

Rule 608

Coalbed Methane Wells

Rule 608 – Coalbed Methane Wells

- Purpose

- Provides for the collection of various monitoring data to verify that water wells, ground and surface waters, and residents of CBM producing basins are adequately protected against methane impacts from shallow CBM development; and
- Should impacts occur that they are quickly identified and mitigated.
- Similar processes have been in place in the San Juan Basin CBM field since 2000 via COGCC Order 112-156 and 112-157 and more than 20 other orders.

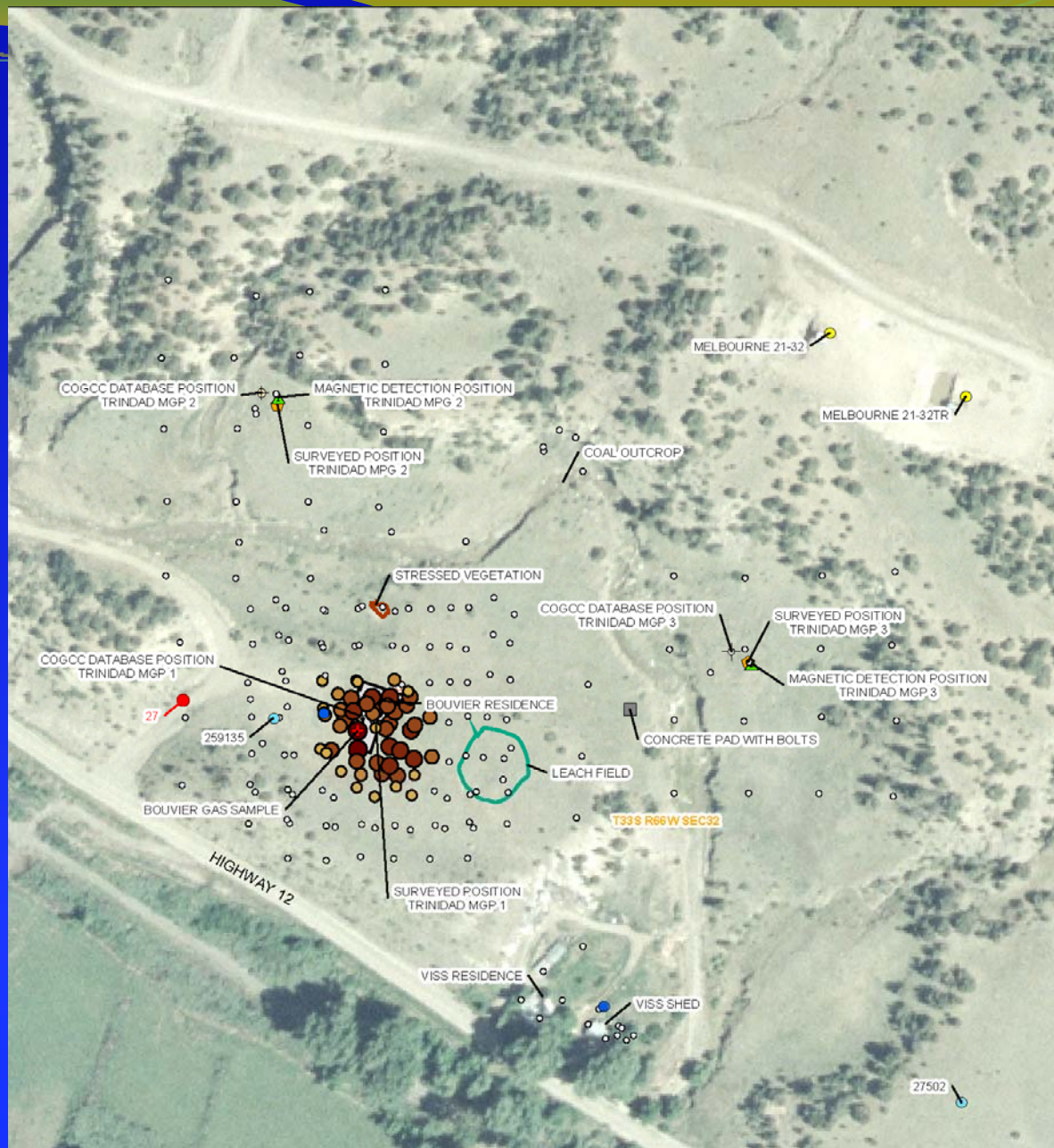
Rule 608.a(1) – P&A'd Wells

- Requires operators to ID all P&A'd wells w/in $\frac{1}{4}$ mile of a proposed CBM well.
 - Assess risk of leaking gas or water to the ground surface based on available plugging and cementing procedures described in reports filed with the COGCC.
 - Notify the Director of the assessment results. Further actions TBD based upon results.

