

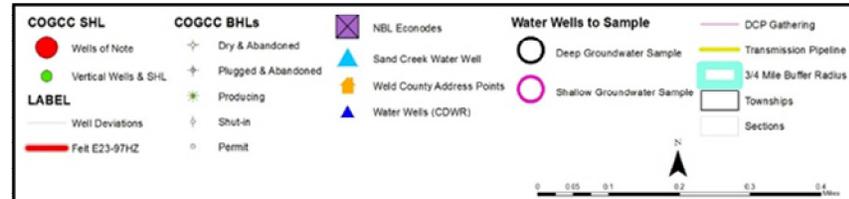
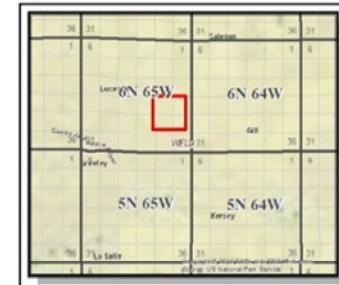
**Sand Creek Monitoring Well –
Form 27 Site Investigation Discussion**

April 13, 2016

Form 27 Tasks – Update from Jan. 28 Meeting

- **Area Map with Group 1 Oil & Gas Wells**
- **Surrounding water well sampling**
- **Engineering evaluation**
 - USIT logs on 4 wells conducted in February
 - Further review of Feit E23-16 (previously P&A'd March 2014)
 - Bradenhead samples
- **Isotopic Gas Analysis**
- **Sand Creek monitoring well**
 - Re-completion of well
 - Additional downhole camera inspection
 - Sampling & flow measurements
 - Well development
- **Next Steps**

Sand Creek Well – Overview of Surrounding Area



Water Well Sampling Results

- **No further impacts identified**
- **Since Jan. 28, received all water well analytical data**
- **Methane results completed**
 - 4 “non-detects” and 2 with trace amounts of methane < 1.0 mg/L
 - Subsequent isotopic analyses showed trace methane to be biogenic
- **Results sent to landowners Feb. 16-19 and sent to COGCC for 318A and remediation file databases**
- **Water well sampling is completed**

USIT Log Findings

➤ USIT Logs run Feb. 5 - Feb. 18

➤ Feit 23-97HZ

- Potential for channeled cement
 - Two potential squeeze locations identified
- Good casing integrity

