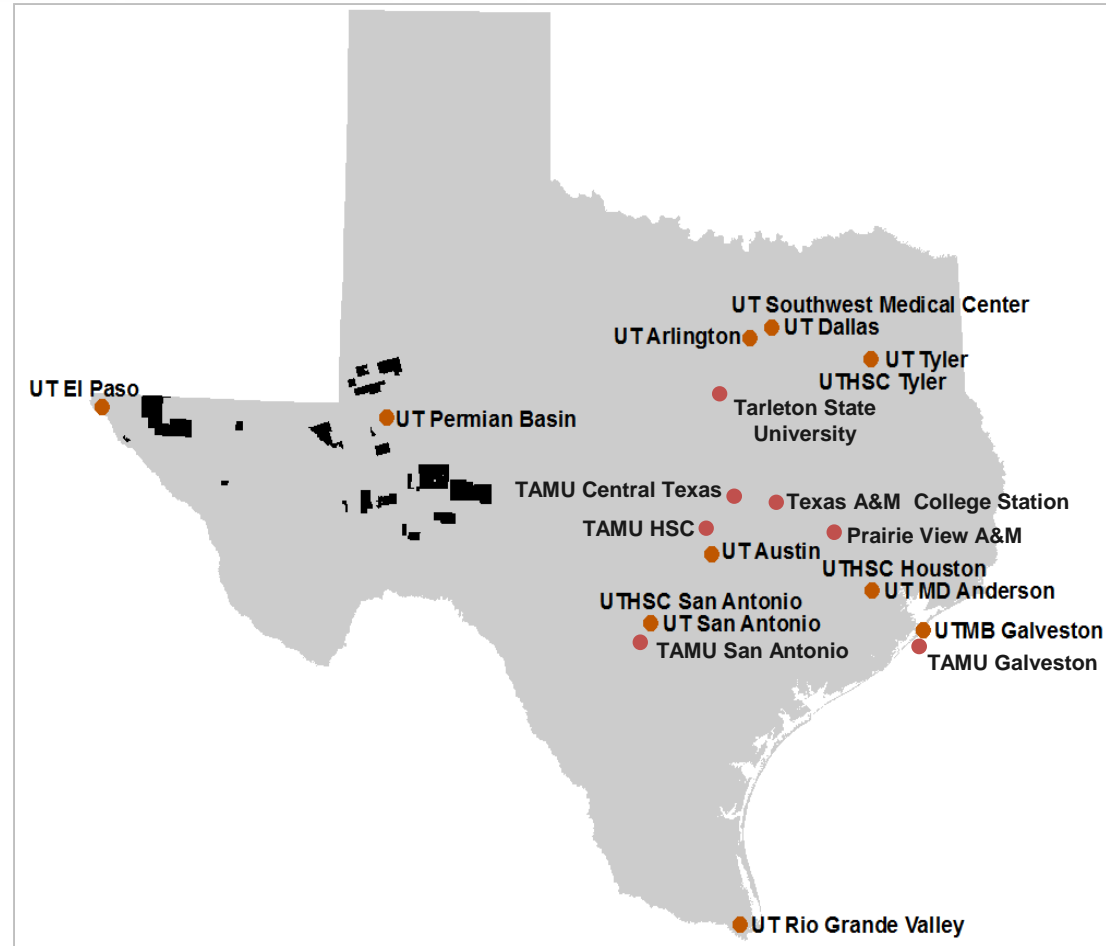


- Surface and mineral rights of 2.1 million acres of “PUF Lands”
- History of land dates back to 1838; first oil discovery in 1923
 - ❑ 20,000 wells drilled to-date
 - ❑ 9,000 wells currently producing
 - ❑ >20,000 identified locations
 - ❑ 4,000 leases, 250+ operators
- Surface leases:
 - ❑ Pipelines and power lines
 - ❑ Grazing and ranching
 - ❑ Renewables - wind and solar
 - ❑ Groundwater sales
 - ❑ Environmental programs
- Primary revenue driver is mineral royalty revenue

❑ Royalties support UT System & Texas A&M System via the “PUF”

The Permanent University Fund (PUF)

- ❑ Benefits 25 institutions across UT and A&M Systems
- ❑ ~\$21 Billion Market Value
 - ❑ ~5% annual distribution
 - 2/3 to UT System
 - 1/3 to A&M System
- ❑ Surface revenue goes into separate fund, which is immediately available to the schools



