[EA]An Art of Bringing Water from Menggala into Bekasap Formation: Managing Bypassed Hydrocarbon through Natural Dump-Flood in Brown Field Area*

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Abstract

The Bohemian-14 well was drilled 37 years ago, in November 1981, as an oil producer and successfully placed on production in June 1982 with initial production of 12% water-cut. Through its lifetime, the well only contributed 3% to the total field cumulative production and reached its limit by the end of 2016 with 99% water-cut; the well was then shut-in due to being uneconomic. During its lifetime of production, some flow units have suffered almost 20% depletion from their original pressure.

Geology

As a part of the Central Sumatra Basin active production Field, Bohemian has quite thick sediments beneath. The Menggala Sand is characterized by blocky vertical amalgamated sand deposited as early post-rift sedimentation during the higher energy of fluvio-environment, resulting in decent quality rock with permeability ranging from 200-600 mD. With the current conditions of strong pressure support of 1,300 psi, the Menggala Sand has ideal potential as an aquifer for natural injection into the shallower Bekasap reservoir. In contrast, the Bekasap was the product of a transitional estuarine system which resulted in relatively shaly, fining-upward sand with variable lateral distribution of bar and sheet sands, and is currently an oil bearing target in this Field (Figure 1, Figure 2, Figure 3).

After months of study, the project team was able to convert the Bohemian-14 as a dedicated dump-flood well. Using the pressure contrast between the deeper prolific Menggala aquifer and shallower Bekasap reservoir, the team was able to trigger natural cross-flow to allow the water to be ‘naturally’ injected into the oil reservoir. After only three months of natural injection, the FAP (Fluid Above Pump) trend of the targeted producer well increased by more than 400 feet, indicating the additional fluid intake triggered by the dump-flood initiation of Bohemian-14. As the Lower Sihapas Group was utilized as natural injection to boost the oil performance of adjacent wells, another treasure

was found in the Upper Petani Gas which opened up a second chance for this well to have its economic life extended. Being an inactive and uneconomic oil producer, the project team was able to delay this well being abandoned by conducting a relatively low-cost well conversion with two current major roles: Upper Petani Gas Producer with more than 200 BOE/D initial gas production and Lower Sihapas *insitu* water injector, a successful pilot project of natural dump-flood resulting in outstanding production improvement of the targeted well with up to 150 BO/D (Figure 4).

Conclusions

This multi-purpose initiative is known to be the first ever applied to a small field area in Central Sumatra Basin. It is opening broad opportunities for inactive wells to be productive again, and even act as a supporting role for adjacent wells to expand the field producing lifetime.

