

## **CARBON CAPTURE & SEQUESTRATION MONITORING WITH HS TECHNOLOGY**

*In situations where the carbon dioxide is injected into a geological formation trap which was formerly tapped to produce oil and/or gas the Hydrocarbon Surveys (HS) technology can be used to monitor the movement of hydrocarbons as they are displaced by the carbon dioxide. It is recommended that an initial 200 ft grid pattern HS survey be run, followed by surveys every six months for two years, then switch to annual surveys.*

HS technology introduction: Copeland Remote Sensing, LLC's Hydrocarbon Surveys technology is a passive receiver of a naturally occurring signal which is enhanced when it travels up through the skin of the earth through zones with hydrocarbons. It is decreased if it passes through faults. The HS system was granted a US Patent, #US 10,761,237 B1 in 2020.

*HS technology is ideal for identifying the shape and location of the permeability-porosity lenses in which have forced the hydrocarbons out of. This is real time and pinpointed directly below the points of HS measurement.*

**Hydrocarbon displacement within the geological trap is similar, whether it is caused by water or carbon dioxide. In this case, we are looking for the increase in areas where the hydrocarbons do not exist to study the size and shape of the sequestration area.** We have chosen three examples of actual field case studies to illustrate different aspects of our HS technology in action.

### **A. The North Texas – Water Flood Lease Study**

In this HS road survey, the petroleum engineer picked an area in which a very old lease had been re-entered with high resolution through the casing logs run. Any new zone which showed promise on the logs were perforated and produced. After the production went down, five of the wells were converted into injector wells. By his reckoning, this lease has been well drained, and the HS system should see low readings on it. As you can see on the HS study presentation, it was.

### **B. The North Texas HS Water Flood Grid Study**

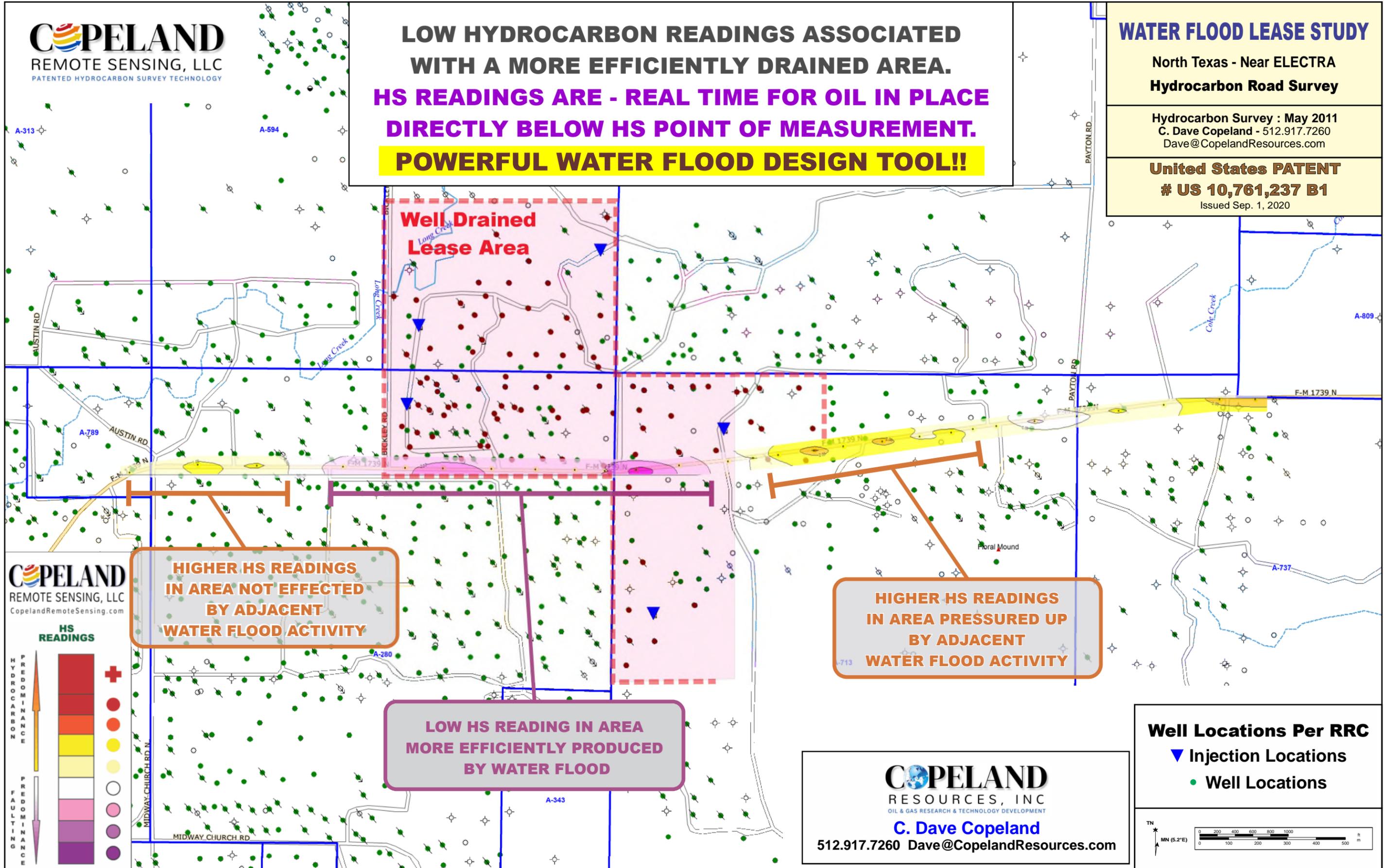
A 300ft grid survey was conducted on this lease, with surprising results. An odd shaped slightly negative area showed up in the SE corner. After studying the map, the client noted that they had been injecting water in the main producing zone for a couple years. HS technology identified the permeability-porosity lenses where the oil had been forced out of. This provided the client with critical information on where to drill new wells and which old wells to start injecting water into.

