Groundwater Management and Optimal Recoverable Storage

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ABSTRACT

The 2017 State Water Plan paints a dire picture for the future of water resources in Texas: total supply deficits of 4.8 and 8.9 million acre-feet under drought of record conditions by the year 2020 and 2070 (respectively) driven by projected rises in population concurrent with declines in available water supplies. At the same time, groundwater management regimes and derivative available groundwater yields have been criticized as overly restrictive; creating a regulation-induced shortage of groundwater. Support for this argument is given by the observation that vast volumes of groundwater, as evidenced by Total Estimated Recoverable Storage, are to remain unutilized under many groundwater management regimes and might otherwise be available to meet projected supply deficits.

If feasibility of extraction is understood only to include economic and hydrogeological constraints it cannot be the only determinant factor for available groundwater as this definition gives no consideration to water quality, subsidence, nor surface water interaction. However, the total volume of extractable groundwater calculated with known feasibility constraints and assumptions still has significant value to groundwater managers. Unfortunately, Total Estimate Recoverable Storage is only a simple estimate of feasible extraction given as 25% and 75% of total volume of groundwater held in storage.

This study details the analysis of groundwater pumping feasibility and simulates the maximum volume of extractable groundwater - Optimal Recoverable Storage - for hydrogeological conditions approximating the central section of the Carrizo-Wilcox aquifer under economic constraints representative for agricultural uses. Three key limitations are applied to simulate feasibility of extraction: (1) the value of water pumped over the pumping costs, (2) the saturated thickness required to meet demand within the pumping period, and (3) the minimum well screen length necessary to support the pumping rate.

Results indicate the saturated thickness required to meet demand within the pumping period is generally the limiting constraint for high-demand users. Alternatively, if demand is low enough and the value of water high enough, Optimal Recoverable Storage may be limited only by the well screen.

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