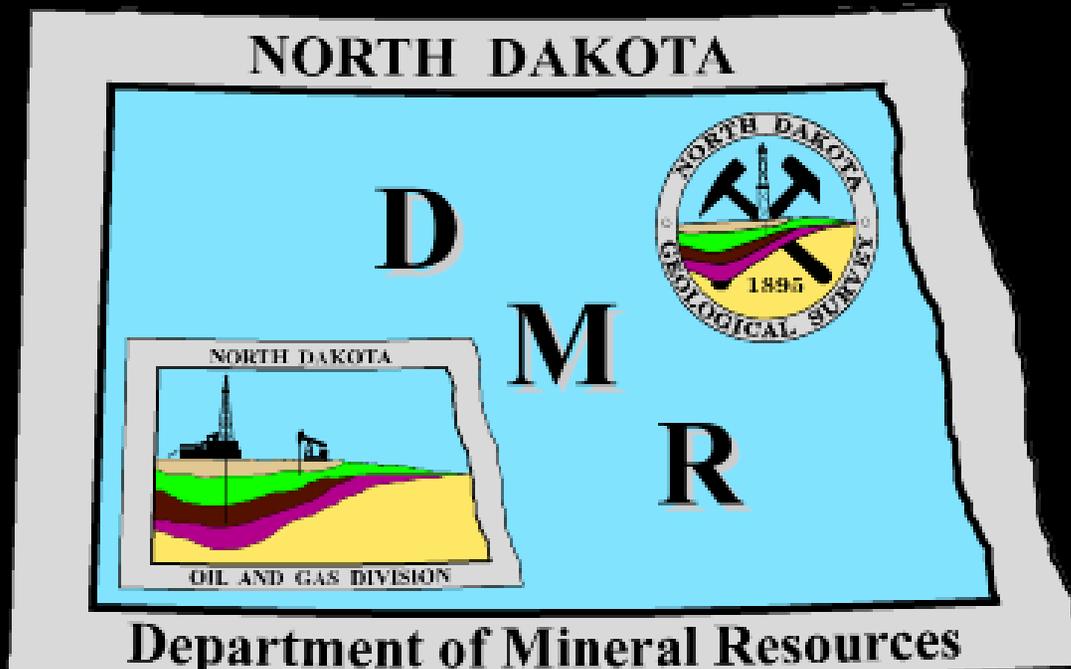


North Dakota Department of Mineral Resources



<http://www.oilgas.nd.gov>

<http://www.state.nd.us/ndgs>

600 East Boulevard Ave. - Dept 405