University Lands: Economic Development Opportunities

Effective Corporate Structure

**Oil and
Gas**



**Water
Resources**



**Solar and
Wind**



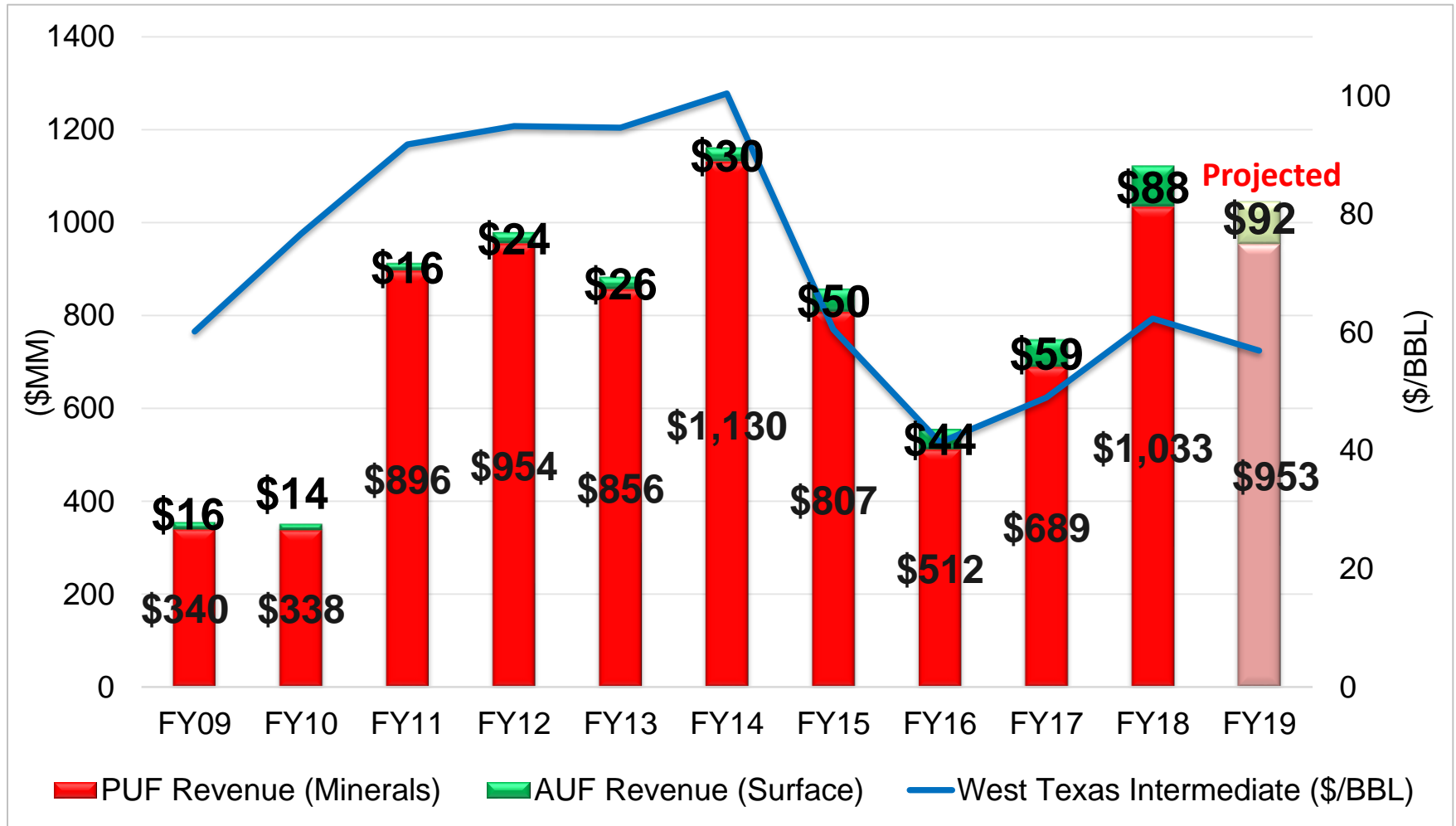
**Other Surface
Activities**



