

Waterflood Control in a Multilateral Well

Background and Subsurface Setting

Saih Rawl Shuaiba is a low permeability limestone oil reservoir operated by Petroleum Development Oman (PDO). Saih Rawl oil wells generally require artificial lift in conjunction with water injection to optimize oil recovery from the matrix carbonate reservoirs.

Multilateral horizontal technology enabled economic production rates from this low-permeability limestone reservoir. The field development well pattern uses horizontal multilateral producers paired with injectors. A horizontal multilateral injector mainbore is drilled parallel with each horizontal multilateral producer, thereby creating a line-drive recovery process.

The natural heterogeneity of the reservoir formation has resulted in preferential flow paths between injectors and producers, and consequently poor sweep efficiency.

Challenge

Many of the wells in the Saih Rawl reservoir produce with 20% water cuts for long periods of time, while others immediately go to 100% water cut upon completion. The average water cut in the Saih Rawl field is around 75%.

A method of controlling early water breakthrough from individual legs in the multilateral well was required. Ultimate recoverables are reduced because of increased water cuts associated with uncontrolled laterals dominating well production.

SmartWell® Solution

To improve waterflood efficiency and to reduce the water cut of produced fluids, PDO installed a SmartWell® system Digital Hydraulics™, allowing for isolation of each lateral in the producers.

To isolate water-producing laterals of the well, remotely-operated downhole interval control valves with isolation packers were installed. An electric submersible pump (ESP) installation was integrated with the provision of a hydraulic disconnect, allowing the replacement of the ESP (upper completion section) without affecting the lower intelligent well section. Hydraulic control line continuity was re-established upon ESP replacement.

This same isolation technology can be applied to water injection wells, further improving the waterflooding efficiency.

Customer Value

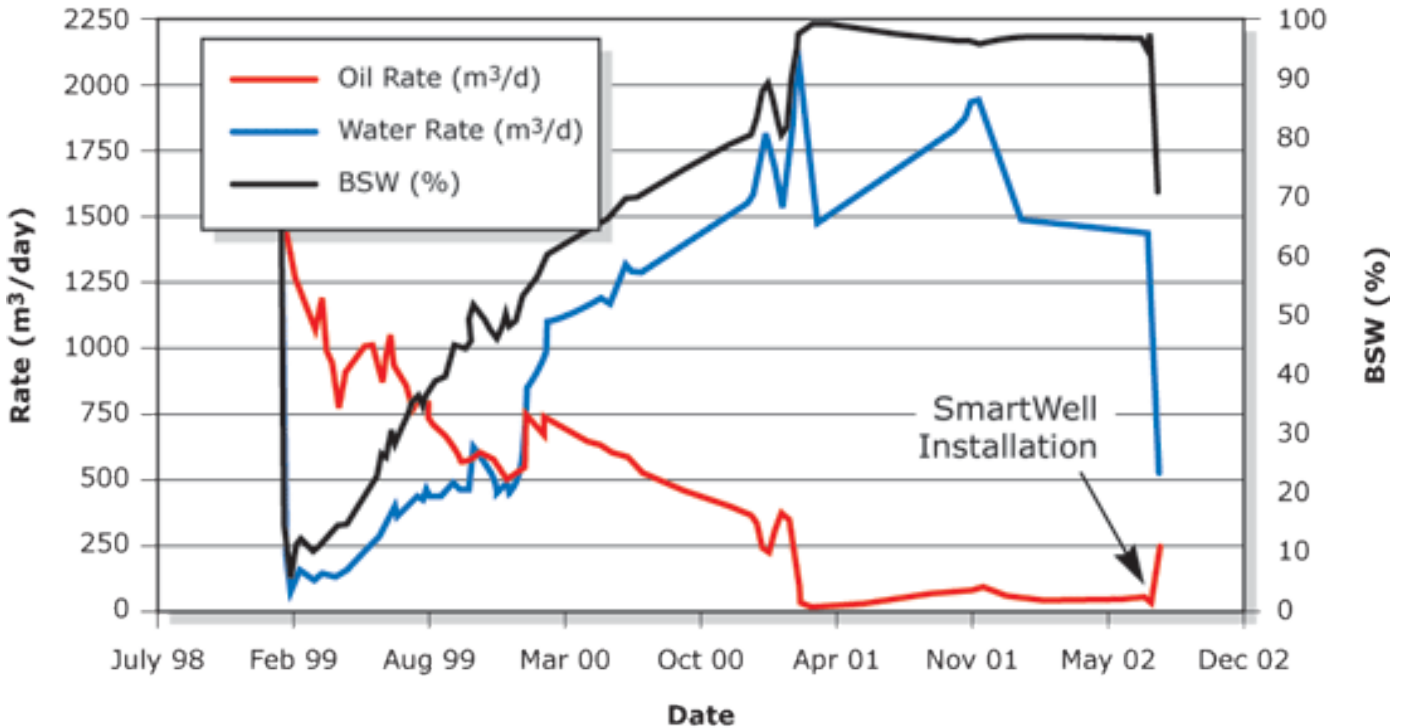
The well has already performed beyond expectations since intelligent production started beginning of July 2002.

Production from the well prior to SmartWell installation had a water cut of 99%. Post installation, oil production was optimized by selectively closing in laterals producing high water cut. Specifically, legs 1 and 2 were shut in, resulting in a net oil production increase of 256 m³/d and reducing the water cut to 71%.

In the first month of production, post SmartWell installation, an incremental volume of more than 96,000 bbl of oil was produced. After six months the incremental production gains had continued.

Additionally, SmartWell® technology has resulted in lower dehydration and water injection costs.

Production Test Data



WD_MG_0179

Details

Client	PDO
Date Deployed	June 2002
Country	Oman
Field/Well	Saih Rawl/SR-108
TVD(m)	1391
MD(m)	2397
Dev (deg)	>90
Temp (deg C)	165
Well Type	Producer
Structure	Land
System	Digital Hydraulics™
Equipment Used	CC-ICVs
No of Zones	4
ICV Size	4 x 3.5"

For more information about any of WellDynamics' products, send an email to smartwell@welldynamics.com or contact your local WellDynamics representative.

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