

# LOGOS Resources II, LLC

## ERDC Meeting Hydraulic Fracturing Overview

October 29, 2019







# Background

# LOGOS Resources II, LLC Background

---



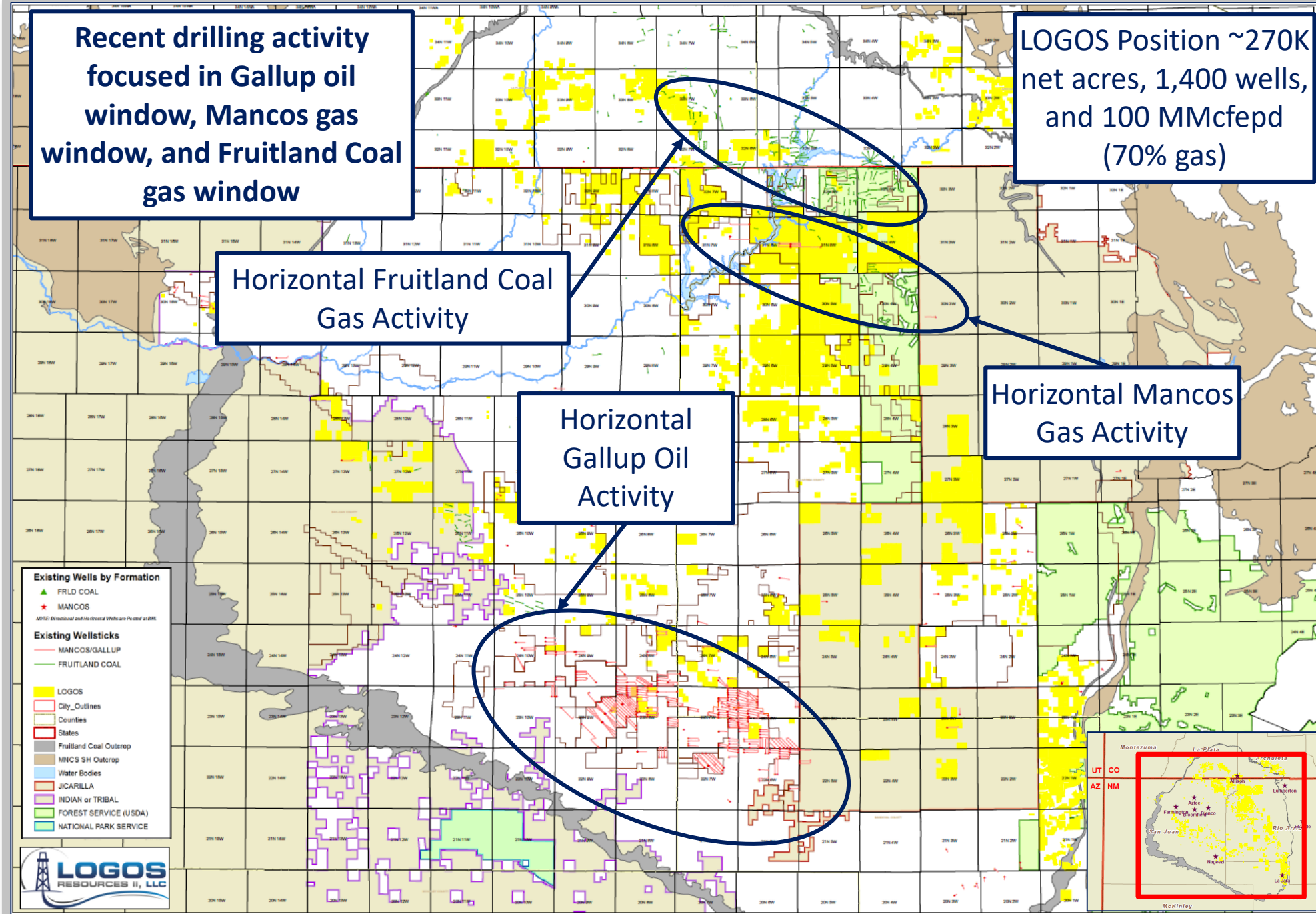
- **San Juan Basin (SJB) pure play oil and gas exploration and production (“E&P”) company**
- **LOGOS Resources II was formed in July 2016 with a capital commitment of \$150 million from ArcLight Capital Partners (“ArcLight”)**
  - Top 10 natural gas producer in the State of New Mexico
  - Total position of ~270,000 net / 410,000 gross acres and currently produce ~100 MMcfepd (70% gas)
  - Operates over 1,400 wells and has drilled 45 horizontal and vertical wells since inception
- **Invested over \$400 million dollars in the region since 2012 with nearly \$100 million in 2019 and have paid over \$40 million in taxes and royalties**
- **Directly employ nearly 80 local residents and at times over an additional 100 local residents**
- **LOGOS Resources I was formed in January 2012 with a total capital commitment of \$100 million from an affiliate of ArcLight**
- **Majority of LOGOS Resources I assets were successfully sold in 2014**

# LOGOS Management Team – Decades of SJB Experience



Name & Title	Years Experience	Previous Experience
<b>Jay Paul McWilliams</b> Chief Executive Officer	<b>&gt;15</b>	<ul style="list-style-type: none"> <li>• Founder of LOGOS II in 2016 and its predecessor, LOGOS I in 2012, which grew production to over 1,700 boe/d before divesting the majority of the assets for a significant return</li> <li>• Previously served as the lead acquisition engineer at LINN Energy, where he led approximately \$1.0 billion in transactions, as well as holding various engineering positions while at Burlington Resources and Resolute Natural Resources</li> <li>• BS Chemical Engineering from New Mexico Tech (Highest Honors) and MBA from Fuqua School of Business at Duke University (Fuqua Scholar)</li> </ul>
<b>John Bruner</b> Sr. Vice President Finance, Accounting, and Regulatory	<b>&gt;30</b>	<ul style="list-style-type: none"> <li>• Formerly in charge of asset management, strategic planning, subsurface management, commercial and business development in various basins around the globe for ConocoPhillips over the course of 28 years</li> <li>• Most recently served as Development and Strategy Manager for ConocoPhillips' San Juan Basin Unit</li> <li>• BS Petroleum and Natural Gas Engineering from Pennsylvania State University</li> </ul>
<b>Kelly Maxwell</b> Sr. Vice President Midstream	<b>&gt;40</b>	<ul style="list-style-type: none"> <li>• Former Operations Manager for ConocoPhillips and Burlington Resources</li> <li>• Extensive experience in gas gathering, hydraulic modeling, compression, facilities optimization and production optimization throughout his 38 year career with ConocoPhillips and Burlington Resources in the San Juan Basin</li> </ul>
<b>Chris Jeffus</b> Vice President Land and Legal	<b>&gt;10</b>	<ul style="list-style-type: none"> <li>• Previously worked in the Rockies and Permian Asset Team at EnerVest where he was responsible for numerous properties throughout New Mexico and Utah, including the negotiation and management of various joint operating, farm-out and gas gathering agreements</li> <li>• Began his career as an associate attorney at a Houston-based oil and gas law firm</li> <li>• BS Accounting and a Master of Science in Finance from Texas A&amp;M University and Juris Doctor from University of Texas School of Law</li> </ul>
<b>Marcia Brueggenjohann</b> Vice President Reservoir	<b>&gt;15</b>	<ul style="list-style-type: none"> <li>• Prior to joining LOGOS, she was the Reservoir Engineering Manager, San Juan &amp; Williston Basins for WPX</li> <li>• Prior to that role, she was the San Juan Basin Reservoir Engineering Team Lead / Reservoir Engineer for WPX</li> <li>• BS Petroleum Engineering from the University of Texas</li> </ul>
<b>Krista McWilliams</b> Engineering Manager	<b>&gt;15</b>	<ul style="list-style-type: none"> <li>• Former senior engineer with ConocoPhillips and Burlington Resources in various capacities</li> <li>• Founder of Diamond Derrick Consulting, a provider of high-quality oil and gas project and data management services</li> <li>• BS Mechanical Engineering from New Mexico Tech (Highest Honors)</li> </ul>

