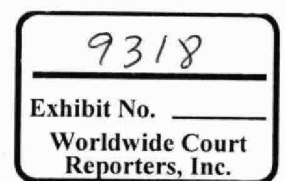


From: Merrill, Robert C  
Sent: Mon Jul 26 14:25:11 2010  
To: Thurmond, Benjamin F; Edwards, Michael L  
Cc: Tooms, Paul J; Yeilding, Cindy; Baker, Kate H (Swift)  
Subject: Bob\_Match\_25July-ML review Final.ppt  
Importance: Normal  
Attachments: Bob\_Match\_25July-ML review Final.ZIP

Michael:  
We're going to include the following this morning.  
Bob

<<...>>



CONFIDENTIAL

BP-HZN-2179MDL04899278  
BPD344-099710

TREX 009318.0001



CONFIDENTIAL



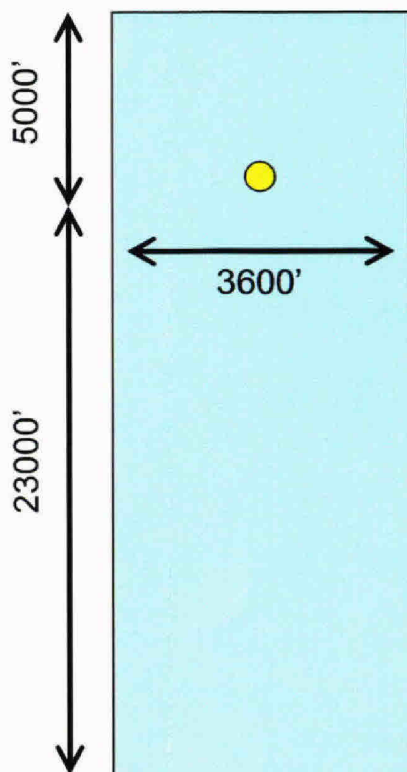
## Draft: PIE Matches of 25-July

MC252

# Rectangular Model – No Aquifer; 45 mbd



- Simplest model to capture key observations



## Static Input Data:

|                  |              |
|------------------|--------------|
| Bo               | 2.310 rb/stb |
| Oil Viscosity    | 0.210 cP     |
| Well Bore Radius | 0.350 ft     |
| Gauge Resolution | 5.000 psi    |

|                       |               |
|-----------------------|---------------|
| Fluid Compressibility | 14 $\mu$ sips |
| Water Compressibility | 3 $\mu$ sips  |
| Rock Compressibility  | 6 $\mu$ sips  |
| Total                 | 19 $\mu$ sips |

|                  |       |                                |
|------------------|-------|--------------------------------|
| Net Thickness    | 93 ft | Includes M56D, M56E, M56F (v2) |
| Porosity         | 21.6% | NetH weighted Average          |
| Water Saturation | 12.2% | NetHxPorosity Average          |

|                        |             |                             |
|------------------------|-------------|-----------------------------|
| Initial Pressure       | 11,856 psia | M56E Sand                   |
| Initial Pressure (WHP) | 8,562       | (corrected using 3294 psia) |

