7-19-2006

Hydrological Analysis of Conjunctive Management Approaches to Increase Freshwater Supplies on the Lower South Platte River, Colorado

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Abstracts of presentations given on Wednesday, 19 July 2006, in session 21 of the UCOWR Conference.

Extended Abstract

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This paper describes conjunctive surface water – groundwater management approaches to water allocation and administration on the South Platte in Colorado (location map in *Figure 1*), focusing in particular on the hydrologic evaluation of the efficacy of the various conjunctive operations proposed to increase supplies.

On the lower South Platte River, to facilitate maximal beneficial use of available water supplies, junior groundwater pumpers are allowed to divert unallocated winter river flows and recharge that water to the alluvial groundwater system via infiltration ponds located at the edges of the alluvial valley. This recharge water flows toward the river in a lagged fashion, and the accretions to the river caused by the recharge is used to replace out-of-priority depletions to the river caused by well pumping. While simple in concept, this scheme requires application of detailed transient surface water – groundwater interaction modeling and water-rights accounting.

Particular hydrologic issues in need of detailed evaluation include: (i) quantification of lagged depletions associated with wells located immediately adjacent to the river that are pumped to divert available winter river flows; (ii) lagged depletions associated with wells that are pumped for irrigation supplies during the growing season when calls on the river are frequent (see river response curves in *Figure 2 and Figure 3*); (iii) the capacity of the aquifer to store and transmit infiltrated surface water from recharge ponds (see *Figure 4 and Figure 5*), and (iv) the lagging of accretions from the recharge ponds to the river.

Prior to receiving a water right decree, the groundwater pumpers must file an application with the State that demonstrates that senior water right holders will not be injured by the juniors' pumping. This water right application process affords potentially impacted senior water rights holders an opportunity to review, and if necessary object to those applications.

Figure 1: Location of South Platte Basin, northeastern Colorado.

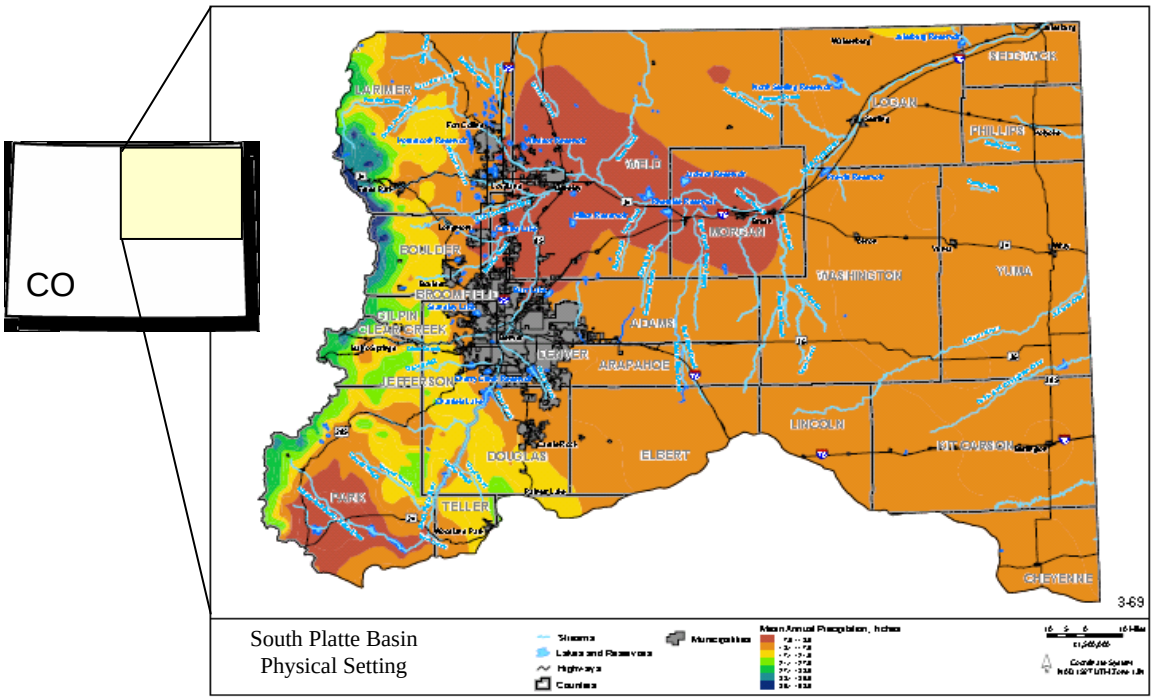

Figure 2: River response functions, illustrating the sensitivity of the model to streambed conductance (or Kriv).

