

Aquifer Heterogeneity and Well-Field Operations Affect Ground-Water  
Flow and Chloride Distribution in the Upper Floridan Aquifer  
West-Central Florida, USA

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Heterogeneous distribution of ground-water chloride concentrations along the coast of west-central Florida is a result of ground-water pumping and aquifer heterogeneity. Well-field operations induce saltwater intrusion and upwelling conditions, resulting in enriched concentrations of both chloride and sulfate in ground water. Acoustic televiewer, caliper, and borehole flow logging techniques indicate that caverns, conduits and enlargement of bedding planes associated within limestone units and fracture porosity associated with dolomite units create two distinct transmissive zones from approximately 100-300 feet and from 550 to 750 feet below land surface. Incremental increases in chloride concentrations occur as the saltwater interface migrates preferentially along the transmissive zones in response to lowered ground-water levels and decreased regional ground-water flow. Borehole flow logs, fluid conductivity logs and continuous monitoring of fluid conductivity at selected fixed depths show that borehole fluid conductivity responds to pumping-related stresses. In addition to inducing saltwater intrusion and upwelling, well-field withdrawals create complex ground-water flow patterns, often through boreholes of active production wells, creating various dilutions and mixtures of freshwater, saltwater, and upwelling water within the aquifer units. Mixtures in sampled wells using the three end-members for mass-balance calculations show that upwelling is well dispersed throughout the aquifer units and that the highest percentages of seawater are found in the 600-750 foot transmissive zone. Isotopic analyses of Deuterium/Oxygen-18 and Strontium-87/86 indicate that saltwater mixing is the primary source of elevated chlorides.

**Keywords:** ground water, chloride, well-field operations, borehole-geophysical methods, carbonate aquifer.