➤ Feit E23-09, Howard 14-26EG, and Howard E26-01

- Good cement coverage
- Good casing integrity

➤ Feit E23-16 (P&A) review

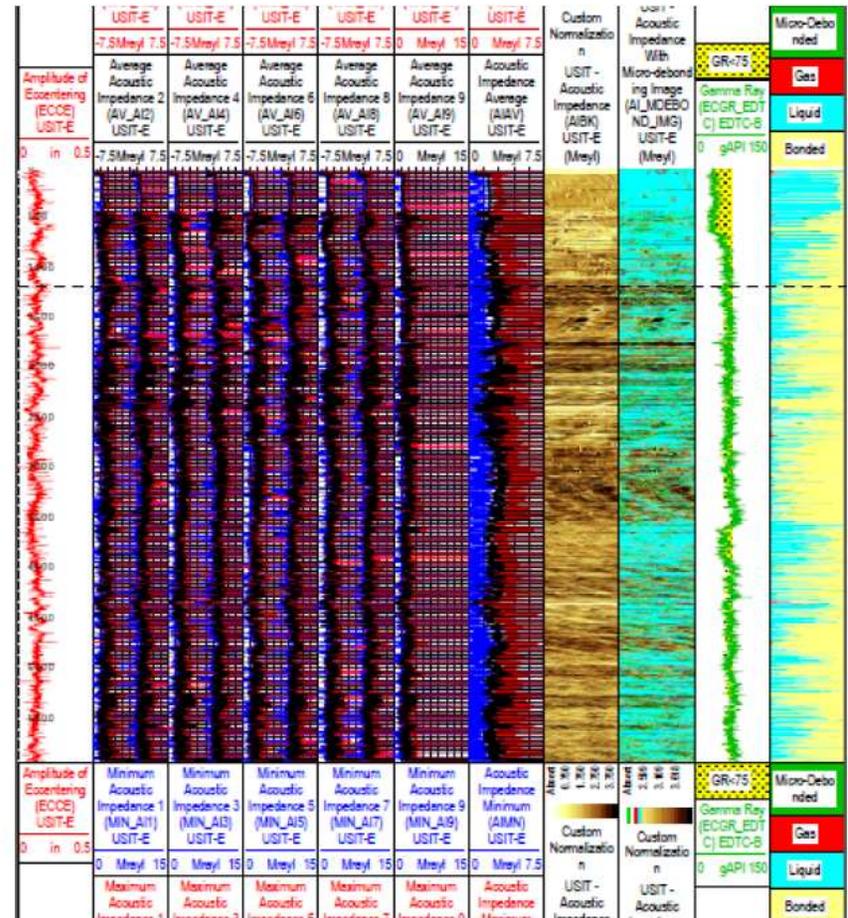
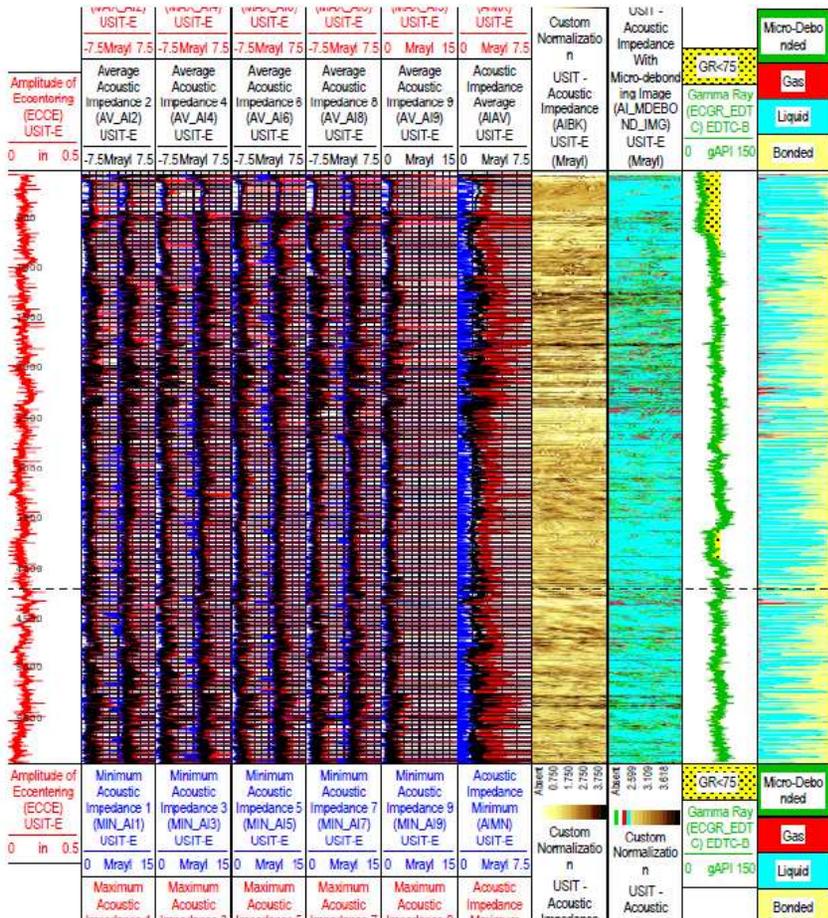
- Well was plugged and abandoned according to COGCC standards Mar 2014
 - Casing patch Jun 2003
 - Codell re-frac Nov 2003
 - P&A Mar 2014