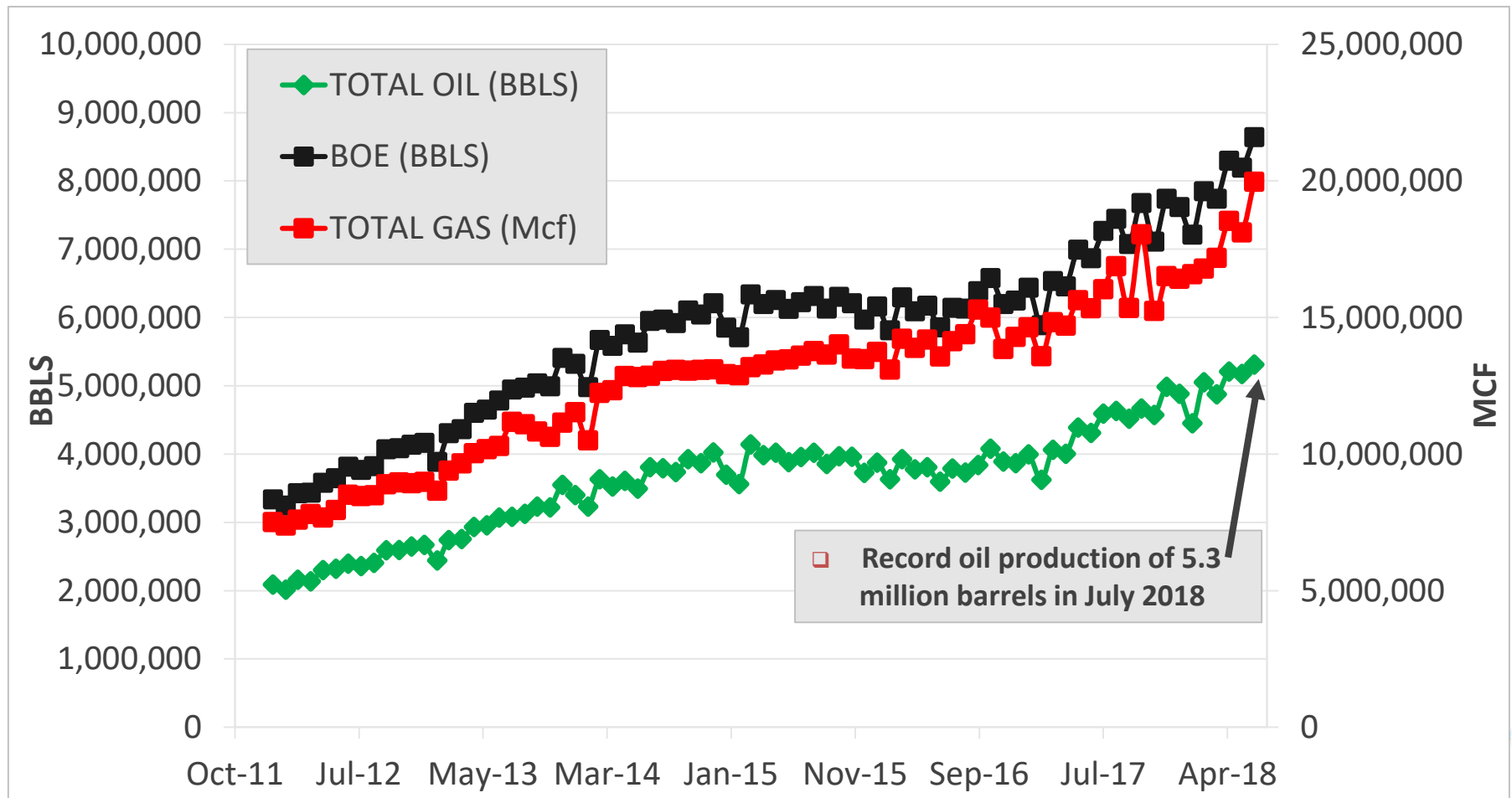
Excellent Environmental Stewardship

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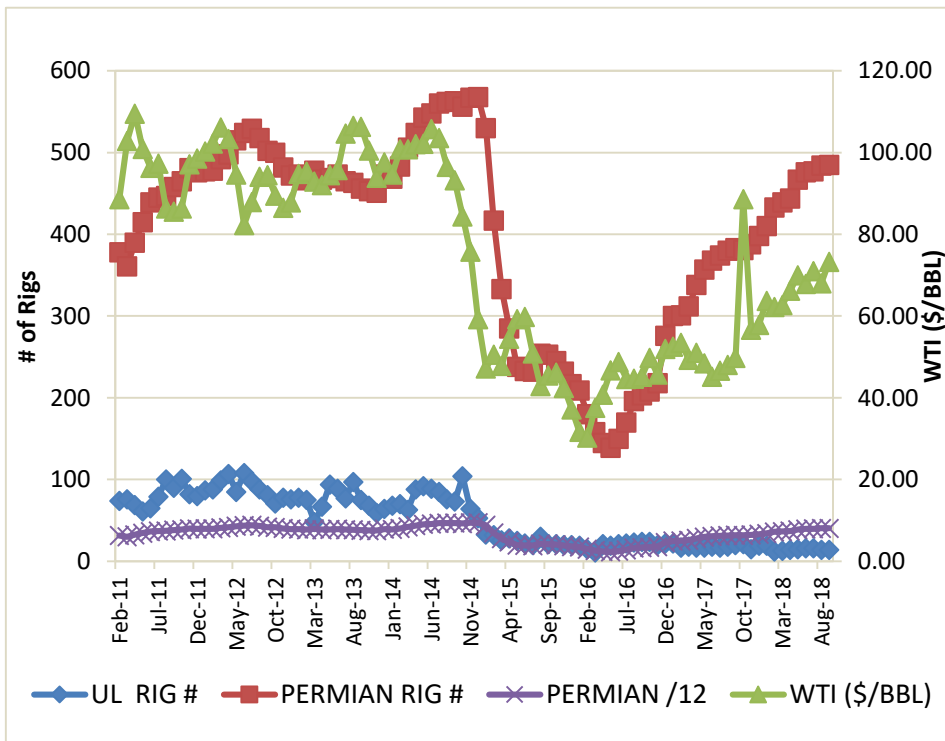
Historical AUF and PUF Revenue vs. Oil Price



