

# Colorado's Regulations on Aquifer Protections and Wellbore Cement and Casing Design



November 2012



OIL & GAS CONSERVATION COMMISSION

# COGCC MISSION

## PROMOTE THE RESPONSIBLE AND BALANCED DEVELOPMENT OF COLORADO'S OIL & GAS RESOURCES

- Ensure: Exploration and production of oil and gas resources are conducted efficiently.
- Mineral owners' rights are protected.
- Oil and gas production is conducted in a manner consistent with **protection of public health, safety, and welfare, including the environment & wildlife resources.**



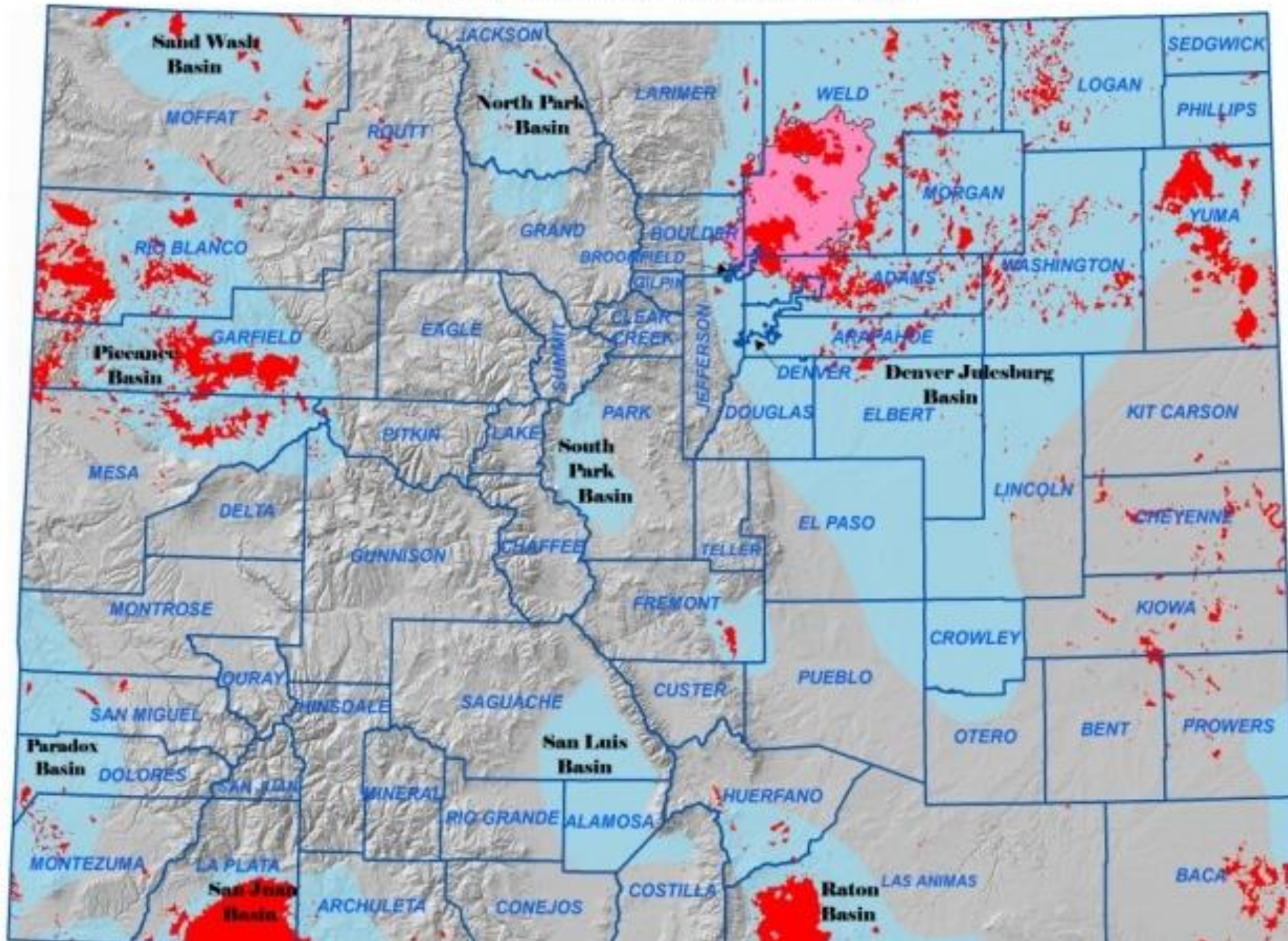
OIL & GAS CONSERVATION COMMISSION

# REGULATIONS

- 100 Definitions
- 200 General
- 300 Drilling, Development, Procedure, and Abandonment
- 400 Units, Enhanced Recovery, and Storage
- 500 Hearings
- 600 Safety
- 700 Financial Assurance
- 800 Aesthetic and Noise
- 900 Waste Management
- 1000 Reclamation
- 1100 Pipelines
- 1200 Wildlife



# OIL AND GAS FIELDS IN COLORADO



# PERMITTING PROCESS

## APPLICATION FOR PERMIT TO DRILL

- APD
- FORM 2
- Provides information regarding the permitting of the wellbore and its construction.
  - Surface & bottom hole location
  - Casing
  - Cementing

## OIL AND GAS LOCATION ASSESSMENT

- OGLA
- FORM 2A
- Provides an assessment of surface location.
  - Area of disturbance
  - Environmental review
  - Hydrology
    - Groundwater
    - Surface water
  - Inter-agency consultation



# DRILLING PERMIT

Well Location

Lease, Spacing, and Pooling Information

Drilling Plans and Procedures



**FORM 2**  
Rev. 6/09

**State of Colorado**  
**Oil and Gas Conservation Commission**  
1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)694-2100 Fax: (303)694-2109

**APPLICATION FOR PERMIT TO:**

1.  Drill,  Deepen,  Re-enter,  Recomplete and Operate

2. TYPE OF WELL:  
OIL  GAS  COALBED  OTHER: \_\_\_\_\_  
SINGLE ZONE  MULTIPLE ZONES  COMMINGLE ZONES

Refilling Sidetrack

3. Name of Operator \_\_\_\_\_ 4. COGCC Operator Number: \_\_\_\_\_

5. Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
6. Contact Name: \_\_\_\_\_ Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

7. Well Name: \_\_\_\_\_ Well Number: \_\_\_\_\_  
8. Unit Name (if appl): \_\_\_\_\_ Unit Number: \_\_\_\_\_

9. Proposed Total Measured Depth: \_\_\_\_\_

**WELL LOCATION INFORMATION**

10. Qtr/Sec: \_\_\_\_\_ Twp: \_\_\_\_\_ Rng: \_\_\_\_\_ Meridian: \_\_\_\_\_  
Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_  
Footage At Surface: \_\_\_\_\_ FALSFL \_\_\_\_\_ FLSFLW \_\_\_\_\_

11. Field Name: \_\_\_\_\_ Field Number: \_\_\_\_\_  
12. Ground Elevation: \_\_\_\_\_ 13. County: \_\_\_\_\_

14. GPS Data: \_\_\_\_\_  
Date of Measurement: \_\_\_\_\_ PDOP Reading: \_\_\_\_\_ Instrument Operator's Name: \_\_\_\_\_

15. If well is:  Directional  Horizontal (highly deviated),  submit deviated drilling plan. Bottomhole Sec Twp Rng: \_\_\_\_\_  
Footage At Top of Prod Zone: \_\_\_\_\_ FALSFL \_\_\_\_\_ FLSFLW \_\_\_\_\_ At Bottom Hole: \_\_\_\_\_ FALSFL \_\_\_\_\_ FLSFLW \_\_\_\_\_

16. Is location in a high density area (Rule 603b)?  Yes  No  
17. Distance to the nearest building, public road, above ground utility or railroad: \_\_\_\_\_  
18. Distance to Nearest Property Line: \_\_\_\_\_ 19. Distance to nearest well permitted/completed in the same formation: \_\_\_\_\_

**LEASE, SPACING AND POOLING INFORMATION**

Objective Formation(s)	Formation Code	Spacing Order Number (s)	Unit Acreage Assigned to Well	Unit Configuration (N/2, SE/4, etc.)