# San Juan Basin Locator Map



## Firm

***Leading private equity firm focused on North American energy infrastructure assets***

- Founded in 2001, \$17 billion of commitments across seven funds
- 108 investments, 67 exits since inception

## Team

***Seasoned investment team augmented by in-house technical, operational, and commercial specialists***

- 34 specialist investment professionals
- Access to 1,000+ portfolio operations professionals through Consolidated Asset Management Services (“CAMS”)
- All investment partners have been with the firm 13 years or longer

## Strategy







***Partner with highly experienced and successful corporates, entrepreneurs, and management teams***

- Provide capital to acquire, finance, construct or develop cash generative energy assets and businesses
- Offer unique resources, industry relationships and insights that enhance decision making and execution

# Introduction to Capital Partners ArcLight (Cont)



## Investing Across the Value Chain and Working with Industry Leaders

	Midstream 	Production 	Power 
\$ Invested	\$9.0 billion	\$3.0 billion	\$9.0 billion
# of Investments	25	20	52
Partners and Counterparts			

*Relationships built through the acquisition, exit, commercial management, and/or joint-ownership*

Note: Select entities with whom ArcLight has a business relationship or has completed a transaction. As of June 30, 2019.

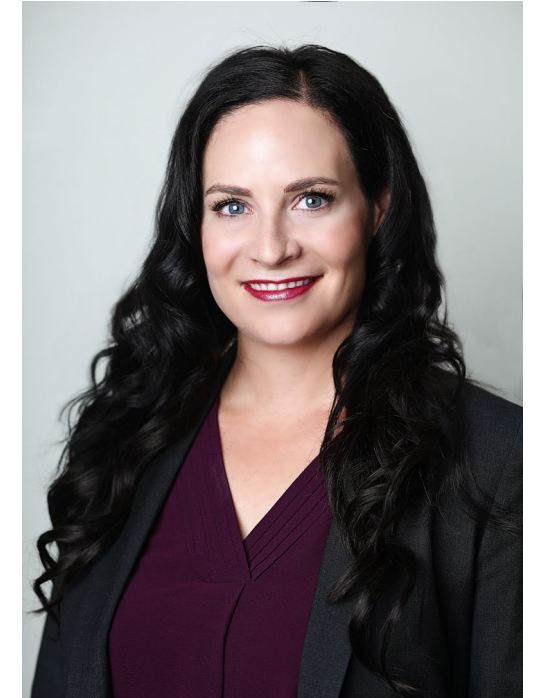
Note: As of June 30, 2019 unless otherwise noted. Portfolio operations professionals refers to CAMS, ArcLight's asset management affiliate. Number of investment professionals as of August 1, 2019.



# Krista McWilliams Background



- **Operations Engineering Manager – LOGOS Resources II, LLC**
- **Member at Large – New Mexico State Water Quality Control Commission (appointee)**
- **Founder and President of Diamond Derrick Consulting**
- **Senior Petroleum Engineer for Burlington Resources/ConocoPhillips**
- **Bachelor of Science in Mechanical Engineering with highest honors from the New Mexico Institute of Mining and Technology (New Mexico Tech)**
- **Other Activities**
  - Leadership New Mexico Core Class of 2020 - current
  - New Mexico Museum of Natural History Foundation Board member – current
  - Four Corners Economic Development Center Board member – current
  - Leadership San Juan Graduate – May 2017
  - Created San Juan College High School Leadership Development Curriculum – 2017
  - Founder of Super Summer STEM Camp at San Juan College – 2016







# Hydraulic Fracturing Overview

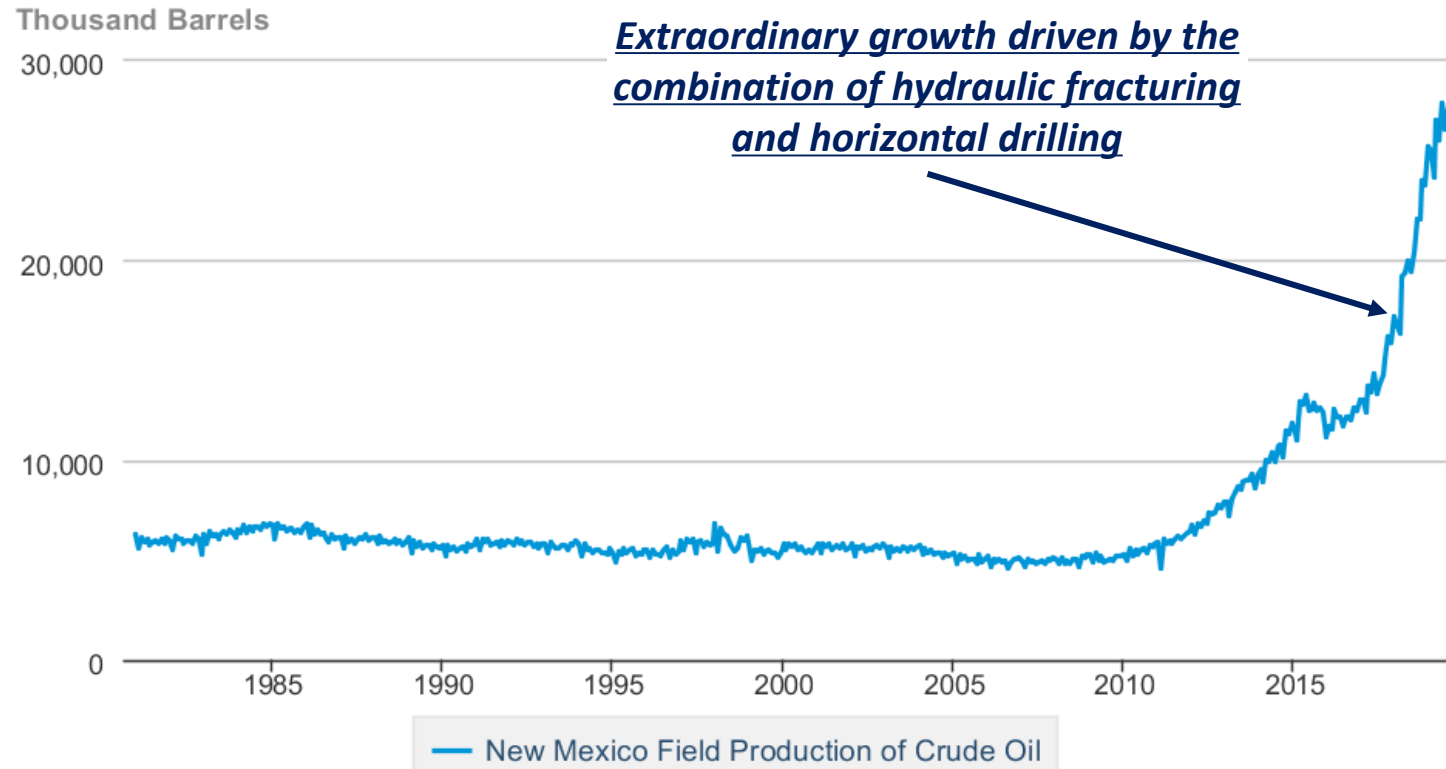
# ERDC Meeting – Hydraulic Fracturing Overview