Rule 608.a(2) P&A'd wells

- Operators must make good faith efforts to obtain access to identified P&A'd wells w/in $\frac{1}{4}$ mile of a proposed CBM well and to conduct soil gas surveys:
 1. Prior to production,
 2. 1 year after first production, and
 3. Every 3 years thereafter.
- Submit results of soil gas surveys to COGCC w/in 3 months of conducting survey or;
- Advise COGCC that access could not be obtained.

Example of Soil Gas Survey Results



Las Animas County - April 2007





P&A Well

27MCF/day

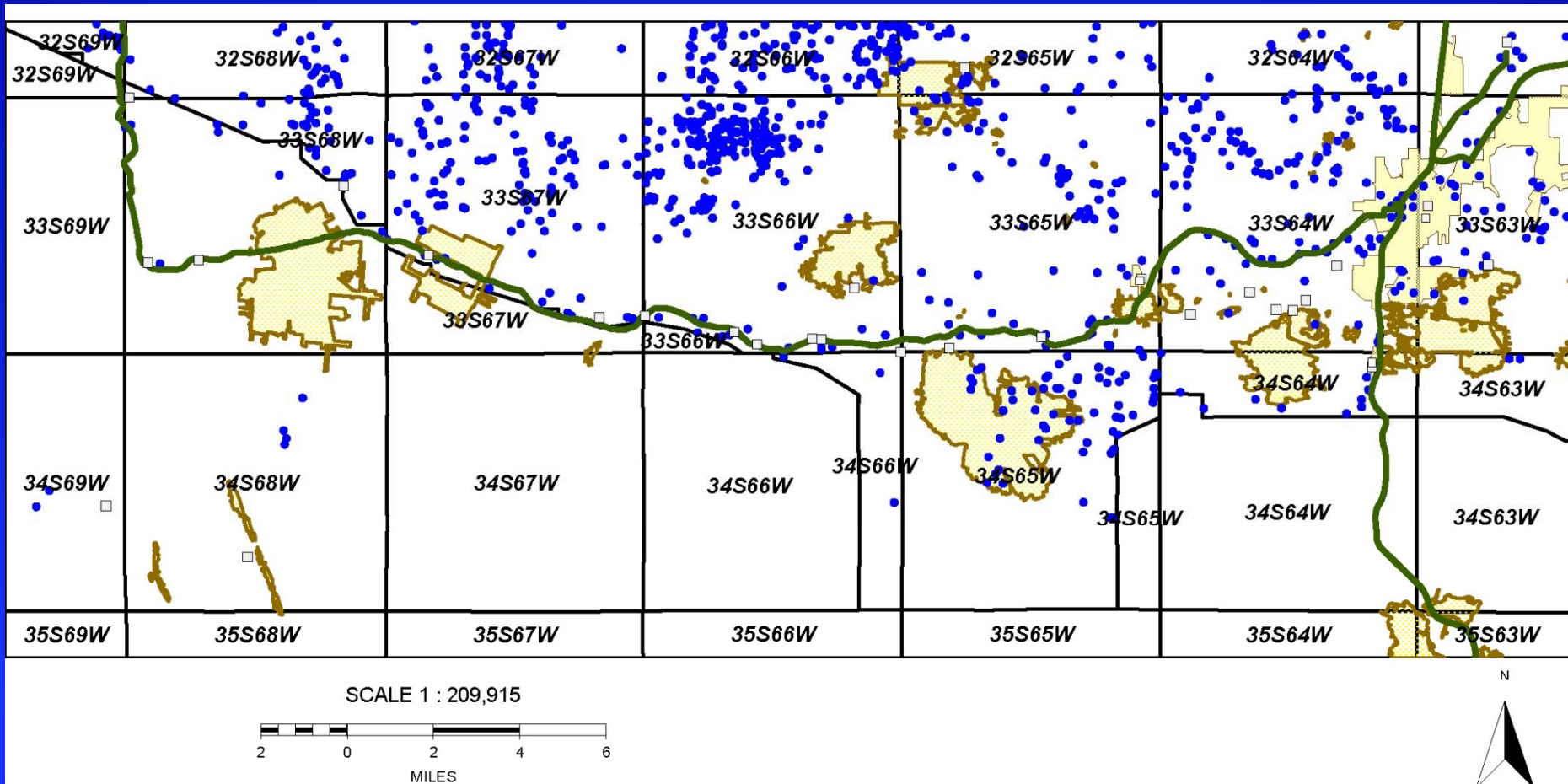
608.b - Water Well Sampling

- When and where is testing required? 608.b.(1)
- What is to be tested? 608.b.(2)
- Free gas detected or dissolved methane >2mg/l 608.b.(3)
- Frequency 608.b.(4)
- Submit Results 608.b.(5)

