CHAPTER V

RESULTS AND DISCUSSION

5.1 Base Case Results

The base case scenario is that the well is made to flow naturally until it is loaded up or produces less than 10 stb/d of abandonment oil rate whichever comes first. The oil recovery factor for the "natural flow" scenario is recorded. After that, gas lift is started with a fixed injection rate between 0.5 to 1.0 MMscfd according to current gas lift operation practice in the studied fields. However, the gas injection rate of 1.0 MMscfd which has been discussed in Section 4.3 appears to be the most suitable. Therefore, it has been selected for the base case simulation. Then, the well is kept producing until it is loaded up or reaches the abandonment oil rate of 20 stb/d whichever comes first. The total oil recovery factor for the "base case with gas lift" or "conventional gas lift" is then captured.

Figure 5.1 illustrates the production and GLR profile of the natural flow for the initial flowing period of the base case. It can be observed that the well would cease flowing when the water cut increases quickly. Even though there is an increase in GLR, it seems to be too low or unable to help lighten the hydrostatic column from increasing water production. It can be inferred that the well is probably loaded up before the oil reservoir reaches the bubble point where the formation GLR should rise dramatically. The recovery factor from the natural flow period of the base case is 32.1% which relatively high. This is probably due to the fact that there is water influx or water drive mechanism for each oil layer apart from its solution-gas drive during the model set up.

Figure 5.2 illustrate the production profile of the base case well model with gas fixed injection rate of 1.0 MMscfd to bring the well back on line. The well continues to flow until it is loaded up. It is very obvious that conventional gas lift is very effective in term of extending the life of the well and improvement of the oil recovery factor from 32.1% (natural flow) to 41.4%. Figure 5.3 shows better illustration of gas injection rate and GLR. As the production continues, GLR increases because the gas injection rate remains constant at 1.0 MMscfd while the total liquid production decreases until the well reaches the abandonment rate.

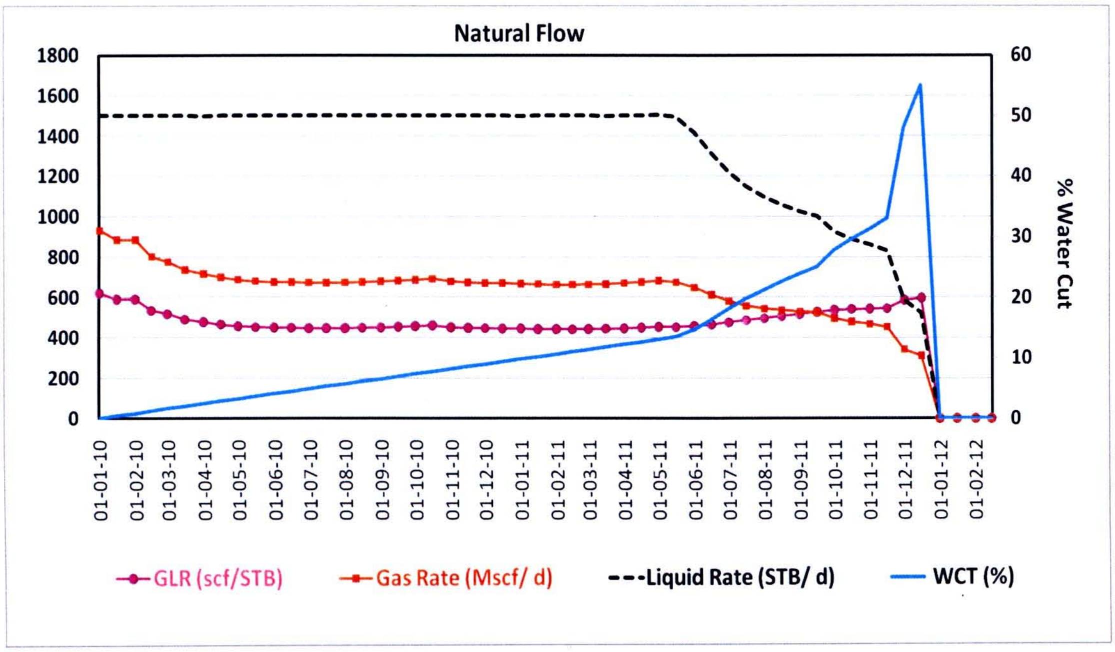

Figure 5.1 Production Profile of the Natural Flow Case

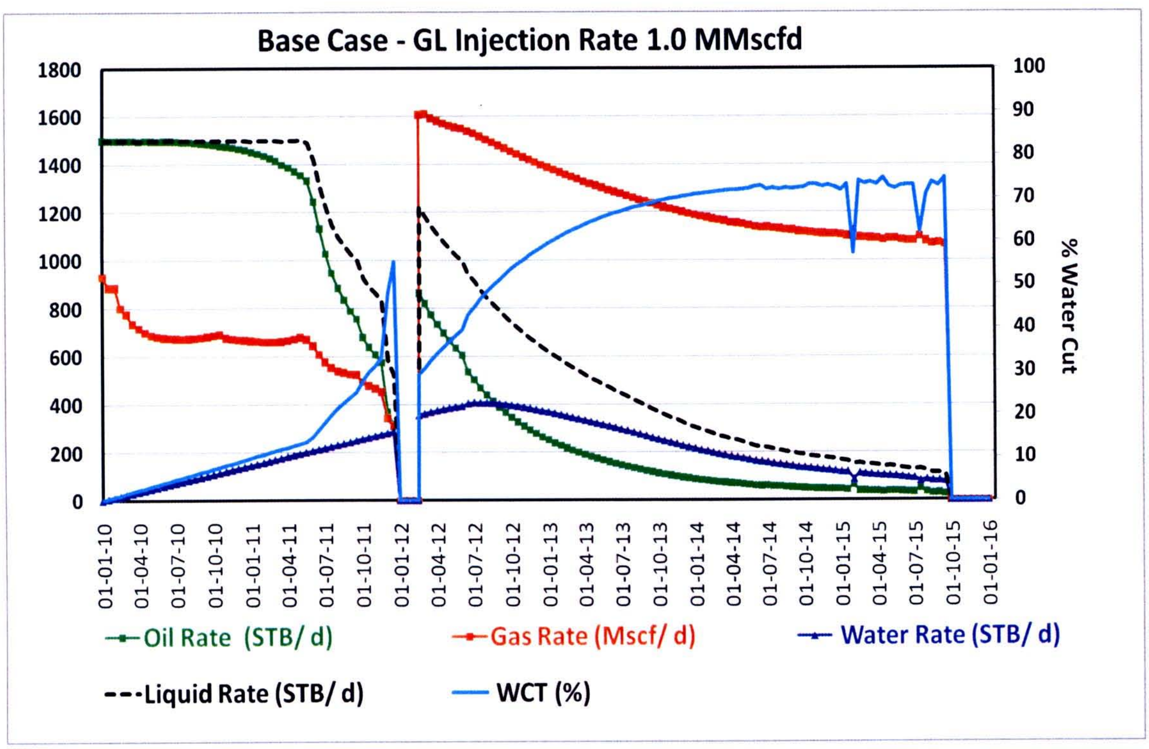

Figure 5.2 Production Profile of the Base Case

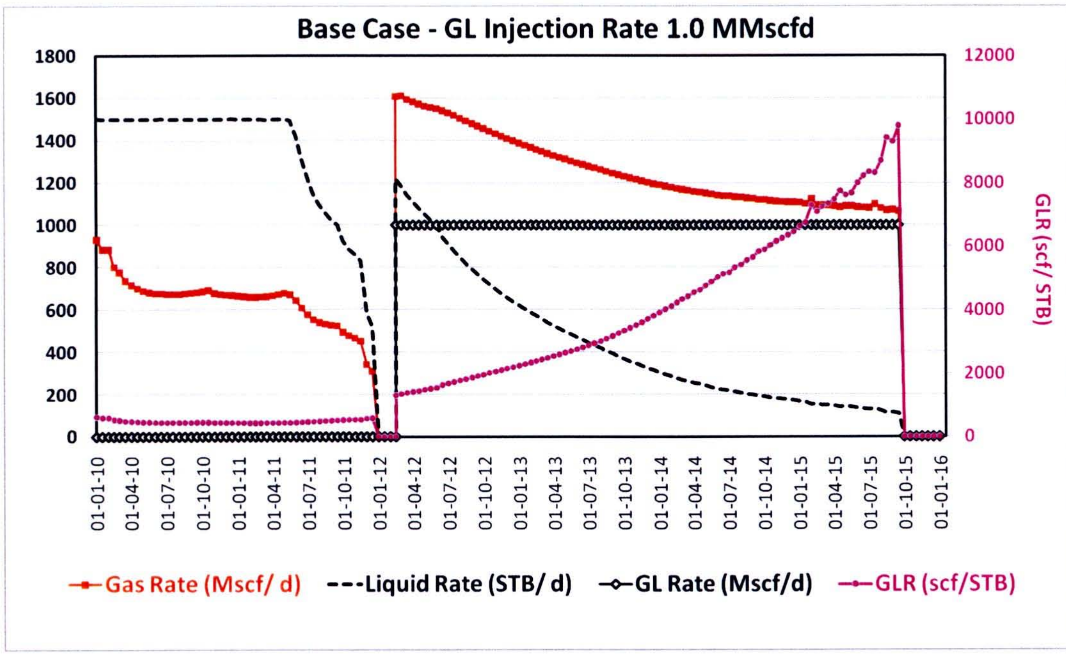

Figure 5.3 Production Profile with Gas Rate and GLR of the Base Case.

After the results for the base case were obtained, the prediction run for each in-situ gas lift scenario was conducted as per previous discussion. All the results and discussion are presented later in this chapter. The recorded results are at times subjected to the software error and hence the bigger picture is of the primary concern rather than being exact on the delivered values.

5.2 Impact of Perforation Schedule of In-situ Gas Zone on Oil Recovery Factor

5.2.1 In-situ Gas Zone @ 5500' TVD

According to Figure 5.4, with the same depth of the in-situ gas zone, it can be observed that

(a) For all scenarios at any given thickness and permeability, the time-lapsed perforation schedule of the in-situ gas zone provides better recovery factors than the concurrent perforation schedule. Referring to Figure 4.8, at the beginning of the production or at high oil rate, a need for GLR is low to avoid too much pressure drop due to friction. Therefore the time-lapsed perforation schedule should prevent too much GLR at the beginning of production. As the production declines, the need for GLR increases. As a result, when the in-situ gas zone is perforated later on or in time-lapsed perforation schedule, it should provide additional gas to increase the total GLR at the better timing even though it may not be at the favorable GLR. In this study, the time-lapsed perforation of the in-situ gas zone occurs when the water cut reaches about 50%.

(b) The scenario with 90-ft thickness and 10 mD and time-lapsed perforation schedule provides the highest recovery factors mainly due to, apart from time-lapsed perforation schedule, effects of thickness and permeability which will be discussed later in Section 5.4.1 (a) and 5.5.1 (a).