- **Hydraulic fracturing is a proven technology used safely for more than 60 years in more than a million wells**
  - Utilizes water and sand to create “fractures” in underground formations that allow oil and natural gas to flow
  - Combination of horizontal drilling and hydraulic fracturing has revitalized the United States’ and New Mexico’s energy outlook with unprecedented oil production and revenue growth
    - Provides substantial revenues to New Mexico and jobs for New Mexican’s
- **Horizontal drilling and hydraulic fracturing allows oil and gas operators to access significantly more oil and gas reserves with substantially less environmental footprint and less capital per energy extracted**
- **Hydraulic fracturing is safe**
  - With proper wellbore construction, ground water is protected
  - Wellbores are generally over a mile below ground while fracture growth is limited to a few hundred feet
  - Fracture fluid is composed of 99.5% Water and Sand and 0.5% additives commonly found in household chemicals
  - Hydraulic fracturing does not cause earthquakes
- **New Mexico’s fresh water utilized for hydraulic fracturing is minimal**
  - Minimal fresh water usage by percentage of total usage
  - Produced water is a byproduct and must be safely reused, disposed or re-purposed

# New Mexico Oil Production – Extraordinary Growth

## New Mexico Field Production of Crude Oil



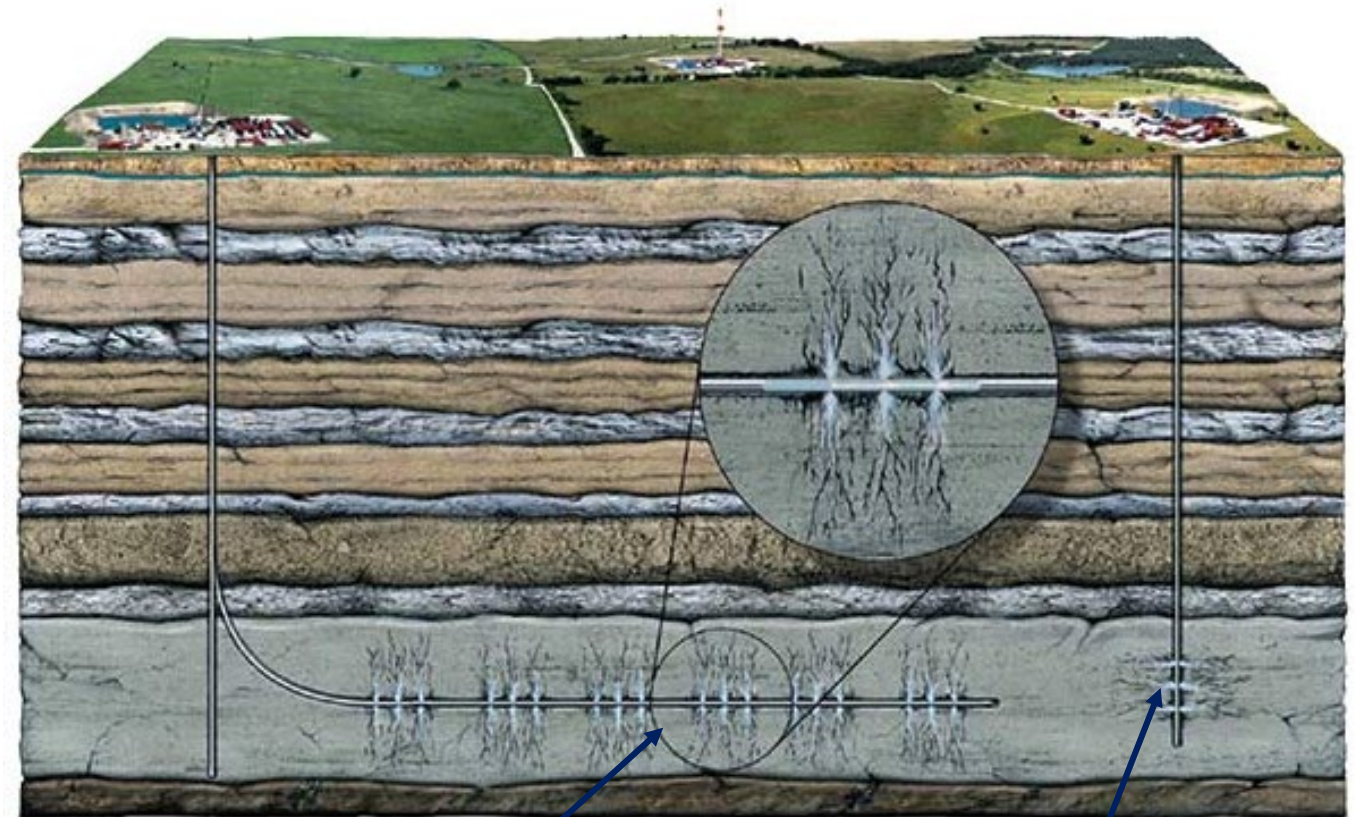
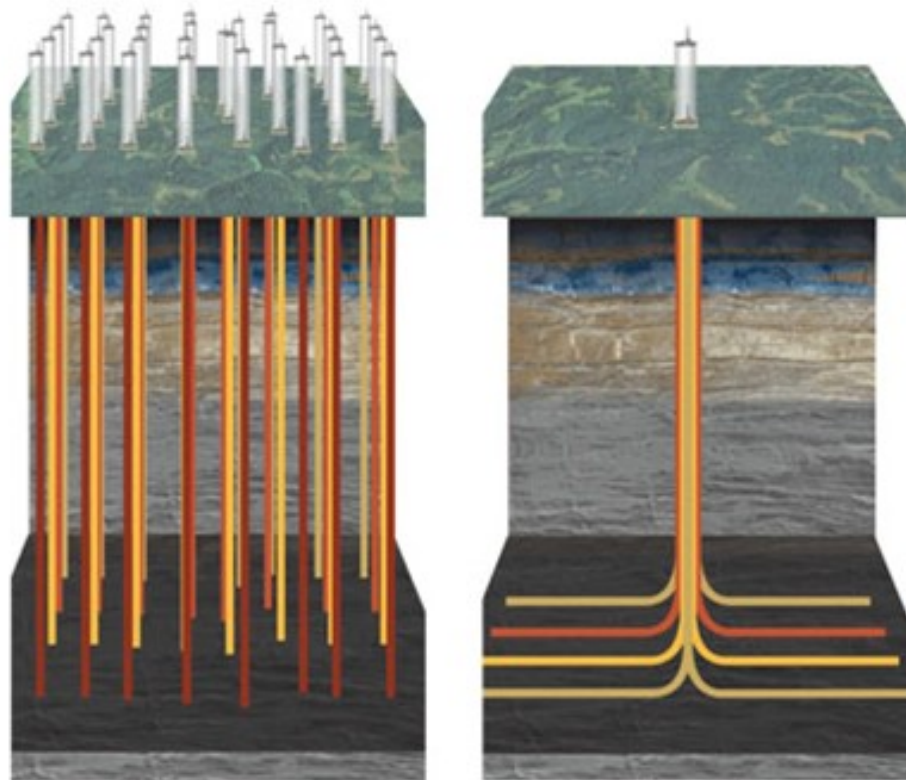
eia Source: U.S. Energy Information Administration