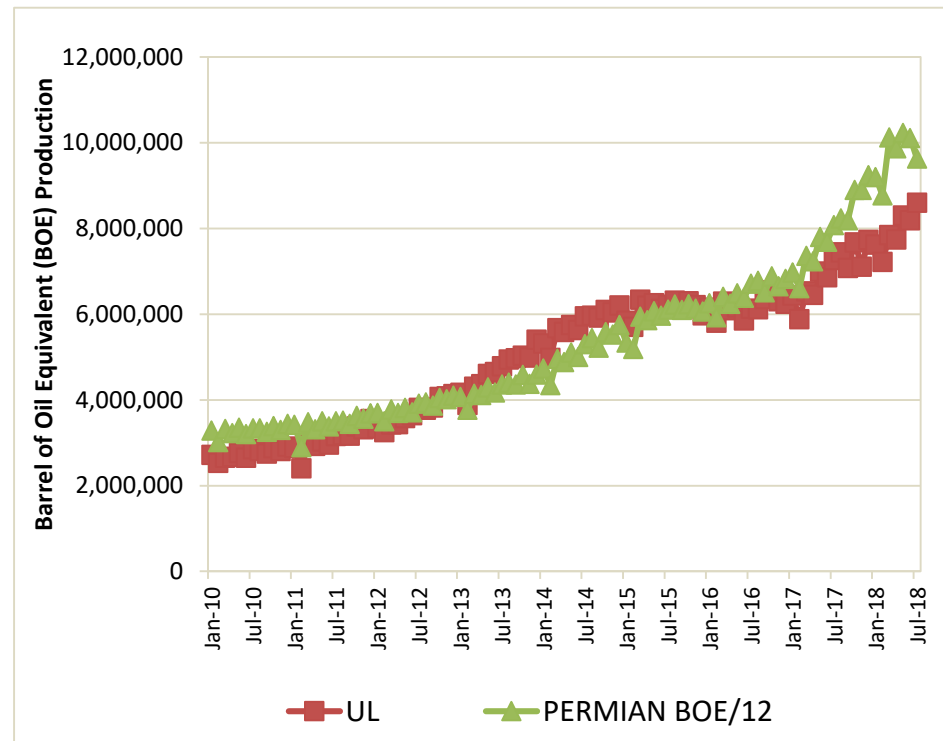
PUF Lands Gross Monthly Production



Strong Correlations Between Permian Basin and PUF Lands

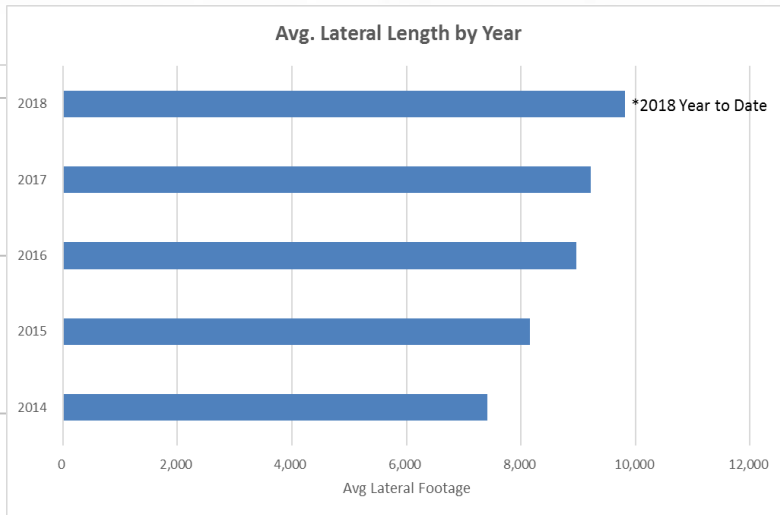


Sources: Baker Hughes, EIA, University Lands



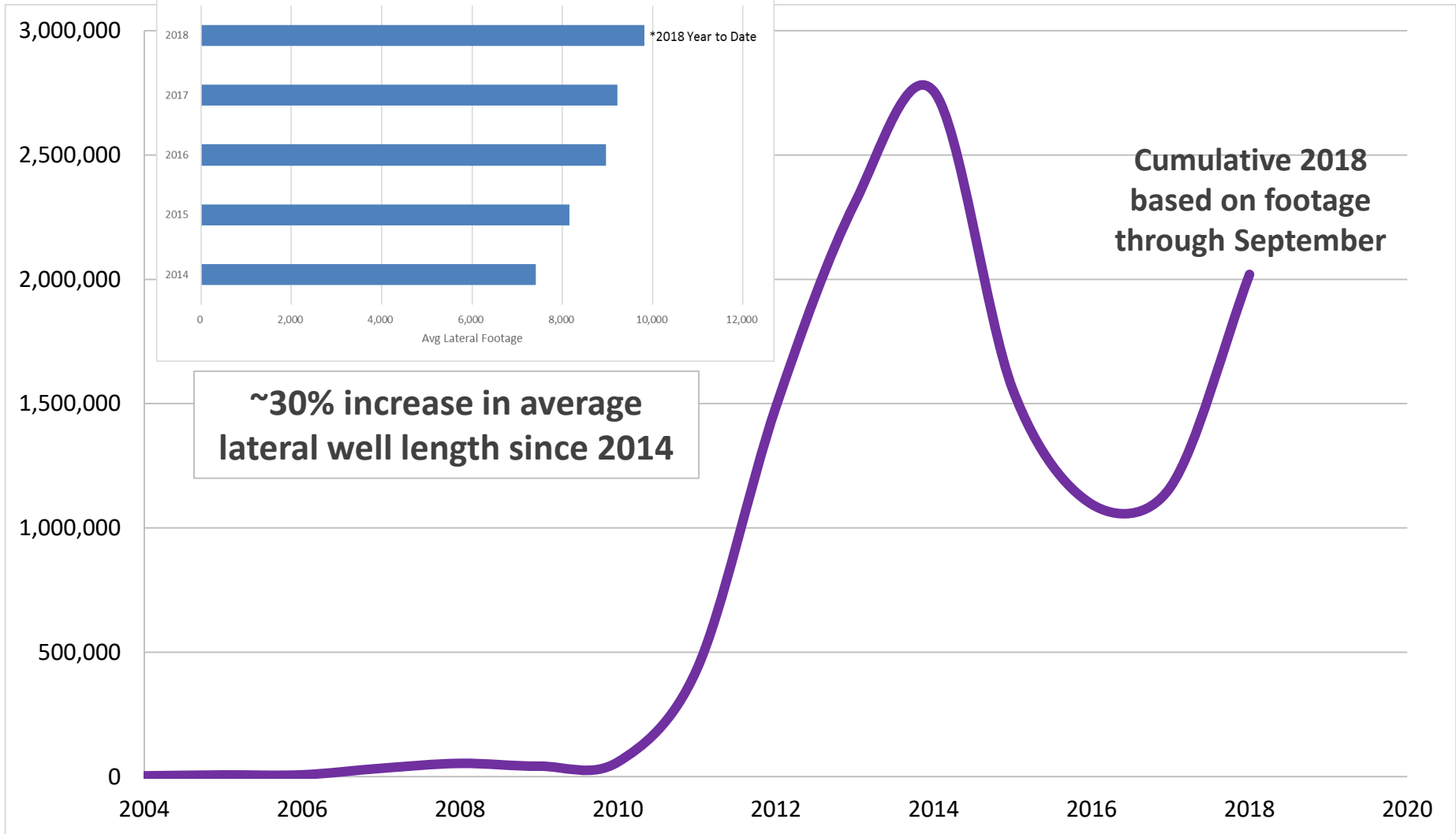
Sources: DrillingInfo, University Lands

Horizontal Footage Drilled Per Year



~30% increase in average lateral well length since 2014

Cumulative 2018 based on footage through September



University Lands: 20 Year Vision

- **Oil and Gas production will still be predominant revenue source**
 - Drilling inventory of 30+ years at normalized rates
 - Assuming consistent development activity and continued technical momentum, production levels could increase 50-100% over time
 - Technology enhancements in all areas of operating activity, including environmental performance
- **Water resources will be a significant contributor to infrastructure improvement and development in West Texas**
 - Enhanced stewardship of existing water resources
 - Desalinization of produced water
- **Solar and wind energy will be developed across PUF Lands**

EDF in China: Keys to Sustainable Long-Term Shale Development – Permian Observations

- While shale development is new, the Permian Basin is in many ways “mature”
 - Significant infrastructure was already in place prior to shale renaissance
 - Geology is relatively predictable and reasonably consistent
- Continue to enhance efficiency and long-term effectiveness through:

Infrastructure & Logistics

- Ensure pipeline takeaway capacity is sufficient
- Minimize transportation logistics and road use
- Ensure sufficient and competent manpower in place