Bismarck, ND 58505-0840

(701) 328-8020

(701) 328-8000

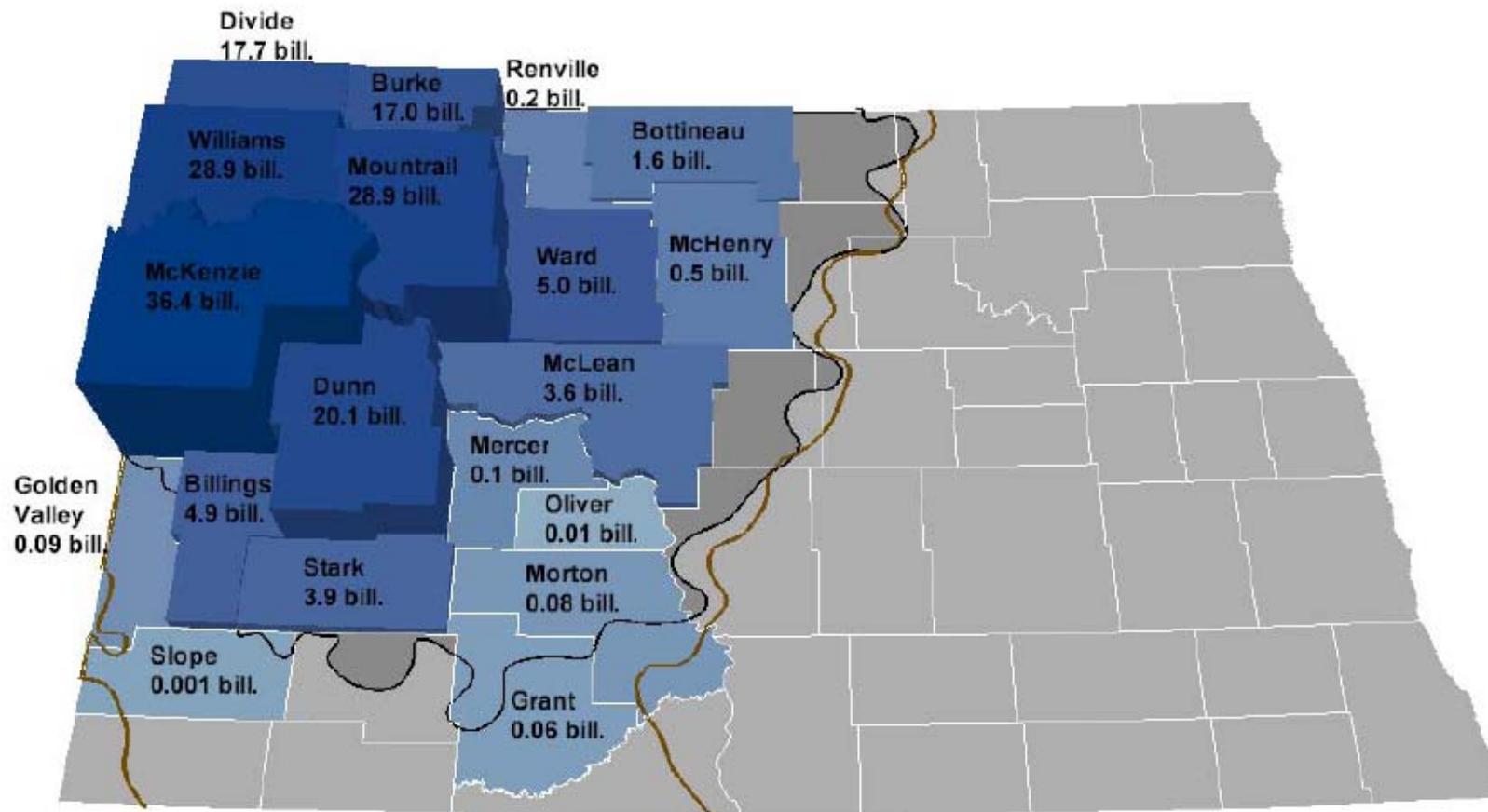
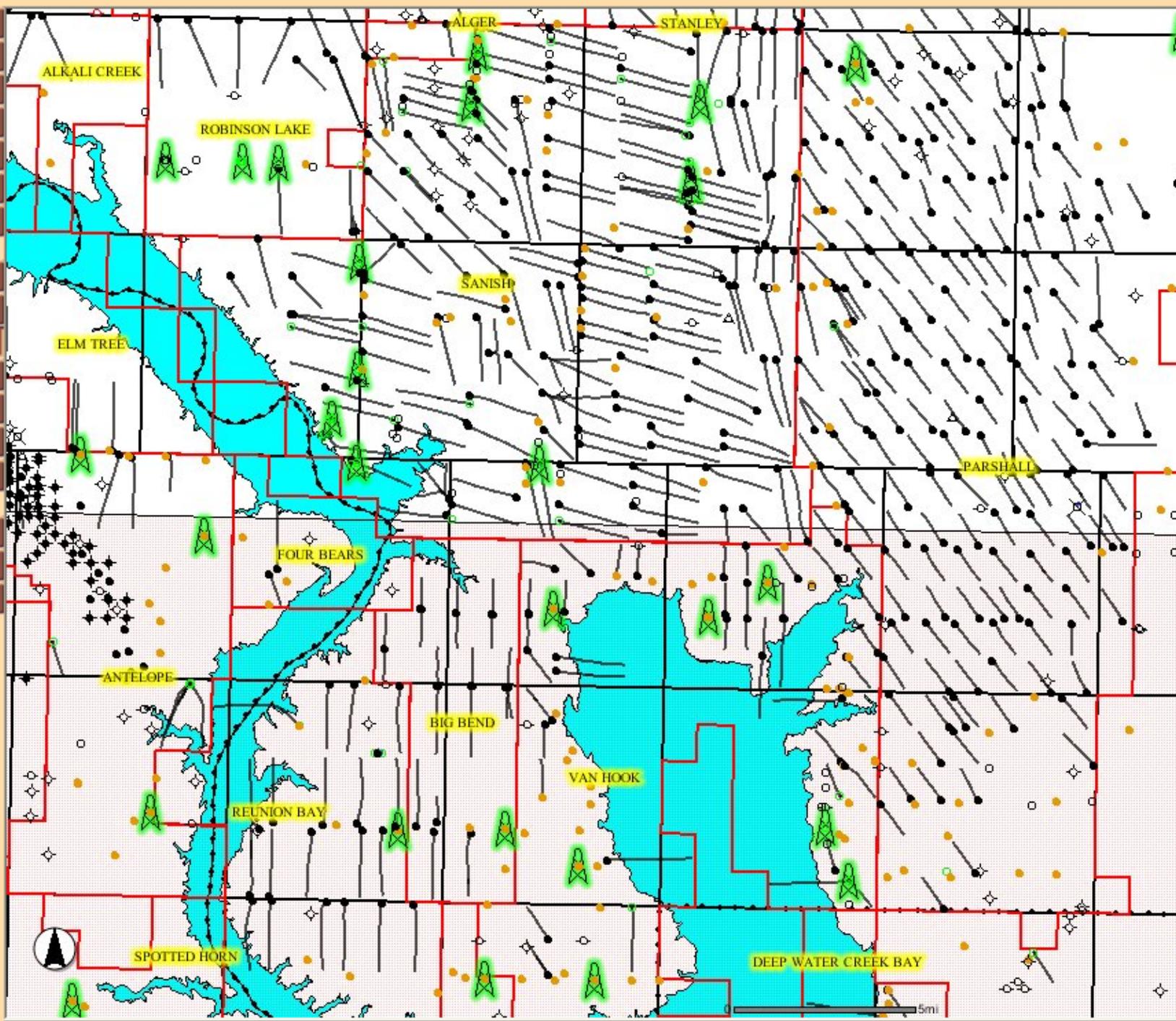


Fig. 7) Combined OOIP for the Three Forks and Bakken by county.