FEIT E23-97HZ USIT Log

USIT logs run by Schlumberger

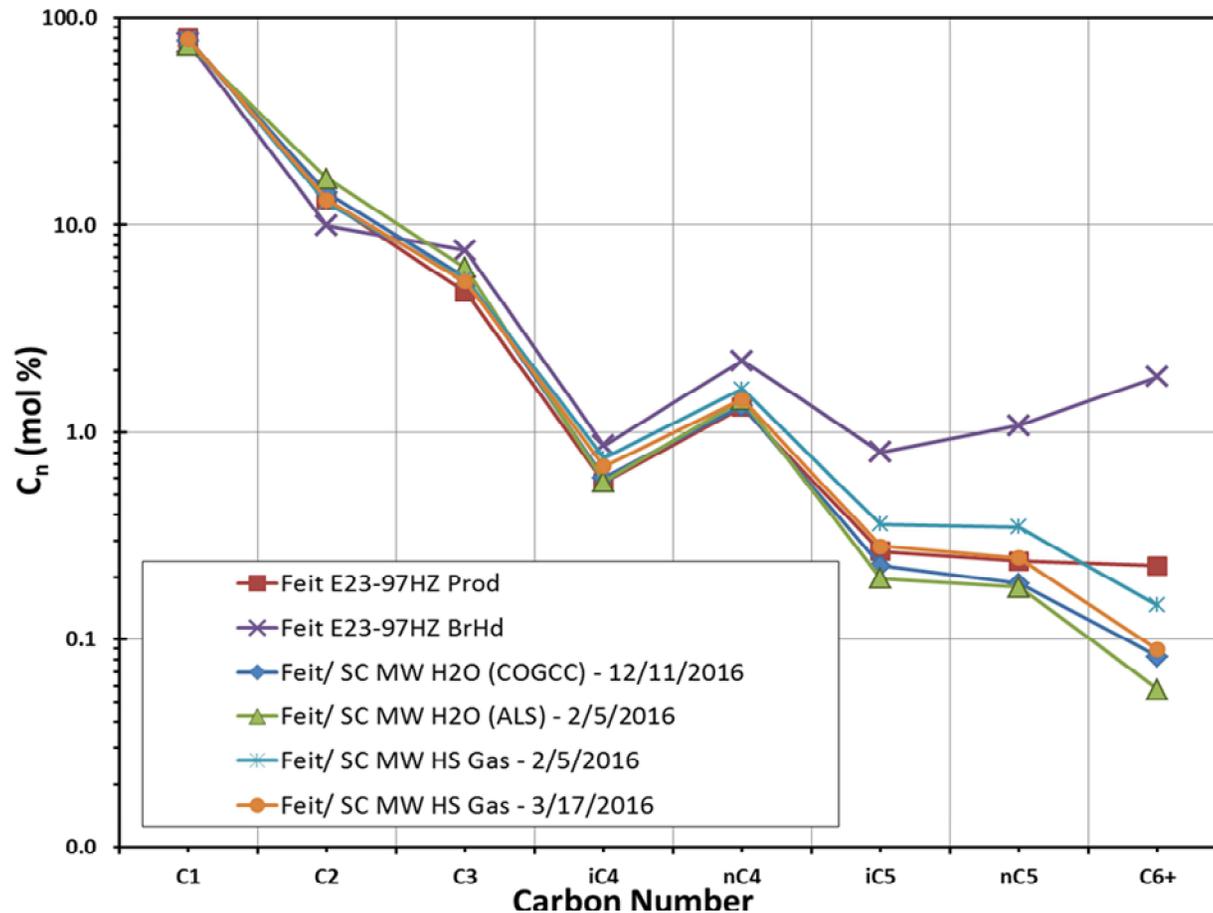
