

# Retaining coalbed methane water discharge permits in Wyoming

CASE STUDY 08-02

A GAS SENSING TECHNOLOGY CORP. SUCCESS STORY

## A coalbed methane field in distress

In 2002 Northwestern Energy permitted the Brennan Street Project, a coalbed methane field in the Clear Creek drainage of the Powder River basin of Wyoming. The field is located in sections 11, 13, 14, and 15 of township 53N and range 80W. It is comprised of 44 wells in total. All wells were completed by perforating through casing. About half of the wells were completed in the Lower Cook seam ranging from 2,100 to 2,400 fbs and the other half in the Smith/Anderson seam ranging in depth from 850 to 1,200 fbs. In 2005, ownership of the field passed to Wolverine and then to Brennan.

Typical Big George coals in the Powder River basin will produce 300 to 1000 barrels of water per day during dewatering. Since the Brook Street Project wells produced only 100 to 300 barrels of water per day, Brennan experimented with acid treatments in order to better connect the coal reservoir to the wellbores, with some success. However, in 2007 Brennan's financial backers entered bankruptcy, impeding Brennan's ability to aggressively pursue workovers of all wells.

On December 11, 2007, the water discharge permits associated with the wells were challenged by the Wyoming State Engineer's Office (SEO). That action included 10 operators and 296 wells in the Clear Creek drainage. Only Brennan and one other operator chose to defend their permits. The remaining operators chose to abandon about 250 wells.

Brennan was given 45 days to show cause that the permits on its 44 wells should not be revoked. Brennan's initial efforts to convince the SEO that the field deserved further development were denied on March 14, 2008. To collect the type of reservoir data required by the SEO, Brennan contracted with Gas Sensing Technology Corp. (GST) on April 25.

## Finding the gas

In order to prove that gas was present in the field, Brennan asked GST to perform a TopSide Solutions reservoir test. Because the wells were already drilled and contained tubing and pumps, other reservoir analysis technologies could not be used.

## **Challenge**

Brennan Engineering and Instrumentation needed to retain its state-issued water discharge permits while it worked to produce 44 coalbed methane wells completed in two seams across 2,240 acres in the Clear Creek drainage of the Powder River basin of Wyoming. Defending the "beneficial use" of its water discharge permits meant that Brennan needed to show that economic gas could be produced from the field via further water production.

## **Solution**

Gas Sensing Technology Corp.'s TopSide Solutions technical service accurately and quickly measures the amount of gas in a field, identifies the location of the gas, and indicates the amount of water required to produce that gas. GST's experience with the state of Wyoming and how it manages coalbed methane produced water assures operators that their reservoirs receive a full and balanced assessment by the state's regulatory agencies.

## **Results**

The two coal seam reservoirs were tested and analyzed at 21 well locations. From those tests \$13.9 million of economic gas-in-place was directly identified, indicating a gas-in-place value of the entire field of more than \$25 million. By analyzing the drawdown required to produce that gas, an average water-gas production ratio of 3.02 was predicted. Based on the data presented by GST, the State Engineer's Office halted its cancellation of the water discharge permits and allowed Brennan to proceed in seeking new financial backers for development of the field.



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[CASE STUDY]

Given its limited remaining capital, Brennan requested a test of just one well in one seam in the field. After discussing the situation, GST and Brennan agreed on a creative financing arrangement that would allow GST to test both seams in the entire field and more effectively defend the permits while conserving Brennan’s financial resources.

Over three weeks in June, GST tested the Lower Cook reservoir at 10 wellbores and the Smith/Anderson reservoir at 11 wellbores. Testing via other wellbores was not possible due to operational issues.

Contrary to expectations, the Lower Cook seam in this area contains economic gas – up to 65 scf/ton of coal. While this gas is under 500 to 700 psia of water head, conservative estimates place the dewatering time expected at 1.5 to 2 years and the water-gas production ratio at 2.5 to 4.5, well within Powder River basin norms for Big George seams.

The Lower Cook seam in this field contains on average 146 MMcf of gas per 80 acre well spacing, representing about 4 Bcf of gas in the field worth more than \$15 million at \$4 gas prices.

