

Oil and Gas Operations: Production Techniques and Regulation in California



Department of Conservation

Overview

- Oil and Gas Production Fundamentals
- Well Stimulation in California
- Historic Regulation and Recent Regulatory Developments

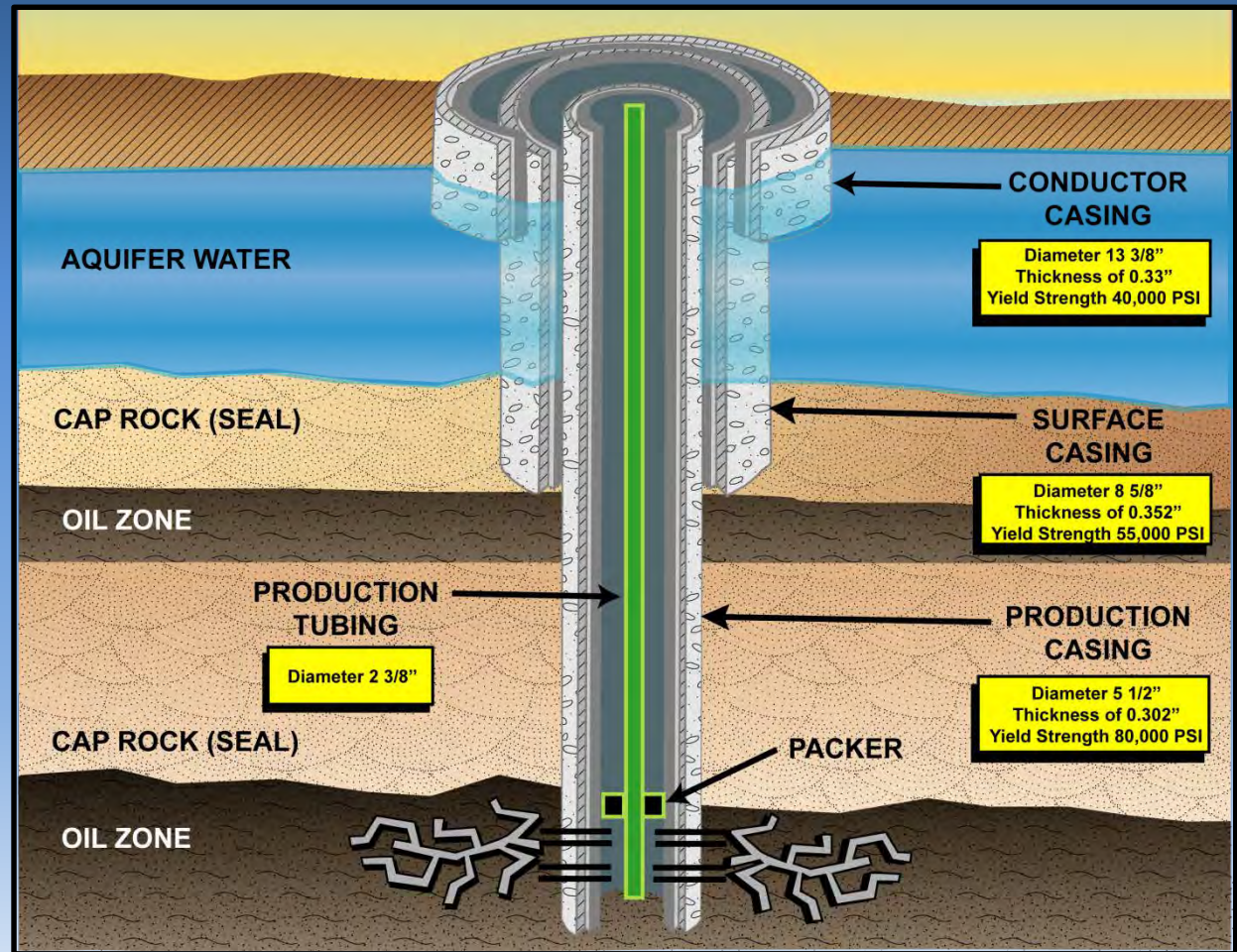


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Oil and Gas Production Fundamentals

Note:

