

# Acid Gas Injection for Enhanced Oil Recovery and Long-Term Storage in Zama Pinnacle Reefs



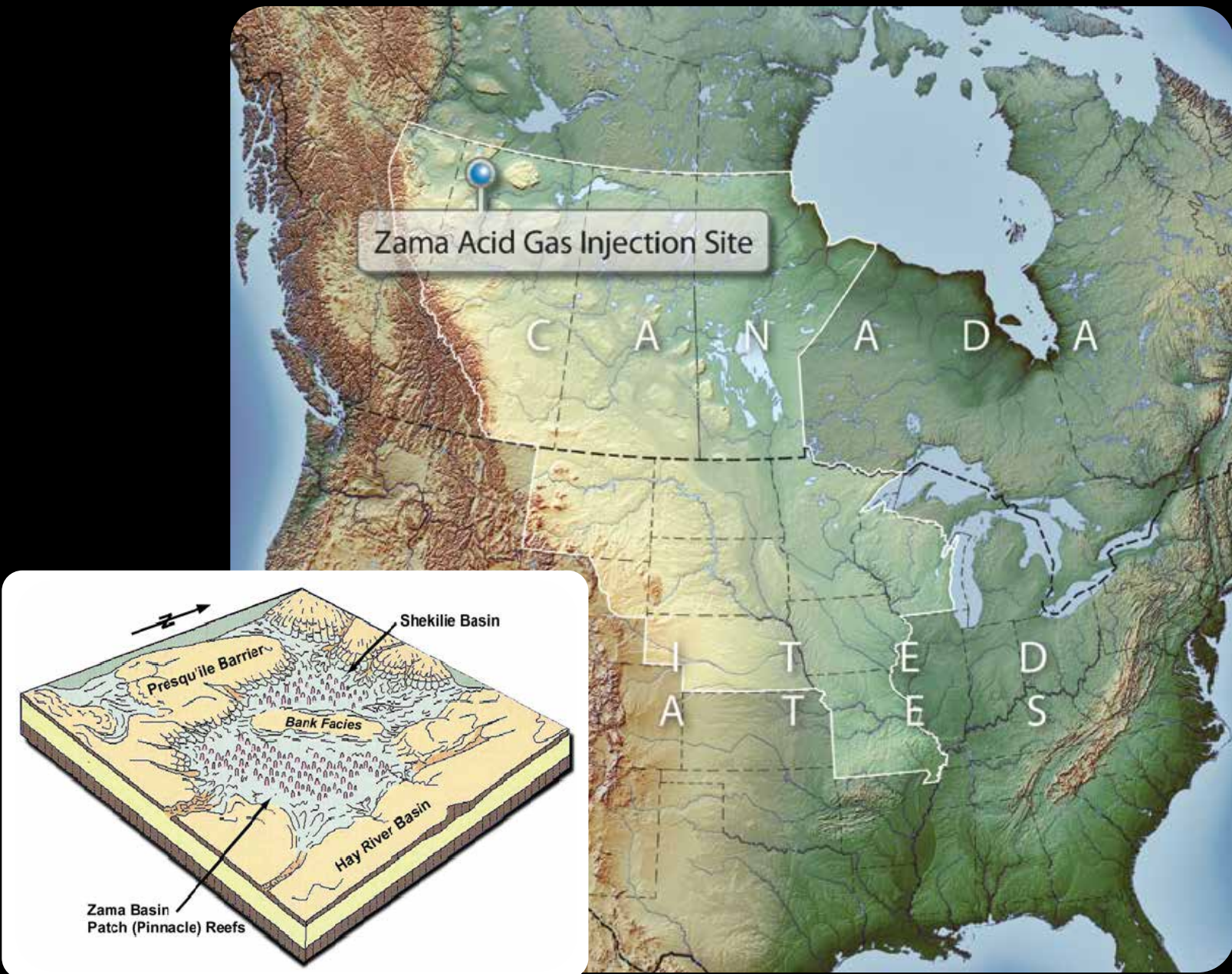
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## Abstract

