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SPE workshop

Strengthening Marginal and Mature Field Ecosystems: Technology, Innovation, and Collaboration

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From Uneconomic to Sustained Oil Recovery: A Real-Field Case of Gas Saturation Redistribution and Gas Cusping Management

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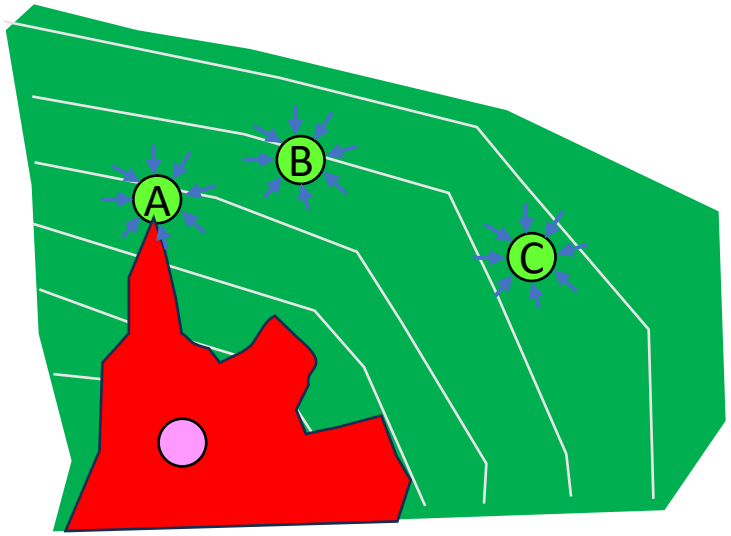
Outline

- Introduction : Gas Cusping in Gas injected Reservoir
- Field Background - Initial Gas Cusping
- Well Shut-in : Gas Redistribution
- Successful Results & Pressure Drawdown Control Strategy
- Summary & Conclusion