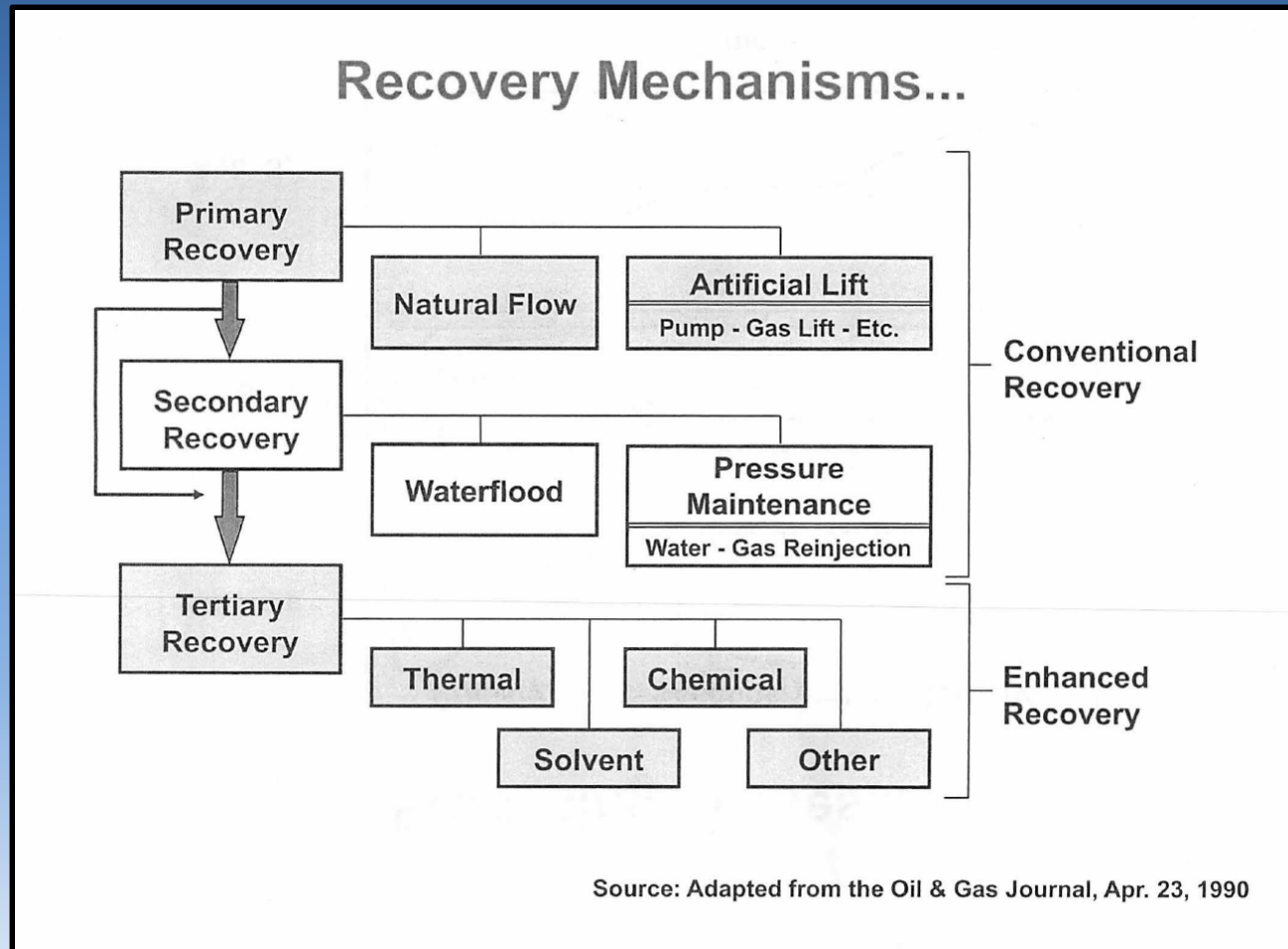
- Geology creates formations/zones
- Well construction



Source: CA Department of Conservation



Oil and Gas Production Fundamentals



Oil and Gas Production Fundamentals

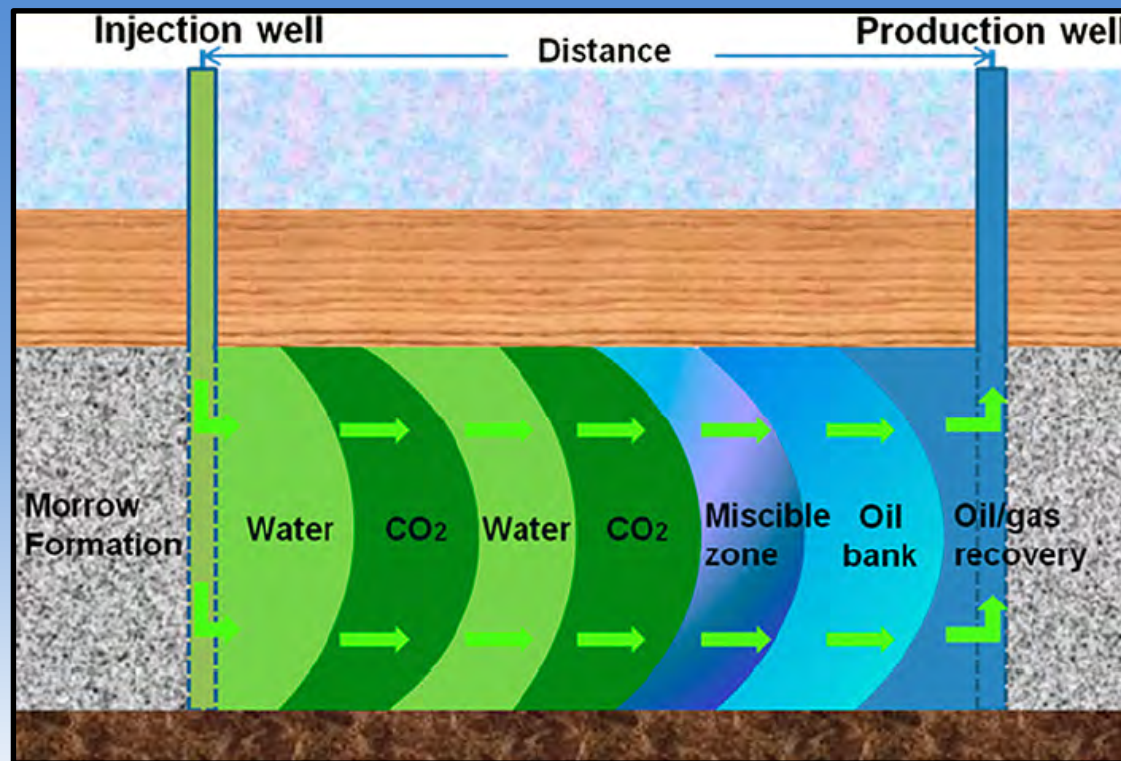
- Primary Recovery
 - Reservoir pressure drive
 - 5-15% of HC in formation recovered



