COLORADO OIL AND GAS CONSERVATION COMMISSION
4M PROJECT COAL BED METHANE MONITORING WELL INSTALLATION REPORT
ARCHULETA COUNTY, COLORADO

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1.0 EXECUTIVE SUMMARY

On behalf of the Colorado Oil and Gas Conservation Commission (COGCC), Souder, Miller & Associates (SMA) supervised the construction of six Fruitland Formation coal bed methane monitoring wells. Oil and gas industry standard well drilling and completion techniques were used. Field work was performed from August 12, 2008 through December 5, 2008. Map 1, Regional Topographic Map and Photo 1, Regional Aerial Photo illustrate the regional orientation of the three sites. The six wells are located in Archuleta County at the following three sites:

1. Wagon Gulch, located in Section 4, Township 34 North, Range 05 West, see Map 2 and Photo 2 illustrate site specific topography.
2. Fosset Gulch, located in Section 14, Township 34 North, Range 05 West, see Map 3 and Photo 3 illustrate site specific topography.
3. Highway 151, located in Section 30, Township 34 North, Range 04 West, see Map 4 and Photo 4 illustrate site specific topography.

Two coal bed methane monitoring wells were installed at each location. The wells at the Wagon Gulch site were installed to depths of 927 feet below ground surface (bgs) and 883 bgs. The wells at Fosset Gulch site were installed to depths of 618 and 660 feet bgs. The wells at the Highway 151 site were each installed to a depth of 330 feet bgs. The wells are equipped with pressure transducers and telemetry equipment. The pressure monitoring and telemetry equipment permits remote internet based monitoring of pressures in the top and bottom of each borehole and calculation of gas pressure and water levels at each location.

SMA recommends ongoing evaluation of data obtained in this study to determine if additional monitoring wells are needed to document potential dangers to the public and the environment from CBM seeps.

2.0 INTRODUCTION

This report details the well site preparation activities, monitoring well drilling, casing installation, perforating, swabbing, and pressure sensing and telemetry equipment installation activities associated with the Archuleta County Colorado Coal Bed Methane (CBM) Monitoring well site locations. The wells sites are known as: Wagon Gulch located in Section 4, Township 34 North, Range 05 West; Fosset Gulch located in Section 14, Township 34 North, Range 05 West; and the Highway 151 located in Section 30, Township 34 North, Range 04 West. See Table 1, Summary of Archuleta County Coal Bed Methane Monitoring Well Details, for specifics of each well for each location. All field activities were performed from August 12, 2008 to December 5, 2008. SMA performed the work pursuant to contract PHA-837 between the Colorado Department of Natural Resources and SMA.

3.0 OBJECTIVES

The objectives are:

1. Drilling and completion of six CBM monitoring wells in the Fruitland Formation within one mile of the outcrop.
2. Conduct lithologic and geophysical logging in each borehole to provide detailed information on subsurface geology including the depth to Fruitland Formation coal seams and the top of the Pictured Cliffs Formation
3. Collect Fruitland Coal cores in sufficient quantity to conduct methane desorption studies from an area with minor CBM production and little data regarding the characteristics of coal seams within the Fruitland Formation. Desorption studies aid in the calculation of the gas in place and the potential for gas generation.
4. Perforate well bores in specific coal intervals to monitor groundwater elevations and gas pressures from specific coal seams within the Fruitland Formation
5. Installation of pressure transducers and telemetry systems to provide remote access to methane gas pressures and groundwater elevations.

4.0 BACKGROUND

The Fruitland Formation in the San Juan Basin extends from southwestern Colorado into New Mexico and is one of the most productive coal bed methane (CBM) reservoirs in the United States. In 2001 and 2002, the COGCC installed seven monitoring wells into the Fruitland Formation at four locations near the outcrop in La Plata County. This work was completed as part of a larger study; the “3M Project”, which refers to its three main components: geologic mapping, groundwater monitoring, and computer modeling. These wells have served to monitor Fruitland Formation pressures and water levels In La Plata County since their installation.

In 2007, the COGCC received a special appropriation from the Colorado Legislature to expand the monitoring network into the eastern part of the San Juan Basin, as well as installing additional wells in the western part of the Basin and performing pilot scale mitigation testing. The eastern area wells will measure formation pressures in the coal seams in the Fruitland Formation and will establish baseline conditions before extensive coal bed methane development occurs in the area. The new, larger study is referred to as the “4M Project”, which refers to the original 3M plus the incorporation of a mitigation component, hence “4M”

The San Juan Basin of Colorado-New Mexico historically has had methane seeps identified along the Fruitland Coal outcrop in La Plata County. To date, no significant seeps attributable to the methane from the Fruitland Formation have been identified in Archuleta County. The northern portion of the San Juan Basin is located in La Plata and Archuleta counties, Colorado. As coal bed methane production was developed in this area in the 1990's and population density increased, gas seeps became more common and a potential risk to residents living in homes not modified to cope with threat of explosion.

To respond to the potential risk of CBM seeps, the COGCC funded the 3M project (Mapping, Modeling and Monitoring) in 2000 to install monitoring wells along the Fruitland Coal outcrop north of Bayfield Colorado and south of Vallecito Lake.

South of the Archuleta County study area, ongoing monitoring well studies for the Southern Ute Tribe, reported in 2008 at the San Juan Basin stakeholders meeting, are showing increasing pressures as CBM production has been developed. In response to results of the Southern Ute studies and to extend the existing monitoring well network into the eastern San Juan Basin, the COGCC initiated a Fruitland Formation reservoir pressure monitoring well program in the Chimney Rock Area of Archuleta County, Colorado with the co-operation of the United States Forest Service (USFS). The study is known as the 4M project (Mapping, Modeling, Monitoring and Mitigation).

5.0 REGIONAL GEOLOGY

The project setting is in the northeast portion of the San Juan Basin near Chimney Rock in Archuleta County. The San Juan Basin is a depression that contains Cambrian, Devonian, Mississippian, Pennsylvanian, Permian, Triassic, Jurassic, Cretaceous, Tertiary and Quaternary rocks (Fasset 1625-B). The project emphasis is on monitoring reservoir pressures and water levels within the Upper Cretaceous Lower Fruitland Formation. The Fruitland Formation outcrops along the northeastern edge of the San Juan Basin. The Kirtland Shale, the Fruitland Formation and the Pictured Cliffs sandstone were identified during drilling activities. All monitoring wells have the long string casing set near the top of the Pictured Cliffs Sandstone and all were perforated at selected intervals within the Fruitland Formation at coal beds identified from open hole and cased hole geophysical logs.

6.0 APPROACH

SMA's approach for the project was to use gas industry standard well designs, material specifications and drilling methods. Standard gas production drilling techniques were chosen for reasons of safety, capability, long term durability and costs. Minor equipment modifications may be necessary to ensure optimum efficiency and accuracy of data collected.

SMA worked with Scorpion Drilling of Farmington, New Mexico to develop the drilling program. Drilling with fluids (mud) was chosen as the preferred method for drilling the wells based on economics and the ability to use a small pad to minimize surface impacts.

The drilling fluids were contained within a closed loop drilling fluid system and consisted of polymer, bentonite, water and caustic soda with lost circulation material as needed. The closed loop drilling fluid system was chosen to reduce pad size and to minimize surface and potential environmental impacts.

Reconditioned bits were used to drill 8 ¾" surface holes for 7" 20 pound per foot steel surface casing, utilizing oilfield cementing techniques. Standard 7" casing heads were utilized to drill 6 ¼" holes to total depth. The long string casing chosen was 4 ½" 10.5 pounds per foot steel. The casing was set by circulating 15.5 lb/gallon cement to surface, to fully seal the annular space, then displacing the casing volume with water so the long string was not full of cement.

7.0 WELL SITE SURVEYING, PERMITTING AND CONSTRUCTION

From August 12, 2008 to September 22, 2008, SMA surveyed and staked the Wagon Gulch, Fosset Gulch, Deep Canyon and the Highway 151 well site locations for the purpose of creating topographic maps for each well site. The topographic maps were then used to create final well site designs pursuant to the USFS specified criteria. These final designs included well pad dimensions, construction diagrams, cut and fill diagrams, access road design and the implementation of storm water pollution prevention best management practices. Applications for permits to drill, figures and diagrams are located in Appendix A. When design modifications were complete, SMA re-surveyed and re-staked each site for the construction of the locations.

From September 23, 2008 to October 25, 2008, Consolidated Constructors of Farmington, New Mexico, under the supervision of SMA, constructed the Wagon Gulch, Fosset Gulch and the Highway 151 well site locations. Each well pad was constructed within the staked areas of disturbance as approved by the USFS. The Deep Canyon location was not constructed at the request of COGCC. Photographs of all locations prior to during drilling and after site reclamation are located in Appendix G.

8.0 COAL BED METHANE MONITORING WELL DRILLING AND INSTALLATION TECHNIQUES COMMON TO ALL PROJECT MONITORING WELLS

From September 27, 2008 to November 11, 2008, Scorpion Drilling Company of Farmington, New Mexico, under the supervision of SMA, drilled six CBM monitoring wells to various depths. Two monitoring wells were installed at each of the three locations utilizing a closed loop mud rotary drilling technique. The following sections discuss methods that were utilized during the drilling and installation of all six monitoring wells.

Generic listing of operations:

1. Stake location and access
2. Build location and access. No drilling pits were required due to modified closed loop system. Lined cuttings pits were used to store and dry cuttings prior to burial on site.
3. Move in drilling rig, water storage tanks, and miscellaneous equipment.
4. Haul water from commercial sources.
5. Spud well, drill to 250 – 260 feet except at the Highway 151 location where surface casing was set to 137 feet due to the shallow target interval.
6. Set 250 feet of surface casing, circulate 15.5 lb/gallon cement to surface.
7. Wait on cement 12 hours- allow cement to cure.
8. Test casing, rig up blow out preventer (BOP).
9. Drill to top of Pictured Cliffs Formation (PC)
10. Run open hole geophysical logs.
11. Run casing to total depth, circulate 15.5 lb/gallon cement to surface.
12. Wait on cement 12 hours- allow cement to cure.
13. Run cased hole logs, perforate.
14. Develop well.
15. Skid drill rig.
16. Transport non-recyclable portion of drilling fluids to disposal and bring in additional water.

Second Borehole:

17. Spud well, drill to 250 – 260 feet except at the Highway 151 location where surface casing was set to 137 feet due to the shallow target interval.
18. Wait on cement 12 hours-allow cement cure.
19. Test casing, rig up BOP.
20. Drill ahead to zone of interest identified by geophysical logs.
21. Cut 30 foot coal core and process.
22. Drill ahead to next zone of interest.
23. Cut 30 foot coal core and process
24. Drill ahead to the PC.
25. Run casing to total depth, circulate 15.5 lb/gallon cement to surface.
26. Wait on cement 12 hours- allow cement to cure.
27. Move out drilling rig

28. Haul waste for disposal and haul drilling fluids to next location.
29. Move in swabbing rig
30. Run cased hole logs and perforate.
31. Develop well
32. Rig down and move to second site.
33. Set tubing head
34. Install transducers and remote terminal unit.
35. Data accessible online
36. Reclamation

8.1 WATER HAULING AND DRILLING FLUID DISPOSAL

Water hauling for drilling and cementing activities was performed by various contractors from Farmington, New Mexico. Water was transported from Allison, Colorado or Ignacio, Colorado.

Waste drilling fluids from the closed loop drilling system were transported by various Farmington, New Mexico area contractors' vacuum trucks. All drilling fluids were disposed of at properly permitted facilities in Farmington, New Mexico. A single vacuum truck was able to transport up to 80 barrels of drilling fluids.

8.2 LITHOLOGIC LOGGING

SMA personnel conducted all lithologic logging activities. Lithological sample descriptions consisted of general mineralogy and sample characteristics including color, grain size, grain shape, degree of cementation, and acid response. Lithological descriptions are located on Figures 1-6. Geophysical, Lithological & Well Construction Diagrams located in Appendix B.

8.3 SURFACE CASING BORE HOLE DRILLING, SURFACE CASING INSTALLATION AND CEMENTING

The borehole for the surface casing for each monitoring well was drilled with an 8 ¾" drilling bit. Each surface casing was constructed with 7" inside diameter, 20 pound per foot steel casing. Each surface casing was installed by San Juan Casing of Farmington, New Mexico except the surface casings at the Highway 151 location. The Highway 151 surface casings were installed by Scorpion Drilling Company, due to the relatively shallow depths of these surface casings. The surface casings were then cemented by Pace Cementing & Acidizing Services or Superior Well Services of Farmington, New Mexico. The cement was mixed to 15.5 pound per gallon consistency and then circulated to the surface and allowed to set for 12 hours. Figures 1-6, As Built Diagrams of each monitoring well, are provided in Appendix C.

8.4 BLOW OUT PREVENTER (BOP)

After cement was allowed to set for at least 12 hours, the Scorpion Drilling Company crew installed a double ram 5000 pound per square inch (psi) rated Weatherford BOP. The BOP was installed on the surface casing and then pressure tested to 600 psi. The BOP diagram is provided in Appendix D.

8.5 LONG STRING BORE HOLE DRILLING AND OPEN HOLE GEOPHYSICAL LOGGING

The long string casing bore hole for each monitoring well was drilled with a 6 1/4" drilling bit. After total depth was reached in each monitoring well, Jet West of Farmington, New Mexico performed open hole geophysical logging of both monitoring wells at the Wagon Gulch location, and on monitoring well number two at both the Fosset Gulch and Highway 151 locations. The open hole geophysical logging suite included gamma ray, bulk density, neutron, temperature, electric resistivity, Acoustic Televiewer and bore hole deviation logs. Geophysical logs are located in Appendix E. Geophysical, Lithological and Well Construction Diagrams are located in Appendix B.

8.6 COAL CORING, COAL SAMPLE COLLECTION AND ANALYSIS

Prior to completing the long string borehole drilling on the Wagon Gulch #2, Fosset Gulch #1 and Highway 151 #1 locations, core samples were collected for analysis. The cored intervals were within the Fruitland Formation coal beds identified based upon the open hole geophysical logs from the first well drilled and drill cutting descriptions. Table 2, Archuleta County Coal Bed Monitoring Well Coal Coring summarizes the cored intervals from each monitoring well.

All coal coring activities were performed by Reed Hycalog, Inc. of Alberta, Canada. All coal samples collected by Reed Hycalog, Inc. were analyzed for coal desorption by Ticora/Weatherford, Inc. of Arvada, Colorado. Ticora/Weatherford collected samples on site and began desorption testing immediately. Cored intervals are illustrated in Figures 1-6, Geophysical, Lithological & Well Construction Diagrams located in Appendix B. Coal desorption analyses are provided in Appendix F. Photos of core samples are provided in Appendix G.

8.7 LONG STRING CASING INSTALLATION AND CEMENTING

After all the open hole geophysical logging and coal coring was complete, each long string casing was constructed with 4 ½" diameter, 10.5 pound per foot steel casing. Each long string casing was installed by San Juan Casing of Farmington, New Mexico. The long string casings were then cemented by Pace Cementing & Acidizing Services or Superior Well Services both of Farmington, New Mexico. The cement was mixed at 15.5 pound per gallon consistency and then circulated to the surface. Figures 1-6, As Built Diagrams of each monitoring well, are provided in Appendix C.

8.8 CASED HOLE LOGGING, PERFORATING AND SWABBING

After construction of each monitoring well, cased hole logging was performed to correlate the depth intervals of the well bore chosen for perforation with the open hole logs. The intervals for perforation were chosen by COGCC and SMA. After cased hole logging was complete, the monitoring wells were perforated using directional explosives. Each monitoring well was perforated at different intervals, however all perforations were completed with four shots per vertical foot (spf). All cased hole logging and perforating was performed by Jet West, Inc. of Farmington, New Mexico. Cased hole logs are located in Appendix E. Perforated intervals of each monitoring well are illustrated in Figures 1-6, As Built Diagrams, provided in Appendix C.

After perforating, each monitoring well was swabbed (developed) to stimulate water and gas production. A specialized swabbing rig made a varying number of runs for each well bore with 4 ½" swabbing cups to remove water from the casing. See Table 3, Archuleta County Coal Bed Methane Monitoring Well Swabbing Activities for swabbing details. All swabbing activities were performed by T&R Swabbing Service of Farmington, New Mexico. The number of swab runs was determined by the SMA onsite geologist after consultation with the COGCC representative.

8.9 TUBING HEADS, PRESSURE TRANSDUCERS AND TELEMETRY SYSTEM INSTALLATION

After swabbing activities were complete, a 2000 psi rated tubing head was installed on the 4 1/2" well casing. Prior to sealing the tubing head, In-Situ, Inc. of Fort Collins, Colorado, under supervision of SMA personnel, installed down hole pressure transducers and well head pressure transducers in each monitoring well. The pressure transducers in each well are 900 psi rated In-Situ, Inc. brand. Each down hole pressure transducer was installed approximately ten feet below the perforated intervals in individual monitoring wells. Then a surface pressure transducer was installed in the tubing well head. All transducers are connected to an In-Situ brand Remote Terminal Unit (RTU) located at each well site location. The RTU records down hole pressures and surface pressures every six hours, or four times daily. The RTUs broadcast the data via satellite uplink to the In-Situ's Data Center which can be accessed at www.isi-data.com.

9.0 WAGON GULCH MONITORING WELL INSTALLATION SPECIFIC DETAILS

9.1 CONSTRUCTION DETAILS FOR MONITORING WELL # 1 API # 05-007-06267-00

From September 27, 2008 to October 2, 2008, Wagon Gulch Monitoring Well # 1 was installed. The surface casing borehole was drilled to a depth of 262 feet bgs and 252 feet of surface casing was installed by circulating cement to the surface. The bore hole for the long string was drilled to 944 feet bgs. Jet West, Inc. ran an open hole log suite. The long string was installed to a depth of 927 feet bgs by circulating cement to the surface.

On October 16, 2008, Jet West, Inc. performed cased hole logging to correlate perforation intervals with open hole logs. After completion of the cased hole logs, the monitoring well was perforated with four spf from 821 to 833 feet bgs. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 2, 2008 In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was set at 840 feet bgs. The surface transducer was installed in the tubing head. All transducers were connected to the RTU and the telemetry system were tested and found to be functioning properly.

9.2 CONSTRUCTION DETAILS FOR MONITORING WELL # 2 API # 05-007-06266-00

From October 7, 2008 to October 13, 2008, Wagon Gulch Monitoring Well # 2 was installed. The surface casing borehole was drilled to a depth of 266 feet bgs and 257 feet of surface casing was installed by circulating cement to the surface.

On October 11, 2008, drilling of the borehole for the long string was halted at a depth of 748 feet bgs. Reed Hycalog, Inc. assembled coring tools and cored the bore hole from 749 to 779 feet bgs. Cored intervals corresponded with the coal beds identified in Wagon Gulch MW#1. Approximately 13 feet of core was recovered containing approximately 1 foot of coal. The bore hole was then advanced to an approximate depth of 808 feet bgs. A second core was attempted from approximately 808 to 820 feet bgs. Approximately 7.3 feet of core was recovered containing approximately two foot of coal. Figure 2 in Appendix C illustrates cored intervals for this monitoring well.

After each coring run, Ticora, Inc., measured and collected the coal samples. The coal samples were then placed in an air tight metal canister and allowed to sit in a warm water bath of 75 degrees Fahrenheit, the measured reservoir temperature from the open hole geophysical logs. The coal samples were then analyzed for adsorbed gas capacity.

After coring activities were complete, the bore hole for the long string was drilled to 883 feet bgs. Jet West, Inc. ran an open hole log suite including an Acoustic Televiewer Log. The long string was installed at depth of 873 feet bgs by circulating cement to the surface.

On October 16, 2008, Jet West, Inc. ran cased hole logs to correlate perforation intervals with open hole logs. Based on cased hole log correlations, the monitoring well was perforated from 752 to 767 feet bgs with four spf. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 2, 2008, In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was installed at 780 feet bgs. The surface transducer was installed in the tubing head. All transducers were connected to the RTU and the telemetry system was tested and found to be functioning properly.

10.0 FOSSET GULCH MONITORING WELL INSTALLATION SPECIFIC DETAILS

10.1 CONSTRUCTION DETAILS FOR MONITORING WELL # 2 API # 05-007-06264-00

From October 17, 2008 to October 22, 2008, Monitoring Well #2 was installed. This monitoring well was drilled first at the Fossett Gulch site to facilitate access due to small well pads and equipment orientation. The surface casing borehole was drilled to a depth of 266 feet bgs and 253 feet of surface casing was installed by circulating cement to the surface. The bore hole for the long string was drilled to 660 feet bgs. Jet West, Inc. ran an open hole log suite. Log. The long string was installed at a depth of 660 feet bgs by circulating cement to the surface.

On November 4, 2008, Jet West, Inc. ran cased hole logs to correlate proposed perforation intervals with those identified in open hole logs. After completion of the cased hole logging, the monitoring well was perforated from 525 to 534 feet bgs and 548 to 551 feet bgs with four spf. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 4, 2008, In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was installed at 560 feet bgs. The surface transducer was installed in the tubing head. All transducers were connected to the RTU and the telemetry system was tested and found to be functioning properly.

10.2 CONSTRUCTION DETAILS FOR MONITORING WELL # 1 API # 05-007-06265-00

Monitoring Well #1 was the second well drilled at the Fosset Gulch site due to the well pad size and accessibility. From October 25, 2008 to October 31, 2008, Monitoring Well #1 was installed. The surface casing borehole was drilled to a depth of 261 feet bgs and 252 feet of surface casing was installed by circulating cement to the surface.

On October 28, 2008, drilling for the long string was halted at a depth of 479 feet bgs for coring in the first coal interval identified while drilling MW#2. Reed Hycalog, Inc. assembled coring tools and cored the bore hole from 480 to 506 feet bgs. This coring attempt was halted due to a jammed core barrel.

On October 29, 2008, the bore hole was conditioned by circulating fluids to the surface and the same core interval was attempted again. 8.6 feet of core was recovered containing approximately three feet of coal. The bore hole was then advanced to an approximate depth of 523 feet bgs. A second core was attempted from approximately 524 to 532 feet bgs. Approximately eight feet of core was recovered containing two feet of coal. Figure 3 in Appendix C illustrates cored intervals for this monitoring well.

After each coring run, Ticora, Inc. measured and collected the coal samples. The coal samples were then placed in an air tight metal canister and allowed to sit in warm water baths of 69 and 72 degrees Fahrenheit, reflecting the measured reservoir temperatures from the intervals in which the coal samples were retrieved. The coal samples were the analyzed for adsorbed gas capacity. Coal gas analysis is located in Appendix F and additional discussion of coal gas analysis is located in Section 11 of this report.

The bore hole for the long string was drilled to 625 feet bgs. No open hole logs were run. The long string was installed to a depth of 618 feet bgs by circulating cement to the surface.

On November 14, 2008, Jet West, Inc. ran cased hole logs to correlate perforation intervals with open hole logs from Borehole #2. After completion of the cased hole logging, the monitoring well was perforated from 482 to 502 feet bgs with four spf. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 4, 2008 In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was installed at 510 feet bgs. The surface transducer was installed in the tubing head. All transducers were connected to the RTU and the telemetry system was tested and found to be functioning properly.

11.0 HIGHWAY 151 MONITORING WELL INSTALLATION SPECIFIC DETAILS

11.1 CONSTRUCTION DETAILS FOR MONITORING WELL # 2 API # 05-007-06271-00

From November 4, 2008 to November 7, 2008, Monitoring Well #2 was installed. This monitoring well was drilled first due to well pad size and equipment orientation. The surface casing borehole was drilled to a depth of 136 feet bgs and 127 feet of surface casing was set by circulating cement to the surface. The bore hole for the long string was drilled to 330 feet bgs. Jet West, Inc. completed the open hole geophysical log suite to 323 feet bgs. The long string was set at a depth of 330 feet bgs by circulating cement to the surface.

On November 16, 2008, Jet West, Inc. ran cased hole logs to correlate perforation intervals with open hole logs. After completion of the cased hole logging, the monitoring well was perforated from 268 to 277 feet bgs and 292 to 301 feet bgs with four spf. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 3, 2008 In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was installed at 310 feet bgs. The surface transducer was installed in the tubing head. All transducers were connected to the RTU and the telemetry system was tested and found to be functioning properly.

11.2 CONTRUCTION DETAILS FOR MONITORING WELL # 1 API # 05-007-06270-00

From November 7, 2008 to November 11, 2008, Monitoring Well #1 was installed as the second well at the Highway 151 location. The surface casing bore hole was drilled to a depth of 137 feet bgs and 136 feet of surface casing was set by circulating cement.

On November 10, 2008, drilling was halted at a depth of 226 feet bgs. Reed Hycalog, Inc. assembled coring tools to core the coal intervals identified in the open hole geophysical log of MW #2. The first core was run from 226 to 246 feet bgs. Six feet of core was recovered containing approximately two feet of coal.

The bore hole was then advanced to a depth of 265 feet bgs. Reed Hycalog made a second coring run from 266 to 287 feet bgs. Approximately eighteen feet of core was recovered containing approximately three feet of coal. Figure 5, located in Appendix C illustrates the cored intervals for this monitoring well.

After each coring run, Ticora, Inc, measured and collected the coal samples. The coal samples were then placed in an air tight metal canister and allowed to sit in a warm water bath at 60 degrees Fahrenheit, the measured reservoir temperature from the open hole geophysical logs. The coal samples were analyzed for adsorbed gas capacity. Coal gas analytical results are located in Appendix F and additional discussion of coal gas analysis is provided in Section 11 of this report.

Following coring activities, the bore hole for the long string was drilled to a total depth of 340 feet bgs. No open hole logs were run. The long string was installed to a depth of 330 feet bgs by circulating cement.

On November 16, 2008, Jet West, Inc. ran cased hole logs to correlate perforation intervals with open hole logs from Monitor Well #2. After completion of the cased hole logs, the monitoring well was perforated from 218 to 222 feet bgs and 231 to 241 feet bgs. After perforating activities were complete, T & R Swabbing Service swabbed the well with minimal fluid recovery.

On December 3, 2008 In-Situ, Inc. and a Helmur Corporation roustabout crew, under the supervision of SMA, installed pressure transducers in the well. The down hole pressure transducer was installed at 250 feet bgs. The surface transducer was installed in the tubing well head. All transducers were connected to the RTU and the telemetry system was tested and found to be functioning.

12.0 DATA INTERPRETATION

12.1 DRILLING OPERATION PROBLEMS

All of the bore holes for the project were drilled without major operational problems. Deviation was the most persistent problem due to the steep dip of the formations close to the outcrop. Bore hole deviation reached 9.25 degrees from vertical at the Wagon Gulch location, 5.0 degrees at the Fosset Gulch location, and 7.7 degrees at the Highway 151 location.

At the Wagon Gulch #2 bore hole, drilling fluid was lost steadily from 180 to 266 feet bgs resulting in some lost drilling time due to the lack of water. Field interpretation of available data indicated that the zone of water loss was located at approximately 180 feet bgs. Surface casing was set and cemented in place when the borehole reached 266 feet bgs, thus sealing off the interval of excessive water loss.

The Fosset Gulch #2 borehole experienced lost circulation at 50 feet bgs and continued losing significant amounts of drilling fluids until surface casing was installed. After the surface casing was set and cemented, significant fluid loss was stopped. The borehole continued to take water, but at a rate anticipated based upon drilling of previous boreholes.

The Highway 151 #1 location experienced a tight spot at about 100 feet bgs that delayed tripping out of the hole to install surface casing and delayed reaching the depth necessary to set the surface casing. It was necessary to rotate and wash the casing down to get the centralizers and surface casing to the desired depth of 127 feet bgs.

12.2 HYDROLOGIC, GEOLOGIC AND GEOPHYSICAL INTERPRETATION

The Kirtland Shale, the Fruitland Formation and the Pictured Cliffs sandstone were identified during drilling activities at the Wagon Gulch, Fosset Gulch and Highway 151 well sites. Geologic contacts are indicated by the electric logs and gamma logs and water bearing zones are indicated on the spontaneous potential (SP) logs illustrated on the open hole geophysical logs located in Appendix B. Geologic contacts can be identified by low API units detected with the gamma tool and high ohms detected by the electric log tool. Water bearing zones are indicated by high readings in milivolts with the SP tool.

The Kirtland Shale is approximately 620 feet thick and was encountered at the Wagon Gulch site from ground surface to 620 feet bgs. The Fruitland Formation is approximately 260 feet thick and was encountered from approximately 620 to 860 feet bgs. The Pictured Cliffs sandstone was encountered from approximately 860 to 938 feet bgs. Two potential water bearing zones from 278-314 feet bgs and 764-776 feet bgs are indicated by the SP log. Figure 1, Geophysical, Lithological & Well Construction Diagrams located in Appendix B illustrates the geologic contacts and water bearing zones.

The Kirtland Shale is approximately 340 feet thick and was encountered at the Fosset Gulch site from ground surface to 340 feet bgs. The Fruitland Formation is approximately 250 feet thick and was encountered from approximately 340 to 590 feet bgs. The Pictured Cliffs sandstone was encountered from approximately 590 to 650 feet bgs. One potential water bearing zone from 478-498 feet bgs are indicated by the SP log. Figure 4, Geophysical, Lithological & Well Construction Diagrams located in Appendix B illustrates the geologic contacts and water bearing zone.

The Kirtland Shale is approximately 150 feet thick and was encountered at the Highway 151 site from ground surface to 150 feet bgs. The Fruitland Formation is approximately 70 feet thick and was encountered from approximately 150 to 320 feet bgs. The Pictured Cliffs sandstone was encountered from approximately 320 to 330 feet bgs. Four potential water bearing zones from 216-222, 230-242 and 268-275 feet bgs are indicated by the SP log. Figure 6, Geophysical, Lithological & Well Construction Diagrams located in Appendix B illustrates the geologic contacts and water bearing zones.

12.3 COAL INFORMATION

The American Society for Testing and Materials (1995) has defined coal as a readily combustible rock containing more than 50% by weight and 70% by volume carbonaceous material including inherent moisture. Following this definition, Fasset 2009 developed a method of defining coal based on open hole density logs for the Fruitland Formation. Fasset stated any material less than 1.75 grams/cubic centimeter (g/cc) on the density curve can be considered to be coal and material with a density less than 1.30 g/cc is considered to be pure coal.

Utilizing Fasset's parameters on bulk density logs at each of the three sites listed yielded the following net coal from the perforation zones.

Wagon Gulch #2	Upper Zones	Interval 740'-768'
API # 05-007-06267-00	13' Coal:	Best Quality 1 ft /1.35 g/cc
	Lower Zones	Interval 813'-840'
	20' Coal:	Best Quality 3 ft/ 1.30 g/cc

At Wagon Gulch, the coal core Ticora described in the Upper Zone as coal with visible cleating showing calcite filled fractures and demonstrating audible desorption. The Lower Zone coal core is described as ranging from rubblized with audible desorption to competent with cleating and audible desorption.

Fosset Gulch #2	Upper Zones	Interval 479'-498'
API # 05-007-06266-00	19' Coal:	Best Quality 3 ft /1.35 g/cc
	Lower Zones	Interval 525'-550'
	6' Coal:	Best Quality 1 ft/ 1.40 g/cc

At Fosset Gulch, the Upper Zone degassed samples were described by Ticora as carbonaceous shale to coal. The Lower Zone degassed samples were described as carbonaceous shale to shaly coal.

Highway 151 #2	Upper Zone	Interval 159'-161'
API # 05-007-06264-00	2' Coal:	Best Quality 1 ft/ 1.50 g/cc
	Intermediate Zone	Interval 216'-241'
	15' Coal:	Best Quality 3 ft /1.35 g/cc
	Lower Zone	Interval 270'-302'
	12' Coal:	Best Quality 1 ft /1.35 g/cc

At Highway 151, the Upper Zone degassed samples were described by Ticora as coal black, vitreous glassy luster and very friable. The Lower Zone is described as coal black, vitreous glassy luster and very friable with one foot demonstrating audible desorption.

At each location, the Upper Zone, the shallower identified coal interval, was perforated in one borehole and the Lower Zone, deeper identified coal interval, was perforated in the other bore hole.

13.0 CONCLUSIONS

SMA has made the following conclusions:

1. Six CBM monitoring wells were successfully drilled and completed with minimal operational problems.
2. Lithologic and geophysical logging was successfully conducted on all boreholes
3. Coal cores for methane desorption study were collect from three bore holes.
4. At each location, remote monitoring equipment was installed, tested and found to functioning properly.

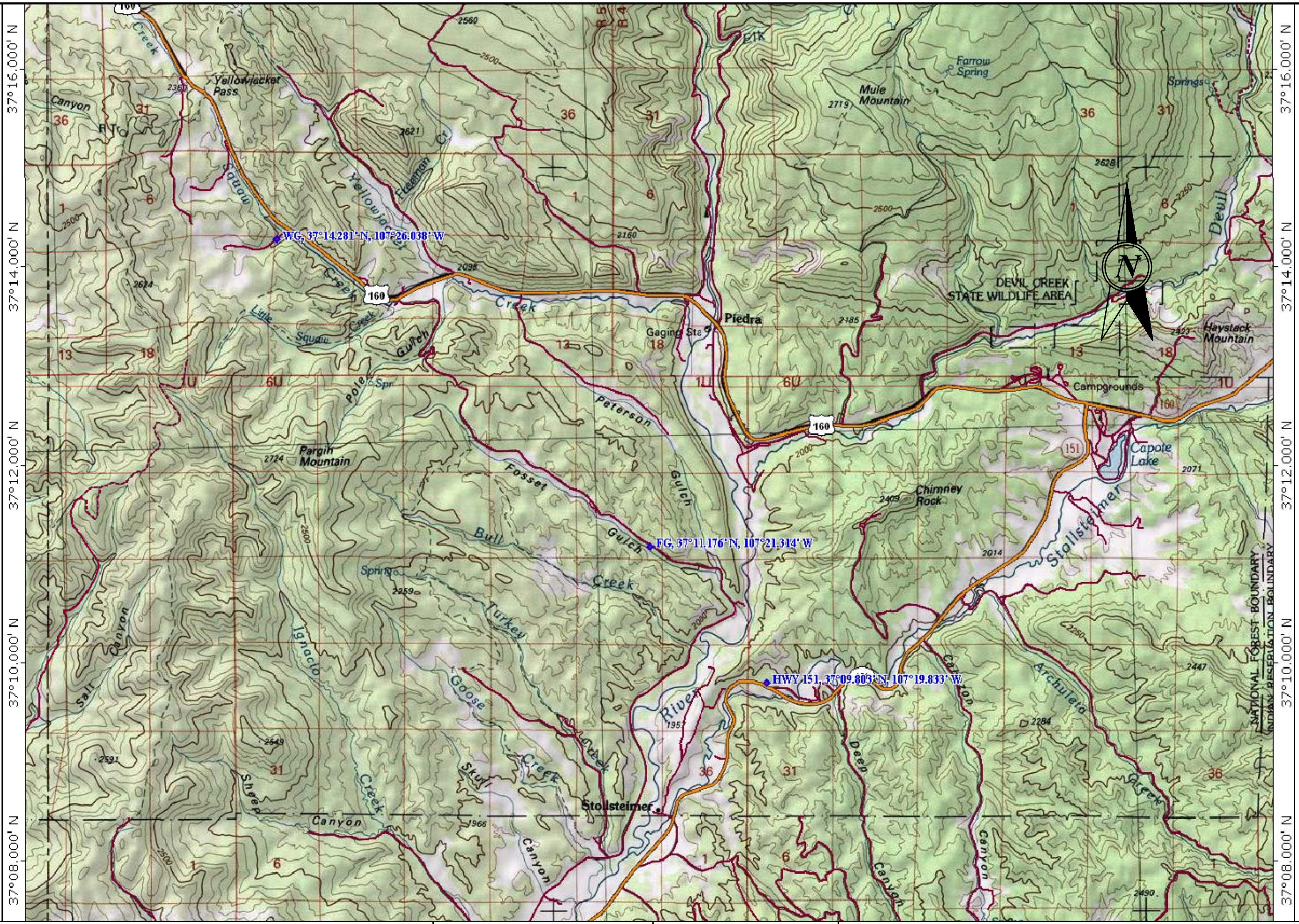
Although core recoveries were rather disappointing, sufficient coal was recovered to yield some desorption and cleat information on the Fruitland Coals. It is anticipated that the formation dip and degree of fracturing of the coal was the cause behind the limited coal recovery. The open hole Acoustic Televiewer log furnished additional information for cleat and fracture analysis.

14.0 RECOMMENDATIONS

SMA recommends ongoing evaluation of data collected in this study to determine if additional monitoring wells are needed to document potential threats to the environment and the public from CBM seeps.

15.0 REFERENCES

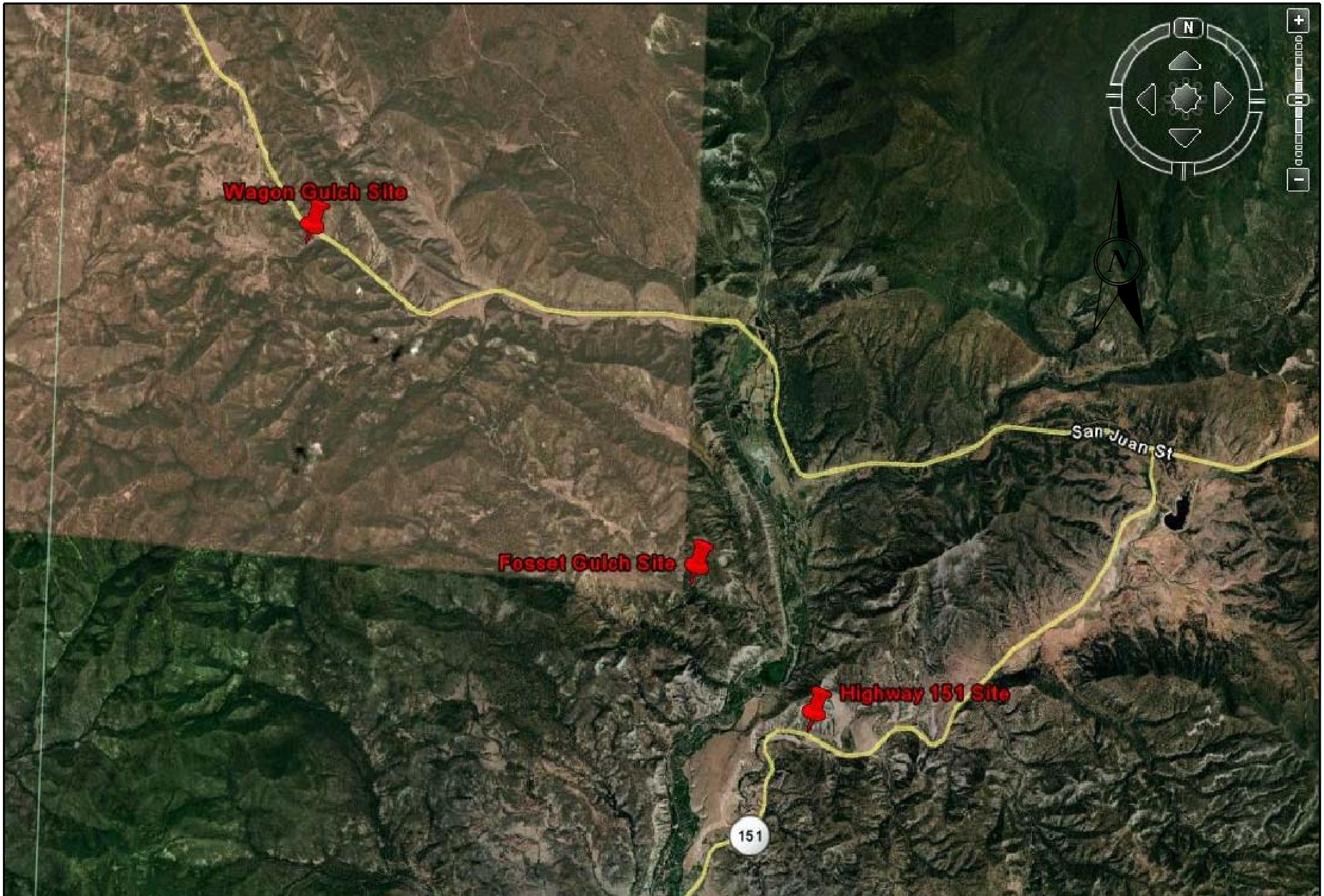
Fasset, James E., United States Geological Survey Professional Paper 1625-B; Chapter Q, Geology and Coal Resources of the Upper Cretaceous Fruitland Formation, San Juan Basin, New Mexico and Colorado.



SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR.
FARMINGTON, NM 87401
PH. (505) 325-5667
FAX (505) 327-1496

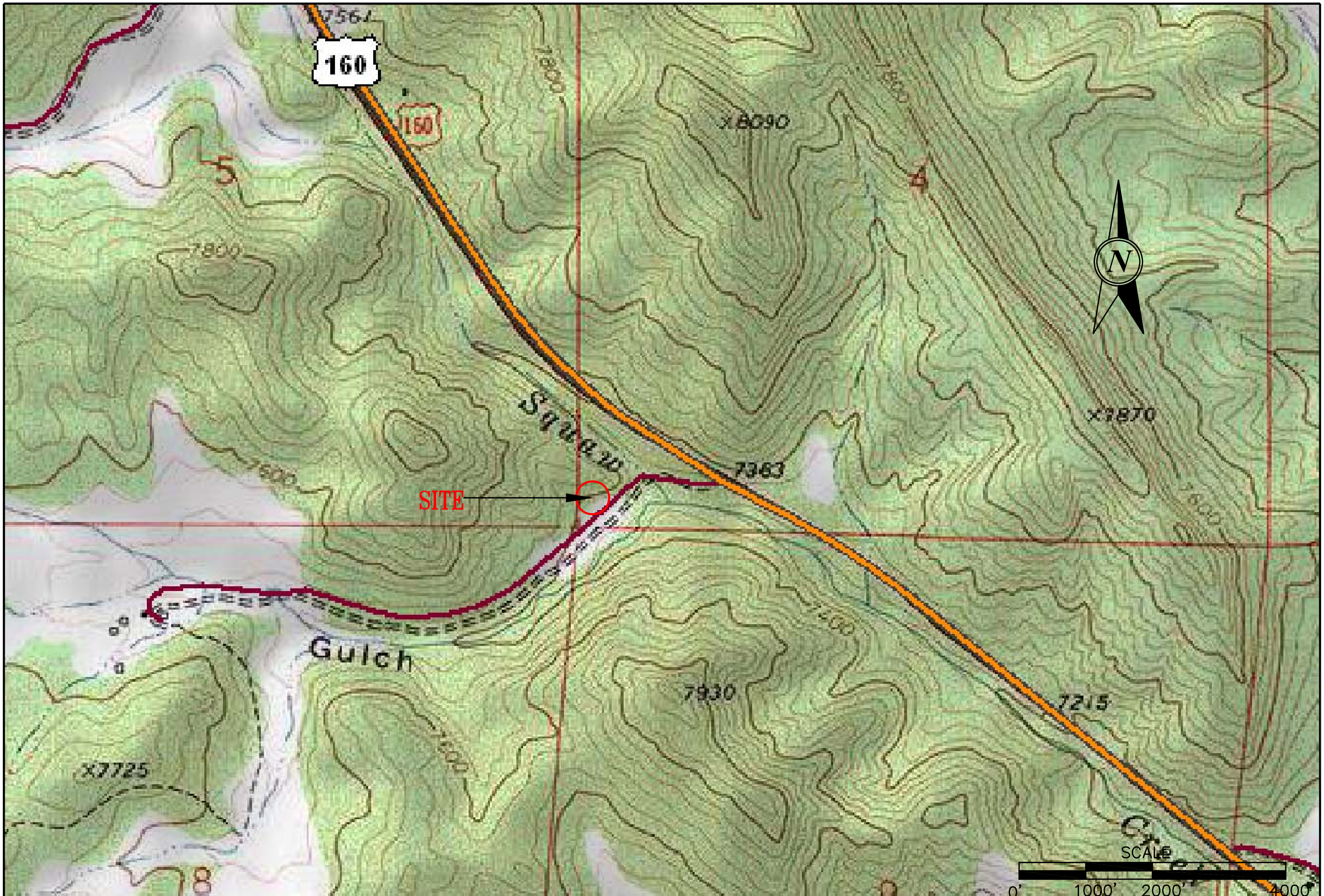
APPROVED: DGF	DATE: 10/20/09
DRAWN BY: TLONG	DATE: 10/20/09
REVISIONS BY:	DATE:
PROJECT #5119088	MAP: 1

REGIONAL TOPOGRAPHIC MAP
COLORADO OIL AND GAS CONSERVATION COMMISSION
ARCHULETA COUNTY SITES



SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. FARMINGTON, NM 87401
PH. (505) 325-5667 FAX (505) 327-1496

APPROVED: DGF	DATE: 10/20/09	REGIOAL AERIAL PHOTO COLORADO OIL AND GAS CONSERVATION COMMISSION ARCHULETA COUNTY SITES
DRAWN BY: TLONG	DATE: 10/20/09	
REVISIONS BY:	DATE:	
PROJECT #5119088	PHOTO: 1	



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PH. (505) 325-5667
FAX (505) 327-1496

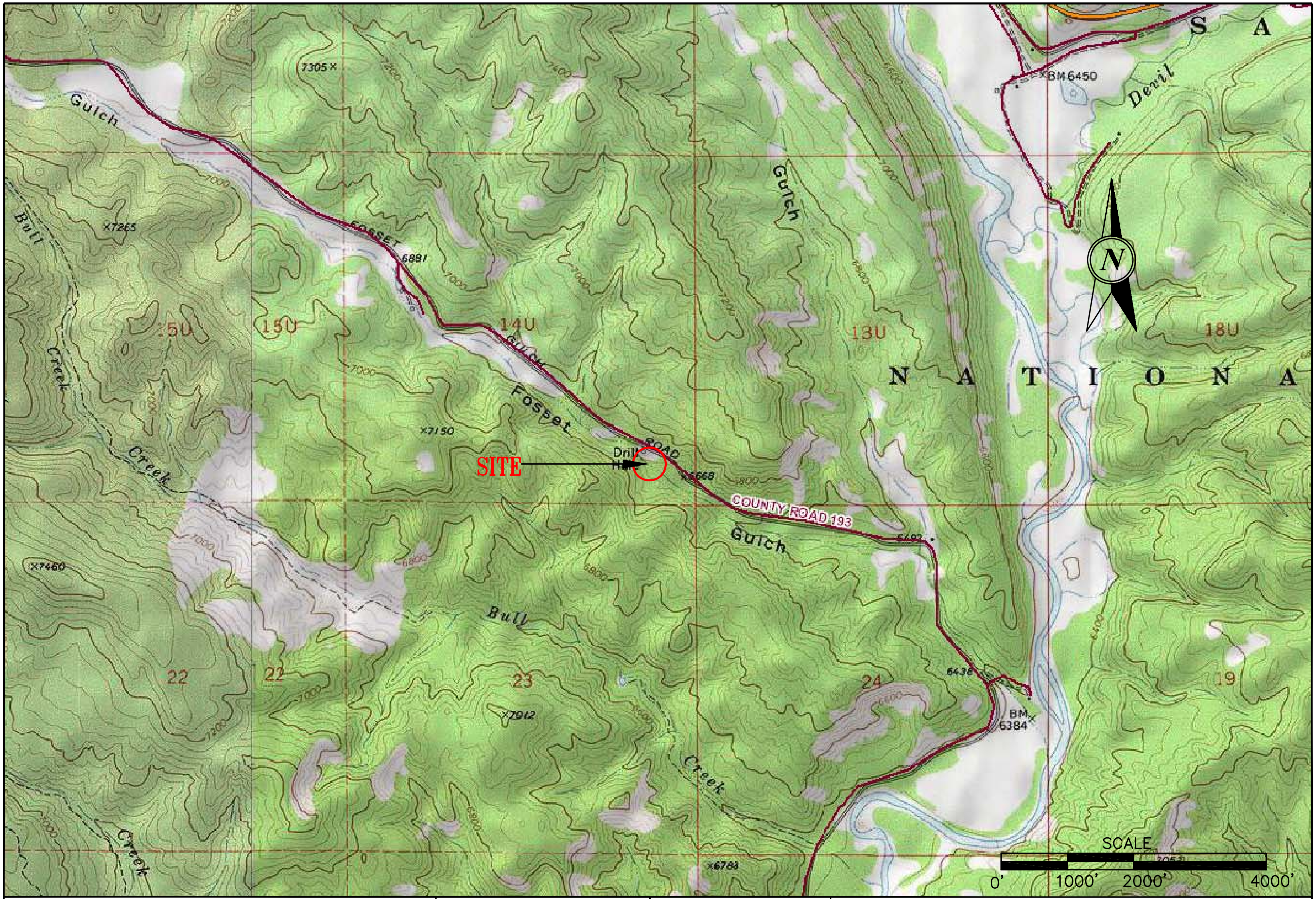
APPROVED: DGF	DATE: 9/17/09
DRAWN BY: TLONG	DATE: 9/17/09
REVISIONS BY:	DATE:
PROJECT #5119088	MAP: 2

SITE SPECIFIC TOPOGRAPHIC MAP
COLORADO OIL AND GAS CONSERVATION COMMISSION
WAGON GULCH SITE
SW1/4 SW1/4 SECTION 4 T35N R5W
ARCHULETA COUNTY, COLORADO

SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. FARMINGTON, NM 87401
PH. (505) 325-5667
FAX (505) 327-1496

APPROVED: DGF	DATE: 9/17/09
DRAWN BY: TLONG	DATE: 9/17/09
REVISIONS BY:	DATE:
PROJECT #5119088	PHOTO: 2

SITE SPECIFIC AERIAL PHOTOGRAPH
COLORADO OIL AND GAS CONSERVATION COMMISSION
WAGON GULCH SITE
SW1/4 SW1/4 SECTION 4 T35N R5W
ARCHULETA COUNTY, COLORADO



APPROVED: DGF	DATE: 9/17/09	
DRAWN BY: TLONG	DATE: 9/17/09	
REVISIONS BY:	DATE:	
PROJECT #5119088	MAP: 3	

SITE SPECIFIC TOPOGRAPHIC MAP
COLORADO OIL AND GAS CONSERVATION COMMISSION
FOSSET GULCH
SE 1/4SE 1/4 SECTION 14U T35N R5W
ARCHULETA COUNTY, COLORADO

SMA
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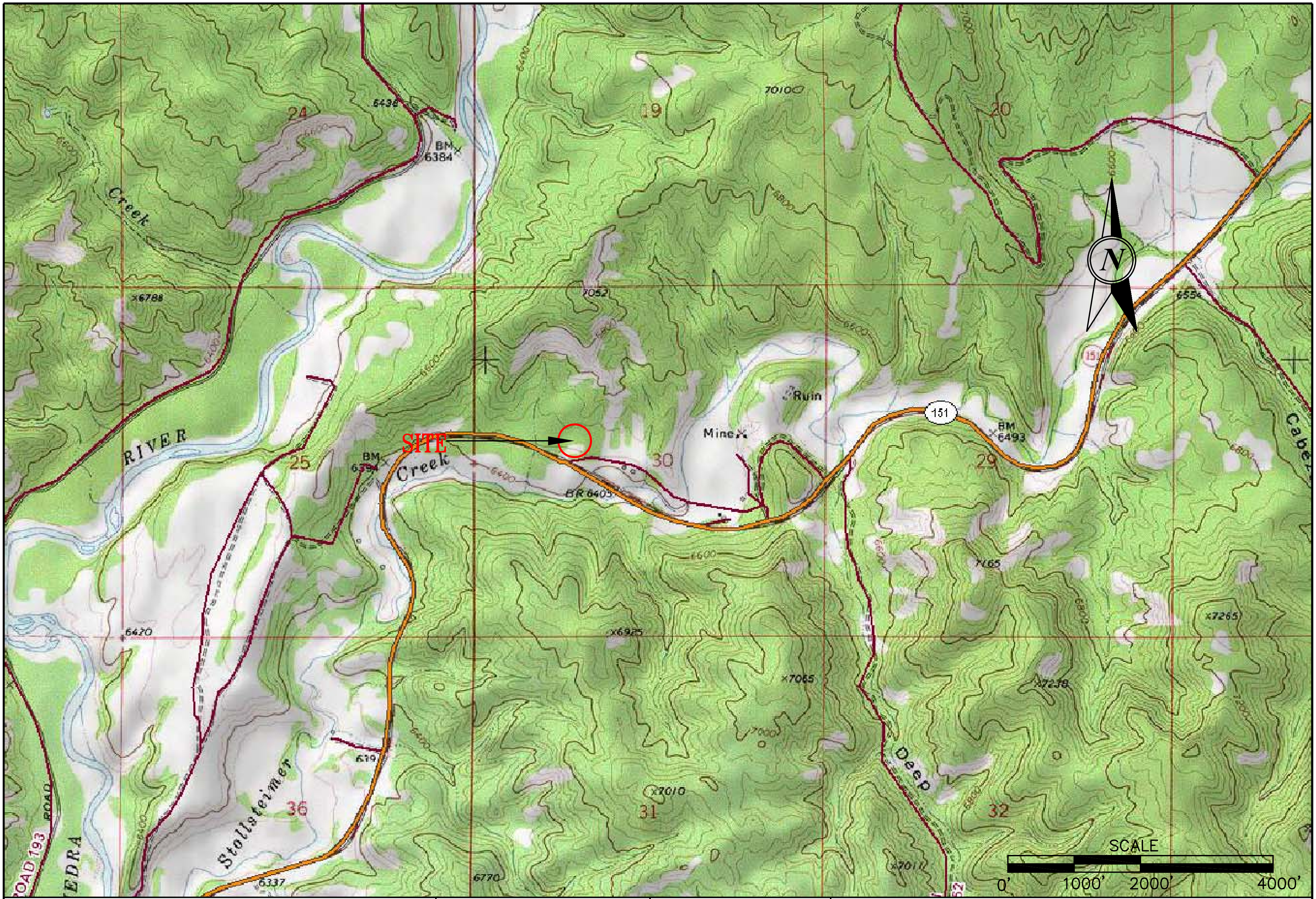
APPROVED: DGF	DATE: 9/17/09
DRAWN BY: TLONG	DATE: 9/17/09
REVISIONS BY:	DATE:
PROJECT #5119088	PHOTO: 3

SITE SPECIFIC AERIAL PHOTOGRAPH
COLORADO OIL AND GAS CONSERVATION COMMISSION
FOSSET GULCH
SE 1/4SE 1/4 SECTION 14U T35N R5W
ARCHULETA COUNTY, COLORADO



SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. FARMINGTON, NM 87401
PH. (505) 325-5667 FAX (505) 327-1496

APPROVED: DGF	DATE: 9/17/09
DRAWN BY: TLONG	DATE: 9/17/09
REVISIONS BY:	DATE:
PROJECT #5119088	MAP: 4

SITE SPECIFIC TOPOGRAPHIC MAP
COLORADO OIL AND GAS CONSERVATION COMMISSION
HIGHWAY 151 SITE
SE1/4 NW1/4 SECTION 30 T34N R4W
ARCHULETA COUNTY, COLORADO

SMA
Civil / Environmental
Scientists & Engineers
612 E. MURRAY DR.
FARMINGTON, NM 87401
PH. (505) 325-5667
FAX (505) 327-1496

APPROVED: DGF	DATE: 9/17/09
DRAWN BY: TLONG	DATE: 9/17/09
REVISIONS BY:	DATE:
PROJECT #5119088	PHOTO: 4

SITE SPECIFIC AERIAL PHOTOGRAPH
COLORADO OIL AND GAS CONSERVATION COMMISSION
HIGHWAY 151 SITE
SE1/4 NW1/4 SECTION 30 T34N R4W
ARCHULETA COUNTY, COLORADO

SMA Project # 5117918

Table 1: Summary of Archuleta County Coal Bed Methane Monitoring Well Details
Colorado Oil Gas Conservation Commission
Coal Bed Methane Monitoring Project

Archuleta County, Colorado

Location	API Number	Monitoring Well	TRS Location	GPS Coordinates	Perforated Intervals (Feet bgs)	Total Depth (Feet BGS)	Down holeTransducer Depth (Feet bgs)
Wagon Gulch	05-007-06267-00	1	Section 4, Township 34 North, Range 05	37.238389° N, 107.433836° W	821-833	927	840
	05-007-06266-00	2			752-767	883	780
Fosset Gulch	05-007-06264-00	1	Section 14, Township 34 North, Range 05	37.18651° N, 107.35527° W	482-502	618	510
	05-007-06265-00	2			525-534;548-551	660	560
Highway 151 Site	05-007-06271-00	1	Section 30, Township 34 North, Range 04	37.163685° N, 107.331061° W	218-222;231-241	330	250
	05-007-06270-00	2			268-277;292-301	330	310

SMA Project # 5117918

Table 2: Archuleta County Coal Bed Methane Monitoring Well Coal Coring
Colorado Oil Gas Conservation Commission
Coal Bed Methane Monitoring Project

Archuleta County, Colorado

Location	API Number	Monitoring Well	Anticipated Core Interval (feet bgs)	Cored Interval (feet bgs)	Cored Length (feet)	Core Recovered (feet)	Coal Recovered (feet)	Coal Desorption Sample ID	Sample Interval (feet bgs)	Total In-situ Gas Content (scf/ton)
Wagon Gulch	05-007-06266-00	2	750-770	749-779	30	13	1.0	43100-1	753.5-754.5	259.5
			810-830	810-826	16.5	7.3	1.0	43100-2	813-814	268.4
							1.0	43100-3	815-816	259.63
Fosset Gulch	05-007-06264-00	1	478-502	480-506	26	8.6	1.0	41547-1	480.3-481.3	114.7
							1.0	41547-2	484.7-485.7	207.1
							1.0	41547-3	487.5-488.5	213.0
			524-532	524-532	8.1	8.1	1.0	41547-4	524-525	6.9
							1.0	41547-5	531.1-532.1	105.0
Highway 151 Site	05-007-06271-00	1	226-246	227-246	19.0	6.0	1.0	41680-1	227.8-228.8	89.7
							1.0	41680-2	229.0-230.0	116.0
			266-287	268-291	23.0	18.4	1.0	41680-3	270.5-271.5	192.8
							1.0	41680-4	271.6-272.3	207.2
							1.0	41680-5	273.5-274.5	113.6

Table 3: Archuleta County Coal Bed Methane Monitoring Well Swabbing Activities
Colorado Oil Gas Conservation Commission
Coal Bed Methane Monitoring Project

Archuleta County, Colorado

SMA Project # 5117918

Location	Date	Monitoring Well	Swabbing Run	Depth to Water Encountered at each swabbing run (feet bgs)	Produced Water (bbls)	Total Water Produced (bbls)
Wagon Gulch	10/16/2008	1	NA	NA	NA	NA
	10/17/2008		1	790	0.49	0.49
	10/16/2008	2	NA	NA	5	5
	10/17/2008		NA	NA	NA	NA
Fosset Gulch	11/14/2008	1	1	300	2.9	3.4
			2	450	0.5	
		2	1	50	3.6	7.5
			2	275	1.6	
			3	380	2.3	
	11/15/2008	1	1	180	2.3	5.61
			2	325	1.99	
			3	450	0.5	
			4	430	0.82	
		2	1	130	0.79	5.59
			2	180	1.75	
			3	290	2.23	
			4	430	0.82	
			5	>525	0	
Highway 151 Site	11/16/2008	1	1	50	2.3	2.89
			2	200	0.15	
			3	190	0.44	
		2	1	44	1.8	3.49
			2	160	0.31	
			3	180	1.1	
			4	250	0.28	
	11/17/2009	1	1	80	1.9	3.25
			2	200	0.15	
			3	190	0.3	
			4	170	0.3	
			5	190	0.6	
		2	1	80	3	3
			2	>268	0	
			3	>268	0	

Note: > = Depth of water that is greater than the top of the upper perforated interval.

APPENDIX A: APPLICATIONS FOR PERMIT TO DRILL, FIGURES AND DIAGRAMS

01360770

FORM 2 Rev 12/05

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

APPLICATION FOR PERMIT TO:

RECEIVED SEP 10 2008 COGCC

1. [✓] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate — Refiling [ ] Sidetrack [ ]

2. TYPE OF WELL: OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitoring; SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ]

3. Name of Operator: COGCC — 4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates, 612 E. Murray Drive; City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA Agent) Phone: (505) 325-5667 Fax: (505) 327-1496
7. Well Name: Wagon Gulch ~~Gas~~ MW 34-5-4 #2 Well Number: #2
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 1400'

WELL LOCATION INFORMATION

10. QtrQtr: SWSW Sec: 4 Twp: 34N Rng: 5W Meridian: NMPM
Latitude: 37.238389 Longitude: 107.433836
Footage At Surface: 36 FNL/FSL: S 56 FEL/FWL: W
11. Field Name: Field Number:
12. Ground Elevation: 7400 13. County: Archuleta
14. GPS Data: Date of Measurement: 8/21/08 PDOP Reading: 5 Instrument Operator's Name: L. Lantz

Complete the Attachment Checklist	OP	COGCC
APD Orig & 1 Copy		
Form 2A		
Well location plat		✓
Topo map		
Mineral lease map		
Surface agmt/Surety		
30 Day notice letter		
Deviated Drilling Plan		
Exception Location Request		
Exception Loc Waivers		
H2S Contingency Plan		
Federal Drilling Permit		

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), **submit deviated drilling plan.** Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

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: 126.87' nearest PL.
18. Distance to Nearest Property Line: 1550 feet 19. Distance to nearest well permitted/completed in the same formation: N/A

20. **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.)
Fruitland	FRLDC	N/A	N/A	

21. Mineral Ownership: [ ] Fee [ ] State [✓] Federal [ ] Indian — Lease #: N/A
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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):

25. Distance to Nearest Mineral Lease Line: N/A 26. Total Acres in Lease: N/A

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 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] 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: Dried cuttings buried on site

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
Surface	8 3/4 in.	7 in.	20 lb.	250 ft.	63	250 ft.	Surface
Long String	6 1/4 in.	4 1/2 in.	10.5 lb.	1400 ft.	180	1400 ft.	Surface
		Stage Tool					

32. BOP Equipment Type: [ ] Annular Preventor [✓] Double Ram [ ] Rotating Head [ ] None
33. Comments: Shaffer pr4essure control 5m LWS 10 foot floor, derrick height 63 feet — monitor well exception location 603a(1)
34. Initial Rule 306 Consultation took place on (date) 08/12/08 , was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.

PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.

I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: [signature] Print Name: Steven Lindblom
Title: EPS II Date: 9/10/08 Email: steven.lindblom@state.co.us

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: David S. Neslin Director of COGCC Date: 9/11/2008

Permit Number: 20086107 Expiration Date: 9/10/2009

API NUMBER
05-007-06266-00

CONDITIONS OF APPROVAL, IF ANY:

Provide 48 hour spud notice to COGCC field inspector Leslie Melton (970) 375-6419 and District Engineer Mark Weems @ 970-259-4587

01360769

FORM 2 Rev 12/05

State of Colorado
Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

RECEIVED
SEP 10 2008
COGCC

APPLICATION FOR PERMIT TO:

1. [✓] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate

2. TYPE OF WELL
OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitoring
SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ]

Refiling [ ]
Sidetrack [ ]

Plugging Bond Surety ID#

3. Name of Operator: COGCC 4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates, 612 E. Murray Drive
City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA Agent) Phone: (505) 325-5667 Fax: (505) 327-1496
7. Well Name: Wagon Gulch ~~Gas~~ MW 34-5-4 ~~#1~~ Well Number: #1
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 1400'

WELL LOCATION INFORMATION

10. QtrQtr: SWSW Sec: 4 Twp: 34N Rng: 5W Meridian: NMPM
Latitude: 37.238958 Longitude: 107.433631
Footage At Surface: 23 FNL/FSL: S 35 FEL/FWL: W
11. Field Name: Field Number:
12. Ground Elevation: 7400 13. County: Archuleta
14. GPS Data:
Date of Measurement: 8/21/08 PDOP Reading: 5 Instrument Operator's Name: L Lantz

Complete the Attachment Checklist	OP	COGCC
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Topo map		
Mineral lease map		
Surface agrmt/Surety		
30 Day notice letter		
Deviated Drilling Plan		
Exception Location Request		
Exception Loc Waivers		
H2S Contingency Plan		
Federal Drilling Permit		

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), submit deviated drilling plan. Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

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: ~~140.89 ft.~~ 131
18. Distance to Nearest Property Line: 1550 feet 19. Distance to nearest well permitted/completed in the same formation: N/A

20. **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.)
Fruitland	FRLDC	N/A	N/A	

21. Mineral Ownership: [ ] Fee [ ] State [✓] Federal [ ] Indian Lease # N/A
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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):

25. Distance to Nearest Mineral Lease Line: N/A 26. Total Acres in Lease: N/A

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 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] 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: Dried cuttings buried on site

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
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Long String	6 1/4 in.	4 1/2 in.	10.5 lb.	1400 ft.	180	1400 ft.	Surface
			Stage Tool				

32. BOP Equipment Type: [ ] Annular Preventor [✓] Double Ram [ ] Rotating Head [ ] None
33. Comments Shaffer pressure control 5m LWS 10 foot floor, rig derrick height 63 feet

34. Initial Rule 306 Consultation took place on (date) 08/12/08 ,was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.
PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.
I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: [signature] Print Name: Steven Lindblom
Title: EPS II Date: 9/1/08 Email: steven.lindblom@state.co.us

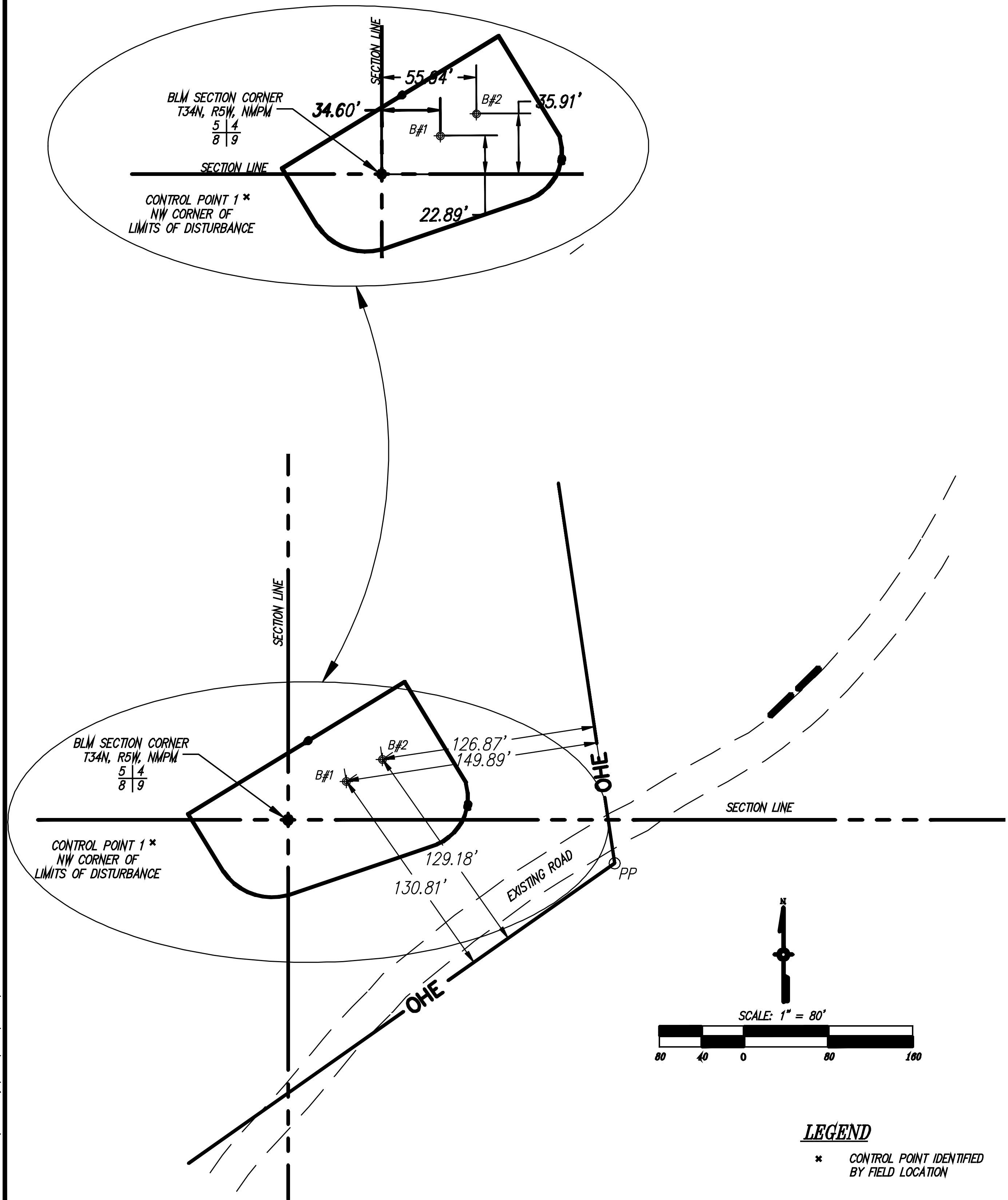
Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.
COGCC Approved: David S. Neslin DKD Director of COGCC Date: 9/11/2008

Permit Number: 20084108 Expiration Date: 9/10/2009

API NUMBER
05-007-06067-00

CONDITIONS OF APPROVAL, IF ANY:

Provide 48 hour spud notice to COGCC field inspector Leslie Melton (970) 375-6419



COGCC FRUITLAND MONITORING PROJECT
WELL NAME WAGON GULCH # 1 & 2
SW/4 SW/4 OF SECTION 4-T34N-R5W

FIGURE
1

REVISIONS
BY ______ DATE ______ DESCR. ______
BY ______ DATE ______ DESCR. ______
BY ______ DATE ______ DESCR. ______

DRAWN GLP
CHECKED CSG
APPROVED DWM
DATE 9/19/2008

SMA
Civil / Environmental Scientists & Engineers

SOUDER, MILLER & ASSOCIATES, 2101 SAN JUAN BLVD, FARMINGTON, NEW MEXICO 87401 TELE: 505-325-7535
Albuquerque – Las Cruces – Santa Fe, NM
Cortez, CO – Monticello, UT

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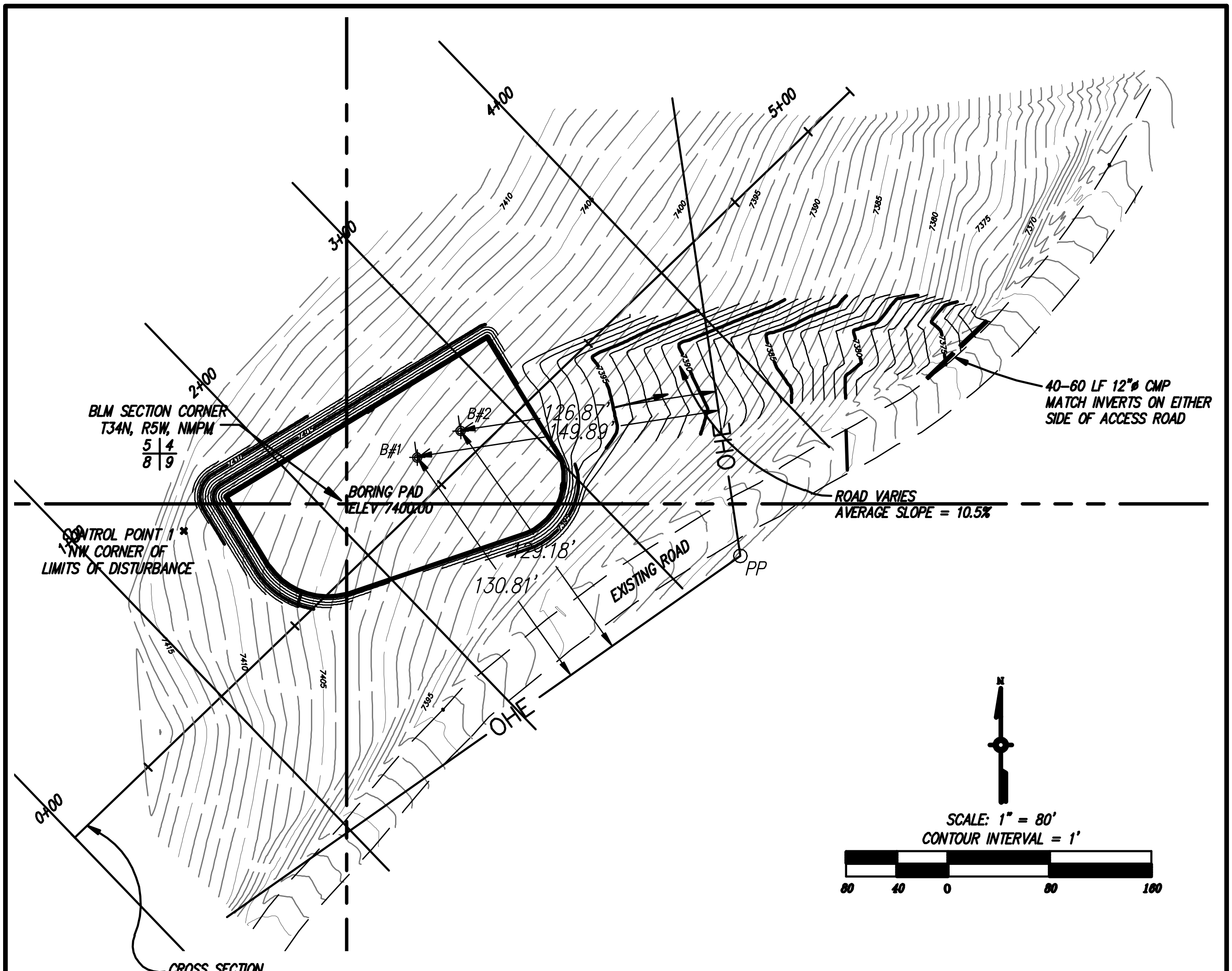

FINISH GRADE PLAN

NOTES:
1) CUT SLOPES TO BE NO GREATER THAN 2:1(H:V)
FILL SLOPES NO GREATER THAN 3:1(H:V), OR NEAR VERTICAL IF ROCK FACE
2) CUT: 2096 CY / FILL: 500 CY / NET CUT 1597 CY
USING ZERO SHRINK COMPACTON FACTOR
3) SEE FIGURE 3 FOR CROSS SECTIONS

LEGEND

×	CONTROL POINT IDENTIFIED BY FIELD LOCATION
B#1 ⌖	BORE HOLE WITH NUMBER DESIGNATION
— OHE —	OVERHEAD ELECTRIC LINE
PP ○	POWER POLE

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COGCC FRUITLAND MONITORING PROJECT
WELL NAME WAGON GULCH # 1 & 2
SW/4 SW/4 OF SECTION 4-T34N-R5W

FIGURE 2

REVISIONS
BY ______ DATE ______ DESCR. ______
BY ______ DATE ______ DESCR. ______
BY ______ DATE ______ DESCR. ______

DRAWN GLP
CHECKED CSG
APPROVED DWM
DATE 9-19/2008

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Albuquerque - Las Cruces - Santa Fe, NM
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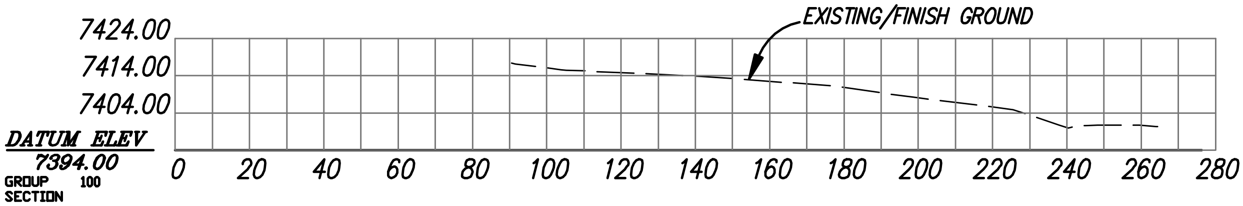
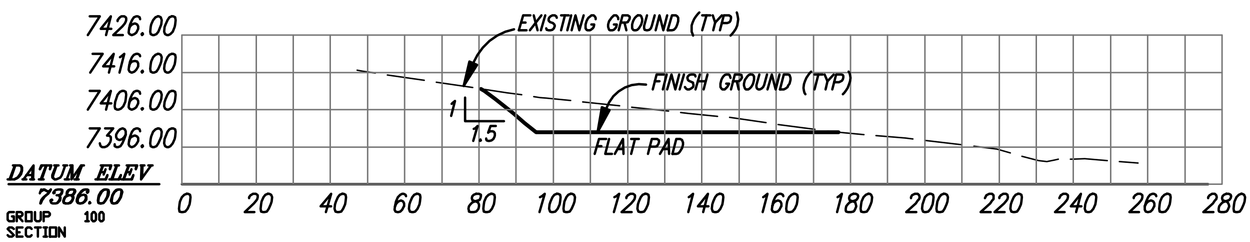
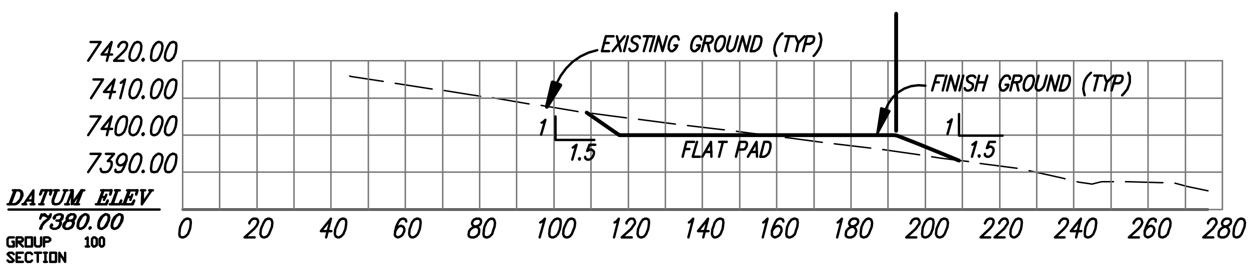


1+00



2+00



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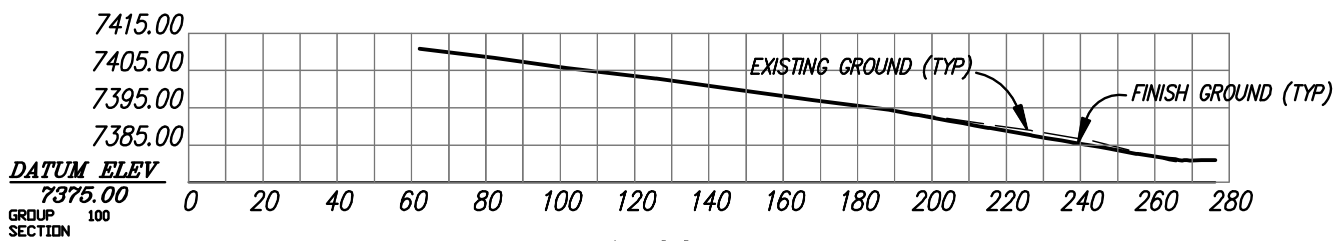

4+00

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COGCC FRUITLAND MONITORING PROJECT
WELL NAME WAGON GULCH # 1 & 2
SW/4 SW/4 OF SECTION 4-T34N-R5W

FIGURE 3

REVISIONS
BY_____ DATE_______ DESCR.________
BY_____ DATE_______ DESCR.________
BY_____ DATE_______ DESCR.________

DRAWN GLP
CHECKED CSG
APPROVED DWM
DATE 9/19/2008

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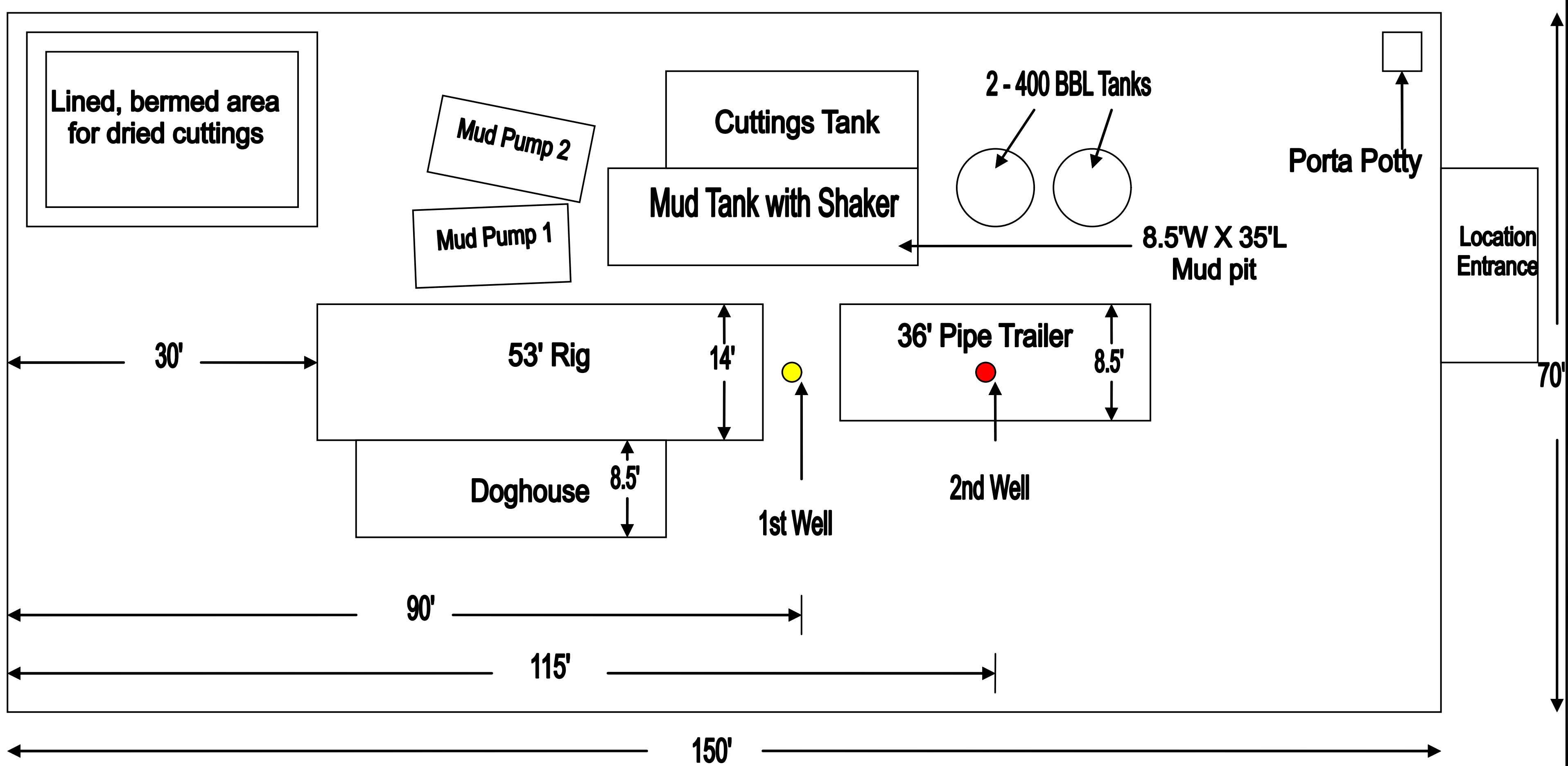
Albuquerque - Las Cruces - Santa Fe, NM
Cortez, CO - Monticello, UT

Scorpion Drilling Footprint



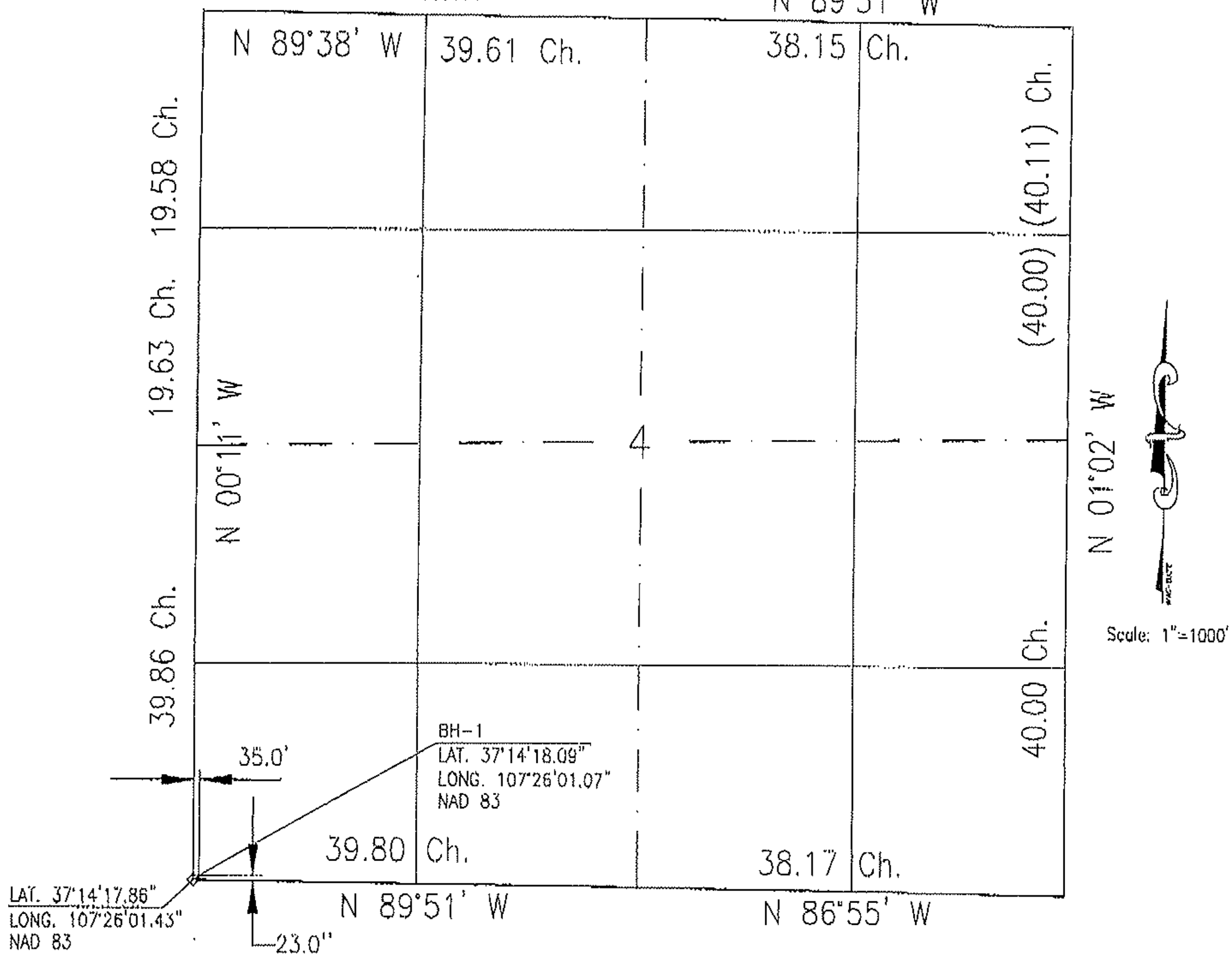
APPROVED: DGF	DATE: 06/12/08
DRAWN BY: LL	DATE: 06/012/08
REVISIONS BY:	DATE:

SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. PH. (505) 325-5667
FARMINGTON, NM 87401 FAX (505) 327-1496

SMA Civil/Environmental Scientists & Engineers

SOUDER, MILLER & ASSOCIATES

SURVEY PLAT
MW-34-5-4 (BH-1)



Operator: Colorado Oil and Gas Conservation Commission		Well Name: MW-34-5-4 (BH-1)	
Section: 4	Township: 34 North	Range: 5 South	Meridian: N.M.P.M.
Footages: 23.0' FSL & 35.0' FWL			County/State: Archuleta, CO
Elevation: 7400'	Requested By: Steven R. Lindblom		

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF KNOWLEDGE AND BELIEF.

[signature] 26 Aug 2008

LYNN D. LANTZ
COLORADO P.L.S. #12046

DATE

REGISTERED PROFESSIONAL LAND SURVEYOR STATE OF COLORADO 12046

NOTES:

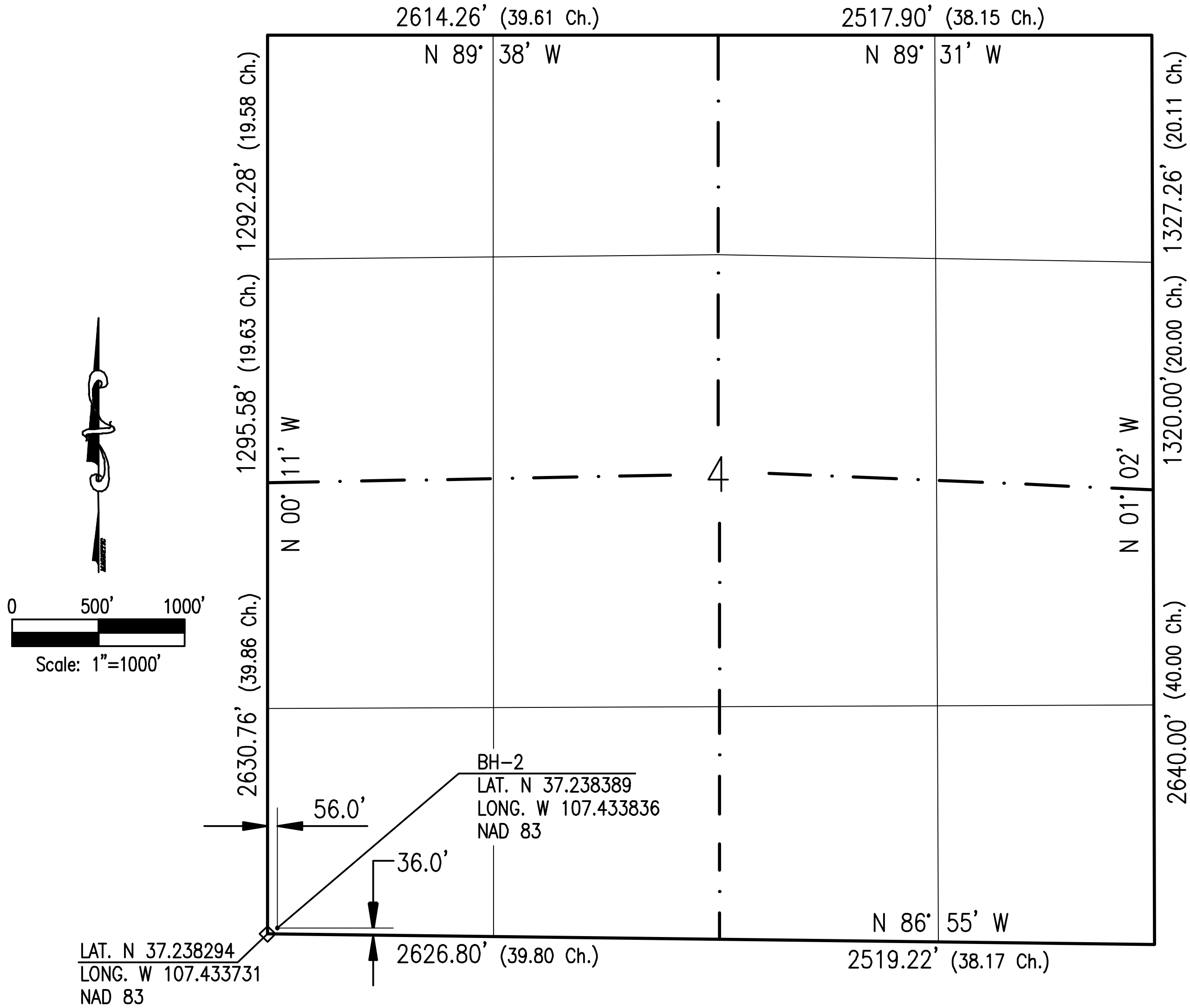
1. There presently exists no visible improvements within 200' of this location other than those shown hereon or on the attached pit and pad diagram.
2. Surface use for the land surrounding this location is national forest land.

BASIS OF ELEVATION

Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

Civil/Environmental Scientists & Engineers
SOUDER, MILLER & ASSOCIATES

SURVEY PLAT
MW-34-5-4 (BH-2)



Operator: Colorado Oil and Gas Conservation Commission		Well Name: MW-34-5-4 (BH-2)	
Section: 4	Township: 34 North	Range: 5 West	Meridian: N.M.P.M.
Footages: 36.0' FSL & 56.0' FWL			County/State: Archuleta, CO
Elevation: 7400'		Requested By: Steven R. Lindblom	

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF KNOWLEDGE AND BELIEF.

LYNN D. LANTZ
COLORADO P.L.S. #12046

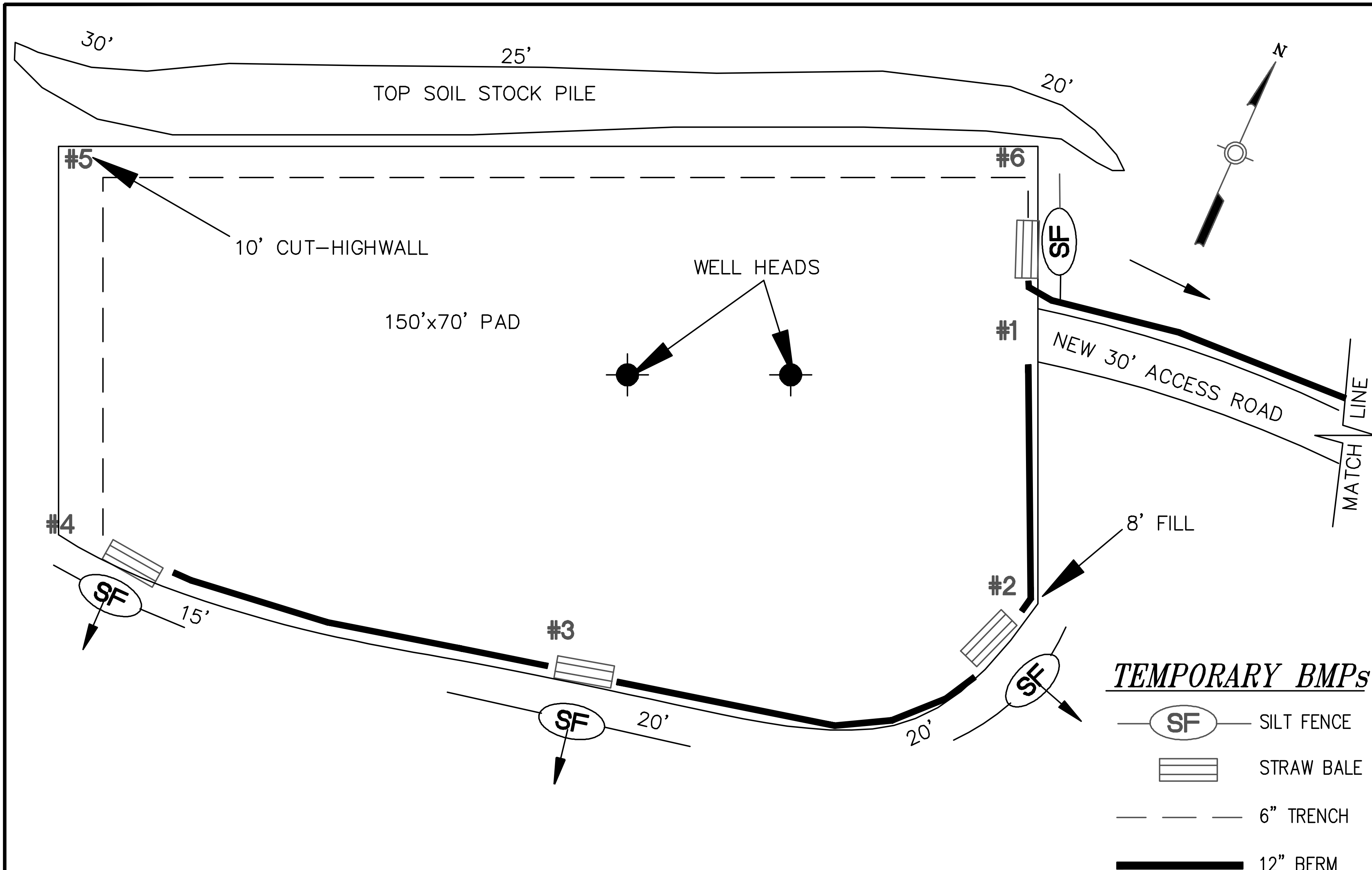
DATE

NOTES:

1. Basis of bearing is approved plat ~~of resurvey of T 34 N, R 5 W, N.M.P.M.,~~ approved June 27, 1947.
2. PDOP for this survey is 5.0'.
3. Section corner monument is a standard GLO Brass Cap dated 1947, set in an iron pipe sorrounded by a pile of stones. There is a metal witness post 2 feet north of the monument.
4. Well location distances calculated from GPS observation collected on 8/21/2008.
5. There presently exists no visible improvements within 200' of this location other than those shown hereon or on the attached pit and pad diagram.
6. Surface use for the land surrounding this location is national forest land.
7. Well location distances are measured perpendicular to section lines.

BASIS OF ELEVATION – Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

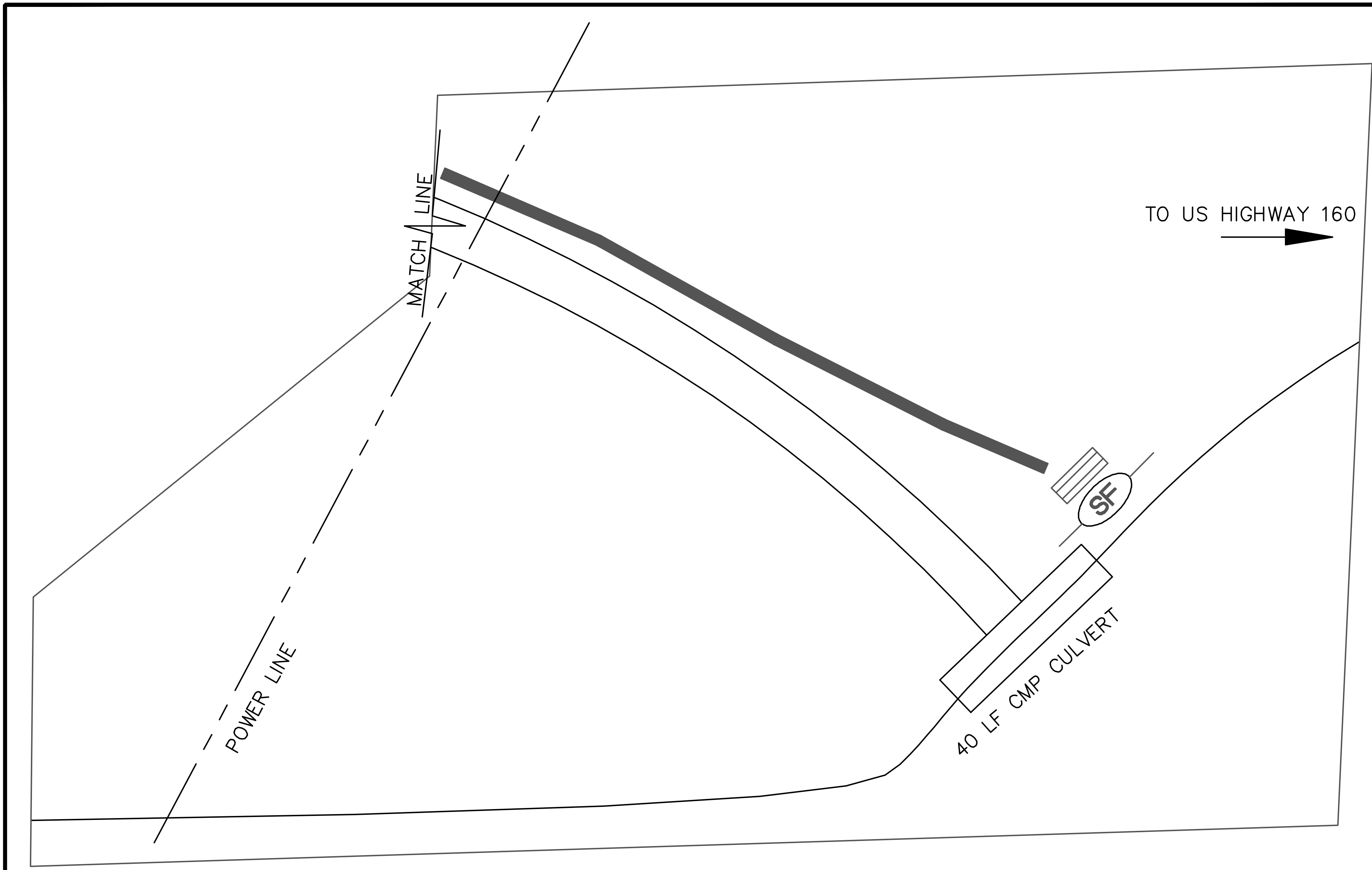
X:\2008 SMA-SUR\2008 SMA SUR DATA\5117918 SITE 1 WAGON GULCH-CO\dwg\MW-34-5-4 (BH-2).dwg



SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR.
FARMINGTON, NM 87401
PH. (505) 327–1072
FAX (505) 327–1496

APPROVED: DFG	DATE: 8/25/08
DRAWN BY: TLONG	DATE: 8/25/08
REVISIONS BY: DWM	DATE: 8/29/08
PROJECT #5117918	FIGURE: 1

WAGON GULCH MW–34–5–5–1
WELL PAD SCHEMATIC DIAGRAM
STORM WATER BEST MANAGEMENT PRACTICES



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APPROVED: DFG	DATE: 8/25/08
DRAWN BY: TLONG	DATE: 8/25/08
REVISIONS BY: DWM	DATE: 8/29/08
PROJECT #5117918	FIGURE: 2

WAGON GULCH MW-34-5-5-1
WELL PAD SCHEMATIC DIAGRAM
STORM WATER BEST MANAGEMENT PRACTICES

01360771

FORM 2 Rev 12/05

RECEIVED SEP 10 2008 COGCC

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

APPLICATION FOR PERMIT TO:

1. [✓] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate

2. TYPE OF WELL: OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitor — SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ] — Refiling [ ] Sidetrack [ ]

3. Name of Operator: COGCC — 4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates, 612 E. Murray Drive — City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA) Agent Phone: (505) 325-5667 Fax: (505) 326-1496
7. Well Name: Fosset Gulch ~~Gas~~ MW 34-5-14 Well Number: #1
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 750 feet

WELL LOCATION INFORMATION

10. QtrQtr: SESE Sec: 14 Twp: 34 N Rng: 05 W Meridian: NMPM N
Latitude: N 37.18651 Longitude: W 107.35527
Footage At Surface: 809 FNL/FSL S 781 FEL/FWL E
11. Field Name: Field Number:
12. Ground Elevation: 6727" 13. County: Archuleta
14. GPS Data: Date of Measurement: 8/21/08 PDOP Reading: 5 Instrument Operator's Name: L. Lantz

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), **submit deviated drilling plan.** Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

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: 100 ft
18. Distance to Nearest Property Line: 1760 19. Distance to nearest well permitted/completed in the same formation: na

20. **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.)
Fruit Land Coal	FRLDC			

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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):

25. Distance to Nearest Mineral Lease Line: 781' 26. Total Acres in Lease: NA

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 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] 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: Dried Cuttings buried on-site

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
Surface	8 3/4"	7"	20#	250	63	250	surface
Long String	6 1/4"	4 1/2"	10.5#	750	97	750	surface
			Stage Tool				

32. BOP Equipment Type: [ ] Annular Preventor [✓] Double Ram [ ] Rotating Head [ ] None
33. Comments Shaffer Pressure Control 5m LWS, rig floor ten feet, derrick is 63', total rig height 73' monitor well

34. Initial Rule 306 Consultation took place on (date) 8/12/08 ,was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.
PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.
I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: [signature] Print Name: Steven Lindblom
Title: 9/10/08 Date: 9/10/08 Email: steven.lindblom@sma...

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: David S. Neslin DKB Director of COGCC Date: 9/11/2008
Permit Number: 20086109 Expiration Date: 9/10/2009

API NUMBER
05-007-06264-00

CONDITIONS OF APPROVAL, IF ANY:

Provide 48 hour spud notice to COGCC field inspector Leslie Melton (970) 375-6419 and District Engineer Mark Weems @ 970-259-4587

01360772

FORM 2 Rev 12/05

State of Colorado
Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

RECEIVED SEP 10 2008 COGCC

APPLICATION FOR PERMIT TO:

1. [✓] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate

2. TYPE OF WELL: OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitor; SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ]
Refiling [ ] Sidetrack [ ]

3. Name of Operator: COGCC — 4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates, 612 E. Murray Drive
City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA) Agent Phone: (505) 325-5667 Fax: (505) 326-1496
7. Well Name: Fosset Gulch ~~Gas NW~~ MW 34-5-14 Well Number: #2
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 750 feet

Complete the Attachment Checklist	OP	COGCC
APD Orig & 1 Copy		
Form 2A		
Well location plat		
Topo map		
Mineral lease map		
Surface agmt/Surety		
30 Day notice letter		
Deviated Drilling Plan		
Exception Location Request		
Exception Loc Waivers		
H2S Contingency Plan		
Federal Drilling Permit		

WELL LOCATION INFORMATION

10. QtrQtr: SESE Sec: 14 Twp: 34 N Rng: 05 W Meridian: NMPM
Latitude: N 37 .18655 Longitude: W 107.35534
Footage At Surface: 822 FNL/FSL: S 802 FEL/FWL: E
11. Field Name: Field Number:
12. Ground Elevation: 6727" 13. County: Archuleta
14. GPS Data:
Date of Measurement: 8/21/08 PDOP Reading: 5 Instrument Operator's Name: L. Lagntz

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), **submit deviated drilling plan.** Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

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: 100 ft
18. Distance to Nearest Property Line: 1760 19. Distance to nearest well permitted/completed in the same formation: na

20. 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.)
Frut Land Coal	FRLDC			

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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):

25. Distance to Nearest Mineral Lease Line: 802' 26. Total Acres in Lease: NA

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 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] 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
Surface	8 3/4"	7"	20#	250	63	250	surface
Long String	6 1/4"	4 1/2"	10.5#	750	97	750	surface
		Stage Tool					

32. BOP Equipment Type: [ ] Annular Preventor [✓] Double Ram [ ] Rotating Head [ ] None
33. Comments: Shaffer Pressure Control 5m LWS, rig floor ten feet, derrick is 63', total rig height 73' Monitor well no Conductor pipe Exception Location 603 a (1)
34. Initial Rule 306 Consultation took place on (date) 8/12/08, was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.
PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.
I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

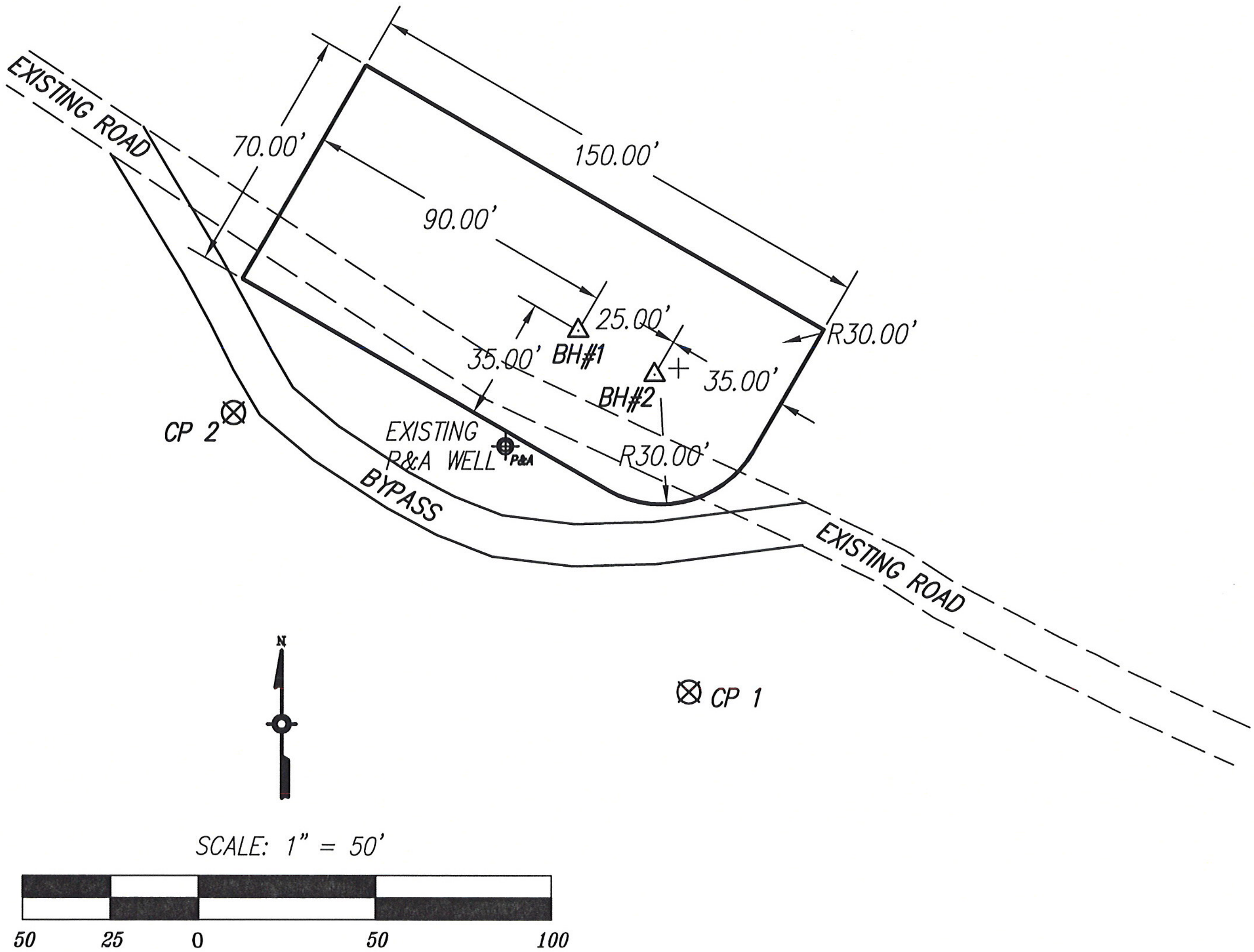
Signed: [signature] Print Name: Steven Lindblom
Title: EPS II Date: 9/10/08 Email: steven.lindblom@state.co.us

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: David S. Neslin Director of COGCC Date: 9/11/2008
Permit Number: 20086110 Expiration Date: 9/10/2009

API NUMBER
05- 007-06265-00

CONDITIONS OF APPROVAL, IF ANY:

Provide 48 hour spud notice to COGCC field inspector Leslie Melton (970) 375-6419 and District Engineer Mark Weems at 970-259-4587



LEGEND

CP 1	CONTROL POINT
BH#2	BORE HOLE WITH NUMBER DESIGNATION

COLORADO REGISTERED PROFESSIONAL ENGINEER
DOUGLAS W. MIZE
32805
8-28-2008

AUGUST 27, 2008

COGCC FRUITLAND MONITORING PROJECT
WELL NAME FOSSET GULCH # 1 & 2
SE/4 SE/4 OF SECTION 14U-T34N-R5W

FIGURE 1

REVISIONS
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____

DRAWN blb
CHECKED csq
APPROVED DWM
DATE AUGUST, 2008

SMA
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Albuquerque – Las Cruces – Santa Fe, NM
Grand Junction – Cortez, CO – Monticello, UT

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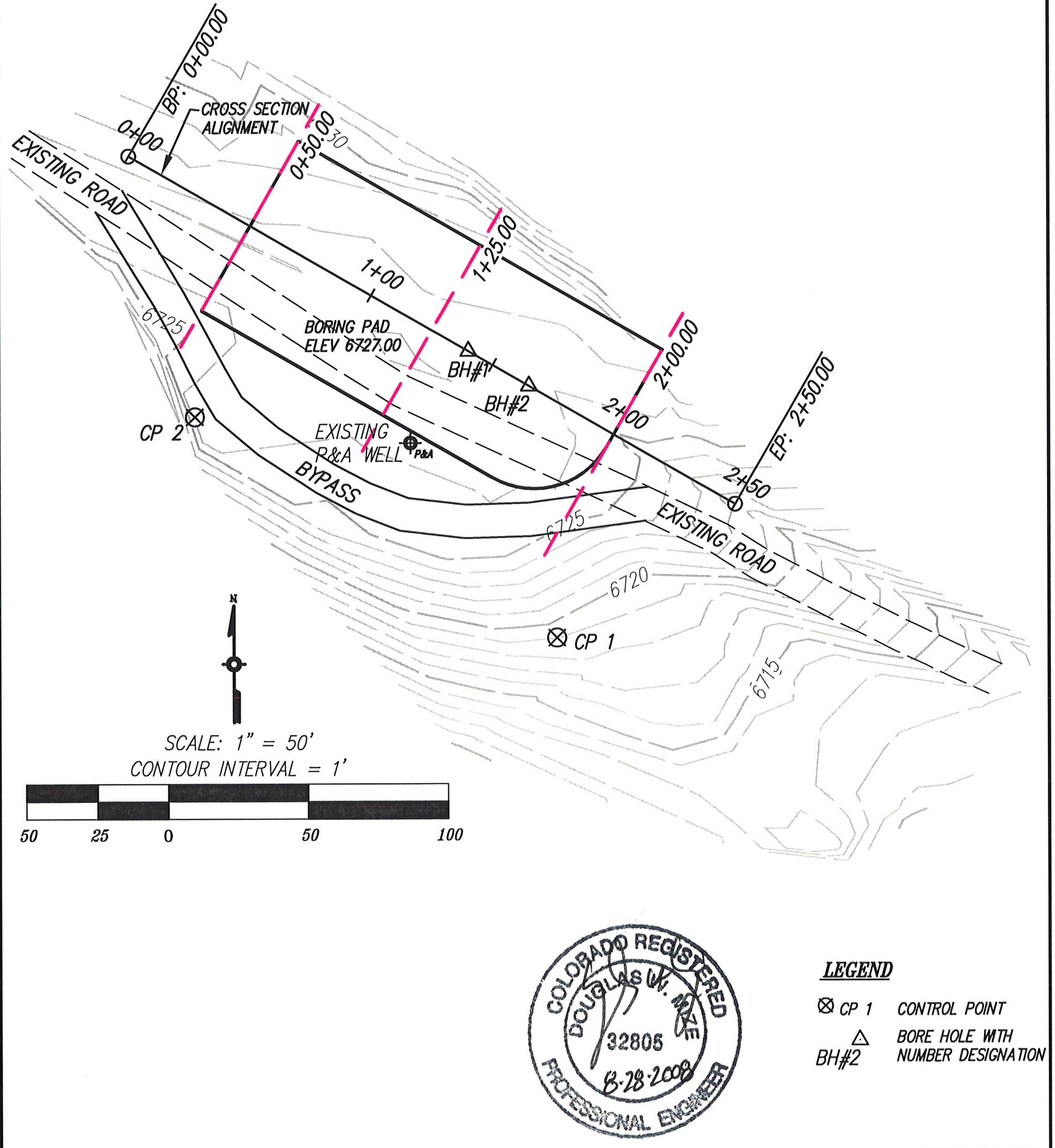

AUGUST 27, 2008

COGCC FRUITLAND MONITORING PROJECT
WELL NAME FOSSET GULCH # 1 & 2
SE/4 SE/4 OF SECTION 14U-T34N-R5W

FIGURE 2

REVISIONS
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____

DRAWN blb
CHECKED csq
APPROVED DWM
DATE AUGUST, 2008

SMA Civil/Environmental Scientists & Engineers

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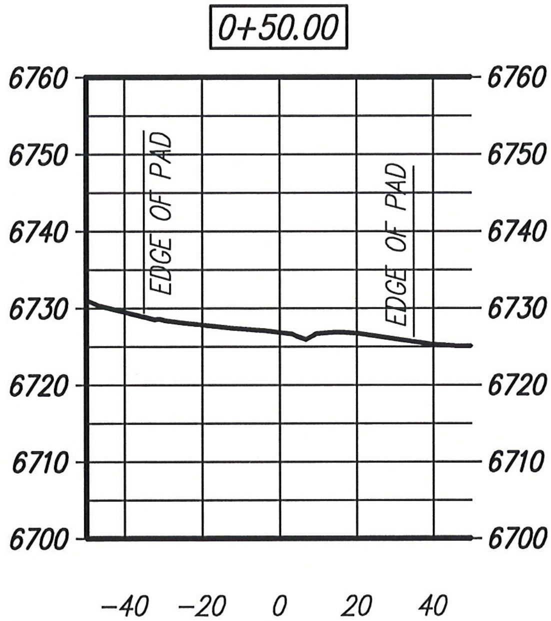

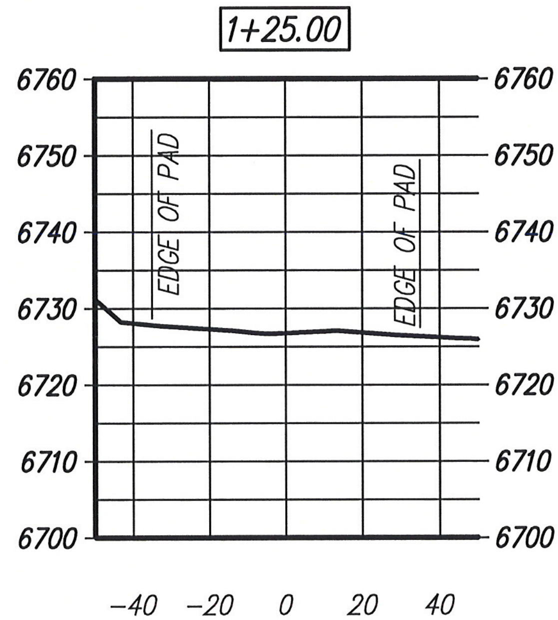

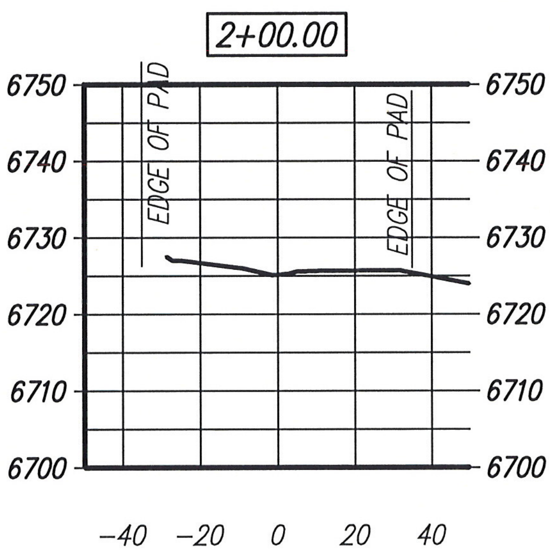

SCALE: HORIZ. 1" = 50'
VERT. 1" = 25'

COLORADO REGISTERED PROFESSIONAL ENGINEER
DOUGLAS W. MIZE
32805
8-28-2008

AUGUST 27, 2008

COGCC FRUITLAND MONITORING PROJECT
WELL NAME FOSSET GULCH # 1 & 2
SE/4 SE/4 OF SECTION 14U-T34N-R5W

FIGURE 3

REVISIONS
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____

DRAWN blb
CHECKED csq
APPROVED DWM
DATE AUGUST, 2008

SMA
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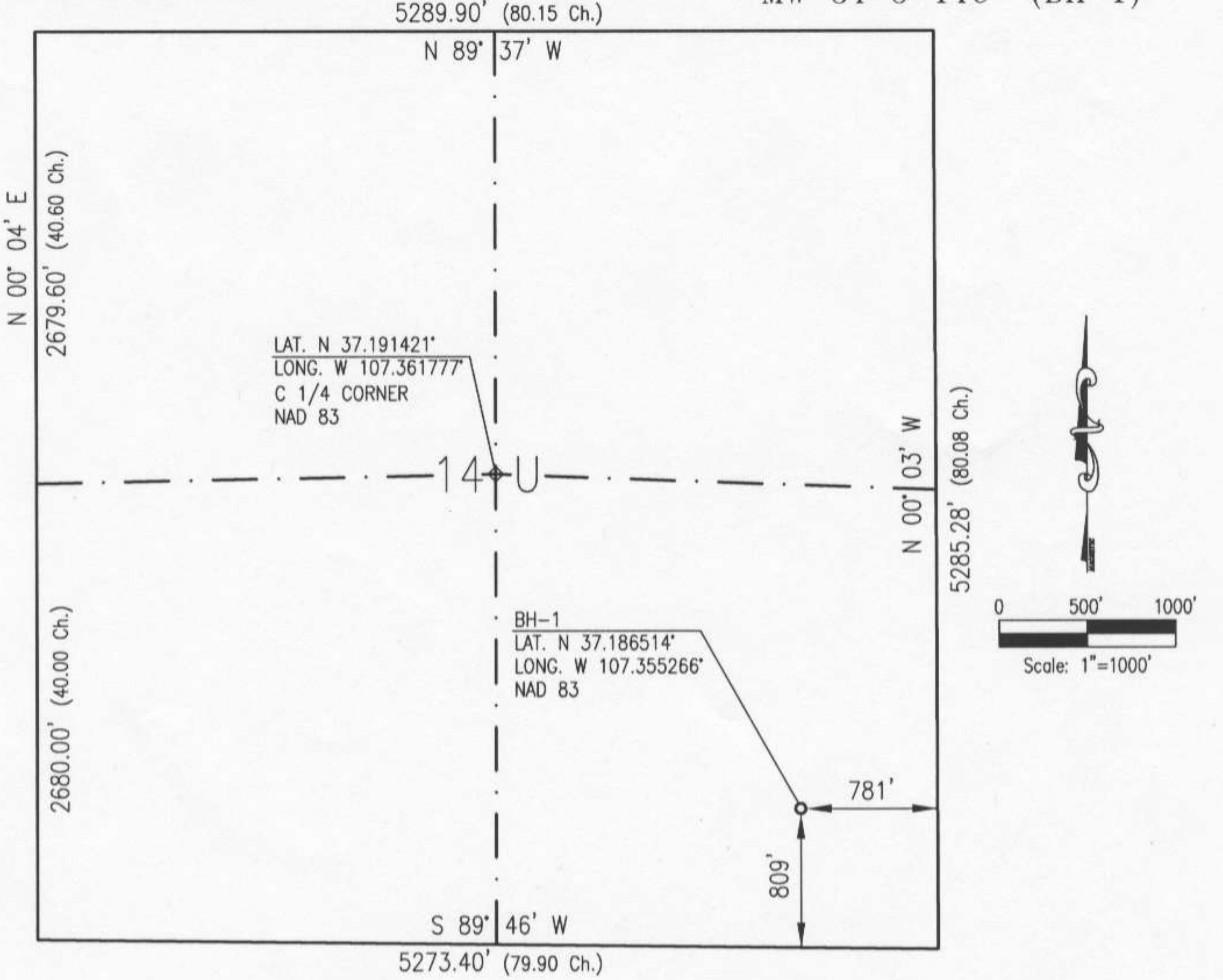
P:\5-FRUITLANDFORMATIONARCHULETADRILLING(5117918)\CAD\DWG\C3D\MW-5-14U-1\MW-5-14U-1TOPO.DWG

SMA
Civil/Environmental Scientists & Engineers
SOUDER, MILLER & ASSOCIATES

FOSSET GULCH SURVEY PLAT
MW-34-5-14U (BH-1)



Operator: Colorado Oil and Gas Conservation Commission		Well Name: MW-34-5-14 U (BH-1)	
Section: 14 U	Township: 34 North	Range: 5 West	Meridian: N.M.P.M.
Footages: 809' FSL & 781' FEL			County/State: Archuleta, CO
Elevation: 6727'		Requested By: Steven R. Lindblom	

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF KNOWLEDGE AND BELIEF.

LYNN DEE LANTZ 12046 LAND SURVEYOR STATE OF COLORADO

LYNN D. LANTZ
COLORADO P.L.S. #12046

8 Sept 2008
DATE

NOTES:

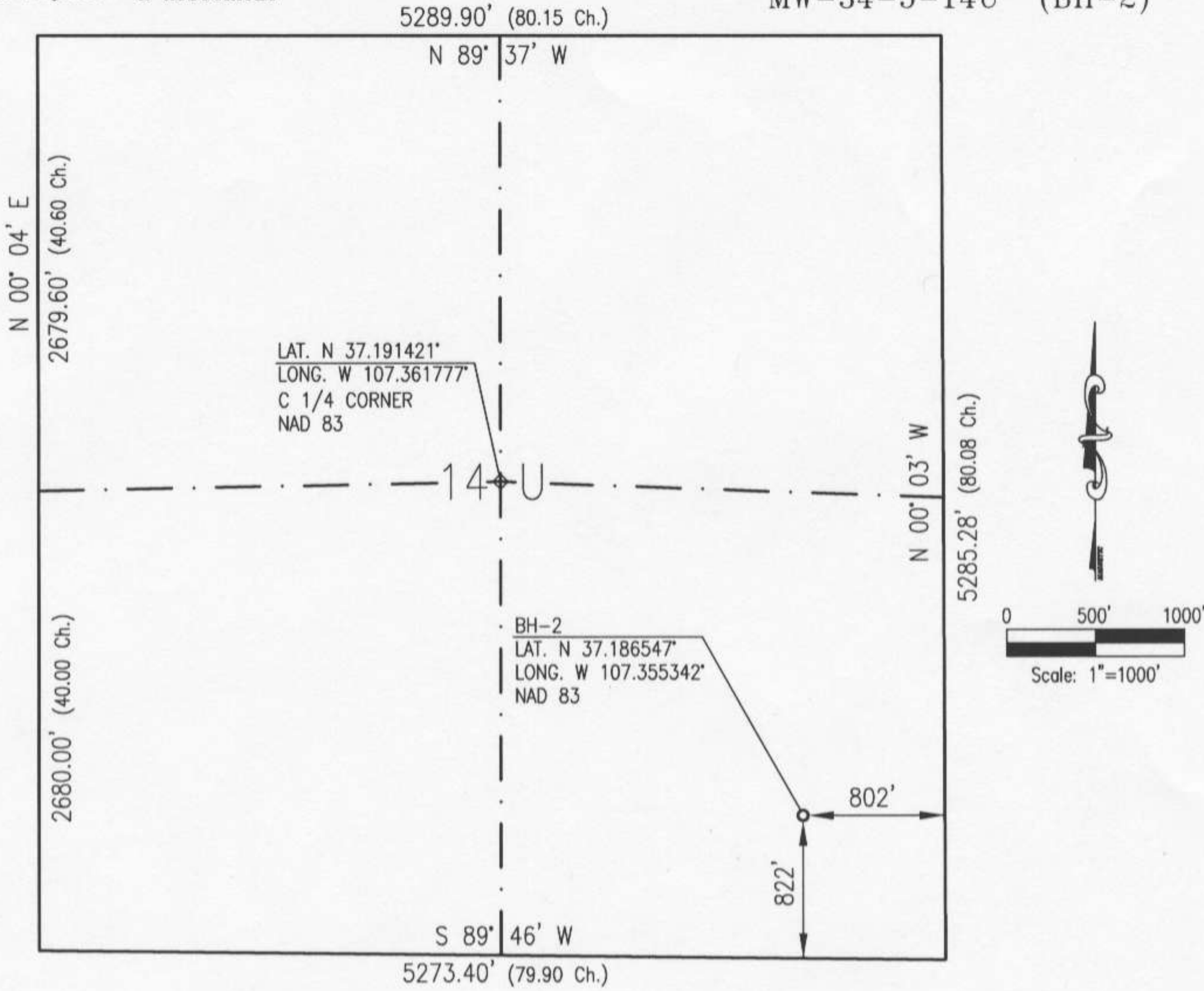
1. Basis of bearing is approved plat of resurvey of T 34 N, R 5 W, N.M.P.M., approved June 27, 1947.
2. PDOP for this survey is 5.0'.
3. Section corner monument is a standard GLO Brass Cap dated 1947, set in an iron pipe sorrounded by a pile of stones. There is a metal witness post 2 feet north of the monument.
4. Well location distances calculated from GPS observation collected on 8/21/2008.
5. There presently exists no visible improvements within 200' of this location other than those shown hereon or on the attached pit and pad diagram.
6. Surface use for the land surrounding this location is national forest land.
7. Well location distances are measured perpendicular to section lines.

BASIS OF ELEVATION – Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

X:\2008 SMA-SUR\2008 SMA SUR DATA\5117918 SITE 2 FOSSET GULCH-CO\dwg\FOSSETT GULCH WELL LOCATION BH1 SHT.dwg

SMA
Civil/Environmental Scientists & Engineers
SOUDER, MILLER & ASSOCIATES

FOSSET GULCH SURVEY PLAT
MW–34–5–14U (BH–2)



Operator: Colorado Oil and Gas Conservation Commission		Well Name: MW–34–5–14 U (BH–2)	
Section: 14 U	Township: 34 North	Range: 5 West	Meridian: N.M.P.M.
Footages: 822' FSL & 802' FEL			County/State: Archuleta, CO
Elevation: 6727'		Requested By: Steven R. Lindblom	

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF KNOWLEDGE AND BELIEF.