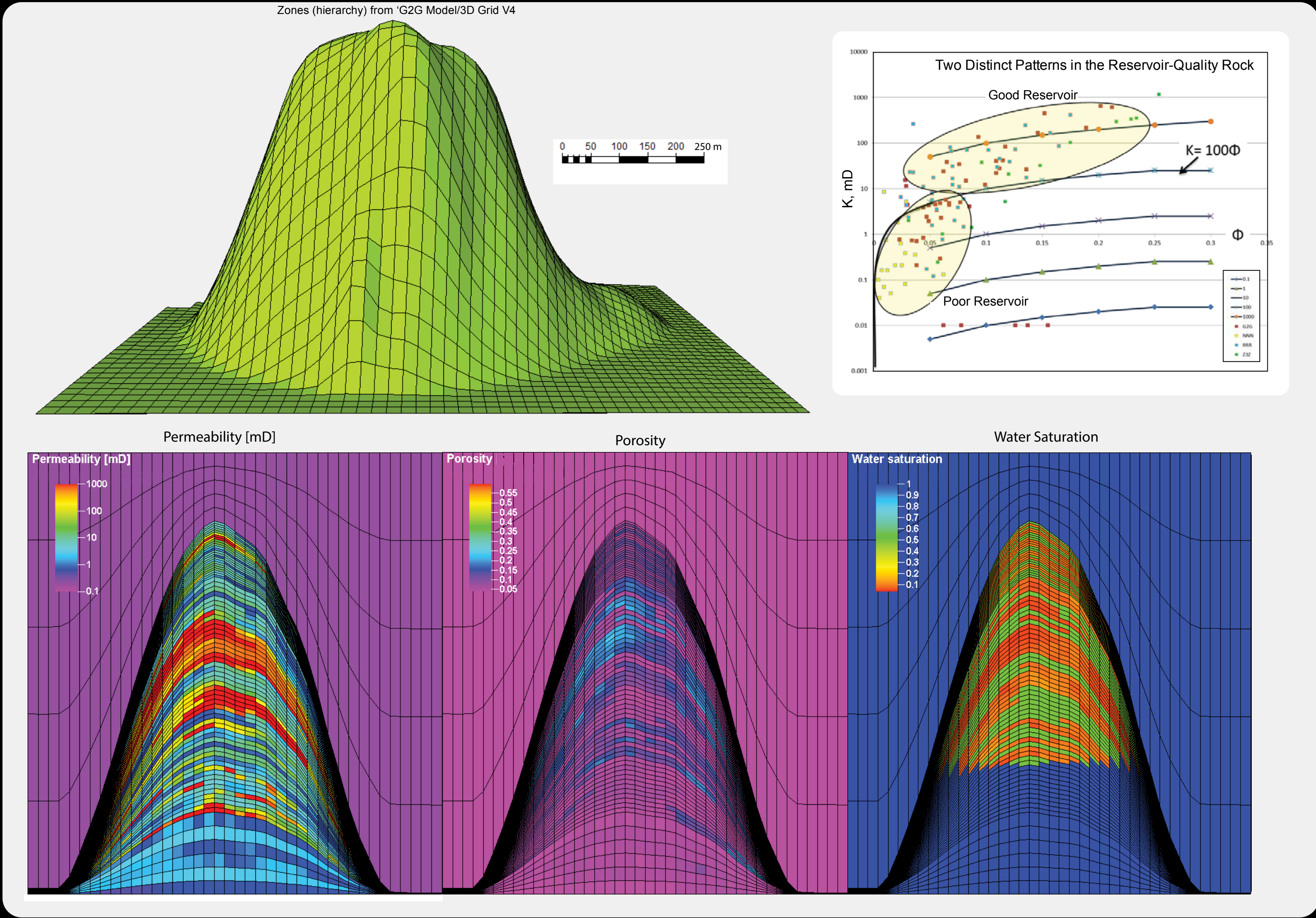
An acid gas disposal and enhanced oil recovery (EOR) site in northwestern Alberta, operated by Apache Canada Ltd., has been the subject of simulation work performed by the Energy & Environmental Research Center at the University of North Dakota. The purpose of the simulations performed was to increase our understanding of the reservoir in order to test the efficacy of monitoring, verification, and accounting techniques for carbon capture and storage.

The hundreds of pinnacle reefs throughout the world hold in excess of 1 million barrels of oil each. These pinnacles represent an excellent opportunity to recover incremental oil through EOR and have a large potential to store CO<sub>2</sub>. This research is to investigate the potential of conducting tertiary oil recovery in pinnacle reefs in the Zama area and the potential for long-term CO<sub>2</sub> storage. Furthermore, the research provides a robust methodology for the evaluation of similar projects in other Zama pinnacle reefs.

