A Methodology for Assessing Monitoring-Well Networks Designed to Protect Wetland and Lake Water Levels

Lavenue, Marsh A.

INTERA Inc., Longmont, Colorado

Abstract

Stress imposed upon water-bearing formations to meet water-production demands often impact more than simply the formation itself. In many instances, pumping from primary aquifers results in water-level declines in secondary surficial aquifers as well as surficial lake and wetland water levels. Reductions in lake and wetland water levels are particularly troublesome in that extended periods of low wetland water levels increase ecological risk to endangered species that often inhabit wetlands and lakes. Since the passage of the endangered species act over a decade ago, special attention has been given to mitigating the impacts to wetlands caused from demand production schedules. One way water-resource managers are balancing water demand against the associated impacts to the environment is by applying operational models which optimize wellfield production schedules. Optimization models solve for the production schedule which meets demand while constrained by minimum water-level targets at surficial aquifer monitoring wells considered surrogates for wetland water levels. The question arises whether the monitoring-wells included in the operational model are in fact representative of wetland and lake water levels. That is: Are the monitoring wells placed in the correct locations? Are more monitoring wells needed in the operational model, or is there redundancy in the monitoring-well network?

A methodology developed to answer these questions takes advantage of the geostatistical structure of the water levels within the surficial aquifer and the sensitivity the surficial water levels have to pumping from an underlying confined aquifer. By identifying the proximity of areas of high sensitivity and high water-level-estimate uncertainty to wetland and lake locations, monitoring gaps are identified. A geostatistical jackknife test is also presented that identifies redundancy in the existing monitoring well network. A case studied is presented from the Tampa Florida area.