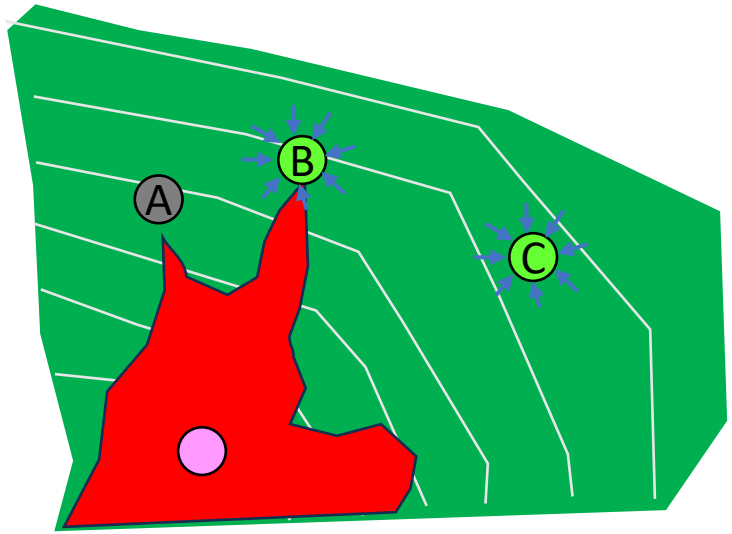
Gas Cusping in Gas injected Reservoir

Initial Gas Cusping



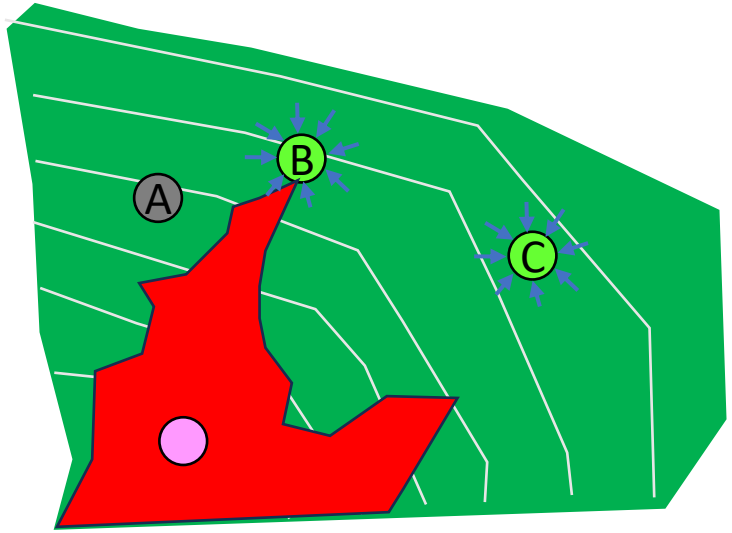
- Gas cusping to the most crestal well
- Remedial actions done but unsuccessful : Controlled drawdown, gas injection suspension.

Strategic Well Shut-in



- Well shut-in, drawdown removed
- Dominant gradient shifted away
- Gas mobility redistributed

