

Compartmentalized Reservoir

Background and Subsurface Setting

Brunei Shell Petroleum's (BSP) Iron Duke field is a structurally complex, offshore field characterized by multiple fault blocks. Drilling results indicate that sealing capacity may vary both vertically and laterally, even along a single fault, thus making it difficult to predict hydrocarbon contacts in different blocks. Further uncertainty is caused by the presence of hard overpressures ($>20\text{kPa/m}$, 2.9 psi/m) below the main reservoirs, complicating well design and increasing drilling costs.

Due to very limited aquifer support, the wells are typically drilled very close to the oil water contact to maximize oil production and minimize GOR. To optimize the recoverables, both the GOR and water production must be managed and controlled.

Challenge

Well ID-19 is one of several development wells in which the operator developed the five reservoir units in block C with a 4.5" monobore completion in order to provide full access to the reservoir section for future reservoir management activities. However, early in the campaign, it was recognized that the reservoirs were far more compartmentalized than previously thought with distinctly separate units and pressure regimes. This knowledge resulted in a shift in the completion design to one that would allow for selectivity. The well was initially completed as a single zone with a 7" liner.

After producing approximately 50% of the perforated section reserves, production logs revealed that several intervals were producing mainly gas. This finding confirmed that the ultimate oil recovery expected from the solution gas drive was unachievable from the conventional completion.

SmartWell® Solution

To develop the remaining oil and optimize production, the well was re-completed.

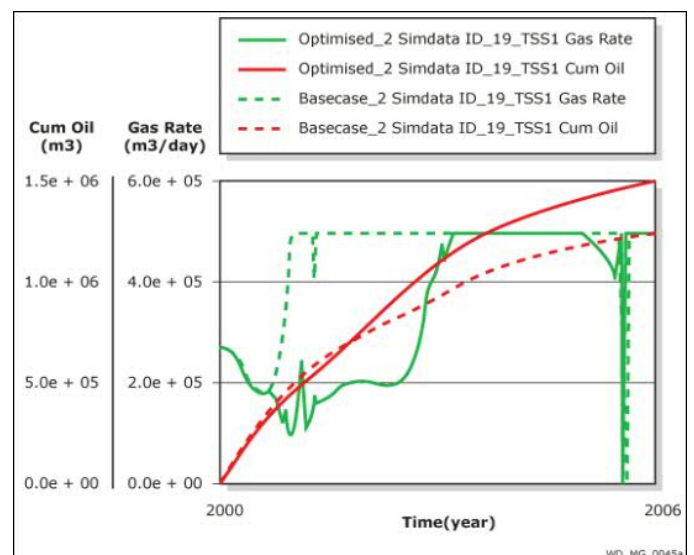
This situation presented a perfect opportunity for a SmartWell® completion, enabling the control of each zone individually or commingled to allow a high GOR zone to lift a low GOR zone (internal gaslift). A five zone Digital Hydraulics™ completion was proposed.