Source: sjvgeology.org

Oil and Gas Production Fundamentals

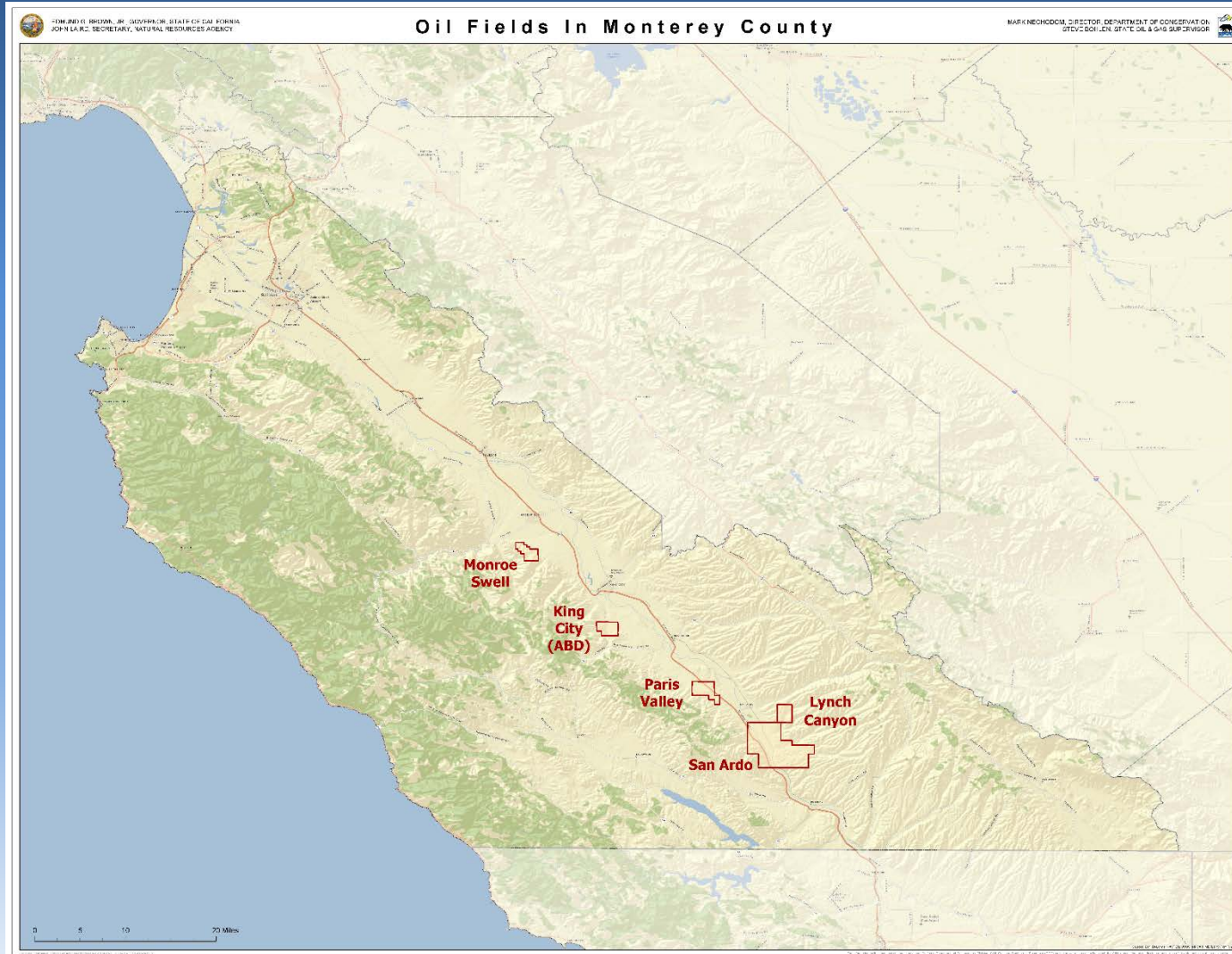
- Secondary Recovery
 - Applied pressure to reservoir (e.g., water flood)
 - Next 30% of HC in formation recovered



Oil and Gas Production Fundamentals

- Tertiary Recovery
 - Increase mobility of hydrocarbon in formation
 - Next 5-15% of HC recovered
 - Could include steaming operations (i.e., water flood with steam or cyclic steaming)
 - Could include hydraulic fracturing of formation