Redistribution to Offset Well

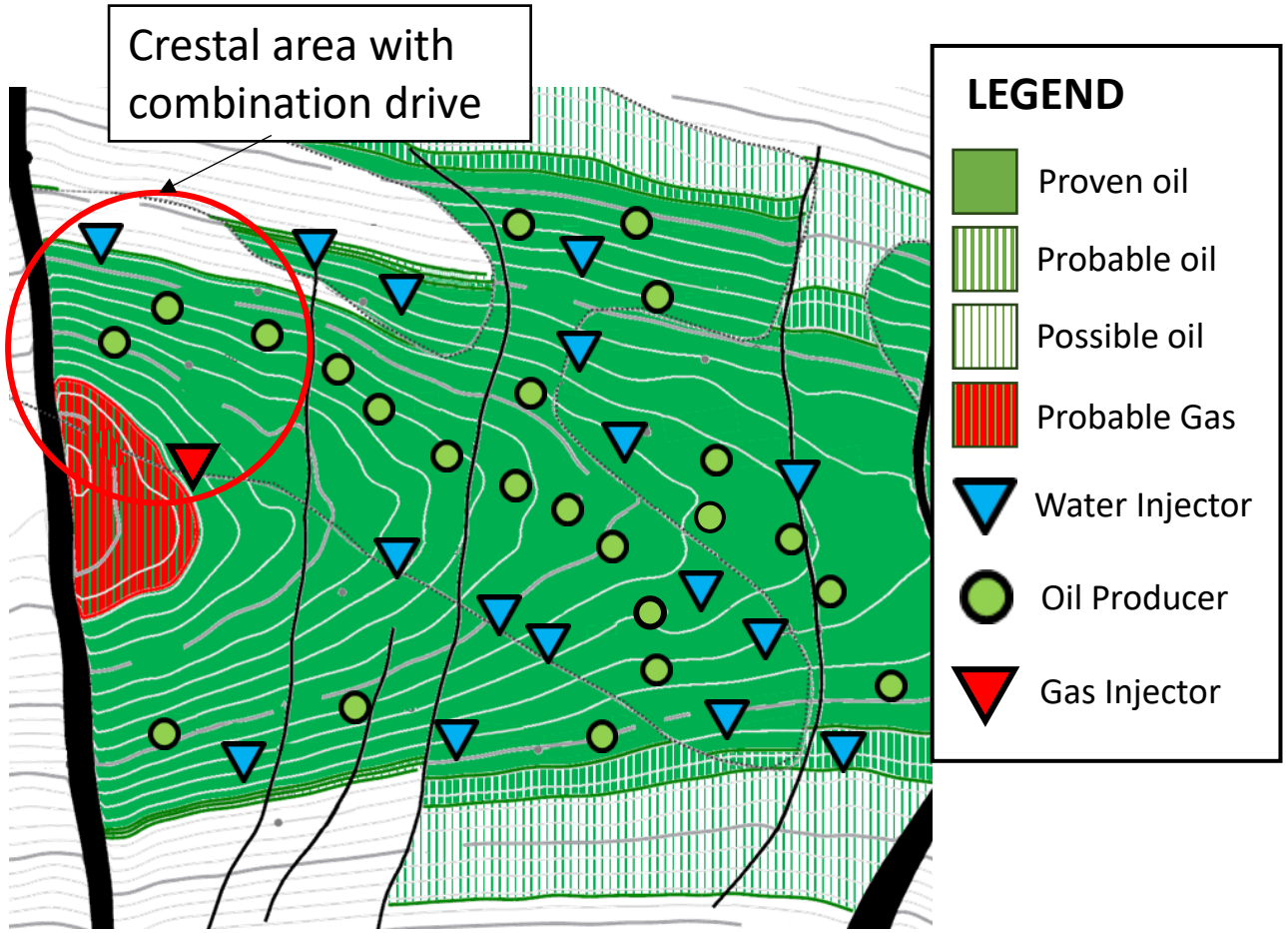


- Offset well maintains lower FBHP
- Gas preferentially migrates laterally
- Reduced gas dominance to the crestal well

Long duration recovery as viable mechanism for reversing adverse gas saturation trend when short-term measures provides limited improvement

Field Background

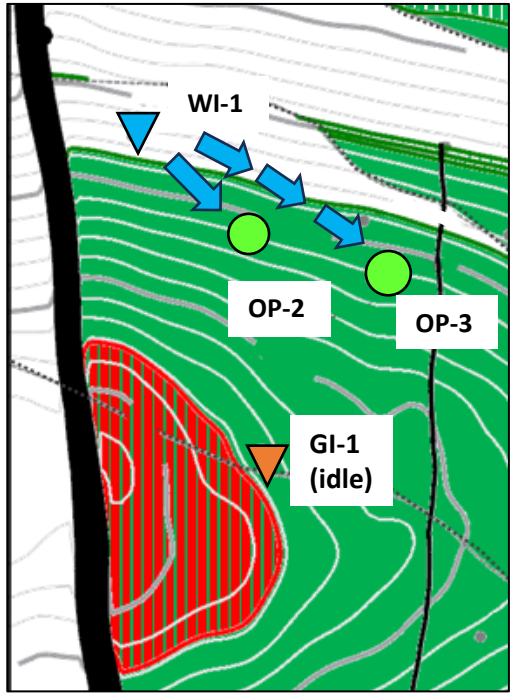
Field A - Top Structure Map



1. Mature reservoir with 20 years production
2. Drive mechanism :
   - Small gas cap, weak to moderate aquifer
   - Water Injection for pressure maintenance and sweep support
   - Combination drive in crestal area - **where the gas cusping issues observed**
3. Reservoir management is critical – balancing pressure & sweep support to maximize recovery

