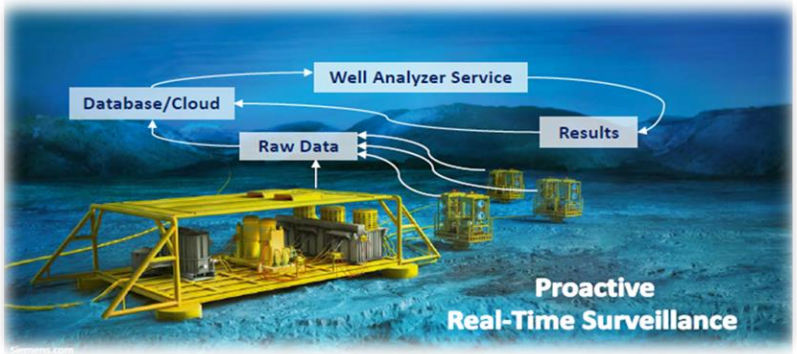
Well Analyzer

Pro-Active

*Automated Real-Time Surveillance **(ARTS)***

Well/Reservoir Evaluation Software Package



VFM/Sudden Water Production in a Deepwater Oil Well

Oilfield Data Services, Inc.

- ✓ Oil & Gas Reservoir Testing and Evaluation
- ✓ Real-Time Pressure Transient Analysis
- ✓ Hydrocarbon Volume Determination
- ✓ Well(s) Performance Tracking
- ✓ Multiphase Rate & BHP Calculations
- ✓ Optimize Gas Lift / Oil Production Rates
- ✓ Life Of Well Surveillance/Analysis
- ✓ Automated PVT Calibration

Oilfield Data Services, Inc.
+1 (713) 521 - 4571 | info@oilfielddataservices.com
Visit: www.odsi-energy.com

ODSI Well Analyzer

Digital Operator Support Real-Time Automated System

Real-Time Reporting on Well/Field KPI's

The Well Analyzer RTS Concept:

Experienced Surveillance Engineers

+

Automation

VFM/PVT	Flow Assurance	Production & Reservoir Performance Optimization		Field Development & NPV Optimization
Virtual Metering	Wax, Hydrates, Asphaltenes, Scale, Corrosion, Emulsion Detection & Mitigation	Auto Real-Time PTA & Reporting	In-place and recoverable hydrocarbon volume monitoring	Short- and long-term asset and NPV Optimization
Auto Real-Time PVT Tuning & Calibration		Scale, Asphaltene detection in reservoir & wellbore	In-place and recoverable hydrocarbon volume monitoring	Drilling Decisions – Optimal Well Placement

Asset Modeling, Monitoring & Diagnostics

Raw sensor data → Data Communication → Intermediate Data Repository → Real-Time Data Management