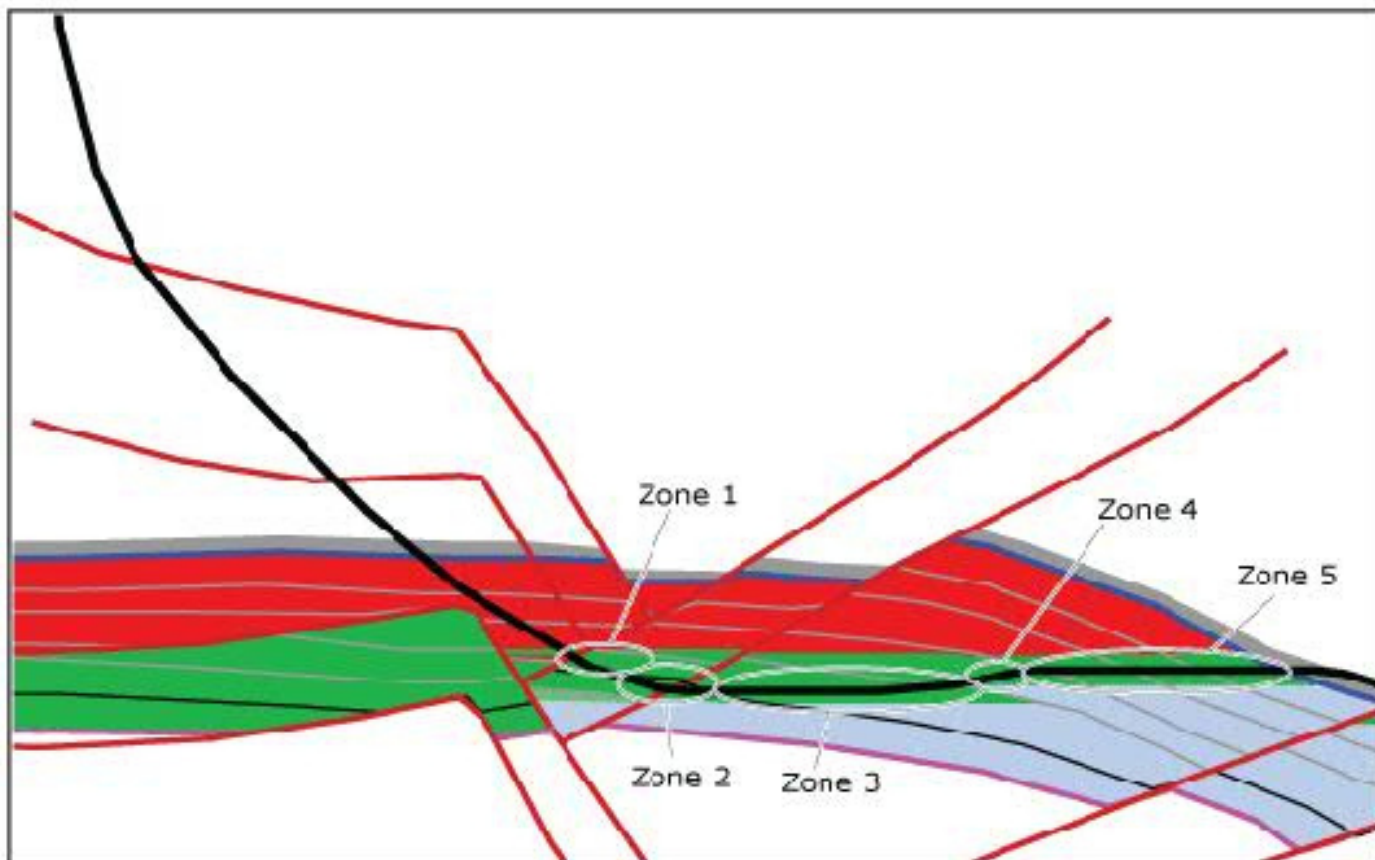
Customer Value

The installation of the IWT in ID-19 was a great success, and was completed in less than eight days, well ahead of schedule. The installation is believed to be one of the first wells in the world having surface control and monitoring in all five zones.

ID-19 started production in mid July 2002. Three zones have been tested individually and commingled using the IWT capability. All equipment is functioning as required and specified.

The initial performance expectations of the IWT technology against the base case indicate that an additional 1.57 mmbbl over six years can be achieved.





Iron Duke Sub-Surface Structure

WD_MG_0066a

Details

Client	BSP
Date Deployed	June 2002
Country	Brunei
Field/Well	Iron Duke/ID-19
TVD(m)	2500
MD(m)	3635
Dev (deg)	>90
Temp (deg C)	N/A
Well Type	Oil Producer
Structure	Platform
System	Digital Hydraulics™
Equipment Used	CC-ICVs
No of Zones	5
ICV Size	5 x 3.5"

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