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The Influence of Streambed Seepage on Water Quantity and Quality: New Tools for Monitoring Fluxes

Abstract: Surface water and ground water are increasingly viewed as a single resource, but it is difficult to determine rates of flow between aquifers and streams (a form of "streambed seepage"), which can have a positive or negative influence of both the quantity of available water and its quality. The primary objectives of our research are to assess the dynamics and impacts of streambed seepage on the amount and chemical characteristics of water within both surface and subsurface reservoirs, and develop new tools for these purposes. We have established a series of gauging stations along two streams in the Pajaro Valley, central-coastal California, where there is extensive agricultural development. We are developing methods to quantify streambed seepage based upon time-series analysis of streambed thermal measurements. We are monitoring the chemistry of water in the streams and in underlying aquifers to assess how streambed seepage influences water quality, particularly nitrate concentrations, and running tracer experiments to quantify exchange rates. Channel losses from one reach of the Pajaro River are 6 to 12 cfs, about 10,000 ac-ft/yr, nearly half of the sustainable basin yield. Multiple thermal stations have been established along each experimental reach. Modeling and calculations indicate that new thermal methods are most sensitive to seepage at rates up to 4 m/day. Tracer tests indicate that there may be significant surface water – ground water exchange, even within sections where there is considerable net water loss. Nitrate concentrations are often high at the top of one reach, but decrease by 30% during flow along the reach. Solute and isotopic analyses indicate that denitrification is most likely responsible for the lowering of nitrate concentrations. Denitrification appears to be linked to streambed seepage.

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