Photo credit: www.energyglobalnews.com

Subsea Deepwater Oil Well

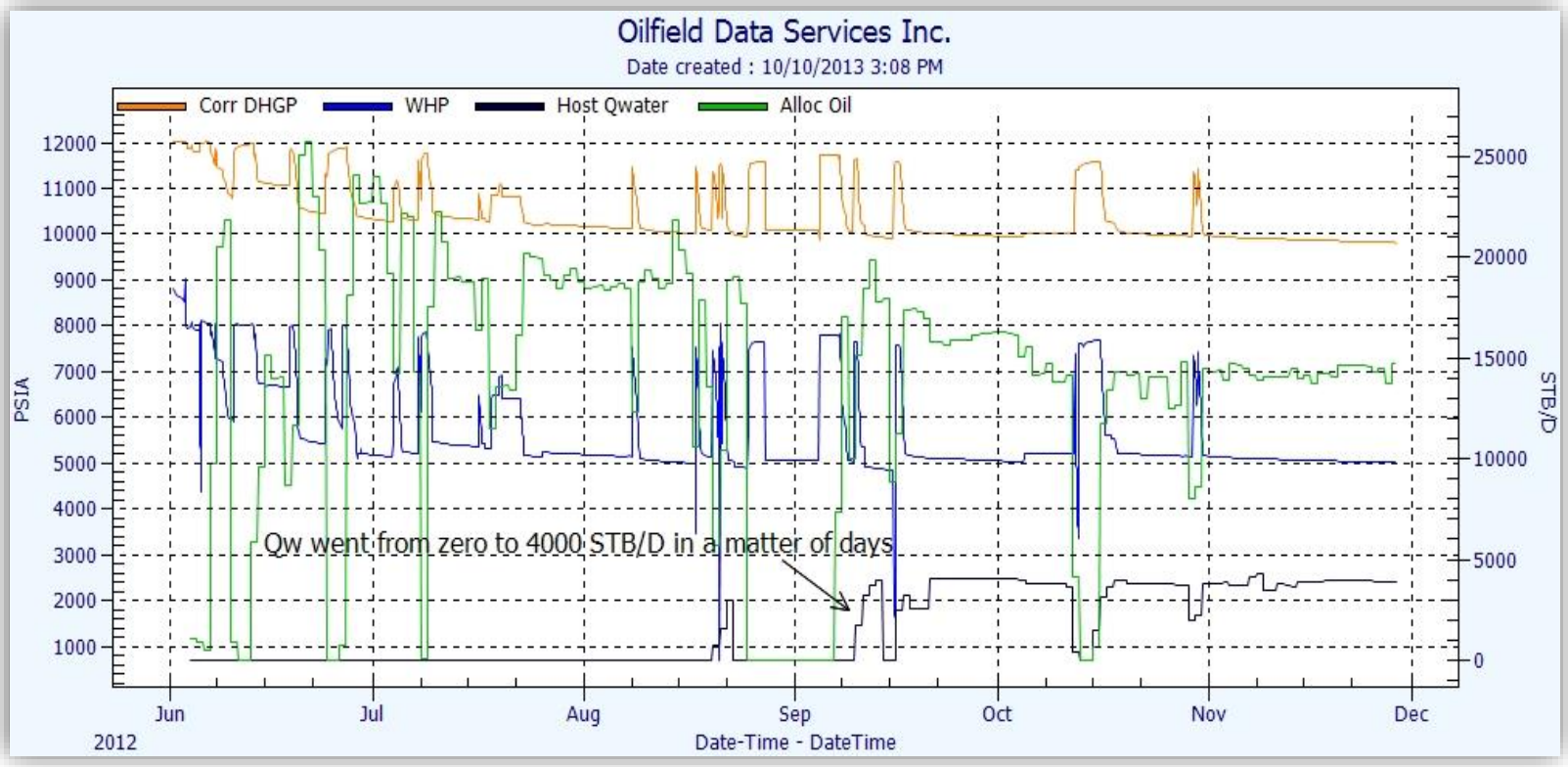
3 Separate Frac Packs

Gulf of Mexico

- 3 Frac Packed Intervals – No Isolation/ICVs
- Well equipped with
  - WHP gauge
  - Downhole gauge
  - Flow meter (MPFM/Boat Anchor)
- The well suddenly started making 4000 STB/D of water
  - The Operator plans a $130 million intervention program to ‘fix’ the well; the Partner decided to find the origin of water production first
- **Objective:**
  - Validate metered rates
  - Determine the origins of water production
  - Perform Auto PTA and Decline Analysis

Provided Data – MPFM Detected Sudden Water Production

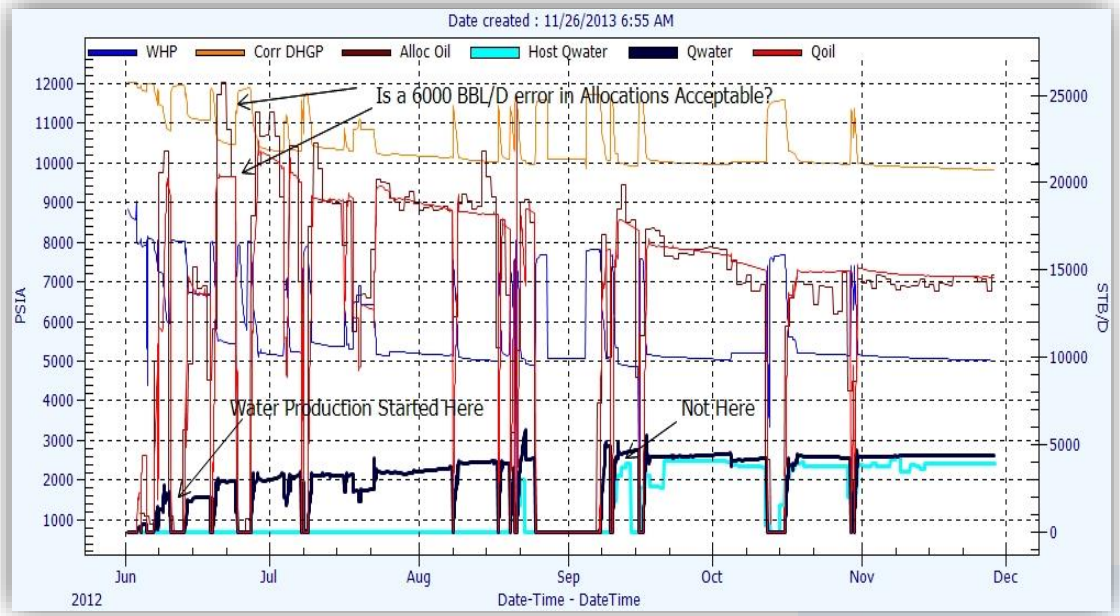
- Water rate went from 0 to 4000 STB/D in a matter of days; the Operator wanted to perform a $130 MM intervention to 'fix' the water problem; the Partner wanted to identify the origin of water production first…Why Spend $130 MM and Shut In a Well Making 15k STBo/D because it 'doesn't match the models'?



