



Department of
Conservation



Department of Conservation Division of Oil, Gas, and Geothermal Resources Bill Bartling – Inland District Deputy

OVERVIEW OF THE DIVISION OF OIL, GAS & GEOTHERMAL
RESOURCES (DOGGR) – PREVENTION FIRST CONFERENCE –
SEPTEMBER 28, 2016 – LONG BEACH CA

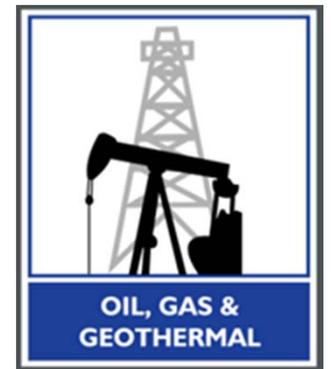
DOGGR mission

Three elements form the foundation for DOGGR operations. The Aquifer Exemption and UIC technical analyses have an emphasis on protection of waters with beneficial use. Beneficial uses of water include:

- Public drinking water supplies
- Residential use
- Agriculture and livestock
- Industrial
- Enhanced oil recovery

The Division supervises the drilling, operation, maintenance, and P&A of oil, gas, and geothermal wells, to prevent damage to:

1. life, health, property, and natural resources
2. underground and surface waters suitable for irrigation or domestic use
3. oil, gas, and geothermal reservoirs



risks on everyone's minds

Oil and gas production provides broad economic and social benefits, but it also comes with risks and impacts that must be effectively addressed

Water Quality

- aquifer exemption process and UIC reviews protect Underground Sources of Drinking Water (USDW)

Hydraulic Fracturing

- first two permits issued under SB4 law - process was rigorous – took over a year

Earthquakes

- State Geologist has stated that unlike Oklahoma, there is no evidence for historic oilfield induced seismicity in California
- California is geologically and operationally not the same as Oklahoma and the geology here is not conducive to generating earthquakes from oilfield activities
- nevertheless, we continue to monitor and study earthquakes

Fugitive emissions

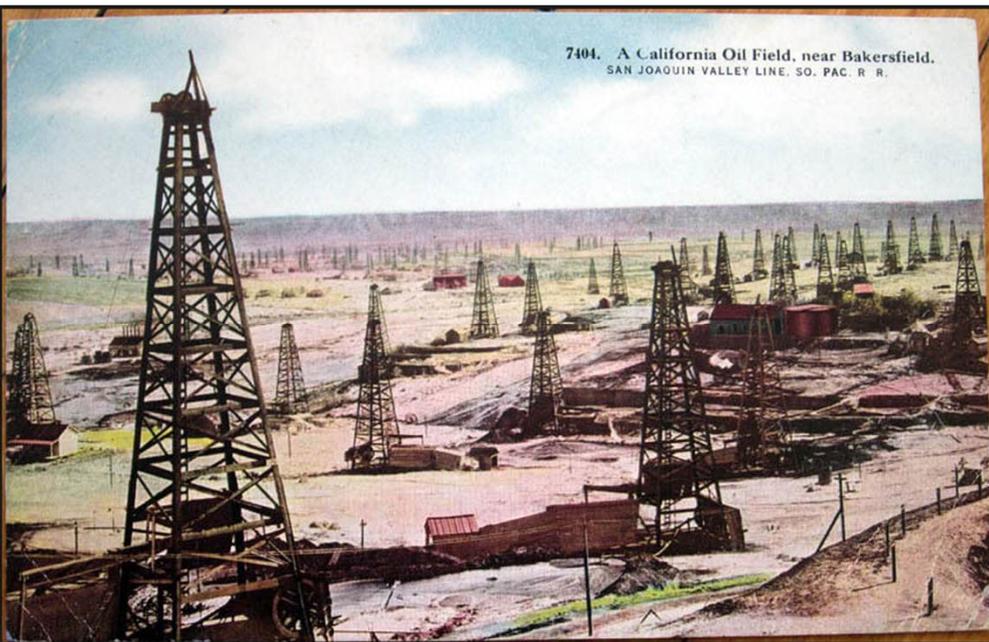
- Aliso Canyon illuminated the issue
- many studies underway, new legislation under consideration

Leaks

- DOGGR regulates leaks from producing infrastructure. New laws drafted to govern programs intended to minimize leaks from tanks, wells and pipelines