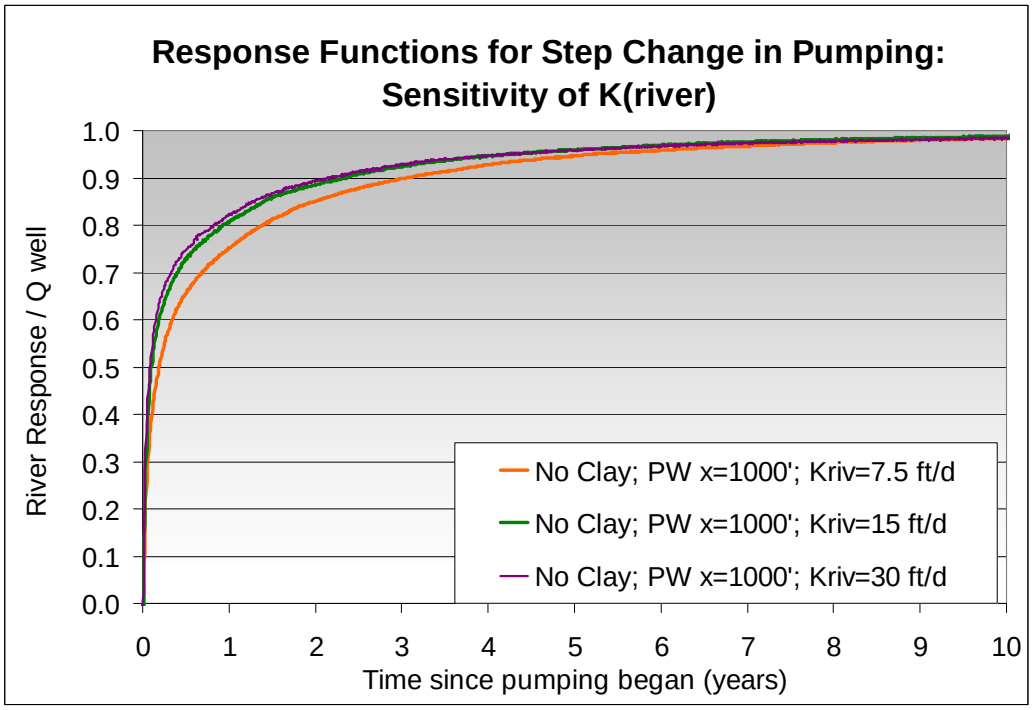

Figure 3: River response functions, illustrating the sensitivity of the model to the presense of a clay layer within the aquifer.