Air Quality

- Continue reducing emissions through adoption of new technology and enforcement of existing regulations

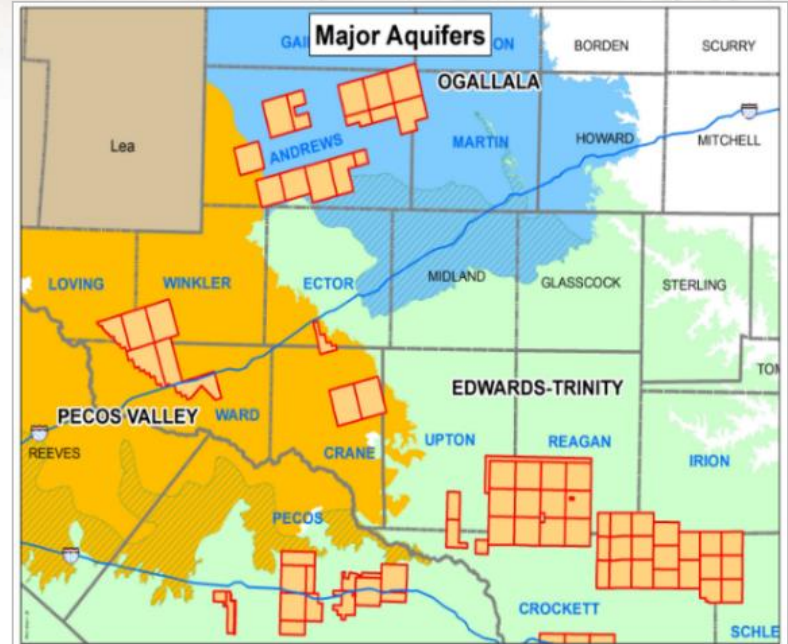
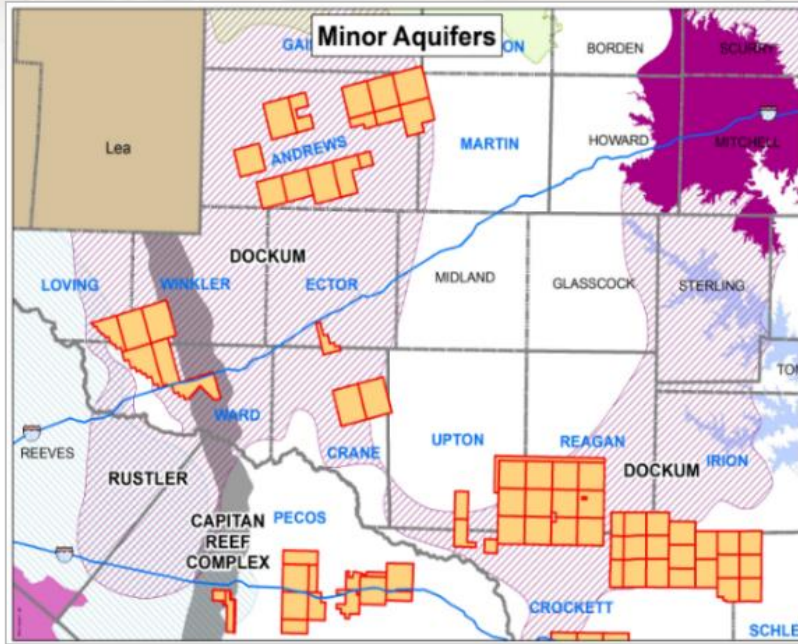
Water

- Promote effective use, disposal of, and re-use of water used in operations

Sand

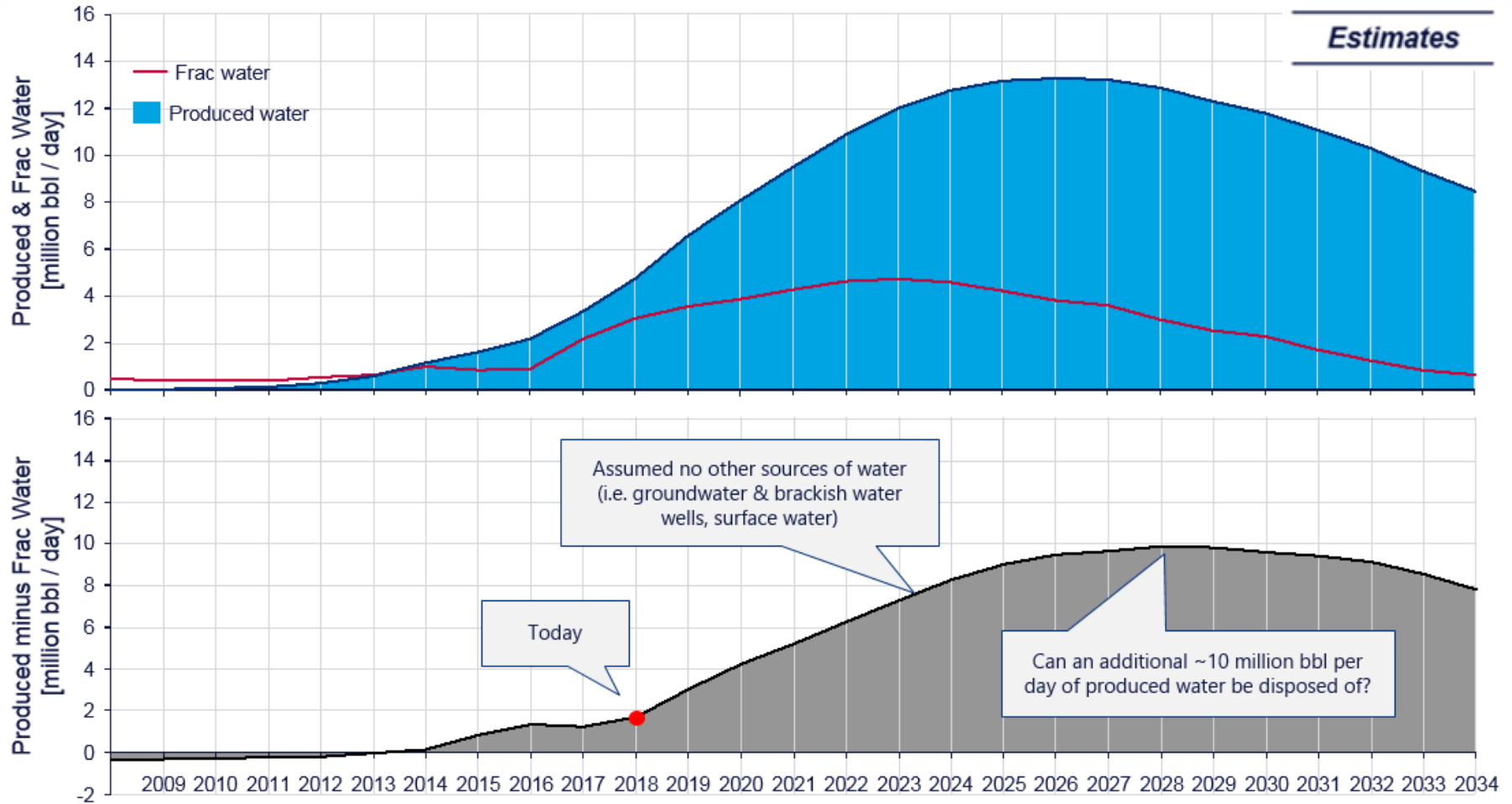
- Provide efficient access to sand for well completions