- Legend / Layers
- Overview Map
- View Entire State
- Previous View
- Clear Selection
- Search
- Generate PDF

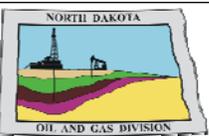
- Zoom In
- Zoom Out
- Pan
- Rect Identify
- Select Object
- Buffer
- Distance

- Find Well
- Find Field/Unit
- Find Section

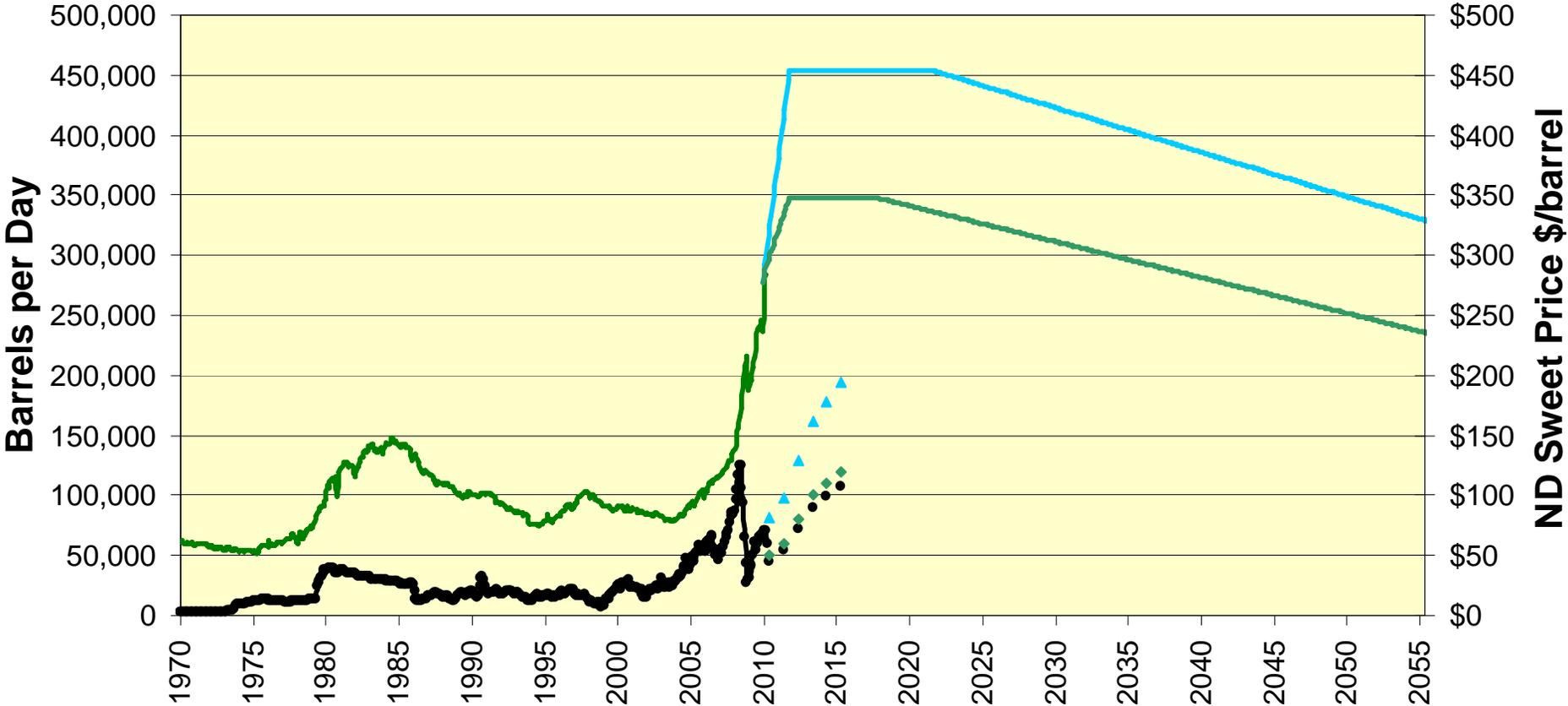


Western North Dakota

- 1,450 to 2,940 wells/year—2,000 expected
 - 100-165 rigs = 12,000 – 19,800 jobs
- 11 - 23 million gallons frac water/day
- 10 to 20 years
 - 21,250 new wells = 20,000-25,000 long term jobs