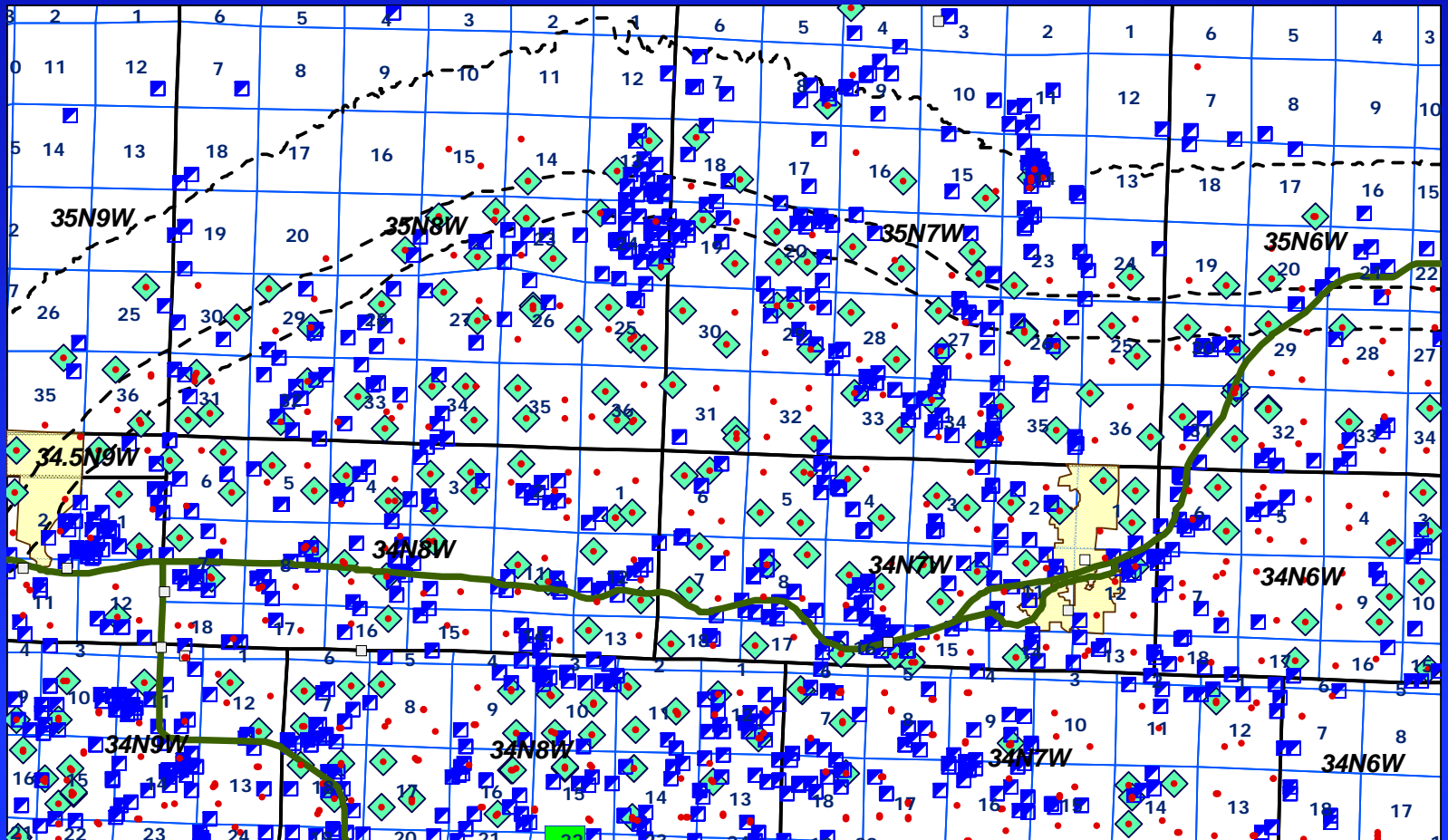
608.b.(1) - Water Well Sampling

- When and where is testing required?
 - If conventional gas well or P&A well within $\frac{1}{4}$ mile of proposed CBM well, then 2 closest water wells within $\frac{1}{2}$ mile of conventional or P&A well shall be sampled.
 - If no conventional or P&A wells within $\frac{1}{4}$ mile, then select 2 water wells within $\frac{1}{4}$ mile of proposed CBM well for sampling.
 - If no water wells within $\frac{1}{4}$ mile or access denied then 2 water wells within $\frac{1}{2}$ mile of the proposed CBM well should be sampled.

Southern Raton Basin Coal Mine Outlines and Domestic Water Wells Available on COGCC Web Site



San Juan Basin – Sampled Water Wells Available on COGCC Web Site



608.b.(2) - Water Well Sampling

- What is to be tested?
 - Major cations – Na, K, Ca, Mg
 - Major anions – Cl, F, Br, SO₄, NO₂, NO₃
 - Dissolved methane (CH₄)
 - Fe, Mn, Se,
 - TDS, specific conductance
 - Field pH and H₂S,
 - Bacteria
 - Field observations – odor, color sediment, effervescence
 - Location per Rule 215

608.b.(3) Water Well Sampling

- If free gas detected or dissolved methane $>2\text{mg/l}$
 - Then isotopic composition of methane (deuterium and carbon isotopes) and gas composition to be determined.
 - If methane is biogenic no further testing
 - If methane is thermogenic or mix of thermogenic and biogenic then operator submits action plan to Director to determine the source of the methane
 - If methane concentration increases by more than 5mg/l between sampling events or concentration is greater than 10mg/l the operator must immediately notify the COGCC and well owner

608.b.(4) Water Well Sampling

- Frequency
 - Before drilling the CBM well
 - Within 1 year after completion of the CBM well
 - 3 and 6 years after post-completion sample
- Good Faith Effort by Operator to obtain permissions and samples
- If baseline quality is maintained after 6 years post completion, then no further testing shall be required.

608.b.(5) - Water Well Sampling

- **Submit Results**
 - Operator shall provide all test results to water well owner within 3 months of sampling.
 - Operator shall provide the Commission with all results in an acceptable electronic data format within 3 months of sampling

608.c. Coal Outcrop and Coal Mine Monitoring

- When and where is testing required? 608.c.(1)
- Gas Seeps Surveys 608.c.(2)
- Submit results 608.c.(3)
- Outcrop and Spring Mapping 608.c.(4)