Evolution of UL Water Management



- 2008 – Unconventional Plays Kick-off
- 2010-2011 – Unprecedented Drought
- 2012 – UL Groundwater Management Plan Initiated
- 2014 – GW Searchable Database with 3D Models
- 2016 – Moved to “Per Barrel” Charge for Water
- 2017 – Published Specs for Produced Water Frac Pit
- 2018 – “Full-Cycle” Water Management Initiative

Wood Mackenzie: Permian Produced, Frac & Net Water Rates



Estimates

Source: Wood Mackenzie NACPAT & analysis

Inventorizing Water Across PUF Lands

Fresh Water Wells (for o&g use)	789
Disposal Wells	156
Estimated Miles of Water Pipeline	1,301
Fresh Water Frac Pits	161
Produced Water Frac Pits	5
Poseidon or Tanks used for Recycling or Flowback	21
Temporary Easements for Water Transfer in 2018	77
Water sales to municipalities	18MM bbls/year
Completion water use on PUF Lands	150MM bbls/year (60% UL water)

How can we encourage operators to use more UL water but to also use that water and related infrastructure more efficiently?

Fresh Water And Produced Water Pits



Frac Pit Failure



University Lands' 2018

Full-Cycle Water Management Initiative

Drive adoption of a more economic and holistic approach to oilfield water management

1. Leverage UL size & scale to produce economies of scale in water-related infrastructure development
2. Increase reuse/recycle of produced and brackish water
3. Reduce costs for operators
4. Increase efficiency, speed of PUF Lands mineral development

A win-win-win: Benefit UL, industry, and the environment

Full-Cycle Water Management

- Promote development of more integrated water production, recycling and disposal systems
- Integrate operators, where appropriate
 - Some operators want to self-manage
 - Operators that want to outsource
- The choice is the operator's, but we believe that there are economies of scale and benefits to connected systems, and that with time, these benefits will become more and more evident
- The key is to also develop reliable third-party service providers

Full-Cycle Water Management Drivers

- Recycling of produced water for use in hydraulic fracturing
- Use of brackish water in lieu of fresh water for completions
- Smarter water disposal through connected disposal network
- Increased monitoring of seismicity related to water injection
- UL incentivizing upstream and midstream water infrastructure development on PUF Lands to promote these best practices and help ensure they continue



