

PRIMARY PERFORMANCE AND RESERVES

The current state of primary depletion is approximately 91 percent in this field and the average well produces a little less than 2 BOPD. The remaining primary reserves of approximately 79 MBO will predominantly come from three wells, the Quail State 2, State BG 2 and 3. The remaining nine active producers are at or near their ultimate primary performance capacity. Unless it is determined to waterflood this field soon, then the economic viability of this field will end. Attachment No. 3 is a structure map with the ultimate oil and gas recoveries along with the cumulative water production posted for each well. Ultimate recoveries were determined by decline curve analysis on each producing well. Production is more controlled by stratigraphy than structure as illustrated by the structure map. The structure dips from north to south at a rate of approximately 100 feet per mile. The best ultimate well in the field, the Atlantic Richfield No. 1 is one of the lowest structurally but is near the thickest part of the Queen sand. The average ultimate oil produced per well is approximately 44 MBO.

As mentioned earlier, the Queen sand has been subdivided into the Queen B and Queen C sands which are consistently present throughout the proposed unit area. Attachment 4 is a cross section with every well log in the field showing the Queen B & C which is the targeted common source of supply. This cross section also contains the perforated intervals for each well. Net isopach maps with over 14 percent density porosity over the Queen B and Queen C are included as Attachments 5 and 6. These maps were used to calculate the reservoir pore volume. Also shown is the proposed waterflood unit boundary. Average porosity and water saturations for the Queen B and Queen C were determined based on the Nu-Tech log analysis. Cross plots of porosity versus water saturation are included as Attachment Nos. 7 and 8. Volumetric original oil in place (OOIP) for the Queen B and Queen C sands has been calculated and is included in Appendix B. The OOIP for the Queen B is 988,800 STB and for the Queen C is 3,478,673 STB. The combined OOIP is 4,467,473 STB. Seventy-eight percent of the OOIP is in the Queen C sand.

Based on an investigation of all the pertinent data including well files, well logs and well histories, all of the current wells in the field have been perforated and adequately stimulated in the Queen B and Queen C sand intervals. Hence there are no remaining behind pipe or non-producing reserves in this field in the targeted waterflood sand intervals. The remaining secondary reserve potential and how best to recover it will be the focus as the study continues.

SECONDARY RESERVE ANALYSIS

Based on the historical performance, the Quail Queen Field is a solution gas drive reservoir. Primary recovery will be approximately 19 percent of the OOIP leaving 81 percent of the OOIP in play. The approach to water flood recovery potential in the Quail Queen Field includes the analysis of an actual case example, within the field, of sustained low volume disposal of produced water into the producing Queen zones of interest in the Quail State SWD #1. Also a nearby Queen waterflood analogy, the West Pearl Queen Unit, that was unitized and flooded beginning in 1964 will be evaluated. And lastly, a calculation of secondary performance utilizing generic relative permeability data, since this type core data is not available from any of the field wells, will be examined.

The Queen has been successfully flooded for years in the Permian Basin and, as mentioned, there is

<i>Pintail</i>	
Oil Conservation Commission	
Case No. _____	
Exhibit No. <u>4</u>	
CASE NO. _____	<u>14001</u>

Well	Primary to 7/1/2007		Secondary to 7/1/2007		Total Pattern Oil,BBLS
	Oil,BBLS	Pattern Fraction	Oil,BBLS	Pattern Fraction	
Quail State 2	105,378	0.25	26,345	1.00	28,109
Quail State 4	37,307	0.25	9,327	1.00	11,388
State BG 3	40,894	0.25	10,224	1.00	13,451
Quail State 6	23,878	0.25	5,970	1.00	8,200
Quail State 1	23,961	1.00	23,961	1.00	23,961
	231,418		75,825		85,107

OOIP reservoir parameters for the 80 acre pattern:

Acres = 80
Avg height = 12.5 feet

Average porosity = 12%
Average water sat'n = 45%

$$\begin{aligned} \text{Pore Volume (PV)} &= 7758 * A * h * \Phi \\ &= 7758 * 80 * 12.5 * 0.12 \\ &= 930,960 \text{ BBLS} \end{aligned}$$

$$\begin{aligned} \text{OOIP} &= (\text{PV} * (1 - S_w)) / \beta_{oi} \\ &= (930,960 * (1 - 0.45)) / 1.15 \\ &= 445,242 \text{ STB} \end{aligned}$$

SWD/Injection to Date:

206,908 BBLS water injected over seven years
0.22 pore volumes injected

As of 7/1/2007:

Primary Recovery Efficiency	17.03%	with 22% of PV injected
Secondary Recovery Efficiency	2.08%	
Total	19.11%	

4 WELL MONTAGE CENTERED AROUND QUAIL STATE SWD #1

