

NUMERICAL INVESTIGATION OF THE ROLE OF MUCK LAYER IN
CONTAMINANT MIGRATION AT STREAM/AQUIFER INTERFACE

Abstract

by Mo'ayyad Shawaqfah, Ph.D.
Washington State University
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Chair: Michael Barber

Surface and ground water interaction at the stream/aquifer interface is a pivotal mechanism governing flow and contaminant transport processes. Rapidly fluctuating stream levels due to stormwater runoff, snowmelt, and reservoir operations create a variably saturated flow region along the stream bank. While the hydrologic importance of the unsaturated groundwater zone has long been recognized, little is known about the effect of this storage region on contaminant migration or the relative impact of the individual factors controlling the rates of movement.

Conceptually, water moves between the stream and aquifer based on several factors including the lateral extent and hydraulic properties of the adjoining aquifer system, the depth of stream penetration into aquifer, the hydraulic properties of the streambank and streambed, and the hydraulic gradient between the stream and aquifer. The importance of this variably saturated bank storage region on contaminants migration was investigated using a 2-D, variably saturated finite element model called HYDRUS_2D. Twelve scenarios were used to quantify the controlling mechanism of the stream/aquifer interaction. Results showed that the muck layer properties were the most important factors in controlling the stream/aquifer interaction.