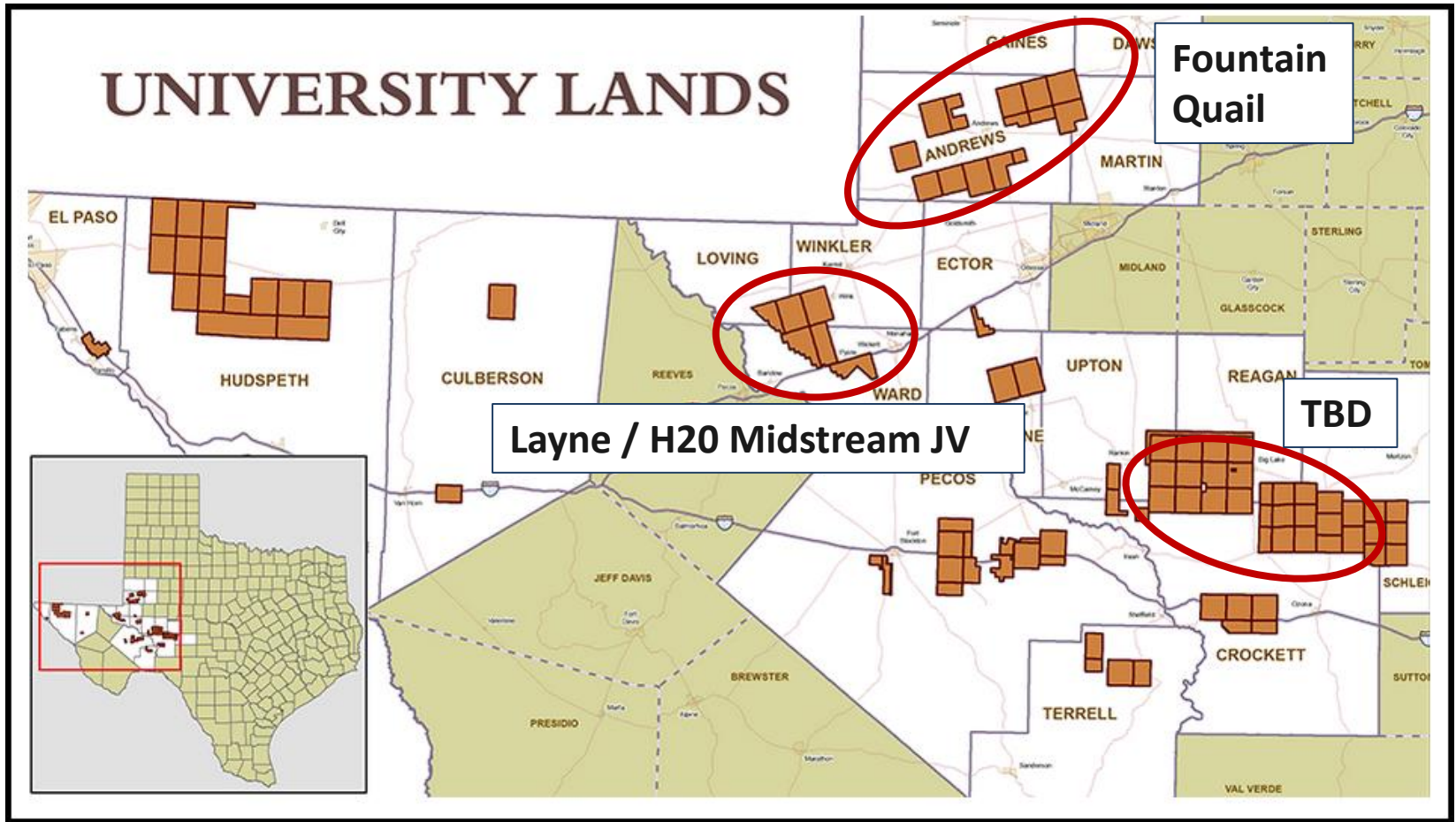
Flow Back Water



Treated – Clean Brine

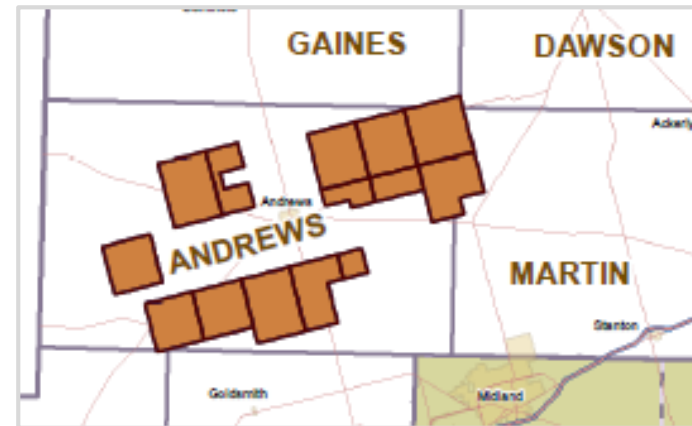


UL's "Preferred Water Service Providers"



UL Northern Midland Basin - Andrews County Area

- Fountain Quail is working hand-in-hand with operators in the Andrews area to solve water management issues that could restrict current or future development on University Lands
- **Establishment of commercial water recycling facilities** will relieve the demand on local disposal zones (which are increasing drilling cost) while also providing an immediate, local source of frac fluid
- Fountain Quail will invest in significant storage assets at the recycling facility to buffer volumes during periods when disposal (water coming into facility) and sourcing (water going out of the facility) demands are not synchronized, enabling predictable disposal and sourcing capacity
- The water will be treated to a high standard such that the treated water will work for any fracturing program. This elevated water quality standard also helps to preserve water quality for longer periods and protect storage assets

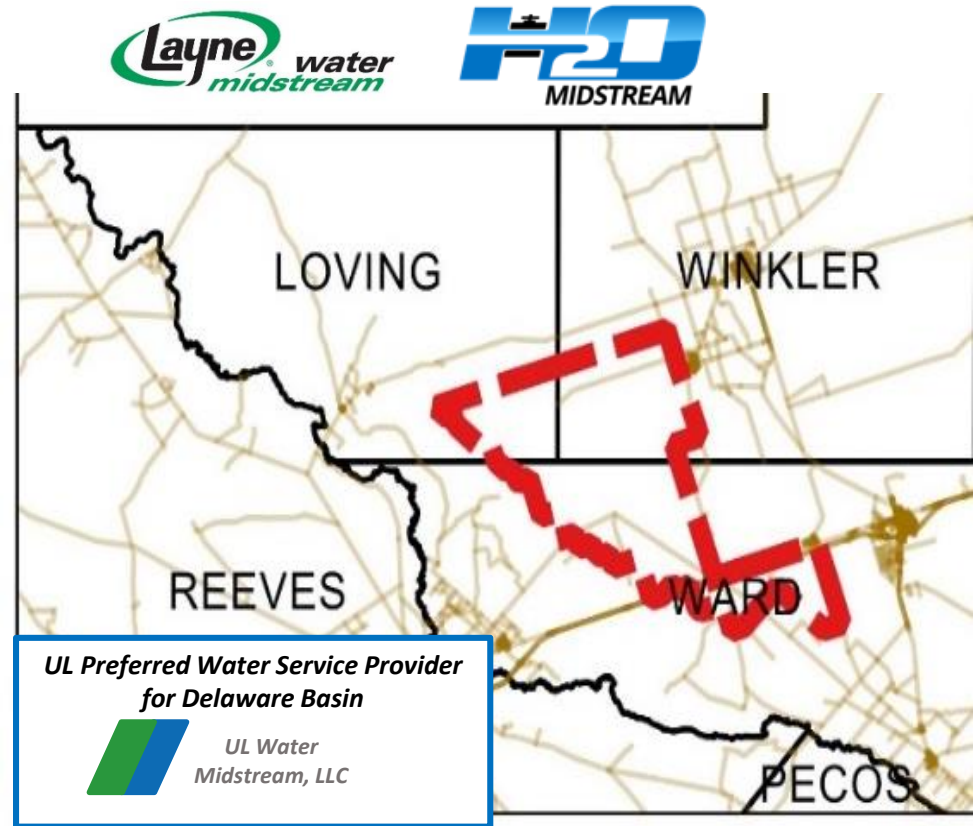


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UL Delaware Basin – Ward, Winkler & Loving