12046

LYNN D. LANTZ
COLORADO P.L.S. #12046

8 Sept 2008
DATE

NOTES:

1. Basis of bearing is approved plat of resurvey of T 34 N, R 5 W, N.M.P.M., approved June 27, 1947.
2. PDOP for this survey is 5.0'.
3. Section corner monument is a standard GLO Brass Cap dated 1947, set in an iron pipe sorrounded by a pile of stones. There is a metal witness post 2 feet north of the monument.
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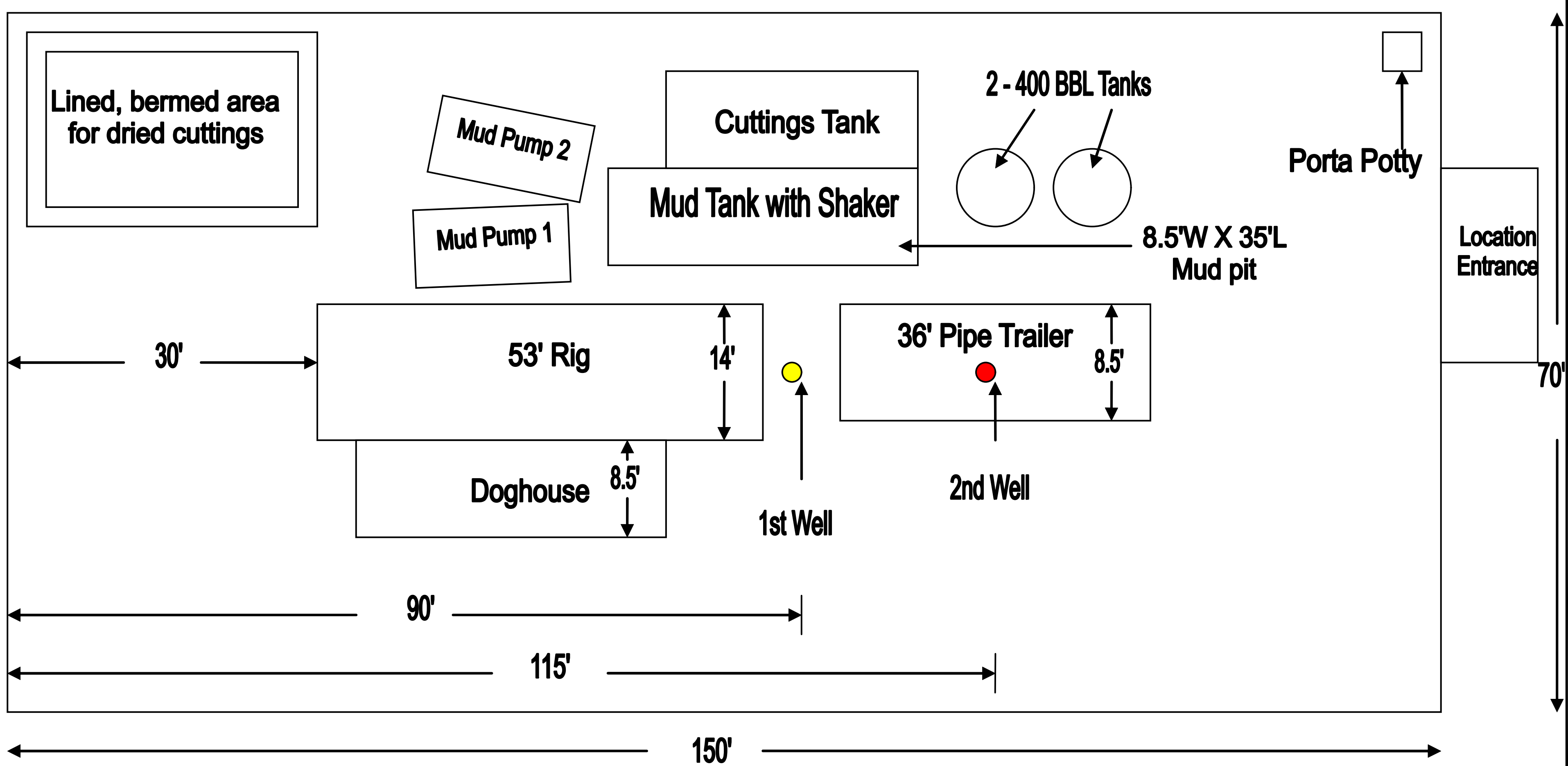
5. There presently exists no visible improvements within 200' of this location other than those shown hereon or on the attached pit and pad diagram.
6. Surface use for the land surrounding this location is national forest land.
7. Well location distances are measured perpendicular to section lines.

BASIS OF ELEVATION – Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

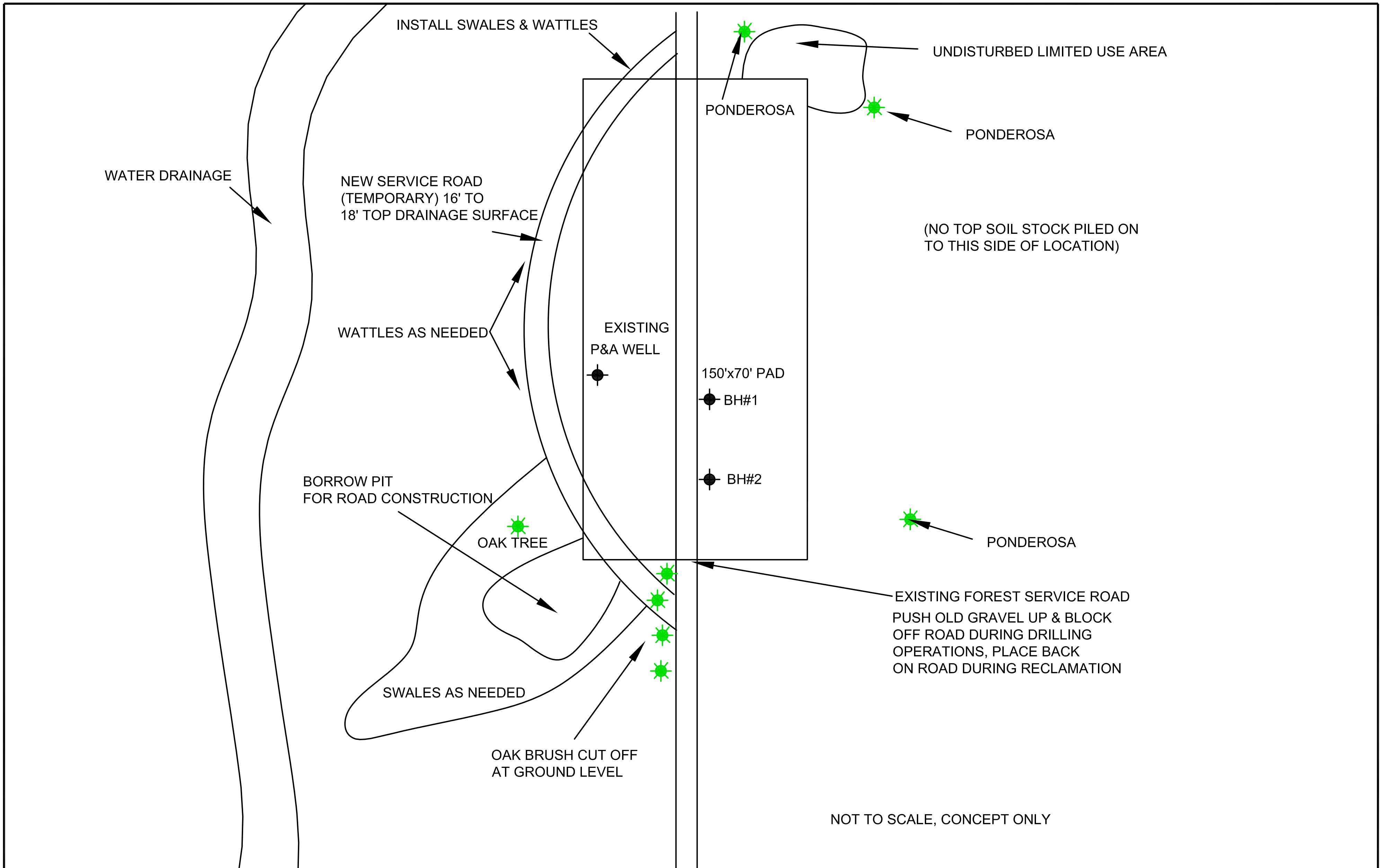
X:\2008 SMA-SUR\2008 SMA SUR DATA\5117918 SITE 2 FOSSET GULCH-CO\dwg\FOSSETT GULCH WELL LOCATION BH2 SHT.dwg

Scorpion Drilling Footprint



APPROVED: DGF	DATE: 06/12/08
DRAWN BY: LL	DATE: 06/012/08
REVISIONS BY:	DATE:

SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. PH. (505) 325-5667
FARMINGTON, NM 87401 FAX (505) 327-1496



SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. FARMINGTON, NM 87401
PH. (505) 327-1072
FAX (505) 327-1496

APPROVED: DFG	DATE: 8/25/08
DRAWN BY: TLONG	DATE: 8/25/08
REVISIONS BY:	DATE:
PROJECT #5117918	FIGURE: 1

FOSSET GULCH MW-34-5-14U-1
WELL PAD DIAGRAM

FORM 2
Rev 12/05

State of Colorado
Oil and Gas Conservation Commission

02034711

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

RECEIVED OCT 21 2008 COGCC

APPLICATION FOR PERMIT TO:

1. [✓] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate — Refiling [ ] Sidetrack [ ]

2. TYPE OF WELL: OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitor
SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ]

3. Name of Operator: COGCC — 4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates 612 E. Murray Drive
City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA Agent) Phone: (505) 325-5667 Fax: (505) 327-1496
7. Well Name: Hwy 151 34-4-30 MW Well Number: #1
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 500 feet

Complete the Attachment Checklist

	OP	COGCC
APD Orig & 1 Copy		
Form 2A	✓	
Well location plat	✓	
Topo map	✓	
Mineral lease map		
Surface agrmt/Surety		
30 Day notice letter		
Deviated Drilling Plan		
Exception Location Request	✓	
Exception Loc Waivers		
H2S Contingency Plan		
Federal Drilling Permit		

WELL LOCATION INFORMATION

10. QtrQtr: SW NW Sec: 30 Twp: 34N Rng: 4W Meridian: NMPM
Latitude: N 37.163685 Longitude: W 107.331061
Footage At Surface: 2152,3 FNL/FSL N 1003,4 FEL/FWL W
11. Field Name: unknown Field Number: 85250
12. Ground Elevation: 6450 13. County: Archuleta

14. GPS Data:
Date of Measurement: 08/21/2008 PDOP Reading: 5,0 Instrument Operator's Name: L. Lantz

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), **submit deviated drilling plan.** Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

16. Is location in a high density area (Rule 603b)? [ ] Yes [✓] No — Right = 63' x 1.5 = 94
17. Distance to the nearest building, public road, above ground utility or railroad: 127 feet OHE
18. Distance to Nearest Property Line: 490 — 19. Distance to nearest well permitted/completed in the same formation: NA

20. **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.)
Fruitland	FRLDC	NA	NA	

21. Mineral Ownership: [ ] Fee [ ] State [✓] Federal [ ] Indian — Lease # NA
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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):
na
25. Distance to Nearest Mineral Lease Line: NA 26. Total Acres in Lease: NA

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 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] 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: Dried cuttings buried on site

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
Surface	8 3/4 in.	7 in.	20 lb.	125 ft.	31	125 ft.	Surface
Long String	6 1/4 in.	4 1/2 in.	10.5 lb.	500 ft.	67	500 ft.	Surface
			Stage Tool				

32. BOP Equipment Type: [ ] Annular Preventor [✓] Double Ram [ ] Rotating Head [ ] None
33. Comments: Shaffer pressure control 5m LWS, Rig floor 10 feet, Derrick height 63 feet, Monitor Well

34. Initial Rule 306 Consultation took place on (date) 08/12/08, was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.
PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.
I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: Dorothy E Baldwin Print Name: DOROTHY E. BALDWIN
Title: ENVIRONMENTAL MANAGER Date: 10/21/08 Email: debbie.baldwin@state.co.us

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: David S. Neslin DED Director of COGCC Date: 10/27/2008
Permit Number: 20087099 Expiration Date: 10/26/2009

API NUMBER
05- 007 - 06271-00

CONDITIONS OF APPROVAL, IF ANY:

48 Hour Spud Notice Required:
To COGCC field inspector Leslie
Melton (970) 375-6419 and
district Engineer Mark Weems (970) 259-4587

FORM 2
Rev 12/05

02034712

State of Colorado
Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax:(303)894-2109

APPLICATION FOR PERMIT TO:

RECEIVED
OCT 21 2008
Plugging Bond Surety ID#
COGCC

1. [x] Drill, [ ] Deepen, [ ] Re-enter, [ ] Recomplete and Operate

2. TYPE OF WELL
OIL [ ] GAS [ ] COALBED [ ] OTHER: Monitor
SINGLE ZONE [ ] MULTIPLE ZONES [ ] COMMINGLE ZONES [ ]

Refiling [ ]
Sidetrack [ ]

3. Name of Operator: COGCC
4. COGCC Operator Number: 5
5. Address: c/o Souder, Miller & Associates 612 E. Murray Drive
City: Farmington State: NM Zip: 87401
6. Contact Name: Denny Foust (SMA Agent) Phone: (505) 325-5667 Fax: (505) 327-1496
7. Well Name: Hwy 151 34-4-30 MW Well Number: #2
8. Unit Name (if appl): Unit Number:
9. Proposed Total Measured Depth: 500 feet

Complete the Attachment Checklist

	OP	COGCC
APD Orig & 1 Copy		
Form 2A		
Well location plat		
Topo map		
Mineral lease map		
Surface agrmt/Surety		
30 Day notice letter		
Deviated Drilling Plan		
Exception Location Request		
Exception Loc Waivers		
H2S Contingency Plan		
Federal Drilling Permit		

WELL LOCATION INFORMATION

10. QtrQtr: SW NW Sec: 30 Twp: 34N Rng: 4W Meridian: NMPM
Latitude: N 37.163631 Longitude: W 107.331008
Footage At Surface: 2172.0 FNL/FSL N 1018.9 FEL/FWL W
11. Field Name: unknown Field Number: 85250
12. Ground Elevation: 6450 13. County: Archuleta
14. GPS Data:
Date of Measurement: 08/21/2008 PDOP Reading: 5.0 Instrument Operator's Name: L. Lantz

15. If well is: [ ] Directional [ ] Horizontal (highly deviated), **submit deviated drilling plan.** Bottomhole Sec Twp Rng:
Footage At Top of Prod Zone: FNL/FSL FEL/FWL At Bottom Hole: FNL/FSL FEL/FWL

16. Is location in a high density area (Rule 603b)? [ ] Yes [x] No
17. Distance to the nearest building, public road, above ground utility or railroad: 109 feet OHE
18. Distance to Nearest Property Line: ~~NA USFS~~ 470 19. Distance to nearest well permitted/completed in the same formation: NA

LEASE, SPACING AND POOLING INFORMATION

20.

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

21. Mineral Ownership: [ ] Fee [ ] State [x] Federal [ ] Indian Lease # NA
22. Surface Ownership: [ ] Fee [ ] State [x] Federal [ ] Indian
23. Is the Surface Owner also the Mineral Owner? [x] Yes [ ] No Surface Surety ID#
23a. If 23 is Yes: Is the Surface Owner(s) signature on the lease? [ ] Yes [x] 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 QtrQtr, Sec, Twp, Rng format enter entire mineral lease description upon which this proposed wellsite is located (attach separate sheet/map if you prefer):
na
25. Distance to Nearest Mineral Lease Line: NA 26. Total Acres in Lease: NA

DRILLING PLANS AND PROCEDURES

27. Is H2S anticipated? [ ] Yes [x] No If Yes, attach contingency plan.
28. Will salt sections be encountered duing drilling? [ ] Yes [x] No
29. Will salt (>15,000 ppm TDS Cl) or oil based muds be used during drilling? [ ] Yes [x] No
30. If questions 27 or 28 are yes, is this location in a sensitive area (Rule 903)? [ ] Yes [ ] No **If 28, 29 or 30 are "Yes" a pit permit may be required.**
31. Mud disposal: [x] Offsite [ ] Onsite
Method: [ ] Land Farming [ ] Land Spreading [ ] Disposal Facility [x] Other: Dried cuttings buried on site

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
Surface	8 3/4 in.	7 in.	20 lb.	125 ft.	31	125 ft.	Surface
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			Stage Tool				

32. BOP Equipment Type: [ ] Annular Preventor [x] Double Ram [ ] Rotating Head [ ] None
33. Comments: Shaffer pressure control 5m LWS. Rig floor 10 feet. Derrick height 63 feet. Monitor Well

34. Initial Rule 306 Consultation took place on (date) 08/12/08 ,was waived, or is not required. Provide supporting documentation if consultation has been waived or if good faith effort did not result in consultation.
PERMIT SUBMITTED TO COGCC PRIOR TO COMPLIANCE WITH RULE 306 CONSULTATION SHALL BE RETURNED UNAPPROVED.
I hereby certify that a complete permit package has been sent to the applicable Local Government Designee(s), and all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: Dorothy E. Baldwin Print Name: DOROTHY E. BALDWIN
Title: ENVIRONMENTAL MANAGER Date: 10/21/08 Email: debbie.baldwin@state.co.us

Based on the information provided herein, this Application for Permit-to-Drill complies with COGCC Rules and applicable orders and is hereby approved.

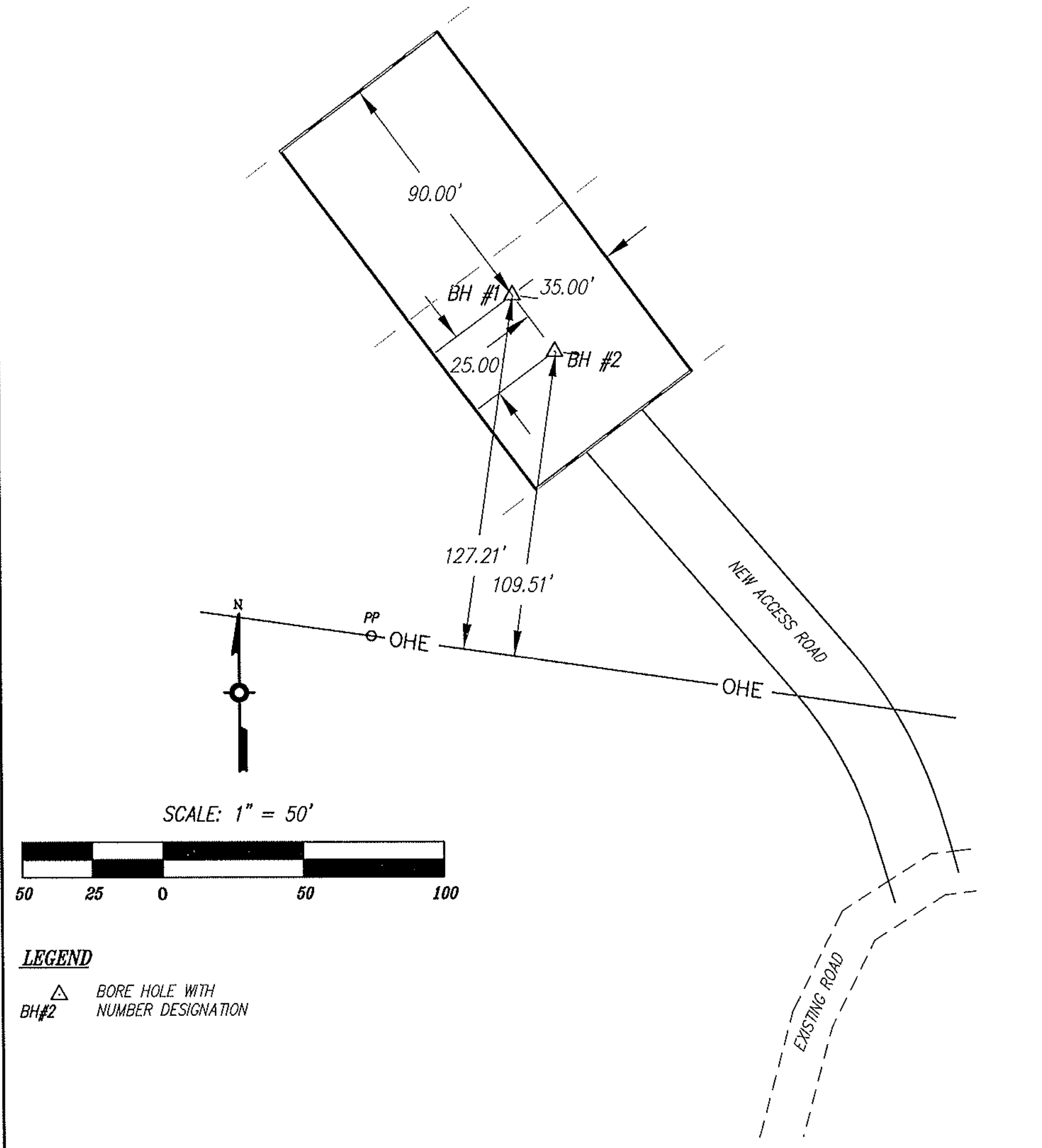
COGCC Approved: David S. Neslin DKD Director of COGCC Date: 10/27/2008

Permit Number: 20087098 Expiration Date: 10/26/2009

API NUMBER
05- 007-06270-00

CONDITIONS OF APPROVAL, IF ANY:

Provide 48 hour spud notice to COGCC field inspector Leslie Melton (970) 375-6419 and District ~~Geologi~~ Engineer Mark Weems (970) 259-4587



COGCC FRUITLAND MONITORING PROJECT
WELL NAME HIGHWAY 151 # 1 & 2
--/4 --/4 OF SECTION 30-T34N-R4W

FIGURE 1

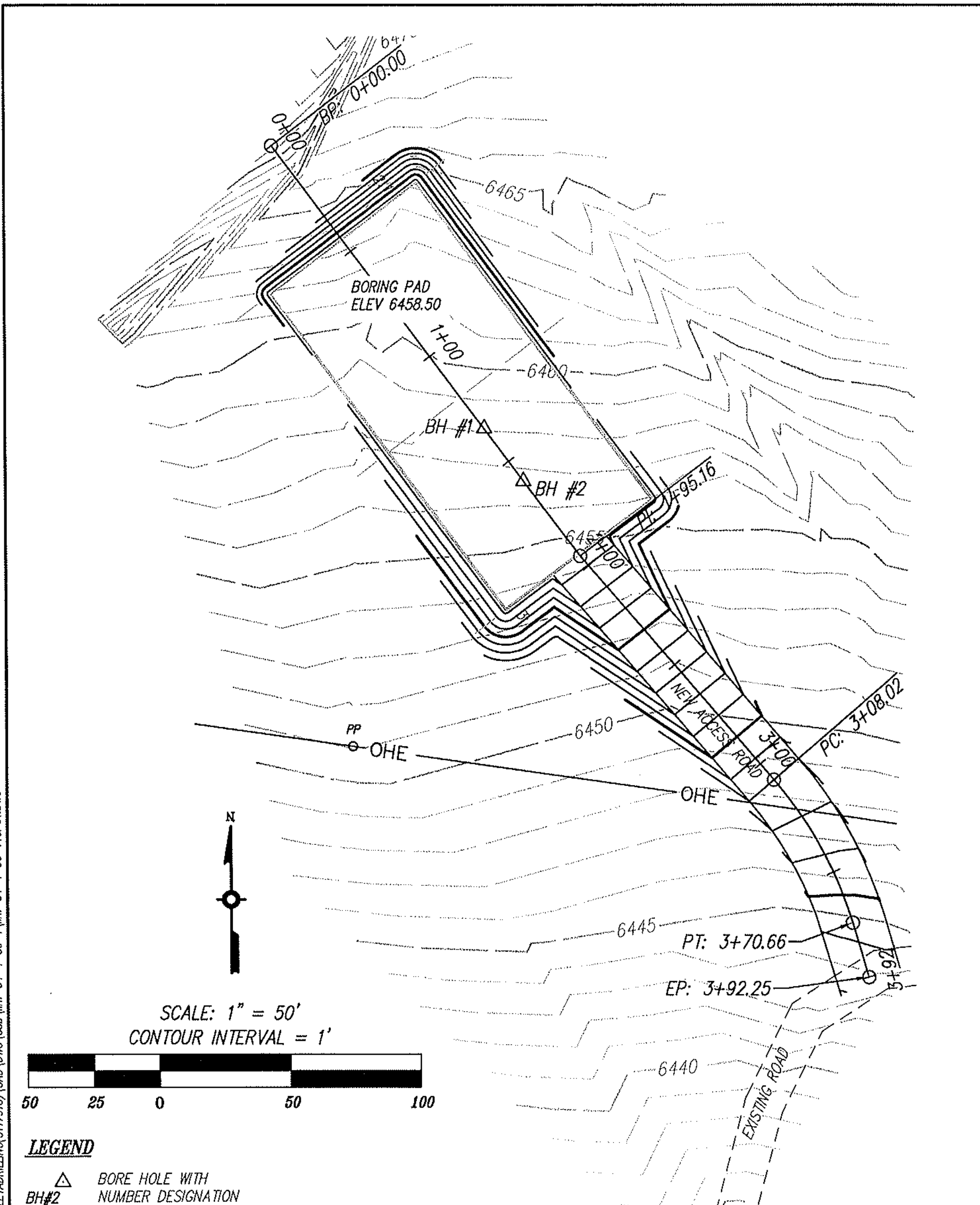
REVISIONS		
BY ______	DATE ______	DESCR. ______
BY ______	DATE ______	DESCR. ______
BY ______	DATE ______	DESCR. ______

DRAWN	blb
CHECKED	csq
APPROVED	DWM
DATE	9/25/2008

SMA
Civil / Environmental Scientists & Engineers

SOUDER, MILLER & ASSOCIATES, 2101 SAN JUAN BLVD, FARMINGTON, NEW MEXICO 87401 TELE: 505-325-7535
Albuquerque – Las Cruces – Santa Fe, NM
Grand Junction – Cortez, CO – Monticello, UT

P:\5-FRUITLANDFORMATIONARCHULETADRILLING(5117918)\CAD\DWG\C3D\MW-34-4-30-1\MW-34-4-30-1TOPO1.DWG



AUGUST 29, 2008

COGCC FRUITLAND MONITORING PROJECT
WELL NAME HIGHWAY 151 # 1 & 2
--/4 --/4 OF SECTION 30-T34N-R4W

FIGURE 2

REVISIONS		
BY _____	DATE _____	DESCR. _____
BY _____	DATE _____	DESCR. _____
BY _____	DATE _____	DESCR. _____

DRAWN blb
CHECKED csq
APPROVED DWM
DATE 9/25/2008

SMA
Civil / Environmental Scientists & Engineers

SOUDER, MILLER & ASSOCIATES, 2101 SAN JUAN BLVD, FARMINGTON, NEW MEXICO 87401 TELE: 505-325-7535
Albuquerque – Las Cruces – Santa Fe, NM
Grand Junction – Cortez, CO – Monticello, UT

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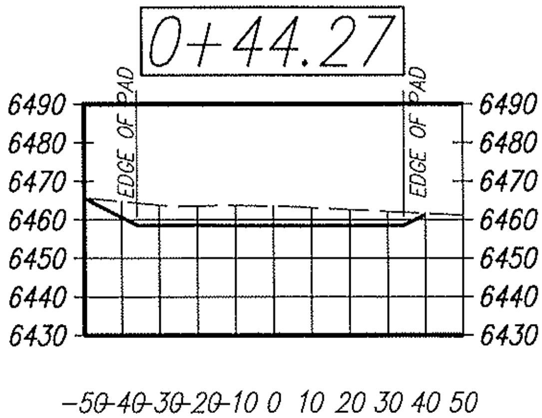
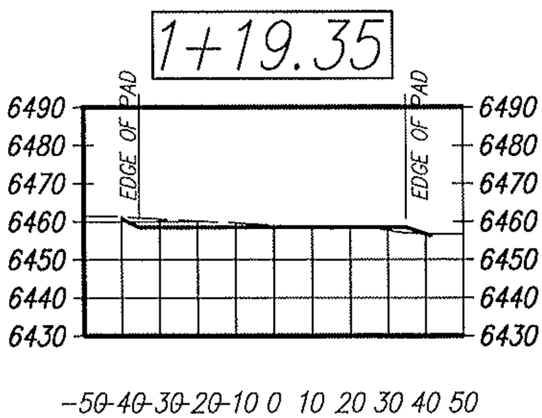
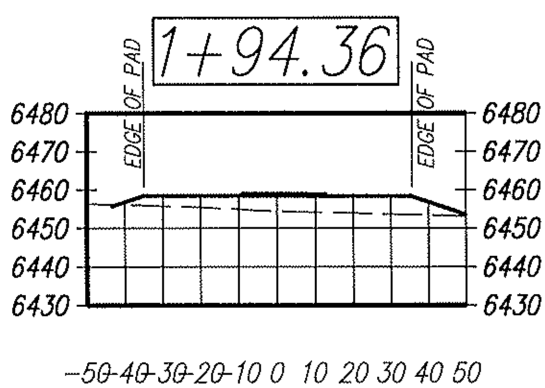






P:\5-FRUITLANDFORMATIONARCHULETADRILLING(5117918)\CAD\DWG\C3D\MW-34-4-30-1\MW-34-4-30-1TOPO1.DWG

COGCC FRUITLAND MONITORING PROJECT
WELL NAME HIGHWAY 151 # 1 & 2
--/4 --/4 OF SECTION 30-T34N-R4W

FIGURE 3

REVISIONS
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____
BY ____ DATE ____ DESCR. ____

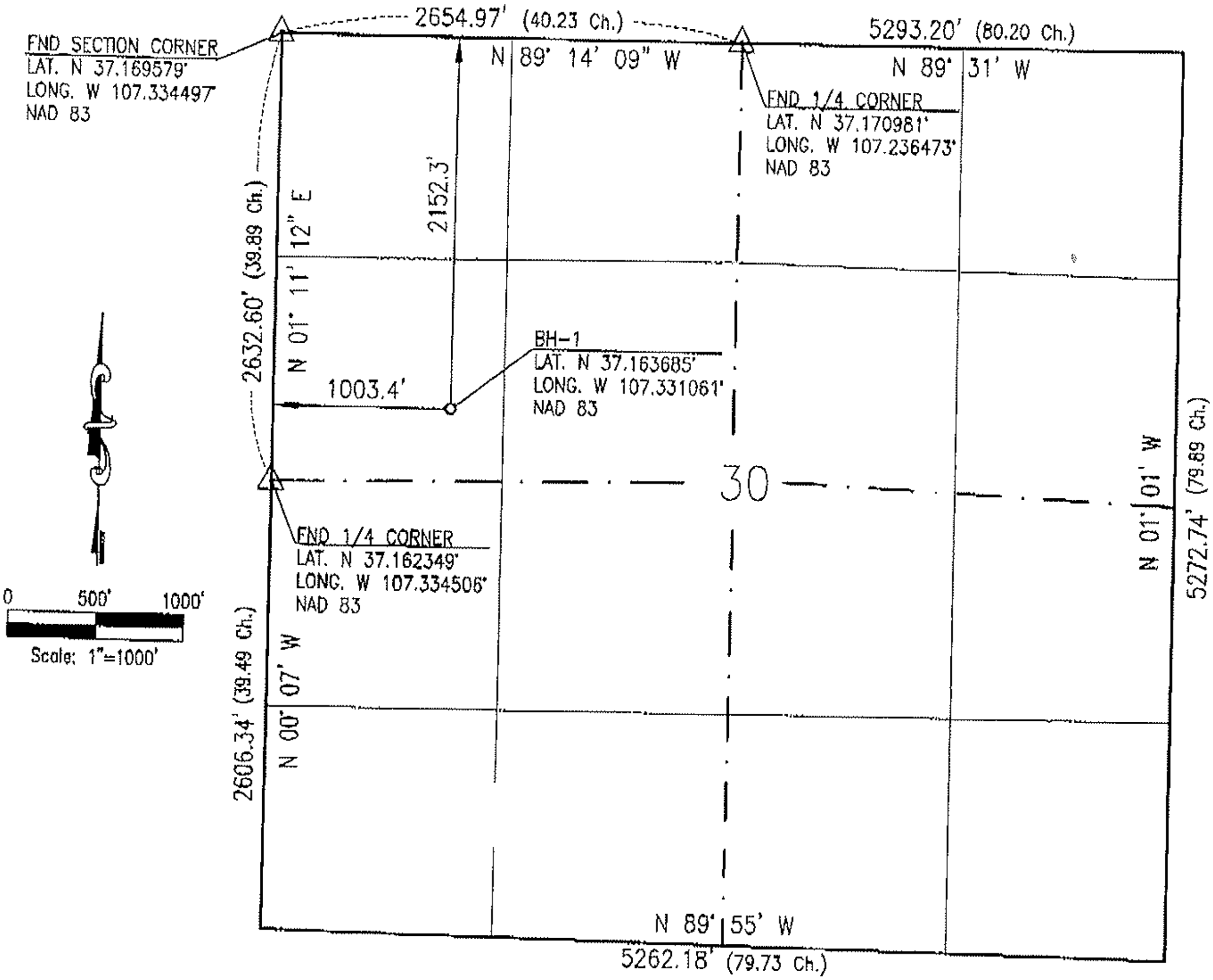
DRAWN blb
CHECKED csg
APPROVED DWM
DATE 9/25/2008

SMA Civil / Environmental Scientists & Engineers

SOUDER, MILLER & ASSOCIATES, 2101 SAN JUAN BLVD, FARMINGTON, NEW MEXICO 87401 TELE: 505-325-7535
Albuquerque – Las Cruces – Santa Fe, NM
Grand Junction – Cortez, CO – Monticello, UT

SMA Scientists, Engineers & Surveyors SOUDER, MILLER & ASSOCIATES

SURVEY PLAT
MW-34-4-30 (BH-1)



Operator: Colorado Oil and Gas Conservation Commission		Well Name: MW-34-4-30 (BH-1)	
Section: 30	Township: 34 North	Range: 4 West	Meridian: N.M.P.M.
Footages: 2152.3' FNL & 1003.4' FWL			County/State: Archuleta, CO
Elevation: 6450'		Requested By: Steven R. Lindblom	

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR, IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF MY KNOWLEDGE AND BELIEF.

LYNN D. LANTZ
COLORADO P.L.S. #12046

LAND SURVEYOR STATE OF COLORADO 12046

9-26-08
DATE

NOTES:

1. Basis of bearing is approved plat of resurvey of T 34 N, R 5 W, N.M.P.M., approved June 27, 1947.
2. PDOP for this survey is 5.0'.
3. Section corner monument is a standard GLO Brass Cap dated 1947, set in an iron pipe sorrounded by a pile of stones. There is a metal witness post 2 feet north of the monument.
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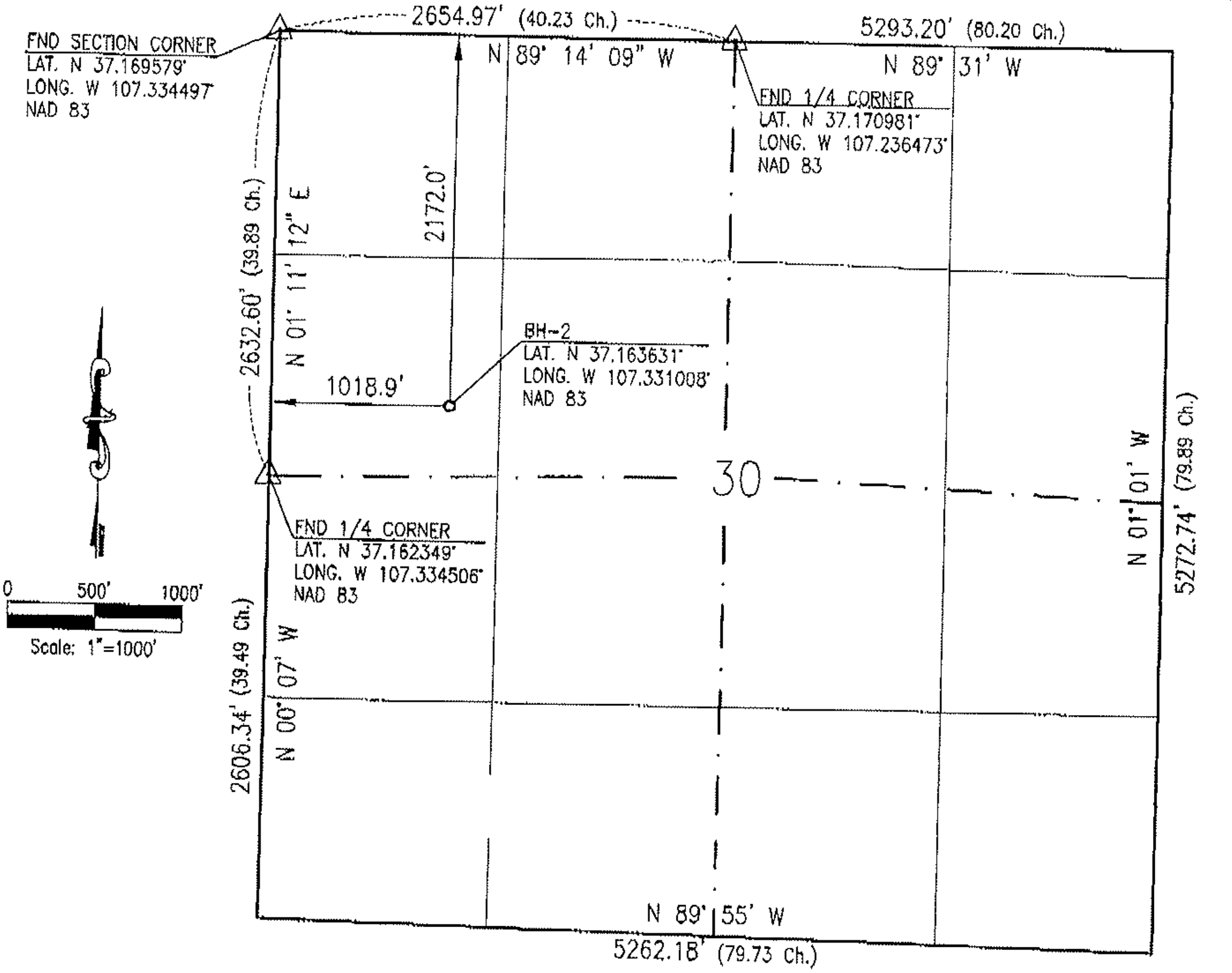
7. Well location distances are measured perpendicular to section lines.

BASIS OF ELEVATION – Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

X:\2008 SMA-SUR\2008 SMA SUR DATA\5177918 SITE 3 HWY 151--CO\dwg\HIGHWAY 151 BH 1.dwg

SMA Scientists, Engineers & Surveyors — SOUDER, MILLER & ASSOCIATES

SURVEY PLAT
MW-34-4-30 (BH-2)



Operator: Colorado Oil and Gas Conservation Commission	Well Name: MW-34-4-30 (BH-2)

Section: 30	Township: 34 North	Range: 4 West	Meridian: N.M.P.M.

Footages: 2172.0' FNL & 1018.9' FWL	County/State: Archuleta, CO
Elevation: 6450'	Requested By: Steven R. Lindblom

I, LYNN D. LANTZ, A REGISTERED PROFESSIONAL SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY DIRECT SUPERVISION AND THAT THIS PLAT ACCURATELY REPRESENTS THIS SURVEY TO THE BEST OF MY KNOWLEDGE AND BELIEF.

[Signature] [Seal: LYNN D. LANTZ 12046 LAND SURVEYOR STATE OF COLORADO]

LYNN D. LANTZ
COLORADO P.L.S. #12046

9-26-08
DATE

NOTES:

1. Basis of bearing is approved plat of resurvey of T 34 N, R 5 W, N.M.P.M., approved June 27, 1947.
2. PDOP for this survey is 5.0'.
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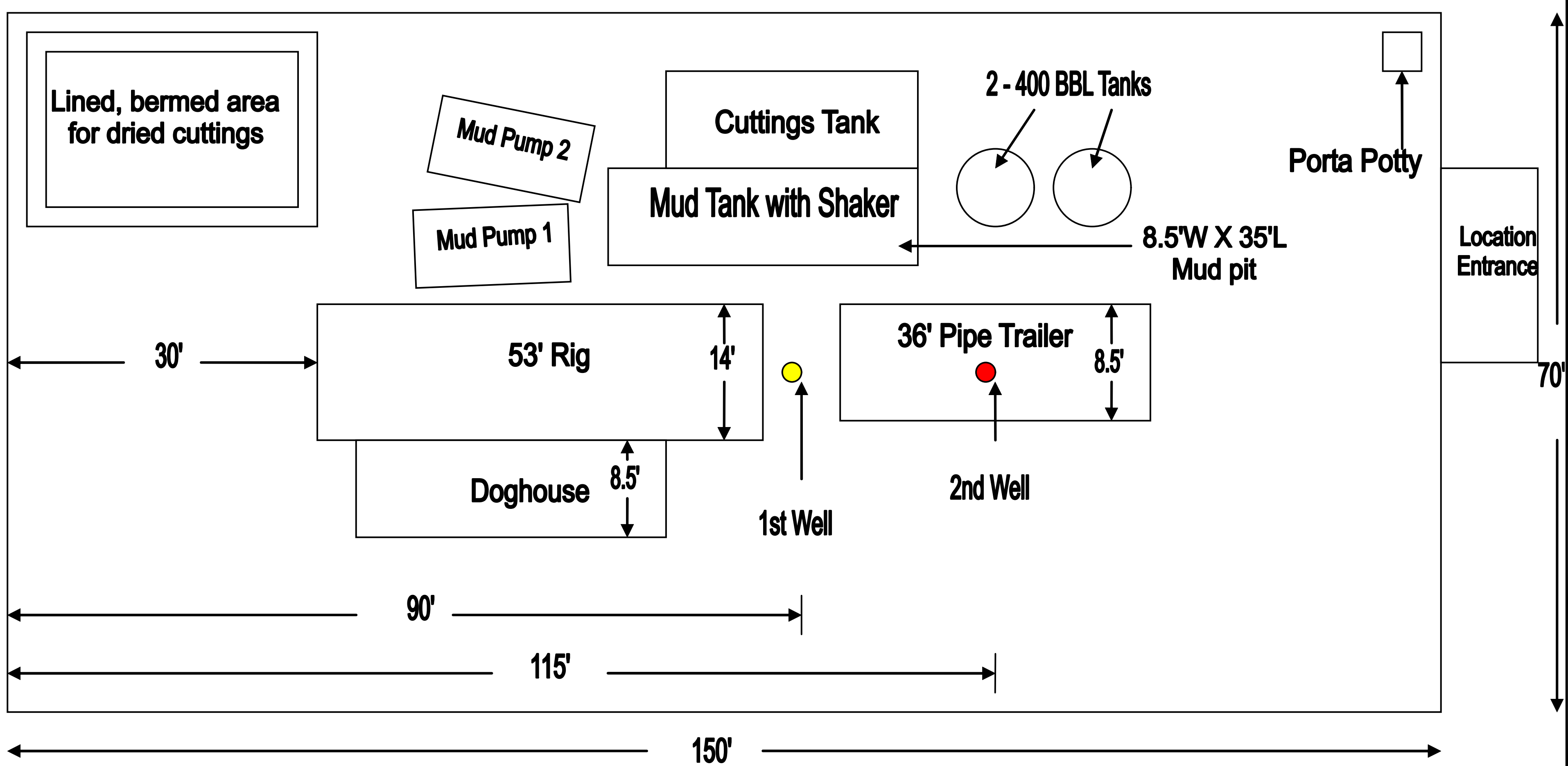
BASIS OF ELEVATION – Topo elevation interpolated from 7.5 min. U.S.G.S. Pargin Mountain Quadrangle Map.

K:\2008 SMA-SUR\2008 SMA SUR DATA\51:7916 SITE 3 HWY 151-CO\dwg\HIGHWAY 151 BH 2.dwg

Scorpion Drilling Footprint



APPROVED: DGF	DATE: 06/12/08
DRAWN BY: LL	DATE: 06/012/08
REVISIONS BY:	DATE:

SMA
Civil / Environmental Scientists & Engineers
612 E. MURRAY DR. PH. (505) 325-5667
FARMINGTON, NM 87401 FAX (505) 327-1496

APPENDIX B: GEOPHYSICAL, LITHOLOGICAL & WELL CONSTRUCTION DIAGRAMS

WAGON GULCH MONITORING WELL #1 DETAILS

DATE STARTED: 9/27/08
DATE COMPLETED: 10/2/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SW/SW QUARTER SECTION 4 TOWNSHIP 34N RANGE 05W
GPS COORDINATES 37.23°, 107.43°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

BORE HOLE: 8 3/4" TO 262' BGS
SURFACE CASING: 7" 20# STEEL TO 252' BGS
CEMENT: 15.5#/GALLON TO SURFACE

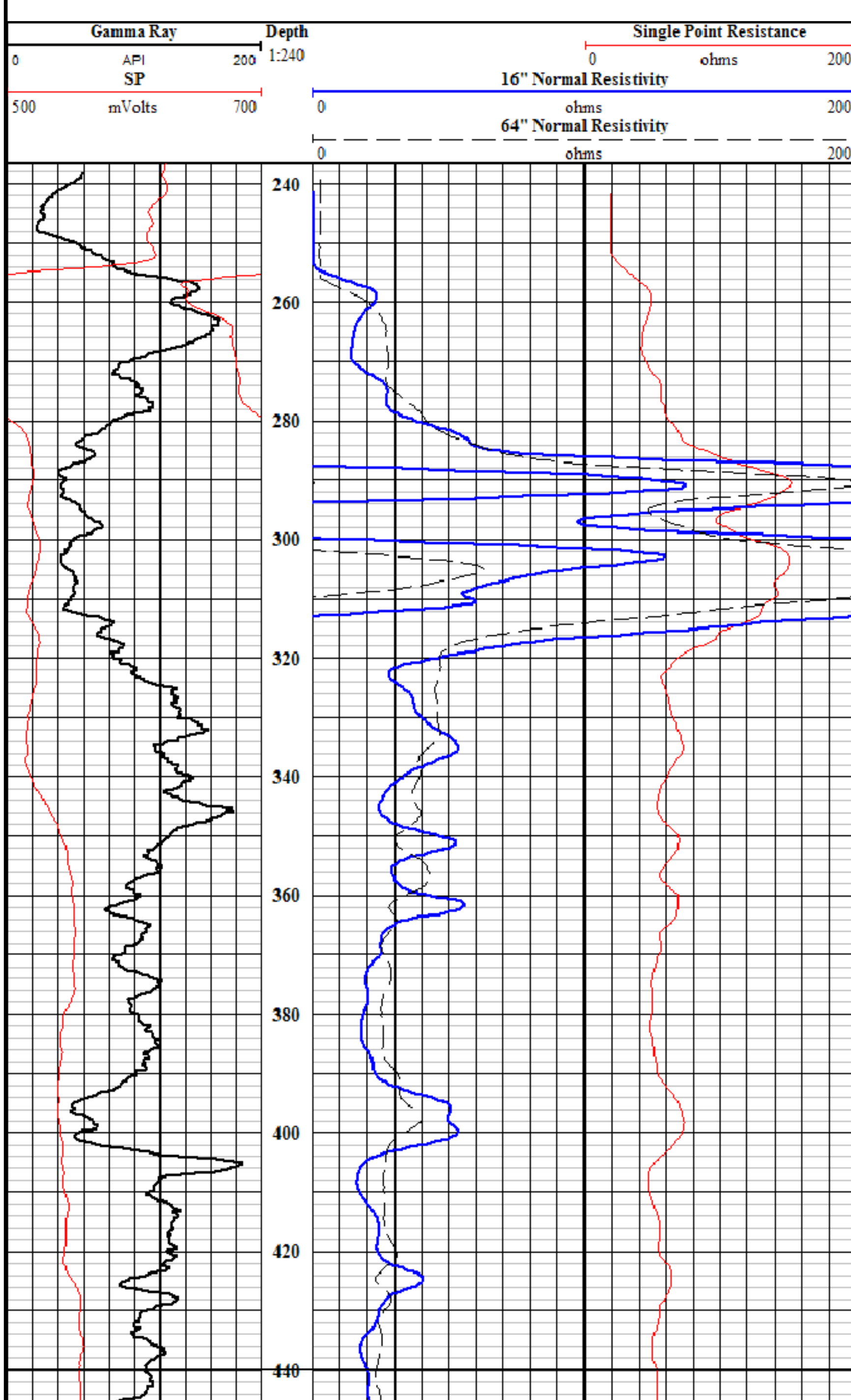
BORE HOLE: 6 1/4" TO 944'
LONG STRING: 4 1/2" 10.5# STEEL TO 927' BGS
CEMENT: 15.5#/GALLON TO SURFACE

PERFORATIONS: 821' TO 833' BGS, 4 SHOTS PER FOOT
TRANSDUCER DEPTHS: 840' BGS AND WELL HEAD

WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

TELEMETRY EQUIPMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

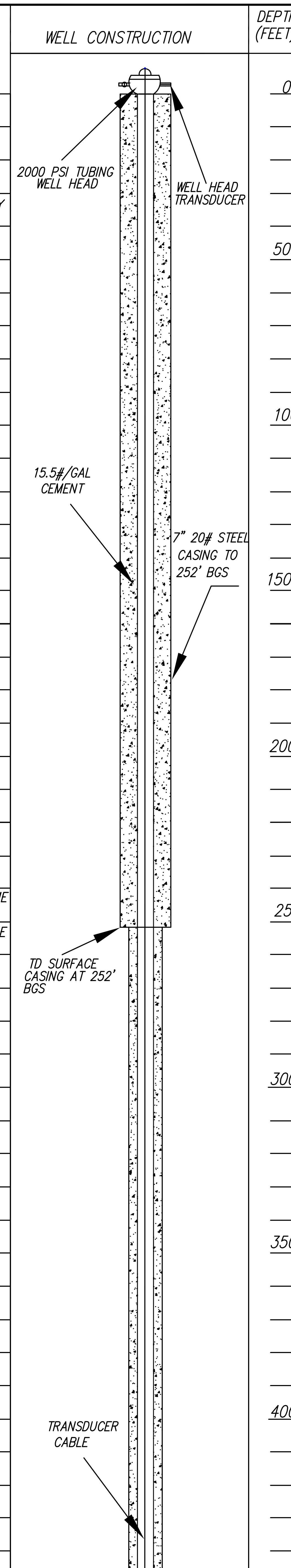
OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL / LITHOLOGICAL DESCRIPTION

- DARK BROWN, SLIGHTLY SANDY CLAY, VERY FINE TO FINE SAND
- DARK BROWN, SLIGHTLY SANDY CLAY, MED. TO COARSE SAND
- DARK BROWN, SLIGHTLY SANDY CLAY, FINE. TO COARSE SAND
- LIGHT BROWN, FINE MILKY SANDSTONE/ CLAY MIX
- LIGHT BROWN, FINE SANDSTONE/ CLAY MIX WITH SS
- LIGHT BROWN, FINE SANDSTONE/ CLAY MIX WITH SS
- LIGHT GRAY, FINE SANDSTONE
- BLUE/GRAY, VERY FINE TO FINE GRAINED SANDSTONE, HARD DRILLING, GLEY 6/10GB
- BLUE/GRAY, VERY FINE TO FINE GRAINED SANDSTONE, HARD DRILLING, GLEY 6/10GB
- BLUE/GRAY, VERY FINE TO FINE GRAINED SANDSTONE, HARD DRILLING, GLEY 6/10GB
- MISSED SAMPLE
- DARK GRAY MUDSTONE
- DARK GRAY FINE GRAINED SANDSTONE WITH MUDSTONE FRAGMENTS
- DARK GRAY FINE SANDSTONE INTERBEDDED MUDSTONE
- LIGHT TO DARK GRAY MUDSTONE
- LIGHT TO DARK GRAY FINE SANDSTONE INTERBEDDED WITH MUDSTONE
- LIGHT TO DARK GRAY FINE SANDSTONE
- LOST CIRCULATION; NO SAMPLE
- LOST CIRCULATION; NO SAMPLE
- LOST CIRCULATION; NO SAMPLE
- BLUE/GRAY FINE GRAINED SANDSTONE
- BLUE/GRAY FINE GRAINED SANDSTONE
- DARK GRAY MUDSTONE
- DARK GRAY FINE GRAINED SANDSTONE
- BLUE/GRAY TO DARK GRAY MUDSTONE, SOME FINE SAND
- BLUE/GRAY TO DARK GRAY MUDSTONE, SOME FINE SAND
- DARK TO LIGHT GRAY MUDSTONE WITH FINE SAND
- DARK GRAY SHALE, HARD DRILLING
- DARK GRAY SHALE INTERBEDDED WITH FINE GRAINED SANDSTONE
- DARK GRAY FINE GRAINED SANDSTONE WITH MILKY QTZ, MILD RESPONSE TO HCL
- DARK GRAY FINE GRAINED SANDSTONE WITH MILKY QTZ, MILD RESPONSE TO HCL
- DARK GRAY FINE GRAINED SANDSTONE WITH MILKY QTZ, MILD RESPONSE TO HCL
- LIGHT GRAY FINE GRAINED SANDSTONE WITH LIGHT GRAY MUDSTONE
- LIGHT GRAY FINE GRAINED SANDSTONE WITH LIGHT GRAY MUDSTONE
- NO SAMPLE
- DARK BROWN FINE GRAINED SANDSTONE INTERBEDDED WITH BLUE/GRAY FINE SS
- DARK BROWN FINE GRAINED SANDSTONE INTERBEDDED WITH BLUE/GRAY FINE SS
- NO SAMPLE
- DARK BLUISH GRAY MUDSTONE
- DARK BLUISH GRAY MUDSTONE INTERBEDDED WITH DARK BROWN FINE GRAINED SS
- DARK BLUISH GRAY MUDSTONE
- DARK BLUISH GRAY MUDSTONE INTERBEDDED WITH DARK BROWN FINE GRAINED SS
- BLUE/GRAY MUDSTONE INTERBEDDED WITH BROWN FINE SS, 10YR 6/4
- BLUE/GRAY MUDSTONE INTERBEDDED WITH BROWN FINE SS, 10YR 6/4
- BLUE/GRAY MUDSTONE INTERBEDDED WITH BROWN FINE SS, 10YR 6/4

WELL CONSTRUCTION



NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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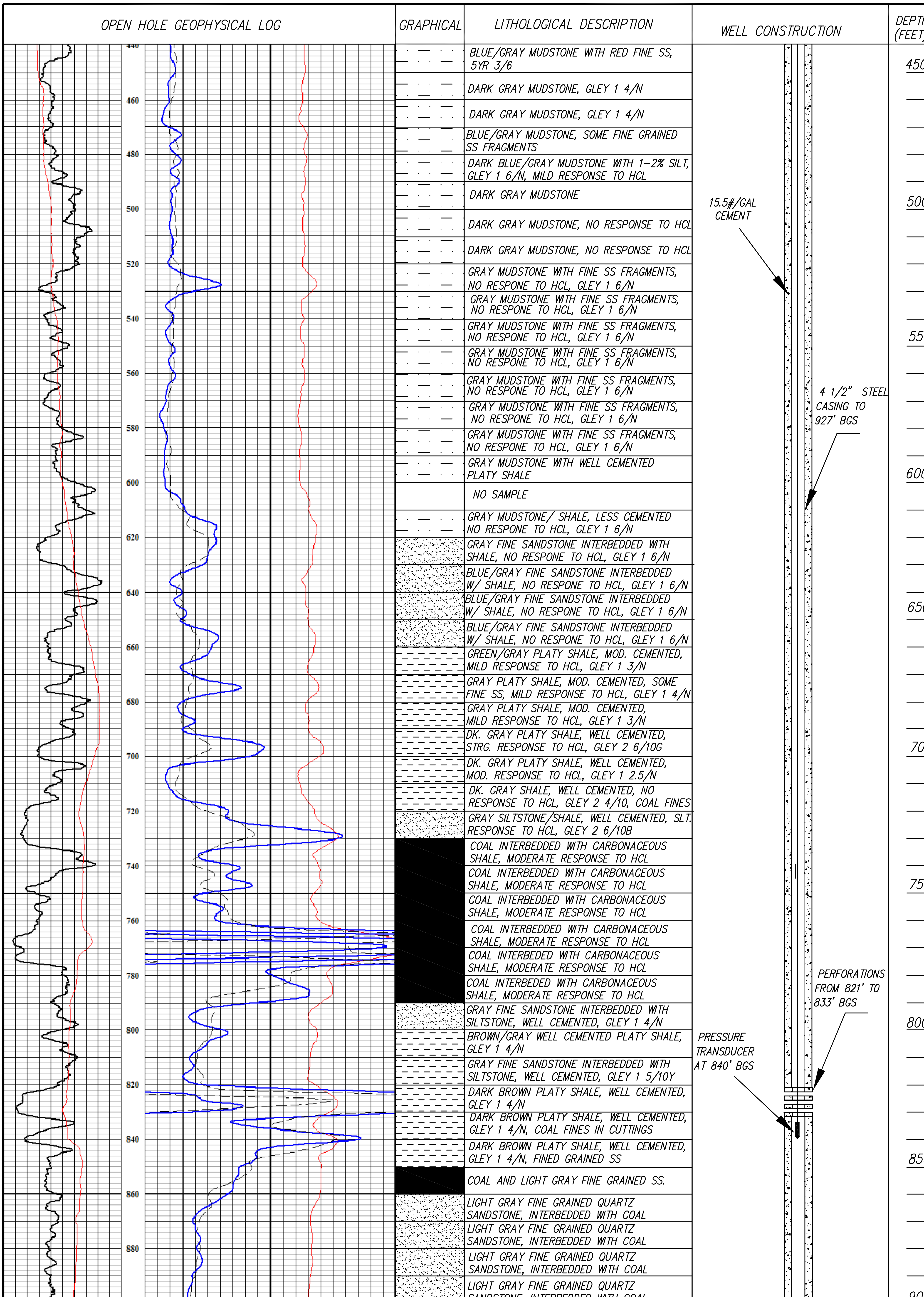
GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
WAGON GULCH MW-34-5-4-1, API # 05-007-06267-00
ARCHULETA COUNTY, COLORADO

FIGURE 1



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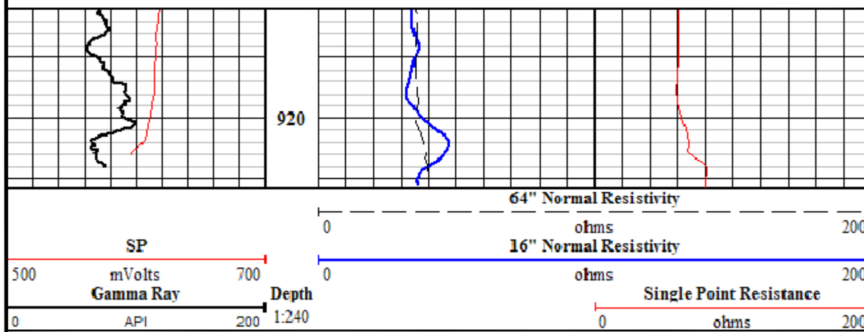
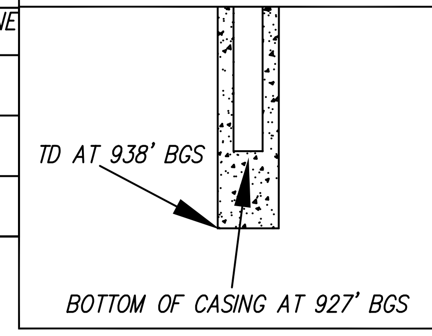
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
WAGON GULCH MW-34-5-4-1, API # 05-007-06267-00
ARCHULETA COUNTY, COLORADO

FIGURE 1

OPEN HOLE GEOPHYSICAL LOG	GRAPHICAL	LITHOLOGICAL DESCRIPTION	WELL CONSTRUCTION	DEPTH (FEET)
		LIGHT GRAY FINE GRAINED QUARZT SANDSTONE INTERBEDDED WITH COAL		
		LIGHT GRAY FINE GRAINED SANDSTONE WITH QUARTZ AND BIOTITE GRAINS		
		LIGHT GRAY FINE GRAINED SANDSTONE WITH QUARTZ AND BIOTITE GRAINS		
		LIGHT GRAY FINE GRAINED SANDSTONE WITH QUARTZ AND BIOTITE GRAINS		940





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GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
WAGON GULCH MW-34-5-4-1, API # 05-007-06267-00
ARCHULETA COUNTY, COLORADO

FIGURE 1

WAGON GULCH MONITORING WELL #2 DETAILS

DATE STARTED: 10/7/08
DATE COMPLETED: 10/13/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SW/SW QUARTER SECTION 4 TOWNSHIP 34N RANGE 05W
GPS COORDINATES 37.23°, 107.43°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

BORE HOLE: 8 3/4" TO 266' BGS
SURFACE CASING: 7" 20# STEEL TO 256' BGS
CEMENT: 15.5#/GALLON TO SURFACE

BORE HOLE: 6 1/4" TO 883'
LONG STRING: 4 1/2" 10.5# STEEL TO 883' BGS
CEMENT: 15.5#/GALLON TO SURFACE

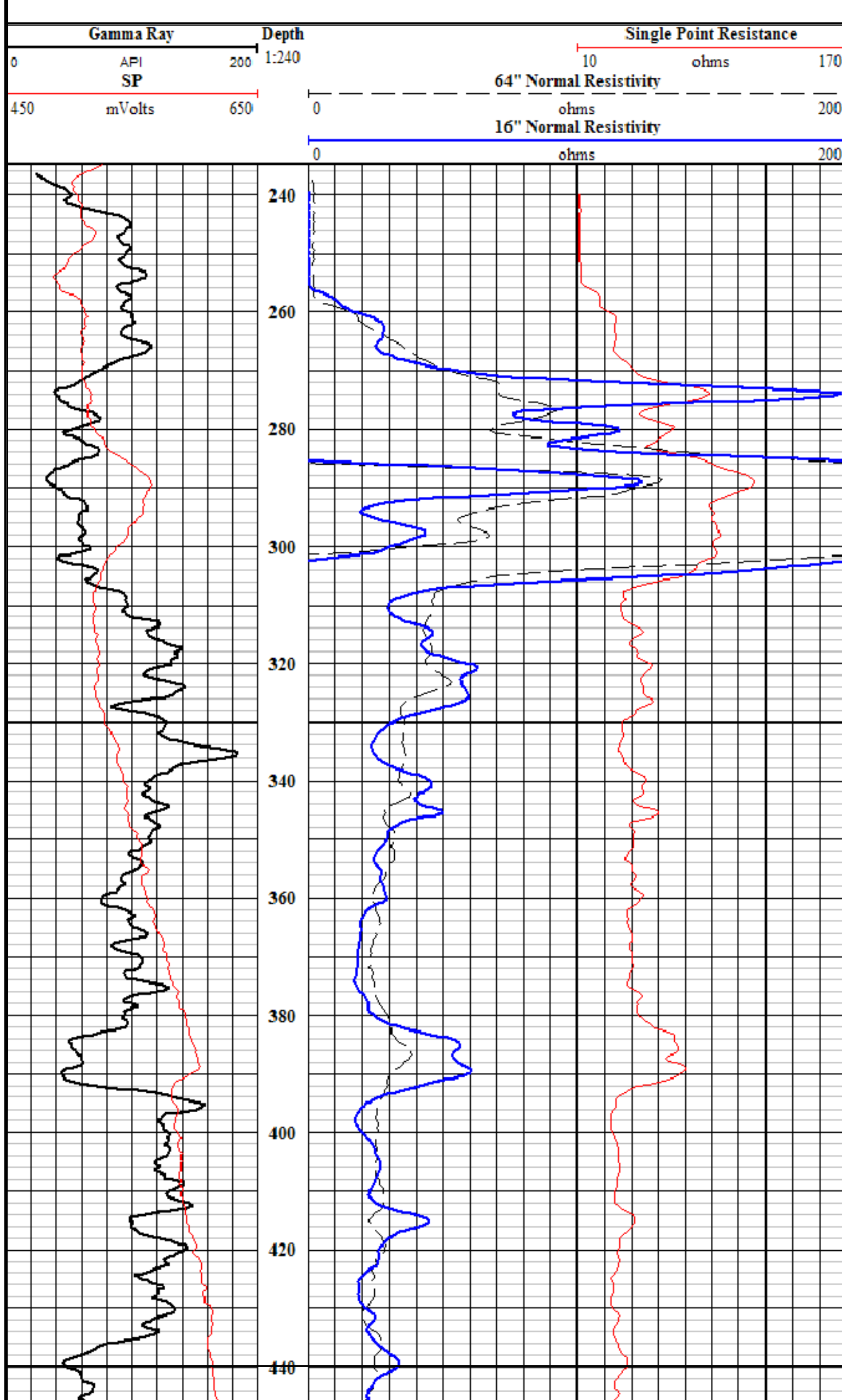
CORED INTERVALS: 749' TO 779' BGS W/ 1.5' RECOVERED
810' TO 818' BGS W/ 4.0' RECOVERED

PERFORATIONS: 752' TO 767' BGS, 4 SHOTS PER FOOT
TRANSDUCER DEPTHS: 780' BGS AND WELL HEAD

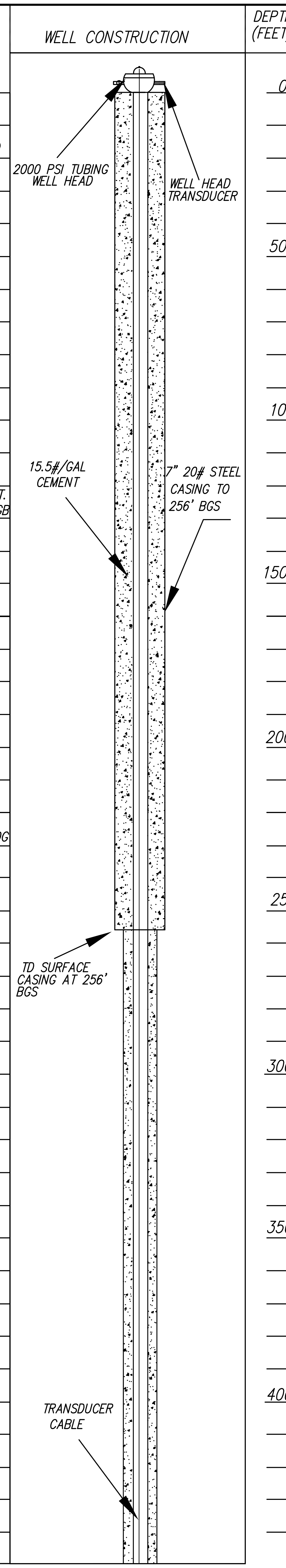
WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

TELEMETRY EQUIPEMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL	LITHOLOGICAL DESCRIPTION
	LIGHT BROWN FINE GRAINED QUARTZ SANDSTONE WTIH SOME CLAY FINES
	LIGHT BROWN FINE GRAINED QUARTZ SANDSTONE, WELL CEMENTED, WELL ROUNDED
	LIGHT BROWN FINE GRAINED QUARTZ SANDSTONE, WELL CEMENTED, WELL ROUNDED
	LIGHT BROWN, FINE GRAINED SAND/SS, WELL ROUNDED
	LIGHT BROWN, FINE MILKY SANDSTONE/ CLAY MIXTURE WITH QUARTZ VEINS
	LIGHT BROWN, FINE SANDSTONE/ CLAY MIX WITH SANDSTONE
	LIGHT GRAY VERY FINE QUARTZ SANDSTONE, SLT. RESPONSE TO HCL, GLEY 2 1/10Y
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/10B
	LIGHT BROWN FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/10B
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/10B
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/10B
	NO SAMPLE
	BLUE/GRAY VERY FINE SS INTERBEDDED W/LT. FINE SS, NO RESPONSE TO HCL GLEY 2 6/5GB
	GRAY MUDSTONE INTERBEDDED W/MED. SS, NO HCL RESPONSE, GLEY 2 3/5B
	GRAY MUDSTONE INTERBEDDED W/MED. SS, NO HCL RESPONSE, GLEY 2 3/5B
	LIGHT TO DARK GRAY FINE SANDSTONE INTERBEDDED WTIH MUDSTONE
	BLUE/GRAY VERY FINE SANDSTONE, SLT. RESPONSE TO HCL, GLEY 6 6/10B
	BLUE/GRAY VERY FINE SANDSTONE, MILD RESPONSE TO HCL, GLEY 2 6/10B
	BLUE/GRAY VERY FINE SANDSTONE, MILD RESPONSE TO HCL, GLEY 2 6/10B
	BLUE/GRAY VERY FINE SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/5B
	BLUE/GRAY VERY FINE SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/5B
	BLUE/GRAY VERY FINE SANDSTONE, NO RESPONSE TO HCL, GLEY 2 5/5GB
	BLUE/GRAY VERY FINE QUARTZ SANDSTONE, RNDED, NO RESPONSE TO HCL, GLEY 2 6/10G
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 7/5GB
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 7/5GB
	LIGHT GRAY FINE QUARTZ SANDSTONE, NO RESPONSE TO HCL, GLEY 2 6/10G
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, NTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	LIGHT GRAY FINE QUARTZ SANDSTONE, INTERBEDDED W/ SILTSTONE, GLEY 1 2.5/N
	DARK GRAY SHALE/SILTSTONE, WELL CEMENTED, GLEY 2 3/10G
	DARK GRAY SHALE/SILTSTONE, WELL CEMENTED, GLEY 2 3/10G
	DARK GRAY SHALE/SILTSTONE, WELL CEMENTED, GLEY 2 3/10G
	LIGHT GRAY SHALE/SILTSTONE, WELL CEMENTED, GLEY 2 8/5PB
	NO SAMPLE
	NO SAMPLE
	NO SAMPLE
	DARK GRAY SHALE/SILTSTONE, WELL CEMENTED, GLEY 2 4/5P
	DARK GRAY SHALE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 2 4/5P
	DARK GRAY SHALE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 2 4/5P
	DARK GRAY SHALE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 2 4/5P



NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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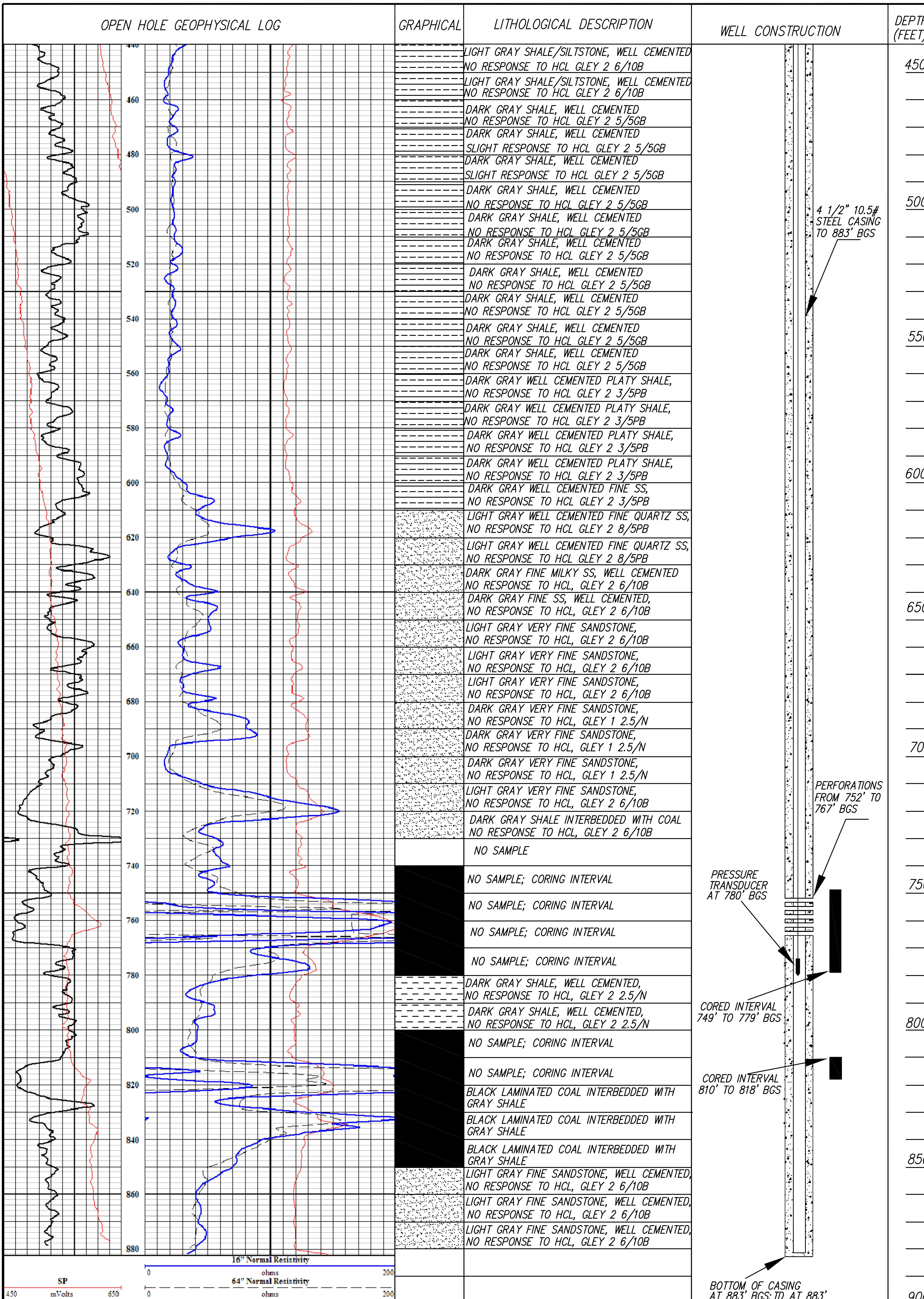
GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
WAGON GULCH MW-34-5-4-2, API # 05-007-06266-00
ARCHULETA COUNTY, COLORADO

FIGURE 2



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COGCC FRUITLAND METHANE MONITORING WELL PROJECT
WAGON GULCH MW-34-5-4-2, API # 05-007-06266-00
ARCHULETA COUNTY, COLORADO

FIGURE 2

FOSSET GULCH MONITORING WELL #1 DETAILS

DATE STARTED: 10/25/08
DATE COMPLETED: 12/04/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SE/SE QUARTER SECTION 14 TOWNSHIP 35N RANGE 05W
GPS COORDINATES 37.18°, 107.35°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

BORE HOLE: 8 3/4" TO 261' BGS
SURFACE CASING: 7" 20# STEEL TO 252' BGS
CEMENT: 15.5#/GALLON TO SURFACE

BORE HOLE: 6 1/4" TO 625
LONG STRING: 4 1/2" 10.5# STEEL TO 618' BGS
CEMENT: 15.5#/GALLON TO SURFACE

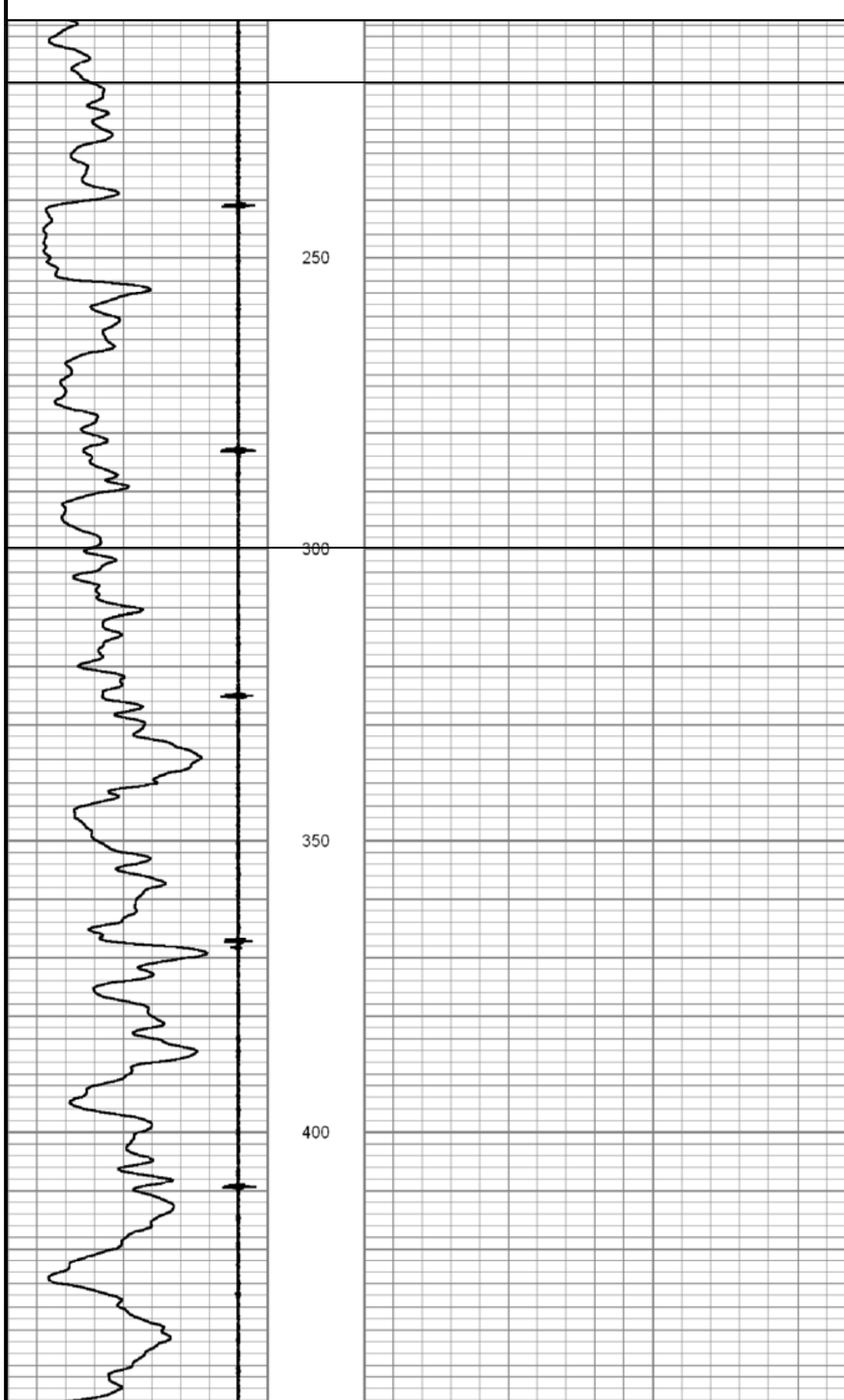
PERFORATIONS: 482' TO 502' BGS, 4 SHOTS PER FOOT

TRANSDUCER DEPTHS: 510' BGS AND WELL HEAD

WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

TELEMETRY EQUIPMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

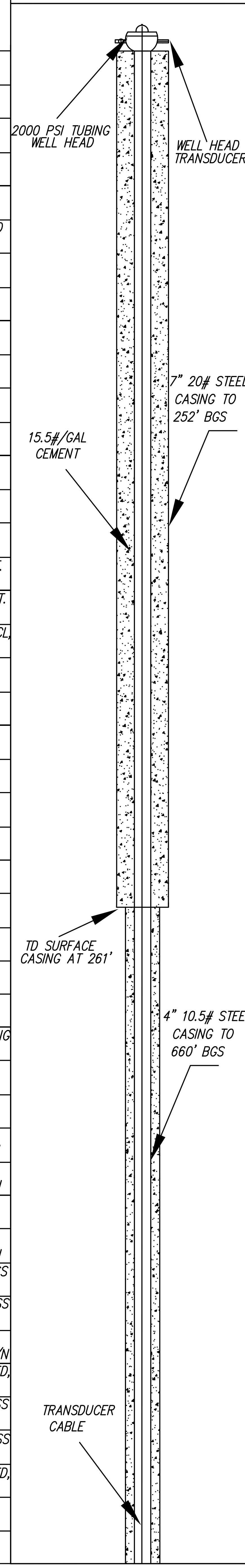
OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL / LITHOLOGICAL DESCRIPTION

LITHOLOGICAL DESCRIPTION
LIGHT BROWN FINE TO MEDIUM SANDSTONE, SUBANGULAR, SOME PEBBLES, 10YR 5/4
LIGHT BROWN FINE TO MEDIUM SANDSTONE, SUBANGULAR, SOME PEBBLES, 10YR 5/4
LIGHT GRAY FINE SANDSTONE, INTERBEDDED WITH DK. GRAY FINE SS, 10 YR 7/2
LIGHT GRAY FINE SANDSTONE, INTERBEDDED WITH DK. GRAY FINE SS, 10 YR 7/2
LIGHT GRAY VERY FINE SANDSTONE, NO REPONSE TO HCL, 5Y 7/2
LIGHT YELLOW FINE SANDSTONE, INTERBEDDED WITH OLIVE VERY FINE SS, 2.5 YR 7/4
PALE OLIVE VERY FINE SANDSTONE, SUBANGULAR 5Y 6/4
LIGHT GRAY VERY FINE SANDSTONE, SLIGHT HCL REACTION, 5 Y 7/2
NO SAMPLE
OLIVE GRAY FINE SANDSTONE, WELL SORTED, NO RESPONSE TO HCL, 5Y 4/2
GREENISH GRAY SHALE, GLEY 2 6/5BG
GREENISH GRAY SHALE INTERBEDDED WITH OLIVE FINE SS, GLEY 2 6/5BG
GREENISH GRAY SHALE INTERBEDDED WITH PALE YELLOW SHALE, GLEY 2 4/1
OLIVE FINE SANDSTONE, INTERBEDDED WITH GREENISH GRAY SHALE, 5Y 4/3
GREENISH GRAY SHALE, INTERBEDDED WITH FINE SANDSTONE, GLEY 1 5/5G
GRAY SHALE INTERBEDDED WITH FINE SS, SLT. RESPONSE TO HCL, GLEY 2 8/1
GRAY SHALE INTERBEDDED WITH FINE SS, SLT. RESPONSE TO HCL, GLEY 1 6/N
GREENISH GRAY SHALE, NO RESPONSE TO HCL, INTERBEDDED W/ FINE SS, GLEY 2 4/10Y
BLUE/GRAY VERY FINE SS INTERBEDDED W/ SHALE, GLEY 2 8/1
GRAY SHALE, NO RESPONSE TO HCL, GELY 1 5/N
BLUE/GRAY SHALE INTERBEDDED WITH VERY FINE SANDSTONE, GLEY 2 5/5B
BLUE/GRAY FINE SANDSTONE, MODERATE TO HCL, GLEY 2 5/5B
DARK GRAY SHALE INTERBEDDED WITH FINE SANDSTONE, GLEY 4/10G
DARK GRAY SHALE INTERBEDDED WITH FINE SANDSTONE, GLEY 4/10G
DARK GRAY SHALE INTERBEDDED WITH FINE SANDSTONE, GLEY 4/10G
DARK GRAY SHALE INTERBEDDED WITH FINE SANDSTONE, GLEY 4/10G
LIGHT GRAY FINE SANDSTONE INTERBEDDED WITH SHALE, GLEY 6/10G
LIGHT GRAY FINE SANDSTONE INTERBEDDED WITH SHALE, GLEY 6/10G
NO SAMPLE
LIGHT GRAY FINE QUARTZ SANDSTONE, STRONG RESPONSE TO HCL, GLEY 1/8N
DARK GRAY FINE SANDSTONE, INTERBEDDED WITH SHALE, GLEY 1 2.5/N
DARK GRAY FINE SANDSTONE, INTERBEDDED WITH SHALE, GLEY 1 2.5/N
DARK SHALE INTERBEDDED WITH FINE SS, MODERATE RESPONSE TO HCL, GLEY 1 2.5/N
DARK SHALE INTERBEDDED WITH FINE SS, MODERATE RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE INTERBEDDED WITH FINE SS, MOD. RESPONSE TO HCL, GLEY 1 8/N
DARK GRAY FINE SS INTERBEDDED WITH SHALE, STRG RESPONSE TO HCL, GLEY 1 8/N
DARK GRAY SHALE INTERBEDDED WITH FINE SS MOD. RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE INTERBEDDED WITH FINE SS MOD. RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE INTERBEDDED LT. GRAY SHALE, MOD RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY FINE SANDSTONE, WELL CEMENTED, MOD. RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE INTERBEDDED WITH FINE SS MOD. RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE INTERBEDDED WITH FINE SS MOD. RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY FINE SANDSTONE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 1 6N
DARK GRAY SHALE WELL CEMENTED, NO RESPONSE TO HCL, GLEY 1 2.5/N
DARK GRAY SHALE WELL CEMENTED, NO RESPONSE TO HCL, GLEY 1 2.5/N

WELL CONSTRUCTION



DEPTH (FEET)

0
50
100
150
200
250
300
350
400

NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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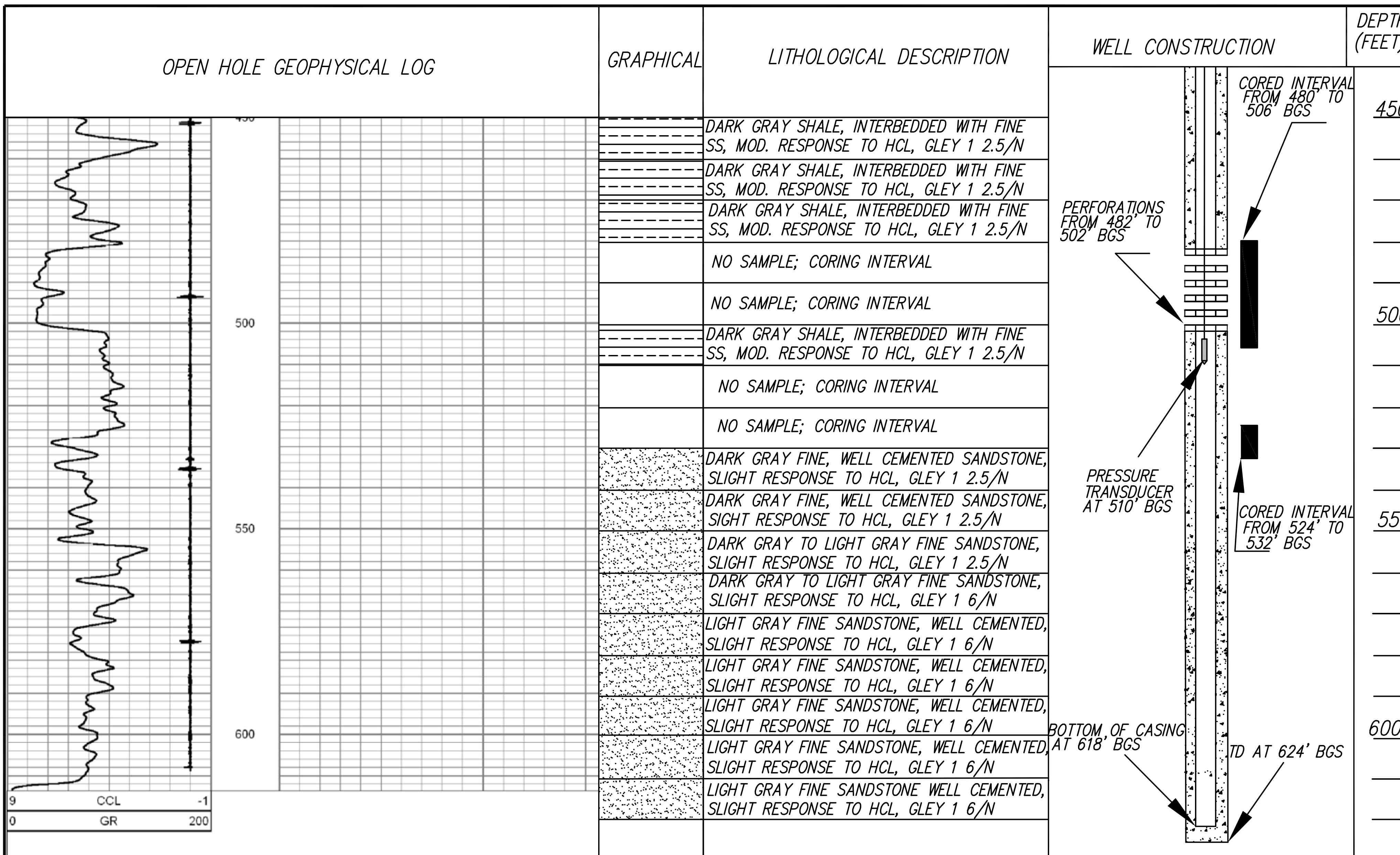
GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
FOSSET GULCH MW-35-5-14-1, API # 05-007-06264-00
ARCHULETA COUNTY, COLORADO

FIGURE 3



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COGCC FRUITLAND METHANE MONITORING WELL PROJECT
FOSSET GULCH MW-35-5-14-1, API # 05-007-06264-00
ARCHULETA COUNTY, COLORADO

FIGURE 3

FOSSET GULCH MONITORING WELL #2 DETAILS

DATE STARTED: 10/17/08
DATE COMPLETED: 12/04/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SE/SE QUARTER SECTION 14 TOWNSHIP 35N RANGE 05W
GPS COORDINATES 37.18°, 107.35°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

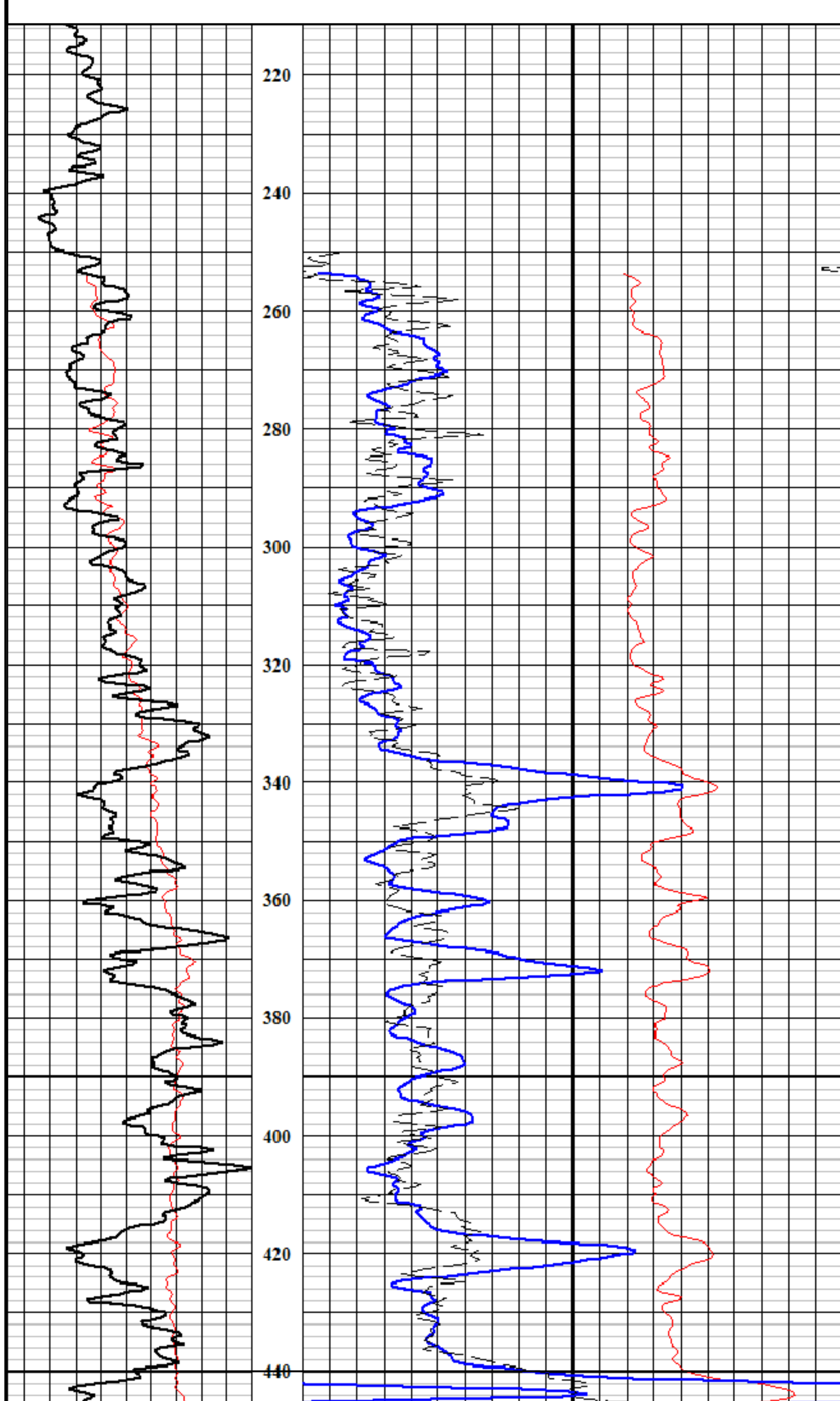
BORE HOLE: 8 3/4" TO 266' BGS
SURFACE CASING: 7" 20# STEEL TO 253' BGS
CEMENT: 15.5#/GALLON TO SURFACE

BORE HOLE: 6 1/4" TO 660
LONG STRING: 4 1/2" 10.5# STEEL TO 660' BGS
CEMENT: 15.5#/GALLON TO SURFACE

PERFORATIONS: 525' TO 534' BGS, 4 SHOTS PER FOOT
548' TO 551' BGS, 4 SHOTS PER FOOT
TRANSDUCER DEPTHS: 560' BGS AND WELL HEAD
WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

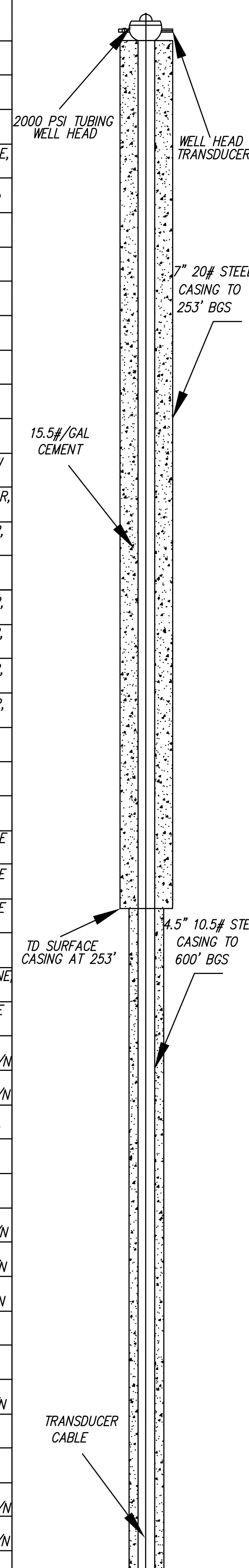
TELEMETRY EQUIPMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL	LITHOLOGICAL DESCRIPTION
	ALLUVIUM
	LIGHT BROWN FINE GRAINED SANDSTONE, NO RESPONSE HCL, 2.5Y 6/4
	LIGHT GREEN/GRAY FINE SANDSTONE, NO RESPONSE HCL, GLEY 1 7.10Y
	LIGHT BROWN, FINE TO VERY FINE SANDSTONE, NO RESPONSE TO HCL, 2.5 Y 6/3
	LIGHT GRAY FN TO VFN SANDSTONE INTERBEDDED W/ BLUE/GRAY SS, 2.5YR 6/2
	LIGHT GRAY SHALE, NO RESPONSE TO HCL GLEY 1 7/1
	LIGHT GRAY SHALE, NO RESPONSE TO HCL GLEY 1 7/10Y
	LIGHT GRAY SHALE, NO RESPONSE TO HCL GLEY 1 7/10Y
	LIGHT GRAY SHALE, NO RESPONSE TO HCL GLEY 1 7/10Y
	LIGHT GRAY SHALE, NO RESPONSE TO HCL GLEY 1 7/10Y
	BLUE/GRAY FINE SANDSTONE, NO RESPONSE TO HCL, GLEY 2 5/6PB
	GRAY FINE SANDSTONE, INTERBEDDED WITH SHALE GLEY 1 5/N
	GRAY SHALE INTERBEDDED W/ PALE YELLOW FINE SS, GLEY 1 6/N
	GRAY FINE GRAINED SANDSTONE, SUBANGULAR, CEDAR FIBER PRESENT, GLEY 1 5/N
	GREEN/GRAY MED. SANDSTONE, SUBANGULAR, MOD. RESPONSE TO HCL, GLEY 2 7/1
	OLIVE MED. SANDSTONE, SUBANGULAR, MOD. RESPONSE TO HCL, 5Y 5/3
	GREEN/GRAY MED. SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 2 7/1
	GREEN/GRAY MED. SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 2 7/1
	GREEN/GRAY MED. SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 2 7/1
	GREEN/GRAY MED. SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 2 7/1
	LIGHT GRAY FINE SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 1 4/5G
	DARK GRAY FINE SANDSTONE, SUBANGULAR, MOD. RESPONSE TO HCL, GLEY 2 4/5P
	DARK GRAY FINE SANDSTONE, SUBANGULAR, NO RESPONSE TO HCL, GLEY 2 4/5P
	DARK GRAY MUDSTONE INTERBEDDED W/ FINE SS, NO RESPONSE TO HCL, GLEY 1 3/N
	LIGHT GRAY MUDSTONE INTERBEDDED W/ FINE SS, NO RESPONSE TO HCL, GLEY 1 5/N
	LIGHT GRAY MUDSTONE INTERBEDDED W/ FINE SS, NO RESPONSE TO HCL, GLEY 1 5/N
	LIGHT GRAY FINE TO MED. QUARTZ SS, MOD. RESPONSE TO HCL, GLEY 1 6/N
	LIGHT GRAY FINE TO MED. QUARTZ SANDSTONE TO HCL, GLEY 1 6/N
	DARK GRAY MUDSTONE, MODERATE RESPONSE TO HCL, GLEY 1 5/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, MOD. RESPONSE TO HCL, GLEY 1 5/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, MOD. RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, NO RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, WELL CEMENTED, NO RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, STG. RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, SLT. RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE, INTERBEDDED WITH FINE SS, SLT. RESPONSE TO HCL, GLEY 1 3/N
	BLUE/GRAY MUDSTONE, WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 4/N
	BLUE/GRAY MUDSTONE, WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 4/N
	DARK GRAY MUDSTONE INTERBEDDED WITH FINE SS, SLT. RESPONSE TO HCL, GLEY 1 4/N
	DARK GRAY MUDSTONE WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE INTERBEDDED WITH FINE SS SLT. REPSPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE INTERBEDDED WITH FINE SS SLT. REPSPONSE TO HCL, GLEY 1 3/N
	DARK GRAY MUDSTONE INTERBEDDED WITH FINE SS SLT. REPSPONSE TO HCL, GLEY 1 3/N

WELL CONSTRUCTION



DEPTH (FEET)
0
50
100
150
200
250
300
350
400

NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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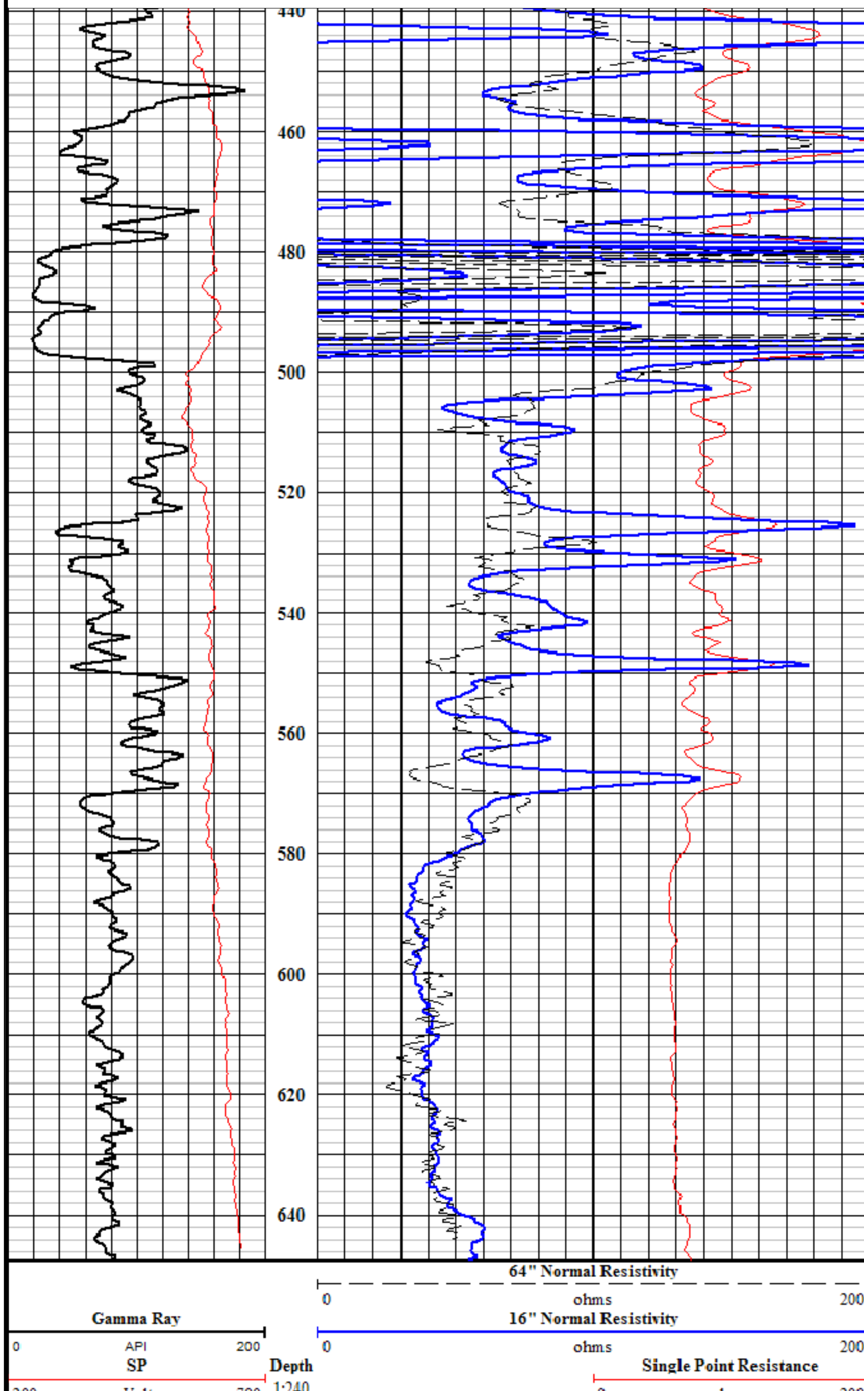
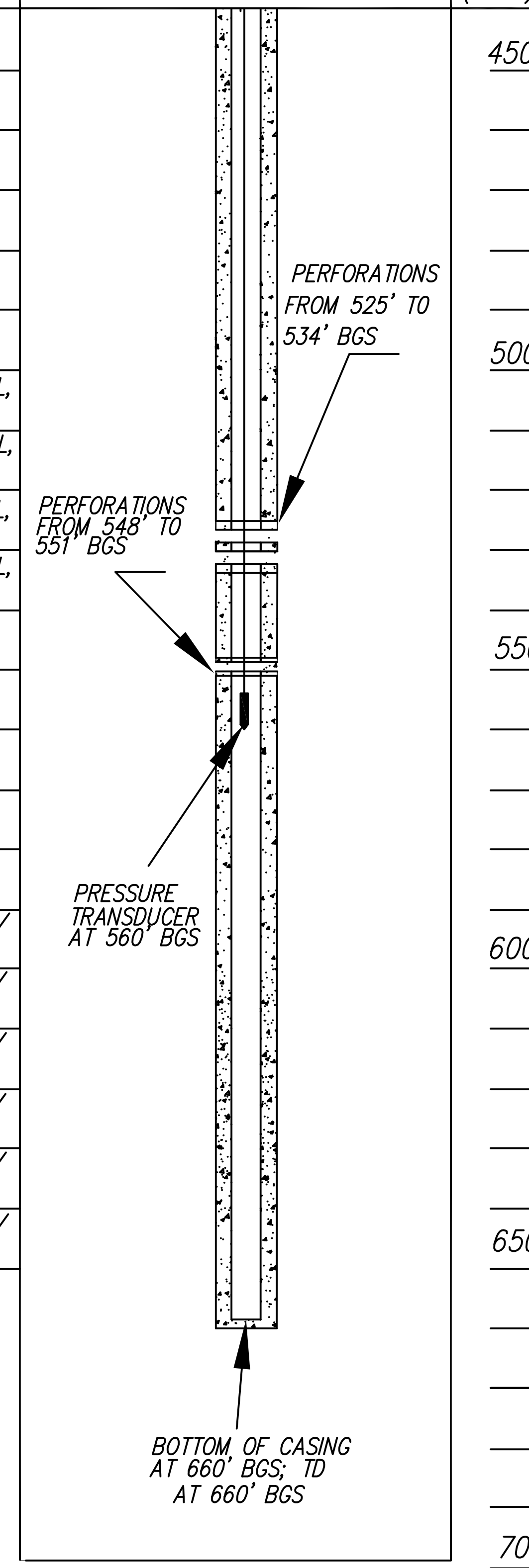
GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
FOSSET GULCH MW-35-5-14-2, API # 05-007-06265-00
ARCHULETA COUNTY, COLORADO

FIGURE 4

OPEN HOLE GEOPHYSICAL LOG	GRAPHICAL	LITHOLOGICAL DESCRIPTION	WELL CONSTRUCTION	DEPTH (FEET)



LITHOLOGICAL DESCRIPTION
DARK GRAY MUDSTONE WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 3/N
DARK GRAY MUDSTONE WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 3/N
DARK GRAY MUDSTONE WELL CEMENTED, SLIGHT RESPONSE TO HCL, GLEY 1 3/N
DARK GRAY MUDSTONE WELL CEMENTED, STRONG RESPONSE TO HCL, GLEY 1 3/N
BLACK COAL, INTERBEDDED WITH GRAY QUARTZ SAND, MODERATE RESPONSE TO HCL
BLACK COAL, BRITTLE
BROWN MUDSTONE, WELL CEMENTED W/ COAL, SLIGHT RESPONSE TO HCL, 5Y 3/1
BROWN MUDSTONE, WELL CEMENTED W/ COAL, SLIGHT RESPONSE TO HCL, 5Y 3/1
BROWN MUDSTONE, WELL CEMENTED W/ COAL, STRONG RESPONSE TO HCL, 5Y 3/1
BROWN MUDSTONE, WELL CEMENTED W/ COAL, STRONG RESPONSE TO HCL, 5Y 3/1
DARK BROWN CALCAREOUS MUDSTONE, WITH COAL, STRONG RESPONSE TO HCL
DARK BROWN MUDSTONE/SHALE, WELL CEMENTED, SLIGHT RESPONSE TO HCL
BROWN MUDSTONE/SHALE, WELL CEMENTED, SLIGHT RESPONSE TO HCL, 5Y 3/1
BROWN MUDSTONE/SHALE, WELL CEMENTED, SLIGHT RESPONSE TO HCL, 5Y 3/1
BROWN MUDSTONE/SHALE, WELL CEMENTED, MODERATE RESPONSE TO HCL, 5Y 3/1
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL
LT. GRAY FINE SANDSTONE, INTERBEDDED W/ MUDSTONE, NO RESPONSE TO HCL



NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
FOSSET GULCH MW-34-5-4-2, API # 05-007-06265-00
ARCHULETA COUNTY, COLORADO

FIGURE 4

HIGHWAY 151 MONITORING WELL #1 DETAILS

DATE STARTED: 11/07/08
DATE COMPLETED: 12/03/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SW/NW QUARTER SECTION 30 TOWNSHIP 34N RANGE 04W
GPS COORDINATES 37.16°, 107.33°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

BORE HOLE: 8 3/4" TO 137' BGS
SURFACE CASING: 7" 20# STEEL TO 126' BGS
CEMENT: 15.5#/GALLON TO SURFACE

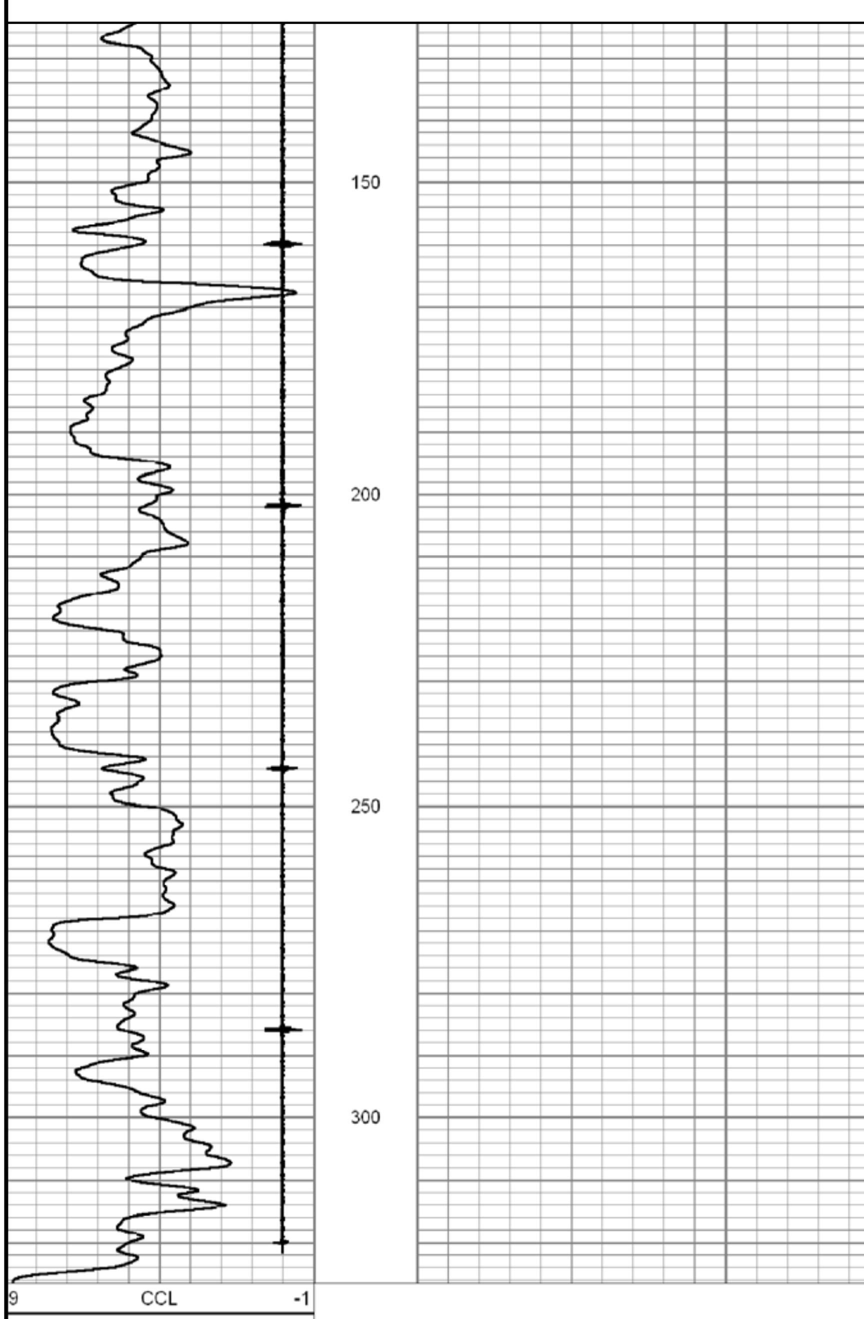
BORE HOLE: 6 1/4" TO 340'
LONG STRING: 4 1/2" 10.5# STEEL TO 340' BGS
CEMENT: 15.5#/GALLON TO SURFACE

PERFORATIONS: 218' TO 222' BGS, 4 SHOTS PER FOOT
231' TO 241' BGS, 4 SHOTS PER FOOT

TRANSDUCER DEPTHS: 250' BGS AND WELL HEAD
WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

TELEMETRY EQUIPMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

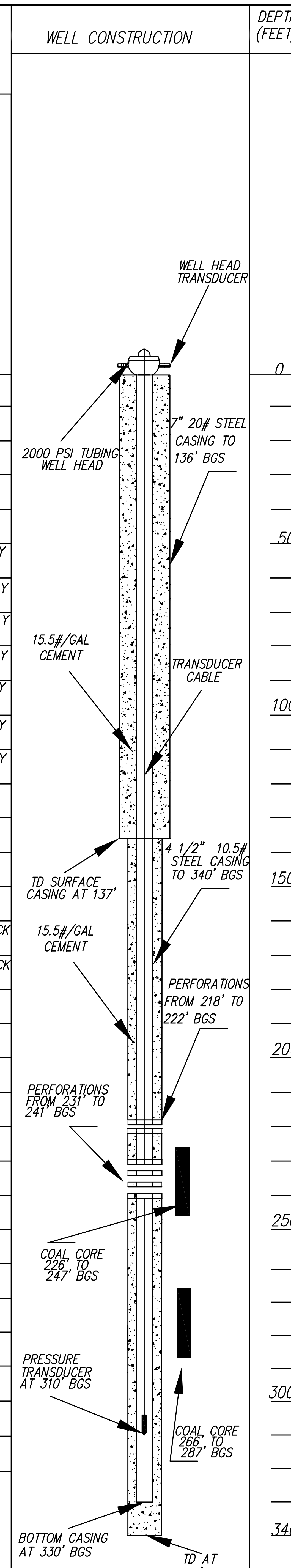
OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL / LITHOLOGICAL DESCRIPTION

LITHOLOGICAL DESCRIPTION
ALLUVUIM
ALLUVUIM
ALLUVUIM
NO SAMPLE
NO SAMPLE
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH GRAY FINE SANDSTONE, GLEY 2 4/1 10B
NO SAMPLE
BLUISH GRAY SHALE GLEY 2 4/1 10B
BLUISH GRAY SHALE GLEY 2 4/1 10B
BLUISH GRAY SHALE GLEY 2 4/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH BLACK CARBONACEOUS SHALE, GLEY 2 5/1 10B
BLUISH GRAY SHALE INTERBEDDED WITH BLACK CARBONACEOUS SHALE, GLEY 2 5/1 10B
BLACK CARBONACEOUS SHALE
NO SAMPLE
COAL AND BLACK CARBONACEOUS SHALE
COAL AND BLACK CARBONACEOUS SHALE
NO SAMPLE; CORE INTERVAL
NO SAMPLE; CORE INTERVAL
NO SAMPLE
BLACK CARBONACEOUS SHALE
NO SAMPLE; CORE INTERVAL
NO SAMPLE; CORE INTERVAL
BLACK CARBONACEOUS SHALE AND COAL
BLACK CARBONACEOUS SHALE INTERBEDDED WITH BLUISH GRAY SHALE, GLEY 2 4/1
BLACK CARBONACEOUS SHALE INTERBEDDED WITH BLUISH GRAY SHALE, GLEY 2 4/1
BLACK CARBONACEOUS SHALE INTERBEDDED BLUISH GRAY SHALE, GLEY 2 4/1

WELL CONSTRUCTION



NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
HIGHWAY 151 MW-34-4-30-1, API # 05-007-06271-00
ARCHULETA COUNTY, COLORADO

FIGURE 5

HIGHWAY 151 MONITORING WELL #2 DETAILS

DATE STARTED: 11/04/08
DATE COMPLETED: 12/03/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER

LOCATION

SW/NW QUARTER SECTION 30 TOWNSHIP 34N RANGE 04W
GPS COORDINATES 37.16°, 107.33°
ARCHULETA COUNTY, COLORADO

CONSTRUCTION DETAILS

BORE HOLE: 8 3/4" TO 137' BGS
SURFACE CASING: 7" 20# STEEL TO 127' BGS
CEMENT: 15.5#/GALLON TO SURFACE

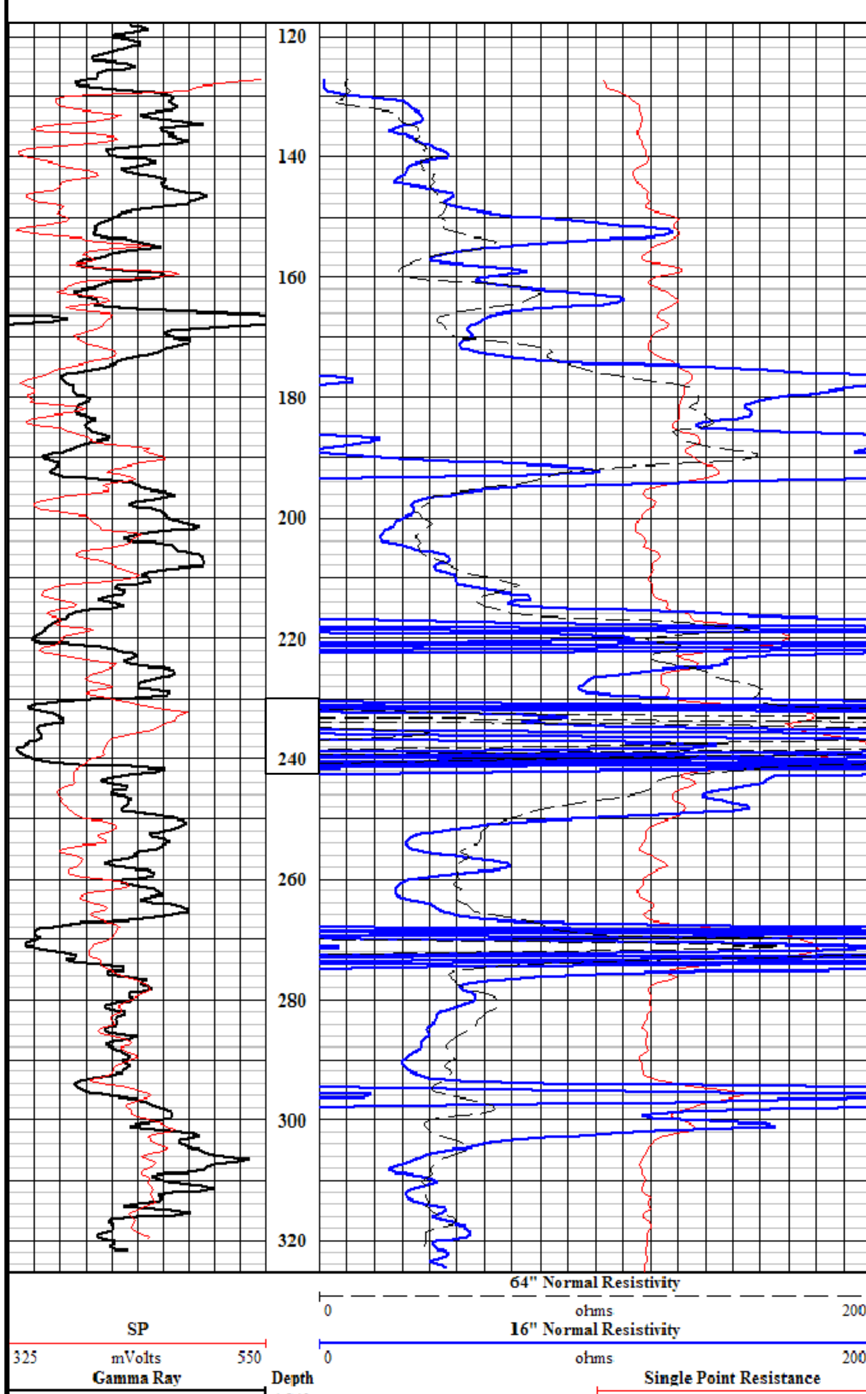
BORE HOLE: 6 1/4" TO 330'
LONG STRING: 4 1/2" 10.5# STEEL TO 330' BGS
CEMENT: 15.5#/GALLON TO SURFACE

PERFORATIONS: 268' TO 277' BGS, 4 SHOTS PER FOOT
292' TO 301' BGS, 4 SHOTS PER FOOT

TRANSDUCER DEPTHS: 310' BGS AND WELL HEAD
WELL HEAD: BIG RED TOOL 2000 PSI TUBING HEAD

TELEMETRY EQUIPMENT: IN-SITU REMOTE TERMINAL UNIT AND PRESSURE TRANSDUCERS WITH CABLES.