# Hydraulic Fracturing – Old vs New Technology

- **Horizontal drilling & multi-stage hydraulic fracturing are the evolution of two very OLD processes.**
  - Horizontal drilling dramatically REDUCES impact on surface and environment and recovers more reserves
  - Vertical drilling has much greater surface disturbance and recovers less reserves
  - More energy per dollar spent and more energy per disturbed surface footprint
- **As a result, New Mexico shale formations that were formerly uneconomic to produce are now the resource of the future.**



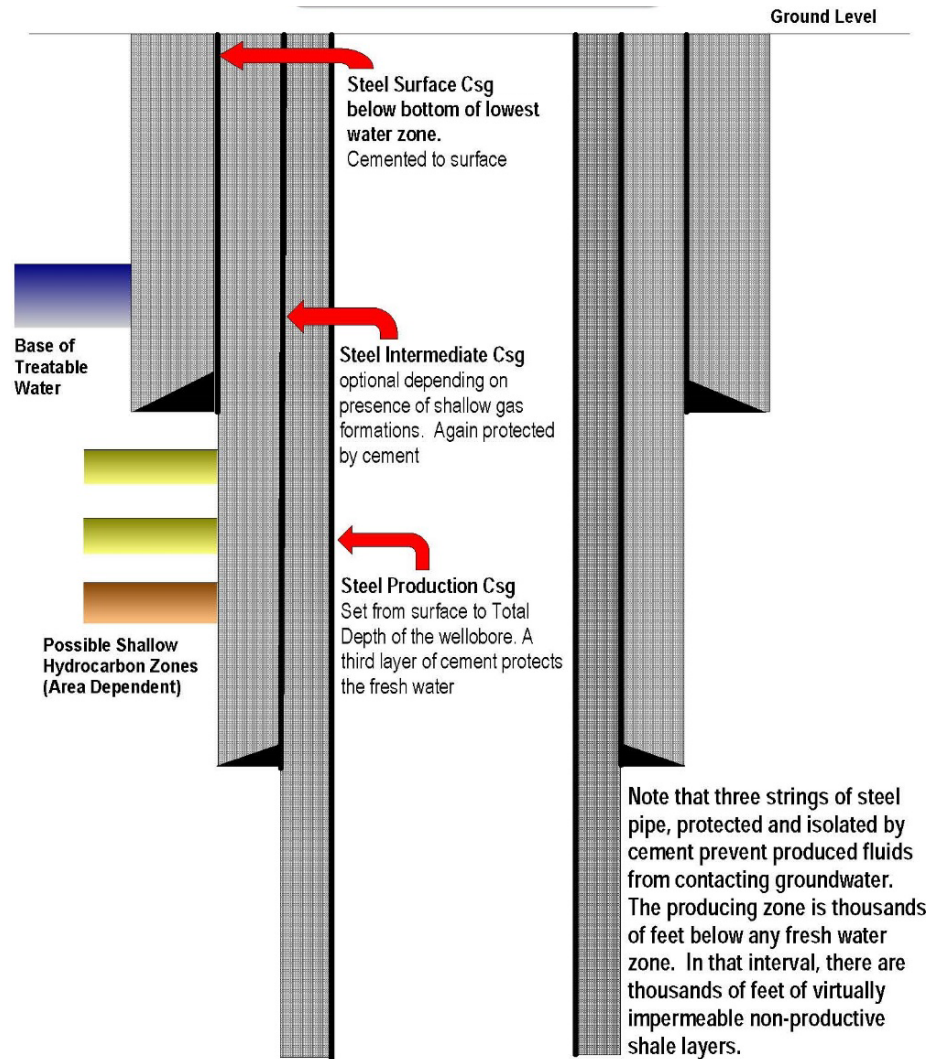
Horizontal wellbore = less surface disturbance and more reserves