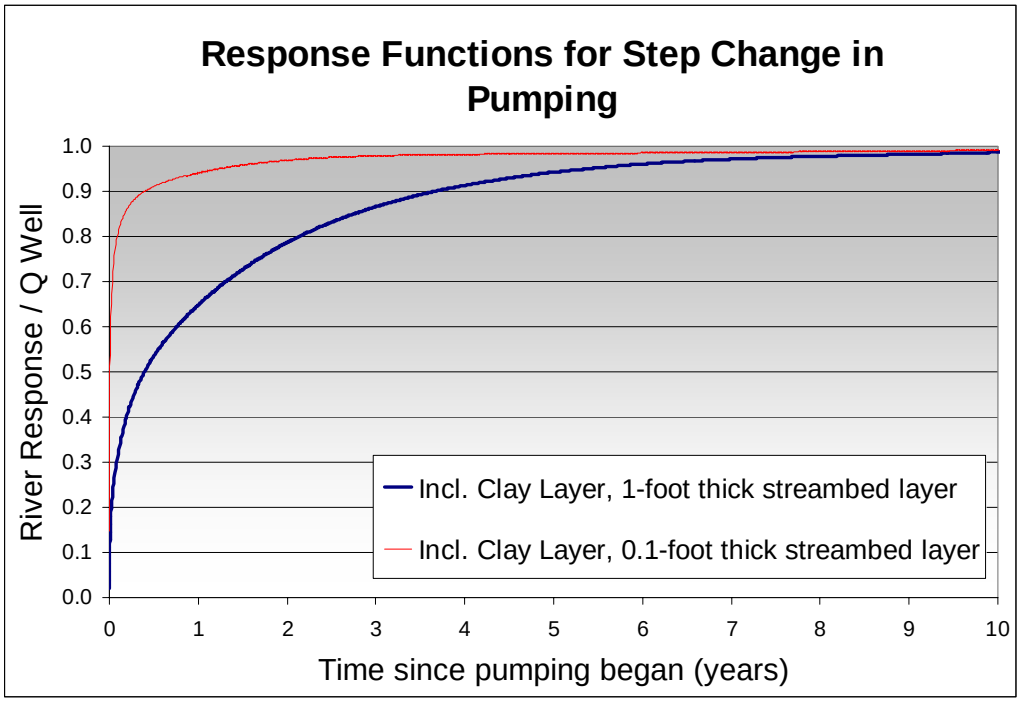

Figure 4: Map view of water table contours from modeling output to analyze aquifer capacity to store and transmit recharge pond water.

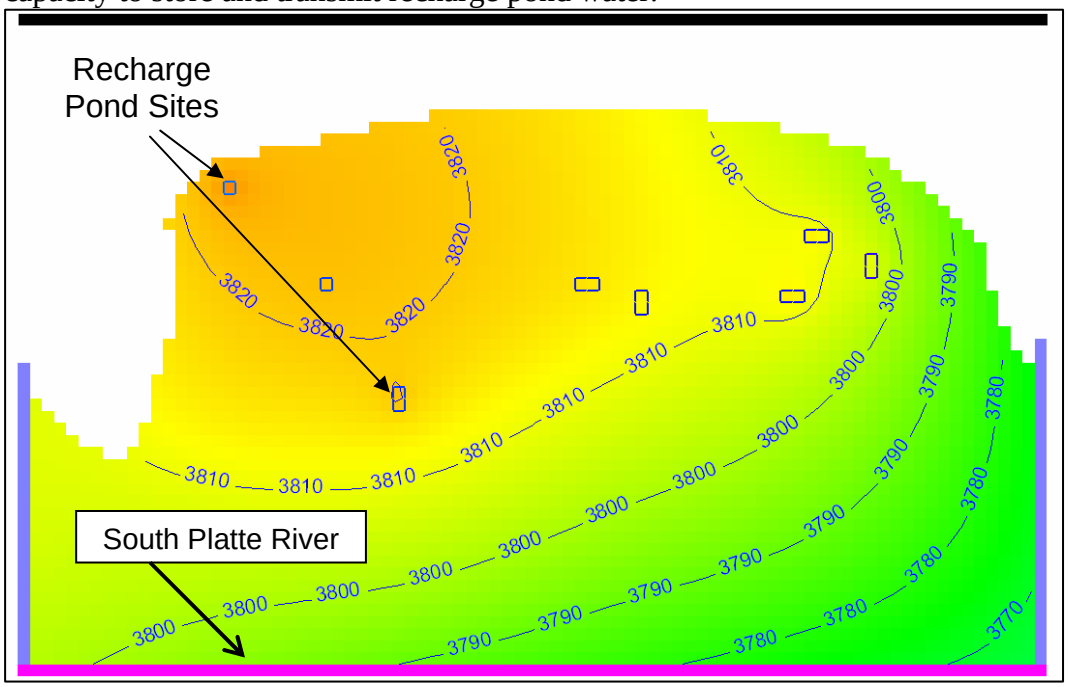

Figure 5: Cross-section view of modeling output to analyze aquifer capacity to store and transmit recharge pond water.