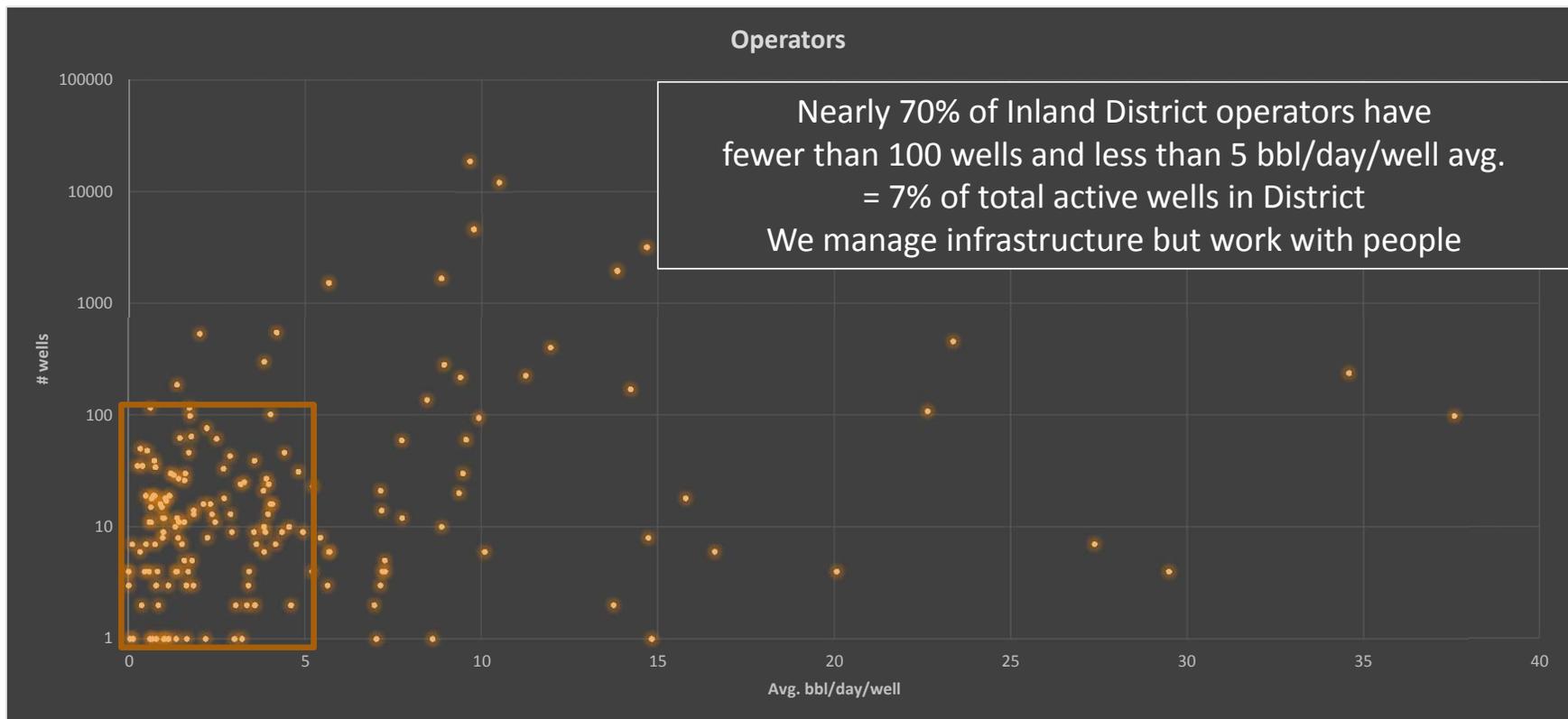


DOGGR through time 1915 - 2016



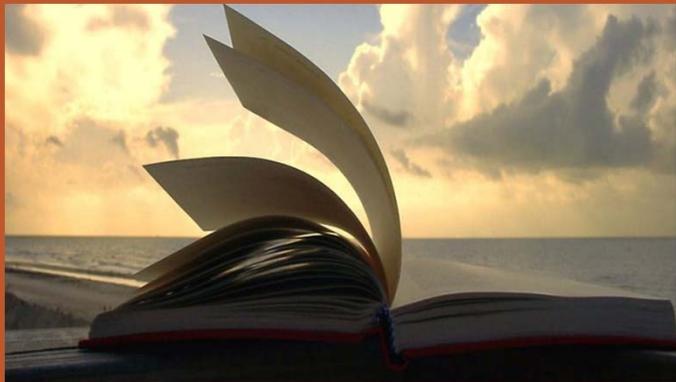
2015 – DOGGR Renewal Plan authored

operator population profile



renewal plan

Four areas of improvement – turning the page on the past



Regulatory Overhaul

- Injection Projects Review to be completed by October 2018
- Aquifer Exemption Review Under way – currently processing 23 applications, most with multiple aquifers

