

xWATER Service Eliminates Disposal of 7.4 Million Gallons by Using 100% Produced Water

Customer repurposes Bakken produced water for a crosslinked fracturing fluid to stimulate reservoir production

CHALLENGE

Reuse produced waters with high hardness in the Bakken without expensive treatment or costly fracturing fluid upgrades.

SOLUTION

Provide advanced, low-cost xWATER* integrated water-flexible fracturing fluid delivery service to accommodate the high hardness and salinity without costly treatment.

RESULTS

Successfully placed 65 stages with no screenouts using 7.4 million gallons of Bakken produced water; added zero freshwater; achieved production comparable to or higher than similar wells using traditional freshwater solutions.



The customer was able to save an average of 650 tanker trucks of water per well using repurposed Bakken produced water.

Minimize freshwater use and stimulation costs

Over the past several years, the Williston basin has experienced a quick and dramatic increase in activity that has resulted in some of the highest stimulation costs in the country, leading to increased interest in the use of produced and flowback water in fracturing operations. Beginning in 2012, a customer engaged Schlumberger to develop a superior technical solution that used 100% produced water, as opposed to the 50% produced water, 50% freshwater fluids they were piloting at the time.

The major challenges to using Williston produced water as a base fluid included dealing with the high concentrations of total dissolved solids (TDS), hardness ions (e.g., calcium, magnesium), and boron, as well as accommodating for the low pH and variability in water quality. The high concentrations of hardness cause traditional fracturing fluid systems to prematurely break down, but removing the hardness in the Bakken water would be cost-prohibitive (>USD 5/bbl by conservative estimates). Furthermore, boron was present in five times the concentration typically used to activate crosslinked fluid systems. In traditional fluids, this would unevenly crosslink the gel and hinder its ability to reliably carry proppant downhole. Given that the Bakken produced water would require such rigorous and expensive treatment or such a high dilution with freshwater to be stable, a different approach was needed.

“Production is as expected. We look forward to continuing to develop our capabilities to use produced water to stimulate our wells, and also look forward to working with Schlumberger in doing so.”

Operator, Williston Basin



xWATER service includes a tailored fracturing fluid specifically designed for the produced water that is being repurposed.

Design a fracturing fluid for the well's water

Rather than treating the water for the fluid requirements, Schlumberger engineered a fluid for the water conditions. Using xWATER service, the team developed a high-TDS friction reducer that was a one-to-one replacement for the friction reducer already being used in the Williston basin. Compatibility and friction loop testing proved it effective for handling the ultra-high TDS of Bakken produced water. The team then constructed a crosslinked system that would perform in 100% produced water without the significant cost increase or operational efficiency penalties of treatment or dilution. The effects of mineral scale were modeled and managed for switching to a 100% produced water fracturing fluid to minimize the formation of solids downhole and maximize permeability.

After innovative design and lab testing, a suitable xWATER service was developed for field testing.

Maximize production with 100% produced water

Schlumberger successfully pumped six hybrid fracturing stages with more than 500,000 gallons of 100% produced water for the customer on a Bakken well in McKenzie County, North Dakota. A subsequent full-scale implementation on a 59-stage, 2-well pad in Williams County, North Dakota, placed over 6.1 million pounds of proppant with 6.9 million gallons of 100% produced water with zero screenouts. Together, the systems used 7.4 million gallons of Bakken produced water in 65 stages, all with no freshwater use and no disposal. The wells using xWATER service yielded production equal to or better than offset wells using traditional freshwater systems.

The water supplied by the customer had not been diluted with fresh water and required no additional treatment to be compatible with xWATER service. This also eliminated secondary waste streams that are generated in treatment regimes. The customer saved an average of 650 truck trips per well. xWATER service offered a functional, robust fluid that performed as well as or better than traditional fluids with no operational issues, no negative effects on operational efficiency, and showed their potential for reducing surface treating pressure when compared to traditional freshwater systems—all with zero fluid-related downtime.

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