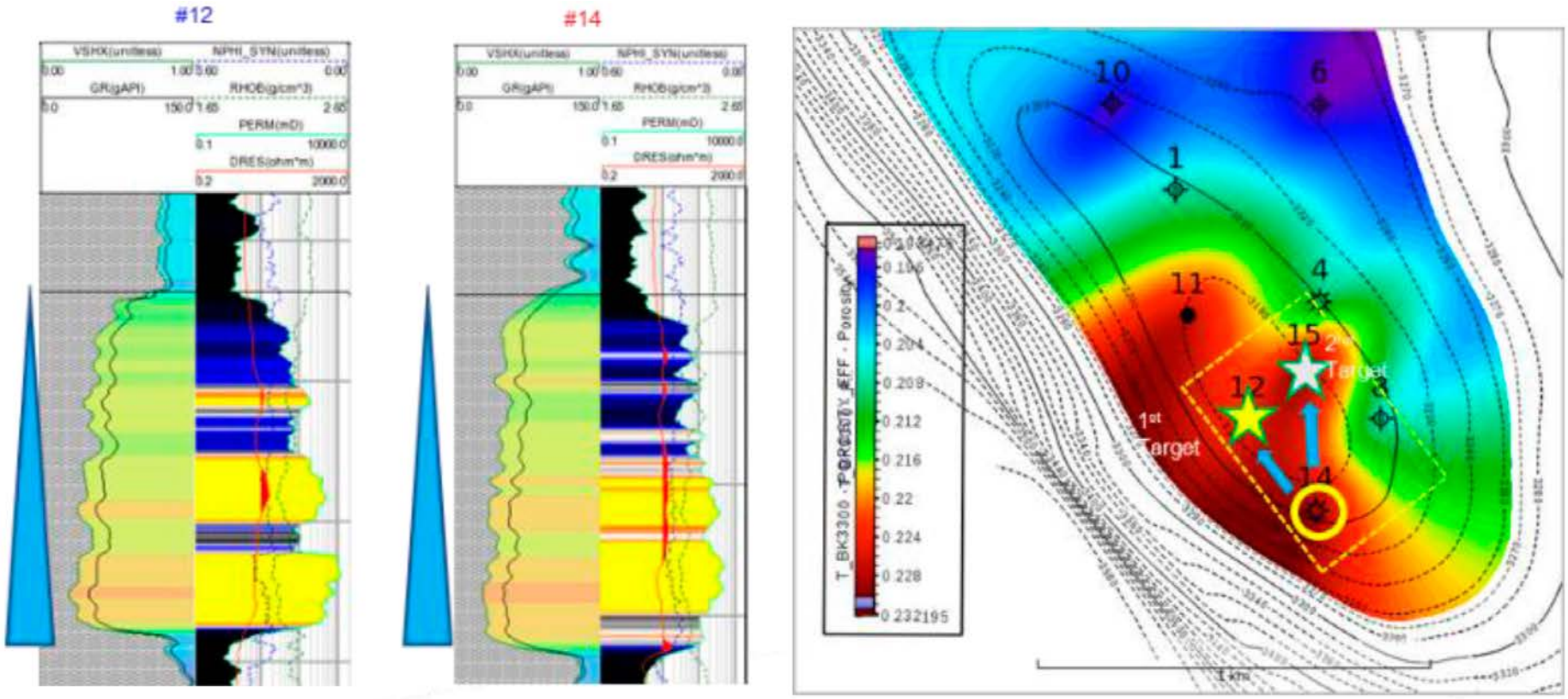

Figure 1. Permeability distribution of BK-M sand (histogram on the left); notice the population trend of LQ is more spread in contrary of med-high quality frequencies. The lateral heterogeneity is shown in the colored map. The fining-upward sand (log curves) shows the vertical mixed energy environment as an indication of lateral variation, impacting the limited well selection for the dump-flood project.

