

Stratigraphic Controls on Salt-Water Intrusion in Siliciclastic Coastal Aquifers: Los Angeles, CA USA

Brian D. Edwards¹, Daniel J. Ponti¹, John C. Tinsley, III¹, Kenneth D. Ehman³,
Michael T. Land³, and Eric G. Reichard²

¹U.S. Geological Survey, Menlo Park, CA 94025 USA

²Skyline Ridge, Inc., Los Gatos, CA 95032 USA

³U.S. Geological Survey, San Diego, CA 92123 USA

The Los Angeles Basin is a densely populated coastal area with a significant dependence on ground water. Throughout the first half of the 20th century, ground-water development caused large water level declines with concomitant intrusion of seawater into some coastal aquifers. United States Geological Survey (USGS) geologists and hydrologists are working cooperatively with local water managers (Water Replenishment District of Southern California and the Los Angeles County Department of Public Works) to: (1) understand and model the stratigraphic architecture of this siliciclastic, structurally complex basin setting, and (2) understand the process of and potential pathways for salt-water intrusion.

Data from more than 2000 trackline-km of single- and multichannel seismic-reflection profiles (60 to 5000 Hz) collected from the Los Angeles/Long Beach harbor complex and adjacent San Pedro shelf define stratal geometries, paleo-channels, and fault traces in the offshore that are potential pathways for salt-water intrusion. Stratigraphic, sedimentologic, and borehole geophysical data from four nearby ~400-m-deep continuously-cored wells provide detailed 1-dimensional reference sections that furnish stratigraphic, age, and facies control for the seismic-reflection profiles. These data are integrated with borehole geophysical data from adjacent water and oil wells into a 3-dimensional model that defines the Pliocene to Recent sequence-stratigraphy of the Dominguez Gap coastal aquifer system.

The youngest unit, the Gaspur aquifer, is intruded with salt water and consists of at least two flat-lying sequences, each marked by basal gravelly sands deposited by the ancestral Los Angeles River as broad channels incised into the coastal plain and continental shelf. Salt water migrates along channels within the Gaspur and into the underlying Gage aquifer (comprised mostly of shallow marine and tidal sands, silts, and clays). Beneath the Gage, a northwest-southeast trending anticlinal structure occurs near the present coastline. To seaward, the Pleistocene San Pedro Formation occurs beneath the Gage and consists of prograding marine-deltaic sands that were deposited within a structural basin. Older Pliocene fluvio-deltaic deposits occur inland and are folded upwards as part of the broad anticlinal structure. These older sediments become the primary freshwater aquifer of the west Los Angeles basin and likely are in hydraulic communication with the type San Pedro Formation. Recent pore fluid and electric log analyses show the upper part of this important aquifer to be saline-intruded near the crest of the fold. This relationship, plus the limited lateral extent of some overlying non-marine aquitard beds, implies that at least part of the saline intrusion is coming into the deeper aquifers from above rather than moving in from the sides.