Monterey County Oil & Gas Production



Monterey County Oil & Gas Production

- Production, 2012

Oil (bbls)	Water (bbls)	Gas (Mcf)
7,410,445	112,839	1,204,383

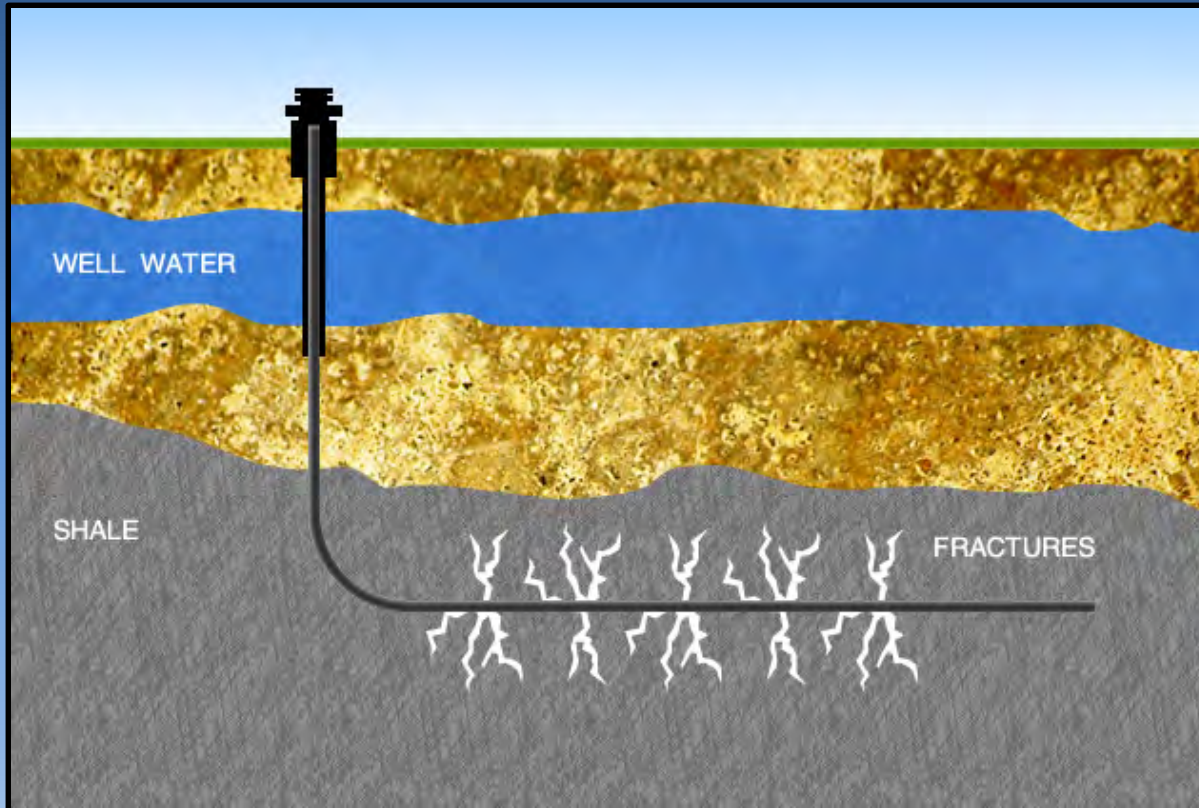
- Injection, 2012

Water/Steam (bbls)	Gas/Air (Mcf)
102,778,542	25,357

- Active Wells, 2013

Production	Injection	Disposal
969	118	30

What is Hydraulic Fracturing ?



- Increase permeability of oil-/gas-bearing formations
- Use of water, proppant, and chemicals to open fissures to allow oil/gas to flow to well
- Recent development? Combination of multi-stage HF in long, horizontal formation
- “Tight” shales or other types of formations require HF

Source: <http://today.uconn.edu/blog/2011/12/fracking-%E2%80%93-good-news-or-bad-for-america%E2%80%99s-energy-needs/>



