Hydraulic Delineation of possible Groundwater Pollution from an industrial River

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ABSTRACT

In most, but the driest regions in the world, the dominant rivers are *effluent*; i.e., are *gaining* water from the ambient groundwater aquifer during most seasons. However, there are instances where large volumes of wastewater discharge from an industrial plant create an `unnatural' industrial river, shifting the natural balance between the river stream and the surrounding groundwater aquifer in such a way that sections of the river may become an *influent* or *loosing* stream during long dry seasons, thus creating the potential for aquifer contamination. This appears to be the case for the industrial *Fenholloway river* in Taylor county, Florida, which is loaded from the outfall of a paper mill plant. To investigate the interaction between this river and the ambient groundwater aquifer and to delineate a possibly contaminated corridor within the aquifer, a field investigation, followed by flow- and particle tracking modeling was carried out. The hydraulic interaction of the stream and the groundwater under seasonal recharge variations is simulated by the USGS MODFLOW model. Lateral 'stagnant' points of the hydraulic gradient computed through transient simulations are connected to delineate the maximal contamination corridor along both sides of the stream. As a second approach, particle tracking simulations based on a Green's function analytical solution of the 2-D transient groundwater flow equation is used. Both time-varying Dirichlet boundary conditions and recharge forcing conditions are employed to compute the dynamic movements of water particles out of the river and along its banks. The modeling results show that lateral migration of contaminants close to the industrial discharge point might be up to several thousands of feet in cross-river direction, during times when the normally gaining (effluent) stream becomes sectionally a loosing (influent) stream. The last situation occurs especially during multiyear-long time spans with less-than-normal precipitation which, for Florida, happens during times between major El Niño occurrences; i.e. during La Niña years.