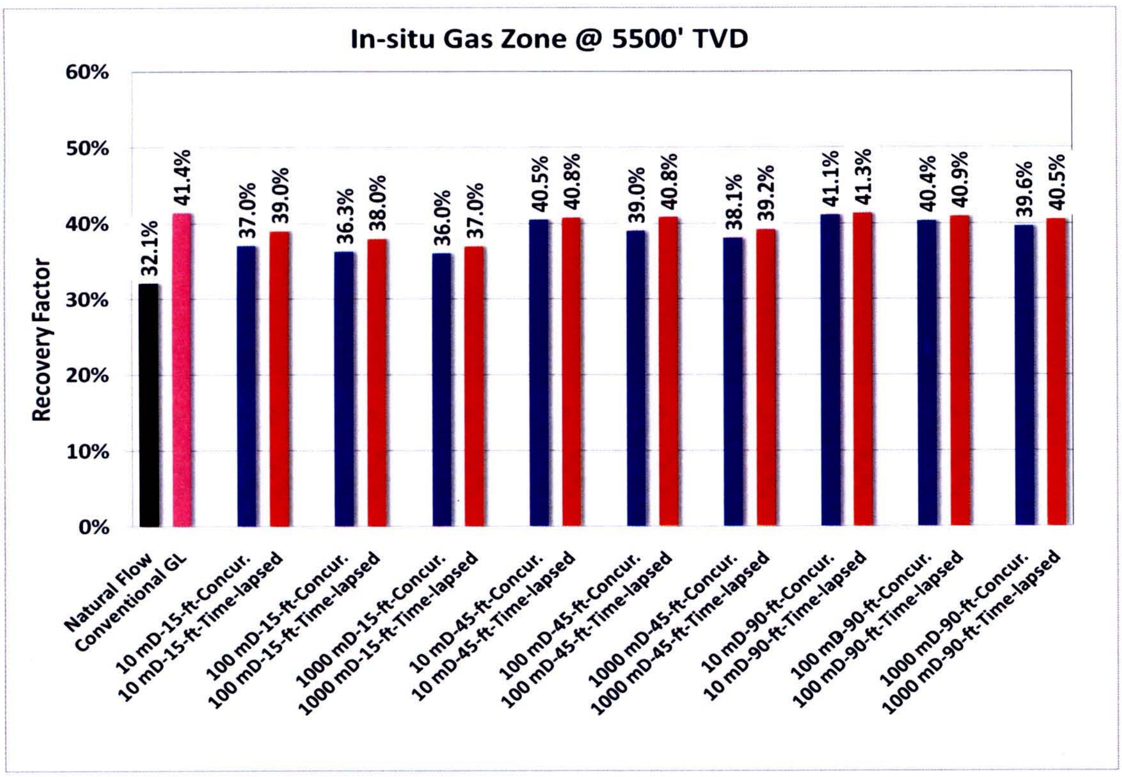

Figure 5.4 Oil Recovery Factors for Concurrent and Time-lapsed Perforation Schedules of In-situ Gas Zone @ 5500' TVD

5.2.2 In-situ Gas Zone @ 6500' TVD

According to Figure 5.5, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous case of in-situ gas zone at 5500' TVD in Section 5.2.1 (a), in all scenarios at any given thickness and permeability, the time-lapsed perforation schedule of the in-situ gas zone provides better recovery factors than the concurrent perforation schedule.

(b) The scenario with 90-ft thickness, 10 mD and time-lapsed perforation schedule provides the highest recovery factors mainly due to, apart from time-lapsed perforation schedule, effects of thickness and permeability which will be discussed later in Section 5.4.1 (a) and 5.5.1 (a).

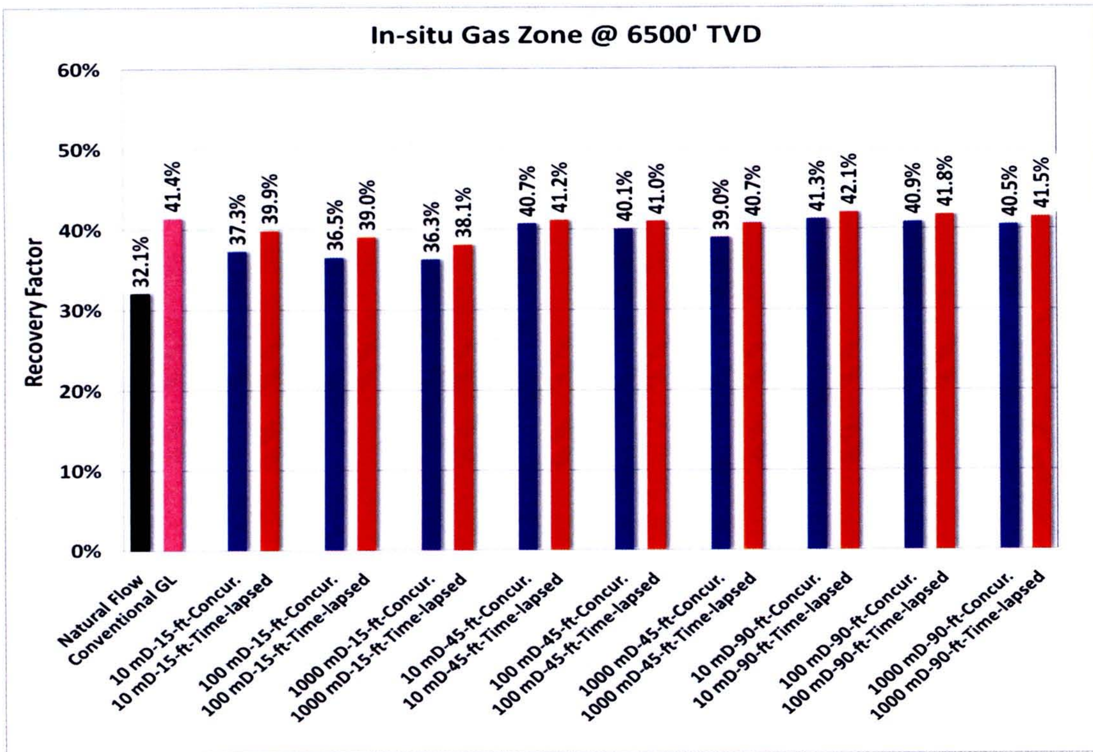

Figure 5.5 Oil Recovery Factors for Concurrent and Time-lapsed Perforation Schedules of In-situ Gas Zone @ 6500' TVD

5.2.3 In-situ Gas Zone @ 7500' TVD

According to Figure 5.6, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous cases of in-situ gas zone at 5500' TVD and 6500' TVD in Sections 5.2.1 (a) and 5.2.2 (a), respectively, in all scenarios at any given thickness and permeability, the time-lapsed perforation schedule of the in-situ gas zone provides better recovery factors than the concurrent perforation schedule.

(b) The scenario with 90-ft thickness and 10 mD and time-lapsed perforation schedule provides the highest recovery factors mainly due to effects of thickness and permeability which will be discussed later in Section 5.4.1 (a) and 5.5.1 (a).

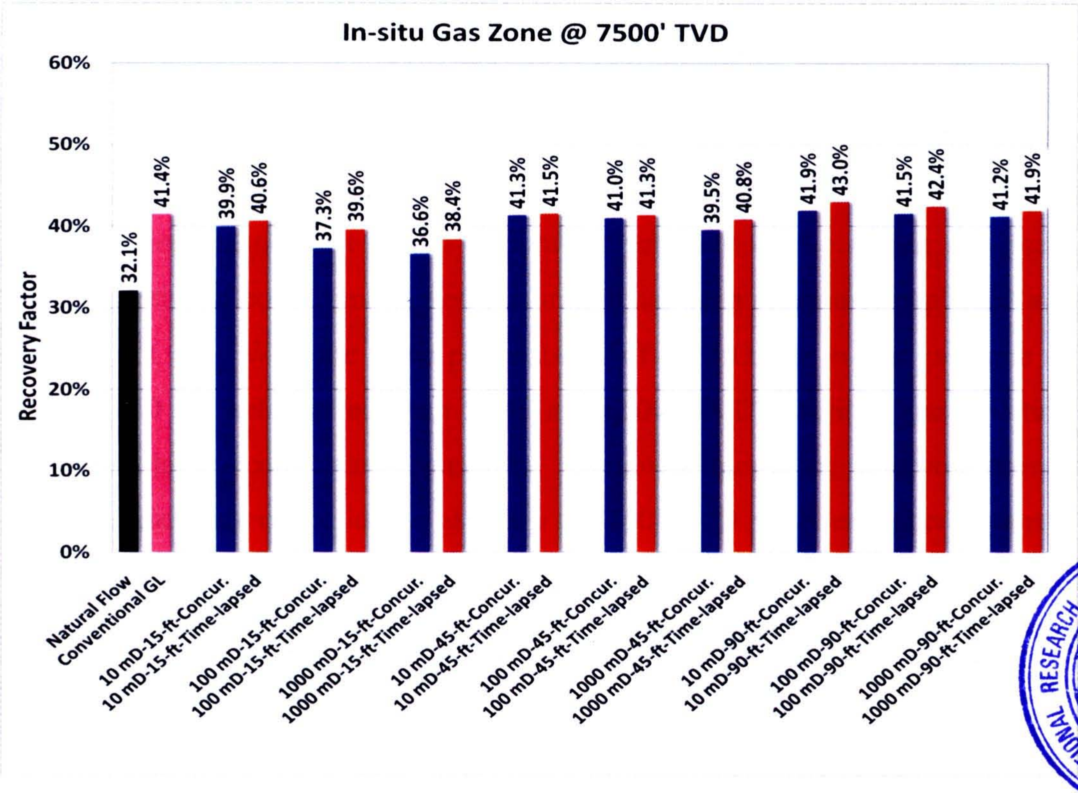

Figure 5.6 Oil Recovery Factors for Concurrent and Time-lapsed Perforation Schedules of In-situ Gas Zone @ 7500' TVD

In summary, at the same depth, *k* and thickness of an in-situ gas zone, the time-lapsed perforation schedule of the in-situ gas zone provides higher recovery factor for every scenario.

5.3 Impact of Depths of In-situ Gas Zone on Oil Recovery Factor

5.3.1 In-situ Gas Zone with 15-ft Thickness

According to Figure 5.7, with the same thickness of in-situ gas zone, it can be observed that

(a) The oil recovery factors appear to slightly increase with depth of the in-situ gas zone in either concurrent or time-lapsed perforation schedule. This effect is similar to the effect of the gas injection depth in conventional gas lift.

(b) The recovery factors for all in-situ gas lift scenarios are less than the base case (41.4%) because of the decline of in-situ gas zone compared to the constant gas injection rate for the base case. As a result, when the in-situ gas zone declines to a point where the GLR is too low to help lighten the hydrostatic column, the well will be loaded up.

(c) The scenario with the in-situ gas zone at 7500’ TVD and 10 mD provides the highest oil recovery factor in time-lapsed perforation schedule because of effects of depths and time-lapsed perforation schedule of the in-situ gas zone. The positive effect of time-lapsed perforation has been previously explained in Section 5.2.1 (a). With the same permeability of 10 mD, the in-situ gas zone at 7500’ TVD has better effect than 5500’ and 6500’ TVD in term of gas injection depth similar to conventional gas lift. Moreover, increasing reservoir pressure and temperature of the in-situ gas zone at 7500’ TVD provides higher expansion ratio of gas when gas is flowing or migrating up the well than the in-situ gas zone at 5500’ and 6500’ TVD. This helps lift the hydrostatic column better as long as it does not exceed favorable GLR.