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Land Use Impacts



Source: www.hittinghome.org

North Dakota -- Before and After



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Land Use Impacts

Existing California
Oilfield
Operations, Lost
Hills Field

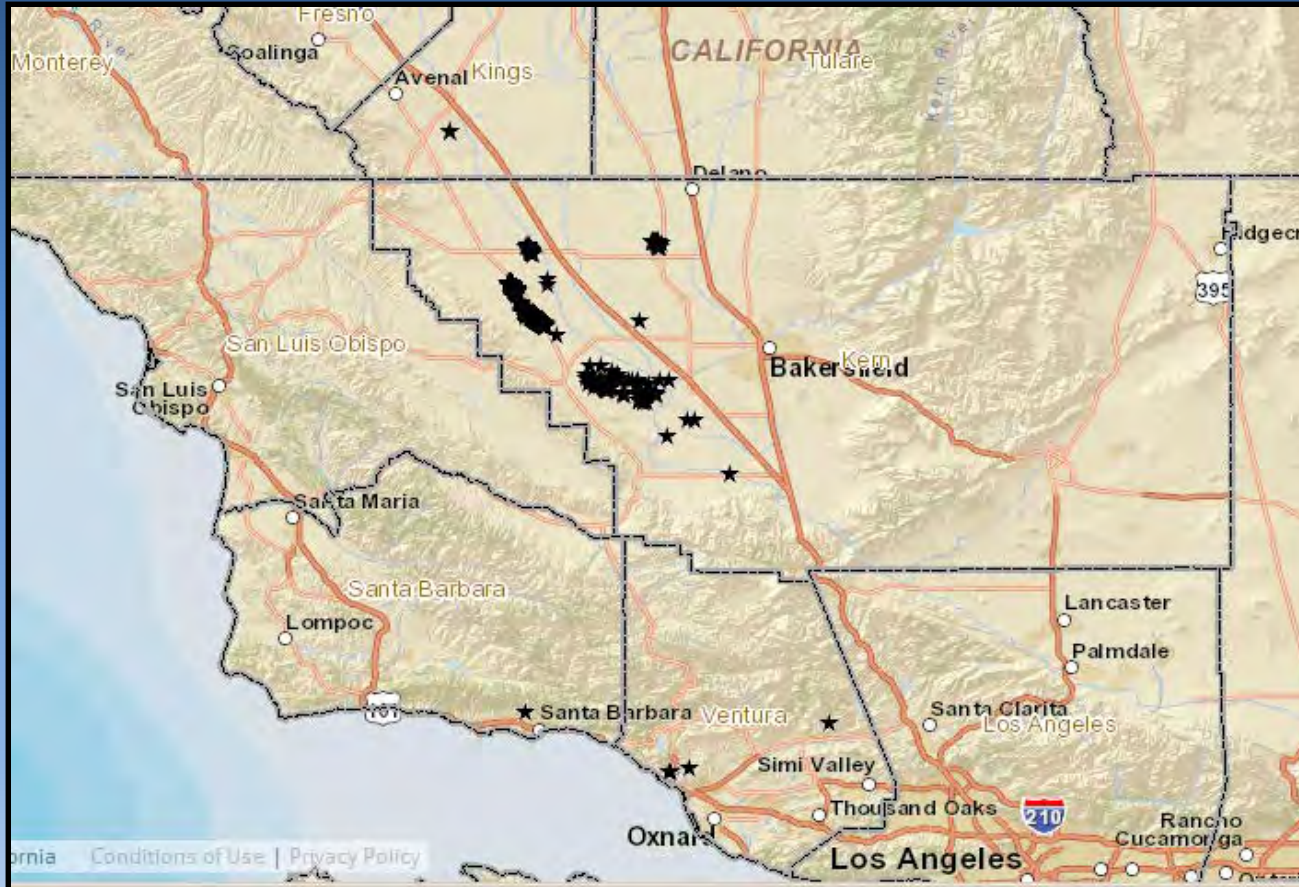


Source: www.aeraenergy.com



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Hydraulic Fracturing in CA – 2013 to date



Source: conservation.ca.gov



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The Monterey Shale?

