CASING AND LEAK DEPTHS, AND SOLUTE TRAVEL TIMES TO WELLS[±]

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ABSTRACT: A mathematical solution based on porous media flow is developed for solute travel time to a well as affected by a leak around the upper part of the casing. Consider a well of radius 0.2 meters (m) penetrating, fully, a semiconfined aquifer of thickness 6 m with impermeable casing length of 4.5 m, and screened casing length 1.5 m. Around the upper 1.5 m of the impermeable casing length, there is a highly permeable region (a leak). The radius of influence of the well is 10 m. The porous flow medium has a hydraulic conductivity of 10 m/day and a porosity of 0.25. Between the water table and the water level in the well, there is a steady state pumped down head difference of 0.3 m. Solute travel time from a point at the bottom of the leak to the well is 2.33 days. If the leak is sealed (grouted), the travel time is 6.24 days. Examples of six different geometries are given. Laboratory studies verify the theory. The computations should be useful in the design and protection of water wells from solutes, such as from agriculture, industry, strip mines, or sanitary landfills.