21. Mineral Ownership:  Fee  State  Federal  Indian Lease # \_\_\_\_\_  
22. Surface Ownership:  Fee  State  Federal  Indian \_\_\_\_\_  
23. Is the Surface Owner also the Mineral Owner?  Yes  No Surface Surety ID# \_\_\_\_\_  
23a. If 23 is Yes: Is the Surface Owner's signature on the lease?  Yes  No  
23b. If 23 is No:  Surface Owners Agreement Attached or  \$25,000 Blanket Surface Bond  \$2,000 Surface Bond  \$5,000 Surface Bond  
24. Using standard Qtr/Sec, Twp, Rng format enter entire mineral lease description upon which this proposed well/site is located (attach separate sheet/map if you prefer): \_\_\_\_\_  
25. Distance to Nearest Mineral Lease Line: \_\_\_\_\_ 26. Total Acres in Lease: \_\_\_\_\_

**DRILLING PLANS AND PROCEDURES**

27. Is H2S anticipated?  Yes  No If Yes, attach contingency plan.  
28. Will salt sections be encountered during drilling?  Yes  No  
29. Will salt (>15,000 ppm TDS Cl) or oil based muds be used during drilling?  Yes  No  
30. If questions 28 or 29 are yes, is this location in a sensitive area (Rule 901a)?  Yes  No If 28, 29 or 30 are "Yes" a pit permit may be required.  
31. Mud disposal:  Offsite  Onsite  
Method:  Land Farming  Land Spreading  Disposal Facility  Other: \_\_\_\_\_

**NOTE:** The use of an earthen pit for Recompletion fluids requires a pit permit (Rule 905b) If air/gas drilling, notify local fire officials.

String	Size of Hole	Size of Casing	Weight Per Foot	Setting Depth	Sacks Cement	Cement Bottom	Cement Top

32. BOP Equipment Type:  Annular Preventor  Double Ram  Rotating Head  None  
33. Comments: \_\_\_\_\_

34. Location ID: \_\_\_\_\_  
35. Is this application in a Comprehensive Drilling Plan?  Yes  No If Yes enter CDP# \_\_\_\_\_  
36. Is this application part of a submitted Oil and Gas Location Assessment?  Yes  No

Signed: \_\_\_\_\_ Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_ Date: \_\_\_\_\_ Email: \_\_\_\_\_

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.  
COGCC Approved: \_\_\_\_\_ Director of COGCC \_\_\_\_\_ Date: \_\_\_\_\_  
Permit Number: \_\_\_\_\_ Expiration Date: \_\_\_\_\_  
05- \_\_\_\_\_ API NUMBER \_\_\_\_\_ CONDITIONS OF APPROVAL, IF ANY: \_\_\_\_\_

# PROTECTING WATER

- **Technical reviews of casing and cementing plans.**
- **Review of surrounding area hydrology, water wells and surface waters.**
- **Baseline water sampling; post-drilling sampling.**
- **Review of operator-provided Best Management Practices to protect water, contain potential spills.**



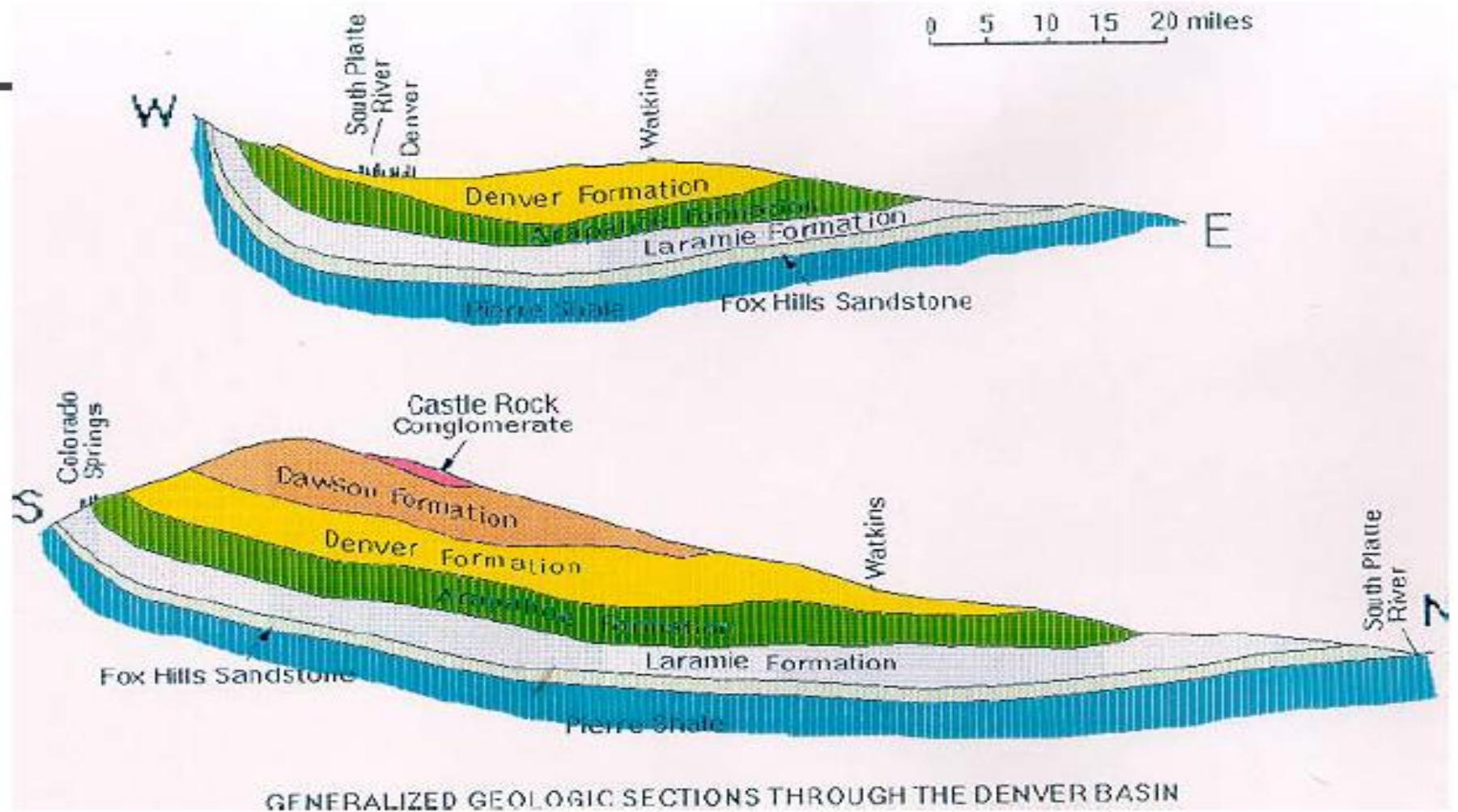
# 317: GENERAL DRILLING RULES

- a. Blowout prevention equipment (“BOPE” ).
- b. Bottom hole location.
- c. Requirement to post permit at the rig and provide spud notice.
- d. Casing program to protect hydrocarbon horizons and ground water.
- e. Surface casing where subsurface conditions are unknown.
- f. Surface casing where subsurface conditions are known.
- g. Alternate aquifer protection by stage cementing.
- h. Surface and intermediate casing cementing.
- i. Production casing cementing.
- j. Production casing pressure testing.
- k. Protection of aquifers and production stratum and suspension of drilling operations before running production casing.
- l. Flaring of gas during drilling and notice to local emergency dispatch.
- m. Protection of productive strata during deepening operations.
- n. Requirement to evaluate disposal zones for hydrocarbon potential.
- o. Requirement to log well.
- p. Remedial cementing during recompletion.

