# Delineating Zones of Seawater Intrusion in a Coastal Southern California Aquifer

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A comprehensive investigation is being conducted by the U.S. Geological Survey in the San Diego, California area to evaluate the suitability of the San Diego Formation and overlying alluvial deposits for use as a drinking water supply. As many as 6 monitoring wells were installed at 10 sites to depths of as much as 2,000 feet for this investigation. Lithologic information was compiled from descriptions of drill cuttings collected at each borehole site and from observations recorded during drilling. Electromagnetic (EM) resistivity logs were obtained prior to the installation of the monitoring wells, and during subsequent site visits. EM resistivity logs are sensitive to changes in lithology and water quality; because the lithology remains constant repeated EM logs can be used to show changes in water-quality due to natural recharge processes, seawater intrusion, or other processes. Monitoring wells were sampled for major-ions, selected minor-ions and trace elements, the stable isotopes of oxygen and hydrogen, and age-dating constituents, including tritium and carbon-14, to identify sources of high-chloride groundwater to the monitoring wells in the San Diego area.

This paper presents lithologic, geophysical, and water-quality data collected from three of the multiple-well monitoring sites located along the San Diego Bay and from two multiple-well monitoring sites located on a plateau away from the coastal area. These monitoring sites were chosen based on their location near the coast and on their close proximity to each other. Lithologic data indicate the hydrogeology of the San Diego area is characterized by alternating layers of marine and non-marine sediment lacking continuity over long distances. Chloride concentrations in sampled wells ranged from 136 mg/L to 40,000 mg/L, the high chloride concentrations suggest the presence of seawater intrusion in several near-coastal monitoring wells. Bromide-to-chloride ratios indicate that chloride concentrations greater than seawater likely result from seawater altered by evaporation. A relation established between EM resistivity, lithology, and water quality allowed for an estimate of the quality of water in intervals not sampled by wells. Finally, the EM resistivity logs, in combination with the water-quality data, is used to distinguish between high-salinity zones that are caused by seawater intrusion from those that are caused by “freshening” of a previously-saline aquifer by recently recharged water.