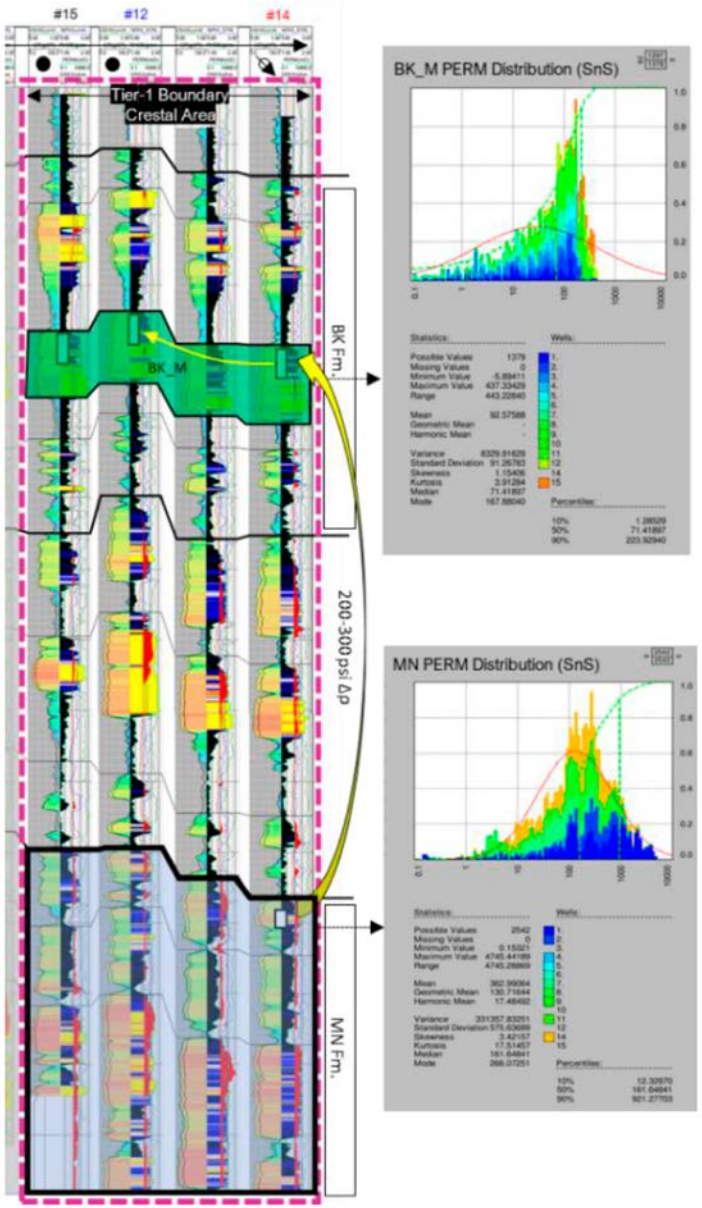

Figure 2. Structural datum correlation showing the Bohemian-14 well, which was designed as the Natural Well Injector to support Bekasap performance at Bohemian-12 (most crestal well). Water being naturally cross-flowed from MN into BK_M lobe with Δρ ranged from 200-300 psi.