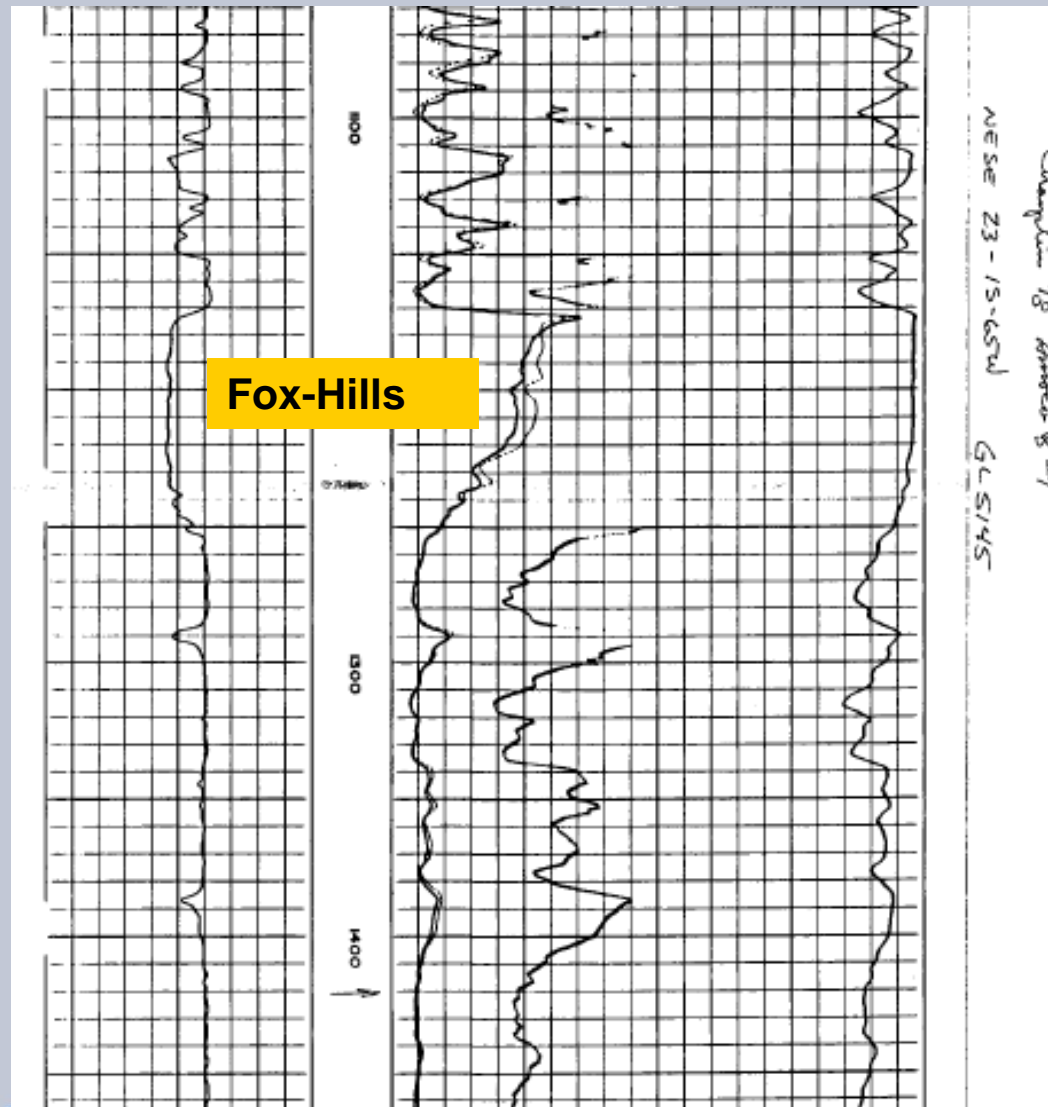




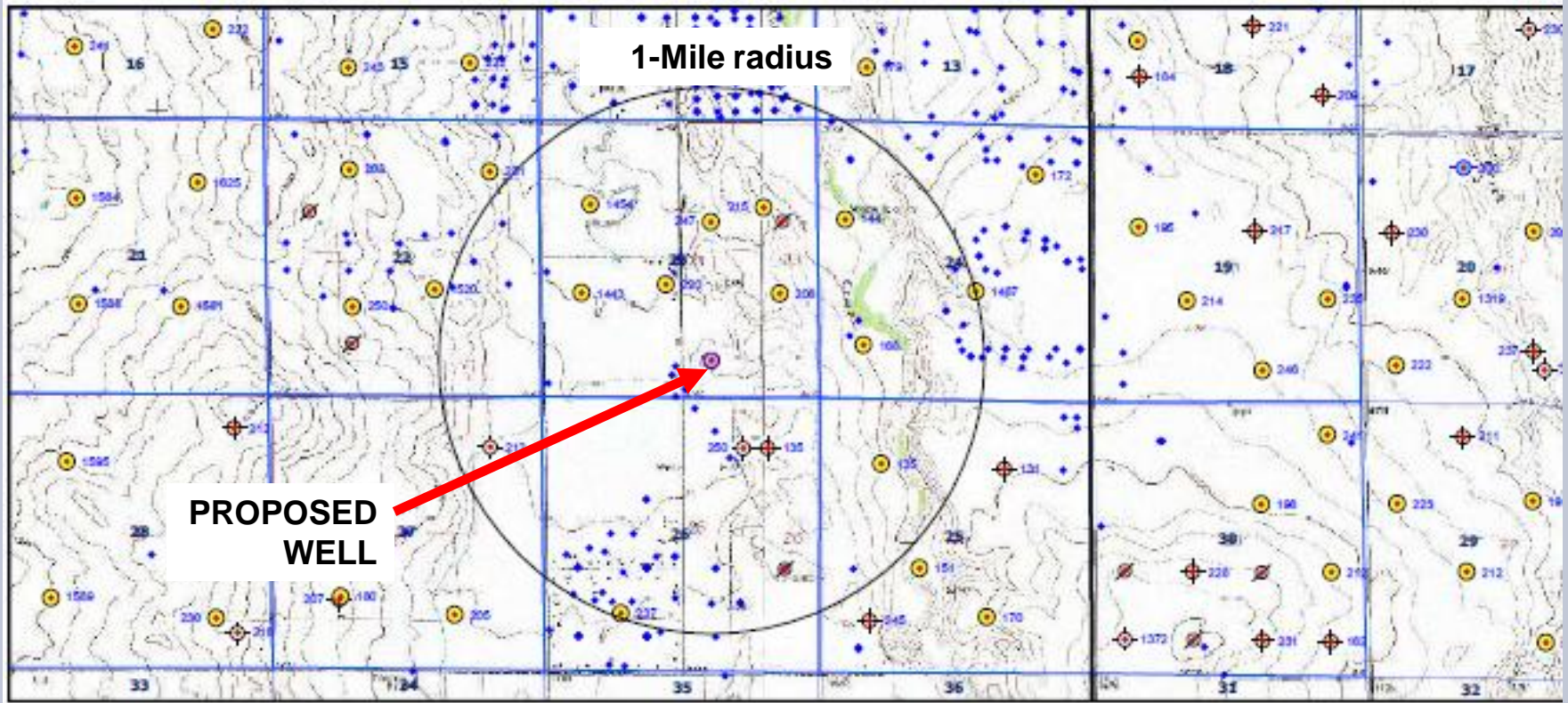
# Colorado Geologic Survey Aquifer Reports



# Geophysical Logs Review



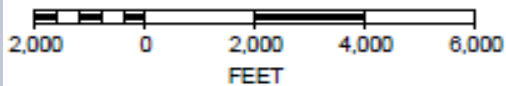
# CDWR Water Well Data



**PROPOSED  
WELL**

**1-Mile radius**

SCALE 1 : 43,837



Red Dots = Existing Wells  
Blue Dots = Water Wells



**OIL & GAS CONSERVATION COMMISSION**

# COGCC RULES PREVENT WATER/GAS/OIL MIGRATION

1. ENSURE SURFACE CASING IN ALL WELLS IS SET AT LEAST 50 FEET BELOW THE DEPTH OF THE DEEPEST WATER WELL OR AQUIFERS
2. ENSURE PRODUCTION CASING ISOLATES ALL HYDROCARBON BEARING ZONES