Process

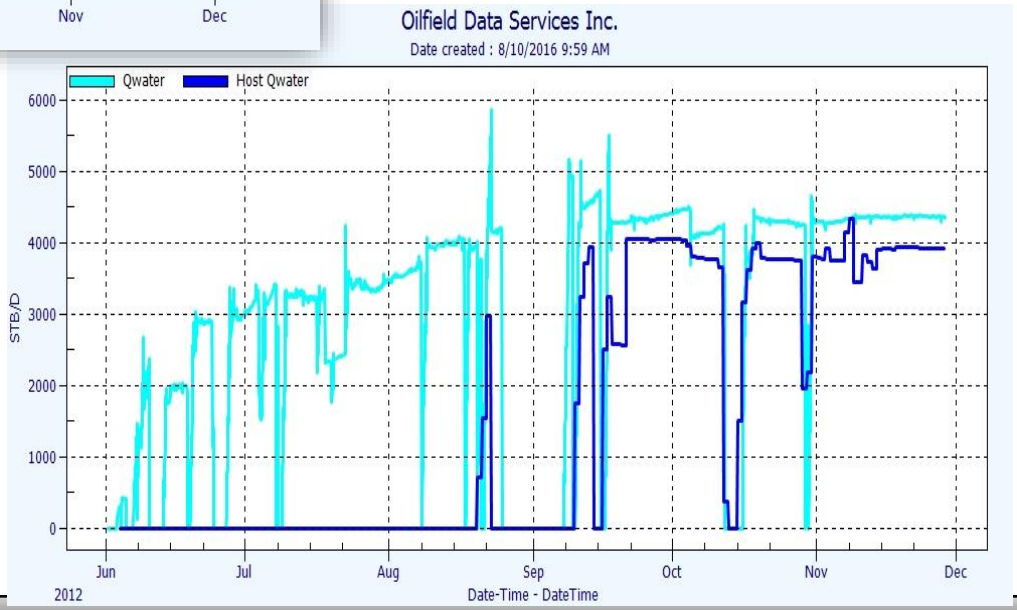
- MPFM rates were QC'd
  - Severe Errors in allocations were detected prior to Sept 2012
- Generally, MPFMs for 2-phase liquid flow are accurate on the total liquid rate measurements, but are likely to be off when it comes to individual oil and water rates (even worse if you start making free gas!)
- The total liquid rate was split into oil and water rates using the pressure drop in the wellbore and fluids' PVT properties
- It quickly became obvious that the MPFM was not calibrated when the well came on-line