Vertical wellbore

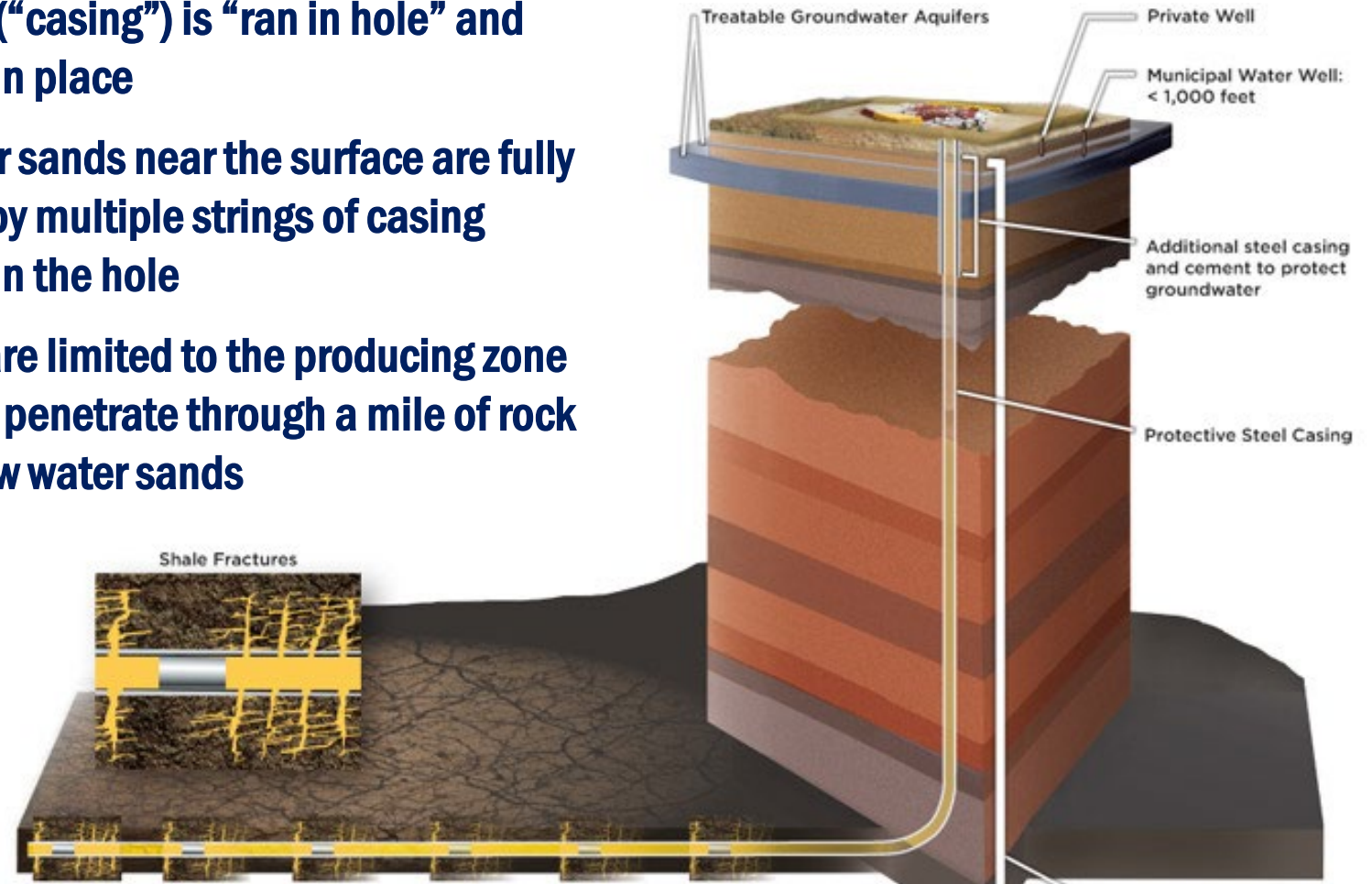


# Cemented Steel Casing Strings Provide Ground Water Protection

## Example Wellbore Casing / Cement Configuration



- Wells are drilled vertically to the producing reservoir and then drilled horizontally for as long 3-miles
- Steel pipe (“casing”) is “ran in hole” and cemented in place
- Fresh water sands near the surface are fully protected by multiple strings of casing cemented in the hole
- Fractures are limited to the producing zone and do not penetrate through a mile of rock into shallow water sands

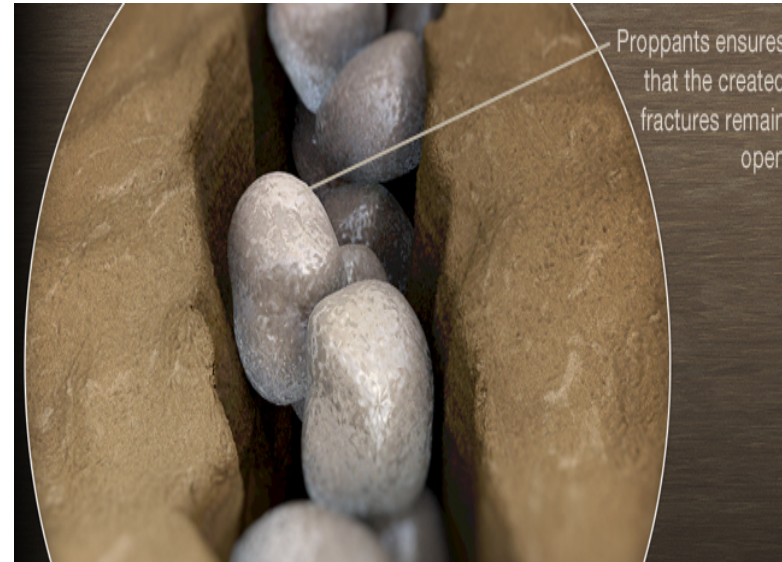


Depth of Shale is 5,000' to 12,000'

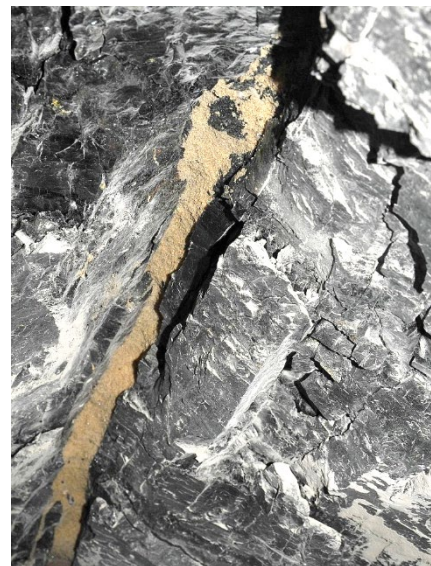


# What is Hydraulic Fracturing?

- **Water and sand (“proppant”) are pumped at high pressures and flow rates to create “fractures” in producing formation**



- **When pressure is released, water is produced and sand remains to prop the “fracture” open**



Dayle Renee  
PHOTOGRAPHY



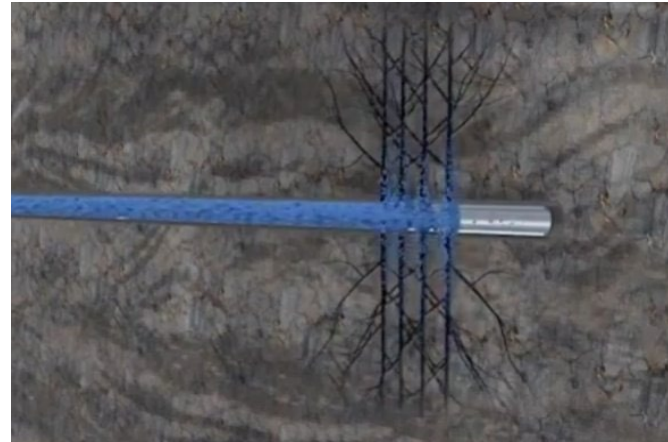
# How Does Hydraulic Fracturing Work?