# WELL BORE DIAGRAM

## DRILL OUT FOR SURFACE CASING

With fresh water to protect the aquifers

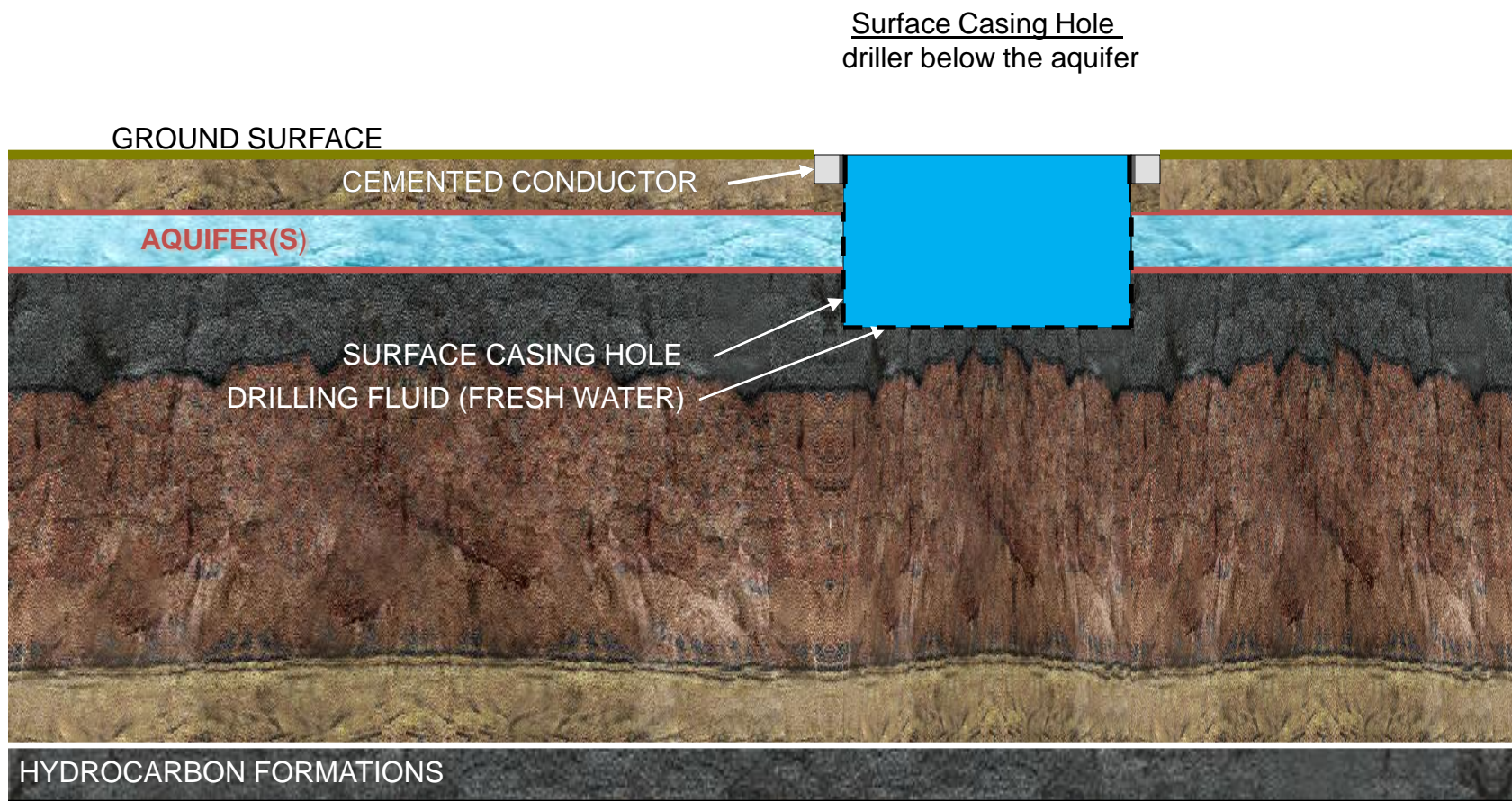


Figure 1

# WELL BORE DIAGRAM

## PLACE & CEMENT SURFACE CASING

To Protect Aquifers

**Per COGCC Rules 317.e, f, g, & h**

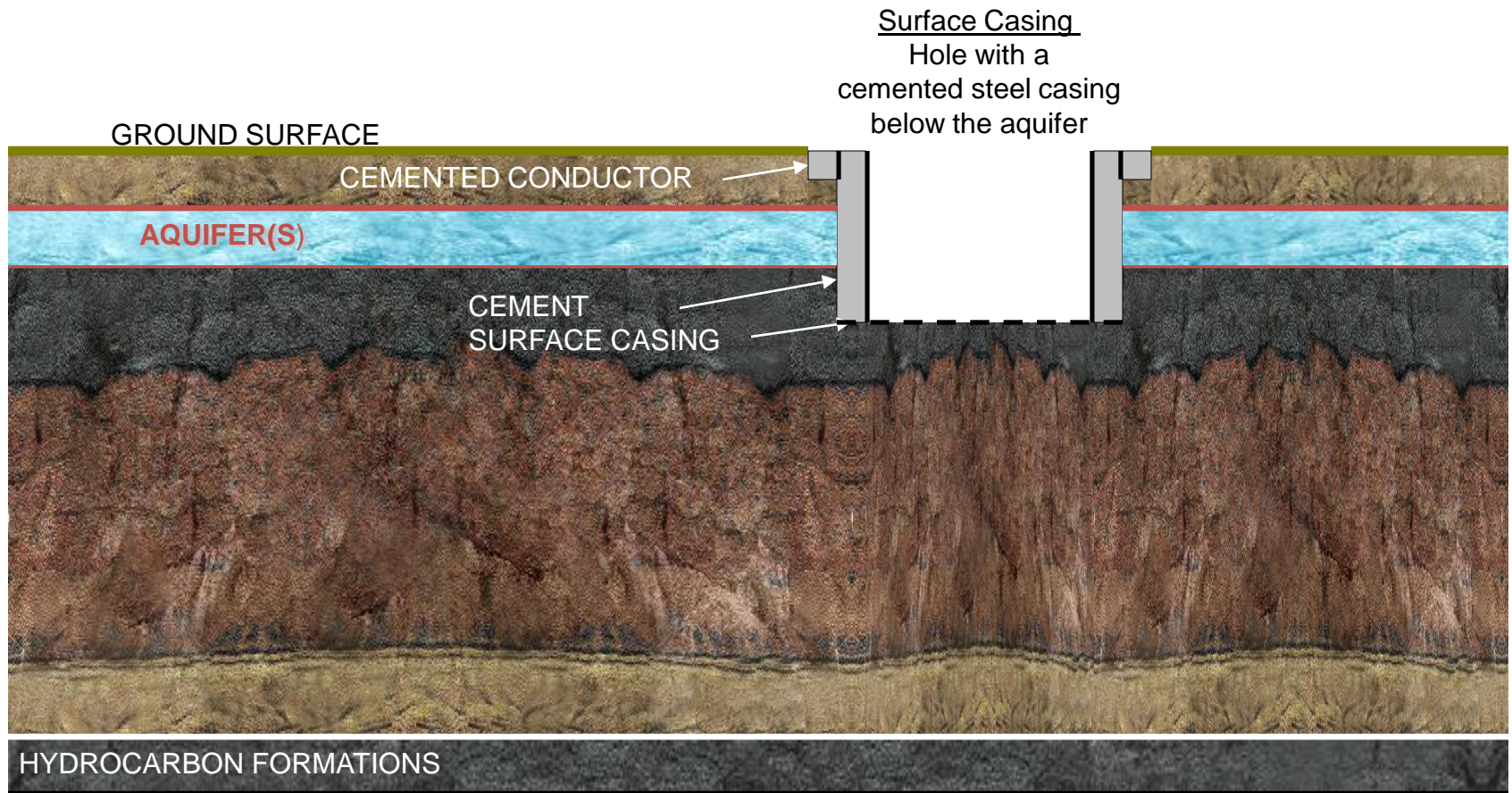