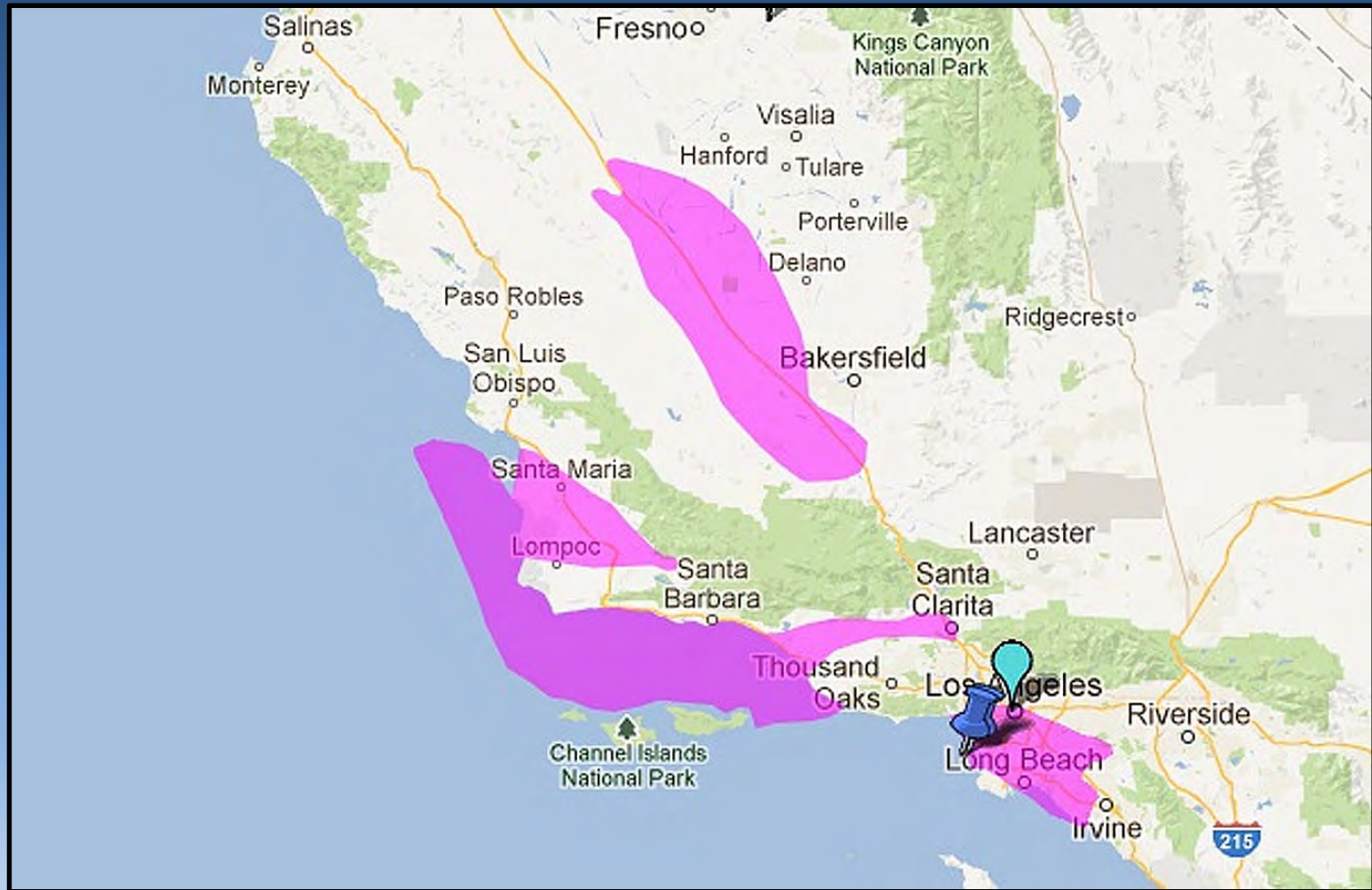


Source: <http://energyinnovation.org>



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The Monterey Shale?

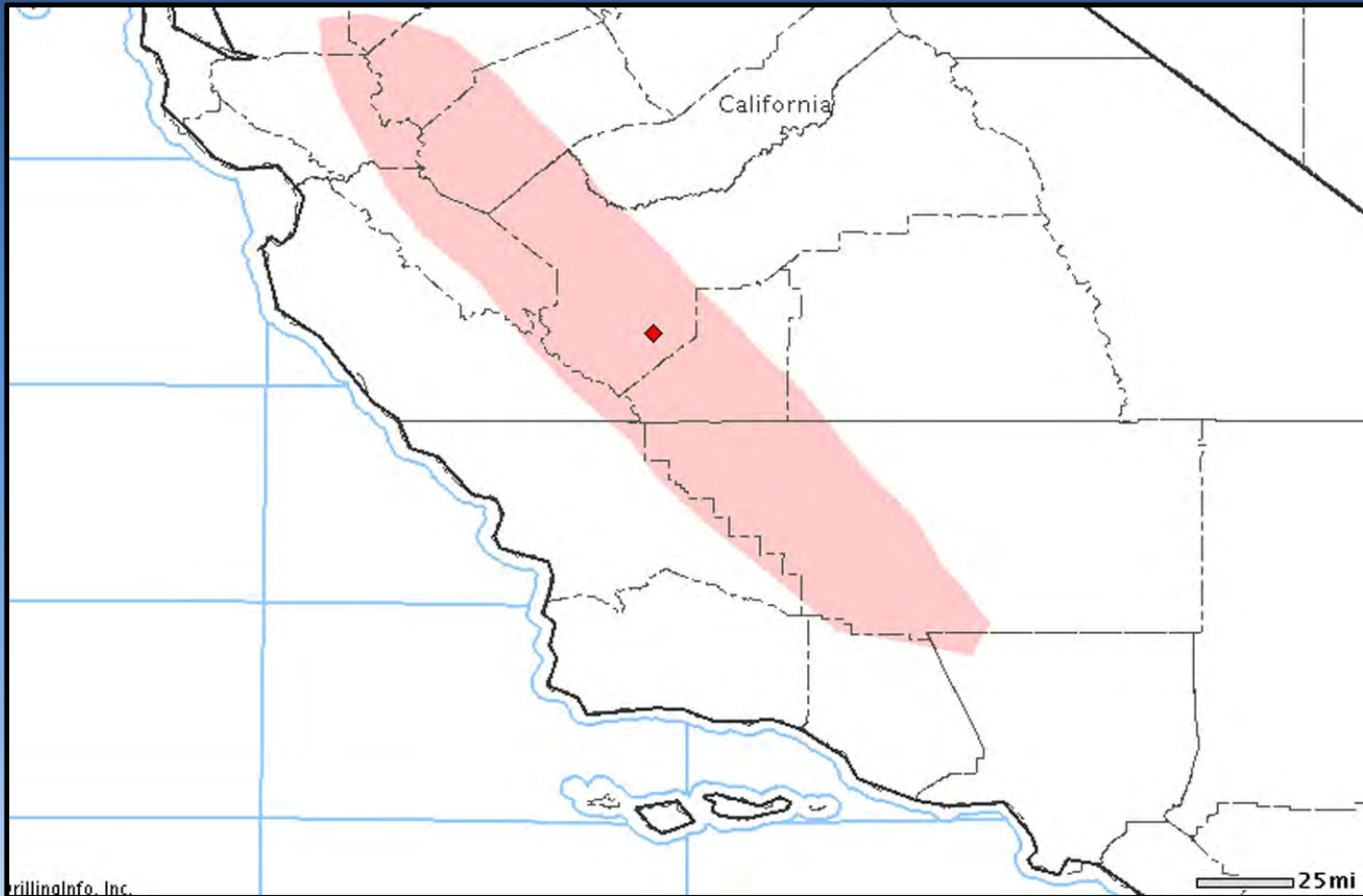


Source: <http://www.indybay.org>



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The Monterey Shale?