## Step 1: Perforate Casing



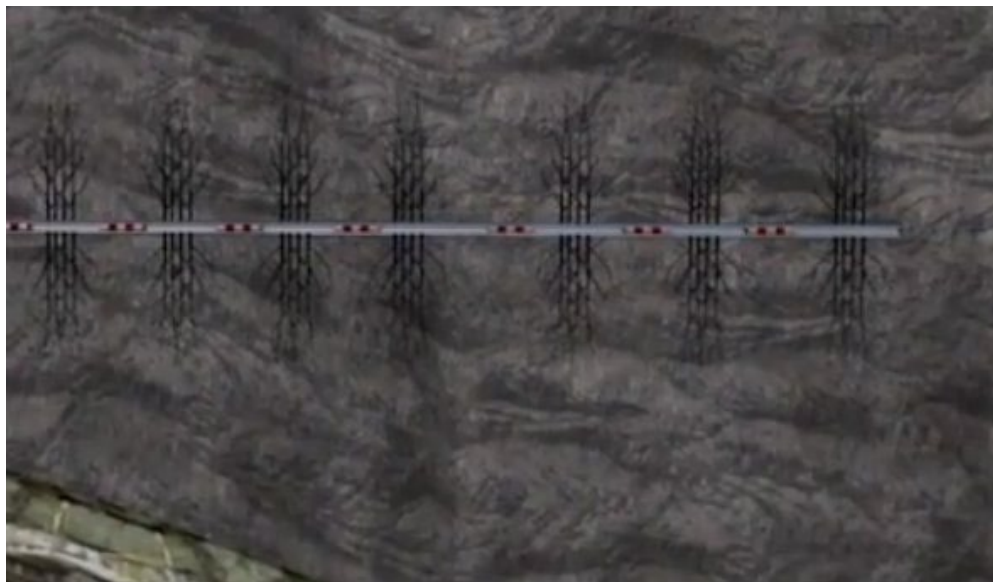
*Allows access to reservoir*

## Step 2: Hydraulic Fracture



*Provides reservoir fluids path to wellbore*

## Step 3: Set Isolation Plugs and Repeat



*Pressure drive draws oil and gas to wellbore and then to surface*

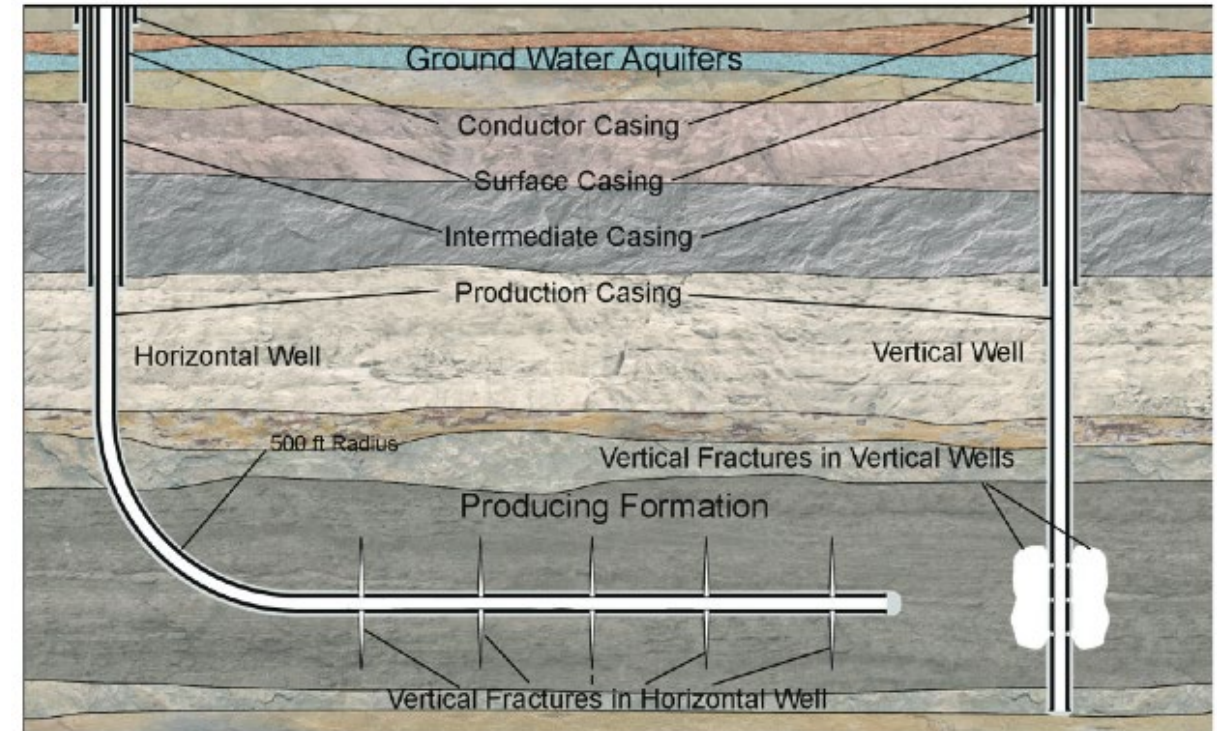
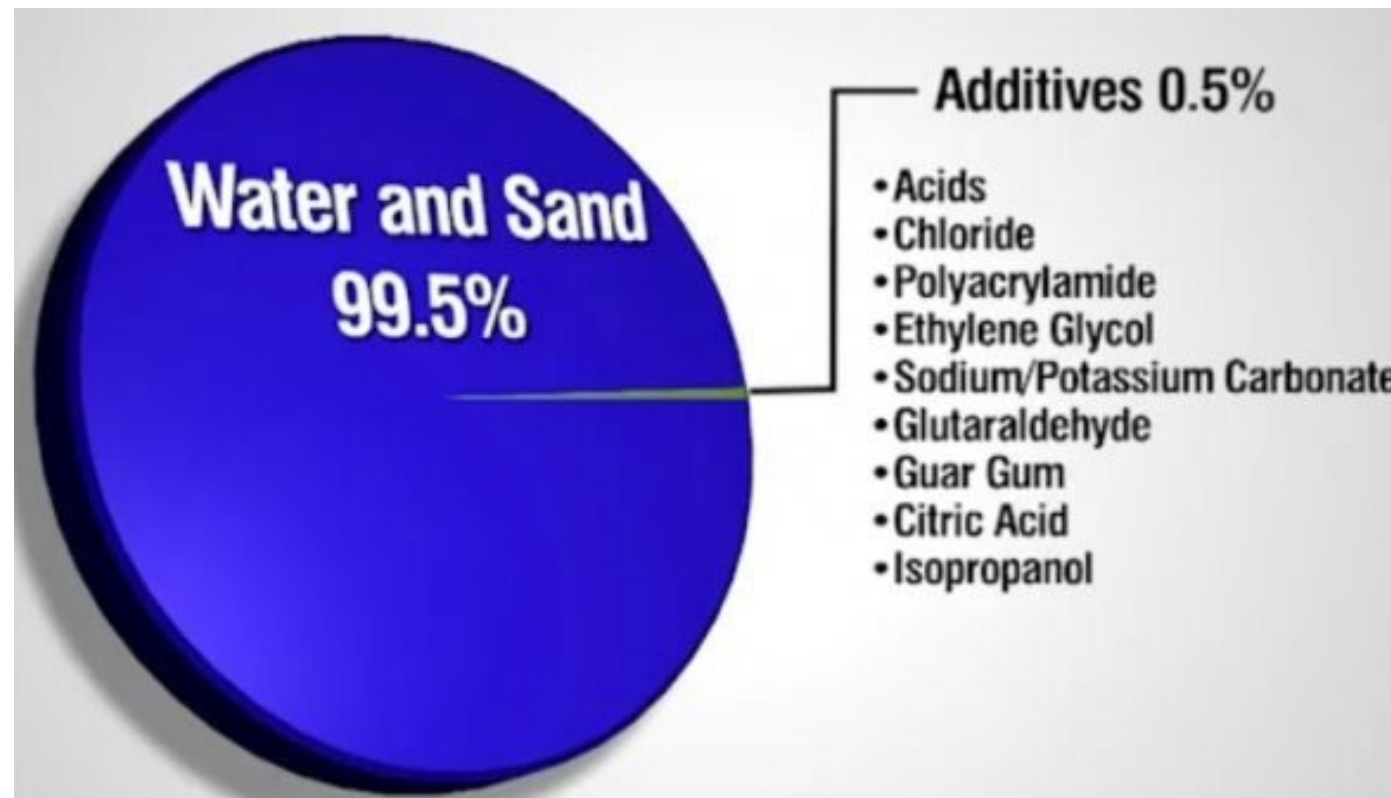