New Regulations

- Well Stimulation - First SB4 permits have recently been issued
- Underground Injection Controls - New draft regulations under review
- Gas Storage - Aliso Canyon has spawned new legislation and new regs. New regs have been issued with wide-ranging application to other state storage sites.
- Idle Wells – new rules for managing and abandoning

Modernize Data Management

- New database and modern analytical and modeling software
- Research projects with the National Laboratories

Ensure a High Quality Work Force

- Hiring highly skilled people recently surplus from oil companies, and training the entire workforce



Research Projects with National Labs and others



- **Earth Observatory (LLNL)** – looking at hydraulic fracture behavior including extent and density via geomechanical modeling and simulation
- **Gas Storage** – Natural gas storage integrity, wellbore integrity and improvement of blowout kill methods
- **Induced seismicity (LBNL)** – assessing the potential of oilfield activities to contribute to seismicity
- **Training** - Hydraulic Fracturing geomechanics
- **Remote Sensing and data processing** – LiDAR, etc.
- **Surface/subsurface integration** – understanding reservoir systems
- **Multi-variate statistical analysis** – risk analysis and portfolio prioritization

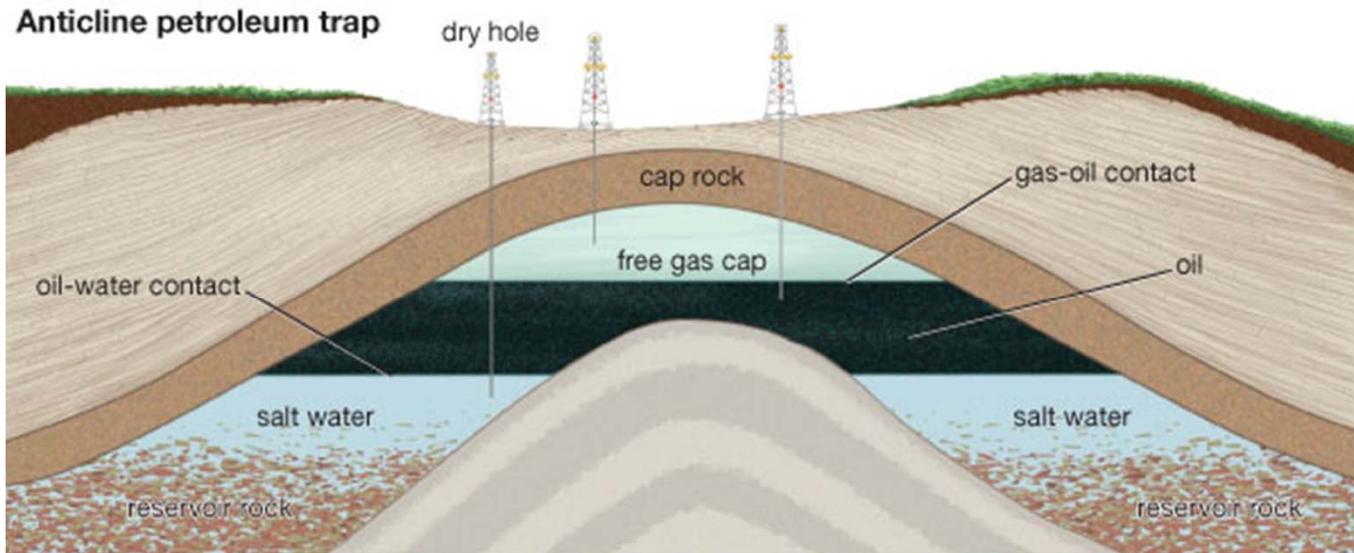


major initiative 1

aquifer exemptions

Authorized by US EPA under the federal safe drinking water act.

Only the US EPA can exempt an aquifer. The State agencies (DOGGR and Water Boards) only enforce Federal and State laws, and submit applications for exemption that have passed rigorous technical evaluation for review and determination by US EPA.