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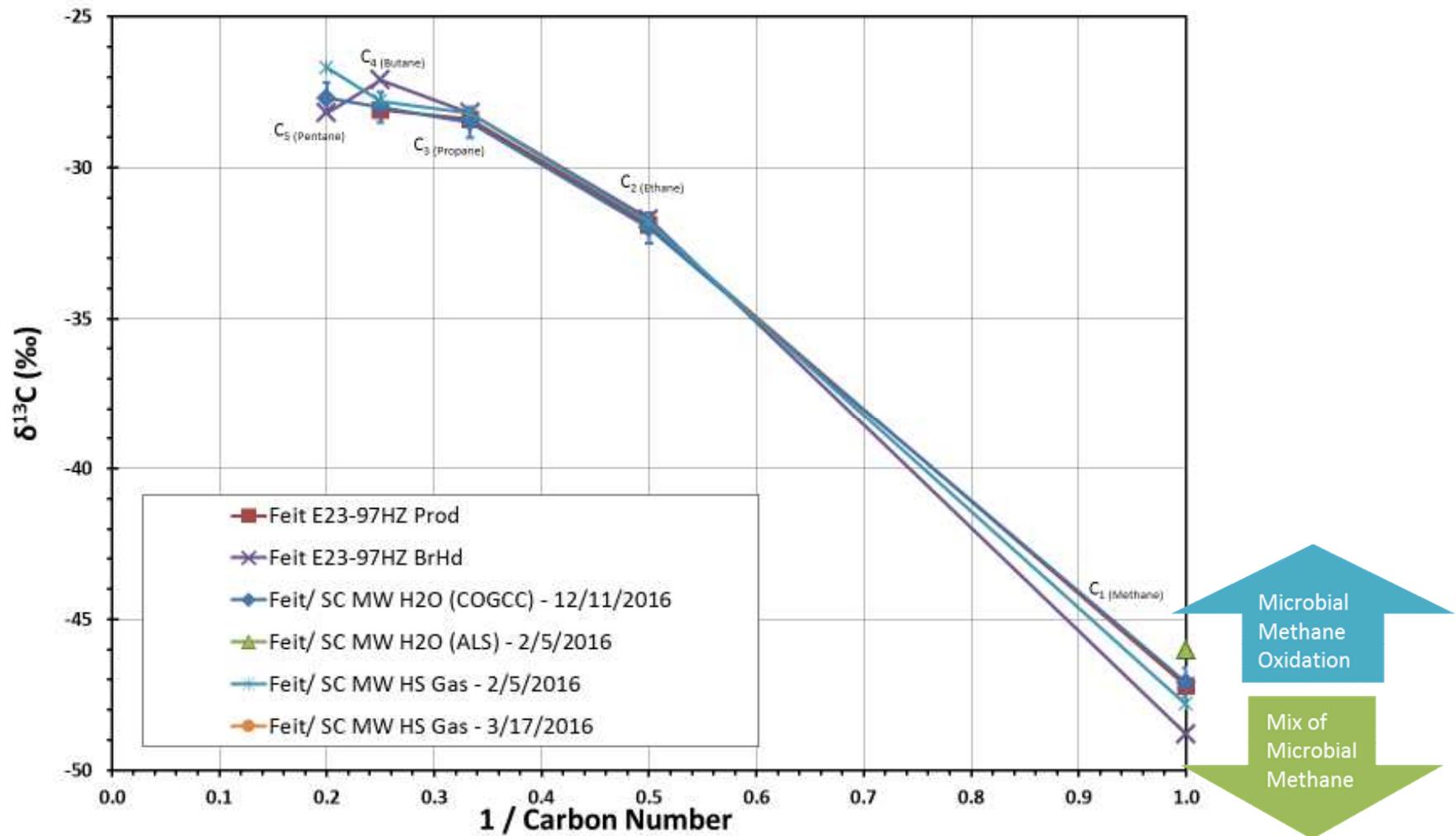
Feit 23-97HZ – Bradenhead Pressure & Samples