The average elevation of the Lower Cook is shown below in Figure 1, along with the measured gas content, critical desorption pressure and required drawdown. The geologic structure of the field shows generally lower elevation coal to the west, typical of the basin, although substructures are evident throughout the field.

Gas content and critical desorption pressure of methane are closely associated to those substructures. This association has been observed by GST staff many times in many basins.

Required drawdown is a convolution of the reservoir pressure, which depends primarily on coal seam depth, and the distribution of gas within the field. The most valuable and producible portions of this field are in its center.

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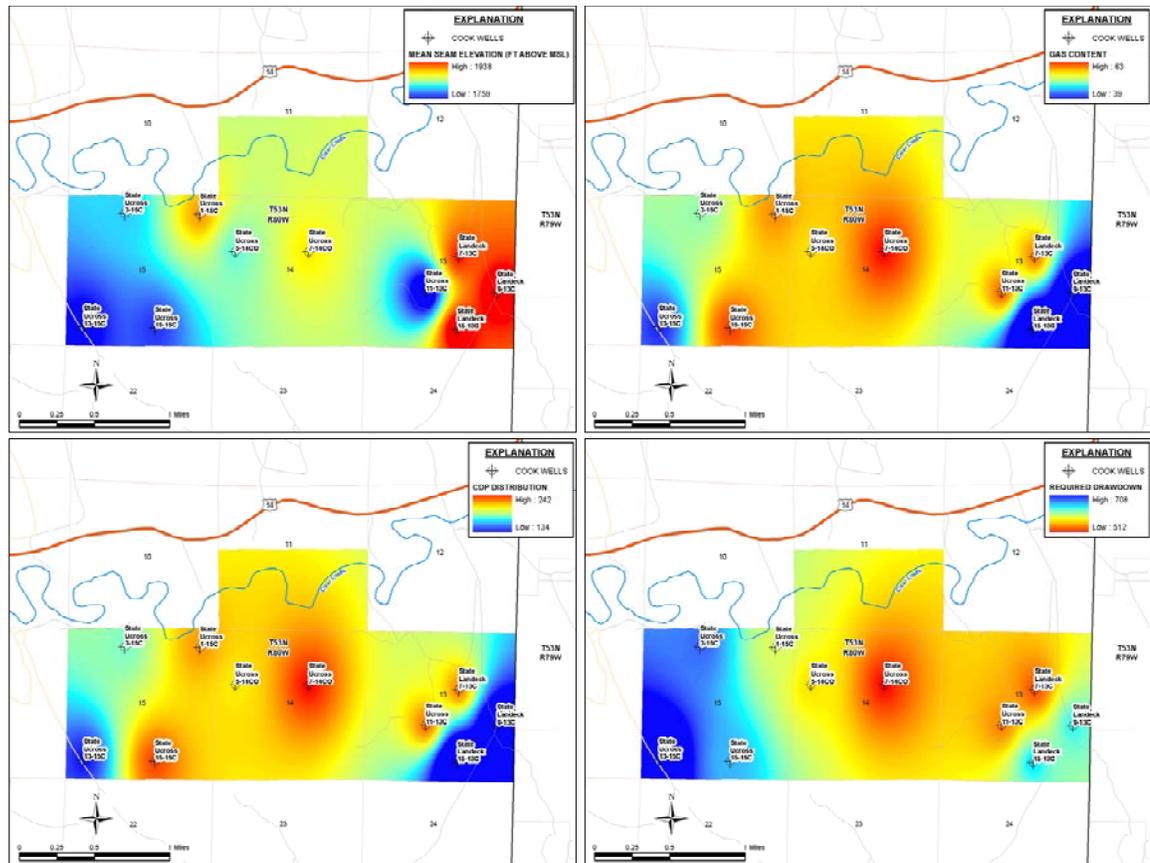


Figure 1: Results of testing on the Cook coal seam in the Brook Street Project



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The Smith/Anderson seam showed results typical of more shallow seams in the basin, with gas contents ranging from 20 to 35 scf/ton. However, most of those wells required drawdowns of only 100 to 200 psia in order to produce gas, resulting in predicted dewatering times of six to twelve months and predicted water-gas production ratio of 1.3 to 3.9.