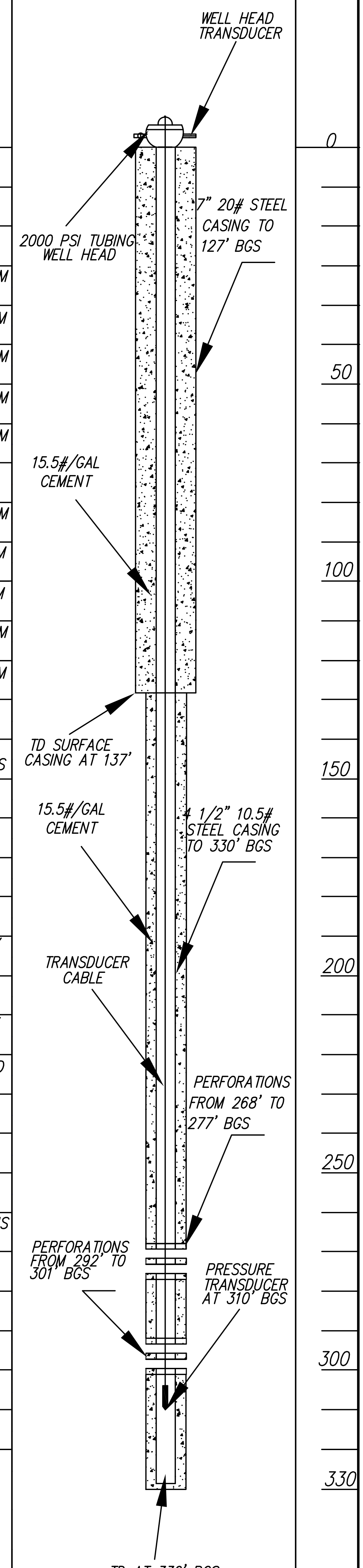
OPEN HOLE GEOPHYSICAL LOG



GRAPHICAL / LITHOLOGICAL DESCRIPTION

LITHOLOGICAL DESCRIPTION
ALLUVIUM, WELL GRADED, 5Y 6/3
ALLUVIUM, WELL GRADED, 5Y 6/3
ALLUVIUM, WELL GRADED, 5Y 6/3
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDTONE, GLEY 2 4/10B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDTONE, GLEY 2 4/10B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 4/10B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SS, GLEY 2 4/10B, COAL FRAGMENTS
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 4/10B
NO RECOVERY; HARD DRILLING
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 5/5B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 5/5B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 5/5B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 5/5B
BLUE/GRAY SHALE INTERBEDDED WITH MEDIUM SANDSTONE, GLEY 2 5/5B
NO SAMPLE
BLUE/GRAY SHALE INTERBEDDED WITH FINE SANDSTONE GLEY 2 5/4PB, COAL FRAGMENTS
BLACK CARBONACEOUS SHALE INTERBEDDED WITH MEDIUM SANDSTONE GLEY 2 5/4PB
BLACK CARBONACEOUS SHALE INTERBEDDED WITH MEDIUM SANDSTONE GLEY 2 5/4PB
LT. BLUE/GRAY MEDIUM SUBROUNDED SS, GLEY 2 7/5PB
BLACK CARBONACEOUS SHALE GLEY 2 2.5/N
BLUE/GRAY VF SANDSTONE INTERBEDDED W/ COAL, GLEY 2 4/10B
BLACK CARBONACEOUS SHALE AND COAL
BLUE/GRAY VF SANDSTONE INTERBEDDED W/ COAL, GLEY 2 4/10B
BLUE/GRAY MEDIUM SANDSTONE INTERBEDDED WITH COAL, GLEY 2 4/10B
NO SAMPLE
BLACK CARBONACEOUS SHALE INTERBEDDED WITH MEDIUM SS AND COAL, GLEY 2 7/1
NO SAMPLE
BLACK COAL INTERBEDDED W/ CARBONACEOUS SHALE, GLEY 2 5/5PB
DARK GRAY FN TO VFN SS INTERBEDED W/ SHALE, 5Y 4/1
BLACK CARBONACEOUS SHALE INTERBEDDED WITH VFN SS, 2.5Y 3/1
BLACK CARBONACEOUS SHALE INTERBEDDED WITH VFN SS, 2.5Y 3/1
DARK BLUE/GRAY SHALE, 2/5Y 4/1
DARK BLUE/GRAY SHALE, 2/5Y 4/1

WELL CONSTRUCTION



NOTE: COLOR DESIGNATION BY MUNSELL COLOR CHART, ADDITIONAL WELL CONSTRUCTION DETAILS IN APPENDIX C

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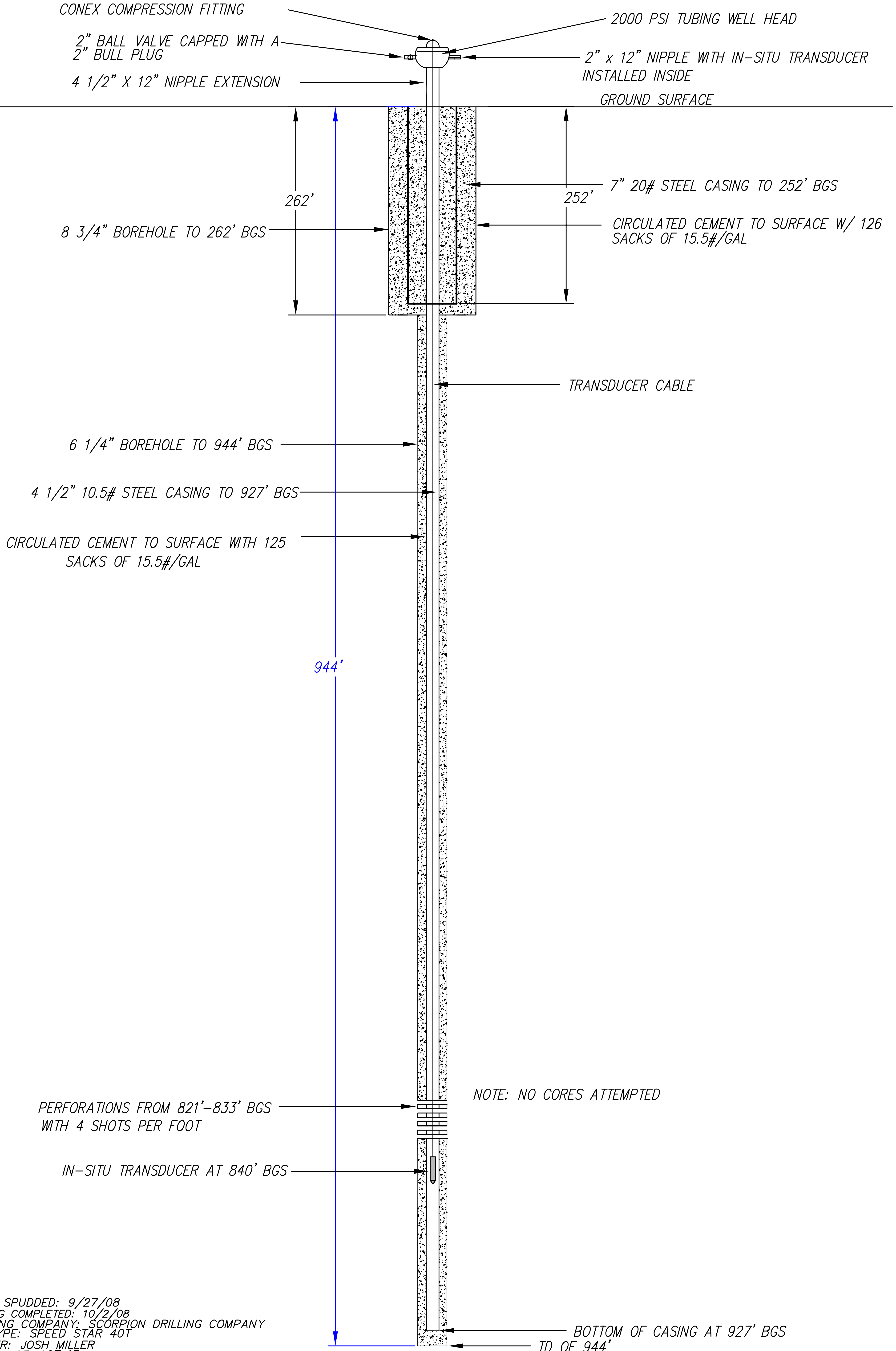
GEOPHYSICAL, LITHOLOGICAL AND WELL CONSTRUCTION DIAGRAM
COGCC FRUITLAND METHANE MONITORING WELL PROJECT
HIGHWAY 151 MW-34-4-30-2, API # 05-007-06270-00
ARCHULETA COUNTY, COLORADO

FIGURE 6

APPENDIX C: AS BUILT WELL DIAGRAMS



DATE SPUDDED: 9/27/08
CASING COMPLETED: 10/2/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.23, 107.43
API # 05-007-06267-00

NOTE: NOT TO SCALE

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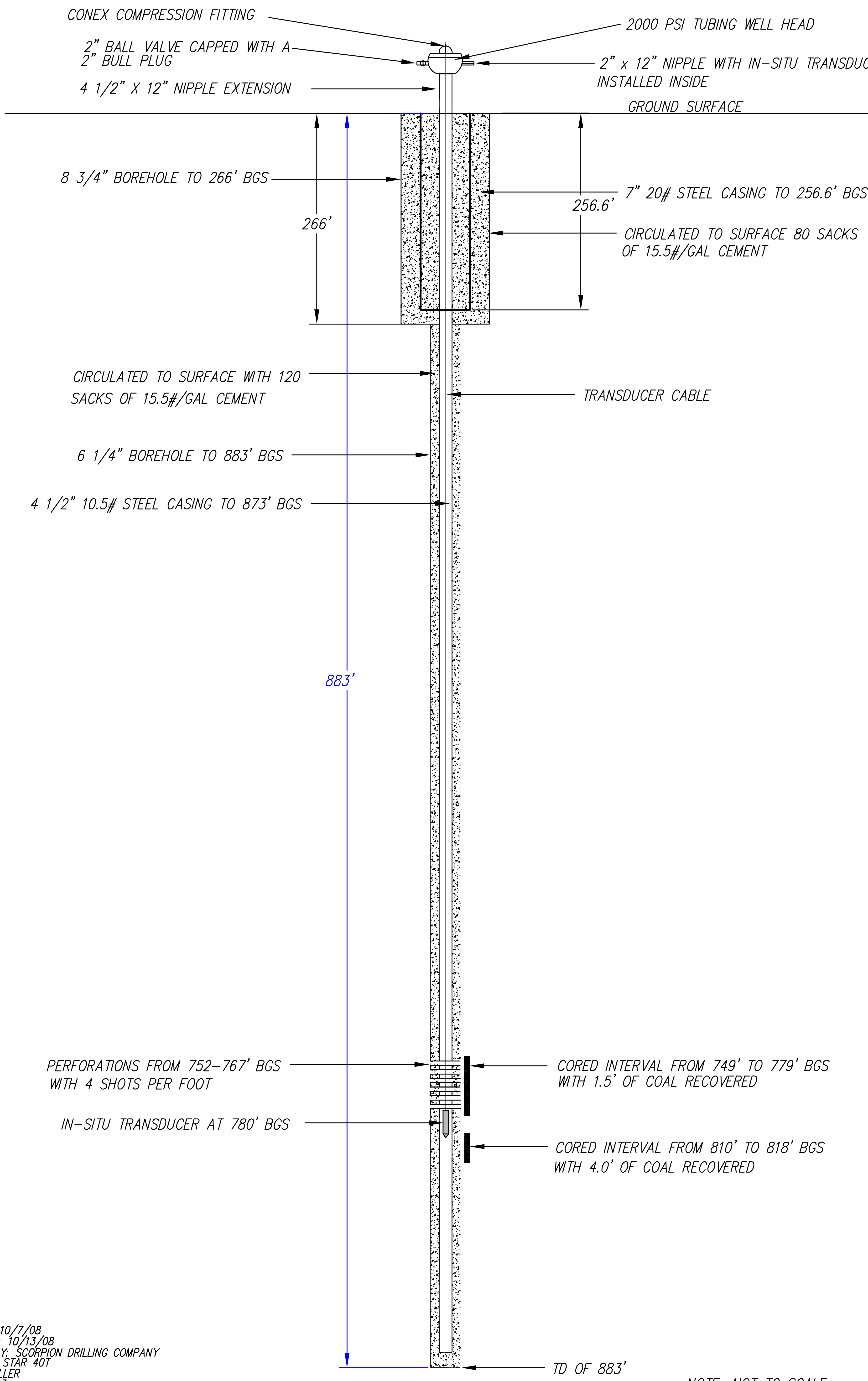
Albuquerque - Las Cruces

APPROVED: DFG	DATE: 1/26/09	WAGON GULCH MONITORING WELL #1
DRAWN BY: TLONG	DATE: 1/26/09	AS BUILT WELL DIAGRAM
REVISIONS BY:	DATE:	SW/SW QUARTER SECTION 4 TOWNSHIP 34N RANGE 05W
PROJECT # 5117918	FIGURE: 1	ARCHULETA COUNTY, COLORADO



DATE STARTED: 10/7/08
DATE COLPLETED: 10/13/08
DRILLING COMPNAY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.23, 107.43
API # 05-007-06266-00

NOTE: NOT TO SCALE

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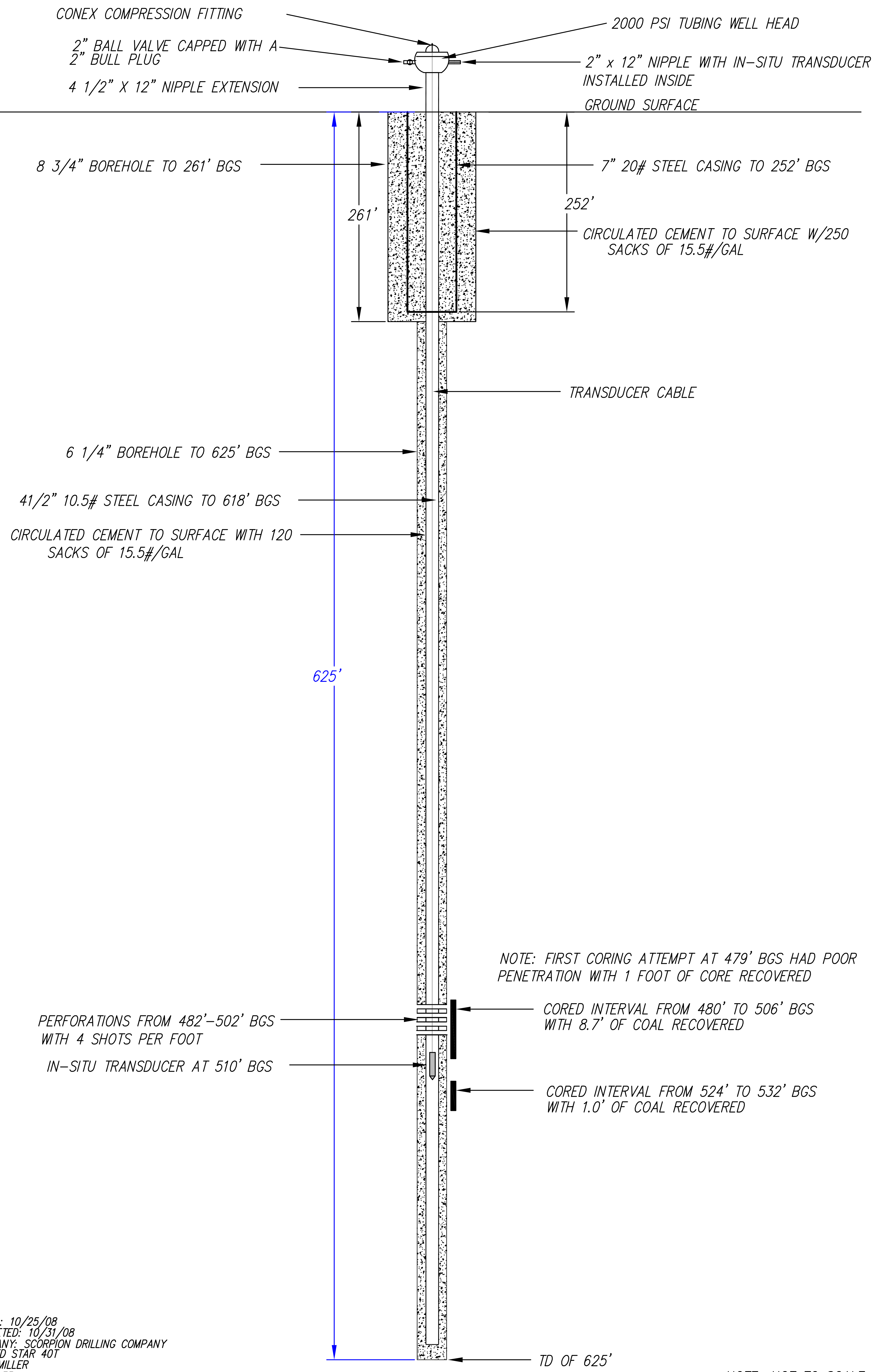
APPROVED: DFG	DATE: 1/26/09	WAGON GULCH MONITORING WELL #2 AS BUILT WELL DIAGRAM
DRAWN BY: TLONG	DATE: 1/26/09	
REVISIONS BY:	DATE:	SW/SW QUARTER SECTION 4 TOWNSHIP 34N RANGE 05W
PROJECT # 5117918	FIGURE: 2	ARCHULETA COUNTY, COLORADO



DATE SPUDDED: 10/25/08
CASING COMPLETED: 10/31/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.18, 107.35
API # 05-007-06264-00

NOTE: NOT TO SCALE

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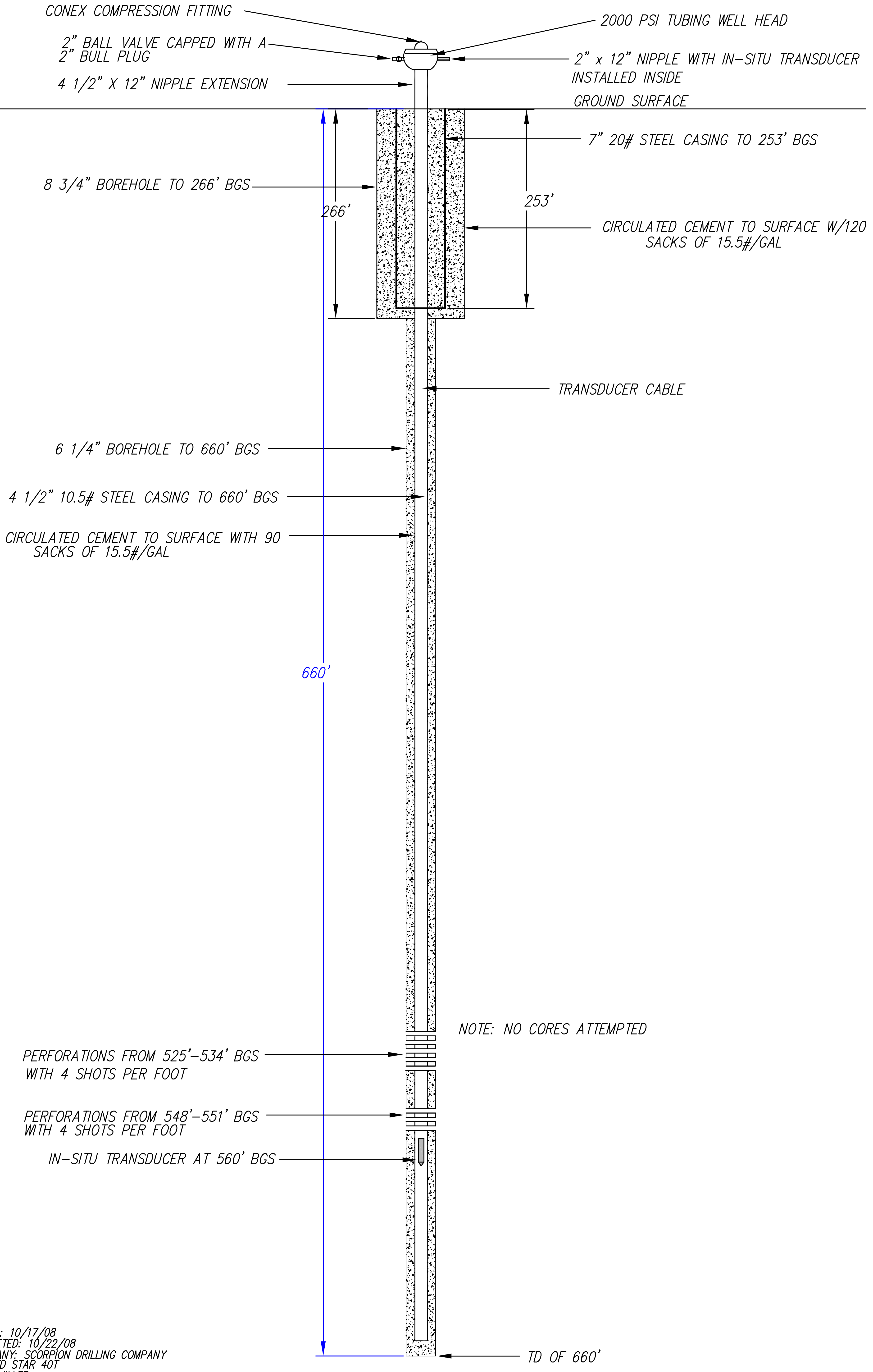
APPROVED: DFG	DATE: 1/26/09	FOSSET GULCH MONITORING WELL #1 AS BUILT WELL DIAGRAM
DRAWN BY: TLONG	DATE: 1/26/09	
REVISIONS BY:	DATE:	SE/SE QUARTER SECTION 14 TOWNSHIP 35N RANGE 05W ARCHULETA COUNTY, COLORADO
PROJECT # 5117918	FIGURE: 3	



DATE SPUDDED: 10/17/08
CASING COMPLETED: 10/22/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.18, 107.35
API # 05-007-06265-00

NOTE: NOT TO SCALE

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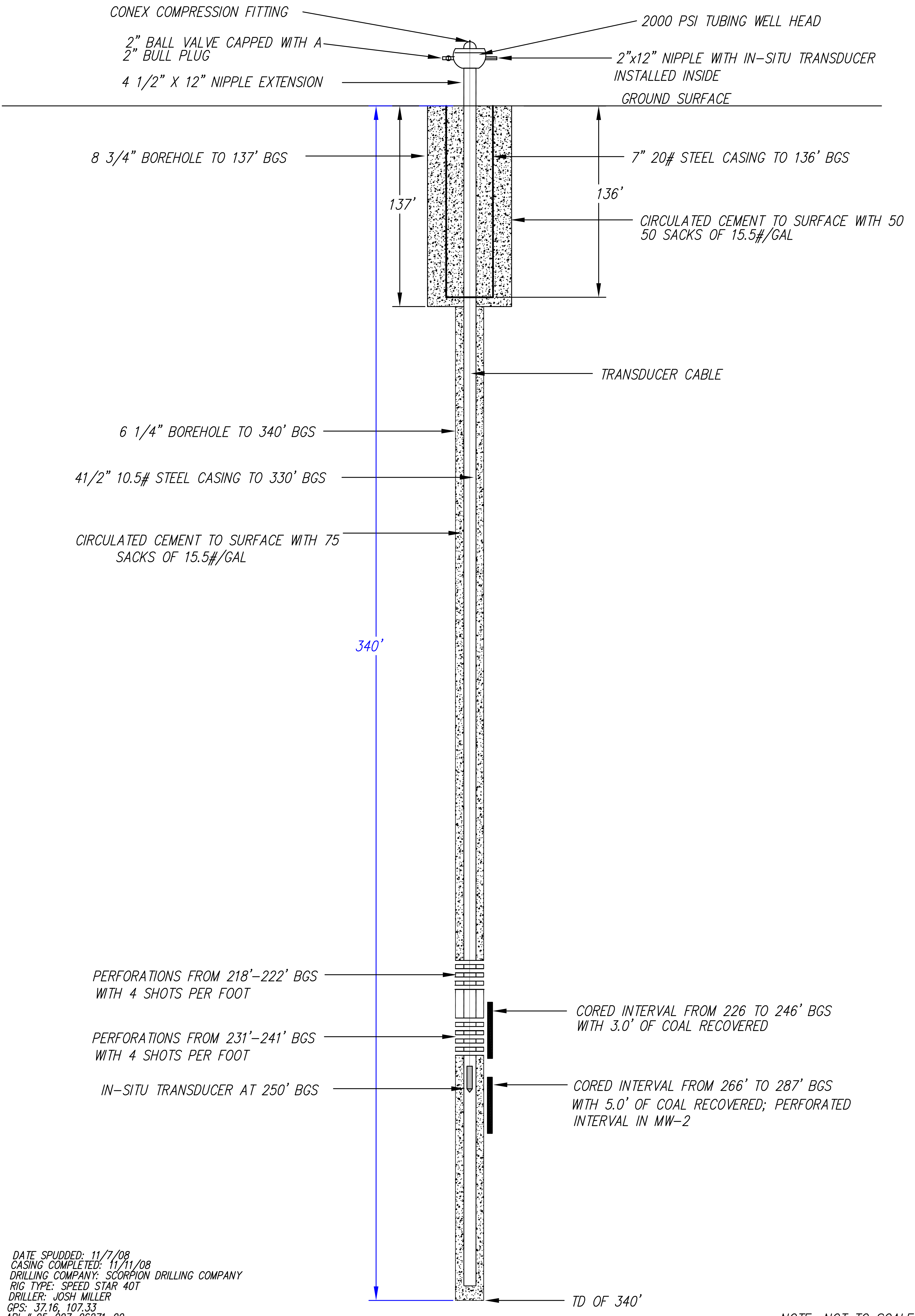
APPROVED: DFG	DATE: 1/26/09
DRAWN BY: TLONG	DATE: 1/26/09
REVISIONS BY:	DATE:
PROJECT # 5117918	FIGURE: 4

FOSSET GULCH MONITORING WELL #2
AS BUILT WELL DIAGRAM

SE/SE QUARTER SECTION 14
TOWNSHIP 35N RANGE 05W
ARCHULETA COUNTY, COLORADO



DATE SPUDDED: 11/7/08
CASING COMPLETED: 11/11/08
DRILLING COMPANY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.16, 107.33
API # 05-007-06271-00

NOTE: NOT TO SCALE

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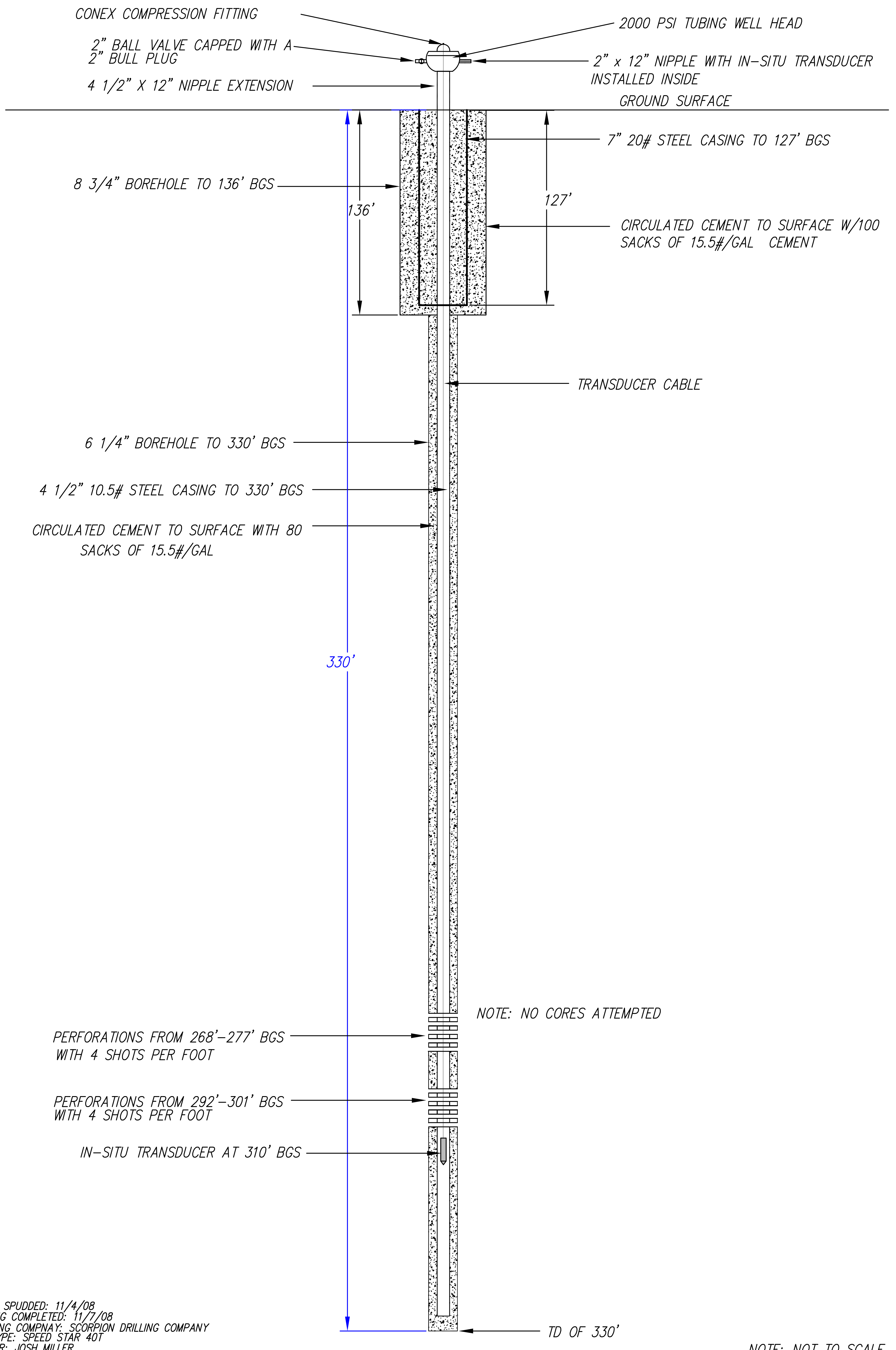
APPROVED: DFG	DATE: 1/26/09
DRAWN BY: TLONG	DATE: 1/26/09
REVISIONS BY:	DATE:
PROJECT # 5117918	FIGURE: 5

HIGHWAY 151 MONITORING WELL #1
AS BUILT WELL DIAGRAM
SW/NW QUARTER SECTION 30
TOWNSHIP 34N RANGE 04W
ARCHULETA COUNTY, COLORADO



DATE SPUDDED: 11/4/08
CASING COMPLETED: 11/7/08
DRILLING COMPNAY: SCORPION DRILLING COMPANY
RIG TYPE: SPEED STAR 40T
DRILLER: JOSH MILLER
GPS: 37.16, 107.33
API # 05-007-06270-00

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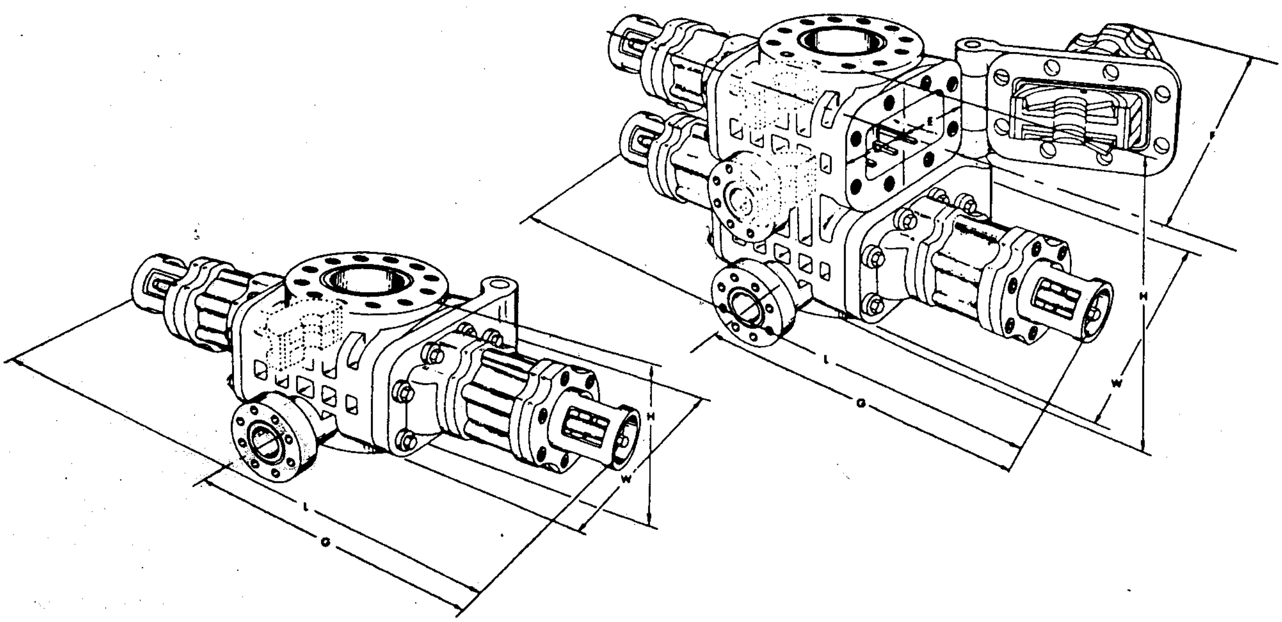
APPROVED: DFG	DATE: 1/26/09
DRAWN BY: TLONG	DATE: 1/26/09
REVISIONS BY:	DATE:
PROJECT # 5117918	FIGURE: 6

HIGHWAY 151 MONITORING WELL #2
AS BUILT WELL DIAGRAM
SW/NW QUARTER SECTION 30
TOWNSHIP 34N RANGE 04W
ARCHULETA COUNTY, COLORADO

APPENDIX D: BOP DIAGRAM

LWS PREVENTERS



DIMENSIONAL DATA

Size Inches	Working Pressure PSI	Test Pressure PSI	Vertical Bore Inches	Length Inches	Width Inches	PREVENTERS WITH MANUAL LOCKS — Approximate Weight in Lbs. — Studded — Single	Studded — Double	Flanged — Single	Flanged — Double	Approximate Height in Inches — Studded — Single	Studded — Double	Flanged — Single	Flanged — Double	D Center to Front Inches	E Center to Rear Inches	F Door Open to Change Rams Inches	G Door Open to Change Rams Inches	Max. Ram Size Inches
4 1/16	10,000	15,000	4 1/16	42 1/2	22	825*	......	......	......	15 1/2*	......	......	......	10 1/4	11 3/4	13 1/4	24	2 7/8
6	3,000	6,000	7 1/16	58	21 1/2	......	2,600	1,600	2,830	......	26 1/4	26 3/8	36 5/8	9 5/16	12 1/8	21	34	5 9/16
6	5,000	10,000	7 1/16	58	21 1/2	......	3,000	1,600	3,340	13 5/8	27 5/8	27 5/8	38 5/8	9 5/16	12 1/8	21	34	5 9/16
7 1/16	15,000	22,500	7 1/16	74 3/4	31	......	11,200	6,400	12,150	......	43 1/2	37 5/8	59 7/8	13 3/8	17 1/2	19 1/4	44	5 9/16
8	3,000	6,000	9	78 1/8	25 3/4	......	5,300	......	5,700	......	29 1/2	......	41 5/8	11 1/8	14 5/8	23	46	7
8	5,000	10,000	9	79 1/2	25 3/4	......	5,300	......	5,900	......	29 1/2	......	45 1/2	11 1/8	14 5/8	23	46	7
9	10,000	15,000	9	86 1/4	35	5,800	......	6,860	......	20 1/2	......	37 1/4	......	14 1/4	20 5/8	31	50	7
10	3,000	6,000	11	72 3/4	25 7/8	2,400	4,500	2,700	4,800	14 1/2	29 3/8	27 1/8	42	11 9/16	14 5/16	21	42	8 5/8
10	5,000	10,000	11	89 1/4	28 3/4	5,600	7,650	6,600	8,600	17	33	34 3/8	50 1/2	12 3/8	16	29 1/2	49 3/4	8 5/8
11	10,000	15,000	11	90 3/8	30 1/4	......	11,175	6,475	12,950	......	44 1/4	39 1/2	63 5/8	12 7/8	17 3/8	37	50 1/2	8 5/8
12	3,000	6,000	13 5/8	92 1/4	30 7/8	4,300	7,500	5,000	8,200	19 1/2	34 1/2	30 5/8	48	13 5/8	17 1/4	27	51 3/4	10 3/4
13 5/8	5,000	10,000	13 5/8	92 3/4	32 5/8	5,500	9,500	6,250	11,050	25 5/8	36	33 5/8	49 5/8	14 3/4	17 7/8	31	53 3/4	10 3/4
13 5/8	10,000	15,000	13 5/8	129	42 7/8	12,790	21,790	15,150	24,150	27	46	45	64	18	24 7/8	41	71	10 3/4
13 5/8	10,000	(New Design Preventer—See Your Shaffer Representative																
16	3,000	4,500	16 3/4	106 1/2	36 5/8	......	8,500	......	10,256	......	35	......	50 3/8	16 1/2	20 1/8	36	59 3/8	13 3/8
16 3/4	5,000	10,000	16 3/4	134	40	11,100	22,350	12,900	24,150	25	50	42 1/2	67 1/2	18	22	41	76	13 3/8
20	2,000	3,000	21 1/4	127	40 5/8	8,100	16,320	9,300	17,600	22 1/2	47 1/2	37 3/4	62 3/4	17 1/4	23 3/8	40 1/2	70	16
20	3,000	4,500	21 1/4	127	40 5/8	8,400	16,400	10,200	18,350	23 1/8	47 1/2	42 3/4	67 3/4	17 1/4	23 3/8	40 1/2	70	16

TYPE LWS PREVENTERS

APPENDIX E: GEOPHYSICAL LOGS

APPENDIX F: COAL DESPRPTION ANALYSIS

Final Report
Reservoir Property Assessment

Souder, Miller & Associates
MW-34-5-4
Fruitland Coals
San Juan Basin
Archuleta County, Colorado

Submitted to:
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Weatherford Laboratories Disclaimer

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Summary

Weatherford Laboratories (WFT Labs) measured properties of three core samples recovered from Fruitland Coals penetrated by Souder, Miller & Associates' MW-34-5-4 well between October 11 and October 12, 2008. Core was collected between 749 and 826 ft. The goals of this project were to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coals at the well location.

Three core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. All three desorption samples were dedicated to collection of multiple gas composition and two desorption samples were dedicated to collection of isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all core samples. Coal characterization was determined for one desorption sample and one composite sample, which included chemical (proximate analysis, ultimate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). One desorption sample and one composite sample were characterized and used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

A variety of factors can influence data quality. Confidence in the analytical results depends on the reliability of reservoir temperature and pressure information available for the cored intervals as well as adherence to sample collection and processing protocols. Relative confidence levels were assigned to describe the reliability of the data discussed in this report. These confidence levels are defined below.

- Low confidence — Data should not be considered representative of reservoir conditions.
- Moderate confidence — Data are suspect but may be useful in conjunction with other information to describe reservoir conditions.
- High confidence — Data are believed to represent reservoir conditions (assuming experimental temperature and pressure data accurately describe initial reservoir conditions).

The conclusions and the confidence in these conclusions are summarized in the remainder of this section.

1. Confidence in the desorption data was high. The lost gas fraction of the three desorption samples ranged from 5.7 to 11.6% of the total gas content. At the conclusion of desorption experiments, all three desorption samples were crushed to determine the remaining gas content as required for accurate total gas content estimates. The percentage of the total gas released by crushing ranged from 20.7 to 34.4% of the total gas content. The average dry, ash-free and in-situ gas contents were 359.5 scf/ton (standard cubic feet per ton) and 262.5 scf/ton, respectively.

2. Estimates of the diffusivity at 75°F, the desorption temperature, ranged from 0.036 to 0.160 μs^{-1}. This range corresponded to sorption times (time to desorb 63% of the gas at the desorption temperature and atmospheric pressure) ranging from 116 to 512 hours. Confidence in this data was high as there was high confidence in the desorption data.

3. Multiple desorption gas samples were collected from three dedicated desorption canisters. These data were integrated as a function of the desorbed gas fraction to estimate the original adsorbed gas composition. Estimates of the adsorbed gas composition included 98.14 mol% methane, with minor concentrations of carbon dioxide (1.48 mol%), propane and heavier hydrocarbons (0.23 mol%), and carbon dioxide (0.15 mol%). The confidence in these data was moderate as there was substantial air contamination in some of the gas composition samples.

4. Results of isotopic analysis for two samples indicated that the released gas was thermogenic in origin. Confidence in this data was high.

5. The density of the three desorption samples was determined after crushing with a helium pycnometer. The density ranged from 1.368 to 1.468 g/cm^3 on an in-situ basis. Confidence in these data was moderate.

6. Estimates of the organic fraction density and inorganic fraction density were of moderate accuracy due to minor variation in the sample moist density. The organic fraction density estimate of 1.184 g/cm^3 was consistent with the maceral composition. The inorganic fraction density of 3.892 g/cm^3 was much greater than the density of moist montmorillonite (2.12 g/cm^3) and moist kaolinite (2.42 g/cm^3). Due to a limited number of points and a relatively small range in ash content, the organic and inorganic density estimates are subject to error.

7. Ash contents from the three desorption samples were moderate, ranging from 0.1988 to 0.2786 weight fraction on an in-situ basis. The moisture holding capacity (in-situ or inherent moisture content) was moderate, ranging from 0.0118 to 0.0181 weight fraction. The sulfur content was low, ranging from 0.0067 to 0.0074 weight fraction on an in-situ basis. Confidence in these data was high.

8. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm. This was not the case for the two isotherm samples. The moist, mineral-matter-free calorific value for sample 41300-1 was 15,162 BTU/lbm and for sample 41300-COMP-1 was 15,368 BTU/lbm. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41300-1 was 0.96% in oil and for sample 41300-COMP-1 was 0.99% in oil placing the rank in the high volatile A bituminous range. There was high confidence in these data.

9. The maceral compositions were determined for the two adsorption isotherm samples. For sample 41300-1, the composition included 87.0% vitrinite, 11.5% inertinite, and 1.5% liptinite. For sample 41300-COMP-1, the composition included 91.7% vitrinite, 6.2% inertinite, and 2.1% liptinite. Confidence in these estimates was high.

10. Confidence in the measured adsorbed methane storage capacity data at the measurement temperature was high as all measurements were performed with state of the art equipment adhering to strict protocols. Two isotherms were determined from one desorption sample and one composite sample. Based upon the reservoir temperature data, the in-situ temperature was 75°F. The isotherm data were measured on samples 41300-1 and 41300-COMP-1, which had ash contents of 0.2786 and 0.2209 weight fraction and moisture contents of 0.0175 and 0.0147 weight fraction. The dry, ash-free Langmuir methane storage capacity for sample 41300-1 was 498.3 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 347.8 scf/ton. The Langmuir pressure was 219.2 psia. The dry, ash-free Langmuir methane storage capacity for sample 41300-COMP-1 was 575.4 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 435.8 scf/ton. The Langmuir pressure was 208.1 psia.

11. At 350.8 psia, the estimated average dry, ash-free methane storage capacity was 333.9 scf/ton. This was less than the average dry, ash-free gas content of 359.8 scf/ton, which indicated the reservoir was saturated. The conclusion may not be accurate if the estimated reservoir conditions were incorrect, e.g. reservoir pressure was underestimated, or reservoir temperature was overestimated.

12. The density and gas content of the coal samples were used to estimate the adsorbed gas-in-place (GIP) volume per unit coal volume. The gas-in-place volume per unit thickness was 506.1 Mscf/acre-ft (thousand standard cubic feet per acre-foot of coal). Confidence in this estimate was high as there was high confidence in the gas content and density data.

Introduction

This report summarizes the procedures and results of the gas desorption and coal characterization program conducted on three core samples recovered from the Souder, Miller & Associates' MW-34-5-4 well between October 11 and October 12, 2008, from depths between 749 and 826 ft. The well is located in the San Juan Basin, specifically Section 5, Township 134N, Range 5W, Archuleta County, Colorado. At the request of Mr. Denny Foust of Souder, Miller & Associates, WFT Labs conducted analyses on the core samples. The goals of this project were to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coals at the well location.

Many of the values presented in this report are time specific. For instance, references to gas content and gas composition are valid on the date the reservoir was sampled. These properties may have been affected by fluid production from the study well, offset wells, or drainage by mining activities since the samples were collected.

Table 1 summarizes the detailed analysis program conducted on the samples after they arrived at WFT Labs' laboratory. Sample 41300-COMP-1 is a mixture of desorption samples 41300-2 and 41300-3. Information concerning the details of the measurements and the resulting data are discussed throughout this report.

Table 1. **Analysis Program Summary**

Sample ID	Can ID	Drill Depth (ft)	Reservoir System	Premium Sample	Sample Handling	Core Photography	Core Lithology	Gas Composition	Isotope	Long-term Residual Gas	Composite Preparation	Density	Moisture/Ash/Sulfur	Moisture Holding Capacity	Proximate/Ultimate/BTU/SO_3 in Ash	Comprehensive Petrography	Isotherm Preparation	Isotherm
41300-1	GT-83	753.5-754.5	Fruitland Coals	X	X	X	X	X	X	X		X	X	X	X	X	X	CH_4
41300-2	GT-184	813.0-814.0	Fruitland Coals	X	X	X	X	X		X	X	X	X	X				
41300-3	GT-210	815.0-816.0	Fruitland Coals	X	X	X	X	X	X	X	X	X	X	X				
41300-COMP-1	-	813.0-816.0	Fruitland Coals									X	X	X	X	X	X	CH_4

Field Activities

WFT Labs field personnel were on location at the well site between October 10 and October 13, 2008. WFT Labs collected drilling and coring operations data, three core samples for desorption measurements, desorbed gas content data, samples for gas composition determination from three canisters, samples for isotopic determination from two canisters, and core that was retained for additional analyses. This section summarizes the field activities.

References to core depths throughout this report are based on driller's depths and may require a depth correction to agree with log depths.

On October 11, 2008, Mr. Denny Foust provided a reservoir temperature of 75°F.

Reservoir pressure data were unavailable at the time this report was written. Estimates of reservoir pressure were based upon a gradient of 0.433 psi/ft. This gradient is equivalent to the pressure exerted by a column of fresh water from the depth of the reservoir to surface.

Scorpion Drilling (Rig #2) from Farmington, Colorado, conducted the drilling operations for the well. Core point depth (749 ft) was reached on October 11, 2008. Coring operations commenced on October 11, 2008, and were completed on October 12, 2008, with a total of two intermittent core runs. A summary of all core runs is presented in Table 2. A field report was issued previously containing details of these operations.[1]

Reed-Hycalog conducted the coring operations. Tools used for coring operations included a 6 1/2-inch CD 93 core bit and a 30-foot long conventional barrel with a solid plastic liner. Coring fluid was composed of polymer-based water.

Table 2. Core Run Summary

Core Run	Cored Interval	Length Cored	Length Recovered	Core Recovery Success	Core Recovery Time	Circulating Fluid Temp.	Fluid Density	Number of Canistered Samples
#	ft	ft	ft	%	min	°F	ppg	#
1	749.0-779.0	30.0	13.0	43.3	72	67.4	8.5	1
2	810.0-826.0	16.5	7.3	44.2	60	67.9	8.5	2
Total	**-**	***46.5***	***20.3***	***43.7***	**-**	**-**	**-**	***3***

Three desorption samples were collected from Fruitland Coals. The core samples were sealed in individual desorption canisters equilibrated to approximate in-situ temperature (75°F) for gas content analysis. All canisters were filled with potable water to minimize headspace volume within the canister. Reduced head space increased the accuracy of the gas content measurements, maximized the quality of gas samples collected for compositional analysis, and reduced oxidation and desiccation of the core. Desorption readings were taken every few minutes for the first few hours, which was important for accurate lost gas content estimates. Gas content measurements continued for at least 24 hours at the well site. Gas composition samples were collected on all canisters. Two canisters (samples 41300-1 and 41300-3) were selected for isotopic analysis.

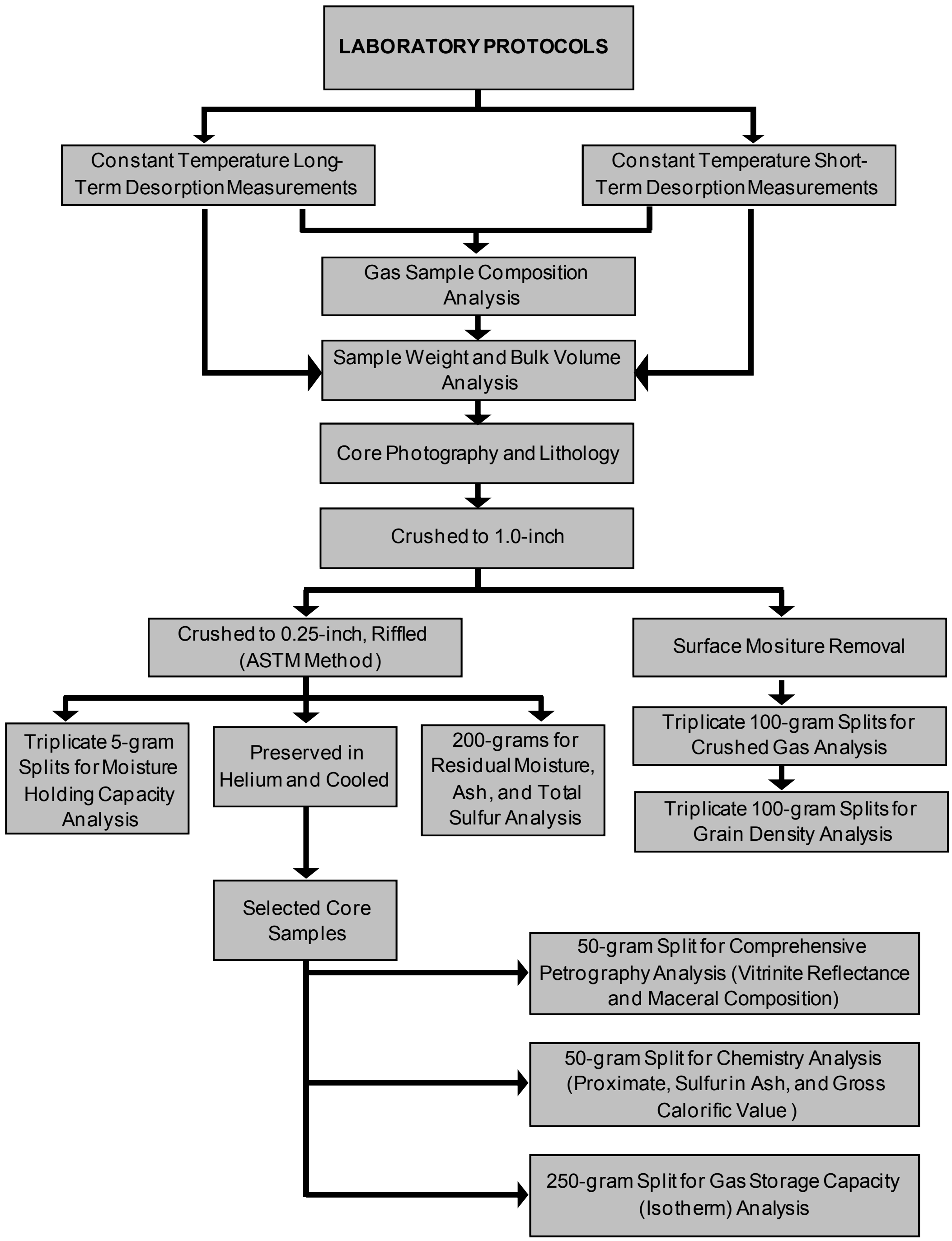
Samples not involved in desorption analysis were sealed in plastic liners and placed in core boxes. These samples and the desorption samples were delivered to WFT Labs' Arvada, Colorado, laboratory.

Laboratory Procedures

WFT Labs performed long-term desorption tests, gas composition analysis, sample bulk composition and property analysis including moisture, density, proximate analysis, ultimate analysis, sulfur-in-ash, gross calorific value, and adsorption isotherm measurements on selected samples. WFT Labs sub-contracted petrography and isotopic analyses on selected samples. The following details typical laboratory procedures and analyses conducted for a coal reservoir property assessment; although, these analyses may or may have been performed on the samples collected at this well.

Samples were processed using systematic procedures that minimized sample aerial oxidation, aerial desiccation (moisture loss), and gas loss. WFT Labs used an in-house improved procedure to air-dry processed samples that differs from the air-drying procedure described in the ASTM Method D 3302. WFT Labs' air-drying procedure attempts not to over-dry samples by only removing surface moisture. Figure 1 summarizes the general sample processing and analysis steps in the form of a flow chart. Some of the analyses summarized in this figure may not have been performed on samples from this project. Sample methodologies rigorously followed best practice analysis protocols developed by ASTM, the Gas Technology Institute (GTI), and WFT Labs.[2,3,4,5,6]

Figure 1. **Sample Processing and Analysis Flow Chart**



Gas Content Measurement Protocol

Desorbed gas volumes were measured as a function of time to the nearest 1 milliliter by head-pressure equalized fluid displacement. The frequency of the measurements was greatest during the early time of desorption tests to ensure sufficient data were available for lost gas content determination. The gas desorption data collected during the gas desorption tests were used to calculate the lost gas content. Lost gas content estimates were obtained from the early time gas content data using WFT Labs' modified version of the U.S. Bureau of Mines' Direct Method.[5,6]

Samples were removed from the canister and the particle size was reduced to a one-inch diameter top size. Triplicate representative splits, approximately 100 grams each, were quickly removed from the gross sample for crushed gas analysis. The splits were individually pulverized to -200 mesh in specialized sealed crushing vessels under an inert gas (helium) atmosphere at approximate reservoir temperature. The released (crushed) gas volume was measured periodically until no measurable gas was released from the crushing vessel. The crushed gas content of the samples was calculated by dividing the released gas volume by the sample weight. An average of gas content from the triplicate splits was used as the final estimate of the crushed gas content.

RapidGas™ is WFT Lab's methodology when samples are removed from desorption samples within three weeks of the start of desorption and pulverized to determine the released gas volume with the crushed gas method. WFT Labs uses the term accelerated gas to describe crushed gas analysis when the desorption time is greater than for *RapidGas* samples but less than the time for long-term desorption samples.

Crushed gas content (also referred to as residual gas content) is used to describe the released gas content when samples are crushed after long-term desorption at approximate reservoir temperature. WFT Labs terminates the long-term desorption measurements when the released gas volume is less than or equal to 0.05 scf/ton-D (standard cubic feet per ton-day) over a several day period.

The total air-dry gas contents were calculated by the sum of the lost gas, measured gas, and crushed gas contents. Residual moisture, ash, moisture holding capacity, and total sulfur content data were then used to convert air-dry basis gas content data to other bases (e.g., dry; dry, ash-free; and in-situ bases). All gas content volumes were converted to and reported in standard cubic feet per ton (2,000 lbm) of rock (scf/ton).

Apparent Diffusivity and Sorption Time

Gas storage and flow through coal seams are generally modeled with dual porosity reservoir models.[6] Gas is stored by adsorption within the primary porosity system within the organic component of the coal matrix. The primary porosity consists of micro- (<2 nanometer diameter) and meso-porosity (2 to 50 nanometer diameter) pores. Gas flows to wells through the secondary porosity system, which consists of macro-pores (>50 nanometers diameter) and natural fractures. Gas flow through the primary porosity is dominated by diffusion and quantified with Fick's Law while gas flow through the secondary porosity is driven by pressure gradients and quantified with Darcy's Law.

Diffusivity is the diffusion coefficient divided by the square of an average diffusion distance. Diffusivity can be estimated from the method used for determining lost gas volume using the relationship listed in Equation 1.

$$\frac{D}{r^2} = \left(\frac{m}{203.1 G_{ad}} \right)^2 \quad (1)$$

where:

D/r^2 *diffusivity, sec*$^{-1}$
m *slope of gas content versus square-root time graph, scf/ton-hr*$^{0.5}$

G_{cad} *air-dry basis total gas content, scf/ton*

Although diffusivity values are used in reservoir models, an easier concept to understand is the sorption time. Sorption time is defined as the time required to desorb 63.2% of the original gas content if a sample is maintained at constant temperature. The relationship used to relate sorption time to diffusivity is listed in Equation 2.

$$\tau = \left(3600\alpha \frac{D}{r^2} \right)^{-1} \qquad (2)$$

where:

τ *sorption time, hr*
α *geometrical shale factor, cm*^{2}

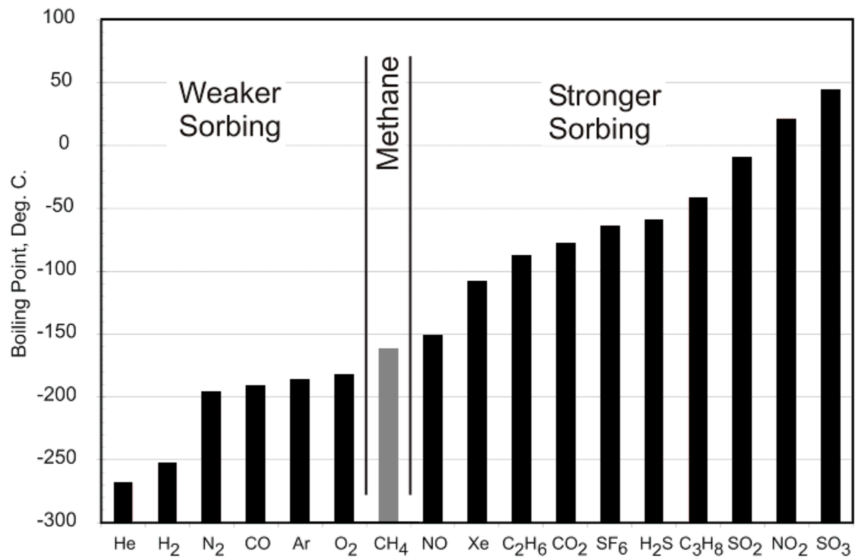
The geometrical shape factor for a sphere, the most common assumed geometry, is 15. The accuracy of the diffusivity value depends weakly upon the competency of the core sample and strongly upon the determination of the lost gas content.

Gas Composition and Isotope Analysis

It is important to determine the composition of the adsorbed gas as the gas composition directly affects the gas storage capacity and critical desorption pressure. The adsorption affinity of gases is related to their atmospheric pressure boiling point as illustrated by Figure 2. Nitrogen tends to decrease in-situ multi-component gas storage capacity while carbon dioxide, ethane, and heavier hydrocarbon gases tend to increase storage capacity. The composition of the gas desorbed from the core samples changes with time, and concentrations of heavier hydrocarbon species tend to increase relative to methane.

The gas composition as a function of desorbed gas fraction data (cumulative desorbed gas content divided by the total gas content) was integrated to determine the adsorbed gas composition for coal samples or for an average of the free and adsorbed gas compositions for shale samples. Gas composition samples were collected from dedicated canisters. These canisters are usually purged with helium at the time of sealing to reduce air contamination. Gas samples were collected periodically before measuring the released gas volume. The gas composition of the initial released gas was determined by extrapolation to zero desorbed gas content. The accuracy of the extrapolation is strongly dependent upon the lost gas content and the number of desorption gas samples taken early in the desorption measurements. If lost gas content is large, i.e., greater than 25%, the estimates of the lost gas composition are probably inaccurate and deficient in the lighter hydrocarbon species. The composition of the gas released by crushing the samples at the end of the desorption measurements must also be corrected for contamination by air.

Figure 2. Relative Sorption Affinity of Gases



Gas sample composition was analyzed at WFT Labs by gas chromatography in accordance with ASTM Method D 1945 (modified). The gas composition was calculated by integrating the gas composition as a function of cumulative desorbed gas content.

Determining the origin of the gas is important in understanding the characteristics of natural gas in a reservoir system or basin. Natural gas derived from two distinct sources listed below can be distinguished based on isotopic composition.[7] Isotopes are atoms whose nuclei contain the same number of protons but a different number of neutrons. Gas isotope ratios were determined by isotope ratio mass spectroscopy.

1. Biogenic Gas: Gas generated by anaerobic decomposition of organic matter in a shallow, low temperature sedimentary environment.

2. Thermogenic Gas: Gas formed in deeply buried sediments by thermal cracking of sedimentary organic matter into hydrocarbon liquids and gas (primary thermogenic gas), or by thermal cracking of oil at high temperatures into gas (secondary thermogenic gas).

Biogenic gas consists primarily of methane and is often referred to as a “dry” gas. Thermogenic gas can be dry or contain concentrations of heavier hydrocarbons (C_{2+}).

The following information is derived from Reference 7. In isotope geochemistry, it is common practice to express isotopic composition in terms of a delta (δ) value, which is a difference from a standard sample. For example, the delta value for substance A is defined by Equation 3.

$$\delta_A = 10^3 \left(\frac{R_A}{R_{st}} - 1 \right) \quad (3)$$

where:

δ_A *delta value of element A, parts per thousands, ‰*
R_A *isotopic ratio of A, dimensionless*
R_{st} *isotopic ratio of a standard, dimensionless*

Carbon has two stable isotopes: ^{12}C and ^{13}C. ^{12}C accounts for 98.89% of all carbon and ^{13}C accounts for 1.11% of the remaining carbon. When the delta value is greater, it is common to consider substance A enriched in the rare, heavier isotope.

Hydrogen has two stable isotopes: H and ^{2}D (deuterium). H accounts for 99.9844% of all hydrogen and ^{2}D accounts for 0.0156% of the remaining hydrogen. Hydrogen exhibits the largest variations in stable isotope ratios of all elements.

Biogenic methane commonly occurs in recent anoxic (low oxygen concentration) sediments in both fresh water, such as lakes and swamps, and marine environments, such as estuaries and shelf regions. There are two primary pathways for methanogenesis, fermentation of acetate and reduction of CO_2. Acetate fermentation is dominant in freshwater environments while CO_2 reduction is dominate in marine environments.

During methanogenic bacterial decomposition of organic material, methane is highly depleted in $\delta^{13}C$ and results in $\delta^{13}C$ values between -110 and -50‰. In marine sediments, methane formed by CO_2 reduction is often more depleted in ^{13}C than when formed by acetate fermentation. Typical values for $\delta^{13}C$ in methane from marine environments range from -110 to -60‰ while those in methane from freshwater environments range from -65 to -50‰.

The difference in methane composition from both environments is even greater for the hydrogen isotopes. Marine bacterial methane has δD values between -250 and -170‰ while biogenic methane in freshwater environments is strongly depleted in deuterium with δD values between -400 to -250‰. This difference is due to the source of the hydrogen. Hydrogen comes from formation water during CO_2 reduction. Seventy-five percent of the hydrogen created by fermentation comes from the methyl group, which is extremely depleted in deuterium.

Thermogenic gas is produced in deeply buried sediments due to modification of the organic matter by various chemical reactions, such as cracking of kerogen. The ^{12}C – ^{13}C bonds are preferentially broken during the first stages of maturation resulting in ^{13}C enrichment, which continues as temperature increases. In general, as thermal maturity of methane increases, the $\delta^{13}C$ values increase. Thermogenic methane commonly has $\delta^{13}C$ values between -50 and -20‰. Methane from non-marine (humic) sources are isotopically enriched relative to those generated from marine (sapropelic sources) and similar levels of thermal maturity. In contrast, δD values are independent on the source of organic material but are highly dependent on the thermal maturity.

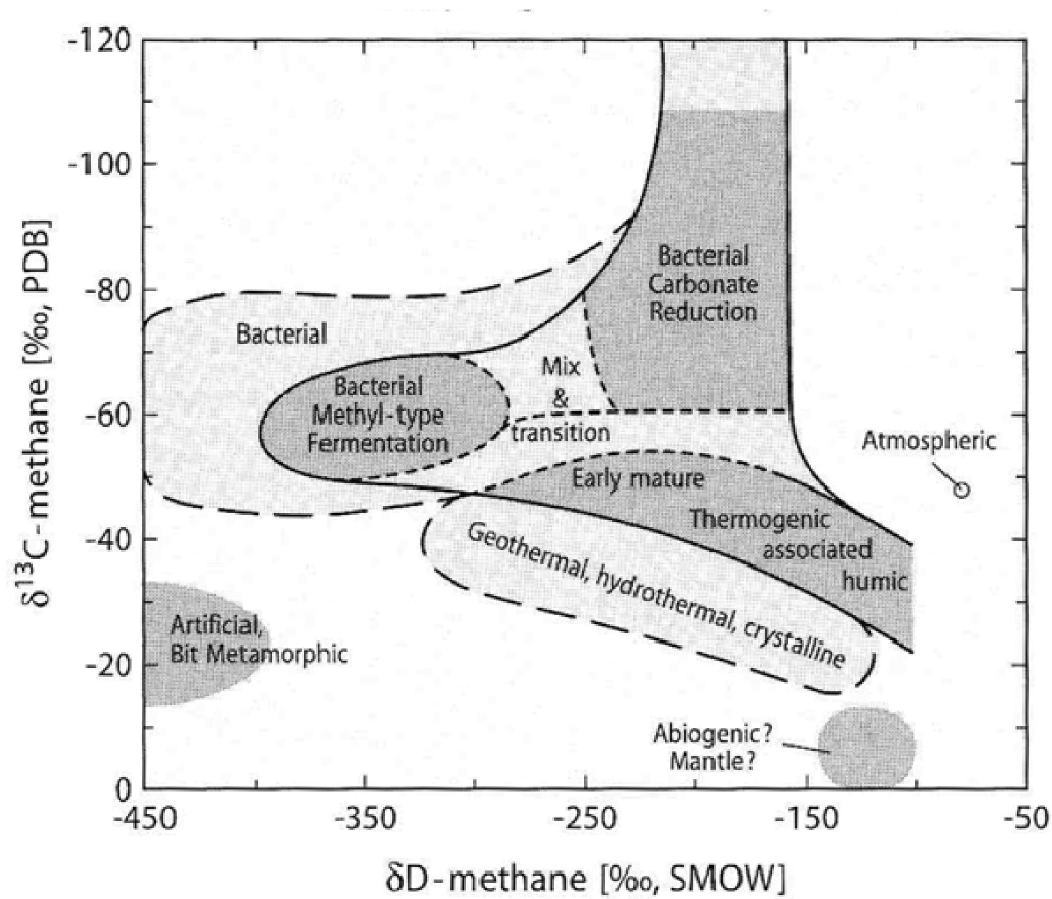
As a side note, migration can enrich methane in $\delta^{12}C$ or $\delta^{13}C$ depending upon the properties of the rock through which the gas is migrating. Recent experiments have demonstrated that $\delta^{13}C$ can be depleted during migration through shale to different degrees depending upon the organic content of the shale.[8]

The process of diffusion can cause significant isotope fractionization. In general, light isotopes are more mobile and diffuse about 1% faster than the heavier isotopes. As a result, light isotopes escape more readily leaving the remaining methane enriched in ^{13}C causing greater $\delta^{13}C$ values.

A gas mixture subjected to a temperature gradient will tend to separate by thermal diffusion; the greater mass species will migrate to the colder temperatures. Gravitational settling in porous media can also cause the heavier isotope to migrate downward.

Whiticar[9] developed a chart for identification of methane sources based upon isotopic ratios. This chart, extracted from Reference 7, is illustrated in Figure 3. The term SMOW in the horizontal axis refers to the standard for hydrogen isotopes, which comes from a sample of mean ocean water distributed in Vienna by the International Atomic Energy Agency. The term PDB in the vertical axis refers to the standard for carbon isotopes, which is a based on Cretaceous PeeDee Belemnites found in South Carolina.

Figure 3. Carbon and Hydrogen Isotope Signatures of Methane Sources



When a helium purged canistered sample is selected for isotope analysis, one or two samples of released gas are collected from the core sample during the desorption measurements after sufficient volume of gas is measured in order to clear the canister head space of residual air. If two gas samples were collected, one sample was taken within the first few hours of the desorption measurements and the second was collected when the rate of desorption decreased significantly but still had enough volume to fill the collection tube (100 ml). If only one gas sample was collected for isotopic analysis, the sample was taken within the first few hours of the desorption measurements. The gas samples collected should be representative of the reservoir gas and are analyzed by isotope-ratio mass spectrometry (IRMS) at Isotech Laboratories, Inc.

Sample Bulk Composition and Property Analysis

Sample bulk composition and property analyses were performed according to ASTM or other standardized methodologies listed in Table 3. Chemical analysis (proximate, total sulfur, sulfur in ash, and heating value) and comprehensive petrography analysis (maceral matter composition, mineral matter composition, and vitrinite reflectance analyses) are typically conducted on selected samples to determine coal composition and thermal maturity (rank). The Center for Applied Energy Research (University of Kentucky) conducts the petrographic analysis. All other listed bulk composition and property analyses were conducted in-house by WFT Labs. Density, moisture holding capacity, chemical analysis, and petrographic analysis procedures are discussed in the following sections.

Table 3. Sample Bulk Composition and Property Analysis Methodologies

Analysis	Methodology
Air-dry moisture loss	WFT Labs' improved methodology
Sample bulk volume	Standard water displacement technique
Density	Helium multi-pycnometry
Moisture holding capacity	WFT Labs' improved methodology
Residual moisture	ASTM D 5142
Ash content	ASTM D 5142
Proximate	ASTM D 5142
Total sulfur	ASTM D 4239C
Sulfur in Ash	ASTM D 5016
Gross calorific value	ASTM D 5865
Maceral and mineral composition	ASTM D 2799
Vitrinite reflectance	ASTM D 2798

Crushed Density Analysis

Density by helium pycnometry determines crushed density values (i.e., density excluding large-scale gas filled pore volume). For coal, the crushed density is almost identical to the bulk density. Crushed density analysis requires the measurement of sample volume and mass. Sample volumes were measured at room temperature conditions on triplicate air-dried samples (representative of each desorption sample) of approximately 100 grams using a helium multi-pycnometer. Helium can penetrate the coal micro-pore structure without adsorption and does not add moisture to the sample. Sample weights were determined to the nearest 0.001 gram using an electronic balance. Sample densities were calculated by dividing the measured sample mass by the sample volume.

Moisture Holding Capacity Analysis

The in-situ (or inherent) moisture of coal is the amount of moisture the coal can hold at 100 percent relative humidity without any moisture present on the surface of the coal particles. The moisture holding capacity approximates the in-situ moisture content of the coal seam.[2]

The moisture holding capacity analysis procedure used by WFT Labs is in accordance with the ASTM Method D 1412 (Equilibrium Moisture). The equilibrium moisture value is defined as the average percentage weight loss upon drying triplicate 5-gram water saturated coal samples [particle size -16 US mesh (1.18 mm)], following equilibration at 96 to 97% relative humidity and 86°F (30°C) for 48 to 72 hours.

Chemical Characterization

Proximate and ultimate analysis provides chemical composition data. Proximate analysis results in estimates of the weight fraction of residual moisture, ash, and volatile matter and the calculation of fixed carbon by difference. Data from proximate analyses are used to classify coal rank and to determine the ratio of combustible to incombustible constituents. Ultimate analysis results in the weight fraction of sulfur, carbon, hydrogen, nitrogen, and oxygen by difference. [2]

The total sulfur content represents the sulfur occurring in both the organic and inorganic components of the coal sample. The total sulfur content is determined in accordance with ASTM D 4239C.

Residual moisture is neither a standard state nor a characteristic property of coal.[2] Residual moisture is dependent on the sample handling, desorption methodology, and the method used to remove excess moisture before analysis. For coal samples, it is important to maintain the residual moisture content at levels slightly greater than the inherent, or in-situ, moisture content. When the total moisture is reduced to the residual moisture value following careful methods, subsequent analyses can be reported on the ASTM as-determined mass basis.

Maceral and Mineral Composition

Maceral and mineral analysis provides organic and mineral composition data. Petrographic characterization of coal reservoir systems is performed by microscopic examination of polished surfaces of crushed particle pellets under reflected white light and ultraviolet light. The volume fraction of organic (maceral) and inorganic (mineral) components is quantified by manual point counting. The volume fraction of clay, quartz, carbonate, and sulfide minerals is also quantified by point counting. The point counting technique is a subjective process and requires a knowledgeable and highly experienced petrographer to obtain consistent data. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the maceral and mineral testing.

Coal Vitrinite Reflectance

The thermal maturity of coal can be quantified petrographically by vitrinite reflectance. The measurement is typically conducted on the polished surface of the crushed particle pellets used for the maceral analysis. Incident white light is reflected off the surface of vitrinite macerals immersed in oil of a specific refractive index. The reflected light is captured by a photo multiplier and converted to analog and digital output. The reflected light is typically reported as the mean-maximum reflectance since vitrinite is anisotropic under incident. Vitrinite reflectance may be the most sensitive indicator of thermal maturity for macerals that have attained a coal rank of medium volatile bituminous and greater. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the vitrinite reflectance testing.

Adsorbed Gas Storage Capacity

Adsorption isotherm data are important because isotherm behavior indicates the maximum gas volume that can be stored at a specific temperature and pressure. The adsorption isotherm determines the gas storage capacity of crushed samples as a function of pressure at constant temperature, which is usually the reservoir temperature. A known weight of crushed rock sample is placed in a volumetric isotherm apparatus and subjected to increasing pressure steps.[10] Gas storage capacity is estimated by material balance analysis of the pressure behavior. For coal, the measurement is performed on samples equilibrated to the inherent, or in-situ, moisture content.

The gas storage capacity of coal typically increases non-linearly as pressure increases. Gas storage capacity also varies as a function of the type of gas species, coal maceral composition, and organic material thermal maturity.

The Langmuir equation listed in Equation 4 is used to model the variation of gas storage capacity as a function of pressure.[11]

$$G_s = G_{sL} \frac{p}{p + p_L} \quad (4)$$

where:

G_s *gas storage capacity, scf/ton*
G_{sL} *Langmuir storage capacity, sct/ton*
p *pressure, psia*
p_L *Langmuir pressure, psia*

The Langmuir storage capacity is the gas storage capacity of the sample at infinite pressure and the Langmuir pressure is the pressure at which the gas storage capacity of the sample equals one-half the Langmuir storage capacity value.

Gas storage capacity is dependent upon pressure, temperature, and organic composition. Table 4 summarizes the effect that each of these parameters has on the gas storage capacity when all other parameters are held constant.

Table 4. Relative Effect of Various Parameters on Gas Storage Capacity

Parameters	As the Parameter:	Gas Storage Capacity:
Pressure	Increases	Increases
Temperature	Increases	Decreases
Moisture Content	Increases	Decreases
Vitrinite/Kerogen III Concentration	Increases	Increases
Thermal Maturity	Increases	Increases

Gas adsorbed in reservoirs typically contains gases other than methane, each gas having different adsorptive affinity, which is related to its atmospheric pressure boiling point. The extended Langmuir equation is used to model multi-component gas storage capacity when gas mixtures are present in coal reservoirs. Adsorption isotherm measurements are conducted independently for each gas component present and then combined mathematically with the extended Langmuir model to produce isotherm data that are representative of the reservoir's gas composition.

Multi-component isotherm relationships can be computed from single component data by use of extended Langmuir theory.[12] Equation 5 lists the extended Langmuir relationship.

$$G_{si} = G_{sLi} \frac{\dfrac{p y_i}{p_{Li}}}{1 + p \sum_{j=1}^{nc} \dfrac{y_i}{p_{Li}}} \qquad (5)$$

where:

G_{si}	*multi-component storage capacity of component i, scf/ton*
G_{sLi}	*single component Langmuir storage capacity of component i, scf/ton*
p_{Li}, p_{Lj}	*single component Langmuir pressure of component i or j, psia*
y_i or y_j	*mole fraction of component i or j in the free gas (vapor) phase, dimensionless*
nc	*number of components*
p	*pressure of the free gas phase, psia*

One limitation in the current application of Equations 4 and 5 is that gas storage capacity is a function of temperature. No simple method accounts for temperature variations unless the isotherms are measured at multiple temperatures. Consequently, the laboratory isotherm data should be measured at an average reservoir temperature or at multiple temperatures to allow for proper correction.

Initial reservoir gas saturation (gas content divided by gas storage capacity) and critical desorption pressure (pressure at which adsorbed gas is released from the adsorbed state) are estimated from the adsorption isotherm analysis and desorption data.[4] The critical desorption pressure is determined by calculating the pressure at which the in-situ gas content equals the in-situ gas storage capacity.

Analysis Results

This section provides summaries and discussions of the analytical results. Laboratory reports (raw data) are provided in the appendices where indicated.

Core Photography and Lithology

At the conclusion of the desorption tests, the samples were removed from desorption canisters. Digital photographs were taken and lithologic descriptions of the desorption samples immediately followed. Photographs and lithologies are included in Appendix I.

Gas Content, Diffusivity, and Sorption Time

The total gas content was determined by summing the lost gas content, measured gas content (desorbed gas content), and the gas content liberated from the crushed sample at the end of desorbed gas analysis. The gas volume measurements were corrected for canister and ambient temperature and ambient pressure variations. Gas contents were reported at standard conditions of 14.7 psia and 60°F. The total gas content estimate was based upon the air-dried sample mass. Residual moisture, moisture holding capacity, ash, and total sulfur content data were used to convert air-dry basis gas content data to other bases (i.e., dry; dry, ash-free; and in-situ bases). Figure 4 illustrates the lost, measured, and crushed gas content on an air-dry basis for each sample. The average air-dry, in-situ, and dry, ash-free adsorbed gas content estimates for core samples are summarized in Table 5. Desorption data including total gas content, measured gas content, and crushed gas content are illustrated in Appendix II.

For the core samples, lost gas contents were obtained from the early time gas content data using WFT Lab's modified version of the Direct Method.[5,6] Extrapolations were made of the early time desorption data measured at reservoir temperature to determine the lost gas content. The lost gas time (time interval used for lost gas extrapolations) ranged from 2.0 to 2.2 hours and all lost gas content values were less than 12% of the total gas content.

Measured gas contents determined from desorption tests for all desorption samples are presented in Table 5. Desorption graphs and data are included in Appendix II.

Crushed gas content was determined for all desorption samples. Crushed gas content data are presented in Table 5.

Diffusivity and sorption time estimates for the core samples are listed in Table 6. The diffusion values were obtained from the gradient of the lost gas slope. Sorption time was computed from the diffusivity values.

In many cases, there is a relationship between the total gas content and the inorganic content of each sample. Figure 5 illustrates this relationship listed in Equation 6. The relationship had a squared correlation coefficient of 0.1856, which was not statistically significant. The poor relationship was due to a limited number of points and a relatively small range in ash contents. The extrapolation to zero inorganic content suggested the organic fraction gas content was 251.2 scf/ton, which was smaller than the average dry, ash-free gas content of 359.5 scf/ton. Because of the poor relationship in the data, the average dry, ash-free gas content was the better gas content average to compare to the adsorption isotherm data to determine the degree of gas saturation.

$$G_c = 251.2 - 41.74(w_a + w_w + w_s) \tag{6}$$

where:

G_c total gas content, scf/ton
w_a ash content, weight fraction
w_w moisture content, weight fraction
w_s sulfur content, weight fraction

Figure 4. **Gas Content Data Summary**

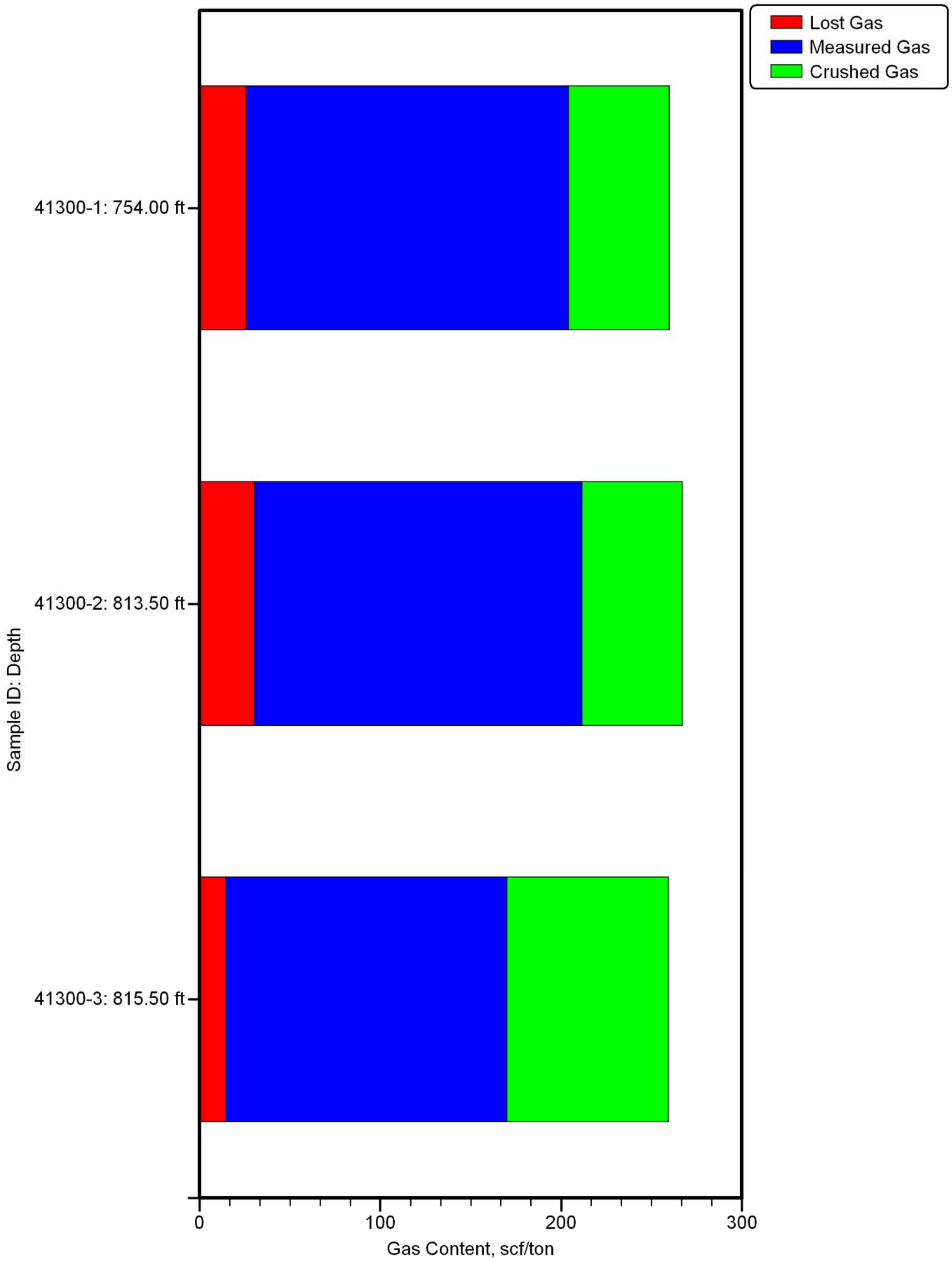


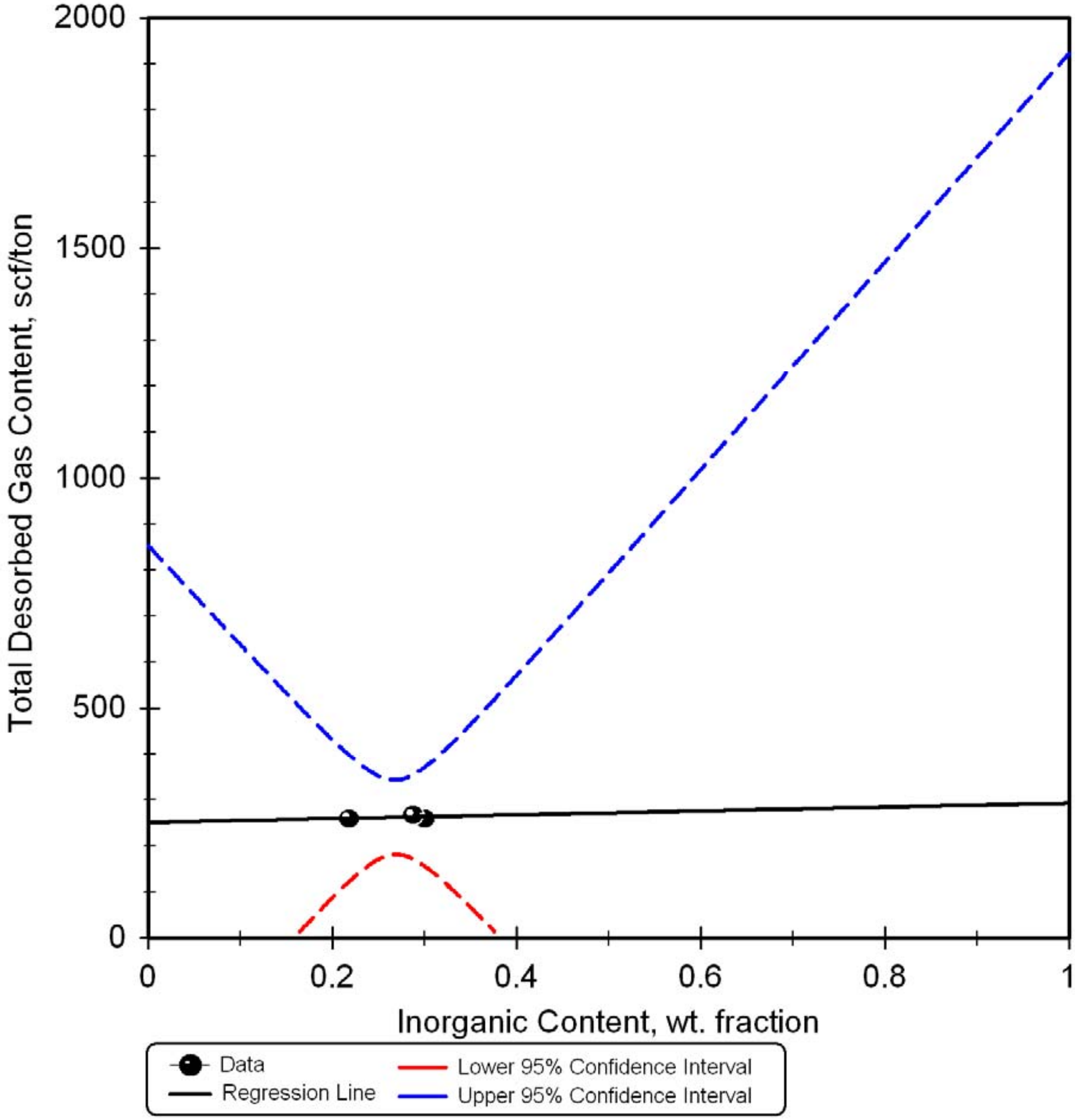
Table 5. **Gas Content Data**

Sample ID	Midpoint Depth	Mass	Lost Gas Time	Lost Gas Fraction	Measured Gas Fraction	Crushed Gas Fraction	Lost Gas Content	Measured Gas Content	Crushed Gas Content	Total Air-Dry Gas Content	Total Dry, Ash-Free Gas Content	Total In-Situ Gas Content
	ft	g	hours	%	%	%	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton
41300-1	754.0	2,200	2.06	10.15	68.45	21.40	26.4	178.1	55.7	260.2	371.8	259.5
41300-2	813.5	1,733	2.03	11.56	67.76	20.69	30.9	181.1	55.3	267.3	374.9	268.4
41300-3	815.5	2,186	2.19	5.72	59.93	34.35	14.9	155.6	89.1	259.6	331.7	259.6
Average	**-**	***2,040***	***2.09***	***9.14***	***65.38***	***25.48***	***24.1***	***171.6***	***66.7***	***262.3***	***359.5***	***262.5***

Table 6. **Diffusivity and Sorption Time Estimates**

Sample ID	Top Depth	Bottom Depth	Sorption Time	Diffusivity
	ft	ft	hr	1/µs
41300-1	753.5	754.5	151.7	0.122
41300-2	813.0	814.0	115.6	0.160
41300-3	815.0	816.0	511.8	0.036
Average	**-**	**-**	***259.7***	***0.106***

Figure 5. **Total Gas Content vs. Inorganic Content**



Gas Composition and Isotope Summary

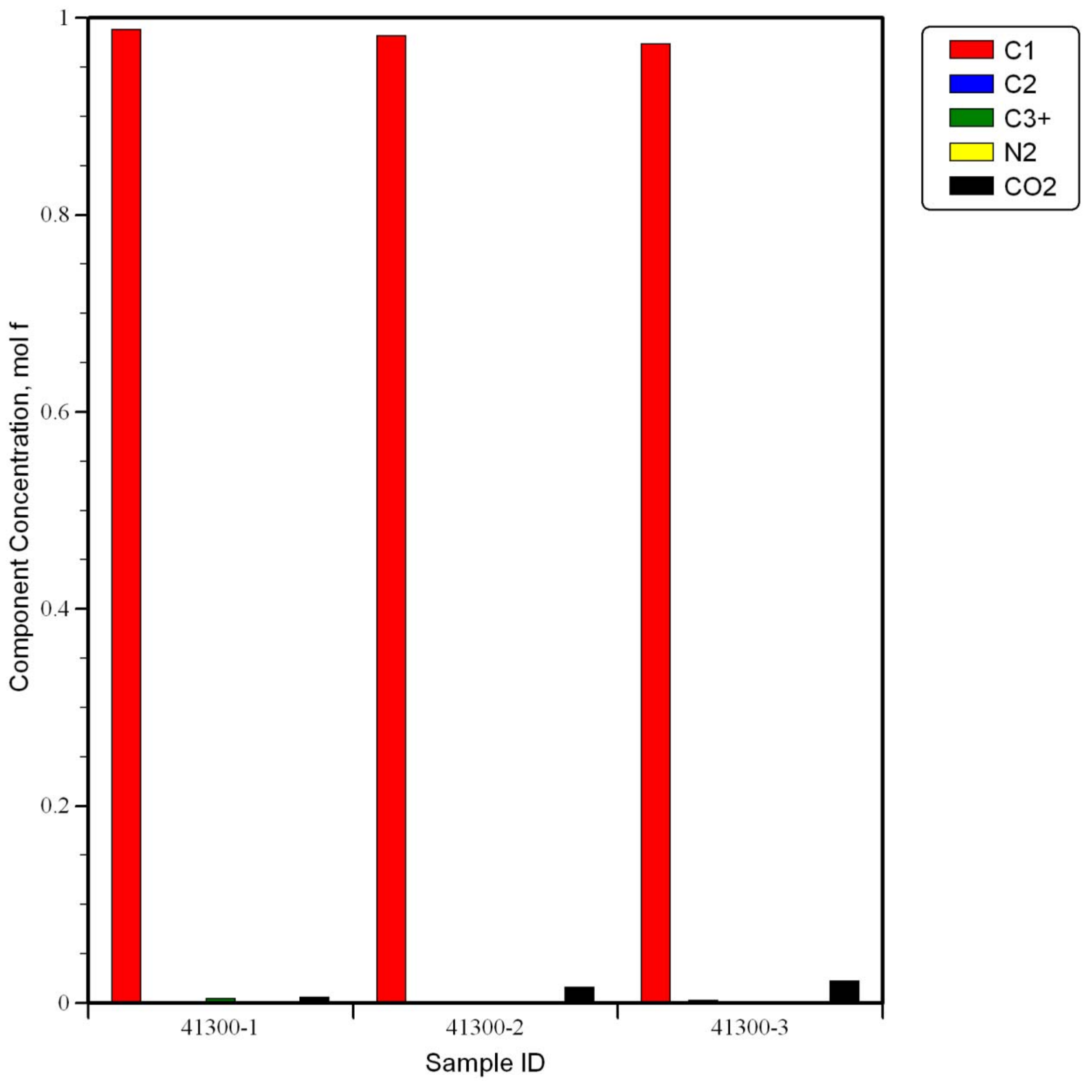
Natural gas produced from coal reservoirs may contain significant volumes of carbon dioxide, nitrogen, and other hydrocarbons in addition to methane. Knowledge of the desorbed gas composition is required to properly evaluate the gas storage capacity. Three canisters were dedicated to collection of multiple desorption gas samples. The gas compositions were corrected for air and hydrogen contamination. The degree of contamination was such that it was necessary to remove all of the nitrogen as well.

Table 7 summarizes the apparent adsorbed gas composition for three samples. The sorbed gas consisted primarily of methane (98.14 mol%). Carbon dioxide (1.48 mol%), propane and heavier hydrocarbons (0.23 mol%), and ethane (0.15 mol%) were also present in smaller concentrations. While nitrogen may be present in the adsorbed gas, contamination precluded an estimate for the adsorbed nitrogen content. Figure 6 graphically illustrates the apparent adsorbed gas composition of the samples. The original gas compositions, contamination corrected gas compositions, gas compositions as a function of desorption fractions, and integrated (adsorbed) gas compositions are all reported in Appendix III.

Table 7. Apparent Adsorbed Gas Composition Results

Sample ID	Midpoint Depth	C_1	C_2	C_{3+}	CO_2	Total
	ft	mol frac	mol frac	mol frac	mol frac	mol frac
41300-1	754.0	0.9885	0.0009	0.0045	0.0061	1.0000
41300-2	813.5	0.9817	0.0014	0.0012	0.0157	1.0000
41300-3	815.5	0.9739	0.0023	0.0012	0.0225	1.0000
Average	**-**	***0.9814***	***0.0015***	***0.0023***	***0.0148***	***1.0000***

Figure 6. Adsorbed Gas Composition



Data obtained from stable isotope analysis from the samples indicate the gas was thermogenic in origin. Results of isotopic analysis for the selected samples are listed in Table 8 and are illustrated by the colored dots in Figure 7 and Figure 8.

^{12}C is lighter than ^{13}C; therefore, it releases from the core samples sooner. This phenomenon was observed when multiple samples of released gas from the same core sample were compared over a period of time. Figure 8 illustrates the increase in ^{13}C concentration with time.

Table 8. Isotope Results

Parameter	Unit	41300-1-1	41300-1-A	41300-3-1	41300-3-A
Midpoint Depth	ft	754.0	754.0	815.5	815.5
Formation	-	Fruitland Coals			
Date/Time Sampled	mm/dd/yyyy hh:mm:ss	10/11/2008 8:32:00	12/10/2008 16:18:00	10/12/2008 16:14:00	12/11/2008 11:53:00
CO_2 Conc.	mol frac	0.6311	0.9242	2.8139	1.5686
C_1 Conc.	mol frac	99.3528	98.9394	96.9697	97.9085
C_2 Conc.	mol frac	0.0324	0.1152	0.1645	0.4405
C_3 Conc.	mol frac	0.0113	0.0015	0.0022	0.0065
iC_4 Conc.	mol frac	0.0065	0.0409	0.0022	0.0118
nC_4 Conc.	mol frac	0.0113	0.0015	0.0000	0.0013
iC_5 Conc.	mol frac	0.0049	0.0061	0.0000	0.0026
nC_5 Conc.	mol frac	0.0081	0.0000	0.0000	0.0000
C_{6+} Conc.	mol frac	0.0113	0.0030	0.0043	0.0026
Total	***mol frac***	***1.0000***	***1.0000***	***1.0000***	***1.0000***
$\delta^{13}C_1$	‰	-44.05	-41.93	-46.79	-40.84
δDC_1	‰	-221.0	-262.0	-232.0	-231.0

Figure 7. Natural Gas Classification (Carbon-Deuterium Stable Isotope Plot)

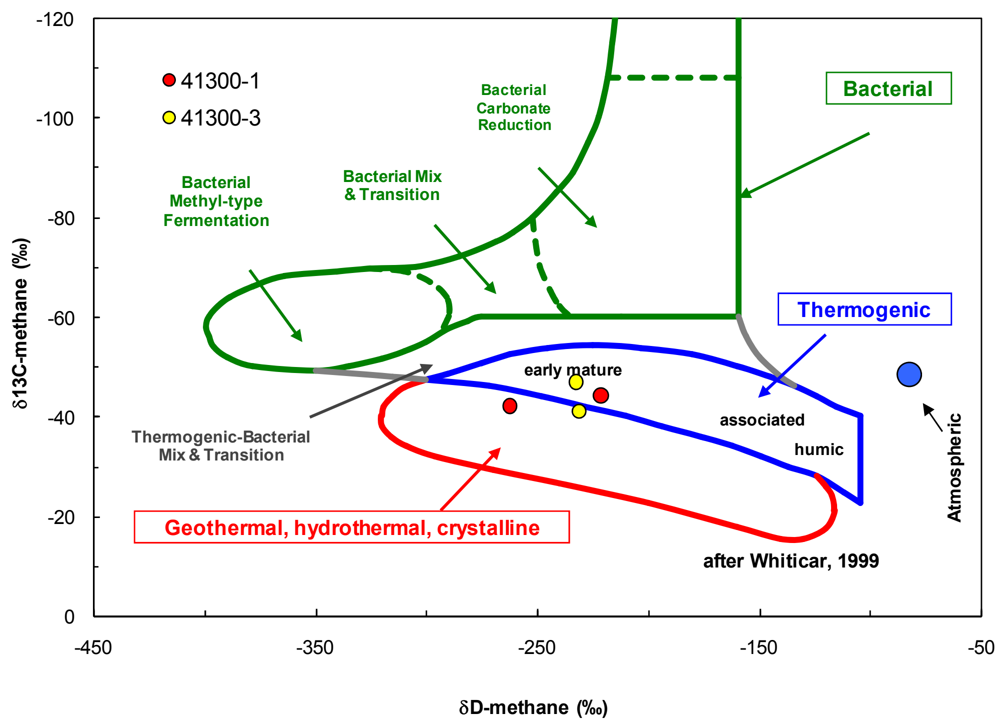
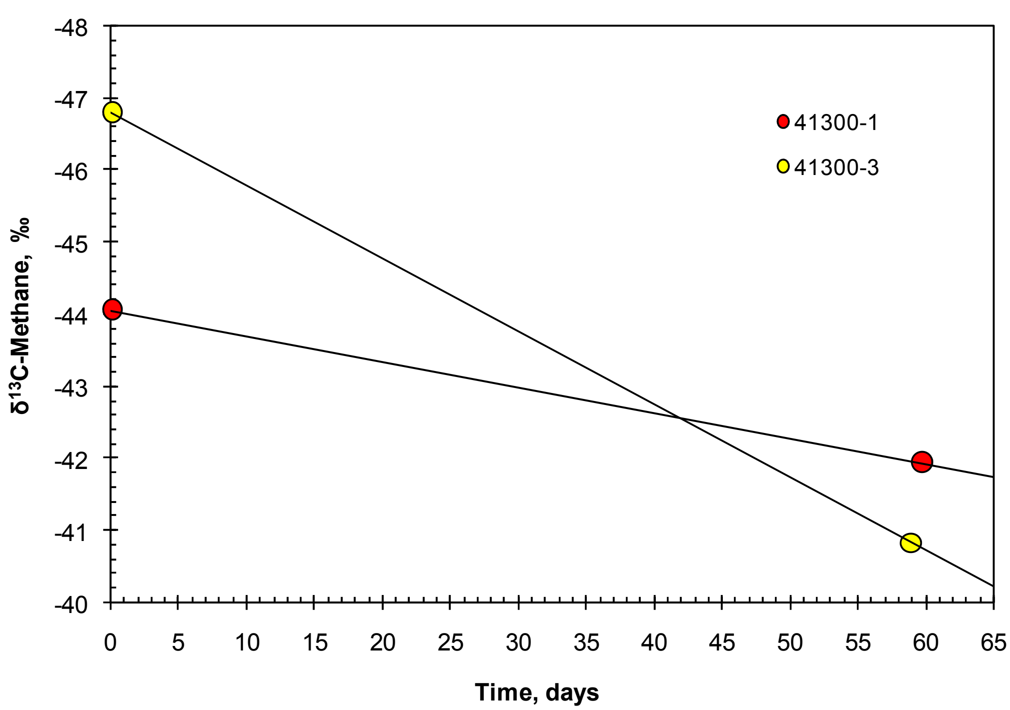


Figure 8. Carbon-13 Concentration vs. Time



Sample Bulk Composition and Property Analysis Results

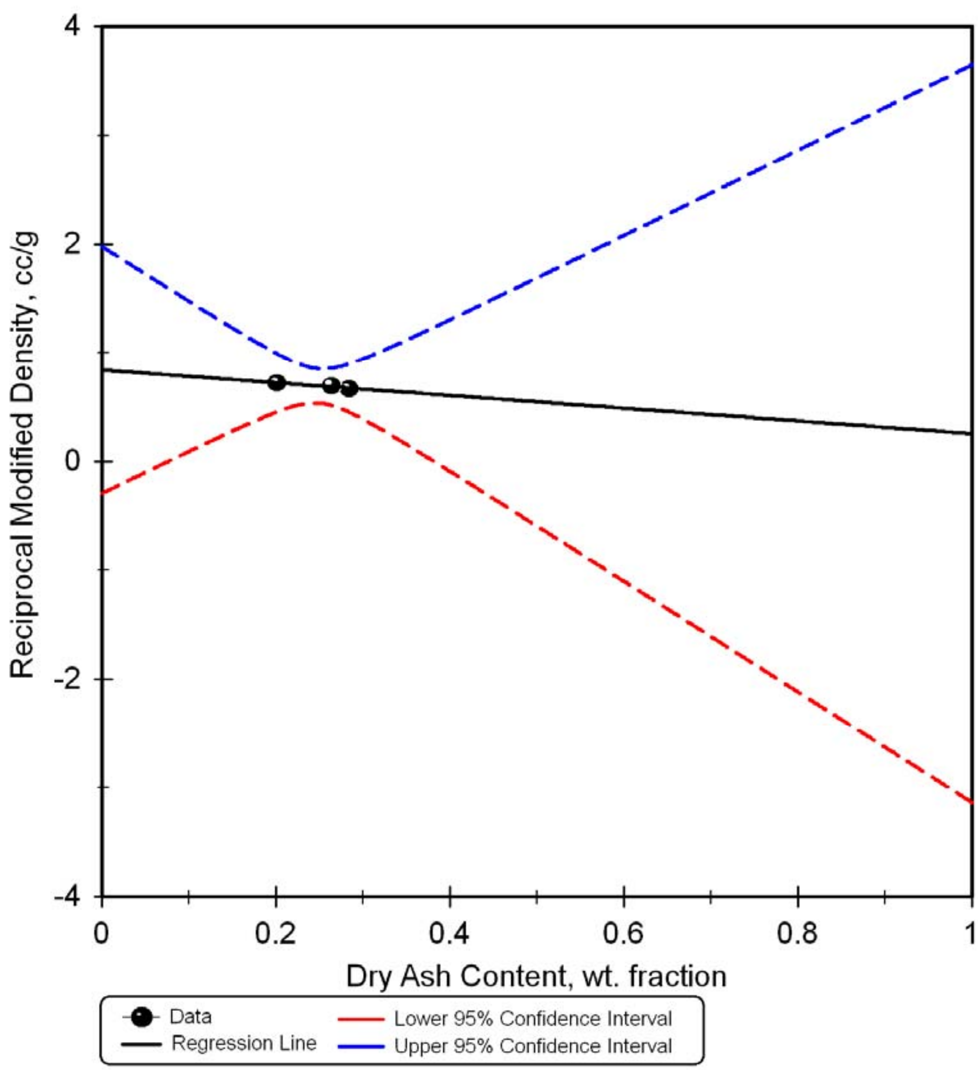
The crushed density, proximate analysis, ultimate analysis, total sulfur, sulfur in ash, gross calorific value, and petrography results for the selected core samples are discussed in the following sub-sections.

Crushed Density Results

Crushed density results are listed in Table 9. The density of coal varies as a function of its composition. Since the mineral matter component of the coal has a significantly higher density than the organic matter component, the density of coal varies as a function of its mineral matter content. The ash content of coal represents the mineral matter component of the coal. When total sulfur content is significant, the total mineral matter present is a function of the ash and sulfur content.

The average organic and inorganic (mineral matter) densities can often be estimated by linear regression of reciprocal density and ash content data.[4] Figure 9 illustrates the relationship between reciprocal modified density and dry ash content for the desorption samples. The relationship was statistically significant (squared correlation coefficient, 0.917).

Figure 9. Reciprocal Modified Density vs. Dry Ash Content



The estimated organic density was 1.184 g/cm^3 and the estimated inorganic density was 3.892 g/cm^3.The organic density of coal in the sub-bituminous and bituminous rank range varies between 1.18 to 1.40 g/cm^3 and depends upon the maceral composition.

The inorganic density is often between the densities of moist montmorillonite (2.12 g/cm^3), moist kaolinite (2.42 g/cm^3), and that of quartz (2.65 g/cm^3). Occasionally, values are observed that approach 3 g/cm^3 due to the presence of carbonates and heavy minerals. The average inorganic density value of 3.892 g/cm^3 was much greater than results observed in the past for San Juan Basin coal. Due to a limited number of points and a relatively small range in ash content, the organic and inorganic density estimates are subject to error.

Table 9. Crushed Density Data

Sample ID	Top Depth	Bottom Depth	Air-Dry Helium Density	In-Situ Helium Density
	ft	ft	g/cm^3	g/cm^3
41300-1	753.5	754.5	1.472	1.468
41300-2	813.0	814.0	1.411	1.417
41300-3	815.0	816.0	1.368	1.368
Average	**-**	**-**	***1.417***	***1.418***

Chemical Characterization Results

Residual moisture, ash, and total sulfur analyses are used to convert data reported on an as-received mass basis to other mass bases such as dry; dry, ash-free; mineral-matter-free (moist or dry); and in-situ bases. It is useful to report data on the dry mass basis to review data without the effect of moisture. It is also useful to report data on the dry, ash-free mass basis to review analyses normalized to 100% organic material. Dry, ash-free values are used to compare gas content and gas storage capacity between different zones or wells since the adsorbed gas is stored predominantly by organic material (i.e., the macerals in coal). Table 10 summarizes the proximate analysis results, which include residual moisture, moisture holding capacity, ash, volatile matter, and fixed carbon results for the desorption samples on an air-dry basis. Complete proximate analysis was performed only on samples selected for isotherm analysis. In-situ proximate analysis results have also been provided in Table 11.

Table 10. Air-Dry Proximate Analysis Data

Sample ID	Top Depth	Bottom Depth	Moisture Holding Capacity	Air-Dry Moisture Content	Air-Dry Ash Content	Air-Dry Volatile Matter Content	Air-Dry Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41300-1	753.5	754.5	0.0175	0.0151	0.2793	0.2832	0.4224
41300-2	813.0	814.0	0.0181	0.0221	0.2574	-	-
41300-3	815.0	816.0	0.0118	0.0120	0.1987	-	-
41300-COMP-1	813.0	816.0	0.0147	0.0134	0.2212	0.2910	0.4744
Average	**-**	**-**	***0.0155***	***0.0157***	***0.2392***	***0.2871***	***0.4484***

Table 11. In-Situ Proximate Analysis Data

Sample ID	Top Depth	Bottom Depth	In-Situ Moisture Content	In-Situ Ash Content	In-Situ Volatile Matter Content	In-Situ Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac
41300-1	753.5	754.5	0.0175	0.2786	0.2826	0.4213
41300-2	813.0	814.0	0.0181	0.2585	-	-
41300-3	815.0	816.0	0.0118	0.1988	-	-
41300-COMP-1	813.0	816.0	0.0147	0.2209	0.2906	0.4738
Average	**-**	**-**	***0.0155***	***0.2392***	***0.2866***	***0.4476***

Ultimate analysis data are summarized in Table 12 on a dry, ash-free basis. Complete ultimate analysis was performed only on samples selected for isotherm analysis. In-situ ultimate analysis results have also been provided in Table 13.

Table 12. Dry, Ash-Free Ultimate Analysis Data

Sample ID	Top Depth	Bottom Depth	Sulfur Content	Carbon Content	Nitrogen Content	Hydrogen Content	Oxygen Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41300-1	753.5	754.5	0.0084	0.8627	0.0183	0.0641	0.0466
41300-2	813.0	814.0	0.0103	-	-	-	-
41300-3	815.0	816.0	0.0085	-	-	-	-
41300-COMP-1	813.0	816.0	0.0092	0.8714	0.0182	0.0610	0.0402
Average	**-**	**-**	***0.0091***	***0.8671***	***0.0182***	***0.0625***	***0.0434***

Table 13. In-Situ Ultimate Analysis Data

Sample ID	Top Depth	Bottom Depth	Sulfur Content	Carbon Content	Hydrogen Content	Nitrogen Content	Oxygen Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41300-1	753.5	754.5	0.0059	0.6072	0.0129	0.0451	0.0328
41300-2	813.0	814.0	0.0074	-	-	-	-
41300-3	815.0	816.0	0.0067	-	-	-	-
41300-COMP-1	813.0	816.0	0.0070	0.6661	0.0139	0.0466	0.0307
Average	**-**	**-**	***0.0068***	***0.6367***	***0.0134***	***0.0459***	***0.0318***

Gross calorific value, fixed carbon content, and volatile matter content were determined to estimate the coal rank (thermal maturity) for the isotherm sample. The procedure documented in ASTM D 388 was used to correct ash content for sulfur in ash, to convert fixed carbon and volatile matter to a dry, mineral matter free basis, and to convert calorific value to a moist, mineral-matter-free basis.[13] The moisture holding capacity data were used to convert dry basis data to a moist basis.

Table 14 summarizes the chemical characterization of the isotherm samples. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm. This was not the case for the two isotherm samples. Vitrinite reflectance data provide more accurate results for coal rank classification.

Table 14. Chemical Characterization Data

Parameter	Unit	41300-1	41300-COMP-1
Top Depth	ft	753.5	813.0
Bottom Depth	ft	754.5	816.0
Chemical Characterization Data			
Moisture Holding Capacity, in-situ basis[1]	wt frac	0.0175	0.0147
Residual Moisture, as received basis	wt frac	0.0151	0.0134
Ash Content, moist basis[2]	wt frac	0.2786	0.2209
Sulfur Content, moist basis	wt frac	0.0059	0.0070
Volatile Matter Content, DMMF basis[3]	wt frac	0.5097	0.5039
Fixed Carbon Content, DMMF basis[3]	wt frac	0.4903	0.4961
Sulfur-in-Ash Content, moist basis	wt frac	0.0089	0.0038
Calorific Value, MMMF basis[4]	BTU/lbm	15,162	15,368

Notes:
1. Moisture holding capacity determined by moisture equilibration at 86°F for 72 hrs at 96-97% relative humidity.
2. Ash content corrected for sulfur-in-ash content.
3. DMMF = Dry, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.
4. MMMF = Moist, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.

Petrographic Characterization Results

This section provides a summary of the petrographic analytical results. Figure 10 illustrates the maceral composition summarized in Table 15, which also includes mineral results. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41300-1 was 0.96% in oil and for sample 41300-COMP-1 was 0.99% in oil, which placed the rank in the high volatile A bituminous range.

Figure 10. Mineral Matter-Free Basis Maceral Composition Summary

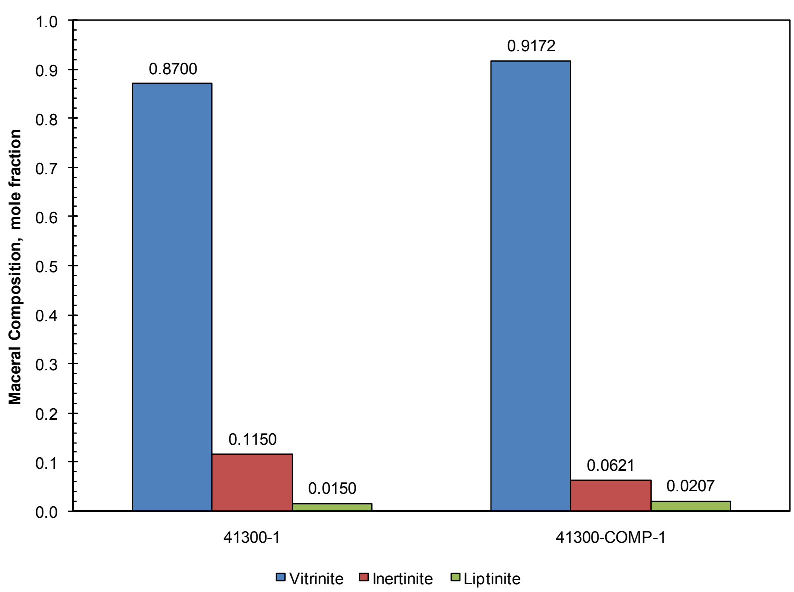


Table 15. Petrographic Data

Parameter	Unit	41300-1	41300-COMP-1
Vitrinite Group Macerals, Mineral-Matter Free Basis			
Telinite	vol frac	0.1550	0.1494
Collotelinite	vol frac	0.5525	0.4184
Vitrodetrinite	vol frac	0.0775	0.2690
Collodetrinite	vol frac	0.0000	0.0000
Corpogelinite	vol frac	0.0850	0.0805
Gelinite	vol frac	0.0000	0.0000
Total Vitrinite	***vol frac***	***0.8700***	***0.9172***
Inertinite Group Macerals, Mineral-Matter Free Basis			
Fusinite	vol frac	0.0550	0.0138
Semifusinite	vol frac	0.0500	0.0299
Micrinite	vol frac	0.0000	0.0000
Macrinite	vol frac	0.0050	0.0092
Secretinite	vol frac	0.0000	0.0000
Funginite	vol frac	0.0050	0.0092
Inertodetrinite	vol frac	0.0000	0.0000
Total Inertinite	***vol frac***	***0.1150***	***0.0621***
Liptinite Group Macerals, Mineral-Matter Free Basis			
Sporinite	vol frac	0.0025	0.0023
Cutinite	vol frac	0.0025	0.0046
Resinite	vol frac	0.0100	0.0138
Alginite	vol frac	0.0000	0.0000
Liptodetrinite	vol frac	0.0000	0.0000
Suberinite	vol frac	0.0000	0.0000
Exsudatinite	vol frac	0.0000	0.0000
Total Liptinite	***vol frac***	***0.0150***	***0.0207***
Mineral Composition, Maceral-Fee Basis			
Clay	vol frac	0.9100	0.9077
Quartz	vol frac	0.0200	0.0154
Carbonate	vol frac	0.0400	0.0000
Sulfide	vol frac	0.0300	0.0769
Total	***vol frac***	***1.0000***	***1.0000***
Vitrinite Reflectance			
Mean-Maximum Reflectance	% in oil	0.96	0.99
Standard Deviation	% in oil	0.05	0.05
Coal Rank based on Vitrinite Reflectance	-	high volatile A bituminous	

Adsorbed Gas Storage Capacity

Two methane isotherm measurements were performed by WFT Labs. The isotherm parameters and gas storage capacity estimates are summarized in Table 16. Figures 11 and 12 illustrate the methane storage capacity as a function of pressure on a dry, ash-free and in-situ basis, respectively.

Table 16. Coal Methane Adsorption Isotherm Parameters

Parameter	Unit	41300-1	41300-COMP-1
Sample Parameters			
Top Depth	ft	753.5	813.0
Bottom Depth	ft	754.5	816.0
Measurement Gas	-	Methane	Methane
Measurement Temperature	°F	75.0	75.0
Moisture Content, in-situ basis	wt frac	0.0175	0.0147
Ash Content, in-situ basis	wt frac	0.2786	0.2209
Sulfur Content, in-situ basis	wt frac	0.0059	0.0070
Organic Content, in-situ basis	wt frac	0.6980	0.7573
Vitrinite Content, mineral-matter-free basis	vol frac	0.870	0.917
inertinite Content, mineral-matter-free basis	vol frac	0.115	0.062
Liptinite Content, mineral matter-free basis	vol frac	0.015	0.021
Calorific Value, moist, mineral-matter-free basis	BTU/lbm	14,914	15,189
Langmuir Parameters			
Langmuir Storage Capacity, dry, ash-free	scf/ton	498.30	575.39
Langmuir Storage Capacity, in-situ	scf/ton	347.81	435.76
Langmuir Pressure	psia	219.22	208.14
Adsorbed Gas Storage Capacity			
Reservoir Pressure	psia	340.87	367.34
Storage Capacity, dry, ash-free	scf/ton	303.27	367.28
Storage Capacity, in-situ	scf/ton	211.68	278.15

For sample 41300-1, the dry, ash-free Langmuir storage capacity was 498.3 scf/ton, the in-situ Langmuir storage capacity was 347.8 scf/ton, and the Langmuir pressure was 219.2 psia. At a reservoir pressure of 340.9 psia, the in-situ storage capacity was 211.7 scf/ton.

For sample 41300-COMP-1, the dry, ash-free Langmuir storage capacity was 575.4 scf/ton, the in-situ Langmuir storage capacity was 435.8 scf/ton, and the Langmuir pressure was 208.1 psia. At a reservoir pressure of 367.3 psia, the in-situ storage capacity was 278.2 scf/ton.

If the reservoir pressure gradient of 0.433 psi/ft is correct, then the average dry, ash-free gas content of 359.5 scf/ton is slightly greater than the average dry, ash-free gas storage capacity of 333.9 scf/ton, which indicated the reservoir was saturated. The conclusion may not be accurate if the estimated reservoir conditions were incorrect, e.g. reservoir pressure was underestimated, or reservoir temperature was overestimated.

Figure 11. **Dry, Ash-Free Methane Isotherm**

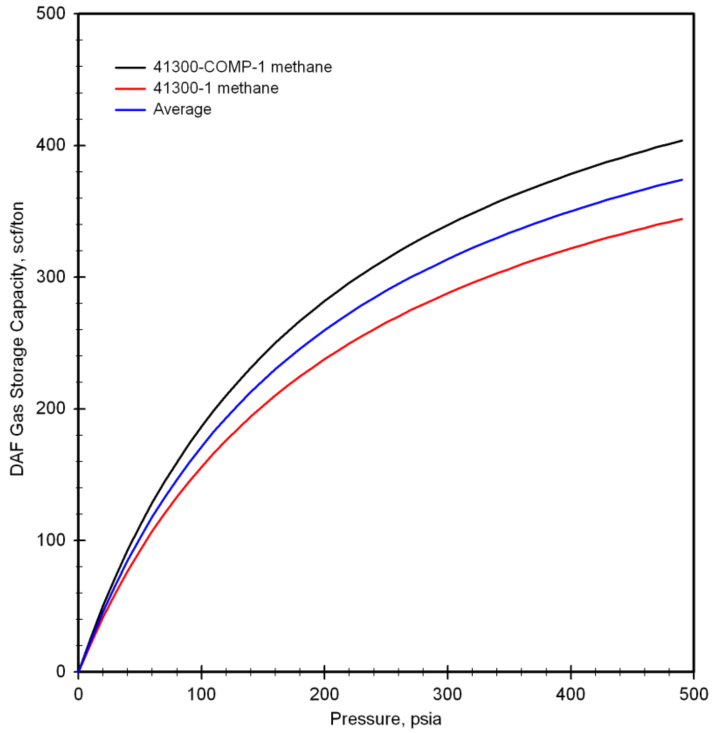
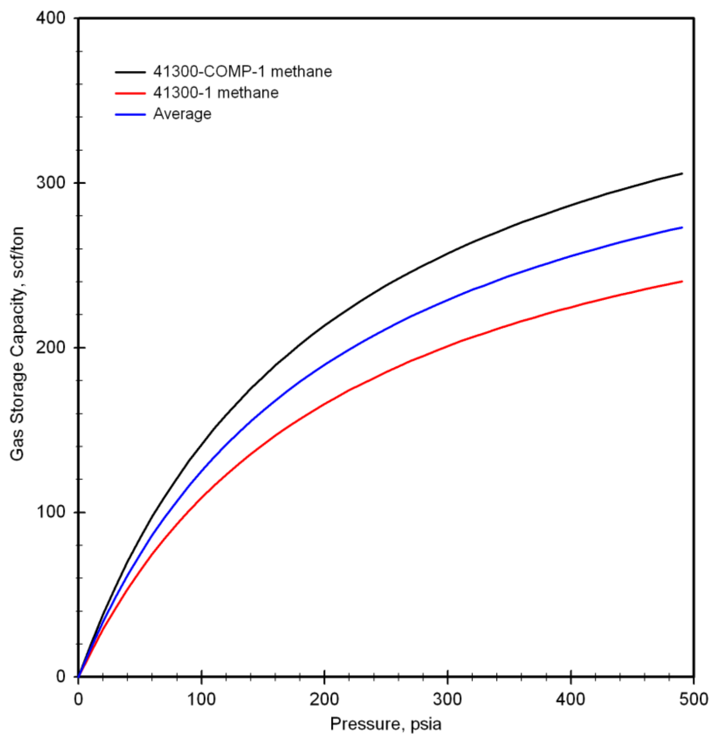


Figure 12. **In-Situ Methane Isotherms**



Adsorbed Gas-in-Place Estimate

Adsorbed gas-in-place (GIP) volume was determined for a unit coal thickness based upon the gas content and density data. Gas-in-place per unit thickness volumes were computed with Equation 8.[4]

$$\frac{G}{Ah} = 1.3597 \rho G_c \tag{8}$$

where:

G *gas-in-place volume, Mscf*
A *reservoir area, acres*
h *reservoir thickness, ft*
ρ *average in-situ density, g/cm^3*
G_c *average in-situ gas content, scf/ton*

The in-situ density and gas content values from the three desorbed core the samples were used for these estimates. Estimated GIP values per unit volume were reported in thousands of cubic feet at standard conditions per unit reservoir volume in acre-feet. These estimates are summarized in Table 17. This table can be used with coal thickness estimates from log data and assumed drainage areas to compute the volume of gas-in-place in an area of interest.

Table 17. Gas-in-Place per Unit Volume Summary

Formation	Top Depth	Bottom Depth	In-Situ Density	In-Situ Gas Content	Gas-In-Place per Volume
	ft	ft	g/cm^3	scf/ton	Mscf/acre-ft
Fruitland Coals	753.5	816.0	1.418	262.5	506.1

Final Summary

Weatherford Laboratories measured properties of three core samples recovered from Fruitland Coals penetrated by the Souder, Miller & Associates' MW-34-5-4 well between October 11 and October 12, 2008. Core was collected between 749 and 826 ft. The goals of this project were to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coals at the well location.

Three core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. All three desorption samples were dedicated to collection of multiple gas composition and two desorption samples were dedicated to collection of isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all core samples. Coal characterization was determined for one desorption sample and one composite sample, which included chemical (proximate analysis, ultimate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). One desorption sample and one composite sample were characterized and used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

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Appendix I

Souder, Miller & Associates
MW-34-5-4
Fruitland Coals

Core Lithology and Photography

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Core Lithology

Client Name: Souder, Miller & Associates **Well Name:** MW-34-5-4 **Job Number:** 41300

SAMPLE ID.	CANISTER ID.	SAMPLE INTERVAL			DESCRIPTION	
		Depth Drilled (feet)	Length (inches)	Core Diameter (inches)	Core Surface Texture	Comments
41300-1	GT-83	753.5-754.5	12.0?	3.50	(coaly) rough	Interbedded black bright coal (35%) and coaly shale to dull coal, mostly rubble, no fractures, massive? bedding, one set of nearly vertical cleats in the bright coal layers with 1-10mm spacing, cleats are tight with calcite mineralization
41300-2	GT-184	813.0-814.0	12.0?	3.5?	(coaly) rough	Black shaly coal, 15% bright coal in layers, mostly rubble, no fractures, cleats with 3-12mm spacing and possible mineralization in bright layers, picture is representative of rubblized sample
41300-3	GT-210	815.0-816.0	11.0?	3.50	(coaly) rough	Black shaly coal, 15% bright coal lenses, partial rubble, possibly poorly developed cleats in varying orientations, sign of stress and shearing, well mixed sediment, no mineralization observed

Lithologist(s): D. Rogers

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Core Photography

Souder, Miller & Associates

MW-34-5-4

Fruitland Coals	41300-1	753.5-754.5 feet

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Core Photography

Souder, Miller & Associates

MW-34-5-4

Fruitland Coals	41300-2	813.0-814.0 feet

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Core Photography

Souder, Miller & Associates

MW-34-5-4

Fruitland Coals	**41300-3**	**815.0-816.0 feet**

Appendix II

Souder, Miller & Associates
MW-34-5-4
Fruitland Coals

Desorption Data and Graphs

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Sample 41300-1 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	feet	753.5
Sample Bottom Depth	feet	754.5
Reservoir Pressure	psia	341.18
Reservoir Pressure Gradient	psi/ft	0.4330
Mud Hydrostatic Pressure	psia	347.63
Mud Density	lbm/gal	8.50
Sample Mass	g	2,200.0
Sample Headspace Volume	cm^3	220.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/11/2008 15:22:45
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/11/2008 16:04:12
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/11/2008 16:05:35
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/11/2008 17:16:14
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/11/2008 18:09:10
Lost Gas Time	hours	2.060
Desorption Time Correction	hours	0.047
Fit Start Time	hours	2.059
Fit End Time	hours	2.165
Fit Start Time	$hours^{0.5}$	1.435
Fit End Time	$hours^{0.5}$	1.471
Lost Gas Content	scf/ton	26.4
Measured Gas Content	scf/ton	178.1
Crushed Gas Content	scf/ton	55.7
Total Gas Content	scf/ton	260.2
Lost Gas Fraction	vol frac	0.1015
Measured Gas Fraction	vol frac	0.6845
Crushed Gas Fraction	vol frac	0.2140
Diffusivity	1/us	0.1
Sorption Time	hours	151.7

Sample 41300-1 Desorption History

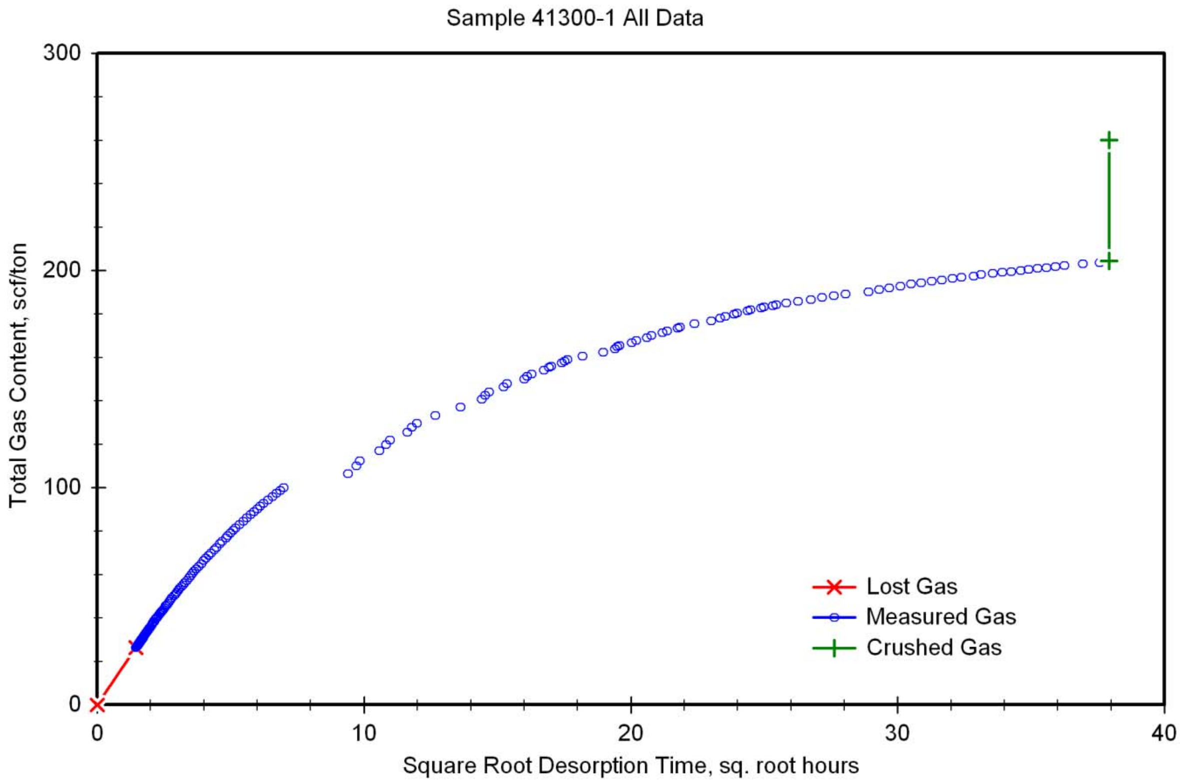
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	$hours^{0.5}$	cm^3	cm^3	°F	°F	psia	scf/ton
10/11/2008 18:09:10	2.0597	1.4352	0.0	0.0	74.1	65.3	11.09	0.00
10/11/2008 18:12:00	2.0595	1.4351	12.0	9.0	74.1	65.3	11.09	0.13
10/11/2008 18:14:00	2.0928	1.4467	25.0	18.6	74.5	65.3	11.09	0.40
10/11/2008 18:16:00	2.1262	1.4581	10.0	7.5	74.5	65.3	11.09	0.51
10/11/2008 18:17:59	2.1592	1.4694	18.0	13.3	74.7	65.3	11.09	0.70
10/11/2008 18:20:00	2.1928	1.4808	8.0	6.0	74.8	64.9	11.09	0.79
10/11/2008 18:22:00	2.2262	1.4920	15.0	11.2	74.8	64.8	11.09	0.95
10/11/2008 18:24:00	2.2595	1.5032	17.0	12.7	74.8	64.6	11.09	1.14
10/11/2008 18:26:00	2.2928	1.5142	20.0	15.0	74.8	64.2	11.09	1.36
10/11/2008 18:27:59	2.3259	1.5251	17.0	12.7	74.8	63.9	11.09	1.54
10/11/2008 18:30:00	2.3595	1.5361	18.0	13.5	74.8	63.5	11.09	1.74
10/11/2008 18:32:00	2.3928	1.5469	26.0	19.5	75.0	62.8	11.09	2.02
10/11/2008 18:34:59	2.4426	1.5629	29.0	21.8	75.0	62.6	11.10	2.34
10/11/2008 18:38:00	2.4928	1.5789	16.0	12.0	74.8	62.6	11.10	2.51
10/11/2008 18:40:00	2.5262	1.5894	17.0	12.7	74.8	62.4	11.10	2.70
10/11/2008 18:42:00	2.5595	1.5998	20.0	15.0	75.0	62.1	11.10	2.92
10/11/2008 18:44:00	2.5928	1.6102	13.0	9.8	74.8	62.1	11.10	3.06
10/11/2008 18:46:00	2.6262	1.6205	16.0	12.0	74.8	61.9	11.09	3.23
10/11/2008 18:48:00	2.6595	1.6308	21.0	15.8	74.8	61.7	11.09	3.46
10/11/2008 18:49:59	2.6926	1.6409	15.0	11.3	74.8	61.5	11.09	3.63
10/11/2008 18:52:00	2.7262	1.6511	17.0	12.8	74.8	61.5	11.09	3.81
10/11/2008 18:53:59	2.7592	1.6611	24.0	18.1	74.7	61.3	11.09	4.08
10/11/2008 18:56:00	2.7928	1.6712	16.0	12.1	74.8	61.2	11.10	4.25
10/11/2008 18:58:00	2.8262	1.6811	14.0	10.5	74.8	61.2	11.09	4.41
10/11/2008 19:00:00	2.8595	1.6910	13.0	9.8	74.8	61.2	11.09	4.55
10/11/2008 19:02:00	2.8928	1.7008	17.0	12.8	74.7	61.0	11.09	4.73
10/11/2008 19:04:00	2.9262	1.7106	14.0	10.5	74.7	61.0	11.10	4.89
10/11/2008 19:05:59	2.9592	1.7202	17.0	12.7	74.7	60.8	11.09	5.07
10/11/2008 19:08:00	2.9928	1.7300	16.0	12.1	74.7	60.8	11.09	5.25
10/11/2008 19:12:00	3.0595	1.7491	34.0	25.6	74.5	60.8	11.09	5.62
10/11/2008 19:14:00	3.0928	1.7586	18.0	13.6	74.5	60.8	11.09	5.82
10/11/2008 19:18:00	3.1595	1.7775	28.0	21.1	74.5	60.6	11.09	6.13
10/11/2008 19:21:59	3.2259	1.7961	32.0	24.1	74.5	60.3	11.09	6.48
10/11/2008 19:26:00	3.2928	1.8146	28.0	21.1	74.5	60.3	11.09	6.79
10/11/2008 19:30:00	3.3595	1.8329	32.0	24.1	74.3	60.3	11.09	7.14
10/11/2008 19:34:00	3.4262	1.8510	33.0	24.9	74.1	60.3	11.09	7.50

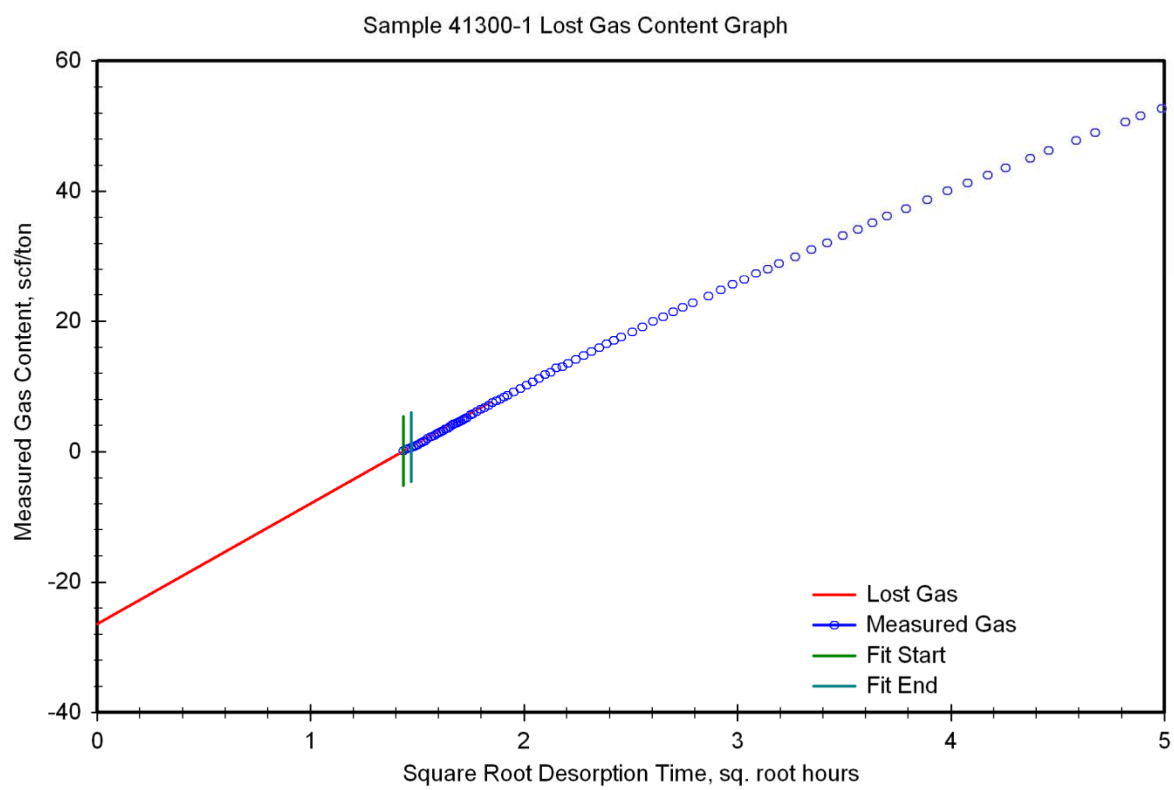
10/11/2008 19:38:00	3.4928	1.8689	25.0	18.9	74.1	60.3	11.10	7.77
10/11/2008 19:42:00	3.5595	1.8867	29.0	21.8	74.1	60.3	11.09	8.09
10/11/2008 19:46:00	3.6262	1.9043	25.0	18.9	73.9	60.3	11.09	8.37
10/11/2008 19:50:00	3.6928	1.9217	27.0	20.4	73.9	60.4	11.09	8.66
10/11/2008 19:57:00	3.8095	1.9518	48.0	36.2	73.9	60.4	11.09	9.19
10/11/2008 20:04:00	3.9262	1.9815	45.0	33.9	73.9	60.6	11.10	9.68
10/11/2008 20:11:00	4.0428	2.0107	49.0	36.9	73.8	60.8	11.10	10.22
10/11/2008 20:18:00	4.1595	2.0395	45.0	33.9	73.6	60.8	11.09	10.72
10/11/2008 20:25:00	4.2762	2.0679	47.0	35.4	73.4	61.0	11.09	11.23
10/11/2008 20:32:00	4.3928	2.0959	52.0	39.1	73.6	61.2	11.09	11.80
10/11/2008 20:39:00	4.5095	2.1236	36.0	27.1	73.6	61.3	11.10	12.20
10/11/2008 20:46:00	4.6262	2.1509	60.0	45.2	73.8	61.3	11.10	12.85
10/11/2008 20:53:00	4.7428	2.1778	22.0	16.6	73.6	61.5	11.10	13.10
10/11/2008 21:00:00	4.8595	2.2044	42.0	31.7	73.4	61.5	11.11	13.56
10/11/2008 21:10:00	5.0262	2.2419	55.0	41.5	73.6	61.5	11.13	14.16
10/11/2008 21:20:00	5.1928	2.2788	56.0	42.2	73.2	61.3	11.12	14.78
10/11/2008 21:30:00	5.3595	2.3151	53.0	40.0	73.4	61.3	11.12	15.36
10/11/2008 21:40:00	5.5262	2.3508	55.0	41.4	73.6	61.2	11.12	15.96
10/11/2008 21:49:59	5.6926	2.3859	54.0	40.8	73.4	61.0	11.12	16.56
10/11/2008 22:00:00	5.8595	2.4206	49.0	37.0	73.4	60.8	11.12	17.10
10/11/2008 22:10:00	6.0262	2.4548	46.0	34.7	73.4	60.8	11.12	17.60
10/11/2008 22:25:00	6.2762	2.5052	72.0	54.5	73.4	60.1	11.13	18.39
10/11/2008 22:40:00	6.5262	2.5546	72.0	54.6	73.4	59.9	11.13	19.19
10/11/2008 22:55:00	6.7762	2.6031	70.0	52.9	73.4	59.5	11.12	19.96
10/11/2008 23:10:00	7.0262	2.6507	66.0	50.1	73.4	59.0	11.13	20.69
10/11/2008 23:25:00	7.2762	2.6974	69.0	52.4	73.4	58.5	11.13	21.45
10/11/2008 23:40:00	7.5262	2.7434	61.0	46.4	73.4	58.1	11.14	22.13
10/11/2008 23:55:00	7.7762	2.7886	65.0	49.5	73.4	57.7	11.14	22.85
10/12/2008 00:20:00	8.1928	2.8623	95.0	72.4	73.2	57.2	11.14	23.90
10/12/2008 00:40:00	8.5262	2.9200	80.0	61.1	73.4	56.5	11.15	24.79
10/12/2008 01:00:00	8.8595	2.9765	75.0	57.4	73.2	55.9	11.15	25.63
10/12/2008 01:19:59	9.1926	3.0319	77.0	58.9	73.0	55.4	11.15	26.49
10/12/2008 01:40:00	9.5262	3.0865	80.0	61.1	74.1	54.9	11.15	27.37
10/12/2008 02:00:00	9.8595	3.1400	66.0	50.7	73.9	54.3	11.16	28.11
10/12/2008 02:19:59	10.1926	3.1926	70.0	53.8	73.8	53.8	11.16	28.90
10/12/2008 02:49:59	10.6926	3.2699	96.0	73.9	73.8	53.1	11.16	29.97
10/12/2008 03:20:00	11.1928	3.3456	98.0	75.6	73.8	52.3	11.17	31.07
10/12/2008 03:49:59	11.6926	3.4194	95.0	73.2	73.8	52.0	11.16	32.14
10/12/2008 04:19:59	12.1926	3.4918	98.0	75.6	73.8	52.0	11.16	33.24
10/12/2008 04:50:00	12.6928	3.5627	88.0	68.0	73.8	51.3	11.16	34.23
10/12/2008 05:19:59	13.1926	3.6322	90.0	69.3	74.1	53.2	11.17	35.24

10/12/2008 05:49:59	13.6926	3.7003	88.0	67.5	74.1	55.4	11.17	36.22
10/12/2008 06:30:00	14.3595	3.7894	103.0	78.7	74.1	57.4	11.17	37.37
10/12/2008 07:15:00	15.1095	3.8871	120.0	92.4	74.3	53.8	11.18	38.71
10/12/2008 08:00:00	15.8595	3.9824	121.0	93.0	74.1	54.7	11.18	40.07
10/12/2008 08:45:00	16.6095	4.0755	108.0	82.7	73.9	57.2	11.19	41.27
10/12/2008 09:32:00	17.3928	4.1705	107.0	82.2	74.3	55.4	11.19	42.47
10/12/2008 10:15:00	18.1095	4.2555	106.0	81.0	74.3	58.3	11.19	43.65
10/12/2008 11:15:00	19.1095	4.3714	130.0	98.8	74.5	60.6	11.19	45.09
10/12/2008 12:00:00	19.8595	4.4564	106.0	80.4	74.3	62.1	11.20	46.26
10/12/2008 13:10:00	21.0262	4.5854	141.0	106.3	74.3	65.5	11.20	47.81
10/12/2008 14:00:00	21.8595	4.6754	110.0	83.0	74.1	65.1	11.19	49.02
10/12/2008 15:20:00	23.1928	4.8159	150.0	113.3	74.5	64.9	11.20	50.67
10/12/2008 16:01:00	23.8762	4.8863	85.0	64.6	74.7	62.1	11.21	51.61
10/12/2008 17:00:00	24.8595	4.9859	105.0	80.4	74.1	58.5	11.22	52.78
10/12/2008 18:01:59	25.8926	5.0885	108.0	82.8	73.8	58.5	11.23	53.98
10/12/2008 19:00:00	26.8595	5.1826	109.0	82.7	73.8	63.9	11.24	55.19
10/12/2008 20:30:00	28.3595	5.3254	135.0	103.1	74.1	61.7	11.26	56.69
10/12/2008 22:00:00	29.8595	5.4644	135.0	103.4	74.1	60.3	11.26	58.19
10/12/2008 23:30:00	31.3595	5.6000	137.0	105.4	73.9	58.3	11.27	59.73
10/13/2008 01:00:00	32.8595	5.7323	133.0	102.7	73.9	56.3	11.27	61.22
10/13/2008 02:30:00	34.3595	5.8617	131.0	101.6	73.9	54.7	11.28	62.70
10/13/2008 04:00:00	35.8595	5.9883	110.0	85.2	73.9	54.7	11.27	63.94
10/13/2008 05:30:00	37.3595	6.1122	121.0	93.9	73.9	54.0	11.28	65.31
10/13/2008 07:00:00	38.8595	6.2337	109.0	84.9	73.9	52.7	11.28	66.55
10/13/2008 09:00:00	40.8595	6.3921	135.0	105.1	73.8	53.2	11.30	68.08
10/13/2008 11:00:00	42.8595	6.5467	138.0	106.1	74.1	64.2	11.39	69.62
10/13/2008 13:00:00	44.8595	6.6977	136.0	101.9	74.1	65.7	11.29	71.11
10/13/2008 15:00:00	46.8595	6.8454	127.0	97.7	74.1	59.2	11.29	72.53
10/13/2008 16:45:00	48.6095	6.9721	115.0	88.8	73.9	56.3	11.28	73.82
10/15/2008 08:27:00	88.3095	9.3973	549.0	437.8	75.0	69.8	11.94	80.20
10/15/2008 14:14:00	94.0928	9.7001	312.0	245.5	75.9	73.2	11.90	83.78
10/15/2008 16:45:00	96.6095	9.8290	199.0	156.8	76.1	73.4	11.89	86.06
10/16/2008 07:59:00	111.8428	10.5756	391.0	310.2	75.2	70.3	11.89	90.58
10/16/2008 13:02:59	116.9092	10.8125	270.0	210.9	76.5	75.5	11.87	93.65
10/16/2008 16:15:00	120.1095	10.9594	171.0	133.8	76.8	75.7	11.86	95.60
10/17/2008 06:48:00	134.6595	11.6043	325.0	257.6	76.3	72.8	11.94	99.35
10/17/2008 11:10:00	139.0262	11.7909	192.0	152.0	76.3	73.7	11.94	101.56
10/17/2008 15:17:59	143.1592	11.9649	161.0	125.5	77.5	78.4	11.92	103.39
10/18/2008 08:16:00	160.1262	12.6541	309.0	244.6	76.1	71.2	11.89	106.95
10/19/2008 09:20:00	185.1928	13.6086	329.0	258.9	75.6	72.6	11.86	110.72
10/20/2008 07:44:00	207.5928	14.4081	321.0	254.1	74.8	73.5	11.94	114.42

