Vertical Well Production Recovery in Horizontal Well Development Field

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Outline

- Operations Overview
- Historical Drilling Strategy
- Project Drivers
- Overall Strategy to ‘Return to Production’ Vertical Wells
- Review Hybrid G Lift Projects
- Wellbore Schematic & Facilities
- Summary of Implemented Projects
- Pumping Unit Installations
Bonanza Operations Overview

Background

• Low GLR
• Low water
• Cod-Nio completions
• Future uses for the wells
• Unloading logistics
Location and Niobrara Overview

- Late Cretaceous: 82-87 million years ago
- Approximately 6000’ in depth
- Horizontal drilling and multi-stage hydraulic fracturing have improved economics
- Predominantly oil and rich gas liquids

Denver Basin Cross Section Showing Bedrock Aquifers Above the Pierre Shale and the Distance Above the Niobrara Formation

Colorado Geological Society 2011
Geologic Description of the Niobrara and Codell

Late Cretaceous

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- **Niobrara Formation**
- Two Structural Units: Smokey Hill Chalk and Fort Hays Limestone
- Smokey Hill member made up of interbedded Chalks and Marls
- Niobrara B Bench and C Bench are primary targets for horizontal wells

- **Codell Sandstone**
- Thinner compared to Niobrara
- Tight, clay rich sand
- Primary target for horizontal wells
Historical Drilling Activity (Wattenberg)

- Vertical - single well pads
- Vertical - multi-well pads
- 2011 – move to horizontal drilling, offsetting existing verticals
Project Drivers

- Horizontal drilling and field development
- ‘Thread the needle’
- Increasing line pressure
- Inconsistent production
- Liquid loading
- Environmental
- Lifting costs
Vertical Well – Overall Strategy

**Return to Production if Possible**
- Upgrade gathering System to reduce line pressure
- Plunger – primary ALS
- Manual RTP techniques; OTT, swabbing
- Install Hybrid GL (Gas Assisted Plunger Lift) set-ups
  - Required multi-well pads with short flowline distances
- PU installations – single wells, multi-Well pads less than 4 Wells on pad

**Un-Economic to RTP**
- TAs
Gathering System Upgrade

- Reduce line pressure from 300# to 90#
RTP Techniques & Plunger Primary ALS

- Plunger – primary ALS
- Manual RTP techniques; OTT, swabbing
- Unsuccessful attempts for wells to run regularly on plunger lift alone
Hybrid GL #1 – G29 Pad

Feb. 23 - 25, 2015
2015 Gas Well Deliquification Workshop
Denver, Colorado
Hybrid GL #1 – G29 Pad, Proposal

- Wells Selection
  - 7 Well Pad
  - 2011/2012 1st production dates
  - Wellheads located at production facilities

- Expected production uplift
  - 38Bopd
  - 39Mcfpd
G29 – AFE Economics

- Aries inputs: 38 Bopd, 39 Mcfpd, exp decline at 13%
- Total upfront investment = $116,920
- LOE = $17,500 (5 Wells @ $2,500 + $5,000 compressor lease)
- Gross Ultimate 79.222 MB, 80.881 MMcf
- ROR = 100%
- Payout = 0.37 yrs (4.4 Mos)
- Life = 11.75 yrs
Wellhead Configuration & Equipment

- EOT Depth
- Stage Tools
- Compression
- Automation
Project #1 – G29 – Production Results

236% BOE Production Increase

38 BOPD
39 Mcf

Production Date

Feb. 23 - 25, 2015
2015 Gas Well Deliquification Workshop
Denver, Colorado
GL #1 – G29 – 576 Days Production
Project #1 – G29 - Economic Lookback

- Project cost $116,920
  - Anticipated payout 4.4 Mos
- Actual payout = < 3 Mos
- Pad Averages:
  - YE 2013 EUR = 17.5 MBOE
  - YE 2014 EUR = 31.4 MBOE

80% EUR Increase!
Subsequent Hybrid GL Installations

- Multi-well pads
- Tie in single wells to horizontal well’s gas lift compressor
Hybrid GL #2 – Sec 5

- 2012 1st production dates
- 8 Wells/1 gas lift compressor
- Wells required constant OTT to run plungers
- Compressor installation 7/2013
- Winter compressor downtime
- Consistent production without OTT, if compressor is running
- Currently shut-in for offset frac treatment
Hybrid GL #3 – M31 Pad

- 2012 1st production dates
- 7 Wells/1 gas lift compressor
- Wells required constant OTT to run plungers
- Regular swabbing
- Compressor installation 8/2013
- Winter compressor freezes
- Consistent production without OTT, if compressor is running
- Working on improving compressor runtime
Subsequent Hybrid Gas Lift Projects

- **I29 Pad** – 12/2013, 8 wells, 2011 & 2012 1st production
- **I17 Pad** – 1/2014, 6 wells, 2011 & 2012 1st production
- **D18 Pad** – 3/2014, 4 wells, 2012 1st production (< 4 mos payout)

**Multi-Well Pads (> 4 wells/ pad)**
Project #6 – 11-20 (7 Wells)

- 7 Wells
  - 2 Spud 2010
  - 2 Spud 2011
  - 3 Spud 2012

- Gas lift turn on 2/13/14

- SI 5/13 for frac prep

- 7/7 Wells BOL but still have reduced production following frac-into
Wells recovered production following shut-in period and frac-into 6/2014
Project #9 - Latham 41-1

- Well required constant OTT to run
- Very inconsistent production profile
- Plumbed into GL from Latham 31-34-1HNB
- Following GL Turn-On, plunger dropped & running 100% cycles
- No OTT Required
Pumping Unit Installations

• Not candidate for Hybrid GL Project
  – <5 Wells on pad
  – Wellheads far distance from facilities

• Very inconsistent production profile

• Well required constant swabbing to run

• Swabbing resulted in oil production

• Producing with original pump installed 8/2014
Pumping Unit Installations

- Not Hybrid GL candidate
- Producing with original pump, installed 9/2014
- Down time 1/2015 due to weather
Summary

- Operations overview
- Historical drilling strategy
- Project drivers
- Overall strategy to ‘return to production’ vertical wells
- Review hybrid gas lift projects
- Wellbore schematic & facilities
- Summary of implemented hybrid gas lift projects
- Pumping unit installations
Thank You

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