- History of Bradenhead pressures ranging from 40-50 psig up to 200 psig
- Bridge plug set on Feb. 4 and USIT log run on Feb. 5
- Bradenhead sample collected on Feb. 17 had a slightly different composition from production gas on the well
- Bradenhead pressure has recently been 0-5 psig
- Wellhead and casing pressure tests have not shown any leaks/loss of pressure



Graph from Dolan Integration Group

Isotopic Analysis – Natural Gas “Chung” Plot

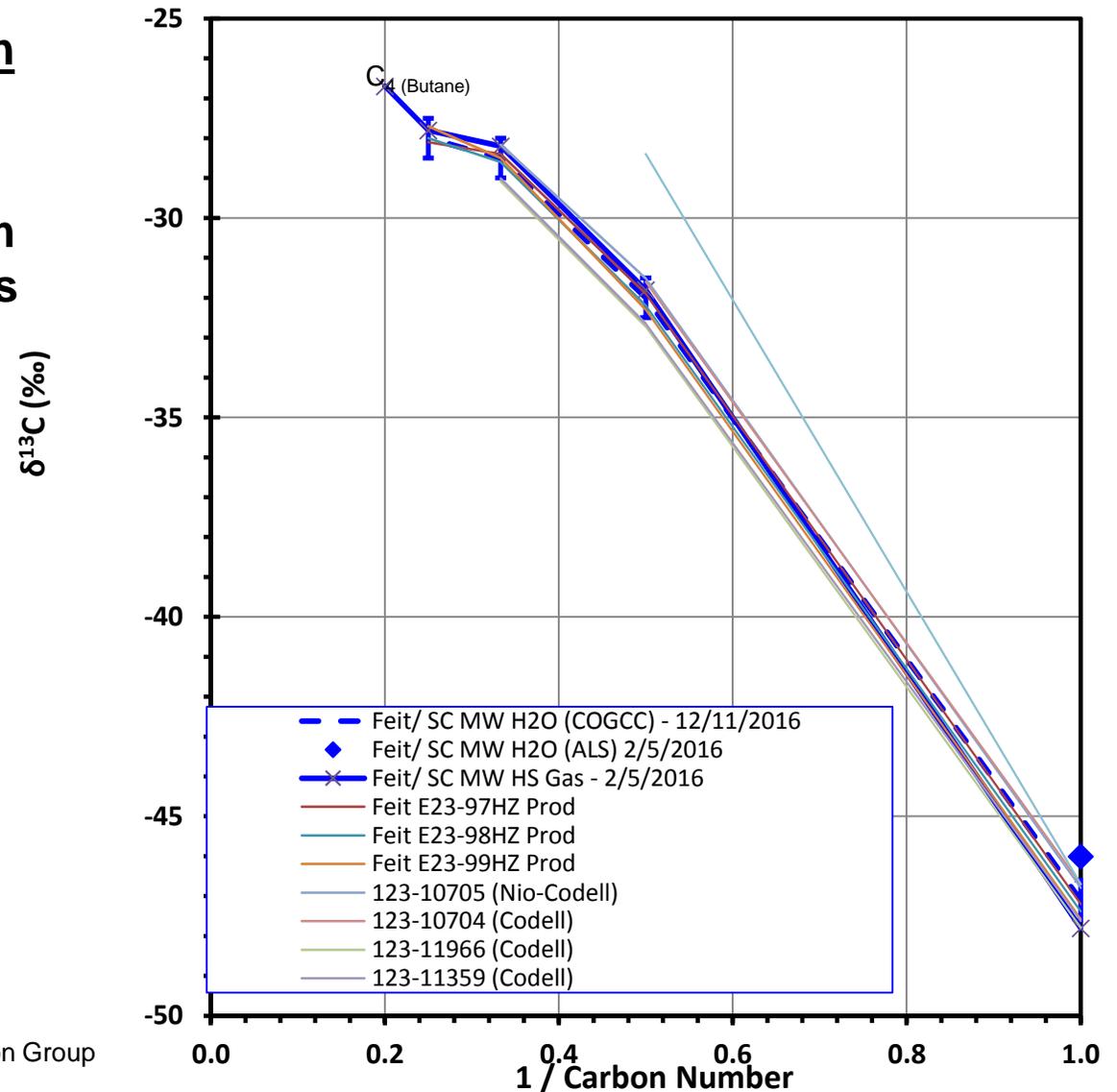


- Analysis by Dolan Integration Group
- Methane stable isotope compositions are susceptible to alteration in the near surface, but ethane and propane stable carbon isotopes are robust in most scenarios.
- The ethane and propane isotopic composition is indistinguishable among samples.

Carbon Isotopes – Natural Gas Plot

➤ Comparing Nearby Production Gas Isotopes

- Production gas signatures from area wells within a 4 mile radius producing Niobrara and Codell do not show much variability, and are potential matches for the gas dissolved in the groundwater



Graph and Analysis from Dolan Integration Group

Conclusions from Gas Composition/Isotope Work

- **Gas is Niobrara/Nio-Codell formation gas and is indistinguishable among various samples within a 4 mile radius**
- **Gas shows no sign of biogenic activity**

Sand Creek Monitoring Well

➤ Downhole camera inspection on Jan. 22

- Free gas bubbles observed entering wellbore at ~120' (bottom of upper screened section)
- Gas believed to be entering wellbore in the 120-260' blanked section and migrating behind the blank PVC pipe until it reached the bottom of the screened section

➤ Re-completion of Sand Creek Well March 8-11

- Objectives:
 - Cover the shallow alluvial aquifer at ~60' to prevent potential gas migration into aquifer
 - "Uncover" the point of gas entry
- Existing wellbore & PVC drilled out and replaced
 - Blank PVC with bentonite from near surface to ~120'
 - Screened section from 120-260'
 - Bentonite chips placed in bottom of well 260-340' to fill it in