10/20/2008 11:29:00	211.3428	14.5376	170.0	134.0	75.2	74.4	11.93	116.37
10/20/2008 15:31:00	215.3762	14.6757	125.0	97.6	74.7	74.1	11.87	117.79
10/21/2008 07:59:00	231.8428	15.2264	212.0	166.3	73.8	70.3	11.80	120.21
10/21/2008 11:42:59	235.5759	15.3485	117.0	91.5	73.8	72.3	11.79	121.54
10/22/2008 08:04:59	255.9426	15.9982	196.0	157.2	72.9	67.4	11.95	123.83
10/22/2008 11:46:00	259.6262	16.1129	105.0	83.0	73.6	72.5	11.94	125.04
10/22/2008 16:38:59	264.5092	16.2637	96.0	75.4	73.8	74.4	11.93	126.14
10/23/2008 08:18:00	280.1595	16.7380	137.0	108.0	72.9	67.4	11.85	127.71
10/23/2008 14:42:00	286.5595	16.9281	112.0	86.7	73.9	73.7	11.80	128.98
10/23/2008 17:08:00	288.9928	16.9998	62.0	48.1	74.7	74.3	11.80	129.68
10/24/2008 06:59:00	302.8428	17.4024	127.0	100.4	73.2	68.3	11.81	131.14
10/24/2008 10:50:00	306.6928	17.5126	73.0	57.6	73.2	70.8	11.83	131.98
10/24/2008 14:12:00	310.0595	17.6085	58.0	44.5	74.5	74.8	11.81	132.63
10/25/2008 10:50:00	330.6928	18.1850	143.0	112.2	73.9	72.6	11.81	134.26
10/26/2008 15:12:00	359.0595	18.9489	164.0	130.3	74.1	74.3	11.99	136.16
10/27/2008 08:23:00	376.2428	19.3970	139.0	111.9	73.6	68.1	12.02	137.79
10/27/2008 11:54:00	379.7595	19.4874	73.0	58.7	73.0	68.1	12.01	138.64
10/27/2008 15:08:00	382.9928	19.5702	54.0	41.8	74.1	74.3	11.96	139.25
10/28/2008 09:00:00	400.8595	20.0215	105.0	83.9	73.8	70.1	11.97	140.47
10/28/2008 16:04:00	407.9262	20.1972	88.0	66.9	76.3	86.1	11.94	141.45
10/29/2008 08:26:00	424.2928	20.5984	115.0	91.0	75.2	71.7	11.91	142.77
10/29/2008 15:40:00	431.5262	20.7732	85.0	64.9	76.1	78.8	11.85	143.72
10/30/2008 08:51:59	448.7259	21.1832	113.0	88.8	75.7	75.0	11.88	145.01
10/30/2008 16:05:00	455.9428	21.3528	80.0	62.7	76.6	76.3	11.90	145.92
10/31/2008 09:27:59	473.3259	21.7561	105.0	83.2	76.6	75.1	11.98	147.14
10/31/2008 13:24:00	477.2595	21.8463	58.0	45.4	76.8	76.5	11.96	147.80
11/01/2008 13:02:00	500.8928	22.3806	114.0	89.1	76.6	76.1	11.92	149.09
11/02/2008 17:45:00	529.6095	23.0132	139.0	105.0	76.6	76.5	11.74	150.62
11/03/2008 09:13:00	545.0762	23.3469	104.0	81.2	74.1	74.3	11.78	151.80
11/03/2008 17:30:00	553.3595	23.5236	73.0	55.2	76.1	79.1	11.75	152.61
11/04/2008 09:39:00	569.5095	23.8644	89.0	68.8	73.4	70.7	11.66	153.61
11/04/2008 15:01:59	574.8926	23.9769	49.0	36.6	74.5	74.7	11.62	154.14
11/05/2008 10:43:00	594.5762	24.3839	85.0	65.8	74.8	73.3	11.66	155.10
11/05/2008 15:38:00	599.4928	24.4845	48.0	37.3	73.8	73.1	11.69	155.64
11/06/2008 10:34:59	618.4426	24.8685	68.0	53.2	73.6	72.9	11.77	156.42
11/06/2008 15:27:00	623.3095	24.9662	39.0	30.4	74.5	73.4	11.79	156.86
11/07/2008 09:13:00	641.0762	25.3195	62.0	48.6	74.1	72.9	11.80	157.57
11/07/2008 15:31:00	647.3762	25.4436	45.0	34.8	75.4	72.9	11.80	158.08
11/08/2008 10:31:59	666.3926	25.8146	52.0	40.7	73.4	73.0	11.80	158.67
11/09/2008 09:33:00	689.4095	26.2566	73.0	55.3	73.6	73.5	11.71	159.48
11/10/2008 10:50:59	714.7092	26.7340	81.0	61.5	74.1	76.8	11.66	160.37

11/11/2008 09:52:00	737.7262	27.1611	76.0	58.7	73.8	78.2	11.75	161.23
11/12/2008 10:02:59	761.9092	27.6027	77.0	59.3	75.0	78.2	11.76	162.09
11/13/2008 09:49:59	785.6926	28.0302	78.0	58.0	75.0	79.8	11.66	162.93
11/15/2008 11:35:59	835.4592	28.9043	97.0	76.4	74.3	74.3	11.90	164.05
11/16/2008 10:40:00	858.5262	29.3006	80.0	62.4	74.5	76.7	11.88	164.96
11/17/2008 09:13:00	881.0762	29.6829	70.0	55.3	75.2	74.2	11.94	165.76
11/18/2008 10:29:00	906.3428	30.1055	73.0	57.0	75.7	75.8	11.92	166.59
11/19/2008 10:07:00	929.9762	30.4955	78.0	60.6	75.4	75.4	11.87	167.47
11/20/2008 09:46:00	953.6262	30.8808	51.0	40.7	72.5	72.9	12.01	168.07
11/21/2008 09:42:00	977.5595	31.2659	59.0	42.2	73.8	73.3	11.78	168.68
11/22/2008 10:07:00	1001.9762	31.6540	58.0	45.4	73.6	74.1	11.82	169.34
11/23/2008 11:10:00	1027.0262	32.0472	58.0	44.8	74.1	75.0	11.80	169.99
11/24/2008 09:23:00	1049.2428	32.3920	49.0	38.7	73.8	73.1	11.90	170.56
11/25/2008 14:35:00	1078.4428	32.8397	60.0	45.3	75.2	74.7	11.82	171.22
11/26/2008 07:59:00	1095.8428	33.1035	47.0	36.9	73.2	72.6	11.82	171.75
11/27/2008 14:53:00	1126.7428	33.5670	53.0	40.9	74.1	74.0	11.80	172.35
11/28/2008 14:21:00	1150.2095	33.9147	46.0	34.2	74.3	74.3	11.70	172.85
11/29/2008 12:26:00	1172.2928	34.2388	39.0	30.3	73.6	72.9	11.72	173.29
11/30/2008 13:43:00	1197.5762	34.6060	35.0	27.4	73.8	72.9	11.77	173.69
12/01/2008 10:46:00	1218.6262	34.9088	42.0	32.6	73.8	73.3	11.76	174.16
12/02/2008 09:45:00	1241.6095	35.2365	42.0	32.3	72.3	68.9	11.69	174.63
12/03/2008 09:43:00	1265.5762	35.5749	41.0	32.0	73.8	75.8	11.82	175.10
12/04/2008 08:58:00	1288.8262	35.9002	40.0	31.5	72.7	74.2	11.88	175.56
12/05/2008 09:40:00	1313.5262	36.2426	38.0	27.5	73.2	74.9	11.75	175.96
12/07/2008 12:11:00	1364.0428	36.9330	68.0	51.6	75.7	74.6	11.73	176.71
12/09/2008 10:31:59	1410.3926	37.5552	49.0	38.4	73.8	75.8	11.85	177.27
12/10/2008 09:01:59	1432.8926	37.8536	52.0	39.9	76.6	72.1	11.84	177.85
12/10/2008 13:52:00	1437.7262	37.9174	21.0	16.6	76.5	70.5	11.85	178.09


Sample 41300-1 All Data
Total Gas Content, scf/ton
300
200
100
0
0
10
20
30
40
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas


Sample 41300-1 Lost Gas Content Graph
Measured Gas Content, scf/ton
60
40
20
0
-20
-40
0
1
2
3
4
5
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End

Sample 41300-2 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	feet	813.0
Sample Bottom Depth	feet	814.0
Reservoir Pressure	psia	366.94
Reservoir Pressure Gradient	psi/ft	0.4330
Mud Hydrostatic Pressure	psia	373.90
Mud Density	lbm/gal	8.50
Sample Mass	g	1,733.0
Sample Headspace Volume	cm^3	825.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/12/2008 13:00:13
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/12/2008 13:31:10
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/12/2008 13:32:19
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/12/2008 14:31:10
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/12/2008 15:34:10
Lost Gas Time	hours	2.031
Desorption Time Correction	hours	0.014
Fit Start Time	hours	2.111
Fit End Time	hours	2.368
Fit Start Time	$hours^{0.5}$	1.453
Fit End Time	$hours^{0.5}$	1.539
Lost Gas Content	scf/ton	30.9
Measured Gas Content	scf/ton	181.1
Crushed Gas Content	scf/ton	55.3
Total Gas Content	scf/ton	267.3
Lost Gas Fraction	vol frac	0.1156
Measured Gas Fraction	vol frac	0.6776
Crushed Gas Fraction	vol frac	0.2069
Diffusivity	1/us	0.2
Sorption Time	hours	115.6

Sample 41300-2 Desorption History

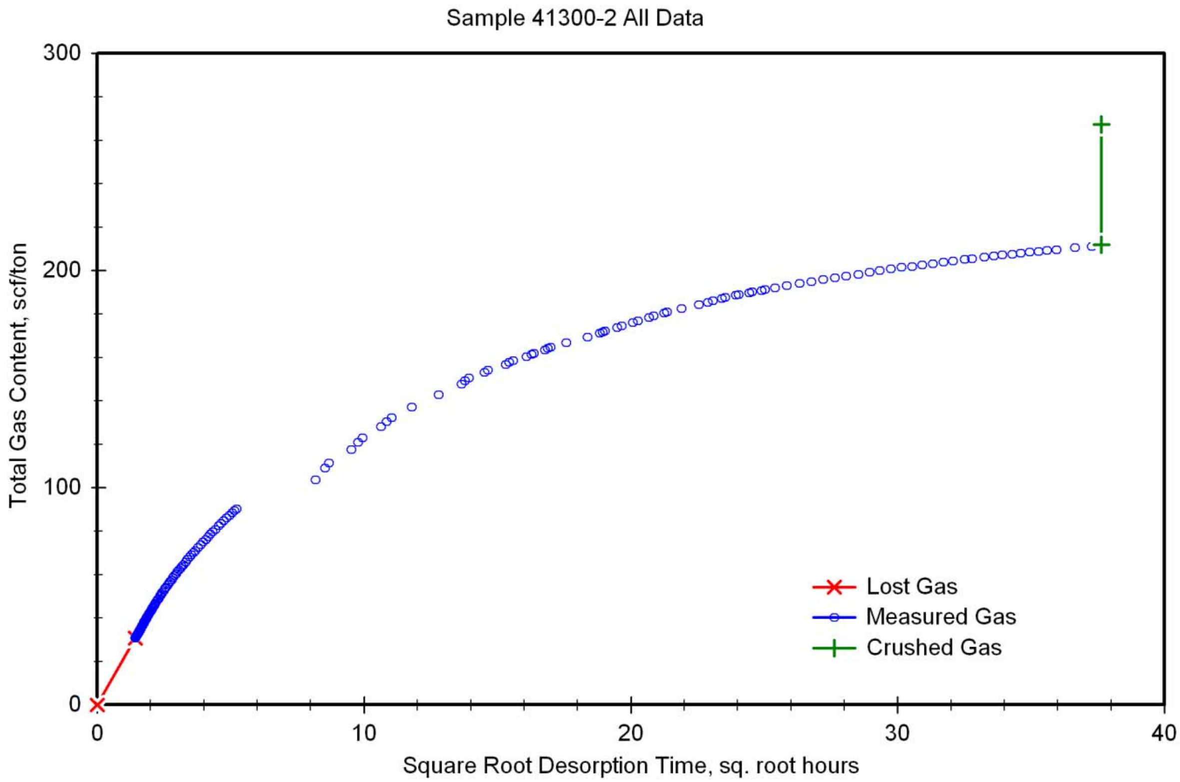
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	$hours^{0.5}$	cm^3	cm^3	°F	°F	psia	scf/ton
10/12/2008 15:34:10	2.0308	1.4251	0.0	0.0	72.1	64.4	11.20	0.00
10/12/2008 15:34:59	2.0306	1.4250	11.0	8.3	72.1	64.4	11.20	0.15
10/12/2008 15:36:59	2.0640	1.4366	23.0	16.4	73.2	64.2	11.21	0.46
10/12/2008 15:39:00	2.0976	1.4483	11.0	8.1	73.4	64.2	11.21	0.61
10/12/2008 15:41:00	2.1309	1.4598	20.0	14.9	73.6	64.0	11.21	0.88
10/12/2008 15:43:00	2.1642	1.4711	17.0	12.9	73.6	63.9	11.21	1.12
10/12/2008 15:45:00	2.1976	1.4824	10.0	7.2	73.9	63.7	11.21	1.25
10/12/2008 15:46:59	2.2306	1.4935	20.0	15.2	73.8	63.5	11.21	1.53
10/12/2008 15:49:00	2.2642	1.5047	18.0	13.6	73.6	63.3	11.21	1.79
10/12/2008 15:51:00	2.2976	1.5158	17.0	12.9	73.6	63.1	11.21	2.02
10/12/2008 15:53:00	2.3309	1.5267	20.0	14.9	73.8	63.0	11.21	2.30
10/12/2008 15:55:00	2.3642	1.5376	20.0	14.8	74.1	62.8	11.21	2.57
10/12/2008 15:57:00	2.3976	1.5484	11.0	8.3	74.1	62.6	11.21	2.73
10/12/2008 15:59:00	2.4309	1.5591	17.0	12.9	74.1	62.4	11.21	2.97
10/12/2008 16:01:00	2.4642	1.5698	17.0	12.9	74.1	62.2	11.21	3.21
10/12/2008 16:02:59	2.4973	1.5803	12.0	8.4	74.7	62.1	11.21	3.36
10/12/2008 16:05:00	2.5309	1.5909	21.0	16.0	74.3	61.9	11.21	3.66
10/12/2008 16:07:00	2.5642	1.6013	15.0	11.4	74.1	61.7	11.21	3.87
10/12/2008 16:09:00	2.5976	1.6117	16.0	12.2	74.1	61.5	11.21	4.09
10/12/2008 16:11:00	2.6309	1.6220	17.0	12.9	74.1	61.2	11.22	4.33
10/12/2008 16:12:59	2.6640	1.6322	16.0	12.1	73.9	61.2	11.21	4.56
10/12/2008 16:16:00	2.7142	1.6475	25.0	19.0	73.9	60.8	11.21	4.91
10/12/2008 16:19:00	2.7642	1.6626	25.0	18.6	74.3	60.6	11.21	5.25
10/12/2008 16:21:00	2.7976	1.6726	17.0	13.0	74.1	60.6	11.21	5.49
10/12/2008 16:24:00	2.8476	1.6875	20.0	15.3	74.3	60.3	11.22	5.77
10/12/2008 16:26:00	2.8809	1.6973	20.0	15.3	74.3	60.1	11.22	6.06
10/12/2008 16:28:00	2.9142	1.7071	12.0	9.2	74.1	60.1	11.22	6.23
10/12/2008 16:31:59	2.9806	1.7264	32.0	24.2	74.3	59.5	11.22	6.67
10/12/2008 16:34:00	3.0142	1.7362	15.0	11.5	74.3	59.4	11.22	6.89
10/12/2008 16:36:00	3.0476	1.7457	14.0	10.4	74.3	59.2	11.21	7.08
10/12/2008 16:38:00	3.0809	1.7552	15.0	11.5	74.3	59.0	11.22	7.29
10/12/2008 16:40:00	3.1142	1.7647	15.0	11.5	74.1	58.8	11.22	7.50
10/12/2008 16:43:00	3.1642	1.7788	21.0	15.8	74.3	58.8	11.22	7.80
10/12/2008 16:46:00	3.2142	1.7928	21.0	16.1	73.9	58.6	11.22	8.09
10/12/2008 16:49:00	3.2642	1.8067	22.0	16.8	73.9	58.6	11.22	8.40
10/12/2008 16:52:00	3.3142	1.8205	19.0	14.5	73.9	58.5	11.22	8.67

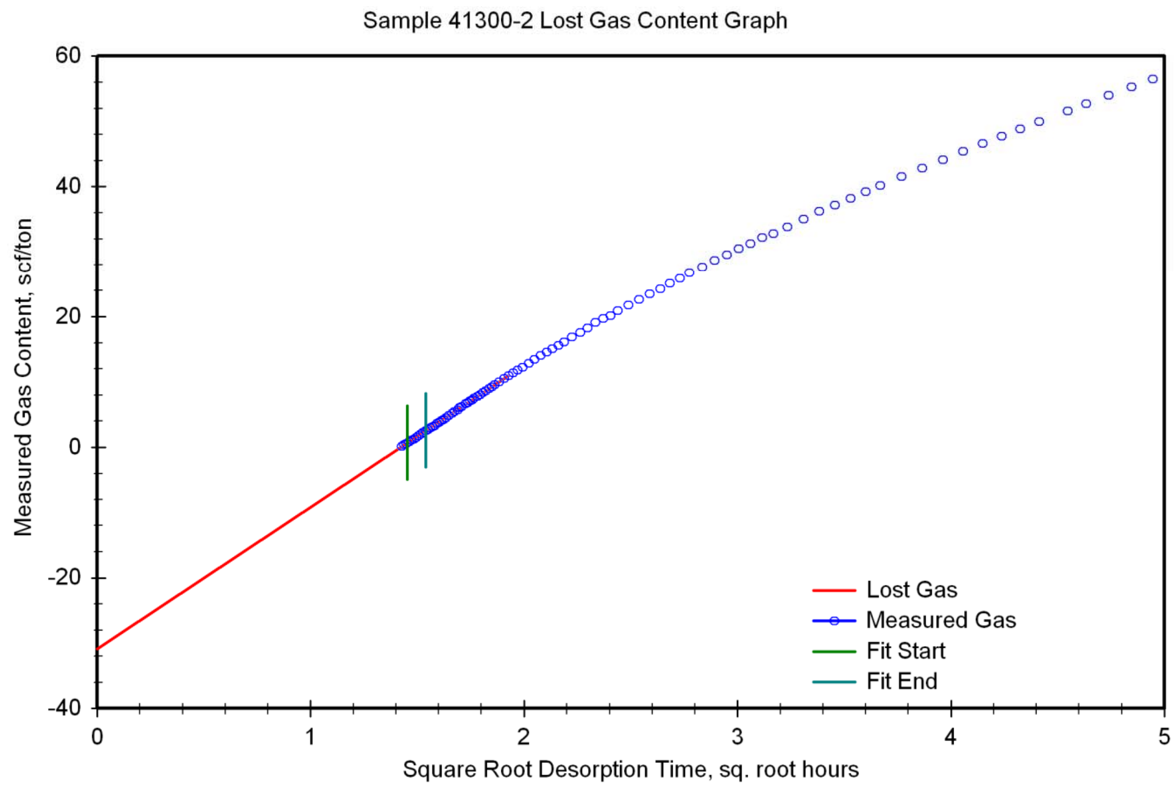
10/12/2008 16:55:00	3.3642	1.8342	23.0	17.6	73.9	58.5	11.22	9.00
10/12/2008 16:57:59	3.4140	1.8477	20.0	15.3	74.1	58.5	11.22	9.28
10/12/2008 17:01:00	3.4642	1.8612	22.0	16.6	74.1	58.5	11.22	9.59
10/12/2008 17:06:00	3.5476	1.8835	33.0	25.3	74.1	58.6	11.22	10.05
10/12/2008 17:11:00	3.6309	1.9055	33.0	25.3	74.1	58.6	11.22	10.52
10/12/2008 17:16:00	3.7142	1.9272	32.0	24.2	74.1	58.6	11.22	10.97
10/12/2008 17:21:00	3.7976	1.9487	31.0	23.7	74.1	58.6	11.22	11.41
10/12/2008 17:26:00	3.8809	1.9700	31.0	23.7	74.1	58.6	11.22	11.85
10/12/2008 17:31:00	3.9642	1.9910	30.0	23.0	73.9	58.6	11.22	12.27
10/12/2008 17:38:00	4.0809	2.0201	43.0	32.5	74.3	58.5	11.22	12.87
10/12/2008 17:45:00	4.1976	2.0488	41.0	31.4	74.3	58.3	11.22	13.45
10/12/2008 17:51:59	4.3140	2.0770	42.0	32.2	74.3	58.3	11.22	14.05
10/12/2008 17:59:00	4.4309	2.1050	36.0	27.6	74.1	58.3	11.22	14.56
10/12/2008 18:06:00	4.5476	2.1325	36.0	27.6	74.1	58.8	11.22	15.07
10/12/2008 18:13:00	4.6642	2.1597	37.0	28.3	73.8	59.2	11.23	15.59
10/12/2008 18:20:00	4.7809	2.1865	40.0	30.2	74.1	59.7	11.23	16.15
10/12/2008 18:30:00	4.9476	2.2243	55.0	41.5	74.5	60.8	11.23	16.92
10/12/2008 18:40:00	5.1142	2.2615	47.0	35.8	74.3	61.7	11.23	17.58
10/12/2008 18:49:59	5.2806	2.2980	49.0	37.3	74.3	62.6	11.23	18.27
10/12/2008 19:00:00	5.4476	2.3340	62.0	47.1	74.3	63.9	11.24	19.14
10/12/2008 19:10:00	5.6142	2.3694	45.0	34.1	74.1	64.0	11.24	19.77
10/12/2008 19:19:59	5.7806	2.4043	30.0	22.8	74.1	64.4	11.24	20.19
10/12/2008 19:30:00	5.9476	2.4388	57.0	43.3	74.1	64.2	11.24	20.99
10/12/2008 19:45:00	6.1976	2.4895	60.0	45.6	73.9	63.3	11.24	21.83
10/12/2008 20:00:00	6.4476	2.5392	60.0	45.7	74.1	62.8	11.25	22.68
10/12/2008 20:15:00	6.6976	2.5880	59.0	45.0	74.1	62.2	11.25	23.51
10/12/2008 20:30:00	6.9476	2.6358	56.0	42.7	74.1	61.7	11.25	24.30
10/12/2008 20:45:00	7.1976	2.6828	63.0	48.1	73.8	61.5	11.26	25.19
10/12/2008 21:00:00	7.4476	2.7290	54.0	40.9	74.1	61.3	11.26	25.94
10/12/2008 21:15:00	7.6976	2.7744	59.0	45.1	74.1	61.2	11.26	26.78
10/12/2008 21:34:59	8.0306	2.8338	62.0	47.4	74.1	60.8	11.26	27.65
10/12/2008 21:55:00	8.3642	2.8921	70.0	53.6	74.1	60.3	11.26	28.65
10/12/2008 22:15:00	8.6976	2.9492	63.0	48.3	74.1	59.9	11.27	29.54
10/12/2008 22:34:59	9.0306	3.0051	64.0	49.1	74.1	59.4	11.27	30.45
10/12/2008 22:55:00	9.3642	3.0601	56.0	43.0	74.1	58.8	11.27	31.24
10/12/2008 23:15:00	9.6976	3.1141	70.0	53.8	74.1	58.5	11.27	32.24
10/12/2008 23:35:00	10.0309	3.1672	43.0	33.1	74.1	58.3	11.27	32.85
10/13/2008 00:00:00	10.4476	3.2323	68.0	52.3	73.9	57.9	11.27	33.82
10/13/2008 00:30:00	10.9476	3.3087	87.0	67.1	73.9	57.0	11.27	35.06
10/13/2008 01:00:00	11.4476	3.3834	80.0	61.8	73.9	56.3	11.27	36.20
10/13/2008 01:30:00	11.9476	3.4565	70.0	54.1	73.9	55.9	11.27	37.20

10/13/2008 02:00:00	12.4476	3.5281	71.0	54.9	73.9	55.4	11.27	38.22
10/13/2008 02:30:00	12.9476	3.5983	70.0	54.3	73.9	54.7	11.28	39.22
10/13/2008 03:00:00	13.4476	3.6671	67.0	51.9	73.9	54.7	11.28	40.18
10/13/2008 03:45:00	14.1976	3.7680	97.0	75.2	73.9	54.7	11.28	41.57
10/13/2008 04:30:00	14.9476	3.8662	90.0	69.8	73.9	54.7	11.28	42.86
10/13/2008 05:15:00	15.6976	3.9620	92.0	71.1	73.9	54.1	11.27	44.17
10/13/2008 06:00:00	16.4476	4.0556	88.0	68.4	73.9	53.4	11.28	45.44
10/13/2008 06:45:00	17.1976	4.1470	85.0	66.2	73.9	52.7	11.28	46.66
10/13/2008 07:30:00	17.9476	4.2365	76.0	59.2	73.8	52.5	11.29	47.76
10/13/2008 08:15:00	18.6976	4.3241	77.0	60.1	73.8	52.0	11.29	48.87
10/13/2008 09:01:00	19.4642	4.4118	78.0	60.8	73.8	53.2	11.30	49.99
10/13/2008 10:12:59	20.6640	4.5458	116.0	89.3	73.8	59.7	11.30	51.64
10/13/2008 11:01:00	21.4642	4.6330	78.0	59.4	74.1	64.4	11.31	52.74
10/13/2008 12:00:00	22.4476	4.7379	92.0	70.1	73.9	64.8	11.31	54.04
10/13/2008 13:01:00	23.4642	4.8440	90.0	67.4	74.1	65.7	11.29	55.28
10/13/2008 14:00:00	24.4476	4.9444	85.0	64.5	74.3	64.4	11.29	56.47
10/13/2008 15:01:00	25.4642	5.0462	81.0	61.8	74.5	59.2	11.29	57.62
10/13/2008 16:00:00	26.4476	5.1427	78.0	60.1	73.8	58.5	11.29	58.73
10/13/2008 16:46:00	27.2142	5.2167	60.0	46.1	74.1	56.3	11.29	59.58
10/15/2008 08:31:00	66.9642	8.1832	890.0	709.7	75.2	69.8	11.94	72.70
10/15/2008 14:16:59	72.7306	8.5282	376.0	293.9	75.9	73.2	11.90	78.13
10/15/2008 16:46:00	75.2142	8.6726	163.0	128.1	76.1	73.4	11.90	80.50
10/16/2008 08:02:00	90.4809	9.5121	419.0	333.3	75.0	68.9	11.89	86.66
10/16/2008 13:05:59	95.5473	9.7748	243.0	186.8	76.5	76.1	11.86	90.12
10/16/2008 16:18:00	98.7476	9.9372	133.0	103.9	77.0	75.7	11.87	92.04
10/17/2008 06:51:00	113.2976	10.6441	355.0	281.1	76.5	73.4	11.94	97.23
10/17/2008 11:13:00	117.6642	10.8473	159.0	125.7	76.5	74.1	11.94	99.56
10/17/2008 15:20:00	121.7809	11.0354	125.0	96.0	77.5	78.2	11.92	101.33
10/18/2008 08:18:00	138.7476	11.7791	344.0	271.3	76.6	71.7	11.89	106.35
10/19/2008 09:24:00	163.8476	12.8003	390.0	307.2	74.5	72.6	11.86	112.03
10/20/2008 07:46:00	186.2142	13.6460	340.0	269.1	75.0	73.5	11.94	117.00
10/20/2008 11:32:59	189.9973	13.7840	107.0	83.8	75.2	74.1	11.93	118.55
10/20/2008 15:34:00	194.0142	13.9289	77.0	58.1	74.8	74.3	11.87	119.62
10/21/2008 08:00:00	210.4476	14.5068	195.0	150.8	73.9	70.7	11.80	122.41
10/21/2008 11:44:00	214.1809	14.6349	75.0	58.1	73.8	72.5	11.79	123.48
10/22/2008 08:08:00	234.5809	15.3160	171.0	137.0	73.0	68.1	11.95	126.01
10/22/2008 11:48:00	238.2476	15.4353	66.0	51.1	73.6	72.5	11.94	126.96
10/22/2008 16:41:00	243.1309	15.5927	64.0	49.2	73.8	74.4	11.93	127.87
10/23/2008 08:22:00	258.8142	16.0877	114.0	87.2	73.0	68.0	11.85	129.48
10/23/2008 14:37:00	265.0642	16.2808	82.0	60.4	74.1	74.0	11.80	130.60
10/23/2008 17:11:00	267.6309	16.3594	36.0	27.1	74.7	74.3	11.80	131.10

10/24/2008 07:02:00	281.4809	16.7774	112.0	88.5	73.6	68.7	11.81	132.74
10/24/2008 10:56:00	285.3809	16.8932	44.0	34.7	73.2	70.8	11.83	133.38
10/24/2008 14:15:00	288.6976	16.9911	40.0	28.1	74.7	75.0	11.81	133.90
10/25/2008 10:50:59	309.2973	17.5868	148.0	116.1	74.3	72.6	11.81	136.04
10/26/2008 15:13:00	337.6642	18.3756	173.0	137.4	74.3	74.4	11.99	138.58
10/27/2008 08:25:00	354.8642	18.8378	121.0	97.3	73.2	68.9	12.02	140.38
10/27/2008 11:57:00	358.3976	18.9314	40.0	31.4	73.4	68.3	12.01	140.96
10/27/2008 15:11:00	361.6309	19.0166	32.0	22.1	74.1	74.4	11.96	141.37
10/28/2008 09:01:59	379.4806	19.4803	99.0	79.1	73.8	70.3	11.97	142.83
10/28/2008 16:05:00	386.5309	19.6604	66.0	47.0	76.1	85.4	11.94	143.70
10/29/2008 08:27:00	402.8976	20.0723	106.0	83.2	75.2	71.9	11.91	145.24
10/29/2008 15:41:00	410.1309	20.2517	63.0	44.4	76.1	78.8	11.85	146.06
10/30/2008 08:53:00	427.3309	20.6720	99.0	77.8	75.9	75.0	11.88	147.50
10/30/2008 16:05:59	434.5473	20.8458	57.0	44.7	76.6	76.5	11.90	148.32
10/31/2008 09:29:00	451.9309	21.2587	87.0	68.9	76.5	75.2	11.98	149.60
10/31/2008 13:25:00	455.8642	21.3510	36.0	27.3	76.5	76.5	11.96	150.10
11/01/2008 13:02:59	479.4973	21.8974	107.0	81.8	76.5	76.1	11.92	151.61
11/02/2008 17:46:00	508.2142	22.5436	144.0	101.8	76.3	76.5	11.74	153.50
11/03/2008 09:19:00	523.7642	22.8859	80.0	62.4	74.7	74.3	11.78	154.65
11/03/2008 17:31:00	531.9642	23.0643	51.0	36.3	75.9	79.5	11.75	155.32
11/04/2008 09:41:00	548.1309	23.4122	75.0	56.5	73.4	70.7	11.66	156.37
11/04/2008 15:03:00	553.4976	23.5265	35.0	23.4	74.1	75.1	11.62	156.80
11/05/2008 10:44:00	573.1809	23.9412	74.0	57.2	74.5	73.3	11.66	157.86
11/05/2008 15:39:00	578.0976	24.0437	29.0	22.5	73.8	73.3	11.69	158.27
11/06/2008 10:36:00	597.0476	24.4346	50.0	39.1	73.4	72.9	11.77	158.99
11/06/2008 15:27:59	601.9140	24.5339	22.0	16.9	74.3	73.6	11.79	159.31
11/07/2008 09:14:00	619.6809	24.8934	51.0	40.0	73.9	72.9	11.80	160.05
11/07/2008 15:32:00	625.9809	25.0196	30.0	22.2	75.0	72.9	11.80	160.46
11/08/2008 10:33:00	644.9976	25.3968	53.0	41.5	73.5	73.2	11.80	161.22
11/09/2008 09:34:59	668.0306	25.8463	72.0	51.2	73.4	74.1	11.71	162.17
11/10/2008 10:53:00	693.3309	26.3312	77.0	56.5	73.6	76.8	11.66	163.21
11/11/2008 09:53:00	716.3309	26.7644	61.0	47.1	73.8	78.2	11.75	164.09
11/12/2008 10:04:00	740.5142	27.2124	68.0	51.7	75.0	78.2	11.76	165.04
11/13/2008 09:51:00	764.2976	27.6459	73.0	49.9	75.0	79.8	11.66	165.96
11/14/2008 09:29:00	787.9309	28.0701	51.0	40.0	73.9	73.3	11.82	166.70
11/15/2008 11:37:00	814.0642	28.5318	58.0	45.7	74.1	74.3	11.90	167.55
11/16/2008 10:41:00	837.1309	28.9332	59.0	44.9	74.5	76.4	11.88	168.38
11/17/2008 09:17:00	859.7309	29.3212	53.0	41.9	74.8	74.3	11.94	169.15
11/18/2008 10:30:00	884.9476	29.7481	60.0	45.4	75.4	75.8	11.92	169.99
11/19/2008 10:08:00	908.5809	30.1427	62.0	45.9	75.4	75.4	11.87	170.84
11/20/2008 09:46:59	932.2306	30.5325	23.0	18.3	72.1	72.9	12.01	171.18

11/21/2008 09:43:00	956.1642	30.9219	58.0	30.6	73.6	73.3	11.78	171.75
11/22/2008 10:08:00	980.5809	31.3142	47.0	36.8	73.6	74.6	11.82	172.43
11/23/2008 11:11:00	1005.6309	31.7117	48.0	36.0	73.9	75.0	11.80	173.09
11/24/2008 09:24:00	1027.8476	32.0601	34.0	26.8	73.8	73.1	11.90	173.59
11/25/2008 14:35:59	1057.0473	32.5123	55.0	37.5	74.8	74.7	11.82	174.28
11/26/2008 08:00:00	1074.4476	32.7788	33.0	25.9	73.2	72.6	11.82	174.76
11/27/2008 14:54:00	1105.3476	33.2468	48.0	35.7	73.8	74.2	11.80	175.42
11/28/2008 14:23:00	1128.8309	33.5981	40.0	25.5	74.1	74.3	11.70	175.89
11/29/2008 12:27:59	1150.9140	33.9251	30.0	23.3	73.4	72.9	11.71	176.32
11/30/2008 13:45:00	1176.1976	34.2957	27.0	21.1	73.6	73.1	11.77	176.71
12/01/2008 10:47:00	1197.2309	34.6010	33.0	25.2	73.6	73.3	11.76	177.18
12/02/2008 09:46:00	1220.2142	34.9316	38.0	26.2	73.0	72.9	11.69	177.66
12/03/2008 09:45:00	1244.1976	35.2732	27.0	21.1	73.6	75.8	11.82	178.05
12/04/2008 09:00:00	1267.4476	35.6012	29.0	22.8	72.4	74.0	11.88	178.48
12/05/2008 09:41:00	1292.1309	35.9462	31.0	16.4	73.0	75.1	11.75	178.78
12/07/2008 12:12:00	1342.6476	36.6422	77.0	55.3	75.6	74.6	11.73	179.80
12/09/2008 10:33:00	1388.9976	37.2693	35.0	27.4	73.6	75.8	11.85	180.31
12/10/2008 09:03:00	1411.4976	37.5699	50.0	34.9	76.6	76.7	11.84	180.95
12/10/2008 13:56:00	1416.3809	37.6348	12.0	9.5	76.8	70.7	11.85	181.13


Sample 41300-2 All Data
Total Gas Content, scf/ton
300
200
100
0
0
10
20
30
40
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas


Sample 41300-2 Lost Gas Content Graph
Measured Gas Content, scf/ton
60
40
20
0
-20
-40
0
1
2
3
4
5
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End

Sample 41300-3 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	feet	815.0
Sample Bottom Depth	feet	816.0
Reservoir Pressure	psia	367.81
Reservoir Pressure Gradient	psi/ft	0.4330
Mud Hydrostatic Pressure	psia	374.79
Mud Density	lbm/gal	8.50
Sample Mass	g	2,186.0
Sample Headspace Volume	cm^3	204.6
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/12/2008 13:01:34
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/12/2008 13:31:10
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/12/2008 13:32:19
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/12/2008 14:31:10
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/12/2008 15:43:53
Lost Gas Time	hours	2.193
Desorption Time Correction	hours	0.002
Fit Start Time	hours	2.254
Fit End Time	hours	2.521
Fit Start Time	$hours^{0.5}$	1.501
Fit End Time	$hours^{0.5}$	1.588
Lost Gas Content	scf/ton	14.9
Measured Gas Content	scf/ton	155.6
Crushed Gas Content	scf/ton	89.1
Total Gas Content	scf/ton	259.6
Lost Gas Fraction	vol frac	0.0572
Measured Gas Fraction	vol frac	0.5993
Crushed Gas Fraction	vol frac	0.3435
Diffusivity	1/us	0.0
Sorption Time	hours	511.8

Sample 41300-3 Desorption History

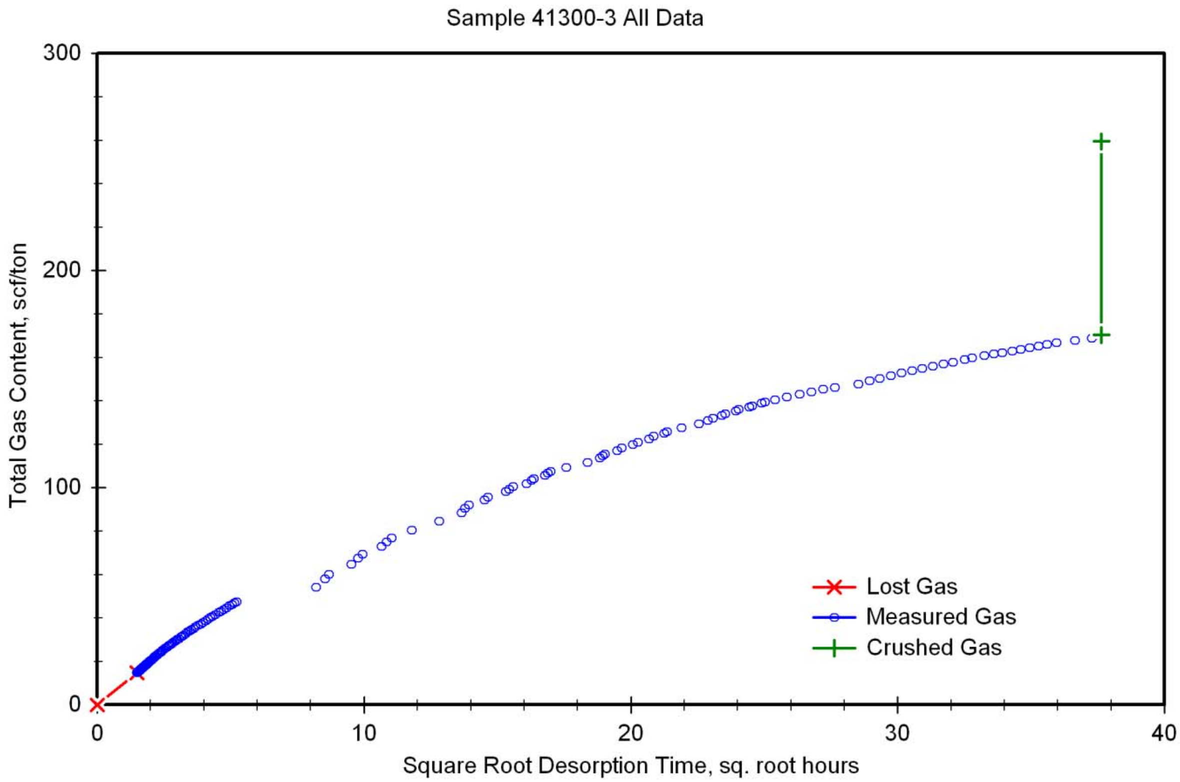
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	$hours^{0.5}$	cm^3	cm^3	°F	°F	psia	scf/ton
10/12/2008 15:43:53	2.1928	1.4808	0.0	0.0	71.4	63.9	11.21	0.00
10/12/2008 15:44:00	2.1926	1.4807	5.0	3.8	71.4	63.9	11.21	0.06
10/12/2008 15:46:00	2.2259	1.4919	7.0	5.3	72.5	63.7	11.21	0.13
10/12/2008 15:48:00	2.2592	1.5031	8.0	6.1	72.9	63.3	11.21	0.22
10/12/2008 15:49:59	2.2923	1.5140	10.0	7.6	73.0	63.3	11.21	0.33
10/12/2008 15:52:00	2.3259	1.5251	9.0	6.8	73.2	63.1	11.21	0.43
10/12/2008 15:53:59	2.3590	1.5359	10.0	7.6	73.8	63.0	11.21	0.54
10/12/2008 15:56:00	2.3926	1.5468	9.0	6.8	74.1	62.8	11.21	0.64
10/12/2008 15:58:00	2.4259	1.5575	9.0	6.8	74.3	62.6	11.21	0.74
10/12/2008 16:00:00	2.4592	1.5682	9.0	6.8	74.3	62.4	11.21	0.84
10/12/2008 16:02:00	2.4926	1.5788	15.0	11.4	74.3	61.9	11.21	1.01
10/12/2008 16:04:00	2.5259	1.5893	7.0	5.3	74.1	61.9	11.21	1.09
10/12/2008 16:05:59	2.5590	1.5997	7.0	5.3	74.5	61.7	11.21	1.17
10/12/2008 16:08:00	2.5926	1.6101	9.0	6.8	74.5	61.5	11.21	1.27
10/12/2008 16:10:00	2.6259	1.6205	10.0	7.6	74.5	61.3	11.21	1.38
10/12/2008 16:12:00	2.6592	1.6307	10.0	7.6	74.3	61.2	11.21	1.49
10/12/2008 16:14:00	2.6926	1.6409	30.0	22.8	74.3	61.0	11.21	1.83
10/12/2008 16:17:00	2.7426	1.6561	15.0	11.4	74.3	60.6	11.21	1.99
10/12/2008 16:19:59	2.7923	1.6710	7.0	5.3	74.3	60.6	11.21	2.07
10/12/2008 16:23:00	2.8426	1.6860	15.0	11.4	74.5	60.4	11.21	2.24
10/12/2008 16:25:00	2.8759	1.6958	8.0	6.1	74.7	60.3	11.22	2.33
10/12/2008 16:27:00	2.9092	1.7056	10.0	7.6	74.7	60.1	11.22	2.44
10/12/2008 16:29:00	2.9426	1.7154	18.0	13.7	74.7	59.7	11.22	2.64
10/12/2008 16:33:00	3.0092	1.7347	16.0	12.2	74.8	59.4	11.22	2.82
10/12/2008 16:34:59	3.0423	1.7442	7.0	5.4	74.7	59.2	11.22	2.90
10/12/2008 16:37:00	3.0759	1.7538	9.0	6.9	75.0	59.2	11.22	3.00
10/12/2008 16:38:59	3.1090	1.7632	7.0	5.4	74.8	58.8	11.22	3.08
10/12/2008 16:41:00	3.1426	1.7727	8.0	6.1	74.7	58.8	11.22	3.17
10/12/2008 16:44:00	3.1926	1.7868	13.0	9.9	74.7	58.8	11.22	3.31
10/12/2008 16:47:00	3.2426	1.8007	14.0	10.7	74.7	58.6	11.22	3.47
10/12/2008 16:50:00	3.2926	1.8145	13.0	10.0	74.3	58.5	11.22	3.62
10/12/2008 16:53:00	3.3426	1.8283	13.0	10.0	74.5	58.5	11.22	3.76
10/12/2008 16:56:00	3.3926	1.8419	13.0	10.0	74.7	58.5	11.22	3.91
10/12/2008 16:59:00	3.4426	1.8554	13.0	10.0	74.7	58.5	11.22	4.05
10/12/2008 17:02:00	3.4926	1.8688	13.0	10.0	74.5	58.5	11.22	4.20
10/12/2008 17:06:59	3.5756	1.8909	21.0	16.1	74.7	58.6	11.22	4.44

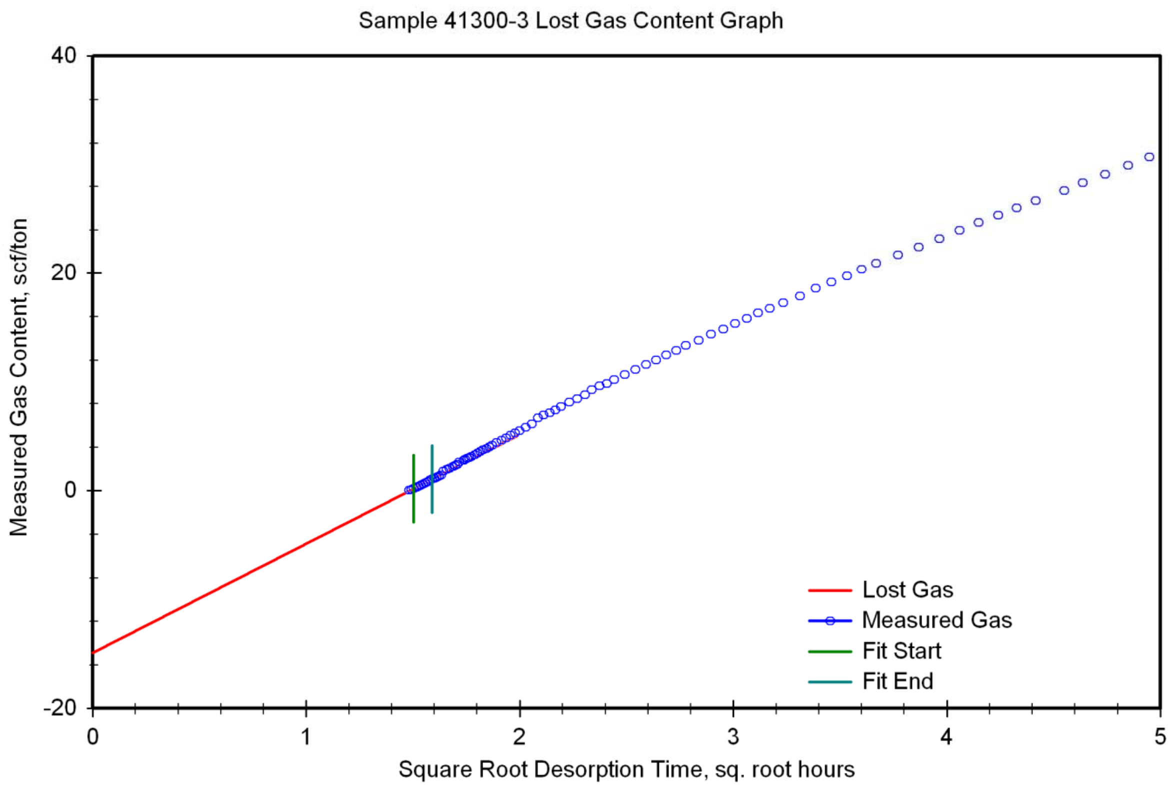
10/12/2008 17:12:00	3.6592	1.9129	21.0	16.1	74.7	58.6	11.22	4.67
10/12/2008 17:16:59	3.7423	1.9345	20.0	15.3	74.7	58.6	11.22	4.90
10/12/2008 17:22:00	3.8259	1.9560	20.0	15.3	74.7	58.6	11.22	5.12
10/12/2008 17:27:00	3.9092	1.9772	20.0	15.3	74.7	58.6	11.22	5.35
10/12/2008 17:32:00	3.9926	1.9981	19.0	14.5	74.5	58.6	11.22	5.56
10/12/2008 17:39:00	4.1092	2.0271	27.0	20.7	74.8	58.5	11.22	5.86
10/12/2008 17:46:00	4.2259	2.0557	26.0	19.9	74.8	58.3	11.22	6.15
10/12/2008 17:53:00	4.3426	2.0839	53.0	40.6	74.7	58.3	11.22	6.75
10/12/2008 18:00:00	4.4592	2.1117	18.0	13.8	74.5	58.3	11.22	6.95
10/12/2008 18:07:00	4.5759	2.1391	22.0	16.8	74.3	58.8	11.22	7.20
10/12/2008 18:14:00	4.6926	2.1662	25.0	19.1	74.1	59.4	11.23	7.48
10/12/2008 18:20:59	4.8090	2.1929	25.0	19.1	74.7	59.9	11.23	7.76
10/12/2008 18:31:00	4.9759	2.2307	35.0	26.7	74.7	61.0	11.23	8.15
10/12/2008 18:41:00	5.1426	2.2677	31.0	23.6	74.7	61.7	11.23	8.49
10/12/2008 18:51:00	5.3092	2.3042	32.0	24.3	74.5	62.8	11.23	8.85
10/12/2008 19:00:00	5.4592	2.3365	40.0	30.4	74.5	63.9	11.24	9.30
10/12/2008 19:10:00	5.6259	2.3719	30.0	22.8	74.1	64.0	11.24	9.63
10/12/2008 19:19:59	5.7923	2.4067	20.0	15.2	74.1	64.4	11.24	9.85
10/12/2008 19:30:00	5.9592	2.4412	37.0	28.1	74.1	64.2	11.24	10.26
10/12/2008 19:45:00	6.2092	2.4918	39.0	29.6	73.9	63.3	11.24	10.70
10/12/2008 20:00:00	6.4592	2.5415	42.0	32.0	74.1	62.8	11.25	11.17
10/12/2008 20:15:00	6.7092	2.5902	40.0	30.5	74.1	62.2	11.25	11.61
10/12/2008 20:30:00	6.9592	2.6380	38.0	29.0	74.1	61.7	11.25	12.04
10/12/2008 20:45:00	7.2092	2.6850	43.0	32.8	73.8	61.5	11.26	12.52
10/12/2008 21:00:00	7.4592	2.7312	37.0	28.3	74.1	61.3	11.26	12.93
10/12/2008 21:15:00	7.7092	2.7765	40.0	30.6	74.1	61.2	11.26	13.38
10/12/2008 21:34:59	8.0423	2.8359	42.0	32.1	74.1	60.8	11.26	13.85
10/12/2008 21:55:00	8.3759	2.8941	47.0	36.0	74.1	60.3	11.26	14.38
10/12/2008 22:15:00	8.7092	2.9511	45.0	34.5	74.1	59.9	11.27	14.89
10/12/2008 22:34:59	9.0423	3.0070	44.0	33.8	74.1	59.4	11.27	15.38
10/12/2008 22:55:00	9.3759	3.0620	40.0	30.7	74.1	58.8	11.27	15.83
10/12/2008 23:15:00	9.7092	3.1160	48.0	36.9	74.1	58.5	11.27	16.37
10/12/2008 23:35:00	10.0426	3.1690	34.0	26.2	74.1	58.3	11.27	16.76
10/13/2008 00:00:00	10.4592	3.2341	48.0	36.9	73.9	57.9	11.27	17.30
10/13/2008 00:30:00	10.9592	3.3105	56.0	43.2	73.9	57.0	11.27	17.93
10/13/2008 01:00:00	11.4592	3.3851	62.0	47.9	73.9	56.3	11.27	18.63
10/13/2008 01:30:00	11.9592	3.4582	49.0	37.9	73.9	55.9	11.27	19.19
10/13/2008 02:00:00	12.4592	3.5298	53.0	41.0	73.9	55.4	11.27	19.79
10/13/2008 02:30:00	12.9592	3.5999	50.0	38.8	73.9	54.7	11.28	20.36
10/13/2008 03:00:00	13.4592	3.6687	52.0	40.3	73.9	54.7	11.28	20.95
10/13/2008 03:45:00	14.2092	3.7695	70.0	54.3	73.9	54.7	11.28	21.74

10/13/2008 04:30:00	14.9592	3.8677	62.0	48.1	73.9	54.7	11.28	22.45
10/13/2008 05:15:00	15.7092	3.9635	67.0	52.0	73.9	54.1	11.27	23.21
10/13/2008 06:00:00	16.4592	4.0570	67.0	52.1	73.9	53.4	11.28	23.97
10/13/2008 06:45:00	17.2092	4.1484	65.0	50.6	73.9	52.7	11.28	24.71
10/13/2008 07:31:00	17.9759	4.2398	60.0	46.8	74.3	52.5	11.29	25.40
10/13/2008 08:16:00	18.7259	4.3273	58.0	45.3	74.3	52.0	11.29	26.06
10/13/2008 09:01:59	19.4923	4.4150	57.0	44.4	73.9	53.4	11.30	26.71
10/13/2008 10:14:00	20.6926	4.5489	83.0	63.8	74.1	59.9	11.30	27.65
10/13/2008 11:02:00	21.4926	4.6360	65.0	49.6	74.3	64.4	11.31	28.38
10/13/2008 12:01:00	22.4759	4.7409	72.0	54.9	74.3	64.8	11.30	29.18
10/13/2008 13:02:00	23.4926	4.8469	72.0	54.7	74.3	65.7	11.29	29.98
10/13/2008 14:01:00	24.4759	4.9473	67.0	51.1	75.2	64.2	11.29	30.73
10/13/2008 15:01:59	25.4923	5.0490	67.0	51.5	74.5	59.2	11.29	31.49
10/13/2008 16:01:00	26.4759	5.1455	63.0	48.5	74.5	58.5	11.29	32.20
10/13/2008 16:47:00	27.2426	5.2194	52.0	40.2	74.7	56.2	11.29	32.79
10/15/2008 08:35:59	67.0590	8.1890	560.0	446.1	75.2	70.3	11.94	39.32
10/15/2008 14:19:59	72.7923	8.5318	334.0	263.7	76.1	73.4	11.90	43.19
10/15/2008 16:47:00	75.2426	8.6742	182.0	143.6	75.9	73.4	11.89	45.29
10/16/2008 08:04:59	90.5423	9.5154	393.0	312.9	75.4	68.4	11.89	49.88
10/16/2008 13:08:00	95.5926	9.7771	243.0	190.2	76.5	76.1	11.86	52.67
10/16/2008 16:19:59	98.7923	9.9394	162.0	127.0	76.8	75.7	11.87	54.53
10/17/2008 06:53:00	113.3426	10.6462	310.0	245.2	76.5	73.9	11.94	58.12
10/17/2008 11:14:00	117.6926	10.8486	188.0	148.6	76.5	74.3	11.94	60.30
10/17/2008 15:20:59	121.8090	11.0367	153.0	119.8	77.4	78.8	11.92	62.05
10/18/2008 08:21:00	138.8092	11.7817	309.0	244.4	76.6	71.7	11.89	65.64
10/19/2008 09:26:00	163.8926	12.8021	360.0	283.7	74.7	72.8	11.87	69.79
10/20/2008 07:47:59	186.2590	13.6477	340.0	269.1	75.0	73.5	11.94	73.74
10/20/2008 11:35:00	190.0426	13.7856	175.0	138.4	75.2	73.7	11.93	75.77
10/20/2008 15:34:59	194.0423	13.9299	123.0	96.6	74.7	74.8	11.87	77.18
10/21/2008 08:03:00	210.5092	14.5089	197.0	155.0	73.9	70.8	11.80	79.45
10/21/2008 11:45:00	214.2092	14.6359	124.0	97.1	73.8	72.6	11.79	80.88
10/22/2008 08:09:00	234.6092	15.3170	205.0	164.1	73.0	68.3	11.95	83.28
10/22/2008 11:49:00	238.2759	15.4362	109.0	86.5	73.6	72.5	11.94	84.55
10/22/2008 16:42:00	243.1592	15.5936	100.0	79.0	73.6	74.3	11.93	85.71
10/23/2008 08:23:59	258.8590	16.0891	125.0	99.2	73.2	68.1	11.85	87.16
10/23/2008 14:38:00	265.0926	16.2817	121.0	94.6	74.1	74.3	11.80	88.55
10/23/2008 17:12:00	267.6592	16.3603	70.0	54.7	74.7	74.4	11.80	89.35
10/24/2008 07:02:59	281.5090	16.7782	138.0	109.0	73.6	68.7	11.81	90.95
10/24/2008 10:57:59	285.4256	16.8945	86.0	67.8	73.4	71.0	11.83	91.94
10/24/2008 14:16:00	288.7259	16.9919	63.0	49.2	74.5	75.2	11.81	92.66
10/25/2008 10:53:00	309.3426	17.5881	164.0	128.7	74.1	72.8	11.81	94.55

10/26/2008 15:14:00	337.6926	18.3764	207.0	164.4	74.3	74.4	11.99	96.96
10/27/2008 08:26:00	354.8926	18.8386	167.0	134.3	73.6	68.9	12.02	98.92
10/27/2008 11:58:00	358.4259	18.9321	90.0	72.4	73.4	68.5	12.01	99.98
10/27/2008 15:12:00	361.6592	19.0173	63.0	49.9	74.1	74.4	11.96	100.72
10/28/2008 09:03:00	379.5092	19.4810	129.0	103.0	73.8	70.5	11.97	102.22
10/28/2008 16:05:59	386.5590	19.6611	105.0	81.4	76.1	85.4	11.94	103.42
10/29/2008 08:28:00	402.9259	20.0730	136.0	107.7	75.0	72.1	11.91	105.00
10/29/2008 15:43:00	410.1759	20.2528	103.0	80.1	75.9	78.8	11.85	106.17
10/30/2008 08:54:00	427.3592	20.6727	132.0	103.7	75.7	75.2	11.88	107.69
10/30/2008 16:07:00	434.5759	20.8465	99.0	77.6	76.5	76.9	11.90	108.83
10/31/2008 09:30:00	451.9592	21.2593	127.0	100.6	76.1	75.2	11.98	110.30
10/31/2008 13:26:00	455.8926	21.3516	73.0	57.6	76.1	76.5	11.96	111.15
11/01/2008 13:04:00	479.5259	21.8981	140.0	110.1	76.1	76.1	11.92	112.76
11/02/2008 17:47:00	508.2426	22.5442	176.0	131.6	75.9	76.5	11.34	114.69
11/03/2008 09:15:00	523.7092	22.8847	131.0	102.2	74.8	74.3	11.78	116.19
11/03/2008 17:32:00	531.9926	23.0650	95.0	73.2	75.9	79.5	11.75	117.26
11/04/2008 09:42:00	548.1592	23.4128	113.0	87.9	73.4	70.7	11.66	118.55
11/04/2008 15:03:00	553.5092	23.5268	72.0	55.4	73.8	74.1	11.62	119.36
11/05/2008 10:45:00	573.2092	23.9418	109.0	84.3	74.3	73.3	11.66	120.60
11/05/2008 15:40:00	578.1259	24.0442	66.0	51.2	73.6	73.3	11.69	121.35
11/06/2008 10:38:00	597.0926	24.4355	94.0	73.5	73.2	72.9	11.77	122.42
11/06/2008 15:29:00	601.9426	24.5345	56.0	43.8	73.9	73.6	11.79	123.07
11/07/2008 09:15:00	619.7092	24.8940	88.0	69.0	73.9	72.9	11.80	124.08
11/07/2008 15:33:00	626.0092	25.0202	61.0	47.8	74.8	72.9	11.80	124.78
11/08/2008 10:34:00	645.0259	25.3974	87.0	68.1	73.2	73.2	11.80	125.77
11/09/2008 09:36:59	668.0756	25.8472	104.0	80.7	73.2	74.1	11.71	126.96
11/10/2008 10:54:00	693.3592	26.3317	110.0	84.6	73.8	76.4	11.66	128.20
11/11/2008 09:53:59	716.3590	26.7649	105.0	81.2	73.8	77.9	11.75	129.39
11/12/2008 10:04:00	740.5259	27.2126	108.0	83.6	75.0	78.0	11.76	130.61
11/13/2008 09:52:00	764.3259	27.6464	67.0	51.2	75.0	79.8	11.66	131.36
11/15/2008 11:38:00	814.0926	28.5323	142.0	111.9	73.8	74.3	11.90	133.00
11/16/2008 10:43:00	837.1759	28.9340	118.0	92.5	74.3	76.4	11.88	134.36
11/17/2008 09:17:59	859.7590	29.3216	106.0	83.8	74.7	74.3	11.94	135.58
11/18/2008 10:31:00	884.9759	29.7485	107.0	84.2	75.2	75.8	11.92	136.82
11/19/2008 10:09:00	908.6092	30.1431	108.0	84.7	75.4	75.4	11.87	138.06
11/20/2008 09:48:00	932.2592	30.5329	83.0	66.2	72.0	72.9	12.01	139.03
11/21/2008 09:44:00	956.1926	30.9224	90.0	70.3	73.7	73.3	11.78	140.06
11/22/2008 10:10:00	980.6259	31.3149	91.0	71.2	73.4	74.6	11.82	141.10
11/23/2008 11:12:00	1005.6592	31.7121	91.0	71.0	73.8	75.3	11.80	142.14
11/24/2008 09:25:00	1027.8759	32.0605	80.0	63.1	73.6	73.3	11.90	143.07
11/25/2008 14:37:00	1057.0759	32.5127	94.0	73.5	74.5	74.7	11.82	144.15

11/26/2008 08:02:00	1074.4926	32.7795	74.0	58.1	73.0	72.8	11.82	145.00
11/27/2008 14:55:00	1105.3759	33.2472	85.0	66.4	73.6	74.2	11.80	145.97
11/28/2008 14:23:59	1128.8590	33.5985	71.0	55.0	73.8	74.5	11.70	146.78
11/29/2008 12:29:00	1150.9426	33.9255	62.0	48.2	73.0	73.3	11.71	147.48
11/30/2008 13:46:00	1176.2259	34.2961	54.0	42.2	73.2	73.3	11.78	148.10
12/01/2008 10:47:59	1197.2590	34.6014	69.0	53.9	73.4	73.3	11.76	148.89
12/02/2008 09:46:59	1220.2423	34.9320	70.0	54.7	72.7	69.2	11.69	149.69
12/03/2008 09:46:00	1244.2259	35.2736	68.0	53.1	73.4	75.8	11.82	150.47
12/04/2008 09:01:00	1267.4759	35.6016	67.0	52.7	73.8	74.0	11.88	151.24
12/05/2008 09:42:00	1292.1592	35.9466	63.0	49.0	72.7	75.1	11.75	151.96
12/07/2008 12:14:00	1342.6926	36.6428	102.0	79.2	75.4	74.8	11.73	153.12
12/09/2008 10:34:00	1389.0259	37.2696	87.0	68.1	73.2	75.8	11.85	154.12
12/10/2008 09:04:00	1411.5259	37.5703	84.0	66.1	76.3	72.5	11.84	155.09
12/10/2008 14:00:00	1416.4592	37.6359	40.0	31.6	76.6	71.2	11.85	155.55


Sample 41300-3 All Data
Total Gas Content, scf/ton
300
200
100
0
0
10
20
30
40
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas


Sample 41300-3 Lost Gas Content Graph
Measured Gas Content, scf/ton
40
20
0
-20
0
1
2
3
4
5
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End

Appendix III

Souder, Miller & Associates
MW-34-5-4
Fruitland Coals

Desorption Gas Composition Results

Weatherford
LABORATORIES

Sample 41300-1 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
10/11/2008 18:34:59	0.9455	0.0007	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0377	0.0124	0.0002	1.0000
10/11/2008 20:46:00	0.9689	0.0006	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0045	0.0212	0.0000	1.0000
10/12/2008 04:19:59	0.8539	0.0003	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0296	0.1097	0.0063	0.0001	1.0000
10/12/2008 20:00:00	0.9776	0.0005	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0163	0.0001	1.0000
10/24/2008 10:50:00	0.9929	0.0006	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0015	0.0009	0.0001	1.0000
11/17/2008 09:13:00	0.8631	0.0005	0.0004	0.0002	0.0001	0.0001	0.0001	0.0001	0.0000	0.0303	0.1052	0.0000	0.0000	1.0000
12/10/2008 13:52:00	0.0605	0.0001	0.0003	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.2047	0.7340	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
10/11/2008 18:34:59	0.9838	0.0007	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0129	0.0000	1.0000
10/11/2008 20:46:00	0.9756	0.0006	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0213	0.0000	1.0000
10/12/2008 04:19:59	0.9922	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0074	0.0000	1.0000
10/12/2008 20:00:00	0.9794	0.0005	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0164	0.0000	1.0000
10/24/2008 10:50:00	0.9955	0.0006	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	1.0000
11/17/2008 09:13:00	0.9982	0.0005	0.0004	0.0003	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
12/10/2008 13:52:00	0.9875	0.0018	0.0054	0.0000	0.0018	0.0018	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41300-1 Corrected Gas Composition vs. Desorbed Fraction

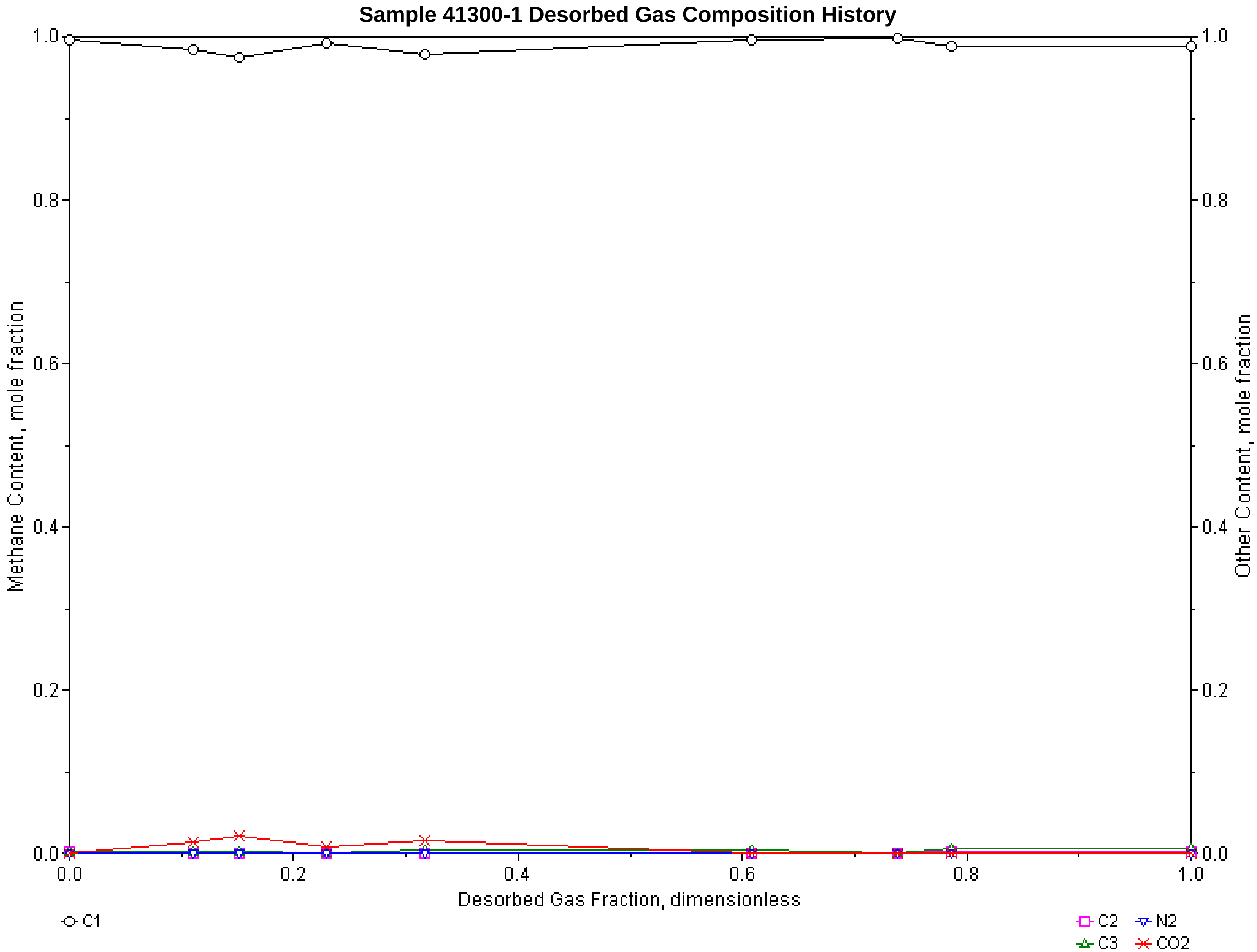
Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.9961	0.0011	0.0028	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
0.1105	0.9838	0.0007	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0129	0.0000	1.0000
0.1509	0.9756	0.0006	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0213	0.0000	1.0000
0.2292	0.9922	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0074	0.0000	1.0000
0.3174	0.9794	0.0005	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0164	0.0000	1.0000
0.6087	0.9955	0.0006	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	1.0000
0.7386	0.9982	0.0005	0.0004	0.0003	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
0.7860	0.9875	0.0018	0.0054	0.0000	0.0018	0.0018	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9875	0.0018	0.0054	0.0000	0.0018	0.0018	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition														
-	0.9885	0.0009	0.0032	0.0000	0.0004	0.0004	0.0004	0.0000	0.0000	0.0000	0.0000	0.0061	0.0000	1.0000

Sample 41300-1 Desorbed Gas Composition History (Lumped)

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_{3+} mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
10/11/2008 18:34:59	0.9455	0.0007	0.0025	0.0010	0.0377	0.0124	0.0002	1.0000
10/11/2008 20:46:00	0.9689	0.0006	0.0025	0.0024	0.0045	0.0212	0.0000	1.0000
10/12/2008 04:19:59	0.8539	0.0003	0.0001	0.0296	0.1097	0.0063	0.0001	1.0000
10/12/2008 20:00:00	0.9776	0.0005	0.0037	0.0000	0.0017	0.0163	0.0001	1.0000
10/24/2008 10:50:00	0.9929	0.0006	0.0031	0.0010	0.0015	0.0009	0.0001	1.0000
11/17/2008 09:13:00	0.8631	0.0005	0.0011	0.0303	0.1052	0.0000	0.0000	1.0000
12/10/2008 13:52:00	0.0605	0.0001	0.0007	0.2047	0.7340	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
10/11/2008 18:34:59	0.9838	0.0007	0.0026	0.0000	0.0000	0.0129	0.0000	1.0000
10/11/2008 20:46:00	0.9756	0.0006	0.0025	0.0000	0.0000	0.0213	0.0000	1.0000
10/12/2008 04:19:59	0.9922	0.0004	0.0001	0.0000	0.0000	0.0074	0.0000	1.0000
10/12/2008 20:00:00	0.9794	0.0005	0.0037	0.0000	0.0000	0.0164	0.0000	1.0000
10/24/2008 10:50:00	0.9955	0.0006	0.0031	0.0000	0.0000	0.0009	0.0000	1.0000
11/17/2008 09:13:00	0.9982	0.0005	0.0012	0.0000	0.0000	0.0000	0.0000	1.0000
12/10/2008 13:52:00	0.9875	0.0018	0.0107	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41300-1 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_{3+} mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.9961	0.0011	0.0028	0.0000	0.0000	0.0000	0.0000	1.0000
0.1105	0.9838	0.0007	0.0026	0.0000	0.0000	0.0129	0.0000	1.0000
0.1509	0.9756	0.0006	0.0025	0.0000	0.0000	0.0213	0.0000	1.0000
0.2292	0.9922	0.0004	0.0001	0.0000	0.0000	0.0074	0.0000	1.0000
0.3174	0.9794	0.0005	0.0037	0.0000	0.0000	0.0164	0.0000	1.0000
0.6087	0.9955	0.0006	0.0031	0.0000	0.0000	0.0009	0.0000	1.0000
0.7386	0.9982	0.0005	0.0012	0.0000	0.0000	0.0000	0.0000	1.0000
0.7860	0.9875	0.0018	0.0107	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9875	0.0018	0.0107	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition								
-	0.9885	0.0009	0.0045	0.0000	0.0000	0.0061	0.0000	1.0000



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Sample 41300-2 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
12/10/2008 13:56:00	0.6992	0.0010	0.0004	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0627	0.2251	0.0112	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
12/10/2008 13:56:00	0.9817	0.0014	0.0006	0.0002	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0157	0.0000	1.0000

Sample 41300-2 Corrected Gas Composition vs. Desorbed Fraction

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.9817	0.0014	0.0006	0.0002	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0157	0.0000	1.0000
0.7931	0.9817	0.0014	0.0006	0.0002	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0157	0.0000	1.0000
1.0000	0.9817	0.0014	0.0006	0.0002	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0157	0.0000	1.0000
Integrated Gas Composition														
-	0.9817	0.0014	0.0006	0.0002	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0157	0.0000	1.0000

Sample 41300-2 Desorbed Gas Composition History (Lumped)

Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
12/10/2008 13:56:00	0.6992	0.0010	0.0008	0.0627	0.2251	0.0112	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
12/10/2008 13:56:00	0.9817	0.0014	0.0012	0.0000	0.0000	0.0157	0.0000	1.0000

Sample 41300-2 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol. fraction	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
0.0000	0.9817	0.0014	0.0012	0.0000	0.0000	0.0157	0.0000	1.0000
0.7931	0.9817	0.0014	0.0012	0.0000	0.0000	0.0157	0.0000	1.0000
1.0000	0.9817	0.0014	0.0012	0.0000	0.0000	0.0157	0.0000	1.0000
Integrated Gas Composition								
-	0.9817	0.0014	0.0012	0.0000	0.0000	0.0157	0.0000	1.0000

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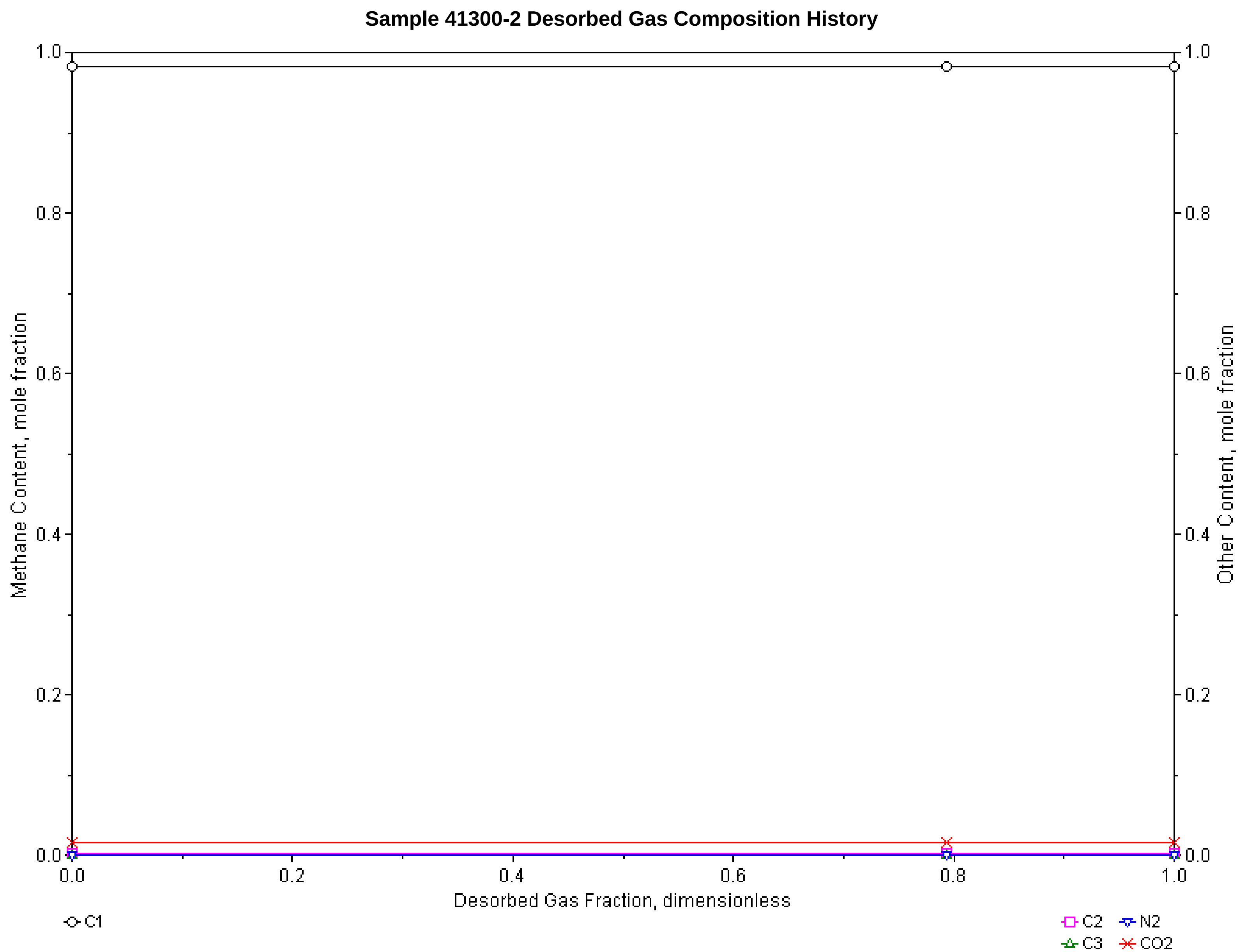

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Sample 41300-3 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
10/12/2008 16:29:00	0.7998	0.0016	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0426	0.1428	0.0117	0.0001	1.0000
10/12/2008 17:53:00	0.9553	0.0021	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0073	0.0240	0.0081	0.0003	1.0000
10/13/2008 08:16:00	0.9717	0.0025	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0029	0.0058	0.0145	0.0002	1.0000
10/24/2008 10:57:59	0.9660	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0009	0.0302	0.0000	1.0000
11/17/2008 09:17:59	0.9693	0.0021	0.0004	0.0002	0.0002	0.0001	0.0001	0.0000	0.0000	0.0018	0.0071	0.0187	0.0000	1.0000
12/10/2008 14:00:00	0.6954	0.0018	0.0004	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0621	0.2227	0.0171	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
10/12/2008 16:29:00	0.9819	0.0019	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0143	0.0000	1.0000
10/12/2008 17:53:00	0.9865	0.0022	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0084	0.0000	1.0000
10/13/2008 08:16:00	0.9805	0.0025	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0147	0.0000	1.0000
10/24/2008 10:57:59	0.9674	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0302	0.0000	1.0000
11/17/2008 09:17:59	0.9780	0.0021	0.0004	0.0002	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0188	0.0000	1.0000
12/10/2008 14:00:00	0.9724	0.0025	0.0005	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0239	0.0000	1.0000

Sample 41300-3 Corrected Gas Composition vs. Desorbed Fraction

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.9594	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0397	0.0000	1.0000
0.0674	0.9819	0.0019	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0143	0.0000	1.0000
0.0832	0.9865	0.0022	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0084	0.0000	1.0000
0.1577	0.9805	0.0025	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0147	0.0000	1.0000
0.4115	0.9674	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0302	0.0000	1.0000
0.5796	0.9780	0.0021	0.0004	0.0002	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0188	0.0000	1.0000
0.6565	0.9724	0.0025	0.0005	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0239	0.0000	1.0000
1.0000	0.9724	0.0025	0.0005	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0239	0.0000	1.0000
Integrated Gas Composition														
-	0.9739	0.0023	0.0008	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0225	0.0000	1.0000

Sample 41300-3 Desorbed Gas Composition History (Lumped)

Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
10/12/2008 16:29:00	0.7998	0.0016	0.0015	0.0426	0.1428	0.0117	0.0001	1.0000
10/12/2008 17:53:00	0.9553	0.0021	0.0029	0.0073	0.0240	0.0081	0.0003	1.0000
10/13/2008 08:16:00	0.9717	0.0025	0.0023	0.0029	0.0058	0.0145	0.0002	1.0000
10/24/2008 10:57:59	0.9660	0.0024	0.0000	0.0004	0.0009	0.0302	0.0000	1.0000
11/17/2008 09:17:59	0.9693	0.0021	0.0011	0.0018	0.0071	0.0187	0.0000	1.0000
12/10/2008 14:00:00	0.6954	0.0018	0.0008	0.0621	0.2227	0.0171	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
10/12/2008 16:29:00	0.9819	0.0019	0.0018	0.0000	0.0000	0.0143	0.0000	1.0000
10/12/2008 17:53:00	0.9865	0.0022	0.0030	0.0000	0.0000	0.0084	0.0000	1.0000
10/13/2008 08:16:00	0.9805	0.0025	0.0024	0.0000	0.0000	0.0147	0.0000	1.0000
10/24/2008 10:57:59	0.9674	0.0024	0.0000	0.0000	0.0000	0.0302	0.0000	1.0000
11/17/2008 09:17:59	0.9780	0.0021	0.0011	0.0000	0.0000	0.0188	0.0000	1.0000
12/10/2008 14:00:00	0.9724	0.0025	0.0012	0.0000	0.0000	0.0239	0.0000	1.0000

Sample 41300-3 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol. fraction	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
0.0000	0.9594	0.0009	0.0000	0.0000	0.0000	0.0397	0.0000	1.0000
0.0674	0.9819	0.0019	0.0018	0.0000	0.0000	0.0143	0.0000	1.0000
0.0832	0.9865	0.0022	0.0030	0.0000	0.0000	0.0084	0.0000	1.0000
0.1577	0.9805	0.0025	0.0024	0.0000	0.0000	0.0147	0.0000	1.0000
0.4115	0.9674	0.0024	0.0000	0.0000	0.0000	0.0302	0.0000	1.0000
0.5796	0.9780	0.0021	0.0011	0.0000	0.0000	0.0188	0.0000	1.0000
0.6565	0.9724	0.0025	0.0012	0.0000	0.0000	0.0239	0.0000	1.0000
1.0000	0.9724	0.0025	0.0012	0.0000	0.0000	0.0239	0.0000	1.0000
Integrated Gas Composition								
-	0.9739	0.0023	0.0012	0.0000	0.0000	0.0225	0.0000	1.0000

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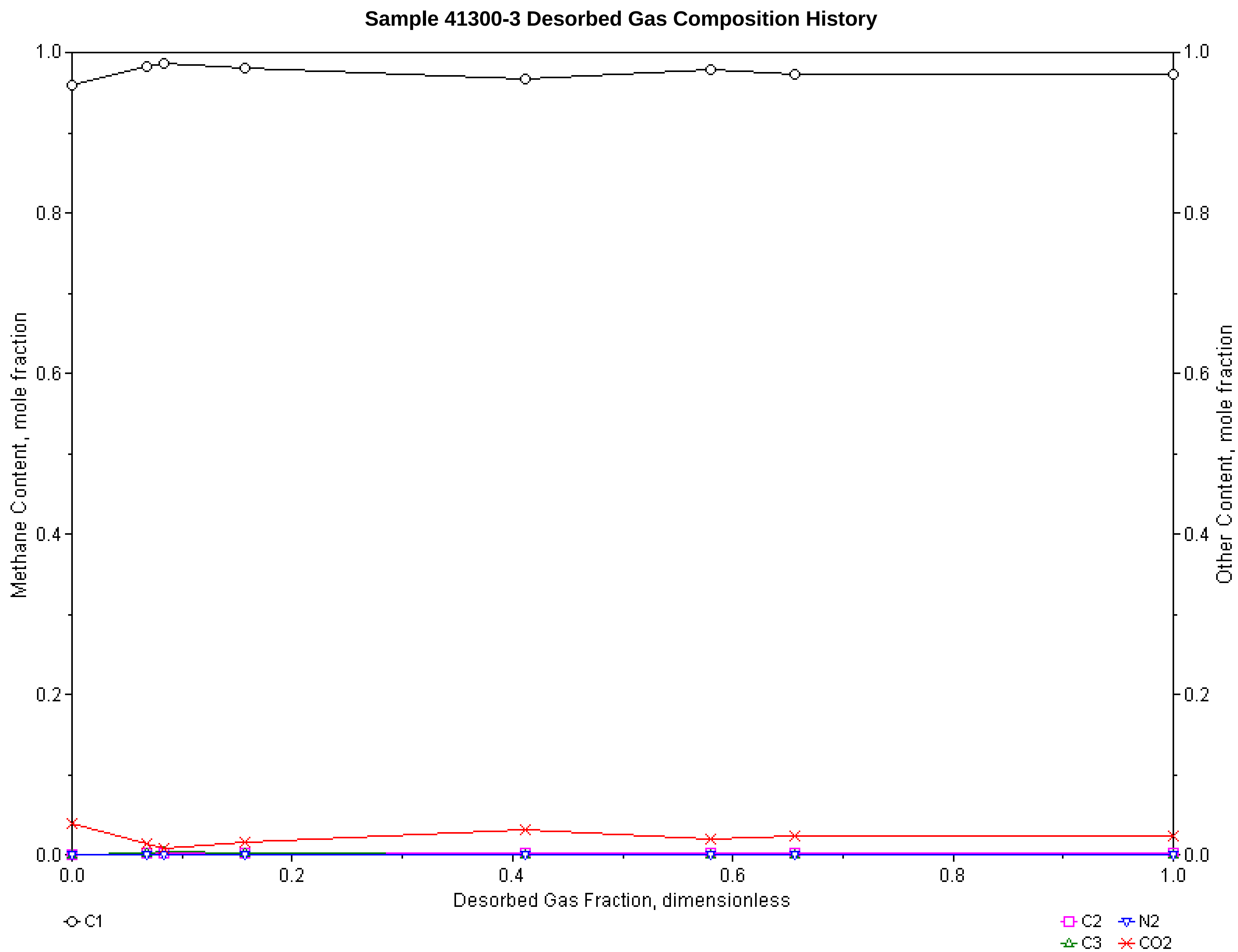

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Appendix IV

Souder, Miller & Associates
MW-34-5-4
Fruitland Coals

Adsorption Isotherm Results

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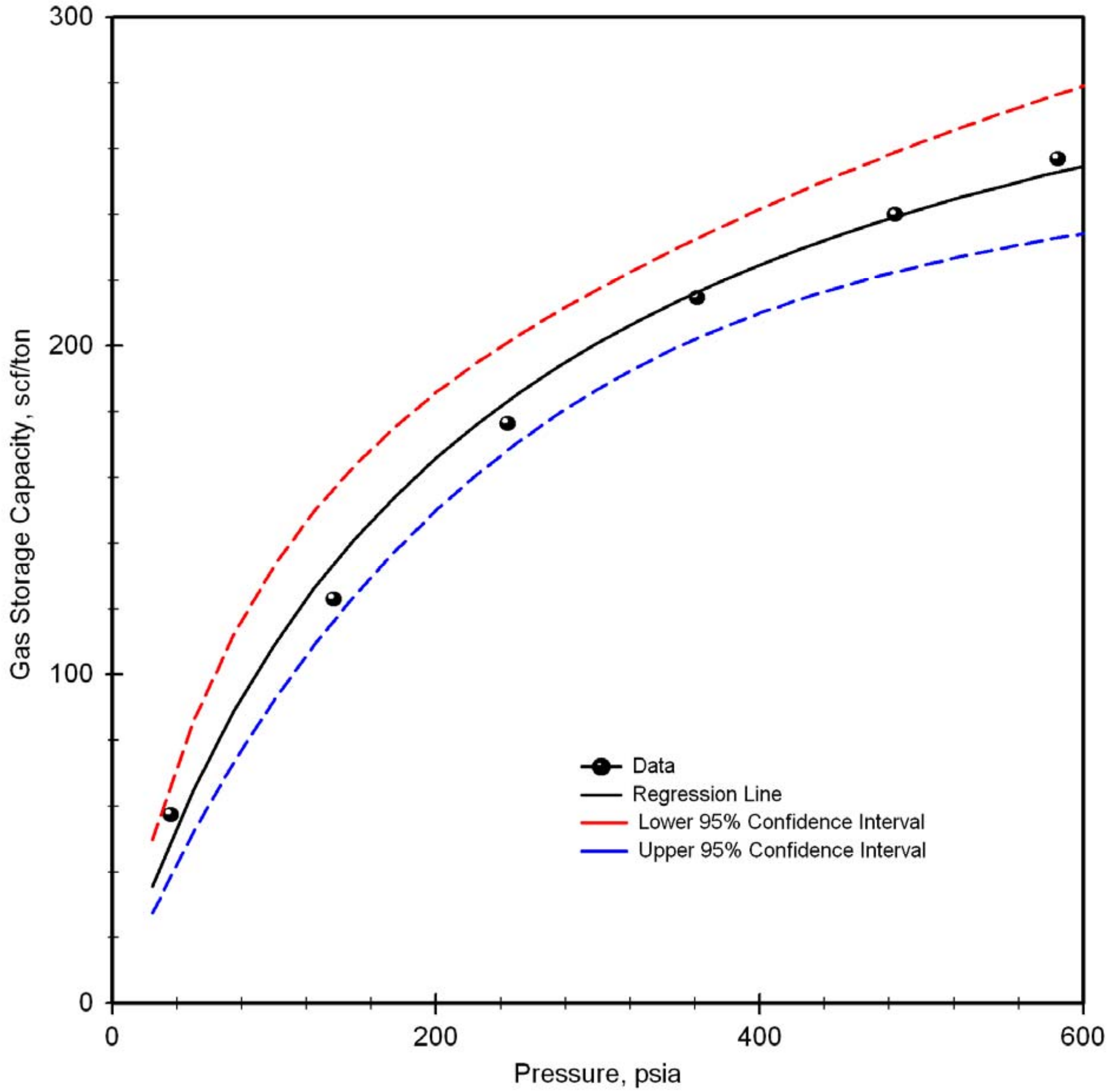
Sample 41300-1 Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	753.5
Bottom Depth	ft	754.5
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	75.02
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.468
Moisture Holding Capacity	wt frac	0.0175
Ash Content	wt frac	0.2786
Volatile Matter Content	wt frac	0.2825
Fixed Carbon Content	wt frac	0.4213
Organic Content	wt frac	0.6980
Sulfur Content	wt frac	0.0059
Carbon Content	wt frac	0.6072
Nitrogen Content	wt frac	0.0129
Hydrogen Content	wt frac	0.0451
Oxygen Content	wt frac	0.0328
Sulfur-in Ash Content	wt frac	0.0089
Vitrinite Content	vol frac	0.870
Inertinite Content	vol frac	0.115
Liptinite Content	vol frac	0.015
Rank Parameters		
Parr Corrected Volatile Matter Content, daf	wt frac	0.5097
Parr Corrected Fixed Carbon Content	wt frac	0.4903
Calorific Value, mmf	BTU/lbm	14,914
Parr Corrected Calorific Value, mmf	BTU/lbm	15,162
Langmuir Parameters		
Number of Points	-	6
Regression Coefficient	-	0.99361
Langmuir Storage Capacity, daf	scf/ton	494.13
Langmuir Storage Capacity, In-Situ	scf/ton	347.81
Langmuir Storage Capacity Range, In-Situ	scf/ton	3.58
Langmuir Pressure	psia	219.22
Langmuir Pressure Range	psia	47.72

Sample 41300-1 Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	scf/ton
36.053	57.470
136.671	123.050
244.151	176.528
360.974	214.847
483.415	240.088
583.901	256.997

Sample 41300-1 Adsorption Isotherm Curve



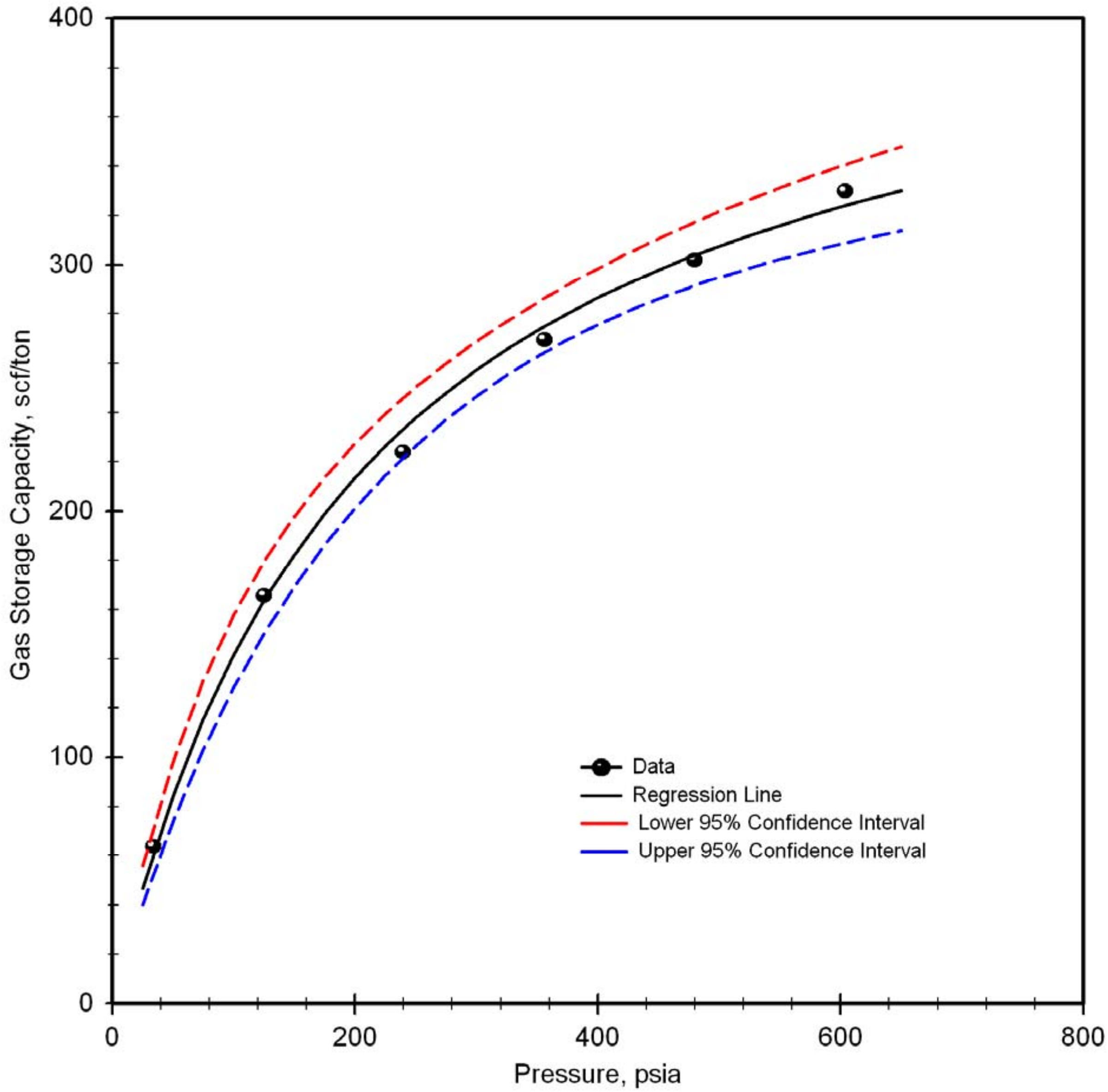
Sample 41300-COMP-1 Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	813.0
Bottom Depth	ft	816.0
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	75.02
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.406
Moisture Holding Capacity	wt frac	0.0147
Ash Content	wt frac	0.2209
Volatile Matter Content	wt frac	0.2906
Fixed Carbon Content	wt frac	0.4738
Organic Content	wt frac	0.7573
Sulfur Content	wt frac	0.0070
Carbon Content	wt frac	0.6661
Nitrogen Content	wt frac	0.0139
Hydrogen Content	wt frac	0.0466
Oxygen Content	wt frac	0.0307
Sulfur-in Ash Content	wt frac	0.0038
Vitrinite Content	vol frac	0.917
Inertinite Content	vol frac	0.062
Liptinite Content	vol frac	0.021
Rank Parameters		
Parr Corrected Volatile Matter Content, daf	wt frac	0.5039
Parr Corrected Fixed Carbon Content	wt frac	0.4961
Calorific Value, mmf	BTU/lbm	15,189
Parr Corrected Calorific Value, mmf	BTU/lbm	15,368
Langmuir Parameters		
Number of Points	-	6
Regression Coefficient	-	0.99811
Langmuir Storage Capacity, daf	scf/ton	570.10
Langmuir Storage Capacity, In-Situ	scf/ton	435.76
Langmuir Storage Capacity Range, In-Situ	scf/ton	4.25
Langmuir Pressure	psia	208.14
Langmuir Pressure Range	psia	24.68

Sample 41300-COMP-1 Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	scf/ton
33.554	64.040
125.038	165.751
239.622	224.143
355.741	269.661
479.332	302.216
603.497	330.069

Sample 41300-COMP-1 Adsorption Isotherm Curve



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Final Report
Reservoir Property Assessment

Souder, Miller & Associates
Fosset Gulch MW 34-5-14U
Fruitland Coals
San Juan Basin
Archuleta County, Colorado

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Summary

Weatherford Laboratories (WFT Labs) measured properties of five core samples recovered from Fruitland Coals penetrated by Souder, Miller & Associates' Fosset Gulch MW 34-5-14U well between October 29 and October 30, 2008. Core was collected between 479.0 and 532.1 ft. The goals of this project were to evaluate the sorbed gas content, coal properties, gas storage capacity, and gas-in-place of the Fruitland Coals at the well location.

Five core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. Two desorption samples were dedicated to collection of multiple gas composition and isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all five core samples. Coal characterization was determined for samples taken from desorption samples 41547-2 and 41547-5, which included chemical (proximate analysis, ultimate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). Samples used for coal characterization were also used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

A variety of factors can influence data quality. Confidence in the analytical results depends on the reliability of reservoir temperature and pressure information available for the cored intervals as well as adherence to sample collection and processing protocols. Relative confidence levels were assigned to describe the reliability of the data discussed in this report. These confidence levels are defined below.

- Low confidence — Data should not be considered representative of reservoir conditions.

- Moderate confidence — Data are suspect but may be useful in conjunction with other information to describe reservoir conditions.

- High confidence — Data are believed to represent reservoir conditions (assuming experimental temperature and pressure data accurately describe initial reservoir conditions).

The conclusions and the confidence in these conclusions are summarized in the remainder of this section.

1. Confidence in the desorption data was high. The lost gas fraction of the five desorption samples ranged from 6.6 to 25.4% of the total gas content. At the conclusion of desorption experiments, all five desorption samples were crushed to determine the remaining gas content as required for accurate total gas content estimates. The percentage of the total gas released by crushing ranged from 17.4 to 72.6% of the total gas content. The average dry, ash-free and in-situ gas contents were 271.7 scf/ton (standard cubic feet per ton) and 129.3 scf/ton, respectively.

2. Estimates of the diffusivity at 69 or 72°F, the desorption temperatures, ranged from 0.089 to 0.973 ms^{-1}. This range corresponded to sorption times (time to desorb 63% of the gas at the desorption temperature and atmospheric pressure) ranging from 19.0 to 207.8 hours. Confidence in this data was high as there was high confidence in the desorption data.

3. Multiple desorption gas samples were collected from two dedicated desorption canisters. These data were integrated as a function of the desorbed gas fraction to estimate the original adsorbed gas composition. Estimates of the adsorbed gas composition included 96.3 mol% methane, with minor concentrations of ethane (2.1 mol%), propane and heavier hydrocarbons (0.9 mol%), and carbon dioxide (0.7 mol%). The confidence in these data was moderate as there was substantial air contamination in some of the gas composition samples.

4. Results of isotopic analysis for sample 41547-2 indicated that the released gas was thermogenic in origin. Results for sample 41547-5 indicated that the released gas was biogenic in origin. Confidence in this data was high.

5. The density of the five desorption samples was determined after crushing with a helium pycnometer. The density ranged from 1.524 to 2.666 g/cm^3 on an in-situ basis. Confidence in these data was high.

6. Estimates of the organic fraction density and inorganic fraction density were of moderate accuracy due to minor variation in the sample moist density. The organic fraction density estimate of 1.214 g/cm^3 was consistent with the maceral composition. The inorganic fraction density of 3.365 g/cm^3 was greater than the density of moist montmorillonite (2.12 g/cm^3) and moist kaolinite (2.42 g/cm^3).

7. Ash contents from the five desorption samples were moderate to high, ranging from 0.3223 to 0.8672 weight fraction on an in-situ basis. The moisture holding capacity (in-situ or inherent moisture content) was moderate, ranging from 0.0125 to 0.0229 weight fraction. The sulfur content was low to moderate, ranging from 0.0061 to 0.0448 weight fraction on an in-situ basis. The confidence in these data was high.

8. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm, which was not the case for the two isotherm samples. The moist, mineral-matter-free calorific value for sample 41547-2 was 15,039 BTU/lbm and for sample 41547-5 was 15,566 BTU/lbm. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41547-2 was 0.99% in oil and for sample 41547-5 was 0.88% in oil placing the ranks in the high volatile A bituminous range. There was high confidence in these data.

9. The maceral compositions were determined for the two adsorption isotherm samples. For sample 41547-2, the composition included 93.7% vitrinite, 5.8% inertinite, and 0.5% liptinite. For sample 41547-5, the composition included 93.0% vitrinite, 7.0% inertinite, and 0.0% liptinite. The confidence in these estimates was high.

10. Confidence in the measured adsorbed methane storage capacity data at the measurement temperature was high as all measurements were performed with state-of-the-art equipment adhering to strict protocols. Two isotherms were determined from two desorption samples. Based upon the reservoir temperature gradient data, the in-situ temperature was 70.5°F. The isotherm data were measured on samples 41547-2 and 41547-5, which had ash contents of 0.3319 and 0.5404 weight fraction, respectively, and moisture contents of 0.0159 and 0.0181 weight fraction, respectively. The dry, ash-free Langmuir methane storage capacity for sample 41547-2 was 665.9 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 430.3 scf/ton. The Langmuir pressure was 174.7 psia. The dry, ash-free Langmuir methane storage capacity for sample 41547-5 was 647.4 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 276.6 scf/ton. The Langmuir pressure was 166.8 psia.

11. At 222.5 psia, the estimated dry, ash-free methane storage capacity was 375.1 scf/ton. This was slightly greater than the dry, ash-free gas content of 336.9 scf/ton. Therefore, the degree of gas saturation (gas content divided by methane storage capacity) was 89.8%.

12. The density and gas content of the coal samples were used to estimate the adsorbed gas-in-place (GIP) volume per unit coal volume. The gas-in-place volume per unit thickness was 291.7 Mscf/acre-ft (thousand standard cubic feet per acre-foot of coal). Confidence in this estimate was high as there was high confidence in the gas content and density data.

The data and the basis of these conclusions are discussed throughout the remainder of this report.

Introduction

This report summarizes the procedures and results of the gas desorption and coal characterization program conducted on five core samples recovered from the Souder, Miller & Associates' Fosset Gulch MW 34-5-14U well between October 29 and October 30, 2008, from depths between 479.0 and 532.1 ft. The well is located in the San Juan Basin, specifically SE/SE Section 34, Township 35N, Range 5W, Archuleta County, Colorado. At the request of Mr. Denny Foust of Souder, Miller & Associates, WFT Labs conducted analyses on the core samples. The goals of this project were to evaluate the sorbed gas content, coal properties, gas storage capacity, and gas-in-place of the Fruitland Coals at the well location.

Many of the values presented in this report are time specific. For instance, references to gas content and gas composition are valid on the date the reservoir was sampled. These properties may have been affected by fluid production from the study well, offset wells, or drainage by mining activities since the samples were collected.

Table 1 summarizes the detailed analysis program conducted on the samples after they arrived at WFT Labs' laboratory. Samples 41547-2 and 41547-5 were selected for coal characterization and isotherm analysis after initial ash content screening was complete. Information concerning the details of the measurements and the resulting data are discussed throughout this report.

Table 1. Analysis Program Summary

Sample ID	Can ID	Drill Depth (ft)	Reservoir System	Premium Sample	Sample Handling	Core Photography	Core Lithology	Gas Composition	Long-term Residual Gas	Density	Moisture/Ash/Sulfur	Moisture Holding Capacity	Proximate/Ultimate/BTU/SO_3 in Ash	Comprehensive Petrography	Isotherm Preparation	Isotherm
41547-1	GT-193	480.3-481.3	Fruitland Coals	X	X	X	X		X	X	X	X				
41547-2	GT-270	484.7-485.7	Fruitland Coals	X	X	X	X	X	X	X	X	X				
41547-2 Isotherm	-	484.7-485.7	Fruitland Coals								X	X	X	X	X	CH_4
41547-3	GT-230	487.5-488.5	Fruitland Coals	X	X	X	X		X	X	X	X				
41547-4	GT-398	524.0-525.0	Fruitland Coals	X	X	X	X		X	X	X	X				
41547-5	GT-247	531.1-532.1	Fruitland Coals	X	X	X	X	X	X	X	X	X				
41547-5 Isotherm	-	531.1-532.1	Fruitland Coals								X	X	X	X	X	CH_4

Field Activities

WFT Labs field personnel were on location at the well site between October 28 and October 31, 2008. WFT Labs collected drilling and coring operations data, five core samples for desorption measurements, desorbed gas content data, samples for gas composition determination from two canisters, samples for isotopic determination from two canisters, and core that was retained for additional analyses. This section summarizes the field activities.

References to core depths throughout this report are based on driller's depths and may require a depth correction to agree with log depths.

On October 28, 2008, Mr. Denny Foust provided reservoir temperatures of 69 and 72°F.

Reservoir Pressure data was provided on October 28, 2008, by Mr. Denny Foust. A pressure gradient of 0.42 psi/ft was used in all calculations in this report.

Scorpion Drilling Company (Rig #2) from Farmington, New Mexico, conducted the drilling operations for the well. Core point depth (479.0 ft) was reached on October 28, 2008. Coring operations commenced on October 29, 2008, and were completed on October 30, 2008, with a total of three intermittent core runs from 479.0 to 532.1 ft. A summary of all core runs is presented in Table 2. A field report was issued previously containing details of these operations.[1]

Reed Hycalog from Casper, Wyoming, conducted the coring operations. Tools used for coring operations included a CD-93 6.25-inch by 3.5-inch core bit for the first two core runs, a CMR-27 6.25-inch by 3.5-inch core bit for the last run, and a 30-foot long conventional plastic inner-core barrel. Coring fluid was composed of freshwater-based bentonite mud.

Table 2. Core Run Summary

Core Run	Cored Interval	Length Cored	Length Recovered	Core Recovery Success	Core Recovery Time	Circulating Fluid Temp.	Fluid Density	Number of Samples
#	ft	ft	ft	%	hh:mm:ss	°F	ppg	#
1	479.0-480.0	1.0	0.0	0.0	1:14:07	62.0	8.6	0
2	480.0-506.0	26.0	8.7	33.5	1:03:25	48.0	8.6	3
3	524.0-532.1	8.1	8.1	100.0	1:02:55	55.9	8.6	2
Total	**-**	***35.1***	***16.8***	***47.9***	**-**	**-**	**-**	***5***

Five desorption samples were collected from Fruitland Coals. The core samples were sealed in individual desorption canisters equilibrated to approximate in-situ temperature (69 or 72°F) for gas content analysis. All canisters were filled with potable water to minimize headspace volume within the canister, excluding sample 41547-4, which was filled with inert silica beads to avoid clay expansion in the carbonaceous shale sample. Reduced head space increased the accuracy of the gas content measurements, maximized the quality of gas samples collected for compositional analysis, and reduced oxidation and desiccation of the core. Desorption readings were taken every few minutes for the first few hours, which was important for accurate lost gas content estimates. Gas content measurements continued for at least 24 hours at the well site. Two canisters (samples 41547-2 and 41547-5) were selected for gas composition and isotopic analysis.

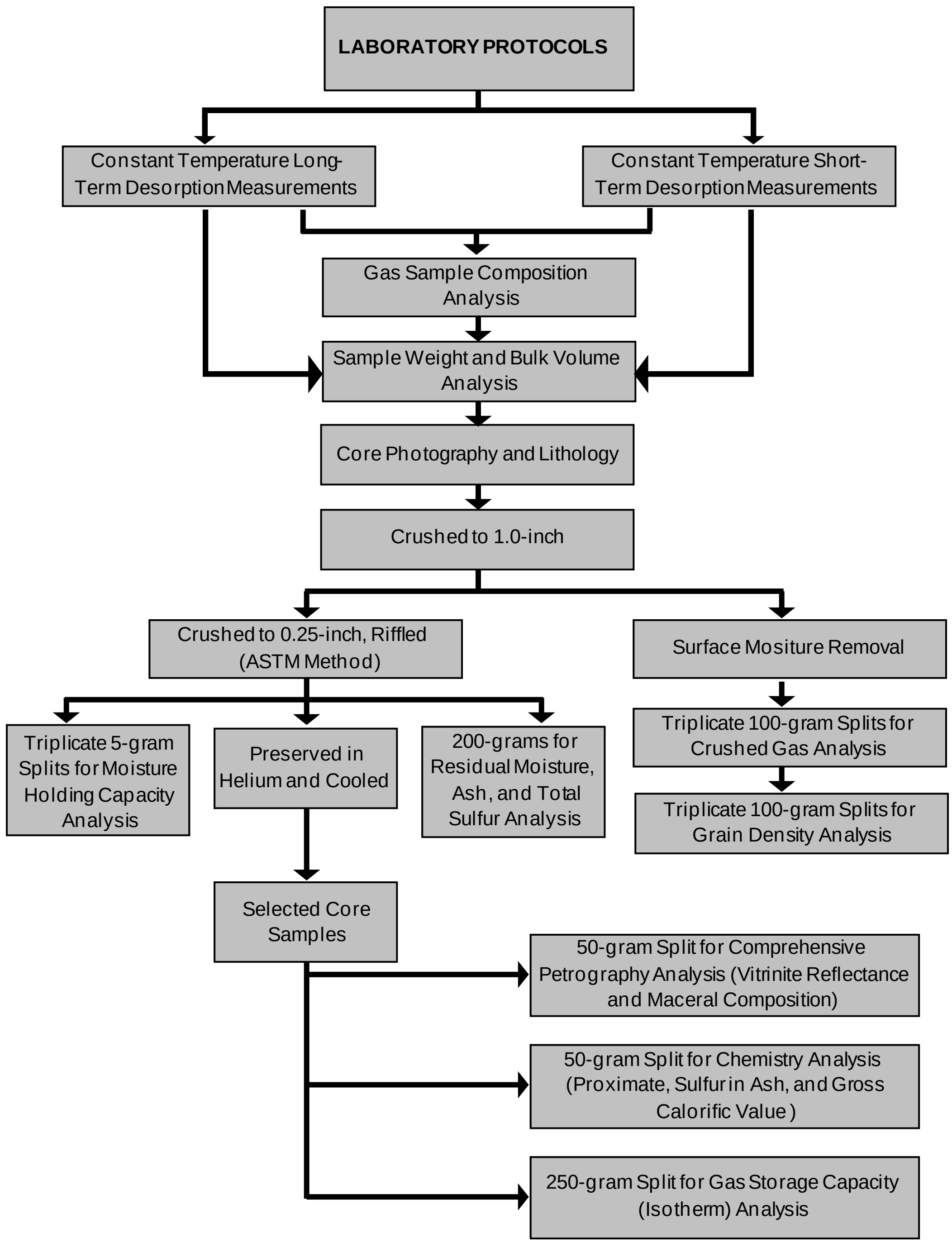
Samples not involved in desorption analysis were sealed in plastic wrap and placed in core boxes. These samples and the desorption samples were delivered to WFT Labs' Arvada, Colorado, laboratory on November 1, 2008. Desorption measurements continued at 69 or 72°F until the samples were crushed to determine the remaining gas content.

Laboratory Procedures

WFT Labs performed long-term desorption tests, gas composition analysis, sample bulk composition and property analysis including moisture, density, proximate analysis, ultimate analysis, sulfur-in-ash, gross calorific value, and adsorption isotherm measurements on selected samples. WFT Labs sub-contracted petrography and isotopic analyses on selected samples. The following details typical laboratory procedures and analyses conducted for a coal reservoir property assessment; although, these analyses may or may not have been performed on the samples collected at this well.

Samples were processed using systematic procedures that minimized sample aerial oxidation, aerial desiccation (moisture loss), and gas loss. WFT Labs used an in-house improved procedure to air-dry processed samples that differs from the air-drying procedure described in the ASTM Method D 3302. WFT Labs' air-drying procedure attempts not to over-dry samples by only removing surface moisture. Figure 1 summarizes the general sample processing and analysis steps in the form of a flow chart. Some of the analyses summarized in this figure may not have been performed on samples from this project. Sample methodologies rigorously followed best practice analysis protocols developed by ASTM, the Gas Technology Institute (GTI), and WFT Labs.[2,3,4,5,6]

Figure 1. **Sample Processing and Analysis Flow Chart**



Gas Content Measurement Protocol

Desorbed gas volumes were measured as a function of time to the nearest 1 milliliter by head-pressure equalized fluid displacement. The frequency of the measurements was greatest during the early time of desorption tests to ensure sufficient data were available for lost gas content determination. The gas desorption data collected during the gas desorption tests were used to calculate the lost gas content. Lost gas content estimates were obtained from the early time gas content data using WFT Labs' modified version of the U.S. Bureau of Mines' Direct Method.[5,6]

Samples were removed from the canister and the particle size was reduced to a one-inch diameter top size. Triplicate representative splits, approximately 100 grams each, were quickly removed from the gross sample for crushed gas analysis. The splits were individually pulverized to -200 mesh in specialized sealed crushing vessels under an inert gas (helium) atmosphere at approximate reservoir temperature. The released (crushed) gas volume was measured periodically until no measurable gas was released from the crushing vessel. The crushed gas content of the samples was calculated by dividing the released gas volume by the sample weight. An average of gas content from the triplicate splits was used as the final estimate of the crushed gas content.

RapidGas™ is WFT Lab's methodology when samples are removed from desorption samples within three weeks of the start of desorption and pulverized to determine the released gas volume with the crushed gas method. WFT Labs uses the term accelerated gas to describe crushed gas analysis when the desorption time is greater than for *RapidGas* samples but less than the time for long-term desorption samples.

Crushed gas content (also referred to as residual gas content) is used to describe the released gas content when samples are crushed after long-term desorption at approximate reservoir temperature. WFT Labs terminates the long-term desorption measurements when the released gas volume is less than or equal to 0.05 scf/ton-D (standard cubic feet per ton-day) over a several day period.

The total air-dry gas contents were calculated by the sum of the lost gas, measured gas, and crushed gas contents. Residual moisture, ash, moisture holding capacity, and total sulfur content data were then used to convert air-dry basis gas content data to other bases (e.g., dry; dry, ash-free; and in-situ bases). All gas content volumes were converted to and reported in standard cubic feet per ton (2,000 lbm) of rock (scf/ton).

Apparent Diffusivity and Sorption Time

Gas storage and flow through coal seams are generally modeled with dual porosity reservoir models.[6] Gas is stored by adsorption within the primary porosity system within the organic component of the coal matrix. The primary porosity consists of micro- (<2 nanometer diameter) and meso-porosity (2 to 50 nanometer diameter) pores. Gas flows to wells through the secondary porosity system, which consists of macro-pores (>50 nanometers diameter) and natural fractures. Gas flow through the primary porosity is dominated by diffusion and quantified with Fick's Law while gas flow through the secondary porosity is driven by pressure gradients and quantified with Darcy's Law.

Diffusivity is the diffusion coefficient divided by the square of an average diffusion distance. Diffusivity can be estimated from the method used for determining lost gas volume using the relationship listed in Equation 1.

$$\frac{D}{r^2} = \left(\frac{m}{203.1 G_{ad}} \right)^2 \tag{1}$$

where:

D/r^2 *diffusivity, sec*$^{-1}$
m *slope of gas content versus square-root time graph, scf/ton-hr*$^{0.5}$

G_{cad} *air-dry basis total gas content, scf/ton*

Although diffusivity values are used in reservoir models, an easier concept to understand is the sorption time. Sorption time is defined as the time required to desorb 63.2% of the original gas content if a sample is maintained at constant temperature. The relationship used to relate sorption time to diffusivity is listed in Equation 2.

$$\tau = \left(3600\,\alpha\,\frac{D}{r^2}\right)^{-1} \tag{2}$$

where:

τ *sorption time, hr*
α *geometrical shale factor, cm*^{2}

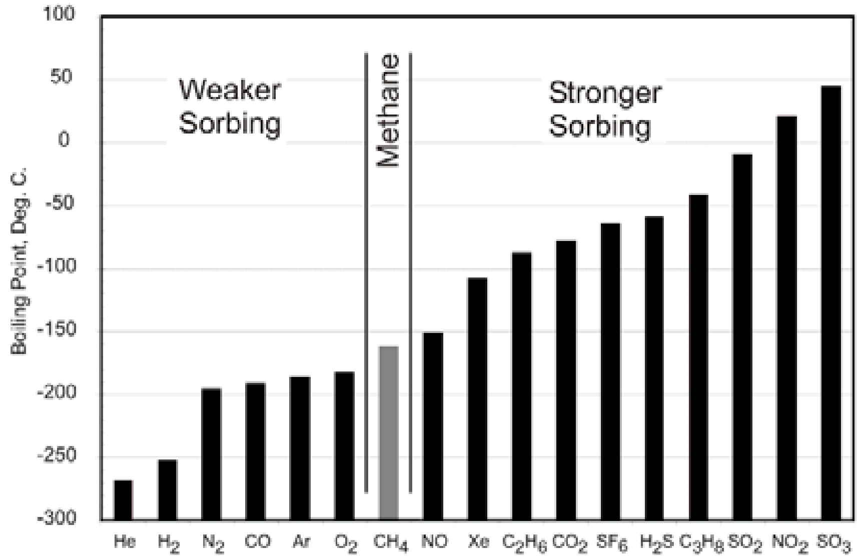
The geometrical shape factor for a sphere, the most common assumed geometry, is 15. The accuracy of the diffusivity value depends weakly upon the competency of the core sample and strongly upon the determination of the lost gas content.

Gas Composition and Isotope Analysis

It is important to determine the composition of the adsorbed gas as the gas composition directly affects the gas storage capacity and critical desorption pressure. The adsorption affinity of gases is related to their atmospheric pressure boiling point as illustrated by Figure 2. Nitrogen tends to decrease in-situ multi-component gas storage capacity while carbon dioxide, ethane, and heavier hydrocarbon gases tend to increase storage capacity. The composition of the gas desorbed from the core samples changes with time, and concentrations of heavier hydrocarbon species tend to increase relative to methane.

The gas composition as a function of desorbed gas fraction data (cumulative desorbed gas content divided by the total gas content) was integrated to determine the adsorbed gas composition for coal samples or for an average of the free and adsorbed gas compositions for shale samples. Gas composition samples were collected from dedicated canisters. These canisters are usually purged with helium at the time of sealing to reduce air contamination. Gas samples were collected periodically before measuring the released gas volume. The gas composition of the initial released gas was determined by extrapolation to zero desorbed gas content. The accuracy of the extrapolation is strongly dependent upon the lost gas content and the number of desorption gas samples taken early in the desorption measurements. If lost gas content is large, i.e., greater than 25%, the estimates of the lost gas composition are probably inaccurate and deficient in the lighter hydrocarbon species. The composition of the gas released by crushing the samples at the end of the desorption measurements must also be corrected for contamination by air.

Figure 2. **Relative Sorption Affinity of Gases**



Gas sample composition was analyzed at WFT Labs by gas chromatography in accordance with ASTM Method D 1945 (modified). The gas composition was calculated by integrating the gas composition as a function of cumulative desorbed gas content.

Determining the origin of the gas is important in understanding the characteristics of natural gas in a reservoir system or basin. Natural gas derived from two distinct sources listed below can be distinguished based on isotopic composition.[7] Isotopes are atoms whose nuclei contain the same number of protons but a different number of neutrons. Gas isotope ratios were determined by isotope ratio mass spectroscopy.

1. Biogenic Gas: Gas generated by anaerobic decomposition of organic matter in a shallow, low temperature sedimentary environment.

2. Thermogenic Gas: Gas formed in deeply buried sediments by thermal cracking of sedimentary organic matter into hydrocarbon liquids and gas (primary thermogenic gas), or by thermal cracking of oil at high temperatures into gas (secondary thermogenic gas).

Biogenic gas consists primarily of methane and is often referred to as a "dry" gas. Thermogenic gas can be dry or contain concentrations of heavier hydrocarbons (C_{2+}).

The following information is derived from Reference 7. In isotope geochemistry, it is common practice to express isotopic composition in terms of a delta (δ) value, which is a difference from a standard sample. For example, the delta value for substance A is defined by Equation 3.

$$\delta_A = 10^3 \left(\frac{R_A}{R_{st}} - 1 \right) \qquad (3)$$

where:

δ_A	*delta value of element A, parts per thousands, ‰*
R_A	*isotopic ratio of A, dimensionless*
R_{st}	*isotopic ratio of a standard, dimensionless*

Carbon has two stable isotopes: ^{12}C and ^{13}C. ^{12}C accounts for 98.89% of all carbon and ^{13}C accounts for 1.11% of the remaining carbon. When the delta value is greater, it is common to consider substance A enriched in the rare, heavier isotope.

Hydrogen has two stable isotopes: H and ^{2}D (deuterium). H accounts for 99.9844% of all hydrogen and ^{2}D accounts for 0.0156% of the remaining hydrogen. Hydrogen exhibits the largest variations in stable isotope ratios of all elements.

Biogenic methane commonly occurs in recent anoxic (low oxygen concentration) sediments in both fresh water, such as lakes and swamps, and marine environments, such as estuaries and shelf regions. There are two primary pathways for methanogenesis, fermentation of acetate and reduction of CO_2. Acetate fermentation is dominant in freshwater environments while CO_2 reduction is dominate in marine environments.

During methanogenic bacterial decomposition of organic material, methane is highly depleted in $d^{13}C$ and results in $d^{13}C$ values between -110 and -50‰. In marine sediments, methane formed by CO_2 reduction is often more depleted in ^{13}C than when formed by acetate fermentation. Typical values for $d^{13}C$ in methane from marine environments range from -110 to -60‰ while those in methane from freshwater environments range from -65 to -50‰.

The difference in methane composition from both environments is even greater for the hydrogen isotopes. Marine bacterial methane has dD values between -250 and -170‰ while biogenic methane in freshwater environments is strongly depleted in deuterium with dD values between -400 to -250‰. This difference is due to the source of the hydrogen. Hydrogen comes from formation water during CO_2 reduction. Seventy-five percent of the hydrogen created by fermentation comes from the methyl group, which is extremely depleted in deuterium.

Thermogenic gas is produced in deeply buried sediments due to modification of the organic matter by various chemical reactions, such as cracking of kerogen. The ^{12}C – ^{13}C bonds are preferentially broken during the first stages of maturation resulting in ^{13}C enrichment, which continues as temperature increases. In general, as thermal maturity of methane increases, the $d^{13}C$ values increase. Thermogenic methane commonly has $d^{13}C$ values between -50 and -20‰. Methane from non-marine (humic) sources are isotopically enriched relative to those generated from marine (sapropelic sources) and similar levels of thermal maturity. In contrast, dD values are independent on the source of organic material but are highly dependent on the thermal maturity.

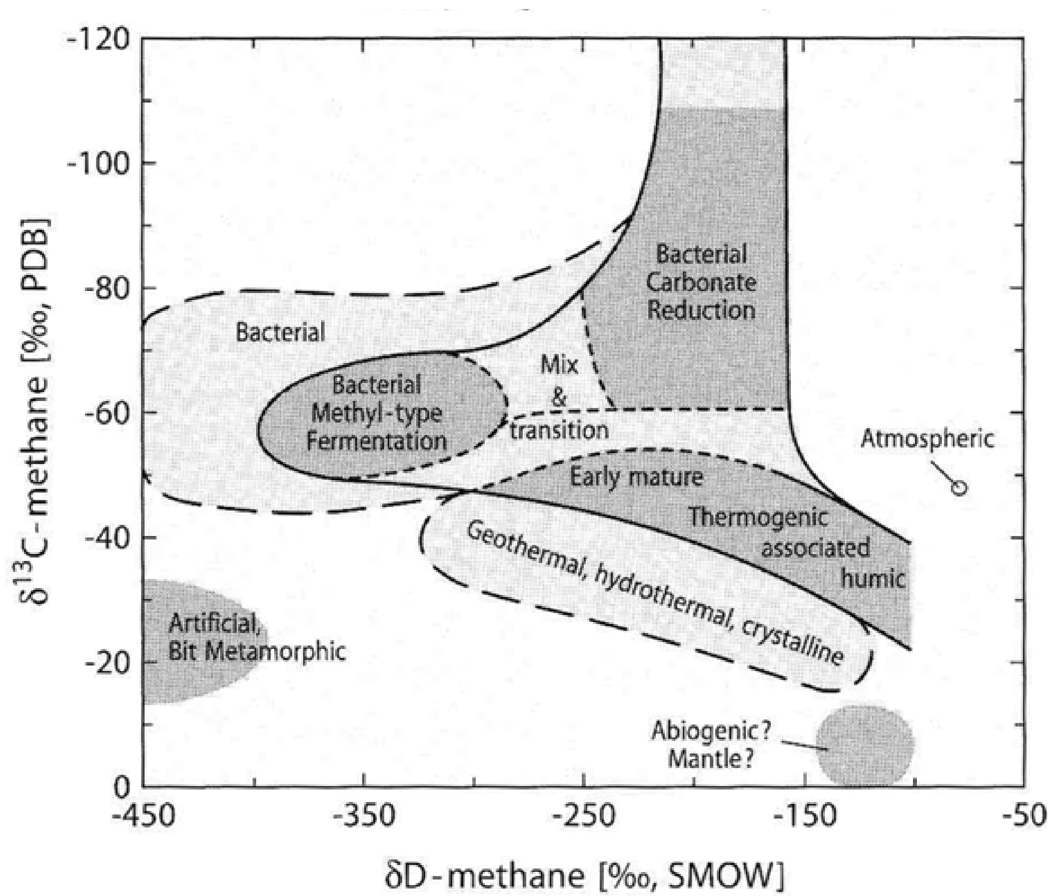
As a side note, migration can enrich methane in $d^{12}C$ or $d^{13}C$ depending upon the properties of the rock through which the gas is migrating. Recent experiments have demonstrated that $d^{13}C$ can be depleted during migration through shale to different degrees depending upon the organic content of the shale.[8]

The process of diffusion can cause significant isotope fractionization. In general, light isotopes are more mobile and diffuse about 1% faster than the heavier isotopes. As a result, light isotopes escape more readily leaving the remaining methane enriched in ^{13}C causing greater $d^{13}C$ values.

A gas mixture subjected to a temperature gradient will tend to separate by thermal diffusion; the greater mass species will migrate to the colder temperatures. Gravitational settling in porous media can also cause the heavier isotope to migrate downward.

Whiticar[9] developed a chart for identification of methane sources based upon isotopic ratios. This chart, extracted from Reference 7, is illustrated in Figure 3. The term SMOW in the horizontal axis refers to the standard for hydrogen isotopes, which comes from a sample of mean ocean water distributed in Vienna by the International Atomic Energy Agency. The term PDB in the vertical axis refers to the standard for carbon isotopes, which is a based on Cretaceous PeeDee Belemnites found in South Carolina.

Figure 3. Carbon and Hydrogen Isotope Signatures of Methane Sources



When a helium purged canistered sample is selected for isotope analysis, one or two samples of released gas are collected from the core sample during the desorption measurements after sufficient volume of gas is measured in order to clear the canister head space of residual air. If two gas samples were collected, one sample was taken within the first few hours of the desorption measurements and the second was collected when the rate of desorption decreased significantly but still had enough volume to fill the collection tube (100 ml). If only one gas sample was collected for isotopic analysis, the sample was taken within the first few hours of the desorption measurements. The gas samples collected should be representative of the reservoir gas and are analyzed by isotope-ratio mass spectrometry (IRMS) at Isotech Laboratories, Inc.

Sample Bulk Composition and Property Analysis

Sample bulk composition and property analyses were performed according to ASTM or other standardized methodologies listed in Table 3. Chemical analysis (proximate, total sulfur, sulfur in ash, and heating value) and comprehensive petrography analysis (maceral matter composition, mineral matter composition, and vitrinite reflectance analyses) are typically conducted on selected samples to determine coal composition and thermal maturity (rank). The Center for Applied Energy Research (University of Kentucky) conducts the petrographic analysis. All other listed bulk composition and property analyses were conducted in-house by WFT Labs. Density, moisture holding capacity, chemical analysis, and petrographic analysis procedures are discussed in the following sections.

Table 3. Sample Bulk Composition and Property Analysis Methodologies

Analysis	Methodology
Air-dry moisture loss	WFT Labs' improved methodology
Sample bulk volume	Standard water displacement technique
Density	Helium multi-pycnometry
Moisture holding capacity	WFT Labs' improved methodology
Residual moisture	ASTM D 5142
Ash content	ASTM D 5142
Proximate	ASTM D 5142
Total sulfur	ASTM D 4239C
Sulfur in Ash	ASTM D 5016
Gross calorific value	ASTM D 5865
Maceral and mineral composition	ASTM D 2799
Vitrinite reflectance	ASTM D 2798

Crushed Density Analysis

Density by helium pycnometry determines crushed density values (i.e., density excluding large-scale gas filled pore volume). For coal, the crushed density is almost identical to the bulk density. Crushed density analysis requires the measurement of sample volume and mass. Sample volumes were measured at room temperature conditions on triplicate air-dried samples (representative of each desorption sample) of approximately 100 grams using a helium multi-pycnometer. Helium can penetrate the coal micro-pore structure without adsorption and does not add moisture to the sample. Sample weights were determined to the nearest 0.001 gram using an electronic balance. Sample densities were calculated by dividing the measured sample mass by the sample volume.

Moisture Holding Capacity Analysis

The in-situ (or inherent) moisture of coal is the amount of moisture the coal can hold at 100 percent relative humidity without any moisture present on the surface of the coal particles. The moisture holding capacity approximates the in-situ moisture content of the coal seam.[2]

The moisture holding capacity analysis procedure used by WFT Labs is in accordance with the ASTM Method D 1412 (Equilibrium Moisture). The equilibrium moisture value is defined as the average percentage weight loss upon drying triplicate 5-gram water saturated coal samples [particle size -16 US mesh (1.18 mm)], following equilibration at 96 to 97% relative humidity and 86°F (30°C) for 48 to 72 hours.

Chemical Characterization

Proximate and ultimate analysis provides chemical composition data. Proximate analysis results in estimates of the weight fraction of residual moisture, ash, and volatile matter and the calculation of fixed carbon by difference. Data from proximate analyses are used to classify coal rank and to determine the ratio of combustible to incombustible constituents. Ultimate analysis results in the weight fraction of sulfur, carbon, hydrogen, nitrogen, and oxygen by difference. [2]

The total sulfur content represents the sulfur occurring in both the organic and inorganic components of the coal sample. The total sulfur content is determined in accordance with ASTM D 4239C.

Residual moisture is neither a standard state nor a characteristic property of coal.[2] Residual moisture is dependent on the sample handling, desorption methodology, and the method used to remove excess moisture before analysis. For coal samples, it is important to maintain the residual moisture content at levels slightly greater than the inherent, or in-situ, moisture content. When the total moisture is reduced to the residual moisture value following careful methods, subsequent analyses can be reported on the ASTM as-determined mass basis.

Maceral and Mineral Composition

Maceral and mineral analysis provides organic and mineral composition data. Petrographic characterization of coal reservoir systems is performed by microscopic examination of polished surfaces of crushed particle pellets under reflected white light and ultraviolet light. The volume fraction of organic (maceral) and inorganic (mineral) components is quantified by manual point counting. The volume fraction of clay, quartz, carbonate, and sulfide minerals is also quantified by point counting. The point counting technique is a subjective process and requires a knowledgeable and highly experienced petrographer to obtain consistent data. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the maceral and mineral testing.