### **C. The Carter RW HS Contours Map with Faults & Diagram**

This HS survey was chosen because it involves a strong water drive formation and the HS technology indicated where the remaining oil was located. It also pointed out faults, including a previously unknown cross fault. Using the HS survey, verified by logs from four vertical wells to the north, the planned horizontal lateral was redirected to the south. This produced a significant oil producer which began an active development program.

**LOW HYDROCARBON READINGS ASSOCIATED WITH A MORE EFFICIENTLY DRAINED AREA.**  
**HS READINGS ARE - REAL TIME FOR OIL IN PLACE DIRECTLY BELOW HS POINT OF MEASUREMENT.**  
**POWERFUL WATER FLOOD DESIGN TOOL!!**

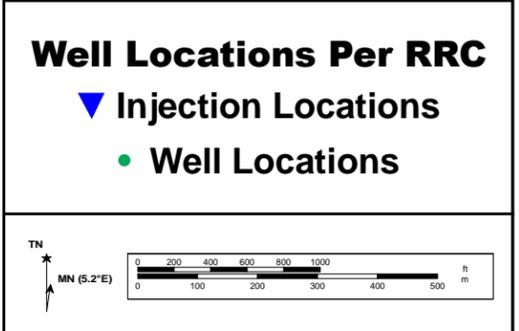
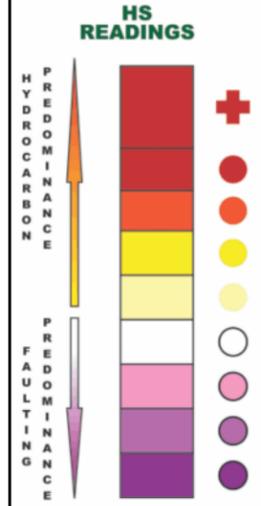
**WATER FLOOD LEASE STUDY**  
 North Texas - Near ELECTRA  
**Hydrocarbon Road Survey**  
 Hydrocarbon Survey : May 2011  
 C. Dave Copeland - 512.917.7260  
 Dave@CopelandResources.com  
**United States PATENT**  
**# US 10,761,237 B1**  
 Issued Sep. 1, 2020