Calculated Multiphase Rates Results



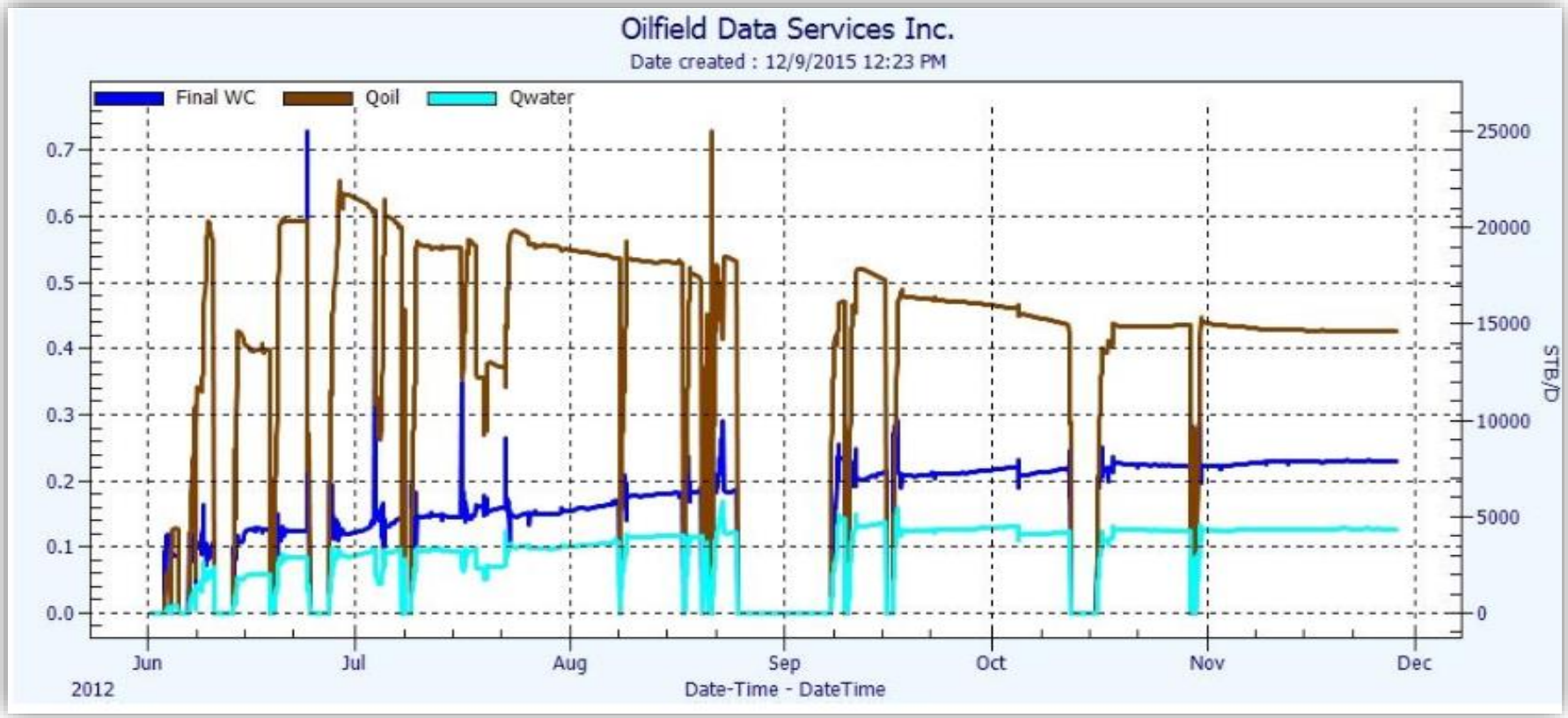
As it turned out, the water production started from the day the well was brought on-line. The operator's allocations were off up to 6000 BBL/D

- Comparison of the measured (dark blue) vs the calculated (teal) water rates
- The meter was not properly calibrated, and the well was producing water from the day it came online