Coal Vitrinite Reflectance

The thermal maturity of coal can be quantified petrographically by vitrinite reflectance. The measurement is typically conducted on the polished surface of the crushed particle pellets used for the maceral analysis. Incident white light is reflected off the surface of vitrinite macerals immersed in oil of a specific refractive index. The reflected light is captured by a photo multiplier and converted to analog and digital output. The reflected light is typically reported as the mean-maximum reflectance since vitrinite is anisotropic under incident. Vitrinite reflectance may be the most sensitive indicator of thermal maturity for macerals that have attained a coal rank of medium volatile bituminous and greater. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the vitrinite reflectance testing.

Adsorbed Gas Storage Capacity

Adsorption isotherm data are important because isotherm behavior indicates the maximum gas volume that can be stored at a specific temperature and pressure. The adsorption isotherm determines the gas storage capacity of crushed samples as a function of pressure at constant temperature, which is usually the reservoir temperature. A known weight of crushed rock sample is placed in a volumetric isotherm apparatus and subjected to increasing pressure steps.[10] Gas storage capacity is estimated by material balance analysis of the pressure behavior. For coal, the measurement is performed on samples equilibrated to the inherent, or in-situ, moisture content.

The gas storage capacity of coal typically increases non-linearly as pressure increases. Gas storage capacity also varies as a function of the type of gas species, coal maceral composition, and organic material thermal maturity.

The Langmuir equation listed in Equation 4 is used to model the variation of gas storage capacity as a function of pressure.[11]

$$G_s = G_{sL} \frac{p}{p + p_L} \tag{4}$$

where:

G_s	*gas storage capacity, scf/ton*
G_{sL}	*Langmuir storage capacity, sct/ton*
p	*pressure, psia*
p_L	*Langmuir pressure, psia*

The Langmuir storage capacity is the gas storage capacity of the sample at infinite pressure and the Langmuir pressure is the pressure at which the gas storage capacity of the sample equals one-half the Langmuir storage capacity value.

Gas storage capacity is dependent upon pressure, temperature, and organic composition. Table 4 summarizes the effect that each of these parameters has on the gas storage capacity when all other parameters are held constant.

Table 4. Relative Effect of Various Parameters on Gas Storage Capacity

Parameters	As the Parameter:	Gas Storage Capacity:
Pressure	Increases	Increases
Temperature	Increases	Decreases
Moisture Content	Increases	Decreases
Vitrinite/Kerogen III Concentration	Increases	Increases
Thermal Maturity	Increases	Increases

Gas adsorbed in reservoirs typically contains gases other than methane, each gas having different adsorptive affinity, which is related to its atmospheric pressure boiling point. The extended Langmuir equation is used to model multi-component gas storage capacity when gas mixtures are present in coal reservoirs. Adsorption isotherm measurements are conducted independently for each gas component present and then combined mathematically with the extended Langmuir model to produce isotherm data that are representative of the reservoir's gas composition.

Multi-component isotherm relationships can be computed from single component data by use of extended Langmuir theory.[12] Equation 5 lists the extended Langmuir relationship.

$$G_{si} = G_{sLi} \frac{\frac{p y_i}{p_{Li}}}{1 + p \sum_{j=1}^{nc} \frac{y_i}{p_{Li}}} \tag{5}$$

where:

G_{si}	*multi-component storage capacity of component i, scf/ton*
G_{sLi}	*single component Langmuir storage capacity of component i, scf/ton*
p_{Li}, p_{Lj}	*single component Langmuir pressure of component i or j, psia*
y_i or y_j	*mole fraction of component i or j in the free gas (vapor) phase, dimensionless*
nc	*number of components*
p	*pressure of the free gas phase, psia*

One limitation in the current application of Equations 4 and 5 is that gas storage capacity is a function of temperature. No simple method accounts for temperature variations unless the isotherms are measured at multiple temperatures. Consequently, the laboratory isotherm data should be measured at an average reservoir temperature or at multiple temperatures to allow for proper correction.

Initial reservoir gas saturation (gas content divided by gas storage capacity) and critical desorption pressure (pressure at which adsorbed gas is released from the adsorbed state) are estimated from the adsorption isotherm analysis and desorption data.[4] The critical desorption pressure is determined by calculating the pressure at which the in-situ gas content equals the in-situ gas storage capacity.

Analysis Results

This section provides summaries and discussions of the analytical results. Laboratory reports (raw data) are provided in the appendices where indicated.

Core Photography and Lithology

At the conclusion of the desorption tests, the samples were removed from desorption canisters. Digital photographs were taken and lithologic descriptions of the desorption samples immediately followed. Photographs and lithologies are included in Appendix I.

Gas Content, Diffusivity, and Sorption Time

The total gas content was determined by summing the lost gas content, measured gas content (desorbed gas content), and the gas content liberated from the crushed sample at the end of desorbed gas analysis. The gas volume measurements were corrected for canister and ambient temperature and ambient pressure variations. Gas contents were reported at standard conditions of 14.7 psia and 60°F. The total gas content estimate was based upon the air-dried sample mass. Residual moisture, moisture holding capacity, ash, and total sulfur content data were used to convert air-dry basis gas content data to other bases (i.e., dry; dry, ash-free; and in-situ bases). Figure 4 illustrates the lost, measured, and crushed gas content on an air-dry basis for each sample. The average air-dry, in-situ, and dry, ash-free adsorbed gas content estimates for core samples are summarized in Table 5. Desorption data including total gas content, measured gas content, and crushed gas content are illustrated in Appendix II.

For the core samples, lost gas contents were obtained from the early time gas content data using WFT Lab's modified version of the Direct Method.[5,6] Extrapolations were made of the early time desorption data measured at reservoir temperature to determine the lost gas content. The lost gas time (time interval used for lost gas extrapolations) ranged from 1.35 to 1.64 hours and all lost gas content values were less than 26% of the total gas content.

Measured gas contents determined from desorption tests for all desorption samples are presented in Table 5. Desorption graphs and data are included in Appendix II.

Residual (crushed) gas content was determined for the five desorption samples. Crushed gas content data are presented in Table 5.

Diffusivity and sorption time estimates for the core samples are listed in Table 6. The diffusion values were obtained from the gradient of the lost gas slope. Sorption time was computed from the diffusivity values.

In many cases, there is a relationship between the total gas content and the inorganic content of each sample. Figure 5 illustrates this relationship listed in Equation 6. The relationship had a squared correlation coefficient of 0.9487, which was statistically significant. The extrapolation to zero inorganic content suggested the organic fraction gas content was 336.9 scf/ton, which was greater than the average dry, ash-free gas content of 271.7 scf/ton.

$$G_c = 336.9 - 357.5(w_a + w_w + w_s) \qquad (6)$$

where:

G_c *total gas content, scf/ton*
w_a *ash content, weight fraction*
w_w *moisture content, weight fraction*
w_s *sulfur content, weight fraction*

Figure 4. **Gas Content Data Summary**

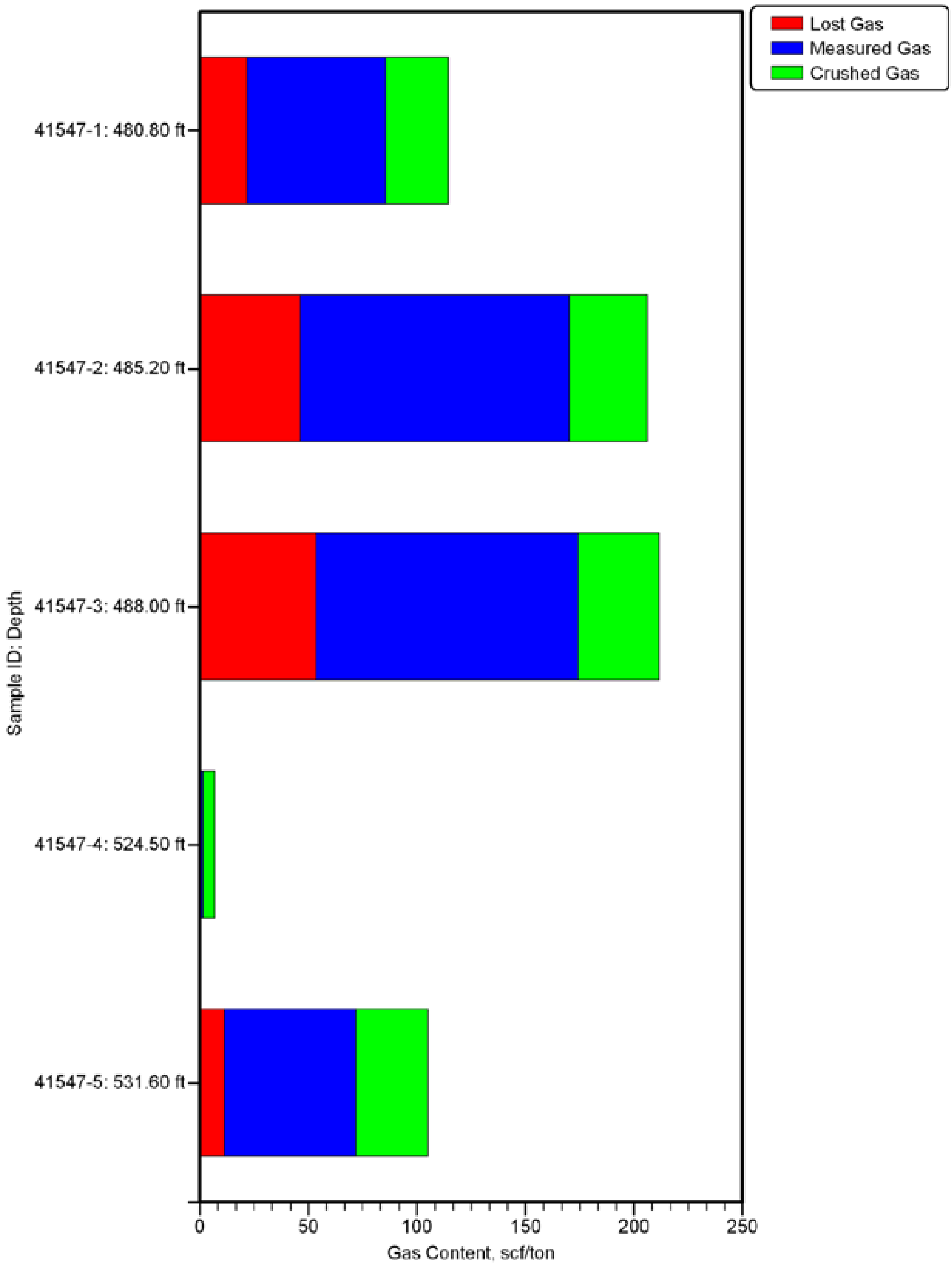


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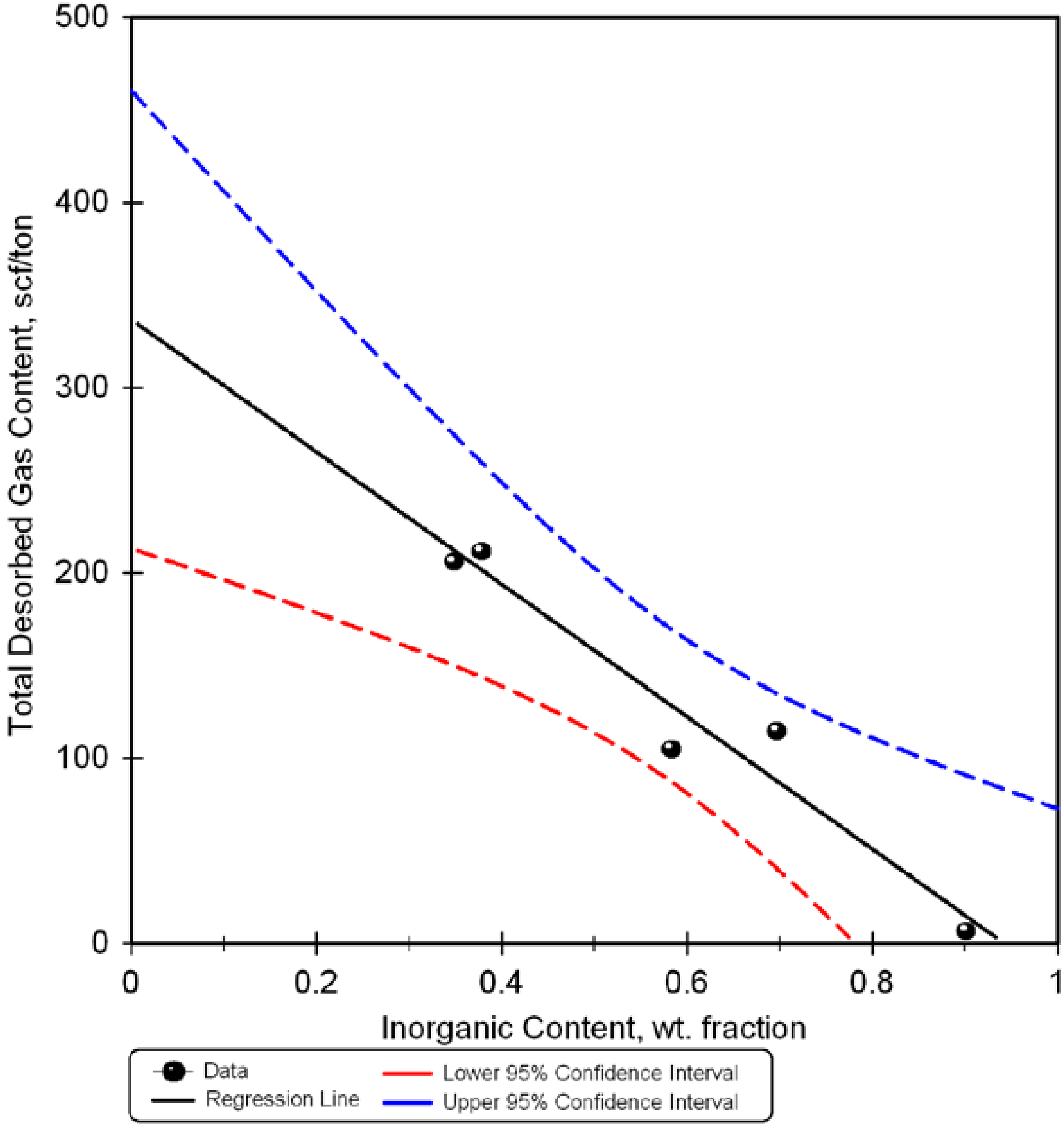
Table 5. **Gas Content Data**

Sample ID	Midpoint Depth	Mass	Lost Gas Time	Lost Gas Fraction	Measured Gas Fraction	Crushed Gas Fraction	Lost Gas Content	Measured Gas Content	Crushed Gas Content	Total Air-Dry Gas Content	Total Dry, Ash-Free Gas Content	Total In-Situ Gas Content
	ft	g	hours	%	%	%	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton
41547-1	480.80	2,019	1.35	19.24	55.65	25.11	22.1	63.9	28.8	114.9	378.9	114.7
41547-2	485.20	1,573	1.48	22.49	60.14	17.37	46.4	124.1	35.8	206.4	316.6	207.1
41547-3	488.00	1,724	1.64	25.42	57.01	17.58	53.8	120.8	37.2	211.9	340.4	213.0
41547-4	524.50	4,532	1.45	6.60	20.78	72.62	0.5	1.4	5.0	6.9	70.2	6.9
41547-5	531.60	2,430	1.57	11.15	57.50	31.34	11.7	60.5	33.0	105.2	252.6	105.0
Average	**-**	***2,456***	***1.50***	***16.98***	***50.22***	***32.80***	***26.9***	***74.2***	***28.0***	***129.1***	***271.7***	***129.3***

Table 6. **Diffusivity and Sorption Time Estimates**

Sample ID	Top Depth	Bottom Depth	Sorption Time	Diffusivity
	ft	ft	hr	1/µs
41547-1	480.30	481.30	26.0	0.712
41547-2	484.70	485.70	21.2	0.874
41547-3	487.50	488.50	19.0	0.973
41547-4	524.00	525.00	207.8	0.089
41547-5	531.10	532.10	95.3	0.194
Average	**-**	**-**	***73.9***	***0.569***

Figure 5. **Total Gas Content vs. Inorganic Content**



Gas Composition and Isotope Summary

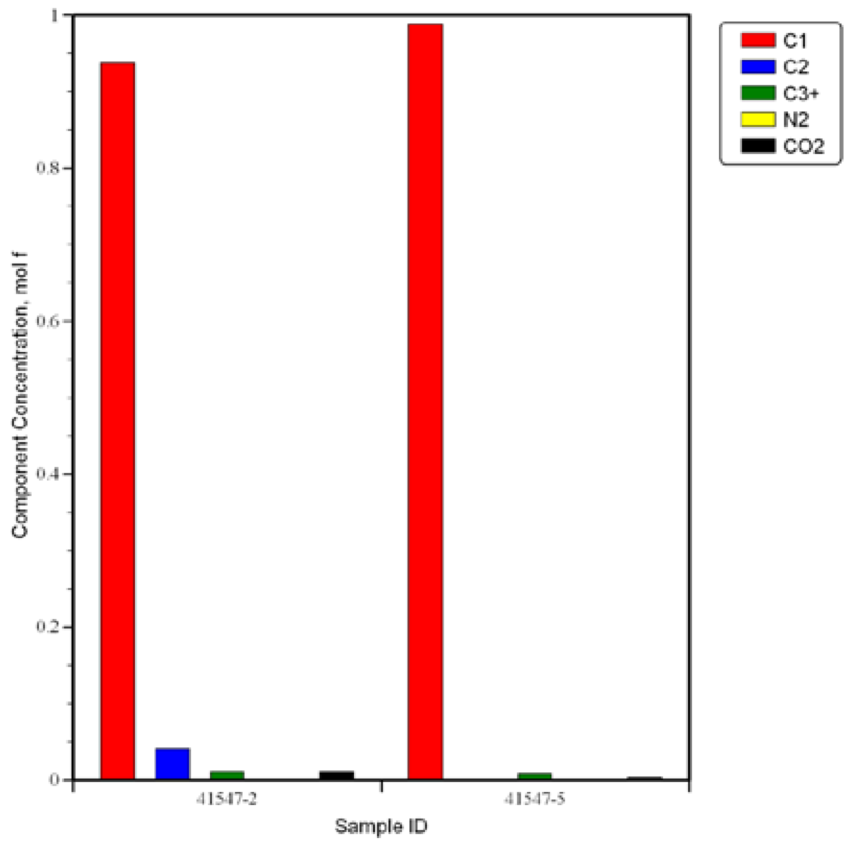
Natural gas produced from coal reservoirs may contain significant volumes of carbon dioxide, nitrogen, and other hydrocarbons in addition to methane. Knowledge of the desorbed gas composition is required to properly evaluate the gas storage capacity. Two canisters were dedicated to collection of multiple desorption gas samples. The gas compositions were corrected for air and hydrogen contamination. The degree of contamination was such that it was necessary to remove all of the nitrogen as well.

Table 7 summarizes the apparent adsorbed gas composition for two samples. The sorbed gas consisted primarily of methane (96.3 mol%). Ethane (2.1 mol%), propane and heavier hydrocarbons (0.9 mol%), and carbon dioxide (0.7 mol%) were also present in smaller concentrations. While nitrogen may be present in the adsorbed gas, contamination precluded an estimate for the adsorbed nitrogen content. Figure 6 graphically illustrates the apparent adsorbed gas composition of the samples. The original gas compositions, contamination corrected gas compositions, gas compositions as a function of desorption fractions, and integrated (adsorbed) gas compositions are all reported in Appendix III.

Table 7. Apparent Adsorbed Gas Composition Results

Sample ID	Midpoint Depth	C_1	C_2	C_{3+}	CO_2	Total
	ft	mol frac	mol frac	mol frac	mol frac	mol frac
41547-2	485.20	0.9377	0.0404	0.0111	0.0108	1.0000
41547-5	531.60	0.9882	0.0013	0.0078	0.0028	1.0000
Average	**-**	***0.9629***	***0.0208***	***0.0094***	***0.0068***	***1.0000***

Figure 6. Adsorbed Gas Composition



Data obtained from stable isotope analysis from sample 41547-2 indicated the gas was thermogenic in origin. Data obtained from sample 41547-5 indicated the gas was biogenic in origin. Results of isotopic analysis for the selected samples are listed in Table 8 and are illustrated by the red and blue dots in Figure 7 and Figure 8.

^{12}C is lighter than ^{13}C; therefore, it releases from the core samples sooner. This phenomenon was observed when multiple samples of released gas from the same core sample were compared over a period of time. Figure 8 illustrates the increase in ^{13}C concentration with time.

Table 8. **Isotope Results**

Parameter	Unit	41547-2-ISO1	41547-2-ISO2	41547-5-ISO1	41547-5-ISO2
Midpoint Depth	ft	485.20	485.20	531.60	531.60
Date/Time Sampled	mm/dd/yyyy hh:mm:ss	10/30/2008 13:19:00	12/15/2008 11:33:00	10/30/2008 19:20:00	12/15/2008 13:17:00
CO_2 Conc.	mol frac	0.0051	0.0101	0.0031	0.0198
C_1 Conc.	mol frac	0.9942	0.9883	0.9963	0.9632
C_2 Conc.	mol frac	0.0006	0.0016	0.0004	0.0016
C_3 Conc.	mol frac	0.0000	0.0000	0.0000	0.0000
iC_4 Conc.	mol frac	0.0000	0.0000	0.0001	0.0023
nC_4 Conc.	mol frac	0.0000	0.0000	0.0000	0.0007
iC_5 Conc.	mol frac	0.0000	0.0000	0.0000	0.0036
nC_5 Conc.	mol frac	0.0000	0.0000	0.0000	0.0016
C_{6+} Conc.	mol frac	0.0000	0.0000	0.0000	0.0072
Total	***mol frac***	***1.0000***	***1.0000***	***1.0000***	***1.0000***
$d^{13}C_1$	‰	-45.6	-43.3	-64.0	-59.0
dDC_1	‰	-239	-242	-262	-277

Figure 7. **Natural Gas Classification (Carbon-Deuterium Stable Isotope Plot)**

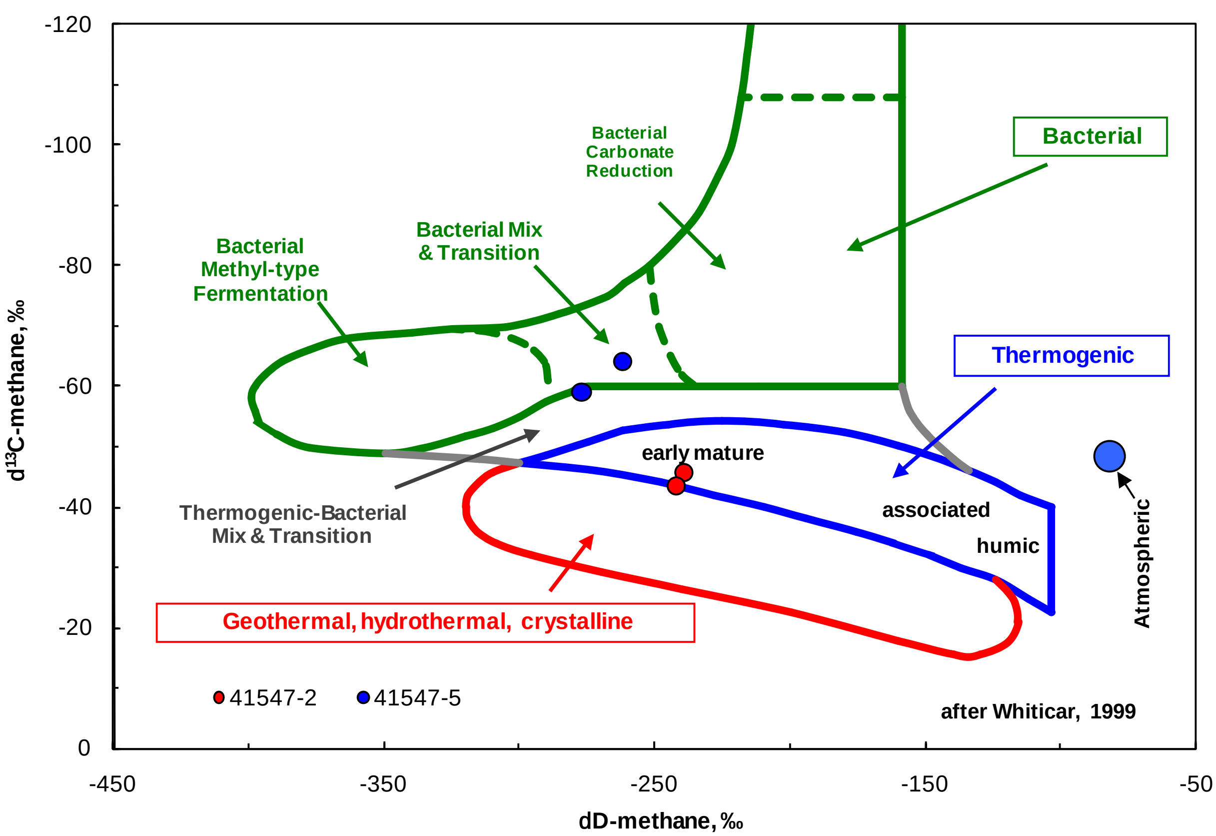
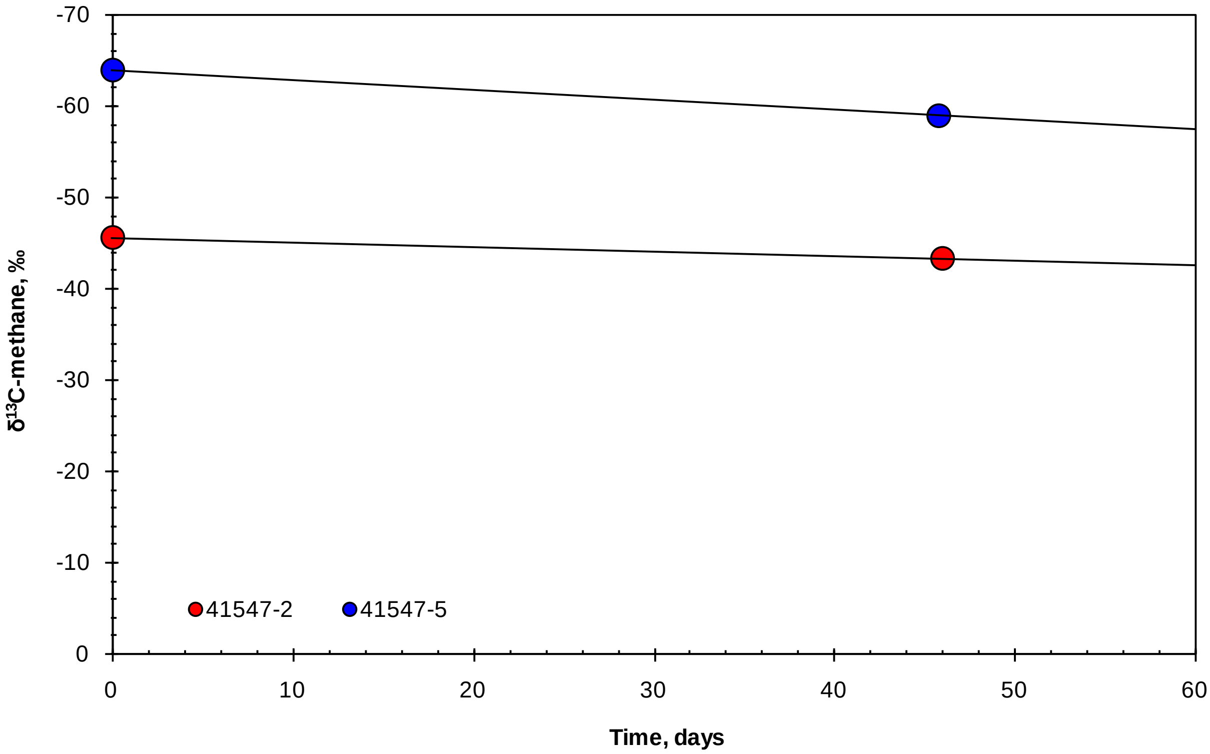


Figure 8. **Carbon-13 Concentration vs. Time**



Sample Bulk Composition and Property Analysis Results

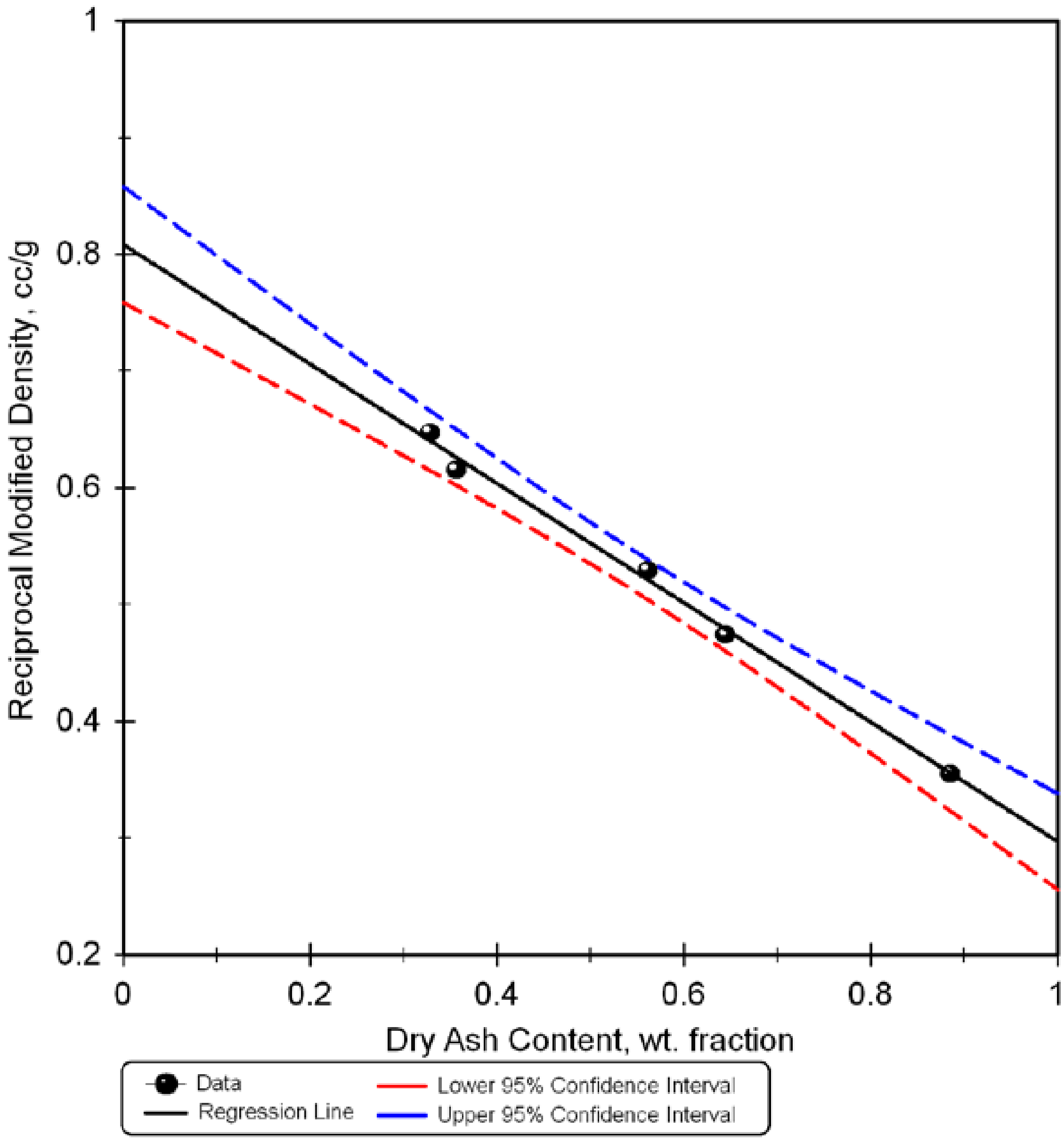
The crushed density, proximate analysis, ultimate analysis, total sulfur, sulfur in ash, gross calorific value, and petrography results for the selected core samples are discussed in the following sub-sections.

Crushed Density Results

Crushed density results are listed in Table 9. The density of coal varies as a function of its composition. Since the mineral matter component of the coal has a significantly higher density than the organic matter component, the density of coal varies as a function of its mineral matter content. The ash content of coal represents the mineral matter component of the coal. When total sulfur content is significant, the total mineral matter present is a function of the ash and sulfur content.

The average organic and inorganic (mineral matter) densities can often be estimated by linear regression of reciprocal density and ash content data.[4] Figure 9 illustrates the relationship between reciprocal modified density and dry ash content for the desorption samples. The relationship was statistically significant (squared correlation coefficient, 0.9954).

Figure 9. **Reciprocal Modified Density vs. Dry Ash Content**



The estimated organic density was 1.214 g/cm^3 and the estimated inorganic density was 3.365 g/cm^3.The organic density of coal in the sub-bituminous and bituminous rank range varies between 1.18 to 1.40 g/cm^3 and depends upon the maceral composition.

The inorganic density is often between the densities of moist montmorillonite (2.12 g/cm^3), moist kaolinite (2.42 g/cm^3), and that of quartz (2.65 g/cm^3). Occasionally, values are observed that approach 3 g/cm^3 due to the presence of carbonates and heavy minerals. The average inorganic density value of 3.365 g/cm^3 was much greater than results observed in the past for San Juan Basin coal.

Table 9. **Crushed Density Data**

Sample ID	Top Depth	Bottom Depth	Air-Dry Helium Density	In-Situ Helium Density
	ft	ft	g/cm^3	g/cm^3
41547-1	480.30	481.30	1.970	1.966
41547-2	484.70	485.70	1.519	1.524
41547-3	487.50	488.50	1.593	1.602
41547-4	524.00	525.00	2.672	2.666
41547-5	531.10	532.10	1.833	1.830
Average	**-**	**-**	***1.917***	***1.918***

Chemical Characterization Results

Residual moisture, ash, and total sulfur analyses are used to convert data reported on an as-received mass basis to other mass bases such as dry; dry, ash-free; mineral-matter-free (moist or dry); and in-situ bases. It is useful to report data on the dry mass basis to review data without the effect of moisture. It is also useful to report data on the dry, ash-free mass basis to review analyses normalized to 100% organic material. Dry, ash-free values are used to compare gas content and gas storage capacity between different zones or wells since the adsorbed gas is stored predominantly by organic material (i.e., the macerals in coal). Table 10 summarizes the proximate analysis results, which include residual moisture, moisture holding capacity, ash, volatile matter, and fixed carbon results for the desorption samples on an air-dry basis. Complete proximate analysis was performed only on samples selected for isotherm analysis. In-situ proximate analysis results have also been provided in Table 11.

Table 10. **Air-Dry Proximate Analysis Data**

Sample ID	Top Depth	Bottom Depth	Moisture Holding Capacity	Air-Dry Moisture Content	Air-Dry Ash Content	Air-Dry Volatile Matter Content	Air-Dry Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41547-1	480.30	481.30	0.0229	0.0211	0.6309	-	-
41547-2	484.70	485.70	0.0172	0.0205	0.3212	-	-
41547-2 Isotherm	484.70	485.70	0.0159	0.0177	0.3313	0.2421	0.4089
41547-3	487.50	488.50	0.0125	0.0180	0.3496	-	-
41547-4	524.00	525.00	0.0204	0.0181	0.8692	-	-
41547-5	531.10	532.10	0.0198	0.0178	0.5511	-	-
41547-5 Isotherm	531.10	532.10	0.0181	0.0178	0.5405	0.1621	0.2795
Average	**-**	**-**	***0.0181***	***0.0187***	***0.5134***	***0.2021***	***0.3442***

Table 11. In-Situ Proximate Analysis Data

Sample ID	Top Depth	Bottom Depth	In-Situ Moisture Content	In-Situ Ash Content	In-Situ Volatile Matter Content	In-Situ Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac
41547-1	480.30	481.30	0.0229	0.6297	-	-
41547-2	484.70	485.70	0.0172	0.3223	-	-
41547-2 Isotherm	484.70	485.70	0.0159	0.3319	0.2426	0.4097
41547-3	487.50	488.50	0.0125	0.3516	-	-
41547-4	524.00	525.00	0.0204	0.8672	-	-
41547-5	531.10	532.10	0.0198	0.5500	-	-
41547-5 Isotherm	531.10	532.10	0.0181	0.5404	0.1621	0.2795
Average	**-**	**-**	***0.0181***	***0.5133***	***0.2023***	***0.3446***

Ultimate analysis data are summarized in Table 12 on a dry, ash-free basis. Complete ultimate analysis was performed only on samples selected for isotherm analysis. In-situ ultimate analysis results have also been provided in Table 13.

Table 12. Dry, Ash-Free Ultimate Analysis Data

Sample ID	Top Depth	Bottom Depth	Sulfur Content	Carbon Content	Nitrogen Content	Hydrogen Content	Oxygen Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41547-1	480.30	481.30	0.1290	-	-	-	-
41547-2	484.70	485.70	0.0100	-	-	-	-
41547-2 Isotherm	484.70	485.70	0.0094	0.8445	0.0175	0.0590	0.0697
41547-3	487.50	488.50	0.0157	-	-	-	-
41547-4	524.00	525.00	0.1263	-	-	-	-
41547-5	531.10	532.10	0.0336	-	-	-	-
41547-5 Isotherm	531.10	532.10	0.0324	0.8208	0.0157	0.0629	0.0682
Average	**-**	**-**	***0.0509***	***0.8326***	***0.0166***	***0.0610***	***0.0689***

Table 13. In-Situ Ultimate Analysis Data

Sample ID	Top Depth	Bottom Depth	In-Situ Sulfur Content	In-Situ Carbon Content	In-Situ Hydrogen Content	In-Situ Nitrogen Content	In-Situ Oxygen Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41547-1	480.30	481.30	0.0448	-	-	-	-
41547-2	484.70	485.70	0.0066	-	-	-	-
41547-2 Isotherm	484.70	485.70	0.0061	0.5508	0.0385	0.0114	0.0454
41547-3	487.50	488.50	0.0100	-	-	-	-
41547-4	524.00	525.00	0.0142	-	-	-	-
41547-5	531.10	532.10	0.0145	-	-	-	-
41547-5 Isotherm	531.10	532.10	0.0143	0.3624	0.0278	0.0069	0.0301
Average	-	-	***0.0158***	***0.4566***	***0.0331***	***0.0092***	***0.0378***

Gross calorific value, fixed carbon content, and volatile matter content were determined to estimate the coal rank (thermal maturity) for the isotherm sample. The procedure documented in ASTM D 388 was used to correct ash content for sulfur in ash, to convert fixed carbon and volatile matter to a dry, mineral matter free basis, and to convert calorific value to a moist, mineral-matter-free basis.[13] The moisture holding capacity data were used to convert dry basis data to a moist basis.

Table 14 summarizes the chemical characterization of the isotherm samples. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm. This was not the case for samples 41547-2 and 41547-5, which had moist, mineral-matter free calorific values of 15,039 and 15,556 BTU/lbm, respectively. Coal rank classification using fixed carbon and calorific values were unreliable for these samples.

Table 14. Chemical Characterization Data

Parameter	Unit	41547-2 Isotherm	41547-5 Isotherm
Top Depth	ft	484.70	531.10
Bottom Depth	ft	485.70	532.10
Chemical Characterization Data			
Moisture Holding Capacity, in-situ basis	wt frac	0.0159	0.0181
Residual Moisture, as-received basis	wt frac	0.0177	0.0178
Sulfur-in-Ash Content, in-situ basis	wt frac	0.0098	0.0012
Corrected Ash Content, in-situ basis	wt frac	0.3319	0.5404
Sulfur Content, in-situ basis	wt frac	0.0061	0.0143
Parr Corrected Volatile Matter Content, DMMF basis	wt frac	0.4932	0.8348
Parr Corrected Fixed Carbon Content, DMMF basis	wt frac	0.5068	0.1652
Parr Corrected Calorific Value, MMMF basis	BTU/lbm	15,039	15,566

Notes:
Moisture holding capacity determined by moisture equilibration at 86°F for 72 hrs at 96-97% relative humidity.
Ash content corrected for sulfur-in-ash content.
DMMF = Dry, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.
MMMF = Moist, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.

Petrographic Characterization Results

This section provides a summary of the petrographic analytical results. Figure 10 illustrates the maceral composition summarized in Table 15, which also includes mineral results. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41547-2 was 0.99% in oil and the mean-maximum vitrinite reflectance for sample 41547-5 was 0.88% in oil placing the rank for both samples in the high volatile A bituminous range.

Figure 10. Mineral Matter-Free Basis Maceral Composition Summary

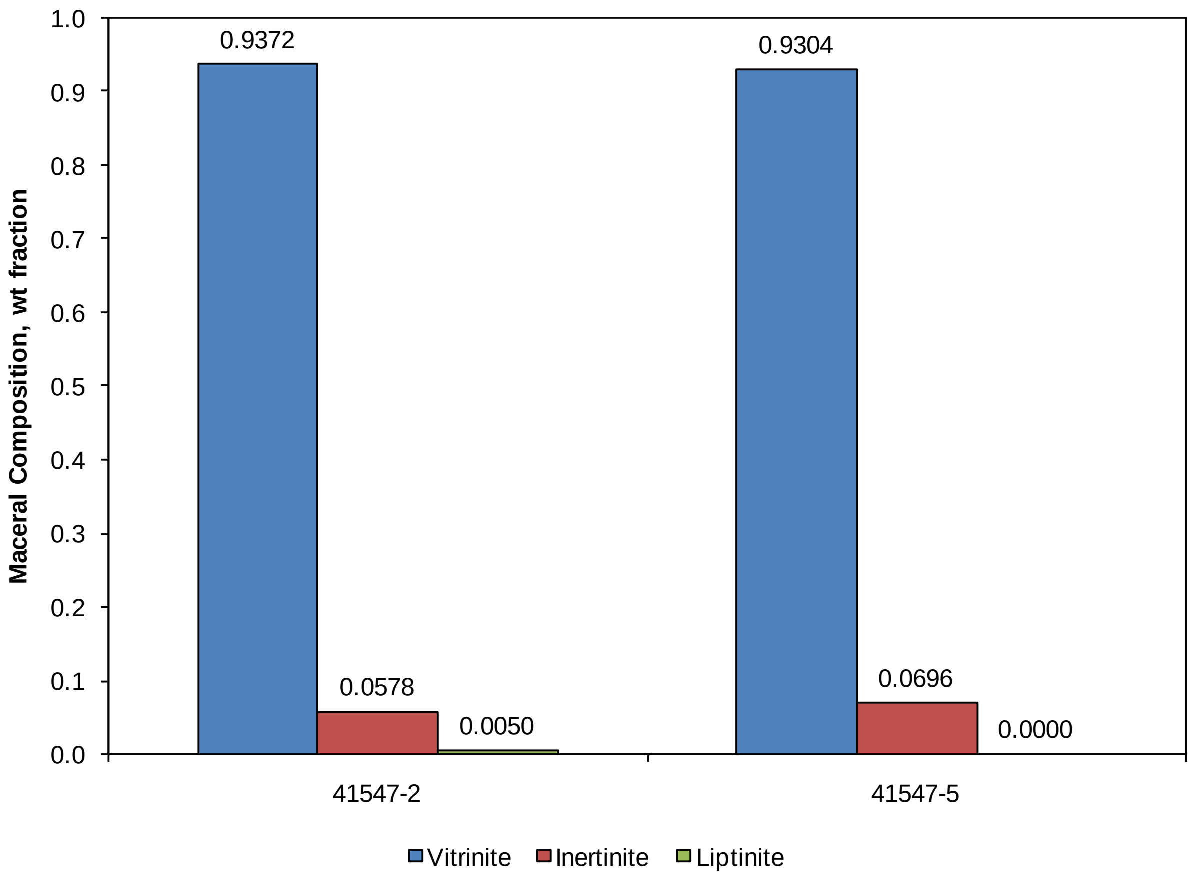


Table 15. **Petrographic Data**

Parameter	Unit	41547-2	41547-5
Vitrinite Group Macerals, Mineral-Matter Free Basis			
Telinite	vol frac	0.0678	0.0476
Collotelinite	vol frac	0.4925	0.4908
Vitrodetrinite	vol frac	0.3392	0.3626
Collodetrinite	vol frac	0.0000	0.0000
Corpogelinite	vol frac	0.0352	0.0256
Gelinite	vol frac	0.0025	0.0037
Total Vitrinite	***vol frac***	***0.9372***	***0.9304***
Inertinite Group Macerals, Mineral-Matter Free Basis			
Fusinite	vol frac	0.0251	0.0220
Semifusinite	vol frac	0.0151	0.0403
Micrinite	vol frac	0.0000	0.0000
Macrinite	vol frac	0.0126	0.0000
Secretinite	vol frac	0.0000	0.0000
Funginite	vol frac	0.0050	0.0037
Inertodetrinite	vol frac	0.0000	0.0037
Total Inertinite	***vol frac***	***0.0578***	***0.0696***
Liptinite Group Macerals, Mineral-Matter Free Basis			
Sporinite	vol frac	0.0000	0.0000
Cutinite	vol frac	0.0000	0.0000
Resinite	vol frac	0.0050	0.0000
Alginite	vol frac	0.0000	0.0000
Liptodetrinite	vol frac	0.0000	0.0000
Suberinite	vol frac	0.0000	0.0000
Exsudatinite	vol frac	0.0000	0.0000
Total Liptinite	***vol frac***	***0.0050***	***0.0000***
Mineral Composition, Maceral-Fee Basis			
Clay	vol frac	0.8431	0.9824
Quartz	vol frac	0.0196	0.0088
Carbonate	vol frac	0.1275	0.0000
Sulfide	vol frac	0.0098	0.0088
Total	***vol frac***	***1.0000***	***1.0000***
Vitrinite Reflectance			
Mean-Maximum Reflectance	% in oil	0.99	0.88
Standard Deviation	% in oil	0.07	0.04
Coal Rank based on Vitrinite Reflectance	-	high volatile A bituminous	

Adsorbed Gas Storage Capacity

Two methane isotherm measurements were performed by WFT Labs. The isotherm parameters and gas storage capacity estimates are summarized in Table 16. Figures 11 and 12 illustrate the methane storage capacity as a function of pressure on a dry, ash-free and in-situ basis, respectively.

Table 16. Coal Methane Adsorption Isotherm Parameters

Parameter	Unit	41547-2	41547-5
Sample Parameters			
Top Depth	ft	484.70	484.70
Bottom Depth	ft	531.10	531.10
Measurement Gas	-	methane	methane
Measurement Temperature	°F	70.52	70.52
Moisture Content, in-situ basis	wt frac	0.0159	0.0181
Ash Content, in-situ basis	wt frac	0.3319	0.5404
Sulfur Content, in-situ basis	wt frac	0.0061	0.0143
Organic Content, in-situ basis	wt frac	0.6461	0.4272
Vitrinite Content, mineral-matter-free basis	vol frac	0.937	0.930
Inertinite Content, mineral-matter-free basis	vol frac	0.058	0.070
Liptinite Content, mineral matter-free basis	vol frac	0.050	0.000
Calorific Value, moist, mineral-matter-free basis	BTU/lbm	14,773	14,801
Langmuir Parameters			
Langmuir Storage Capacity, dry, ash-free	scf/ton	665.91	647.35
Langmuir Storage Capacity, in-situ	scf/ton	430.26	276.56
Langmuir Pressure	psia	174.69	166.78
Adsorbed Gas Storage Capacity			
Reservoir Pressure	psia	215.40	234.89
Storage Capacity, dry, ash-free	scf/ton	367.71	378.56
Storage Capacity, in-situ	scf/ton	237.59	161.73

For sample 41547-2, the dry, ash-free Langmuir storage capacity was 665.9 scf/ton, the in-situ Langmuir storage capacity was 430.3 scf/ton, and the Langmuir pressure was 174.7 psia. At a reservoir pressure of 215.4 psia, the in-situ storage capacity was 237.6 scf/ton.

For sample 41547-5, the dry, ash-free Langmuir storage capacity was 647.4 scf/ton, the in-situ Langmuir storage capacity was 276.6 scf/ton, and the Langmuir pressure was 166.8 psia. At a reservoir pressure of 234.9 psia, the in-situ storage capacity was 161.7 scf/ton.

Figure 11. **Dry, Ash-Free Methane Isotherm**

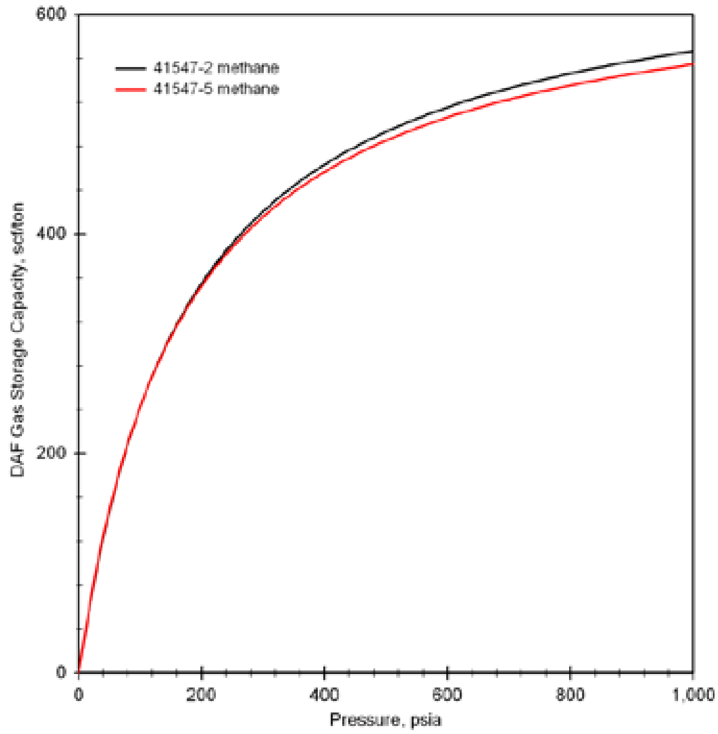
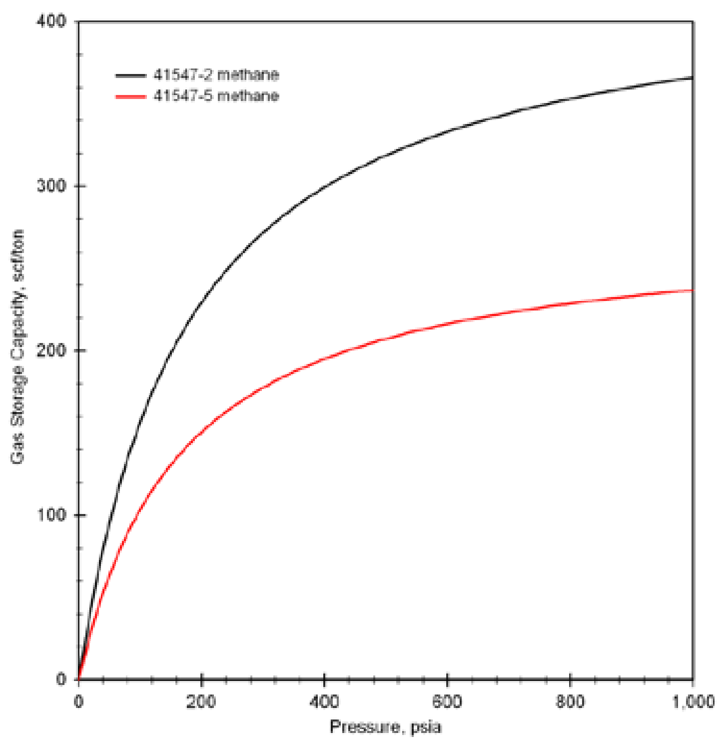


Figure 12. **In-Situ Methane Isotherms**



Often there is a relationship between methane storage capacity and inorganic content at reservoir pressure. Figure 13 illustrates this relationship listed in Equation 7 at a reservoir pressure of 222.5 psia.

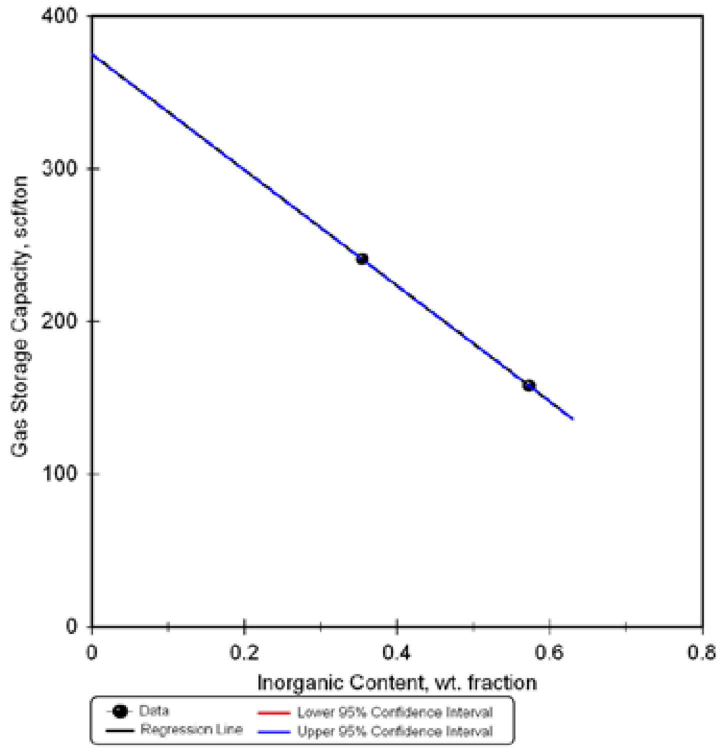
Extrapolation to zero inorganic content suggested the dry, ash-free storage capacity was 375.1 scf/ton. This value was larger than the dry, ash-free gas content of 336.9 scf/ton determined from Equation 6 discussed earlier and indicated that the reservoir was slightly undersaturated. This difference may be due to underestimation of the reservoir temperature, an overestimation of reservoir pressure, differences in maceral composition and thermal maturities between the samples, or limited data available for regression.

$$G_s = 375.1 - 378.9(w_a + w_w + w_s) \qquad (7)$$

where:

G_s *gas storage capacity, scf/ton*
w_a *ash content, weight fraction*
w_w *moisture content, weight fraction*
w_s *sulfur content, weight fraction*

Figure 13. Methane Storage Capacity vs. Inorganic Content



If the reservoir pressure gradient of 0.42 psi/ft is correct, then the dry, ash-free gas content of 336.9 scf/ton from Equation 6 is 89.8% of the dry, ash-free gas storage capacity from Equation 7.

Adsorbed Gas-in-Place Estimate

Adsorbed gas-in-place (GIP) volume was determined for a unit coal thickness based upon the gas content and density data. Gas-in-place per unit thickness volumes were computed with Equation 8.[4]

$$\frac{G}{Ah} = 1.3597\, r\, G_c \qquad (8)$$

where:

G *gas-in-place volume, Mscf*
A *reservoir area, acres*
h *reservoir thickness, ft*
r *average in-situ density, g/cm*^{3}
G_c *average in-situ gas content, scf/ton*

The in-situ density and gas content values from the five desorbed core the samples were used for these estimates. Estimated GIP values per unit volume were reported in thousands of cubic feet at standard conditions per unit reservoir volume in acre-feet. These estimates are summarized in Table 17. This table can be used with coal thickness estimates from log data and assumed drainage areas to compute the volume of gas-in-place in an area of interest.

Table 17. Gas-in-Place per Unit Volume Summary

Coal Seam	Top Depth	Bottom Depth	In-Situ Density	In-Situ Gas Content	Gas-In-Place per Volume
	ft	ft	g/cm^3	scf/ton	Mscf/acre-ft
Fruitland Coals	480.3	532.1	1.491	143.9	291.7

Final Summary

Weatherford Laboratories measured properties of five core samples recovered from Fruitland Coals penetrated by Souder, Miller & Associates' Fosset Gulch MW 34-5-14U well between October 29 and October 30, 2008. Core was collected between 479.0 and 532.1 ft. The goals of this project were to evaluate the sorbed gas content, coal properties, gas storage capacity, and gas-in-place of the Fruitland Coals at the well location.

Five core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. Two desorption samples were dedicated to collection of multiple gas composition and isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all five core samples. Coal characterization was determined for samples taken from desorption samples 41547-2 and 41547-5, which included chemical (proximate analysis, ultimate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). Samples used for coal characterization were also used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

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Appendix I

Souder, Miller & Associates
Fosset Gulch MW 34-5-142
Fruitland Coals

Core Lithology and Photography

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Core Lithology

Client Name: Souder, Miller & Associates **Well Name:** Fosset Gulch MW 34-5-142 **Job Number:** 41547

SAMPLE ID.	CANISTER ID.	SAMPLE INTERVAL			DESCRIPTION	
		Depth Drilled (feet)	Length (inches)	Core Diameter (inches)	Core Surface Texture	Comments
41547-1	GT-193	480.3-481.3	10.0?	3.50	rough and rubblized	Black gray/brown carbonaceous shale to coaly shale, rubblized because of massive? bedding plane parts and parts along possible cleats, large woody debris and bright coal lenses throughout, two parallel vertical fractures (cleats?) with calcite mineralization on fracture faces
41547-2	GT-270	484.7-485.7	6.0?	3.40	rough and muddy	Black banded dull coal, mostly rubble, cleats?, one possible vertical fracture, very mud contaminated, no observed mineralization
41547-3	GT-230	487.5-488.5	10.0?	3.4?	rough and rubblized	Dark gray siltstone and black coal?, sample is rubblized to pulverized, one competent section appears to be siltstone, rubble appears to be coal judging by heft
41547-4	GT-398	524.0-525.0	12.00	3.40	slightly rough with bit marks	Dark gray siltstone, semi-competent - a few parts on massive? bedding, fluid saturated, shelly lag throughout but especially concentrated at mid-core, shells are whole and appear to be aragonite, core is fairly hard
41547-5	GT-247	531.1-532.1	11.50	3.40	(coaly) rough with bit marks	Interbedded black shaly coal, banded coal, and carbonaceous shale; few bands of bright coal, semi-competent - parts on indeterminate bedding, one fracture down vertical center of core (not a centerline fracture), poorly developed cleats

Lithologist(s): D. Rogers

Core Photography

Souder, Miller & Associates

Fosset Gulch MW 34-5-142

Fruitland Coals	41547-1	480.3-481.3 feet

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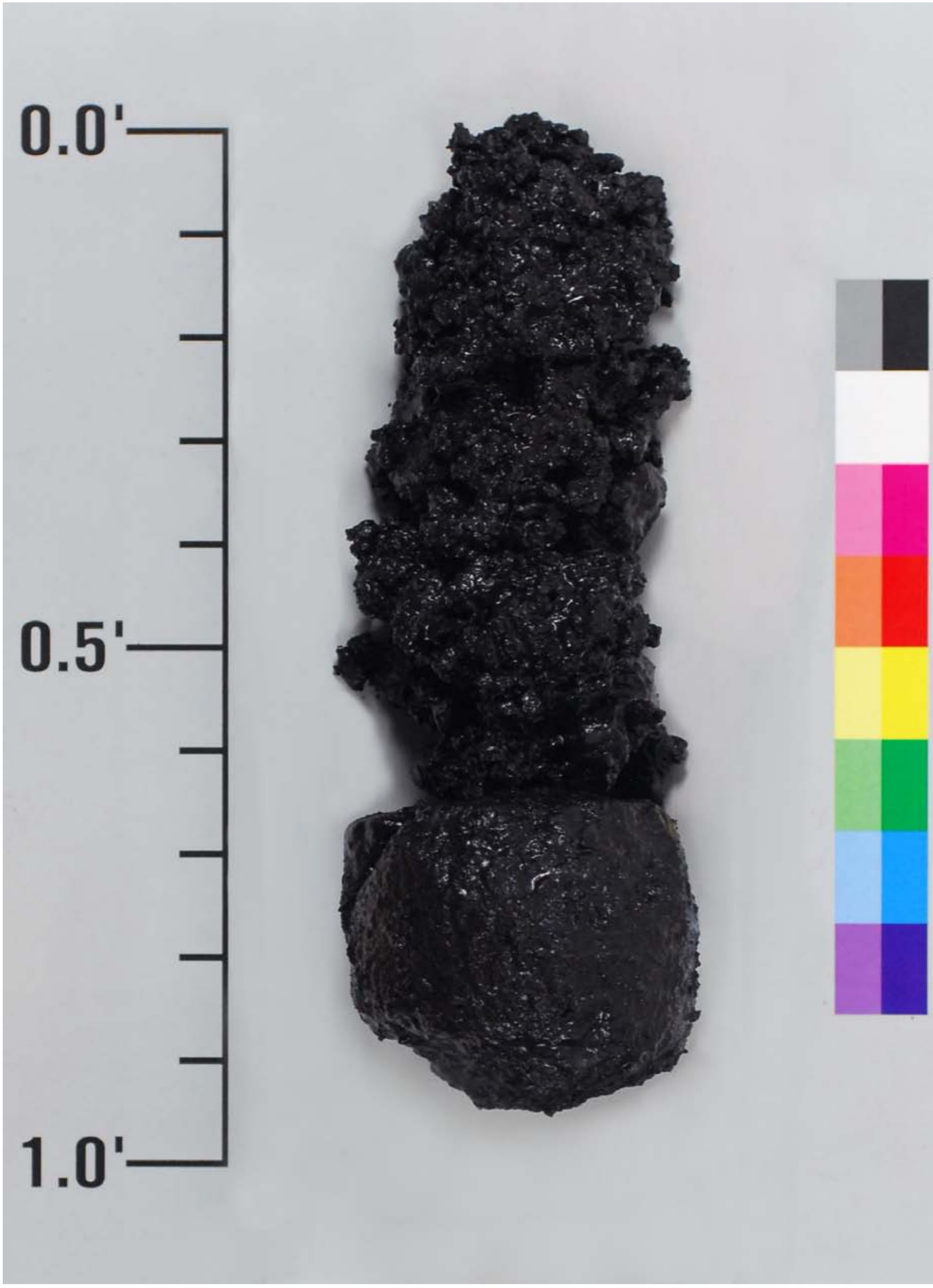
Core Photography

Souder, Miller & Associates
Fosset Gulch MW 34-5-142



Fruitland Coals	41547-2	484.7-485.7 feet

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Fosset Gulch MW 34-5-142

Fruitland Coals	41547-3	487.5-488.5 feet

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Core Photography

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Fosset Gulch MW 34-5-142

Fruitland Coals	**41547-4**	**524.0-525.0 feet**

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Core Photography

Souder, Miller & Associates

Fosset Gulch MW 34-5-142

Fruitland Coals	41547-5	531.1-532.1 feet

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Appendix II

Souder, Miller & Associates
Fosset Gulch MW 34-5-142
Fruitland Coals

Desorption Data and Graphs

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Sample 41547-1 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	480.30
Sample Bottom Depth	ft	481.30
Reservoir Pressure	psia	216.63
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	229.49
Mud Density	lbm/gal	8.60
Sample Mass	g	2,019.0
Sample Headspace Volume	cm^3	168.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/30/2008 08:25:02
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/30/2008 09:48:14
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/30/2008 09:52:01
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/30/2008 10:51:40
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/30/2008 11:13:10
Lost Gas Time	hours	1.353
Desorption Time Correction	hours	0.081
Fit Start Time	hours	1.387
Fit End Time	hours	1.632
Fit Start Time	hours*0.5	1.178
Fit End Time	hours*0.5	1.278
Lost Gas Content	scf/ton	22.1
Measured Gas Content	scf/ton	63.9
Crushed Gas Content	scf/ton	28.8
Total Gas Content	scf/ton	114.9
Lost Gas Fraction	vol frac	0.1924
Measured Gas Fraction	vol frac	0.5565
Crushed Gas Fraction	vol frac	0.2511
Diffusivity	1/us	0.7
Sorption Time	hours	26.0

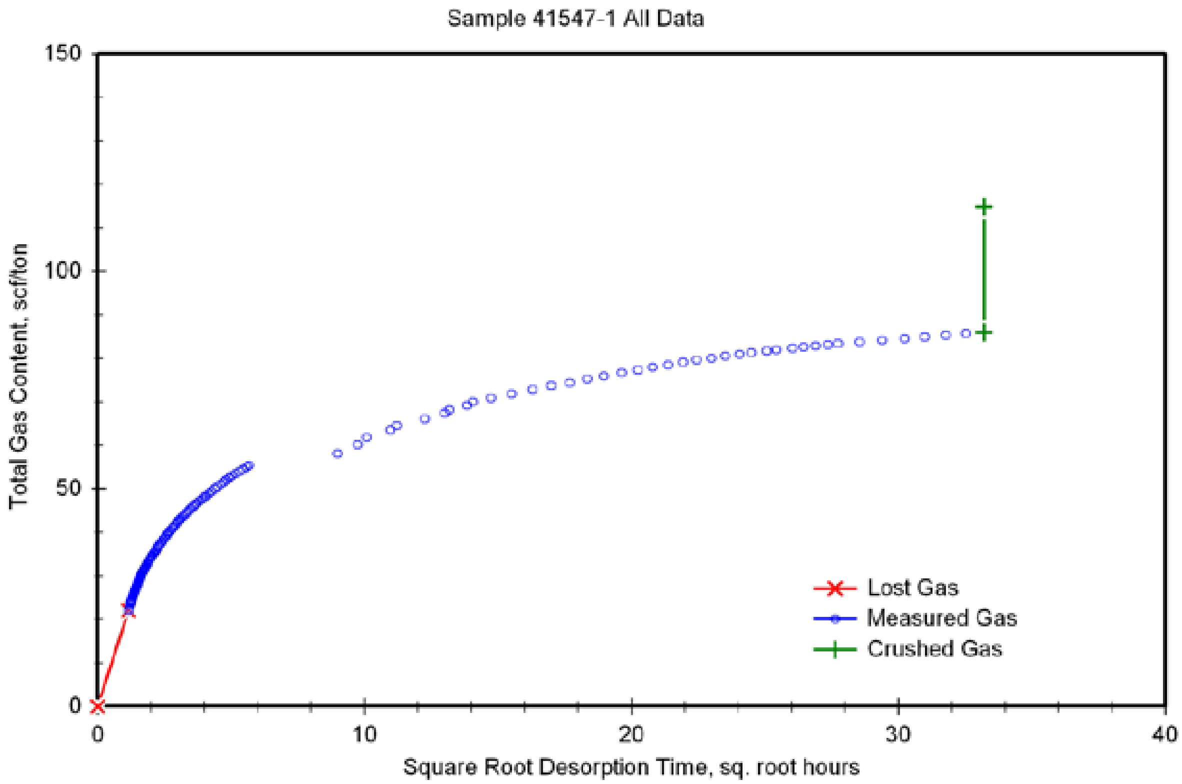
Sample 41547-1 Desorption History

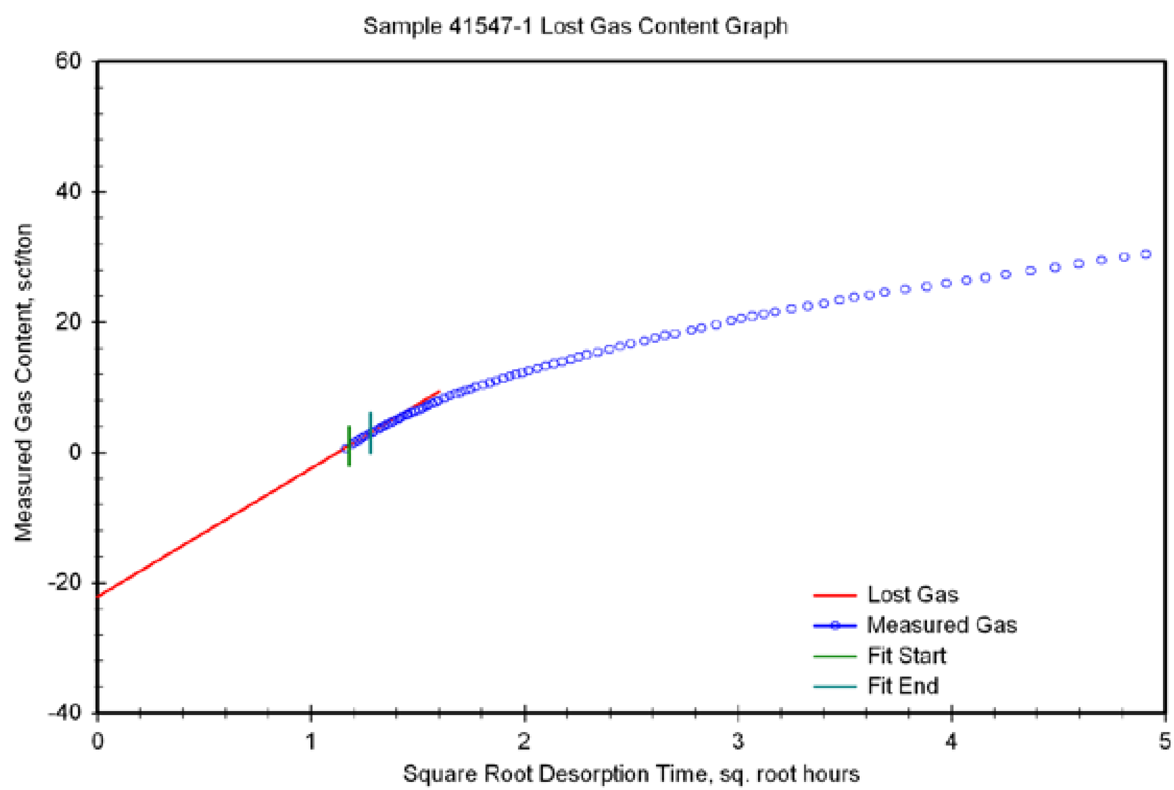
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
10/30/2008 11:13:10	1.3525	1.1630	0.0	0.0	68.2	57.9	11.66	0.00
10/30/2008 11:18:00	1.3522	1.1629	52.0	41.4	68.2	57.9	11.66	0.66
10/30/2008 11:22:00	1.4189	1.1912	53.0	41.9	69.6	58.4	11.66	1.32
10/30/2008 11:23:59	1.4520	1.2050	24.0	19.1	69.6	58.8	11.66	1.62
10/30/2008 11:26:00	1.4856	1.2188	23.0	18.3	69.6	59.5	11.66	1.91
10/30/2008 11:28:00	1.5189	1.2324	22.0	17.4	69.6	60.2	11.66	2.19
10/30/2008 11:30:00	1.5522	1.2459	21.0	16.6	69.8	60.8	11.66	2.45
10/30/2008 11:32:59	1.6020	1.2657	26.0	20.4	69.9	62.4	11.66	2.78
10/30/2008 11:35:59	1.6520	1.2853	29.0	22.8	69.4	63.5	11.66	3.14
10/30/2008 11:37:00	1.6689	1.2919	15.0	11.8	69.6	63.5	11.66	3.33
10/30/2008 11:41:00	1.7356	1.3174	31.0	24.4	69.6	63.6	11.66	3.72
10/30/2008 11:42:59	1.7686	1.3299	20.0	15.8	69.6	63.6	11.66	3.97
10/30/2008 11:45:00	1.8022	1.3425	15.0	11.8	69.6	63.8	11.66	4.15
10/30/2008 11:47:00	1.8356	1.3548	19.0	15.0	69.4	64.0	11.66	4.39
10/30/2008 11:49:59	1.8853	1.3731	19.0	14.8	69.8	64.2	11.66	4.63
10/30/2008 11:51:59	1.9186	1.3851	18.0	14.2	69.6	64.2	11.66	4.85
10/30/2008 11:55:00	1.9689	1.4032	21.0	16.5	69.4	64.5	11.66	5.11
10/30/2008 11:57:00	2.0022	1.4150	17.0	13.4	68.4	64.7	11.66	5.32
10/30/2008 11:59:00	2.0356	1.4267	16.0	12.5	68.5	65.1	11.66	5.52
10/30/2008 12:01:59	2.0853	1.4441	15.0	11.6	68.9	65.4	11.65	5.71
10/30/2008 12:04:00	2.1189	1.4556	16.0	12.5	68.9	65.8	11.65	5.91
10/30/2008 12:06:00	2.1522	1.4671	20.0	15.7	68.9	66.2	11.65	6.16
10/30/2008 12:08:59	2.2020	1.4839	18.0	14.1	68.9	66.2	11.65	6.38
10/30/2008 12:13:00	2.2689	1.5063	19.0	14.9	68.9	67.1	11.65	6.62
10/30/2008 12:16:00	2.3189	1.5228	18.0	14.1	68.9	68.0	11.65	6.84
10/30/2008 12:19:00	2.3689	1.5391	20.0	15.6	68.9	69.8	11.65	7.08
10/30/2008 12:20:59	2.4020	1.5498	17.0	13.2	68.9	70.7	11.65	7.29
10/30/2008 12:24:00	2.4522	1.5660	21.0	16.3	69.1	70.7	11.65	7.55
10/30/2008 12:27:00	2.5022	1.5818	22.0	17.1	69.1	71.0	11.65	7.82
10/30/2008 12:30:00	2.5522	1.5976	22.0	17.1	69.1	71.9	11.65	8.09
10/30/2008 12:34:59	2.6353	1.6234	25.0	19.3	69.1	73.4	11.65	8.40
10/30/2008 12:40:00	2.7189	1.6489	25.0	19.3	69.1	74.3	11.65	8.71
10/30/2008 12:45:00	2.8022	1.6740	24.0	18.4	69.1	75.0	11.65	9.00
10/30/2008 12:49:59	2.8853	1.6986	24.0	18.5	69.1	75.7	11.65	9.29
10/30/2008 12:55:00	2.9689	1.7231	23.0	17.7	69.1	75.3	11.65	9.57
10/30/2008 13:00:00	3.0522	1.7471	22.0	16.8	69.1	76.4	11.64	9.84

10/30/2008 13:05:00	3.1356	1.7708	22.0	16.9	69.1	77.0	11.64	10.11
10/30/2008 13:12:00	3.2522	1.8034	24.0	18.3	69.1	77.3	11.64	10.40
10/30/2008 13:19:00	3.3689	1.8355	28.0	21.5	69.1	77.0	11.64	10.74
10/30/2008 13:26:00	3.4856	1.8670	27.0	20.7	69.1	76.8	11.64	11.07
10/30/2008 13:33:00	3.6022	1.8980	27.0	20.6	69.1	76.8	11.63	11.39
10/30/2008 13:40:00	3.7189	1.9284	27.0	20.7	69.1	77.0	11.63	11.72
10/30/2008 13:47:00	3.8356	1.9585	25.0	19.1	69.1	77.1	11.63	12.03
10/30/2008 13:54:00	3.9522	1.9880	24.0	18.4	69.1	77.5	11.63	12.32
10/30/2008 14:01:00	4.0689	2.0172	25.0	19.1	69.1	78.8	11.63	12.62
10/30/2008 14:11:00	4.2356	2.0581	30.0	22.9	69.1	79.1	11.63	12.98
10/30/2008 14:21:00	4.4022	2.0982	26.0	19.8	69.1	79.8	11.63	13.30
10/30/2008 14:31:00	4.5689	2.1375	26.0	19.7	69.1	80.7	11.62	13.61
10/30/2008 14:41:00	4.7356	2.1761	31.0	23.5	69.1	83.3	11.62	13.98
10/30/2008 14:51:00	4.9022	2.2141	30.0	22.7	68.9	84.3	11.62	14.34
10/30/2008 15:01:00	5.0689	2.2514	29.0	21.9	68.9	83.8	11.62	14.69
10/30/2008 15:11:00	5.2356	2.2881	28.0	21.2	68.9	82.9	11.62	15.03
10/30/2008 15:26:00	5.4856	2.3421	35.0	26.5	68.9	82.5	11.62	15.45
10/30/2008 15:41:00	5.7356	2.3949	37.0	28.0	69.1	82.5	11.62	15.89
10/30/2008 15:56:00	5.9856	2.4465	33.0	24.9	69.4	82.7	11.62	16.29
10/30/2008 16:11:00	6.2356	2.4971	36.0	27.2	69.4	83.6	11.62	16.72
10/30/2008 16:30:00	6.5522	2.5597	41.0	31.2	69.1	79.8	11.62	17.22
10/30/2008 16:45:00	6.8022	2.6081	34.0	26.0	69.1	77.9	11.63	17.63
10/30/2008 17:00:00	7.0522	2.6556	31.0	23.7	69.1	76.1	11.62	18.00
10/30/2008 17:15:00	7.3022	2.7023	24.0	18.4	69.1	75.3	11.63	18.30
10/30/2008 17:40:00	7.7189	2.7783	41.0	31.9	69.1	69.4	11.63	18.80
10/30/2008 17:56:00	7.9856	2.8259	30.0	23.2	69.1	71.7	11.63	19.17
10/30/2008 18:20:59	8.4020	2.8986	41.0	31.9	69.1	69.2	11.64	19.68
10/30/2008 18:45:00	8.8022	2.9669	46.0	35.8	69.3	68.0	11.64	20.25
10/30/2008 19:01:00	9.0689	3.0115	27.0	21.2	69.3	65.3	11.64	20.58
10/30/2008 19:19:59	9.3853	3.0635	28.0	22.1	69.1	62.7	11.64	20.93
10/30/2008 19:41:00	9.7356	3.1202	27.0	21.3	69.4	63.1	11.65	21.27
10/30/2008 20:01:00	10.0689	3.1732	27.0	21.3	69.4	62.2	11.65	21.61
10/30/2008 20:30:00	10.5522	3.2484	35.0	27.7	69.8	60.8	11.66	22.05
10/30/2008 21:00:00	11.0522	3.3245	37.0	29.2	69.8	62.4	11.66	22.51
10/30/2008 21:30:00	11.5522	3.3989	35.0	27.7	69.6	62.2	11.66	22.95
10/30/2008 22:01:00	12.0689	3.4740	37.0	29.1	69.8	64.0	11.66	23.41
10/30/2008 22:30:00	12.5522	3.5429	34.0	26.8	70.2	64.2	11.67	23.84
10/30/2008 23:01:00	13.0689	3.6151	32.0	25.0	69.8	68.1	11.68	24.23
10/30/2008 23:31:00	13.5689	3.6836	31.0	24.2	69.4	69.2	11.68	24.62
10/31/2008 00:15:00	14.3022	3.7818	35.0	27.7	69.3	62.4	11.68	25.06
10/31/2008 01:01:00	15.0689	3.8819	38.0	29.9	69.1	66.0	11.69	25.53

10/31/2008 01:45:00	15.8022	3.9752	38.0	29.6	70.0	66.5	11.69	26.00
10/31/2008 02:30:00	16.5522	4.0684	36.0	28.3	69.8	66.2	11.69	26.45
10/31/2008 03:15:00	17.3022	4.1596	35.0	27.5	69.6	66.2	11.69	26.89
10/31/2008 04:02:00	18.0856	4.2527	39.0	30.7	68.9	65.4	11.69	27.37
10/31/2008 05:01:00	19.0689	4.3668	41.0	32.4	69.4	62.7	11.70	27.89
10/31/2008 06:03:00	20.1022	4.4836	43.0	33.7	69.8	66.5	11.70	28.42
10/31/2008 07:02:59	21.1020	4.5937	46.0	36.5	69.8	62.0	11.70	29.00
10/31/2008 08:03:00	22.1022	4.7013	43.0	34.0	69.8	64.2	11.71	29.54
10/31/2008 09:03:00	23.1022	4.8065	38.0	30.6	69.3	55.2	11.72	30.03
10/31/2008 10:02:59	24.1020	4.9094	36.0	28.9	69.6	55.7	11.72	30.49
10/31/2008 11:03:00	25.1022	5.0102	34.0	27.1	69.6	60.0	11.72	30.92
10/31/2008 12:33:00	26.6022	5.1577	39.0	30.4	69.1	71.4	11.70	31.40
10/31/2008 14:03:00	28.1022	5.3012	46.0	35.2	69.1	76.2	11.68	31.96
10/31/2008 15:33:00	29.6022	5.4408	43.0	33.1	69.3	75.3	11.68	32.48
10/31/2008 17:03:00	31.1022	5.5769	40.0	31.0	69.3	72.8	11.68	32.97
10/31/2008 18:00:00	32.0522	5.6615	31.0	24.1	69.3	71.6	11.68	33.36
11/02/2008 18:20:00	80.3856	8.9658	220.0	171.4	72.3	72.9	11.74	36.08
11/03/2008 08:26:00	94.4856	9.7204	169.0	132.3	69.8	69.7	11.72	38.18
11/03/2008 15:04:59	101.1353	10.0566	131.0	102.3	72.1	71.5	11.75	39.80
11/04/2008 10:08:00	120.1856	10.9629	136.0	105.6	69.6	69.3	11.66	41.47
11/04/2008 15:07:00	125.1689	11.1879	92.0	70.3	70.7	70.6	11.61	42.59
11/05/2008 15:48:00	149.8522	12.2414	120.0	94.0	69.8	68.6	11.70	44.08
11/06/2008 10:54:00	168.9522	12.9982	101.0	79.6	69.1	68.6	11.77	45.34
11/06/2008 15:14:00	173.2856	13.1638	65.0	50.5	72.5	68.2	11.78	46.15
11/07/2008 09:17:00	191.3356	13.8324	82.0	64.8	70.5	68.8	11.80	47.17
11/07/2008 15:34:59	197.6353	14.0583	60.0	47.2	71.2	69.3	11.80	47.92
11/08/2008 10:49:00	216.8689	14.7265	73.0	57.1	69.8	73.9	11.80	48.83
11/09/2008 09:56:00	239.9856	15.4915	77.0	58.9	69.3	73.9	11.71	49.76
11/10/2008 11:15:00	265.3022	16.2881	79.0	60.4	69.4	74.3	11.66	50.72
11/11/2008 10:08:00	288.1856	16.9760	71.0	55.7	69.8	69.6	11.75	51.61
11/12/2008 10:18:00	312.3522	17.6735	63.0	49.6	70.0	68.4	11.76	52.39
11/13/2008 10:05:00	336.1356	18.3340	65.0	49.5	70.0	68.8	11.66	53.18
11/14/2008 09:41:00	359.7356	18.9667	60.0	47.8	69.4	68.0	11.88	53.94
11/15/2008 11:22:00	385.4189	19.6321	54.0	42.6	70.5	71.4	11.89	54.61
11/16/2008 11:31:00	409.5689	20.2378	53.0	42.0	69.3	69.8	11.86	55.28
11/17/2008 09:52:00	431.9189	20.7827	48.0	37.8	70.0	75.9	11.94	55.88
11/18/2008 10:42:00	456.7522	21.3718	49.0	38.4	70.7	70.4	11.91	56.49
11/19/2008 10:19:59	480.3853	21.9177	51.0	39.5	71.8	71.1	11.87	57.11
11/20/2008 09:58:00	504.0189	22.4504	36.0	29.0	69.1	68.6	12.01	57.57
11/21/2008 09:59:00	528.0356	22.9790	40.0	28.7	69.8	68.6	11.78	58.03
11/22/2008 10:26:00	552.4856	23.5050	36.0	28.2	69.4	73.2	11.82	58.48

11/23/2008 11:25:00	577.4689	24.0306	35.0	27.0	69.8	75.0	11.80	58.91
11/24/2008 09:34:00	599.6189	24.4871	29.0	23.1	69.8	68.9	11.90	59.27
11/25/2008 14:00:00	628.0522	25.0610	31.0	23.5	69.6	73.0	11.82	59.64
11/26/2008 08:15:00	646.3022	25.4225	26.0	20.3	68.5	75.0	11.82	59.97
11/27/2008 15:36:00	677.6522	26.0318	28.0	21.6	69.3	68.9	11.79	60.31
11/28/2008 13:50:59	699.9020	26.4557	26.0	19.3	69.6	69.5	11.70	60.62
11/29/2008 12:51:00	722.9022	26.8868	21.0	16.5	68.4	68.9	11.71	60.88
11/30/2008 14:15:00	748.3022	27.3551	16.0	12.6	68.4	68.2	11.77	61.08
12/01/2008 10:24:00	768.4522	27.7210	21.0	16.3	69.3	68.1	11.77	61.34
12/03/2008 09:16:00	815.3189	28.5538	27.0	21.3	67.5	69.2	11.82	61.67
12/05/2008 09:04:59	863.1353	29.3792	31.0	23.3	68.7	70.7	11.75	62.04
12/07/2008 11:49:59	913.8853	30.2305	38.0	28.7	70.9	74.1	11.73	62.50
12/09/2008 09:49:59	959.8853	30.9820	30.0	23.6	69.3	73.2	11.85	62.87
12/11/2008 11:04:00	1009.1189	31.7666	30.0	23.2	69.8	72.5	11.83	63.24
12/13/2008 11:51:00	1057.9022	32.5254	38.0	23.9	71.8	73.2	11.43	63.62
12/15/2008 07:30:00	1101.5522	33.1896	25.0	19.7	69.1	68.7	11.78	63.93


Sample 41547-1 All Data
Total Gas Content, scf/ton
150
100
50
0
0
10
20
30
40
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas


Sample 41547-1 Lost Gas Content Graph
Measured Gas Content, scf/ton
60
40
20
0
-20
-40
0
1
2
3
4
5
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End

Sample 41547-2 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	484.70
Sample Bottom Depth	ft	485.70
Reservoir Pressure	psia	218.48
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	231.46
Mud Density	lbm/gal	8.60
Sample Mass	g	1,573.0
Sample Headspace Volume	cm^3	761.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/30/2008 08:37:55
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/30/2008 09:48:14
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/30/2008 09:52:01
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/30/2008 10:51:40
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/30/2008 11:21:03
Lost Gas Time	hours	1.484
Desorption Time Correction	hours	0.049
Fit Start Time	hours	1.531
Fit End Time	hours	1.818
Fit Start Time	hours*0.5	1.237
Fit End Time	hours*0.5	1.348
Lost Gas Content	scf/ton	46.4
Measured Gas Content	scf/ton	124.1
Crushed Gas Content	scf/ton	35.8
Total Gas Content	scf/ton	206.4
Lost Gas Fraction	vol frac	0.2249
Measured Gas Fraction	vol frac	0.6014
Crushed Gas Fraction	vol frac	0.1737
Diffusivity	1/us	0.9
Sorption Time	hours	21.2

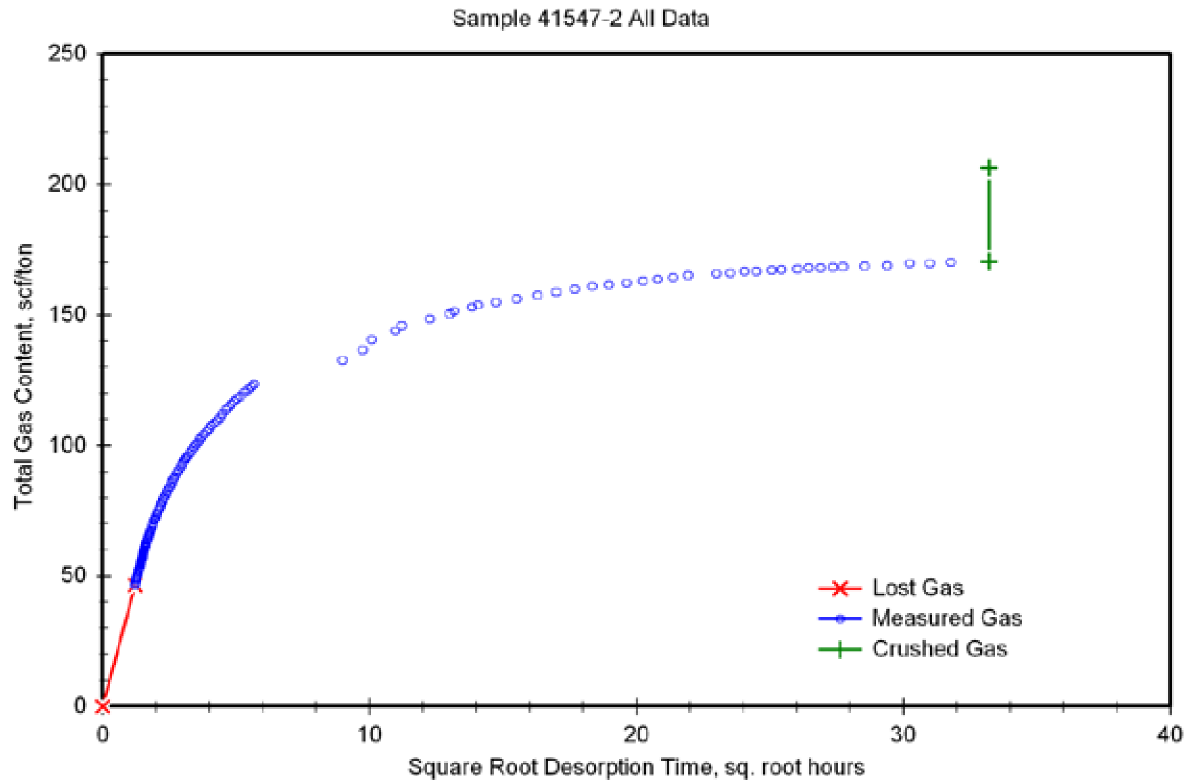
Sample 41547-2 Desorption History

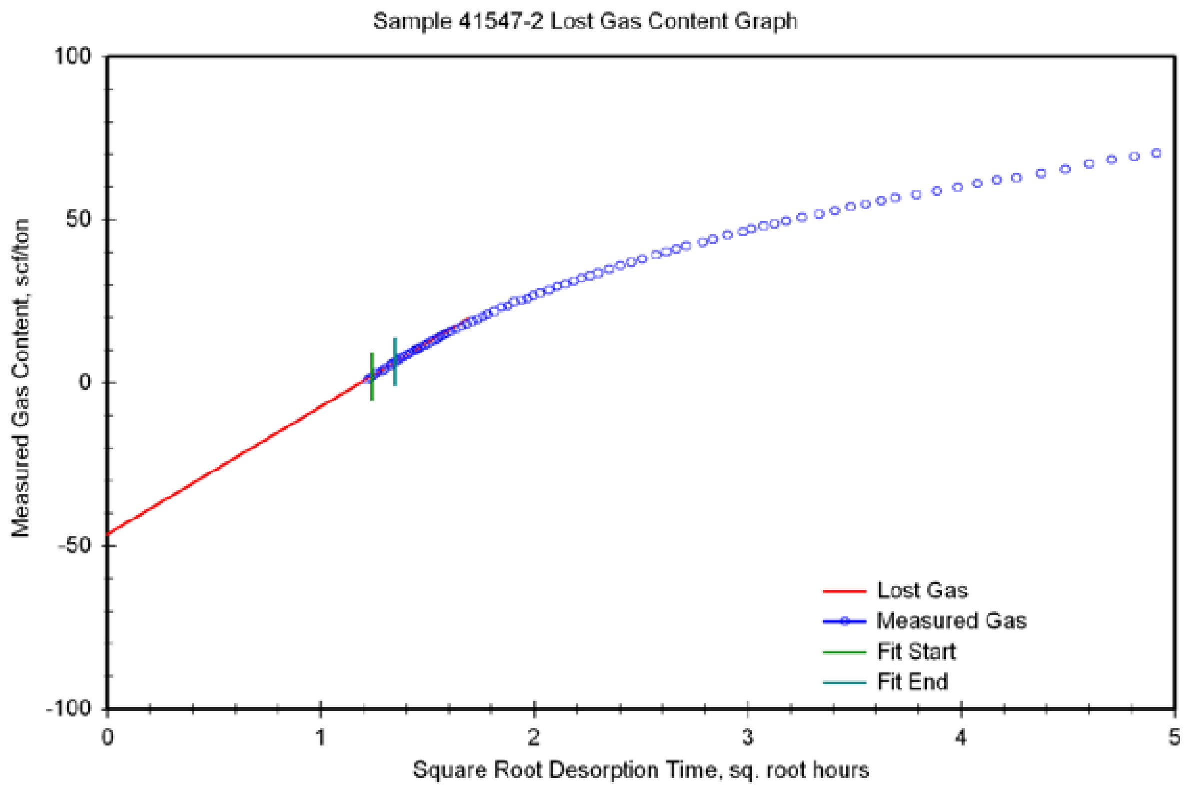
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
10/30/2008 11:21:03	1.4839	1.2181	0.0	0.0	69.6	58.6	11.66	0.00
10/30/2008 11:23:59	1.4836	1.2180	62.0	49.3	69.6	58.6	11.66	1.00
10/30/2008 11:26:00	1.5172	1.2318	44.0	35.0	69.6	58.8	11.66	1.72
10/30/2008 11:28:00	1.5506	1.2452	40.0	31.7	69.6	59.9	11.66	2.36
10/30/2008 11:30:00	1.5839	1.2585	46.0	36.3	69.8	60.2	11.66	3.10
10/30/2008 11:34:00	1.6506	1.2847	41.0	32.3	69.3	63.1	11.66	3.76
10/30/2008 11:35:59	1.6836	1.2975	38.0	29.6	69.6	63.5	11.66	4.36
10/30/2008 11:40:00	1.7506	1.3231	62.0	48.8	69.6	63.5	11.66	5.36
10/30/2008 11:42:00	1.7839	1.3356	41.0	31.6	70.2	63.6	11.66	6.00
10/30/2008 11:44:00	1.8172	1.3481	30.0	23.6	69.6	63.8	11.66	6.48
10/30/2008 11:46:00	1.8506	1.3604	34.0	26.8	69.4	64.0	11.66	7.03
10/30/2008 11:48:00	1.8839	1.3726	36.0	27.9	69.8	64.2	11.66	7.60
10/30/2008 11:49:58	1.9167	1.3844	31.0	24.4	69.3	64.0	11.66	8.09
10/30/2008 11:53:00	1.9672	1.4026	33.0	26.0	69.3	64.4	11.66	8.62
10/30/2008 11:55:00	2.0006	1.4144	33.0	25.8	69.4	64.5	11.66	9.15
10/30/2008 11:58:00	2.0506	1.4320	34.0	26.7	69.3	64.7	11.66	9.69
10/30/2008 12:00:00	2.0839	1.4436	28.0	21.7	69.3	65.3	11.65	10.13
10/30/2008 12:01:59	2.1170	1.4550	31.0	24.2	69.4	65.6	11.65	10.63
10/30/2008 12:04:00	2.1506	1.4665	29.0	22.7	69.4	65.8	11.65	11.09
10/30/2008 12:07:00	2.2006	1.4834	30.0	23.5	69.4	66.2	11.65	11.57
10/30/2008 12:10:00	2.2506	1.5002	34.0	26.6	69.4	66.5	11.65	12.11
10/30/2008 12:13:00	2.3006	1.5168	41.0	32.1	69.4	67.1	11.65	12.76
10/30/2008 12:16:00	2.3506	1.5332	35.0	27.1	69.6	68.1	11.65	13.32
10/30/2008 12:19:00	2.4006	1.5494	36.0	28.0	69.6	69.8	11.65	13.89
10/30/2008 12:20:59	2.4336	1.5600	30.0	23.3	69.6	70.7	11.65	14.36
10/30/2008 12:24:00	2.4839	1.5760	30.0	23.3	69.6	70.7	11.65	14.84
10/30/2008 12:27:00	2.5339	1.5918	31.0	24.0	69.6	71.4	11.65	15.33
10/30/2008 12:30:00	2.5839	1.6075	34.0	26.4	69.6	71.9	11.65	15.86
10/30/2008 12:34:58	2.6667	1.6330	49.0	37.9	69.6	73.4	11.65	16.63
10/30/2008 12:40:00	2.7506	1.6585	48.0	37.0	69.6	74.3	11.65	17.39
10/30/2008 12:45:00	2.8339	1.6834	50.0	38.3	69.6	75.0	11.65	18.17
10/30/2008 12:49:59	2.9170	1.7079	48.0	36.9	69.6	75.7	11.65	18.92
10/30/2008 12:55:00	3.0006	1.7322	46.0	35.4	69.6	75.3	11.65	19.64
10/30/2008 13:00:00	3.0839	1.7561	44.0	33.5	69.6	76.4	11.64	20.32
10/30/2008 13:05:00	3.1672	1.7797	44.0	33.7	69.6	77.0	11.64	21.01
10/30/2008 13:12:00	3.2839	1.8122	57.0	43.4	69.6	77.3	11.64	21.89

10/30/2008 13:19:00	3.4006	1.8441	92.0	70.5	69.6	77.0	11.64	23.33
10/30/2008 13:26:00	3.5172	1.8754	23.0	17.6	69.6	76.8	11.64	23.69
10/30/2008 13:33:00	3.6339	1.9063	86.0	65.4	69.6	76.8	11.63	25.02
10/30/2008 13:40:00	3.7506	1.9366	26.0	19.9	69.6	77.0	11.63	25.43
10/30/2008 13:47:00	3.8672	1.9665	45.0	34.5	69.6	77.1	11.63	26.13
10/30/2008 13:54:00	3.9839	1.9960	47.0	36.0	69.6	77.5	11.63	26.86
10/30/2008 14:01:00	4.1006	2.0250	48.0	36.6	69.6	78.8	11.63	27.61
10/30/2008 14:11:00	4.2672	2.0657	61.0	46.5	69.6	79.1	11.63	28.56
10/30/2008 14:21:00	4.4339	2.1057	67.0	51.1	69.6	79.8	11.63	29.60
10/30/2008 14:31:00	4.6006	2.1449	51.0	38.5	69.6	80.7	11.62	30.38
10/30/2008 14:41:00	4.7672	2.1834	60.0	45.4	69.6	83.3	11.62	31.31
10/30/2008 14:51:00	4.9339	2.2212	56.0	42.3	68.9	84.3	11.62	32.17
10/30/2008 15:01:00	5.1006	2.2584	54.0	40.1	69.6	83.3	11.62	32.98
10/30/2008 15:11:00	5.2672	2.2950	52.0	39.4	69.6	82.9	11.62	33.79
10/30/2008 15:26:00	5.5172	2.3489	76.0	57.6	68.9	82.5	11.62	34.96
10/30/2008 15:41:00	5.7672	2.4015	64.0	47.5	69.8	82.5	11.62	35.93
10/30/2008 15:56:00	6.0172	2.4530	70.0	53.0	69.4	83.1	11.62	37.01
10/30/2008 16:11:00	6.2672	2.5034	66.0	49.9	69.4	83.6	11.62	38.02
10/30/2008 16:31:00	6.6006	2.5692	77.0	58.7	69.4	79.7	11.62	39.22
10/30/2008 16:46:00	6.8506	2.6174	64.0	49.0	69.1	77.7	11.63	40.22
10/30/2008 17:01:00	7.1006	2.6647	55.0	41.9	69.1	76.1	11.62	41.07
10/30/2008 17:16:00	7.3506	2.7112	58.0	44.6	69.1	75.3	11.63	41.98
10/30/2008 17:41:00	7.7672	2.7870	78.0	60.6	69.1	69.4	11.63	43.21
10/30/2008 17:57:00	8.0339	2.8344	52.0	40.2	69.1	71.7	11.63	44.03
10/30/2008 18:20:59	8.4336	2.9041	84.0	65.3	69.3	69.2	11.64	45.36
10/30/2008 18:46:00	8.8506	2.9750	71.0	55.4	69.3	68.0	11.64	46.49
10/30/2008 19:01:00	9.1006	3.0167	51.0	40.0	69.3	65.1	11.65	47.30
10/30/2008 19:21:00	9.4339	3.0715	52.0	41.0	68.9	62.7	11.64	48.14
10/30/2008 19:41:00	9.7672	3.1253	47.0	37.0	69.4	63.1	11.65	48.89
10/30/2008 20:01:00	10.1006	3.1781	50.0	39.4	69.4	62.7	11.65	49.70
10/30/2008 20:30:00	10.5839	3.2533	63.0	49.7	69.8	60.6	11.66	50.71
10/30/2008 21:01:00	11.1006	3.3318	69.0	54.5	69.6	62.4	11.66	51.82
10/30/2008 21:31:00	11.6006	3.4060	65.0	51.3	69.6	62.7	11.66	52.86
10/30/2008 22:02:00	12.1172	3.4810	68.0	53.2	69.9	64.0	11.66	53.95
10/30/2008 22:31:00	12.6006	3.5497	62.0	48.9	70.2	64.2	11.67	54.94
10/30/2008 23:02:00	13.1172	3.6218	60.0	47.0	69.8	68.1	11.68	55.90
10/30/2008 23:31:00	13.6006	3.6879	54.0	42.2	69.4	69.2	11.68	56.76
10/31/2008 00:16:00	14.3506	3.7882	61.0	48.3	69.1	62.2	11.68	57.74
10/31/2008 01:01:00	15.1006	3.8859	72.0	56.6	69.1	66.0	11.69	58.89
10/31/2008 01:46:00	15.8506	3.9813	76.0	58.8	69.9	66.5	11.69	60.09
10/31/2008 02:31:00	16.6006	4.0744	68.0	53.5	69.8	66.2	11.69	61.18

10/31/2008 03:16:00	17.3506	4.1654	62.0	48.8	69.8	66.0	11.69	62.17
10/31/2008 04:02:59	18.1336	4.2584	51.0	40.1	68.9	65.8	11.69	62.99
10/31/2008 05:02:00	19.1172	4.3723	77.0	60.8	69.3	62.9	11.70	64.23
10/31/2008 06:03:00	20.1339	4.4871	82.0	63.9	69.8	66.5	11.70	65.53
10/31/2008 07:02:59	21.1336	4.5971	107.0	84.9	69.8	62.0	11.70	67.26
10/31/2008 08:03:00	22.1339	4.7047	72.0	56.9	69.8	64.5	11.71	68.42
10/31/2008 09:03:00	23.1339	4.8098	63.0	50.7	69.8	55.2	11.72	69.45
10/31/2008 10:02:59	24.1336	4.9126	66.0	53.0	69.8	55.9	11.72	70.53
10/31/2008 11:03:00	25.1339	5.0134	57.0	45.4	69.6	60.2	11.72	71.46
10/31/2008 12:33:00	26.6339	5.1608	70.0	54.0	69.4	71.6	11.70	72.56
10/31/2008 14:03:00	28.1339	5.3041	88.0	66.9	69.4	76.2	11.68	73.92
10/31/2008 15:33:00	29.6339	5.4437	74.0	56.8	69.4	75.7	11.68	75.08
10/31/2008 17:03:00	31.1339	5.5798	68.0	52.5	69.6	72.8	11.68	76.15
10/31/2008 18:00:00	32.0839	5.6643	50.0	38.9	69.6	71.7	11.68	76.94
11/02/2008 18:20:59	80.4336	8.9685	584.0	455.0	72.3	73.3	11.74	86.20
11/03/2008 08:27:00	94.5339	9.7229	261.0	204.2	69.4	70.0	11.72	90.36
11/03/2008 15:07:00	101.2006	10.0598	234.0	181.9	72.0	71.5	11.75	94.07
11/04/2008 10:09:00	120.2339	10.9651	221.0	170.4	69.4	69.3	11.66	97.54
11/04/2008 15:08:59	125.2336	11.1908	136.0	101.6	70.7	70.7	11.62	99.61
11/05/2008 15:49:00	149.9006	12.2434	158.0	123.7	69.9	68.8	11.70	102.13
11/06/2008 10:56:00	169.0172	13.0007	120.0	94.5	69.1	68.8	11.77	104.05
11/06/2008 15:15:00	173.3339	13.1656	65.0	48.2	72.1	68.2	11.78	105.04
11/07/2008 09:17:59	191.3836	13.8341	92.0	72.6	70.3	68.9	11.80	106.51
11/07/2008 15:36:00	197.6839	14.0600	62.0	48.0	71.1	69.3	11.80	107.49
11/08/2008 10:50:59	216.9336	14.7287	74.0	57.9	69.6	74.3	11.82	108.67
11/09/2008 09:58:00	240.0506	15.4936	85.0	61.0	69.1	73.9	11.71	109.91
11/10/2008 11:16:00	265.3506	16.2896	86.0	63.7	69.3	74.1	11.66	111.21
11/11/2008 10:09:00	288.2339	16.9775	70.0	55.0	69.1	68.6	11.75	112.33
11/12/2008 10:19:00	312.4006	17.6749	70.0	54.9	70.0	68.4	11.76	113.45
11/13/2008 10:09:00	336.2339	18.3367	76.0	53.8	70.0	68.8	11.66	114.55
11/14/2008 09:42:00	359.7839	18.9680	40.0	31.8	69.3	68.0	11.88	115.20
11/15/2008 11:23:59	385.4836	19.6337	45.0	34.5	70.5	71.4	11.89	115.90
11/16/2008 11:32:59	409.6336	20.2394	46.0	36.4	69.3	69.8	11.86	116.64
11/17/2008 09:53:00	431.9672	20.7838	41.0	32.3	70.0	75.9	11.94	117.30
11/18/2008 10:43:00	456.8006	21.3729	44.0	32.7	70.7	70.6	11.91	117.96
11/19/2008 10:21:00	480.4339	21.9188	60.0	43.9	71.8	71.1	11.87	118.86
11/21/2008 09:59:00	528.0672	22.9797	38.0	27.9	69.6	68.8	11.78	119.43
11/22/2008 10:27:00	552.5339	23.5060	25.0	19.6	69.4	72.8	11.82	119.83
11/23/2008 11:26:00	577.5172	24.0316	27.0	19.6	69.8	74.6	11.80	120.23
11/24/2008 09:34:58	599.6667	24.4881	15.0	11.9	69.8	68.9	11.90	120.47
11/25/2008 14:02:00	628.1172	25.0623	23.0	14.3	69.6	72.8	11.82	120.76

11/26/2008 08:16:59	646.3670	25.4237	12.0	9.4	68.7	74.4	11.82	120.95
11/27/2008 15:36:59	677.7003	26.0327	21.0	15.1	69.1	69.1	11.80	121.26
11/28/2008 13:52:00	699.9506	26.4566	24.0	13.7	69.1	70.0	11.70	121.54
11/29/2008 12:52:00	722.9506	26.8877	11.0	8.6	68.4	68.9	11.71	121.72
11/30/2008 14:16:59	748.3670	27.3563	7.0	5.5	68.4	68.4	11.77	121.83
12/01/2008 10:25:00	768.5006	27.7218	16.0	11.8	69.1	68.1	11.77	122.07
12/03/2008 09:17:00	815.3672	28.5546	7.0	5.5	67.5	69.2	11.82	122.18
12/05/2008 09:06:00	863.1839	29.3800	29.0	18.1	68.7	70.7	11.75	122.55
12/07/2008 11:51:00	913.9339	30.2313	52.0	36.7	70.9	74.1	11.73	123.30
12/09/2008 09:51:00	959.9339	30.9828	5.0	3.9	69.1	73.2	11.85	123.38
12/11/2008 11:04:58	1009.1667	31.7674	22.0	15.5	69.8	72.6	11.83	123.69
12/15/2008 07:34:59	1101.6670	33.1914	28.0	20.1	69.1	68.7	11.78	124.10


Sample 41547-2 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas
250
200
150
100
50
0
0
10
20
30
40


Sample 41547-2 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End
100
50
0
-50
-100
0
1
2
3
4
5

Sample 41547-3 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	487.50
Sample Bottom Depth	ft	488.50
Reservoir Pressure	psia	219.66
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	232.71
Mud Density	lbm/gal	8.60
Sample Mass	g	1,724.0
Sample Headspace Volume	cm^3	741.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/30/2008 08:40:39
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/30/2008 09:48:14
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/30/2008 09:52:01
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/30/2008 10:51:40
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/30/2008 11:30:12
Lost Gas Time	hours	1.636
Desorption Time Correction	hours	0.013
Fit Start Time	hours	1.695
Fit End Time	hours	1.952
Fit Start Time	hours*0.5	1.302
Fit End Time	hours*0.5	1.397
Lost Gas Content	scf/ton	53.8
Measured Gas Content	scf/ton	120.8
Crushed Gas Content	scf/ton	37.2
Total Gas Content	scf/ton	211.9
Lost Gas Fraction	vol frac	0.2542
Measured Gas Fraction	vol frac	0.5701
Crushed Gas Fraction	vol frac	0.1758
Diffusivity	1/us	1.0
Sorption Time	hours	19.0

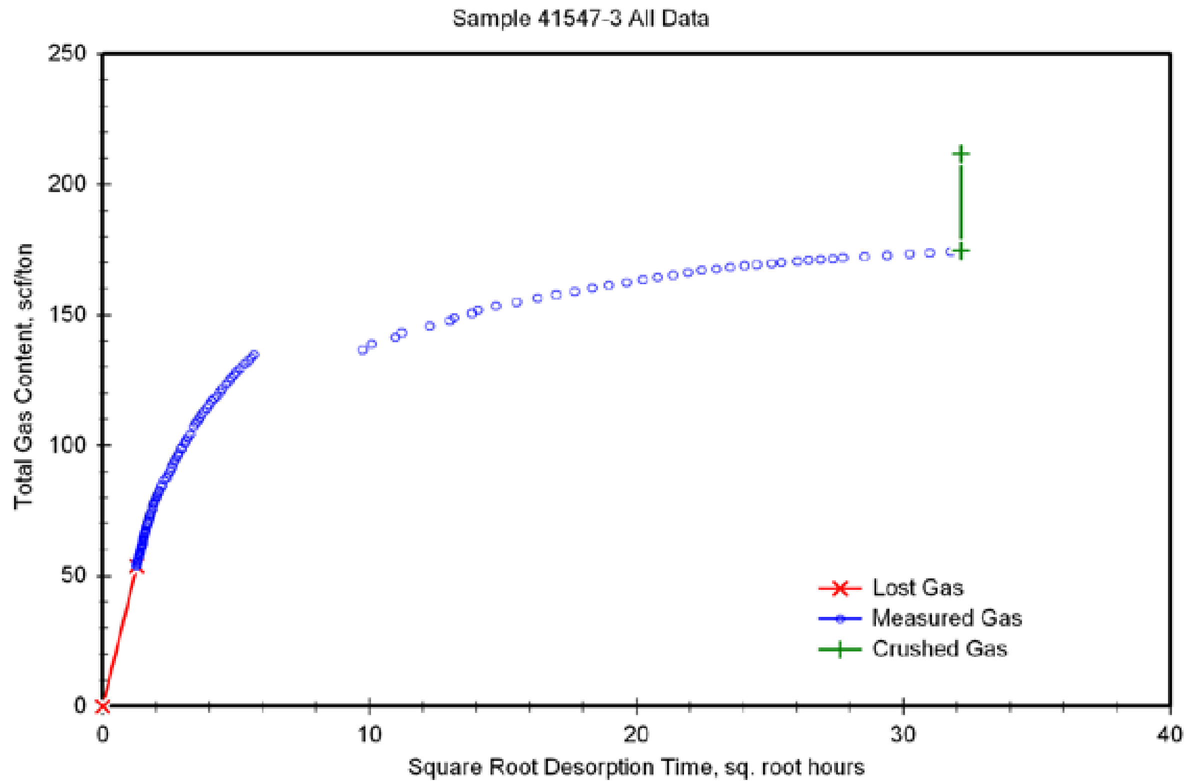
Sample 41547-3 Desorption History

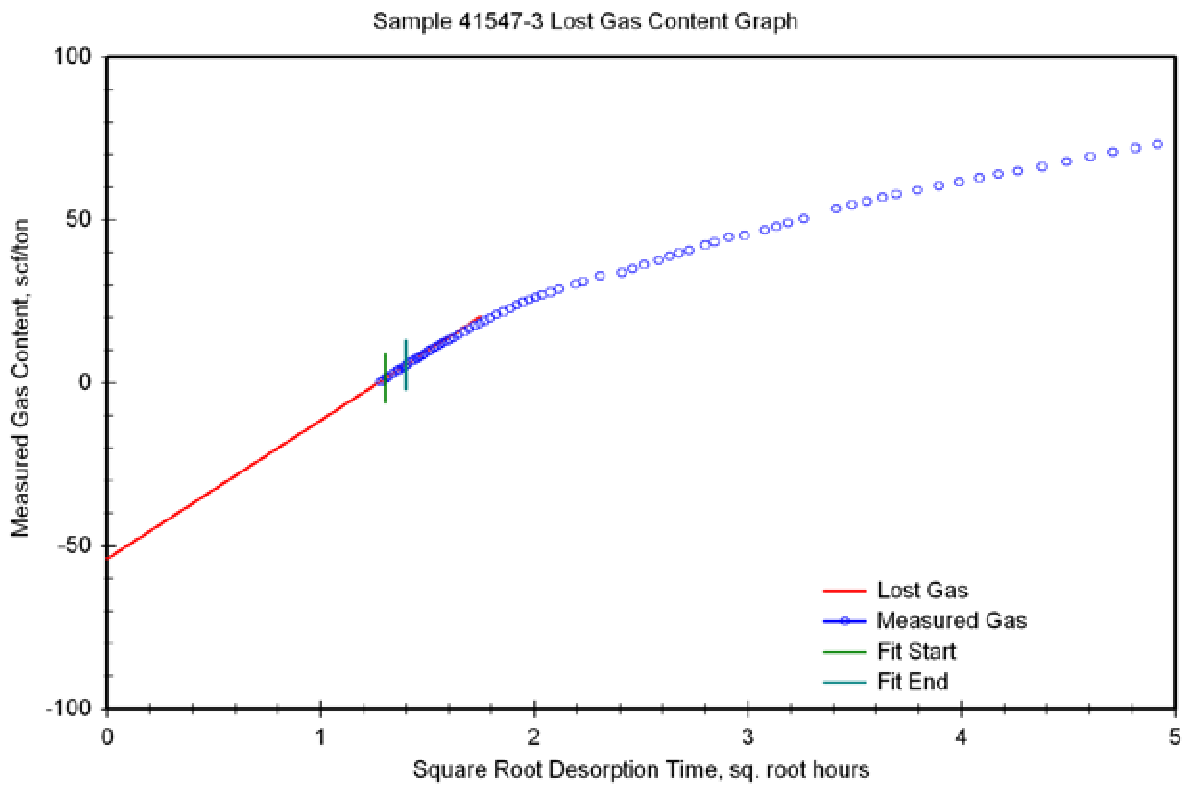
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
10/30/2008 11:30:12	1.6364	1.2792	0.0	0.0	70.0	61.1	11.66	0.00
10/30/2008 11:31:00	1.6361	1.2791	27.0	21.4	70.0	61.1	11.66	0.40
10/30/2008 11:32:59	1.6692	1.2920	36.0	28.5	70.0	61.8	11.66	0.93
10/30/2008 11:35:00	1.7028	1.3049	45.0	35.5	69.3	63.3	11.66	1.58
10/30/2008 11:37:00	1.7361	1.3176	33.0	25.7	69.6	63.5	11.66	2.06
10/30/2008 11:40:00	1.7861	1.3365	61.0	47.8	69.8	63.6	11.66	2.95
10/30/2008 11:42:59	1.8359	1.3549	45.0	35.0	70.2	63.6	11.66	3.60
10/30/2008 11:45:00	1.8695	1.3673	36.0	28.3	69.6	63.8	11.66	4.13
10/30/2008 11:47:00	1.9028	1.3794	39.0	30.7	69.4	64.0	11.66	4.70
10/30/2008 11:49:00	1.9361	1.3915	42.0	32.8	69.6	64.2	11.66	5.31
10/30/2008 11:51:00	1.9695	1.4034	34.0	26.8	69.6	64.0	11.66	5.81
10/30/2008 11:54:00	2.0195	1.4211	52.0	40.9	69.4	64.5	11.66	6.57
10/30/2008 11:56:00	2.0528	1.4328	30.0	23.6	69.4	64.5	11.66	7.00
10/30/2008 11:59:00	2.1028	1.4501	44.0	34.6	68.3	65.1	11.66	7.65
10/30/2008 12:01:00	2.1361	1.4616	33.0	24.5	69.4	65.3	11.65	8.10
10/30/2008 12:03:00	2.1695	1.4729	34.0	26.7	69.4	65.6	11.65	8.60
10/30/2008 12:04:59	2.2025	1.4841	33.0	25.9	69.4	66.0	11.65	9.08
10/30/2008 12:08:00	2.2528	1.5009	40.0	31.3	69.4	66.2	11.65	9.66
10/30/2008 12:10:00	2.2861	1.5120	38.0	29.7	69.4	66.9	11.65	10.21
10/30/2008 12:13:00	2.3361	1.5284	45.0	35.2	69.4	67.2	11.65	10.86
10/30/2008 12:16:00	2.3861	1.5447	39.0	30.2	69.6	68.1	11.65	11.43
10/30/2008 12:19:00	2.4361	1.5608	37.0	28.8	69.6	69.8	11.65	11.96
10/30/2008 12:20:59	2.4692	1.5714	35.0	27.2	69.4	70.7	11.65	12.47
10/30/2008 12:24:00	2.5195	1.5873	27.0	21.0	69.4	70.7	11.65	12.86
10/30/2008 12:27:00	2.5695	1.6030	39.0	30.0	69.6	71.4	11.65	13.41
10/30/2008 12:30:00	2.6195	1.6185	40.0	31.0	69.6	71.9	11.65	13.99
10/30/2008 12:34:59	2.7025	1.6439	65.0	50.2	69.6	73.4	11.65	14.92
10/30/2008 12:40:00	2.7861	1.6692	59.0	45.5	69.6	74.3	11.65	15.77
10/30/2008 12:45:00	2.8695	1.6940	64.0	49.0	69.6	75.0	11.65	16.68
10/30/2008 12:49:59	2.9525	1.7183	63.0	48.5	69.6	75.7	11.65	17.58
10/30/2008 12:55:00	3.0361	1.7425	57.0	43.9	69.6	75.3	11.65	18.40
10/30/2008 13:00:00	3.1195	1.7662	54.0	41.2	69.6	76.4	11.64	19.16
10/30/2008 13:05:00	3.2028	1.7896	58.0	44.5	69.6	77.0	11.64	19.99
10/30/2008 13:12:00	3.3195	1.8219	70.0	53.4	69.6	77.3	11.64	20.98
10/30/2008 13:19:00	3.4361	1.8537	68.0	52.1	69.6	77.0	11.64	21.95
10/30/2008 13:26:00	3.5528	1.8849	72.0	55.2	69.6	76.8	11.64	22.98

10/30/2008 13:33:00	3.6695	1.9156	65.0	49.3	69.6	76.8	11.63	23.89
10/30/2008 13:40:00	3.7861	1.9458	65.0	49.8	69.6	77.0	11.63	24.82
10/30/2008 13:47:00	3.9028	1.9756	60.0	46.0	69.6	77.1	11.63	25.67
10/30/2008 13:54:00	4.0195	2.0049	55.0	42.1	69.6	77.5	11.63	26.46
10/30/2008 14:01:00	4.1361	2.0337	43.0	32.8	69.6	78.8	11.63	27.07
10/30/2008 14:11:00	4.3028	2.0743	60.0	45.8	69.6	79.1	11.63	27.92
10/30/2008 14:21:00	4.4695	2.1141	78.0	59.4	69.6	79.8	11.63	29.02
10/30/2008 14:41:00	4.8028	2.1915	94.0	70.9	69.6	83.3	11.62	30.34
10/30/2008 14:51:00	4.9695	2.2292	55.0	41.5	69.4	84.3	11.62	31.11
10/30/2008 15:12:00	5.3195	2.3064	122.0	92.2	69.6	82.9	11.62	32.82
10/30/2008 15:41:00	5.8028	2.4089	75.0	56.6	69.8	82.5	11.62	33.88
10/30/2008 15:56:00	6.0528	2.4602	89.0	67.2	70.0	82.7	11.62	35.12
10/30/2008 16:11:00	6.3028	2.5105	83.0	62.8	69.8	83.6	11.62	36.29
10/30/2008 16:33:00	6.6695	2.5825	103.0	78.5	69.4	79.8	11.62	37.75
10/30/2008 16:47:59	6.9192	2.6304	84.0	64.2	69.6	77.9	11.63	38.94
10/30/2008 17:03:00	7.1695	2.6776	67.0	51.4	69.6	76.1	11.63	39.90
10/30/2008 17:18:00	7.4195	2.7239	61.0	46.9	69.6	75.3	11.63	40.77
10/30/2008 17:42:59	7.8359	2.7993	111.0	86.2	69.6	69.4	11.63	42.37
10/30/2008 17:58:00	8.0861	2.8436	70.0	54.2	69.6	71.7	11.63	43.38
10/30/2008 18:20:59	8.4692	2.9102	91.0	70.8	69.6	69.2	11.64	44.69
10/30/2008 18:46:59	8.9025	2.9837	45.0	35.1	69.3	68.0	11.64	45.35
10/30/2008 19:21:00	9.4695	3.0772	115.0	90.6	68.9	62.7	11.64	47.03
10/30/2008 19:42:00	9.8195	3.1336	72.0	56.7	69.4	63.1	11.65	48.08
10/30/2008 20:02:00	10.1528	3.1863	75.0	59.2	69.4	62.2	11.65	49.18
10/30/2008 20:31:00	10.6361	3.2613	87.0	68.7	69.8	60.8	11.66	50.46
10/30/2008 21:31:00	11.6361	3.4112	203.0	160.5	69.4	62.2	11.66	53.44
10/30/2008 22:02:00	12.1528	3.4861	83.0	64.8	69.9	64.0	11.66	54.65
10/30/2008 22:31:00	12.6361	3.5547	79.0	62.3	70.2	64.2	11.67	55.80
10/30/2008 23:03:00	13.1695	3.6290	77.0	60.3	69.8	68.1	11.68	56.92
10/30/2008 23:32:00	13.6528	3.6950	71.0	55.4	69.4	69.2	11.68	57.95
10/31/2008 00:16:00	14.3861	3.7929	82.0	64.9	69.1	62.4	11.68	59.16
10/31/2008 01:02:00	15.1528	3.8927	90.0	70.8	69.1	66.0	11.69	60.47
10/31/2008 01:47:00	15.9028	3.9878	89.0	68.9	70.0	66.5	11.69	61.76
10/31/2008 02:32:00	16.6528	4.0808	86.0	67.6	70.0	66.2	11.69	63.01
10/31/2008 03:17:00	17.4028	4.1717	76.0	59.8	69.4	66.2	11.69	64.12
10/31/2008 04:02:59	18.1692	4.2625	66.0	52.0	68.9	65.4	11.69	65.09
10/31/2008 05:03:00	19.1695	4.3783	95.0	74.9	69.4	62.7	11.70	66.48
10/31/2008 06:04:00	20.1861	4.4929	96.0	75.3	69.6	66.5	11.70	67.88
10/31/2008 07:04:00	21.1861	4.6028	109.0	86.5	69.6	62.0	11.70	69.49
10/31/2008 08:04:00	22.1861	4.7102	95.0	75.1	69.6	64.2	11.71	70.88
10/31/2008 09:04:00	23.1861	4.8152	83.0	66.8	69.8	55.2	11.72	72.12

10/31/2008 10:04:00	24.1861	4.9179	80.0	64.3	69.8	55.7	11.72	73.32
10/31/2008 11:04:00	25.1861	5.0186	77.0	61.2	70.0	60.0	11.72	74.46
10/31/2008 12:34:00	26.6861	5.1659	91.0	70.8	69.4	71.6	11.70	75.77
10/31/2008 14:04:00	28.1861	5.3091	100.0	75.7	69.8	76.2	11.68	77.18
10/31/2008 15:34:00	29.6861	5.4485	98.0	75.4	69.8	75.7	11.68	78.58
10/31/2008 17:04:00	31.1861	5.5845	89.0	69.1	69.6	72.6	11.68	79.86
10/31/2008 18:00:00	32.1195	5.6674	65.0	50.5	69.6	71.7	11.68	80.80
11/03/2008 08:27:00	94.5695	9.7247	144.0	112.7	69.6	70.0	11.72	82.90
11/03/2008 15:08:59	101.2692	10.0633	147.0	114.0	72.0	71.8	11.75	85.01
11/04/2008 10:10:00	120.2861	10.9675	185.0	142.4	69.4	69.3	11.66	87.66
11/04/2008 15:11:00	125.3028	11.1939	120.0	89.0	70.3	71.7	11.61	89.32
11/05/2008 15:49:59	149.9525	12.2455	175.0	137.0	69.4	68.9	11.70	91.86
11/06/2008 10:57:00	169.0695	13.0027	144.0	113.4	69.1	68.9	11.77	93.97
11/06/2008 15:16:00	173.3861	13.1676	82.0	63.5	70.9	68.6	11.79	95.15
11/07/2008 09:24:00	191.5195	13.8391	117.0	92.3	69.9	69.3	11.80	96.86
11/07/2008 15:36:59	197.7359	14.0619	83.0	64.6	70.7	69.3	11.80	98.06
11/08/2008 10:52:00	216.9861	14.7304	99.0	77.3	69.4	74.4	11.80	99.50
11/09/2008 09:59:00	240.1028	15.4953	109.0	80.6	69.1	73.5	11.71	101.00
11/10/2008 11:19:00	265.4361	16.2922	110.0	82.6	69.1	73.5	11.66	102.53
11/11/2008 10:10:00	288.2861	16.9790	97.0	76.3	69.4	68.6	11.75	103.95
11/12/2008 10:19:59	312.4525	17.6763	93.0	73.3	70.0	68.4	11.76	105.31
11/13/2008 10:09:00	336.2695	18.3377	91.0	65.6	70.0	68.8	11.66	106.53
11/14/2008 09:43:00	359.8361	18.9693	72.0	57.3	69.1	68.0	11.88	107.60
11/15/2008 11:25:00	385.5361	19.6351	69.0	54.6	68.8	71.6	11.89	108.61
11/16/2008 11:34:00	409.6861	20.2407	70.0	53.6	69.3	70.4	11.86	109.61
11/17/2008 09:53:59	432.0192	20.7851	62.0	48.9	70.0	75.9	11.94	110.52
11/18/2008 10:44:00	456.8528	21.3741	66.0	50.4	70.5	70.7	11.91	111.45
11/19/2008 10:21:59	480.4859	21.9200	75.0	55.7	71.8	71.1	11.87	112.49
11/20/2008 10:00:00	504.1195	22.4526	60.0	48.3	68.7	68.6	12.01	113.38
11/21/2008 10:00:00	528.1195	22.9809	51.0	27.5	69.6	68.9	11.78	113.89
11/22/2008 10:28:00	552.5861	23.5072	42.0	33.0	69.3	72.8	11.82	114.51
11/23/2008 11:27:00	577.5695	24.0327	41.0	30.5	69.8	74.4	11.80	115.07
11/24/2008 09:36:00	599.7195	24.4892	30.0	23.9	69.6	68.9	11.90	115.52
11/25/2008 14:04:59	628.2025	25.0640	36.0	24.6	69.4	72.8	11.82	115.97
11/26/2008 08:16:59	646.4025	25.4244	25.0	19.1	68.5	74.1	11.79	116.33
11/27/2008 15:39:00	677.7695	26.0340	31.0	24.3	69.1	69.3	11.80	116.78
11/28/2008 13:54:00	700.0195	26.4579	32.0	20.1	69.1	70.0	11.70	117.15
11/29/2008 12:53:59	723.0192	26.8890	21.0	16.5	68.4	68.9	11.71	117.46
11/30/2008 14:18:00	748.4195	27.3573	16.0	12.6	68.4	68.6	11.77	117.69
12/01/2008 10:26:00	768.5528	27.7228	24.0	17.9	69.1	68.1	11.77	118.03
12/03/2008 09:17:59	815.4192	28.5555	23.0	18.2	67.7	69.2	11.82	118.36

12/05/2008 09:07:00	863.2361	29.3809	36.0	23.9	68.7	70.7	11.75	118.81
12/07/2008 11:51:59	913.9859	30.2322	55.0	39.1	70.9	74.1	11.73	119.54
12/09/2008 09:53:59	960.0192	30.9842	27.0	21.2	69.3	73.2	11.85	119.93
12/11/2008 11:06:00	1009.2195	31.7682	34.0	25.0	70.0	72.6	11.83	120.39
12/12/2008 11:13:00	1033.3361	32.1455	35.0	20.7	70.3	80.7	11.71	120.78


Sample 41547-3 All Data
Total Gas Content, scf/ton
250
200
150
100
50
0
0
10
20
30
40
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas


Sample 41547-3 Lost Gas Content Graph
Measured Gas Content, scf/ton
100
50
0
-50
-100
0
1
2
3
4
5
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End