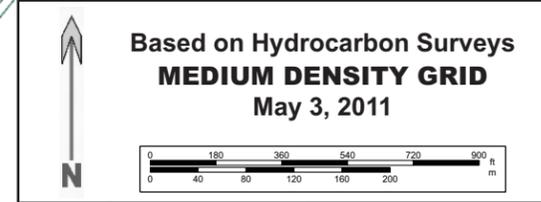
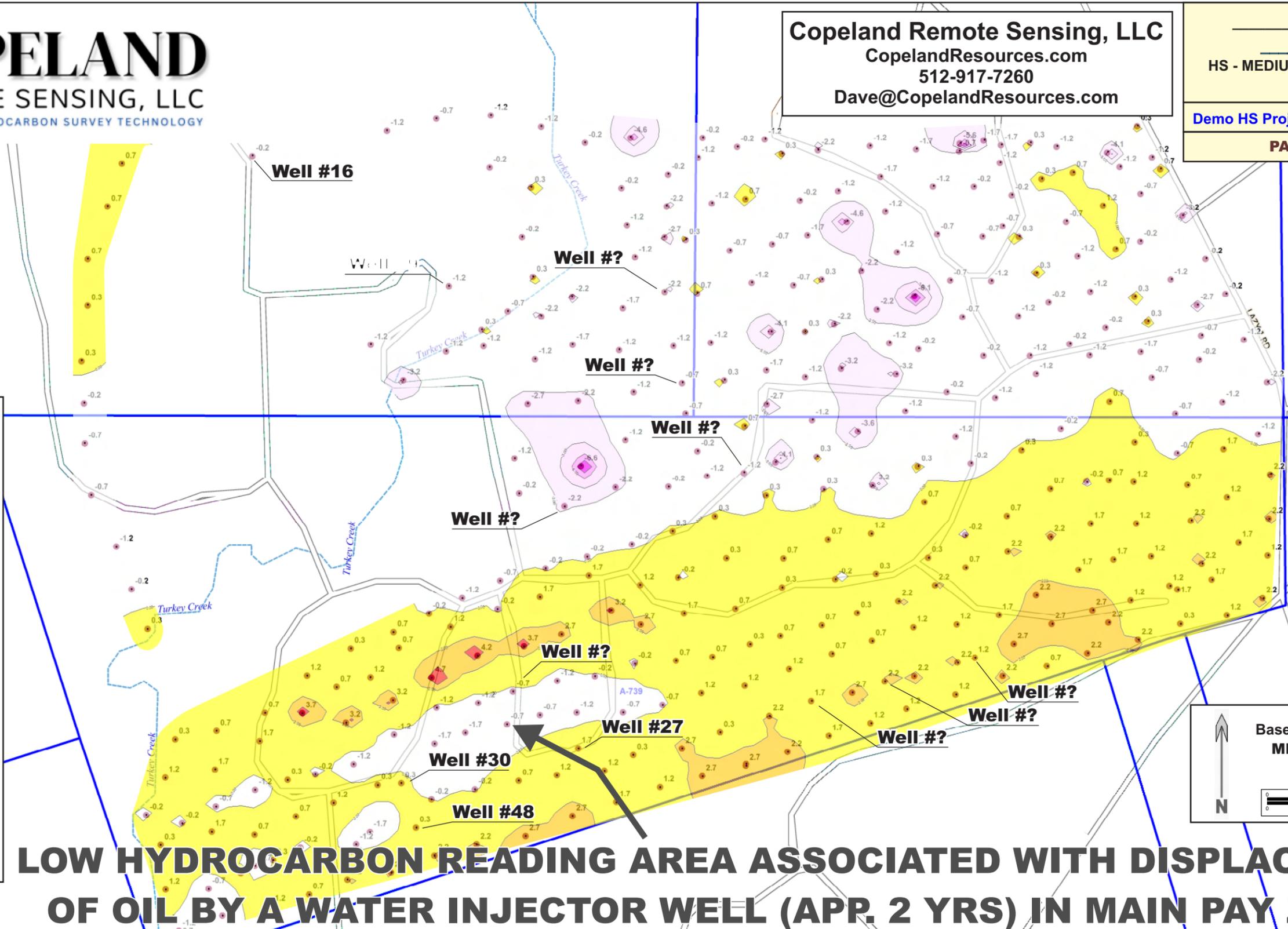
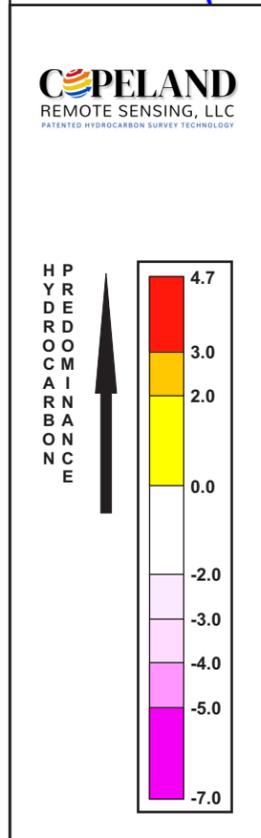