North Dakota Oil Production and Price



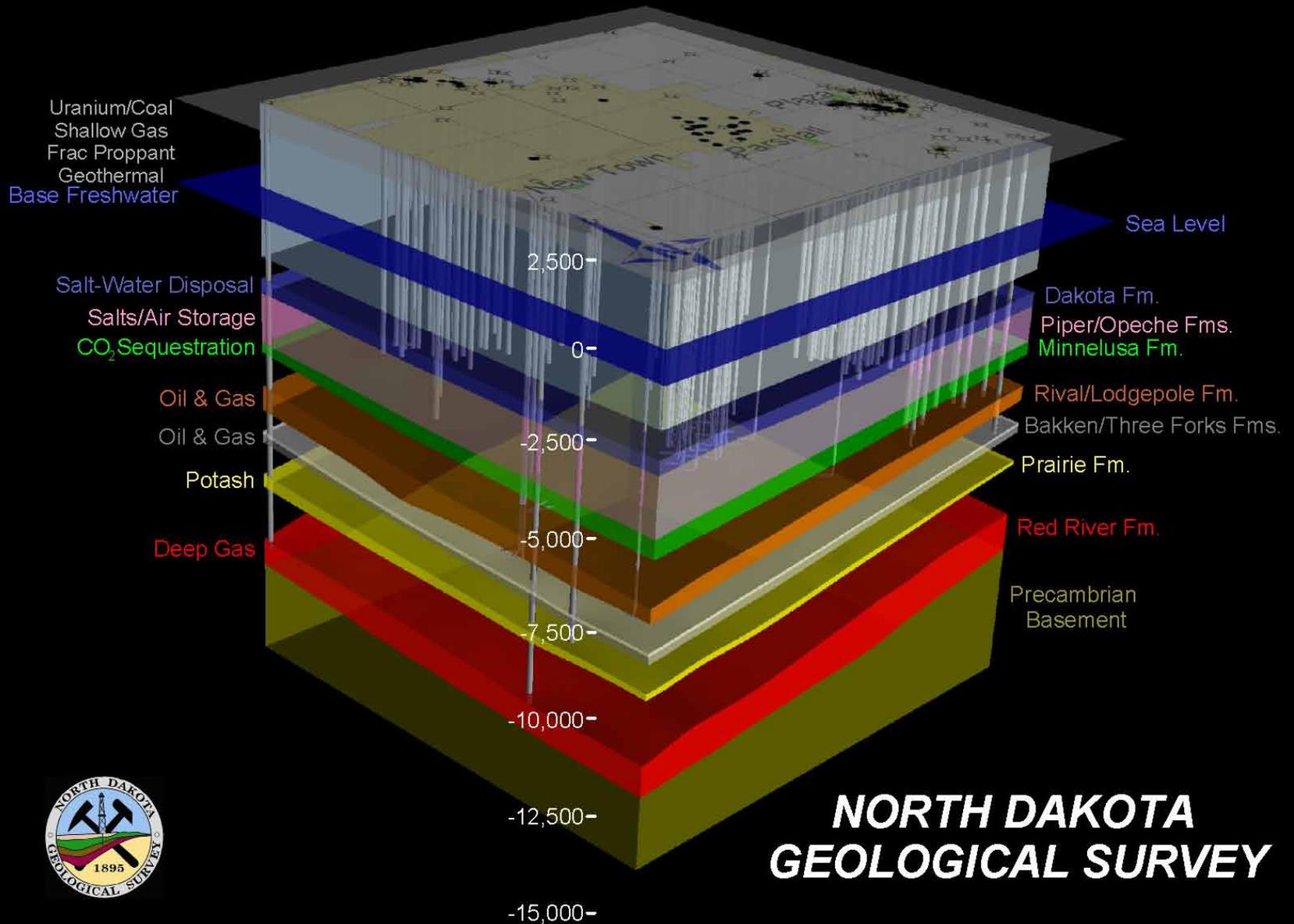
1,750 Bakken and Three Forks wells drilled and completed