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- collect and analyze scientific and engineering data to document areas of hydrocarbon concentrations
- define the geological features that contain the hydrocarbons and associated water
- sub-surface rock formations must meet specific Federal and State criteria to be classified as exempt
- these are designed to ensure that underground sources of drinking water (USDW's) remain protected.



waters of the san joaquin valley

Waters are fresh on the east, saline on the west and fresh above saline in the middle.

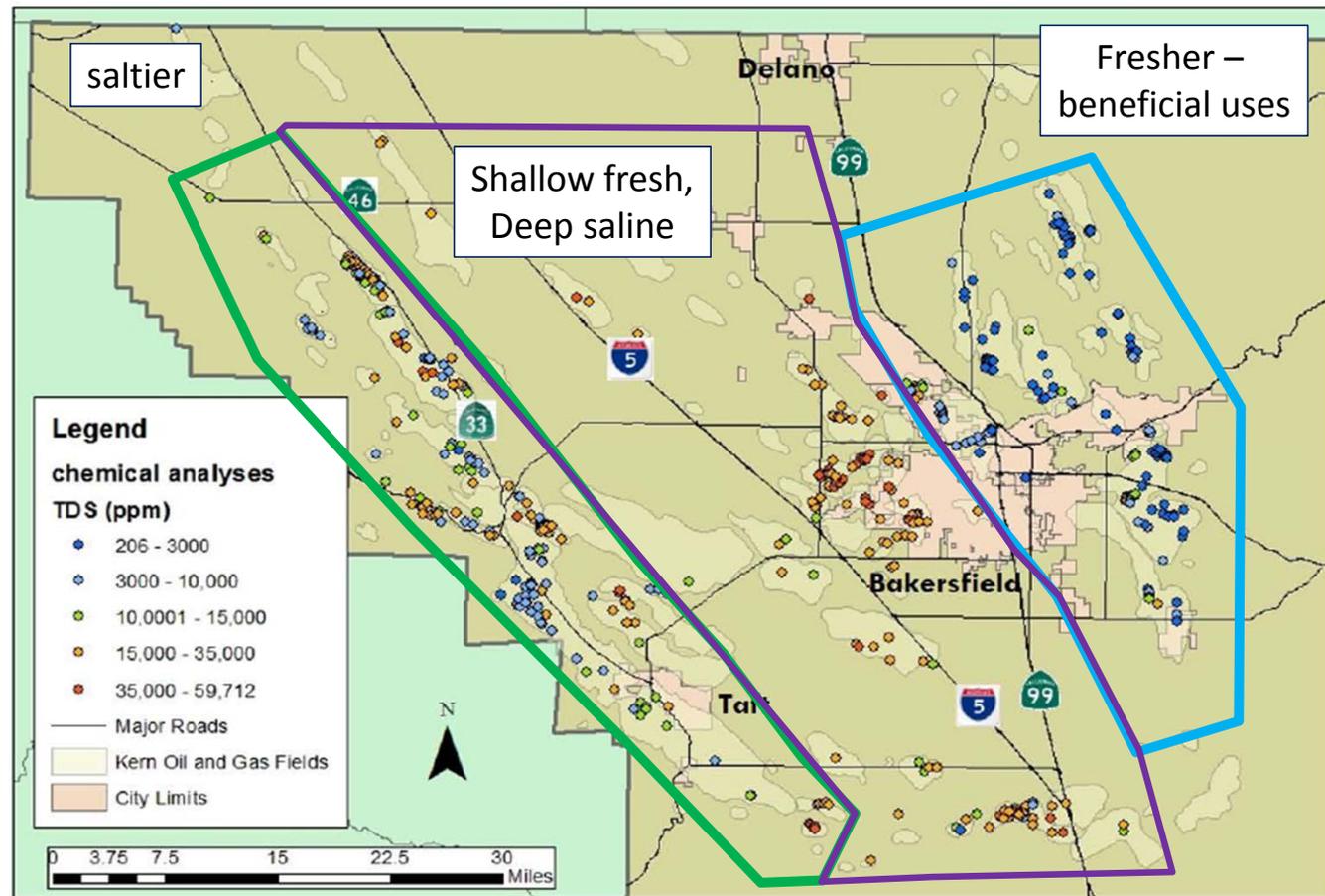
This is due to:

fresh water recharge from the Sierra Nevada range via the Kern River and other waterways

sparse rainfall in the west to dilute saline formation waters

deeper formations deposited in marine environments in the central and western areas