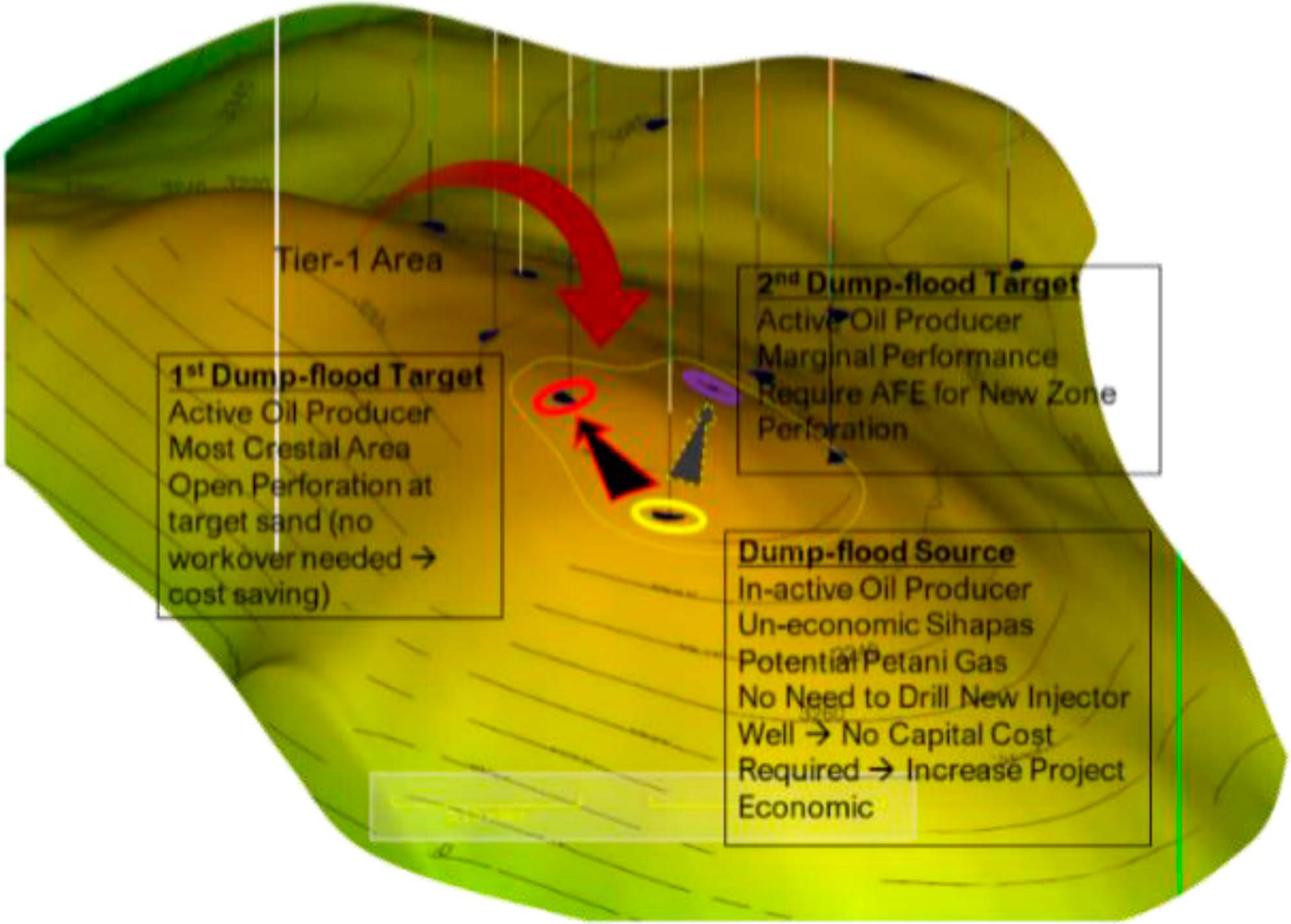

Figure 3. 3D top structure configuration of Bekasap target sand showing relatively less complex structural features, but limited penetrated wells, creates a challenge to imitate the water-flood system.

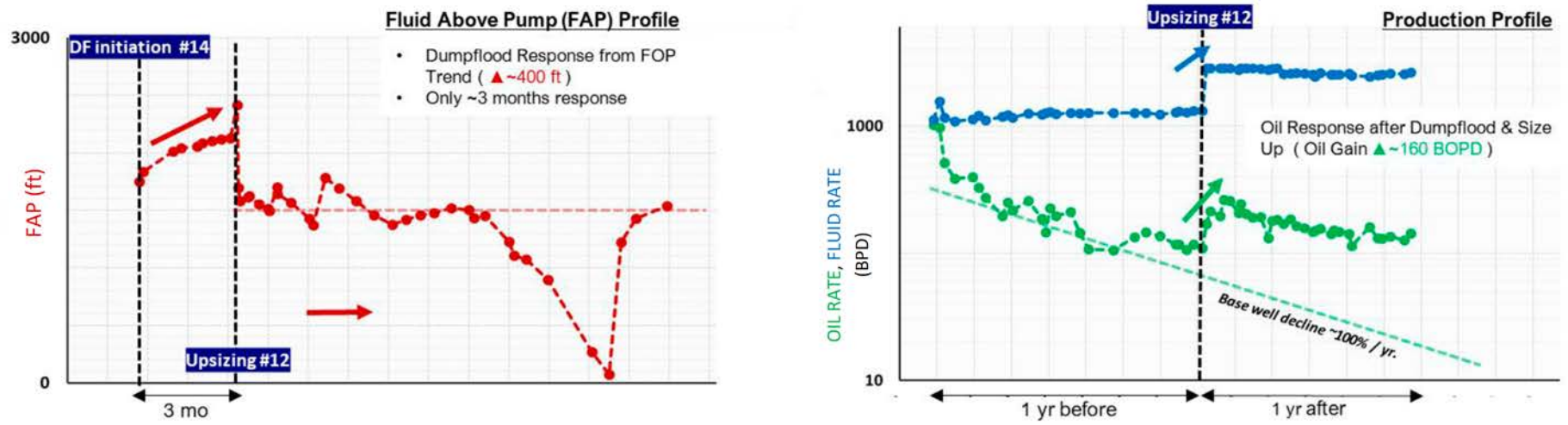

Figure 4. FAP (Fluid Above Pump) chart showing target well after dump-flood (left), and production response chart (right)