Ann Bleed

From: Roger Patterson [rpatterson@dnr.state.ne.us]
Sent: Monday, August 25, 2003 1:58 PM
To: Ann Bleed (E-mail)
Subject: FW: Burt et al.

-----Original Message-----
From: Lee Wilson & Associates [mailto:lwa@lwasf.com]
Sent: Monday, August 18, 2003 3:36 PM
To: David Cookson; Roger Patterson
Subject: Burt et al.

Draft comment on Burt paper. If okay, will circulate to NE team to see if others want to comment and/or co-author.

Lee Wilson

Comment on "Statistical estimation of streamflow depletion from irrigation wells" by Oscar R. Burt, Maurice Baker and Glenn A. Helmers. Water Resources Research, Vol. 38, No. 12.

Comment by ***

Burt et al. use statistical methods to quantify the influence of irrigation wells on annual streamflows at two locations: Frenchman Creek, a tributary of the Republican River in southwestern Nebraska; and the entire Republican River above the gage at Hardy, Nebraska. Those who may wish to apply the statistical methods elsewhere may be interested in knowing about the results of a new MODFLOW model of the Republican River Basin, which was completed jointly by the States of Nebraska, Colorado and Kansas and which is considered to be reasonably calibrated against all relevant hydrologic data. The MODFLOW model has been adopted for the purpose of accounting for well pumping effects on streamflow, with respect to the terms of the Republican River Compact.

The statistical method computes a much larger impact of irrigation pumping on streamflow than does the calibrated computer model. This can be illustrated by comparing the results at the Hardy gage. The MODFLOW simulation computes a net effect of irrigation pumping on flows at the Hardy gage as having reduced flows to a value that is about 0.75 of the long-term average flow. Additional reductions in flow are ascribed to changes in surface water hydrology. Burt et al. indicate that pumping accounts for essentially all of the observed flow reduction and compute it as reducing flows to approximately 0.25 of the 1950 rate. Thus the effect of pumping on flow computed by Burt et al. is about 3 times greater than the effect computed by the MODFLOW model.

Burt et al. also postulate various hydrologic cause-effect relationships in the basin. One relationship is that the observed reduction in variability of flows results from the lowering of the water table and a corresponding buffering effect on streamflow. No such relationship was observed in the ground water model. Based on work done in construction of the MODFLOW model, the primary factor impacting flow variability has been changes in the surface water regime of the basin, not ground water.

Another relationship postulated by Burt et al. is that the causal effect of precipitation is to impact the

interaction of seasonal cones of depression in the water table and the amount of surface water emanating from precipitation and irrigation return flows. In the calibrated flow model, the causal effect of precipitation is to affect the amount of irrigation pumping that is needed to meet crop needs, and the amount of recharge that occurs from irrigated and non-irrigated lands.

These comparisons are provided without examining which aspects of the different methods could explain different results. Our purpose is simply to observe that application of the statistical methods developed by Burt et al. produced results for the Republican River that differ substantially from the results of a calibrated ground water flow model of the same system.