Figure from:
Gillespie, Kong and Anderson –
CSUB 2016



federal exemption criteria



Exemption criteria as specified in 40 CFR 146.4

a) The aquifer does not currently serve as a source of drinking water

b) The aquifer cannot now, and will not in the future, serve as a source of drinking water because:

1) It is mineral, hydrocarbon, or geothermal energy producing, or can be demonstrated by a permit application for a Class II operation to contain hydrocarbons that considering their quantity and location are expected to be commercially producible

OR

2) The aquifer is situated at a depth or location that makes the recovery of water for drinking water purposes economically or technologically impractical

OR

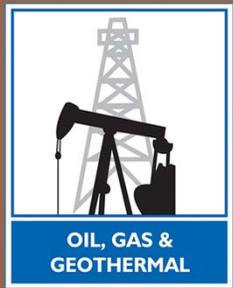
3) The aquifer is so contaminated by natural or unnatural sources that it would be economically or technologically impractical to render that water fit for human consumption

OR

c) TDS is more than 3,000 and less than 10,000 and it is not reasonably expected to supply a public water system.



state exemption criteria



Exemption criteria as specified in PRC 3131(a)

1. Criteria set forth in Section 146.4 of Title 40 of the Code of Federal Regulations have been met
2. The injection of fluids will not affect the quality of water that is, or may reasonably be, used for any beneficial use
3. The injected fluid will remain in the aquifer or portion of the aquifer that would be exempted

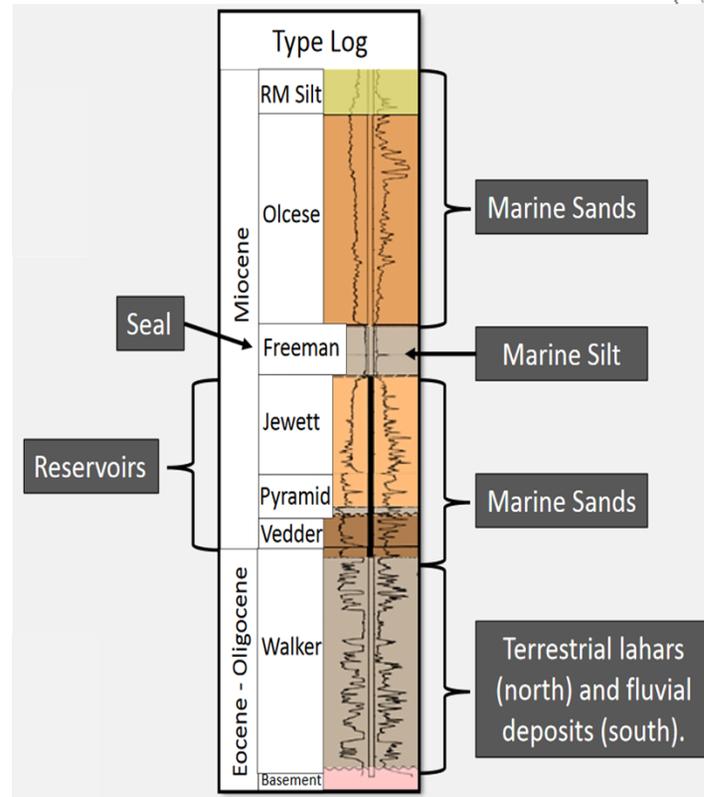
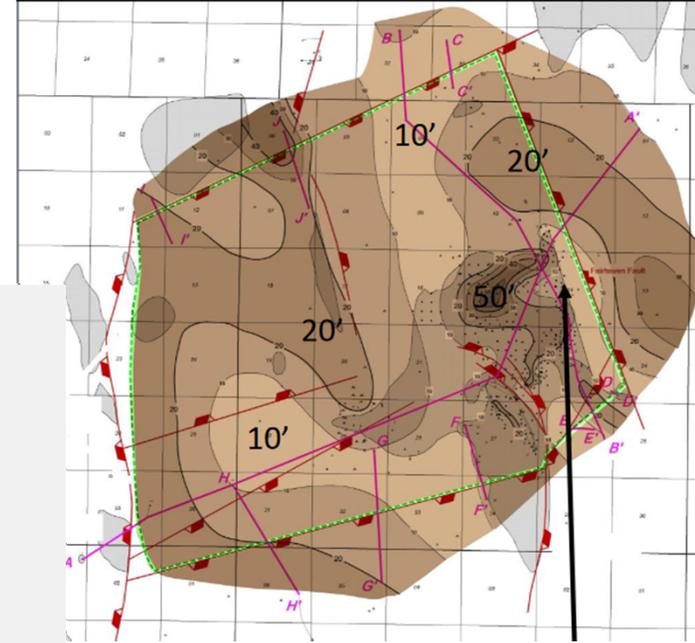
vertical stratigraphic containment

It must be demonstrated that zones proposed for exemption are stratigraphically isolated from actual or potential zones with waters with beneficial use.