Outcrop & Gas Seep Mapping



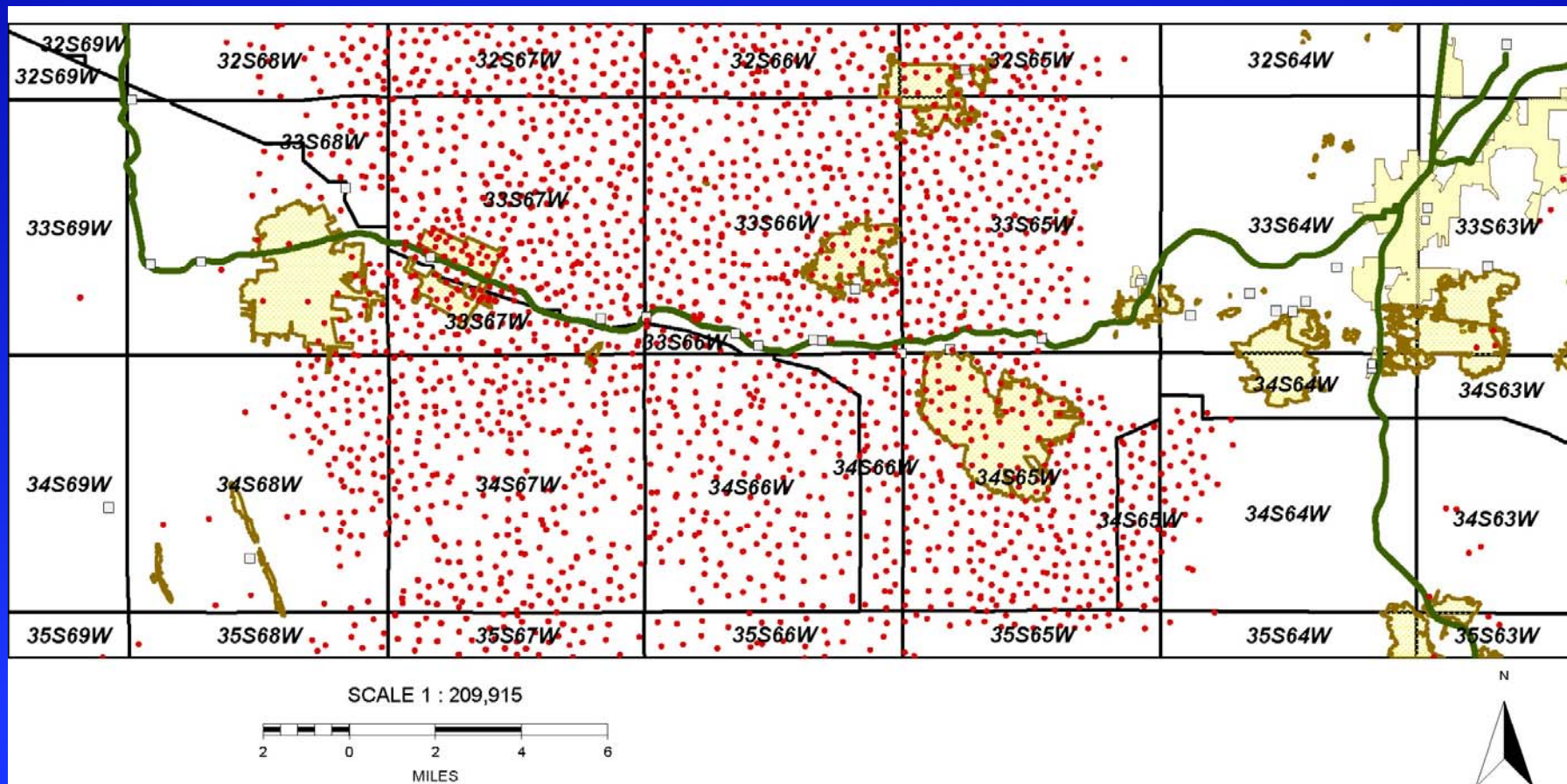
608.c.(1) Coal Outcrop and Coal Mine Monitoring

- If CBM well is w/in 2 miles of the outcrop of the contact between coal and underlying formation, or coal mine the operator shall:
 - Survey the outcrop.
 - Review publicly available geologic and hydrogeologic data
 - Interview landowners
 - Identify springs or water or gas seeps that discharge from the coal-bearing formation

608.c.(2) Coal Outcrop and Coal Mine Monitoring

- If a gas seep is identified during the survey:
 - The location and areal extent shall be surveyed in accordance with Rule 215
 - The concentration of the soil gas shall be determined
 - A sample of the gas shall be collected for compositional and stable isotope analysis of the methane (carbon & deuterium), if possible
 - Annual surveys shall be conducted
 - Submit results to the COGCC and surface owner w/in 3 months of completion of field work.

