Preliminary Results from Wolfcamp Spacing Pilots and Microseismic in Southwestern Martin County, Texas

Michael Langeler

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1Geoscience Manager, RSP Perm, L.L.C., Dallas, Texas (mlangeler@rsppermian.com)

Abstract

In 2014, RSP Permian initiated three Upper Wolfcamp spacing pilots testing varying vertical and horizontal distances between laterals in the Cross Bar Ranch and Johnson Ranch areas. RSP also ran surface array microseismic along with downhole monitoring on the Cross Bar Ranch 2017 Wolfcamp A, Lower and Middle Spraberry stacked lateral test. These three intervals were then simultaneously fracked. The results of these three pilots and microseismic have confirmed previous spacing conclusions in the Upper Wolfcamp and led to new proposed lateral spacing pilots in the Spraberry.
Preliminary Results from Wolfcamp Spacing Pilots and Microseismic in Southwestern Martin County, Texas

Michael Langelier
RSP’s Acreage in the Midland Basin

Focus Areas

Cross Bar / Johnson Ranch

Glasscock Acquisitions
RSP Johnson / Cross Bar Ranch Leases – T/Dean Structure
Johnson / Cross Bar Ranch X-Section – Open Hole Logs
Lower Spraberry Avg: 30.5 MMBO/Sec.

Wolfcamp A Avg: 22.5 MMBO/Sec.

Wolfcamp B Avg: 30.3 MMBO/Sec.
RSP Johnson / Cross Bar Ranch Leases - T/Strawn Structure
Cowden Johnson Ranch 3D - Inversion

CBR 3028 WB – Abandoned Lateral

CBR 3015 WD
RSP Johnson Ranch Pilot
Johnson Ranch Wolfcamp A/B Spacing Pilot

WC A & B Full Development  “Factory Mode”

1018 WA/WB  Producing
1019 WA/WB  2/22 Frac Date
1021 WA/WB  3/8 Frac Date
1022 WB, 1023 WB  3/22 Frac Date
1017 (WD) WA  3/8 Frac Date
1017 (WB) WA  3/8 Frac Date

Gun Barrel View

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Johnson Ranch 1018 WA/WB Production

Artificial Lift
PWOP

Flowing

BoD/

Producing Days

0 10 20 30 40 50 60 70 80 90

JR 1018WA  JR 1018WB
RSP Cross Bar Ranch Pilots

- **Nu Tech Logs**

**MAP:**
- **Cross Bar Ranch 1717 Pilot**
- **Locations:**
  - **MARTIN CO**
  - **ANDREWS CO**
  - **MIDLAND CO**
  - **West Cowden Lease**
  - **Kimberly Lease**
  - **Johnson Ranch Lease**
  - **Glass Ranch Lease**
  - **Estes Prospect**

**NDM:**
- **N**

**RSP Permian Logo:**
Cross Bar 1717 WC A/B Spacing Pilot – Encouraging Early Results

Treating pressures during zipper frac indicated wells are not in communication

Map of Cross Bar Ranch 1717

1717WB – 30-day IP: 867 Boe/d
1717WA – 30-day IP: 928 Boe/d
6,955 LL
7,107 LL

665 MBOE (7,000’ lateral)

6,955’
7,107’

1717 WA
1717 WB

Gun Barrel View

Treating pressures during zipper frac indicated wells are not in communication.
• Wolfcamp B - 1st prod 8/2013
• WB Cum Prod – 111 Mboe 8/2014
• WC A / LS / MS – 1st prod 9/2014
Crossbar Ranch WC A/B Spacing Pilots

Gun Barrel Views

WC A/WC B completed simultaneously

WC A completed 1 year after WC B

Crossbar 1717

Crossbar 2017

WC A/WC B completed simultaneously

WC A completed 1 year after WC B

CROSS 1717 WA & 1717 WB

CROSS 2017 WA & 2017 WB

CBR 2017 WA vs. 1717 WA

CBR 1717 WA & WB
Cross Bar Ranch Microseismic
WB Pinnacle results  2013

Map View

Depth View

Monitor Wells

250 x 100 ft grids

Events are sized by magnitude and colored by stage

Spraberry Top
L. Spraberry Top
Dean Top
Wolfcamp A Top
Wolfcamp B Top

2017MS Wellbore
2017LS Wellbore
2017WA Wellbore
2017H Wellbore
Surface Acquisition Summary Actual - 2014