22,000 potential wells possible in thermal mature area

4.9 to 7.2 billion barrels = \$350 – 500 billion

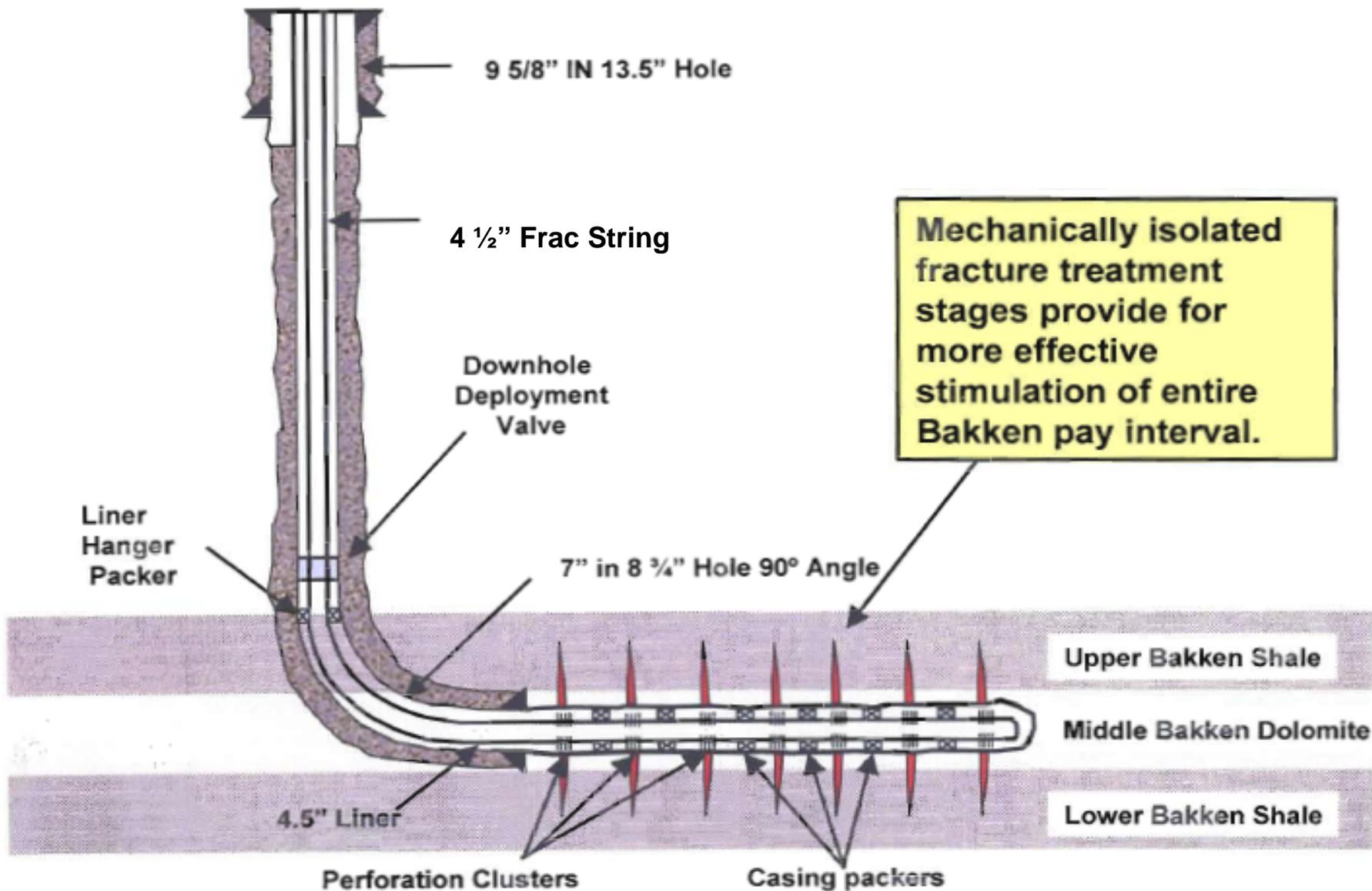


Three-Dimensional Geologic Model of the Parshall Area

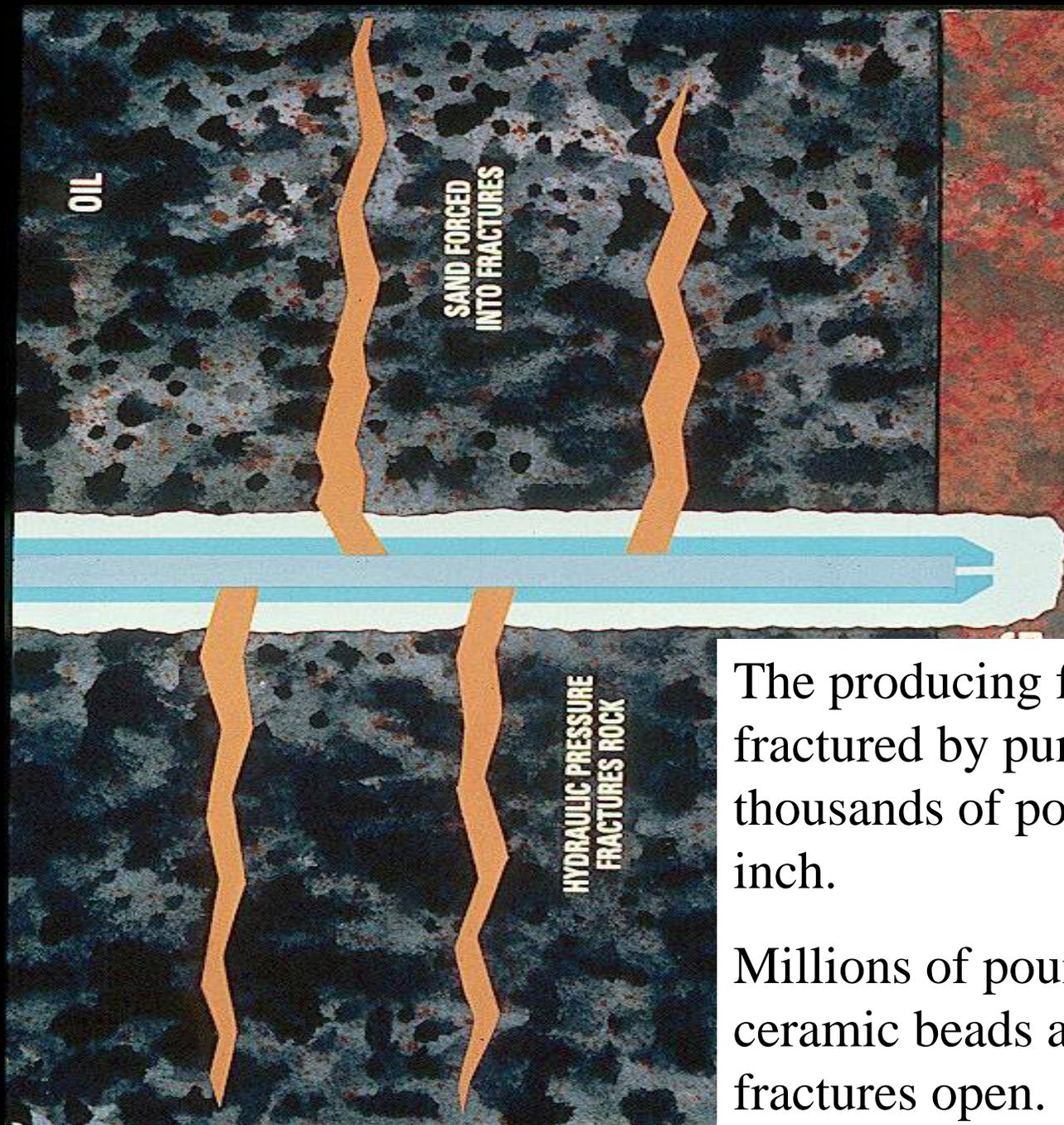


ND Water Commission

61-04-02. Permit for beneficial use of water required. Any person, before commencing any construction for the purpose of appropriating waters of the state or before taking waters of the state from any constructed works, shall first secure a water permit from the state engineer unless such construction or taking from such constructed works is for domestic or livestock purposes or for fish, wildlife, and other recreational uses or unless otherwise provided by law. However, immediately upon completing any constructed works for domestic or livestock purposes or for fish, wildlife, and other recreational uses, the water user shall notify the state engineer of the location and acre-feet [1233.48 cubic meters] capacity of such constructed works, dams, or dugouts. Regardless of proposed use, however, all water users shall secure a water permit prior to constructing an impoundment capable of retaining more than twelve and one-half acre-feet [15418.52 cubic meters] of water or the construction of a well from which more than twelve and one-half acre-feet [15418.52 cubic meters] of water per year will be appropriated. If a permit is not required of a landowner or the landowner's lessee to appropriate less than twelve and one-half acre-feet [15418.52 