Figure 2

# WELL BORE DIAGRAM

## DRILL OUT FOR PRODUCTION HOLE

Fluid inflow control by drilling fluid weight

**Per COGCC Rules 317.e, f, g, & h**

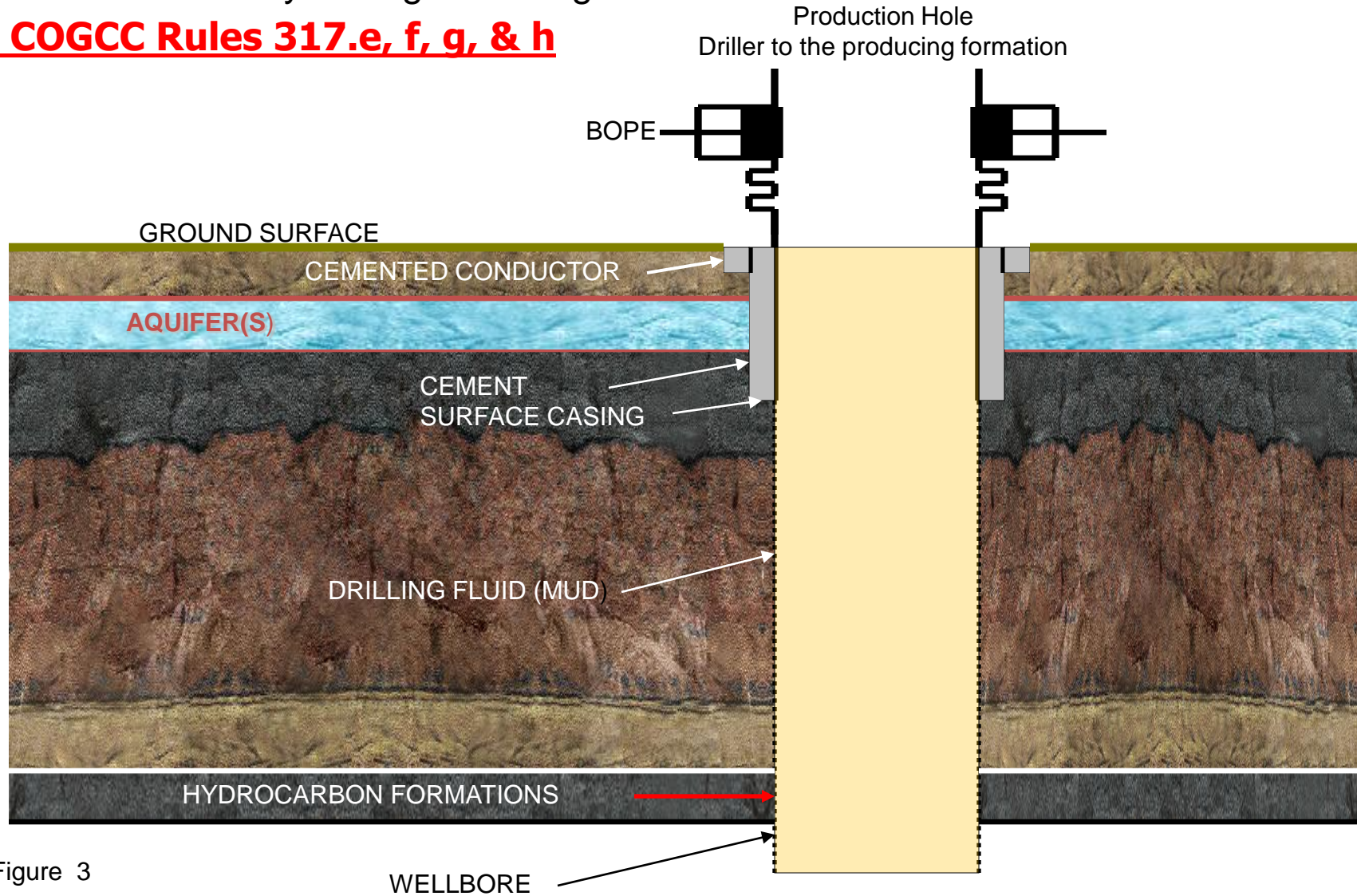
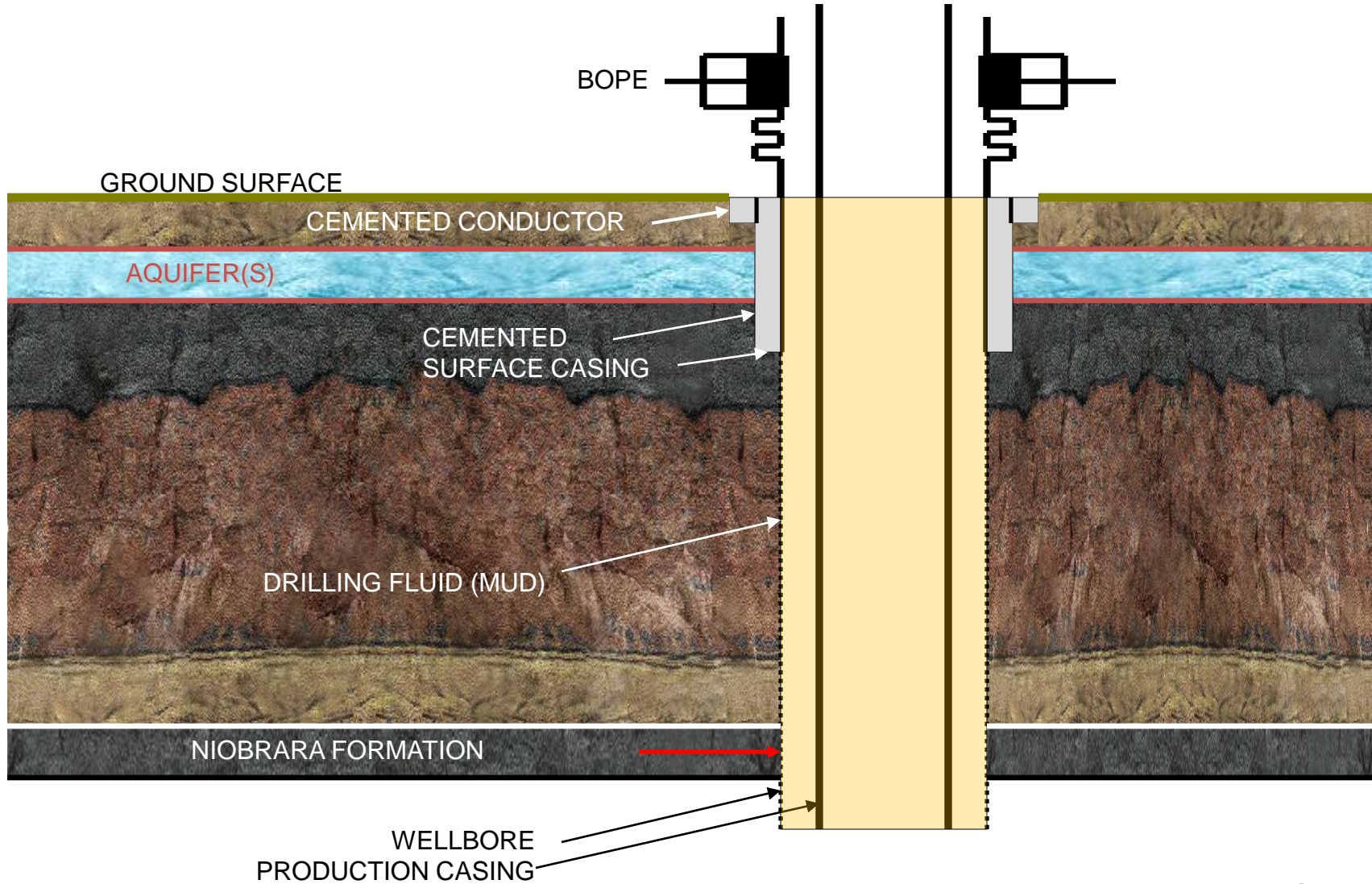