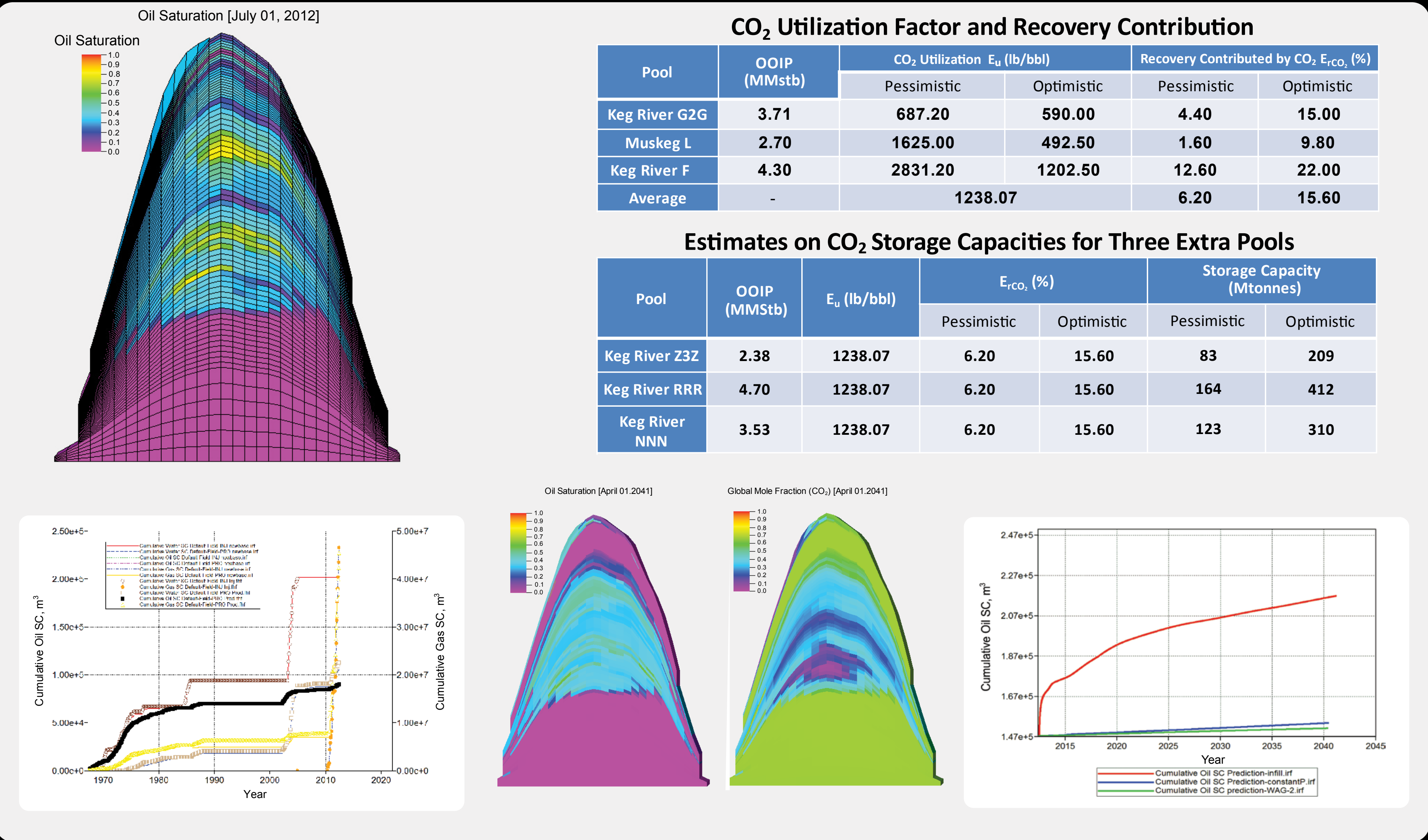
A detailed review was carried out which evaluated the historic data for all of the targeted pinnacles. As a part of this evaluation, fluid behavior was studied for both EOR efficiency and long-term storage purposes. A high-resolution heterogeneous geocellular model was constructed for each of the three pinnacles under investigation. Each of these models was run through a high-resolution history match and long-term predictions for EOR and scenarios to investigate using pinnacle reefs for CO<sub>2</sub> storage. Based on this workflow, the CO<sub>2</sub> sweep efficiency, storage capacity for each pinnacle, and the potential injection programs were estimated.



## Geologic Modeling



## Dynamic Modeling for CO<sub>2</sub> EOR Potential and Storage



## Summary

This investigation of the geologic storage of CO<sub>2</sub> in the Zama pinnacles was focused on acid gas injection in partially depleted hydrocarbon reservoirs for the purpose of simultaneous EOR, acid gas disposal, and CO<sub>2</sub> storage. The feasibility of using existing wells as storage sites and the potential risks and factors related to the degradation of the cap rock in long-term storage were examined. High-resolution geocellular models for the F, G2G, and Muskeg L pools were constructed. Each model was history-matched to production data, and estimates for EOR and storage efficiencies were made. Dynamic injection simulations were conducted, with multiple scenarios developed to investigate using these pinnacles for CO<sub>2</sub> storage and to provide information for EOR program design and optimization. The simulation work also allowed for the extrapolation of potential oil recovery and CO<sub>2</sub> storage efficiency in other Zama pinnacles. The results of these efforts indicate that the combination of EOR, acid gas disposal, and CO<sub>2</sub> storage can be successfully conducted in the pinnacles in the Zama area, and this approach could be applied to similar pinnacle reef structures in other geologic formations.

## Acknowledgments

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