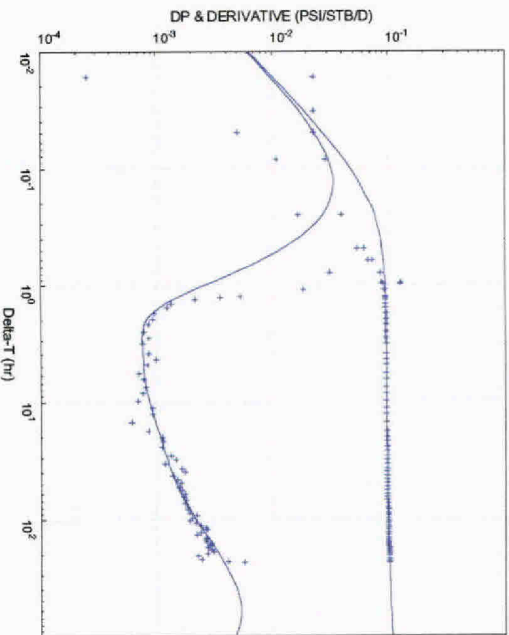
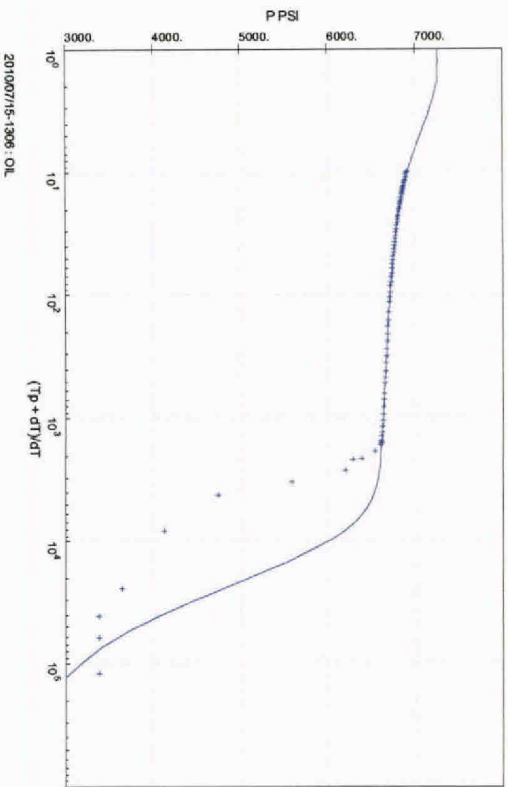
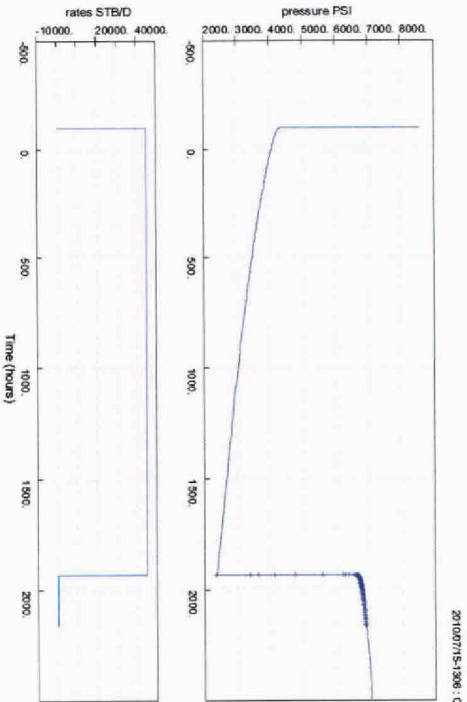
## Model Linear (homogeneous)

|                  |              |
|------------------|--------------|
| Wellbore Storage | 1.07 bbl/psi |
| Permeability     | 450 mD       |
| Skin             | 50.0         |
| Pi               | 8,562 psia   |

|    |           |        |
|----|-----------|--------|
| +X | 23,000 ft | 28,000 |
| -X | 5,000 ft  |        |
| +Y | 1,800 ft  | 3,600  |
| -Y | 1,800 ft  |        |

|                       |                           |
|-----------------------|---------------------------|
| Pore Volume           | 2.025E+09 ft <sup>3</sup> |
| H/C Pore Volume       | 317 mmrb                  |
| Original Oil In Place | 137 mmstb                 |

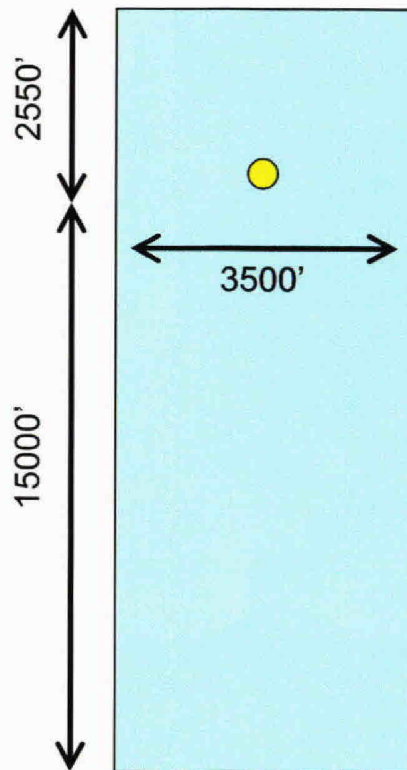
# Rectangular Model – No Aquifer; 45 mbd