Figure 3—Example of a Horizontal and Vertical Well

- Increased efficiency for drilling and completions
- Reduced footprint
- Two mile lateral can replace up to 60 vertical wells

# Fracture Fluid Components – Water and Household Products



Typical Additives Used in Fracturing Fluid and COMMON HOUSEHOLD ITEMS

SODIUM CHLORIDE  
used in table salt



ETHYLENE GLYCOL  
used household  
cleaners



BORATE SALTS  
used in cosmetics



SODIUM/POTASSIUM  
CARBONATE  
used in detergent



GUAR GUM  
used in ice cream



ISOPROPANOL  
used in deodorant

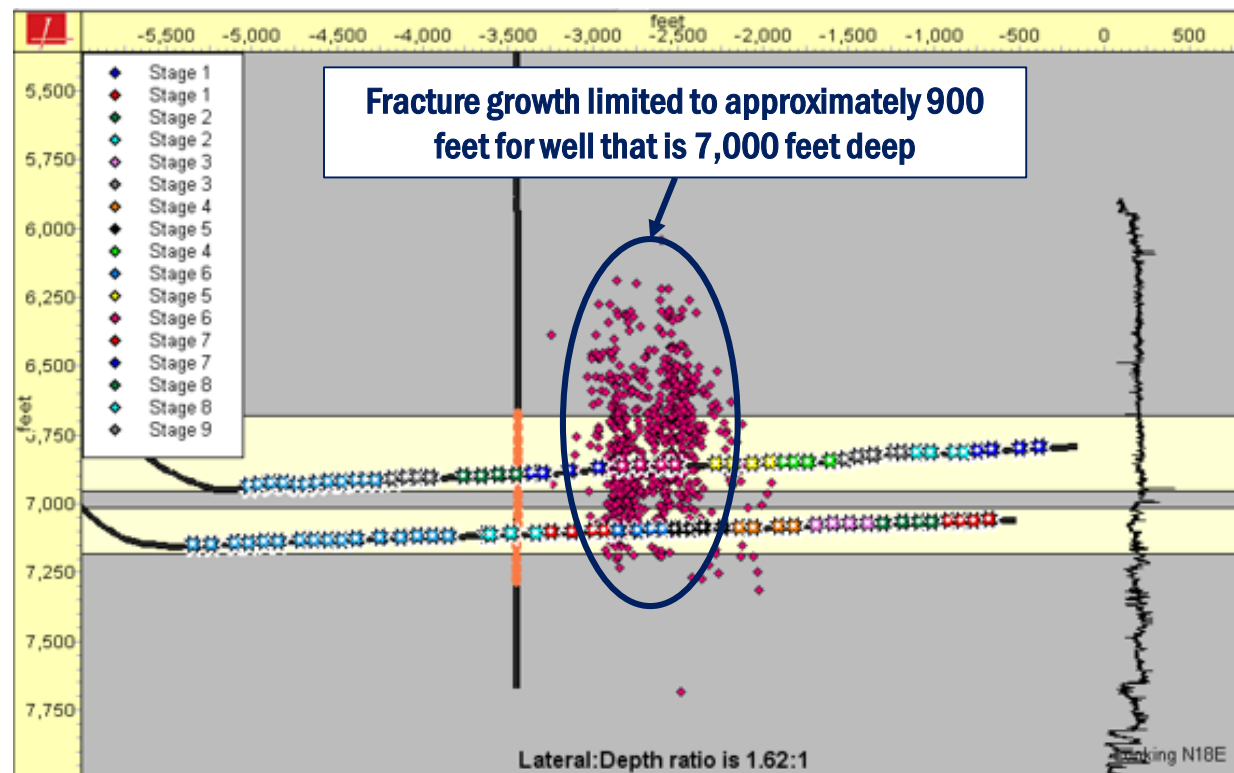


**A small amount of chemicals are added for various functions, all of which can be found in products in your home**

# Hydraulic Fracturing – Measuring Fracture Growth

Fracture height growth is limited and is nowhere near the shallow aquifer zones

Microseismic Data from LOGOS San Juan Basin Horizontal Mancos Gas Well

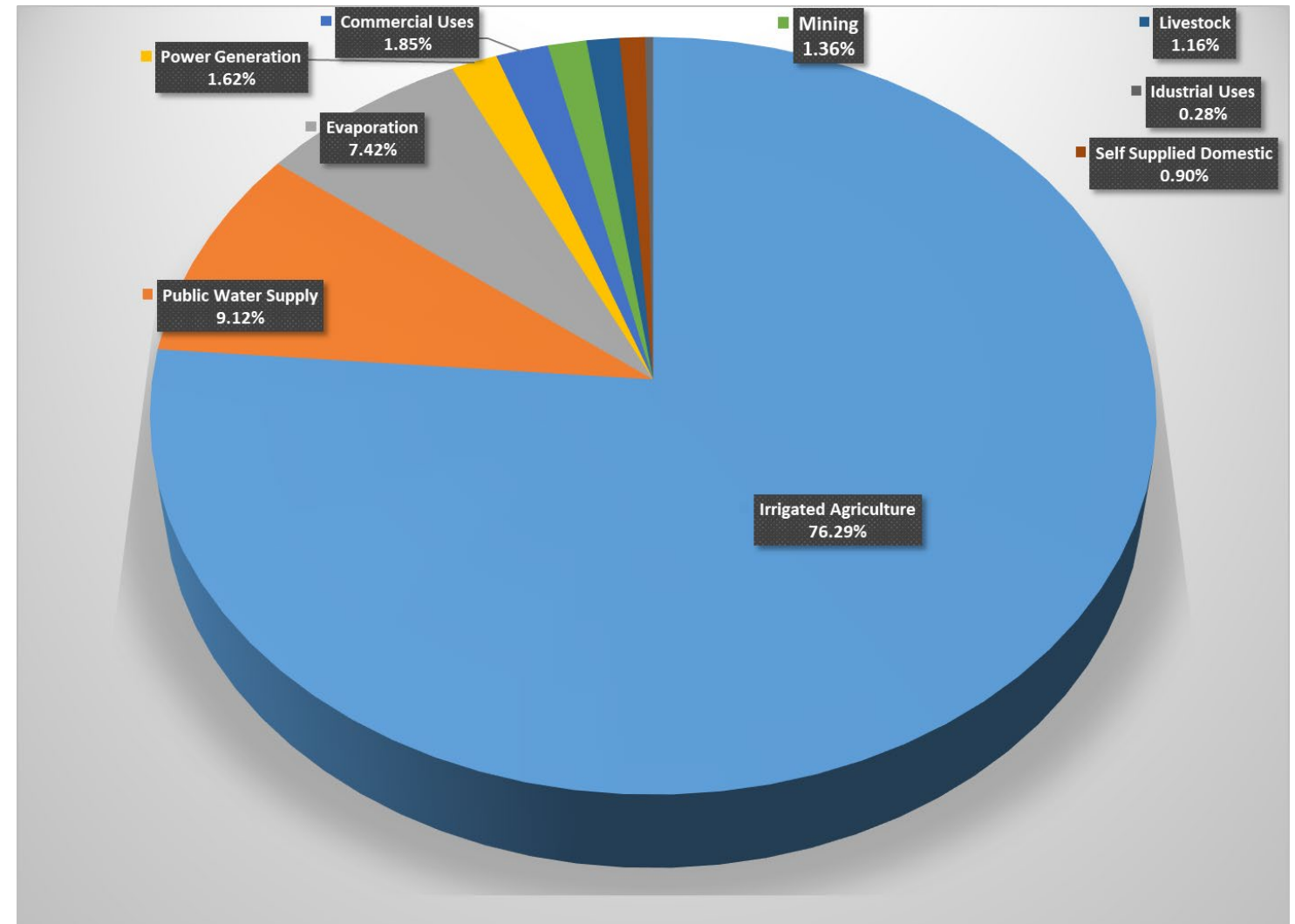




# 2015 New Mexico Water Usage

- In 2015, withdrawals for all water use categories combined totaled 3,114,255 acre-feet (AF).
- Overall Water Usage by and for Oil and Gas amounts to less than 0.25% of water used in New Mexico
  - Less than 16% of 1.36% Mining Usage (~6,534 AF)

## Oil and Gas Water Usage



Note: One acre-foot is the amount of water that would cover an acre of land to a depth of 1 foot, = 43,560 cubic feet, approximately 325,851 U.S. gallons

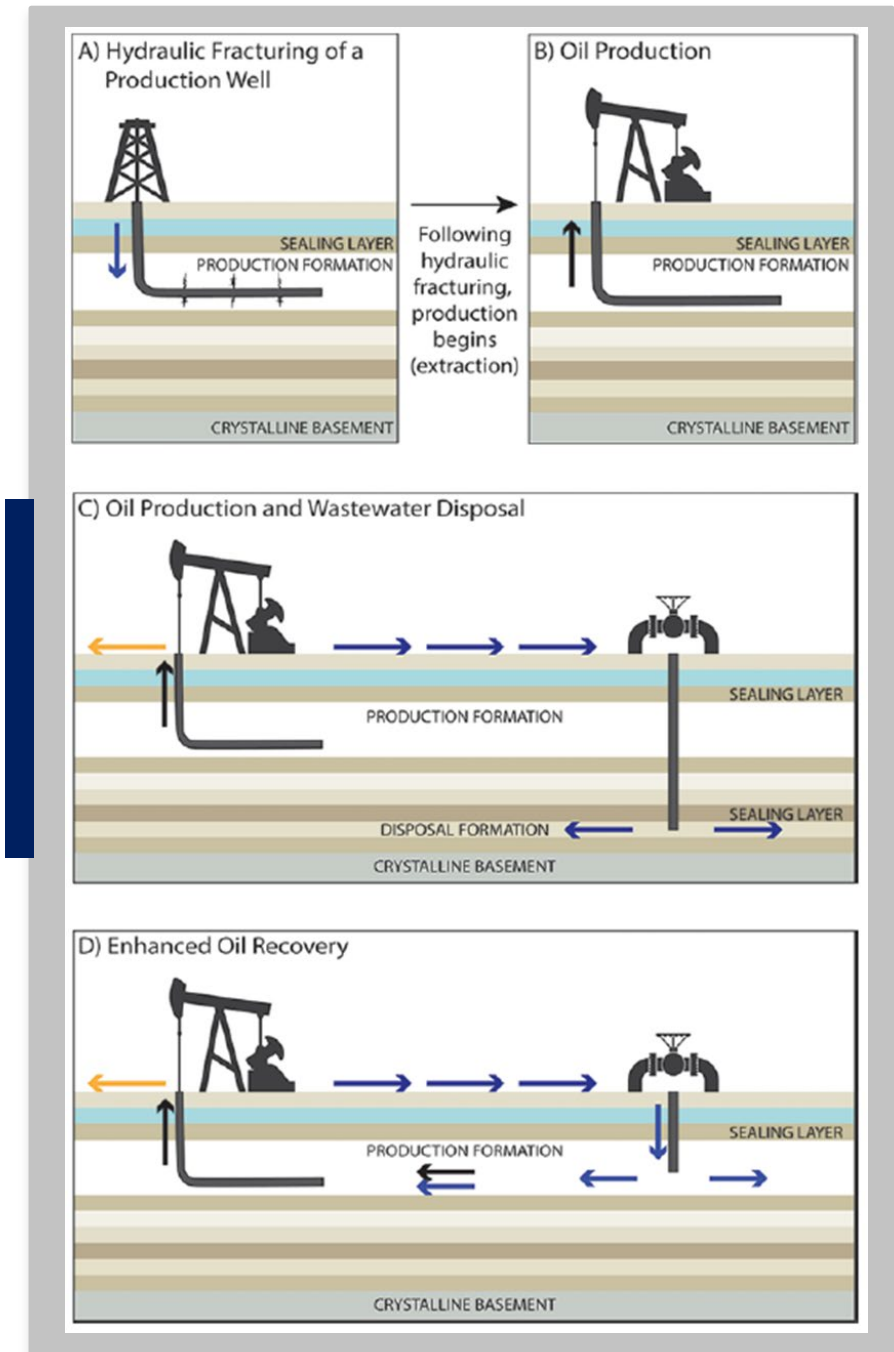
# Produced Water

- **Produced Water is the water that comes out of the reservoir with the oil and gas**