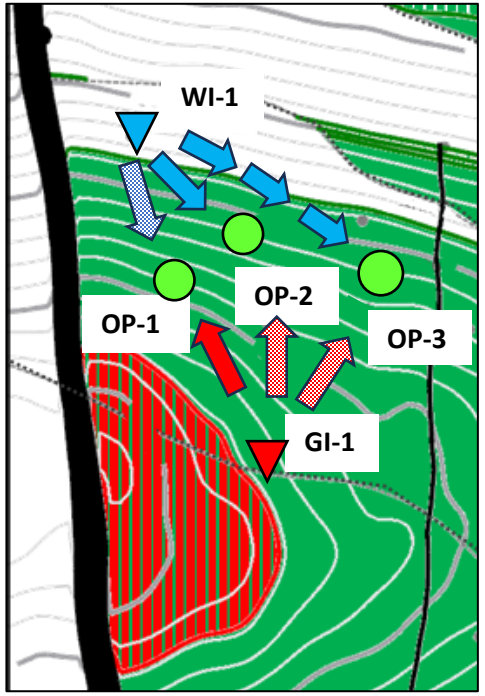
Field Background – Initial Gas Cusping

Pre Infill Campaign



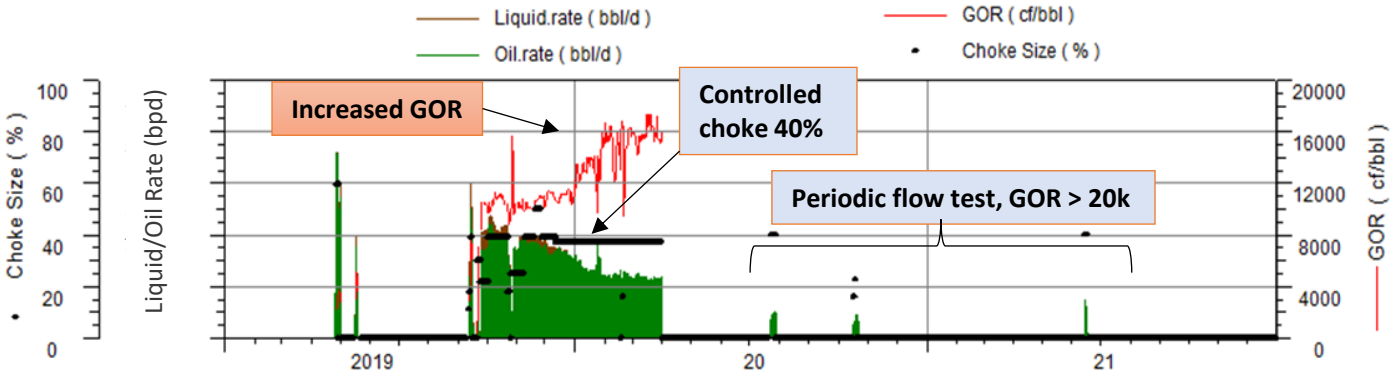
- GI idle due to source gas reservoir depleted (subsurface dumpflood)
- Dropping pressure to near bubble point

Post Infill Campaign

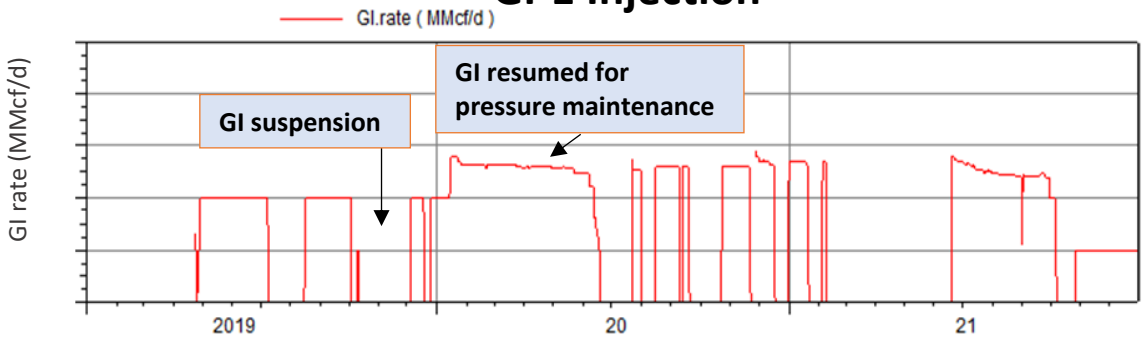


- Additional 1 OP and GI reactivation
- Reservoir re-pressurization become priority
- Gas cusping toward OP-1