Vertical permeability and the lateral extents and thickness of stratigraphic confining layers must be documented

The distribution and thickness of stratigraphic confining layers are defined and mapped from well and geophysical data

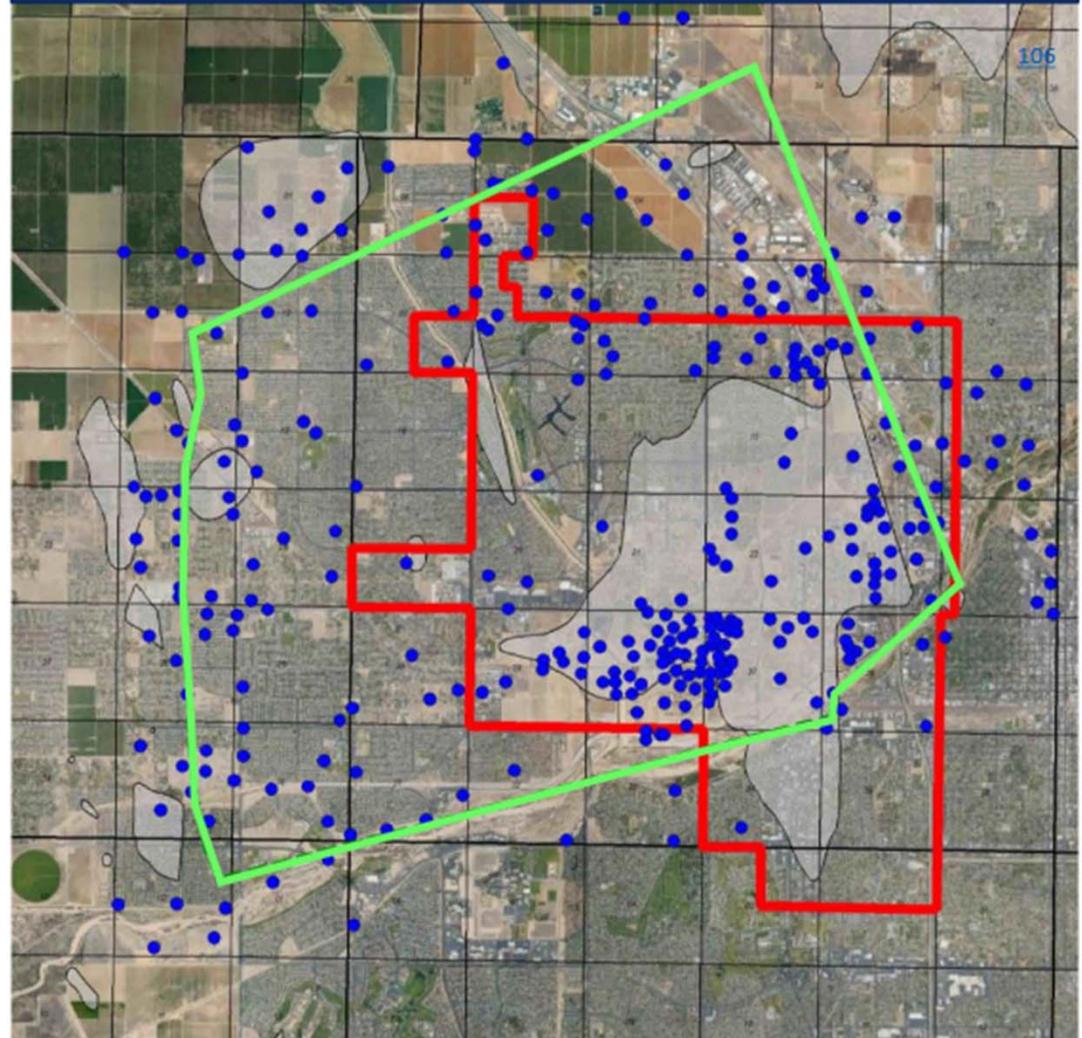
Isopach Map of the Overlying Confining Shale



mapping water wells

All water wells which produce for beneficial use within and for an effective distance beyond the proposed exemption area are mapped and analyzed to determine if there is any current, or risk of any future hydrologic connectivity to the zone being proposed for injection.