Figure 3

# WELL BORE DIAGRAM SET PRODUCTION CASING





# WELL BORE DIAGRAM

## PLACE & CEMENT PRODUCTION

### CASING

Fluid inflow prevented by cement

**Per COGCC Rules 317.i, j, & k and verified per Rule 308A**

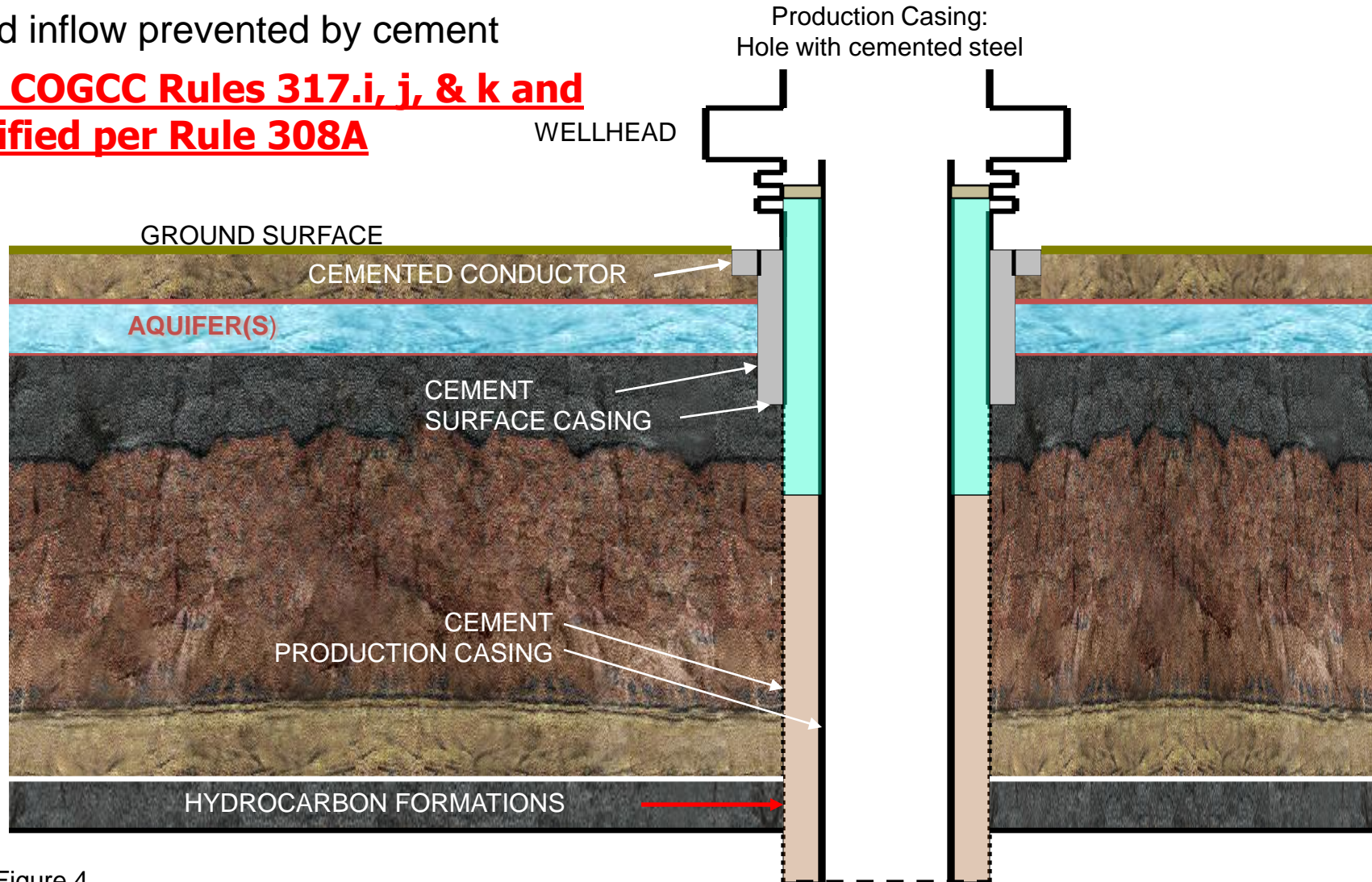


Figure 4

# CEMENT BOND LOG

317.o. Requirement to log well. For all new drilling operations, the operator shall be required to run a minimum of a resistivity log with gamma-ray or other petrophysical log(s) approved by the Director that adequately describe the stratigraphy of the wellbore. *A cement bond log shall be run on all production casing or, in the case of a production liner, the intermediate casing, when these casing strings are run.* These logs and all other logs run shall be submitted with the Well Completion or Recompletion Report and Log, Form 5. Open hole logs shall be run at depths that adequately verify the setting depth of surface casing and any aquifer coverage. These requirements shall not apply to the unlogged open hole completion intervals, or to wells in which no open hole logs are run.