**HIGHER HS READINGS IN AREA NOT EFFECTED BY ADJACENT WATER FLOOD ACTIVITY**

**HIGHER HS READINGS IN AREA PRESSURED UP BY ADJACENT WATER FLOOD ACTIVITY**

**LOW HS READING IN AREA MORE EFFICIENTLY PRODUCED BY WATER FLOOD**



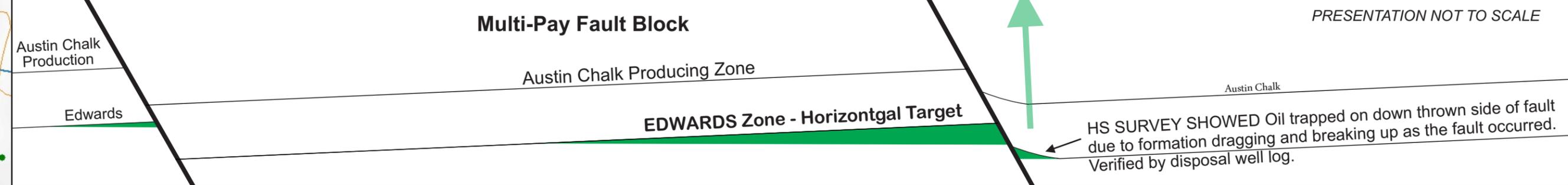
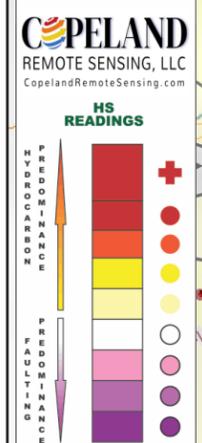
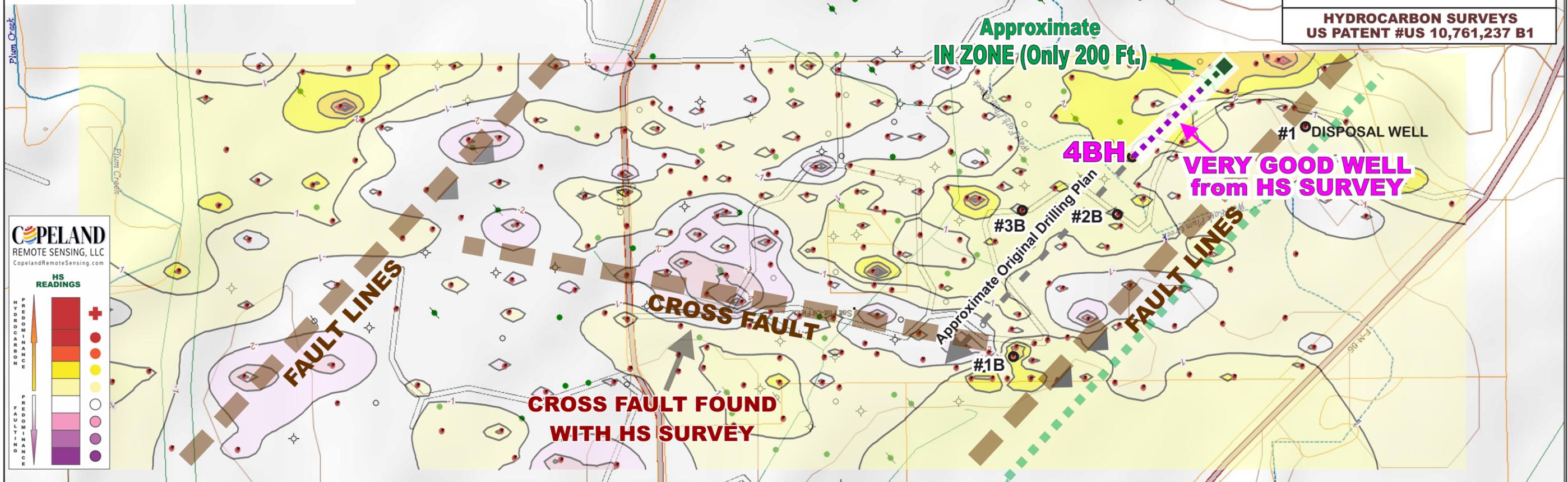