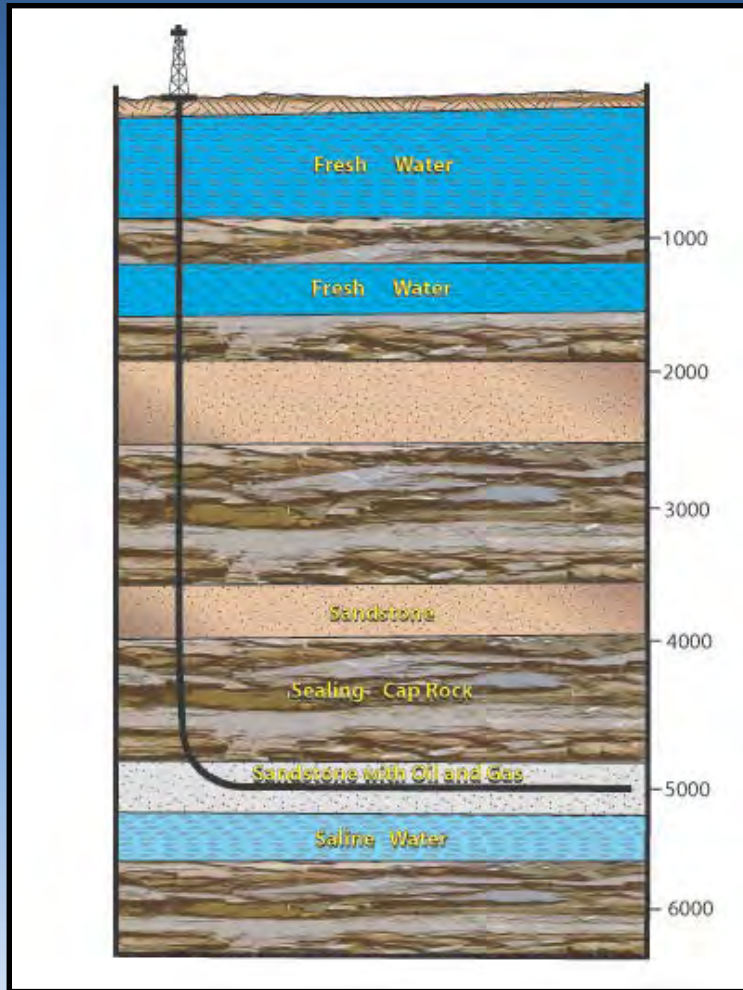


Source: <http://info.drillinginfo.com>

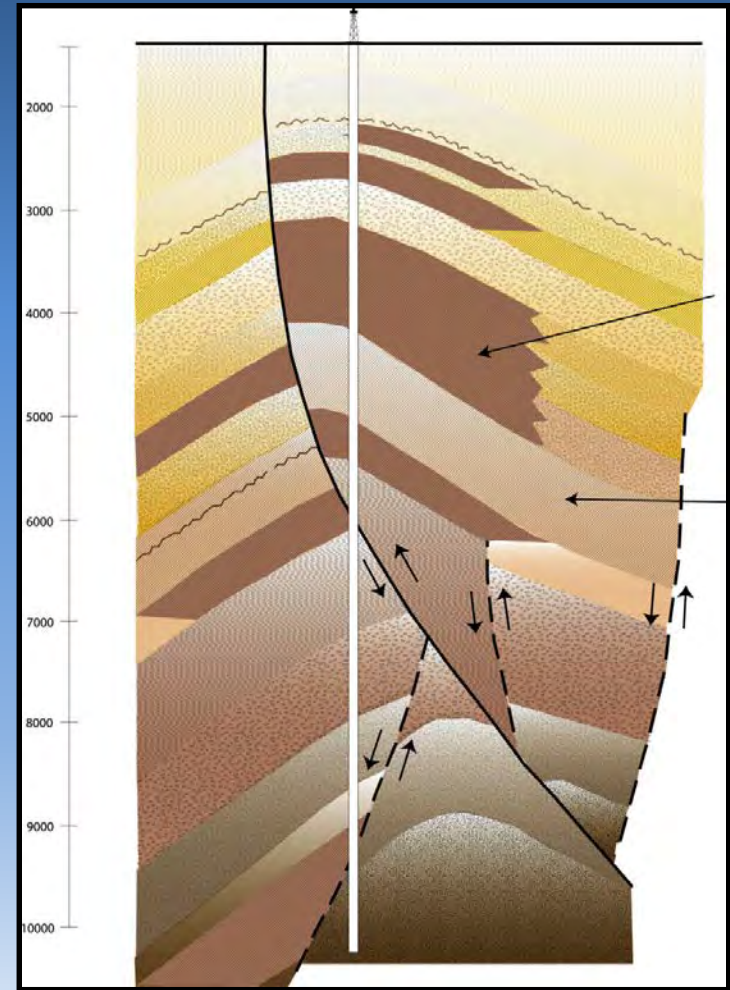


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Geology of Oil and Gas Deposits