30	Gamma Ray (GAPI)	130	0	Amplitude (mV)	85	200	Variable Density	120
-15	CCL	3	0	Amplified Amplitude (mV)	30			

# Cement Bond Logs to verify placement of cement

**Per COGCC Rule 317.o** requires cement bond logs for all wells.

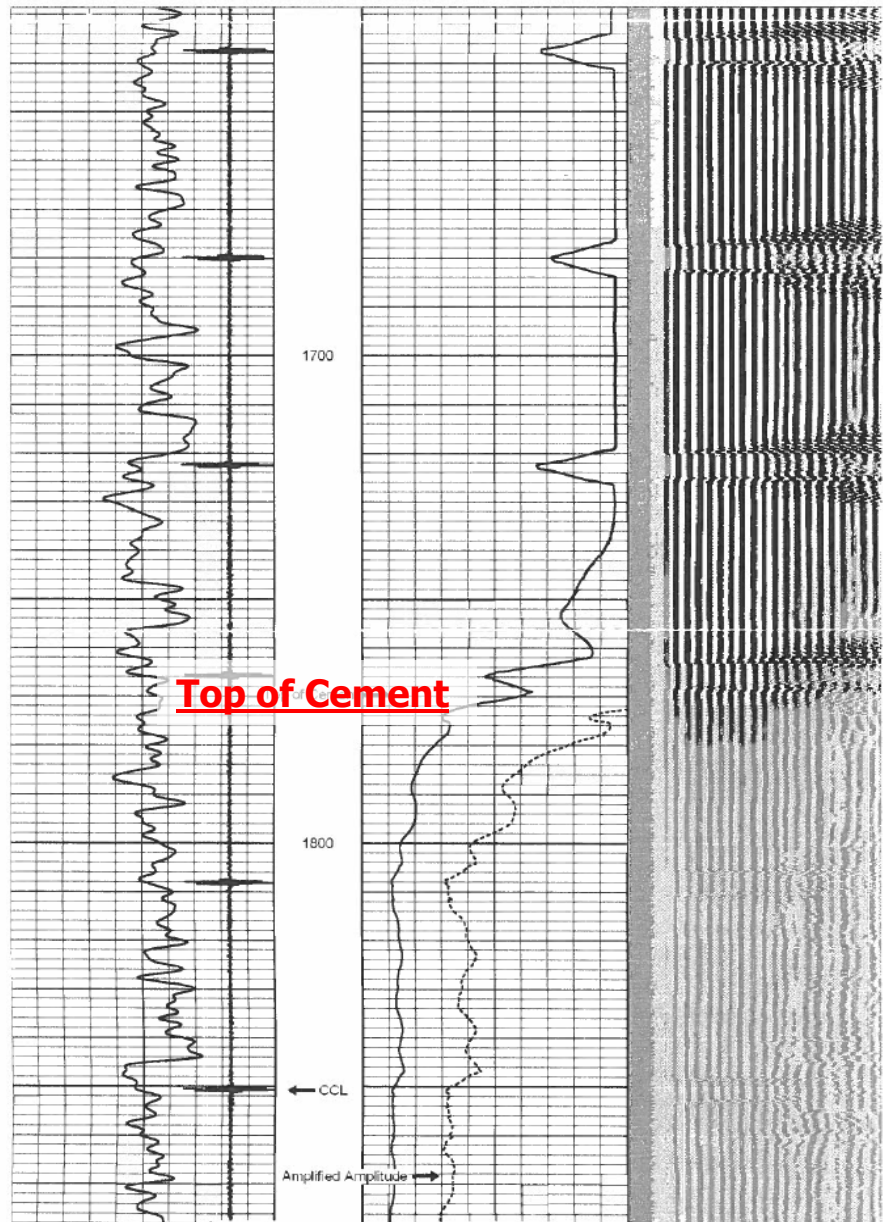


Figure 5

# FRAC JOB – WELL SITE

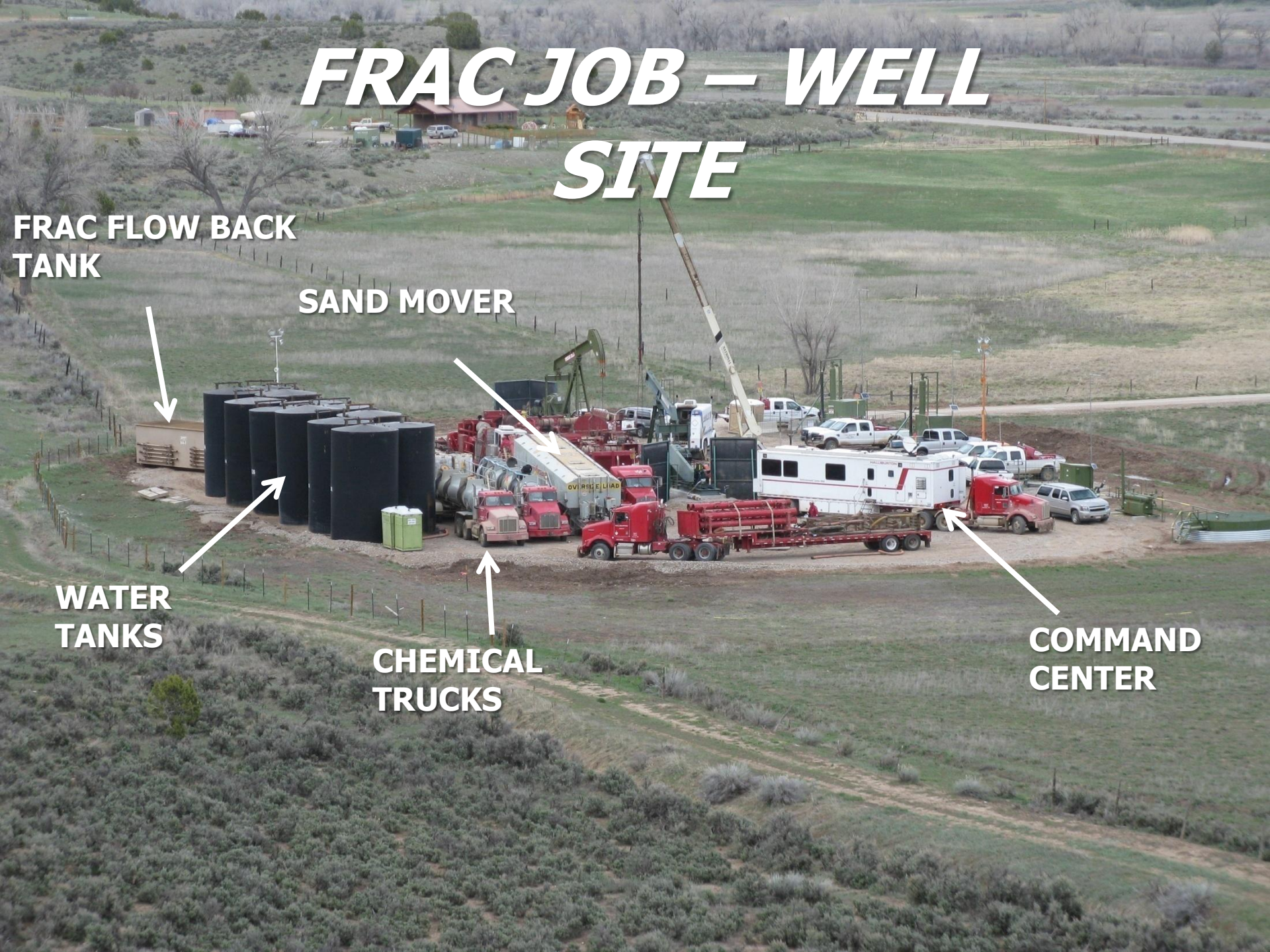
FRAC FLOW BACK TANK

SAND MOVER

WATER TANKS

CHEMICAL TRUCKS

COMMAND CENTER



# COGCC Hydraulic Fracturing Rules

- **Rule 205** Inventory chemicals.
- **Rule 205A** Disclosure.
- **Rule 305.e.(1)A** Landowner Notice of intent to hydraulic fracture treatment at time of permitting.
- **Rule 316C** 48-Hour notice of treatment to Local Governmental Designee and the Landowner.
- **Rule 317** Well casing and cementing; Cement bond logs.
- **Rule 317B** Setbacks and precautions near surface waters and tributaries that are sources of public drinking water.
- **Rule 341** Monitor pressures during stimulation.
- **Rule 608** Special requirements for CBM wells.
- **Rules 903 & 904** Pit permitting, lining, monitoring, & secondary containment
- **Rule 906** Requires Commission, CDPHE and the landowner of any spill that threatens to impact any water of the state.



# 341. BRADENHEAD MONITORING DURING WELL STIMULATION OPERATIONS

- The placement of all stimulation fluids shall be confined to the objective formations during treatment to the extent practicable.
- During stimulation operations, bradenhead annulus pressure shall be continuously monitored and recorded on all wells being stimulated.
- If at any time during stimulation operations the bradenhead annulus pressure increases more than 200 psig the operator shall verbally notify the Director as soon as practicable, but no later than twenty-four (24) hours following the incident. Within fifteen (15) days after the occurrence, the operator shall submit a Sundry Notice, Form 4, giving all details, including corrective actions taken.
- If intermediate casing has been set on the well being stimulated, the pressure in the annulus between the intermediate casing and the production casing shall also be monitored and recorded.
- The operator shall keep all well stimulation records and pressure charts on file and available for inspection by the Commission for a period of at least five (5) years. Under Rule 502.b.(1), an operator may seek a variance from these bradenhead monitoring, recording, and reporting requirements under appropriate circumstances.



