

Case Study

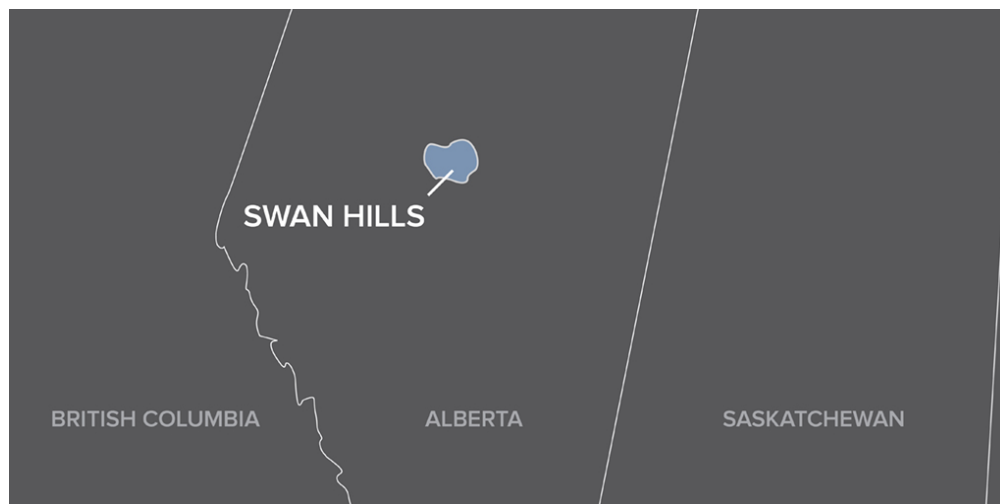
RapidMATRIX system increases production in carbonate oil reservoirs

CANADA, SWAN HILLS
RAPIDMATRIX LIMITED ENTRY SYSTEM

Background

Located approximately 200 km northwest of Edmonton, the Swan Hills area is Canada's largest conventional carbonate oil reservoir. After its discovery in the 1950s, the play was developed using vertical drilling methods targeting the Swan Hills formation reef complex, which is supported by an extended platform. Together, they form part of the middle to late Devonian Beaverhill Lake group.

The Swan Hills reefs are well known for their thick stack, and excellent porosity and permeability measurements. Reaching a thickness of 60 m, the reefs have an average porosity of 7.8% and average permeability of 20 mD. However, due to the lower porosity and permeability (4.8% and 2 mD, respectively) and heterogeneous nature of the extended platform, an advanced completions technology was needed in order to capture the remaining pay in the depleted reefs and exploit the reserves in the tighter platform.



Challenge

An operator working in the Swan Hills area was seeking an effective method to stimulate both the reef and platform sections of the reservoir and increase production. Stimulation methods using acid effectively dissolve carbonate minerals increasing access to reserves and improving production. However, because the acid naturally flows to the highest

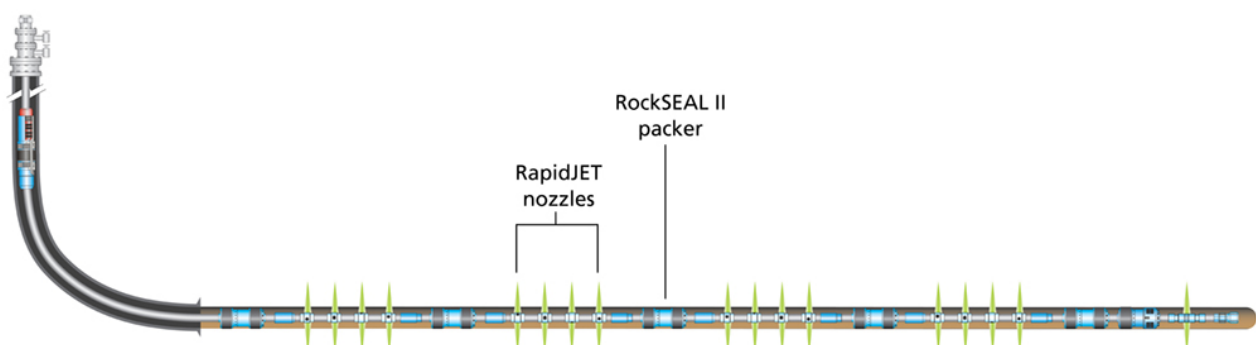
permeability areas, it can leave lower permeability rock untreated and result in water production due to overstimulation of higher permeability zones. Therefore, in heterogeneous carbonate formations like the Swan Hills, it is imperative that the acid stimulation be evenly distributed across the horizontal wellbore.

Acid stimulation can be performed at low or high pressure depending on the desired outcome. Matrix acidization stimulates at low pressures to place acid around the wellbore without fracturing the formation. It is commonly used in reservoirs with high permeability, such as in the Swan Hills reef complex, in order to remove formation damage and avoid water-bearing intervals. Conversely, acid fracturing uses higher pressures to fracture the rock and create highly conductive flow paths. This completion method is used in formations where the permeability is very low, as in the Swan Hills platform.

Solution

Since the operator had extensive experience in horizontal drilling and multi-stage fracturing methods, they decided to meet this challenge with the Packers Plus RapidMATRIX® and StackFRAC® systems. Both are open hole, multi-stage systems that allow for customized stimulation of the entire length of the wellbore in one continuous pumping operation. Mechanical isolation is achieved with RockSEAL® II packers, allowing for exact placement of stimulation fluid and enabling the option to avoid undesirable sections of the wellbore. The StackFRAC system uses FracPORT™ sleeves between the packers; whereas the RapidMATRIX system uses a limited entry design with a series of RapidJET™ nozzles.

For the higher permeability reef complex, the RapidMATRIX system (Figure 1) was used to stimulate wells with matrix acidization. Using a jetting action, the RapidJET nozzles evenly distribute the acid across the stimulation interval. For the lower permeability platform, a combination StackFRAC–RapidMATRIX system (Figure 2) was used. This modular system allows for a higher pressure rating to effectively acid fracture the rock.



Results

The wells that used the StackFRAC–RapidMATRIX combination system had an average lateral length of 1,200 m with up to 14 stages and average 3-month initial production rates were 32 m³ per day (200 bbl/d). The RapidMATRIX system completed wells had an average lateral of 900 m with up to 9 stages and resulted in average 3-month initial production rates of 37 m³ per day (235 bbl/d).

Operators seeking to increase efficiencies in unconventional oilfields rely on new and innovative technologies. Advancements in the design of Packers Plus systems provide operators with efficient and cost-effective systems to complete their open hole, multi-stage horizontal wells. RapidMATRIX and combination StackFRAC– RapidMATRIX systems have been run worldwide allowing operators to successfully exploit a variety of tight carbonate reservoirs.