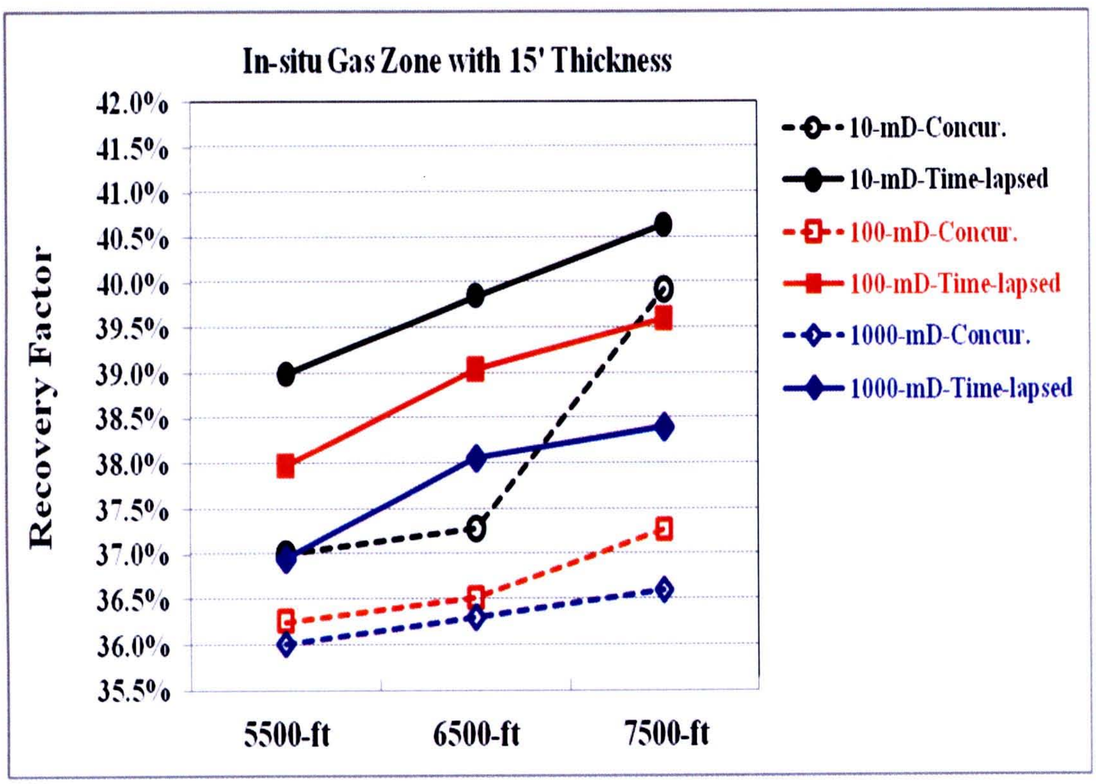

Figure 5.7 Oil Recovery Factors for In-situ Gas Zone with 15’ Thickness

5.3.2 In-situ Gas Zone with 45-ft Thickness

According to Figure 5.8, with the same thickness of in-situ gas zone, it can be observed that

(a) Similar to the previous case of in-situ gas zone with 15-ft thickness, oil recovery factors appear to slightly increase with depth of the in-situ gas zone in either concurrent or time-lapsed perforation schedule. This effect is similar to the effect of the gas injection depth in conventional gas lift.

(b) There is one scenario in which the in-situ gas zone at 7500' TVD with 10 mD is perforated in time-lapsed schedule can catch up with or exceed the oil recovery factor of the base case (41.4%). This scenario also provides highest oil recovery because of effects of time-lapsed perforation schedule and depth of the in-situ gas zone which have been already discussed in Sections 5.2.1 (a) and 5.3.1 (a), respectively.

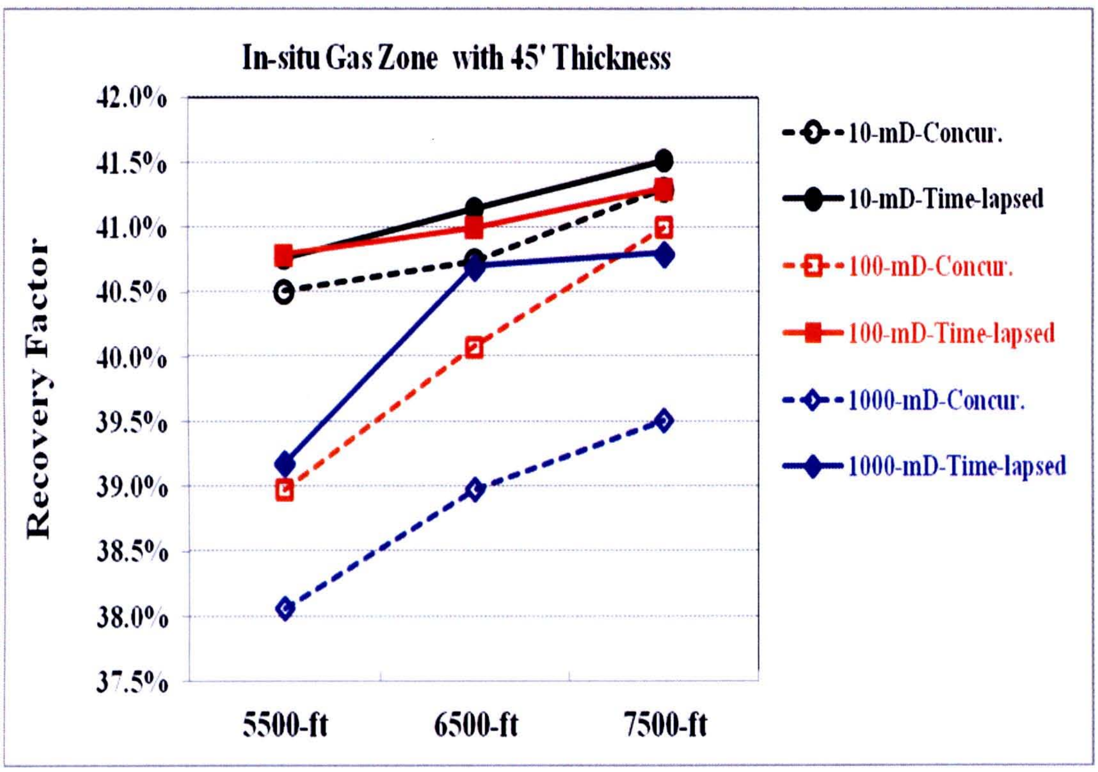

Figure 5.8 Oil Recovery Factors for In-situ Gas Zone with 45' Thickness

5.3.3 In-situ Gas Zone with 90-ft Thickness

According to Figure 5.9, with the same thickness of in-situ gas zone, it can be observed that

(a) Similar to the previous cases of in-situ gas zone with 15-ft and 45-ft thickness, oil recovery factors still appear to slightly increase with depth of the in-situ gas zone in either concurrent or time-lapsed perforation schedule. This effect is similar to the effect of the gas injection depth in conventional gas lift.

(b) The following eight scenarios can catch up with or exceed the oil recovery factor of the base case (or 41.4% in conventional gas lift):

  (i) concurrent perforation schedule:

  - in-situ gas zones at 7500' TVD with 10 mD and 100 mD

  (ii) time-lapsed perforation schedule:

  - in-situ gas zones at 6500' TVD with 10 mD, 100 mD and 1000 mD
  - in-situ gas zones at 7500' TVD with 10 mD, 100 mD and 1000 mD

(c) The scenario with the in-situ gas zone at 7500' TVD and 10 mD provides the highest oil recovery in time-lapsed perforation because of effects of time-lapsed perforation schedule and depth of the in-situ gas zone which have been already discussed in Sections 5.2.1 (a) and 5.3.1 (a), respectively. Figure 5.10 illustrates the production profile of this particular case.

Figures 5.11 and 5.12 also illustrate that the summary of oil recovery factors which appear to increase with depth of the in-situ gas zone and this holds true in either concurrent or time-lapsed perforation schedule.

In summary, given the same thickness and k of an in-situ gas zone, the oil recovery factors appear to increase with depth of the in-situ gas zone in either concurrent or time-lapsed perforation schedule. This effect is similar to the effect of the gas injection depth in conventional gas lift.

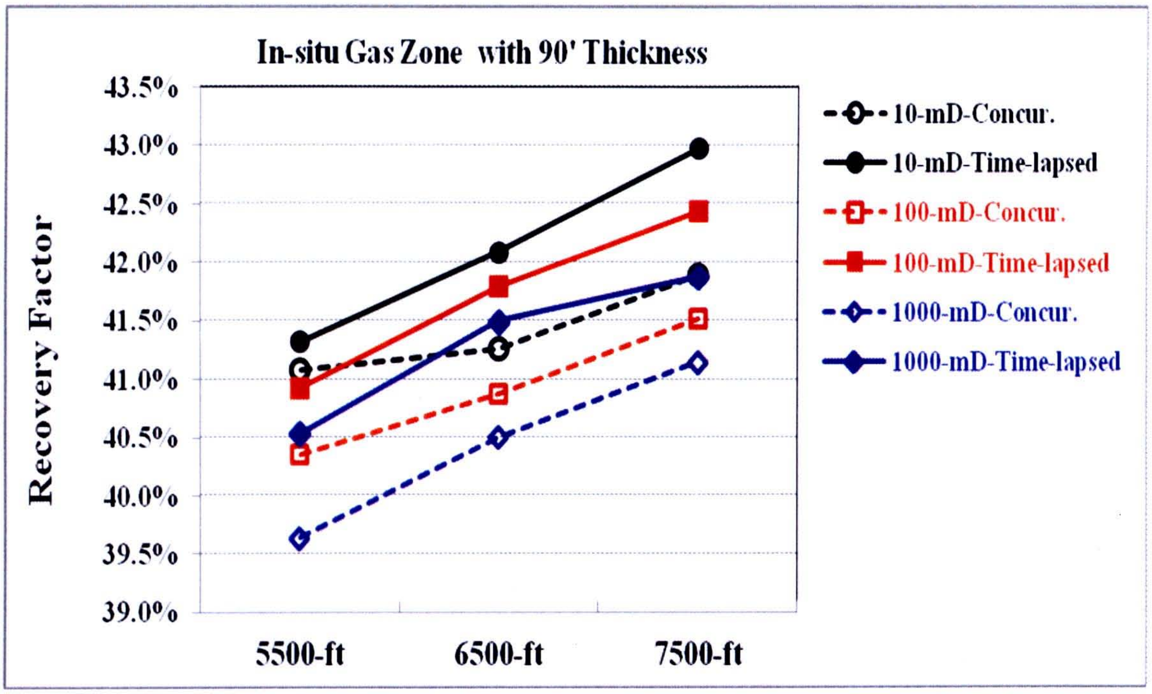

Figure 5.9 Oil Recovery Factors for In-situ Gas Zone with 90' Thickness

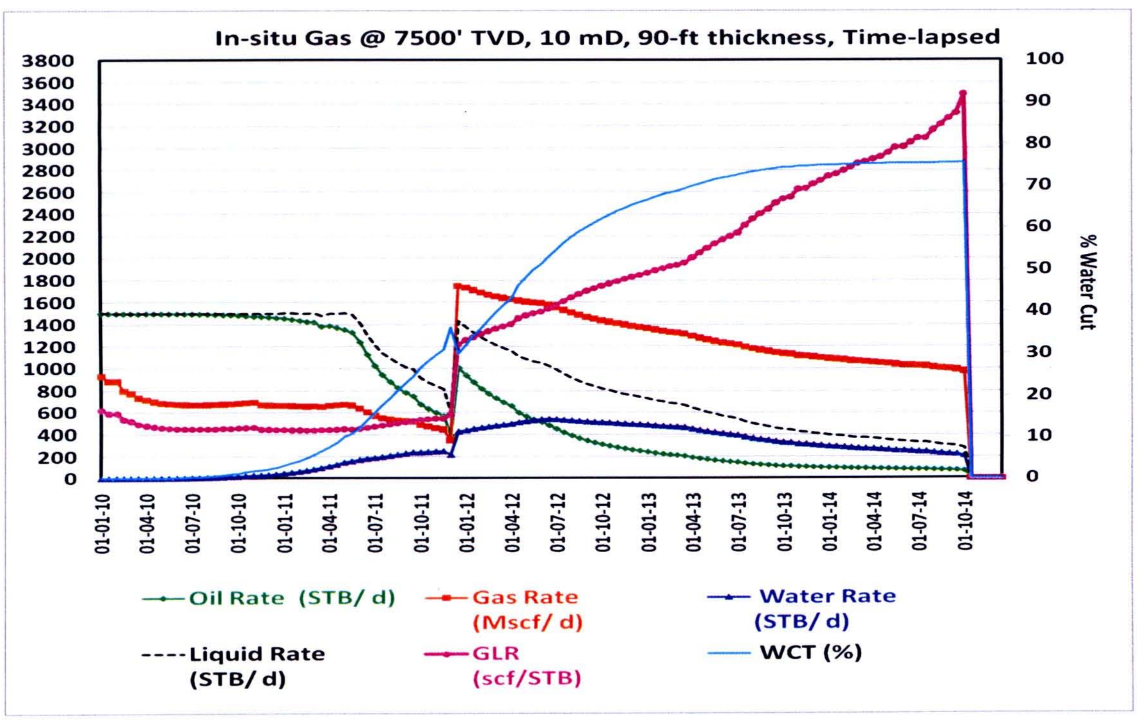

Figure 5.10 Production Profile for Well with In-situ Gas Zone at 7500' TVD with 10 mD, 90' Thickness and Time-lapsed Perforation Schedule

