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Effect of discrepancy between field test conditions and model assumptions on parameter estimation

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Pumping tests are usually used to generate drawdown data for aquifer parameter estimation. When drawdown data of different observation wells are used, the curve matching technique frequently yields different values for each individual parameter, in contradiction to the homogeneous condition normally assumed in most well hydraulics theories. For a constant-drawdown pumping test, it is shown that this issue may be caused by the discrepancy between the field test conditions and the model assumptions. When the discrepancy is removed in the well hydraulics model, each parameter determined using drawdown data of different observation wells is constant. The constant-head test was conducted in an unconfined glacial till of saturated thickness (b) of 2.5 m. A pumping well and four observation wells were involved, and they were all fully screened through b. During the 24-hour test, drawdown in the pumping well was held constant at 1.5 m, and the water table was falling in the screen sections of the four observation wells. Since the pumping well was left only 1.0 m (40% of b) effective screen length for water entrance, it actually responded to the pumping as a partially penetrating one. The observation wells, however, were under the partially submerged conditions where the effective screen length for water entrance decreased with time. A mathematical model is developed to account for the partially penetrating effect and the partially submerged conditions, assuming the unconfined aquifer to be homogeneous and vertically anisotropic. When the partially penetrating and/or the partially submerged effects are ignored, the parameters of specific yield (S_y), the

storage coefficient(S), and the horizontal (K_r) and the vertical (K_z) hydraulic conductivities determined are different for the four sets of drawdown data. When these effects are considered, constant aquifer parameters are obtained for drawdown data of the observation wells. This study demonstrates that the inhomogeneous results of parameter estimation may be due to the fact that the well hydraulics model used for data analysis fails to closely account for the field test conditions.