LA-UR-11-11176
Approved for public release; distribution is unlimited.

Title: Variable-Rate Pumping Test Analysis for Aquifer Parameter Evaluation

Author(s): Birdsell, Kay H.
Mishra, Phoolendra K.
Vesselinov, Velimir V.

Intended for: DOE
American Geophysical Union Fall meeting, 2011-12-05/2011-12-09 (San Francisco, California, United States)
Groundwater
Reading Room
RCRA

AGU 2011

ABSTRACT

Variable-Rate Pumping Test Analysis for Aquifer Parameter Evaluation

Kay H. Birdsell, Phoolendra K. Mishra and Velimir V. Vesselinov

Computational Earth Science Group, Earth and Environmental Sciences Division
Los Alamos National Laboratory, MS T003, Los Alamos NM 87545, U.S.A.

The most common method to infer aquifer properties is based on analysis of drawdown and/or recovery data recorded from pumping tests. The analysis is frequently based on fitting observed pressure responses to appropriate analytical solutions for radial flow towards the pumping well. For mathematical simplicity, analytical solutions are commonly derived for constant-rate pumping conditions. However, often times the pumping rate during the test is varied either intentionally or due to technical difficulties during the test. Using principles of superposition, the constant-rate analytical solutions are frequently applied to analyze pumping tests that are conducted with variable pumping rates. In this study, we propose a novel methodology that approximates a time-varying pumping history as a series of segments with linearly varying pumping rates, and use it to evaluate the effects of pumping variation on aquifer parameter estimation. Our approach is demonstrated using existing analytical solutions for confined aquifers (Mishra and Neuman 2011), but it is also applicable to unconfined and/or leaky aquifers. The methodology is validated using a synthetic pumping test. We also apply our methodology to analyze the pumping test data by inversely estimating the apparent aquifer parameters using the code MADS (http://ees.lanl.gov/staff/monty/codes/mads).