Paper No. 2-3

Presentation Time: 8:30 AM-8:45 AM

ANALYTIC ELEMENT MODELING OF TRANSIENT SALTWATER INTERFACE RESPONSE IN A LAYERED FRESHWATER LENS AQUIFER

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Development of new well fields, or management of existing well fields, in coastal aquifers is made especially challenging by the requirement to balance competing objectives of maximizing extraction rates for water supply, while preventing or mitigating the impacts of saltwater intrusion. Hydrogeologic investigation, water supply planning, and engineering design studies for such well fields should include an analysis of saltwater interface response to pumping. These analyses have often been performed with modeling techniques that span the range from simple nomograph solutions, through analytic element models, to more complex numerical sharp-interface and density-dependent flow and salinity transport models.

This presentation is intended to introduce the application of a new analytic element model, AnAqSim, for saltwater interface analyses. AnAqSim is based on the subdomain method of Fitts (2010). AnAqSim is capable of simulating flow in isotropic or anisotropic subdomains; multiple layers with spatially-variable vertical leakage between layers (3-D); ability to transition from multi-layer modeling in the area of interest to fewer layers or a single layer in the far-field; and fully transient flow using finite-difference time steps. It is also capable of solving for the position of a saltwater interface.

In this study, simulation results for freshwater lens aquifers with hydrogeologic conditions similar to those on Cape Cod, Massachusetts demonstrate the effect of increased vertical anisotropy in hydraulic conductivity on reducing the upconing rise of the saltwater interface beneath a shallow partially penetrating water supply well. Similar damping of interface rise is observed in simulations that include lower permeability silty-sand or silt-clay type layers at depths in the aquifer between the well screen and the saltwater interface.

The model demonstrates that, as would be expected, transient response to pumping (i.e. drawdown, interface rise, and thinning of the freshwater lens in the vicinity of the well field) is more rapid for smaller values of aquifer storativity.

2011 GSA Annual Meeting in Minneapolis (9–12 October 2011)
General Information for this Meeting

Handouts:

- GSA Presentation - McLane - Oct 2011.pdf (365.5KB) - Upload Presentation File (After Meeting)
- GSA Presentation Notes - McLane - Nov 2011.pdf (81.6KB) - Upload Presentation File (After Meeting)

Session No. 2
Hydrogeology I: Water Resources and Water Balances
Minneapolis Convention Center: Room M100FG
8:00 AM-12:00 PM, Sunday, 9 October 2011

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