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A PURSUIT OF BY-PASSED OIL: REDEVELOPMENT OF UPPER MIOCENE STEVENS “MAIN BODY B” RESERVOIRS AT ELK HILLS; OCCIDENTAL OF ELK HILLS, INC

When Elk Hills was acquired in 1998, existing data indicated large areas of Main Body B had been effectively swept by 20 years of peripheral waterflooding. Innovative reservoir characterization and surveillance techniques were integrated to reveal unswept layers that are now being redeveloped.

Stevens sand reservoirs are highly-stratified stacked turbidites deposited on the 31S anticline. Production histories are complex, with wells producing from multiple commingled zones and reservoirs. Upon acquisition, Oxy undertook a reservoir characterization effort focused on comprehensive correlation and mapping combined with new petrophysical modeling. Concurrently, several “surveillance” wells were drilled in swept areas to evaluate remaining potential. This effort, combined with 3D modeling and reservoir simulation, provided an improved understanding of sand distribution, reservoir quality, waterflood behavior, and remaining targets. On this foundation, Oxy implemented a “by-layer” waterflood management, in contrast to the previous operator’s strategy of balancing voidage within geographic areas.

Characterization and mapping of 28 distinct flow-unit layers revealed sand distribution patterns result from interplay of syndepositional structural growth and offset stacking. Although all reservoir quality sands are open in injectors, detailed surveillance revealed that individual layers responded to peripheral waterflooding differently. Pressure conditions and flood-fronts varied significantly by layer and significant sweep inefficiencies were recognized.

Recent infill wells targeted by-passed oil in unswept layers. Zone-specific fracture stimulations and commingled completions of flow-units above and below flood-swept sands resulted in rates >500 BOPD where existing offsets produced <100 BOPD at 90% water-cut. Realigned peripheral injection combined with layer-specific pattern flooding should optimize oil recovery.