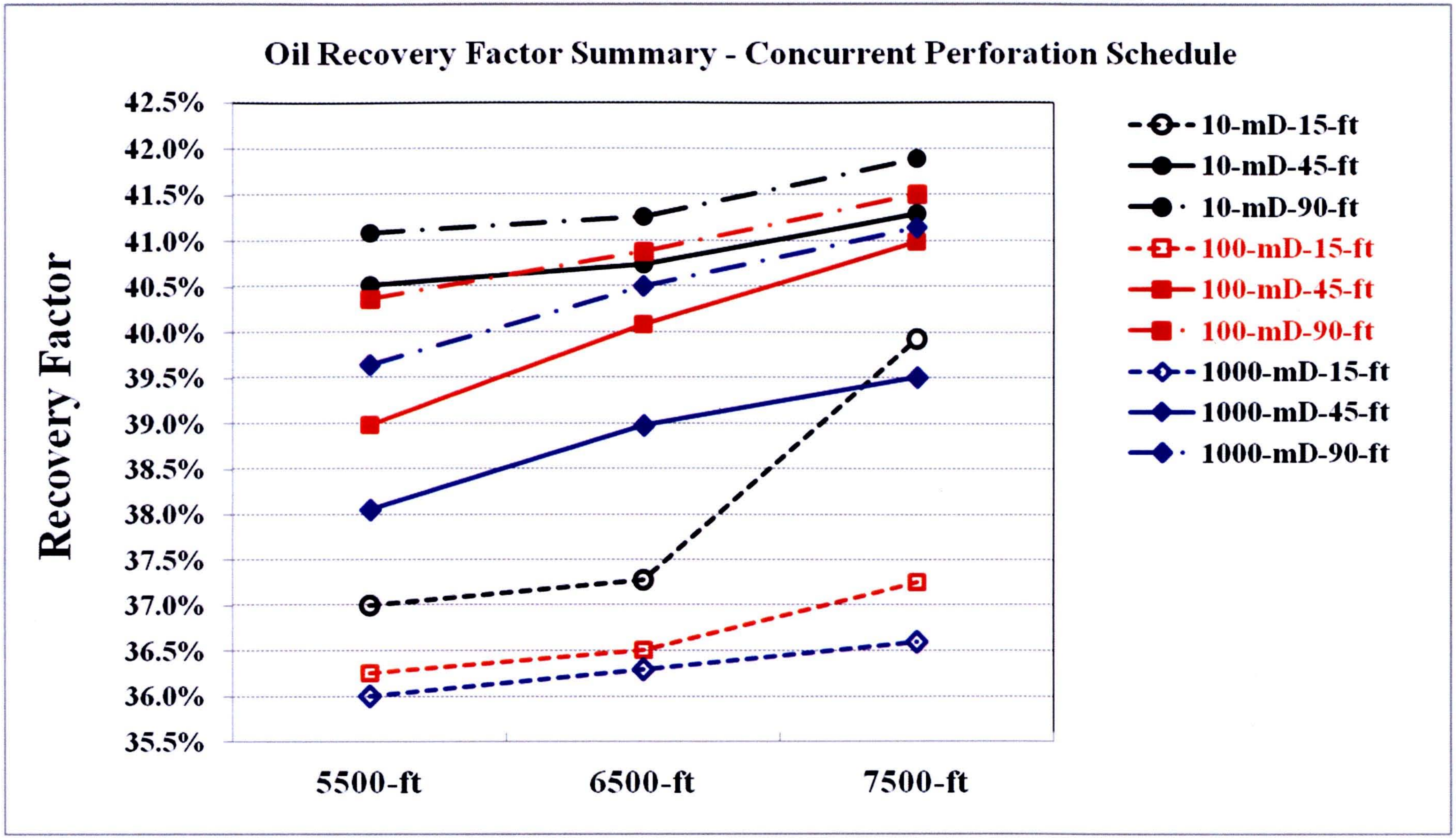

Figure 5.11 Oil Recovery Factor Summary for Concurrent Perforation Schedule of In-situ Gas Zone

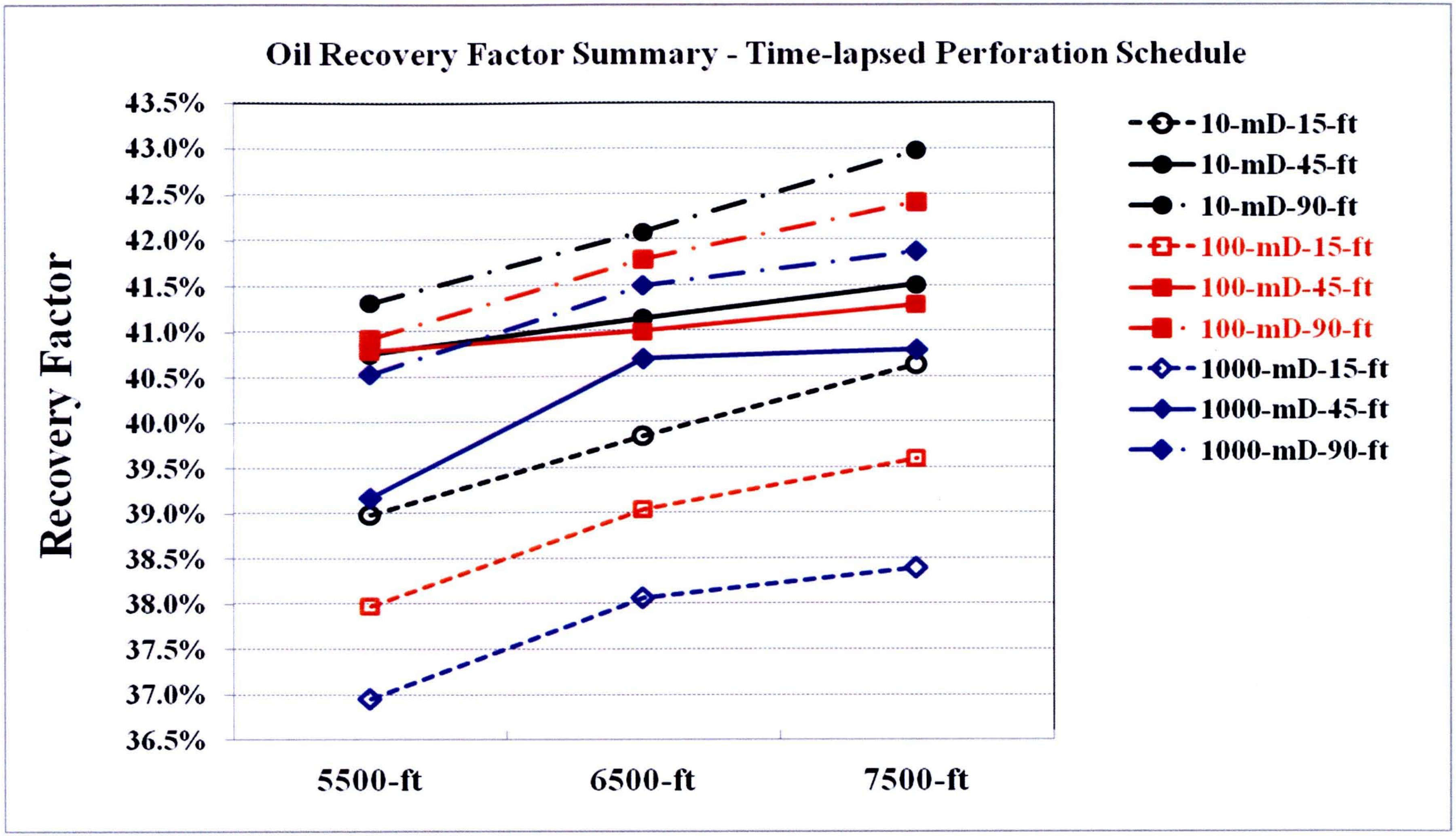

Figure 5.12 Oil Recovery Factor Summary for Time-lapsed Perforation Schedule of In-situ Gas Zone

5.4 Impact of Thickness of In-situ Gas Zone on Oil Recovery Factor

5.4.1 In-situ Gas Zone @ 5500' TVD

According to Figure 5.13, with the same depth of the in-situ gas zone, it can be observed that

(a) In either concurrent or time-lapsed perforation schedule, increasing the thickness of the in-situ gas zone helps improve the recovery factors. According to Figure 4.8, as oil rate declines, a need for GLR increases. Figures 5.14 (a), (b) and (c) compare oil production profiles of in-situ gas zone at 5500' TVD with 10 mD and concurrent perforation schedule among 15-ft, 45-ft and 90-ft thickness. It can be observed that the thicker the in-situ gas zone, the longer the gas can produce (or higher cumulative gas production), resulting in higher cumulative oil production or recovery factor. On the other hand, the larger OGIP (increasing with thickness as referred to Table 4.3), can provide gas rate to maintain sufficient GLR for longer period of time. For this reason, in each scenario at any given depth and *k* in either concurrent or time-lapsed perforation schedule, the in-situ gas zone with 90-ft thickness or the largest OGIP will provide higher recovery factor than the scenarios with 15-ft and 45-ft thicknesses.

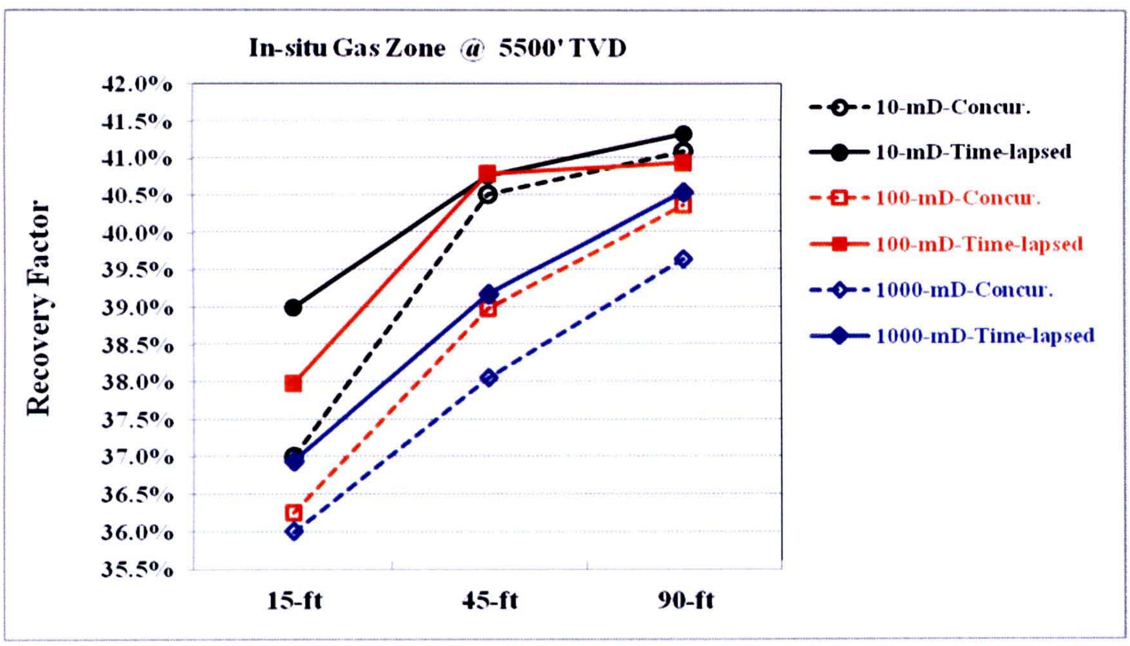

Figure 5.13 Oil Recovery Factors for In-situ Gas Zone @ 5500' TVD with Various Thicknesses

(b) The scenario in which the in-situ gas zone is 90-ft thickness with 10 mD and perforated in time-lapsed schedule provides the highest oil recovery factor mainly due to the benefits of time-lapsed perforation schedule and its thickness or OGIP which have been previously discussed in Section 5.2.1 (a) and 5.4.1 (a), respectively.