# Rectangular Model – No Aquifer; 30 mbd



- Simplest model to capture key observations



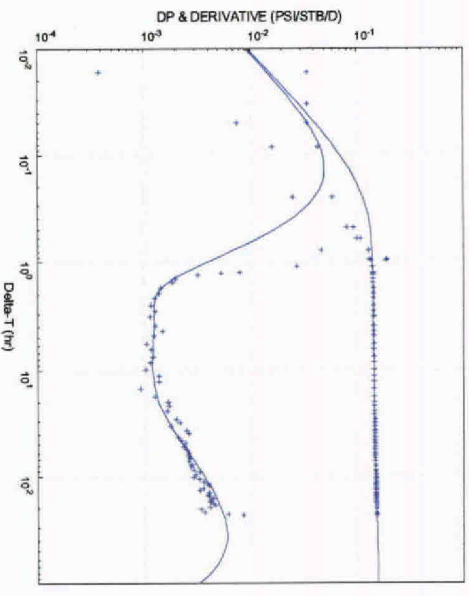
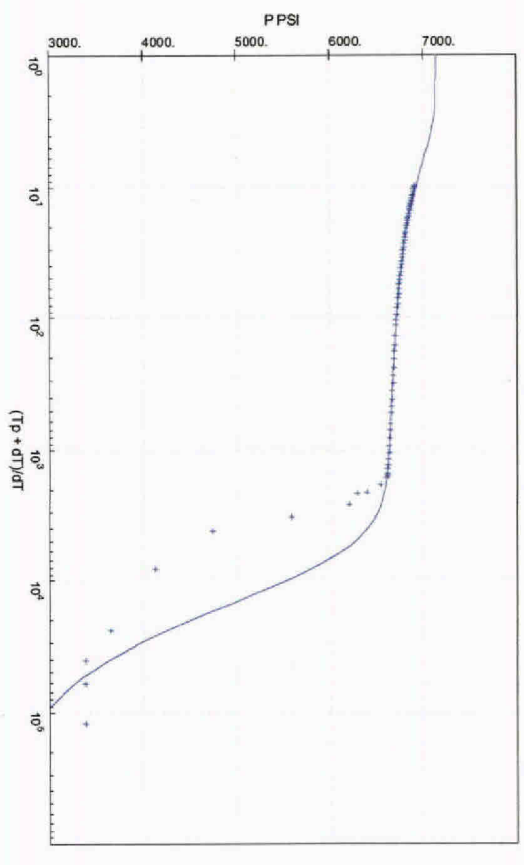
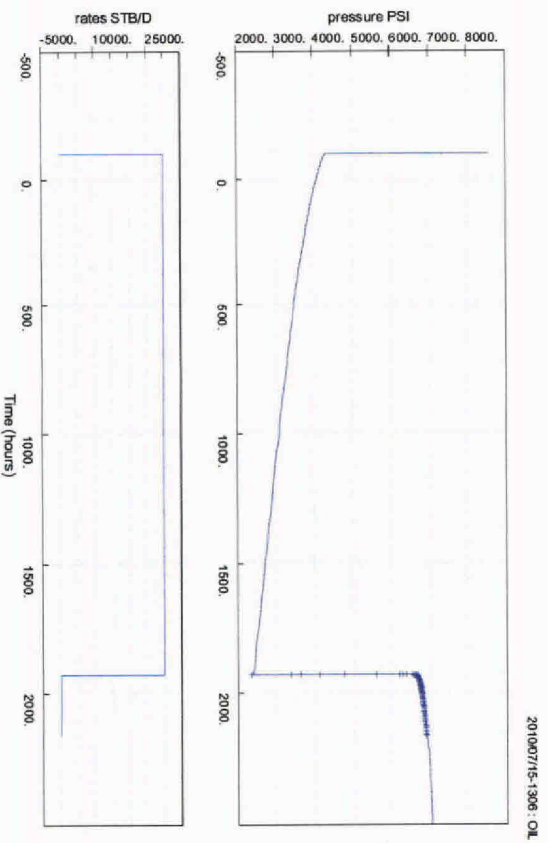
## Static Input Data:

|                        |               |                                |
|------------------------|---------------|--------------------------------|
| Bo                     | 2.310 rb/stb  |                                |
| Oil Viscosity          | 0.210 cP      |                                |
| Well Bore Radius       | 0.350 ft      |                                |
| Gauge Resolution       | 5.000 psi     |                                |
| Fluid Compressibility  | 14 $\mu$ sips |                                |
| Water Compressibility  | 3 $\mu$ sips  |                                |
| Rock Compressibility   | 6 $\mu$ sips  |                                |
| Total                  | 19 $\mu$ sips |                                |
| Net Thickness          | 93 ft         | Includes M56D, M56E, M56F (v2) |
| Porosity               | 21.6%         | NetH weighted Average          |
| Water Saturation       | 12.2%         | NetHxPorosity Average          |
| Initial Pressure       | 11,856 psia   | M56E Sand                      |
| Initial Pressure (WHP) | 8,562         | (corrected using 3294 psia)    |

## Model

|                       |                           |        |
|-----------------------|---------------------------|--------|
|                       | Linear (homogeneous)      |        |
| Wellbore Storage      | 0.51 bbl/psi              |        |
| Permeability          | 280 mD                    |        |
| Skin                  | 46.0                      |        |
| Pi                    | 8,562 psia                |        |
| +X                    | 15,000 ft                 | 17,550 |
| -X                    | 2,550 ft                  |        |
| +Y                    | 1,750 ft                  | 3,500  |
| -Y                    | 1,750 ft                  |        |
| Pore Volume           | 1.234E+09 ft <sup>3</sup> |        |
| H/C Pore Volume       | 193 mmb                   |        |
| Original Oil In Place | 84 mmstb                  |        |

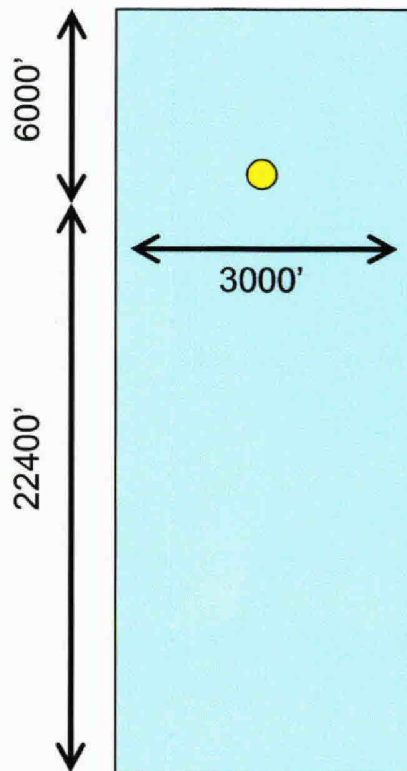
# Rectangular Model – No Aquifer; 30 mbd