WELL BORE DIAGRAM  
STIMULATION – Hydraulic Fracture

**Per COGCC Rule 341**

**Bradenhead valve monitoring  
during stimulation treatment  
per Rule 341**

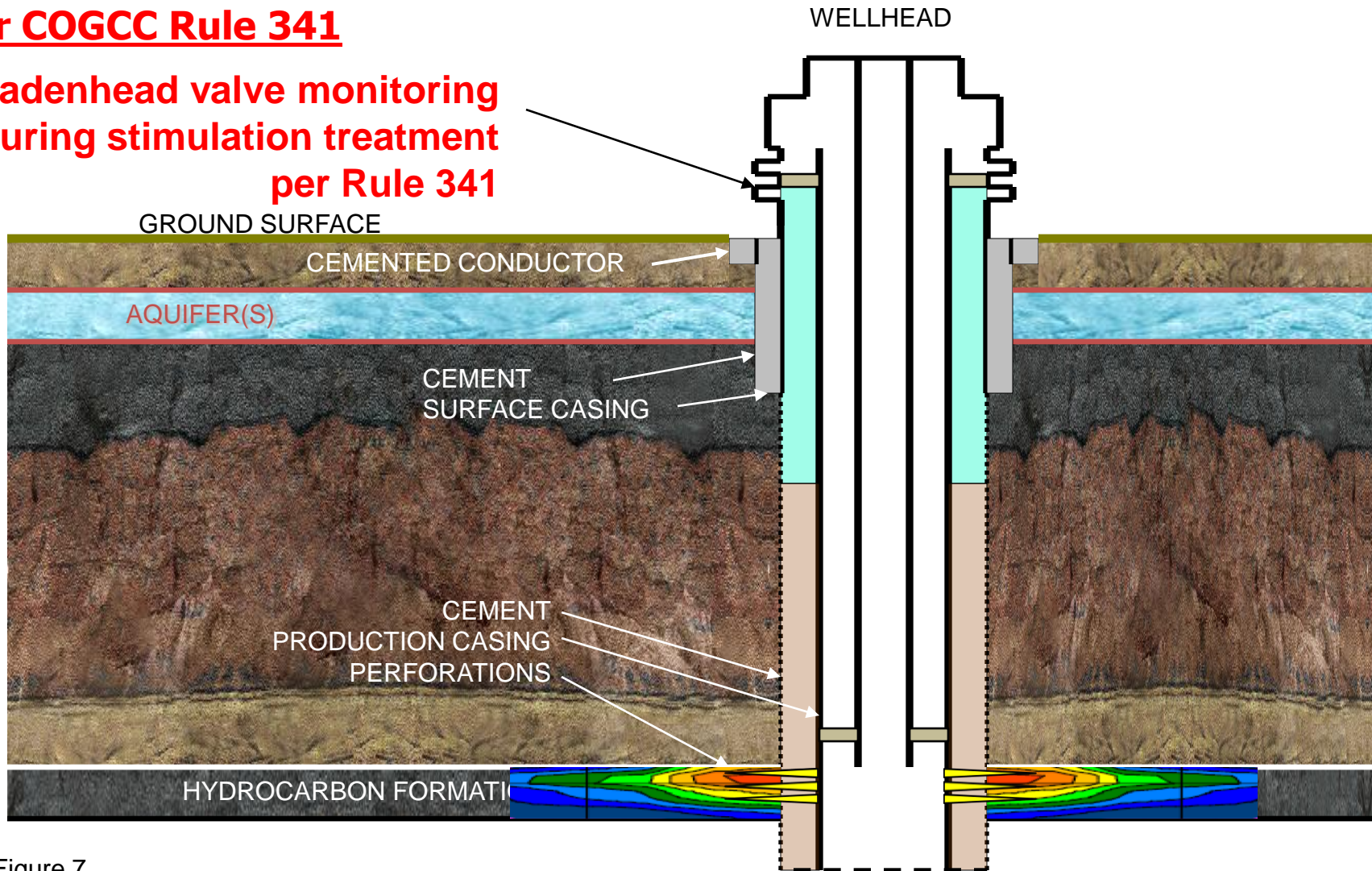


Figure 7

# HYDRAULIC FRACTURING

- More than 90% of oil and gas wells today are hydraulically fractured.
- As of April 1, 2012 operators must disclose all fracturing ingredients and concentrations to [FracFocus.org](http://FracFocus.org). Operators must file paperwork to certify proprietary claims.
- Rules require cement bond logs and pressure monitoring to ensure integrity of well and cement work.





# GROUND WATER PROTECTION

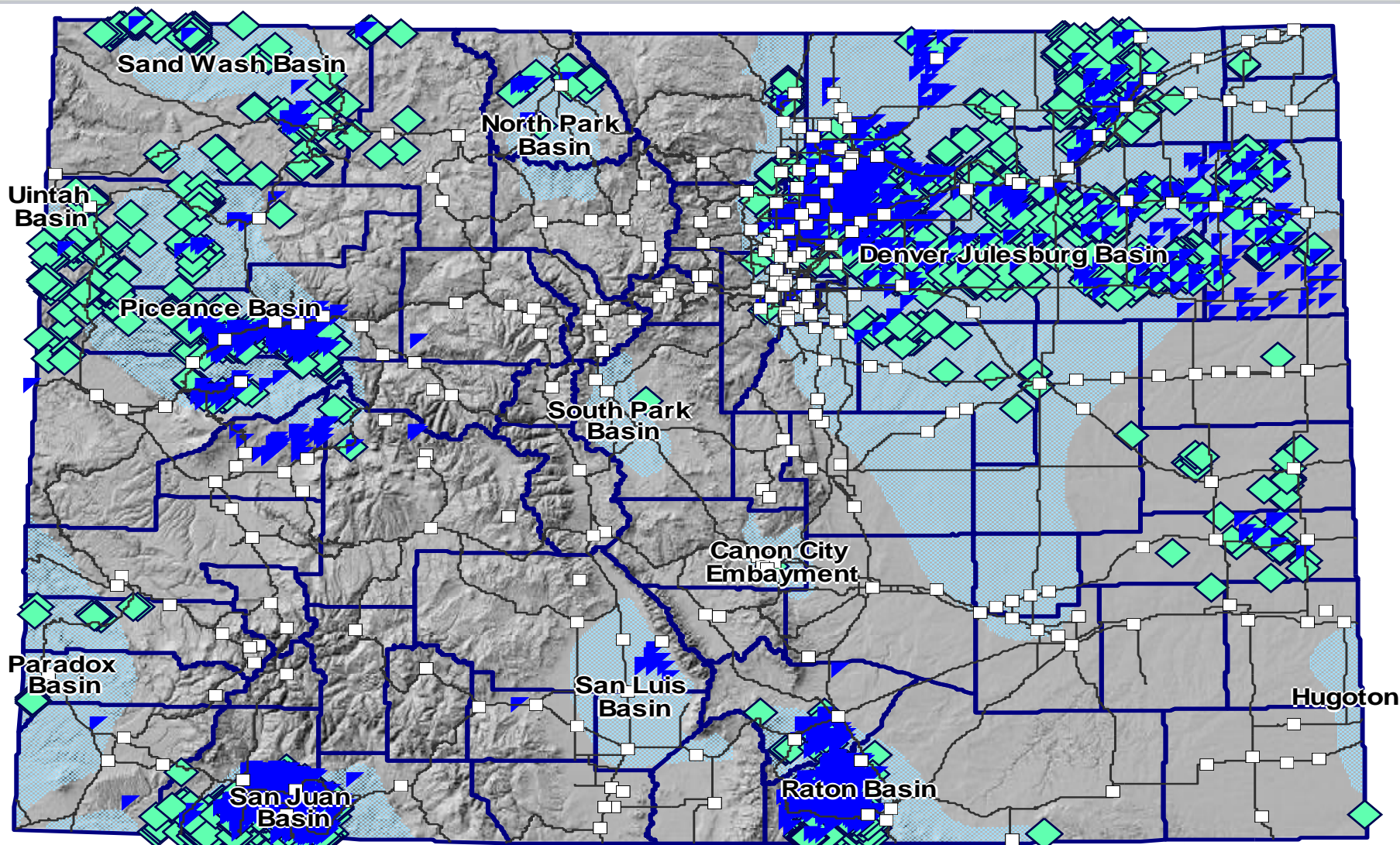
- Properly drilling, completing, operating, and P&A to ensure and maintain isolation of productive zones from GW & SW.
- Properly storing, treating, reusing/recycling, transporting, and disposing of wastes.
- Properly installing and maintaining associated equipment & E&P waste management facilities.
- Rapid response to and thorough remediation of impacts from spills and releases.



# GROUND WATER PROTECTION INVESTIGATIONS & MONITORING

- Water Quality Database containing analytical results from more than 6,000 water wells.
- Collected by the COGCC, Operators, other agencies
- Studies by COGCC to establish Baseline and Current Conditions
- Collected in response to complaints and requests
- Required by Orders of the Commission (Cause 112)
- Required by Rules (317B, 318A.e.4., 608, 908)
- Required as part of Site Investigation and Remediation activities.





- Blue – water samples
- Green – oil/gas well samples



OIL & GAS CONSERVATION COMMISSION



## PRINT PAGE

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October 25, 2012

**PUBLIC ANNOUNCEMENTS****[Statewide Water Sampling and Monitoring Rulemaking](#)** (10/16/2012)

New and amended rules for statewide water sampling and monitoring. (600 Series)

**[Statewide Setbacks and Aesthetic and Noise Control Rulemaking](#)** (10/16/2012)

New and amended rules for statewide setbacks and aesthetic and noise control. (100, 200, 300, 500, 600, 800, 900, 1100, and 1200 Series)

**[Broomfield & Greater Wattenberg Area Rulemaking](#)** (07/13/2012)

Consider amendments to Rule 318A, concerning horizontal/infill wells in GWA in Broomfield &amp; 100-Series Rules for definition of "horizontal well".

**[Hearing Dates November through January Updated](#)** *New*

Commission Hearing dates and times for November through January updated.

**[Jim Milne Named Environmental Manager](#)** (10/17/2012)

Jim Milne named Environmental Manager, effective November 1, 2012. Click here to see his Bio.

**[Water Sampling Data Now Available](#)** (09/19/2012)

The data contains information from the COGA voluntary sampling program. The database is under construction and will continue to have historical information added in the coming months.

**[Form 41 Requirements and Instructions](#)** (04/24/2012)

Form 41, Trade Secret Claim of Entitlement instructions can be found on the Forms page.

**[Form 41, Trade Secret Claim Form Now Available](#)** (04/23/2012)

Form 41, Trade Secret Claim of Entitlement is now available to be filed through eForm. A paper version can be found on the Forms page.

**[HOT TOPICS](#)****[Setback Review Stakeholder Group](#)** (03/23/2012)

The COGCC Setback Review Stakeholder Group documentation web pages

**[Hydraulic Fracturing Information](#)** (06/07/2011)

With the public's interest in and concern about the potential impacts of fracking on public health and the environment, the COGCC has compiled information for the public's review.

**QUESTIONS?**