- The amount of water produced with the oil and gas fluid can range from 1:10 or 10:1 per barrel of oil depending on the formation
- Operators are looking for ways to re-use and recycle fracture fluid and produced water as well as put it to work for other beneficial use
- Excess “waste” water needs to be disposed or re-injected into the reservoir
- Disposal wells are non productive formations where water can safely be injected

- **Fracking does not cause earthquakes**

- Induced seismic activity in Oklahoma is due to massive injection of produced water into an area that already had high seismic activity
- Injection into Arbuckle formation has caused increased pressure in pre-existing faults
- Problem areas have ceased injection and successfully reduced seismic activity





# Hydraulic Fracturing Summary

- **Combination of horizontal drilling and hydraulic fracturing has revitalized the United States' and New Mexico's energy outlook with unprecedented oil production and revenue growth**
- **America's oil and natural gas production has more than doubled since 2005 driven by horizontal drilling and hydraulic fracturing**
- **EIA projects a 50% increase in world energy usage by 2050**
- **Hydraulically fracturing horizontal wells is the key technical breakthrough that will continue to allow the U.S. to be an important part in supplying the worlds energy needs**
- **Hydraulic fracturing is safe, is not a new technology and will be the future of further development**

Energy consumption in the United States (1776-2018)  
quadrillion British thermal units