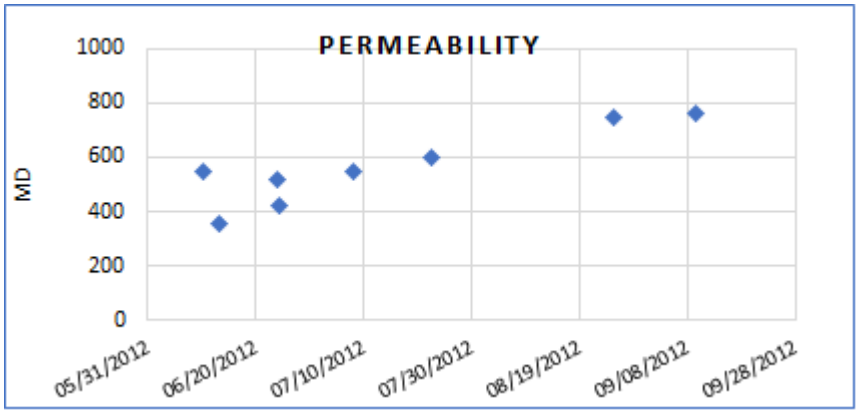
Calculated Multiphase Rates Results

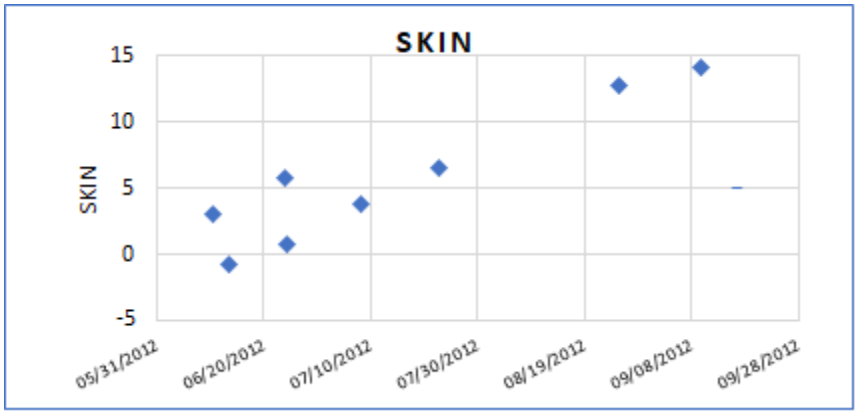
- The Final Calculated Oil and Water rates are presented below
- The water came from a WET ‘oil zone’ that was added at the last minute because the geophysicist colored the sand green ☹

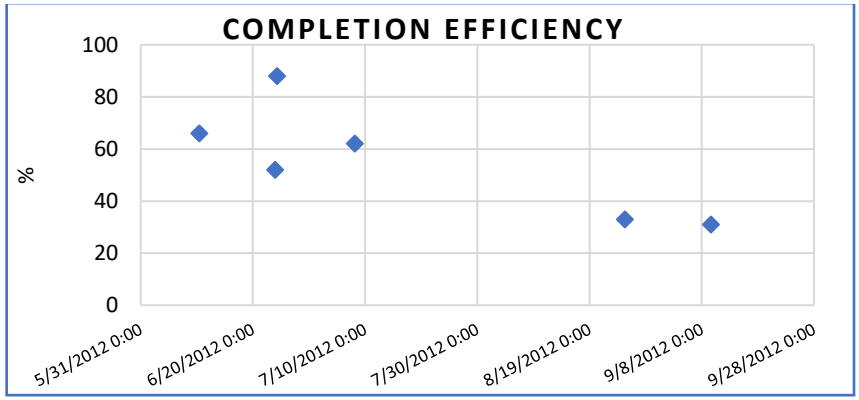


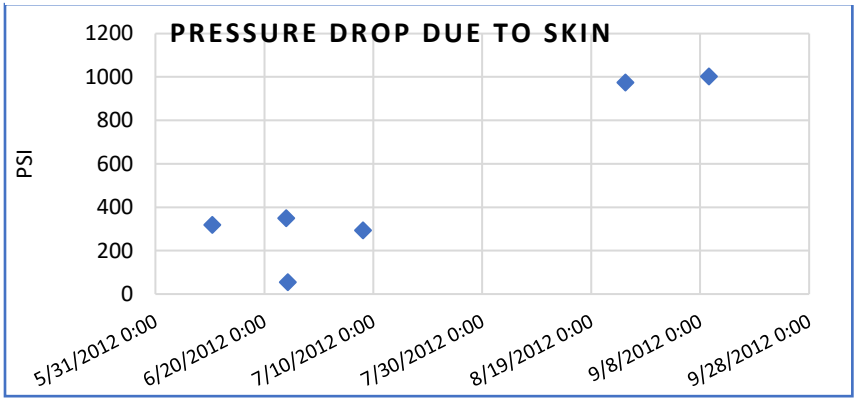
Diagnostic Auto-PTA

- High perm ~ 500 md
- Skin was getting worse with time
  - From 0 to 14 (screen plugging w/asphaltenes)
- Productivity was getting worse with time (increasing skin)