- Treatment Dates: 8/4/14 – 8/24/14
- Acquired data from: 8/4/14 – 8/24/14
- 20 days of continuous data, 199 pump hours
- Target Formations:
  - Middle Spraberry at 8600 ft from KB
  - Lower Spraberry at 9250 ft from KB
  - Wolfcamp ‘A’ at 9,650 ft from KB
- The array consist of 20 lines radiating out from the well head covering an area of approximately 20 square miles
- There are 4918 stations in the array, station spacing is 50 feet
- The CBR 2017H well is shown in blue
- The CBR 2017MS well is shown in orange
- The CBR 2017LS well is shown in green
- The CBR 2017WA well is shown in red
- The CBR 2901 well is shown as a magenta dot
- The CBR 2907 well is shown as a yellow dot
- Data was acquired using Sercel 428 recording system at 2 ms sample rate
LS Well Surface Microseismic Results

Map View

Depth View Looking East

Grid Size
X: 250 ft
Y: 250 ft
Z: 100 ft

Events are sized by amplitude and colored by stage

250’ X 100’ Grids
WA Well Surface Microseismic Results

Map View

Depth View Looking East

Grid Size
X: 250 ft
Y: 250 ft
Z: 100 ft

Events are sized by amplitude and colored by stage
All Wells Surface Results Colored By Well

Map View

Depth View Looking East

Events are sized by amplitude and colored by stage.

Grid Size
X: 250 ft
Y: 250 ft
Z: 100 ft
Cross Bar Ranch 2017 Stacked Pad Microseismic Review

Cross Bar Ranch 2017 Stacked Pad Microseismic Lateral Wellbore Spacing (Map View)

All Stages
Middle Spraberry

All Stages
Lower Spraberry

All Stages
Wolfcamp A / Wolfcamp B

Longitudinal distance from stage center (feet)

Perpendicular distance from stage center (feet)

Propped Fracture Volume

MicroSeismic

Lower Spraberry

Middle Spraberry

Wolfcamp A / Wolfcamp B

Maximum Propped Total Length:

450 ft

300 ft

400 ft

Microseismic Suggested Lateral Wellbore Spacing:

400 ft

300 ft

400 ft

RSP Selected Lateral Wellbore Spacing

← 450 – 500 ft →
**Cross Bar Ranch 2017 Stacked Pad Microseismic Review**

### Vertical Wellbore Spacing

<table>
<thead>
<tr>
<th>Layer</th>
<th>MS</th>
<th>LS</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Vertical Wellbore Spacing:</td>
<td>625 ft</td>
<td>430 ft</td>
<td></td>
</tr>
<tr>
<td>Maximum Propped Total Height:</td>
<td>400 ft</td>
<td>280 ft</td>
<td>350 ft</td>
</tr>
<tr>
<td>Median Propped Total Height:</td>
<td>300 ft</td>
<td>260 ft</td>
<td>200 ft</td>
</tr>
</tbody>
</table>

- Vertical wellbore spacing between the MS and LS wells is likely excessive, leaving potential for possible Jo Mill locations.
- Vertical wellbore spacing between the LS and WA wells is likely sufficient.

![Vertical Wellbore Spacing Diagram](image-url)

**Commentary**

- Vertical wellbore spacing between the MS and LS wells is likely excessive, leaving potential for possible Jo Mill locations.
- Vertical wellbore spacing between the LS and WA wells is likely sufficient.
### Regional Microseismic Results – Propped Fracture Estimates

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>XBAR RANCH</th>
<th>SALE RANCH</th>
<th>SCHARBAUER RANCH</th>
<th>D.L. HUTT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MS</strong></td>
<td>300’ / 225’</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>LS</strong></td>
<td>260’ / 150’</td>
<td>—</td>
<td>320’ / 200’</td>
<td>—</td>
</tr>
<tr>
<td><strong>WA</strong></td>
<td>250’ / 200’</td>
<td>320’ / 150’</td>
<td>220’ / 256’</td>
<td>304’ / 173’</td>
</tr>
<tr>
<td><strong>WB</strong></td>
<td>250’ / 250’</td>
<td>320’ / 165’</td>
<td>—</td>
<td>185’ / 316’</td>
</tr>
</tbody>
</table>

* Data from Docket # 7C-0291169 and 7C-0291171 Hearing Exhibits
Cross Bar Microseismic – Conclusions and Implications

Preliminary Microseismic Conclusions:

- **Middle Spraberry** – Micro seismic indicates 10 wells across one mile
- **Jo Mill** – Microseismic indicates undeveloped gap between MS and LS
- **Lower Spraberry** – Microseismic indicates 10 wells across one mile
- **Dean** – Microseismic indicates Dean is covered by LS and WA stimulation
- **Wolfcamp A** – Microseismic indicates correct spacing of 5 wells across one mile
- **Wolfcamp B** – Microseismic indicates correct spacing of 5 wells across one mile
- **Wolfcamp D (Cline)** – No data available for verification of spacing

Potential for 40 horizontal wells across 1 mile section