cubic meters] of water from any source for domestic or livestock purposes or for fish, wildlife, and other recreational uses, those appropriators may apply for water permits in order to clearly establish a priority date and the state engineer may waive any fee or hearing for such applications. An applicant for a water permit to irrigate need not be the owner of the land to be irrigated.







The producing formation is fractured by pumping water at thousands of pounds per square inch.

Millions of pounds of sand or ceramic beads are pumped to hold fractures open.

- **Compound**
 - **Purpose**
 - **Common application**
- Fresh Water – 80.5%
- Proppant – 19.0%
 - Allows the fractures to remain open so the oil and gas can escape
 - Drinking water filtration, play ground sand
- Acids - 0.12%
 - Help dissolve minerals and initiate fractures in rock (pre-fracture)
 - Swimming pool cleaner
- Petroleum distillates – 0.088%
 - Dissolve polymers and minimize friction
 - Make-up remover, laxatives, and candy
- Isopropanol – 0.081%
 - Increases the viscosity of the fracture fluid
 - Glass cleaner, antiperspirant, and hair color
- Potassium chloride – 0.06%
 - Creates a brine carrier fluid
 - Low-sodium table salt substitute
- Guar gum – 0.056%
 - Thickens the water to suspend the sand
 - Thickener used in cosmetics, baked goods, ice cream, toothpaste, sauces, and salad dressing
- Ethylene glycol – 0.043%
 - Prevents scale deposits in the pipe
 - Automotive antifreeze, household cleansers, deicing, and caulk

