Influence of Fracture Proximity and Vertical Extent on Source Water Quality from the Lower Arcadia Formation (Miocene) Brackish Groundwater Public Water Supply Wellfields in Southwest Florida

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ABSTRACT

The lower portion of the Arcadia Formation of the Hawthorn Group (early to middle Miocene), locally referred to as the Lower Hawthorn aquifer, is the primary source of groundwater supply for municipal reverse osmosis water treatment plants in Southwest Florida. It is the least brackish and shallowest source having adequate yield for that purpose. The Lower Hawthorn aquifer in Southwest Florida is a confined artesian aquifer, typically about 275 feet thick and ranging between the depths of 450 to 900 feet below land surface, depending on location. The aquifer is composed mostly of carbonate rocks, predominantly limestone. Complex hydrostratigraphic and structural relationships characterize the aquifer and these can strongly influence groundwater quality and yield. Dual (fracture and matrix) porosity and triple (fracture, paleokarstic or cavernous, and matrix) porosity systems are present and affect the viability, water treatment cost, and expected life of Lower Hawthorn aquifer supply wells. This paper focuses on the effect of fracture systems. An understanding of the presence and location of fracture systems is important for the proper simulation of these high permeability conduits in three-dimensional hydraulic and solute transport computer models used for impact analyses, design of wellfield expansions, optimal wellfield operation, and prediction of future feedwater quality deterioration. The impact of fractures on the productive histories of five of the largest (in terms of withdrawal allocation) reverse osmosis supply wellfields constructed in Southwest Florida since 2000 is reviewed. Well failure rates, due to poor feedwater quality related to fracture proximity, are anticipated to ultimately exceed 35% in those wellfields. The economic impact from such well failures is significant. Methods for identifying the presence and delineating the location and vertical extent of fracture systems prior to installing public water supply wells are discussed.

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