- **UL** chose **UL Water Midstream (ULWM)** as the **Preferred Water Service Provider** for its 167,000 acres in Loving, Winkler, and Ward Counties based on its **integrated midstream approach** and **proven execution capabilities** across the full water value chain
- ULWM is a **joint venture between H₂O Midstream and Layne Water Midstream** to bring full-cycle water midstream solutions to E&P companies operating on University Lands
 - **H₂O Midstream** – formed in 2016 by midstream industry veterans to focus exclusively on water; backed by investors with \$70B+ in assets under management
 - **Layne** - 135+ years of history; publicly traded with \$2B equity market capitalization



The UL-ULWM Preferred Provider Agreement provides incentives for H₂O/Layne to rapidly build source, gathering, re-use, storage and disposal infrastructure to reduce water logistics costs, enhance mineral development, and increase sustainability on UL acreage

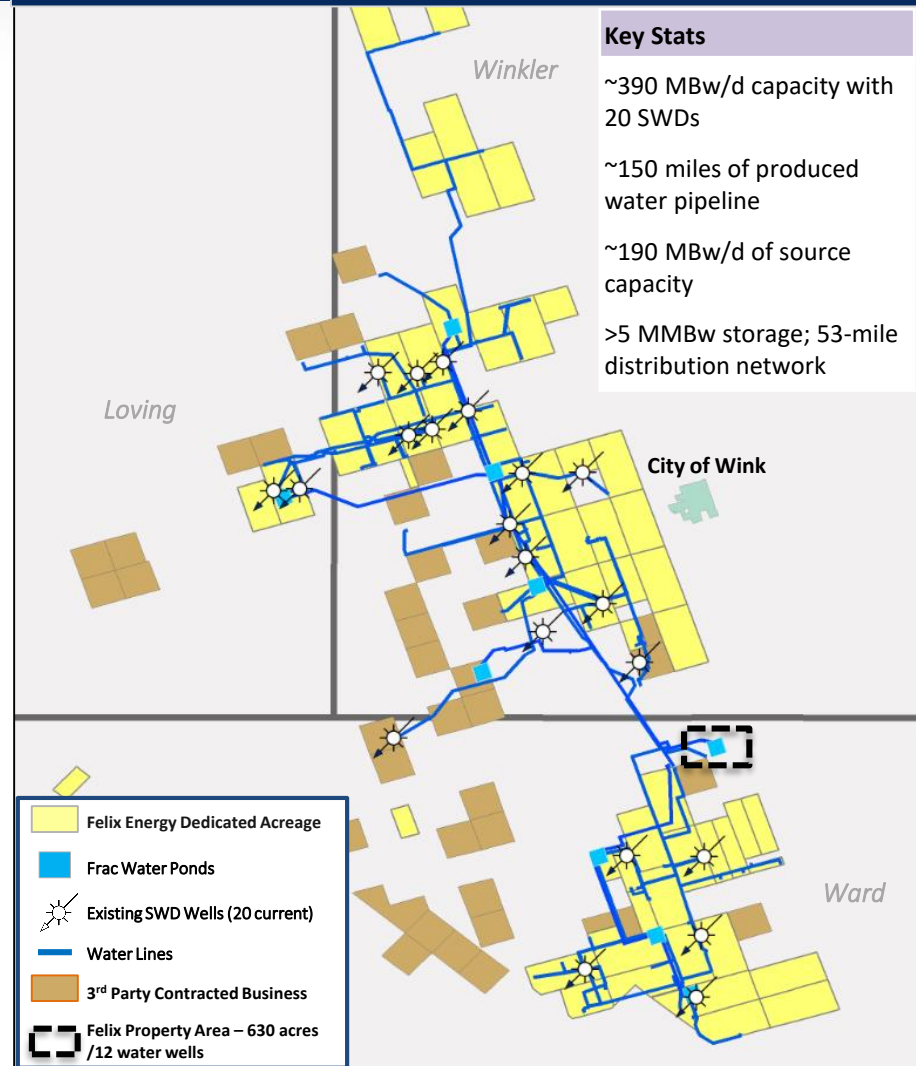
H₂O/Layne are designing a full-cycle midstream solution and seeking to build and/or acquire strategic pipeline, source water and disposal networks to combine with organic growth

Felix Water



- Created in 2016 to address water needs of Felix Energy, who is currently operating 9 rigs with ~30 MBoe/d of current production and projected >300 MBw/d by YE 2019
- Staffed with experienced midstream and operations personnel, but has producer's mindset with regards to customer service, flow assurance and SWD placement (away from pads and faults)
- Worked extensively with University Lands to develop an integrated and redundant networked disposal system for Felix and adjacent third party operators
- Piloted multiple water "re-use" products and believes waste water re-use is the future of the business in addition to being responsible as conservationists

Felix Water – Source and Produced Water Systems



Produced Water Recycle Facility, Crockett County



- 2.2 million barrels flowback and produced water recycled since inception
- Developing a centralized produced water disposal program to minimize SWD costs
- Reduced truck traffic and overall LOE and SWD costs

University Lands: Closing Thoughts



- Over time, water management will consolidate similar to midstream business
- UL is working with operators and third parties to establish more **integrated and efficient** water infrastructure in the Permian
 - ✓ Lower cost
 - ✓ Lower traffic
 - ✓ Better for the environment
 - ✓ Better for business