OP-1 Performance



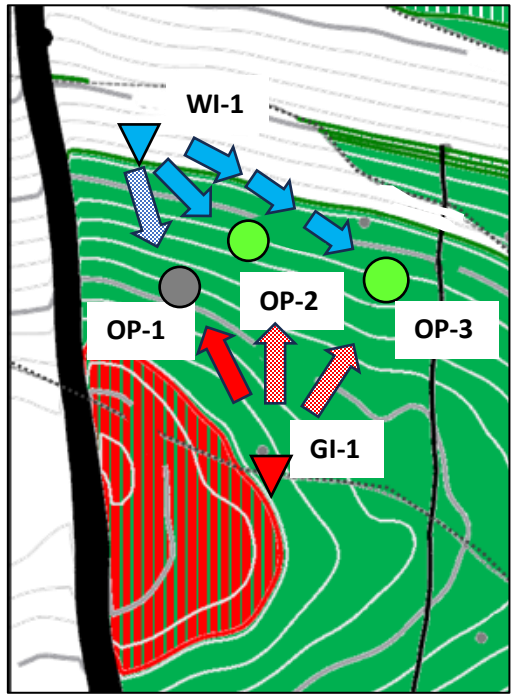
GI-1 Injection



- Increasing GOR up to 16k cf/bbl
- High gas production generated surface backpressure, negatively affecting offset well performance.
- Continued OP-1 production yielded negligible field incremental oil

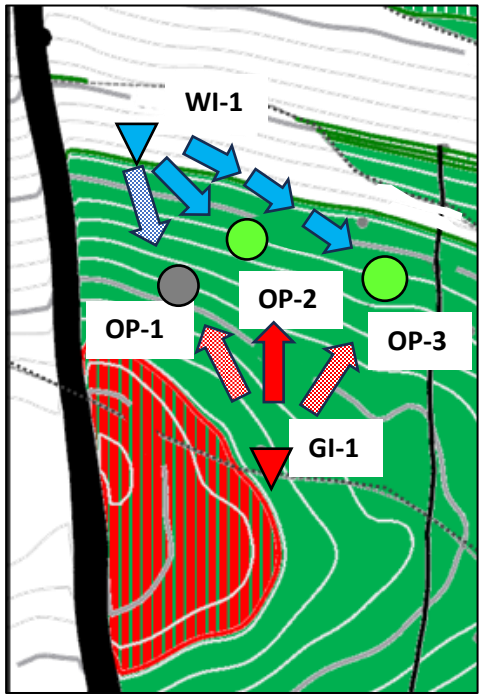
Well Shut-in : Gas Redistribution

Strategic Well Shut-in



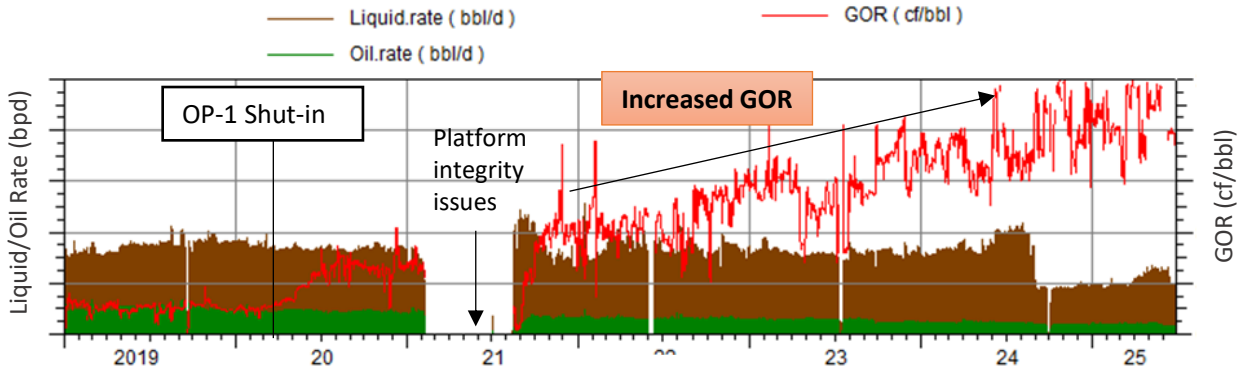
- OP-1 placed under shut-in
- Periodic flow tests performed