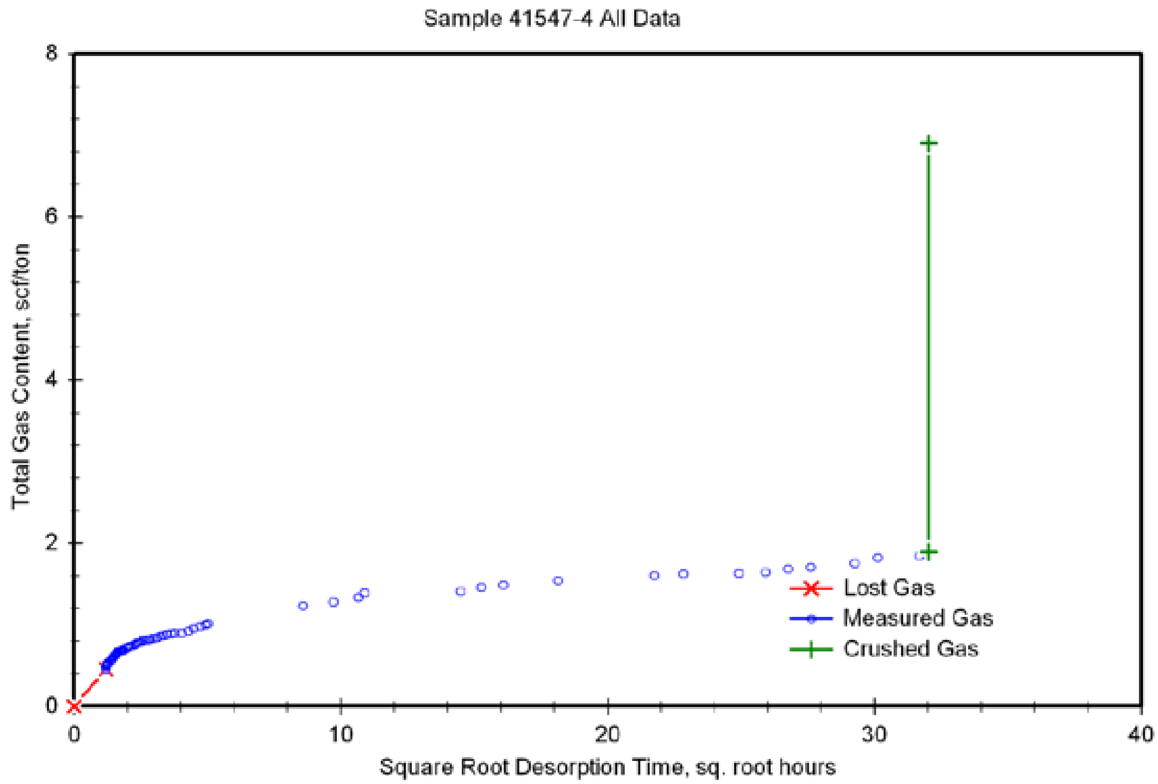
Sample 41547-4 Desorption Parameters

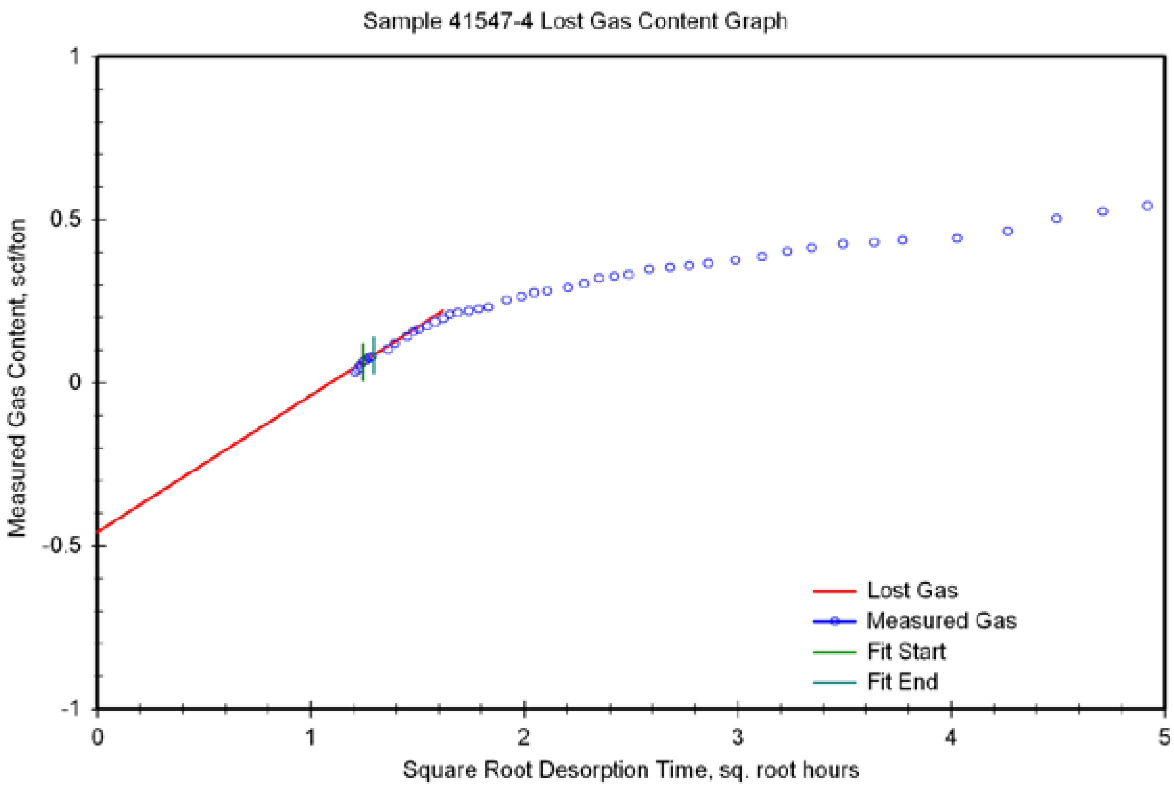
Parameter	Unit	Value
Sample Top Depth	ft	524.00
Sample Bottom Depth	ft	525.00
Reservoir Pressure	psia	234.99
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	249.02
Mud Density	lbm/gal	8.60
Sample Mass	g	4,532.0
Sample Headspace Volume	cm^3	545.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/30/2008 16:02:48
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/30/2008 16:45:11
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/30/2008 16:48:57
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/30/2008 17:48:06
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/30/2008 18:16:06
Lost Gas Time	hours	1.453
Desorption Time Correction	hours	0.000
Fit Start Time	hours	1.546
Fit End Time	hours	1.670
Fit Start Time	hours*0.5	1.244
Fit End Time	hours*0.5	1.292
Lost Gas Content	scf/ton	0.5
Measured Gas Content	scf/ton	1.4
Crushed Gas Content	scf/ton	5.0
Total Gas Content	scf/ton	6.9
Lost Gas Fraction	vol frac	0.0660
Measured Gas Fraction	vol frac	0.2078
Crushed Gas Fraction	vol frac	0.7262
Diffusivity	1/us	0.1
Sorption Time	hours	207.8

Sample 41547-4 Desorption History

Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
10/30/2008 18:16:00	1.4525	1.2052	0.0	0.0	66.4	69.4	11.64	0.00
10/30/2008 18:16:06	1.4525	1.2052	6.0	4.7	66.4	69.4	11.64	0.03
10/30/2008 18:17:59	1.4839	1.2181	2.0	1.6	66.7	69.2	11.64	0.04
10/30/2008 18:20:00	1.5175	1.2319	2.0	1.6	67.5	69.4	11.64	0.05
10/30/2008 18:22:00	1.5508	1.2453	2.0	1.6	68.2	69.4	11.64	0.07
10/30/2008 18:24:00	1.5841	1.2586	1.0	0.8	68.4	69.4	11.64	0.07
10/30/2008 18:26:00	1.6175	1.2718	1.0	0.8	68.7	68.3	11.64	0.08
10/30/2008 18:27:59	1.6505	1.2847	1.0	0.8	68.7	68.3	11.64	0.08
10/30/2008 18:40:00	1.8508	1.3604	4.0	3.1	71.2	68.0	11.64	0.10
10/30/2008 18:45:00	1.9341	1.3907	3.0	2.3	72.0	68.0	11.64	0.12
10/30/2008 18:55:00	2.1008	1.4494	4.0	3.1	72.1	66.2	11.64	0.14
10/30/2008 19:00:00	2.1841	1.4779	3.0	2.4	72.3	65.4	11.64	0.16
10/30/2008 19:05:00	2.2675	1.5058	1.0	0.8	72.7	64.4	11.64	0.17
10/30/2008 19:12:00	2.3841	1.5441	2.0	1.6	72.7	63.1	11.65	0.18
10/30/2008 19:19:00	2.5008	1.5814	2.0	1.6	72.7	62.7	11.64	0.19
10/30/2008 19:26:00	2.6175	1.6179	2.0	1.6	72.5	62.6	11.64	0.20
10/30/2008 19:31:59	2.7172	1.6484	2.0	1.6	72.5	63.1	11.65	0.21
10/30/2008 19:40:00	2.8508	1.6884	1.0	0.8	72.3	63.3	11.65	0.22
10/30/2008 19:50:00	3.0175	1.7371	1.0	0.8	72.3	63.3	11.65	0.22
10/30/2008 20:00:00	3.1841	1.7844	1.0	0.8	72.1	62.6	11.65	0.23
10/30/2008 20:10:00	3.3508	1.8305	1.0	0.8	72.1	62.0	11.65	0.23
10/30/2008 20:29:00	3.6675	1.9151	4.0	3.2	72.9	60.9	11.66	0.25
10/30/2008 20:45:00	3.9341	1.9835	2.0	1.6	72.7	60.4	11.66	0.27
10/30/2008 21:00:00	4.1841	2.0455	2.0	1.6	72.5	62.2	11.66	0.28
10/30/2008 21:15:00	4.4341	2.1057	1.0	0.8	72.5	62.6	11.66	0.28
10/30/2008 21:40:00	4.8508	2.2025	2.0	1.6	72.3	62.6	11.66	0.29
10/30/2008 22:00:00	5.1841	2.2769	2.0	1.6	72.0	64.0	11.66	0.30
10/30/2008 22:19:58	5.5169	2.3488	3.0	2.4	72.7	64.0	11.66	0.32
10/30/2008 22:40:00	5.8508	2.4188	1.0	0.8	72.5	64.2	11.67	0.33
10/30/2008 23:00:00	6.1841	2.4868	1.0	0.8	72.5	68.0	11.67	0.33
10/30/2008 23:30:00	6.6841	2.5854	3.0	2.3	73.0	69.2	11.68	0.35
10/31/2008 00:00:00	7.1841	2.6803	1.0	0.8	72.9	65.1	11.68	0.35
10/31/2008 00:30:00	7.6841	2.7720	1.0	0.8	72.1	67.6	11.69	0.36
10/31/2008 01:00:00	8.1841	2.8608	1.0	0.8	72.0	65.8	11.69	0.37
10/31/2008 01:45:00	8.9341	2.9890	2.0	1.6	72.1	66.5	11.69	0.38
10/31/2008 02:30:00	9.6841	3.1119	2.0	1.6	72.0	66.2	11.69	0.39

10/31/2008 03:15:00	10.4341	3.2302	3.0	2.4	72.1	66.2	11.69	0.40
10/31/2008 04:01:00	11.2008	3.3468	2.0	1.6	72.1	65.3	11.69	0.42
10/31/2008 05:01:00	12.2008	3.4930	2.0	1.6	72.1	62.7	11.70	0.43
10/31/2008 06:01:59	13.2172	3.6355	1.0	0.8	71.8	66.5	11.70	0.43
10/31/2008 07:02:00	14.2175	3.7706	1.0	0.8	72.5	62.0	11.70	0.44
10/31/2008 09:01:59	16.2172	4.0271	1.0	0.8	72.1	55.2	11.72	0.44
10/31/2008 11:00:00	18.1841	4.2643	4.0	3.2	72.0	59.7	11.72	0.47
10/31/2008 13:00:00	20.1841	4.4927	7.0	5.4	72.1	73.5	11.70	0.50
10/31/2008 15:00:00	22.1841	4.7100	4.0	3.1	72.1	76.4	11.68	0.53
10/31/2008 17:00:00	24.1841	4.9177	3.0	2.3	72.1	72.8	11.68	0.54
10/31/2008 18:00:00	25.1841	5.0184	3.0	2.3	72.1	71.0	11.68	0.56
11/02/2008 18:27:59	73.6505	8.5820	40.0	31.1	72.9	74.0	11.74	0.78
11/03/2008 15:10:00	94.3508	9.7134	8.0	6.3	72.1	72.0	11.75	0.82
11/04/2008 10:12:00	113.3841	10.6482	11.0	8.6	69.6	69.3	11.66	0.88
11/04/2008 15:12:00	118.3841	10.8804	9.0	7.0	70.5	71.5	11.62	0.93
11/08/2008 10:54:00	210.0841	14.4943	4.0	3.1	69.8	74.4	11.80	0.96
11/09/2008 10:00:00	233.1841	15.2704	9.0	7.0	69.4	73.2	11.71	1.01
11/10/2008 11:19:59	258.5172	16.0785	5.0	3.9	69.4	73.5	11.66	1.03
11/13/2008 10:10:00	329.3508	18.1480	10.0	7.8	70.0	68.8	11.66	1.09
11/19/2008 10:23:00	473.5675	21.7616	11.0	8.7	71.8	71.1	11.87	1.15
11/21/2008 10:01:00	521.2008	22.8298	4.0	3.1	69.8	69.3	11.78	1.17
11/25/2008 14:06:00	621.2841	24.9256	1.0	0.8	69.6	72.6	11.82	1.18
11/27/2008 15:40:00	670.8508	25.9008	3.0	2.4	69.3	69.3	11.79	1.19
11/29/2008 12:55:00	716.1008	26.7601	7.0	5.5	68.5	68.9	11.71	1.23
12/01/2008 10:27:00	761.6341	27.5977	3.0	2.4	69.1	68.1	11.77	1.25
12/05/2008 09:08:00	856.3175	29.2629	9.0	7.1	68.7	70.8	11.75	1.30
12/07/2008 11:54:00	907.0841	30.1178	13.0	10.1	70.9	74.4	11.73	1.37
12/11/2008 11:06:59	1002.3005	31.6591	3.0	2.4	70.0	72.6	11.83	1.39
12/12/2008 11:15:00	1026.4341	32.0380	9.0	6.9	70.5	80.0	11.71	1.44


Sample 41547-4 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas
0
2
4
6
8
0
10
20
30
40


Sample 41547-4 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End
1
0.5
0
-0.5
-1
0
1
2
3
4
5

Sample 41547-5 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	531.10
Sample Bottom Depth	ft	532.10
Reservoir Pressure	psia	237.97
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	252.19
Mud Density	lbm/gal	8.60
Sample Mass	g	2,430.0
Sample Headspace Volume	cm^3	250.0
Date Time Sample Cored	mm/dd/yyyy hh:mm:ss	10/30/2008 16:43:25
Date Time Sample Start Out of Well	mm/dd/yyyy hh:mm:ss	10/30/2008 16:45:11
Date Time Desorption Time Zero	mm/dd/yyyy hh:mm:ss	10/30/2008 16:48:57
Date Time Sample at Surface	mm/dd/yyyy hh:mm:ss	10/30/2008 17:48:06
Date Time Sample Canister Sealed	mm/dd/yyyy hh:mm:ss	10/30/2008 18:22:55
Lost Gas Time	hours	1.566
Desorption Time Correction	hours	0.001
Fit Start Time	hours	1.677
Fit End Time	hours	1.897
Fit Start Time	hours*0.5	1.295
Fit End Time	hours*0.5	1.377
Lost Gas Content	scf/ton	11.7
Measured Gas Content	scf/ton	60.5
Crushed Gas Content	scf/ton	33.0
Total Gas Content	scf/ton	105.2
Lost Gas Fraction	vol frac	0.1115
Measured Gas Fraction	vol frac	0.5750
Crushed Gas Fraction	vol frac	0.3134
Diffusivity	1/us	0.2
Sorption Time	hours	95.3

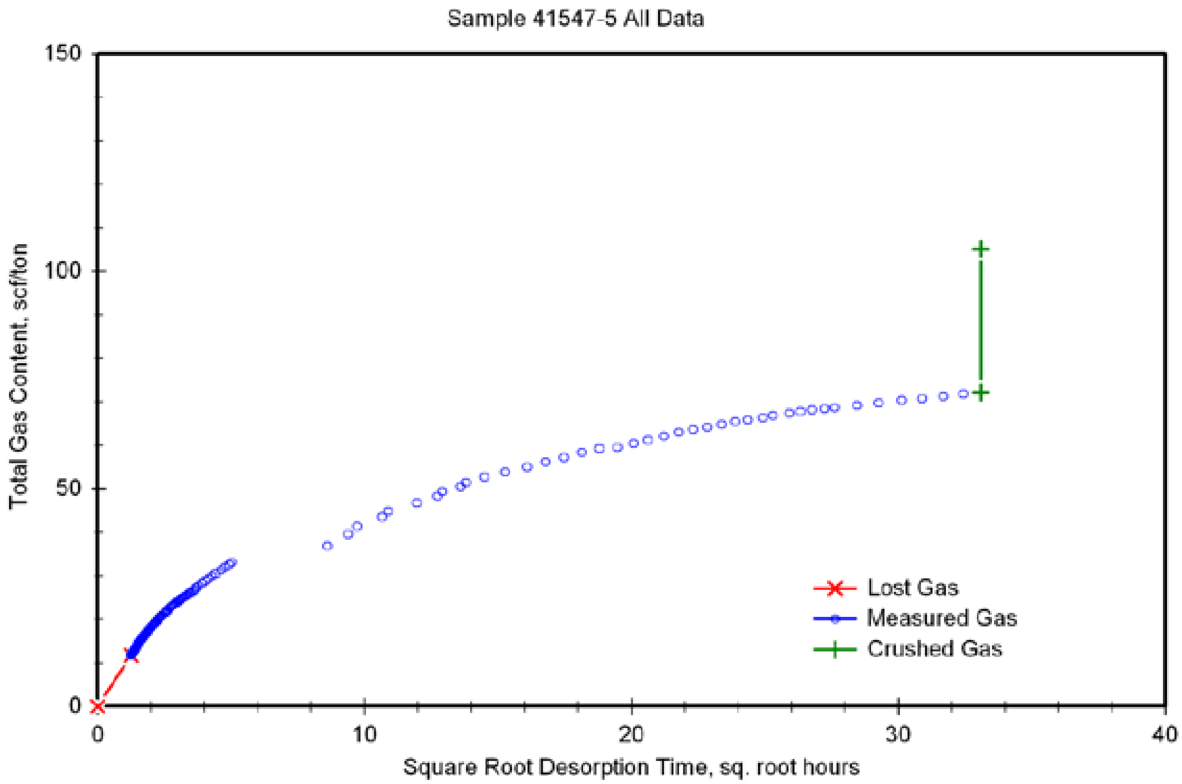
Sample 41547-5 Desorption History

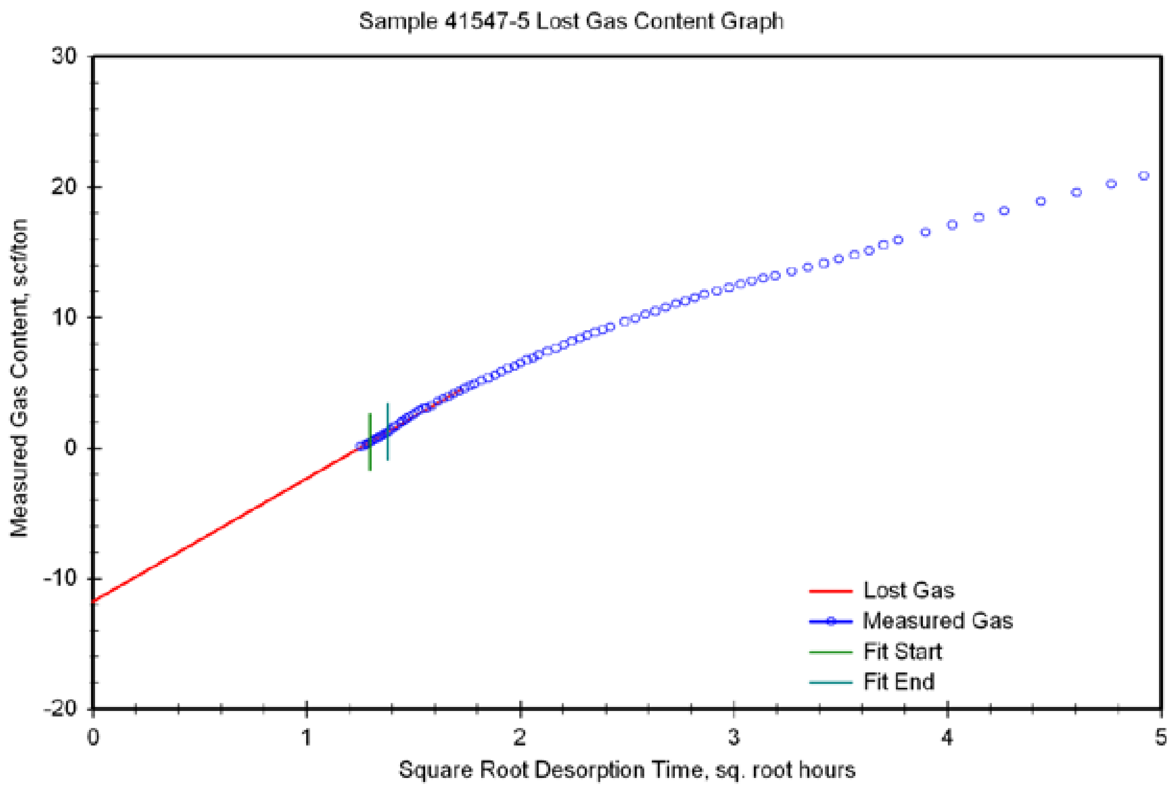
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Canister Temp.	Ambient Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
10/30/2008 18:22:55	1.5661	1.2514	0.0	0.0	68.5	68.7	11.64	0.00
10/30/2008 18:23:00	1.5661	1.2514	17.0	13.2	68.5	68.7	11.64	0.17
10/30/2008 18:25:00	1.5994	1.2647	5.0	3.9	68.5	68.7	11.64	0.23
10/30/2008 18:27:00	1.6328	1.2778	9.0	7.0	68.5	68.7	11.64	0.32
10/30/2008 18:29:00	1.6661	1.2908	11.0	8.5	68.7	68.3	11.64	0.43
10/30/2008 18:31:00	1.6994	1.3036	11.0	8.4	69.1	68.3	11.64	0.54
10/30/2008 18:33:00	1.7328	1.3163	13.0	10.1	69.1	68.3	11.64	0.67
10/30/2008 18:34:58	1.7655	1.3287	10.0	7.7	69.4	68.1	11.64	0.78
10/30/2008 18:36:59	1.7991	1.3413	12.0	9.0	70.3	67.8	11.64	0.90
10/30/2008 18:39:00	1.8328	1.3538	12.0	9.1	70.9	68.0	11.64	1.02
10/30/2008 18:41:00	1.8661	1.3661	12.0	9.2	71.4	68.0	11.64	1.14
10/30/2008 18:43:00	1.8994	1.3782	12.0	9.2	71.8	68.0	11.64	1.26
10/30/2008 18:45:00	1.9328	1.3902	16.0	12.4	72.0	68.1	11.64	1.42
10/30/2008 18:48:00	1.9828	1.4081	25.0	19.5	72.1	67.4	11.64	1.68
10/30/2008 18:49:59	2.0158	1.4198	6.0	4.7	72.1	67.2	11.64	1.74
10/30/2008 18:53:00	2.0661	1.4374	24.0	18.8	72.0	66.2	11.64	1.99
10/30/2008 18:55:00	2.0994	1.4489	12.0	9.4	72.0	66.5	11.64	2.11
10/30/2008 18:58:00	2.1494	1.4661	16.0	12.5	72.1	65.8	11.64	2.28
10/30/2008 19:00:00	2.1828	1.4774	11.0	8.6	72.0	65.3	11.64	2.39
10/30/2008 19:02:59	2.2325	1.4941	17.0	13.3	72.3	64.9	11.65	2.57
10/30/2008 19:05:59	2.2825	1.5108	17.0	13.1	72.9	64.2	11.65	2.74
10/30/2008 19:09:00	2.3328	1.5273	17.0	13.4	72.5	63.3	11.65	2.92
10/30/2008 19:12:00	2.3828	1.5436	11.0	8.6	72.7	63.1	11.65	3.03
10/30/2008 19:15:00	2.4328	1.5597	7.0	5.5	72.7	62.9	11.65	3.10
10/30/2008 19:19:58	2.5155	1.5860	19.0	14.9	72.7	62.7	11.64	3.30
10/30/2008 19:25:00	2.5994	1.6123	29.0	22.9	72.5	62.6	11.64	3.60
10/30/2008 19:30:00	2.6828	1.6379	17.0	13.4	72.7	62.7	11.65	3.78
10/30/2008 19:34:59	2.7658	1.6631	21.0	16.5	72.3	63.3	11.65	3.99
10/30/2008 19:40:00	2.8494	1.6880	20.0	15.8	72.3	63.3	11.65	4.20
10/30/2008 19:45:00	2.9328	1.7125	19.0	15.0	72.1	62.9	11.65	4.40
10/30/2008 19:50:00	3.0161	1.7367	20.0	15.7	72.3	63.3	11.65	4.61
10/30/2008 19:55:00	3.0994	1.7605	17.0	13.4	72.1	62.9	11.65	4.78
10/30/2008 20:00:00	3.1828	1.7840	16.0	12.6	72.1	62.7	11.65	4.95
10/30/2008 20:06:59	3.2991	1.8164	25.0	19.8	72.1	61.8	11.65	5.21
10/30/2008 20:14:00	3.4161	1.8483	19.0	15.0	72.0	61.8	11.65	5.41
10/30/2008 20:21:00	3.5328	1.8796	22.0	17.4	72.0	61.5	11.66	5.64

10/30/2008 20:28:00	3.6494	1.9103	22.0	17.2	72.7	60.9	11.66	5.86
10/30/2008 20:35:00	3.7661	1.9406	24.0	19.0	72.7	60.2	11.66	6.11
10/30/2008 20:42:00	3.8828	1.9705	19.0	15.1	72.7	60.2	11.66	6.31
10/30/2008 20:49:00	3.9994	1.9999	22.0	17.4	72.7	60.9	11.66	6.54
10/30/2008 20:56:00	4.1161	2.0288	22.0	17.4	72.7	62.0	11.66	6.77
10/30/2008 21:03:00	4.2328	2.0574	18.0	14.2	72.5	62.6	11.66	6.96
10/30/2008 21:10:00	4.3494	2.0855	20.0	15.7	72.7	62.6	11.66	7.17
10/30/2008 21:20:00	4.5161	2.1251	25.0	19.7	72.3	62.4	11.66	7.43
10/30/2008 21:30:00	4.6828	2.1640	25.0	19.8	72.3	62.2	11.66	7.69
10/30/2008 21:40:00	4.8494	2.2021	24.0	19.0	72.1	62.4	11.66	7.94
10/30/2008 21:49:59	5.0158	2.2396	24.0	18.9	72.0	63.3	11.67	8.19
10/30/2008 22:00:00	5.1828	2.2766	24.0	18.9	71.8	64.0	11.66	8.44
10/30/2008 22:10:00	5.3494	2.3129	21.0	16.2	72.7	64.0	11.66	8.65
10/30/2008 22:19:58	5.5155	2.3485	21.0	16.6	72.7	64.0	11.67	8.87
10/30/2008 22:30:00	5.6828	2.3839	22.0	17.3	72.5	64.2	11.67	9.10
10/30/2008 22:40:00	5.8494	2.4186	22.0	17.3	72.5	64.2	11.67	9.32
10/30/2008 23:00:00	6.1828	2.4865	35.0	27.4	72.5	68.0	11.68	9.69
10/30/2008 23:15:00	6.4328	2.5363	27.0	21.0	72.9	68.7	11.68	9.96
10/30/2008 23:30:00	6.6828	2.5851	29.0	22.6	73.0	69.2	11.68	10.26
10/30/2008 23:45:00	6.9328	2.6330	27.0	21.1	72.9	67.8	11.68	10.54
10/31/2008 00:00:00	7.1828	2.6801	26.0	20.5	72.9	64.9	11.68	10.81
10/31/2008 00:15:00	7.4328	2.7263	24.0	19.0	72.7	62.6	11.69	11.06
10/31/2008 00:30:00	7.6828	2.7718	25.0	19.8	72.1	62.7	11.69	11.32
10/31/2008 00:45:00	7.9328	2.8165	23.0	18.1	72.0	64.2	11.69	11.56
10/31/2008 01:00:00	8.1828	2.8606	23.0	18.1	72.0	66.0	11.69	11.80
10/31/2008 01:19:58	8.5155	2.9181	26.0	20.4	72.0	66.2	11.69	12.07
10/31/2008 01:40:00	8.8494	2.9748	25.0	19.6	72.1	66.5	11.69	12.33
10/31/2008 02:00:00	9.1828	3.0303	26.0	20.4	72.0	66.3	11.69	12.60
10/31/2008 02:19:59	9.5158	3.0848	24.0	18.9	72.0	66.2	11.69	12.84
10/31/2008 02:39:00	9.8328	3.1357	20.0	15.7	72.0	66.2	11.69	13.05
10/31/2008 03:00:00	10.1828	3.1910	19.0	14.9	72.1	66.0	11.69	13.25
10/31/2008 03:30:00	10.6828	3.2684	32.0	25.2	72.1	65.9	11.69	13.58
10/31/2008 04:00:00	11.1828	3.3441	28.0	22.1	72.1	65.3	11.69	13.87
10/31/2008 04:30:00	11.6828	3.4180	30.0	23.7	72.1	63.4	11.70	14.18
10/31/2008 05:00:00	12.1828	3.4904	31.0	24.6	72.1	62.7	11.70	14.51
10/31/2008 05:30:00	12.6828	3.5613	31.0	24.4	71.8	66.5	11.70	14.83
10/31/2008 06:00:00	13.1828	3.6308	31.0	24.4	71.8	66.5	11.70	15.15
10/31/2008 06:30:00	13.6828	3.6990	42.0	33.1	72.1	65.4	11.71	15.59
10/31/2008 07:00:00	14.1828	3.7660	39.0	30.7	72.5	62.0	11.70	15.99
10/31/2008 08:00:00	15.1828	3.8965	56.0	44.3	72.5	64.0	11.71	16.58
10/31/2008 09:00:00	16.1828	4.0228	54.0	43.5	72.1	55.2	11.72	17.15

10/31/2008 10:00:00	17.1828	4.1452	52.0	41.9	71.8	54.6	11.72	17.70
10/31/2008 11:00:00	18.1828	4.2641	50.0	39.8	72.0	59.7	11.72	18.23
10/31/2008 12:30:00	19.6828	4.4365	68.0	52.8	72.1	70.7	11.70	18.92
10/31/2008 14:00:00	21.1828	4.6025	69.0	52.9	72.1	76.2	11.68	19.62
10/31/2008 15:30:00	22.6828	4.7626	66.0	50.8	72.1	75.9	11.68	20.29
10/31/2008 17:00:00	24.1828	4.9176	62.0	48.1	72.1	72.6	11.68	20.92
10/31/2008 18:00:00	25.1828	5.0182	52.0	40.4	72.1	70.7	11.68	21.46
11/02/2008 18:32:00	73.7161	8.5858	361.0	280.8	73.0	74.2	11.74	25.16
11/03/2008 08:30:00	87.6828	9.3639	260.0	203.3	70.4	70.4	11.72	27.84
11/03/2008 15:12:00	94.3828	9.7151	187.0	146.1	72.1	72.2	11.75	29.76
11/04/2008 10:14:00	113.4161	10.6497	206.0	159.9	69.6	69.3	11.66	31.87
11/04/2008 15:13:00	118.3994	10.8812	127.0	97.3	70.5	70.9	11.62	33.16
11/05/2008 15:52:00	143.0494	11.9603	186.0	145.6	69.8	68.9	11.70	35.07
11/06/2008 10:57:59	162.1491	12.7338	153.0	120.5	69.1	68.9	11.77	36.66
11/06/2008 15:17:00	166.4661	12.9022	93.0	72.9	71.1	68.8	11.79	37.62
11/07/2008 09:26:00	184.6161	13.5874	124.0	97.8	70.0	69.5	11.80	38.91
11/07/2008 15:38:00	190.8161	13.8136	85.0	66.8	70.7	69.3	11.80	39.79
11/08/2008 10:55:00	210.0994	14.4948	113.0	88.3	69.8	74.3	11.80	40.96
11/09/2008 10:01:00	233.1994	15.2709	116.0	88.8	69.4	73.2	11.71	42.13
11/10/2008 11:21:00	258.5328	16.0790	120.0	92.0	69.4	73.2	11.66	43.34
11/11/2008 10:12:00	281.3828	16.7745	109.0	85.7	69.4	68.6	11.75	44.47
11/12/2008 10:21:59	305.5491	17.4800	107.0	84.2	70.0	68.4	11.76	45.58
11/13/2008 10:11:00	329.3661	18.1484	106.0	80.9	70.0	68.8	11.66	46.65
11/14/2008 09:44:00	352.9161	18.7861	93.0	74.0	69.1	68.0	11.88	47.63
11/15/2008 11:28:00	378.6494	19.4589	27.0	21.3	69.8	71.4	11.89	47.91
11/16/2008 11:35:59	402.7825	20.0694	85.0	66.9	69.3	71.1	11.86	48.79
11/17/2008 09:56:00	425.1161	20.6183	79.0	62.3	70.2	75.7	11.94	49.61
11/18/2008 10:45:00	449.9328	21.2116	80.0	62.4	70.7	74.8	11.91	50.43
11/19/2008 10:24:00	473.5828	21.7620	82.0	63.7	71.8	71.1	11.87	51.27
11/20/2008 10:01:00	497.1994	22.2980	60.0	48.2	68.9	68.9	12.01	51.91
11/21/2008 10:01:00	521.1994	22.8298	66.0	47.7	69.8	69.5	11.78	52.53
11/22/2008 10:29:00	545.6661	23.3595	58.0	45.5	69.4	73.2	11.82	53.13
11/23/2008 11:28:00	570.6494	23.8883	57.0	44.1	69.6	74.4	11.80	53.72
11/24/2008 09:36:59	592.7991	24.3475	50.0	39.8	69.8	69.1	11.90	54.24
11/25/2008 14:06:59	621.2991	24.9259	53.0	40.4	69.4	72.6	11.82	54.77
11/26/2008 08:19:00	639.4994	25.2883	43.0	33.7	68.5	74.1	11.82	55.22
11/27/2008 15:42:00	670.8828	25.9014	44.0	34.1	69.1	69.3	11.79	55.67
11/28/2008 13:56:00	693.1161	26.3271	43.0	32.1	69.1	70.0	11.70	56.09
11/29/2008 12:57:00	716.1328	26.7607	33.0	25.8	68.5	69.1	11.71	56.43
11/30/2008 14:19:59	741.5158	27.2308	26.0	20.5	68.4	68.6	11.77	56.70
12/01/2008 10:28:00	761.6494	27.5980	35.0	27.3	69.1	68.1	11.77	57.06

12/03/2008 09:20:00	808.5161	28.4344	44.0	34.8	67.6	69.4	11.82	57.52
12/05/2008 09:08:59	856.3325	29.2632	51.0	38.5	68.7	70.8	11.75	58.03
12/07/2008 11:55:00	907.0994	30.1181	60.0	45.3	71.1	74.4	11.73	58.62
12/09/2008 09:56:00	953.1161	30.8726	48.0	37.8	69.4	73.2	11.85	59.12
12/11/2008 11:08:00	1002.3161	31.6594	49.0	38.0	70.0	72.6	11.83	59.62
12/13/2008 12:52:00	1052.0494	32.4353	59.0	37.5	71.8	73.4	11.43	60.11
12/15/2008 07:40:00	1094.8494	33.0885	39.0	30.7	69.1	68.7	11.78	60.52


Sample 41547-5 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
150
100
50
0
0
10
20
30
40
Lost Gas
Measured Gas
Crushed Gas


Sample 41547-5 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
30
20
10
0
-10
-20
0
1
2
3
4
5
Lost Gas
Measured Gas
Fit Start
Fit End

Appendix III

Souder, Miller & Associates
Fosset Gulch MW 34-5-142
Fruitland Coals

Desorption Gas Composition Results

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Sample 41547-2 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
10/30/2008 13:33:00	0.2052	0.0213	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1549	0.6167	0.0018	0.0000	1.0000
10/30/2008 15:26:00	0.0089	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2003	0.7902	0.0006	0.0000	1.0000
10/31/2008 07:02:59	0.0760	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1847	0.7384	0.0006	0.0001	1.0000
10/31/2008 14:03:00	0.2157	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1560	0.6278	0.0001	0.0000	1.0000
11/07/2008 09:17:59	0.9852	0.0011	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0031	0.0072	0.0004	1.0000
12/15/2008 07:34:59	0.0326	0.0009	0.0000	0.0000	0.0000	0.0009	0.0009	0.0000	0.0000	0.2108	0.7540	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
10/30/2008 13:33:00	0.8986	0.0933	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
10/30/2008 15:26:00	0.9403	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0597	0.0000	1.0000
10/31/2008 07:02:59	0.9899	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
10/31/2008 14:03:00	0.9979	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	1.0000
11/07/2008 09:17:59	0.9897	0.0011	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0000	1.0000
12/15/2008 07:34:59	0.9250	0.0250	0.0000	0.0000	0.0000	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41547-2 Corrected Gas Composition vs. Desorbed Fraction

Desorbed Fraction vol frac	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.8986	0.0933	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.3462	0.8986	0.0933	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.3943	0.9403	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0597	0.0000	1.0000
0.5509	0.9899	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.5831	0.9979	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	1.0000
0.7411	0.9897	0.0011	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0000	1.0000
0.8263	0.9250	0.0250	0.0000	0.0000	0.0000	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9250	0.0250	0.0000	0.0000	0.0000	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition														
-	0.9377	0.0404	0.0002	0.0000	0.0000	0.0054	0.0054	0.0000	0.0000	0.0000	0.0000	0.0108	0.0000	1.0000

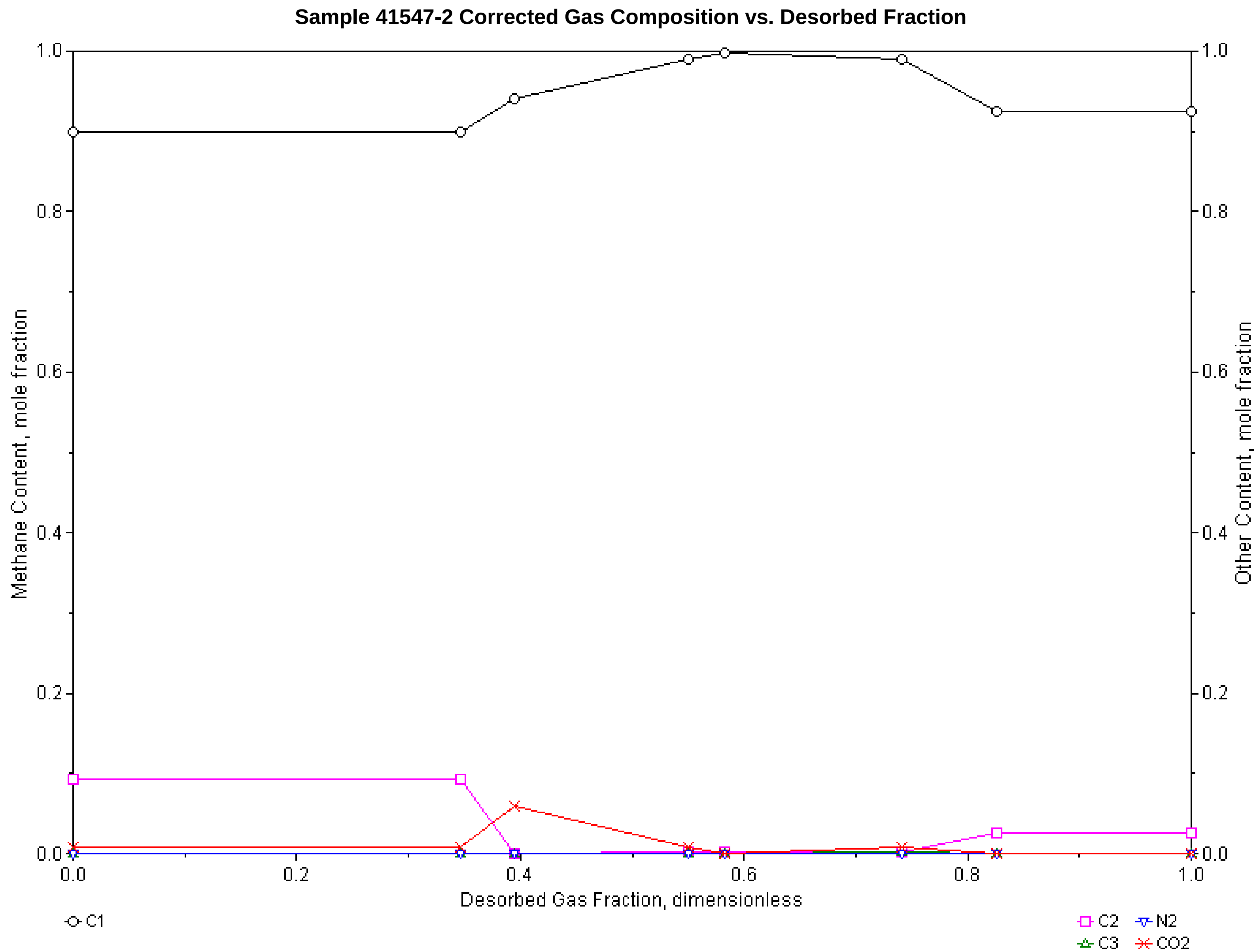
Sample 41547-2 Desorbed Gas Composition History (Lumped)

Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
10/30/2008 13:33:00	0.2052	0.0213	0.0000	0.1549	0.6167	0.0018	0.0000	1.0000
10/30/2008 15:26:00	0.0089	0.0000	0.0000	0.2003	0.7902	0.0006	0.0000	1.0000
10/31/2008 07:02:59	0.0760	0.0001	0.0000	0.1847	0.7384	0.0006	0.0001	1.0000
10/31/2008 14:03:00	0.2157	0.0004	0.0000	0.1560	0.6278	0.0001	0.0000	1.0000
11/07/2008 09:17:59	0.9852	0.0011	0.0020	0.0011	0.0031	0.0072	0.0004	1.0000
12/15/2008 07:34:59	0.0326	0.0009	0.0018	0.2108	0.7540	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
10/30/2008 13:33:00	0.8986	0.0933	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
10/30/2008 15:26:00	0.9403	0.0000	0.0000	0.0000	0.0000	0.0597	0.0000	1.0000
10/31/2008 07:02:59	0.9899	0.0019	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
10/31/2008 14:03:00	0.9979	0.0018	0.0000	0.0000	0.0000	0.0004	0.0000	1.0000
11/07/2008 09:17:59	0.9897	0.0011	0.0020	0.0000	0.0000	0.0072	0.0000	1.0000
12/15/2008 07:34:59	0.9250	0.0250	0.0500	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41547-2 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
0.0000	0.8986	0.0933	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.3462	0.8986	0.0933	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.3943	0.9403	0.0000	0.0000	0.0000	0.0000	0.0597	0.0000	1.0000
0.5509	0.9899	0.0019	0.0000	0.0000	0.0000	0.0081	0.0000	1.0000
0.5831	0.9979	0.0018	0.0000	0.0000	0.0000	0.0004	0.0000	1.0000
0.7411	0.9897	0.0011	0.0020	0.0000	0.0000	0.0072	0.0000	1.0000
0.8263	0.9250	0.0250	0.0500	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9250	0.0250	0.0500	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition								
-	0.9377	0.0404	0.0111	0.0000	0.0000	0.0108	0.0000	1.0000

Souder, Miller & Associates, Fosset Gulch MW 34-5-14U



Weatherford
LABORATORIES

Sample 41547-5 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
10/30/2008 19:02:59	0.0634	0.0001	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1882	0.7473	0.0004	0.0000	1.0000
10/30/2008 21:20:00	0.0679	0.0001	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1875	0.7428	0.0001	0.0000	1.0000
10/31/2008 06:30:00	0.0691	0.0001	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1841	0.7450	0.0001	0.0000	1.0000
10/31/2008 12:30:00	0.1673	0.0002	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1635	0.6668	0.0004	0.0000	1.0000
10/31/2008 17:00:00	0.1243	0.0005	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1752	0.6974	0.0010	0.0000	1.0000
11/07/2008 09:26:00	0.9722	0.0011	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0213	0.0001	0.0005	1.0000
12/15/2008 07:40:00	0.1399	0.0002	0.0000	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.1880	0.6713	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
10/30/2008 19:02:59	0.9827	0.0009	0.0105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0059	0.0000	1.0000
10/30/2008 21:20:00	0.9740	0.0012	0.0237	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	1.0000
10/31/2008 06:30:00	0.9737	0.0014	0.0235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0000	1.0000
10/31/2008 12:30:00	0.9860	0.0009	0.0106	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	1.0000
10/31/2008 17:00:00	0.9755	0.0036	0.0129	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0000	1.0000
11/07/2008 09:26:00	0.9948	0.0011	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	1.0000
12/15/2008 07:40:00	0.9946	0.0011	0.0000	0.0011	0.0011	0.0011	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41547-5 Corrected Gas Composition vs. Desorbed Fraction

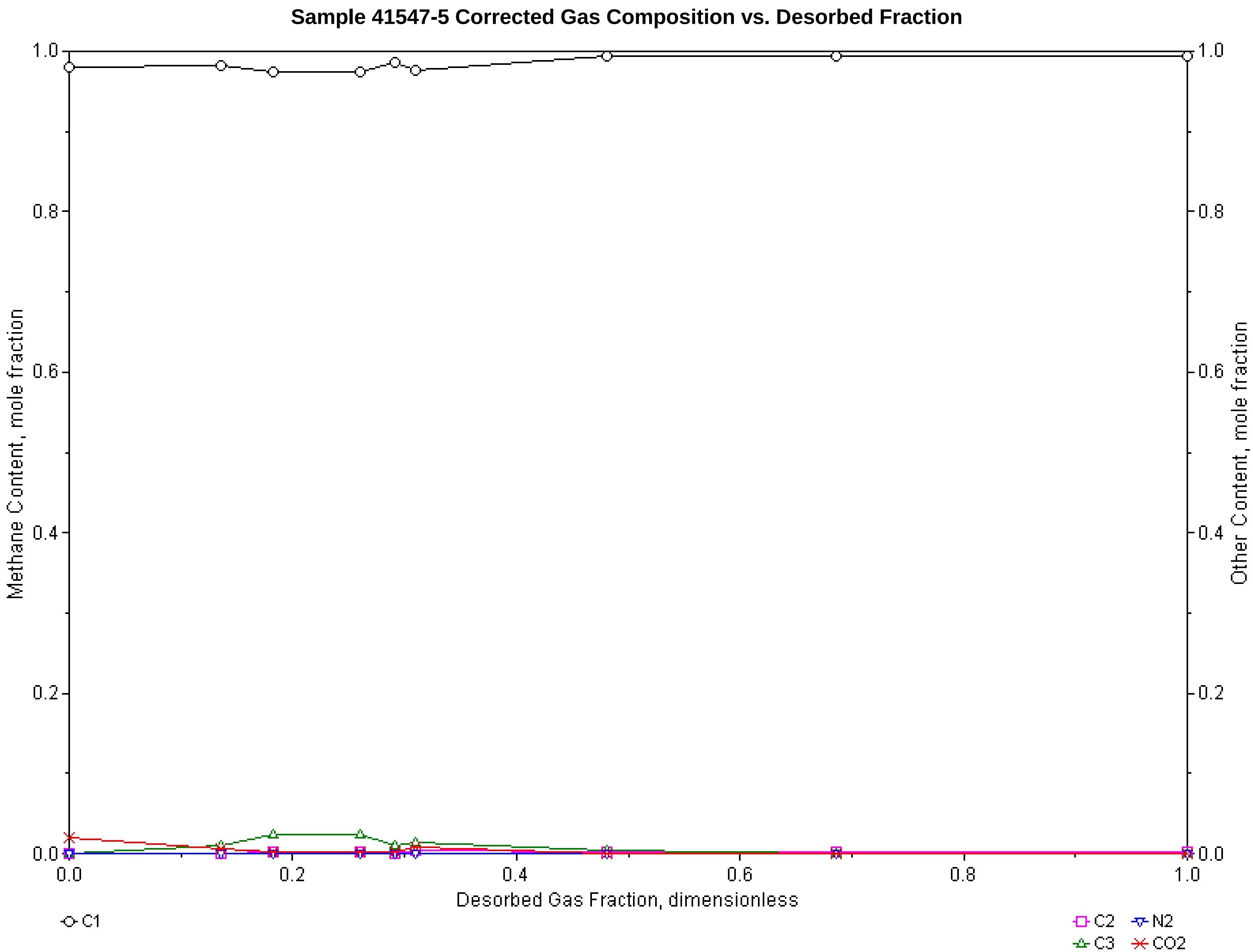
Desorbed Fraction vol frac	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.9807	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0193	0.0000	1.0000
0.1359	0.9827	0.0009	0.0105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0059	0.0000	1.0000
0.1821	0.9740	0.0012	0.0237	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	1.0000
0.2596	0.9737	0.0014	0.0235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0000	1.0000
0.2913	0.9860	0.0009	0.0106	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	1.0000
0.3103	0.9755	0.0036	0.0129	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0000	1.0000
0.4813	0.9948	0.0011	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	1.0000
0.6866	0.9946	0.0011	0.0000	0.0011	0.0011	0.0011	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9946	0.0011	0.0000	0.0011	0.0011	0.0011	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition														
-	0.9882	0.0013	0.0060	0.0004	0.0004	0.0004	0.0004	0.0000	0.0000	0.0000	0.0000	0.0028	0.0000	1.0000

Sample 41547-5 Desorbed Gas Composition History (Lumped)

Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
10/30/2008 19:02:59	0.0634	0.0001	0.0007	0.1882	0.7473	0.0004	0.0000	1.0000
10/30/2008 21:20:00	0.0679	0.0001	0.0017	0.1875	0.7428	0.0001	0.0000	1.0000
10/31/2008 06:30:00	0.0691	0.0001	0.0017	0.1841	0.7450	0.0001	0.0000	1.0000
10/31/2008 12:30:00	0.1673	0.0002	0.0018	0.1635	0.6668	0.0004	0.0000	1.0000
10/31/2008 17:00:00	0.1243	0.0005	0.0016	0.1752	0.6974	0.0010	0.0000	1.0000
11/07/2008 09:26:00	0.9722	0.0011	0.0039	0.0009	0.0213	0.0001	0.0005	1.0000
12/15/2008 07:40:00	0.1399	0.0002	0.0006	0.1880	0.6713	0.0000	0.0000	1.0000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
10/30/2008 19:02:59	0.9827	0.0009	0.0105	0.0000	0.0000	0.0059	0.0000	1.0000
10/30/2008 21:20:00	0.9740	0.0012	0.0237	0.0000	0.0000	0.0011	0.0000	1.0000
10/31/2008 06:30:00	0.9737	0.0014	0.0235	0.0000	0.0000	0.0014	0.0000	1.0000
10/31/2008 12:30:00	0.9860	0.0009	0.0106	0.0000	0.0000	0.0024	0.0000	1.0000
10/31/2008 17:00:00	0.9755	0.0036	0.0129	0.0000	0.0000	0.0079	0.0000	1.0000
11/07/2008 09:26:00	0.9948	0.0011	0.0040	0.0000	0.0000	0.0001	0.0000	1.0000
12/15/2008 07:40:00	0.9946	0.0011	0.0043	0.0000	0.0000	0.0000	0.0000	1.0000

Sample 41547-5 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
0.0000	0.9807	0.0000	0.0000	0.0000	0.0000	0.0193	0.0000	1.0000
0.1359	0.9827	0.0009	0.0105	0.0000	0.0000	0.0059	0.0000	1.0000
0.1821	0.9740	0.0012	0.0237	0.0000	0.0000	0.0011	0.0000	1.0000
0.2596	0.9737	0.0014	0.0235	0.0000	0.0000	0.0014	0.0000	1.0000
0.2913	0.9860	0.0009	0.0106	0.0000	0.0000	0.0024	0.0000	1.0000
0.3103	0.9755	0.0036	0.0129	0.0000	0.0000	0.0079	0.0000	1.0000
0.4813	0.9948	0.0011	0.0040	0.0000	0.0000	0.0001	0.0000	1.0000
0.6866	0.9946	0.0011	0.0043	0.0000	0.0000	0.0000	0.0000	1.0000
1.0000	0.9946	0.0011	0.0043	0.0000	0.0000	0.0000	0.0000	1.0000
Integrated Gas Composition								
-	0.9882	0.0013	0.0078	0.0000	0.0000	0.0028	0.0000	1.0000



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Appendix IV

Souder, Miller & Associates
Fosset Gulch MW 34-5-142
Fruitland Coals

Adsorption Isotherm Results

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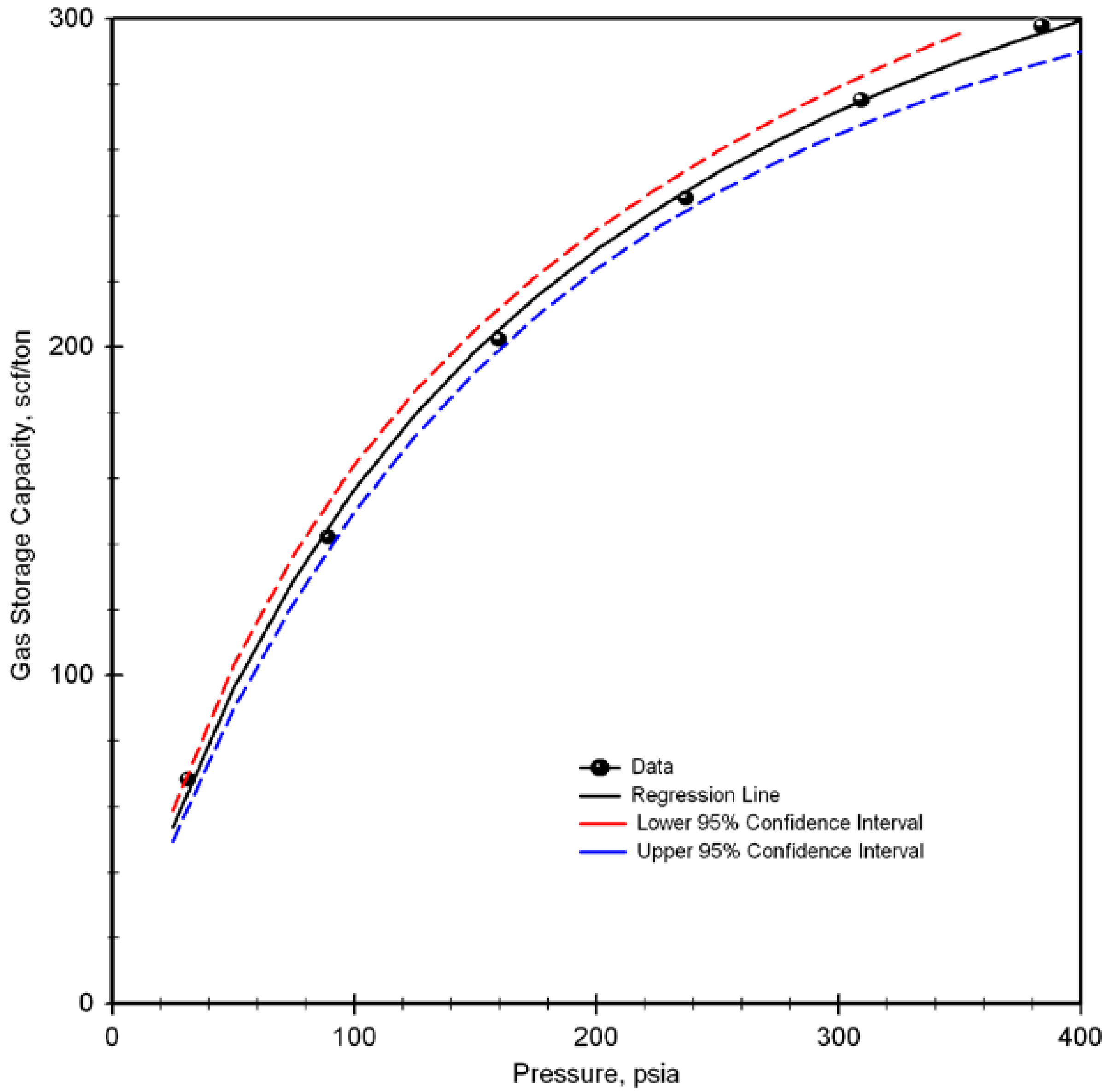
Sample 41547-2 Coal Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	484.70
Bottom Depth	ft	485.70
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	70.52
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.522
Moisture Holding Capacity	wt frac	0.0159
Ash Content	wt frac	0.3319
Volatile Matter Content	wt frac	0.2425
Fixed Carbon Content	wt frac	0.4097
Organic Content	wt frac	0.6461
Sulfur Content	wt frac	0.0061
Carbon Content	wt frac	0.5508
Nitrogen Content	wt frac	0.0114
Hydrogen Content	wt frac	0.0385
Oxygen Content	wt frac	0.0454
Sulfur-in-Ash Content	wt frac	0.0098
Vitrinite Content	vol frac	0.937
Inertinite Content	vol frac	0.058
Liptinite Content	vol frac	0.050
Rank Parameters		
Parr Corrected Volatile Matter Content, dry, ash-free	wt frac	0.4932
Parr Corrected Fixed Carbon Content	wt frac	0.5068
Calorific Value, mmmf	BTU/lbm	14,773
Parr Corrected Calorific Value, mmmf	BTU/lbm	15,039
Langmuir Parameters		
Number of Points	-	6
Squared Regression Coefficient	-	0.9990
Langmuir Storage Capacity, dry, ash-free	scf/ton	659.67
Langmuir Storage Capacity, in-situ	scf/ton	430.26
Langmuir Storage Capacity Range, in-situ	scf/ton	1.83
Langmuir Pressure	psia	174.69
Langmuir Pressure Range	psia	11.77

Sample 41547-2 Isotherm Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	**scf/ton**
31.272	68.399
89.029	142.203
159.667	202.459
236.846	245.444
309.150	275.367
383.730	297.931

Sample 41547-2 Isotherm Adsorption Isotherm



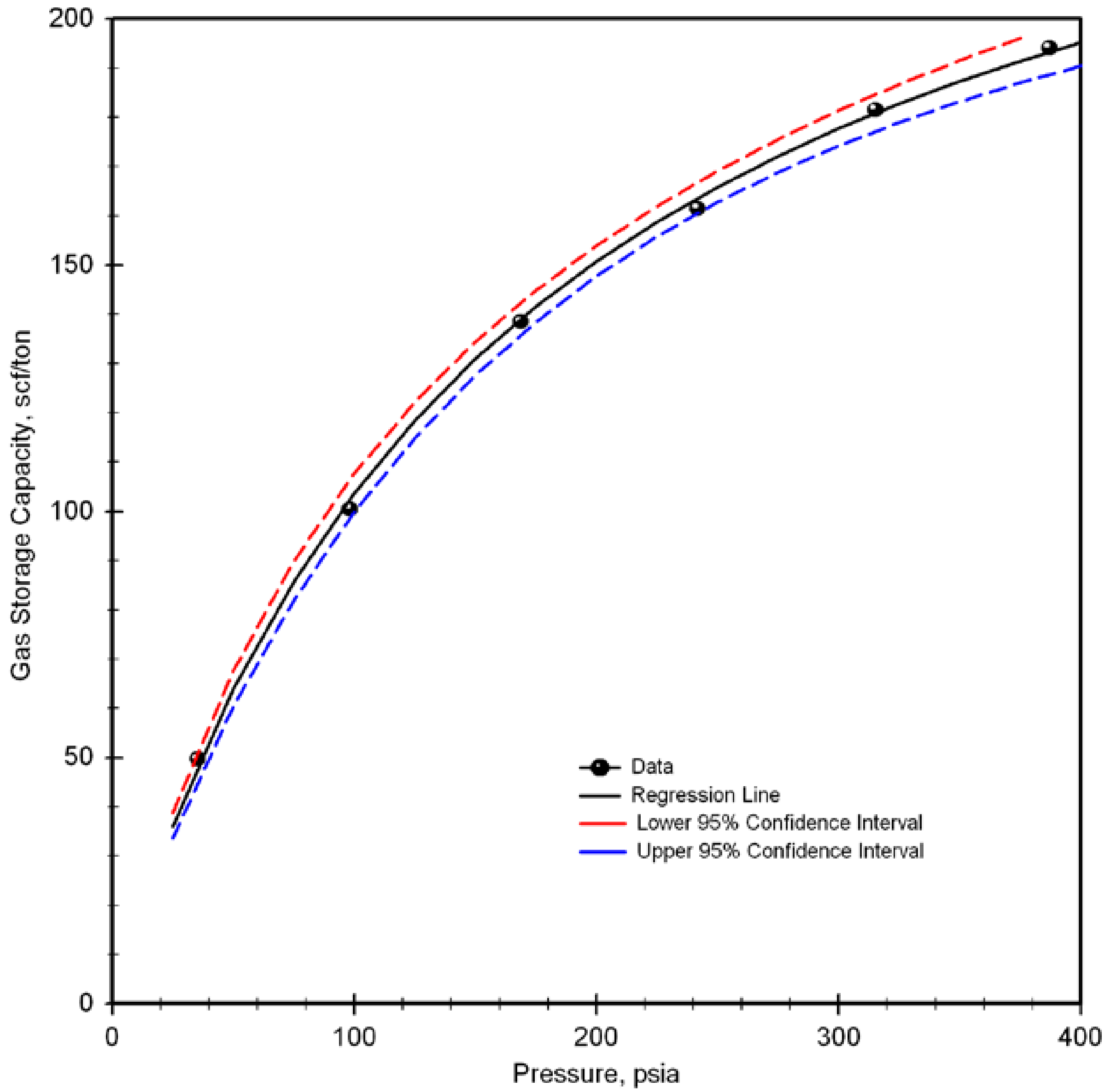
Sample 41547-5 Coal Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	531.10
Bottom Depth	ft	532.10
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	70.52
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.833
Moisture Holding Capacity	wt frac	0.0181
Ash Content	wt frac	0.5404
Volatile Matter Content	wt frac	0.1621
Fixed Carbon Content	wt frac	0.2795
Organic Content	wt frac	0.4272
Sulfur Content	wt frac	0.0143
Carbon Content	wt frac	0.3624
Nitrogen Content	wt frac	0.0069
Hydrogen Content	wt frac	0.0278
Oxygen Content	wt frac	0.0301
Sulfur-in-Ash Content	wt frac	0.0012
Vitrinite Content	vol frac	0.930
Inertinite Content	vol frac	0.070
Liptinite Content	vol frac	0.000
Rank Parameters		
Parr Corrected Volatile Matter Content, dry, ash-free	wt frac	0.8349
Parr Corrected Fixed Carbon Content	wt frac	0.1651
Calorific Value, mmmf	BTU/lbm	14,801
Parr Corrected Calorific Value, mmmf	BTU/lbm	15,566
Langmuir Parameters		
Number of Points	-	6
Squared Regression Coefficient	-	0.9994
Langmuir Storage Capacity, dry, ash-free	scf/ton	626.34
Langmuir Storage Capacity, in-situ	scf/ton	276.56
Langmuir Storage Capacity Range, in-situ	scf/ton	0.55
Langmuir Pressure	psia	166.78
Langmuir Pressure Range	psia	9.63

Sample 41547-5 Isotherm Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	**scf/ton**
35.195	49.760
98.092	100.553
168.541	138.571
241.616	161.593
315.003	181.637
386.902	194.151

Sample 41547-5 Isotherm Adsorption Isotherm



Final Report
Reservoir Property Assessment

Souder, Miller & Associates
Hwy 151 34-4-39 MW #1
Fruitland Coal
San Juan Basin
Archuleta County, Colorado

Submitted to:
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Summary

Weatherford Laboratories (WFT Labs) measured properties of five core samples recovered from Fruitland Coals penetrated by Souder, Miller & Associate's Hwy 151 34-4-39 MW #1 well on November 10, 2008. Core was collected between 227 and 291 ft. The goal of this project was to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coal at the well location.

Five core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. Three desorption samples were dedicated to collection of multiple gas composition and two desorption samples were dedicated to collection of isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all core samples. Coal characterization was determined for two desorption samples, which included chemical (proximate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). These two desorption samples were also used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

A variety of factors can influence data quality. Confidence in the analytical results depends on the reliability of reservoir temperature and pressure information available for the cored intervals as well as adherence to sample collection and processing protocols. Relative confidence levels were assigned to describe the reliability of the data discussed in this report. These confidence levels are defined below.

- Low confidence — Data should not be considered representative of reservoir conditions.
- Moderate confidence — Data are suspect but may be useful in conjunction with other information to describe reservoir conditions.
- High confidence — Data are believed to represent reservoir conditions (assuming experimental temperature and pressure data accurately describe initial reservoir conditions).

The conclusions and the confidence in these conclusions are summarized in the remainder of this section.

1. Confidence in the desorption data was high. The lost gas fraction of the five desorption samples ranged from 5.7 to 11.0% of the total gas content. At the conclusion of desorption experiments, all five desorption samples were crushed to determine the remaining gas content as required for accurate total gas content estimates. The percentage of the total gas released by crushing ranged from 20.3 to 54.2% of the total gas content. The average dry, ash-free and in-situ gas contents were 208.9 scf/ton (standard cubic feet per ton) and 143.9 scf/ton, respectively.

2. Estimates of the diffusivity at 60°F, the desorption temperature, ranged from 0.055 to 0.202 μs^{-1}. This range corresponded to sorption times (time to desorb 63% of the gas at the desorption temperature and atmospheric pressure) ranging from 91.6 to 335.0 hours. Confidence in this data was high as there was high confidence in the desorption data.

3. Multiple desorption gas samples were collected from three dedicated desorption canisters. These data were integrated as a function of the desorbed gas fraction to estimate the original adsorbed gas composition. Estimates of the adsorbed gas composition included 97.6 mol% methane, with minor concentrations of carbon dioxide (2.1 mol%), propane and heavier hydrocarbons (0.2 mol%), and ethane (0.2 mol%). The confidence in these data was moderate as there was substantial air contamination in some of the gas composition samples.

4. Results of isotopic analysis for two samples indicated that the origin of the released gas was transitional biogenic-thermogenic. Confidence in this data was high.

5. The density of the five desorption samples was determined after crushing with a helium pycnometer. The density ranged from 1.340 to 1.744 g/cm^3 on an in-situ basis. Confidence in these data was high.

6. Estimates of the organic fraction density and inorganic fraction density were of moderate accuracy due to minor variation in the sample moist density. The organic fraction density estimate of 1.259 g/cm^3 was consistent with the maceral composition. The inorganic fraction density of 3.041 g/cm^3 was greater than the density of moist montmorillonite (2.12 g/cm^3) and moist kaolinite (2.42 g/cm^3).

7. Ash contents from the five desorption samples were low to moderate, ranging from 0.1361 to 0.5192 weight fraction on an in-situ basis. The moisture holding capacity (in-situ or inherent moisture content) was moderate, ranging from 0.0119 to 0.0209 weight fraction. The sulfur content was low to moderate, ranging from 0.0053 to 0.0367 weight fraction on an in-situ basis. Confidence in these data was high.

8. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm, which was not the case for the two isotherm samples. The Parr corrected moist, mineral-matter-free calorific value for sample 41680-2 was 15,633 BTU/lbm and for sample 41680-4 was 15,461 BTU/lbm. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41680-2 was 1.02% in oil and for sample 41680-4 was 1.12% in oil placing the rank in the high volatile A bituminous range. There was high confidence in these data.

9. The maceral compositions were determined for the two adsorption isotherm samples. For sample 41680-2, the composition included 92.0% vitrinite, 6.4% inertinite, and 1.6% liptinite. For sample 41680-4, the composition included 93.8% vitrinite, 5.5% inertinite, and 0.7% liptinite. Confidence in these estimates was high.

10. Confidence in the measured adsorbed methane storage capacity data at the measurement temperature was high as all measurements were performed with state of the art equipment adhering to strict protocols. Two isotherms were determined from two desorption samples. Based upon the reservoir temperature data, the in-situ temperature was 60°F. The isotherm data were measured on samples 41680-2 and 41680-4, which had ash contents of 0.1362 and 0.1917 weight fraction and moisture contents of 0.0119 and 0.0140 weight fraction. The dry, ash-free Langmuir methane storage capacity for sample 41680-2 was 643.4 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 543.7 scf/ton. The Langmuir pressure was 126.0 psia. The in-situ methane storage capacity was 258.4 scf/ton. The dry, ash-free Langmuir methane storage capacity for sample 41680-4 was 643.9 scf/ton. At the in-situ ash content and moisture content, the Langmuir methane storage capacity was 507.0 scf/ton. The Langmuir pressure was 112.0 psia. The in-situ methane storage capacity was 274.7 scf/ton.

11. At 118.6 psia, the estimated average dry, ash-free methane storage capacity was 271.5 scf/ton. This was substantially greater than the dry, ash-free gas content of 175.1 scf/ton. Therefore, the degree of gas saturation (gas content divided by methane storage capacity) was 64.5%. The critical desorption pressure (pressure at which gas is released from the coal) was estimated to be 44.4 psia. The critical desorption pressure estimate is independent of the reservoir pressure estimate.

12. The density and gas content of the coal samples were used to estimate the adsorbed gas-in-place (GIP) volume per unit coal volume. The gas-in-place volume per unit thickness was 291.7 Mscf/acre-ft (thousand standard cubic feet per acre-foot of coal). Confidence in this estimate was high as there was high confidence in the gas content and density data.

Introduction

This report summarizes the procedures and results of the gas desorption and coal characterization program conducted on five core samples recovered from the Souder, Miller & Associate's Hwy 151 34-4-39 MW #1 well on November 10, 2008, from depths between 227 and 291 ft. The well is located in the San Juan Basin, specifically SE/NW Section 30, Township 34S, Range 4W, Archuleta County, Colorado. At the request of Mr. Denny Foust of Souder, Miller & Associates, WFT Labs conducted analyses on the core samples. The goal of this project was to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coal at the well location.

Many of the values presented in this report are time specific. For instance, references to gas content and gas composition are valid on the date the reservoir was sampled. These properties may have been affected by fluid production from the study well, offset wells, or drainage by mining activities since the samples were collected.

Table 1 summarizes the detailed analysis program conducted on the samples after they arrived at WFT Labs' laboratory. Information concerning the details of the measurements and the resulting data are discussed throughout this report.

Table 1. **Analysis Program Summary**

Sample ID	Can ID	Drill Depth (ft)	Reservoir System	Premium Sample	Sample Handling	Core Photography	Core Lithology	Gas Composition	Long-term Residual Gas	Isotope	Density	Moisture/Ash/Sulfur	Moisture Holding Capacity	Proximate/BTU/SO_3 in Ash	Comprehensive Petrography	Isotherm Preparation	Isotherm
41680-1	GTI-027	227.8-228.8	Fruitland Coal	X	X	X	X		X		X	X	X				
41680-2	GTI-019	229.0-230.0	Fruitland Coal	X	X	X	X	X	X	X	X	X	X	X	X	X	CH_4
41680-3	GTI-115	270.5-271.5	Fruitland Coal	X	X	X	X		X		X	X	X				
41680-4	GTI-028	271.6-272.3	Fruitland Coal	X	X	X	X	X	X		X	X	X	X	X	X	CH_4
41680-5	GTI-048	273.5-274.5	Fruitland Coal	X	X	X	X	X	X	X	X	X	X				

Field Activities

WFT Labs field personnel were on location at the well site between November 9 and November 11, 2008. WFT Labs collected drilling and coring operations data, five core samples for desorption measurements, desorbed gas content data, samples for gas composition determination from three canisters, samples for isotopic determination from two canisters, and core that was retained for additional analyses. This section summarizes the field activities.

References to core depths throughout this report are based on driller's depths and may require a depth correction to agree with log depths.

On November 10, 2008, Mr. Denny Foust provided a reservoir temperature of 60°F.

Reservoir Pressure data was confirmed on February 11, 2009, by Mr. Denny Foust. A pressure gradient of 0.42 psi/ft was used in all calculations in this report.

Scorpion Drilling (Rig #2) from Farmington, New Mexico, conducted the drilling operations for the well. Core point depth (227 ft) was reached on November 9, 2008. Coring operations commenced on November 10, 2008, and were completed on the same day with a total of two intermittent core runs from 227 to 246 ft and from 268 to 291 ft. A summary of all core runs is presented in Table 2. A field report was issued previously containing details of these operations.[1]

Reed Hycalog from Casper, Wyoming, conducted the coring operations. Tools used for coring operations included a 6.5-inch by 3.5-inch CMR 27 core bit and a 30-foot long conventional solid plastic inner-core barrel. Coring fluid was composed of polymer-based mud.

Table 2. **Core Run Summary**

Core Run	Cored Interval	Length Cored	Length Recovered	Core Recovery Success	Core Recovery Time	Circulating Fluid Temp.	Fluid Density	Number of Samples
#	ft	ft	ft	%	mm:ss	°F	ppg	#
1	227.0-246.0	19.0	6.0	31.6	30:12	50.5	8.5	2
2	268.0-291.0	23.0	18.4	80.0	31:47	51.5	8.5	3
Total	**-**	***42.0***	***24.4***	***58.1***	**-**	**-**	**-**	***5***

Five desorption samples were collected from the Fruitland Coal. The core samples were sealed in individual desorption canisters equilibrated to approximate in-situ temperature (60°F) for gas content analysis. All canisters were filled with potable water to minimize headspace volume within the canister. Reduced head space increased the accuracy of the gas content measurements, maximized the quality of gas samples collected for compositional analysis, and reduced oxidation and desiccation of the core. Desorption readings were taken every few minutes for the first few hours, which was important for accurate lost gas content estimates. Gas content measurements continued for at least 24 hours at the well site. Three canisters (samples 41680-2, 41680-4, and 41680-5) were selected for gas composition and two canisters (41680-2 and 41680-5) were selected for isotopic analysis.

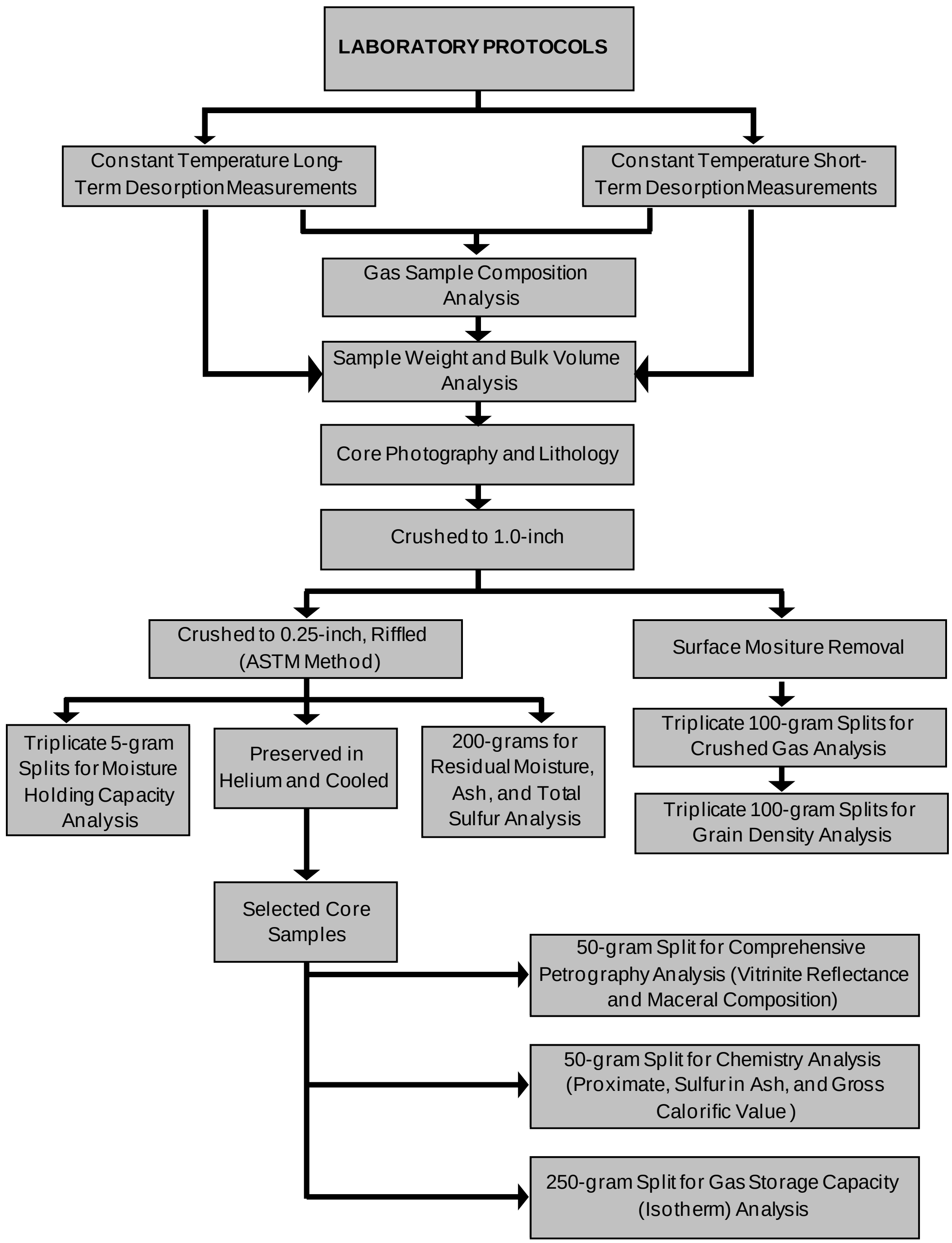
Samples not involved in desorption analysis were sealed in plastic liners and placed in core boxes. These samples and the desorption samples were delivered to WFT Labs' Arvada, Colorado, laboratory. Desorption continued at 60°F until the samples were crushed to determine the remaining gas content.

Laboratory Procedures

WFT Labs performed long-term desorption tests, gas composition analysis, sample bulk composition and property analysis including moisture, density, proximate analysis, sulfur content, sulfur-in-ash, gross calorific value, and adsorption isotherm measurements on selected samples. WFT Labs sub-contracted petrography and isotopic analyses on selected samples. The following details typical laboratory procedures and analyses conducted for a coal reservoir property assessment; although, these analyses may or may have been performed on the samples collected at this well.

Samples were processed using systematic procedures that minimized sample aerial oxidation, aerial desiccation (moisture loss), and gas loss. WFT Labs used an in-house improved procedure to air-dry processed samples that differs from the air-drying procedure described in the ASTM Method D 3302. WFT Labs' air-drying procedure attempts not to over-dry samples by only removing surface moisture. Figure 1 summarizes the general sample processing and analysis steps in the form of a flow chart. Some of the analyses summarized in this figure may not have been performed on samples from this project. Sample methodologies rigorously followed best practice analysis protocols developed by ASTM, the Gas Technology Institute (GTI), and WFT Labs.[2,3,4,5,6]

Figure 1. **Sample Processing and Analysis Flow Chart**



Gas Content Measurement Protocol

Desorbed gas volumes were measured as a function of time to the nearest 1 milliliter by head-pressure equalized fluid displacement. The frequency of the measurements was greatest during the early time of desorption tests to ensure sufficient data were available for lost gas content determination. The gas desorption data collected during the gas desorption tests were used to calculate the lost gas content. Lost gas content estimates were obtained from the early time gas content data using WFT Labs' modified version of the U.S. Bureau of Mines' Direct Method.[5,6]

Samples were removed from the canister and the particle size was reduced to a one-inch diameter top size. Triplicate representative splits, approximately 100 grams each, were quickly removed from the gross sample for crushed gas analysis. The splits were individually pulverized to -200 mesh in specialized sealed crushing vessels under an inert gas (helium) atmosphere at approximate reservoir temperature. The released (crushed) gas volume was measured periodically until no measurable gas was released from the crushing vessel. The crushed gas content of the samples was calculated by dividing the released gas volume by the sample weight. An average of gas content from the triplicate splits was used as the final estimate of the crushed gas content.

RapidGas™ is WFT Lab's methodology when samples are removed from desorption samples within three weeks of the start of desorption and pulverized to determine the released gas volume with the crushed gas method. WFT Labs uses the term accelerated gas to describe crushed gas analysis when the desorption time is greater than for *RapidGas* samples but less than the time for long-term desorption samples.

Crushed gas content (also referred to as residual gas content) is used to describe the released gas content when samples are crushed after long-term desorption at approximate reservoir temperature. WFT Labs terminates the long-term desorption measurements when the released gas volume is less than or equal to 0.05 scf/ton-D (standard cubic feet per ton-day) over a several day period.

The total air-dry gas contents were calculated by the sum of the lost gas, measured gas, and crushed gas contents. Residual moisture, ash, moisture holding capacity, and total sulfur content data were then used to convert air-dry basis gas content data to other bases (e.g., dry; dry, ash-free; and in-situ bases). All gas content volumes were converted to and reported in standard cubic feet per ton (2,000 lbm) of rock (scf/ton).

Apparent Diffusivity and Sorption Time

Gas storage and flow through coal seams are generally modeled with dual porosity reservoir models.[6] Gas is stored by adsorption within the primary porosity system within the organic component of the coal matrix. The primary porosity consists of micro- (<2 nanometer diameter) and meso-porosity (2 to 50 nanometer diameter) pores. Gas flows to wells through the secondary porosity system, which consists of macro-pores (>50 nanometers diameter) and natural fractures. Gas flow through the primary porosity is dominated by diffusion and quantified with Fick's Law while gas flow through the secondary porosity is driven by pressure gradients and quantified with Darcy's Law.

Diffusivity is the diffusion coefficient divided by the square of an average diffusion distance. Diffusivity can be estimated from the method used for determining lost gas volume using the relationship listed in Equation 1.

$$\frac{D}{r^2} = \left(\frac{m}{203.1 G_{ad}} \right)^2 \qquad (1)$$

where:

D/r^2 *diffusivity, sec*$^{-1}$
m *slope of gas content versus square-root time graph, scf/ton-hr*$^{0.5}$

G_{cad} *air-dry basis total gas content, scf/ton*

Although diffusivity values are used in reservoir models, an easier concept to understand is the sorption time. Sorption time is defined as the time required to desorb 63.2% of the original gas content if a sample is maintained at constant temperature. The relationship used to relate sorption time to diffusivity is listed in Equation 2.

$$\tau = \left(3600\alpha \frac{D}{r^2}\right)^{-1} \qquad (2)$$

where:

τ *sorption time, hr*
α *geometrical shale factor, cm*^{2}

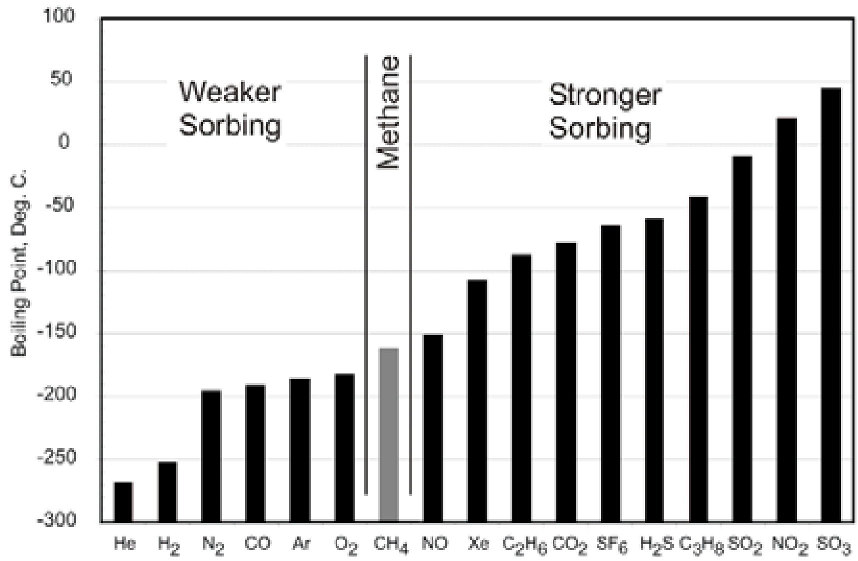
The geometrical shape factor for a sphere, the most common assumed geometry, is 15. The accuracy of the diffusivity value depends weakly upon the competency of the core sample and strongly upon the determination of the lost gas content.

Gas Composition and Isotope Analysis

It is important to determine the composition of the adsorbed gas as the gas composition directly affects the gas storage capacity and critical desorption pressure. The adsorption affinity of gases is related to their atmospheric pressure boiling point as illustrated by Figure 2. Nitrogen tends to decrease in-situ multi-component gas storage capacity while carbon dioxide, ethane, and heavier hydrocarbon gases tend to increase storage capacity. The composition of the gas desorbed from the core samples changes with time, and concentrations of heavier hydrocarbon species tend to increase relative to methane.

The gas composition as a function of desorbed gas fraction data (cumulative desorbed gas content divided by the total gas content) was integrated to determine the adsorbed gas composition for coal samples or for an average of the free and adsorbed gas compositions for shale samples. Gas composition samples were collected from dedicated canisters. These canisters are usually purged with helium at the time of sealing to reduce air contamination. Gas samples were collected periodically before measuring the released gas volume. The gas composition of the initial released gas was determined by extrapolation to zero desorbed gas content. The accuracy of the extrapolation is strongly dependent upon the lost gas content and the number of desorption gas samples taken early in the desorption measurements. If lost gas content is large, i.e., greater than 25%, the estimates of the lost gas composition are probably inaccurate and deficient in the lighter hydrocarbon species. The composition of the gas released by crushing the samples at the end of the desorption measurements must also be corrected for contamination by air.

Figure 2. **Relative Sorption Affinity of Gases**



Gas sample composition was analyzed at WFT Labs by gas chromatography in accordance with ASTM Method D 1945 (modified). The gas composition was calculated by integrating the gas composition as a function of cumulative desorbed gas content.

Determining the origin of the gas is important in understanding the characteristics of natural gas in a reservoir system or basin. Natural gas derived from two distinct sources listed below can be distinguished based on isotopic composition.[7] Isotopes are atoms whose nuclei contain the same number of protons but a different number of neutrons. Gas isotope ratios were determined by isotope ratio mass spectroscopy.

1. Biogenic Gas: Gas generated by anaerobic decomposition of organic matter in a shallow, low temperature sedimentary environment.

2. Thermogenic Gas: Gas formed in deeply buried sediments by thermal cracking of sedimentary organic matter into hydrocarbon liquids and gas (primary thermogenic gas), or by thermal cracking of oil at high temperatures into gas (secondary thermogenic gas).

Biogenic gas consists primarily of methane and is often referred to as a “dry” gas. Thermogenic gas can be dry or contain concentrations of heavier hydrocarbons (C_{2+}).

The following information is derived from Reference 7. In isotope geochemistry, it is common practice to express isotopic composition in terms of a delta (δ) value, which is a difference from a standard sample. For example, the delta value for substance A is defined by Equation 3.

$$\delta_A = 10^3 \left(\frac{R_A}{R_{st}} - 1 \right) \tag{3}$$

where:

δ_A *delta value of element A, parts per thousands, ‰*
R_A *isotopic ratio of A, dimensionless*
R_{st} *isotopic ratio of a standard, dimensionless*

Carbon has two stable isotopes: ^{12}C and ^{13}C. ^{12}C accounts for 98.89% of all carbon and ^{13}C accounts for 1.11% of the remaining carbon. When the delta value is greater, it is common to consider substance A enriched in the rare, heavier isotope.

Hydrogen has two stable isotopes: H and ^{2}D (deuterium). H accounts for 99.9844% of all hydrogen and ^{2}D accounts for 0.0156% of the remaining hydrogen. Hydrogen exhibits the largest variations in stable isotope ratios of all elements.

Biogenic methane commonly occurs in recent anoxic (low oxygen concentration) sediments in both fresh water, such as lakes and swamps, and marine environments, such as estuaries and shelf regions. There are two primary pathways for methanogenesis, fermentation of acetate and reduction of CO_2. Acetate fermentation is dominant in freshwater environments while CO_2 reduction is dominate in marine environments.

During methanogenic bacterial decomposition of organic material, methane is highly depleted in $\delta^{13}C$ and results in $\delta^{13}C$ values between -110 and -50‰. In marine sediments, methane formed by CO_2 reduction is often more depleted in ^{13}C than when formed by acetate fermentation. Typical values for $\delta^{13}C$ in methane from marine environments range from -110 to -60‰ while those in methane from freshwater environments range from -65 to -50‰.

The difference in methane composition from both environments is even greater for the hydrogen isotopes. Marine bacterial methane has δD values between -250 and -170‰ while biogenic methane in freshwater environments is strongly depleted in deuterium with δD values between -400 to -250‰. This difference is due to the source of the hydrogen. Hydrogen comes from formation water during CO_2 reduction. Seventy-five percent of the hydrogen created by fermentation comes from the methyl group, which is extremely depleted in deuterium.

Thermogenic gas is produced in deeply buried sediments due to modification of the organic matter by various chemical reactions, such as cracking of kerogen. The ^{12}C – ^{13}C bonds are preferentially broken during the first stages of maturation resulting in ^{13}C enrichment, which continues as temperature increases. In general, as thermal maturity of methane increases, the $\delta^{13}C$ values increase. Thermogenic methane commonly has $\delta^{13}C$ values between -50 and -20‰. Methane from non-marine (humic) sources are isotopically enriched relative to those generated from marine (sapropelic sources) and similar levels of thermal maturity. In contrast, δD values are independent on the source of organic material but are highly dependent on the thermal maturity.

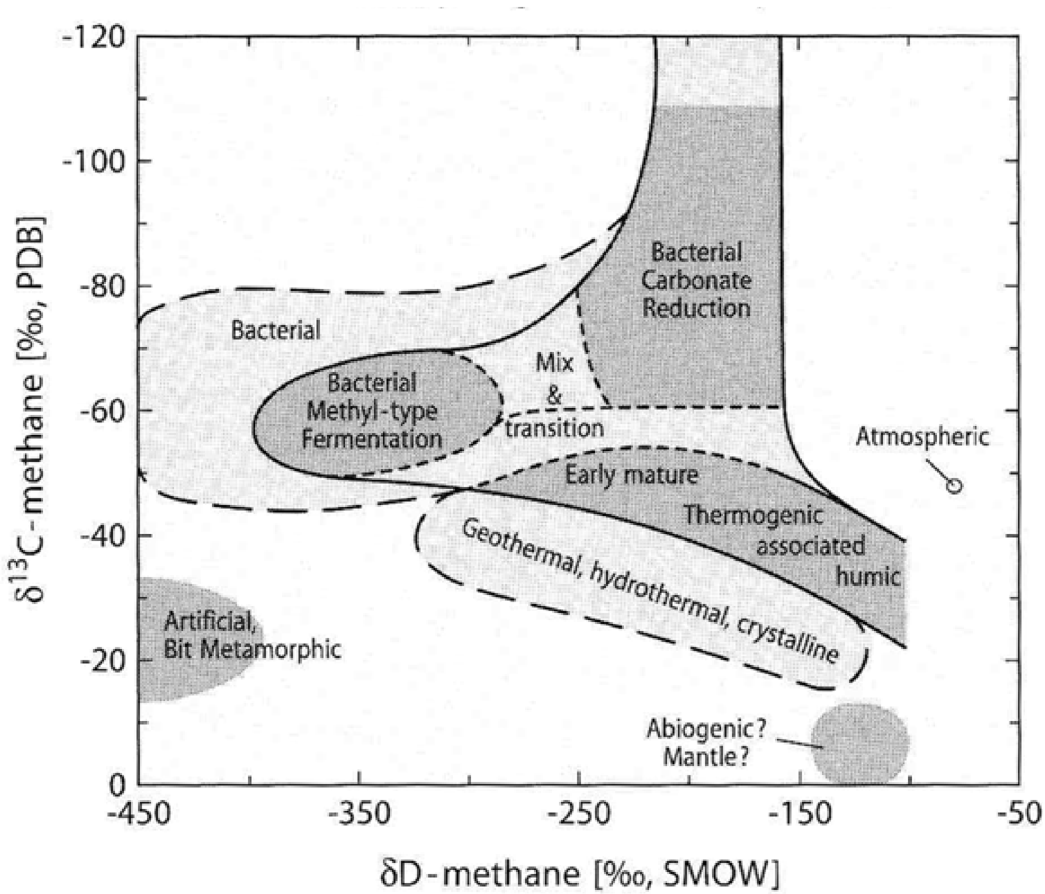
As a side note, migration can enrich methane in $\delta^{12}C$ or $\delta^{13}C$ depending upon the properties of the rock through which the gas is migrating. Recent experiments have demonstrated that $\delta^{13}C$ can be depleted during migration through shale to different degrees depending upon the organic content of the shale.[8]

The process of diffusion can cause significant isotope fractionization. In general, light isotopes are more mobile and diffuse about 1% faster than the heavier isotopes. As a result, light isotopes escape more readily leaving the remaining methane enriched in ^{13}C causing greater $\delta^{13}C$ values.

A gas mixture subjected to a temperature gradient will tend to separate by thermal diffusion; the greater mass species will migrate to the colder temperatures. Gravitational settling in porous media can also cause the heavier isotope to migrate downward.

Whiticar[9] developed a chart for identification of methane sources based upon isotopic ratios. This chart, extracted from Reference 7, is illustrated in Figure 3. The term SMOW in the horizontal axis refers to the standard for hydrogen isotopes, which comes from a sample of mean ocean water distributed in Vienna by the International Atomic Energy Agency. The term PDB in the vertical axis refers to the standard for carbon isotopes, which is a based on Cretaceous PeeDee Belemnites found in South Carolina.

Figure 3. Carbon and Hydrogen Isotope Signatures of Methane Sources



When a helium purged canistered sample is selected for isotope analysis, one or two samples of released gas are collected from the core sample during the desorption measurements after sufficient volume of gas is measured in order to clear the canister head space of residual air. If two gas samples were collected, one sample was taken within the first few hours of the desorption measurements and the second was collected when the rate of desorption decreased significantly but still had enough volume to fill the collection tube (100 ml). If only one gas sample was collected for isotopic analysis, the sample was taken within the first few hours of the desorption measurements. The gas samples collected should be representative of the reservoir gas and are analyzed by isotope-ratio mass spectrometry (IRMS) at Isotech Laboratories, Inc.

Sample Bulk Composition and Property Analysis

Sample bulk composition and property analyses were performed according to ASTM or other standardized methodologies listed in Table 3. Chemical analysis (proximate, total sulfur, sulfur in ash, and heating value) and comprehensive petrography analysis (maceral matter composition, mineral matter composition, and vitrinite reflectance analyses) are typically conducted on selected samples to determine coal composition and thermal maturity (rank). The Center for Applied Energy Research (University of Kentucky) conducts the petrographic analysis. All other listed bulk composition and property analyses were conducted in-house by WFT Labs. Density, moisture holding capacity, chemical analysis, and petrographic analysis procedures are discussed in the following sections.

Table 3. Sample Bulk Composition and Property Analysis Methodologies

Analysis	Methodology
Air-dry moisture loss	WFT Labs' improved methodology
Sample bulk volume	Standard water displacement technique
Density	Helium multi-pycnometry
Moisture holding capacity	WFT Labs' improved methodology
Residual moisture	ASTM D 5142
Ash content	ASTM D 5142
Proximate	ASTM D 5142
Total sulfur	ASTM D 4239C
Sulfur in Ash	ASTM D 5016
Gross calorific value	ASTM D 5865
Maceral and mineral composition	ASTM D 2799
Vitrinite reflectance	ASTM D 2798

Crushed Density Analysis

Density by helium pycnometry determines crushed density values (i.e., density excluding large-scale gas filled pore volume). For coal, the crushed density is almost identical to the bulk density. Crushed density analysis requires the measurement of sample volume and mass. Sample volumes were measured at room temperature conditions on triplicate air-dried samples (representative of each desorption sample) of approximately 100 grams using a helium multi-pycnometer. Helium can penetrate the coal micro-pore structure without adsorption and does not add moisture to the sample. Sample weights were determined to the nearest 0.001 gram using an electronic balance. Sample densities were calculated by dividing the measured sample mass by the sample volume.

Moisture Holding Capacity Analysis

The in-situ (or inherent) moisture of coal is the amount of moisture the coal can hold at 100 percent relative humidity without any moisture present on the surface of the coal particles. The moisture holding capacity approximates the in-situ moisture content of the coal seam.[2]

The moisture holding capacity analysis procedure used by WFT Labs is in accordance with the ASTM Method D 1412 (Equilibrium Moisture). The equilibrium moisture value is defined as the average percentage weight loss upon drying triplicate 5-gram water saturated coal samples [particle size -16 US mesh (1.18 mm)], following equilibration at 96 to 97% relative humidity and 86°F (30°C) for 48 to 72 hours.

Chemical Characterization

Proximate and ultimate analysis provides chemical composition data. Proximate analysis results in estimates of the weight fraction of residual moisture, ash, and volatile matter and the calculation of fixed carbon by difference. Data from proximate analyses are used to classify coal rank and to determine the ratio of combustible to incombustible constituents. Ultimate analysis results in the weight fraction of sulfur, carbon, hydrogen, nitrogen, and oxygen by difference. [2]

The total sulfur content represents the sulfur occurring in both the organic and inorganic components of the coal sample. The total sulfur content is determined in accordance with ASTM D 4239C.

Residual moisture is neither a standard state nor a characteristic property of coal.[2] Residual moisture is dependent on the sample handling, desorption methodology, and the method used to remove excess moisture before analysis. For coal samples, it is important to maintain the residual moisture content at levels slightly greater than the inherent, or in-situ, moisture content. When the total moisture is reduced to the residual moisture value following careful methods, subsequent analyses can be reported on the ASTM as-determined mass basis.

Maceral and Mineral Composition

Maceral and mineral analysis provides organic and mineral composition data. Petrographic characterization of coal reservoir systems is performed by microscopic examination of polished surfaces of crushed particle pellets under reflected white light and ultraviolet light. The volume fraction of organic (maceral) and inorganic (mineral) components is quantified by manual point counting. The volume fraction of clay, quartz, carbonate, and sulfide minerals is also quantified by point counting. The point counting technique is a subjective process and requires a knowledgeable and highly experienced petrographer to obtain consistent data. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the maceral and mineral testing.

Coal Vitrinite Reflectance

The thermal maturity of coal can be quantified petrographically by vitrinite reflectance. The measurement is typically conducted on the polished surface of the crushed particle pellets used for the maceral analysis. Incident white light is reflected off the surface of vitrinite macerals immersed in oil of a specific refractive index. The reflected light is captured by a photo multiplier and converted to analog and digital output. The reflected light is typically reported as the mean-maximum reflectance since vitrinite is anisotropic under incident. Vitrinite reflectance may be the most sensitive indicator of thermal maturity for macerals that have attained a coal rank of medium volatile bituminous and greater. A third-party commercial laboratory, Center for Applied Energy Research (University of Kentucky), conducted the vitrinite reflectance testing.

Adsorbed Gas Storage Capacity

Adsorption isotherm data are important because isotherm behavior indicates the maximum gas volume that can be stored at a specific temperature and pressure. The adsorption isotherm determines the gas storage capacity of crushed samples as a function of pressure at constant temperature, which is usually the reservoir temperature. A known weight of crushed rock sample is placed in a volumetric isotherm apparatus and subjected to increasing pressure steps.[10] Gas storage capacity is estimated by material balance analysis of the pressure behavior. For coal, the measurement is performed on samples equilibrated to the inherent, or in-situ, moisture content.

The gas storage capacity of coal typically increases non-linearly as pressure increases. Gas storage capacity also varies as a function of the type of gas species, coal maceral composition, and organic material thermal maturity.

The Langmuir equation listed in Equation 4 is used to model the variation of gas storage capacity as a function of pressure.[11]

$$G_s = G_{sL} \frac{p}{p + p_L} \tag{4}$$

where:

G_s *gas storage capacity, scf/ton*
G_{sL} *Langmuir storage capacity, sct/ton*
p *pressure, psia*
p_L *Langmuir pressure, psia*

The Langmuir storage capacity is the gas storage capacity of the sample at infinite pressure and the Langmuir pressure is the pressure at which the gas storage capacity of the sample equals one-half the Langmuir storage capacity value.

Gas storage capacity is dependent upon pressure, temperature, and organic composition. Table 4 summarizes the effect that each of these parameters has on the gas storage capacity when all other parameters are held constant.

Table 4. Relative Effect of Various Parameters on Gas Storage Capacity

Parameters	As the Parameter:	Gas Storage Capacity:
Pressure	Increases	Increases
Temperature	Increases	Decreases
Moisture Content	Increases	Decreases
Vitrinite/Kerogen III Concentration	Increases	Increases
Thermal Maturity	Increases	Increases

Gas adsorbed in reservoirs typically contains gases other than methane, each gas having different adsorptive affinity, which is related to its atmospheric pressure boiling point. The extended Langmuir equation is used to model multi-component gas storage capacity when gas mixtures are present in coal reservoirs. Adsorption isotherm measurements are conducted independently for each gas component present and then combined mathematically with the extended Langmuir model to produce isotherm data that are representative of the reservoir's gas composition.

Multi-component isotherm relationships can be computed from single component data by use of extended Langmuir theory.[12] Equation 5 lists the extended Langmuir relationship.

$$G_{si} = G_{sLi} \frac{\frac{py_i}{p_{Li}}}{1 + p\sum_{j=1}^{nc} \frac{y_i}{p_{Li}}} \qquad (5)$$

where:

G_{si} *multi-component storage capacity of component i, scf/ton*
G_{sLi} *single component Langmuir storage capacity of component i, scf/ton*
p_{Li}, p_{Lj} *single component Langmuir pressure of component i or j, psia*
y_i or y_j *mole fraction of component i or j in the free gas (vapor) phase, dimensionless*
nc *number of components*
p *pressure of the free gas phase, psia*

One limitation in the current application of Equations 4 and 5 is that gas storage capacity is a function of temperature. No simple method accounts for temperature variations unless the isotherms are measured at multiple temperatures. Consequently, the laboratory isotherm data should be measured at an average reservoir temperature or at multiple temperatures to allow for proper correction.

Initial reservoir gas saturation (gas content divided by gas storage capacity) and critical desorption pressure (pressure at which adsorbed gas is released from the adsorbed state) are estimated from the adsorption isotherm analysis and desorption data.[4] The critical desorption pressure is determined by calculating the pressure at which the in-situ gas content equals the in-situ gas storage capacity.

Analysis Results

This section provides summaries and discussions of the analytical results. Laboratory reports (raw data) are provided in the appendices where indicated.

Core Photography and Lithology

At the conclusion of the desorption tests, the samples were removed from desorption canisters. Digital photographs were taken and lithologic descriptions of the desorption samples immediately followed. Photographs and lithologies are included in Appendix I.

Gas Content, Diffusivity, and Sorption Time

The total gas content was determined by summing the lost gas content, measured gas content (desorbed gas content), and the gas content liberated from the crushed sample at the end of desorbed gas analysis. The gas volume measurements were corrected for canister and ambient temperature and ambient pressure variations. Gas contents were reported at standard conditions of 14.7 psia and 60°F. The total gas content estimate was based upon the air-dried sample mass. Residual moisture, moisture holding capacity, ash, and total sulfur content data were used to convert air-dry basis gas content data to other bases (i.e., dry; dry, ash-free; and in-situ bases). Figure 4 illustrates the lost, measured, and crushed gas content on an air-dry basis for each sample. The average air-dry, in-situ, and dry, ash-free adsorbed gas content estimates for core samples are summarized in Table 5. Desorption data including total gas content, measured gas content, and crushed gas content are illustrated in Appendix II.

For the core samples, lost gas contents were obtained from the early time gas content data using WFT Lab's modified version of the Direct Method.[5,6] Extrapolations were made of the early time desorption data measured at reservoir temperature to determine the lost gas content. The lost gas time (time interval used for lost gas extrapolations) ranged from 1.03 to 1.45 hours and all lost gas content values were less than 11% of the total gas content.

Measured gas contents determined from desorption tests for all desorption samples are presented in Table 5. Desorption graphs and data are included in Appendix II.

Residual (crushed) gas content was determined for the five desorption samples. Crushed gas content data are presented in Table 5.

Diffusivity and sorption time estimates for the core samples are listed in Table 6. The diffusion values were obtained from the gradient of the lost gas slope. Sorption time was computed from the diffusivity values.

In many cases, there is a relationship between the total gas content and the inorganic content of each sample. Figure 5 illustrates this relationship listed in Equation 6. The relationship had a squared correlation coefficient of 0.1114, which was not statistically significant. The extrapolation to zero inorganic content suggested the organic fraction gas content was 175.1 scf/ton, which was less than the average dry, ash-free gas content of 208.9 scf/ton.

$$G_c = 175.1 - 106.7(w_a + w_w + w_s) \tag{6}$$

where:

G_c *total gas content, scf/ton*
w_a *ash content, weight fraction*
w_w *moisture content, weight fraction*
w_s *sulfur content, weight fraction*

Figure 4. **Gas Content Data Summary**

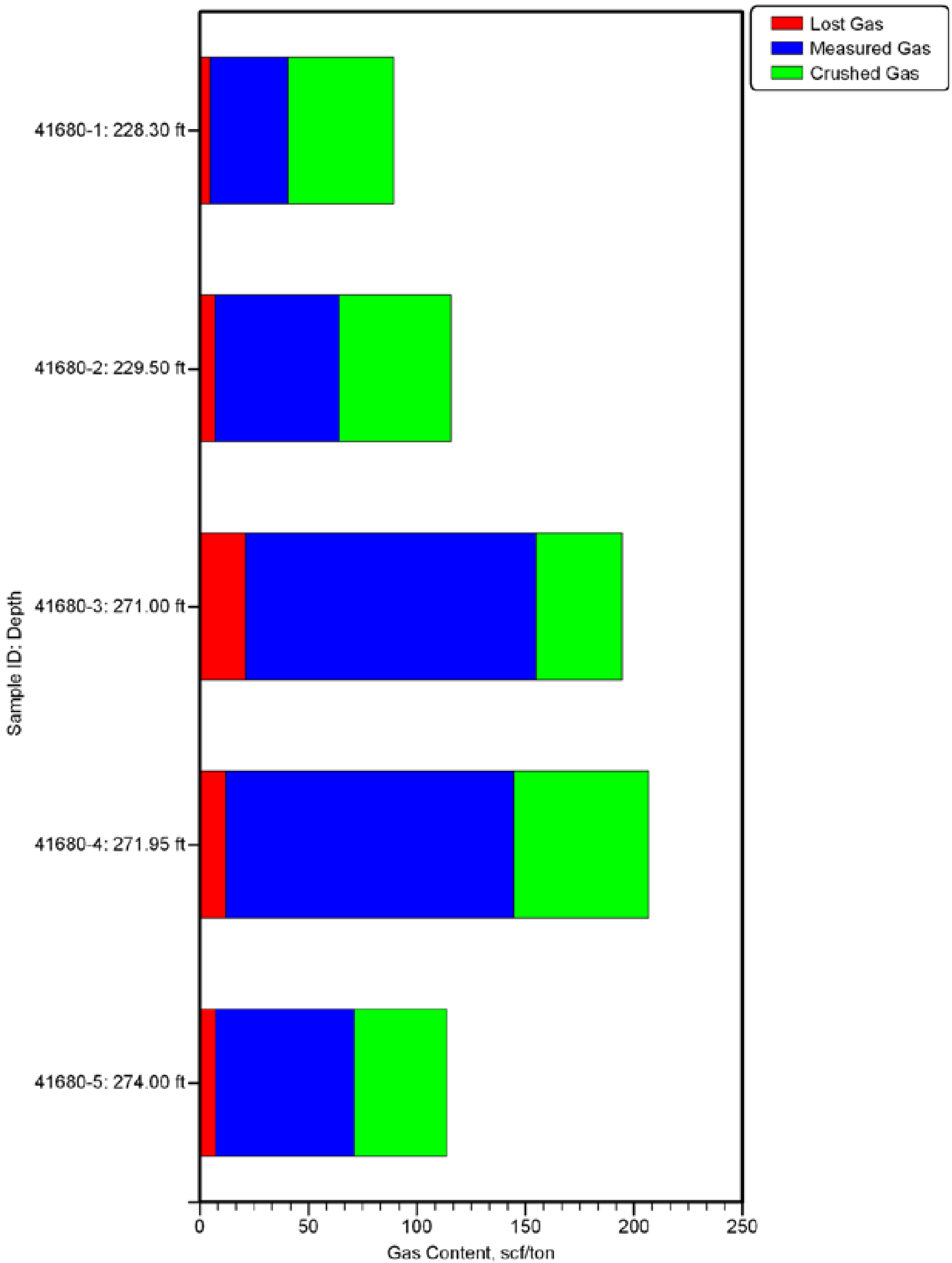


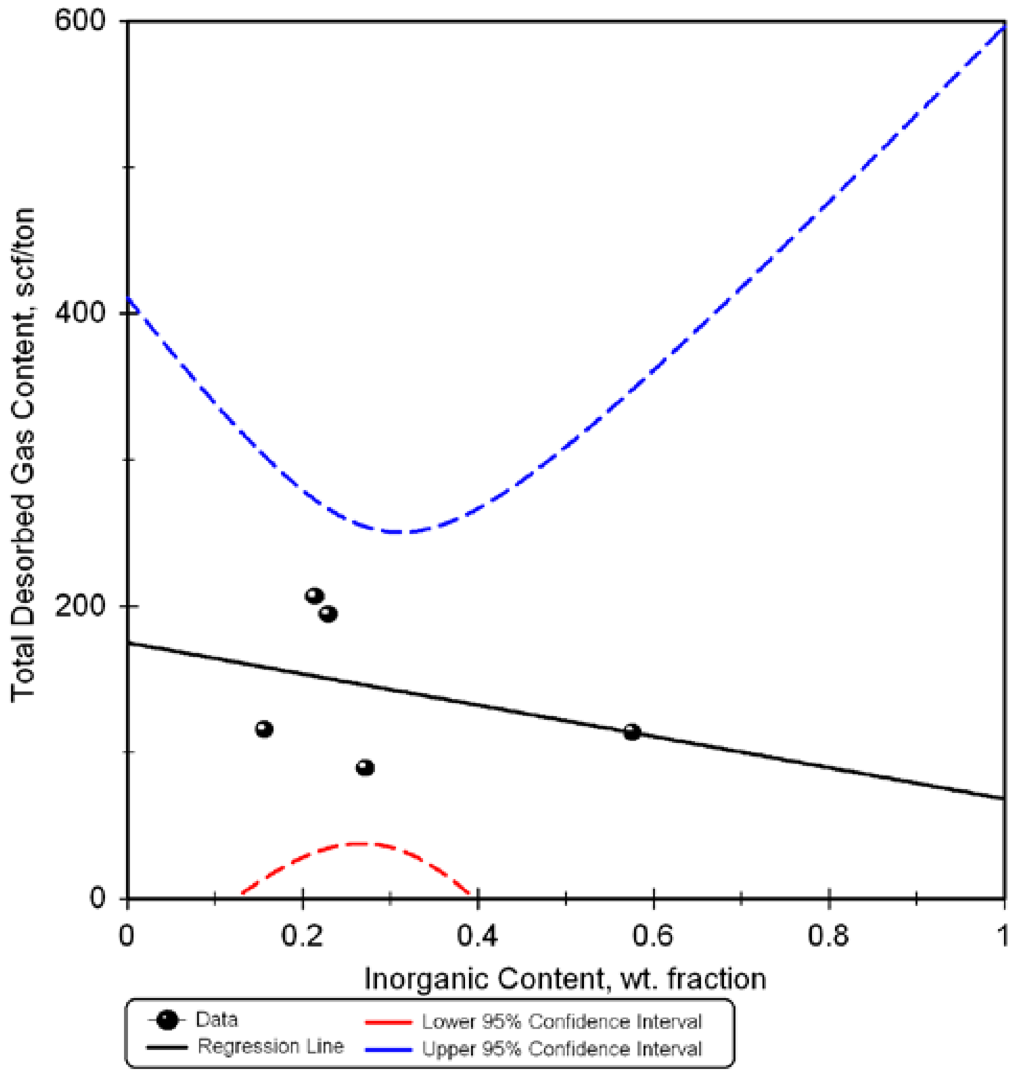
Table 5. **Gas Content Data**

Sample ID	Midpoint Depth	Mass	Lost Gas Time	Lost Gas Fraction	Measured Gas Fraction	Crushed Gas Fraction	Lost Gas Content	Measured Gas Content	Crushed Gas Content	Total Air-Dry Gas Content	Total Dry, Ash-Free Gas Content	Total In-Situ Gas Content
	ft	g	hours	%	%	%	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton	scf/ton
41680-1	228.3	2,093	1.42	5.67	40.14	54.19	5.1	35.9	48.5	89.6	122.8	89.7
41680-2	229.5	2,044	1.23	6.26	49.38	44.36	7.3	57.2	51.4	115.9	137.3	116.0
41680-3	271.0	2,129	1.45	10.99	68.73	20.28	21.4	133.9	39.5	194.8	252.5	192.8
41680-4	272.0	1,443	1.03	5.95	64.09	29.95	12.3	132.6	62.0	206.9	263.1	207.2
41680-5	274.0	2,060	1.28	6.63	56.18	37.19	7.6	64.0	42.4	114.0	268.5	113.6
Average	**-**	***1,954***	***1.28***	***7.10***	***55.70***	***37.19***	***10.7***	***84.7***	***48.8***	***144.2***	***208.9***	***143.9***

Table 6. **Diffusivity and Sorption Time Estimates**

Sample ID	Top Depth	Bottom Depth	Sorption Time	Diffusivity
	ft	ft	hr	1/μs
41680-1	227.8	228.8	335.0	0.055
41680-2	229.0	230.0	238.2	0.078
41680-3	270.5	271.5	91.6	0.202
41680-4	271.6	272.3	214.3	0.086
41680-5	273.5	274.5	216.9	0.085
Average	**-**	**-**	***219.2***	***0.101***

Figure 5. **Total Gas Content vs. Inorganic Content**



Gas Composition and Isotope Summary

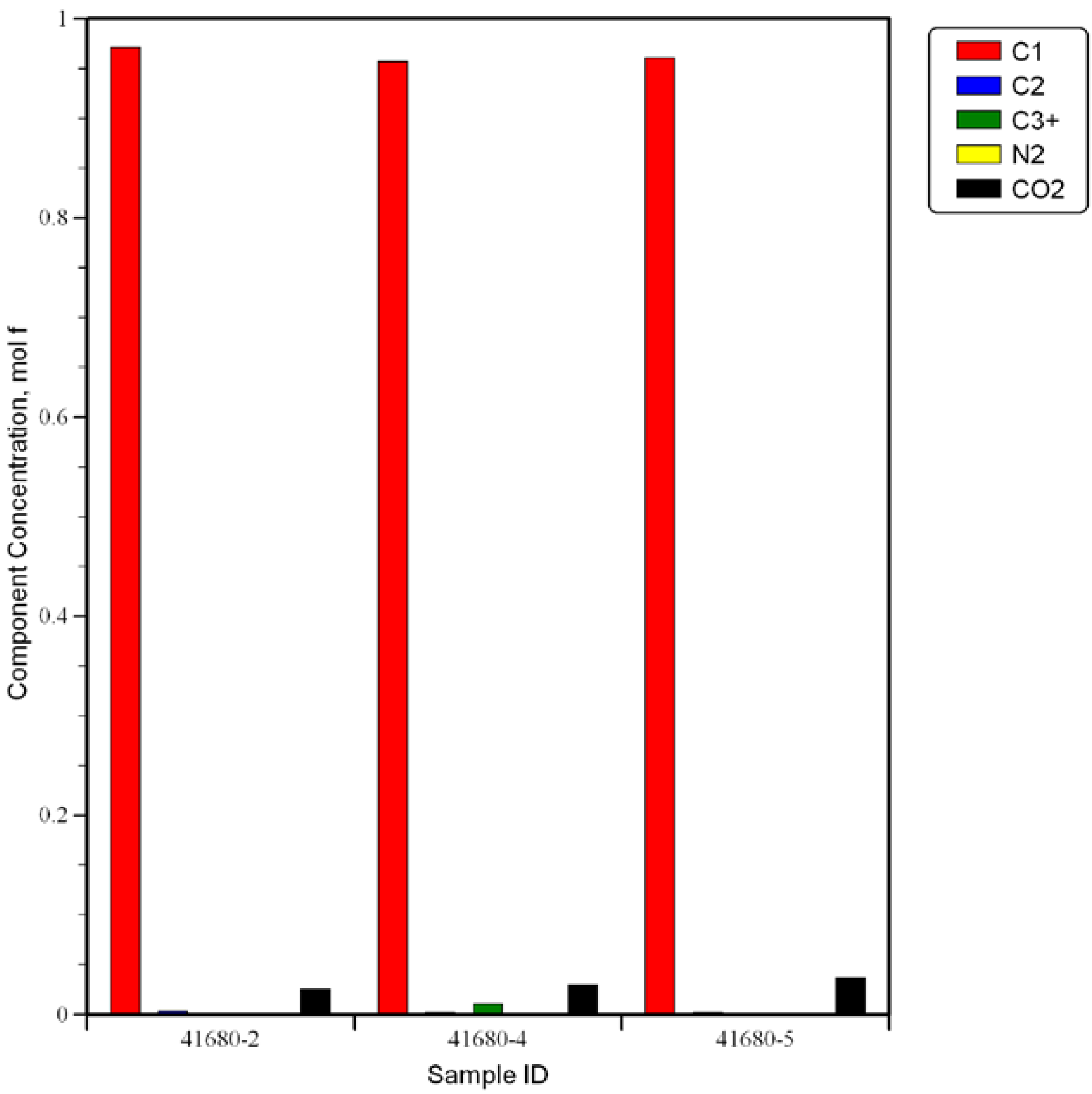
Natural gas produced from coal reservoirs may contain significant volumes of carbon dioxide, nitrogen, and other hydrocarbons in addition to methane. Knowledge of the desorbed gas composition is required to properly evaluate the gas storage capacity. Three canisters were dedicated to collection of multiple desorption gas samples. The gas compositions were corrected for air and hydrogen contamination. The degree of contamination was such that it was necessary to remove all of the nitrogen as well.

Table 7 summarizes the apparent adsorbed gas composition for three samples. The sorbed gas consisted primarily of methane (97.6 mol%). Carbon dioxide (2.1 mol%), propane and heavier hydrocarbons (0.2 mol%), and ethane (0.2 mol%) were also present in smaller concentrations. While nitrogen may be present in the adsorbed gas, contamination precluded an estimate for the adsorbed nitrogen content. Figure 6 graphically illustrates the apparent adsorbed gas composition of the samples. The original gas compositions, contamination corrected gas compositions, gas compositions as a function of desorption fractions, and integrated (adsorbed) gas compositions are all reported in Appendix III.

Table 7. **Apparent Adsorbed Gas Composition Results**

Sample ID	Midpoint Depth	C_1	C_2	C_{3+}	CO_2	Total
	ft	mol frac	mol frac	mol frac	mol frac	mol frac
41680-2	229.5	0.9710	0.0029	0.0005	0.0257	1.0000
41680-4	272.0	0.9574	0.0019	0.0107	0.0300	1.0000
41680-5	274.0	0.9608	0.0020	0.0003	0.0370	1.0000
Average	**-**	***0.9755***	***0.0016***	***0.0023***	***0.0207***	***1.0000***

Figure 6. **Adsorbed Gas Composition**

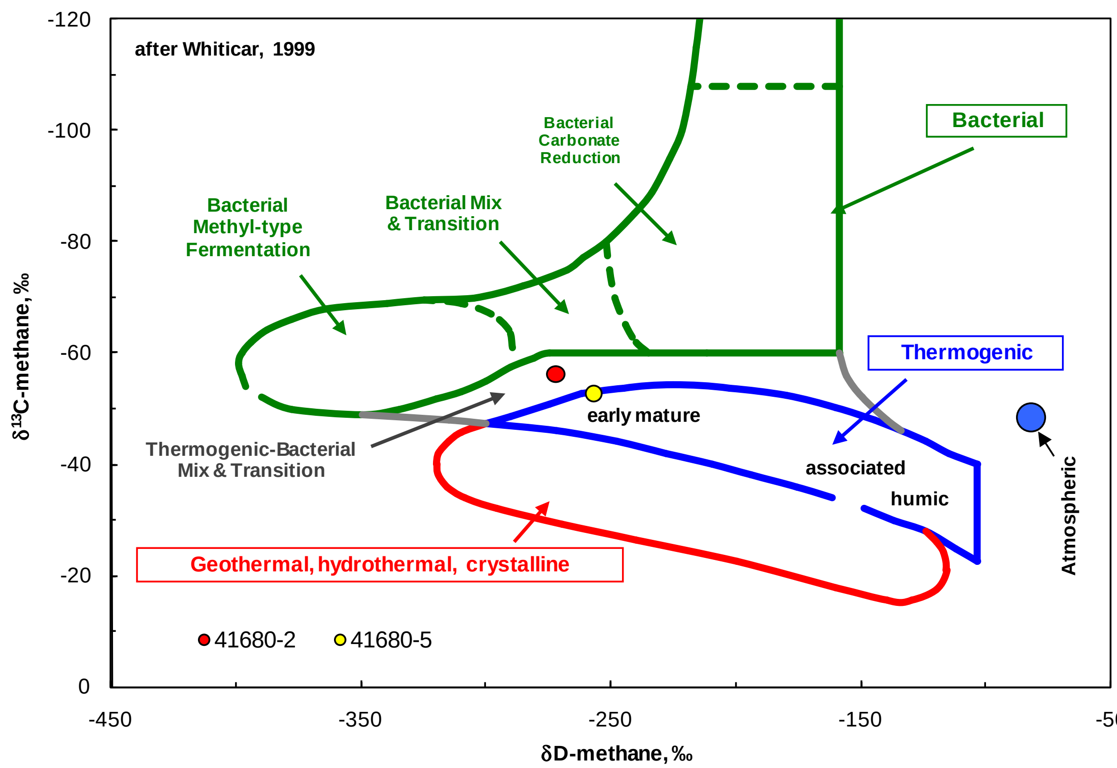


Data obtained from stable isotope analysis from the samples indicate the original gas was transitional biogenic-thermogenic. Results of isotopic analysis for the selected samples are listed in Table 8 and are illustrated by the red and yellow dots in Figure 7.

Table 8. Isotope Results

Parameter	Unit	41680-2	41680-5
Midpoint Depth	ft	229.5	274.0
Date/Time Sampled	mm/dd/yyyy hh:mm:ss	11/11/2008 17:38:00	11/11/2008 17:36:00
CO_2 Conc.	mol frac	0.0042	0.0065
C_1 Conc.	mol frac	0.9951	0.9930
C_2 Conc.	mol frac	0.0007	0.0005
C_3 Conc.	mol frac	0.0000	0.0000
iC_4 Conc.	mol frac	0.0000	0.0000
nC_4 Conc.	mol frac	0.0000	0.0000
iC_5 Conc.	mol frac	0.0000	0.0000
nC_5 Conc.	mol frac	0.0000	0.0000
C_{6+} Conc.	mol frac	0.0000	0.0000
Total	***mol frac***	***1.0000***	***1.0000***
$\delta^{13}C_1$	‰	-56.0	-52.5
δDC_1	‰	-272	-257

Figure 7. Natural Gas Classification (Carbon-Deuterium Stable Isotope Plot)



Sample Bulk Composition and Property Analysis Results

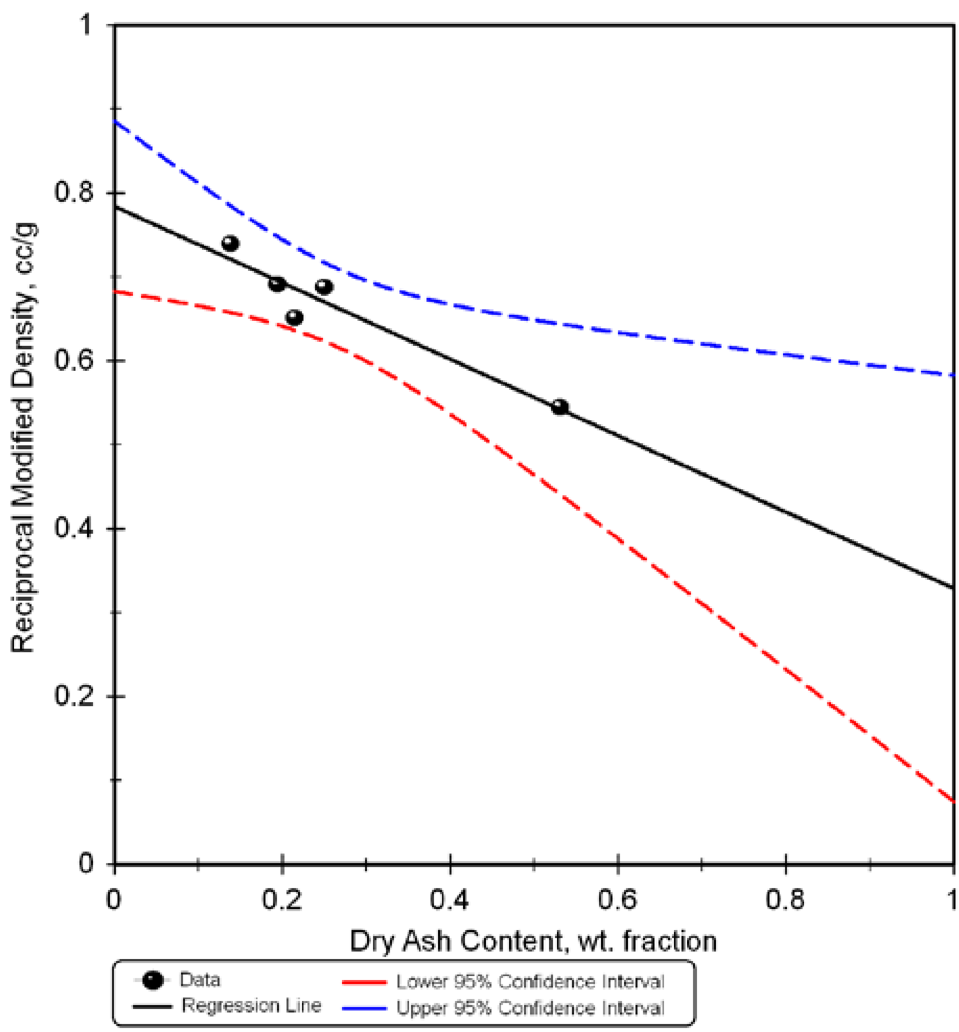
The crushed density, proximate analysis, total sulfur, sulfur in ash, gross calorific value, and petrography results for the selected core samples are discussed in the following sub-sections.

Crushed Density Results

Crushed density results are listed in Table 9. The density of coal varies as a function of its composition. Since the mineral matter component of the coal has a significantly higher density than the organic matter component, the density of coal varies as a function of its mineral matter content. The ash content of coal represents the mineral matter component of the coal. When total sulfur content is significant, the total mineral matter present is a function of the ash and sulfur content.

The average organic and inorganic (mineral matter) densities can often be estimated by linear regression of reciprocal density and ash content data.[4] Figure 8 illustrates the relationship between reciprocal modified density and dry ash content for the desorption samples. The relationship was statistically significant (squared correlation coefficient, 0.9126).

Figure 8. **Reciprocal Modified Density vs. Dry Ash Content**



The estimated organic density was 1.259 g/cm^3 and the estimated inorganic density was 3.041 g/cm^3.The organic density of coal in the sub-bituminous and bituminous rank range varies between 1.18 to 1.40 g/cm^3 and depends upon the maceral composition.

The inorganic density is often between the densities of moist montmorillonite (2.12 g/cm^3), moist kaolinite (2.42 g/cm^3), and that of quartz (2.65 g/cm^3). Occasionally, values are observed that approach 3 g/cm^3 due to the presence of carbonates and heavy minerals. The average inorganic density value of 3.041 g/cm^3 was higher than results observed in the past for San Juan Basin coal.

Table 9. Crushed Density Data

Sample ID	Top Depth	Bottom Depth	Air-Dry Helium Density	In-Situ Helium Density
	ft	ft	g/cm^3	g/cm^3
41680-1	227.8	228.8	1.433	1.435
41680-2	229.0	230.0	1.339	1.340
41680-3	270.5	271.5	1.518	1.503
41680-4	271.6	272.3	1.429	1.431
41680-5	273.5	274.5	1.751	1.744
Average	**-**	**-**	***1.494***	***1.491***

Chemical Characterization Results

Residual moisture, ash, and total sulfur analyses are used to convert data reported on an as-received mass basis to other mass bases such as dry; dry, ash-free; mineral-matter-free (moist or dry); and in-situ bases. It is useful to report data on the dry mass basis to review data without the effect of moisture. It is also useful to report data on the dry, ash-free mass basis to review analyses normalized to 100% organic material. Dry, ash-free values are used to compare gas content and gas storage capacity between different zones or wells since the adsorbed gas is stored predominantly by organic material (i.e., the macerals in coal). Table 10 summarizes the proximate analysis results, which include residual moisture, moisture holding capacity, ash, volatile matter, and fixed carbon results for the desorption samples on an air-dry basis. Complete proximate analysis was performed only on samples selected for isotherm analysis. In-situ proximate analysis results have also been provided in Table 11.

Table 10. Air-Dry Proximate Analysis Data

Sample ID	Top Depth	Bottom Depth	Moisture Holding Capacity	Air-Dry Moisture Content	Air-Dry Ash Content	Air-Dry Volatile Matter Content	Air-Dry Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac	wt frac
41680-1	227.8	228.8	0.0196	0.0209	0.2448	-	-
41680-2	229.0	230.0	0.0119	0.0131	0.1360	0.2746	0.5764
41680-3	270.5	271.5	0.0200	0.0103	0.2125	-	-
41680-4	271.6	272.3	0.0140	0.0153	0.1914	0.2512	0.5421
41680-5	273.5	274.5	0.0209	0.0175	0.5211	-	-
Average	**-**	**-**	***0.0173***	***0.0154***	***0.2612***	***0.2629***	***0.5592***

Table 11. In-Situ Proximate Analysis Data

Sample ID	Top Depth	Bottom Depth	In-Situ Moisture Content	In-Situ Ash Content	In-Situ Volatile Matter Content	In-Situ Fixed Carbon Content
	ft	ft	wt frac	wt frac	wt frac	wt frac
41680-1	227.8	228.8	0.0196	0.2451	-	-
41680-2	229.0	230.0	0.0119	0.1362	0.2749	0.5771
41680-3	270.5	271.5	0.0200	0.2104	-	-
41680-4	271.6	272.3	0.0140	0.1917	0.2515	0.5428
41680-5	273.5	274.5	0.0209	0.5192	-	-
Average	**-**	**-**	***0.0173***	***0.2605***	***0.2632***	***0.5599***

Ultimate analysis was not performed on these samples excluding sulfur content determination. Sulfur content both on a dry, ash-free and in-situ basis are included in Table 12.

Table 12. Sulfur Content Data

Sample ID	Top Depth	Bottom Depth	Dry, Ash-Free Sulfur Content	In-Situ Sulfur Content
	ft	ft	wt frac	wt frac
41680-1	227.8	228.8	0.0073	0.0053
41680-2	229.0	230.0	0.0082	0.0070
41680-3	270.5	271.5	0.0076	0.0058
41680-4	271.6	272.3	0.0088	0.0070
41680-5	273.5	274.5	0.0798	0.0367
Average	**-**	**-**	***0.0223***	***0.0124***

Gross calorific value, fixed carbon content, and volatile matter content were determined to estimate the coal rank (thermal maturity) for the isotherm sample. The procedure documented in ASTM D 388 was used to correct ash content for sulfur in ash, to convert fixed carbon and volatile matter to a dry, mineral matter free basis, and to convert calorific value to a moist, mineral-matter-free basis.[13] The moisture holding capacity data were used to convert dry basis data to a moist basis.

Table 13 summarizes the chemical characterization of the isotherm samples. Coal rank is best determined using calorific value data on a moist, mineral-matter-free basis when the dry, mineral-matter-free fixed carbon values are less than 0.69 weight fraction and the moist, mineral-matter-free calorific value is less than 14,000 BTU/lbm. This was not the case for the two isotherm samples. Vitrinite reflectance data provide more accurate results for coal rank classification.

Table 13. Chemical Characterization Data

Parameter	Unit	41680-2	41680-4
Top Depth	ft	229.0	271.6
Bottom Depth	ft	230.0	272.3
Moisture Holding Capacity, in-situ basis	wt frac	0.0119	0.0140
Residual Moisture, as-received basis	wt frac	0.0131	0.0153
Sulfur-in-Ash Content, in-situ basis	wt frac	0.0020	0.0014
Corrected Ash Content, in-situ basis	wt frac	0.1362	0.1917
Sulfur Content, in-situ basis	wt frac	0.0070	0.0070
Parr Corrected Volatile Matter Content, DMMF basis	wt frac	0.4368	0.4358
Parr Corrected Fixed Carbon Content, DMMF basis	wt frac	0.5632	0.5642
Parr Corrected Calorific Value, MMMF basis	BTU/lbm	15,633	15,461

Notes:
1. Moisture holding capacity determined by moisture equilibration at 86°F for 72 hr at 96-97% relative humidity.
2. Ash content corrected for sulfur-in-ash content.
3. DMMF = Dry, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.
4. MMMF = Moist, mineral-matter-free basis determined with sulfur corrections in accordance with ASTM D 388.