The thick Smith/Anderson seam contained on average 101 MMcf of gas per 80 acre well spacing, representing about 2.8 Bcf of gas in the field worth more than \$10 million at \$4 gas prices.

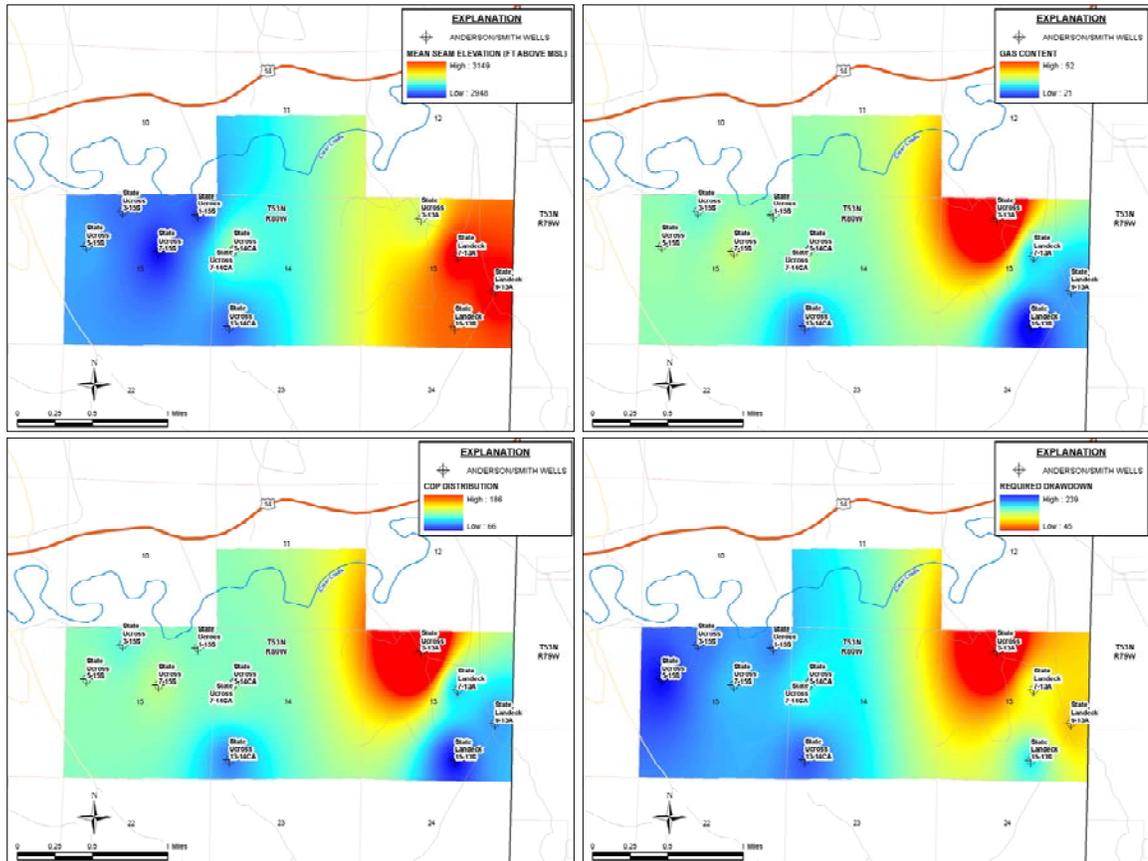


Figure 2: Results of testing on the Smith/Anderson coal seam in the Brook Street Project

Assuming that these results can be extrapolated to the untested portions of the reservoir, the GST testing results indicate a total gas-in-place for the field of about 7 Bcf, worth more than \$25 million for the operator and more than \$3 million in tax revenue for the state of Wyoming.

On June 30, 2008, GST presented these results to the SEO. Based on the value of the reservoir and its producibility, the SEO allowed Brennan to retain its water discharge permits in the area while it seeks financial backing for further development.

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