Gas Redistribution

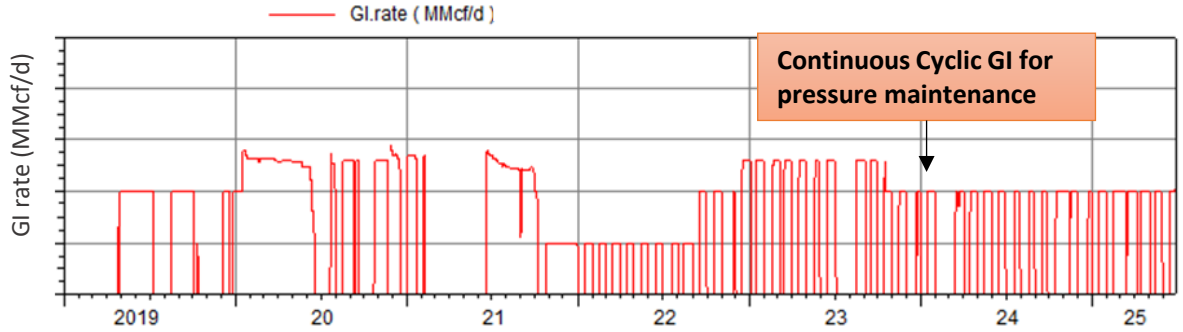


- Offset well maintains active at lower FBHP
- Gas preferentially migrates laterally

OP-2 Performance



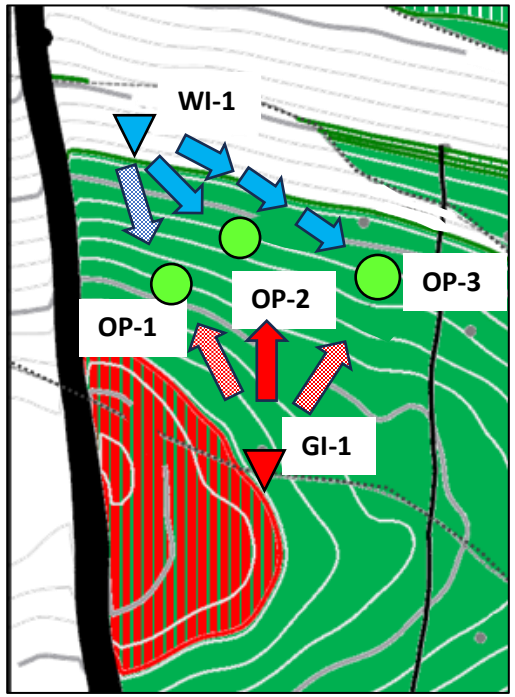
GI-1 Injection



- Increasing GOR in OP-2, indicates gas saturation re-distribution overtime

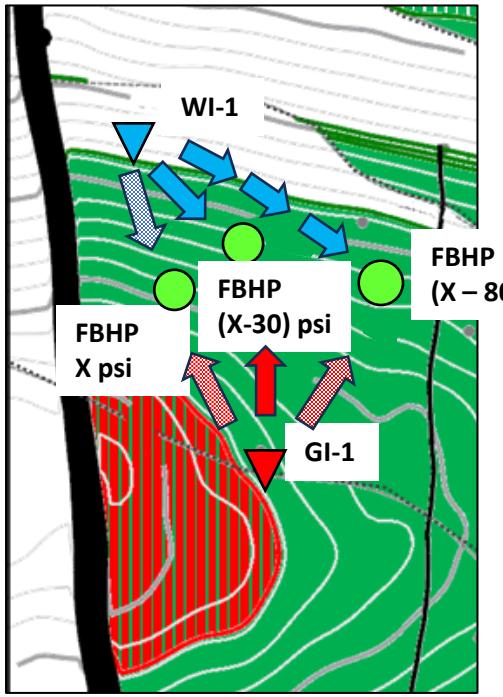
Well Reactivation & FBHP Control Strategy

Successful Results (After 3-years)

