Aquifer Storage and Recovery of Reclaimed Water in Florida: Hydrogeological Issues

Robert G. Maliva, Vice President, Missimer Groundwater Science, Inc., Fort Myers, Florida, USA

Coauthor: Thomas M. Missimer

ABSTRACT

Aquifer storage and recovery (ASR) is increasingly being pursued as part of the solution to meet long-term water needs in Florida. Reuse of reclaimed water for irrigation is part of the goal of the State to encourage and promote conservation of freshwater resources. South Florida has a pronounced seasonality in rainfall with summer rainy season and a winter and spring dry season. In many communities nearly all reclaimed water is sent to the reuse system during the dry season, with excess water being available during the rest of the year. The lack of dry season supply prevents connection of new customers to reuse system and thus achievement of greater overall annual reuse rates. ASR is being looked upon by utilities as a means of increasing the supply of reclaimed water during dry season.

The major regulatory issue pertaining to reclaimed water ASR systems is that virtually all of the prospective storage zone aquifers are considered to be Underground Sources of Drinking Water (USDWs) because they have total dissolved solids concentrations of less that 10,000 mg/L. The injected reclaimed water must meet at the point of injection all applicable groundwater standards, which include the Florida primary and secondary drinking water standards. Migration of reclaimed water into aquifer may be locally used for public health. Reclaimed water may meet all promulgated maximum contaminant levels and yet still pose a health risk due to unregulated micro-organisms and compounds, such as endocrine disrupting compounds (EDCs) and pharmaceuticals and personal care products (PPCPs).

The migration of reclaimed water during storage is the critical hydrogeologic issue controlling both ASR system recovery efficiency and regulatory compliance, as far as impacts to other groundwater users. A paradigm for ASR systems in general has been that stored water forms a 'bubble' that does not migrate far from ASR wells. The 'bubble' paradigm has been burst with a growing awareness that all aquifers are heterogeneous to varying degrees. Ileterogeneity in hydraulic conductivity profoundly controls the distribution of the stored water within ASR storage zone aquifer and the rate and direction of the stored water migration.

The failure of some ASR systems in Florida has been due to a lack of initial recognition of the existence of potential impacts of highly transmissive flow zones or conduits within the chose ASR storage zones. The flow zones either allowed for rapid lateral migration of stored water away from the ASR will and/or the vertical migration of saline water into the ASR storage zone. The Florida ASR experience illustrates the importance of performing a detailed aquifer characterization before making the commitment to construction a full ASR system at a site. Incorporation of site-specific data on aquifer

heterogeneity obtained from a test well program into a solute-transport program that includes density-driven flow and fluid mixing (e.g., SEAWAT) can allow for better prediction of ASR system performance and the likely extent of the vertical and horizontal migration of stored reclaimed water.