Petrographic Characterization Results

This section provides a summary of the petrographic analytical results. Figure 9 illustrates the maceral composition summarized in Table 14, which also includes mineral results. For coal ranks of medium volatile bituminous or greater, coal rank is best determined using vitrinite reflectance data. The mean-maximum vitrinite reflectance for sample 41680-2 was 1.02% in oil and for sample 41680-5 was 1.12% in oil placing the rank in the high volatile A bituminous range.

Figure 9. Mineral Matter-Free Basis Maceral Composition Summary

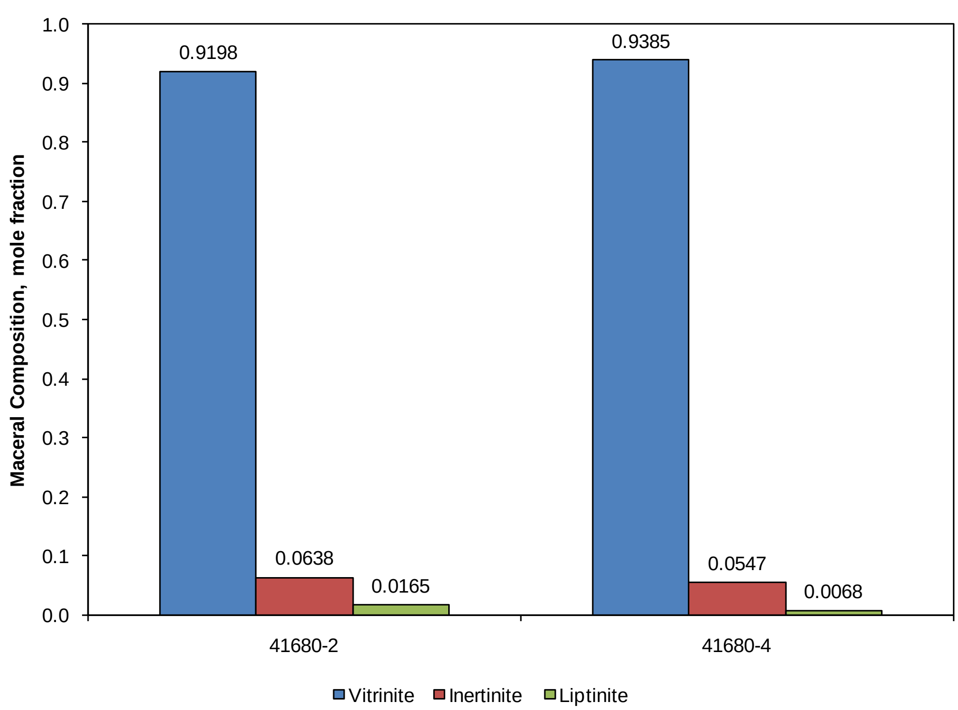


Table 14. **Petrographic Data**

Parameter	Unit	41680-2	41680-4
Vitrinite Group Macerals, Mineral-Matter Free Basis			
Telinite	vol frac	0.1461	0.1481
Collotelinite	vol frac	0.4259	0.5011
Vitrodetrinite	vol frac	0.2881	0.2210
Collodetrinite	vol frac	0.0000	0.0000
Corpogelinite	vol frac	0.0576	0.0638
Gelinite	vol frac	0.0021	0.0046
Total Vitrinite	***vol frac***	***0.9198***	***0.9385***
Inertinite Group Macerals, Mineral-Matter Free Basis			
Fusinite	vol frac	0.0350	0.0273
Semifusinite	vol frac	0.0144	0.0205
Micrinite	vol frac	0.0000	0.0000
Macrinite	vol frac	0.0082	0.0000
Secretinite	vol frac	0.0000	0.0000
Funginite	vol frac	0.0062	0.0046
Inertodetrinite	vol frac	0.0000	0.0023
Total Inertinite	***vol frac***	***0.0638***	***0.0547***
Liptinite Group Macerals, Mineral-Matter Free Basis			
Sporinite	vol frac	0.0021	0.0000
Cutinite	vol frac	0.0123	0.0068
Resinite	vol frac	0.0021	0.0000
Alginite	vol frac	0.0000	0.0000
Liptodetrinite	vol frac	0.0000	0.0000
Suberinite	vol frac	0.0000	0.0000
Exsudatinite	vol frac	0.0000	0.0000
Total Liptinite	***vol frac***	***0.0165***	***0.0068***
Mineral Composition, Maceral-Fee Basis			
Clay	vol frac	0.8571	0.9508
Quartz	vol frac	0.1429	0.0492
Carbonate	vol frac	0.0000	0.0000
Sulfide	vol frac	0.0000	0.0000
Total	***vol frac***	***1.0000***	***1.0000***
Vitrinite Reflectance			
Mean-Maximum Reflectance	% in oil	1.02	1.12
Standard Deviation	% in oil	0.03	0.05
Coal Rank based on Vitrinite Reflectance	-	high volatile A bituminous	

Adsorbed Gas Storage Capacity

Two methane isotherm measurements were performed by WFT Labs. The isotherm parameters and gas storage capacity estimates are summarized in Table 15. Figures 10 and 11 illustrate the methane storage capacity as a function of pressure on a dry, ash-free and in-situ basis, respectively.

Table 15. Coal Methane Adsorption Isotherm Parameters

Parameter	Unit	41680-2	41680-4
Sample Parameters			
Top Depth	ft	229.0	229.0
Bottom Depth	ft	271.6	271.6
Measurement Gas	-	methane	methane
Measurement Temperature	°F	60.08	60.08
Moisture Content, in-situ basis	wt frac	0.0119	0.0140
Ash Content, in-situ basis	wt frac	0.1362	0.1917
Sulfur Content, in-situ basis	wt frac	0.0070	0.0070
Organic Content, in-situ basis	wt frac	0.8450	0.7873
Vitrinite Content, mineral-matter-free basis	vol frac	0.920	0.939
Inertinite Content, mineral-matter-free basis	vol frac	0.064	0.055
Liptinite Content, mineral matter-free basis	vol frac	0.017	0.007
Calorific Value, moist, mineral-matter-free basis	BTU/lbm	15,587	15,349
Langmuir Parameters			
Langmuir Storage Capacity, dry, ash-free	scf/ton	643.40	643.89
Langmuir Storage Capacity, in-situ	scf/ton	543.66	506.96
Langmuir Pressure	psia	125.97	112.00
Adsorbed Gas Storage Capacity			
Reservoir Pressure	psia	114.07	132.45
Storage Capacity, dry, ash-free	scf/ton	305.75	348.88
Storage Capacity, in-situ	scf/ton	258.36	274.69

For sample 41680-2, the dry, ash-free Langmuir storage capacity was 643.4 scf/ton, the in-situ Langmuir storage capacity was 543.7 scf/ton, and the Langmuir pressure was 126.0 psia. At a reservoir pressure of 114.1 psia, the in-situ storage capacity was 258.4 scf/ton.

For sample 41680-4, the dry, ash-free Langmuir storage capacity was 643.9 scf/ton, the in-situ Langmuir storage capacity was 507.0 scf/ton, and the Langmuir pressure was 112.0 psia. At a reservoir pressure of 132.4 psia, the in-situ storage capacity was 274.7 scf/ton.

Figure 10. **Dry, Ash-Free Methane Isotherms**

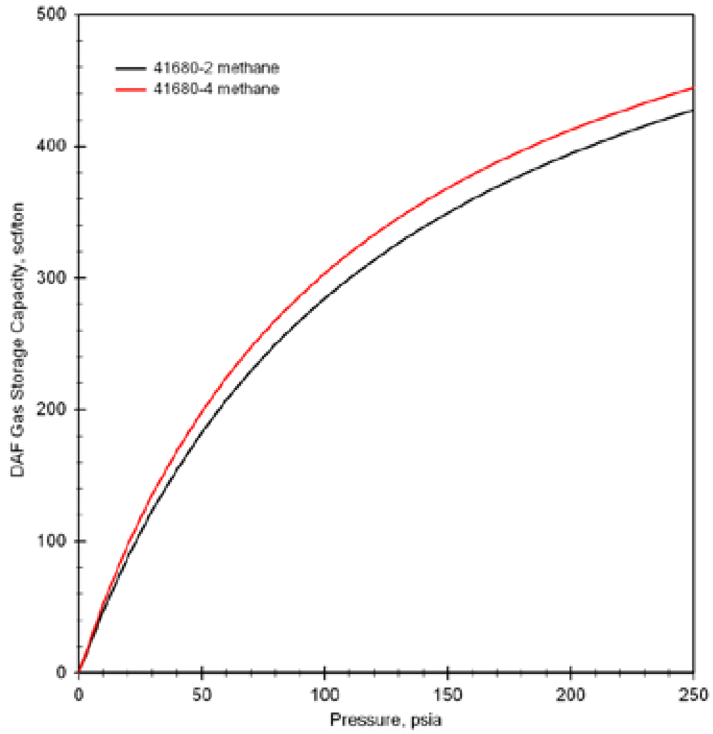
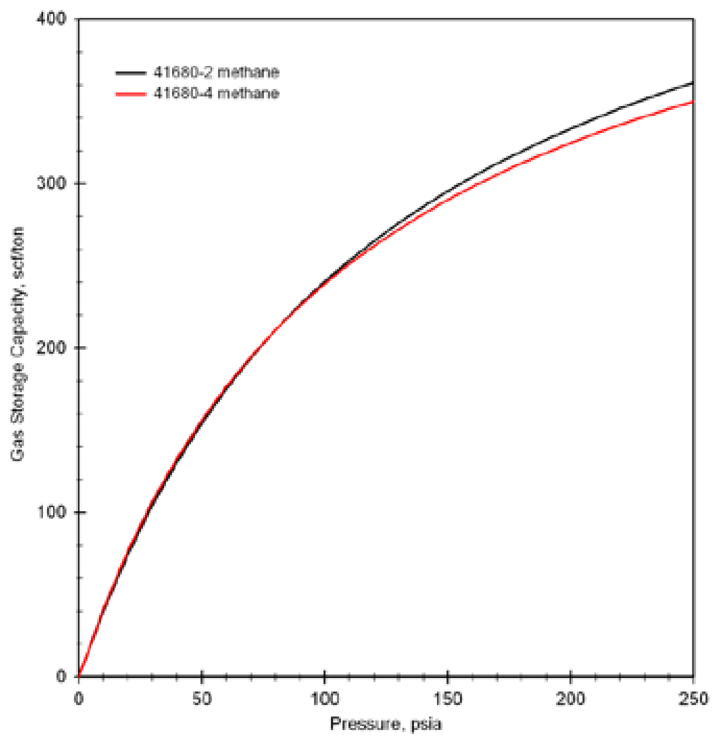


Figure 11. **In-Situ Methane Isotherms**



Often there is a relationship between methane storage capacity and inorganic content at reservoir pressure. Figure 12 illustrates this relationship listed in Equation 7 at a reservoir pressure of 118.6 psia.

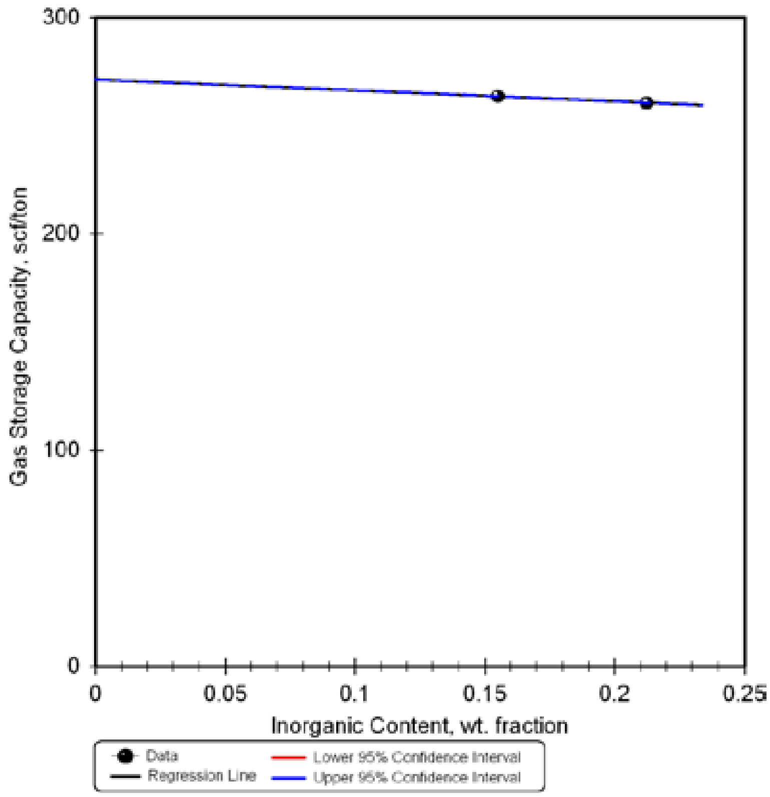
Extrapolation to zero inorganic content suggested the dry, ash-free storage capacity was 271.5 scf/ton. The average dry, ash-free gas content determined from the desorption samples was 208.9 scf/ton. Both values were larger than the dry, ash-free gas content of 175.1 scf/ton determined from Equation 6 discussed earlier and indicated that the reservoir was undersaturated. This difference may be due to underestimation of the reservoir temperature, an overestimation of reservoir pressure, or differences in maceral composition and thermal maturities between the samples.

$$G_s = 271.5 - 50.39(w_a + w_w + w_s) \quad (7)$$

where:

G_s	*gas storage capacity, scf/ton*
w_a	*ash content, weight fraction*
w_w	*moisture content, weight fraction*
w_s	*sulfur content, weight fraction*

Figure 12. **Methane Storage Capacity vs. Inorganic Content**



If the reservoir pressure gradient of 0.42 psi/ft is correct, then the dry, ash-free gas content of 175.1 scf/ton is only 64.5% of the dry, ash-free gas storage capacity.

The corresponding critical desorption pressure (the pressure at which gas would be released from adsorption) is 44.4 psia. This estimate is independent of the reservoir pressure estimate. Unless the reservoir pressure is equal to the critical desorption pressure (corresponding to a reservoir pressure gradient of approximately 0.129 psi/ft, which is unlikely), the reservoir is undersaturated, which will hinder gas production.

Adsorbed Gas-in-Place Estimate

Adsorbed gas-in-place (GIP) volume was determined for a unit coal thickness based upon the gas content and density data. Gas-in-place per unit thickness volumes were computed with Equation 8.[4]

$$\frac{G}{Ah} = 1.3597 \rho G_c \qquad (8)$$

where:

G	*gas-in-place volume, Mscf*
A	*reservoir area, acres*
h	*reservoir thickness, ft*
ρ	*average in-situ density, g/cm*^{3}
G_c	*average in-situ gas content, scf/ton*

The in-situ density and gas content values from the five desorbed core the samples were used for these estimates. Estimated GIP values per unit volume were reported in thousands of cubic feet at standard conditions per unit reservoir volume in acre-feet. These estimates are summarized in Table 16. This table can be used with coal thickness estimates from log data and assumed drainage areas to compute the volume of gas-in-place in an area of interest.

Table 16. Gas-in-Place per Unit Volume Summary

Seam	Top Depth	Bottom Depth	In-Situ Density	In-Situ Gas Content	Gas-In-Place per Volume
	ft	ft	g/cm^3	scf/ton	Mscf/acre-ft
Fruitland Coal	227.0	291.0	1.491	143.9	291.7

Final Summary

Weatherford Laboratories measured properties of five core samples recovered from Fruitland Coals penetrated by Souder, Miller & Associate's Hwy 151 34-4-39 MW #1 well on November 10, 2008. Core was collected between 227 and 291 ft. The goal of this project was to evaluate the sorbed gas content, gas storage capacity, coal properties, and gas-in-place of the Fruitland Coal at the well location.

Five core samples were desorbed to determine total gas content (lost plus measured plus crushed gas content) estimates. Three desorption samples were dedicated to collection of multiple gas composition and two desorption samples were dedicated to collection of isotopic samples throughout the desorption history. Density, moisture, and sulfur analyses were performed on all core samples. Coal characterization was determined for two desorption samples, which included chemical (proximate analysis, sulfur content, sulfur-in-ash content, and heating value) and petrological analyses (vitrinite reflectance and maceral composition). These two desorption samples were also used for two methane adsorption isotherm measurements to determine methane storage capacity versus pressure at constant temperature.

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Appendix I

Souder, Miller & Associates
Highway 151 34-4-39 MW #1
Fruitland Coal

Core Lithology and Photography

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LABORATORIES

Core Lithology

Client Name: Souder, Miller & Associates **Well Name:** Highway 151 34-4-39 MW #1 **Job Number:** 41680

SAMPLE ID.	CANISTER ID.	SAMPLE INTERVAL			DESCRIPTION	
		Depth Drilled (feet)	Length (inches)	Core Diameter (inches)	Core Surface Texture	Comments
41680-1	GTI-027	227.8-228.8	12.0?	3.40	(coaly) rough	Black shaly banded coal - 50% fibrous and 50% bright, partial rubble, no distinct cleats or fractures, well mixed sediments and discreet shaly layers
41680-2	GTI-019	229.0-230.0	11.50	3.40	(coaly) rough	Black shaly banded coal - 50% dull and 50% bright, competent, moderate to poorly developed cleats, no fractures, well mixed sediments
41680-3	GTI-115	270.5-271.5	11.5?	3.50	(coaly) rough	Black banded shaly coal - approximately 50% dull and 50% bright, semi-competent - parts along poorly developed cleats, no obvious fractures, few possible layers of sediment
41680-4	GTI-028	271.6-272.3	12.0?	3.5?	(coaly) rough	Interbedded bright and dull coal, a few larger competent pieces but mostly 1cm sized rubble, possible cleats, no observed fractures, heavy - possible well mixed sediments, picture is representative of rubble
41680-5	GTI-048	273.5-274.5	12.0?	3.5?	(coaly) rough	Black shaly coal to carbonaceous shale, mostly rubble with a few larger competent pieces, possible two sets of vertical cleats, signs of internal shearing

Lithologist(s): D. Rogers

Core Photography

Souder, Miller & Associates

Highway 151 34-4-39 MW #1

Fruitland Coal	**41680-1**	**227.8-228.8 feet**

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Core Photography

Souder, Miller & Associates

Highway 151 34-4-39 MW #1

Fruitland Coal	41680-2	229.0-230.0 feet

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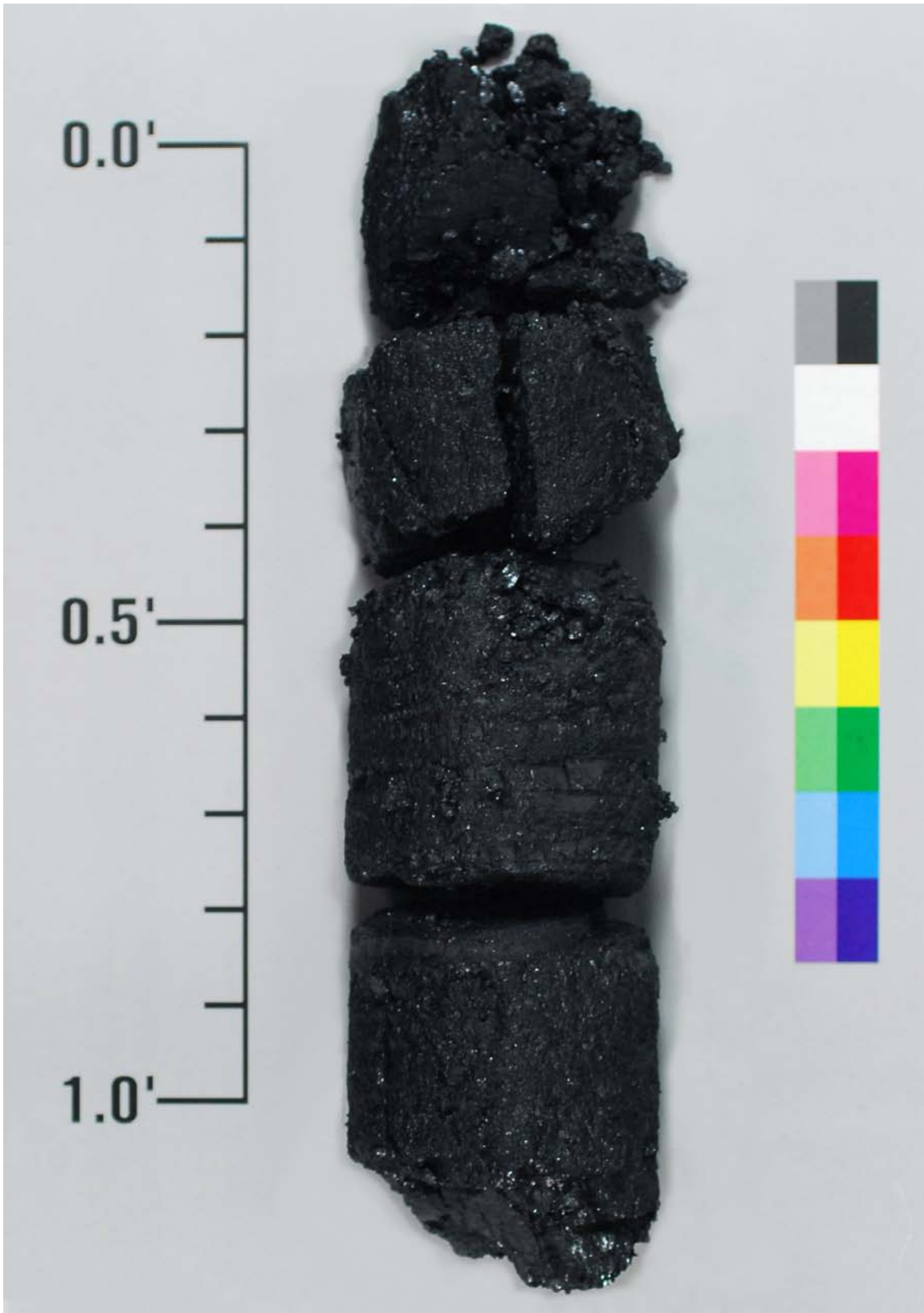
Core Photography

Souder, Miller & Associates

Highway 151 34-4-39 MW #1



Fruitland Coal	41680-3	270.5-271.5 feet

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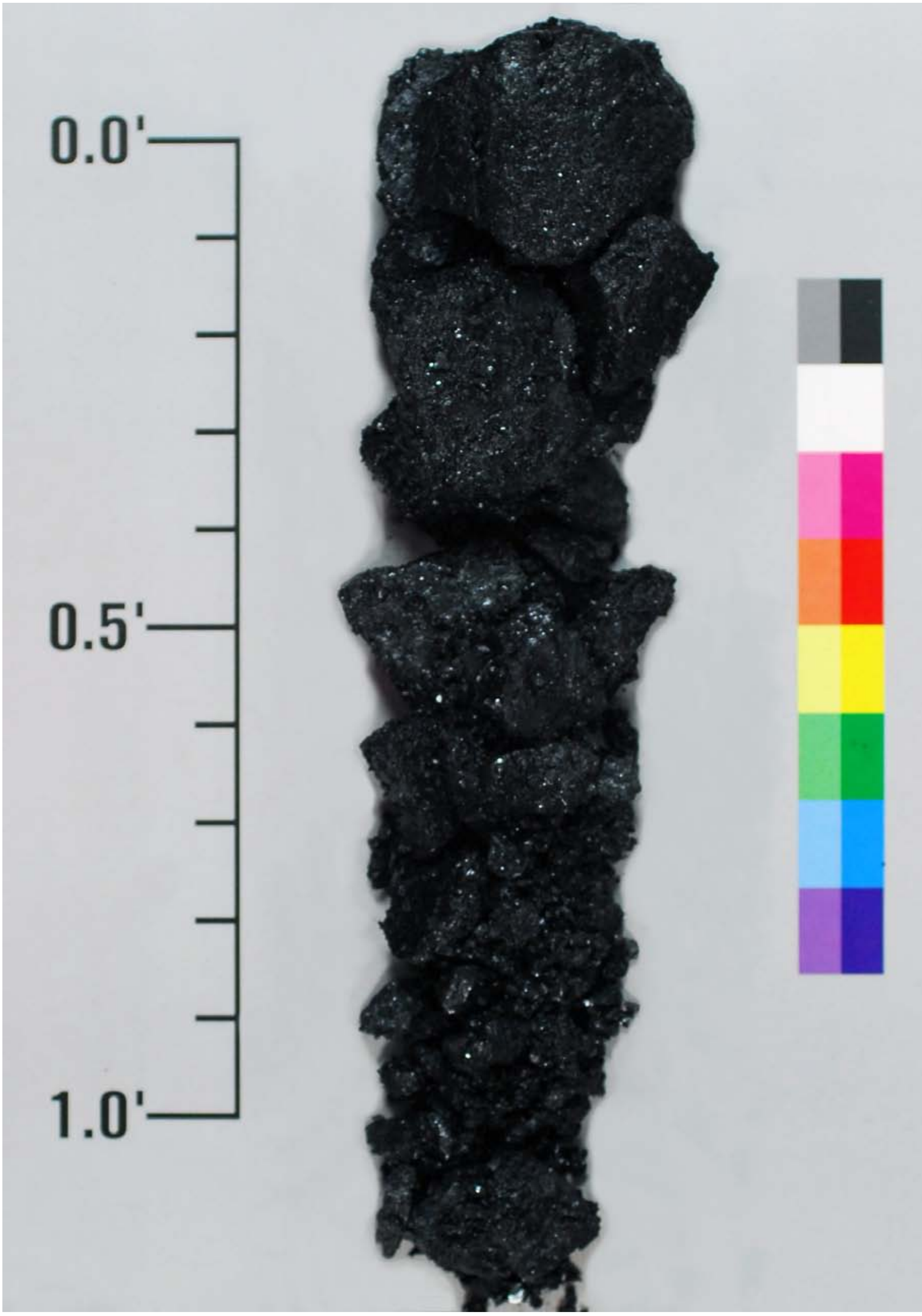
Core Photography

Souder, Miller & Associates

Highway 151 34-4-39 MW #1



Fruitland Coal	41680-4	271.6-272.3 feet

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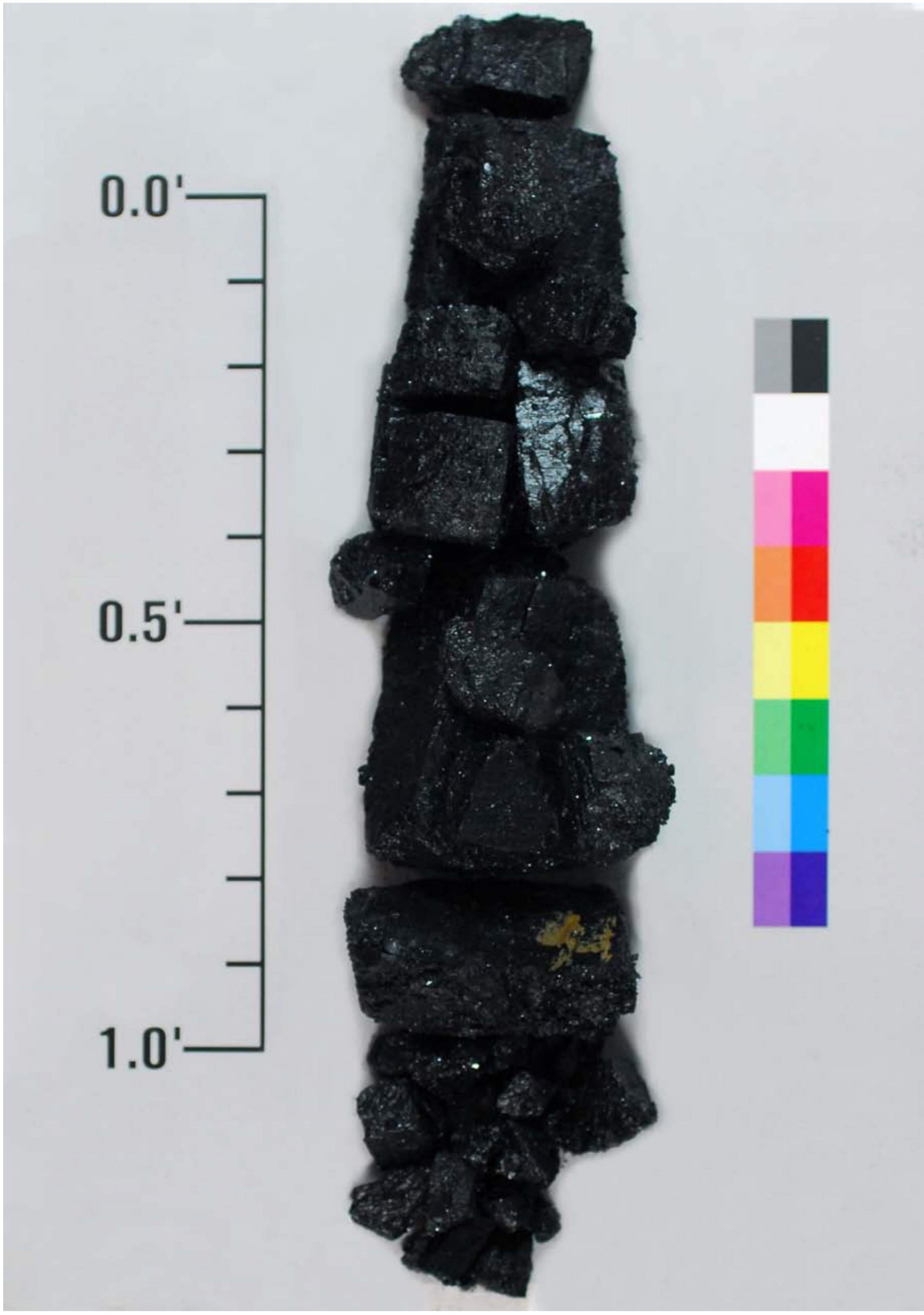
Core Photography

Souder, Miller & Associates

Highway 151 34-4-39 MW #1



Fruitland Coal	41680-5	273.5-274.5 feet

Appendix II

Souder, Miller & Associates
Highway 151 34-4-39 MW #1
Fruitland Coal

Desorption Data and Graphs

Weatherford
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Sample 41680-1 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	227.80
Sample Bottom Depth	ft	228.80
Reservoir Pressure	psia	110.58
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	115.50
Mud Density	lbm/gal	8.50
Sample Mass	g	2,093.0
Sample Headspace Volume	cm^3	800.0
Date Time Sample Cored		11/10/2008 11:30:56
Date Time Sample Start Out of Well		11/10/2008 11:53:25
Date Time Desorption Time Zero		11/10/2008 11:54:53
Date Time Sample at Surface		11/10/2008 12:23:37
Date Time Sample Canister Sealed		11/10/2008 13:19:55
Lost Gas Time	hours	1.417
Desorption Time Correction	hours	0.034
Fit Start Time	hours	1.426
Fit End Time	hours	1.653
Fit Start Time	hours*0.5	1.194
Fit End Time	hours*0.5	1.286
Lost Gas Content	scf/ton	5.1
Measured Gas Content	scf/ton	35.9
Crushed Gas Content	scf/ton	48.5
Total Gas Content	scf/ton	89.6
Lost Gas Fraction	vol frac	0.0567
Measured Gas Fraction	vol frac	0.4014
Crushed Gas Fraction	vol frac	0.5419
Diffusivity	1/us	0.1
Sorption Time	hours	335.0

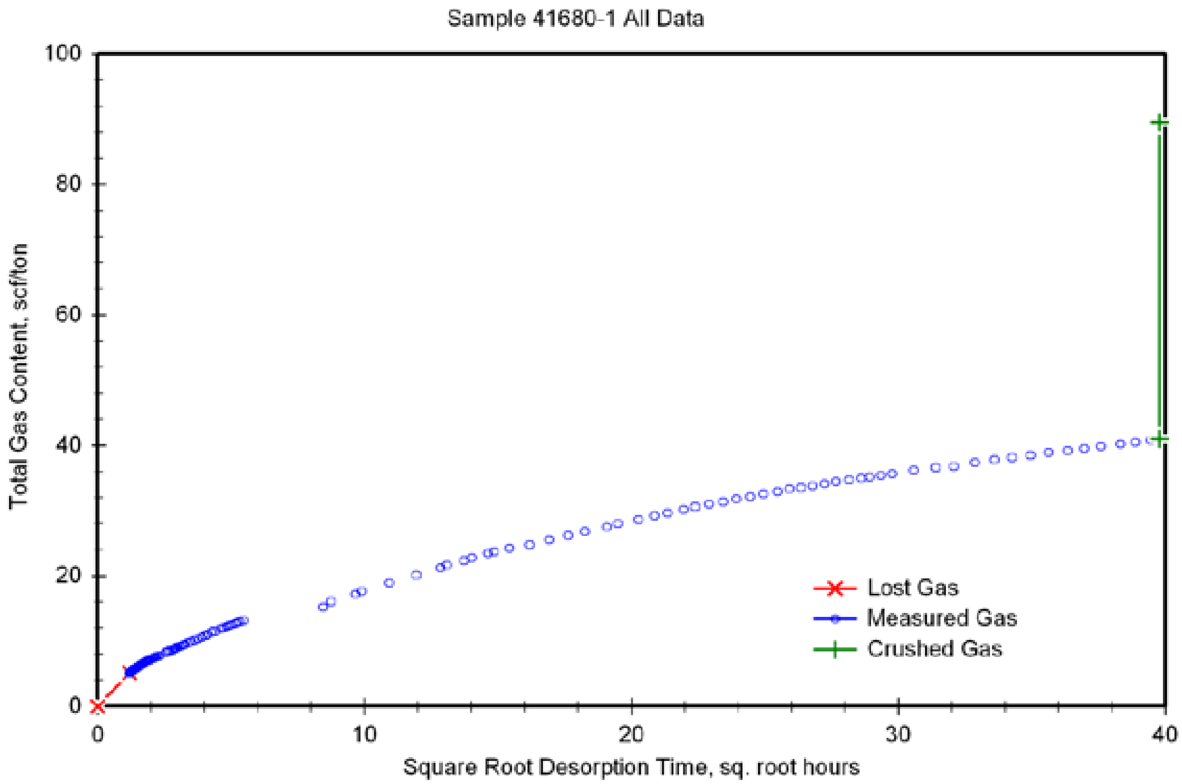
Sample 41680-1 Desorption History

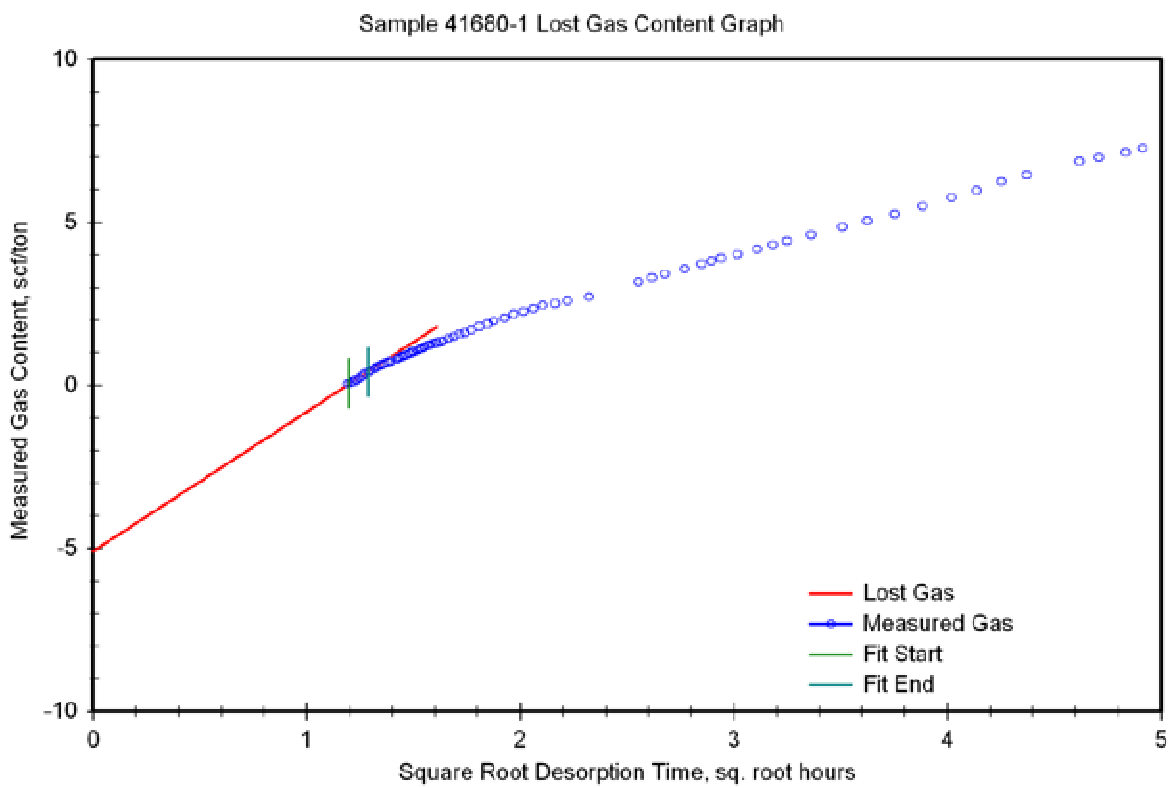
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Ambient Temp.	Canister Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
11/10/2008 13:19:55	1.4172	1.1905	0.0	0.0	57.7	55.2	11.55	0.00
11/10/2008 13:21:59	1.4171	1.1904	5.0	4.0	57.7	55.2	11.55	0.06
11/10/2008 13:24:00	1.4507	1.2045	6.0	1.2	60.6	55.2	11.55	0.08
11/10/2008 13:26:00	1.4840	1.2182	6.0	3.4	61.7	55.2	11.55	0.13
11/10/2008 13:28:00	1.5174	1.2318	5.0	3.1	62.4	54.9	11.55	0.18
11/10/2008 13:30:00	1.5507	1.2453	5.0	3.5	62.8	54.7	11.55	0.23
11/10/2008 13:31:59	1.5838	1.2585	6.0	4.8	62.6	54.7	11.55	0.31
11/10/2008 13:34:00	1.6174	1.2718	5.0	4.0	62.4	54.5	11.55	0.37
11/10/2008 13:37:00	1.6674	1.2913	5.0	4.0	62.4	54.3	11.56	0.43
11/10/2008 13:38:00	1.6840	1.2977	5.0	3.2	62.8	54.1	11.55	0.48
11/10/2008 13:41:00	1.7340	1.3168	4.0	3.2	63.0	54.1	11.56	0.53
11/10/2008 13:43:00	1.7674	1.3294	4.0	3.2	62.4	54.1	11.55	0.58
11/10/2008 13:45:00	1.8007	1.3419	3.0	2.4	62.6	53.8	11.56	0.61
11/10/2008 13:47:00	1.8340	1.3543	3.0	2.4	62.4	53.8	11.55	0.65
11/10/2008 13:49:00	1.8674	1.3665	3.0	2.2	62.8	53.8	11.56	0.68
11/10/2008 13:50:59	1.9004	1.3786	3.0	2.4	62.8	53.8	11.56	0.72
11/10/2008 13:53:00	1.9340	1.3907	3.0	2.4	62.8	53.6	11.56	0.75
11/10/2008 13:57:59	2.0171	1.4202	5.0	4.0	62.4	53.4	11.56	0.82
11/10/2008 14:00:00	2.0507	1.4320	3.0	1.9	62.8	53.4	11.56	0.84
11/10/2008 14:02:00	2.0840	1.4436	3.0	2.4	62.6	53.4	11.56	0.88
11/10/2008 14:04:00	2.1174	1.4551	3.0	2.4	62.6	53.4	11.56	0.92
11/10/2008 14:06:00	2.1507	1.4665	2.0	1.6	62.6	53.8	11.56	0.94
11/10/2008 14:08:00	2.1840	1.4778	3.0	2.4	62.6	54.3	11.56	0.98
11/10/2008 14:10:00	2.2174	1.4891	3.0	2.4	62.6	54.9	11.56	1.01
11/10/2008 14:12:00	2.2507	1.5002	3.0	2.4	62.6	55.6	11.56	1.05
11/10/2008 14:15:00	2.3007	1.5168	3.0	2.1	62.6	55.6	11.56	1.08
11/10/2008 14:16:59	2.3338	1.5277	3.0	2.4	62.6	55.6	11.56	1.12
11/10/2008 14:19:00	2.3674	1.5386	2.0	1.6	62.6	55.6	11.56	1.14
11/10/2008 14:21:00	2.4007	1.5494	2.0	1.6	62.6	55.4	11.56	1.17
11/10/2008 14:23:59	2.4504	1.5654	4.0	3.2	62.6	54.9	11.56	1.22
11/10/2008 14:26:00	2.4840	1.5761	2.0	1.6	62.6	53.8	11.56	1.24
11/10/2008 14:29:00	2.5340	1.5919	3.0	2.4	62.4	53.6	11.56	1.28
11/10/2008 14:32:00	2.5840	1.6075	3.0	2.4	62.4	53.4	11.56	1.31
11/10/2008 14:35:00	2.6340	1.6230	3.0	2.4	62.4	53.4	11.56	1.35
11/10/2008 14:38:00	2.6840	1.6383	3.0	2.4	62.2	53.2	11.56	1.39
11/10/2008 14:42:59	2.7671	1.6635	5.0	4.0	62.2	53.1	11.56	1.45

11/10/2008 14:48:00	2.8507	1.6884	5.0	4.0	62.2	53.1	11.56	1.51
11/10/2008 14:53:00	2.9340	1.7129	5.0	4.0	62.2	53.1	11.56	1.57
11/10/2008 14:58:00	3.0174	1.7371	5.0	4.0	62.1	53.1	11.56	1.63
11/10/2008 15:04:59	3.1338	1.7702	7.0	5.6	62.0	53.8	11.57	1.72
11/10/2008 15:13:00	3.2674	1.8076	8.0	6.4	61.9	55.6	11.57	1.81
11/10/2008 15:20:59	3.4004	1.8440	7.0	5.5	61.9	57.9	11.57	1.90
11/10/2008 15:27:59	3.5171	1.8754	7.0	5.2	61.9	59.7	11.57	1.98
11/10/2008 15:39:00	3.7007	1.9237	7.0	5.5	61.9	61.0	11.57	2.06
11/10/2008 15:49:00	3.8674	1.9666	10.0	7.8	61.9	63.0	11.57	2.18
11/10/2008 16:00:00	4.0507	2.0126	7.0	5.5	61.9	64.4	11.57	2.27
11/10/2008 16:11:00	4.2340	2.0577	8.0	6.2	62.0	66.2	11.58	2.36
11/10/2008 16:21:59	4.4171	2.1017	8.0	6.2	59.4	66.2	11.58	2.46
11/10/2008 16:37:00	4.6674	2.1604	5.0	3.9	59.2	61.5	11.58	2.52
11/10/2008 16:53:00	4.9340	2.2213	7.0	5.5	59.2	60.8	11.58	2.60
11/10/2008 17:19:59	5.3838	2.3203	10.0	7.9	58.3	56.3	11.58	2.72
11/10/2008 18:27:00	6.5007	2.5496	40.0	29.9	60.6	50.0	11.59	3.18
11/10/2008 18:46:59	6.8338	2.6141	10.0	8.0	60.6	50.4	11.59	3.30
11/10/2008 19:07:00	7.1674	2.6772	10.0	8.0	60.6	54.9	11.60	3.43
11/10/2008 19:37:00	7.6674	2.7690	12.0	9.5	60.6	56.1	11.60	3.57
11/10/2008 20:03:00	8.1007	2.8462	14.0	11.1	60.4	58.8	11.60	3.74
11/10/2008 20:19:59	8.3838	2.8955	6.0	4.7	60.4	61.0	11.61	3.81
11/10/2008 20:35:00	8.6340	2.9384	7.0	5.5	60.4	62.4	11.61	3.90
11/10/2008 21:01:59	9.0838	3.0139	10.0	7.8	60.4	63.9	11.61	4.02
11/10/2008 21:36:00	9.6507	3.1066	14.0	11.0	60.6	64.8	11.62	4.19
11/10/2008 22:04:00	10.1174	3.1808	11.0	8.6	60.6	65.1	11.62	4.32
11/10/2008 22:30:00	10.5507	3.2482	10.0	7.8	60.6	66.4	11.62	4.44
11/10/2008 23:15:00	11.3007	3.3617	17.0	13.0	60.8	67.5	11.62	4.64
11/11/2008 00:14:00	12.2840	3.5049	19.0	14.8	60.8	67.1	11.63	4.86
11/11/2008 01:05:00	13.1340	3.6241	17.0	13.0	60.8	66.2	11.63	5.06
11/11/2008 02:01:00	14.0674	3.7506	17.0	13.3	60.8	65.3	11.63	5.27
11/11/2008 03:01:00	15.0674	3.8817	20.0	15.5	60.8	69.6	11.63	5.51
11/11/2008 04:05:59	16.1504	4.0188	24.0	18.0	61.5	70.9	11.63	5.78
11/11/2008 05:03:00	17.1007	4.1353	18.0	13.9	61.7	71.6	11.64	5.99
11/11/2008 06:01:59	18.0838	4.2525	22.0	16.8	62.1	72.0	11.64	6.25
11/11/2008 07:02:59	19.1004	4.3704	19.0	14.7	62.2	72.7	11.65	6.48
11/11/2008 09:16:00	21.3174	4.6171	33.0	26.4	61.9	55.9	11.66	6.88
11/11/2008 10:07:00	22.1674	4.7082	10.0	8.1	60.8	50.2	11.66	7.00
11/11/2008 11:19:59	23.3838	4.8357	13.0	10.4	59.4	53.1	11.65	7.16
11/11/2008 12:06:00	24.1507	4.9143	10.0	8.0	59.0	52.2	11.65	7.29
11/11/2008 13:05:00	25.1340	5.0134	11.0	8.5	58.8	54.3	11.64	7.42
11/11/2008 14:19:00	26.3674	5.1349	18.0	12.2	60.1	57.9	11.63	7.60

11/11/2008 15:04:59	27.1338	5.2090	12.0	9.6	59.7	56.7	11.64	7.75
11/11/2008 16:02:00	28.0840	5.2994	17.0	13.7	59.0	49.6	11.64	7.96
11/11/2008 17:40:00	29.7174	5.4514	10.0	8.1	58.1	48.2	11.65	8.09
11/13/2008 11:12:00	71.2507	8.4410	170.0	132.9	59.9	59.9	11.66	10.12
11/13/2008 16:34:59	76.6338	8.7541	74.0	58.4	59.9	59.9	11.65	11.01
11/14/2008 09:07:00	93.1674	9.6523	90.0	72.7	59.9	59.9	11.87	12.13
11/14/2008 13:59:00	98.0340	9.9012	42.0	32.8	60.6	72.1	11.88	12.63
11/15/2008 11:14:00	119.2840	10.9217	99.0	79.9	61.3	61.2	11.90	13.85
11/16/2008 10:10:00	142.2174	11.9255	101.0	80.3	61.0	65.8	11.88	15.08
11/17/2008 08:34:00	164.6174	12.8303	89.0	70.5	61.0	73.4	11.94	16.16
11/17/2008 15:12:00	171.2507	13.0863	37.0	27.7	61.9	71.6	11.93	16.58
11/18/2008 08:19:59	188.3838	13.7253	63.0	49.9	61.2	73.0	11.92	17.35
11/18/2008 16:18:00	196.3507	14.0125	37.0	23.5	63.7	76.2	11.88	17.71
11/19/2008 09:49:59	213.8838	14.6248	57.0	46.0	63.0	60.3	11.87	18.41
11/19/2008 16:05:00	220.1340	14.8369	22.0	17.1	62.2	78.2	11.86	18.67
11/20/2008 09:27:59	237.5171	15.4116	40.0	32.2	60.3	67.6	12.01	19.17
11/21/2008 09:10:00	261.2174	16.1622	60.0	35.8	59.9	59.9	11.78	19.71
11/22/2008 09:46:59	285.8338	16.9066	62.0	48.5	61.0	74.6	11.82	20.46
11/23/2008 10:46:00	310.8174	17.6300	58.0	45.2	59.9	75.3	11.80	21.15
11/24/2008 09:01:59	333.0838	18.2506	47.0	37.3	61.5	70.1	11.90	21.72
11/25/2008 15:52:00	363.9174	19.0766	66.0	48.4	60.8	73.4	11.82	22.46
11/26/2008 07:31:59	379.5838	19.4829	40.0	31.7	59.9	67.8	11.82	22.95
11/27/2008 14:27:00	410.5007	20.2608	57.0	44.4	59.9	66.7	11.80	23.63
11/28/2008 14:42:00	434.7507	20.8507	54.0	35.1	61.0	75.0	11.70	24.16
11/29/2008 11:45:00	455.8007	21.3495	41.0	31.6	60.4	77.9	11.72	24.65
11/30/2008 13:05:00	481.1340	21.9348	40.0	31.0	60.3	77.3	11.77	25.12
12/01/2008 09:16:00	501.3174	22.3901	35.0	25.1	62.1	67.8	11.77	25.51
12/02/2008 08:31:00	524.5674	22.9034	42.0	30.4	60.6	69.2	11.69	25.97
12/03/2008 09:03:00	549.1007	23.4329	31.0	24.5	59.7	68.7	11.82	26.35
12/04/2008 08:48:00	572.8507	23.9343	31.0	25.0	61.2	60.6	11.88	26.73
12/05/2008 08:54:00	596.9507	24.4326	40.0	24.0	61.5	71.2	11.75	27.10
12/06/2008 09:58:00	622.0174	24.9403	35.0	27.2	61.3	77.9	11.83	27.51
12/07/2008 12:42:00	648.7507	25.4706	42.0	25.7	62.1	75.2	11.72	27.91
12/08/2008 10:25:00	670.4674	25.8934	38.0	22.8	63.0	59.9	11.61	28.26
12/09/2008 09:40:00	693.7174	26.3385	18.0	14.1	61.3	74.1	11.85	28.47
12/10/2008 08:55:00	716.9674	26.7762	26.0	18.9	62.1	72.5	11.84	28.76
12/11/2008 09:29:00	741.5340	27.2311	28.0	22.1	60.8	71.9	11.84	29.10
12/12/2008 08:42:59	764.7671	27.6544	32.0	18.8	61.9	72.3	11.75	29.39
12/13/2008 12:46:00	792.8174	28.1570	50.0	20.0	62.6	73.9	11.44	29.70
12/14/2008 14:01:00	818.0674	28.6019	21.0	16.3	61.5	71.4	11.66	29.95
12/15/2008 08:51:59	836.9171	28.9295	13.0	10.3	60.4	68.7	11.78	30.10

12/16/2008 08:57:00	861.0007	29.3428	31.0	16.1	60.8	70.8	11.65	30.35
12/17/2008 09:40:00	885.7174	29.7610	23.0	18.0	61.0	70.5	11.73	30.62
12/19/2008 10:02:59	934.1004	30.5631	42.0	31.4	61.0	71.0	11.71	31.11
12/21/2008 13:34:59	985.6338	31.3948	36.0	28.1	61.7	76.8	11.83	31.53
12/23/2008 07:50:00	1027.8840	32.0606	37.0	13.2	61.3	76.8	11.54	31.74
12/25/2008 12:32:00	1080.5840	32.8722	56.0	41.2	63.3	71.6	11.55	32.37
12/27/2008 12:16:00	1128.3174	33.5904	34.0	26.6	62.1	66.7	11.65	32.77
12/29/2008 08:21:00	1172.4007	34.2403	25.0	19.7	61.5	72.8	11.84	33.08
12/31/2008 09:15:00	1221.3007	34.9471	35.0	23.7	61.7	76.8	11.78	33.44
01/02/2009 08:23:59	1268.4504	35.6153	44.0	27.3	61.3	73.7	11.65	33.86
01/04/2009 11:13:00	1319.2674	36.3217	25.0	20.1	61.2	60.0	11.83	34.16
01/06/2009 09:10:00	1365.2174	36.9488	40.0	19.8	61.3	73.5	11.63	34.47
01/08/2009 08:38:00	1412.6840	37.5857	31.0	24.7	61.7	60.4	11.72	34.85
01/10/2009 16:25:00	1468.4674	38.3206	27.0	21.2	61.5	73.7	11.84	35.17
01/12/2009 10:15:00	1510.3007	38.8626	21.0	16.6	63.1	73.5	11.91	35.42
01/14/2009 09:22:00	1557.4174	39.4641	29.0	22.2	60.6	72.1	11.84	35.76
01/15/2009 09:23:00	1581.4340	39.7672	15.0	11.8	61.9	74.1	11.90	35.94


Sample 41680-1 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
0
20
40
60
80
100
0
10
20
30
40
Lost Gas
Measured Gas
Crushed Gas


Sample 41680-1 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
-10
-5
0
5
10
0
1
2
3
4
5
Lost Gas
Measured Gas
Fit Start
Fit End

Sample 41680-2 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	229.00
Sample Bottom Depth	ft	230.00
Reservoir Pressure	psia	111.09
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	116.03
Mud Density	lbm/gal	8.50
Sample Mass	g	2,044.0
Sample Headspace Volume	cm^3	600.0
Date Time Sample Cored		11/10/2008 11:31:38
Date Time Sample Start Out of Well		11/10/2008 11:53:25
Date Time Desorption Time Zero		11/10/2008 11:54:53
Date Time Sample at Surface		11/10/2008 12:23:37
Date Time Sample Canister Sealed		11/10/2008 13:08:55
Lost Gas Time	hours	1.234
Desorption Time Correction	hours	0.035
Fit Start Time	hours	1.325
Fit End Time	hours	1.531
Fit Start Time	hours*0.5	1.151
Fit End Time	hours*0.5	1.237
Lost Gas Content	scf/ton	7.3
Measured Gas Content	scf/ton	57.2
Crushed Gas Content	scf/ton	51.4
Total Gas Content	scf/ton	115.9
Lost Gas Fraction	vol frac	0.0626
Measured Gas Fraction	vol frac	0.4938
Crushed Gas Fraction	vol frac	0.4436
Diffusivity	1/us	0.1
Sorption Time	hours	238.2

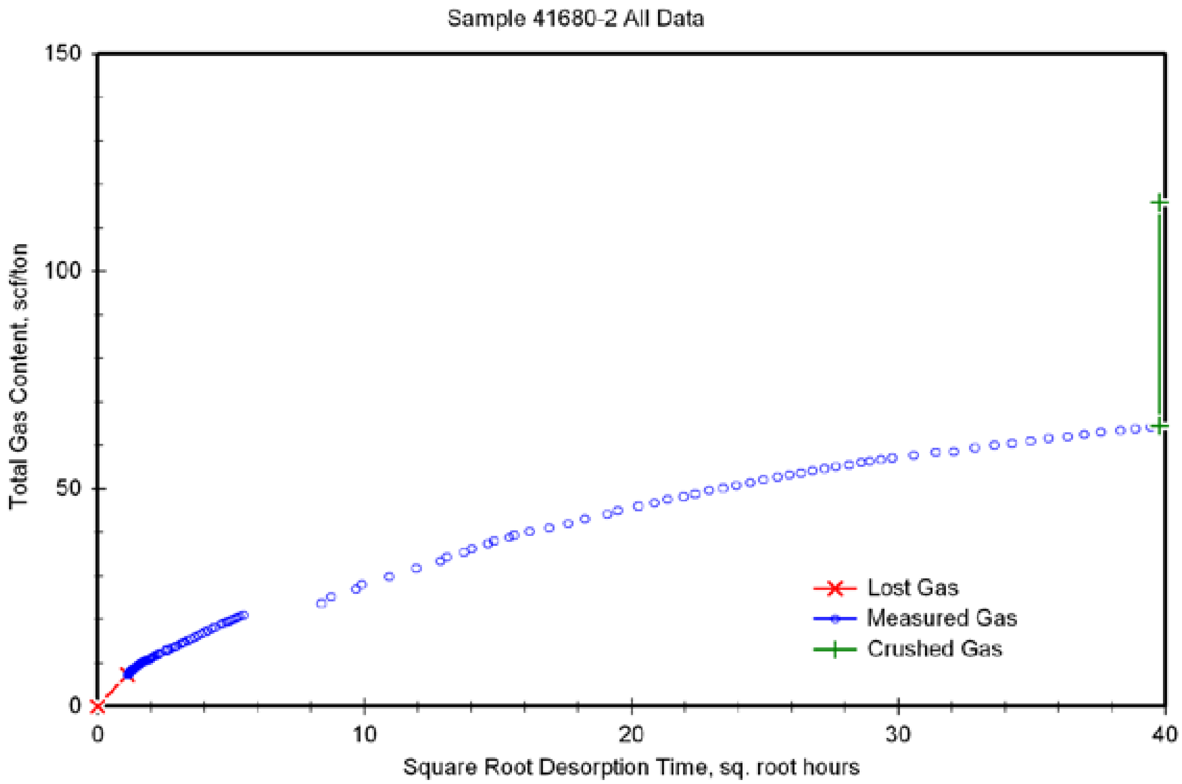
Sample 41680-2 Desorption History

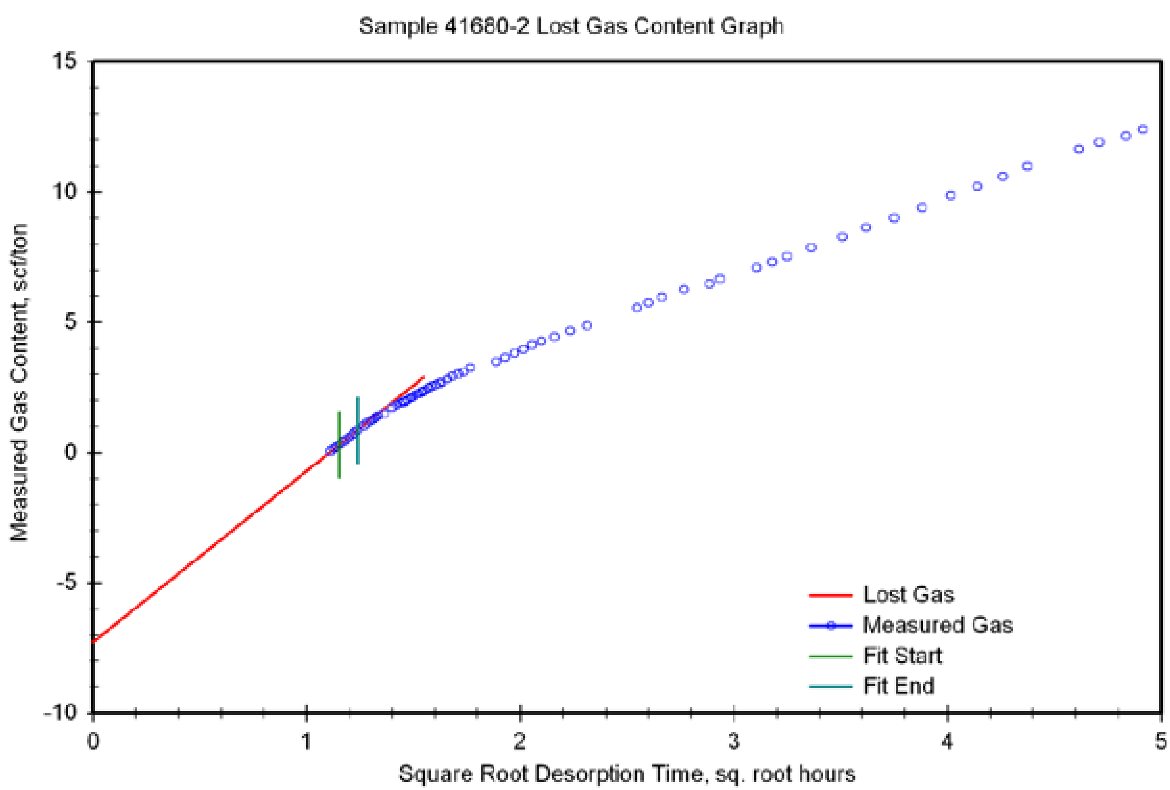
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Ambient Temp.	Canister Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
11/10/2008 13:08:55	1.2339	1.1108	0.0	0.0	57.0	56.1	11.55	0.00
11/10/2008 13:11:00	1.2338	1.1107	6.0	4.8	57.0	56.1	11.55	0.07
11/10/2008 13:12:59	1.2668	1.1255	10.0	5.8	59.5	55.9	11.56	0.17
11/10/2008 13:15:00	1.3004	1.1404	8.0	4.6	61.2	55.6	11.55	0.24
11/10/2008 13:17:00	1.3338	1.1549	8.0	5.1	62.6	55.6	11.55	0.32
11/10/2008 13:19:00	1.3671	1.1692	8.0	6.3	62.4	55.4	11.55	0.42
11/10/2008 13:21:00	1.4004	1.1834	8.0	6.3	62.4	55.4	11.56	0.52
11/10/2008 13:23:00	1.4338	1.1974	8.0	5.6	63.0	55.2	11.55	0.60
11/10/2008 13:25:00	1.4671	1.2112	7.0	5.6	63.0	55.2	11.55	0.69
11/10/2008 13:27:00	1.5004	1.2249	7.0	5.6	63.0	54.9	11.55	0.78
11/10/2008 13:29:00	1.5338	1.2385	7.0	5.6	63.0	54.9	11.55	0.87
11/10/2008 13:33:00	1.6004	1.2651	14.0	11.0	63.1	54.5	11.55	1.04
11/10/2008 13:34:59	1.6335	1.2781	7.0	5.6	63.0	54.5	11.55	1.13
11/10/2008 13:38:00	1.6838	1.2976	7.0	5.6	62.8	54.1	11.56	1.21
11/10/2008 13:40:00	1.7171	1.3104	6.0	4.4	63.0	54.1	11.55	1.28
11/10/2008 13:42:00	1.7504	1.3230	6.0	4.8	63.0	54.1	11.56	1.36
11/10/2008 13:44:00	1.7838	1.3356	5.0	4.0	63.0	54.0	11.56	1.42
11/10/2008 13:47:59	1.8501	1.3602	7.0	5.6	63.0	53.8	11.56	1.51
11/10/2008 13:54:00	1.9504	1.3966	18.0	14.3	63.0	53.6	11.56	1.73
11/10/2008 13:57:59	2.0168	1.4201	7.0	5.6	62.8	53.4	11.56	1.82
11/10/2008 14:01:00	2.0671	1.4377	5.0	4.0	62.8	53.4	11.56	1.88
11/10/2008 14:03:00	2.1004	1.4493	4.0	3.2	62.6	53.4	11.56	1.93
11/10/2008 14:04:59	2.1335	1.4606	4.0	3.2	62.6	53.4	11.56	1.98
11/10/2008 14:06:59	2.1668	1.4720	4.0	3.2	62.6	54.0	11.56	2.03
11/10/2008 14:09:00	2.2004	1.4834	5.0	4.0	62.6	54.7	11.56	2.09
11/10/2008 14:11:00	2.2338	1.4946	5.0	4.0	62.6	55.2	11.56	2.16
11/10/2008 14:14:00	2.2838	1.5112	6.0	4.6	62.6	55.6	11.56	2.23
11/10/2008 14:16:00	2.3171	1.5222	3.0	2.2	62.8	55.6	11.56	2.26
11/10/2008 14:18:00	2.3504	1.5331	4.0	3.2	62.6	55.6	11.56	2.31
11/10/2008 14:19:59	2.3835	1.5439	4.0	3.2	62.6	55.6	11.56	2.36
11/10/2008 14:22:00	2.4171	1.5547	4.0	3.2	62.6	55.2	11.56	2.41
11/10/2008 14:25:00	2.4671	1.5707	6.0	4.8	62.8	54.5	11.56	2.49
11/10/2008 14:28:00	2.5171	1.5865	5.0	4.0	62.6	53.6	11.56	2.55
11/10/2008 14:31:00	2.5671	1.6022	5.0	4.0	62.4	53.6	11.56	2.61
11/10/2008 14:34:00	2.6171	1.6177	5.0	4.0	62.4	53.4	11.56	2.67
11/10/2008 14:37:00	2.6671	1.6331	5.0	4.0	62.4	53.2	11.56	2.73

11/10/2008 14:42:00	2.7504	1.6584	8.0	6.4	62.2	53.1	11.56	2.83
11/10/2008 14:47:00	2.8338	1.6834	8.0	6.4	62.2	53.1	11.56	2.93
11/10/2008 14:51:59	2.9168	1.7079	7.0	5.6	62.2	53.1	11.56	3.02
11/10/2008 14:57:00	3.0004	1.7322	8.0	6.4	62.1	53.1	11.56	3.12
11/10/2008 15:04:00	3.1171	1.7655	11.0	8.7	61.9	55.4	11.57	3.26
11/10/2008 15:30:00	3.5504	1.8843	20.0	15.8	61.9	59.7	11.57	3.51
11/10/2008 15:40:00	3.7171	1.9280	12.0	9.4	61.9	61.2	11.57	3.65
11/10/2008 15:49:59	3.8835	1.9707	14.0	10.8	61.9	63.0	11.57	3.82
11/10/2008 16:00:00	4.0504	2.0126	13.0	10.2	61.9	64.4	11.57	3.98
11/10/2008 16:10:00	4.2171	2.0536	13.0	10.1	62.1	66.2	11.58	4.14
11/10/2008 16:21:00	4.4004	2.0977	13.0	10.1	59.4	66.2	11.58	4.30
11/10/2008 16:36:00	4.6504	2.1565	11.0	8.6	59.4	61.7	11.58	4.43
11/10/2008 16:56:00	4.9838	2.2324	21.0	16.5	59.0	60.1	11.58	4.69
11/10/2008 17:18:00	5.3504	2.3131	14.0	11.1	59.0	56.7	11.58	4.87
11/10/2008 18:26:00	6.4838	2.5463	57.0	44.6	60.6	50.0	11.59	5.57
11/10/2008 18:42:00	6.7504	2.5982	15.0	12.1	60.6	49.6	11.59	5.75
11/10/2008 19:02:00	7.0838	2.6615	17.0	13.3	60.6	62.9	11.59	5.96
11/10/2008 19:36:00	7.6504	2.7659	25.0	19.9	60.4	56.1	11.60	6.28
11/10/2008 20:16:00	8.3171	2.8839	17.0	13.4	60.4	60.6	11.61	6.49
11/10/2008 20:32:59	8.6001	2.9326	13.0	10.2	60.4	62.4	11.61	6.65
11/10/2008 21:34:59	9.6335	3.1038	37.0	29.0	60.6	64.8	11.62	7.10
11/10/2008 22:02:59	10.1001	3.1781	18.0	14.1	60.6	65.1	11.62	7.32
11/10/2008 22:30:00	10.5504	3.2481	18.0	14.1	60.6	66.4	11.62	7.54
11/10/2008 23:15:00	11.3004	3.3616	28.0	21.8	60.6	67.5	11.62	7.88
11/11/2008 00:14:00	12.2838	3.5048	34.0	26.5	60.6	67.1	11.63	8.30
11/11/2008 01:02:59	13.1001	3.6194	29.0	22.5	60.6	66.2	11.63	8.65
11/11/2008 02:00:00	14.0504	3.7484	30.0	23.1	61.0	65.3	11.63	9.01
11/11/2008 03:00:00	15.0504	3.8795	33.0	25.6	60.8	70.0	11.63	9.42
11/11/2008 04:04:00	16.1171	4.0146	37.0	28.5	61.2	70.9	11.63	9.86
11/11/2008 05:04:00	17.1171	4.1373	29.0	22.4	61.5	71.6	11.64	10.21
11/11/2008 06:04:00	18.1171	4.2564	33.0	25.2	62.1	72.0	11.64	10.61
11/11/2008 07:05:00	19.1338	4.3742	31.0	24.0	62.2	72.7	11.65	10.98
11/11/2008 09:15:00	21.3004	4.6152	53.0	42.3	61.9	56.5	11.66	11.65
11/11/2008 10:08:00	22.1838	4.7100	21.0	17.0	60.8	50.0	11.66	11.91
11/11/2008 11:19:00	23.3671	4.8340	20.0	16.1	59.5	53.1	11.66	12.17
11/11/2008 12:04:59	24.1335	4.9126	20.0	16.1	59.0	51.4	11.65	12.42
11/11/2008 13:05:00	25.1338	5.0134	17.0	13.4	58.8	54.1	11.64	12.63
11/11/2008 14:08:00	26.1838	5.1170	29.0	21.4	60.1	57.9	11.63	12.96
11/11/2008 15:04:59	27.1335	5.2090	16.0	12.7	59.7	56.7	11.64	13.16
11/11/2008 16:02:00	28.0838	5.2994	17.0	13.7	59.0	49.3	11.64	13.38
11/11/2008 17:32:59	29.6001	5.4406	25.0	20.2	58.1	49.8	11.65	13.70

11/13/2008 10:12:00	70.2504	8.3816	225.0	170.9	67.0	59.7	11.66	16.38
11/13/2008 16:36:00	76.6504	8.7550	121.0	95.9	62.6	59.9	11.65	17.88
11/14/2008 09:13:00	93.2671	9.6575	147.0	118.8	62.4	59.9	11.87	19.74
11/14/2008 14:03:00	98.1004	9.9046	82.0	64.8	60.8	72.1	11.88	20.76
11/15/2008 11:15:00	119.3004	10.9225	150.0	120.8	61.7	61.7	11.90	22.65
11/16/2008 10:11:00	142.2338	11.9262	145.0	115.7	61.3	65.8	11.88	24.46
11/17/2008 08:35:00	164.6338	12.8310	138.0	109.3	60.8	73.2	11.94	26.18
11/17/2008 15:13:00	171.2671	13.0869	70.0	54.8	61.2	71.6	11.93	27.03
11/18/2008 08:21:00	188.4004	13.7259	98.0	77.4	61.2	73.0	11.92	28.25
11/18/2008 16:19:00	196.3671	14.0131	66.0	48.3	63.0	76.1	11.88	29.00
11/19/2008 09:51:00	213.9004	14.6253	90.0	71.8	63.5	60.3	11.87	30.13
11/19/2008 16:05:59	220.1501	14.8375	52.0	40.6	61.7	78.0	11.86	30.76
11/20/2008 09:29:00	237.5338	15.4121	68.0	54.8	60.3	67.6	12.01	31.62
11/20/2008 15:30:00	243.5504	15.6061	43.0	32.7	60.8	60.1	11.97	32.14
11/21/2008 09:11:00	261.2338	16.1627	66.0	55.1	60.1	60.4	12.27	33.00
11/22/2008 09:48:00	285.8504	16.9071	87.0	49.4	60.6	74.2	11.82	33.77
11/23/2008 10:47:59	310.8501	17.6309	91.0	70.1	60.4	75.3	11.80	34.87
11/24/2008 09:03:00	333.1004	18.2510	75.0	59.6	62.6	70.1	11.90	35.81
11/25/2008 15:53:00	363.9338	19.0770	95.0	73.0	60.8	73.4	11.82	36.95
11/26/2008 07:38:00	379.6838	19.4855	63.0	49.9	59.9	67.8	11.82	37.73
11/27/2008 14:32:00	410.5838	20.2629	83.0	64.8	60.3	66.7	11.80	38.75
11/28/2008 14:44:00	434.7838	20.8515	76.0	54.5	60.8	73.7	11.70	39.60
11/29/2008 11:49:59	455.8835	21.3514	62.0	47.8	61.0	77.5	11.72	40.35
11/30/2008 13:09:00	481.2004	21.9363	58.0	45.1	60.8	75.7	11.77	41.06
12/01/2008 09:17:00	501.3338	22.3905	53.0	40.8	61.7	67.8	11.77	41.70
12/02/2008 08:32:59	524.6001	22.9042	59.0	44.4	60.1	69.0	11.69	42.39
12/03/2008 09:04:00	549.1171	23.4332	46.0	36.4	59.9	68.9	11.82	42.96
12/04/2008 08:49:00	572.8671	23.9346	49.0	39.6	61.2	60.6	11.88	43.58
12/05/2008 08:55:00	596.9671	24.4329	55.0	38.2	60.8	71.2	11.75	44.18
12/06/2008 09:59:00	622.0338	24.9406	53.0	41.3	61.2	76.8	11.83	44.83
12/07/2008 12:43:00	648.7671	25.4709	59.0	41.3	61.2	75.3	11.72	45.48
12/08/2008 10:28:00	670.5171	25.8943	52.0	34.8	63.0	59.9	11.61	46.03
12/09/2008 09:41:00	693.7338	26.3388	34.0	26.7	61.0	74.3	11.85	46.44
12/10/2008 08:56:00	716.9838	26.7766	40.0	30.8	61.3	72.5	11.84	46.93
12/11/2008 09:30:00	741.5504	27.2314	41.0	32.3	60.8	71.9	11.84	47.43
12/12/2008 08:44:00	764.7838	27.6547	44.0	30.3	61.3	72.1	11.75	47.91
12/13/2008 12:46:59	792.8335	28.1573	58.0	30.0	62.6	73.9	11.44	48.38
12/14/2008 14:02:00	818.0838	28.6022	36.0	27.9	61.2	71.4	11.66	48.82
12/15/2008 08:53:00	836.9338	28.9298	26.0	20.5	60.6	68.7	11.78	49.14
12/16/2008 08:58:00	861.0171	29.3431	39.0	24.9	60.3	70.8	11.65	49.53
12/17/2008 09:43:00	885.7671	29.7618	31.0	24.3	60.6	70.5	11.73	49.91

12/19/2008 10:04:00	934.1171	30.5633	54.0	40.9	60.6	71.0	11.70	50.55
12/21/2008 13:37:00	985.6671	31.3953	51.0	39.9	61.2	75.5	11.83	51.17
12/23/2008 07:50:59	1027.9001	32.0609	32.0	12.7	61.3	76.0	11.54	51.37
12/25/2008 12:33:00	1080.6004	32.8725	70.0	53.8	61.5	71.6	11.55	52.22
12/27/2008 12:17:00	1128.3338	33.5907	49.0	38.3	61.0	66.9	11.65	52.82
12/29/2008 08:22:00	1172.4171	34.2406	39.0	30.7	61.0	72.8	11.84	53.30
12/31/2008 09:16:00	1221.3171	34.9473	45.0	31.9	61.7	76.2	11.78	53.80
01/02/2009 08:25:00	1268.4671	35.6155	53.0	36.0	61.2	73.7	11.65	54.36
01/04/2009 11:14:00	1319.2838	36.3219	37.0	29.7	61.3	60.9	11.83	54.83
01/06/2009 09:12:00	1365.2504	36.9493	46.0	28.0	60.6	73.0	11.63	55.27
01/08/2009 08:40:00	1412.7171	37.5861	41.0	32.6	60.6	61.0	11.72	55.78
01/10/2009 16:29:00	1468.5338	38.3215	38.0	29.8	61.3	73.5	11.84	56.25
01/12/2009 10:16:00	1510.3171	38.8628	28.0	22.1	61.9	73.9	11.91	56.59
01/14/2009 09:23:00	1557.4338	39.4643	30.0	22.0	60.6	72.1	11.84	56.94
01/15/2009 09:24:00	1581.4504	39.7675	23.0	18.1	61.3	74.1	11.90	57.22





Weatherford LABORATORIES

Sample 41680-3 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	270.50
Sample Bottom Depth	ft	271.50
Reservoir Pressure	psia	128.52
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	134.36
Mud Density	lbm/gal	8.50
Sample Mass	g	2,129.0
Sample Headspace Volume	cm^3	680.0
Date Time Sample Cored		11/10/2008 15:28:20
Date Time Sample Start Out of Well		11/10/2008 16:06:45
Date Time Desorption Time Zero		11/10/2008 16:08:18
Date Time Sample at Surface		11/10/2008 16:38:32
Date Time Sample Canister Sealed		11/10/2008 17:35:10
Lost Gas Time	hours	1.448
Desorption Time Correction	hours	0.031
Fit Start Time	hours	1.795
Fit End Time	hours	2.155
Fit Start Time	hours*0.5	1.340
Fit End Time	hours*0.5	1.468
Lost Gas Content	scf/ton	21.4
Measured Gas Content	scf/ton	133.9
Crushed Gas Content	scf/ton	39.5
Total Gas Content	scf/ton	194.8
Lost Gas Fraction	vol frac	0.1099
Measured Gas Fraction	vol frac	0.6873
Crushed Gas Fraction	vol frac	0.2028
Diffusivity	1/us	0.2
Sorption Time	hours	91.6

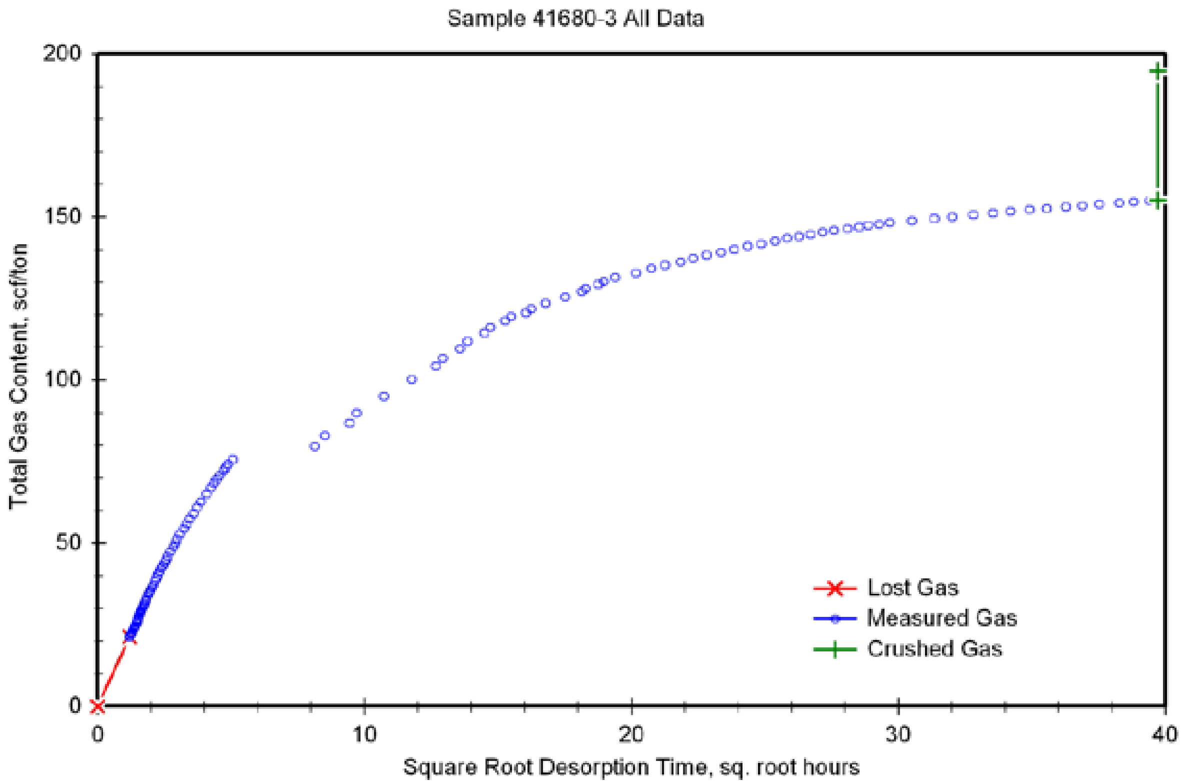
Sample 41680-3 Desorption History

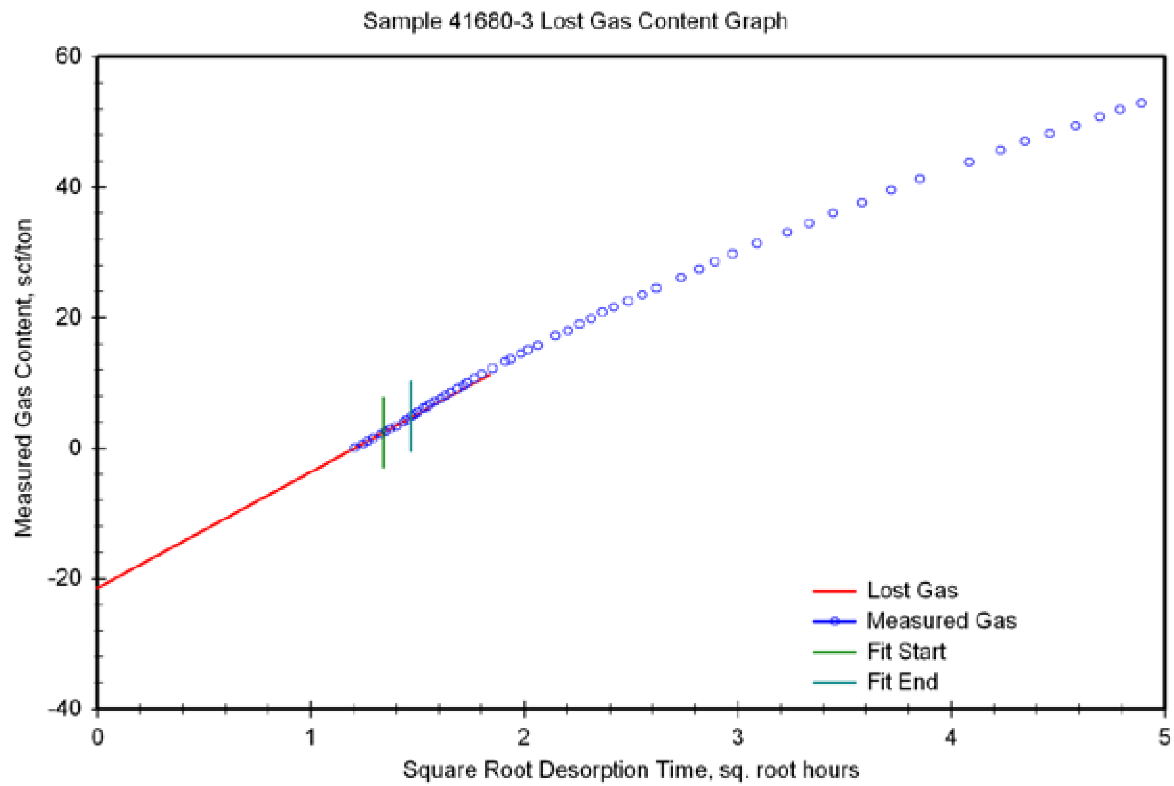
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Ambient Temp.	Canister Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
11/10/2008 17:35:10	1.4478	1.2032	0.0	0.0	56.3	54.7	11.58	0.00
11/10/2008 17:37:00	1.4477	1.2032	9.0	7.2	56.3	54.7	11.58	0.11
11/10/2008 17:42:59	1.5475	1.2440	51.0	38.8	58.1	54.3	11.58	0.69
11/10/2008 17:46:00	1.5977	1.2640	31.0	24.5	58.3	54.0	11.58	1.06
11/10/2008 17:49:59	1.6641	1.2900	42.0	32.8	59.0	53.6	11.58	1.55
11/10/2008 17:56:00	1.7644	1.3283	56.0	44.7	59.2	53.1	11.59	2.23
11/10/2008 17:59:00	1.8144	1.3470	27.0	21.4	59.2	52.7	11.58	2.55
11/10/2008 18:03:00	1.8811	1.3715	37.0	29.6	59.2	52.7	11.59	2.99
11/10/2008 18:07:00	1.9477	1.3956	38.0	30.4	59.4	52.5	11.59	3.45
11/10/2008 18:13:00	2.0477	1.4310	52.0	40.5	60.3	52.3	11.59	4.06
11/10/2008 18:16:00	2.0977	1.4484	24.0	19.1	60.4	52.2	11.59	4.35
11/10/2008 18:20:00	2.1644	1.4712	52.0	41.5	60.6	51.1	11.59	4.97
11/10/2008 18:22:00	2.1977	1.4825	23.0	18.5	60.6	50.4	11.59	5.25
11/10/2008 18:25:00	2.2477	1.4992	23.0	18.3	60.6	50.0	11.59	5.52
11/10/2008 18:30:00	2.3311	1.5268	49.0	39.4	60.6	49.8	11.59	6.12
11/10/2008 18:33:00	2.3811	1.5431	17.0	13.7	60.6	49.8	11.59	6.32
11/10/2008 18:36:00	2.4311	1.5592	42.0	33.8	60.6	49.6	11.59	6.83
11/10/2008 18:40:00	2.4977	1.5804	30.0	24.1	60.6	49.6	11.59	7.20
11/10/2008 18:45:00	2.5811	1.6066	39.0	31.4	60.6	50.0	11.59	7.67
11/10/2008 18:49:00	2.6477	1.6272	37.0	29.7	60.6	51.3	11.59	8.11
11/10/2008 18:53:59	2.7308	1.6525	37.0	29.6	60.6	52.2	11.59	8.56
11/10/2008 19:01:00	2.8477	1.6875	53.0	42.4	60.6	52.9	11.59	9.20
11/10/2008 19:05:59	2.9308	1.7120	33.0	26.4	60.6	53.4	11.60	9.59
11/10/2008 19:10:00	2.9977	1.7314	39.0	31.1	60.6	55.2	11.60	10.06
11/10/2008 19:17:00	3.1144	1.7648	57.0	45.4	60.6	55.9	11.60	10.74
11/10/2008 19:24:00	3.2311	1.7975	52.0	41.3	60.6	56.8	11.60	11.37
11/10/2008 19:34:59	3.4141	1.8477	75.0	59.7	60.4	56.1	11.60	12.26
11/10/2008 19:49:00	3.6477	1.9099	86.0	68.3	59.7	57.2	11.61	13.29
11/10/2008 19:54:00	3.7311	1.9316	34.0	26.5	60.1	57.9	11.61	13.69
11/10/2008 20:06:00	3.9311	1.9827	70.0	55.0	60.4	59.7	11.61	14.52
11/10/2008 20:14:00	4.0644	2.0160	48.0	37.9	60.4	60.4	11.61	15.09
11/10/2008 20:25:00	4.2477	2.0610	63.0	49.4	60.6	61.7	11.61	15.83
11/10/2008 20:46:00	4.5977	2.1442	123.0	96.5	60.4	63.7	11.61	17.28
11/10/2008 21:01:00	4.8477	2.2018	65.0	50.8	60.6	63.9	11.61	18.05
11/10/2008 21:16:00	5.0977	2.2578	86.0	67.4	60.6	64.2	11.61	19.06
11/10/2008 21:31:00	5.3477	2.3125	74.0	58.0	60.6	64.8	11.62	19.93

11/10/2008 21:46:00	5.5977	2.3660	78.0	61.1	60.4	65.1	11.62	20.85
11/10/2008 22:01:00	5.8477	2.4182	66.0	51.5	60.6	65.1	11.62	21.63
11/10/2008 22:21:00	6.1811	2.4862	83.0	64.9	60.6	66.0	11.62	22.60
11/10/2008 22:41:00	6.5144	2.5523	81.0	63.2	60.6	66.6	11.62	23.56
11/10/2008 23:01:00	6.8477	2.6168	87.0	67.6	60.6	66.9	11.62	24.57
11/10/2008 23:38:00	7.4644	2.7321	137.0	107.0	60.8	66.6	11.63	26.18
11/11/2008 00:07:00	7.9477	2.8192	113.0	88.2	60.8	66.9	11.63	27.51
11/11/2008 00:32:00	8.3644	2.8921	92.0	71.8	60.8	67.1	11.63	28.59
11/11/2008 01:01:00	8.8477	2.9745	103.0	80.5	60.8	66.2	11.63	29.80
11/11/2008 01:42:00	9.5311	3.0872	137.0	107.2	60.8	66.0	11.63	31.42
11/11/2008 02:35:59	10.4308	3.2297	149.0	115.6	61.2	68.5	11.63	33.16
11/11/2008 03:16:00	11.0977	3.3313	118.0	91.7	61.0	69.4	11.63	34.54
11/11/2008 04:02:00	11.8644	3.4445	129.0	99.7	61.3	70.9	11.63	36.04
11/11/2008 05:00:00	12.8311	3.5820	146.0	112.9	61.7	71.6	11.64	37.74
11/11/2008 06:00:00	13.8311	3.7190	160.0	123.7	62.1	72.0	11.64	39.60
11/11/2008 07:00:00	14.8311	3.8511	150.0	116.1	62.2	72.7	11.65	41.34
11/11/2008 08:49:59	16.6641	4.0822	213.0	167.5	61.3	64.6	11.66	43.86
11/11/2008 10:02:59	17.8808	4.2286	150.0	121.3	60.8	50.0	11.66	45.69
11/11/2008 11:02:00	18.8644	4.3433	113.0	91.2	59.9	51.1	11.66	47.06
11/11/2008 12:03:00	19.8811	4.4588	101.0	81.4	59.0	51.4	11.65	48.29
11/11/2008 13:08:00	20.9644	4.5787	101.0	80.9	58.5	54.3	11.64	49.50
11/11/2008 14:13:00	22.0477	4.6955	114.0	88.6	59.9	57.9	11.63	50.84
11/11/2008 15:07:00	22.9477	4.7904	92.0	73.3	59.7	56.8	11.64	51.94
11/11/2008 16:04:00	23.8977	4.8885	82.0	66.3	59.4	49.3	11.64	52.94
11/11/2008 17:41:00	25.5144	5.0512	108.0	87.7	58.1	47.8	11.65	54.26
11/13/2008 10:15:00	66.0811	8.1290	370.0	275.7	75.0	61.5	11.66	58.41
11/13/2008 16:40:00	72.4977	8.5146	290.0	216.2	89.2	59.9	11.65	61.66
11/14/2008 09:08:59	88.9808	9.4330	310.0	250.5	93.4	59.9	11.87	65.43
11/14/2008 14:08:00	93.9644	9.6935	260.0	205.1	63.7	72.8	11.88	68.51
11/15/2008 11:16:59	115.1141	10.7291	425.0	342.6	63.1	62.2	11.90	73.67
11/16/2008 10:18:00	138.1311	11.7529	430.0	342.5	63.7	65.8	11.88	78.82
11/17/2008 08:38:00	160.4644	12.6675	344.0	272.6	62.8	73.0	11.94	82.93
11/17/2008 15:15:00	167.0811	12.9260	207.0	164.4	61.3	71.4	11.93	85.40
11/18/2008 08:23:00	184.2144	13.5726	246.0	193.1	62.6	72.8	11.92	88.30
11/18/2008 16:21:00	192.1811	13.8629	188.0	144.8	63.3	75.2	11.88	90.48
11/19/2008 09:52:00	209.6977	14.4809	223.0	177.8	64.9	60.3	11.87	93.16
11/19/2008 16:08:00	215.9644	14.6957	146.0	114.0	63.5	77.3	11.86	94.88
11/20/2008 09:31:00	233.3477	15.2757	162.0	130.5	61.2	67.6	12.01	96.84
11/20/2008 15:32:00	239.3644	15.4714	112.0	89.1	61.2	60.4	11.97	98.18
11/21/2008 09:13:00	257.0477	16.0327	107.0	77.8	60.3	60.6	11.78	99.35
11/21/2008 15:59:00	263.8144	16.2424	105.0	83.0	60.3	67.8	11.79	100.60

11/22/2008 09:51:00	281.6811	16.7834	138.0	107.9	62.1	73.4	11.82	102.22
11/23/2008 10:50:59	306.6808	17.5123	161.0	124.6	62.1	74.4	11.80	104.10
11/24/2008 09:06:00	328.9311	18.1365	145.0	115.2	62.4	69.8	11.90	105.83
11/24/2008 13:55:00	333.7477	18.2688	80.0	61.6	61.5	72.8	11.85	106.76
11/25/2008 07:45:00	351.5811	18.7505	112.0	88.4	61.7	69.8	11.85	108.09
11/25/2008 15:56:00	359.7644	18.9675	79.0	59.2	63.1	73.2	11.82	108.98
11/26/2008 07:41:00	375.5144	19.3782	92.0	72.9	61.0	67.4	11.82	110.08
11/27/2008 14:34:00	406.3977	20.1593	124.0	97.4	61.2	66.7	11.80	111.55
11/28/2008 14:48:00	430.6311	20.7517	118.0	86.2	62.2	72.6	11.70	112.84
11/29/2008 11:53:00	451.7144	21.2536	95.0	73.6	61.7	75.0	11.72	113.95
11/30/2008 13:12:59	477.0475	21.8414	85.0	66.4	61.3	73.5	11.77	114.95
12/01/2008 09:19:00	497.1477	22.2968	85.0	65.5	62.6	67.6	11.77	115.93
12/02/2008 08:38:00	520.4644	22.8137	89.0	67.4	61.2	68.9	11.69	116.95
12/03/2008 09:08:59	544.9808	23.3448	79.0	62.5	63.0	68.9	11.82	117.89
12/04/2008 08:51:59	568.6975	23.8474	74.0	58.1	67.4	60.6	11.88	118.76
12/05/2008 08:57:00	592.7811	24.3471	76.0	59.5	61.5	70.8	11.75	119.66
12/06/2008 10:01:00	617.8477	24.8565	73.0	57.1	63.3	75.3	11.83	120.52
12/07/2008 12:45:00	644.5811	25.3886	78.0	55.8	63.0	75.0	11.72	121.36
12/08/2008 10:30:00	666.3311	25.8134	70.0	48.9	64.0	61.2	11.61	122.10
12/09/2008 09:43:00	689.5477	26.2592	50.0	39.3	63.5	73.7	11.85	122.69
12/10/2008 08:58:00	712.7977	26.6983	54.0	42.5	62.4	72.1	11.84	123.33
12/11/2008 09:32:00	737.3644	27.1545	53.0	41.8	62.1	71.6	11.84	123.95
12/12/2008 08:46:00	760.5977	27.5789	54.0	38.1	62.2	71.6	11.75	124.53
12/13/2008 12:49:00	788.6477	28.0829	69.0	38.3	61.5	73.5	11.43	125.10
12/14/2008 14:04:59	813.9141	28.5292	46.0	35.7	62.4	71.4	11.66	125.64
12/15/2008 08:55:00	832.7477	28.8574	34.0	26.8	61.7	68.3	11.78	126.05
12/16/2008 09:00:00	856.8311	29.2717	47.0	30.4	61.5	70.1	11.65	126.50
12/17/2008 09:45:00	881.5811	29.6914	33.0	25.8	65.3	70.5	11.73	126.89
12/19/2008 10:05:59	929.9308	30.4948	53.0	40.4	64.9	71.0	11.70	127.50
12/21/2008 13:38:59	981.4808	31.3286	52.0	40.7	62.8	75.2	11.83	128.11
12/23/2008 07:56:00	1023.7644	31.9963	65.0	37.5	62.0	76.0	11.55	128.68
12/25/2008 12:34:59	1076.4141	32.8088	61.0	46.5	62.6	71.7	11.55	129.37
12/27/2008 12:19:00	1124.1477	33.5283	48.0	37.6	61.7	66.9	11.65	129.94
12/29/2008 08:23:59	1168.2308	34.1794	40.0	31.5	62.4	72.8	11.84	130.41
12/31/2008 09:17:59	1217.1308	34.8874	43.0	30.1	63.0	75.7	11.78	130.87
01/02/2009 08:27:00	1264.2811	35.5567	48.0	29.1	64.8	73.7	11.65	131.31
01/04/2009 11:16:59	1315.1141	36.2645	37.0	29.6	62.6	63.1	11.83	131.75
01/06/2009 09:14:00	1361.0644	36.8926	43.0	23.0	63.5	72.8	11.63	132.10
01/08/2009 08:49:00	1408.6477	37.5320	40.0	31.8	61.5	61.3	11.72	132.58
01/10/2009 16:30:00	1464.3311	38.2666	36.0	28.3	61.2	73.4	11.84	133.00
01/12/2009 10:18:00	1506.1311	38.8089	26.0	20.5	63.3	73.9	11.91	133.31

01/14/2009 09:36:59	1553.4475	39.4138	32.0	20.5	64.8	72.5	11.84	133.62
01/15/2009 09:26:00	1577.2644	39.7148	21.0	16.5	62.8	74.3	11.90	133.87


Sample 41680-3 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Crushed Gas
200
150
100
50
0
0
10
20
30
40


Sample 41680-3 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
Lost Gas
Measured Gas
Fit Start
Fit End
60
40
20
0
-20
-40
0
1
2
3
4
5

Sample 41680-4 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	271.60
Sample Bottom Depth	ft	272.30
Reservoir Pressure	psia	128.91
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	134.78
Mud Density	lbm/gal	8.50
Sample Mass	g	1,443.0
Sample Headspace Volume	cm^3	1093.0
Date Time Sample Cored		11/10/2008 15:30:23
Date Time Sample Start Out of Well		11/10/2008 16:06:45
Date Time Desorption Time Zero		11/10/2008 16:08:18
Date Time Sample at Surface		11/10/2008 16:38:32
Date Time Sample Canister Sealed		11/10/2008 17:10:11
Lost Gas Time	hours	1.031
Desorption Time Correction	hours	0.080
Fit Start Time	hours	1.134
Fit End Time	hours	1.291
Fit Start Time	hours*0.5	1.065
Fit End Time	hours*0.5	1.136
Lost Gas Content	scf/ton	12.3
Measured Gas Content	scf/ton	132.6
Crushed Gas Content	scf/ton	62.0
Total Gas Content	scf/ton	206.9
Lost Gas Fraction	vol frac	0.0595
Measured Gas Fraction	vol frac	0.6409
Crushed Gas Fraction	vol frac	0.2995
Diffusivity	1/us	0.1
Sorption Time	hours	214.3

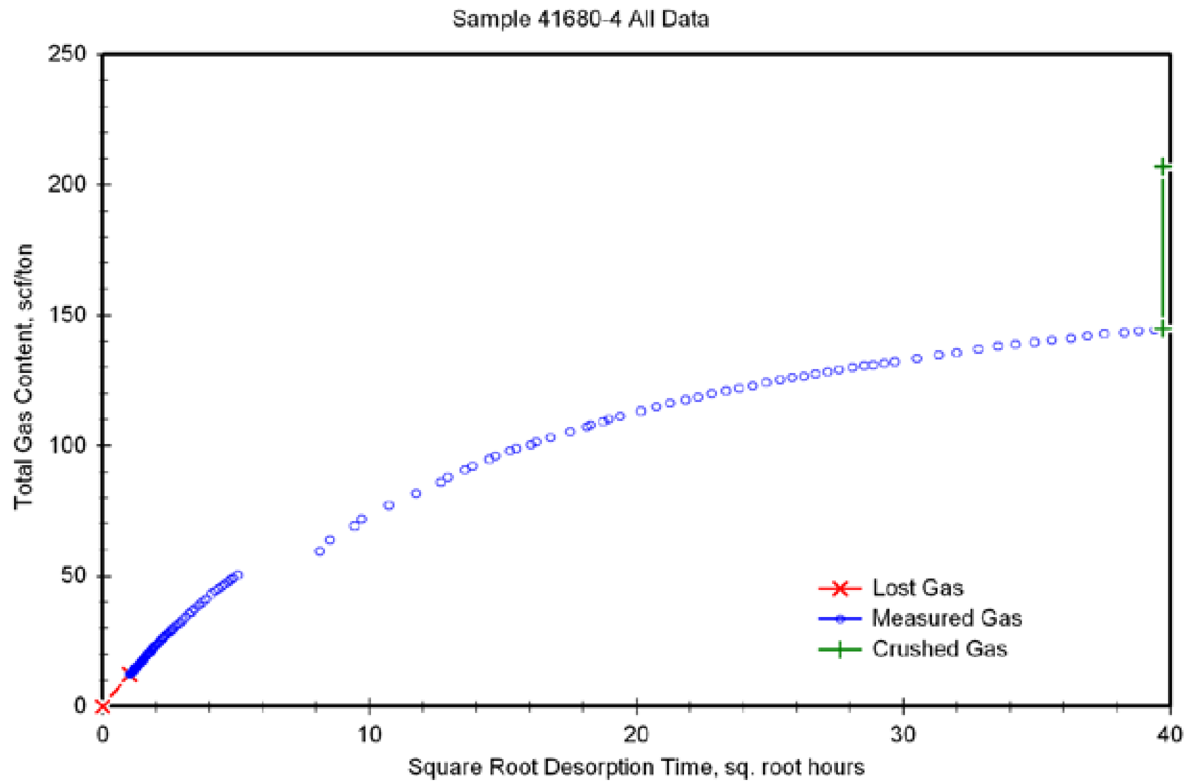
Sample 41680-4 Desorption History

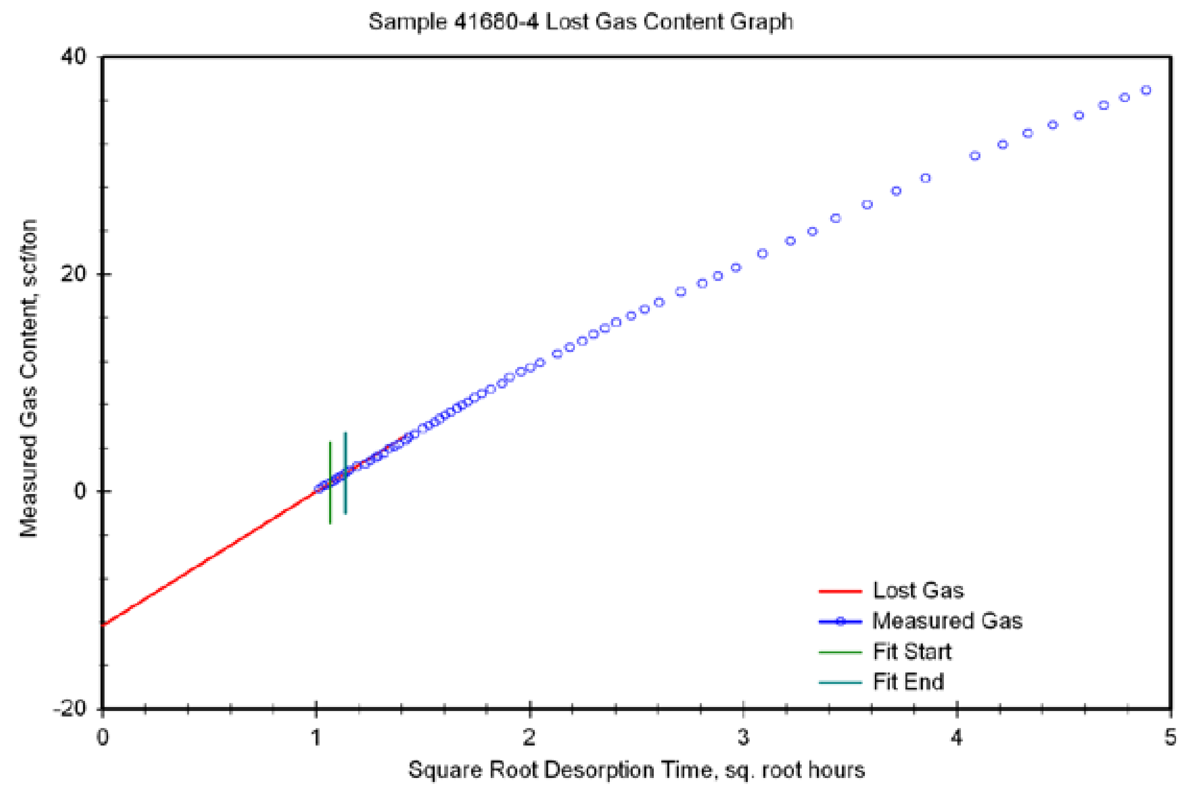
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Ambient Temp.	Canister Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
11/10/2008 17:10:11	1.0314	1.0156	0.0	0.0	57.2	57.6	11.58	0.00
11/10/2008 17:15:00	1.0314	1.0156	17.0	13.5	57.2	57.6	11.58	0.30
11/10/2008 17:16:59	1.0644	1.0317	13.0	10.3	56.8	57.2	11.58	0.53
11/10/2008 17:19:00	1.0980	1.0479	11.0	6.9	57.9	56.5	11.58	0.68
11/10/2008 17:21:00	1.1314	1.0637	10.0	7.3	58.3	56.1	11.58	0.84
11/10/2008 17:23:00	1.1647	1.0792	11.0	8.2	58.6	55.8	11.58	1.02
11/10/2008 17:25:00	1.1980	1.0945	12.0	8.2	59.4	55.8	11.58	1.21
11/10/2008 17:27:00	1.2314	1.1097	12.0	8.3	59.9	55.8	11.58	1.39
11/10/2008 17:29:00	1.2647	1.1246	11.0	8.7	59.7	55.6	11.58	1.59
11/10/2008 17:31:00	1.2980	1.1393	14.0	10.1	60.1	55.4	11.58	1.81
11/10/2008 17:32:59	1.3311	1.1537	8.0	6.4	60.1	55.2	11.59	1.95
11/10/2008 17:38:00	1.4147	1.1894	22.0	16.7	60.4	54.5	11.58	2.32
11/10/2008 17:44:00	1.5147	1.2307	15.0	12.0	59.9	54.1	11.58	2.59
11/10/2008 17:47:00	1.5647	1.2509	15.0	11.6	60.1	53.6	11.58	2.85
11/10/2008 17:51:00	1.6314	1.2772	16.0	12.8	59.9	53.4	11.58	3.13
11/10/2008 17:53:00	1.6647	1.2902	10.0	8.0	59.9	53.2	11.59	3.31
11/10/2008 17:57:00	1.7314	1.3158	17.0	13.2	59.9	53.1	11.58	3.60
11/10/2008 18:01:00	1.7980	1.3409	21.0	16.8	59.9	52.7	11.59	3.97
11/10/2008 18:04:59	1.8644	1.3654	13.0	10.4	59.7	52.7	11.59	4.20
11/10/2008 18:08:00	1.9147	1.3837	13.0	10.4	59.4	52.5	11.58	4.43
11/10/2008 18:14:00	2.0147	1.4194	22.0	16.3	60.4	52.2	11.59	4.80
11/10/2008 18:16:00	2.0480	1.4311	15.0	11.7	60.6	52.2	11.59	5.06
11/10/2008 18:20:59	2.1311	1.4598	15.0	12.0	60.6	50.7	11.59	5.32
11/10/2008 18:27:59	2.2477	1.4992	30.0	24.1	60.6	50.0	11.59	5.86
11/10/2008 18:33:00	2.3314	1.5269	17.0	13.7	60.6	49.6	11.59	6.16
11/10/2008 18:38:00	2.4147	1.5539	15.0	12.1	60.6	49.6	11.59	6.43
11/10/2008 18:42:00	2.4814	1.5752	18.0	14.5	60.4	49.6	11.60	6.75
11/10/2008 18:46:59	2.5644	1.6014	18.0	13.8	60.6	50.2	11.59	7.06
11/10/2008 18:52:00	2.6480	1.6273	17.0	13.6	60.5	51.8	11.59	7.36
11/10/2008 18:58:00	2.7480	1.6577	18.0	14.4	60.6	52.9	11.60	7.68
11/10/2008 19:02:59	2.8311	1.6826	18.0	14.4	60.6	52.9	11.60	8.00
11/10/2008 19:08:00	2.9147	1.7072	15.0	12.0	60.6	54.9	11.60	8.26
11/10/2008 19:15:00	3.0314	1.7411	22.0	17.5	60.4	55.8	11.60	8.65
11/10/2008 19:21:59	3.1477	1.7742	21.0	16.4	60.6	56.7	11.60	9.02
11/10/2008 19:31:00	3.2980	1.8160	25.0	19.9	60.4	56.1	11.60	9.46
11/10/2008 19:43:00	3.4980	1.8703	30.0	23.9	60.3	56.1	11.60	9.99

11/10/2008 19:50:59	3.6311	1.9055	33.0	26.2	60.1	57.7	11.61	10.57
11/10/2008 20:03:00	3.8314	1.9574	28.0	21.7	60.4	58.8	11.61	11.05
11/10/2008 20:14:00	4.0147	2.0037	23.0	18.2	60.4	60.4	11.61	11.45
11/10/2008 20:25:00	4.1980	2.0489	25.0	19.7	60.4	61.5	11.61	11.89
11/10/2008 20:45:00	4.5314	2.1287	48.0	37.7	60.4	63.7	11.61	12.73
11/10/2008 21:00:00	4.7814	2.1866	33.0	25.5	60.6	63.9	11.61	13.29
11/10/2008 21:15:00	5.0314	2.2431	35.0	27.4	60.4	64.2	11.61	13.90
11/10/2008 21:30:00	5.2814	2.2981	34.0	26.6	60.4	64.8	11.62	14.49
11/10/2008 21:45:00	5.5314	2.3519	35.0	27.1	60.6	65.1	11.62	15.09
11/10/2008 22:00:00	5.7814	2.4044	29.0	22.7	60.6	65.1	11.62	15.60
11/10/2008 22:19:59	6.1144	2.4727	34.0	26.6	60.6	65.8	11.62	16.19
11/10/2008 22:40:00	6.4480	2.5393	36.0	28.1	60.6	66.6	11.62	16.81
11/10/2008 23:00:00	6.7814	2.6041	37.0	28.2	60.8	66.9	11.62	17.44
11/10/2008 23:32:00	7.3147	2.7046	56.0	43.7	60.8	66.6	11.63	18.41
11/11/2008 00:06:00	7.8814	2.8074	45.0	35.1	60.6	66.7	11.63	19.19
11/11/2008 00:30:00	8.2814	2.8777	41.0	32.0	60.6	67.1	11.63	19.90
11/11/2008 01:00:00	8.7814	2.9633	44.0	34.1	60.8	66.2	11.63	20.66
11/11/2008 01:45:00	9.5314	3.0873	73.0	57.1	60.8	66.0	11.63	21.92
11/11/2008 02:35:00	10.3647	3.2194	70.0	54.2	61.0	68.5	11.63	23.13
11/11/2008 03:15:00	11.0314	3.3213	51.0	39.6	61.0	69.4	11.63	24.01
11/11/2008 04:00:00	11.7814	3.4324	69.0	53.0	61.3	70.9	11.63	25.18
11/11/2008 05:01:00	12.7980	3.5774	74.0	57.3	61.5	71.5	11.64	26.46
11/11/2008 06:01:00	13.7980	3.7146	71.0	54.7	61.9	72.0	11.64	27.67
11/11/2008 07:02:59	14.8311	3.8511	70.0	54.0	62.2	72.7	11.65	28.87
11/11/2008 08:53:00	16.6647	4.0822	118.0	92.8	61.7	64.2	11.66	30.93
11/11/2008 09:59:00	17.7647	4.2148	60.0	48.5	60.8	50.0	11.66	32.01
11/11/2008 10:59:00	18.7647	4.3318	56.0	45.2	59.9	51.1	11.66	33.01
11/11/2008 11:59:00	19.7647	4.4457	44.0	35.5	59.0	51.4	11.65	33.80
11/11/2008 13:05:59	20.8811	4.5696	48.0	37.6	58.8	54.3	11.63	34.63
11/11/2008 14:10:00	21.9480	4.6849	55.0	42.3	59.9	57.9	11.64	35.57
11/11/2008 15:06:00	22.8814	4.7834	42.0	33.5	59.7	56.7	11.64	36.32
11/11/2008 16:05:00	23.8647	4.8852	36.0	29.1	58.8	49.5	11.64	36.96
11/11/2008 17:42:00	25.4814	5.0479	54.0	43.9	58.1	47.5	11.65	37.94
11/13/2008 10:16:00	66.0480	8.1270	540.0	423.0	61.0	61.0	11.66	47.33
11/13/2008 16:37:00	72.3980	8.5087	243.0	190.5	62.1	59.9	11.65	51.55
11/14/2008 09:10:00	88.9480	9.4312	300.0	241.4	63.9	59.9	11.82	56.91
11/14/2008 14:06:00	93.8814	9.6892	145.0	114.5	60.8	72.3	11.88	59.46
11/15/2008 11:16:00	115.0480	10.7260	300.0	240.8	62.1	62.1	11.90	64.80
11/16/2008 10:16:00	138.0480	11.7494	260.0	207.9	61.3	65.8	11.88	69.42
11/17/2008 08:35:59	160.3811	12.6642	248.0	196.5	60.8	73.0	11.94	73.78
11/17/2008 15:14:00	167.0147	12.9234	104.0	81.2	61.2	71.4	11.93	75.58

11/18/2008 08:22:00	184.1480	13.5701	161.0	127.4	61.0	73.0	11.92	78.41
11/18/2008 16:19:59	192.1144	13.8605	95.0	68.5	62.6	75.7	11.88	79.93
11/19/2008 09:51:00	209.6314	14.4787	144.0	115.1	62.8	60.3	11.87	82.49
11/19/2008 16:07:00	215.8980	14.6935	75.0	58.5	61.9	77.5	11.86	83.79
11/20/2008 09:30:00	233.2814	15.2736	105.0	84.6	60.1	67.6	12.01	85.67
11/20/2008 15:31:00	239.2980	15.4693	57.0	41.9	60.8	60.3	11.97	86.60
11/21/2008 09:12:00	256.9814	16.0306	105.0	71.0	60.1	60.6	11.78	88.17
11/21/2008 15:58:00	263.7480	16.2403	54.0	42.7	60.1	67.8	11.79	89.12
11/22/2008 09:49:00	281.5980	16.7809	100.0	78.4	60.8	73.7	11.82	90.86
11/23/2008 10:49:00	306.5980	17.5099	131.0	100.8	60.6	74.8	11.80	93.10
11/24/2008 09:04:00	328.8480	18.1342	105.0	83.4	61.3	70.1	11.90	94.95
11/24/2008 13:54:00	333.6814	18.2669	40.0	27.8	61.3	72.8	11.85	95.57
11/25/2008 07:43:00	351.4980	18.7483	83.0	65.7	60.6	69.8	11.85	97.02
11/25/2008 15:53:59	359.6811	18.9653	51.0	38.5	60.4	73.5	11.82	97.88
11/26/2008 07:40:00	375.4480	19.3765	68.0	53.9	59.9	67.8	11.82	99.08
11/27/2008 14:32:59	406.3311	20.1577	111.0	86.6	60.1	66.7	11.80	101.00
11/28/2008 14:46:00	430.5480	20.7497	105.0	73.8	60.4	73.0	11.70	102.64
11/29/2008 11:51:59	451.6477	21.2520	79.0	61.1	60.6	76.1	11.72	103.99
11/30/2008 13:11:00	476.9647	21.8395	74.0	57.7	60.3	74.6	11.77	105.27
12/01/2008 09:17:59	497.0811	22.2953	68.0	50.9	61.7	67.8	11.77	106.40
12/02/2008 08:34:00	520.3480	22.8111	75.0	55.5	60.1	68.9	11.69	107.64
12/03/2008 09:08:00	544.9147	23.3434	61.0	48.2	60.3	68.9	11.82	108.71
12/04/2008 08:51:00	568.6314	23.8460	58.0	46.8	60.3	60.6	11.88	109.75
12/05/2008 08:56:00	592.7147	24.3457	71.0	45.6	60.6	70.8	11.75	110.76
12/06/2008 09:59:00	617.7647	24.8549	63.0	49.2	60.8	76.2	11.83	111.85
12/07/2008 12:44:00	644.5147	25.3873	76.0	50.2	61.2	75.2	11.72	112.96
12/08/2008 10:29:00	666.2647	25.8121	65.0	38.2	64.0	61.2	11.61	113.81
12/09/2008 09:42:00	689.4814	26.2580	34.0	26.7	61.2	73.7	11.85	114.41
12/10/2008 08:57:00	712.7314	26.6970	47.0	35.8	61.5	72.1	11.84	115.20
12/11/2008 09:31:00	737.2980	27.1532	48.0	37.8	60.8	71.7	11.84	116.04
12/12/2008 08:45:00	760.5314	27.5777	55.0	36.5	60.8	71.7	11.75	116.85
12/13/2008 12:48:00	788.5814	28.0817	80.0	35.5	61.7	73.7	11.43	117.64
12/14/2008 14:03:00	813.8314	28.5277	35.0	27.2	60.6	71.4	11.66	118.24
12/15/2008 08:54:00	832.6814	28.8562	23.0	18.1	60.6	68.5	11.78	118.64
12/16/2008 08:59:00	856.7647	29.2705	50.0	29.0	60.4	70.5	11.65	119.29
12/17/2008 09:44:00	881.5147	29.6903	40.0	31.3	61.2	70.7	11.73	119.98
12/19/2008 10:05:00	929.8647	30.4937	73.0	54.7	61.2	71.0	11.70	121.20
12/21/2008 13:38:00	981.4147	31.3275	67.0	52.4	62.1	75.3	11.83	122.36
12/23/2008 07:50:59	1023.6311	31.9942	82.0	42.0	61.7	76.0	11.54	123.29
12/25/2008 12:34:00	1076.3480	32.8077	88.0	67.6	62.2	71.6	11.55	124.79
12/27/2008 12:17:59	1124.0811	33.5273	57.0	44.6	61.5	66.9	11.65	125.78

12/29/2008 08:23:00	1168.1647	34.1784	41.0	32.3	61.7	72.3	11.84	126.50
12/31/2008 09:17:00	1217.0647	34.8865	57.0	39.3	62.1	76.2	11.78	127.37
01/02/2009 08:26:00	1264.2147	35.5558	66.0	41.8	61.7	73.7	11.65	128.30
01/04/2009 11:16:00	1315.0480	36.2636	40.0	32.0	61.3	62.6	11.83	129.01
01/06/2009 09:13:00	1360.9980	36.8917	60.0	31.4	61.3	72.8	11.63	129.71
01/08/2009 08:47:00	1408.5647	37.5308	44.0	35.0	61.5	61.2	11.72	130.49
01/10/2009 16:30:00	1464.2814	38.2659	38.0	29.8	61.9	73.5	11.84	131.15
01/12/2009 10:17:00	1506.0647	38.8080	29.0	22.9	62.4	73.9	11.91	131.66
01/14/2009 09:33:00	1553.3314	39.4123	37.0	25.9	61.3	72.3	11.84	132.23
01/15/2009 09:25:00	1577.1980	39.7140	22.0	17.3	61.9	74.3	11.90	132.62


Sample 41680-4 All Data
Total Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
0
50
100
150
200
250
0
10
20
30
40
Lost Gas
Measured Gas
Crushed Gas


Sample 41680-4 Lost Gas Content Graph
Measured Gas Content, scf/ton
Square Root Desorption Time, sq. root hours
-20
0
20
40
0
1
2
3
4
5
Lost Gas
Measured Gas
Fit Start
Fit End

Sample 41680-5 Desorption Parameters

Parameter	Unit	Value
Sample Top Depth	ft	273.50
Sample Bottom Depth	ft	274.50
Reservoir Pressure	psia	129.78
Reservoir Pressure Gradient	psi/ft	0.4200
Mud Hydrostatic Pressure	psia	135.68
Mud Density	lbm/gal	8.50
Sample Mass	g	2,060.0
Sample Headspace Volume	cm^3	889.0
Date Time Sample Cored		11/10/2008 15:31:52
Date Time Sample Start Out of Well		11/10/2008 16:06:45
Date Time Desorption Time Zero		11/10/2008 16:08:18
Date Time Sample at Surface		11/10/2008 16:38:32
Date Time Sample Canister Sealed		11/10/2008 17:24:50
Lost Gas Time	hours	1.276
Desorption Time Correction	hours	0.053
Fit Start Time	hours	1.341
Fit End Time	hours	1.838
Fit Start Time	hours*0.5	1.158
Fit End Time	hours*0.5	1.356
Lost Gas Content	scf/ton	7.6
Measured Gas Content	scf/ton	64.0
Crushed Gas Content	scf/ton	42.4
Total Gas Content	scf/ton	114.0
Lost Gas Fraction	vol frac	0.0663
Measured Gas Fraction	vol frac	0.5618
Crushed Gas Fraction	vol frac	0.3719
Diffusivity	1/us	0.1
Sorption Time	hours	216.9

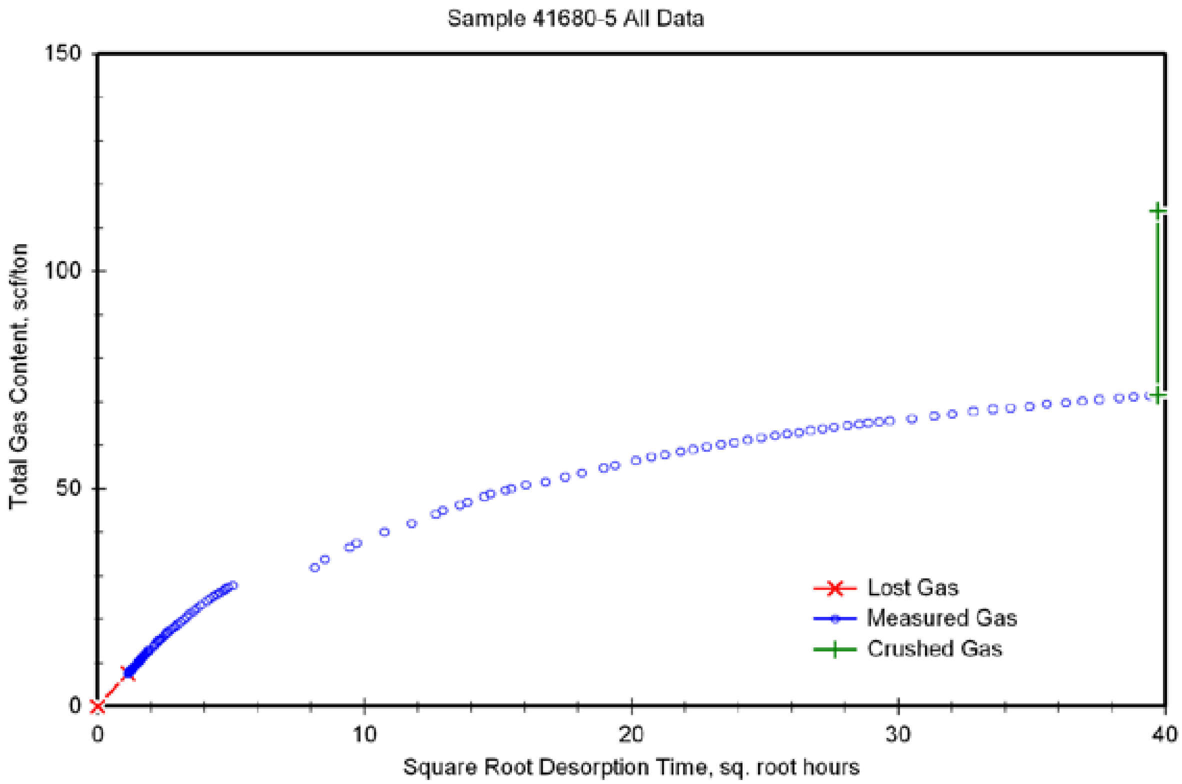
Sample 41680-5 Desorption History

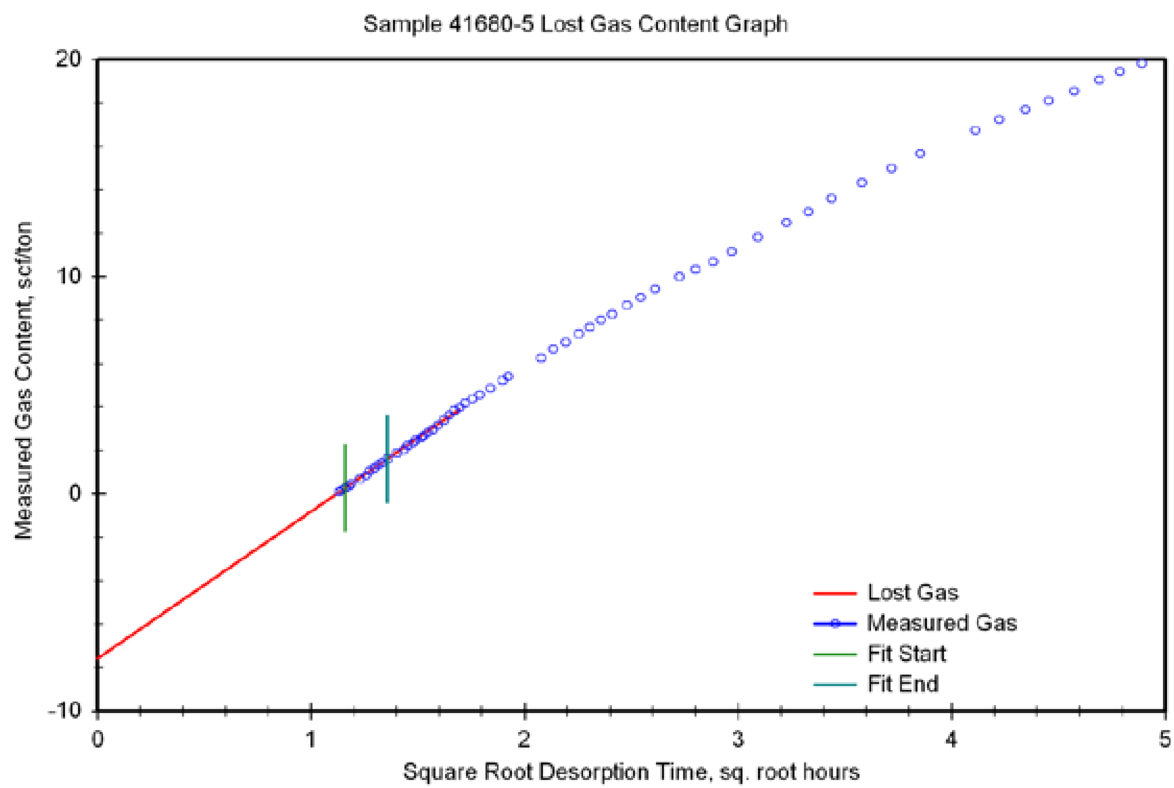
Date Time	Desorption Time	Sq. Root Desorption Time	Measured Gas Volume	Corrected Gas Volume	Ambient Temp.	Canister Temp.	Ambient Pressure	Cumulative Gas Content
mm/dd/yyyy hh:mm:ss	hours	hrs*0.5	cm^3	cm^3	°F	°F	psia	scf/ton
11/10/2008 17:24:50	1.2756	1.1294	0.0	0.0	56.1	55.6	11.58	0.00
11/10/2008 17:28:00	1.2755	1.1294	10.0	7.9	56.1	55.6	11.58	0.12
11/10/2008 17:30:00	1.3089	1.1441	10.0	4.7	58.5	55.6	11.58	0.20
11/10/2008 17:32:00	1.3422	1.1585	10.0	6.1	60.1	55.4	11.59	0.29
11/10/2008 17:34:00	1.3755	1.1728	8.0	6.1	60.1	55.2	11.58	0.39
11/10/2008 17:35:59	1.4086	1.1868	8.0	6.1	60.3	54.9	11.58	0.48
11/10/2008 17:42:00	1.5089	1.2284	19.0	15.1	60.3	54.5	11.58	0.72
11/10/2008 17:46:00	1.5755	1.2552	13.0	10.4	60.1	54.1	11.58	0.88
11/10/2008 17:49:00	1.6255	1.2750	15.0	12.0	60.1	53.6	11.58	1.06
11/10/2008 17:51:59	1.6752	1.2943	10.0	8.0	59.9	53.4	11.58	1.19
11/10/2008 17:55:00	1.7255	1.3136	13.0	10.4	59.7	53.1	11.59	1.35
11/10/2008 17:58:00	1.7755	1.3325	10.0	8.0	59.7	52.9	11.59	1.47
11/10/2008 18:01:59	1.8419	1.3572	13.0	10.1	59.9	52.7	11.59	1.63
11/10/2008 18:08:59	1.9586	1.3995	21.0	16.5	60.1	52.3	11.59	1.89
11/10/2008 18:15:00	2.0589	1.4349	13.0	10.0	60.4	52.2	11.59	2.04
11/10/2008 18:17:59	2.1086	1.4521	17.0	13.3	60.6	51.8	11.59	2.25
11/10/2008 18:22:00	2.1755	1.4750	9.0	7.2	60.6	50.5	11.59	2.36
11/10/2008 18:24:00	2.2089	1.4862	9.0	7.2	60.6	50.0	11.59	2.48
11/10/2008 18:29:00	2.2922	1.5140	12.0	9.7	60.6	49.8	11.59	2.63
11/10/2008 18:31:00	2.3255	1.5250	6.0	4.8	60.6	49.8	11.59	2.70
11/10/2008 18:34:59	2.3919	1.5466	12.0	9.7	60.6	49.6	11.59	2.85
11/10/2008 18:39:00	2.4589	1.5681	10.0	8.0	60.6	49.6	11.59	2.98
11/10/2008 18:44:00	2.5422	1.5944	17.0	13.7	60.6	49.6	11.59	3.19
11/10/2008 18:49:00	2.6255	1.6203	19.0	15.2	60.4	51.8	11.59	3.43
11/10/2008 18:53:59	2.7086	1.6458	18.0	14.4	60.6	52.2	11.60	3.65
11/10/2008 18:59:00	2.7922	1.6710	15.0	12.0	60.6	52.9	11.60	3.84
11/10/2008 19:04:00	2.8755	1.6957	14.0	11.2	60.6	52.9	11.60	4.01
11/10/2008 19:09:00	2.9589	1.7201	14.0	11.2	60.6	55.0	11.60	4.18
11/10/2008 19:16:00	3.0755	1.7537	16.0	12.7	60.6	55.9	11.60	4.38
11/10/2008 19:23:00	3.1922	1.7867	15.0	11.9	60.6	56.8	11.60	4.57
11/10/2008 19:34:00	3.3755	1.8373	25.0	19.9	60.6	56.1	11.60	4.88
11/10/2008 19:47:00	3.5922	1.8953	31.0	24.6	60.1	57.0	11.61	5.26
11/10/2008 19:53:00	3.6922	1.9215	15.0	11.5	60.4	57.7	11.61	5.44
11/10/2008 20:30:00	4.3089	2.0758	69.0	54.2	60.4	62.4	11.61	6.28
11/10/2008 20:45:00	4.5589	2.1351	33.0	25.9	60.4	63.7	11.61	6.68
11/10/2008 21:00:00	4.8089	2.1929	25.0	19.3	60.6	63.9	11.61	6.99