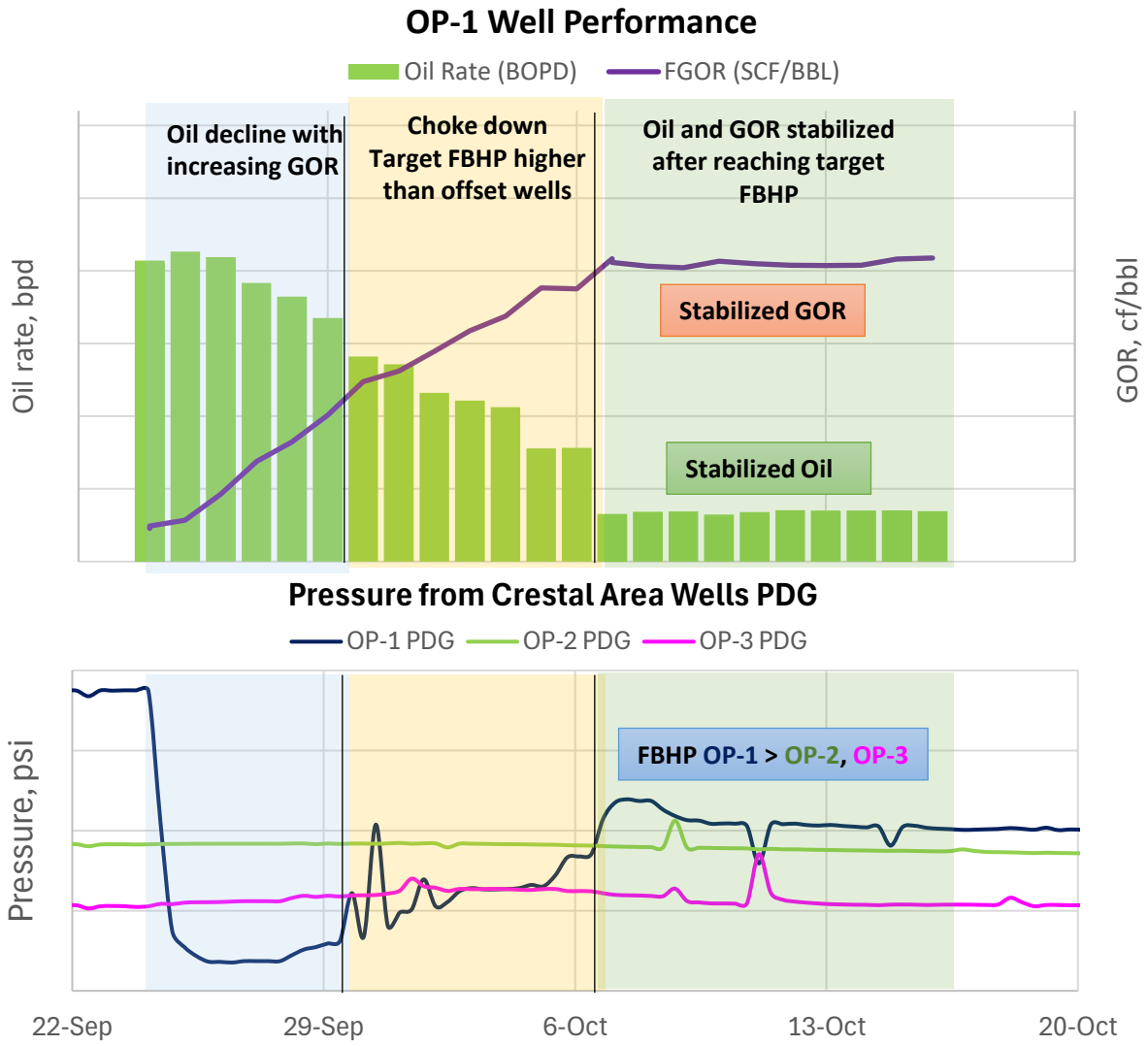


- OP-1 reactivated at 5x oil rate higher than before well shut-in at low GOR
- Steep oil decline with increasing GOR observed

Drawdown Control Strategy



- Well choke back with target FBHP higher than offset well
- Steep decline arrested



Summary & Conclusion

- Severe gas cusping in a depletion-driven sandstone reservoir rendered the well uneconomic.
- Well shut-in with periodic flow test is a viable reservoir management option when immediate measures provide limited improvement.
- Strategic pressure drawdown management can ultimately stabilized oil production and mitigate gas cusping.
- Sustainable recovery was achieved not through aggressive intervention, but through timely and disciplined reservoir management.

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