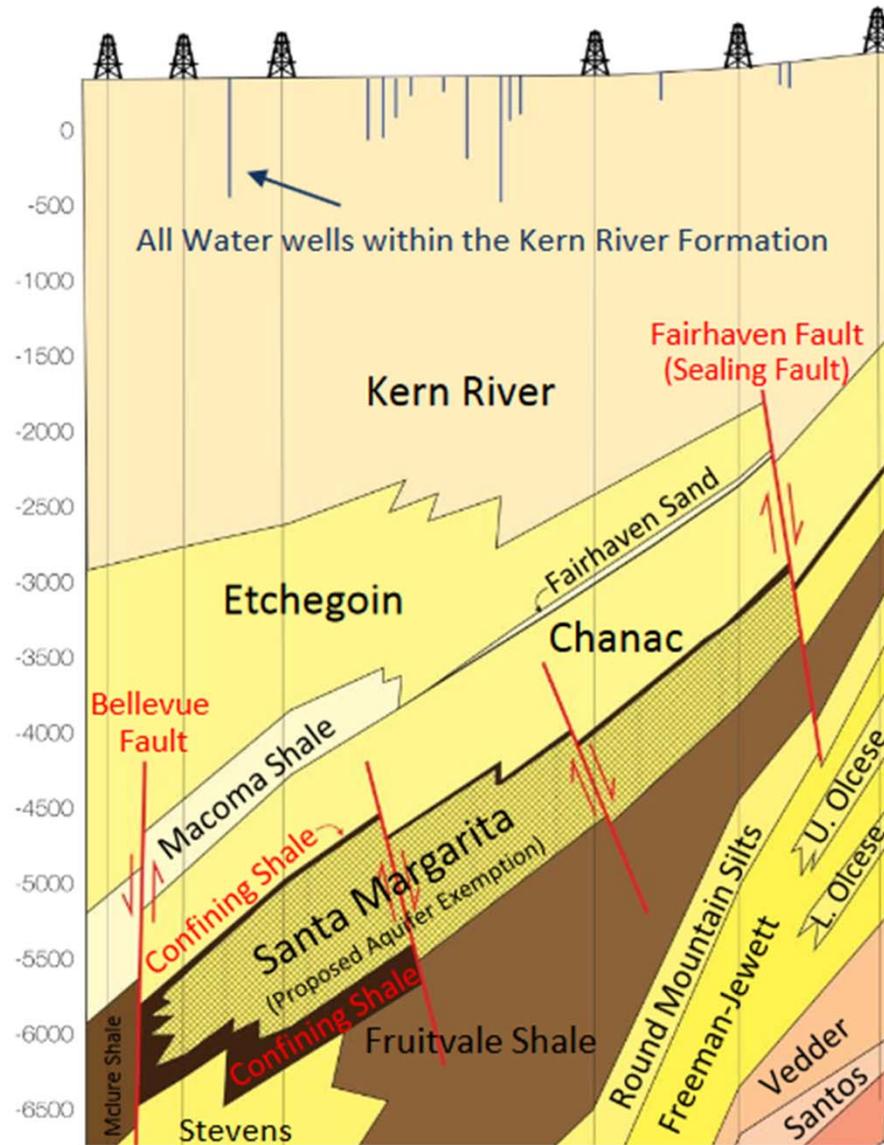
Active Water wells in the project area



isolation of water wells from exemption zone

It must be demonstrated that the proposed exempted zones have containment boundaries, such as impermeable shales, faults or stratigraphic pinchouts to ensure that injected fluids remain in the exempted zone.