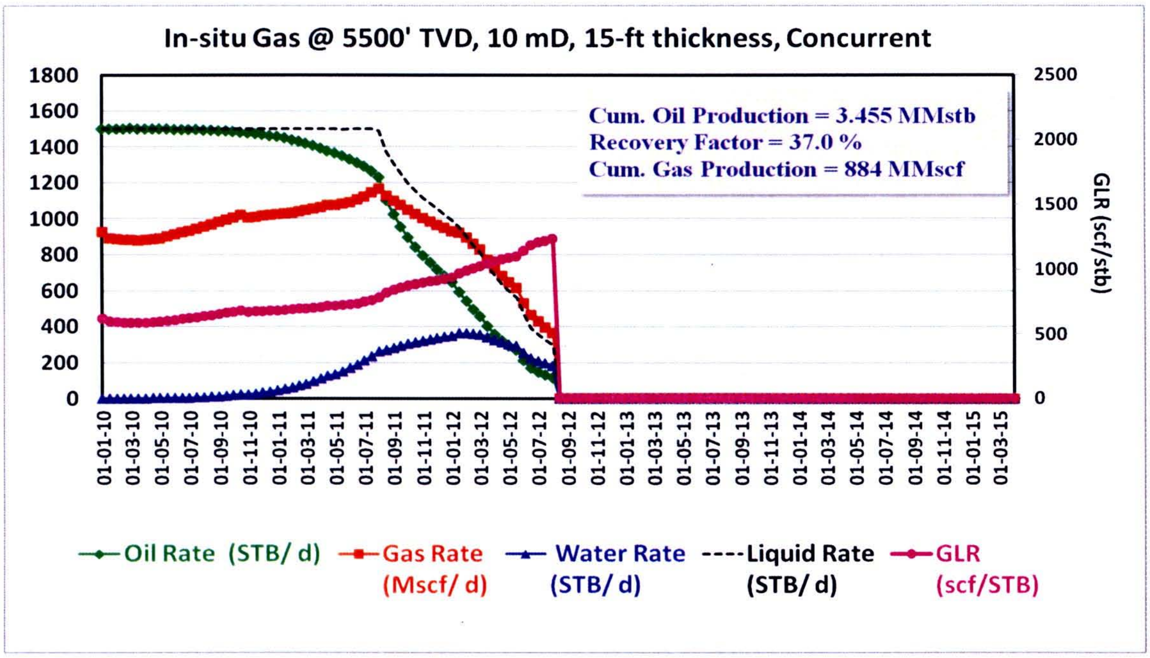

Figure 5.14 (a) 15-ft Thickness

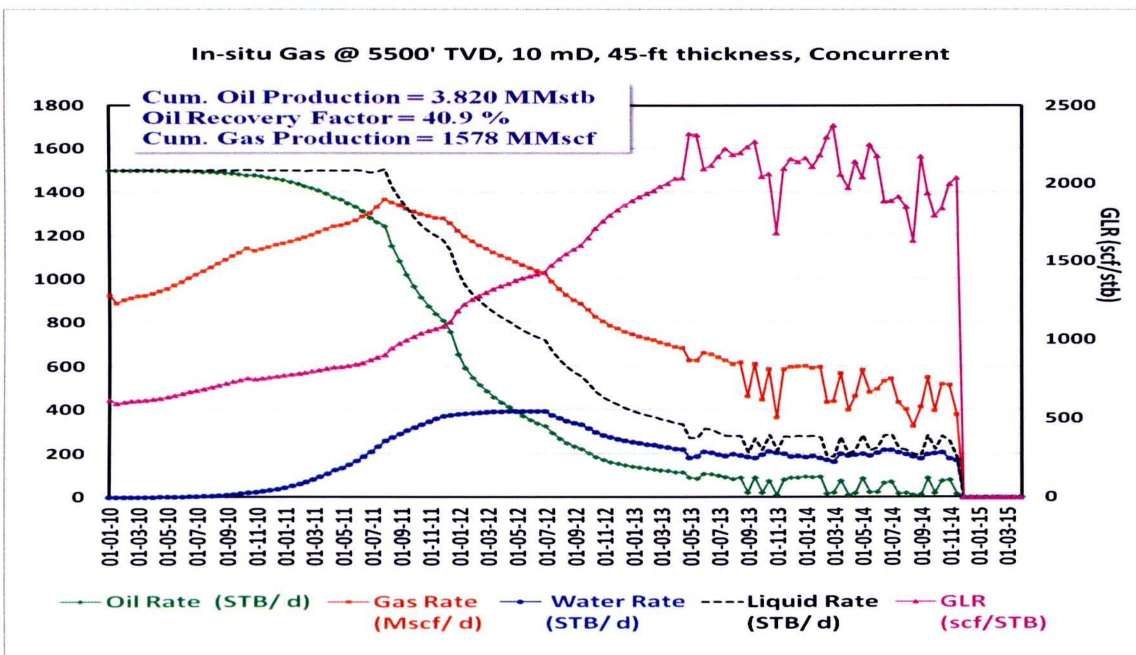

Figure 5.14 (b) 45-ft Thickness

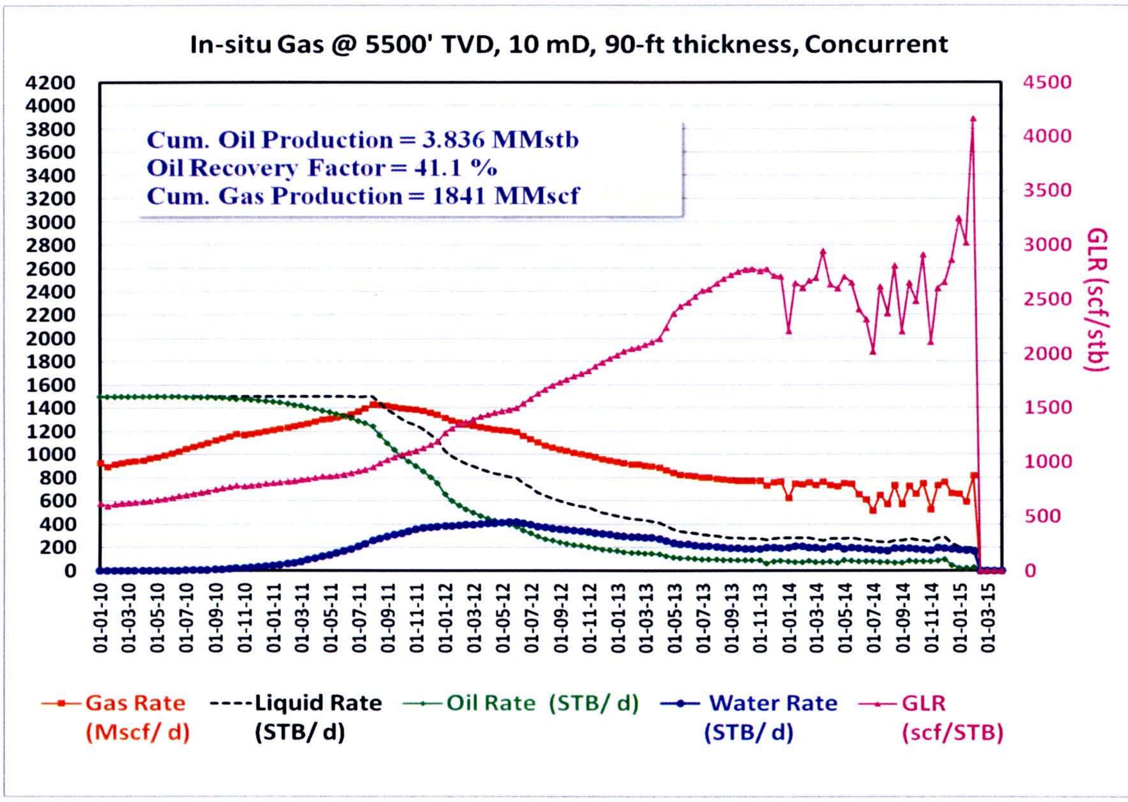

Figure 5.14 (c) 90-ft Thickness

Figure 5.14 Comparison of Cumulative Oil Production, Recovery Factor and Production Profile of In-situ Gas Zone at 5500' TVD, 10 mD, Concurrent Perforation Schedule with Various Thicknesses (a) 15-ft, (b) 45-ft and (c) 90-ft

5.4.2 In-situ Gas Zone @ 6500' TVD

According to Figure 5.15, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous case of in-situ gas zone at 5500' TVD, in either concurrent or time-lapsed perforation schedule, increasing the thickness of the in-situ gas zone helps improve the recovery factors.

(b) Three scenarios in time-lapsed perforation schedule for in-situ gas zones with 90-ft thickness and 10 mD, 100 mD and 1000 mD can exceed the oil recovery factor of the base case (or conventional gas lift). All scenarios have 90 ft thickness or the largest OGIP that provides gas rate to maintain sufficient GLR for longer period.

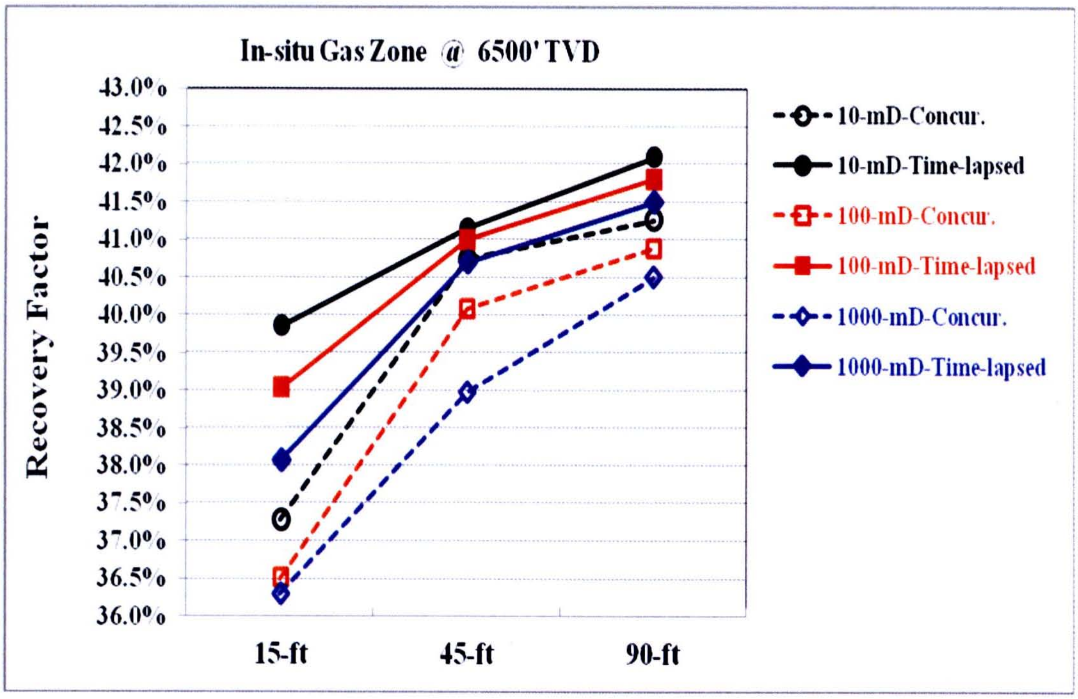

Figure 5.15 Oil Recovery Factors for In-situ Gas Zone @ 6500' TVD with Various Thicknesses

5.4.3 In-situ Gas Zone @ 7500' TVD

According to Figure 5.16, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous cases of in-situ gas zone at 5500' and 6500' TVD, in either concurrent or time-lapsed perforation schedule, increasing the thickness of the in-situ gas zone helps improve the recovery factors.

(b) The following six scenarios can exceed the oil recovery factor of the base case (or conventional gas lift):

(i) concurrent perforation schedule:

- in-situ gas zones with 90-ft thickness and *k* of 10 mD and 100 mD

(ii) time-lapsed perforation schedule:

- in-situ gas zones with 45-ft thickness and *k* of 10 Md
- in-situ gas zones with 90-ft thickness and *k* of 10 mD, 100 mD and 1000 mD

(c) The scenario in which the in-situ gas zone is 90-ft thickness with 10 mD and perforated in time-lapsed schedule provides the highest oil recovery factor mainly due to the benefits of both time-lapsed perforation schedule and its thickness or OGIP.