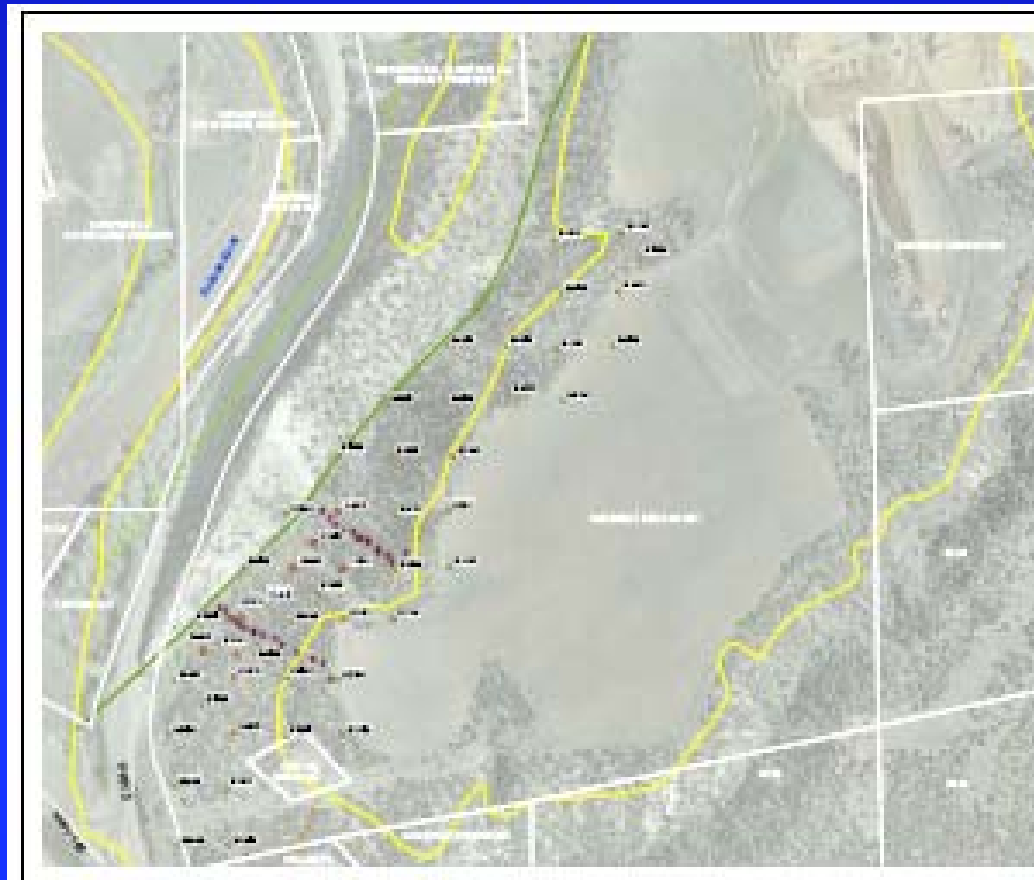
Southern Raton Basin Coal Mine Outlines and Oil and Gas Wells Available on COGCC Web Site



San Juan Basin - Soil Gas Monitoring Available on COGCC Web Site Library



San Juan Basin - Soil Gas Monitoring Available on COGCC Web Site Library



608.c.(3) Coal Outcrop and Coal Mine Monitoring

- If a gas seep is identified during the survey:
 - Submit analytical data to the COGCC in electronic format
 - COGCC shall advise landowners, local government, the Colorado Geological Survey (CGS), and Colorado Division of Reclamation, Mining, and Safety (DRMS), as appropriate.
 - Collaborative efforts may be developed between area stakeholders to produce a geologic hazard survey to determine if the area should be designated a geologic hazard.

608.c.(4) Coal Outcrop and Coal Mine Monitoring

- If CBM well is w/in 2 miles of the outcrop of the contact between coal and underlying formation, the operator shall:
 - Survey the outcrop
 - Review publicly available geologic and hydrogeologic data
 - Interview landowners
- Identify springs or water seeps that discharge from the coal-bearing formation

608.c.(4) Coal Outcrop and Coal Mine Monitoring

- If a water seep is identified during the survey:
 - The location and areal extent shall be surveyed in accordance with Rule 215
 - The flow rate shall be determined
 - Photographs shall be taken
 - Collect and analyze a water sample in accordance with Rule 608.b.(2)
 - Annual surveys shall be conducted
 - Submit results to the COGCC and surface owner w/in 3 months of completion of filed work.
 - Submit analytical data to the COGCC in electronic format

608.d. Static Bottom-Hole Pressure Survey

- Prior to Production the Operator shall obtain a static bottom-hole pressure test on the 1st well drilled in each 1/4 section
- Survey shall be either a direct static bottom hole pressure or static water level measurement
- Submit to COGCC on Form 13 –Bottom Hole Pressure to report
- Submit with Form 5a –Completed Interval Report

608.e. - Bradenhead Testing

- New and existing well must be equipped with bradenhead access to annulus between the production and surface casing with approved fittings to allow safe and convenient determination of pressure and fluid flow.
- Biennial tests on all wells capable of production, injection and observation.
- Results submitted to COGCC on Form 17.

608.f. Locally Specific Field Orders

- Provisions of Rule 608 may be modified or superseded on a basin, region or county-specific basis by field orders developed by the COGCC in consultation with affected parties, with Director approval
- Additionally, an Operator or other affected party has the right to file an application with the COGCC to develop field orders that modify Rule 608 requirements with an explanation of good cause