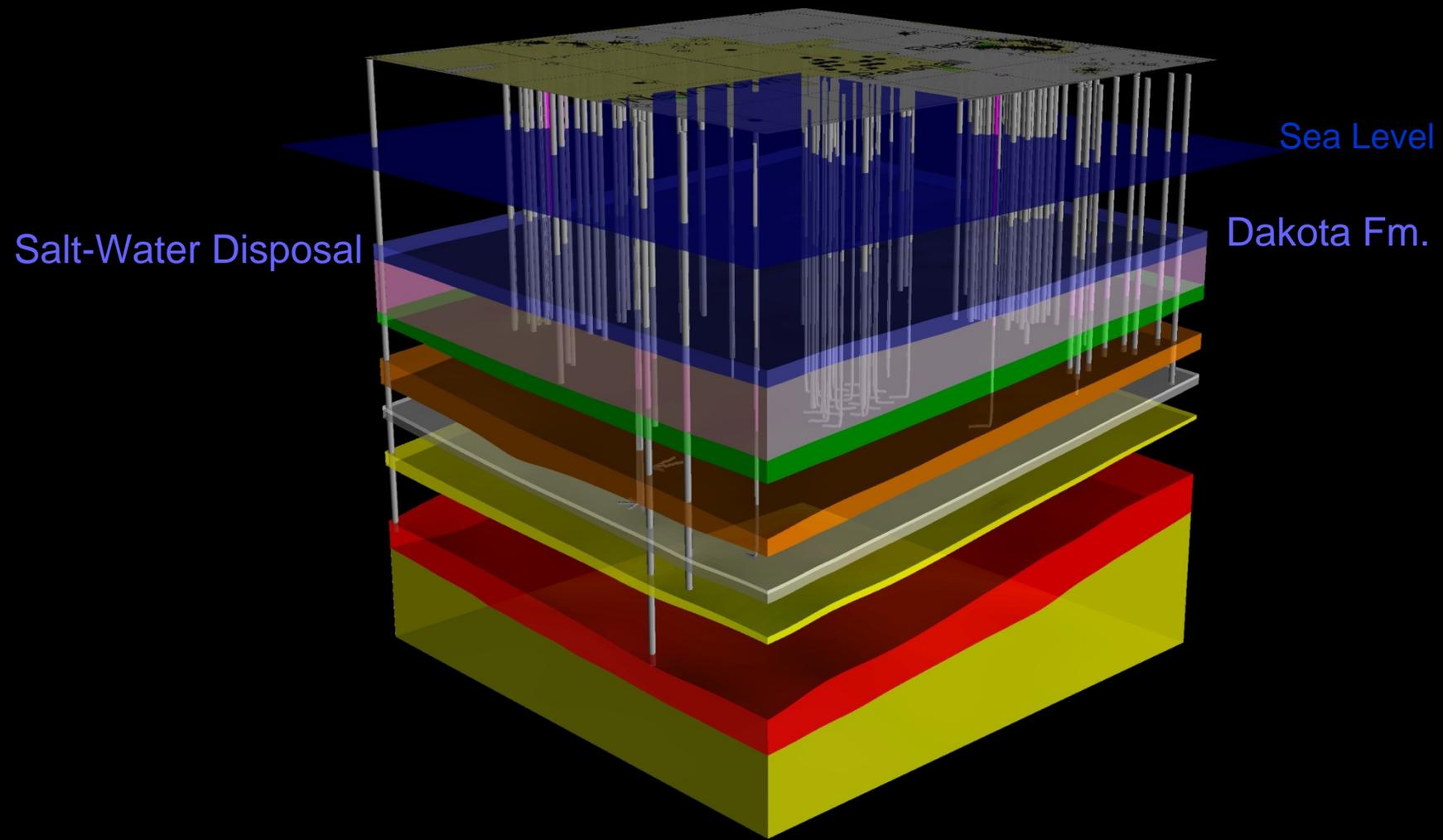


- Sodium or potassium carbonate – 0.011%
 - Improves the effectiveness of other components, such as cross-linkers
 - Washing soda, detergents, soap, water softeners, glass and ceramics
- Sodium Chloride – 0.01%
 - Delays break down of the gel polymer chains
 - Table Salt
- Polyacrylamide – 0.009%
 - Minimizes friction between fluid and pipe
 - Water treatment, soil conditioner
- Ammonium bisulfite – 0.008%
 - Removes oxygen from the water to protect the pipe from corrosion
 - Cosmetics, food and beverage processing, water treatment
- Borate salts – 0.007%
 - Maintain fluid viscosity as temperature increases
 - Used in laundry detergents, hand soaps and cosmetics
- Citric Acid – 0.004%
 - Prevents precipitation of metal oxides
 - Food additive; food and beverages; lemon juice
- N, n-Dimethyl formamide – 0.002%
 - Prevents the corrosion of the pipe
 - Used in pharmaceuticals, acrylic fibers and plastics
- Glutaraldehyde – 0.001%
 - Eliminates bacteria in the water
 - Disinfectant; Sterilizer for medical and dental equipment