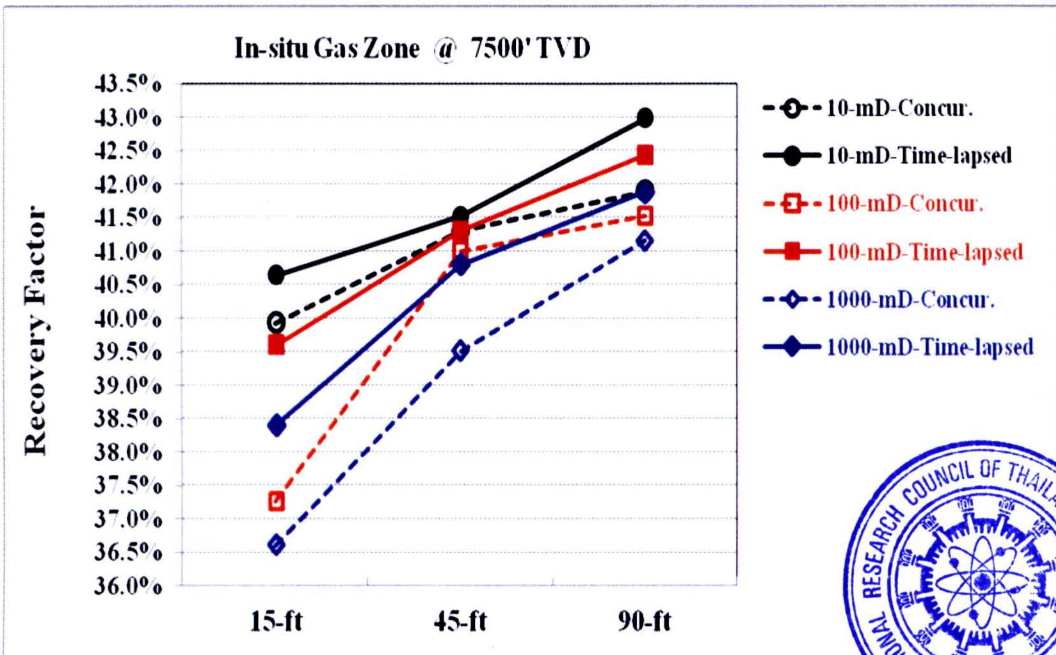

Figure 5.16 Oil Recovery Factors for In-situ Gas Zone @ 7500' TVD with Various Thicknesses

In summary, at the same depth and *k* of an in-situ gas zone, the oil recovery factors appear to increase with thickness (or OGIP as referred to Table A2 in Appendix A) of the in-situ gas zone in either concurrent or time-lapsed perforation schedule. Some scenarios can catch up with or exceed the base case's oil recovery factor.

5.5 Impact of Permeability of In-situ Gas Zone on Oil Recovery Factor

5.5.1 In-situ Gas Zone @ 5500' TVD.

According to Figure 5.17, with the same depth of the in-situ gas zone, it can be observed that

(a) All scenarios with the same thickness in either concurrent or time-lapsed perforation schedule, the recovery factor decreases with increasing *k* of the in-situ gas zone. The scenarios with the higher *k* provide the higher gas rate and GLR than the scenarios with lower *k*. From Figures 5.18 (a) and (b) illustrate a comparison between scenarios with the in-situ gas zone with *k* of 10 mD and 1000 mD. The case with higher *k* provides higher in-situ gas rate, resulting in higher or excessive GLR that adversely affect the recovery factor. In addition, according to Table 5.1, for each thickness in the time-lapsed perforation schedule, apparently the immediate gas rate and GLR after perforation on in-situ gas zone increases with increasing *k*. The immediate oil rate after the in-situ gas zone is perforated is about 900 stb/d which requires about 800 scf/stb of GLR according to Figure 4.8. Even though immediate GLR from all cases with each *k* are excessive, GLR from cases with *k* of 100 mD and 1000 mD appear be much more excessive than the cases with *k* of 10 mD. As a result, the case with *k* of 10 mD which has less friction due to less excessive GLR provides higher recovery factor.

(b) None of scenario can provide recovery factor greater than the base case. However, the scenario in which the in-situ gas zone is 90-ft thickness with 10 mD and perforated in time-lapsed schedule provides the highest oil recovery factor mainly due to the benefits of time-lapsed perforation schedule, its thickness or OGIP and its lowest *k* previously explained in Section 5.5.1 (a).

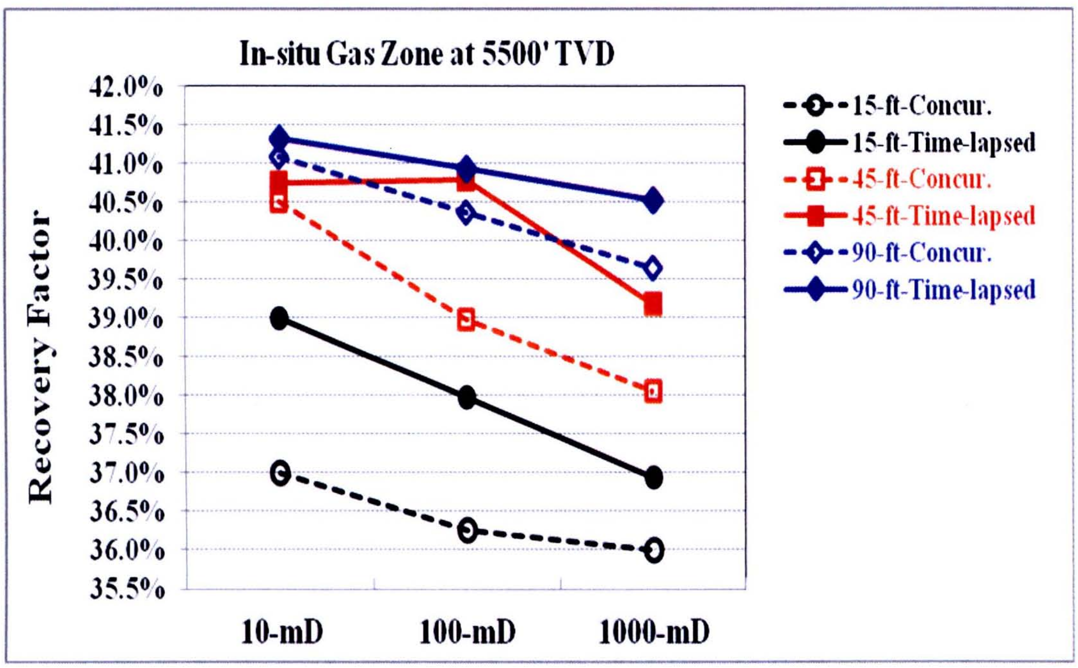

Figure 5.17 Oil Recovery Factors for In-situ Gas Zone @ 5500' TVD with Various Permeabilities

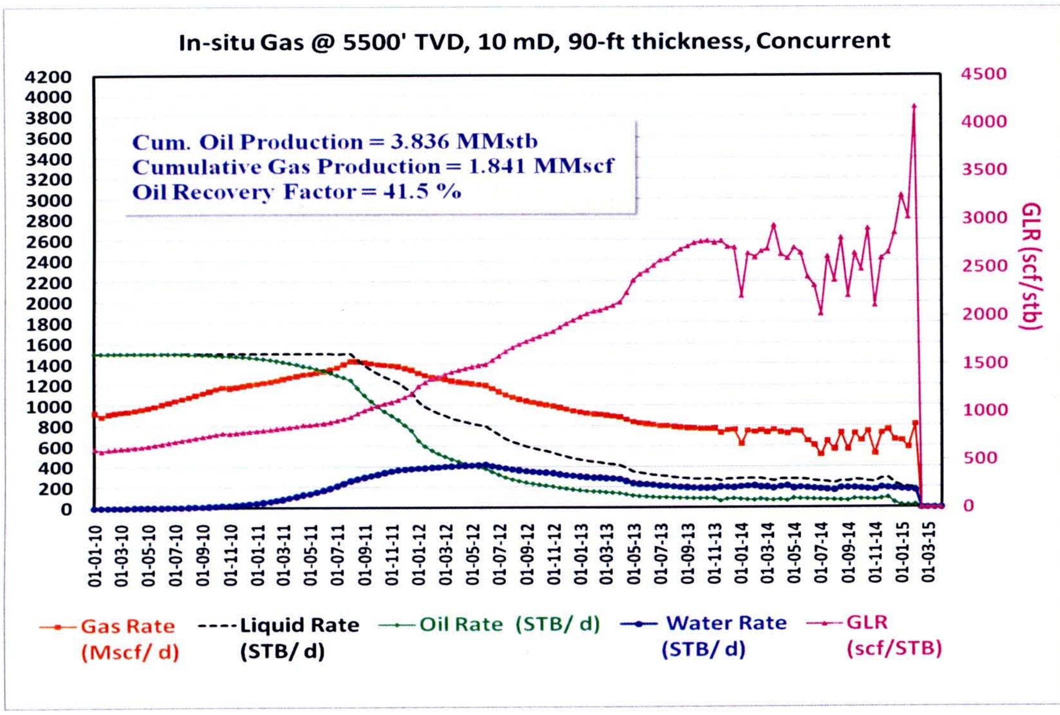

Figure 5.18 (a)

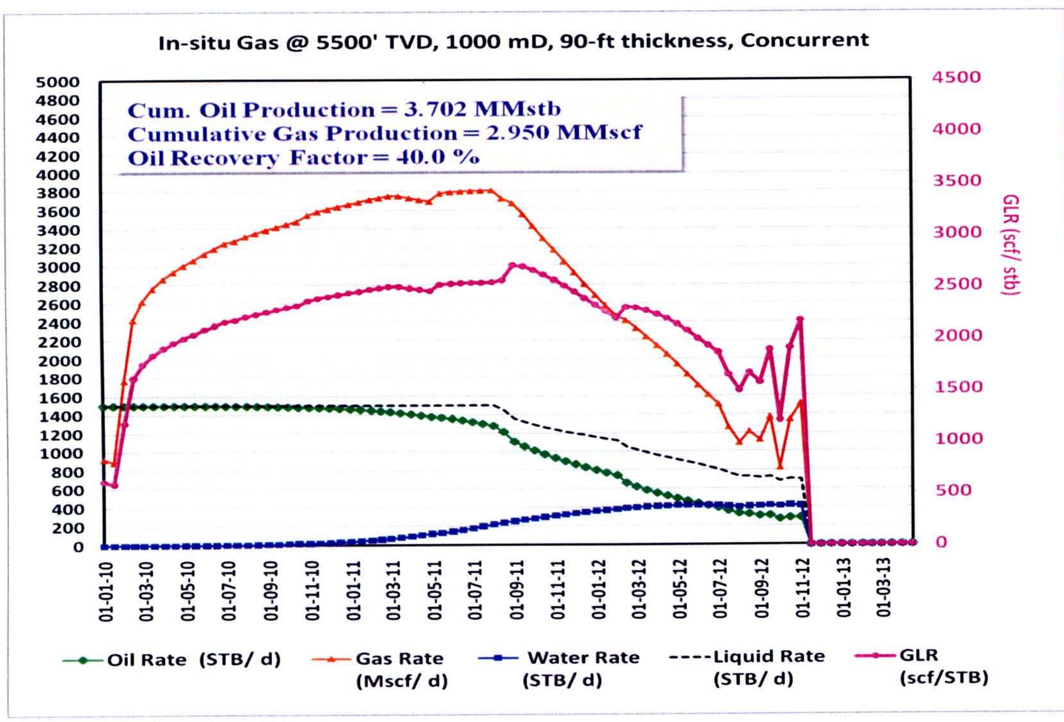

Figure 5.18 (b)

Figure 5.18 Comparison of Production Profiles of In-situ Gas Zone at 5500' TVD, 90-ft Thickness, Concurrent Perforation Schedule between (a) 10 mD vs. (b) 1000 mD

Table 5.1 Immediate Gas Rate and GLR after Time-lapsed Perforation on In-situ Gas Zone at 5500' TVD

Thickness (ft)	**Permeability (mD)**	**Immediate Gas Rate (MMscfd)**	**Immediate GLR (scf/stb)**
15	10	1.380	1085
	100	3.230	2739
	1000	8.186	20824
45	10	1.436	1111
	100	3.279	2799
	1000	8.219	21069
90	10	1.448	1118
	100	3.299	2912
	1000	8.179	21261

5.5.2 In-situ Gas Zone @ 6500' TVD

According to Figure 5.19, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous case of in-situ gas zone at 5500' TVD, all scenarios with the same thickness in either concurrent or time-lapsed perforation schedule, the recovery factor decreases with increasing *k* of the in-situ gas zone. This effect has been already discussed in section 5.5.1 (a) using Table 5.2.