Source: CA Dept of Conservation

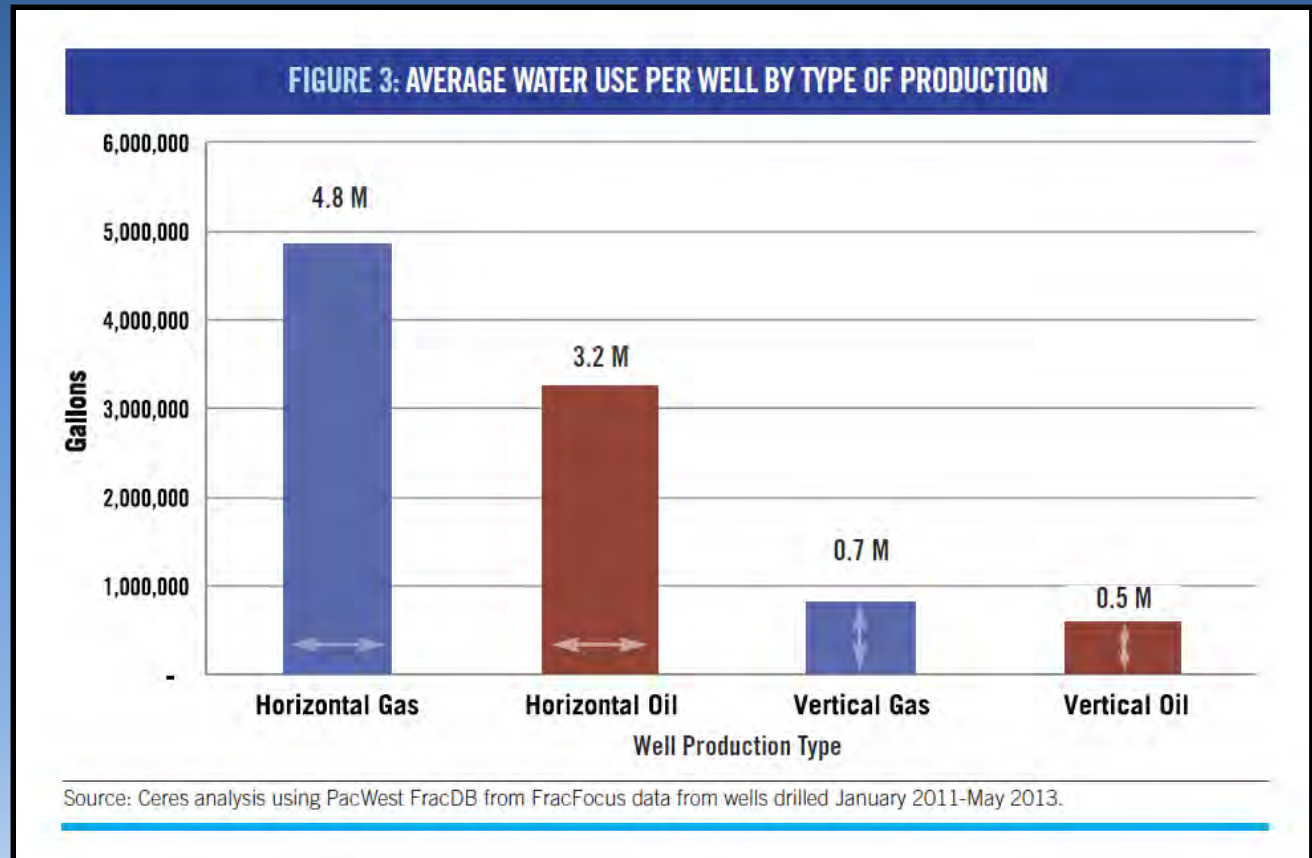


Source: CA Dept of Conservation



Water Use in Hydraulic Fracturing

- Nat'l water use for HF in 2014
- CA avg. water use per HF ≈ 160,000 gallons
- Total CA water use all HF in 2013 ≈ 300 acre feet



Source: "Hydraulic Fracturing & Water Stress: Water Demand by the Numbers"
www.ceres.org, Boston, MA, Feb. 2014



Historic Regulation

- Well Construction Standards
 - Focus on competent well bores
 - Ensure “zonal isolation”
- Facilities regulation
 - Covers pipelines, collection/separation vessels / tanks
 - Includes Spill Prevention and Contingency Planning



Senate Bill 4

Permanent Regulations

- Will require:
 - Permit from DOGGR
 - Neighbor notification
 - Pre-WST evaluation of formation & well
 - Monitoring during and after WST
 - Water quality monitoring plans and water management plans
 - Public disclosure of job and chemicals used
- Process for adoption



Senate Bill 4

Interim Regulations

- **Now** require:
 - Neighbor notification
 - Pre-WST pressure testing of well and surface equipment
 - Water quality monitoring plans
 - Disclosure of HF fluid content
 - Public disclosure



Senate Bill 4

“Well Stimulation” EIR and Independent Scientific Study

- EIR
 - WST as a “project”
 - Process for EIR
- Independent Study
 - Procurement near complete
 - SB 4 direction and scope of study



Conclusion



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