➤ Downhole camera inspection March 17

- High turbidity in water – could see very little except for turbulence caused by gas entering wellbore
- Natural gas point of entry appears to be ~227'
- 227' corresponds with sandy streak observed in log of original well

Sand Creek Monitoring Well

➤ Observations after re-completion on Mar. 17

- Shut-in gas pressure appears to be relatively low (~1 psig)
- Available data suggests flow on the order of 1-10 scfm
- Gas flow can be effectively stopped with cap on well
 - Plan to inspect with IR camera to verify seal
- Fluid level ~24' below surface

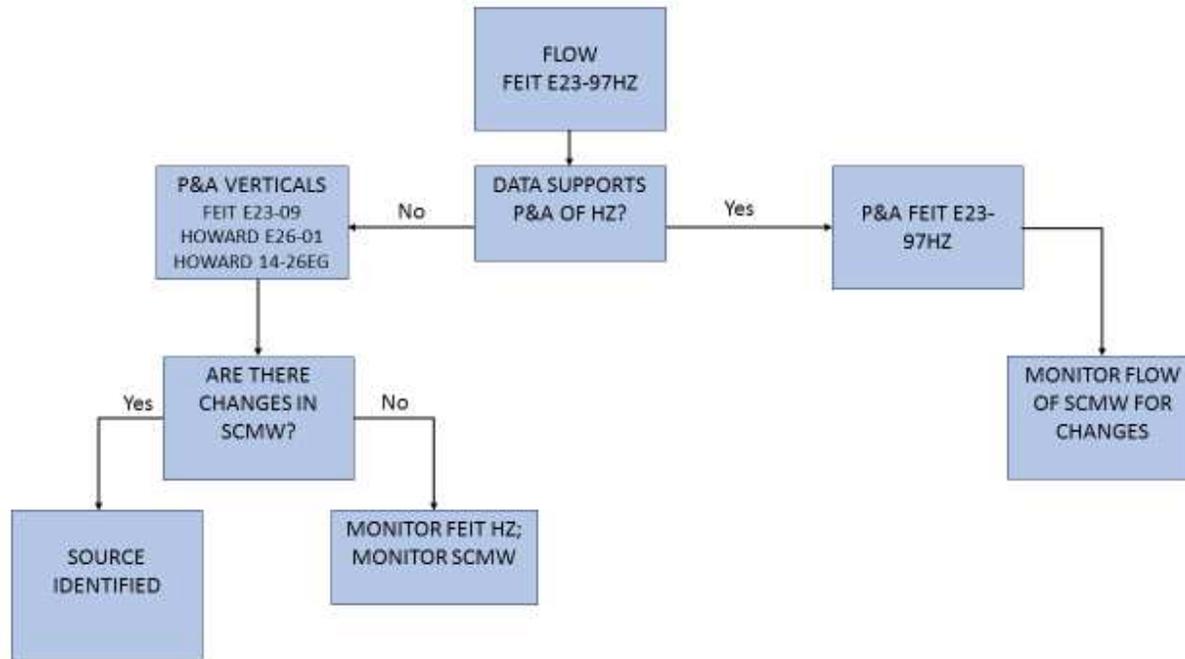
➤ Well development efforts

- Well was swabbed and purged on Apr. 7
 - Water samples were collected after water cleared and parameters stabilized
- Available data suggests well is recovering at 1-2 gpm at a depth of approximately 127' bgs
 - Presumably Laramie Fox Hills – sampled Apr. 7 and being analyzed for Stiff diagram

➤ Ongoing well evaluation efforts

- Arranging for additional measurements and gas sampling
 - Headspace gas sample collected Apr. 11
 - Weekly flow measurements planned (may be reduced to monthly based on results)
- Well will remain capped

Proposed Next Steps – Logic Diagram



Proposed Next Steps – Additional Details

➤ **Monitoring well**

- Begin weekly measurements of gas flow and composition
 - Reduce analytical frequency if gas composition is observed to be stable

➤ **Proceed with P&A of 3 vertical wells**

- Start P&A planning/notification – plug ~ May 15-June 1

➤ **Feit 23-97HZ well**

- Bring well back on production and track Bradenhead pressure