(b) The scenarios in which the in-situ gas zone is 90-ft thickness with 10 mD and perforated in time-lapsed schedule can exceed the oil recovery factor of the base case mainly due mainly due to the benefits of time-lapsed perforation schedule, its thickness or OGIP and its lowest *k* previously explained in Section 5.5.1 (a).

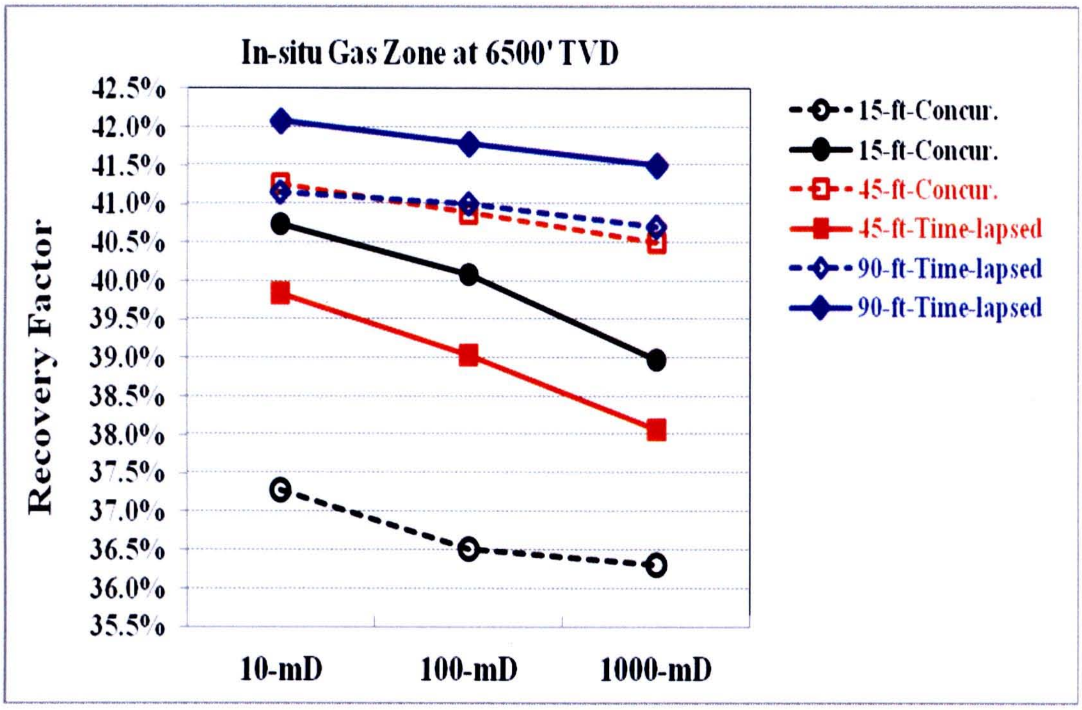

Figure 5.19 Oil Recovery Factors for In-situ Gas Zone @ 6500' TVD with Various Permeabilities

Table 5.2 Immediate Gas Rate and GLR after Time-lapsed Perforation on In-situ Gas Zone at 6500' TVD

Thickness (ft)	Permeability (mD)	Immediate Gas Rate (MMscfd)	Immediate GLR (scf/stb)
15	10	1.525	1130
	100	3.672	2993
	1000	8.855	22828
45	10	1.590	1118
	100	3.727	3059
	1000	8.878	23024
90	10	1.604	1125
	100	3.740	3076
	1000	8.883	23073

5.5.3 In-situ Gas Zone @ 7500' TVD

According to Figure 5.20, with the same depth of the in-situ gas zone, it can be observed that

(a) Similar to the previous cases of in-situ gas zone at 5500' TVD and 6500' TVD, all scenarios with the same thickness in either concurrent or time-lapsed perforation schedule, the recovery factor decreases with increasing *k* of the in-situ gas zone. This effect has been already discussed in section 5.5.1 (a) using Table 5.3

(b) The scenarios in which the in-situ gas zone is 90-ft thickness with 10 mD and perforated in time-lapsed schedule can exceed the oil recovery factor of the base case mainly due to the benefits of time-lapsed perforation schedule, its thickness or OGIP and its lowest *k* previously explained in Section 5.5.1 (a).

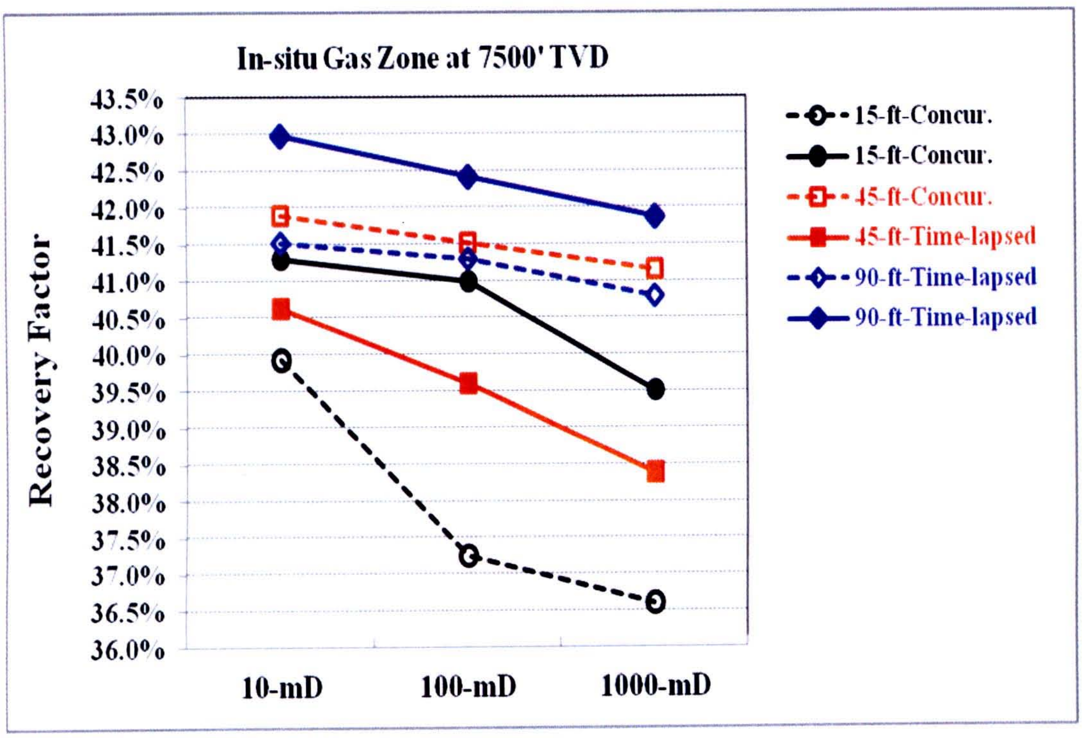

Figure 5.20 Oil Recovery Factors for In-situ Gas Zone @ 7500' TVD with Various Permeabilities

Table 5.3 Immediate Gas Rate and GLR after Time-lapsed Perforation on In-situ Gas Zone at 7500' TVD.

Thickness (ft)	Permeability (mD)	Immediate Gas Rate (MMscfd)	Immediate GLR (scf/stb)
15	10	1.67	1174
	100	4.13	3631
	1000	9.17	24816
45	10	1.734	1257
	100	4.188	3708
	1000	9.188	25021
90	10	1.747	1219
	100	4.203	3729
	1000	9.193	25070

5.6 Impact of Perforation Interval on Recovery Factor

In order to improve the recovery factor based on understandings of effects of *k* and time-lapsed perforation schedule, there are some attempts to vary the perforation interval of the in-situ gas zone to observe its impact on the recovery factors.

5.6.1 Increased Perforation Intervals on In-situ Gas Zone with *k* of 10 mD

Figures 5.21 (a) and (b) is a comparison of cumulative oil production, recovery factor and production profile of in-situ gas zone at 7500' TVD with 10 mD, 15-ft thickness and time-lapsed perforation schedule between 1 ft and 2 ft perforation interval on the in-situ gas zone. It is noted that increasing the perforation interval on the in-situ gas zone with low *k* can improve the recovery factor due to the fact that the gas rate from 2 ft perforation interval is higher from larger open flow area (more perforation holes) than 1 ft perforation interval resulting in higher GLR.