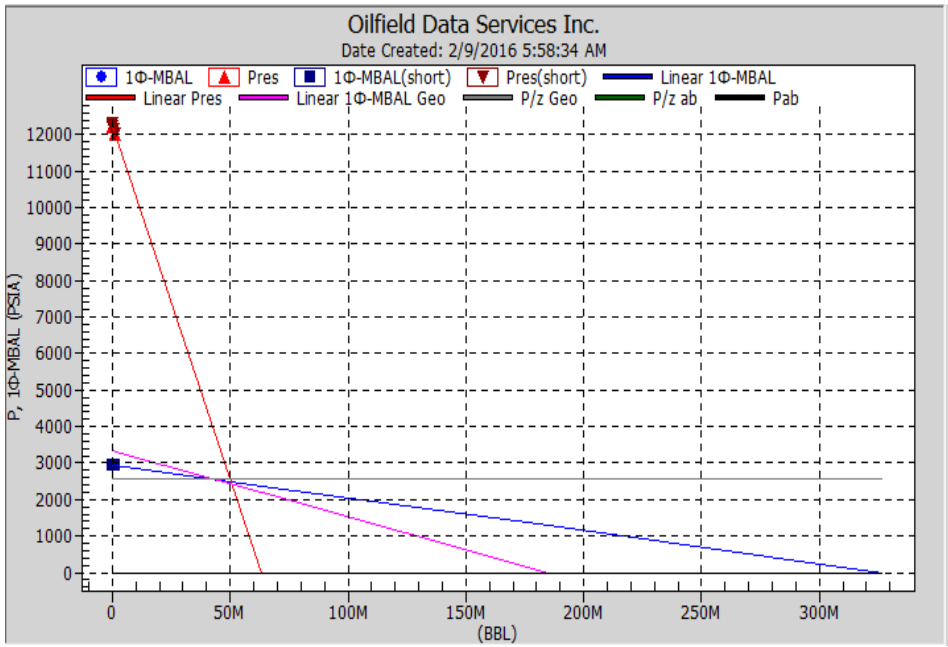


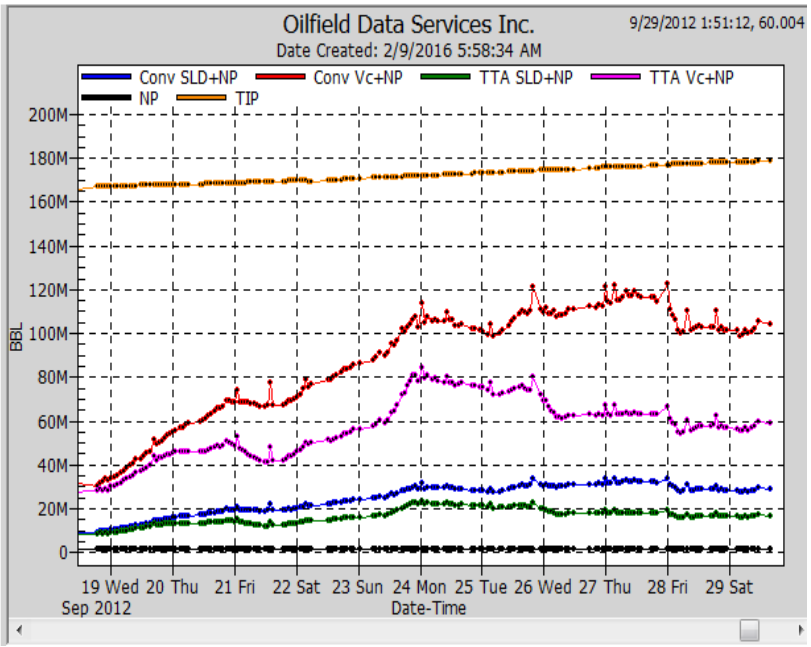






Automated HC Volume: In-place, Connected & Mobile





The well is likely to have very strong water drive, hence

- Total in-place volume is ~ 65 MM STB
- Hydraulically connected to the well volume ~ 30 MM STB
- Mobile (minimum producible) volume ~ 20 MM STB

- Note: It is important to know how big or small your reservoir can be until you know the drive mechanism. WA RTS calculates the connected and mobile HC volumes and stores those values on client's database

Results & Conclusions

- MPFMs were generally accurate on the total liquid rate, but were off on individual oil and water rates
- Given the pressure drop in the wellbore, the software can split the total liquid rate into its components, providing solutions for:
  - Improperly calibrated flow meters
  - Poor separator testing methods
  - Errors in oil and water allocations
- Once the rate is calculated, WA RTS can perform auto-PTA and HC volume calculations
- Water production started from Day 1, not in Month 4!
- Use the ‘thumbs out’ rule to find HC pay!
- Don’t spend money on a problem you can’t fix!