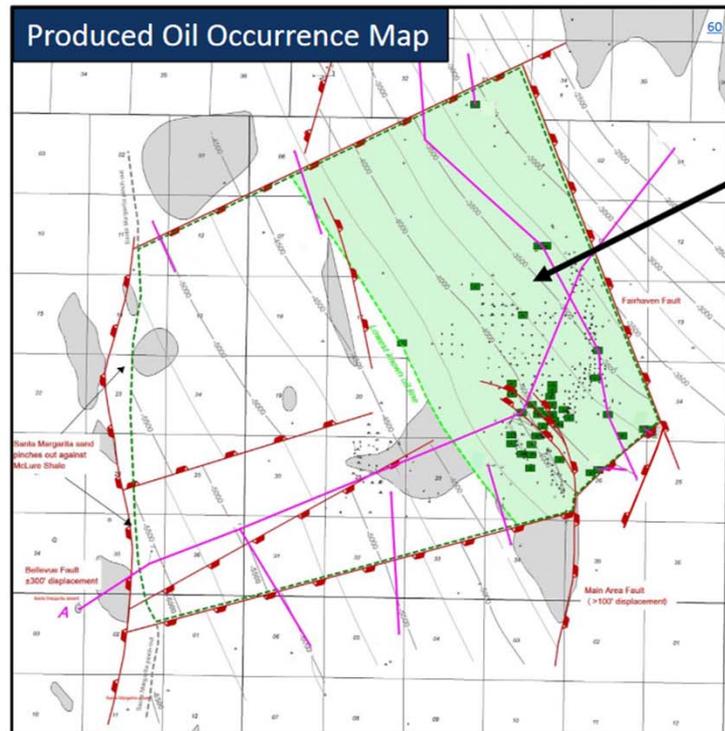
This diagram shows a proposed exempted zone and the water wells in the area, completed several thousand feet above and separated from the proposed exempted zone.



hydrocarbon producing

As a key criteria for exemption is the presence of hydrocarbons in the aquifer, documentation is cataloged from producing wells, subsurface samples and well logs to map the extent of these hydrocarbons.

Water produced with oil from these zones is in an emulsified state. These waters, and the waters remaining in the aquifer often have high salinities and nearly universally contain dissolved or entrained components of the hydrocarbons making the water unfit for any beneficial use.



- Historically producible oil in the Santa Margarita Formation
- Up to 55% pore space oil saturation

 Hydrocarbon Producible Area

 Well with oil occurrence and/or historical production



water chemistry

Typical water chemistry analysis including drinking water standards, proposed exempted aquifer chemistry and proposed injectate water chemistry.

Note that in this case, the quality of the injectate is higher than the native formation waters although still exceeding Drinking Water Standards. Over time, these formation waters will continue to freshen through this process.

| Constituent | CA Title 22 Drinking Water Standards Max. Contaminant Level (mg/l) | Avg. Santa Margarita Fm. Measured Contaminant Level (mg/l) | Proposed Injectate Measured Contaminant Level (mg/l) | |
|--------------------------------|---|---|---|--|
| Total Dissolved Solids* | 1,000 | 7,179 | 1,800 | |
| Chloride | 500 | 3,818 | 140 | Meets drinking water standards. ¹² |
| Iron | 0.3 | 2,864 | 0.61 | |
| pH | 8.5 Units | 9 | 7.85 | |
| Sulfate | 500 | 322 | 23 | Exceeds drinking water standards. |
| Specific Conductance | 1,600 Micromohs | 14,493 | 2,700 | |
| Boron | 1 | 7 | .47 | Exceeds drinking water standards but is less than existing formation contaminants. |
| Calcium | 120 | 369 | 120 | |
| Magnesium | 120 | 43 | 39 | |
| Potassium | - | 77 | 13 | |
| Sodium | 100 | 2,005 | 310 | |
| Benzene (µg/l) | 1 | 2,705 | - | Proposed injectate does not degrade aquifer quality |
| Ethylbenzene (µg/l) | 680 | 2,696 | - | |
| Toluene (µg/l) | 100 | 2,043 | - | |
| Xylene (µg/l) | 1,750 | 2,656 | - | |



California's SGMA

Requires finding new sources of water



- develop regulations to revise groundwater basin boundaries
- adopt regulations for evaluating and implementing Groundwater Sustainability Plans (GSPs) and coordination agreements
- identify basins subject to critical conditions of overdraft
- ***identify water available for groundwater replenishment***
- publish best management practices for the sustainable management of groundwater.



oil and agriculture do mix

Cawelo Water District Produced Water Project

For more than 2 decades, ~29 million gallons of filtered and treated water per day, 10.4 billion gallons per year, have been delivered to agricultural uses

- water quality analysis reported the levels of acetone in Cawelo's produced water were 280 times below the maximum concentration considered safe for drinking water;
- petroleum hydrocarbons in Cawelo's produced water were 750 times below the maximum concentration considered safe for drinking water
- crops irrigated with Cawelo's produced water had the same chemical composition as crops irrigated with other water supplies.
- other fields also provide water to agricultural districts



thank you for listening





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