11/10/2008 21:16:00	5.0755	2.2529	32.0	25.1	60.6	64.2	11.61	7.38
11/10/2008 21:30:00	5.3089	2.3041	25.0	19.6	60.6	64.8	11.62	7.68
11/10/2008 21:45:00	5.5589	2.3577	28.0	21.9	60.6	65.1	11.62	8.02
11/10/2008 22:00:00	5.8089	2.4102	23.0	18.0	60.6	65.1	11.62	8.30
11/10/2008 22:19:59	6.1419	2.4783	33.0	25.8	60.6	66.0	11.62	8.70
11/10/2008 22:40:00	6.4755	2.5447	30.0	23.4	60.6	66.6	11.62	9.07
11/10/2008 23:00:00	6.8089	2.6094	32.0	24.4	60.8	66.9	11.62	9.45
11/10/2008 23:37:00	7.4255	2.7250	46.0	35.9	60.6	66.6	11.63	10.00
11/11/2008 00:01:59	7.8419	2.8003	28.0	21.6	60.6	66.2	11.62	10.34
11/11/2008 00:30:00	8.3089	2.8825	31.0	24.2	60.6	67.1	11.63	10.72
11/11/2008 01:00:00	8.8089	2.9680	37.0	28.7	60.8	66.2	11.63	11.16
11/11/2008 01:45:00	9.5589	3.0917	55.0	43.0	60.8	66.0	11.63	11.83
11/11/2008 02:35:00	10.3922	3.2237	56.0	43.1	61.2	68.5	11.63	12.50
11/11/2008 03:16:00	11.0755	3.3280	40.0	31.1	61.0	69.4	11.63	12.98
11/11/2008 04:01:00	11.8255	3.4388	54.0	41.5	61.3	70.9	11.63	13.63
11/11/2008 05:00:00	12.8089	3.5789	59.0	45.5	61.7	71.6	11.64	14.34
11/11/2008 06:00:00	13.8089	3.7160	56.0	43.1	62.1	72.0	11.64	15.01
11/11/2008 07:01:00	14.8255	3.8504	55.0	42.5	62.2	72.7	11.65	15.67
11/11/2008 09:04:59	16.8919	4.1100	88.0	70.0	60.8	59.0	11.66	16.76
11/11/2008 10:01:00	17.8255	4.2220	39.0	31.6	60.8	50.0	11.66	17.25
11/11/2008 11:03:00	18.8589	4.3427	37.0	29.8	59.7	52.0	11.66	17.71
11/11/2008 12:01:00	19.8255	4.4526	33.0	26.6	59.0	51.4	11.65	18.12
11/11/2008 13:05:59	20.9086	4.5726	37.0	29.3	58.6	54.3	11.63	18.58
11/11/2008 14:11:00	21.9922	4.6896	44.0	32.9	59.9	57.9	11.63	19.09
11/11/2008 15:06:00	22.9089	4.7863	31.0	24.7	59.7	56.8	11.64	19.47
11/11/2008 16:05:59	23.9086	4.8896	27.0	21.8	59.0	49.5	11.64	19.81
11/11/2008 17:35:59	25.4086	5.0407	28.0	22.7	58.1	49.3	11.65	20.17
11/13/2008 10:27:00	66.2589	8.1400	340.0	264.8	61.0	63.0	11.66	24.28
11/13/2008 16:40:00	72.4755	8.5133	160.0	126.2	61.2	60.1	11.65	26.25
11/14/2008 09:14:00	89.0422	9.4362	212.0	170.6	61.9	59.9	11.82	28.90
11/14/2008 14:12:00	94.0089	9.6958	91.0	71.8	61.2	73.0	11.88	30.02
11/15/2008 11:19:59	115.1419	10.7304	205.0	165.4	61.5	61.7	11.90	32.59
11/16/2008 10:21:00	138.1589	11.7541	161.0	128.7	60.8	65.8	11.88	34.59
11/17/2008 08:41:00	160.4922	12.6686	169.0	134.0	60.6	72.8	11.94	36.67
11/17/2008 15:16:00	167.0755	12.9258	65.0	50.5	61.0	71.2	11.93	37.46
11/18/2008 08:23:59	184.2086	13.5723	106.0	83.6	61.0	72.8	11.92	38.76
11/18/2008 16:23:00	192.1922	13.8633	64.0	46.4	61.9	75.0	11.88	39.48
11/19/2008 09:53:00	209.6922	14.4808	98.0	77.5	62.6	60.3	11.87	40.69
11/19/2008 16:09:00	215.9589	14.6955	50.0	39.1	61.9	77.0	11.86	41.29
11/20/2008 09:32:00	233.3422	15.2755	65.0	52.4	60.2	67.6	12.01	42.11
11/20/2008 15:33:00	239.3589	15.4712	35.0	25.2	60.6	60.6	11.97	42.50

11/21/2008 09:14:00	257.0422	16.0325	70.0	58.4	59.9	60.6	12.27	43.41
11/22/2008 09:53:00	281.6922	16.7837	93.0	45.0	60.6	72.6	11.82	44.11
11/23/2008 10:53:00	306.6922	17.5126	96.0	73.6	60.6	73.7	11.80	45.25
11/24/2008 09:08:00	328.9422	18.1368	74.0	58.8	60.8	69.8	11.90	46.17
11/25/2008 15:57:00	359.7589	18.9673	98.0	72.7	60.6	73.2	11.82	47.30
11/26/2008 07:43:00	375.5255	19.3785	56.0	44.4	59.9	67.4	11.82	47.99
11/27/2008 14:35:00	406.3922	20.1592	83.0	64.6	60.1	66.7	11.80	48.99
11/28/2008 14:54:00	430.7089	20.7535	75.0	52.5	60.3	72.1	11.71	49.81
11/29/2008 11:54:00	451.7089	21.2534	49.0	38.0	60.3	74.1	11.72	50.40
11/30/2008 13:14:00	477.0422	21.8413	50.0	39.1	60.3	72.6	11.77	51.01
12/01/2008 09:20:00	497.1422	22.2967	46.0	34.8	61.2	67.6	11.77	51.55
12/02/2008 08:39:00	520.4589	22.8136	52.0	37.4	60.1	68.9	11.69	52.13
12/03/2008 09:10:00	544.9755	23.3447	41.0	32.4	60.3	68.9	11.82	52.64
12/04/2008 08:53:00	568.6922	23.8473	40.0	32.3	60.6	60.6	11.88	53.14
12/05/2008 08:58:00	592.7755	24.3470	51.0	32.2	60.6	70.7	11.75	53.64
12/06/2008 10:02:00	617.8422	24.8564	45.0	35.3	60.8	73.7	11.83	54.19
12/07/2008 12:46:00	644.5755	25.3885	54.0	33.8	61.2	76.0	11.70	54.71
12/08/2008 10:30:00	666.3089	25.8130	47.0	28.4	63.0	61.2	11.60	55.16
12/09/2008 09:44:00	689.5422	26.2591	22.0	17.3	61.2	73.7	11.85	55.42
12/10/2008 08:59:00	712.7922	26.6982	33.0	25.4	61.2	72.1	11.84	55.82
12/11/2008 09:33:00	737.3589	27.1544	35.0	27.6	60.6	71.2	11.84	56.25
12/12/2008 08:47:00	760.5922	27.5788	40.0	25.4	61.0	71.6	11.75	56.64
12/13/2008 12:49:59	788.6419	28.0828	60.0	25.8	61.3	73.5	11.43	57.05
12/14/2008 14:06:00	813.9089	28.5291	22.0	17.1	60.6	71.4	11.66	57.31
12/15/2008 08:56:00	832.7422	28.8573	17.0	13.4	60.4	68.3	11.78	57.52
12/16/2008 09:01:00	856.8255	29.2716	38.0	21.4	60.3	70.1	11.65	57.85
12/17/2008 09:46:00	881.5755	29.6913	21.0	16.4	60.6	70.5	11.73	58.11
12/19/2008 10:07:00	929.9255	30.4947	48.0	35.7	60.6	71.0	11.70	58.66
12/21/2008 13:40:00	981.4755	31.3285	44.0	34.4	61.0	74.6	11.83	59.20
12/23/2008 08:00:00	1023.8089	31.9970	60.0	27.4	62.0	74.0	11.54	59.62
12/25/2008 12:36:00	1076.4089	32.8087	54.0	41.5	61.0	71.7	11.55	60.27
12/27/2008 12:20:00	1124.1422	33.5282	40.0	31.3	60.6	66.9	11.65	60.76
12/29/2008 08:23:59	1168.2086	34.1791	26.0	20.4	61.0	72.8	11.84	61.07
12/31/2008 09:19:00	1217.1255	34.8873	39.0	26.5	61.2	75.7	11.78	61.49
01/02/2009 08:29:00	1264.2922	35.5569	47.0	28.6	61.0	73.7	11.65	61.93
01/04/2009 11:18:00	1315.1089	36.2644	26.0	20.8	61.0	63.8	11.83	62.25
01/06/2009 09:15:00	1361.0589	36.8925	46.0	23.6	60.8	72.8	11.63	62.62
01/08/2009 08:49:59	1408.6419	37.5319	31.0	24.7	61.0	61.3	11.72	63.00
01/10/2009 16:31:00	1464.3255	38.2665	27.0	21.2	63.3	73.4	11.84	63.33
01/12/2009 10:19:00	1506.1255	38.8088	20.0	15.8	61.5	73.9	11.91	63.58
01/14/2009 09:38:00	1553.4422	39.4137	27.0	18.1	60.8	72.5	11.84	63.86

01/15/2009 09:27:00	1577.2589	39.7147	15.0	11.8	61.0	74.4	11.90	64.04





Weatherford LABORATORIES

Appendix III

Souder, Miller & Associates
Highway 151 34-4-39 MW #1
Fruitland Coal

Desorption Gas Composition Results

Weatherford
LABORATORIES

Sample 41680-2 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
11/10/2008 13:54:00	0.00403	0.00006	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19454	0.80113	0.00022	0.00001	1.00000
11/10/2008 21:34:58	0.00230	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19460	0.80293	0.00017	0.00000	1.00000
11/11/2008 10:08:00	0.00472	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19455	0.80012	0.00060	0.00001	1.00000
12/03/2008 09:04:00	0.92476	0.00050	0.00037	0.00012	0.00012	0.00012	0.00012	0.00000	0.00000	0.00399	0.06826	0.00162	0.00000	1.00000
01/14/2009 09:23:00	0.93827	0.00066	0.00000	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00450	0.05444	0.00159	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
11/10/2008 13:54:00	0.93477	0.01463	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05060	0.00000	1.00000
11/10/2008 21:34:58	0.93291	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06709	0.00000	1.00000
11/11/2008 10:08:00	0.88696	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.11304	0.00000	1.00000
12/03/2008 09:04:00	0.99678	0.00054	0.00040	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00000	0.00000	0.00175	0.00000	1.00000
01/14/2009 09:23:00	0.99704	0.00070	0.00000	0.00014	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00169	0.00000	1.00000

Sample 41680-2 Corrected Gas Composition vs. Desorbed Fraction

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.93788	0.03911	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02300	0.00000	1.00000
0.0776	0.93477	0.01463	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05060	0.00000	1.00000
0.1239	0.93291	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06709	0.00000	1.00000
0.1654	0.88696	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.11304	0.00000	1.00000
0.4334	0.99678	0.00054	0.00040	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00000	0.00000	0.00175	0.00000	1.00000
0.5539	0.99704	0.00070	0.00000	0.00014	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00169	0.00000	1.00000
1.0000	0.99704	0.00070	0.00000	0.00014	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00169	0.00000	1.00000
Integrated Gas Composition														
	0.97099	0.00288	0.00008	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.02566	0.00000	1.00000

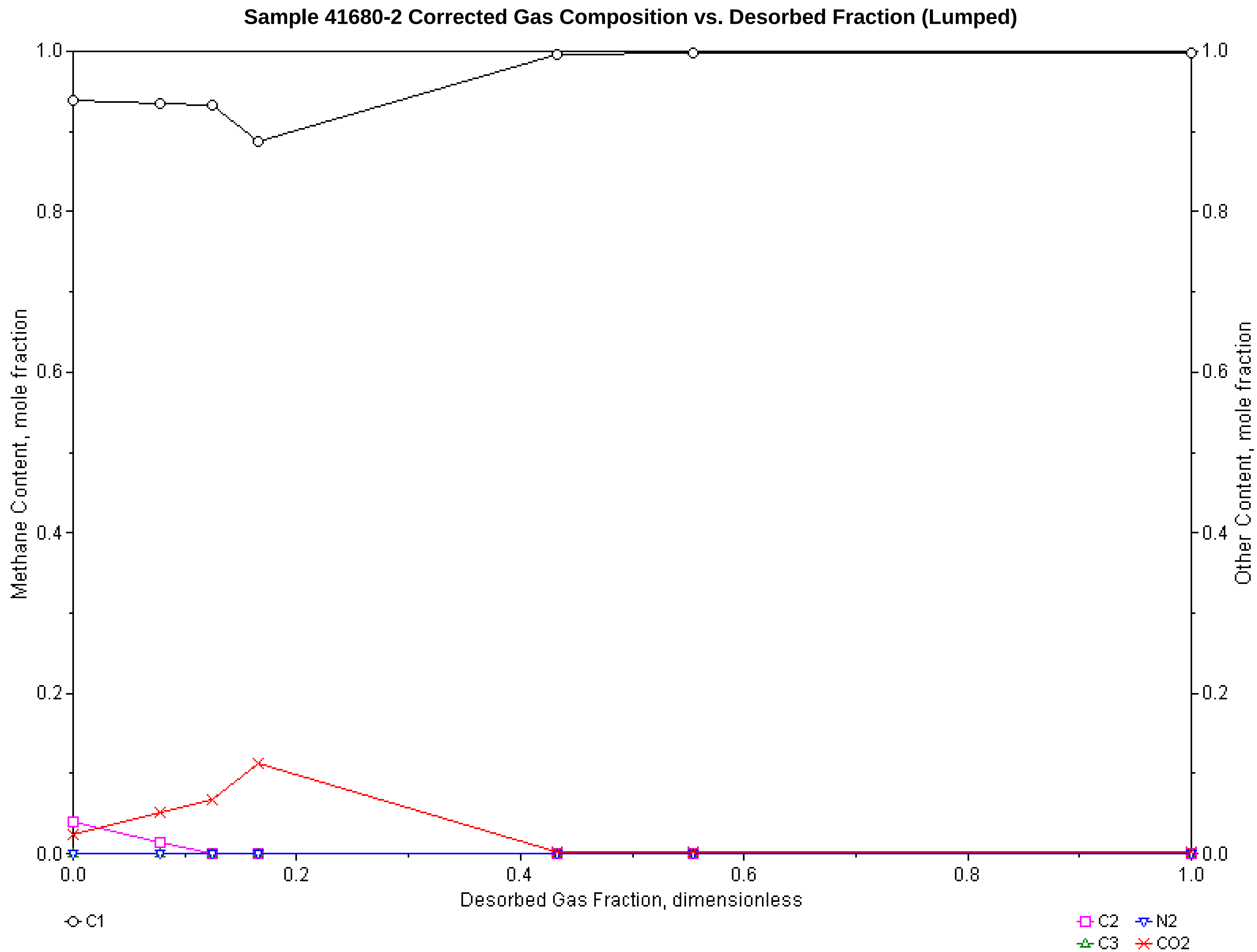
Sample 41680-2 Desorbed Gas Composition History (Lumped)

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_{3+} mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
11/10/2008 13:54:00	0.00403	0.00006	0.00000	0.19454	0.80113	0.00022	0.00001	1.00000
11/10/2008 21:34:58	0.00230	0.00000	0.00000	0.19460	0.80293	0.00017	0.00000	1.00000
11/11/2008 10:08:00	0.00472	0.00000	0.00000	0.19455	0.80012	0.00060	0.00001	1.00000
12/03/2008 09:04:00	0.92476	0.00050	0.00087	0.00399	0.06826	0.00162	0.00000	1.00000
01/14/2009 09:23:00	0.93827	0.00066	0.00053	0.00450	0.05444	0.00159	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
11/10/2008 13:54:00	0.93477	0.01463	0.00000	0.00000	0.00000	0.05060	0.00000	1.00000
11/10/2008 21:34:58	0.93291	0.00000	0.00000	0.00000	0.00000	0.06709	0.00000	1.00000
11/11/2008 10:08:00	0.88696	0.00000	0.00000	0.00000	0.00000	0.11304	0.00000	1.00000
12/03/2008 09:04:00	0.99678	0.00054	0.00094	0.00000	0.00000	0.00175	0.00000	1.00000
01/14/2009 09:23:00	0.99704	0.00070	0.00056	0.00000	0.00000	0.00169	0.00000	1.00000

Sample 41680-2 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_{3+} mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.93788	0.03911	0.00000	0.00000	0.00000	0.02300	0.00000	1.00000
0.0776	0.93477	0.01463	0.00000	0.00000	0.00000	0.05060	0.00000	1.00000
0.1239	0.93291	0.00000	0.00000	0.00000	0.00000	0.06709	0.00000	1.00000
0.1654	0.88696	0.00000	0.00000	0.00000	0.00000	0.11304	0.00000	1.00000
0.4334	0.99678	0.00054	0.00094	0.00000	0.00000	0.00175	0.00000	1.00000
0.5539	0.99704	0.00070	0.00056	0.00000	0.00000	0.00169	0.00000	1.00000
1.0000	0.99704	0.00070	0.00056	0.00000	0.00000	0.00169	0.00000	1.00000
Integrated Gas Composition								
	0.97099	0.00288	0.00047	0.00000	0.00000	0.02566	0.00000	1.00000

Souder, Miller & Associates, Hwy 151 34-4-39 MW #1



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Sample 41680-4 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
11/10/2008 19:43:00	0.00299	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19404	0.80261	0.00037	0.00000	1.00000
11/10/2008 23:32:00	0.00500	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19462	0.80001	0.00036	0.00001	1.00000
12/02/2008 08:34:00	0.02605	0.00015	0.00045	0.00015	0.00015	0.00015	0.00015	0.00000	0.00000	0.21246	0.76029	0.00000	0.00000	1.00000
01/14/2009 09:33:00	0.98426	0.00064	0.00000	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00335	0.01122	0.00000	0.00000	1.00000
01/15/2009 16:18:00	0.16181	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.18287	0.65504	0.00000	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
11/10/2008 19:43:00	0.89048	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
11/10/2008 23:32:00	0.93243	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06757	0.00000	1.00000
12/02/2008 08:34:00	0.95604	0.00549	0.01648	0.00549	0.00549	0.00549	0.00549	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
01/14/2009 09:33:00	0.99882	0.00065	0.00000	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
01/15/2009 16:18:00	0.99826	0.00174	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000

Sample 41680-4 Corrected Gas Composition vs. Desorbed Fraction

Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.89048	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
0.1078	0.89048	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
0.1485	0.93243	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.06757	0.00000	1.00000
0.5797	0.95604	0.00549	0.01648	0.00549	0.00549	0.00549	0.00549	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
0.6986	0.99882	0.00065	0.00000	0.00013	0.00013	0.00013	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
1.0000	0.99826	0.00174	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
Integrated Gas Composition														
	0.95742	0.00191	0.00453	0.00154	0.00154	0.00154	0.00154	0.00000	0.00000	0.00000	0.00000	0.02998	0.00000	1.00000

Sample 41680-4 Desorbed Gas Composition History (Lumped)

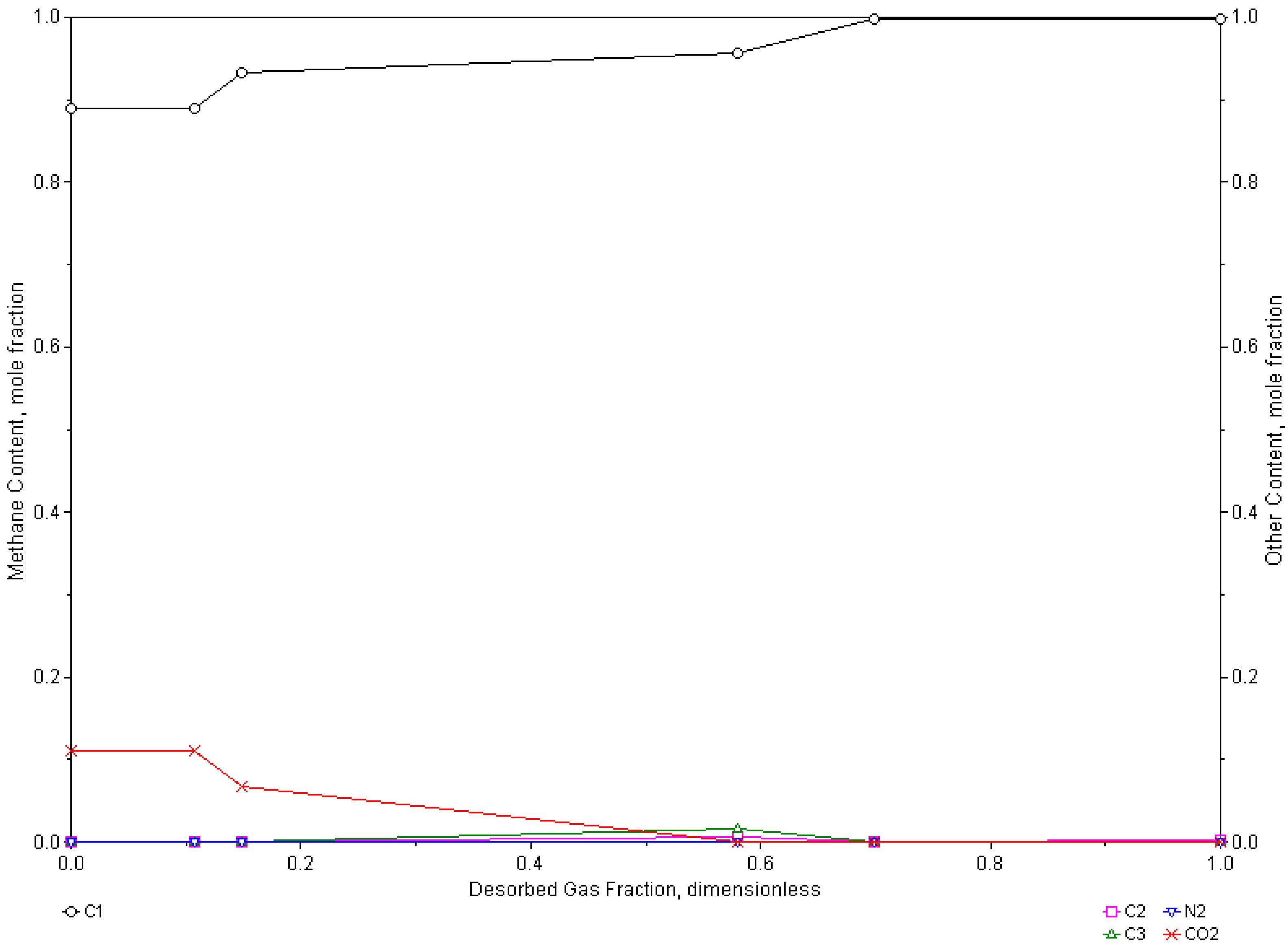
Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**
11/10/2008 19:43:00	0.00299	0.00000	0.00000	0.19404	0.80261	0.00037	0.00000	1.00000
11/10/2008 23:32:00	0.00500	0.00000	0.00000	0.19462	0.80001	0.00036	0.00001	1.00000
12/02/2008 08:34:00	0.02605	0.00015	0.00105	0.21246	0.76029	0.00000	0.00000	1.00000
01/14/2009 09:33:00	0.98426	0.00064	0.00052	0.00335	0.01122	0.00000	0.00000	1.00000
01/15/2009 16:18:00	0.16181	0.00028	0.00000	0.18287	0.65504	0.00000	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
11/10/2008 19:43:00	0.89048	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
11/10/2008 23:32:00	0.93243	0.00000	0.00000	0.00000	0.00000	0.06757	0.00000	1.00000
12/02/2008 08:34:00	0.95604	0.00549	0.03846	0.00000	0.00000	0.00000	0.00000	1.00000
01/14/2009 09:33:00	0.99882	0.00065	0.00052	0.00000	0.00000	0.00000	0.00000	1.00000
01/15/2009 16:18:00	0.99826	0.00174	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000

Sample 41680-4 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol. fraction	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**	**mol frac**
0.0000	0.89048	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
0.1078	0.89048	0.00000	0.00000	0.00000	0.00000	0.10952	0.00000	1.00000
0.1485	0.93243	0.00000	0.00000	0.00000	0.00000	0.06757	0.00000	1.00000
0.5797	0.95604	0.00549	0.03846	0.00000	0.00000	0.00000	0.00000	1.00000
0.6986	0.99882	0.00065	0.00052	0.00000	0.00000	0.00000	0.00000	1.00000
1.0000	0.99826	0.00174	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
Integrated Gas Composition								
	0.95742	0.00191	0.01069	0.00000	0.00000	0.02998	0.00000	1.00000

Souder, Miller & Associates, Hwy 151 34-4-39 MW #1

Sample 41680-4 Corrected Gas Composition vs. Desorbed Fraction (Lumped)



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Sample 41680-5 Desorbed Gas Composition History

Date Time mm/dd/yyyy hh:mm:ss	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
11/10/2008 20:30:00	0.00278	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19465	0.80221	0.00028	0.00007	1.00000
11/11/2008 09:04:59	0.00350	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.19441	0.80163	0.00047	0.00000	1.00000
12/02/2008 08:39:00	0.97711	0.00827	0.00000	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00262	0.01158	0.00000	0.00000	1.00000
01/14/2009 09:38:00	0.97486	0.00056	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00531	0.01885	0.00000	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History														
O_2, N_2, and H_2 Removed														
11/10/2008 20:30:00	0.90792	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.09208	0.00000	1.00000
11/11/2008 09:04:59	0.88249	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.11751	0.00000	1.00000
12/02/2008 08:39:00	0.99119	0.00839	0.00000	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
01/14/2009 09:38:00	0.99900	0.00057	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000

Sample 41680-5 Corrected Gas Composition vs. Desorbed Fraction

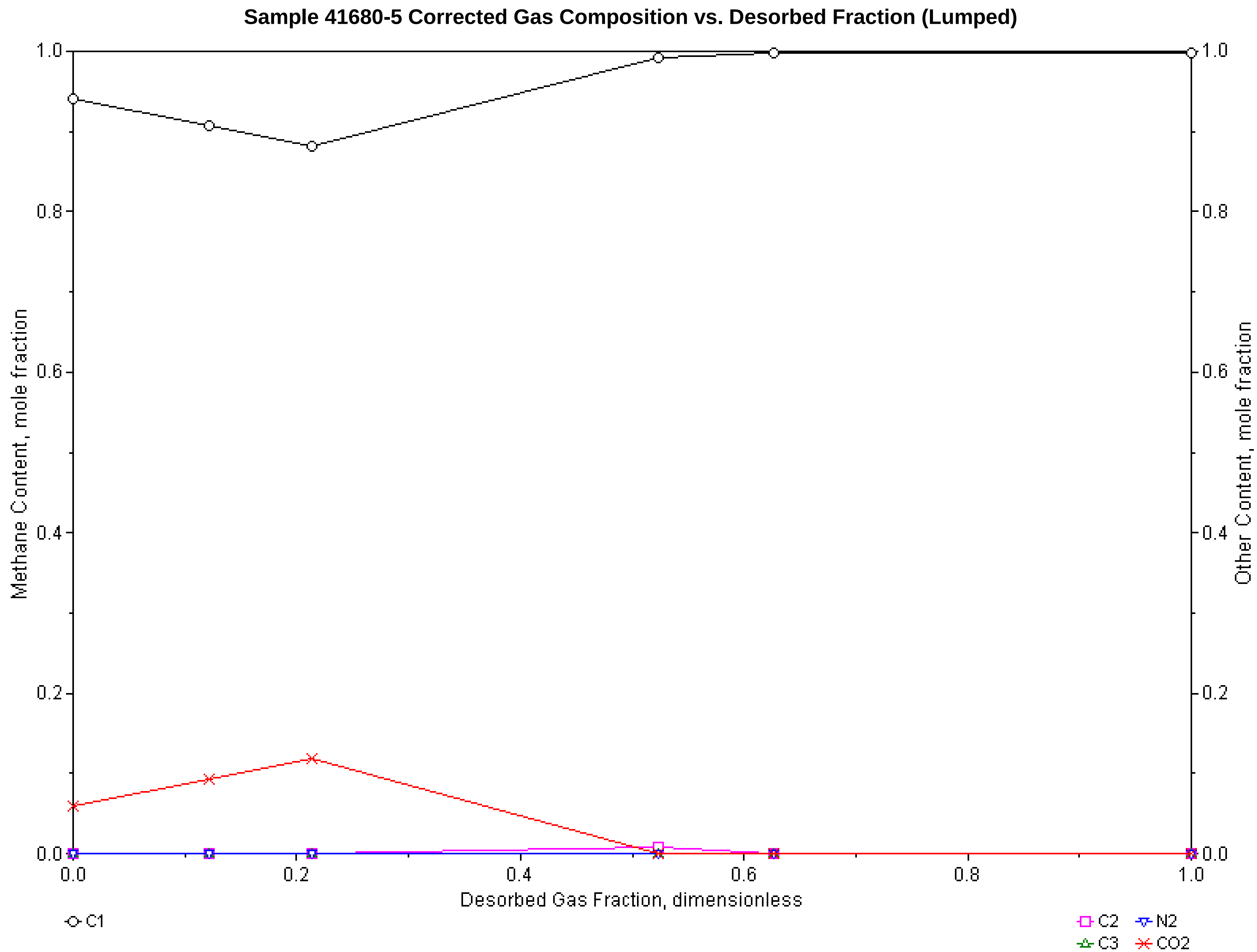
Desorbed Fraction vol. fraction	C_1 mol frac	C_2 mol frac	C_3 mol frac	iC_4 mol frac	nC_4 mol frac	iC_5 mol frac	nC_5 mol frac	C_6 mol frac	C_7 mol frac	O_2 mol frac	N_2 mol frac	CO_2 mol frac	H_2 mol frac	Total mol frac
0.0000	0.94153	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05847	0.00000	1.00000
0.1214	0.90792	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.09208	0.00000	1.00000
0.2133	0.88249	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.11751	0.00000	1.00000
0.5236	0.99119	0.00839	0.00000	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
0.6265	0.99900	0.00057	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
1.0000	0.99900	0.00057	0.00000	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
Integrated Gas Composition														
	0.96075	0.00198	0.00000	0.00006	0.00009	0.00009	0.00003	0.00000	0.00000	0.00000	0.00000	0.03700	0.00000	1.00000

Sample 41680-5 Desorbed Gas Composition History (Lumped)

Date Time	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
mm/dd/yyyy hh:mm:ss	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
11/10/2008 20:30:00	0.00278	0.00000	0.00000	0.19465	0.80221	0.00028	0.00007	1.00000
11/11/2008 09:04:59	0.00350	0.00000	0.00000	0.19441	0.80163	0.00047	0.00000	1.00000
12/02/2008 08:39:00	0.97711	0.00827	0.00041	0.00262	0.01158	0.00000	0.00000	1.00000
01/14/2009 09:38:00	0.97486	0.00056	0.00042	0.00531	0.01885	0.00000	0.00000	1.00000
Contamination Corrected Desorption Gas Composition History								
O_2, N_2, and H_2 Removed								
11/10/2008 20:30:00	0.90792	0.00000	0.00000	0.00000	0.00000	0.09208	0.00000	1.00000
11/11/2008 09:04:59	0.88249	0.00000	0.00000	0.00000	0.00000	0.11751	0.00000	1.00000
12/02/2008 08:39:00	0.99119	0.00839	0.00042	0.00000	0.00000	0.00000	0.00000	1.00000
01/14/2009 09:38:00	0.99900	0.00057	0.00043	0.00000	0.00000	0.00000	0.00000	1.00000

Sample 41680-5 Corrected Gas Composition vs. Desorbed Fraction (Lumped)

Desorbed Fraction	C_1	C_2	C_{3+}	O_2	N_2	CO_2	H_2	Total
vol. fraction	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac	mol frac
0.0000	0.94153	0.00000	0.00000	0.00000	0.00000	0.05847	0.00000	1.00000
0.1214	0.90792	0.00000	0.00000	0.00000	0.00000	0.09208	0.00000	1.00000
0.2133	0.88249	0.00000	0.00000	0.00000	0.00000	0.11751	0.00000	1.00000
0.5236	0.99119	0.00839	0.00042	0.00000	0.00000	0.00000	0.00000	1.00000
0.6265	0.99900	0.00057	0.00043	0.00000	0.00000	0.00000	0.00000	1.00000
1.0000	0.99900	0.00057	0.00043	0.00000	0.00000	0.00000	0.00000	1.00000
Integrated Gas Composition								
	0.96075	0.00198	0.00027	0.00000	0.00000	0.03700	0.00000	1.00000



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Appendix IV

Souder, Miller & Associates
Highway 151 34-4-39 MW #1
Fruitland Coal

Adsorption Isotherm Results

Weatherford
LABORATORIES

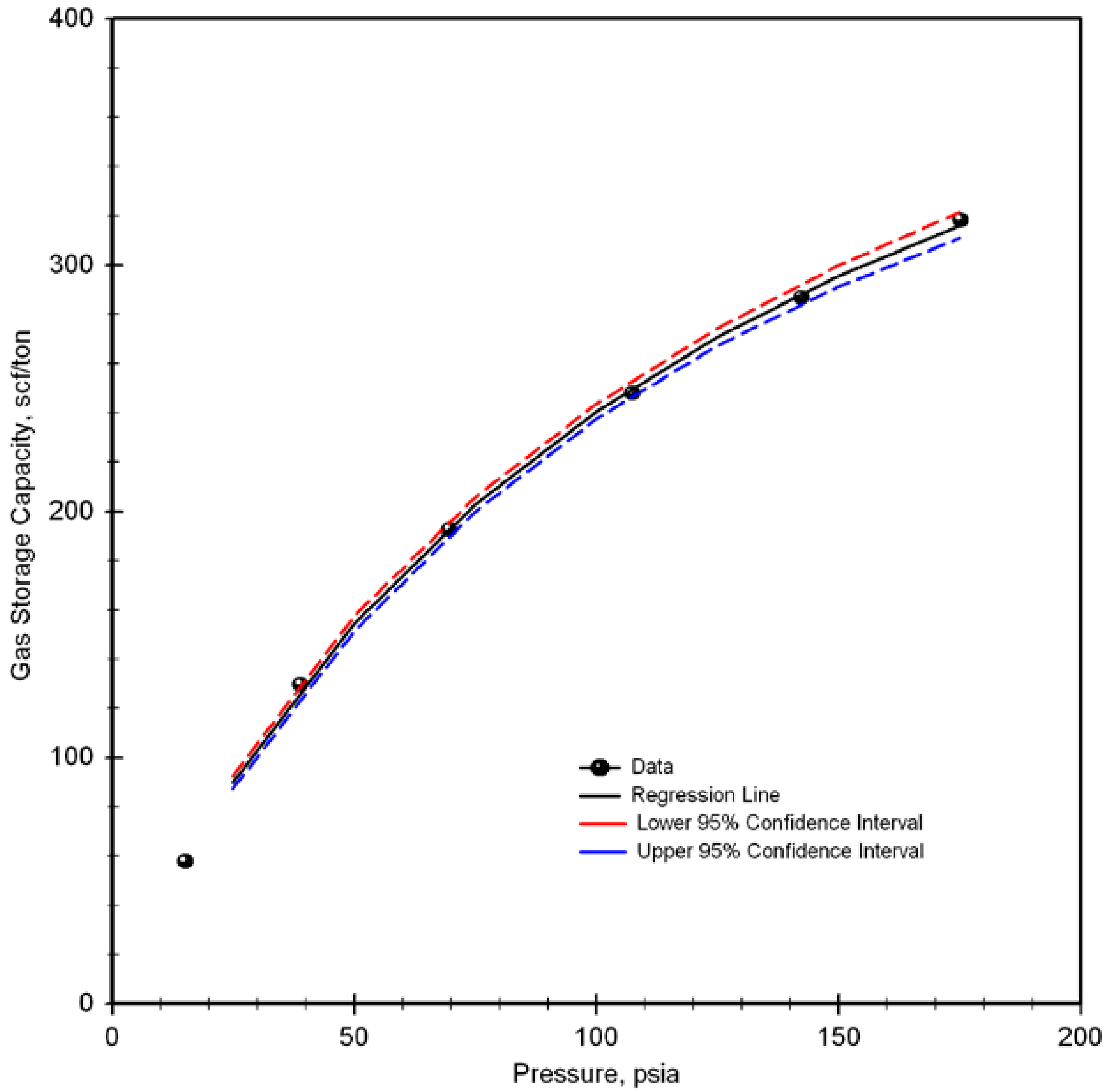
Sample 41680-2 Coal Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	229.00
Bottom Depth	ft	230.00
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	60.08
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.340
Moisture Holding Capacity	wt frac	0.0119
Ash Content	wt frac	0.1362
Volatile Matter Content	wt frac	0.2749
Fixed Carbon Content	wt frac	0.5771
Organic Content	wt frac	0.8450
Sulfur Content	wt frac	0.0070
Sulfur-in Ash Content	wt frac	0.0020
Vitrinite Content	vol frac	0.920
Inertinite Content	vol frac	0.064
Liptinite Content	vol frac	0.017
Rank Parameters		
Parr Corrected Volatile Matter Content, daf	wt frac	0.4368
Parr Corrected Fixed Carbon Content	wt frac	0.5632
Calorific Value, mmf	BTU/lbm	15,587
Parr Corrected Calorific Value, mmf	BTU/lbm	15,633
Langmuir Parameters		
Number of Points	-	6
Regression Coefficient	-	0.9996
Langmuir Storage Capacity, daf	scf/ton	638.13
Langmuir Storage Capacity, In-Situ	scf/ton	543.66
Langmuir Storage Capacity Range, In-Situ	scf/ton	1.96
Langmuir Pressure	psia	125.97
Langmuir Pressure Range	psia	3.03

Sample 41680-2 Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	**scf/ton**
15.056	57.958
38.840	129.783
69.568	192.604
107.294	248.129
142.236	286.951
175.162	318.396

Sample 41680-2 Adsorption Isotherm Data



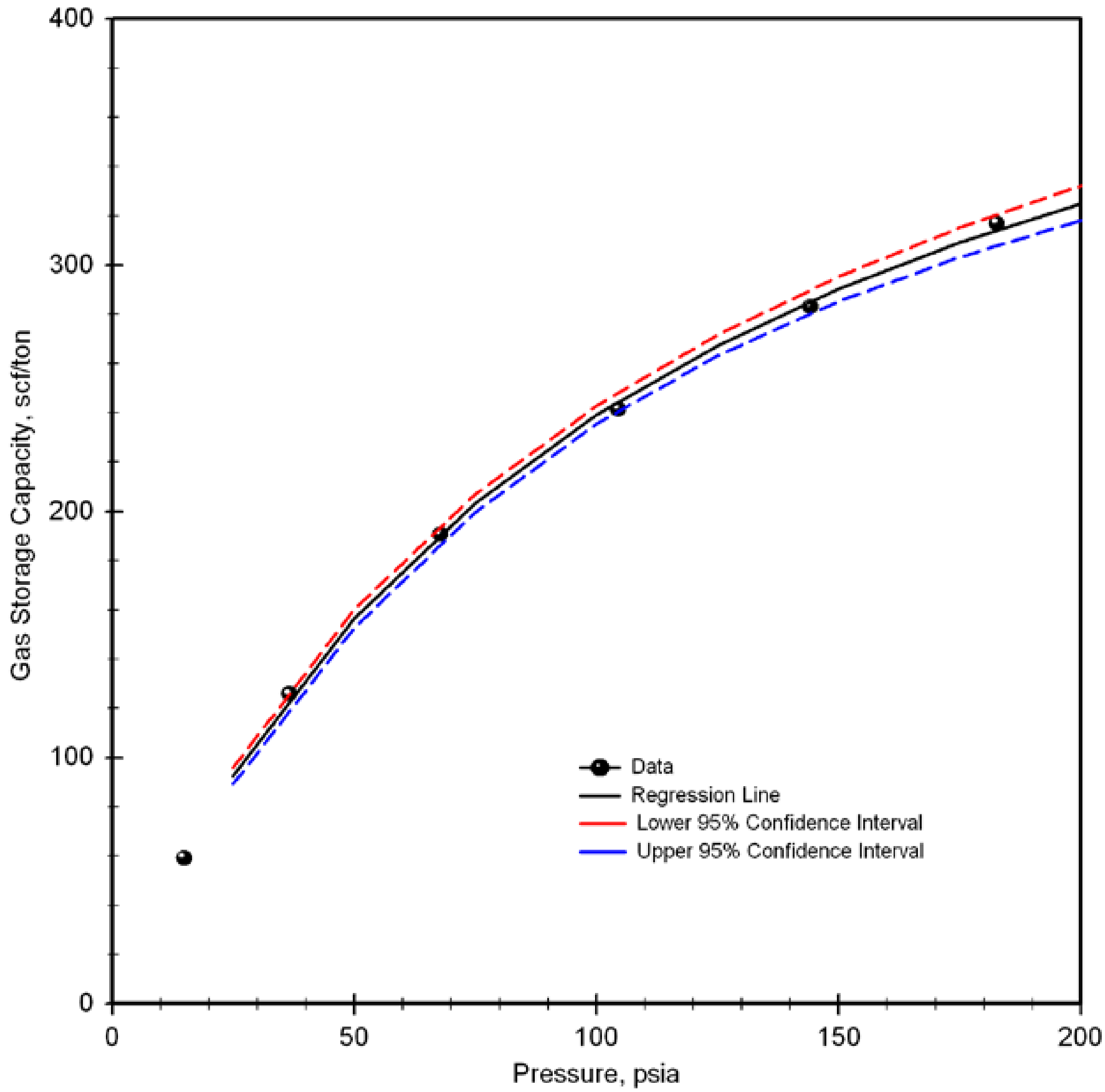
Sample 41680-4 Coal Adsorption Isotherm Parameters

Parameter	Unit	Value
Top Depth	ft	271.60
Bottom Depth	ft	272.30
Isotherm Parameters		
Measurement Gas	-	methane
Measurement Temperature	°F	60.08
In-Situ Sample Characterization		
Crushed Density	g/cm^3	1.431
Moisture Holding Capacity	wt frac	0.0140
Ash Content	wt frac	0.1917
Volatile Matter Content	wt frac	0.2515
Fixed Carbon Content	wt frac	0.5428
Organic Content	wt frac	0.7873
Sulfur Content	wt frac	0.0070
Sulfur-in Ash Content	wt frac	0.0014
Vitrinite Content	vol frac	0.939
Inertinite Content	vol frac	0.055
Liptinite Content	vol frac	0.007
Rank Parameters		
Parr Corrected Volatile Matter Content, daf	wt frac	0.4358
Parr Corrected Fixed Carbon Content	wt frac	0.5642
Calorific Value, mmf	BTU/lbm	15,349
Parr Corrected Calorific Value, mmf	BTU/lbm	15,461
Langmuir Parameters		
Number of Points	-	6
Regression Coefficient	-	0.9995
Langmuir Storage Capacity, daf	scf/ton	638.24
Langmuir Storage Capacity, In-Situ	scf/ton	506.96
Langmuir Storage Capacity Range, In-Situ	scf/ton	2.91
Langmuir Pressure	psia	112.00
Langmuir Pressure Range	psia	3.19

Sample 41680-4 Adsorption Isotherm Data

Pressure	Storage Capacity, in-situ
psia	**scf/ton**
14.798	59.370
36.578	126.023
67.650	190.829
104.451	241.719
144.039	283.243
182.599	317.028

Sample 41680-4 Adsorption Isotherm Data



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APPENDIX G: SITE PHOTOGRAPHS

Photo 1: View of Fosset Gulch site before well pad construction.

Photo 2: View of Highway 151 site before well pad construction.

Photo 3: View of drilling operations at the Wagon Gulch site.

Photo 4: View of drilling operations at the Wagon Gulch site.

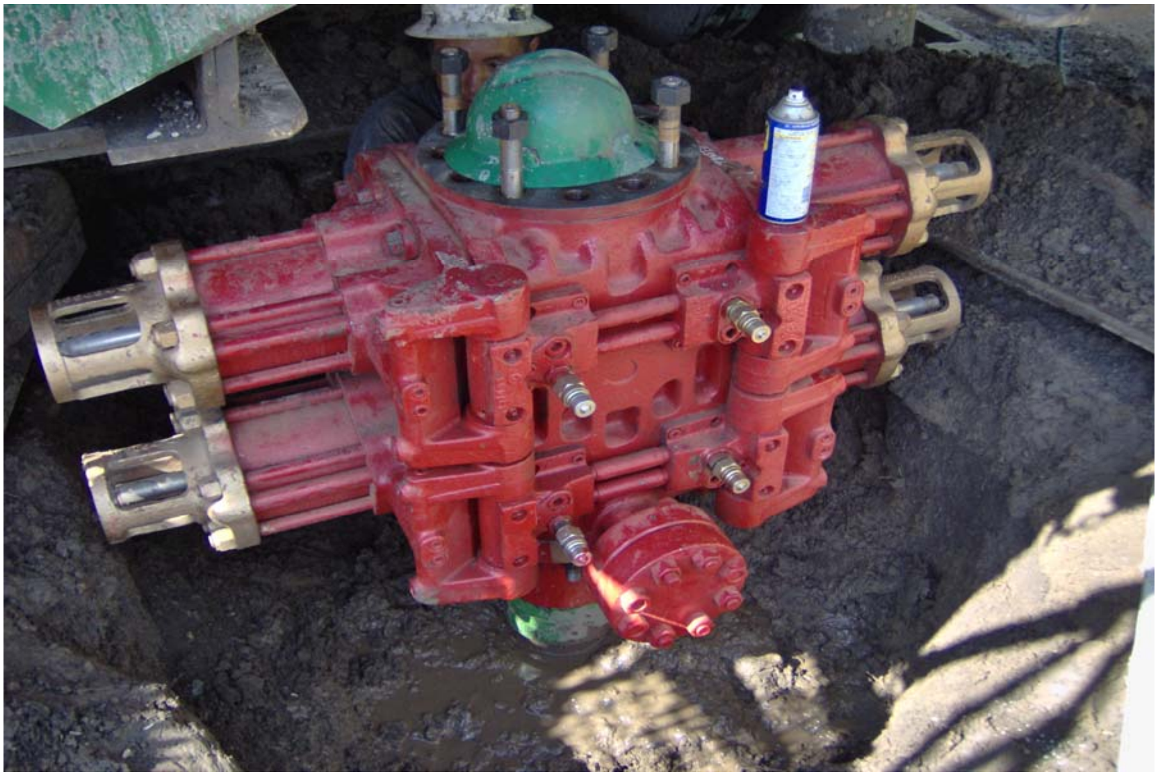

Photo 5: View of Blow-Out Preventer at the Wagon Gulch site.

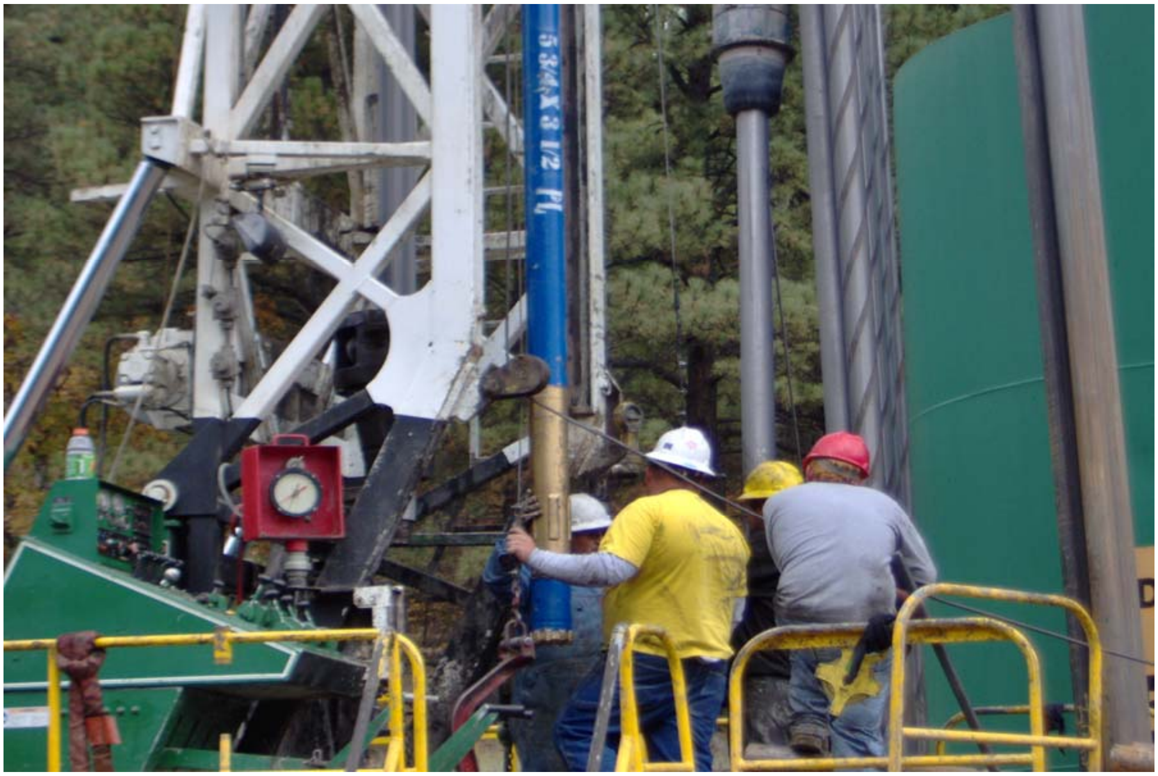

Photo 6: View of core barrel for coal core retrieval at the Wagon Gulch site.

Photo 7: View of core barrel for coal core retrieval at the Wagon Gulch site.

Photo 8: View of core barrel sleeve at the Wagon Gulch site.

Photo 9: View of core sample at the Wagon Gulch Site.

Photo 10: View of core sample at the Wagon Gulch site.

Photo 11: View of core samples at the Fosset Gulch site.

Photo 12: View of core samples at the Fosset Gulch site.

Photo 13: View of 4.5" steel casing at the Wagon Gulch site

Photo 14: View of 4.5" steel casing installation at the Wagon Gulch site.

Photo 15: View of cementing operations at the Wagon Gulch site.

Photo 16: View of cementing operations at the Wagon Gulch site.

Photo 17: View of perforating operations at the Wagon Gulch site.

Photo 18: View of perforating operations at the Wagon Gulch site.

Photo 19: View of perforating tools at the Fosset Gulch site.

Photo 20: View of swabbing operations at the Wagon Gulch site.


Photo 21: View of telemetry system at the Highway 151 site.


Photo 22: View of telemetry system installation the Wagon Gulch site

Photo 23: View of the Wagon Gulch site after reclamation.

Photo 24: View of the Wagon Gulch site after reclamation.

Photo 25: View of the Fosset Gulch site after reclamation.

Photo 26: View of the Fosset Gulch site after reclamation.

Photo 27: View of the Highway 151 site after reclamation.

Photo 28: View of the Highway 151 site after reclamation.

APPENDIX H: OPERATIONS AND MAINTENANCE MANUAL

COLORADO OIL AND GAS CONSERVATION COMMISSION COAL BED METHANE MONITORING WELL OPERATION AND MAINTENANCE MANUAL ARCHULETA COUNTY, COLORADO

Souder, Miller & Associates ♦ P.O. Box 2606 ♦ Farmington, NM 87499-2606
612 East Murray Drive ♦ Farmington, NM 87401-6624 ♦ (505) 325-5667 ♦ fax (505) 327-1496

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Attachment: In-Situ, Inc. Rugged Reader Operator's Manual

1.0 NOTIFICATIONS

Colorado Oil and Gas Conservation Commission (COGCC) shall be notified prior to site entrance, blowing down wells, well head maintenance, remote terminal unit (RTU) and transducer maintenance for the coal bed methane (CBM) gas monitoring wells located at the Wagon Gulch, Fosset Gulch and Highway 151 well sites. Potential hazards to the environment and public health exist while performing maintenance on CBM wells and proper precautions should be taken.

2.0 SAFETY EQUIPMENT AND PRECAUTIONS

The following are required for entrance to CBM well sites:

1. Hard Hat
2. Steel Toe Boots
3. ANSI 75 rated safety glasses
4. Hearing Protection
5. Work Gloves
6. First Aid Kit
7. Fire Extinguisher

The following may be needed for specific tasks while working on CBM well sites:

1. Fire Retardant Clothing (FRC)
2. Atmospheric Testing Equipment

The following activities are prohibited while working on CBM wells sites:

1. No smoking or open flames
2. No drugs or alcohol
3. No firearms
4. No inappropriate behavior

3.0 EQUIPMENT AND TOOLS

The following list of equipment and tools may be needed for proper maintenance of CBM monitoring wells:

1. Pipe Wrenches (24” and 36”)
2. Sledge hammers (2 pound and 7 pound)
3. 2 inch ball valve handle
4. 3 or 4 inch high pressure hoses
5. 4 inch union/coupler (National Pipe Thread, NPT)
6. 4 to 3 inch reducer (NPT)
7. Minimum of a 100 barrel capacity tank
8. Thread Seal
9. Teflon Tape

10. Hand Tools

4.0 BLOWING DOWN THE MONITORING WELLS

Prior to performing maintenance on CBM monitoring wells, gas and water pressures must be released from each monitoring well. ***Near by property owners shall be notified prior to the blowing down of CBM wells as high noise levels may occur***. In order to release the gas and water pressure from a CBM monitoring well, the bull plug at the end of the 2 inch ball valve must be removed. A 24 inch pipe wrench can be used to remove the bull plug. After bull plug removal, the 2 inch ball valve can be opened. A ball valve handle must be used to open the 2 inch ball valve. Currently all handles have been removed from all the monitoring wells for safety purposes. Attach the handle to the ball valve and open the ball valve to release the gas and water pressure.

While removing the bull plug and prior to opening the ball valve, make sure that all site personnel are not in front of the ball valve orifice. If the ball valve is leaking, high gas and water pressures may exist and can cause serious injury or death. Personnel opening the ball valve shall stand behind the ball valve to open it and shall be wearing hearing protection, eye protection and gloves.

Once the 2 inch ball valve has been opened, allow sufficient time for the monitoring well to depressurize before continuing maintenance.

5.0 WELL HEAD TRANSDUCER REMOVAL

In order to perform maintenance or replacement on the surface well head pressure transducers, the 2 inch by 12 inch threaded nipple must be removed. A 24 inch pipe wrench can be used for removal of the 2 inch nipple. ***Caution must be used while removal of the 2 inch nipple so as not to damage the pressure transducer or cable connections.***

Once the 2 inch by 12 inch nipple has been removed from the wellhead, slide the nipple along the transducer’s communication cable to gain access to the cable connection and wellhead connection. Disconnect the communication cable from the transducer prior to removing the transducer from the wellhead. The cable connections have a twist locking mechanism. ***Hand strength is sufficient for removal. Do not use tools for disconnecting the communication cable from the transducer as that damage may occur.***

Once the transducer’s communication cable has been disconnected, slide the 2 inch nipple off of the cable. Next the pressure transducer can be removed from the wellhead. A crescent wrench can be used to remove the transducer from the threaded bull plug attached to the well head.

6.0 DOWN HOLE TRANSDUCER REMOVAL

The down hole pressure transducers at the Wagon Gulch, Fosset Gulch and Highway 151 sites are installed at different depths. Transducer cables are hung from a steel ring that has been secured within the tubing heads. The communication cables are attached to the steel ring by a carabiner. The carabiner must be detached from the steel ring before proceeding to remove the cable and transducer. ***The communication cable must have a secondary security device to prevent the transducer and cable from falling into the monitoring well while removing. A cable tied to a stationary object is recommended as a secondary security device.***

The length of cable and transducer is heavy and may require multiple people to remove entire length.

7.0 TUBING HEAD REMOVAL

SMA recommends that a professional oil and gas wellhead servicing company be used for the removal of monitoring well tubing heads. The servicing company can provide or make arrangements for all the necessary equipment for water/gas control and tubing head removal.

8.0 REMOTE TERMINAL UNIT AND TRANSDUCER PROGRAMMING

The In-situ, Inc. Rugged Reader Operator’s Manual is provided in this Appendix. Please refer to operator’s manual for programming instructions.

*Rugged*Reader®

OPERATOR'S MANUAL

August 2006

Contents

1 INTRODUCTION

The ultra-rugged RuggedReader®—rock solid and field ready in the most extreme environments—is your reliable field companion. Designed for Windows Mobile® 5.0, your RuggedReader features a wide variety of application software choices, including Win-Situ® Mobile, control software for In-Situ's Level TROLL®, and Pocket-Situ 4 for In-Situ's MP TROLL® 9500, miniTROLL®, and MP TROLL® 9000.

WINDOWS MOBILE® 5.0

The Windows Mobile 5.0 operating system, designed for mobile devices, provides familiar Microsoft programs like Outlook® Mobile. Many Windows applications are compatible with Windows Mobile. You can use Windows Mobile to access Word, Excel®, and PowerPoint® files on your mobile device, or you can use Windows Mobile to access your e-mail messages and contacts from your Microsoft Outlook account.

More information about Windows Mobile 5.0 can be found at http://www.Microsoft.com/windowsmobile/5/default.mspx.

HOW TO USE THIS MANUAL

This operator's manual is designed as both a start-up guide and a permanent reference for the RuggedReader's features and applications.

Section 1: Introduction to the RuggedReader® and to In-Situ Inc. — Anatomy of the RuggedReader — Accessories — Warranty — Instrument Repair & Return Recommendations

Section 2: Getting Started — Installing & charging the battery pack — Installing Microsoft ActiveSync®

Section 3: Using the Hardware — Buttons — Power — Stylus — Touchscreen — CF and SD cards

Section 4: A quick overview of basic software operations in the Windows Mobile operating system

Section 5: Using ActiveSync®

Section 6: Using In-Situ Software — Win-Situ Mobile — Pocket-Situ 4 — TDG Logger — Transferring data files from the RuggedReader to a desktop computer

Section 7: Care and Maintenance of the RuggedReader

Conventions

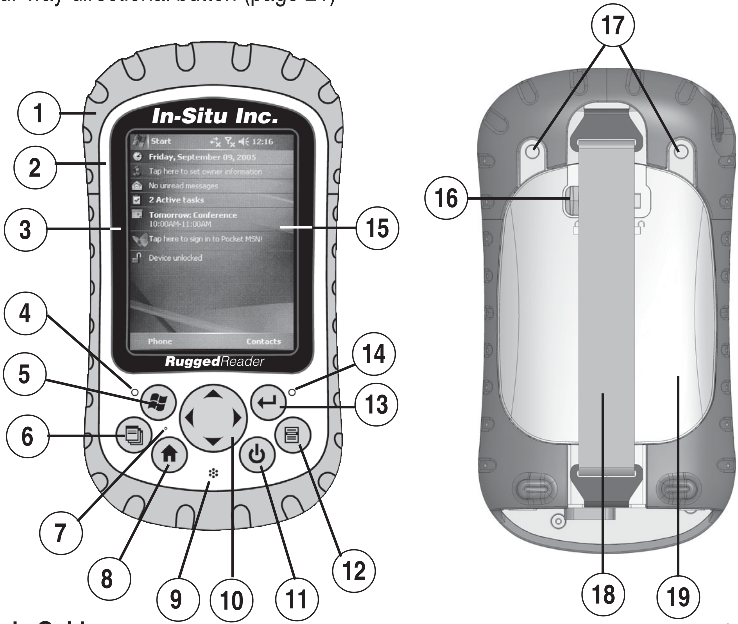
Throughout this operator's manual you will see the following symbols:

The check mark highlights a tip about a convenient feature of the RuggedReader or its software

The exclamation point calls your attention to a requirement or important action that should not be overlooked

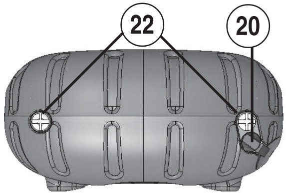
THE ANATOMY OF THE RUGGEDREADER

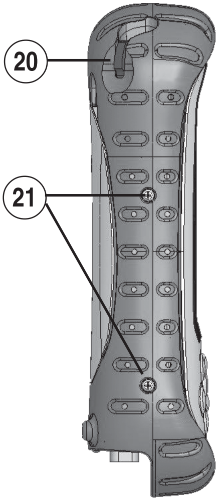
1 Elastomer overmold
2 Magnesium case front
3 Display bezel
4 Charge LED (page 32)
5 Start menu button (page 21)
6 Applications Manager button (page 21)
7 Microphone
8 Home button (page 21)
9 Speaker
10 Four-way directional button (page 21)
11 Power button (pages 23-24)
12 Context menu button (page 21)
13 Enter button (page 21)
14 Notification LED (p. 32)
15 Touchscreen/display (pages 30-31)
16 Battery door latch
17 Accessory attachment points
18 Hand strap
19 Battery door



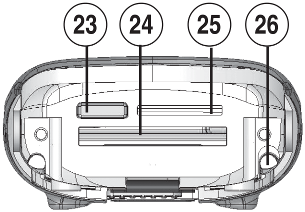
20 Stylus
21 Main screws (do not remove)
22 Top cap screws (captive) (page 33)
23 Slot for future accessory
24 Compact Flash card slot (page 33)
25 Secure Digital I/O card slot (page 33)
26 Stylus slot
27 USB Client (mini B)
28 12V DC jack
29 9-pin serial port
30 USB Host (mini A)
31 Cable routing channel

Top view with top cap

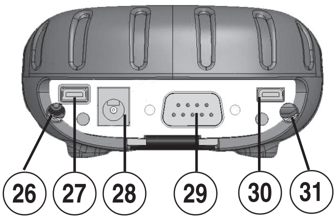




Top view without top cap



Communications module



WHAT WE PROVIDE

Accessories:

- Battery
- Stylus
- USB communications cable
- End User License Agreement (EULA)
- Wall charger & 4 plugs
- 12V auto adapter
- Dashboard accessory pad
- Screen Protectors (2)

Installed In-Situ software:

- Win-Situ Mobile (Pocket-Situ 5), for use with Level TROLLs
- Pocket-Situ 4, for use with miniTROLLs, TROLL 9500s, and TROLL 9000s
- TDG Logger, for use with T506 Total Dissolved Gas probes

Reference Tools:

- A quick start guide
- Getting Started CD from Microsoft (installs ActiveSync®)
- In-Situ Software/Resource CD (includes user's guide)

Accessories

Accessory / Replacement Part	Catalog No.
12V Auto Charger Adapter	55410
Lithium-Ion Battery Pack	55420
USB Communication Cable	55430
Hand Strap	55440
Stylus	55460
Screen Protectors (2)	55470
CF Card, 512 MB	55480
CF Card, Bluetooth	55490
Dashboard Accessory Pad	59250

Warranty

In-Situ Inc. warrants that this product shall be free from defects in materials and workmanship for a period of Two Years when properly installed and operated in accordance with the instruction manuals provided by, or available through, In-Situ Inc., and when used within the design specifications for the product. The warranty period begins on the day the product is shipped to the customer or distributor and is non-transferable.

In-Situ Inc. agrees to repair, or, at its option, replace at no charge, components that have been proven to be defective during the warranty period, provided that the warranted product is shipped, postage prepaid, to In-Situ Inc.

These warranties do not apply to any product that has been damaged either by negligence, accident, acts of God, War, or misuse by any other person. Nor do these warranties apply to any product that has been repaired, altered, serviced, or modified by an unauthorized person.

IMPORTANT: *Contact In-Situ (see next page) for a Return Materials Authorization (RMA) number and shipping instructions before shipping the device to In-Situ Inc.*

HOW TO CONTACT US

Technical Support: 800 446 7488

Toll-free 24 hours a day in the U.S. and Canada

Address: In-Situ Inc.
221 E. Lincoln Ave.
Fort Collins, CO 80524 USA

Phone: 970 498 1500
Fax: 970 498 1598
Internet: www.in-situ.com
e-mail: support@in-situ.com

__WARNING:__ Do not attempt to service the device yourself. This action voids the warranty.

__TIP:__ To locate your device's serial number, tap Start > Settings > System tab > System Config.

__TIP:__ Please keep your RMA number for future reference.

To Obtain Repair Service (U.S.)

If you suspect that your RuggedReader is malfunctioning and repair is required, you can help assure efficient servicing by following these guidelines:

1. Call or e-mail In-Situ Technical Support (support@in-situ.com). Have the product model and serial number handy.

   To locate the device serial number and other identification information:
   a. Tap Start > Settings.
   b. In the Settings window, tap the System tab.
   c. Scroll down and tap System Config.

2. Be prepared to describe the problem, including how the RuggedReader was being used and conditions noted at the time of the malfunction.

3. If Tech Support determines that service is needed, they will ask that your company pre-approve a specified dollar amount for repair charges. When the pre-approval is received, Tech Support will assign an RMA (Return Material Authorization) number.

4. Carefully pack your RuggedReader in its original shipping box, if possible.

5. Mark the RMA number clearly on the outside of the box with a marker or label.

6. Send the package, shipping prepaid, to

   In-Situ Inc.
   ATTN: Repairs
   221 E. Lincoln Ave.
   Fort Collins, CO 80524

The warranty does not cover damage during transit. In-Situ recommends the customer insure all shipments. Warranty repairs will be shipped back prepaid.

Outside the U.S.

Contact your international In-Situ distributor for repair and service information.

2 GETTING STARTED

***TIP:** If you used the Quick Start guide to set up your RuggedReader, you completed Steps 1-5.*

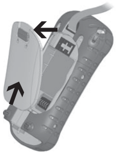
This chapter repeats the installation instructions in the RuggedReader Quick Start guide. If you used the Quick Start guide to set up your RuggedReader, you completed Steps 1-5.

STEP 1: INSTALL THE BATTERY PACK

1. Slowly unhook and lift up the bottom latch of the hand strap. CAUTION: Do not let the hand strap hook hit the display.

2. Press on the battery door and slide the latch to the right to unlock it.

3. Remove the battery door.



4. Insert the battery pack so battery contacts match up.

5. Insert the tabs on the bottom of the battery door into the case slots. Make sure the door latch is all the way to the right and properly aligned. Then close the battery door.

6. Press firmly on the battery door and slide the latch to the left to lock it.

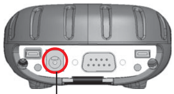
7. Reattach the hand strap.

STEP 2: CHARGE THE BATTERY PACK

1. Mount the plug onto the wall charger (if it is not already assembled).

2. Plug the wall charger into an outlet.

3. Plug the other end of the wall charger into the DC jack on the RuggedReader. The device turns on after a few seconds, and a flashing red light appears to signal the device is charging.



TIP: *Note: After a few minutes the device suspends, and the flashing red LED turns off, but the device keeps charging.*

4. Charging the RuggedReader for 4.5 hours charges it up to 95%. Let the device charge for 6 hours to get a full charge.

STEP 3: CALIBRATE THE TOUCHSCREEN

When you first power your RuggedReader, or after a device reset, you will be prompted to calibrate the touchscreen. Using the stylus, follow the instructions on the screen.

To protect the touchscreen, we recommend that you apply a screen protector. See Protecting the Touchscreen in Section 3.

STEP 4: INSTALL ActiveSync® ON A DESKTOP COMPUTER

Windows Mobile 5.0 requires that you use ActiveSync 4.1 or greater. The Getting Started CD installs ActiveSync 4.1 on your desktop computer.

1. Insert the Getting Started CD into your desktop computer.

   The CD runs automatically.

   The options presented will differ depending on whether ActiveSync is currently installed on your computer.

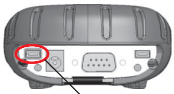
2. Follow the directions on the screen to install the latest version of ActiveSync on your desktop computer.

Install ActiveSync ***before*** *attaching the USB cable to the desktop PC or to the RuggedReader.*

STEP 5: CREATE AN ActiveSync CONNECTION

Install ActiveSync on your desktop computer before creating a connection.

1. Plug USB Client end (mini B) of the USB communications cable into your RuggedReader when instructed by ActiveSync.



USB Client (mini B)

2. Plug the USB Host end (full size A) of the USB communications cable into your desktop computer.

3. Establish an ActiveSync partnership by following the instructions on the desktop computer screen.

TIP: *ActiveSync may refer to the device "cradle" On the RuggedReader, this means to plug in the mini B end of the USB cable.*

Tips for Your First ActiveSync Connection

- To use In-Situ's RuggedReader software, we recommend you set up a "Guest" connection in ActiveSync.

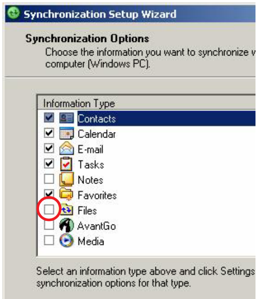
To connect as a "Guest," just click Cancel on the first page of the Sync Setup wizard. ActiveSync then recognizes your device as a Guest.

Setting up as a Guest creates a temporary relationship with a desktop computer. Each time the device connects to the desktop, you need to set it up as a Guest by clicking Cancel at the first screen of the Sync Setup Wizard.

TIP: *Multiple RuggedReaders will not synchronize with ActiveSync on the same desktop computer. To connect multiple devices to your desktop computer, connect each as a guest.*

- Synchronization of Pocket-Situ 4 or Win-Situ Mobile (Pocket-Situ 5) data files is handled by an In-Situ utility called "Win-Situ® Sync," which automates the transfer of data files from your RuggedReader to the Win-Situ working directory on your desktop PC. Even with a full synchronization partnership these files are not synchronized automatically by ActiveSync. For information on these In-Situ programs, see Section 6.

- The alternative to a Guest connection is a full synchronization partnership. You can set up Contacts, Calendar, E-mail, Tasks, etc. to automatically synchronize whenever ActiveSync makes a connection. Notes do not synchronize, and Files synchronize one way—from the desktop computer to the RuggedReader.



CAUTION: When setting up a full synchronization partnership, be sure to leave the "Files" option unchecked in the Sync Setup Wizard. A file in the synchronization folder on the desktop computer can overwrite a file of the same name on the RuggedReader.

THE NEXT STEP

You are now ready to use your RuggedReader.

- To find out about hardware features—buttons, touchscreen, stylus—continue to Section 3
- For Windows Mobile software features, go to Section 4
- For details on Microsoft ActiveSync, check out Section 5
- To start using In-Situ's RuggedReader applications to talk to your In-Situ devices, turn to Section 6

3 USING THE HARDWARE

This chapter describes the hardware components of the RuggedReader:

- Buttons
- Power Management: suspending, powering off, and resetting the RuggedReader
- Stylus
- Touchscreen
- LEDs signals
- Peripheral Devices (CF and SD cards, USB drives)

BUTTONS

The following chart shows the names and functions of each button on the keypad.

Button	Name	Function
	Start menu button	Provides a menu of applications
	Applications Manager button	Lets you switch between or close running applications; allows you to view memory allocations
	Home button	Returns you to the Today screen
	Context menu button	Displays the context menu related to the item selected (similar to a right-click on a desktop computer)
	Enter button	Enters the selected soft key or option
	Power button	Turns the RuggedReader on and off, resets, suspends (see more details in the Power button section)
	Four-way directional button	Allows you to navigate

Customizing Button Functions

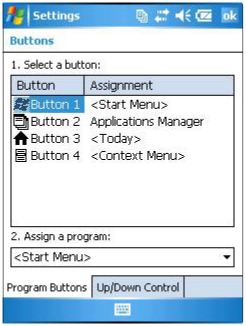
Each button performs a specific function. You can customize the function of the following four buttons to open programs or perform shortcuts:

- Start menu button (Button 1)
- Applications Manager button (Button 2)
- Home button (Button 3)
- Context menu button (Button 4)

***TIP:** The functions assigned to the Enter button, power button, and Four-way directional button cannot be customized.*

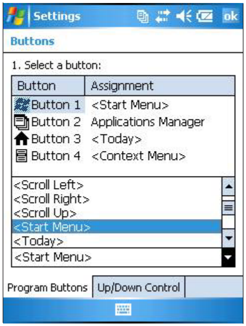
To reassign a program or shortcut to a button:

1. Tap Start > Settings > Personal tab > Buttons. A list of buttons and their current assignments is displayed on the Program Buttons tab.



2. Tap the button you want to reassign.

3. In the Assign a program box, tap the program or shortcut you want to assign to the button.



4. Tap OK.

POWER

The power button allows you to power on, suspend, power off, and reset the device. A series of keypad actions lets you restore factory defaults to the registry or to the whole device. Below are instructions for each action.

Suspending

Suspending the RuggedReader is different from powering it off:

- Suspending the device puts it to sleep, and when it is turned back on, the device remembers where it was. Some battery power is used.
- Powering off the device closes all programs and turns off all of the power. No battery power is used.

We recommend suspending your device if you want to resume your task or if you plan to use the device on a daily basis.

1. To suspend your device, press the power button briefly and release.
2. To resume the device from suspend mode, press the power button again.

__TIP:__ If the device suspends while it is charging, the flashing red light disappears. However, the device continues to charge.

__TIP:__ The RuggedReader suspends automatically after a specified period of time with no activity. To change this automatic timeout, tap Start > Settings > System tab > Power > Advanced tab.

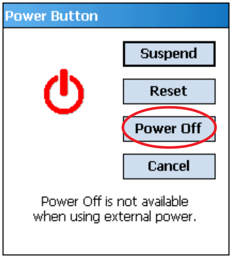
Powering Off

Powering off ends all programs and removes power from all system components except for the real-time clock. Unlike suspend mode, the device resets when it is powered on again.

To preserve battery power, we recommend you power off the device if it will be left unused for two weeks or longer.

To power off the RuggedReader:

__TIP:__ The device cannot be powered off while it is plugged into the wall charger.



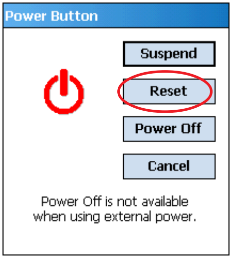
1. Save your open files and close any running programs.
2. Press ⏻ until the power button menu appears.
3. Tap Power Off.

   The keypad backlight stays on for a few seconds after the device shuts off. Until the keypad backlight turns off, the device cannot be powered on again.

To power on your RuggedReader, hold down ⏻ until the green notification light appears. Introductory splash screens will be displayed, then the Today screen. This process takes about a minute.

Resetting the Device (Soft Reset)

Some programs require you to reset your device during installation. Follow the steps below to reset the RuggedReader:



1. Save open files and close any running programs.
2. Press ⏻ until the power button menu appears.
3. Choose Reset.

If your device is locked up, you can reset it without the power button menu. Just press the power button for 10 seconds or until the screen goes dark. After a few seconds, the device turns on again.

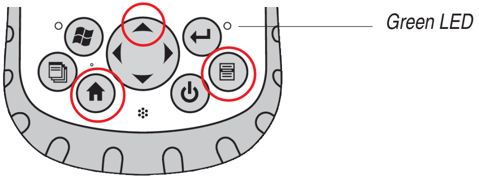
Restoring Factory Defaults (Hard Reset)

__WARNING:__ Restoring the device to its original factory state will permanently erase data saved on the device, software installed by In-Situ Inc. (Win-Situ Mobile, Pocket-Situ 4, TDG Logger), any software you installed, and any changes you made to the device, including settings changes.

Follow the steps below to restore the hard drive, settings, and icons to their original factory state on your device. WARNING! Restoring the device to its original factory state will permanently erase data saved on the device, any software you installed, and any changes you made to the device, including settings changes.

To restore the device to its original factory state, follow these steps:

1. Reset the device from the power button menu or by holding down the power button until the display goes dark.
2. When the green LED light appears on the front of the RuggedReader, simultaneously press and hold the following buttons for several seconds: the Home button, the up arrow on the Four-way directional button, and the Context menu button.



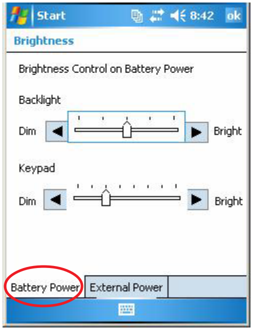
3. Hold the buttons until the RuggedReader splash screen appears and then disappears. Factory settings are restored automatically.

Conserving Power

The RuggedReader has several settings that let you save battery power.

Backlight

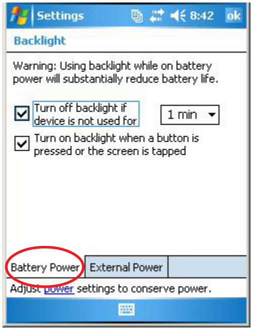
To dim or turn off the display and keypad backlights:



1. Tap Start > Settings > System tab > Brightness.
2. Select the Battery Power tab.
3. Drag the backlight slider slightly to the left to dim the backlight, or all the way to the left to turn it off. If the backlight does not turn off completely, tap on the arrow to the left of the Backlight slider.
4. Tap OK.

Adjusting the Backlight Timer

By default, the display and keypad backlights turn off after one minute of inactivity. You can adjust the time when the backlight turns off:



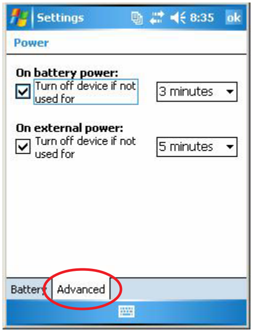
1. Tap Start > Settings > System tab > Backlight.
2. Select the Battery Power tab.
3. Set the options as you want them.
4. Tap OK.

Automatic Suspend

By default, the RuggedReader will suspend automatically after three minutes of inactivity when on battery power.

To adjust the time when the device suspends, follow these steps:

1. Tap Start > Settings > System tab > Power.
2. Select the Advanced tab.
3. Adjust the device timeout as desired.
4. Tap OK.



TIP: *To resume the device from suspend at any time, press*

THE STYLUS

Like the left button on a desktop computer mouse, the stylus is a tool that lets you select items and enter data. Like the right button, the stylus lets you perform shortcuts like cutting and pasting. Instructions for these tasks are listed in the chart below.

The stylus is stored in an open slot at the top of the device. A hole in the end allows you to attach a lanyard.

To do this . . .	Follow these steps
Select an item	Tap once
Enter data	See Entering Information on the following page
Open an item or file	Tap the item or file
Open a context menu for an item	Tap and hold the item. The context menu appears.
Cut or copy	1. Tap and hold 2. Select Cut or Copy from the context menu
Paste	1. Tap and hold the area where you want to paste 2. Select Paste from the context menu
Drag and drop	1. Tap the item(s) 2. Drag the item(s) to the destination 3. Lift up the stylus
Select multiple items	Drag the stylus over the items

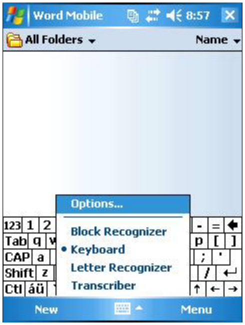
Entering Information

You have several options for entering information into your RuggedReader using the stylus.

- On-screen Keyboard utility (the default input method)
- Letter Recognizer—recognizes character strokes and gestures
- Block Recognizer—recognizes letters from single strokes
- Transcriber—recognizes cursive, print, or mixed handwriting

When you are ready to enter text, you can switch from the default input method (keyboard) by following these steps:

1. On the bottom center of the screen, tap the arrow next to the input method icon. If the arrow is not displayed, tap the input method icon, then tap the arrow.
2. The input method menu appears, as shown here. Tap the input method you want from the list of options.
3. Using the selected input method, enter your text.



TIP: *For more details about each input method, go to Start > Settings > Input and choose the input method from the Input window.*

THE TOUCHSCREEN

Protecting the Touchscreen

The touchscreen is sealed to protect your device against water and dust. Protect your touchscreen from impact, pressure, or abrasive substances that could damage it. To further protect the touchscreen, apply one of the adhesive screen protectors that came with your RuggedReader. We recommend that you apply a new screen protector every 30 days. Extra screen protectors are available from In-Situ Inc. (catalog no. 55470).

To apply a screen protector, follow these steps:

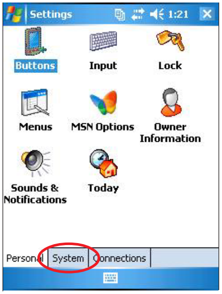
1. Make sure the RuggedReader screen is free of oils and dirt. You can wipe it with a microfiber cloth.
2. Peel back the paper liner from the screen protector, exposing approximately one inch.

3. Align bottom corners of the screen protector with the RuggedReader screen, sticky side down.
4. Smooth the screen protector while peeling back the liner, working out air bubbles as you go. Continue smoothing until the paper liner is removed.

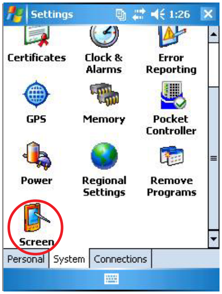
TIP: *Some air bubbles may still be visible, but they fade away in a short time. You can use a credit card to gently push out any excess air.*

Calibrating the Touchscreen

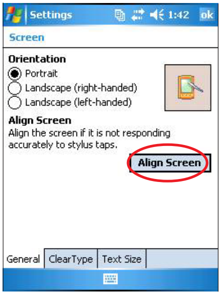
If the touchscreen is not responding accurately to stylus taps, try calibrating it manually:



1. Tap Start > Settings > System tab.



2. Scroll down and tap on the Screen icon.



3. In the Screen Settings window, select the Align screen button.
4. Follow the directions on the display to calibrate the touchscreen.
5. After you calibrate the touchscreen, the Screen window appears again. Click OK to exit the screen.

LED SIGNALS

The RuggedReader signals events and processes using LEDs.

Charge LED (Red)

This red light appears to the left of the Start menu button on the keypad.

Flashing : battery is currently charging
Solid : wall charger is connected but battery is fully charged

When the device is suspended or powered off, the charge LED does not appear.

Notification LED (Green)

The green LED is located to the right of the Enter button on the keypad. It appears briefly when you power on the unit after the device is reset or restored to factory defaults.

USING PERIPHERAL DEVICES

The RuggedReader accepts several peripheral devices.

- The USB Host (mini A) accepts devices like USB flash drives and keyboards.
- The Compact Flash (CF) and Secure Digital (SD) card slots accept memory cards and SDIO cards, such as GPS, modem, and Bluetooth cards.

TIP: To be compatible with Windows Mobile 5.0, some USB serial devices require drivers. Refer to your USB device's manual or contact the manufacturer to determine compatibility.

USB Devices

To install a USB device, plug the mini end of a USB communications cable into the USB Host (labeled A on your device). You may need to use a USB mini-to-full size adapter.

USB Host (mini A)

Removing the Top Cap

CAUTION: *When the top cap is removed, the RuggedReader is not sealed. Avoid exposing the device to moisture when the top cap is removed.*

The removable top cap protects the RuggedReader and storage cards. To remove the top cap:

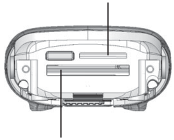
1. Remove the stylus.
2. Unscrew the top screws until you can slide the top cap off. The screws remain attached to the top cap.
3. Pull off the top cap.

TIP: *After removing a card, wait at least 6 seconds before inserting the same or another card. The RuggedReader needs this time to properly identify and use the newly inserted card. If a card is reinserted too quickly, the device may need to reset. To minimize this problem, close all programs before changing or reinserting a card.*

Installing a CF or SD Card

Remove the top cap as above and insert the card. The system should automatically detect and use the card. If the card is not recognized, try the following:

- Install an appropriate driver.
- Consult the user's guide that came with the card.



Reattaching the Top Cap

1. Make sure the hand strap is attached to its top latch.
2. Place the top cap over the case. Be sure the tabs are slotted into the sides of the case.
3. Use a screwdriver to turn the screws until they are firmly in place.

CAUTION: *Tighten the top cap screws firmly after you replace the top cap. Failure to replace the top cap properly may void your warranty.*

Note: Once the top cap rests against the magnesium case front, the screws become harder to turn. Apply an extra ¼ to ½ turn to properly seal the top cap.

Working with Files on a Peripheral Device

You can run programs located on a peripheral device, copy files from a peripheral device onto your RuggedReader, and back up files from the RuggedReader onto a peripheral device. Use File Explorer to find, run, open, and copy these files as you would other files on the RuggedReader. See Exploring Files in Section 4.

Tip: To access a CF or SD card in File Explorer, be sure to go all the way to the top (My Device) level:

1. Tap Start > Programs > File Explorer.
2. If My Device does not already appear as the current directory, tap on the arrow next to the directory that appears, then select My Device from the drop-down menu.

File Explorer at My Device Level

If a CF or SD storage card is installed, it appears at the top (My Device) level

4 BASIC OPERATIONS

This section covers things you need to know to perform everyday tasks on your RuggedReader.

THE TODAY SCREEN

The Today screen is the default screen you see when your device powers on. From the Today screen you can view or select

- Today's date
- Owner information
- Messages
- Tasks
- Upcoming appointments

The Today screen allows you to lock or unlock your device. Locking the device disables your screen for easy cleaning.

- To lock the device, simply tap on the words "Device unlocked."
- To unlock the device, tap on the word "Unlock" on the two screens that appear.

***TIP:** To access the Start menu, tap the Start menu icon Start in the top left corner of the screen, or press the Start menu button on the keypad.*

THE START MENU

The Start menu is the main access point to all programs, files, and settings in Windows Mobile. A description of each Start menu option follows.

- **Today.** The default RuggedReader display
- **Calendar.** Appointments and events
- **Contacts.** Contact information for your colleagues
- **Field PC Tutorial.** Describes basic procedures (e.g., replacing batteries) for easy reference
- **Microsoft Internet Explorer.** Internet browser
- **Messaging.** This e-mail client allows you to send and receive e-mail from Microsoft Outlook using ActiveSync on your desktop computer. With a direct Internet connection, you can adjust Messaging to send e-mail directly from the RuggedReader
- **Windows Media Player.** Plays audio and video files
- **Running programs.** If a program is running, it is listed on the Start menu. For example, in the picture above, Notes and PowerPoint Mobile are running. Tap on the program name to open the application
- **Programs.** Opens the Programs menu window, where you can view and access installed programs. To run a program, tap on it. For a list of the Programs installed on your RuggedReader, see Appendix C
- **Settings.** Displays three settings tabs: Personal, System, and Connections. For the location of specific settings, see the table in Appendix C. To change your settings, tap on the setting you want to change, adjust the setting controls, tap OK

- **Help.** Windows Mobile help is context-sensitive—the help screen information is directly related to what you are doing on the device. For some programs, you can open the program first, then tap Start > Help

STATUS ICONS

Status icons on the top line show the status of operations.

Icon	Name	Function
	Charge indicator, or	Shows device is charging
	Battery capacity	Tap to view remaining power
	Speaker	Tap to control volume
	Applications Manager	Tap to switch or close programs
	ActiveSync Connection	Shows connection status

For an additional list of icons and functions, Tap Start > Help, select *Overview of the Today screen*, tap *What do those status icons indicate?*

SOFT KEYS

These context-sensitive keys appear as words, buttons, or tabs on the menu bar. Tap on these keys to perform actions or open menus. Here you see soft keys on the Today screen.

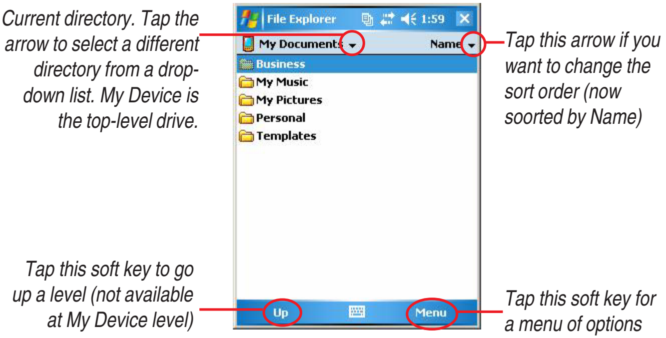
EXPLORING FILES

Use File Explorer to explore files stored on the RuggedReader or on a peripheral device:

1. Tap Start > Programs > File Explorer. File Explorer launches.
2. The current directory appears on the top line. To browse a different directory, do one of the following:
   - Tap the arrow next to the directory name, select the one you want from the drop-down list, or
   - Tap the “Up” soft key to go up a level.

   My Device is the top-level directory on the RuggedReader (the device drive) and allows you to explore all files, including those stored on a properly installed CF or SD card.
3. Navigate the file directory by tapping on the folders and files you want.

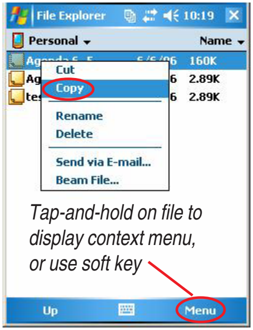
File Explorer



Working with Files

Locate the file you want in File Explorer, as described on the previous page.

- To run a program, tap it once.
- To manipulate a file—copy, cut, delete, rename—do one of the following:
    - Use the "right-click" context menu: hold the stylus on a file until a pop-up menu appears, then tap the action you want, or
    - Use the "Menu" soft key: select the file, tap the "Menu" soft key at the bottom of the screen, tap Edit, tap an action.
- To manipulate multiple files, drag the stylus over the files. Once selected, use the context menu or the "Menu" soft key to choose an option.
- To paste a copied file or files, first navigate to the destination folder (My Device, CF card, SD card, My Documents, etc.). Then do one of the following:
    - Tap and hold the stylus on the white space below the existing files until the pop-up menu appears, select Paste, or
    - Tap the folder, tap the "Menu" soft key, tap Edit > Paste.



CLOSING RUNNING PROGRAMS

> ***TIP:** Tapping on the X in the top right corner of a program only minimizes the program; it continues to run in the background.*

To free memory and allow the device to run faster, close programs that are not being used:

1. Tap on the Applications Manager icon at the top of the screen or press the Applications Manager button.
2. Select the program you want to close.
3. Tap Stop. Or close all running programs by tapping Stop All.

SWITCHING BETWEEN RUNNING PROGRAMS

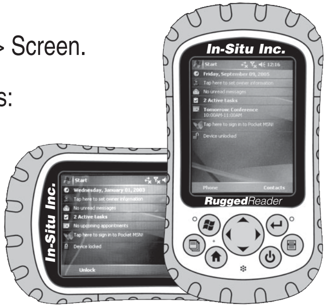
1. Tap on the Applications Manager icon or press the Applications Manager button.
2. Select the program you want to switch to.
3. Tap Activate. The program comes to the forefront.

ROTATING THE SCREEN

The RuggedReader can show information in portrait or landscape view. To change the orientation:

1. Select Start > Settings > System tab > Screen.
2. Choose from three screen orientations:
   Portrait,
   Landscape (right-handed), or
   Landscape (left-handed).

   The buttons automatically adjust for the screen orientation.



BACKING UP DATA

Your RuggedReader's non-volatile flash memory is designed to protect your data. However, it is still a good idea to back up your work regularly by saving information to a desktop computer or to a Compact Flash (CF) or Secure Digital (SD) card.

Backing up to a Desktop Computer

Use ActiveSync on the desktop computer. Follow the steps in Section 5 under the heading Transferring Files To & From the RuggedReader.

__TIP:__ Use Win-Situ Sync to copy TROLL data files from the RuggedReader. See details in Section 6.

Backing up to a CF or SD card

Use File Explorer on the RuggedReader. See the steps earlier in this section.

5 USING ActiveSync®

The Getting Started section of this manual explained how to create an ActiveSync connection between your RuggedReader and your desktop computer. This section describes these ActiveSync tasks:

- Reconnecting
- Exploring the RuggedReader from a desktop computer
- Transferring files to and from the RuggedReader

***TIP:** Microsoft ActiveSync version 4.1 or later is required to connect to the RuggedReader. This is supplied on the Getting Started CD. See installation instructions in Section 2 of this manual.*

RE-ESTABLISHING A CONNECTION

To re-establish an ActiveSync connection, follow these steps:

1. If you plan to charge the RuggedReader while it is connected in ActiveSync, plug the wall charger into the RuggedReader now.
2. Plug the USB Client end (mini B) of the USB communications cable into your RuggedReader.

3. Plug the USB Host end (full size A) into your desktop computer.
4. ActiveSync automatically detects the device.

***TIP:** If your device has trouble connecting, check firewall settings, remove laptop from docking station if attached, check the Microsoft website for Windows Mobile/Active Sync issues.*

a. If you have not connected before or connected as a Guest, the Pocket PC Sync Setup Wizard is displayed. Do one of the following:

- To connect as a Guest (recommended), click Cancel. You are now connected as a Guest.
- To set up a full synchronizing partnership, click Next and select the items to synchronize (DO NOT INCLUDE Files and Notes)

b. If you created a full synchronizing partnership the first time you connected, ActiveSync synchronizes the items you selected.

A guest connection is a temporary relationship with a desktop computer. Each time the device connects to the desktop, you need to set it up as a guest by cancelling the Pocket PC Sync Setup Wizard.

If Win-Situ Sync is installed on the desktop PC, it may launch automatically when ActiveSync detects the connection. You can disable this automatic launch if you want. See Using Win-Situ Sync in Section 6.

EXPLORING THE RUGGEDREADER FROM THE DESKTOP COMPUTER

You can explore and manipulate files on the RuggedReader from the desktop computer using ActiveSync. To explore the RuggedReader, follow these steps:

1. Connect the RuggedReader to the desktop and re-establish an ActiveSync Guest connection or partnership.

   Once connected, the Rugged Reader acts like a new drive called “Mobile Device” on the desktop computer.

2. To access the new “Mobile Device” drive (RuggedReader) from the desktop computer, click Tools > Explore Device in the ActiveSync window on your desktop computer.

   A list of folders appears, similar to File Explorer.

Double-click on My Windows-Mobile Based Device to see the folders on your RuggedReader.

From the list of folders, you can cut, copy, rename, and delete files, and you can transfer files to the desktop computer. See the following page for details.

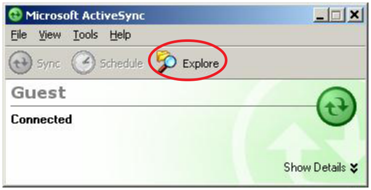
TRANSFERRING FILES TO & FROM THE RUGGEDREADER

***TIP:** Win-Situ Sync can automatically synchronize data files from In-Situ's RuggedReader applications to the Win-Situ data folders on your desktop PC. Use the "manual" method described here to transfer files created in other applications, or if Win-Situ Sync is not available.*

You can copy or move files between the RuggedReader and a desktop computer using ActiveSync. File transfer is done **from the desktop computer side**.

To transfer files **from** the RuggedReader **to** the desktop computer:

1. Connect the RuggedReader to the desktop and re-establish an ActiveSync Guest connection or partnership.
2. In the ActiveSync window on your desktop computer, click the Explore icon on the toolbar or select Explore Device from the ActiveSync Tools menu.



3. On the desktop computer, open My Computer or Windows Explorer.
4. In the ActiveSync window, navigate to the file(s) or folder(s) you want to copy or move, select them, right-click, and select Copy or Cut from the pop-up menu.
5. In My Computer or Windows Explorer on the desktop computer, navigate to the folder where you want to place the files, right-click on a blank area of the folder and select Paste from the pop-up menu.

***TIP:** As an alternative to cut/paste, you can drag and drop files and folders between the windows.*

To transfer files **to** the RuggedReader **from** the desktop computer, follow steps 1 through 3. Then

- In Step 4, navigate to and select files on the desktop computer,
- In Step 5, switch to the ActiveSync window, navigate to the folder where you want to put the files, drag or paste onto the RuggedReader.

6 USING IN-SITU SOFTWARE

Control software for In-Situ instruments is pre-installed, licensed, and ready to run on your new RuggedReader.

For this Instrument	Use this Program
Level TROLL®	Win-Situ® Mobile (formerly Pocket-Situ 5)
Multi-Parameter TROLL® 9500, Multi-Parameter TROLL® 9000, miniTROLL®	Pocket-Situ 4
T506 Total Dissolved Gas probe	TDG Logger

TIP: *Win-Situ Mobile talks to Level TROLLs. Pocket-Situ 4 talks to Multi-Parameter TROLLs and miniTROLLs.*

USING WIN-SITU® MOBILE

Win-Situ Mobile communicates with Level TROLLs. A brief overview of the software is presented here. If you need help, refer to the Win-Situ Mobile Quick Start included with your RuggedReader.

TIP: For convenience in launching Win-Situ Mobile, you can assign it to one of the keypad buttons. See the procedure in Section 3.

TIP: If the program launches in "demo" mode, you can activate it with the license key and activation code from your In-Situ License Agreement. Or contact In-Situ Technical Support at 1-800-446-7488.

Connect the Hardware

Connect the Level TROLL to the RuggedReader's 9-pin serial port (see the RuggedReader Quick Start guide).

Launch the Software

Press the power button . Tap Start to display the Start menu.

Tap Programs > Win-Situ Mobile . The program launches and displays the functional area called "My Data"

Connect to the Level TROLL

Tap the Connect button

When connected, focus shifts to the functional area called "Home." A real-time reading of each Level TROLL parameter is displayed. Readings update automatically.

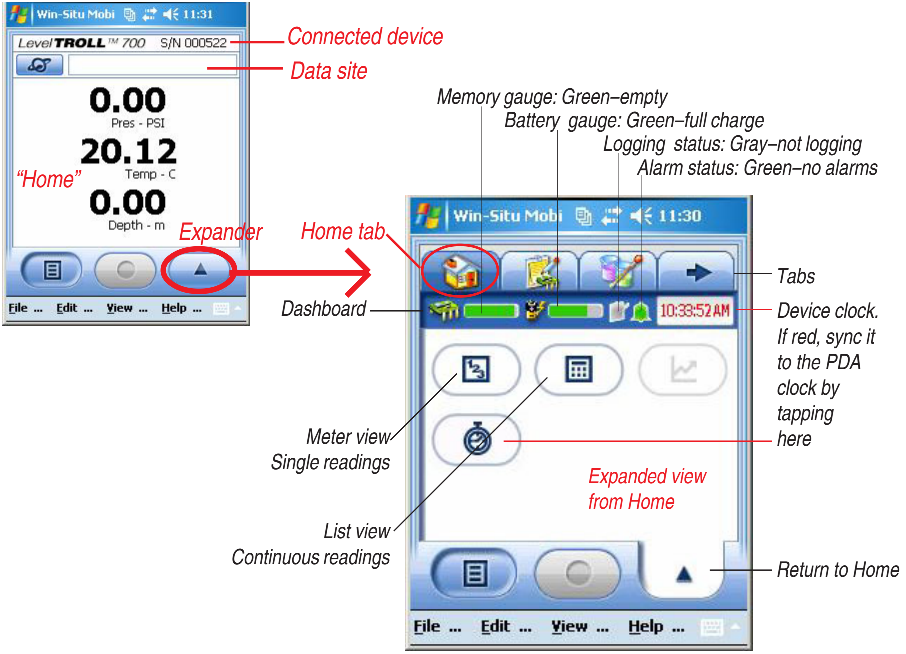
 = Device is not connected

 = Device is connected

The following page introduces the buttons and functions in the Win-Situ Mobile Home screen.

Win-Situ Mobile, Functions from "Home" Tab

Note the all-important Expander button. It expands your view of available functions on all tabs



Set the TROLL's Clock

Set the Level TROLL clock before logging: From Home, tap this sequence: → → → →

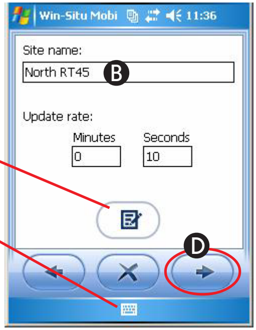
= *Expander*

= *OK*

= *Next*

Add a Data Site

Data logs are organized and filed by the **Site** where the data were collected. The first thing you will be asked for in a log configuration is a site name. If a default site is provided, it may be used. But to clearly identify the place where data were logged, enter a new site, like this:



A File menu > New Site, New button

B You are prompted for a Site name. There are 2 keypads you can use to enter text:
cellphone-type keypad
standard keypad

C Key in a short identifying name, then tap OK or to close the keypad

D Accept the default update rate, tap next

E In the next screen, enter site coordinates if you want, or tap OK to finish

F When the new site is shown again, tap OK

G When the Home tab returns to the screen, tap the site button , select the new site, tap OK. Your new site is now shown in the Home tab and is ready to use in logs.

Set up a Data Log

A Tap View menu > Logging to go to the Logging tab.

B At the Logging tap, tap the Expander button.

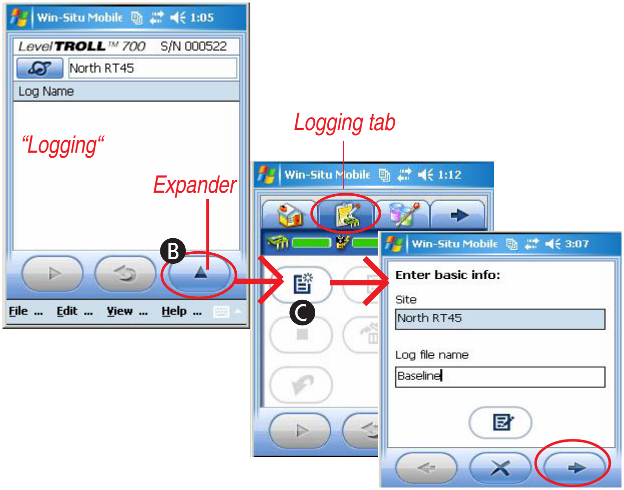
C In the Expander, tap the New button. The logging setup wizard starts. Follow the steps in the wizard, tapping Next to continue in each screen. For help on the prompts, see the Win-Situ Mobile Quick Start included with your RuggedReader.

At the end of the Logging Setup Wizard, a summary of the log setup is shown. Tap OK to write the log to the Level TROLL.

= *Expander*

= *OK*

= *Next*



Start the Log

 = Manual Start log

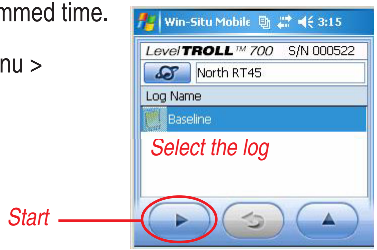
 = Scheduled Start log

 = Running log

A Scheduled log starts at its programmed time.

To start a Manual log: Tap View menu > Logging, tap the log, tap Start.

You can safely disconnect from the RuggedReader now.

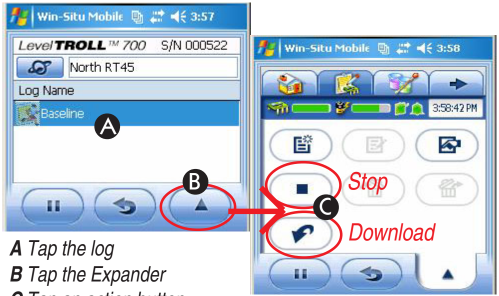


Download/View the Log

Tap View menu > Logging, tap the log, tap the Expander, tap Download . To view the data, select Yes at the end of the download. In My Data tab, tap View .

Stop the Log

Tap View menu > Logging, tap the log, tap the Expander, tap Stop 



A *Tap the log*
B *Tap the Expander*
C *Tap an action button*

Exit Win-Situ Mobile

When you're ready to exit Win-Situ Mobile, tap File menu > Exit.

USING POCKET-SITU 4

TIP: Pocket-Situ 4 talks to Multi-Parameter TROLLs and miniTROLLs.

If you've used Win-Situ® 4 to communicate with your TROLL 9500, miniTROLL, or TROLL 9000, you already know how to run Pocket-Situ! If you need help, refer to the Win-Situ 4/Pocket-Situ 4 user's guide on the In-Situ Software/Resource CD. A brief overview is given here.

Connect the Hardware

Connect the instrument to the RuggedReader's 9-pin serial port (see the RuggedReader Quick Start guide).

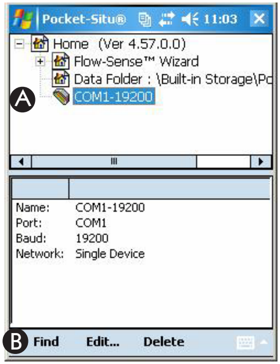
TIP: If the program launches in "demo" mode, you can activate it with the license key and activation code from your In-Situ License Agreement. Or contact In-Situ Technical Support at 1-800-446-7488.

Launch the Software

Press the power button on the RuggedReader. Tap Start to display the Start menu. Tap Programs > Pocket-Situ 4

On your first connection, follow the Connection Wizard to set up the COM port. Select a **Direct** connection to **One** device on **COM1** at **19200** baud.

"Find" the TROLL



A Tap the COM port.

B Tap **Find**. Pocket-Situ connects: First, the TROLL appears in the Navigation tree. Then Pocket-Situ retrieves device information. This can take a moment for an MP TROLL.

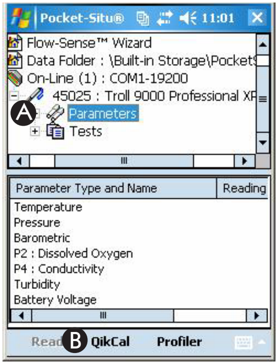
After the connection is made, the TROLL is shown in the Navigation tree with all device information.

If you are prompted to upgrade the device firmware, do so.

Set the TROLL's Clock

Select the TROLL in the tree and tap **Edit**, then **Clock** to synchronize the device clock to the RuggedReader clock.

Calibrate Water Quality Sensors



A Select **Parameters**

B Tap **QikCal**

Read Parameters

single reading:

A Select any parameter

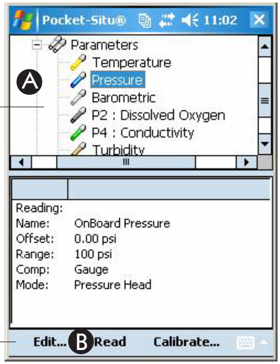
B Tap **Read**

Continuous readings (profiling):

A Select **Parameters**

B Tap **Profiler**

Make a selection



Tap an action

Log Data

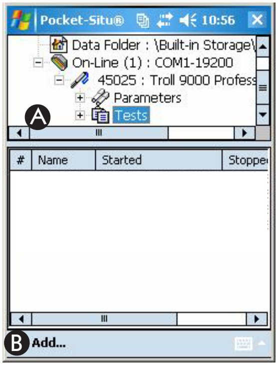
First, set up a test:

A Tap **Tests**

B Tap **Add**

C Follow the Wizard

When finished, the test appears in the Navigation tree.



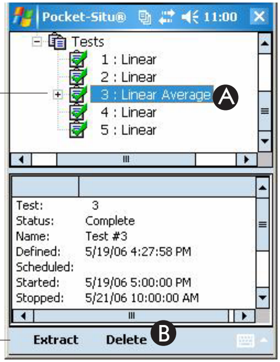
To start, stop, extract (download/view), or delete a test

A Tap a test

B Tap an action

Tap a test

Tap an action. Available actions depend on test status



Exit Pocket-Situ

When you're ready to exit Pocket-Situ:

Scroll to the top of the Navigation tree, tap **Home**

Tap **Exit**

USING TDG LOGGER

This application can display and log total dissolved gas and temperature readings from In-Situ's T506 TDG probe.

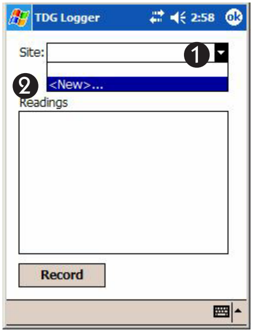
1. Connect the T506 to the RuggedReader's 9-pin serial port.

2. On the RuggedReader, tap Start > Programs > TDG Logger.

   The TDG Logger application will launch, and in a moment device readings will be displayed. Allow a few minutes for the readings to stabilize.

To record (log) readings, you must first specify a site. The Record button is dimmed out (unavailable) until a site is entered.

To enter a site:



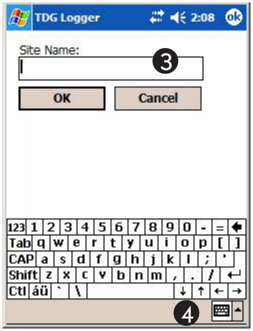
1. Tap the down arrow beside the site box.

2. Select <New>.

3. Tap to put the cursor in the Site Name box.

4. Tap the keyboard symbol and enter a site name.

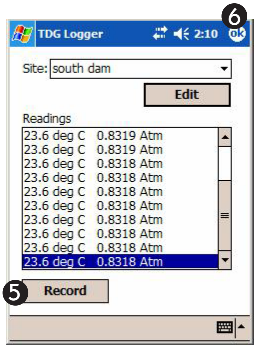
   Tap OK when finished.



5. Tap the Record button to log readings.

6. Output will be logged until you tap OK to exit TDG Logger, or disconnect the probe.

   Readings will be logged to a .txt file on the RuggedReader (Built-In Storage \ TDGLogger) with the same name as the site. For the example here, use the File Explorer to navigate to My Device \ Built-In Storage \ TDGLogger \ south dam.txt.



TRANSFERRING FILES FROM THE RUGGEDREADER TO A DESKTOP/LAPTOP PC

Insure the following are installed on your desktop/laptop PC:

- Microsoft ActiveSync
- Win-Situ 5 for Level TROLL, and/or
- Win-Situ 4 for TROLL 9500, TROLL 9000, miniTROLL

Using Win-Situ® Sync (Automatic Transfer)

__TIP:__ If Win-Situ Sync is not available, ActiveSync may be used to manually transfer the files. See the following page.

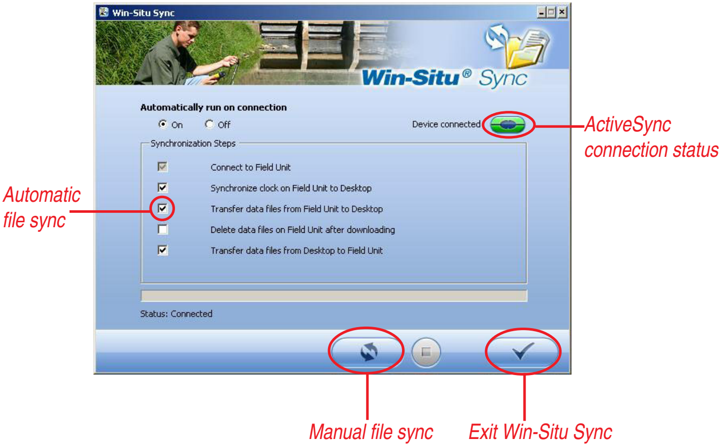
Win-Situ Sync can do the following on every ActiveSync connection (this is the default), or manually any time it is launched:

- Pull log data from Win-Situ Mobile on the RuggedReader to Win-Situ 5 on the desktop
- Pull log data from Pocket-Situ 4 on the RuggedReader to Win-Situ 4 on the desktop
- Pull log data from TDG Logger on the RuggedReader to MyDocuments \ TDGLogger on the desktop
- Optionally delete these files from the RuggedReader after the transfer
- Synchronize the RuggedReader time with the PC
- Push selected data files from Win-Situ 5 to Win-Situ Mobile
- Push selected Low Flow and data files from Win-Situ 4 to Pocket-Situ 4

1. Install Win-Situ Sync from the In-Situ website at www.in-situ.com (click on Downloads), or from the In-Situ Software/Resource CD.

2. When installed, the program will launch on ActiveSync connection. If the utility does not start automatically, briefly disconnect and then reconnect the USB cable. ActiveSync starts, and Win-Situ Sync begins to synchronize.

Application defaults are as shown below (you can change them). Progress is tracked as the steps are completed.



Using Microsoft ActiveSync (Manual Transfer)

If Win-Situ Sync is not available, ActiveSync can be used to transfer files manually from the RuggedReader to the desktop. Follow the procedure in Section 5, Transferring Files To & From the RuggedReader.

After the Transfer (either method)

To view the data, launch Win-Situ 5 or Win-Situ 4 on the desktop.

In the data area, navigate to and select the log file or test file.

To export to spreadsheet format, select File menu > Export to CSV or Export to Excel.

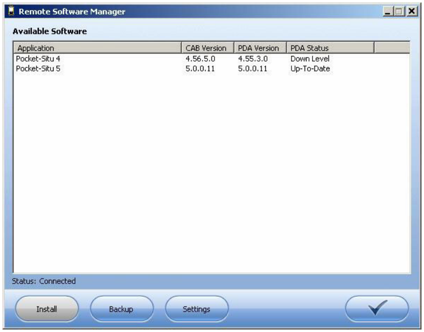
REINSTALLING THE IN-SITU SOFTWARE

TIP: *If possible, we recommend you re-establish an ActiveSync connection before downloading software. This simplifies installation.*

If you need to re-install the In-Situ software, follow these steps. Software may be installed from the In-Situ Software/Resource CD or the Downloads section of the In-Situ website at www.in-situ.com.

1. Do one of the following:
   - Insert the In-Situ Software/Resource CD in the CD drive of your desktop/laptop computer. (If the menu does not display automatically, choose Run from the Windows Start menu and type D:\ISISoftwareCD.html, where *D* is your CD-ROM drive letter.) Select Win-Situ Mobile or Pocket-Situ 4. Click on Setup. Follow the instructions to install the desktop utility, Win-Situ Software Manager, to your local hard drive. OR
   - Go to www.in-situ.com, click on Downloads, then on Software. Right-click on the Win-Situ Mobile or Pocket-Situ 4 link and select "Save Target As..." to download the desktop utility, Win-Situ Software Manager. Double-click the exe file to install the utility.
2. When prompted, launch the Software Manager utility. (You can also launch it from the Windows Start menu > Programs > In-Situ Inc folder.)
3. Connect to the RuggedReader via ActiveSync (if not already connected).

The Software Manager utility displays the available and current versions of software and the status of each.



4. Select the software to add to the RuggedReader and press the "Install" button. The selected software will be installed on the RuggedReader.

TIP: *If the software launches in "demo" mode after re-installation, you can activate it with the License Key and Activation Code from the In-Situ License Agreement shipped with your RuggedReader. Or contact In-Situ Technical Support at 1-800-446-7488.*

Installing from a CAB File

You can install Win-Situ Mobile or Pocket-Situ 4 onto the RuggedReader without an installation utility if you have the application's install file on your desktop/laptop computer as a "CAB" (a form of compressed application).

1. On the desktop: Connect in ActiveSync and drag the CAB into any folder on the RuggedReader. (See the procedure Transferring Files To & From the RuggedReader in Section 5.)

2. On the RuggedReader: Use File Explorer to navigate to the CAB file and tap to run it. (See Exploring Files in Section 4.) This installs the application.

The CAB file remains on the RuggedReader for re-installation of the application, if needed.

7 CARE AND MAINTENANCE

STORING THE RUGGEDREADER AND BATTERY PACKS

Storage Temperature Range

The RuggedReader can be stored at temperatures between -22° F and 140° F (-30° C to 60° C). If possible, store your RuggedReader indoors. Doing so helps protect your device from extreme temperatures and helps it run efficiently at startup.

Storing for Less than Two Weeks

If you plan to store your device for less than two weeks, suspend the device by following these steps:

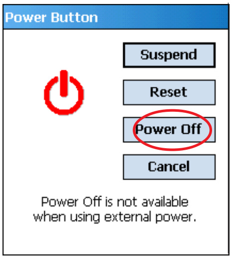
1. As a precaution, back up your data onto a desktop computer or an external storage device such as a CF or SD card.
2. Leave the battery pack in the device.
3. If you plan to store the device longer than a few days, it is a good idea to leave the device connected to the wall charger to make sure the battery pack is fully charged.
4. Suspend the device (press the power button briefly and release).

Storing for More than Two Weeks

To store the device safely for longer than two weeks, follow these steps:

1. Back up your data.
2. Tap the Applications Manager icon to close all running programs.
3. Charge the battery pack to full capacity (100%).
4. Unplug the wall charger.
5. Press the power button until the power button menu appears.
6. Select Power Off from the menu.
7. Place the RuggedReader in a safe, dry place.

__TIP:__ The device cannot be powered off while it is plugged into the wall charger.



Taking the RuggedReader out of Extended Storage

The battery pack discharges slightly during extended storage periods. When you are ready to use your RuggedReader again, follow these steps so your battery pack runs efficiently:

1. Plug the RuggedReader into a charger.
2. Charge the battery pack.

   You can check the battery power status by tapping on the battery icon at the top of the screen.

PROTECTING AGAINST MECHANICAL SHOCK

The RuggedReader is designed for protection against mechanical shock. It can be dropped from up to five feet onto concrete. Shock protection is guaranteed only when the top cap and main piece are securely in place.

SAFELY USING THE BATTERY PACK

- Use only battery packs approved for use with this device.
- Do not store or leave your device or battery pack near a heat source such as a radiator, fireplace, stove, electric heater, or other heat-generating appliance or otherwise expose it to temperatures in excess of 140° F (60° C).
- Do not try to open the battery pack.
- Do not carry a battery pack in your pocket, purse, or other container where metal objects (such as car keys or paper clips) could short-circuit the battery pack terminals.
- Charge the battery pack only in the RuggedReader.
- Charge the battery pack in temperatures between 32°F and 95°F (0° C and 32° C).
- Keep the battery pack contacts clean. If they get dirty wipe them off with a soft cloth.
- Dispose of the battery pack properly. See Disposing of the RuggedReader and Batteries.

Use only the AC adapter shipped with your RuggedReader. Damage caused by the use of third-party converters is not covered by the warranty.

SAFELY USING THE WALL CHARGER

- Use only wall chargers intended for the RuggedReader. Using any other external power source can damage your product and voids your warranty.
- Wall chargers are designed for indoor use only. Avoid using the wall charger in wet, outdoor areas.
- Unplug the wall charger from the power outlet when it is not being used to charge the device.

REPLACING THE BATTERY PACK

CAUTION: The device only stays on for about five seconds without a power source. ***Always suspend your device before replacing the battery pack.***

To replace the battery pack, follow these steps:

1. Close all running programs.
2. **Suspend the device** (press the power button briefly and release).
3. Slowly unhook and lift up the bottom hand strap latch. CAUTION: Do not let the hand strap hook hit the display.

4. Press on the battery door about ¼" beneath the door latch and slide the door latch to the right.

5. Remove the battery door.

   The door may make a noise while it is being removed, caused by the door scraping against the battery. The sound is normal and no damage is done when you hear this sound.

6. Remove the old battery pack.
7. Make sure the battery contacts of the replacement battery pack are clean and dry.

8. Insert the replacement battery pack, lining up the battery contacts with the RuggedReader contacts.

9. Insert the tabs on the bottom of the battery door into the case slots. Close the battery door, making sure the door latch is in the unlock position as the door meets the case.

10. With the door latch in the unlock position, press on the battery door just below the door latch and slide the latch to the left to lock it.

11. Reattach the hand strap.

Note: If you remove the battery from your device and the device is still attached to the wall charger, the battery icon still appears on the display. When the battery is replaced, charging resumes.

For instructions on charging a battery, see Step 2 in Section 2. For guidelines on caring for your battery pack, see Safely Using the Battery Pack earlier in this section.

USING THE RUGGEDREADER IN EXTREME TEMPERATURES

The RuggedReader operates from -22° F to 122° F (-30° C to 50° C). To help your device function properly, store it device indoors when possible.

Other tips:

- If the RuggedReader is exposed to temperatures below 14° F (-10°C), the device may slow down or its display backlight may become dim to reduce the load on the battery power.
- Extremely low or high temperatures may prevent the battery pack from charging. Charge the battery pack in temperatures between 32°F and 95°F (0° C and 32° C).

Always make sure the top cap is on and the screws are fitted tightly before you begin cleaning your RuggedReader.

CLEANING THE RUGGEDREADER

CAUTION: Long exposure to the following may damage your device:

· pine oil
· oil-based paint
· automotive brake cleaner
· isopropyl alcohol
· carburetor cleaner

If the device is exposed to one of these, wipe it off with a mild cleaning solution. After exposure to a salt water environment, rinse in clean water and dry.

***TIP:** Try to avoid prolonged direct exposure to salt water, mud, or debris. Rinse the Rugged Reader in clean running water, shake or wipe to remove moisture, especially from the connectors. Note that the battery door may trap water or dirt.*

Touchscreen

To clean the touchscreen, follow these steps:

1. Press the power button briefly to suspend the device.
2. If you applied a protector to the touchscreen, carefully remove it.

3. Apply water or a mild cleaning solution such as Windex or 409 to a microfiber cloth and gently wipe off the touchscreen. Other approved cleaners include Citrus Wonder and Citrus All Purpose Cleaner. CAUTION: Do not use tissues, paper towels, or harsh cleaning agents to clean the touchscreen.

4. If you used a cleaning solution, rinse the touchscreen with water and dry it with a microfiber cloth.

5. Press the power button to resume the device.

Case Overmolding

Clean the rubber-like overmolding that surrounds the case with a cloth and a mild cleaning solution like 409 or Citrus Wonder. Rinse with water and wipe dry.

Communications Module

This is the area housing the USB port, DC jack, and serial port. To clean the communications module, run it under a faucet. Use a soft toothbrush or toothpick to clean out any remaining dirt. Shake or blot to dry.

Speaker and Microphone

If debris gets in the speaker or microphone, use a soft bristle brush to remove it. Do not insert any object into the speaker or microphone holes.

Stylus Slot

Rinse the stylus slot with water. Shake to remove the excess.

Display Bezel

If the edge under the bezel gets dirty, use a microfiber cloth to remove the debris. Do not remove the bezel.

Do not attempt to service the RuggedReader yourself. *This action voids the warranty.*

REPAIRING THE RUGGEDREADER

If the RuggedReader is in need of repair, contact In-Situ Inc. for a Return Materials Authorization (RMA) number as described in Section 1. Do not attempt to service the device yourself. This action voids the warranty.

DISPOSING OF THE RUGGEDREADER AND BATTERIES

Do not dismantle your RuggedReader. To recycle your RuggedReader, return it to your distributor.

The lithium-ion battery packs for your RuggedReader are recyclable. Avoid placing them in the trash or the municipal waste system.

To find the nearest battery recycling center in the USA, visit the Rechargeable Battery Recycling Corporation's website at www.rbrc.org/call2recycle/index.html or call 1-800-8-battery.

ENVIRONMENTAL HAZARDS

The RuggedReader contains no mercury or cadmium.

8 TROUBLESHOOTING

Answers to issues not addressed here may be available through on-device help or the Windows Mobile website from Microsoft at www.Microsoft.com/mobile. If you cannot find answers to your questions through these methods, contact In-Situ Inc. as described in Section 1.

Problem

The touchscreen does not respond accurately to stylus taps.

Solutions

- Try recalibrating the touchscreen. (See Calibrating the Touchscreen in Section 3.)
- If the device is not responding to stylus taps at all and you are on the Today screen, look to see if the device is locked. To unlock the device, press the "Unlock" soft key on the screen.
- If the device is unlocked but the stylus continues to respond inaccurately, close all open programs and reset the device. (Press ⏻ until the power button menu appears, choose Reset.)

Problem

During calibration, the screen does not respond to stylus strokes or does not complete the calibration process.

Solutions

Check to see if there is something stuck underneath the bezel. Use a microfiber cloth to remove any excess debris. Also check to see if there is damage or wear on any area of the touchscreen. In case of damage, contact In-Situ Inc.

Problem

The RuggedReader runs slowly.

Solutions

It is possible that you have too many programs running. Try closing any programs you are not using. To view and close running programs:

1. Tap on the Applications Manager icon .
2. Tap on the Running Programs tab in the Applications Manager window.
3. Select a program and tap Stop. This closes the program.

Problem

My RuggedReader quickly drops its ActiveSync connection to my desktop computer.

Solutions

Firewall programs sometimes cause ActiveSync connection problems. In these cases, the firewall sees the RuggedReader as a strange and possibly hostile computer and prevents the device from connecting to the desktop computer. To allow the mobile device to connect to your desktop computer, follow these steps:

1. Use the serial cable to connect your device to the desktop computer. Follow the ActiveSync wizard instructions.
2. If your firewall application brings up a warning message asking whether you want to allow a connection, check the option to allow the connection and click "Yes." Note: If the warning message above does not appear when you try to connect to the desktop computer but the device is still being dropped, contact your system administrator.

For other ActiveSync issues, visit www.Microsoft.com/Windowsmobile/help/ActiveSync/default.mspx.

Problem

The RuggedReader locks up.

Solution

To reset the device, press and hold the power button for 10 seconds or until the screen goes dark. The device turns on again after a few seconds.

APPENDIX A: SPECIFICATIONS

Operating System	Microsoft® Windows Mobile® 5.0
Processor	Intel® XScale® PXA270, 300 MHz
Memory	64 MB low-power RAM
Storage	Internal solid-state 128 MB Flash
Display	3.5" (89 mm) QVGA active matrix color TFT transflective (outdoor) viewable) LCD with LED backlight; 240 x 320 pixels
Touchscreen	Sealed, resistive, pressure sensitive
CF and SD Card Slots	Compact Flash (Type I or Type II), Secure Digital (SD or SDIO); CF card slot provides 3.3 volts; user accessible, sealed
Keyboard	Four-way directional button, standard key functions, LED backlit keys
Physical	6.5" length x 3.5" wide x 1.7" thick (165 x 89 x 43 mm), 17 oz (482 g); magnesium case with elastomer overmold
Operating Temperature	-22° to 122° F (-30° to 50° C)
Storage Temperature	-22° to 140° F (-30° to 60° C)
IP67	Sealed rating, waterproof and dustproof
MIL-STD-810F	Water, humidity, sand and dust, vibration, altitude, shock, high temperature, low temperature, temperature shock
Shock Absorbency	Multiple drops onto concrete from 5 ft (1.5 m) through temperatures ranging from -22 to 122° F (-30 to 50° C)

Batteries	Intelligent, rechargeable Li-Ion battery pack, 14 W-hr (nom.), operates for more than 20 hours on one charge, charges in 3 to 5 hours, internal circuitry sealed against moisture when battery is removed, change without tools
Communications Module	9-pin D-sub connector, USB Host (Mini A), USB Client (Mini B), 12 VDC jack for power input and battery charging; modular; field replaceable
Wireless Communication options	Bluetooth-supported with CF or SD Bluetooth card, Wi-Fi supported, wireless cellular modem
Internal Clock	Battery-backed real time clock keeps time and date when battery is removed
Development Environment	SDK for Windows Mobile for Embedded Visual C++ version 4.0 and Visual Studio 2005
Enunciators	External power/charge LED and notification LED; other enunciators on system tray
Standard Accessories	Rechargeable Li-Ion battery, wall charger (universal voltage, output 12V, 0.84A max.), USB sync cable, captured full-size stylus, hand strap, screen protectors, quick start guide, dashboard accessory pad, Microsoft Getting Started CD, In-Situ Software/Resource CD
Certifications	FCC Class A, European CE Mark
Software Included	Microsoft Internet Explorer® Mobile, Microsoft Office Mobile (Word Mobile, Excel® Mobile, PowerPoint® Mobile), Microsoft Outlook® Mobile (Inbox, Calendar, Contacts, Instant Messaging, Tasks, Notes, Spell Checker), Microsoft ActiveSync® 4.0 for desktop computer, Terminal Services Client, Microsoft Windows Media Player 10 Mobile, Calculator, games, Pictures and Videos (image and video viewer), Voice Recorder, Handwriting Recognition, Win-Situ® Mobile, Pocket-Situ 4, TDG Logger

9-PIN SERIAL PORT PINOUTS

Pin #	Description
1	Data Carrier Detect (DCD) Input
2	Receive Data (RCD) Input
3	Transmit Data (TXD) Output
4	Data Terminal Ready (DTR) Output
5	Ground (GND)
6	Data Set Ready (DSR) Input
7	Request To Send (RTS) Output
8	Clear To Send (CTS) Input
9	Ring Indicator (RI) Input

APPENDIX B: CERTIFICATIONS & REGULATORY INFORMATION

REGULATORY INFORMATION

U.S.A.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is used in a commercial or residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not used in accordance with the user's guide, may cause harmful interference to radio communication. Operation of this equipment is subject to the following two conditions:

1. The device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 450 14

Manufacturer's Name:	Juniper Systems, Inc.
Manufacturer's Address:	1132 West 1700 North Logan, UT 84321 USA

Declares, under our sole responsibility, that the product:

Product Name:	Archer Field PC
Model Number:	1.01
Product Options:	ALL

Conforms to the following Product Specifications:

- Emissions Testing EN 55022
- Immunity Testing EN 55024
- Electrostatic Discharge Immunity (IEC 61000-4-2)
- Radiated Immunity (IEC 61000-4-3)
- Electrical Fast Transients (EFT) Immunity (IEC 61000-4-4)
- Surge Immunity (IEC 61000-4-5)
- Conducted Immunity (IEC 61000-4-6)
- Power Frequency Magnetic Field Immunity (IEC 61000-4-8)
- Power Quality (dips and sags) (IEC 61000-4-11)

CAUTION: Only approved accessories may be used with this equipment. In general, all cables must be high quality, shielded, correctly terminated, and normally restricted to two meters in length. AC adapters approved for this product employ special provisions to avoid radio interference and should not be altered or substituted. Unapproved modifications or operations beyond or in conflict with these instructions for use may void authorization by the authorities to operate the equipment.

APPENDIX C: PROGRAMS & SETTINGS

TIP: Many programs provide on-device help. To use it, open the program, then tap Start > Help.

APPLICATIONS IN THE PROGRAMS MENU

The Programs menu lists applications installed on your RuggedReader. To access the Programs menu, tap Start > Programs. Applications in the Programs menu are described below in the order they appear.

Games. Bubble Breaker and Solitaire.

ActiveSync. Synchronizes your RuggedReader with a desktop or laptop computer. You can also use ActiveSync to explore your RuggedReader and synchronize your contacts, calendar, e-mail, and more.

Calculator. Simulates a calculator.

Download Agent. Automates the process of downloading RuggedReader software updates from the Internet directly to your RuggedReader. If you are connected through ActiveSync to a PC with an Internet connection or if you are connected to the Internet through a modem card such as a dial-up, Ethernet, Wi-Fi, cellular, or Bluetooth card, Download Agent automatically displays available updates to the RuggedReader.

Excel Mobile. Lets you view and create charts. Compatible with Microsoft Excel— open and edit an Excel chart from your desktop computer using Excel Mobile on your RuggedReader.

File Explorer. Lets you view, expand, and collapse the RuggedReader directory folders so you can locate files.

Modem Link. Allows you to connect your RuggedReader to the Internet or computer network through Compact Flash (CF) and Secure Digital (SD) adapters (e.g., 56K dial-up modem or Ethernet adapters).

Notes. Lets you create personal notes or record voice clips. If you don't see the Recording toolbar, tap Menu > View Recording Toolbar.

Pictures & Videos. Lets you preview a picture or video without opening it.

Pocket MSN. Gives you quick access to your MSN Hotmail Inbox and your MSN Messenger account.

Pocket-Situ 4. Installed by In-Situ Inc.

PowerPoint Mobile. Lets you view or rehearse PowerPoint presentations built on a desktop computer.

Search. Searches for files or programs on the RuggedReader.

Tasks. Stores and tracks new and existing tasks.

Terminal Services Client. Lets you log on to a PC running Terminal Services or Remote Desktop and use all of the programs available on that PC from your mobile device.

TDG Logger. Installed by In-Situ Inc.

Win-Situ Mobile. Installed by In-Situ Inc.

Word Mobile. Creates and edits documents with graphics while maintaining document formatting. Compatible with Microsoft Word—open and edit a Word file from your desktop computer using Word Mobile.

Programs Installed by In-Situ Inc.

Pocket-Situ 4. Control software for MP TROLL 9500s, miniTROLLs, and MP TROLL 9000s.

TDG Logger. Displays and logs readings from In-Situ's T506 Total Dissolved Gas probe.

Win-Situ Mobile. Control software for Level TROLLs.

ACCESSING PROGRAMS ON THE GETTING STARTED CD

In addition to installing ActiveSync, the Getting Started CD that came with your RuggedReader provides links to purchase additional programs from Microsoft. If you wish to take advantage of these, insert the Getting Started CD into your desktop computer, select "Add new programs to my device," and follow the instructions. For further help, visit Microsoft's website, www.Microsoft.com/mobile.

SETTINGS

To access settings, tap Start > Settings. The Settings window appears, showing three menu tabs: Personal settings, System settings, and Connections settings. The table below shows the location of specific settings.

To change settings on your device: Choose one of the tabs at the bottom of the Settings screen, tap on the setting you want to change, adjust the setting controls and tap OK.

Settings

Setting	Personal settings	System settings	Connections settings
About		X	
Backlight		X	
Beam			X
Bluetooth			X
Buttons	X		
Brightness		X	
Certificates		X	
Clock & Alarms		X	
Connections			X
Error Reporting		X	
Input	X		
Lock	X		
Memory		X	
Menus	X		
MSN options	X		
Network cards			X
Owner Info	X		
Power		X	
Regional Settings		X	
Remove Programs		X	
Screen		X	
Sounds & Notifications	X		
Today	X		

In-Situ Inc.

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