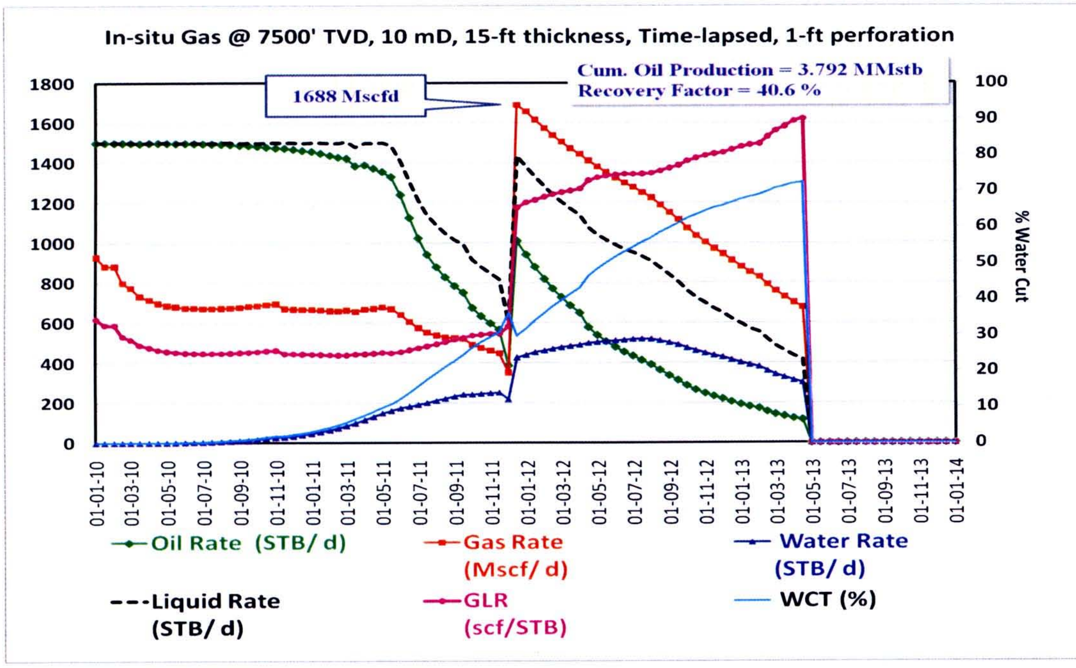

Figure 5.21 (a) 1 ft Perforation Interval

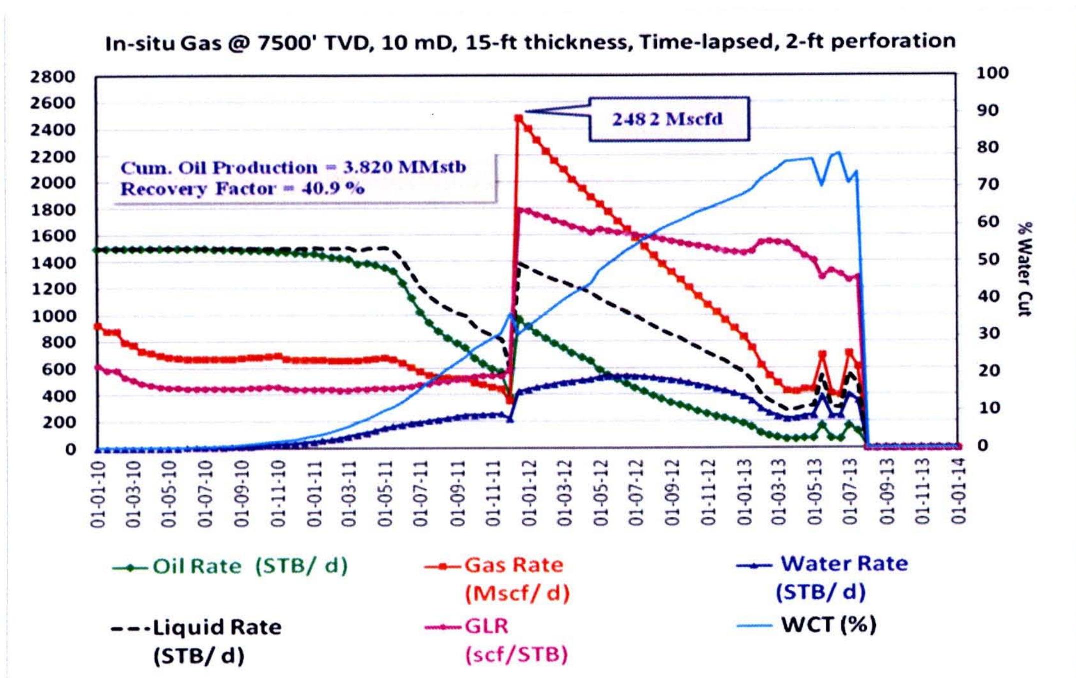

Figure 5.21 (b) 2 ft Perforation Interval

Figure 5.21 Comparison of Cumulative Oil Production, Recovery Factors and Production Profiles of In-situ Gas Zone at 7500' TVD with 10 mD, 15-ft Thickness and Time-lapsed Perforation Schedule with (a) 1-ft and (b) 2-ft Perforation Interval on In-situ Gas Zone

5.6.2 Decreased Perforation Intervals on In-situ Gas Zone with *k* of 1000 mD

Figures 5.22 (a) and (b) is a comparison of cumulative oil production, recovery factor and production profile of in-situ gas zone at 5500' TVD with 1000 mD, 15-ft thickness and time-lapsed perforation schedule between 1 ft (6 shots) and 0.33 ft (2 shots) of perforation interval on the in-situ gas zone. It is noted that decreasing the perforation interval or number of shots on the in-situ gas zone with high *k* can improve the recovery factor due to the fact that the excessive gas rate from 1 ft perforation interval is reduced by less flow area (less perforation holes); thus reducing friction.

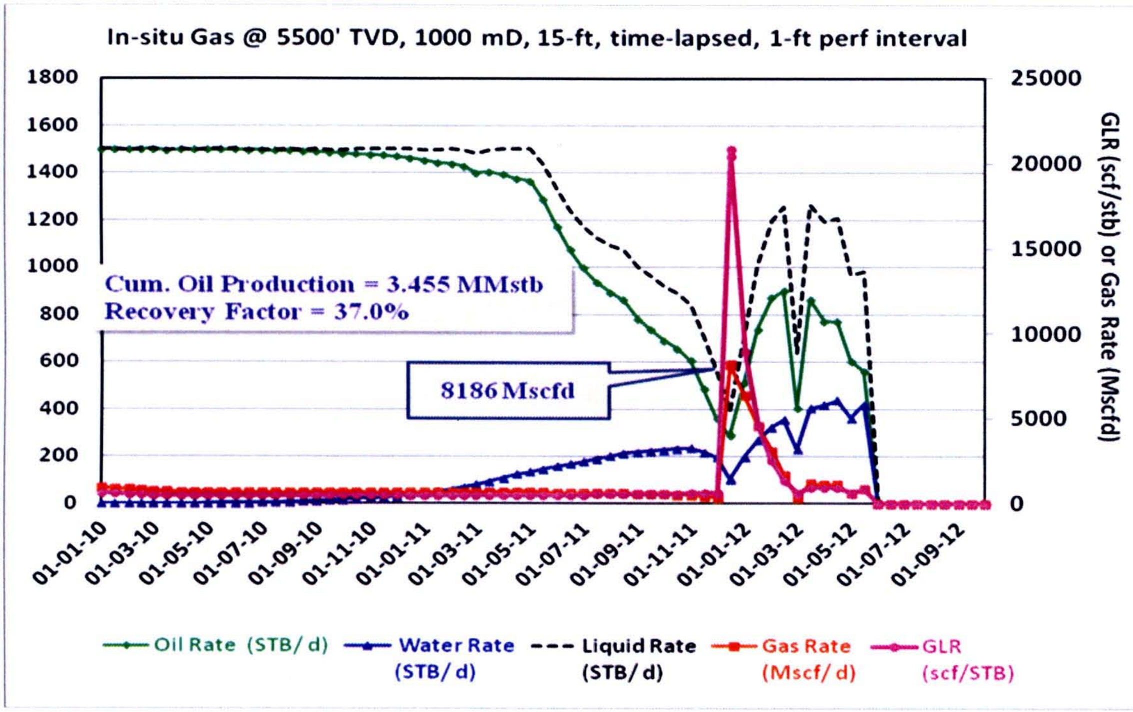

Figure 5.22 (a) 1 ft Perforation Interval

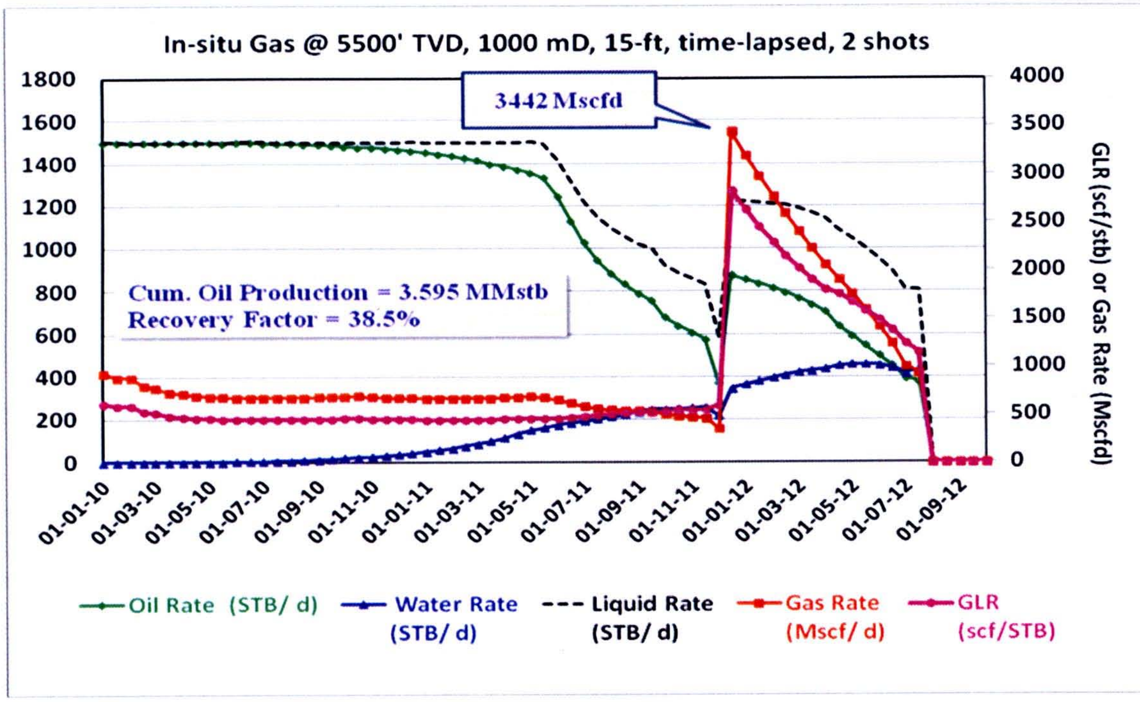

Figure 5.22 (b) 0.33 ft (2 shots) of Perforation Interval

Figure 5.22 Comparison of Cumulative Oil Production, Recovery Factors and Production Profile of In-situ Gas Zone at 5500' TVD with 1000 mD, 15-ft Thickness and Time-lapsed Perforation Schedule with (a) 1-ft and (b) 0.33-ft (2 shots) Perforation Interval on In-situ Gas Zone

5.6.3 Effect of Perforation Interval of In-situ Gas Zone at 7500-ft with 100 mD on Oil Recovery Factor

In order to further evaluate the impact of the perforation intervals of the in-situ gas zone with 15-ft and 45-ft thickness, some more simulation cases were run.

According to Table 5.4 and Table 5.5, increasing perforation interval of the in-situ gas lift zone from 1 ft to 1.5 ft for both concurrent and time-lapsed perforation schedules slightly improves the recovery factors. However, further increasing the perforation interval of the in-situ gas lift zone from 1.5 ft to 2.0 ft decreases the recovery factors. This can be explained using the data for the cases with the concurrent perforation schedule in Table 5.4 as an example that increasing the perforation interval of the in-situ gas lift zone from 1 ft to 1.5 ft increases the initial gas rate or GLR which has a positive impact on the recovery factor resulting in a gain in recovery factor by about 0.45%.

However, further increasing the perforation interval of the in-situ gas lift zone to 2.0 ft results in higher initial gas rate or GLR which slightly improves the recovery factor by 0.06% only when compared to the case with the perforation interval of 1 ft and this is worse than the case with the perforation interval of 1.5 ft. Very small improvement for the case with the perforation interval of 2 ft could be mainly due to the fact that the GLR start to become excessive resulting in higher friction in the tubing.

It can be inferred that every case with 1.5 ft perforation interval provides the highest recovery factors among three perforation intervals.

Table 5.4 Effect of Perforation Interval of In-situ Gas Lift Zone at 7500-ft with 100 mD and 15 ft thickness on Recovery Factors

Perforation Interval of In-situ Gas Zone	Concurrent					Time-lapsed			Diff. in RF (Time-lapsed) - (Concur.)
	Initial Gas Rate (Mscfd)	Initial GLR (scf/stb)	Cum. Oil Production (MMstb)	Recovery Factor (%)	Gain/ Loss in RF Compared to 1-ft Case (%)	Cum. Oil Production (MMstb)	Recovery Factor (%)	Gain/ Loss in RF Compared to 1-ft Case (%)	
1 ft	1804	1203	3.480	37.26%		3.699	39.60%		**2.34%**
1.5 ft	5724	3816	3.552	37.71%	**0.45%**	3.759	39.91%	0.31%	**2.20%**
2.0 ft	6483	4322	3.485	37.32%	**0.06%**	3.714	39.77%	0.17%	**2.45%**

Table 5.5 Effect of Perforation Interval of In-situ Gas Lift Zone at 7500-ft with 100 mD and 45 ft thickness on Recovery Factors

Perforation Interval of In-situ Gas Zone	Concurrent					Time-lapsed			Diff. in RF (Time-lapsed) - (Concur.)
	Initial Gas Rate (Mscfd)	Initial GLR (scf/stb)	Cum. Oil Production (MMstb)	Recovery Factor (%)	Gain/ Loss in RF Compared to 1-ft Case (%)	Cum. Oil Production (MMstb)	Recovery Factor (%)	Gain/ Loss in RF Compared to 1-ft Case (%)	
1 ft	4964	3309	3.829	41.00%		3.857	41.30%		**0.30%**
1.5 ft	5950	3900	3.902	41.78%	**0.78%**	3.930	42.08%	0.78%	**0.30%**
2.0 ft	6698	4465	3.885	41.60%	**0.60%**	3.919	41.96%	0.66%	**0.36%**