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Lateral Well Measurements Increase Average Production by 200–300% Per Stage in the Niobrara

Operator uses engineered completions and geomodeling to improve production and allow for more accurate well placement and stimulation designs

CHALLENGE

Optimize production performance in the B chalk and C chalks of the Niobrara.

SOLUTION

Acquire log data along a section of the lateral, engineer a completion using the Completion Advisor module within the Mangrove* engineered stimulation design in the Petrel platform and evaluate results using Flow Scanner* horizontal and deviated well production logging system production logs. Build a layer-centric 3D geomodel using eXpandBG* near-wellbore to reservoir scale modeling software to further understand the production results and tailor stimulation designs.

RESULTS

Achieved higher perforation efficiency and greater overall production from the engineered stages compared to those completed geometrically. Increased average production by 200–300% per stage.

Identify areas to perforate

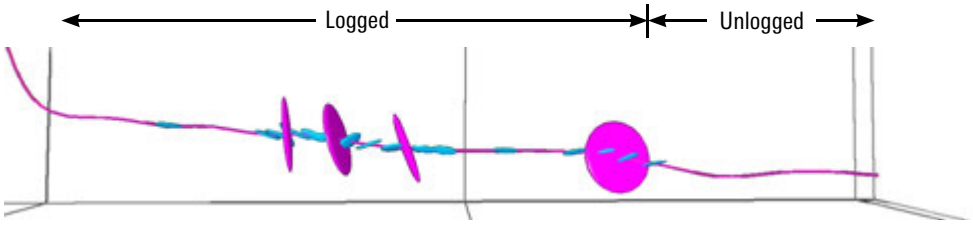
Geometrically designed completion strategies are implemented under the assumption that there are no variations in stimulation parameters along the length of the lateral. The result is often characterized by low perforation efficiency and marginally acceptable well economics. In an effort to improve production, an operator looked to an engineered solution which accounts for variability along the lateral, improving completion quality by minimizing stress contrast within each stage, while also targeting the highest reservoir quality.

Create a geomodel to improve well placement

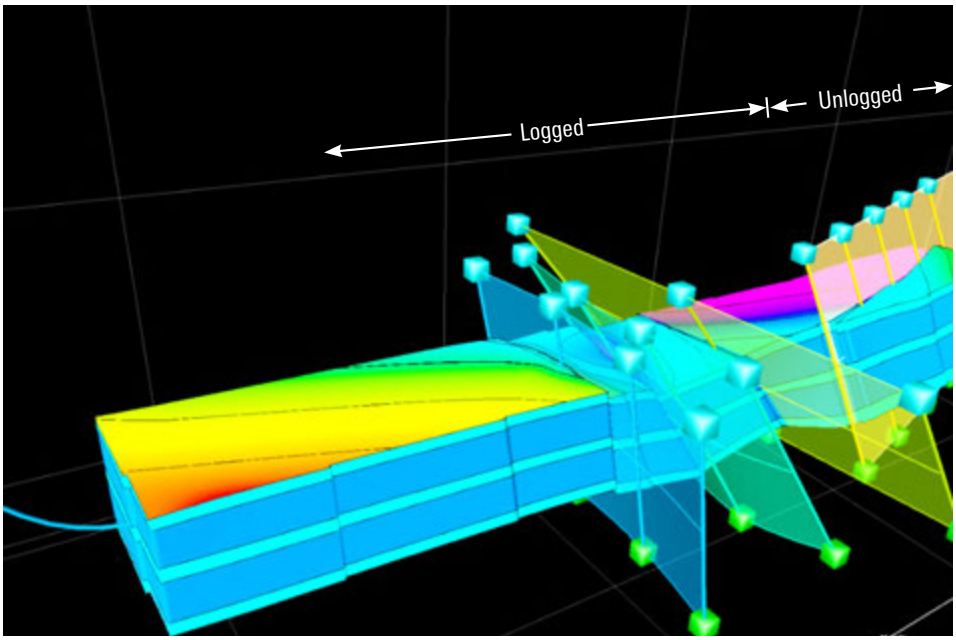
Schlumberger used the Completion Advisor module to create an engineered completion design to optimize staging and perforation cluster placement. Once the design was implemented, the Flow Scanner logging system was used to evaluate the results. Based on these measurements, an eXpandBG software geomodel was used to assess well and stage placement within a stratigraphic and structural framework, as well as to further understand production results. When stages were observed to be completely out of zone, this information was archived for use in future stimulation designs.

Stimulation results

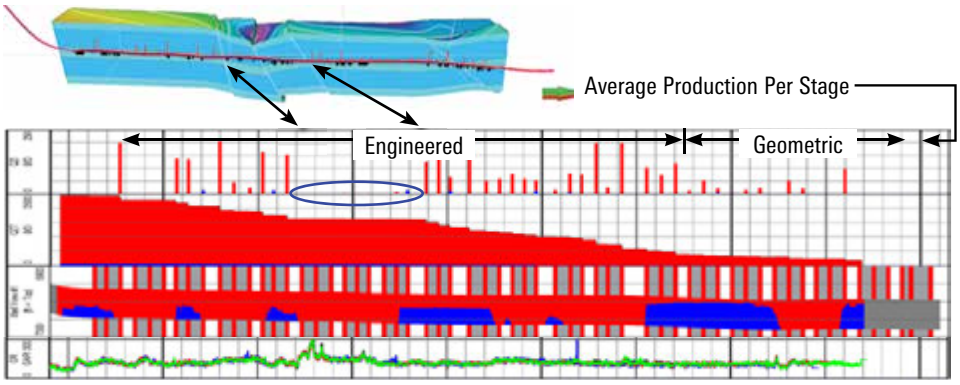
The engineered completion resulted in a 65% reduction in stress contrast across perforation clusters and a 200–300% increase in average production per stage. After completion, a geomodel was constructed to understand why a number of stages still did not exhibit production. The geomodel demonstrated the well was not placed as expected using total gamma rays during the drilling process. Fault blocks were identified, and it was observed that the nonproductive stages were situated within the graben, well above the intended zone. By correlating the eXpandBG software model and the production results, the operator was able to reassess well placement practices and evaluate strategies for effectively stimulating all stages, as well as utilize the model as a predictive tool in tailoring future stimulation designs.



Well profile: Structural dip (cyan) and faults (magenta) are obtained from borehole image data. The toe of the well was not logged and in turn was geometrically staged.



eXpandBG software was utilized to evaluate well and stage placement within a 3D stratigraphic and structural framework. This model enabled better understanding of production results to inform the customer's future well placement practices. Future well designs can avoid potential well or stage placement issues using the knowledge gained from this model.



Flow Scanner logging system production logs were acquired along the length of the lateral. Engineered stages proved a 200–300% increase in average production per stage. The geomodel demonstrated the nonproductive stages were out of zone within a graben. Note the gamma ray does not readily identify variability along the lateral.

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