**LOW HYDROCARBON READING AREA ASSOCIATED WITH DISPLACEMENT OF OIL BY A WATER INJECTOR WELL (APP. 2 YRS) IN MAIN PAY ZONE.**  
**HS READINGS ARE - PIN POINTED AND REAL TIME FOR OIL IN PLACE!**  
**HYDROCARBON SURVEYS (HS) IS A POWERFUL WATER FLOOD DESIGN TOOL!!**

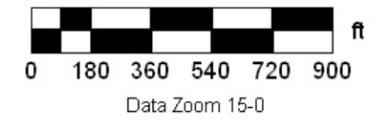
**Hydrocarbon Surveys SUCCESS**  
**Direction of lateral REVERSED AFTER HS SURVEY**

NORTH SOUTH OIL, LLC  
 RW Carter Lease - Texas RRC #14965  
 RW Carter 4BH - API 42-055-34885  
 Caldwell County, Texas  
**Hydrocarbon Survey Map**  
 HydrocarbonSurveys.com  
 Mapping based on Medium Density Survey  
 February 23, 2008.

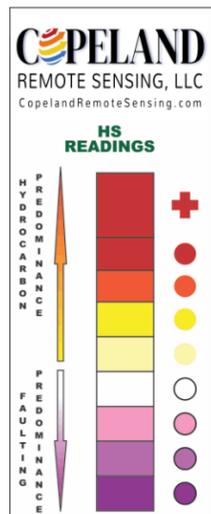
**HYDROCARBON SURVEYS**  
**US PATENT #US 10,761,237 B1**



**Hydrocarbon Surveys Field Example: The direction of the horizontal lateral was change to encounter a HS HIGH READING AREA. The well only has 200 feet in zone. Lease production was 75,116 BARRELS OIL IN THE FIRST 19 MONTHS and was still producing approximately 91 barrels per day (App. 2800 ft TVD).**