# USGS Parameters – Increased $C_r$ , 50 mbd



- Simplest model to capture key observations

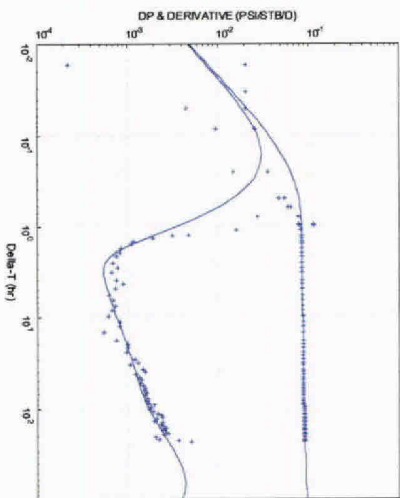
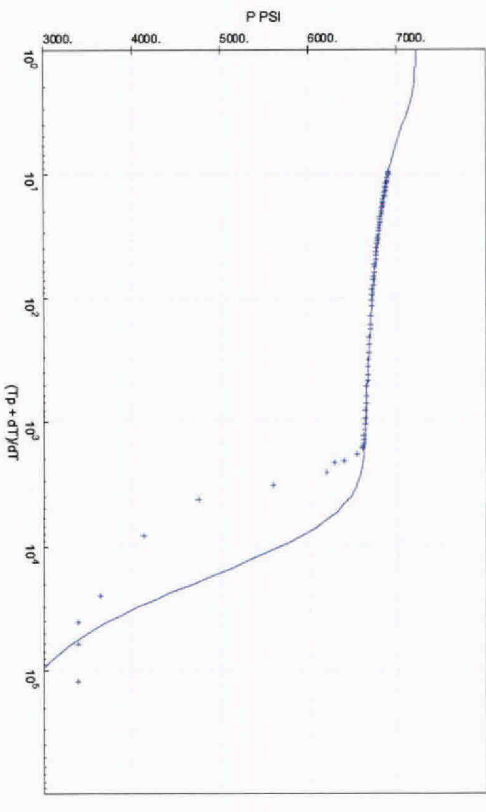
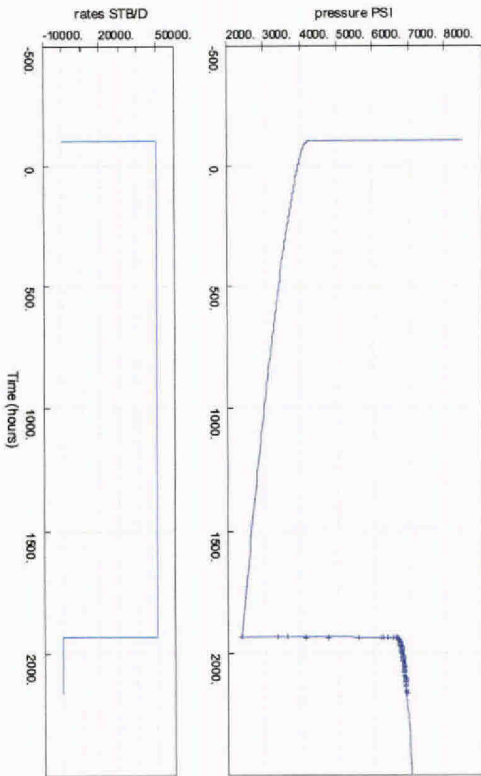


| Static Input Data:     |                           |                                |
|------------------------|---------------------------|--------------------------------|
| Bo                     | 2.350 rb/stb              |                                |
| Oil Viscosity          | 0.168 cP                  |                                |
| Well Bore Radius       | 0.350 ft                  |                                |
| Gauge Resolution       | 5.000 psi                 |                                |
| Fluid Compressibility  | 14.6 $\mu$ sips           |                                |
| Water Compressibility  | 3.0 $\mu$ sips            |                                |
| Rock Compressibility   | 14.0 $\mu$ sips           |                                |
| Total                  | 27 $\mu$ sips             |                                |
| Net Thickness          | 90 ft                     | Includes M56D, M56E, M56F (v2) |
| Porosity               | 21.0%                     | NetH weighted Average          |
| Water Saturation       | 10.0%                     | NetHxPorosity Average          |
| Initial Pressure       | 11,856 psia               | M56E Sand                      |
| Initial Pressure (WHP) | 8,562                     | (corrected using 3294 psia)    |
| Model                  |                           |                                |
|                        | Linear (homogeneous)      |                                |
| +X                     | 22,400                    | 28,400                         |
| -X                     | 6,000                     |                                |
| +Y                     | 1,500                     | 3,000                          |
| -Y                     | 1,500                     |                                |
| Pore Volume            | 1.610E+09 ft <sup>3</sup> |                                |
| H/C Pore Volume        | 258 mmb                   |                                |
| Original Oil In Place  | 110 mmstb                 |                                |

Note: +/- X split assumed



# USGS Parameters – Increased $C_r$ , 50 mbd



# Conclusions



- Observed pressure behaviour consistent with “normal” well behaviour:
  - Elongated reservoir
  - Limited support
- Numerous subsurface realisations can match the data reasonably well, considering:
  - Uncertainty in flow rate
  - Uncertainty in connected volume
  - Uncertainty in static parameters ( $C_r$ , channel size)
  - Uncertainty in flowing bottom hole pressure
  - Uncertainty in final static bottom hole pressure
- These analyses do not change the previous conclusion that leaks greater than 5mbd would be detectable through the wellhead pressure response.