Better Results Through Integrated Production Modeling

Larry Harms, Production Optimization Engineer, ConocoPhillips
Results we get depend on managing/engineering the entire system.

Facility Engineer

Geoscientist

Reservoir Engineer

Production Engineer

Operations

Reservoir Engineer
Well takes too many resources to keep Unloaded and might be able to make more. What should we do?
La Perla 36
Plunger unsuccessful
2.875” Tubing
12 BCF Produced
SIWHP – 425 psig
Barrel # 1 - Reservoir Engineer

What should we do?
It’s on its Projected Decline, I don’t see a problem!
Calculated Recovery is 88% and expected ultimate recovery is 85% - It’s depleted don’t mess with it

From P/Z
13,500 MMCF OGIP
What should we do?
Operations Feedback

• Let’s swab it
What should we do?
Production Engineer Feedback

- Below Turner Critical Rate of 386 MCFD
- Plunger Lift Unsuccessful
- Look at Siphon String or Smaller Tubing
Prediction for 1.75” Coil Tubing
365 MCFD
What should we do?
Facility Engineer’s Feedback

• Pressure Drop in Piping is Low
  no bottlenecks

• Compression is limited to 75
  psig suction minimum but have
  extra horsepower available

• Look at Wellhead Compressor
440 MCFD @ 15 psig

Actual capacity will vary depending on gas characteristics.
Decision Dilemma

What should we do?
Decision Debate

- PE – Let’s run the Coil Tubing
- FE – The compressor will probably get us more rate
- Operations/Maintenance – I don’t have any money in my operating budget for that
- RE – There’s really not much gas left I’m not sure we should do anything

We need Economics
We need Flowstreams
We need to work together
Integrated Production Modeling

Wellhead

Flowline

Compr1

Sales

La Perla 36

Facilities Model

Well Nodal Analysis

Lobo 1

Reservoir Tank Model

Petroleum Experts GAP
La Perla 36 Siphon String Options

![Graph showing La Perla 36 Siphon String Options with data points for March 2004 to March 2013. The graph includes three lines representing different options: 1.75 CT, 1.75 CT with early WHC, and 1.75 CT with WHC. The y-axis represents MCFD (Million Cubic Feet per Day), and the x-axis represents the years from March 2004 to March 2013.]
La Perla 36 All Option Comparison

- Base, 2.875
- WH Comp.
- 1.75 CT
- 1.75CT w/WHC
- 1.75CT w/early WHC
- WHC 0 psi Suct.

MCFD

Mar-04, Mar-05, Mar-06, Mar-07, Mar-08, Mar-09, Mar-10, Mar-11, Mar-12, Mar-13
## Summary of Option Results

<table>
<thead>
<tr>
<th>Option</th>
<th>Incr. MMCF</th>
<th>Abandonment PSI</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>As Is</td>
<td>102</td>
<td>569</td>
<td>Nov-04</td>
</tr>
<tr>
<td>WH Comp.</td>
<td>382</td>
<td>466</td>
<td>May-07</td>
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<tr>
<td>WHC O psi Suct.</td>
<td>386</td>
<td>462</td>
<td>Apr-07</td>
</tr>
<tr>
<td>1.75&quot; CT</td>
<td>423</td>
<td>446</td>
<td>Nov-08</td>
</tr>
<tr>
<td>1.75&quot; CT + WHC</td>
<td>696</td>
<td>344</td>
<td>Feb-13</td>
</tr>
<tr>
<td>1.75&quot; CT Early WHC</td>
<td>695</td>
<td>344</td>
<td>Aug-12</td>
</tr>
</tbody>
</table>
Special Thanks to Sunil Shalia
For use of This Model
Incremental Horse Power Required

Date

HP - 120
HP - 80
HP - 40
HP - 10
Integrated Production Modeling - Cons

- It’s just a model
- Dangerous in the wrong hands
- Time
- Availability/Reliability of Info required
- Computing resources required
- Plunger/Soap/Intermitter hard to model
Integrated Production Modeling - Pros

• Optimize Total System
• All disciplines on the “same page”
• Full Life Cycle Flow streams for Economic Analysis
• Easily examine multiple options
• Easy to use for Gas Wells
• Potentially answer “age old” problems
We have the tools
We have the technology
We have the know how to get
Better Results
If we work together