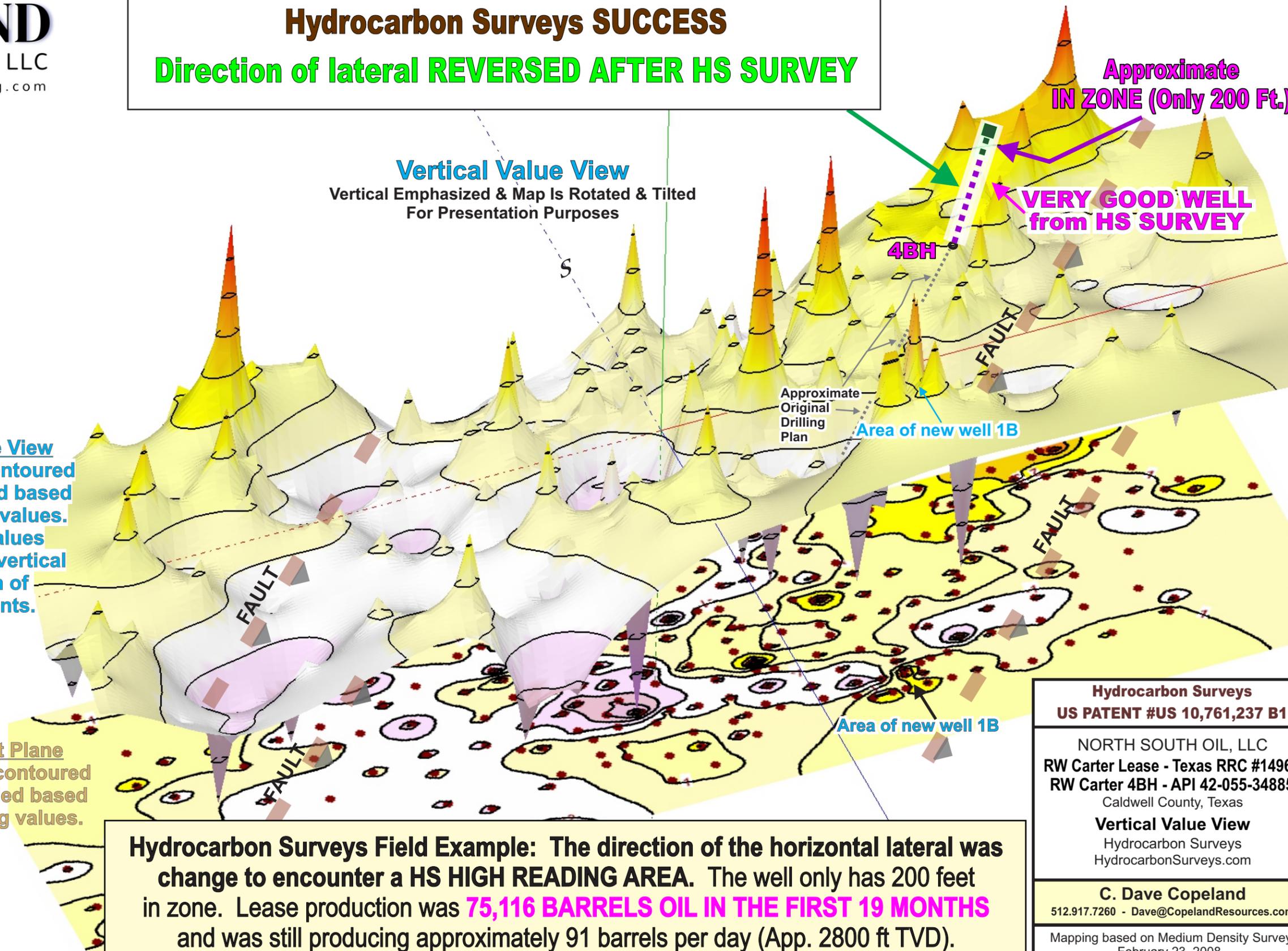
**Hydrocarbon Surveys SUCCESS**  
**Direction of lateral REVERSED AFTER HS SURVEY**



**Vertical Value View**  
 This plane is contoured and color coded based on HS reading values. ALSO, HS Values determine the vertical disposition of HS data points.

**Normal Flat Plane**  
 This plane is contoured and color coded based on HS reading values.

**Vertical Value View**  
 Vertical Emphasized & Map Is Rotated & Tilted For Presentation Purposes



**Hydrocarbon Surveys Field Example:** The direction of the horizontal lateral was change to encounter a HS HIGH READING AREA. The well only has 200 feet in zone. Lease production was **75,116 BARRELS OIL IN THE FIRST 19 MONTHS** and was still producing approximately 91 barrels per day (App. 2800 ft TVD).

**Hydrocarbon Surveys**  
 US PATENT #US 10,761,237 B1

NORTH SOUTH OIL, LLC  
 RW Carter Lease - Texas RRC #14965  
 RW Carter 4BH - API 42-055-34885  
 Caldwell County, Texas

**Vertical Value View**  
 Hydrocarbon Surveys  
 HydrocarbonSurveys.com

**C. Dave Copeland**  
 512.917.7260 - Dave@CopelandResources.com

Mapping based on Medium Density Survey  
 February 23, 2008.