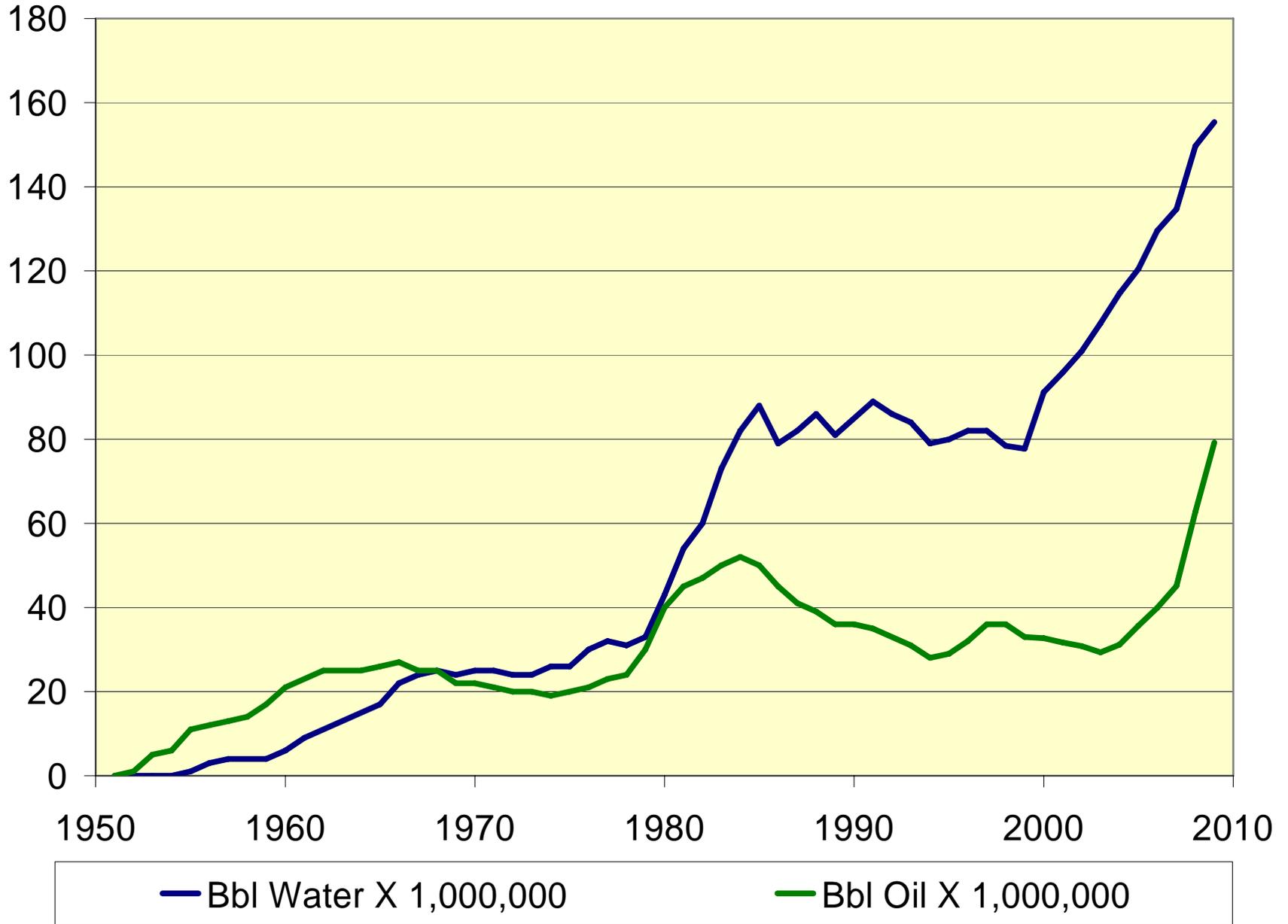
43-02-03-19.2. DISPOSAL OF WASTE. All waste associated with exploration or production of oil and gas must be properly disposed of in an authorized facility in accord with all applicable local, state, and federal laws and regulations. This is not to be construed as requiring the offsite disposal of drilling mud or drill cuttings associated with the drilling of a well. However, top water remaining in the reserve pit used in the drilling and completion operations is to be removed from the reserve pit and disposed of in an authorized disposal well or used in a manner approved by the director. The disposition or use of the water must be included on the sundry notice (form 4) reporting the plan of reclamation pursuant to section 43-02-03-19.

43-02-03-19.3 EARTHEN PITS AND OPEN RECEPTACLES. Except as otherwise provided in section 43-02-03-19, no saltwater, drilling mud, crude oil, waste oil, or other waste shall be stored in earthen pits or open receptacles except in an emergency and upon approval by the director. An earthen pit or open receptacle may be temporarily used to retain oil, water, or fluids generated in well servicing or plugging operations. A pit or receptacle used for this purpose must be sufficiently impermeable to provide adequate temporary containment of the oil, water, or fluids. The contents of the pit or receptacle must be removed within seventy-two hours after operations have ceased and must be disposed of at an authorized facility in accordance with section 43-02-03-19.2. The director may permit pits or receptacles used solely for the purpose of flaring casinghead gas. A pit or receptacle used for this purpose must be sufficiently impermeable to provide adequate temporary containment of fluids. Permission for such pit or receptacle will be conditioned on keeping it free of any saltwater, crude oil, waste oil, or other waste. Saltwater, drilling mud, crude oil, waste oil, or other waste shall be removed from the pit or receptacle within twenty-four hours after being discovered and must be disposed of at an authorized facility in accordance with section 43-02-03-19.2.





North Dakota Oil vs Water Production



ND Department of Health

23-33-04. Chemical use data and confidentiality requirement. The department may require chemical use data from product registrants on products that have been or may likely be found in ground water in order to conduct its ground water protection program. This information must include chemical registration data and sales information. The department shall keep this information confidential.

23-33-05. Ground water standards. The department shall establish standards for compounds in ground water as set forth by other states and the United States environmental protection agency unless new scientifically confirmed data provides justification for changing these standards.

23-33-06. Ground water quality monitoring. The department shall conduct ground water quality monitoring activities in cooperation with the state engineer and other state agencies. Based on monitoring results, the department shall implement or require appropriate mitigation activities or remedial action to prevent future contamination of ground water. The commissioner may implement or require appropriate mitigation activities pursuant to chapter 4-35 to prevent future contamination of ground water as it relates to the use of pesticides.

23-33-07. Notification requirement. Any person with verifiable information on the presence of contamination of ground water within the state shall notify the department regarding such contamination.

33-16-02.1-11. Discharge of wastes. Following are general requirements for all waste discharges or chemical additions:

4. Any spill or discharge of waste which causes or is likely to cause pollution of waters of the state must be reported immediately. The owner, operator, or person responsible for a spill or discharge must notify the department as soon as possible (701-328-5210) or the North Dakota hazardous materials emergency assistance and spill reporting number (1-800-472-2121) and provide all relevant information about the spill. Depending on the severity of the spill or accidental discharge, the department may require the owner or operator to:
 - a. Take immediate remedial measures;
 - b. Determine the extent of pollution to waters of the state;
 - c. Provide alternate water sources to water users impacted by the spill or accidental discharge; or
 - d. Any other actions necessary to comply with this chapter.